Network Device Library

Release v12.03

Allen-Bradley
by ROCKWELL AUTOMATION

Reference Manual

Original Instructions

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.

IMPORTANT Identifies information that is critical for successful application and understanding of the product.

These labels may also be on or inside the equipment to provide specific precautions.

SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.

BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

The following icon may appear in the text of this document.

Identifies information that is useful and can help to make a process easier to do or easier to understand.

Chapter 7

Single Device Level Ring (raC_Opr_NetDLR1, raC_Opr_NetDLR1_Lite)

Chapter 8

3-Ring Device Level Ring (raC_Opr_NetDLR3, raC_Opr_NetDLR3_Lite)

Chapter 9

Parallel Redundancy Protocol (raC_Opr_NetPRP)

Device Object Libraries Overview

Our Device Object Libraries enable you to easily interface with Rockwell Automation® intelligent devices like drives, motion, network switches, sensors, IO and more. The libraries contain tested, documented, and lifecycle-managed objects which can be used with machine builder, process, and packaged libraries or as standalone components. Device objects include HMI faceplates for FactoryTalk® View ME/SE and Studio 5000 View Designer® software and provide a user interface that seamlessly integrates with the products.

HMI faceplates are standard display files that provide a common user interface. These are HMI pop-up screens used to display detailed information related to a specific instruction or device. In systems that follow ISA 101.1 design guidelines, faceplates are often referred to as Level 4 displays.

Pre-configured Device Objects include an Add-On Instruction Rung and an HMI Faceplate providing the following benefits:

- Collect, Process and Deliver Data between Smart Devices and Application Logic
- Detailed Device Data Collection and Delivery
- Enhanced Device Status and Diagnostics
- Common Control Interfaces maximizing Flexible Automation Device Selection & Application Code Reuse

Device Object Use Cases:

- Basic Device Maintenance and Diagnostics
- Virtual Device Operations for Startup and Commissioning
- Operator and Program Control for Velocity Machine and Process Applications

Device Object Libraries may be downloaded from the Product Compatibility and Download Center. Search for “Library”.

Application Code Manager

Studio 5000® Application Code Manager is a tool that can be used with Device Object Libraries to streamline project and machine development. This bulk coding tool allows you to easily design and standardize functionality with reusable application code.

Enable more efficient project development with reusable libraries of code:

- Quickly create and deploy projects through our Application Content Libraries
- Import Rockwell provided application content libraries to expedite system development

- Build your own reusable code that can be managed and deployed across your entire enterprise
- Easily configure objects in bulk with reusable code to increase application development, no additional programming is necessary
- Consolidate content for Studio 5000 Logix Designer®, FactoryTalk® View Studio, FactoryTalk® Alarms & Events, FactoryTalk® Historian to configure an object a single time and generate content for each of those software packages.

See the section on Using the Library with Application Code Manager for more details.

Other Application Code Libraries

This Device Object Library may be used in harmony with other Application Code Libraries including other Device Object Libraries (Network, IO, IO-Link, Safety Device Libraries) or Application Libraries (PlantPAx® Process Objects library, Machine Builder Libraries). All libraries are intended to follow similar design philosophies to provide a consistent experience for operators and maintenance staff.

A complete list of Application Code Libraries from Rockwell Automation® follows.

Item	Description
PlantPAx® Process Library	Rockwell Automation® Library of Process Objects provides application templates, Endress + Hauser library objects, Application Code Manager library objects, and tools and utilities for PlantPAx® DCS applications. Includes the following: • Graphics for built-in instructions • HMI images and Help files • Logix diagnostic objects • Process objects • Control strategies • Sequencer objects • PlantPAx® Configuration Tools for Tags, Alarms and Historian • Color Change • Historian -- Asset Framework template and objects
Machine Builder Libraries	Tested, documented and life-cycle managed library objects and faceplates for use with Studio 5000® Application Code Manager for use primarily with OEM and discrete machine applications.
Common Application Libraries	Commonly used application library objects and faceplates for use with Studio 5000® Application Code Manager including basic functions like unit conversion and data collection.
Independent Cart Technology Libraries	ICT Libraries for iTRAK and MagneMotion including MagneMover LITE and QuickStick for Studio 5000® Application Code Manager
I/O Device Library	Provides objects for Rockwell Automation® 1756, 1769, 1734, 1794, 1738, 1732E, 1719, 5069, 5094 I/O modules including pre-configured status and diagnostic faceplates
IO-Link Device Library	Provides IO-Link master and sensor objects including pre-configured status and diagnostic faceplates
Network Device Library	Provides objects for Stratix® switch and Device Level Ring network objects
Power Device Library	Provides objects for discrete, velocity, motion, and power monitor devices
Safety Device Library	Provides safety objects to interface with safety I/O
Electrical Protection Device Library	Provides a standard to represent protection devices within your electrical distribution system

Libraries can be accessed from the Product Compatibility and Download Center.

Software and Firmware Upgrades

When you update software or firmware revisions, we recommend that you verify the impact on performance and memory utilization before implementing the upgrade on the production system. For FactoryTalk® View or ControlLogix®® platforms, we recommend that you review the release notes and verify the impact of the upgrade on performance and memory utilization.

You can also verify the compatibility of the upgrade with the installed software and operating systems in use on your system. See the Product Compatibility and Download Center.

Rockwell Automation® Services and Support

System Support offers technical assistance that is tailored for control systems. Some of the features include the following:

- Highly experienced team of engineers with training and systems experience
- Use of online remote diagnostic tools
- Access to otherwise restricted TechConnect℠ Knowledgebase content
- 24-hour, 7 days per week, 365 days per year of phone-support coverage upgrade option

For more information, contact your local distributor or Rockwell Automation® representative or see http://www.rockwellautomation.com/support.

You can view or download publications at http://www.rockwellautomation.com/literature. To order paper copies of technical documentation, contact your local Allen-Bradley® distributor or Rockwell Automation® sales representative.

Rockwell Automation® Network Device Library

The Network Device Library is a tested, documented, and life cycle managed object library. The Device Library provides pre-configured status and diagnostic faceplates and AOI sets for Rockwell Automation® network devices. The Network Device Objects may be used with Machine Builder, Process, and Packaged Libraries or as standalone components. Network Device Library add-on instructions objects collect, process, and deliver data between hardware devices and application logic.

The Network Device Library includes Add-On Instructions (AOIs) and HMI Faceplates for Allen-Bradley® Stratix® Switch products, Device-Level Ring (DLR) network monitoring and Parallel Redundancy Protocol (PRP) network monitoring.

This document includes the functional requirements of the Stratix® Switch , Device-Level Ring and Parallel Redundancy Protocol device objects.

The Network Device Library may be downloaded from the Product Compatibility and Download Center. Search for Network Device Library.

Compatibility

Compatible Software

- Studio 5000 Logix Designer® v30.02.00, v31.02.00, v32.04.00, v33.01.01, or v34.01.00 for PAC Application Development
- Studio 5000® Application Code Manager v4.0 and later for bulk code configuration
- Studio 5000 View Designer® v5.01 and later for PanelView™ 5000 Application Development
- FactoryTalk® View Studio for FactoryTalk View ME/SE or PanelView™ Plus Application Development
  - Stratix® Switch Device Objects: v10.00.01 and later
  - Device Level Ring Objects: v11.00.00 and later
  - Parallel Redundancy Protocol Objects: v11.00.00 and later

Compatible Hardware

- PanelView™ 5500/5510/5310 with v5 or later firmware
- PanelView™ Plus
  - Stratix® Switch Device Objects: v11 or later firmware
  - Device Level Ring Objects: v11 or later firmware

  - Parallel Redundancy Protocol Objects: v11 or later firmware
- ControlLogix®/GuardLogix® 5570 or 5580 controller with v30.011 or later firmware
- CompactLogix™/Compact GuardLogix® 5580 or 5570 controller with v30.011 or later firmware
- Stratix® 2500 with v2.003 or later firmware
- Stratix® 5200 with v17.12.01 or later firmware
- Stratix® 5400/5410 with IOS rev 15.2(7)E1a or later
- Stratix® 5700/ArmorStratix™ 5700 with IOS rev 15.2(7)E1a or later
- Stratix® 5800 with IOS rev 17.02(7)E1a or later

Summary of Changes

This publication contains the following new or updated information. This list includes substantive updates only and is not intended to reflect all changes.

Topic	Page
Added Parallel Redundancy Protocol PRP Device Object	157-170
Added references to Stratix 5200 device support	all

Footprint

Each instruction requires memory footprint within the Logix controller. The following characteristics apply:

- **Definition:** Estimated memory required to store the object definition, including all dependents
- **Instance:** Estimated memory required per object instantiated.
- **Execution (L85E):** Estimated execution time / scan footprint evaluated in 1756-L85E PAC

Device Object Footprint

Device Object	Defintion (kB)	Instance (kB)	Execution (µs)
raC_Dvc_StratixSwitch	161.41	18.34	123
raC_Opr_NetDLR1_	141.00	26.00	42
raC_Opr_NetDLR1_Lite	105.44	11.32	68
raC_Dvc_NetDLR3	165.00	27.00	48
raC_Opr_NetPRP	111.09	12.50	340

- **Execution (L75):** Estimated execution time / scan footprint evaluated in 1756-L75 PAC

Device Object Footprint

Device Object	Defintion (kB)	Instance (kB)	Execution (µs)
raC_Opr_NetDLR1_	161.00	26.00	820
raC_Opr_NetDLR1_Lite	117.83	11.47	480
raC_Dvc_NetDLR3	191.00	27.00	890

Additional resources

For a complete understanding of Rockwell Automation safety applications it is recommended to review the following documents.

Resource	Description
Stratix Ethernet Device Specifications Technical Data, 1783-TD001	Provides specifications for Stratix® Ethernet switches and other devices.
Deploying Device Level Ring within a Converged Plantwide Ethernet Architecture Design Guide, publication ENET-TD015	Represents a collaborative development effort from Rockwell Automation and Cisco Systems®. Provides application requirements, technology, and design considerations to deploy Device Level Ring (DLR) technology through a plant-wide Industrial Automation and Control System (IACS) network infrastructure.
EtherNet/IP Device Level Ring Application Technique ENET-AT007	This publication describes DLR network operation, topologies, configuration considerations, and diagnostic methods.
Stratix Managed Switches User Manual, 1783-UM007	Describes how to configure, monitor, and troubleshoot Stratix® 5400, 5410, 5700, 8000, 8300, and ArmorStratix™ 5700 managed switches.
ControlLogix EtherNet/IP Network Devices User Manual, 1756-UM004	Describes how to configure and use EtherNet/IP devices to communicate on the EtherNet/IP network.
Ethernet Reference Manual, publication ENET-RM002	Describes basic Ethernet concepts, infrastructure components, and infrastructure features.
Troubleshoot EtherNet/IP Networks Application Technique, publication ENET-AT003	Describes troubleshooting techniques for Integrated Architecture products on EtherNet/IP networks.
Ethernet/IP Parallel Redundancy Protocol Application Technique ENET-AT006D	Describes how you can configure a Parallel Redundancy Protocol (PRP) network with a compatible device or switch.
Deploying Parallel Redundancy Protocol within a Converged Plantwide Ethernet Architecture ENET-TD021B	Designing & Deploying the Parallel Redundancy Protocol within a Converged Plantwide Ethernet Architecture (CPwE PRP)
Application Code Manager User Manual LOGIX-UM003	Studio 5000® Application Code Manager is a tool that enables more efficient project development with libraries of reusable code.

Library Components

The Network Device Library is a tested, documented, and life cycle managed object library. The Device Library provides pre-configured status and diagnostic faceplates and AOI sets for Allen-Bradley® Stratix® Switches, Device Level Ring (DLR) networks, and Parallel Redundancy Protocol (PRP) networks. The Network Device Objects may be used with Machine Builder, Process, and Packaged Libraries or as standalone components. Network Device Library add-on instructions objects collect, process, and deliver data between hardware devices and application logic.

Network Device Instructions

The Network Device Library includes instructions to interface with Stratix® managed network switches and Device Level Ring (DLR) networks.

A single Stratix® Switch Add-On Instruction is used for any compatible Stratix® or ArmorStratix™ managed switch (2500/ 5400/5410/5700/5800). Specific HMI faceplates are used for each Stratix® model.

The Stratix® Switch Objects included are as follows:

- raC_Dvc_Stratix® - Generic Stratix® Switch

The Device Level Ring (DLR) add-on instructions support either a single ring with up to 12 nodes (DLR1 Lite), a single ring with up to 56 nodes (DLR1) or up to 3 rings each with up to 54 nodes (DLR3). The DLR1 Add-On Instruction can be paired with either the 24 node or 56 node HMI faceplates depending on the network size. It is recommended to use a PanelView™ Plus 7 with a minimum resolution of 640x390 for 24 node HMI faceplates and a minimum resolution of 800x600 for 56 node HMI faceplates.

The Device Level Ring (DLR) Objects includes are as follows:

- raC_Opr_NetDLR1
- raC_Opr_NetDLR1_Lite
- raC_Opr_NetDLR3

The Parallel Redundancy Protocol (PRP) Objects includes are as follows:

- raC_Opr_NetPRP

There are two types of instruction in this library:

- Device (Dvc): instruction used for devices (e.g. Stratix® Switch).
- Operation (Opr): instruction used for operation (e.g. Network Monitoring)

Network Device Instructions

Add-On Instruction	Compatible Device/Network	FactoryTalk® View ME Faceplate	FactoryTalk® View SE Faceplate	Version
raC_Dvc_Stratix	Stratix® 2500	(raC-12_03-ME) raC_Dvc_S2500-Faceplate	(raC-12_03-SE) raC_Dvc_S2500-Faceplate	12.03
	Stratix® 5200	(raC-12_03-ME) raC_Dvc_S5200-Faceplate	(raC-12_03-SE) raC_Dvc_S5200-Faceplate	12.03
	Stratix® 5400	(raC-12_03-ME) raC_Dvc_S5400-Faceplate	(raC-12_03-SE) raC_Dvc_S5400-Faceplate	12.03
	Stratix® 5410	(raC-12_03-ME) raC_Dvc_S5410-Faceplate	(raC-12_03-SE) raC_Dvc_S5410-Faceplate	12.03
	Stratix® 5700 ArmorStratix™ 5700	(raC-12_03-ME) raC_Dvc_S5700-Faceplate	(raC-12_03-SE) raC_Dvc_S5700-Faceplate	12.03
	Stratix® 5800	(raC-12_03-ME) raC_Dvc_S5800-Faceplate	(raC-12_03-SE) raC_Dvc_S5800-Faceplate	12.03
raC_Opr_NetDLR1	Single Ring 24 Notes Maximum	(raC-12_02-ME) raC_Opr_NetDLR1_24Node-Faceplate	(raC-12_02-SE) raC_Opr_NetDLR1_24Node-Faceplate	12.02
	Single Ring 56 Notes Maximum	(raC-12_02-ME) raC_Opr_NetDLR1_56Node-Faceplate	(raC-12_02-SE) raC_Opr_NetDLR1_56Node-Faceplate	12.02
raC_Opr_NetDLR1_Lite	Single Ring 12 Nodes Maximum	(raC-12_02-ME) raC_Opr_NetDLR1_12Node-Faceplate	(raC-12_02-SE) raC_Opr_NetDLR1_12Node-Faceplate	12.02
raC_Opr_NetDLR3	3-Rings Maximum 56 Nodes Maximum	(raC-12_02-ME) raC_Opr_NetDLR3_56Node-Faceplate	(raC-12_02-SE) raC_Opr_NetDLR3_56Node-Faceplate	12.02
raC_Opr_NetPRP	PRP Node Table applicable with 1756-EN2TP, 1756-EN4TR, 5094-AEN2TR And maximum 240 PRP Nodes	(raC-12_03-ME) raC_Opr_NetPRP-Faceplate	(raC-12_03-SE) raC_Opr_NetPRP-Faceplate	12.03

Add-On Instruction	Compatible Device/Network	Studio 5000 View Designer® Faceplate	Version
raC_Dvc_Stratix	Stratix® 2500	(raC-12_02-VD) raC_Dvc_S2500_FP	12.03
	Stratix® 5200	(raC-12_02-VD) raC_Dvc_S5200_FP	12.03
	Stratix® 5400	(raC-12_02-VD) raC_Dvc_S5400-FP	12.03
	Stratix® 5410	(raC-12_02-VD) raC_Dvc_S5410-FP	12.03
	Stratix® 5700 ArmorStratix™ 5700	(raC-12_02-VD) raC_Dvc_S5700-FP	12.03
	Stratix® 5800	(raC-12_02-VD) raC_Dvc_S5800-FP	12.03
raC_Opr_NetDLR1	Single Ring 24 Notes Maximum	(raC-12_02-VD) raC_Opr_NetDLR1_24Node-FP	12.02
	Single Ring 56 Notes Maximum	(raC-12_02-VD) raC_Opr_NetDLR1_56Node-FP	12.02
raC_Opr_NetDLR1_Lite	Single Ring 12 Nodes Maximum	(raC-12_02-VD) raC_Opr_NetDLR1_12Node-FP	12.02
raC_Opr_NetDLR3	3-Rings Maximum 56 Nodes Maximum	(raC-12_02-VD) raC_Opr_NetDLR3_56Node-FP	12.02
raC_Opr_NetPRP	PRP Node Table applicable with 1756-EN2TP, 1756-EN4TR, 5094-AEN2TR And maximum 240 PRP Nodes	(raC-12_03-VD) raC_Opr_NetPRP-FP	12.03

Library Folders and Files

When you extract the library from the downloaded .zip folder, you will find the following folder and file structure. Note that some items are generalized with *TYPE* (e.g. Dvc, Opr, Tec) and *OBJECT* (e.g. 45DMS, 46CLR, etc). The major and minor versions are represented by X and Y respectively.

Level 1	Level 2	Level 3	File Type	Description
ApplicationCodeManagerLibraries			**Folder**	**Application Code Manager files**
	Attachments (.HZ1 and .txt files)		Folder	ACM Object Attachments
	(RA-LIB)_Device_Asset-Control_*GROUP*_raC_Dvc_*OBJECT*_(X.Y).HSL4		HSL4	ACM Asset-Control Object
	(RA-LIB)_Device_Device_*GROUP*_raC_Dvc_*OBJECT*_(X.Y).HSL4		HSL4	ACM Device Object
HMI - FactoryTalk® View ME			**Folder**	**FactoryTalk® View ME files**
	Displays - gfx		Folder	FT View ME display files
		(raC-X_YY-ME) raC_*TYPE(OBJECT*-faceplate.gfx	GFX	Object Faceplate display
	Global Objects - ggfx		Folder	FT View ME Global Object files
		(raC-X-ME) Graphic Symbols - LIBRARY.ggfx	GGFX	Graphic Symbol/Launch Button global objects
		(raC-X-ME) Toolbox - LIBRARY.ggfx	GGFX	Toolbox global objects
HMI - FactoryTalk® View SE			**Folder**	**FactoryTalk® View SE Files**
	Displays - gfx		Folder	FT View SE display files
		(raC-X_YY-SE) raC_*TYPE(OBJECT*-faceplate.gfx	GFX	Object Faceplate display
	Global Objects - ggfx		Folder	FT View SE Global Object files
		(raC-X-SE) Graphic Symbols - LIBRARY.ggfx	GGFX	Graphic Symbol/Launch Button global objects
		(raC-X-SE) Toolbox - LIBRARY.ggfx	GGFX	Toolbox global objects
HMI - ViewDesigner - vpd			**Folder**	**View Designer Files**
	(raC-X_YY-VD) raC_Dvc_Stratix.vpd (raC-X_YY-VD) raC_Opr_NetDLR.vpd		VPD	Object faceplate and graphic symbol/launch buttons
HMI FactoryTalk® View Images - png			**Folder**	**FT View ME/SE image files**
	images.png		PNG	FTView ME/SE images
Reference Manuals			**Folder**	**Manuals**
	RAC-RM400B.pdf		PDF	Reference manual
Studio 5000 Logix Designer Files - L5X			**Folder**	**Studio 5000® AOI and RUNG import files**
	raC_*TYPE(OBJECT*_X.YY_RUNG.L5X		L5X	Object rung import
	raC_*TYPE(OBJECT*_X.YY_AOI.L5X		L5X	Object AOI import
	ReadMe.txt		TXT	Explanation of standard vs PlantPAx® files
Videos			**Folder**	**How-to and Operational Overview Videos**
	How_To_Import_and_Configure_*TYPE*_Objects_in_FTViewME.mp4		MP4	How-to Video
	How_To_Import_and_Configure_*TYPE*_Objects_in_FTViewSE.mp4		MP4	How-to Video
	How_To_Import_and_Configure_*TYPE*_Objects_in_LogixDesigner.mp4		MP4	How-to Video
	How_To_Configure_*TYPE*_Objects_in_ViewDesigner.mp4		MP4	How-to Video
	Operational_Overview_of_*OBJECT*_Faceplate.mp4		MP4	Operational Overview video
LIBRARYDeviceLibrary_ReleaseNotes_vX.YY.pdf			PDF	Release Notes
ReadMe.txt			TXT	Explanation of setup.cmd
SetUp.cmd			CMD	Application Code Manager setup script to register library

Visualization Files

Each Add-On Instruction has associated visualization files that provide a common user interface. The Network Device Library supports two HMI options each with their own files supplied:

- FactoryTalk® View ME (Machine Edition)
- FactoryTalk® View SE (Site Edition)
- Studio 5000 View Designer®

FactoryTalk® View Visualization Files

You must import these files in the following order:

- Images (.png files)
- Global Objects(.ggfx file type)
- HMI faceplates (.gfx file type)

File Type Abbreviations	FactoryTalk® View ME	FactoryTalk® View SE	Description
Images (.png)	All .png files in the *HMI FactoryTalk View Images • png* folder. **IMPORTANT:** FactoryTalk® View application renames PNG files when they are imported with a .bmp file extension, but the files retain a .png format.	All .png files in the *HMI FactoryTalk View Images • png* folder. **IMPORTANT:** FactoryTalk® View application renames PNG files when they are imported with a .bmp file extension, but the files retain a .png format.	Common icons that are used in the Global Objects and standard displays for all objects.
Global objects (.ggfx)	(raC-12-ME) Graphic Symbols - Network Device.ggfx	(raC-12-SE) Graphic Symbols - Network Device.ggfx	Graphic symbols or launch buttons used to open faceplate displays from other displays.
	(raC-12-ME) Toolbox - Network Device.ggfx	(raC-12-SE) Toolbox - Network Device.ggfx	Common objects used across multiple device faceplates.
Standard displays (.gfx)	(raC-12_02-ME) precedes name of the display.	(raC-12_02-SE) precedes name of the display.	e.g. (raC-12_02-SE) raC_Dvc_S5700-Faceplate.gfx

Global object files contain Graphic Symbols that are created once and referenced multiple times on multiple displays in an application. When changes are made to a global object, all instances in the application are automatically updated.

Global objects serve two purposes:

- Toolbox files contain common elements that are used to build faceplate displays.
- Graphic Symbols files contain device symbols or launch buttons that you can use to build your application displays. Select the symbol to open the corresponding faceplate display.

Standard display files, commonly called faceplates, provide a common user interface.

Studio 5000 View Designer® Visualization Files

Two Studio 5000 View Designer® project files are supplied which contain faceplates and launch buttons for the Network Device Library. These are split into a project for Stratix® switch objects *(raC_12_02-VD) raC_Dvc_Stratix.vpd* and a project for Device Level Ring Objects *(raC-12_02-VD) raC_Opr_NetDLR.vpd*. These files are found in the *HMI - ViewDesigner - vpd* folder. Inside of the VPD file you will find a the required display files inside of the *User-Defined Screens* folder.

Display Type	View Designer Screen	Description
Screen	Toolbox	Graphic symbols or launch buttons used to open faceplate/pop-up displays from other displays.
Pop-Up	raC_Dvc_ precedes name of the pop-up.	Faceplate display for specific device. e.g. raC_Dvc_S5700_FP

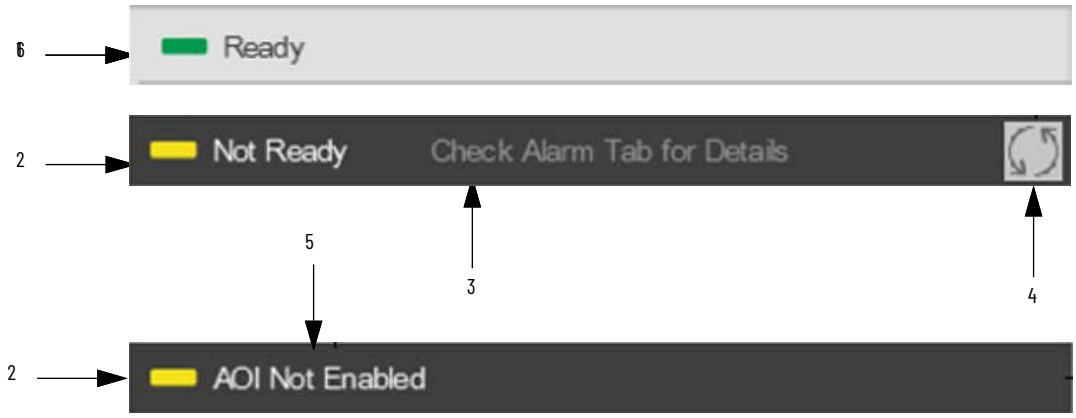
Basic Faceplate Attributes

Faceplates consist of tabs, and each tab consists of one or more pages. The Home tab is displayed when the faceplate is initially opened. The faceplate provides the means for operators, maintenance personnel, engineers, and others to interact with a device or instruction instance, which includes a view of its status and values. Faceplates may also manipulate an instruction through its commands and settings. Select the appropriate icon on the left of the faceplate to access a specific tab. This section provides an overview of the faceplate attributes that are common across the objects. More details are supplied in the individual section for each object.

Common Status Banner

At the top of all device object faceplates there is a common status banner which provides the following information:

- Ready (green LED icon) or Not Ready (yellow LED icon) status
- Faulted (banner will show Not Ready with fault message)
- Communication Loss



Item	Description
1	Ready state displays green LED icon and grey background.
2	Faulted state shows yellow LED icon and Not Ready status.
3	Fault message for latest fault present.
4	Fault reset button
5	Add-On Instruction not enabled status

Faceplate Navigation

All device object faceplates have navigation tabs on the left side of the faceplate. Navigation tabs may vary based on device type. The active tab will show as a light grey, while an inactive tab will show as a dark grey.


Active Tab


Inactive Tab

The common tabs are shown below.


Home Tab


Ring Tab


Port Details Tab

Fault Tab


Switch/Node Tab

Faceplate Revision Notes

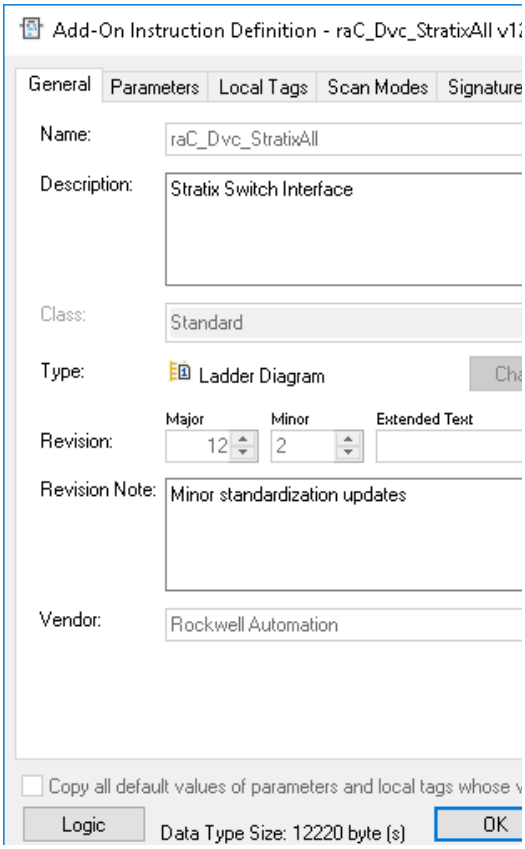
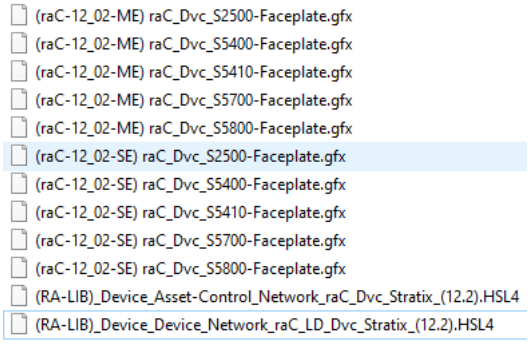
By clicking on the open space near the bottom left corner of the faceplate you can momentarily view revision notes and details of the active faceplate. This may be useful in troubleshooting or when communicating with Rockwell Automation® Tech Support.

Item	Description
1	Click near the bottom right corner to temporarily open up the revision notes dialogue
2	Revision number
3	Faceplate display name
4	Close revision information button

Library Versions

Each library object has a revision x.yy where: x is the Major Revision number and yy is the Minor Revision number. Each release of the library comes with release notes that describe the changes that were made since the last release. You can find the revision number of the object in a number of locations as shown below.

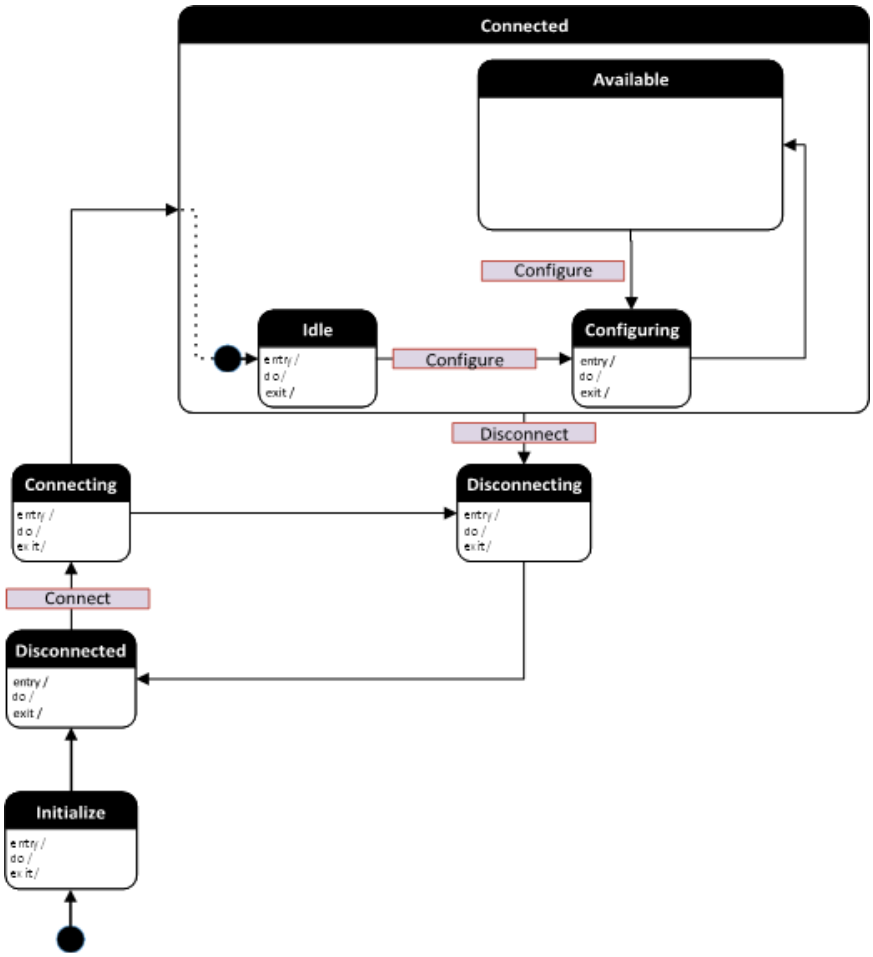
Component	Example
The Add-On Instruction in Logix Designer application has revision information visible when the instruction is selected in the Controller Organizer.	Class: Standard Description: Stratix Switch Interface Revision: v12.2 Revision Note: Minor standardization updates Vendor: Rockwell Automation Data Type Size: 12220 bytes Created: 4/24/2017 7:41:25 AM Created By: Not Available Edited: 7/4/2022 4:56:12 AM Edited By: Not Available Signature ID: <none> Protection Type: Source Key Protection Name: Unknown Protection Protection Permissions: +View, Use

Component	Example
The Add-On Instruction Definition General tab shows the revision number along with basic revision notes. Refer to the release notes for complete revision notes.	
The faceplate in FactoryTalk® View software has revision information visible when the pointer is clicked just inside the lower left corner of the faceplate.	
The revision number is shown in the file names for GFX, VPD, ACM.HSL4, AOI.L5X, and RUNG.L5X files.	

State Model

The following section will discuss the state model for Device Object. The figure below shows the core logic states.

By default, each state is active for a minimum of 256us to allow for evaluation of state outside of the ADO instance in the user program



Interfaces

Device object interfaces are intended to provide the application programmer a class based harmonized interface for interacting with the device object from user code. Standard control interfaces are used for passing device inputs (Inp), device configuration (Cfg), Settings (Set), Commands (Cmd) and Status (Sts).

In the Network Device Library, only a Status (Sts) interface is provided for the raC_Dvc_StratixAll object. This interface called *Ref_Ctrl_Sts* provides status information for the object such as connected, warning and fault statuses. The data-type used is *raC_UDT_ItfAD_Stratix_Sts*. This common interface allows you to easily switch between Stratix® switch devices without having to update user code. For complete information on this interface, please refer to the raC_Dvc_Stratix® section of this manual.

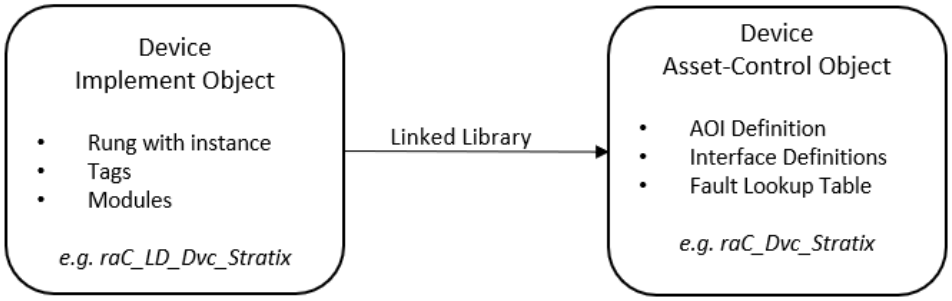
Application Code Manager

Architectural Overview

Device libraries, as with most Application Code Libraries are divided into 2 logical groups: either Asset-Control Object or Device Implement Object.

Asset-Control Objects contain the asset definition of an object and any associated content which belongs to the asset. This includes controller tags, add-on instructions, data types, and attachments such as HMI content and documentation. These are found under the *(RA-LIB) Device > Asset-Control* folder and have names like *raC_Dvc_xxxx* where *xxxx* is the device name.

Device Implement Objects contain an instance of an asset-control object and provide all related configuration of the asset. The Device implement type is the application code (e.g. programming rung). This includes the required controller tags, programs, modules, and FactoryTalk® View ME/SE symbols. These are found under the *(RA-LIB) Device > Device* folder and have names like *raC_LD_Dvc_xxxx* where *xxxx* is the device name. LD stands for ladder logic.



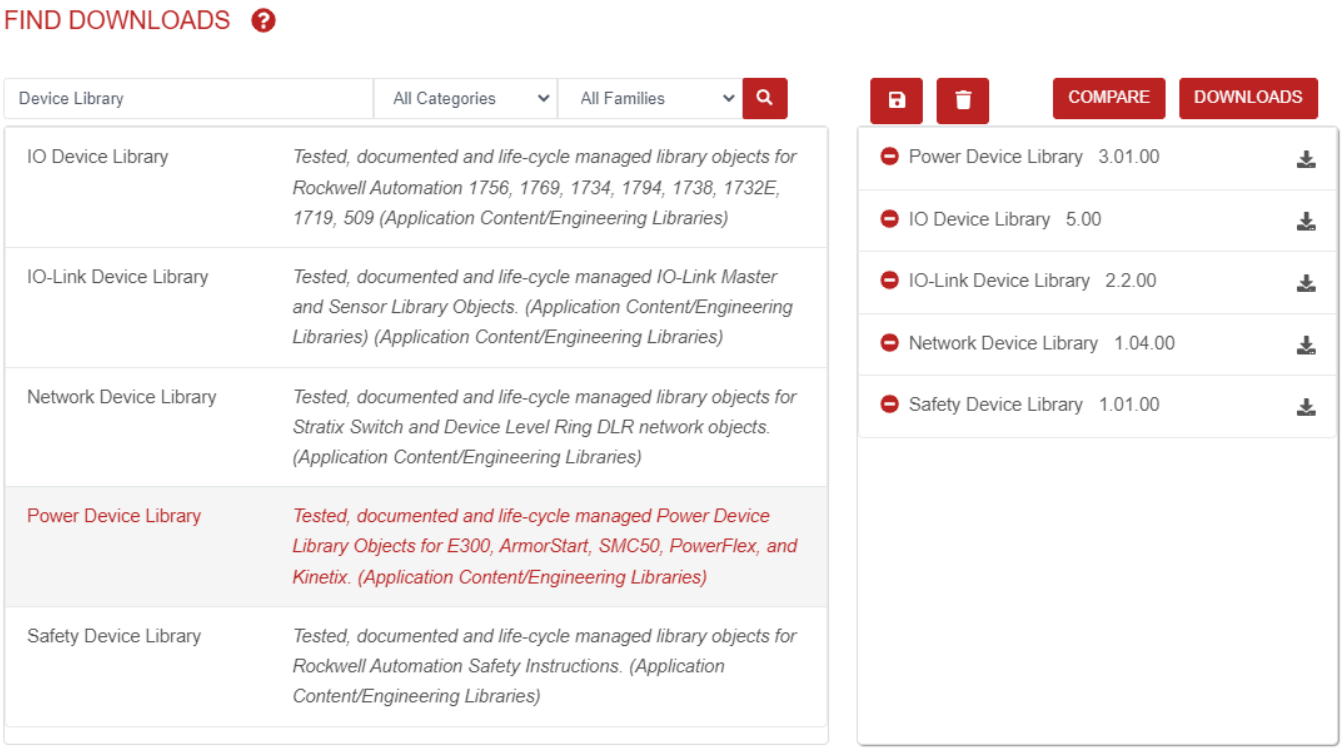
Using the Library

Install the Library

Download the Library

For the latest compatible software information and to download the Rockwell Automation® Library, see the Product Compatibility and Download Center.

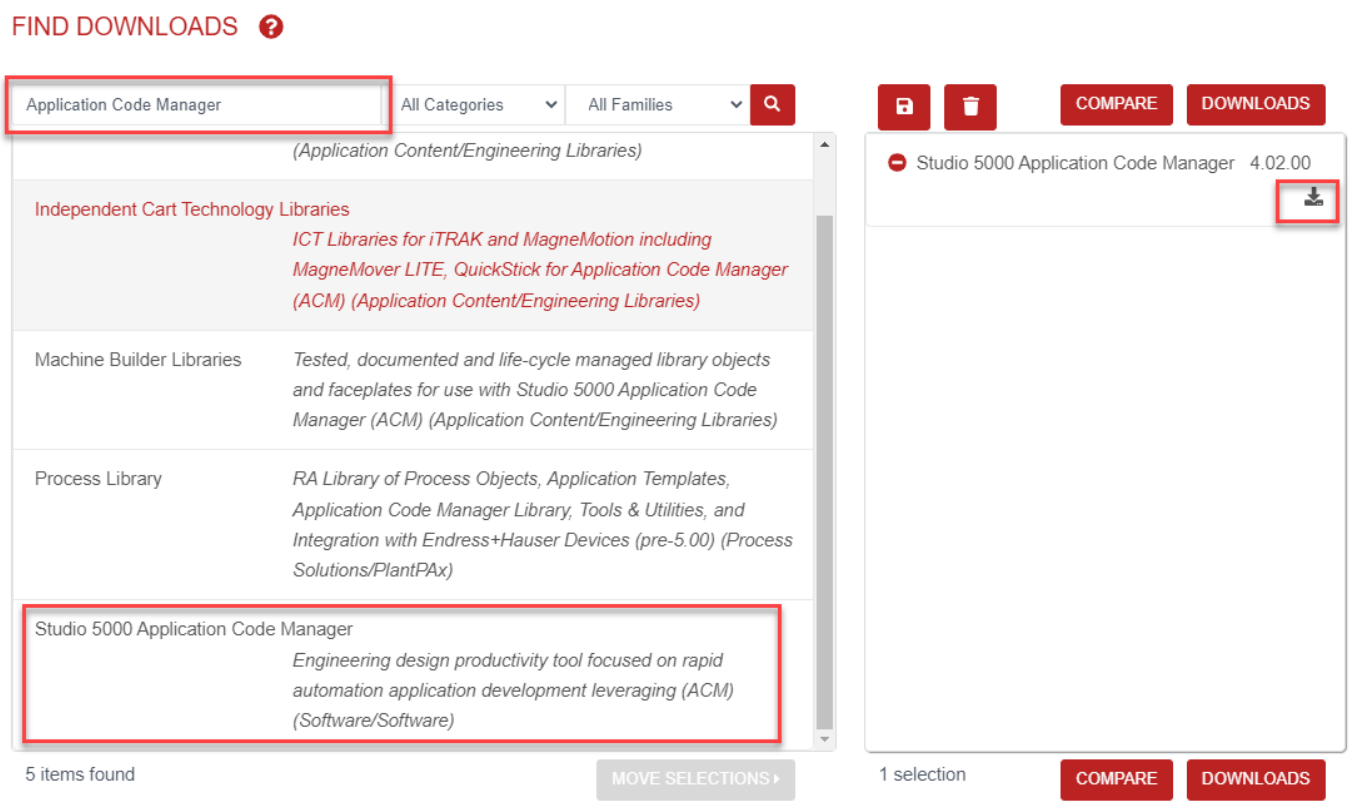
Search “Device Library” or filter on Application Content to quickly find the library.



Download & Install Studio 5000® Application Code Manager

Studio 5000® Application Code Manager is free to install from Rockwell Automation’s Product Compatibility and Download Center.

Search “Application Code Manager” and select the item to download.



Extract the downloaded .zip file by running the *4.xx.00-Studio5000_ACM-DVD.exe* executable file. This will extract a new folder containing a *Setup.exe* file which can be run to begin product installation.

Follow the prompts from the splash screen until installation is complete. Note that a SQL server is required for Application Code Manager. SQL Server Express is offered for free and is included in the Application Code Manager installer.

Register Libraries in Studio 5000® Application Code Manager

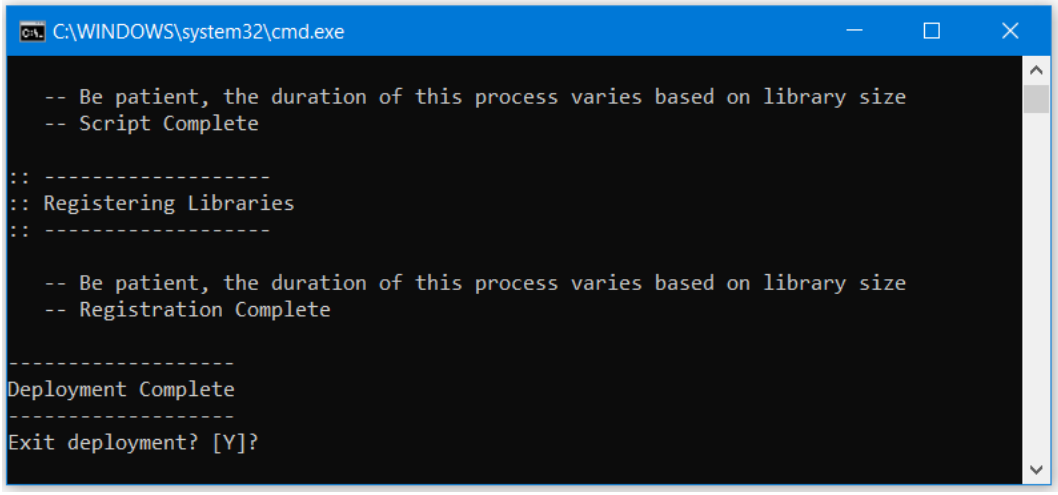
It is recommended that you use Studio 5000® Application Code Manager or the Studio 5000® "Import Library Objects" Plug-In Wizard to import device library objects into a Logix 5000 controller project. To use the library in Application Code Manager you must first register the libraries.

Using Studio 5000® Application Code Manager is not mandatory although it is highly recommended to reduce the likelihood of configuration errors and simplify the workflow. Alternatively, you can import the RUNG.L5X files directly into a Studio 5000® project.

The *Lite* version of Studio 5000® Application Code Manager is free of charge and can be downloaded from the Product Compatibility and Download Centre. None of the features included in the Standard (paid) version are required to use Device Object Libraries.

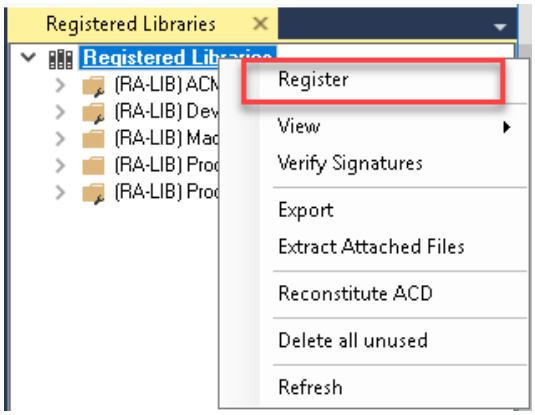
Register Complete Library Automatically

To automatically register the entire library, find and run the *setup.cmd* file in the root folder of the library files. You will see a windows console appear as the script runs. When it is complete it will display “Deployment Complete”. Enter “Y” to exist the console.



Register Individual Library Objects Manually

As an alternative to registering the entire library using the setup.cmd script, you can manually register one or multiple library objects in Studio 5000® Application Code Manager. Open up Application Code Manager and view the Registered Libraries panel on the right. Right-click on *Registered Libraries* and select *Register*. Browse to the *ApplicationCodeManagerLibraries* folder within the library files and select any HSL4 files that you would like to register. Note you may select more than one at a time. Once you complete registering the desired objects they will be shown under the *(RA-LIB) Device* solution folder.



Message Paths

CIP message paths must be defined as strings in all DLR objects to communicate with the network. This includes the following parameters:

Instruction	Message Path Parameter	Description
raC_Opr_NetDLR1	Ref_Path_to_DLR	Path to any module on Ring
raC_Opr_NetDLR1_Lite	Ref_Path_to_DLR	Path to any module on Ring
raC_Opr_NetDLR3_RingOfSwitches	Ref_Paths.Ref_Ring1_Path	Path to any module on Ring 1
	Ref_Paths.Ref_Ring2_Path	Path to any module on Ring 2
	Ref_Paths.Ref_Ring3_Path	Path to any module on Ring 3
	Ref_Paths.Ref)Switch_Paths[10]	CIP Paths to Stratix Switches

CIP paths are written using a combination of numbers for ports and slots from the current device to the destination device. For DLR paths you can point the message to *any* module on the Ring. For simplicity in most cases we use the most immediate module on the ring such as the 1756-EN2TR module, embedded Ethernet port, or ETAP device.

Message paths generally follow three possible structures:

- Controllers with an in-chassis Ethernet Module or ETAP: 1,Slot#,2,IPAddress
  - 1: Backplane from this controller
  - Slot#: Slot number which the in-chassis Ethernet module is located
  - 2: Ethernet Network
  - IPAddress: IP Address of any device on the network. Generally this is set to the IP address of the Ethernet module (e.g. 1756-En2TR) or ETAP which is first connected to the DLR network.
- Controllers with an Embedded DLR Ethernet Ports: 2,IPAddress
  - 2: Ethernet Network
  - IPAddress: IP Address of any device on the network. Generally this is set to the IP address of the the controller's embedded DLR ports.
- CompactLogix 5380 controllers with Ethernet Ports in Dual-IP mode: 3,IPAddress or 4,IPAddress
  - 3 or 4: Ethernet Network. Use 3 for port A1; Use 4 for port A2.
  - IPAddress: IP Address of any device on the network. Generally this is set to the IP address of the the controller's embedded DLR ports.

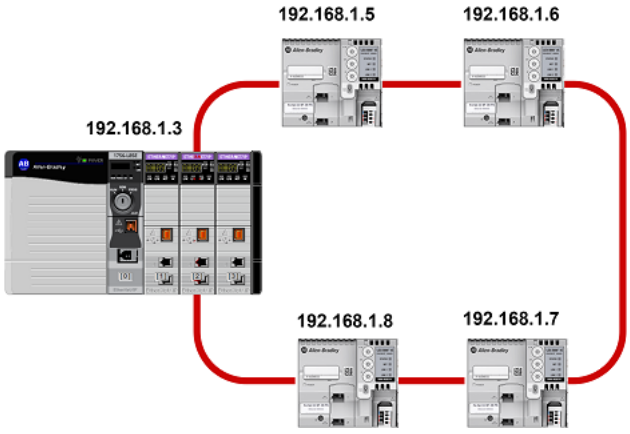
Examples are shown below.

Message Path Example 1 - ControlLogix® with Dual-Port Ethernet Module

For ControlLogix® with EN2TR/EN3TR/EN4TR module with IP address 192.168.1.3 in slot 2 directly connected to the DLR network:

Message Path: 1, 2, 2, 192.168.1.3

Item	Description
1	Backplane of this controller 1756-L8x
2	Slot 2 - 1756-EN2TR Ethernet module connected to DLR network
2	Ethernet Network
192.168.1.3	IP Address of 1756-EN2TR ethernet module

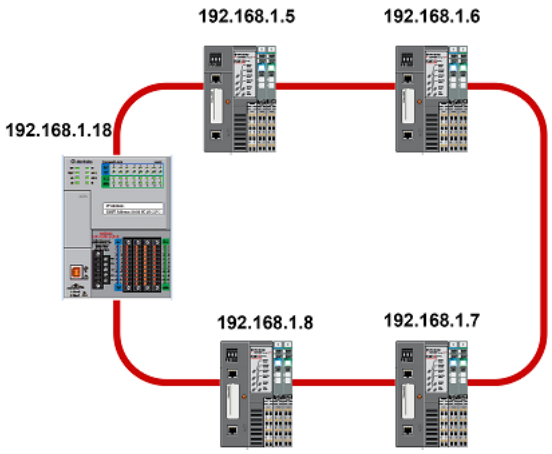


Message Path Example 2 - CompactLogix® 5370 with Dual-Ports

For CompactLogix® with embedded dual Ethernet Ports and an IP address of 192.168.1.18 directly connected to the DLR network:

Message Path: 2, 192.168.1.18

Item	Description
2	Ethernet Network (Direct from embedded Ethernet port)
192.168.1.18	IP Address of CompactLogix ®Embedded Ethernet port

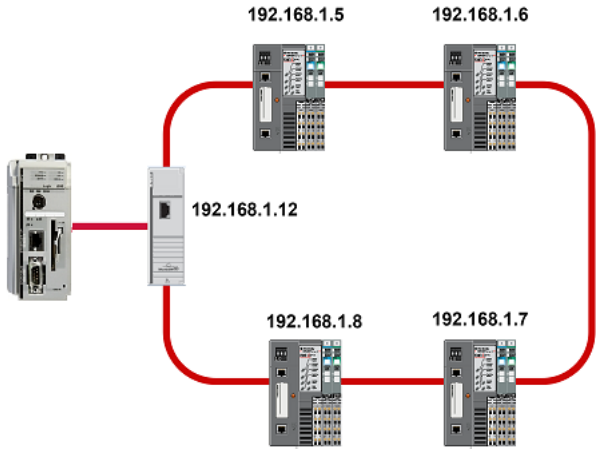


Message Path Example 3 - CompactLogix® 5370 with ETAP

For a legacy CompactLogix® with a single Ethernet Port where an ETAP with IP address of 192.168.1.12 is used to connect to the DLR network:

Message Path: 1,1,2, 192.168.1.12

Item	Description
1	Backplane of this controller
1	Slot 1 - Ethernet port is always in slot 1
2	Ethernet Network (Direct from embedded Ethernet port)
192.168.1.12	IP Address of ETAP device

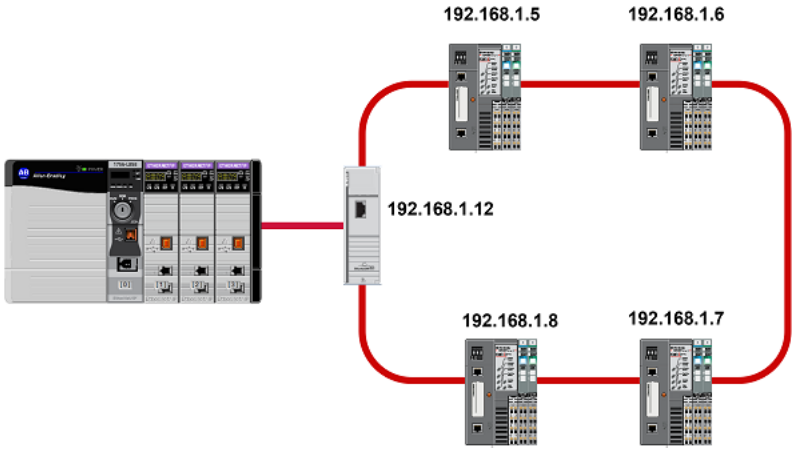


Message Path Example 4- ControlLogix® with Single-Port Ethernet Module

For a ControlLogix® with a single-port Ethernet module (1756-EN2T/1756-ENBT) in slot 3 and an ETAP with IP address of 192.168.1.12 is used to connect to the DLR network:

Message Path: 1,3,2, 192.168.1.12

Item	Description
1	Backplane of this controller
3	Slot 3- EN2T Module Slot
2	Ethernet Network
192.168.1.12	IP Address of ETAP device

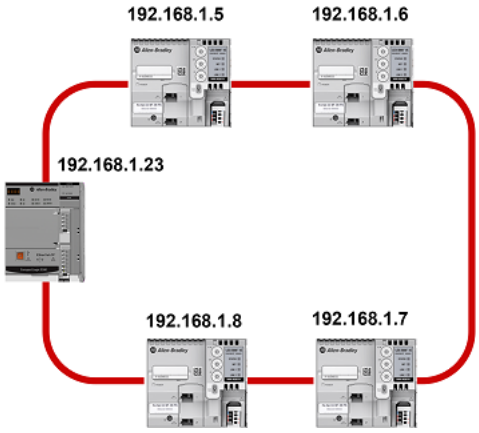


Message Path Example 5 - CompactLogix® 5380 with Ports in DLR Mode

For a CompactLogix® with the Ethernet ports set to DLR mode with an IP of 192.168.1.23 connected directly to the DLR network:

Message Path: 2, 192.168.1.23

Item	Description
2	Ethernet Network
192.168.1.23	IP Address CompactLogix®



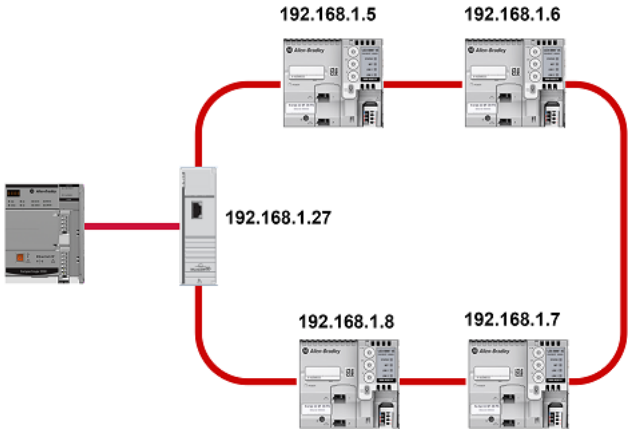
Message Path Example 6- CompactLogix® 5380 with Ports in Dual IP Mode

For a CompactLogix® with the Ethernet ports set to Dual IP mode connected to the DLR network via an ETAP with an IP of 192.168.1.27:

Message Path using port A1: 3, 192.168.1.27

Message Path using port A2: 4, 192.168.1.27

Item	Description
3 or 4	Embedded Ethernet Network. Use 3 for port A1. Use 4 for port A2.
192.168.1.27	IP Address CompactLogix®



Importing Logic into Studio 5000® Projects

There are multiple methods to using the logic in a Studio 5000® application. For projects that are being developed from scratch using Studio 5000® Application Code Manager along with other Application Code Libraries such as the PlantPAx® Process Objects Library or the Machine Builder Library, you can continue to use the Device Object Libraries in Application Code Manager. For existing applications where devices are being added, it is recommended to use the Studio 5000® Plug-In "Import Library Objects" Wizard. Alternatively you can import the RUNG.L5X files into your program and configure them manually.

In the Library there is a folder named *Videos* which contains many How-To and Operational Overview Videos which walk step-by-step through each process. You can refer to the following videos for this section:
"How_To_Import_and_Configure_Stratix_Switch_Device_Objects_in_Logix_Designer"
"How To Import and Configure Single DLR Object Components in Logix Designer"
"How To Import and Configure Three DLR Object Components in Logix Designer"

It is not recommended to simply import the AOI.L5X files and attempt to build your own logic rung. Doing so will increase the likelihood of configuration errors and likely miss logic that is required outside of the Add-On Instruction.
AOI files should only be imported when updating an existing application from a previous version of a Device Object Library to a newer one.

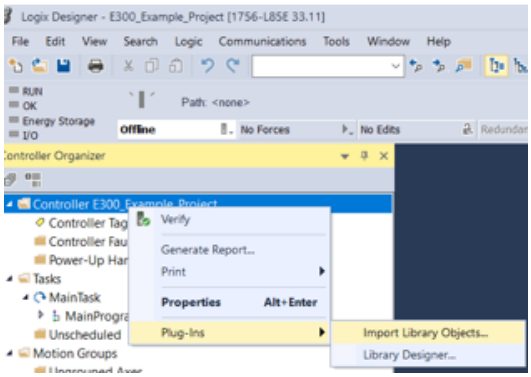
Below is a table to capture recommendations on when to use which tool or workflow when importing and configuring device objects.

Tool/Workflow	Description of when to use	Software Requirements
Studio 5000® Application Code Manager (full application)	Project is developed from scratch using Application Code Manager along with PlantPAx® or Machine Builder libraries.	Studio 5000 Logix Designer® Studio 5000® Application Code Manager (Lite)
Studio 5000® Plug-In "Import Library Objects" Wizard	Application Code Manager is installed but not required for the entire project. Application has already been developed but some Device Objects need to be added.	Studio 5000 Logix Designer® Studio 5000® Application Code Manager (Lite)
Import RUNG.L5X File	Application Code Manager is not installed. Application has already been developed but some Device Objects need to be added. Familiar with rung import workflow.	Studio 5000 Logix Designer®
Import AOI.L5X File	Updating existing application that contains an older version of a Device Object AOI.	Studio 5000 Logix Designer®

Import Library Objects Wizard

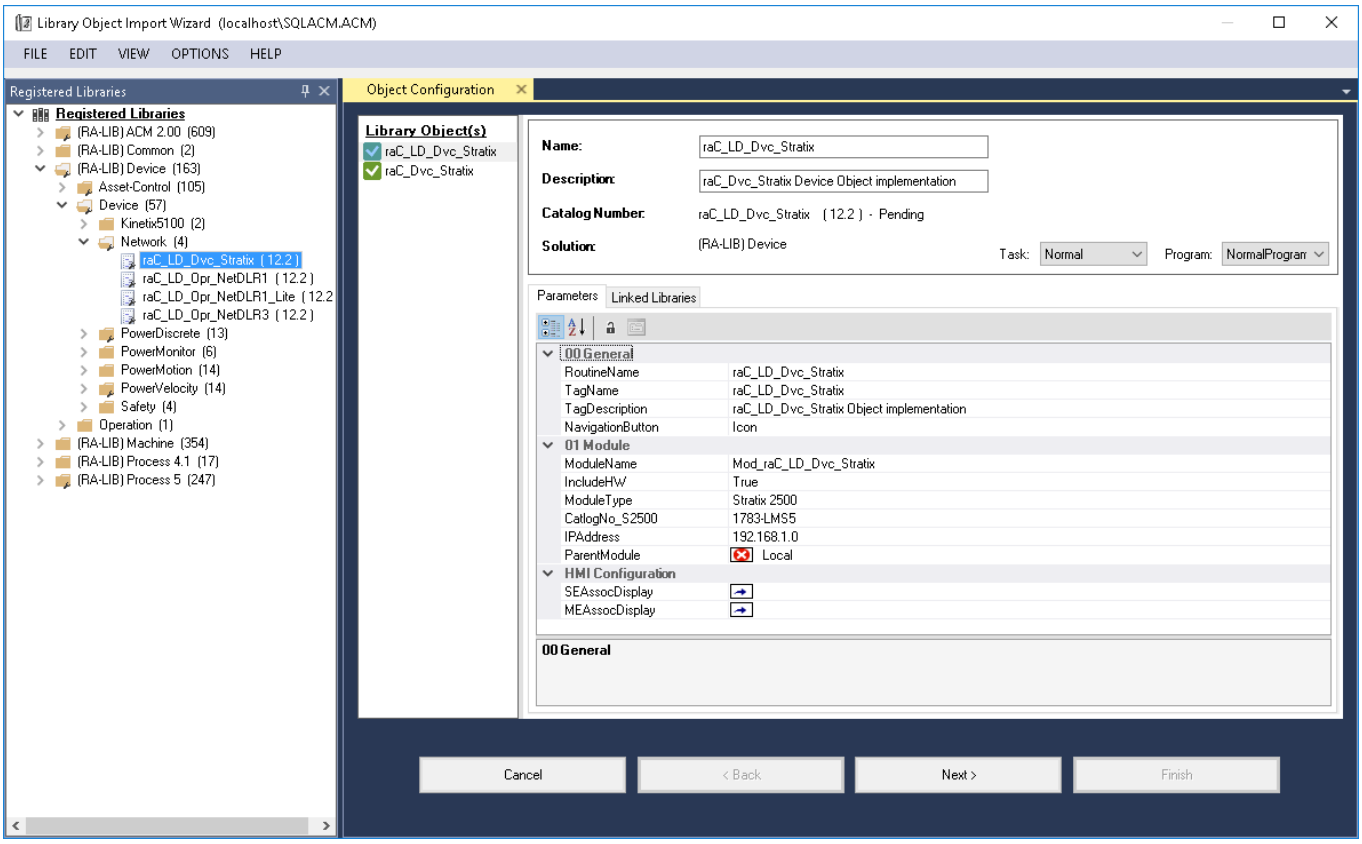
The most simple way to import a Device Object into an existing application is to use the Studio 5000® Plug-In "Import Library Objects" wizard. This plug-in requires Application Code Manager to be installed but does not require it to be open or have a project created.

Right click on an item (e.g. Controller, Task, Program, etc) in the Controller Organizer and select *Plug-Ins* > *Import Library Objects...*



This will launch a small wizard version of Application Code Manager inside of your Studio 5000 Logix Designer® Project. In the Registered Libraries panel on the left, find your desired object under *Registered Libraries* > *(RA-LIB) Device* > *Device* and drag it into the Library Object(s) list in the Object Configuration Tab.

Stratix/Configuration



Perform the following configuration:

Parameters - 00 General:

- Enter a **name** and **description**. Maximum name length can be 22 characters. Note that other parameters such as the RoutineName, TagName, etc will auto-complete based on these fields.
- Assign the **Task** and **Program**.

Parameters - 01 Module:

- You can choose to automatically create the Stratix® switch module in your program if not already included by setting **IncludeHW** to True.
- Assign the desired **ModuleName**, **ModuleType**, **CatalogNo** for the hardware.
- Assign a unique **IPAddress.**
- Set the **ParentModule** to the name of the Ethernet communications adapter that the switch is connected to. If using the embedded Ethernet port on a 5580 controller then leave this as *Local*. Note that this may show a red 'X' next to the name even though the program will be correctly generated and compile.

Parameters - HMI Configuration:

- The HMI Configuration options are not used in the Plug-In Wizard and can be ignored.

Linked Libraries:

- Click next or click on the *Linked Libraries* tab. Click the *Auto Create* button to automatically create all of the required linked libraries.

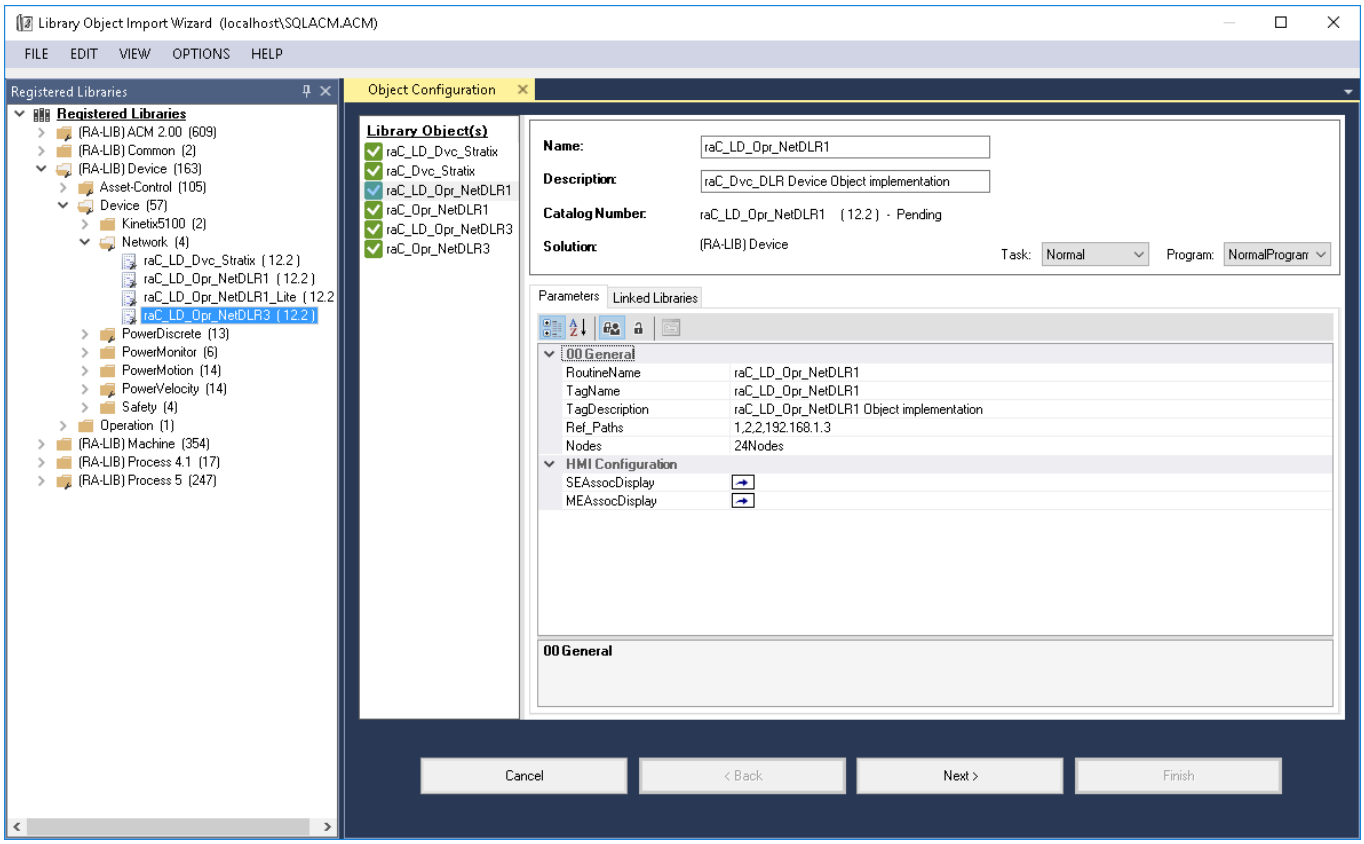
You can manually create new linked libraries or point to existing linked libraries if necessary. You may need to do this if you would like to use an older version of library objects when multiple versions are installed in Application Code Manager.

Complete the Import:

- On the following screen you can select the desired Merge Actions. Generally these can be left with the default actions.
  - Add: used when AOIs don't previously exist in application
  - Overwrite: usually preferred. Used when AOIs previously exist but may or may not be the same revision.
  - Use Existing: used when AOIs previously exist in the application and you do not wish to overwrite the existing items.
- Click next and you can now see any new logic and modules that will be created.
- Click Finish to complete the import.

DLR Configuration

DLR configuration will vary slightly depending on whether DLR1, DLR1_Lite or DLR3 objects are used.



Parameters - 00 General:

- Enter a **name** and **description**. Maximum name length can be 22 characters. Note that other parameters such as the RoutineName, TagName, etc will auto-complete based on these fields.

- Assign the **Task** and **Program**.
- Set the **Ref_Paths** parameter to the CIP path of the DLR node (e.g. 1,2,2,192.168.1.3). See Message Paths for more information and examples on assigning this string.
- Note that the DLR3 object can have paths to a maximum of three rings as well as paths to two switches.

Parameters - HMI Configuration:

- The HMI Configuration options are not used in the Plug-In Wizard and can be ignored.

Linked Libraries:

- Click next or click on the *Linked Libraries* tab. Click the *Auto Create* button to automatically create all of the required linked libraries.

You can manually create new linked libraries or point to existing linked libraries if necessary. You may need to do this if you would like to use an older version of library objects when multiple versions are installed in Application Code Manager.

Complete the Import:

- On the following screen you can select the desired Merge Actions. Generally these can be left with the default actions.
  - Add: used when AOIs don't previously exist in application
  - Overwrite: usually preferred. Used when AOIs previously exist but may or may not be the same revision.
  - Use Existing: used when AOIs previously exist in the application and you do not wish to overwrite the existing items.
- Click next and you can now see any new logic and modules that will be created.
- Click Finish to complete the import.

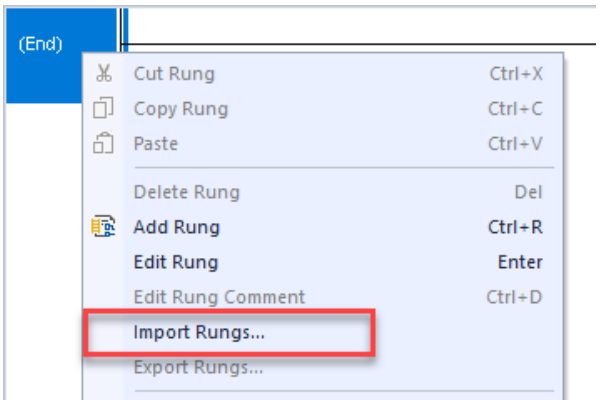
Import Rung Logic

An Add-On Instruction is defined once in each controller project, and can be instantiated multiple times in your application code. To use pre-engineered logic, import each desired RUNG.L5X file into a controller project. The process is similar for both Stratix® switch and DLR objects.

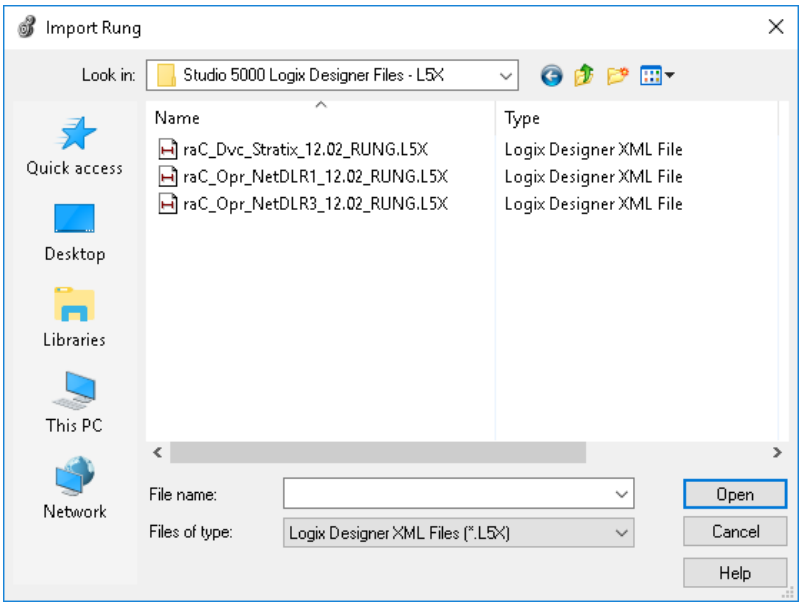
1. In the Studio 5000 Logix Designer® application, open a new or existing project.

IMPORTANT Add-On Instruction definitions can be imported, but not updated, online.

2. Choose or create a new ladder routine to open. Right-click in the routine ladder and choose Import Rungs...



3. Select the desired RUNG and Select Import. The file will have a name like *raC_Dvc_Stratix_12.02_RUNG.L5X*.



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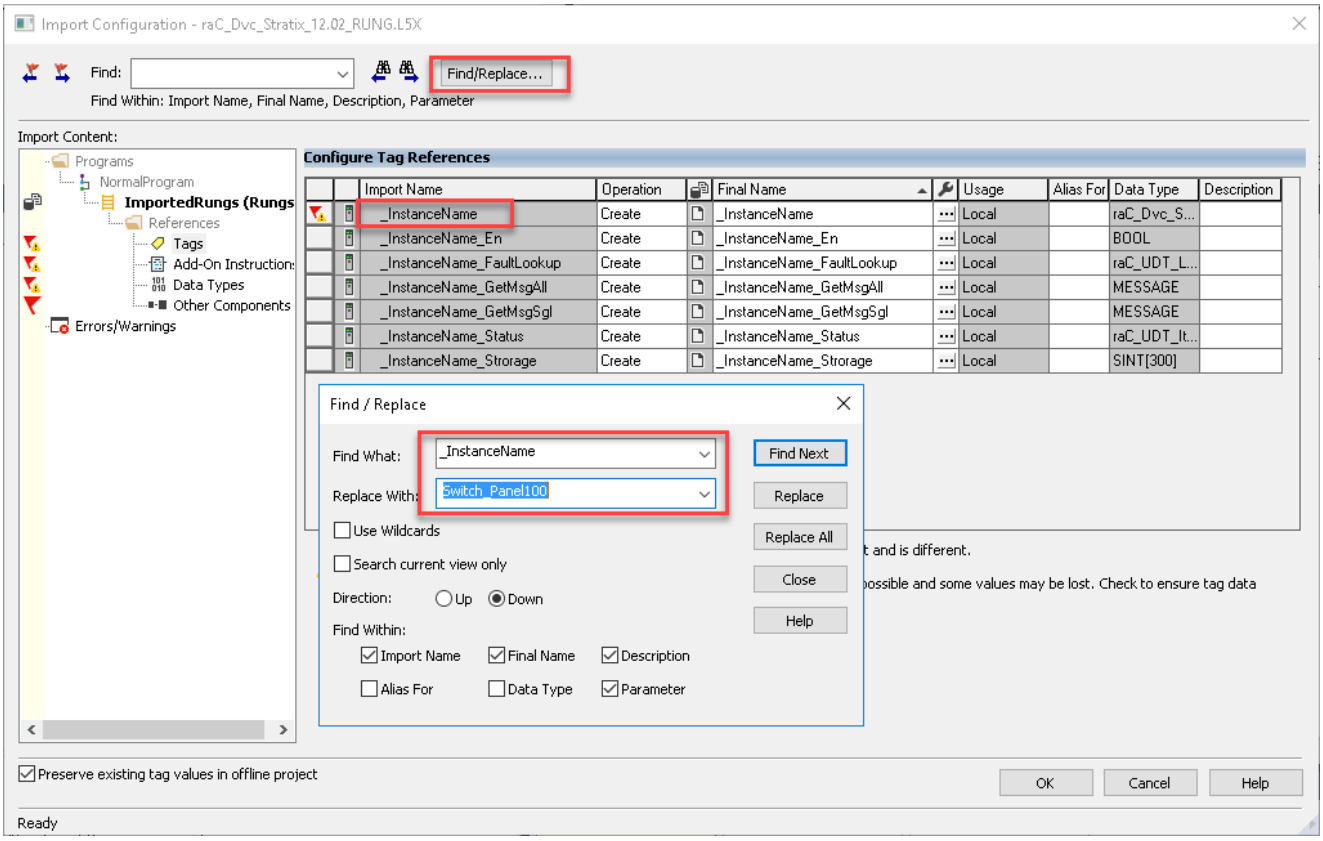
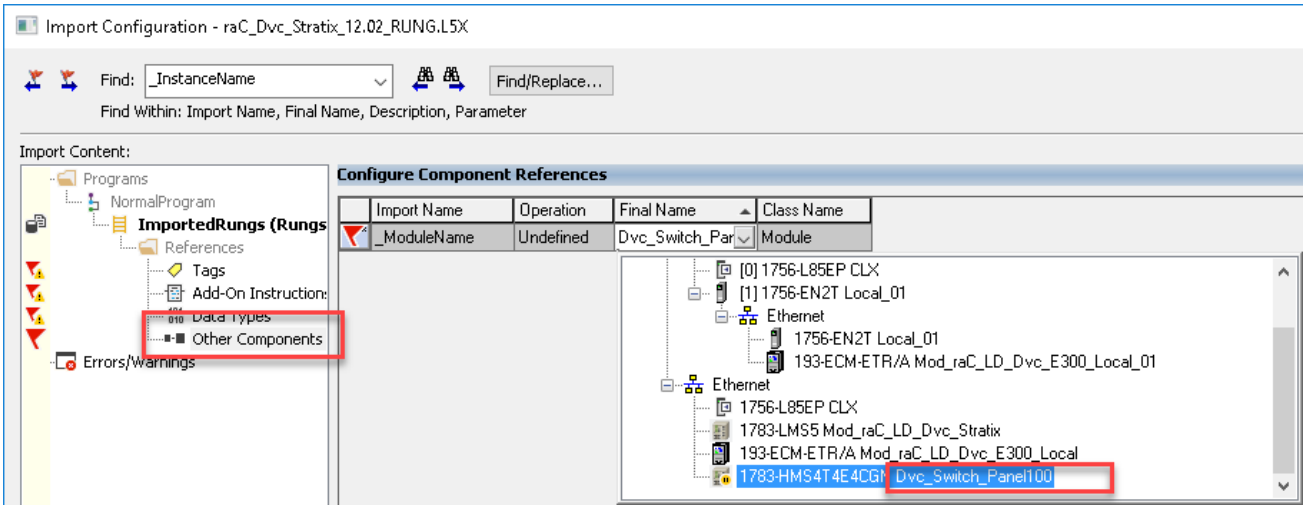
Both "RUNG" and "AOI" .L5X files are provided. Import the RUNG file to get all required additional tags, data types, and message configurations.

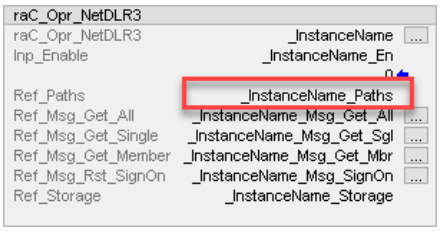
4. An *Import Configuration* dialogue window will open and display generic Import names which include "_InstanceName". Click the *Find/Replace...* button and replace all instances of "_InstanceName" with your desired device name (e.g. "Switch_Panel100").



5. For Stratix® switch objects, click on the *Other Components* section to set the ModuleName. Type or browse to the name of the Stratix® Switch module. In this example our module is called “Dvc_Switch_Panel100”. This step is not required for DLR objects.



6. The rung will now be imported into your ladder routine.
7. For DLR objects you will need to manually set-up the paths to the DLR rings (and up to two switches for DLR3). In the imported rung, right-click on the *_InstanceName_Paths* tag and select *monitor.*



Name	Value	Description
_InstanceName_Paths	{...}	
_InstanceName_Paths.Ref_Ring1_Path	'1,1,2,192.168.10.1'	Path to a module on Ring 1
_InstanceName_Paths.Ref_Ring2_Path	'1,2,2,192.168.20.1'	Path to a module on Ring 2
_InstanceName_Paths.Ref_Ring3_Path	'1,3,2,192.168.30.1'	Path to a module on Ring 3
_InstanceName_Paths.Ref_Switch1_Path	'1,4,2,192.168.1.20'	CIP Path to Stratix Switch 1
_InstanceName_Paths.Ref_Switch2_Path	'1,4,2,192.168.1.21'	CIP Path to Stratix Switch 2

See Message Paths for more information and examples on assigning this string.

Using Studio 5000 View Designer®

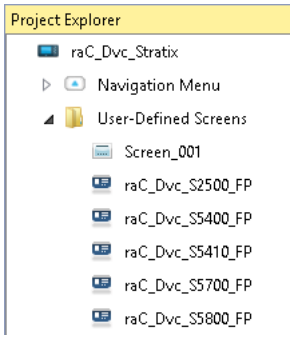
Using Studio 5000 View Designer® Project Files

Studio 5000 View Designer® may be used for HMI development for PanelView™ 5000 applications. Open up your Studio 5000 View Designer® project alongside a second application instance running the required VPD file in the library folder *HMI - ViewDesigner - vpd*.

In the Library there is a folder named *Videos* which contains many How-To and Operational Overview Videos which walk step-by-step through each process. You can refer to the following videos for this section:
"How_To_Import_and_Configure_Stratix_Switch_Device_Objects_in_ViewDesigner"
"How To Configure DLR Object Components in View Designer"

You will notice there are two screens available under the *User-Defined Screens* folder:

- Screen_001: This has the graphic symbol launch buttons for the faceplate.
- raC_Dvc_xxxxx_FP: This is a faceplate pop-up screen.

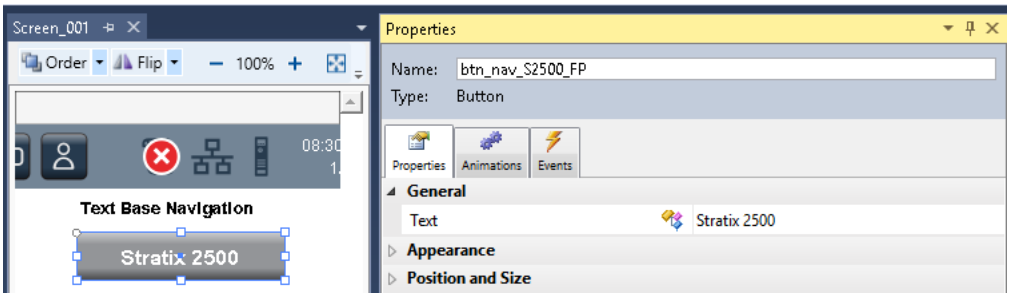


To include these files in your project, perform the following steps:

- Copy the entire faceplate _FP screen from the supplied VPD project to your project application.
- Open the Screen_01 screen and copy the desired graphic symbol and paste it into a screen in your project application.

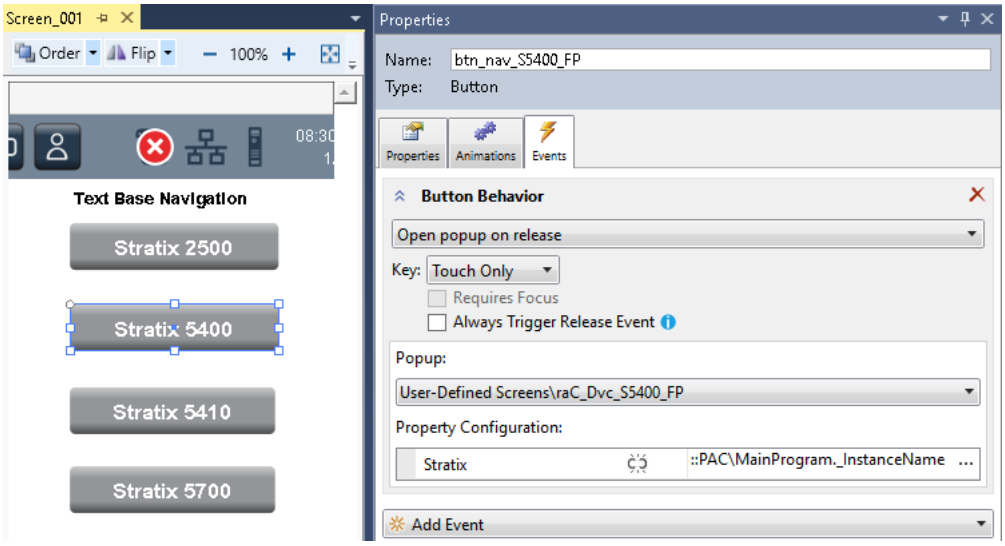
Configuring View Designer Objects

For text based buttons, you can assign the text shown on the button by highlighting the button. View the *Properties* tab and modify the *General* > *Text* parameter as required.



To link the launch button to the faceplate, highlight the button and view the *Events* tab of within the *Properties* pane. If not already configured, set an Event to *Open popup on release* with the following settings:

- Key: Touch Only
- Popup: Select desired faceplate screen
- Stratix/AOI_Tag: Browse to AOI backing tag for the device object in your controller file



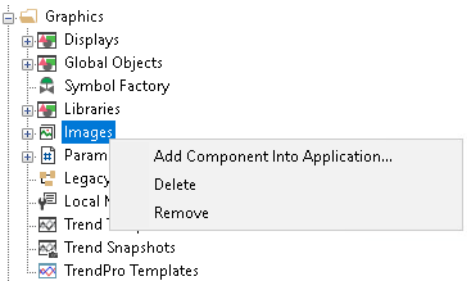
Using FactoryTalk® View Studio

Import FactoryTalk® View Visualization Files

There are several components to import for the visualization files. You import files from the downloaded Rockwell Automation® library files via FactoryTalk® View ME or FactoryTalk® View SE. The workflow is the same for both FactorTalk View ME and SE.

In the Library there is a folder named *Videos* which contains many How-To and Operational Overview Videos which walk step-by-step through each process. You can refer to the following videos for this section:
"How_To_Import_and_Configure_Stratix_Switch_Device_Objects_in_FTViewME"
"How_To_Import_and_Configure_Stratix_Switch_Device_Objects_in_FTViewSE"
"How To Import and Configure DLR Object Components in FTView ME"
"How To Import and Configure DLR Object Components in FTView SE"

All image and display items can be imported either by right-clicking in FactoryTalk® View on the Graphic sub-folder (e.g. Displays, Global Objects, Images) or simply dragging and dropping the files into the application.



Import files in this order:

1. Import HMI Images files.

   Select all the images in the *\HMI FactoryTalk® View Images - png* folder and Open.

2. Import Global Object files

   Select the global object (.ggfx) files from the *\HMI - FactoryTalk® View ME\Global Objects - ggfx* or *\HMI - FactoryTalk® View SE\Global Objects - ggfx* folder

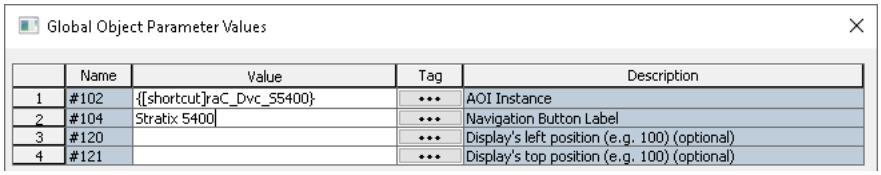
3. Import HMI Faceplates

Select the faceplate (.gfx) files from the *\HMI - FactoryTalk® View ME\Displays - gfx* or *\HMI - FactoryTalk® View SE\Displays - gfx* folder

Configuring FactoryTalk® View Objects

Once the files have been imported into the FactoryTalk® View Studio project, you can begin using them in your application. Open the *Global Display (raC-12-ME) Graphic Symbols - Network Device*. Copy the desired launch button style and paste it into a display in your application where you would like to open the faceplate. For more information on graphic symbols, refer to the Graphic Symbols section of the specific device type chapter in this manual.

To configure the graphic symbol launch button, right-click and select *Global Object Parameter Values*. The Global Object Parameter value for the Backing Tag (#102) is mandatory while the custom Navigation Button Label (#104) and display position values (#120, #121) are optional. If you do not enter in a custom text label it will by default show the AOI's .@Description field. You can browse for the tag in your controller project by clicking '...' or manually type them in. These parameters may vary depending on the graphic symbol used, please refer to the Graphic Symbols section of the device type for detailed information.



These Global Object Parameter Values are automatically configured when you use Studio 5000® Application Code Manager to design and configure your project. Refer to Using Studio 5000® Application Code Manager for more information.

Library Upgrades

Add-On Instruction Upgrades

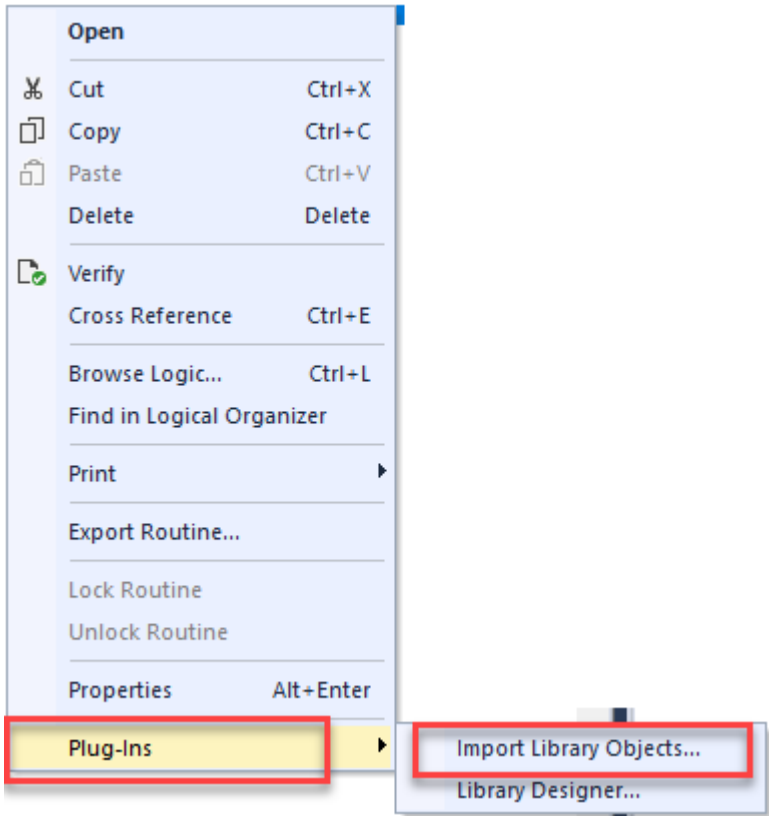
There are two methods to upgrading existing device object add-on instructions in a project. You can do this either by using the ***Studio 5000® Plug-In Import Library Objects Wizard*** or by importing ***individual add-on instruction AOI.L5X files***. Both methods are described in the following sections.

Note that all updates to Add-On Instructions must be done with Studio 5000 Logix Designer® in OFFLINE mode and a download to the controller is required.

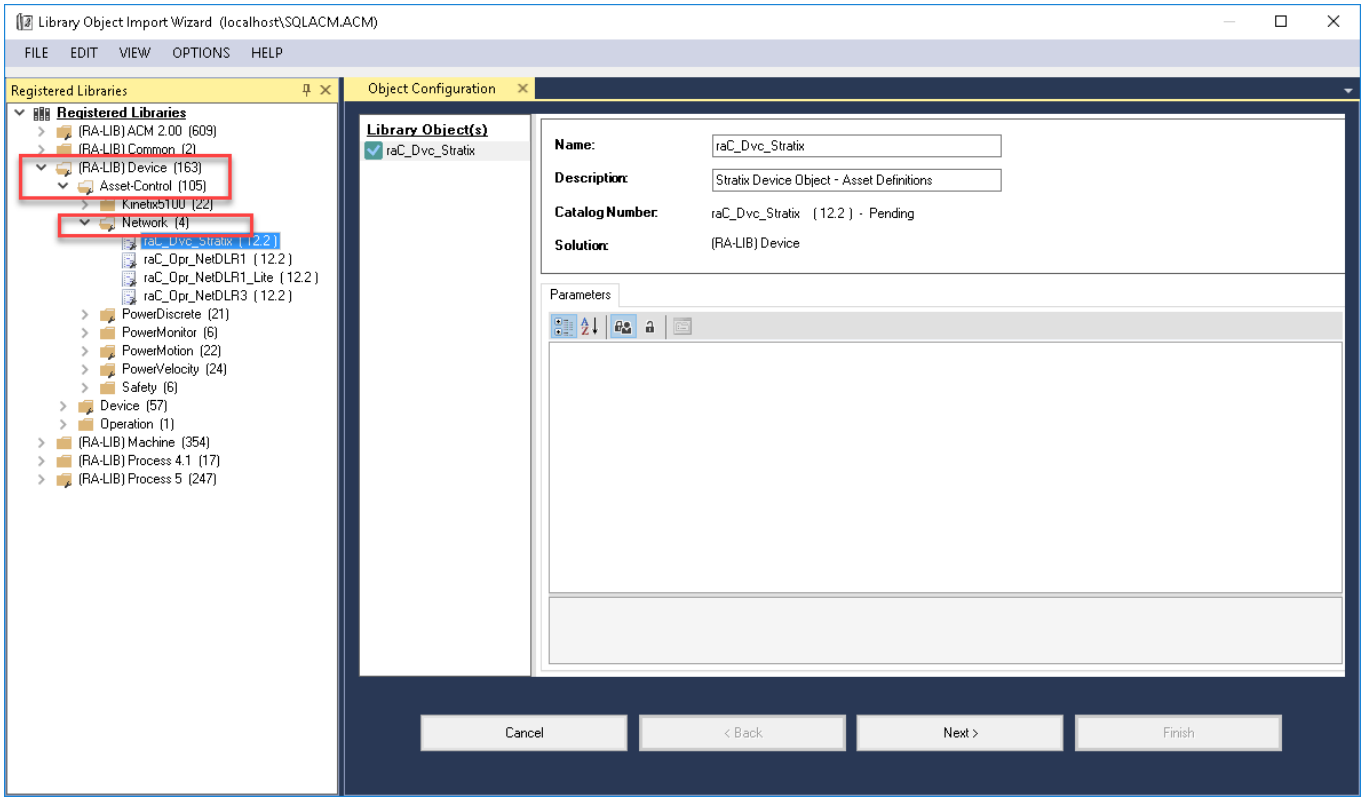
Upgrades Using Studio ºZZZ/Plug•In to Import Library Objects

If Studio 5000® Application Code Manager is installed, you can use the Studio 5000® Plug-In *Import Library Objects* Wizard to update existing Add-On Instructions. For complete information on Studio 5000® Application Code Manager, refer to the section Using Application Code Manager.

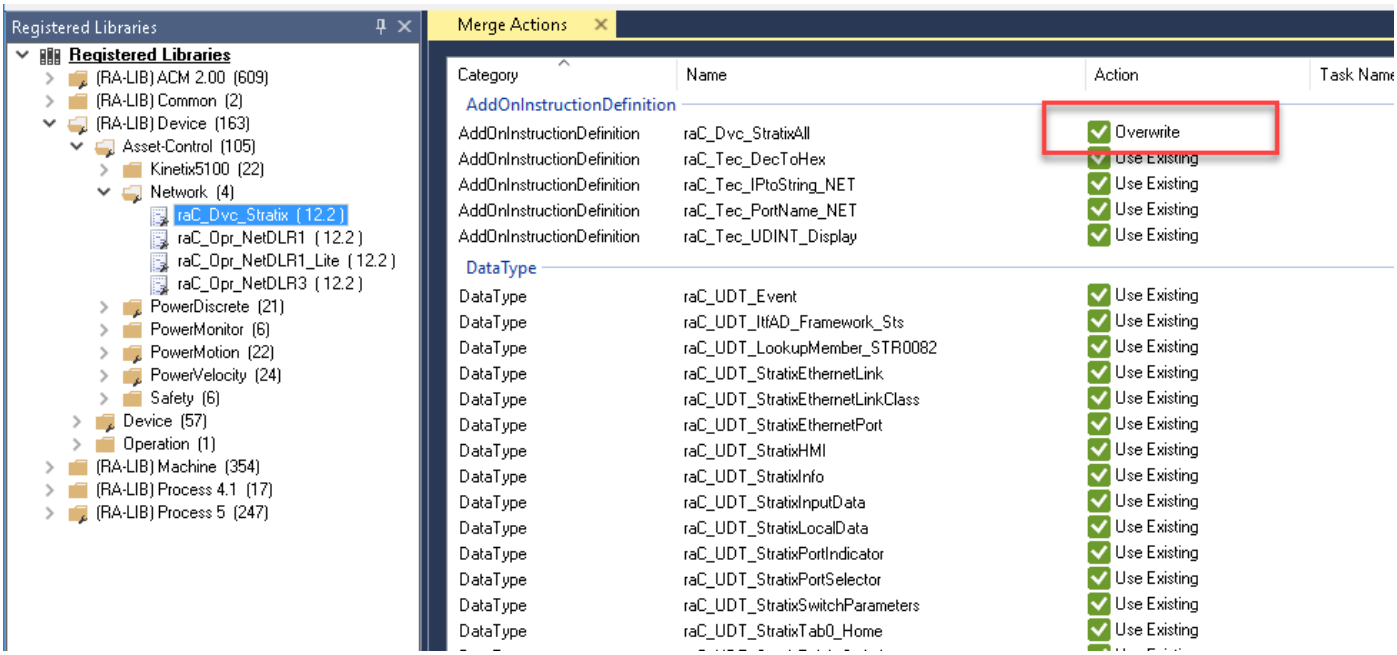
Right-click in your controller organizer or within a routine to access *Plug-Ins* > *Import Library Objects...*



The *Library Object Import Wizard* dialogue window will open. Under *Registered Libraries* expend *(RA-LIB) Device* > *Asset-Control* and find the desired object and version. Drag the object into the *Object Configuration* window on the right.



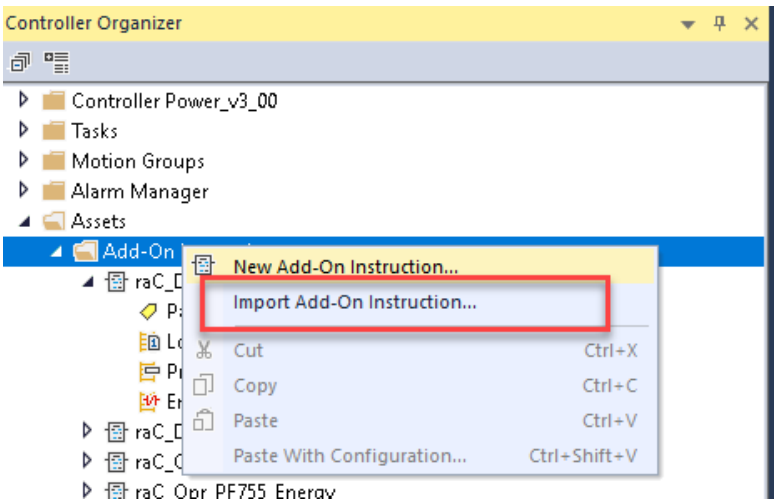
In the *Merge Actions* window, select the *Action* for the *AddOnIntructionDefinition* to *Overwrite*. This will update any existing instance of the object to the newer version. You may also choose to overwrite any other DataTypes or Tags. Review the release notes of the latest library release to understand what may be impacted. Click next and finish to complete the process.



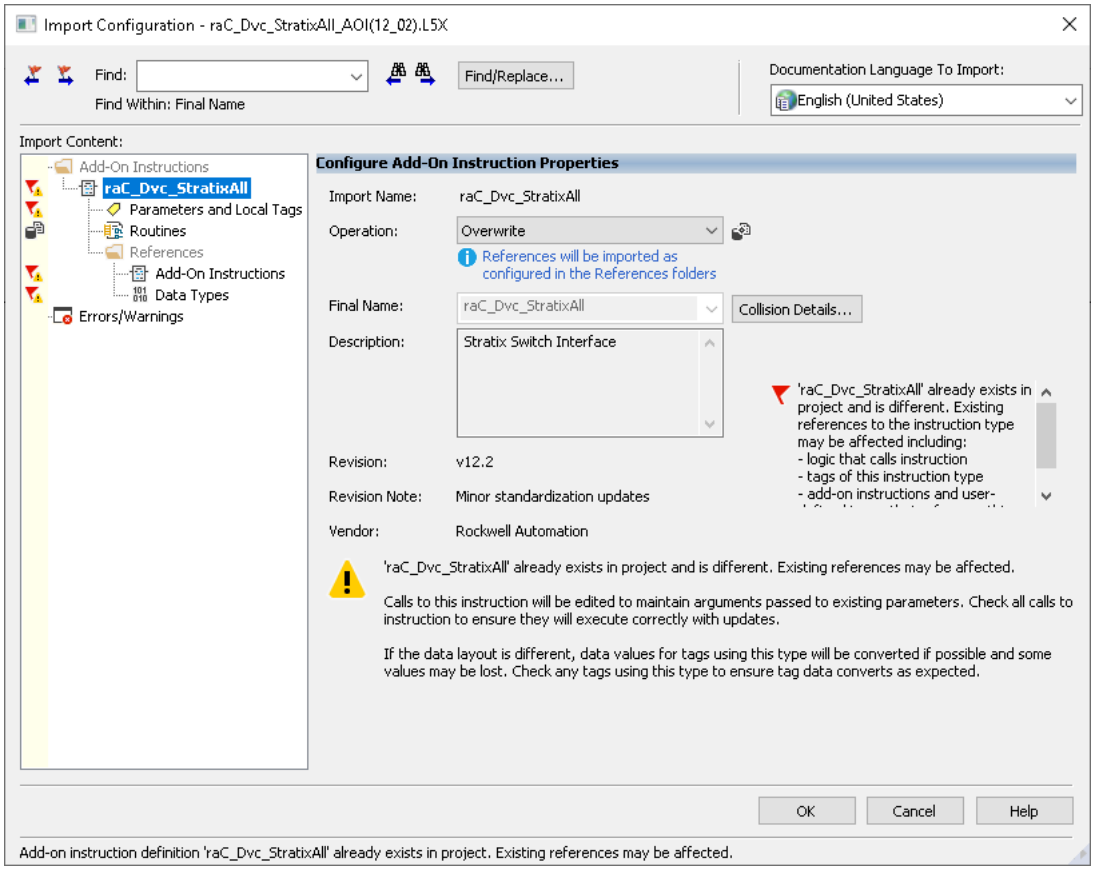
Upgrades by Importing AOI L5X Files

To upgrade or migrate a project that uses a previous library version to a newer one, the add-on instruction L5X files are supplied. To perform an upgrade to an object perform the following steps:

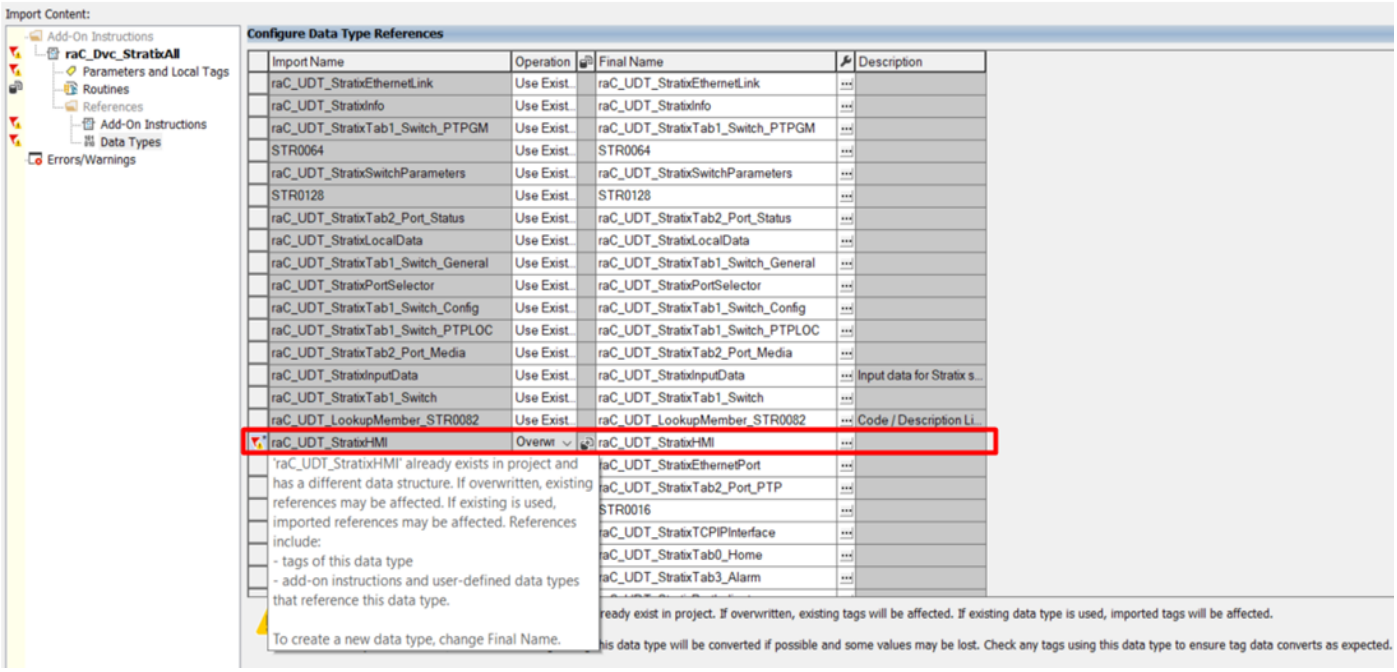
- Open the controller file. Note changes must be done offline.
- In the *Controller Organizer* pane right-click on *Assets* > *Add-On Instructions* and select *Import Add-On Instruction.* Navigate to the AOI.L5X file in the *Studio 5000 Logix Designer Files - L5X* and Open.



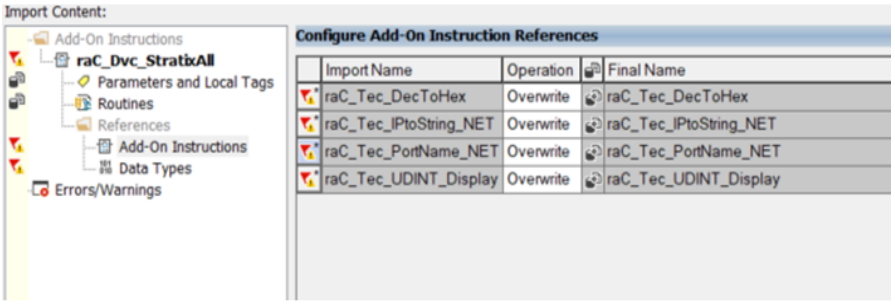
- You will be prompted that there is an existing version of the instruction that is different. Choose *Overwrite* as the operation.



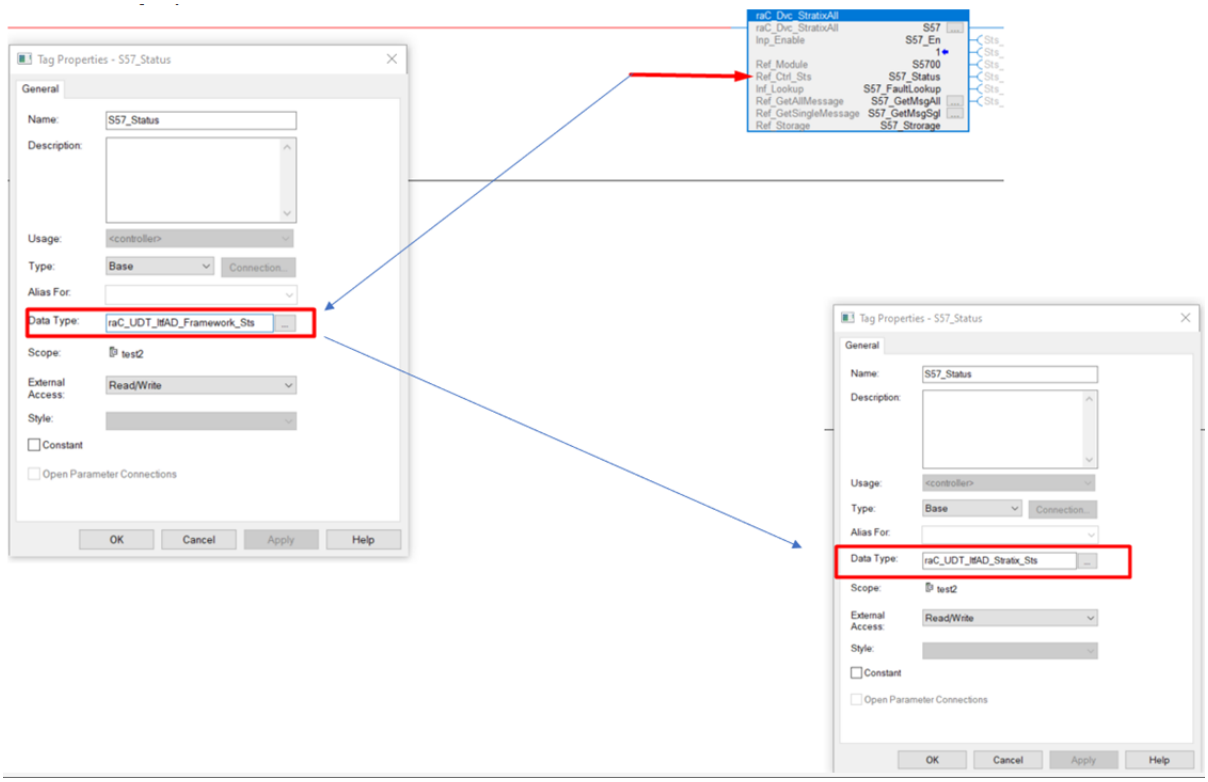
- If the Red flag exist in the References. e.g.
  a. In Data Type: Wherever it shows Differences, we must select Overwrite operation.



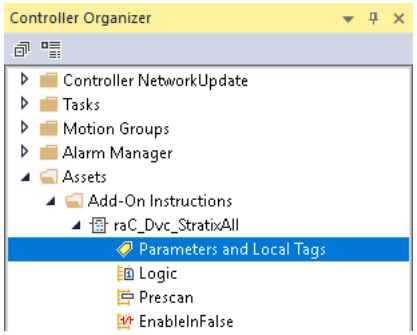
b. Add-On Instructions: For all Add-On Instruction select Overwrite option.



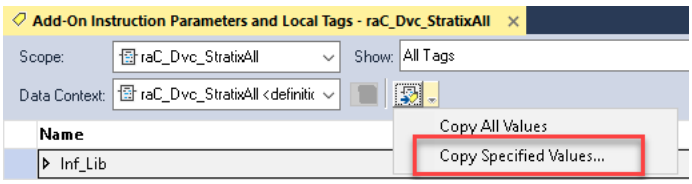
- Select OK once you have read and understood the warnings. Your existing logic will be updated with the new add-on instruction. Verify that your code compiles and test adequately.
- After compilation if there is an error with the "**Ref_Ctrl_Sts**" parameter, it is necessary to manually modify the Data type of each instance of the "**Ref_Ctrl_Sts**" parameter to the new data type "**raC_UDT_ItfAD_Stratix_Sts.**"

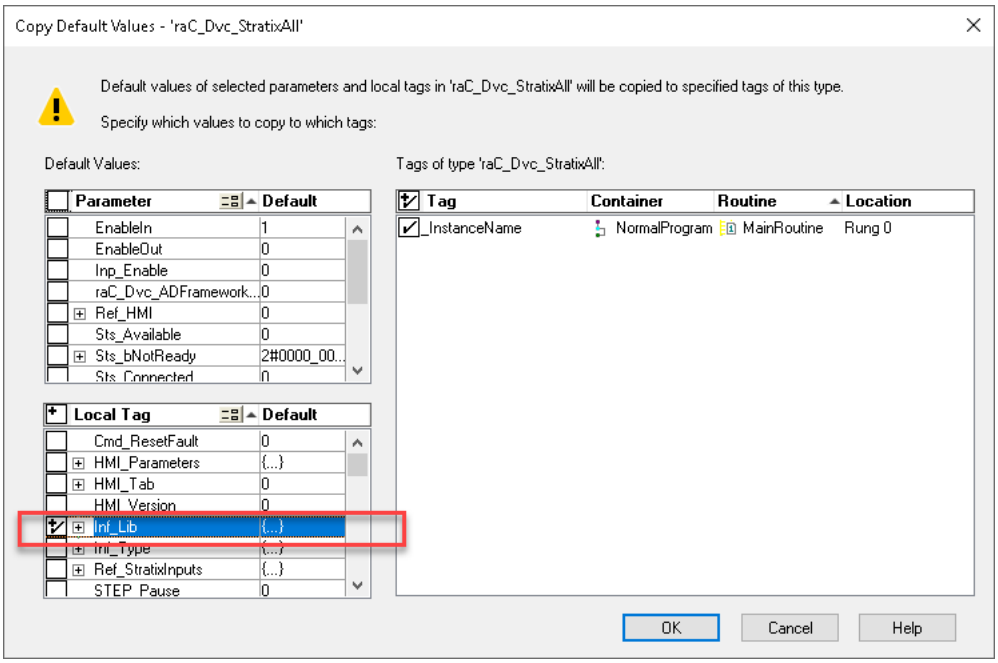


- In order to ensure the HMI faceplate still works properly you will need to update the object's library information stored in the Inf_Lib tag. In the *Controller Organizer* pane under *Assets > Add-On Instructions* expend the device object that was updated. Double-click on *Parameters and Local Tags* to open up the instructions tags.

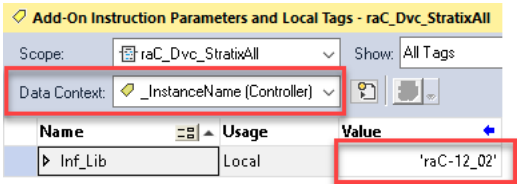


- In the *Add-On Instruction Parameters and Local Tags* window, you may notice that the Inf_Lib tag in the add-on instruction definition matches the new library revision number. Click on the down-arrow to the right of the copy button and select *Copy Specified Values...*





- In the *Copy Default Values* window, be sure to **first uncheck all Parameters and Local Tags** by clicking the +/- box in the top right. Failure to do so may result in overwriting settings in the existing objects.
- Check only *Inf_Lib* in the *Local Tag* area. On the right, all affected objects should be selected. Click OK.
- You can now confirm that the *Inf_Lib* tag has been updated to the current library (e.g. 'raC-12_02') by changing the *Data Context* drop-down to a specific device object.



FactoryTalk® View Upgrades

To upgrade a device object in a FactoryTalk® View ME/SE application, simply import the new faceplate .gfx display file into the application. If any global objects or images have been added or modified, you may need to import these as well. Any unused displays from previous versions may be removed or deleted from the application.

Note that the reference to the faceplate version is set in the Add-On Instruction Local Tag *Inf_Lib* so there does not need to be other modifications to the HMI application.

Studio 5000 View Designer® Upgrades

To upgrade a device object in a Studio 5000 View Designer® application, simply import the open the new View Designer .vpd file and copy the raC_Dvc_xxxxx_FP pop-up screen into the existing application. Find any graphic symbol launch buttons in the application that open the faceplate, and update the Action to open the new pop-up screen. Any unused pop-up screens from previous versions may be removed or deleted from the application.

Using Application Code Manager

Overview of Application Code Manager

Studio 5000® Application Code Manager is a tool that enables more efficient project development with libraries of reusable code. Application Code Manager creates modular objects with customizable configuration parameters using the reusable content. Application Code Manager can also create the associated visualization, historical and alarming elements for a project.

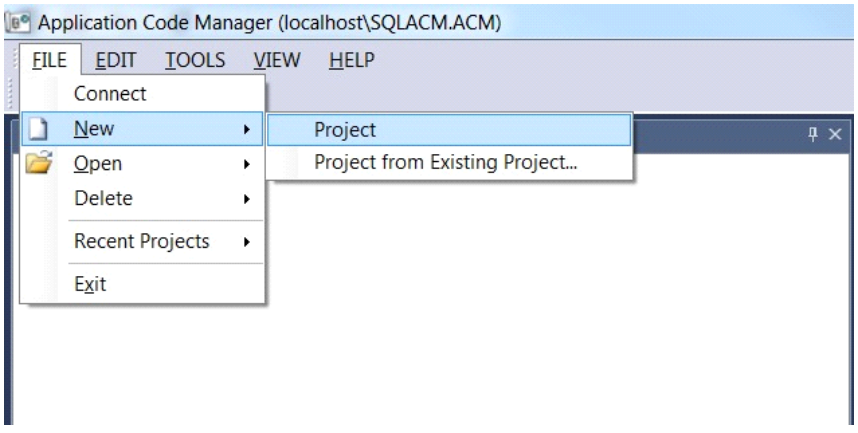
Studio 5000® Application Code Manager can be easily used along with Rockwell Automation® application code libraries such as the PlantPAx® Process Objects Library, Machine Builder Library, and Device Object Libraries. For more information on Studio 5000® Application Code Manager, refer to the Application Code Manager User Manual.

Creating a New Project

Begin by opening Application Code Manager.

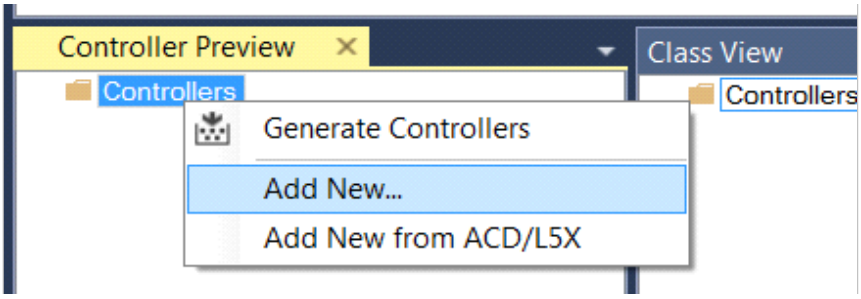
Note: the last project (if any) is opened by default; otherwise a blank screen is displayed.

Create a New Project or open an existing project. Navigate to *File* > *New* > *Project*.



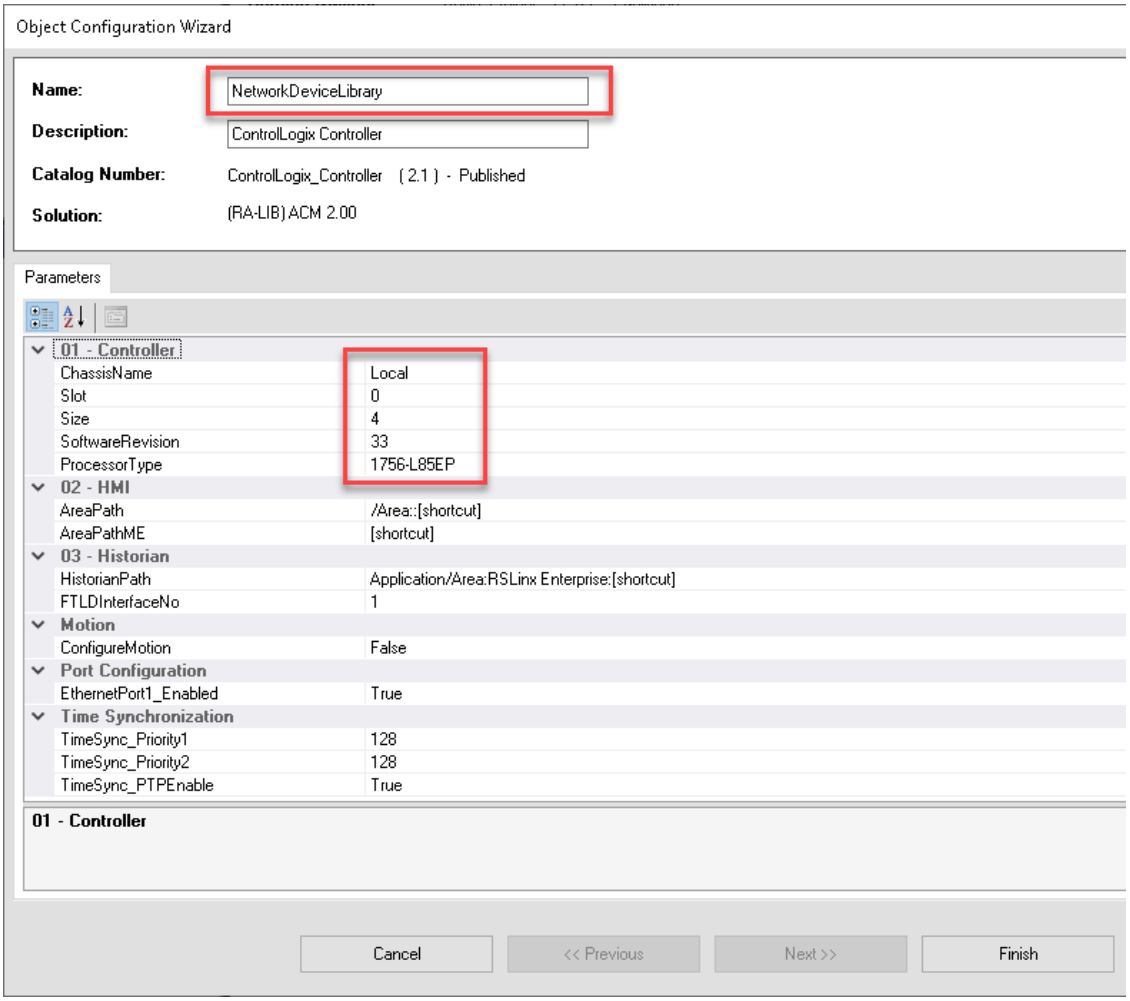
Select the desired project type (e.g. *(RA-LIB) ACM 2.00 Project - Basic_Project*) and fill in the *Name* and *Description*.

To add a new controller to a project, in the *Controller Preview* window, right-click on *Controllers* and select *Add New...*

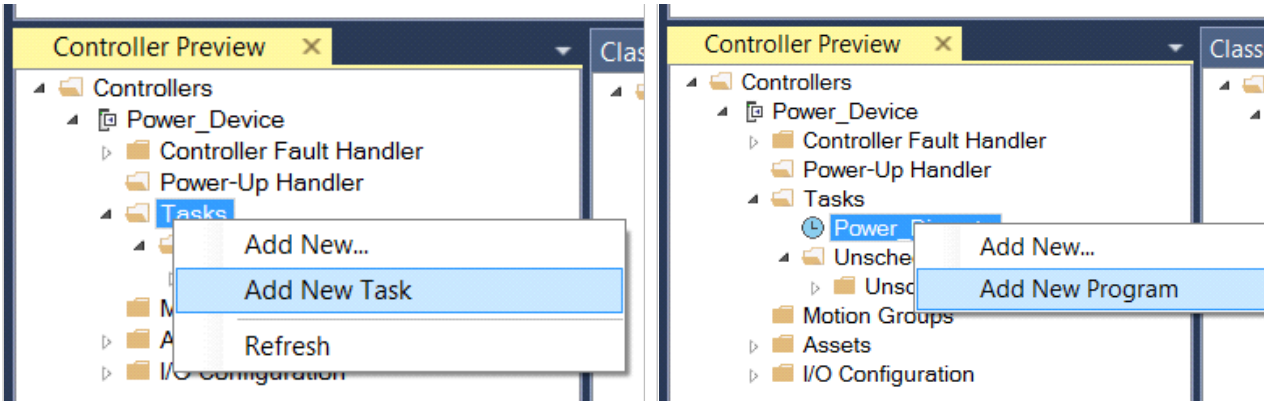


Select the desired controller type (e.g. *ControlLogix®_Controller, GuardLogix_Controller, CompactLogix_Controller, etc*). Enter a *Name* and *Description* for the controller. Select the appropriate Chassis and Processor configurations.

You can also configure the HMI *AreaPath* and.or *AreaPathME* parameters which will be referenced if you use Application Code Manager to generate FactoryTalk® View ME/SE displays with graphic symbol launch buttons.



You can now add in any desired tasks and programs to your controller. Right-Click on the *Tasks* folder underneath your controller in the *Controller Preview* and *Add New Task*. Similarly, right-click on any Task and select *Add New Program*. Complete the desired parameters for Tasks and Programs such as name, type, period, etc.

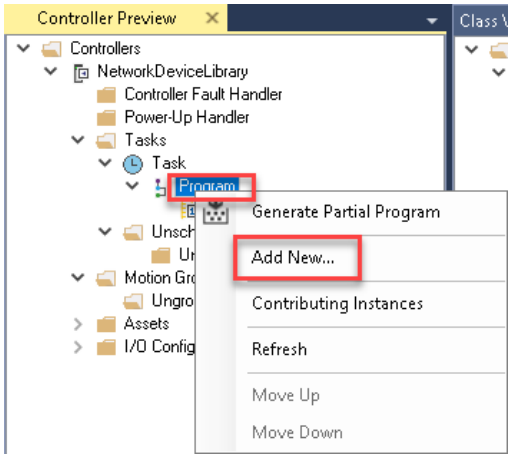


Adding & Configuring Device Objects

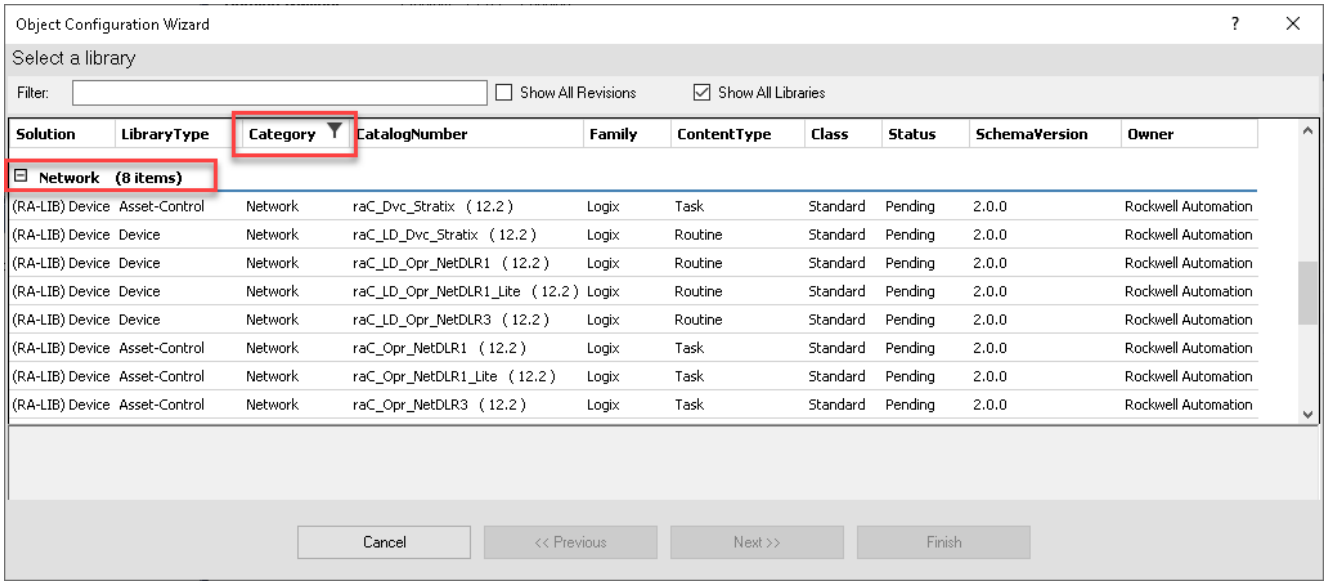
Prior to adding in any Device Objects, ensure you have registered the library in Application Code Manager. Refer to Registering Libraries in Studio 5000® Application Code Manager for details.

Adding Stratix Device Instructions

To add a Device Object into a project, right-click on a Program and *Add New...*

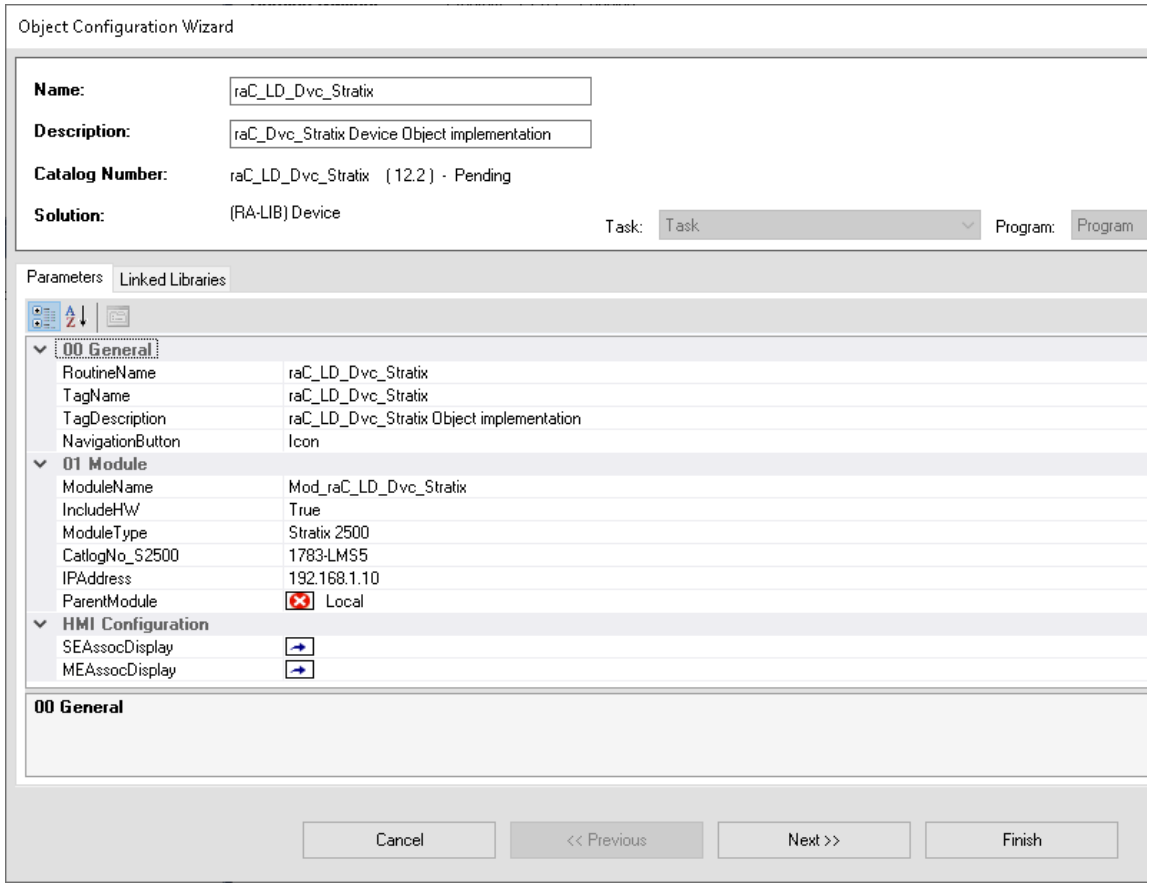


- In the *Object Configuration Wizard* dialogue window you can click on the *Category* heading to group objects by category and find *Network*. Select the desired Network object with Library Type *Device* (e.g. *raC_LD_Dvc_Stratix)* and click *Next*.



- Fill in all of the required configuration parameters for the device object. The following example shows a configuration of the raC_LD_Dvc_Stratix object.

Perform the following configuration:



Parameters - 00 General:

- Enter a **name** and **description**. Maximum name length can be 22 characters. Note that other parameters such as the RoutineName, TagName, etc will auto-complete based on these fields.
- Assign the **Task** and **Program**.

Parameters - 01 Module:

- You can choose to automatically create the Stratix® switch module in your program if not already included by setting **IncludeHW** to True.
- Assign the desired **ModuleName**, **ModuleType**, **CatalogNo** for the hardware.
- Assign a unique **IPAddress.**
- Set the **ParentModule** to the name of the Ethernet communications adapter that the switch is connected to. If using the embedded Ethernet port on a 5580 controller then leave this as *Local*. Note that this may show a red 'X' next to the name even though the program will be correctly generated and compile.

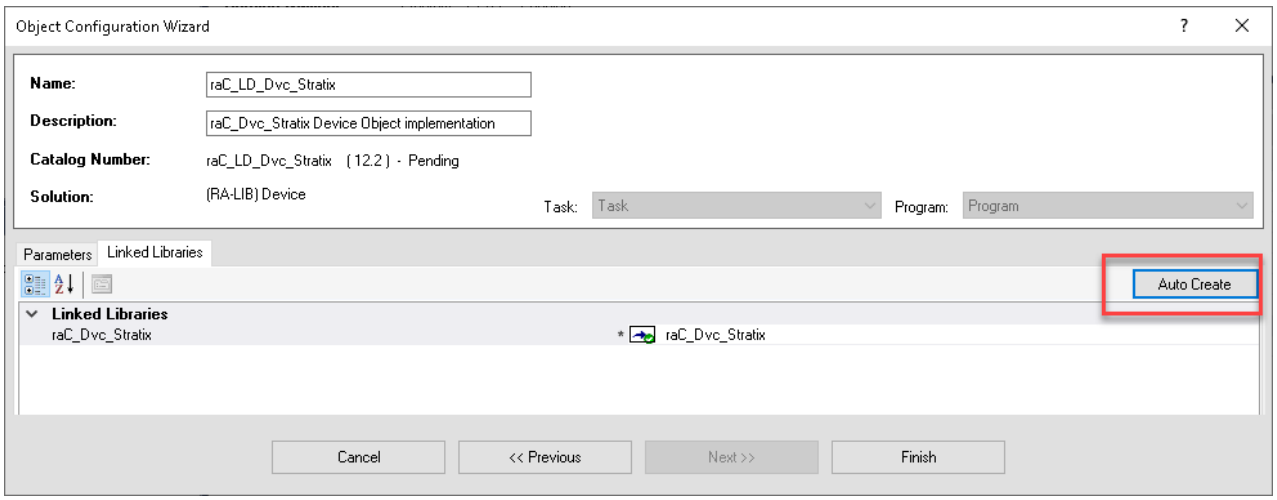
Parameters - HMI Configuration:

- Navigation Button: Choose *Icon* or *Text* type navigation button.
- For HMI Configuration refer to Configuring Displays.

Linked Libraries:

- Click next or click on the *Linked Libraries* tab. Click the *Auto Create* button to automatically create all of the required linked libraries.

You can manually create new linked libraries or point to existing linked libraries if necessary. You may need to do this if you would like to use an older version of library objects when multiple versions are installed in Application Code Manager.

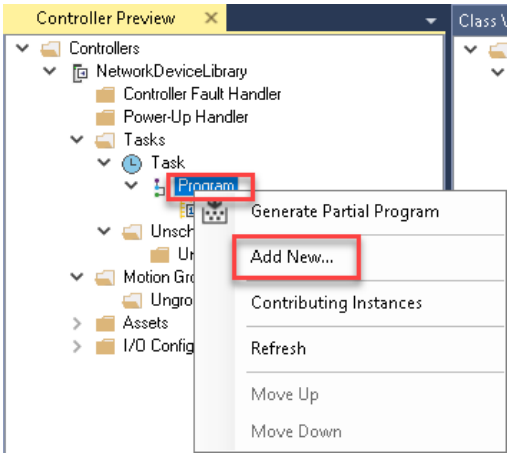


- Click Finish to complete the object configuration.

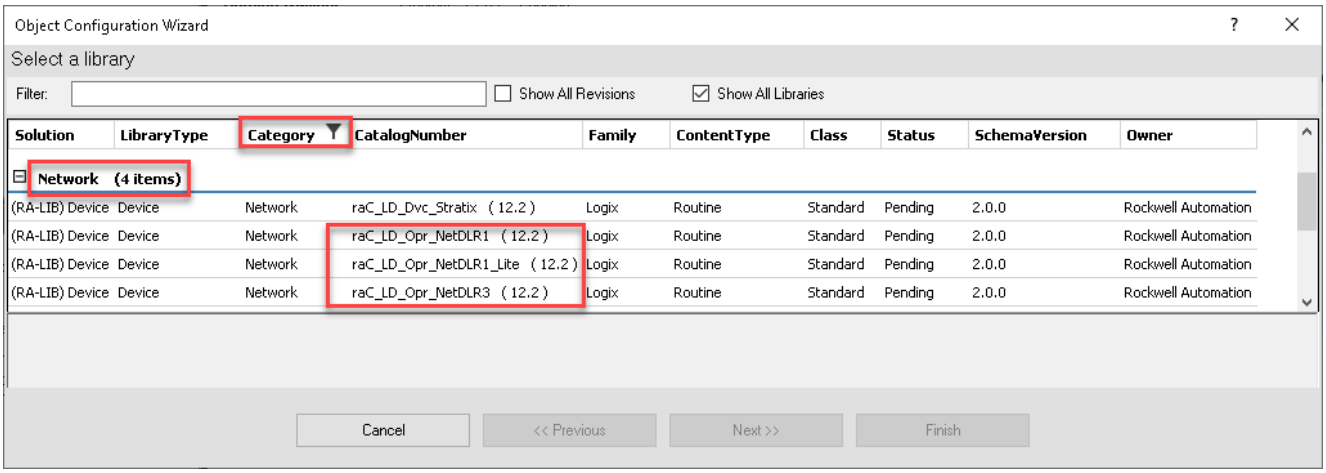
For specific devices details, refer to the appropriate chapter in this manual.

Adding DLR Device Object

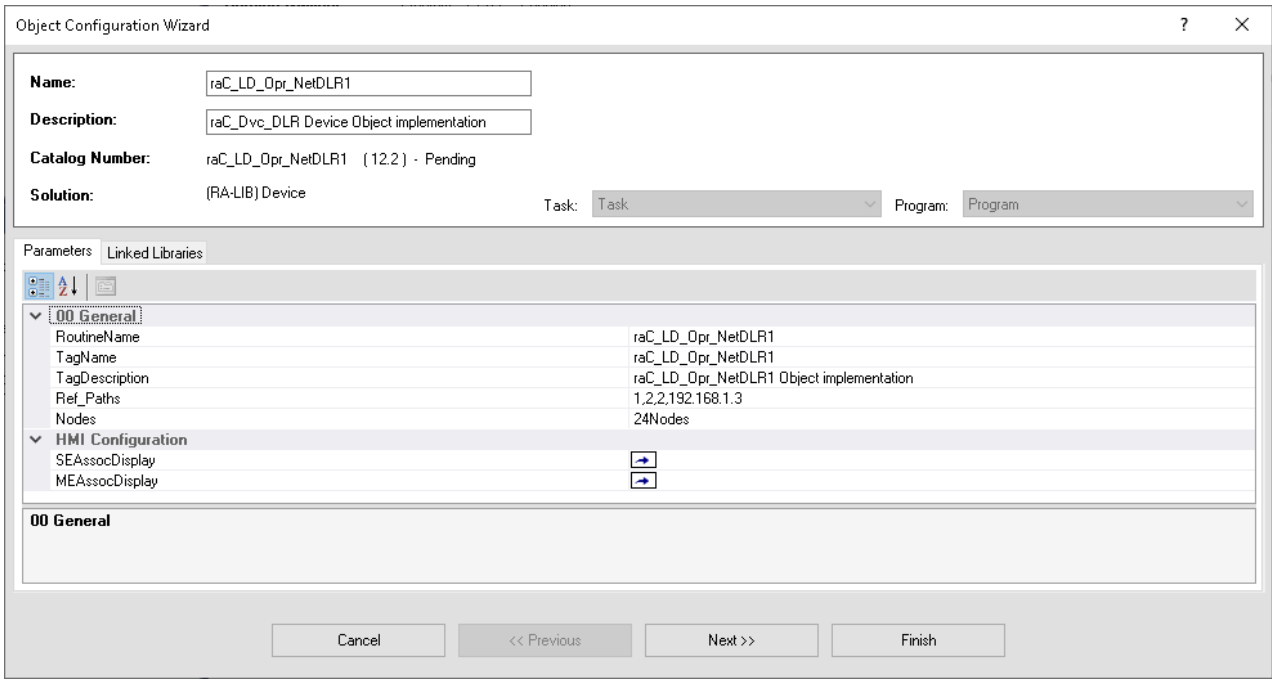
To add a DLR Object into a project, right-click on a Program and *Add New...*



In the *Object Configuration Wizard* dialogue window you can click on the *Category* heading to group objects by category and find *Network*. Select the desired DLR object of type *Device* (e.g. *raC_LD_Opr_NetDLR1*, *raC_LD_Opr_NetDLR1_Lite*, or *raC_LD_Opr_NetDLR3)* and click *Next*.



- Fill in all of the required configuration parameters for the device object. The following example shows a configuration of the raC_LD_Opr_NetDLR1 object.



Perform the following configuration:Parameters - 00 General:

- Enter a **name** and **description**. Maximum name length can be 22 characters. Note that other parameters such as the RoutineName, TagName, etc will auto-complete based on these fields.
- Assign the **Task** and **Program**.
- Set the **Ref_Paths** parameter to the CIP path of the DLR node (e.g. 1,2,2,192.168.1.3). See Message Paths for more information and examples on assigning this string.
- Note that the DLR3 object can have paths to a maximum of three rings as well as paths to two switches.

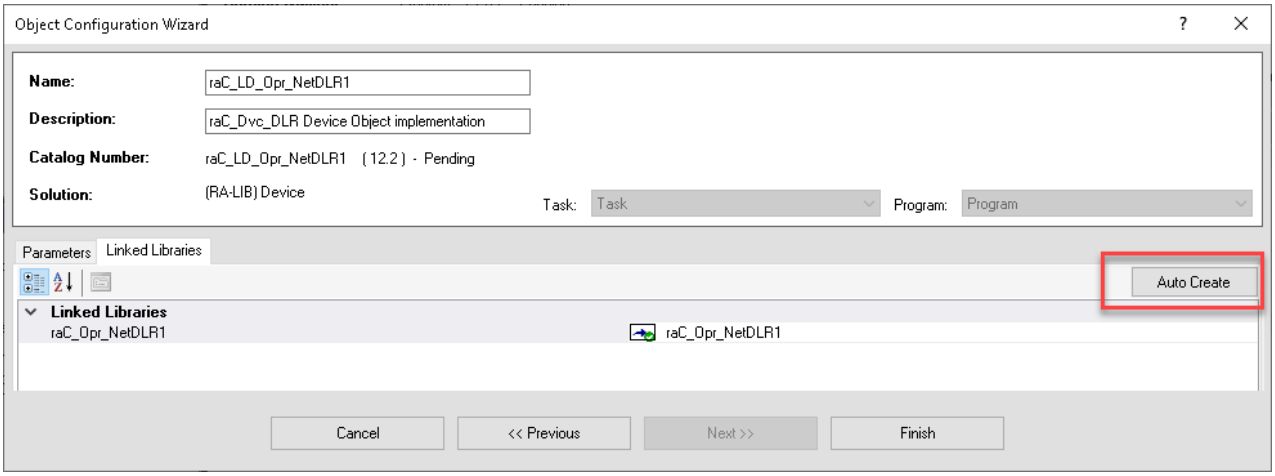
Parameters - HMI Configuration:

- Nodes (DLR1 only): Choose *24Node* or *56Nodes* as the maximum network size to assign the appropriate HMI display.
- For HMI Configuration refer to Configuring Displays.

Linked Libraries:

- Click next or click on the *Linked Libraries* tab. Click the *Auto Create* button to automatically create all of the required linked libraries.

You can manually create new linked libraries or point to existing linked libraries if necessary. You may need to do this if you would like to use an older version of library objects when multiple versions are installed in Application Code Manager.



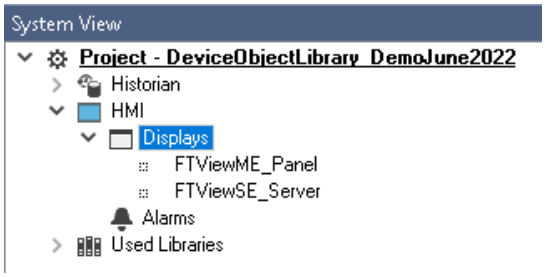
- Click Finish to complete the object configuration.

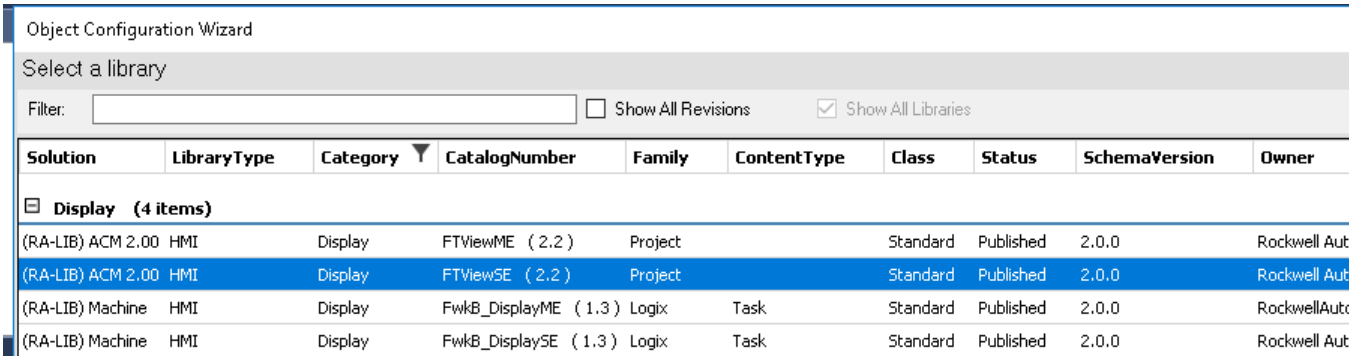
For specific devices details, refer to the appropriate chapter in this manual.

Configuring Displays

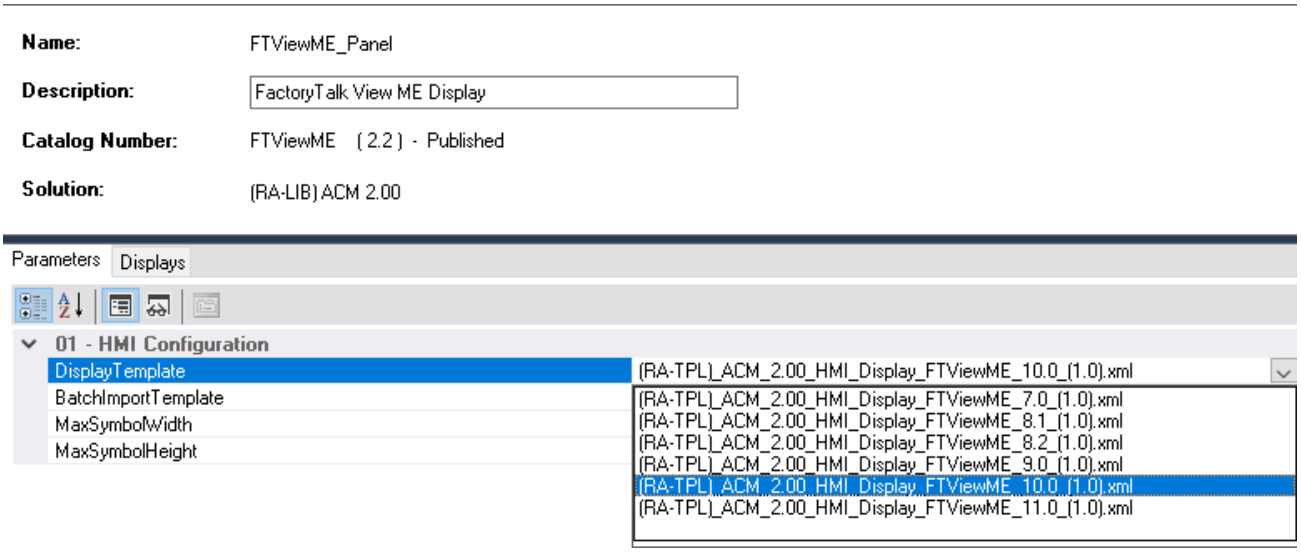
Application Code Manager can be used to automatically configure graphic symbol launch buttons for device objects In FactoryTalk® View ME or SE. Note that Application Code Manager is not compatible with Studio 5000 View Designer® applications.

First you must add Displays to your project. Under the *System View* panel expand *HMI* and right-click on *Displays* to select *Add*. Choose the type of display (e.g. *FTViewME* or *FTViewSE* depending on your project requirements.

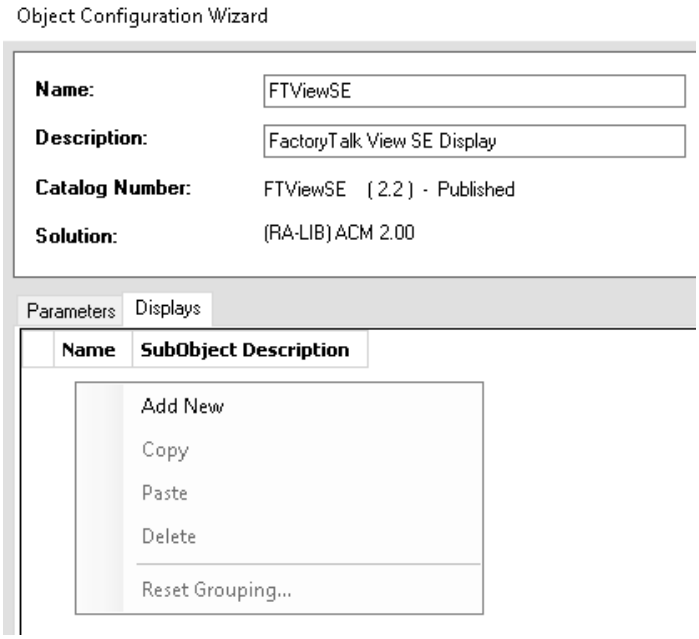




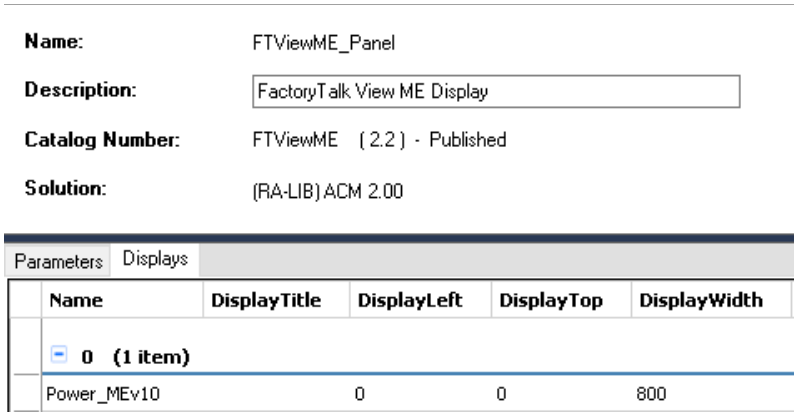
In the display object parameter configuration, you must select the *DisplayTemplate* type to match the version of FactoryTalk® View application that you are using.



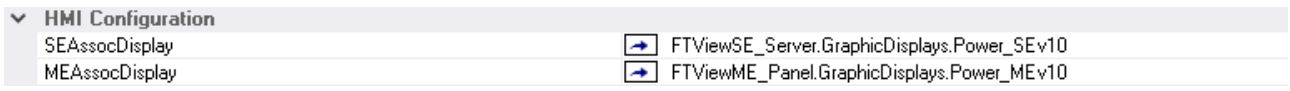
Navigate to the *Displays* tab where you can right-click and *Add New* display.

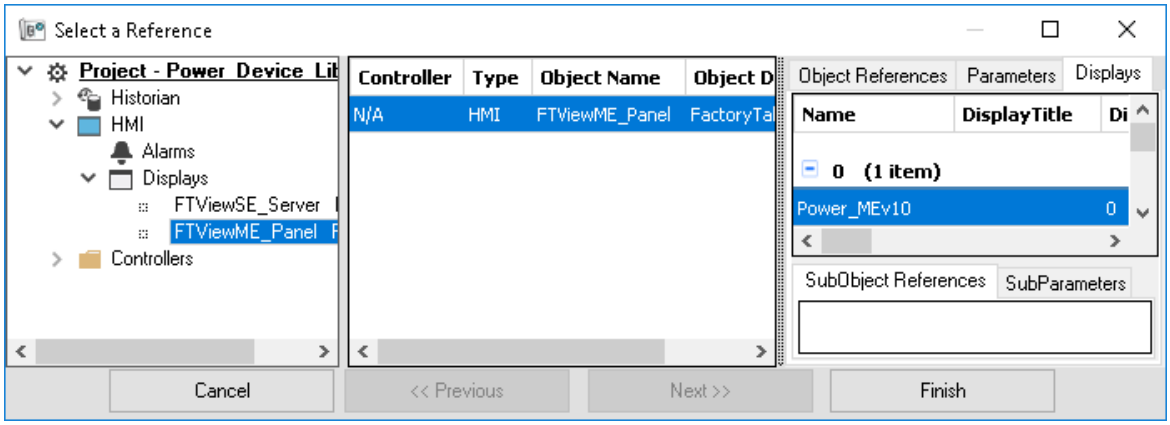


Set the desired name and display parameters. Generally all display parameters aside from *Name* can be left as default since this will often be used as a temporary display where object launch buttons are copied from.



Return to your device object configuration and view the *HMI Configuration* section of the parameters. You can browse or type in the HMI_Server_Name.HMI_Display_Name.



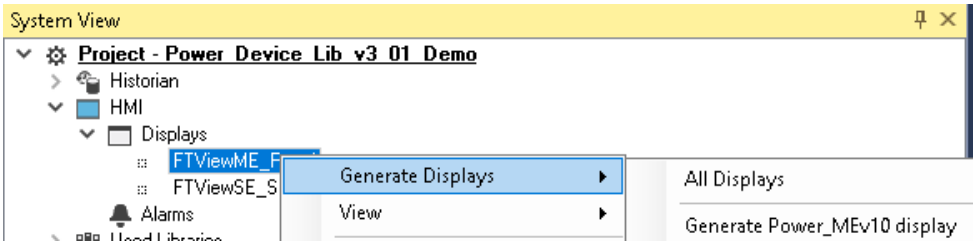


If you browse for the display, select the desired display server in the left panel, then click on the *Display* tab in the right panel and select the specific display. Click finish.

This workflow can be followed for either FactoryTalk® View ME or SE depending on the project requirements.

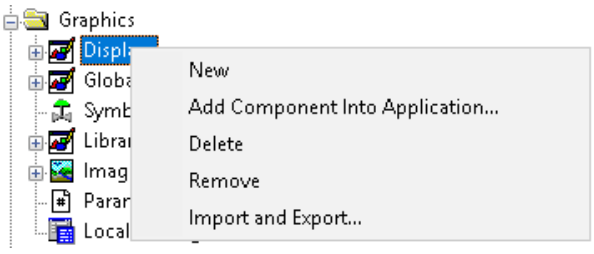
Generating Displays

Once you have assigned displays to all of the device objects, you can generate the displays. In the *System View* highlight the desired display server under *HMI > Display* and right-click to select *Generate Displays > All Displays* or select individual displays. Choose a place to save the generated files and take note of it.



Importing Displays into FactoryTalk® View Studio

To import the configured displays, open your FactoryTalk® View ME/SE project in FactoryTalk® View Studio. Right-click on *Graphic > Displays* and select *Import and Export...*

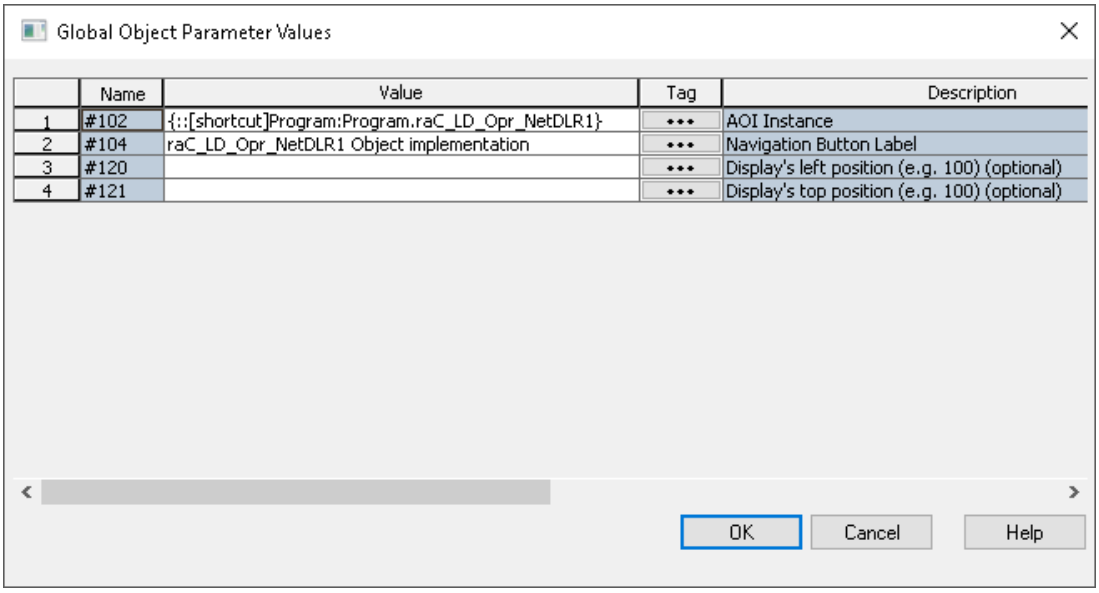


Follow the required prompts:

- Import graphic information into displays
- Choose whether or not to backup displays
- Choose either a *Single display import file* (must have an existing or blank display to import into) or *Multiple displays batch import file* if *All Displays* was used to Generate Displays.
- If this is the first time it is recommended to import *Multiple displays batch import file* and then *Create new objects on the display*.
- If you have done this before and are updating the imported display after modifying your Application Code Manager project, you can choose *Update existing objects on the display*.
- Browse for the BatchImport.xml file or individual display.xml file.

Open up the newly imported display. Notice that there are graphic symbol launch buttons labeled and configured for each item that was configured in Application Code Manager.

Right-click on the object and select *Global Object Parameters* to view that all of the parameters have been pre-configured for you.

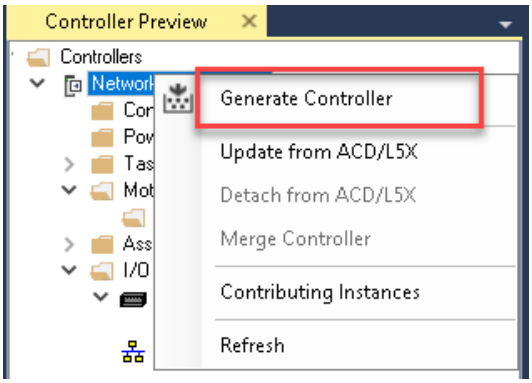


You may not copy and paste this graphic symbol onto any other display in your application.

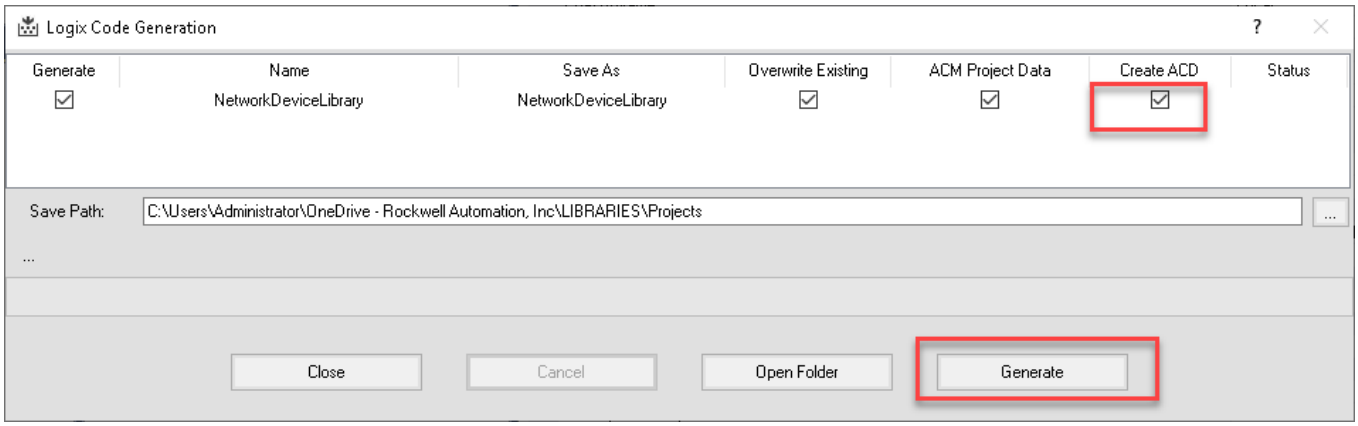
Generating Controller Files

Once you have completed configuring your project in Studio 5000® Application Code Manager, you can generate the controller file for use in Studio 5000 Logix Designer®.

In the *Controller Preview* pane right-click on the controller name within the *Controllers* folder and select *Generate Controller*.



In the *Logix Code Generation* dialogue window you will need to check *Create ACD*. You ma also need to check *Overwrite Existing* if this is not the first time generating the controller code.



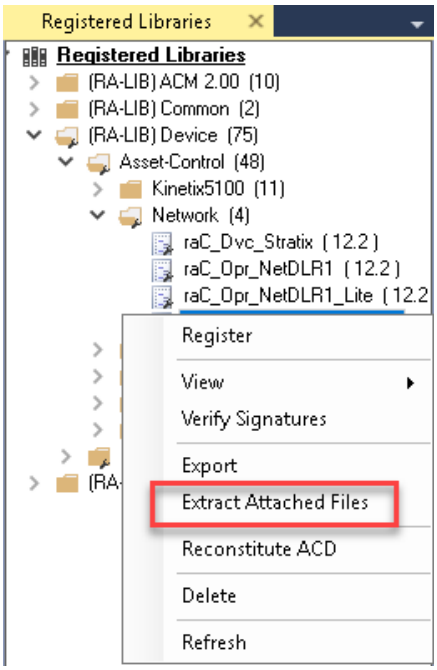
Once the controller file is generated, you can navigate to the location set in *Save Path* and open your file. Note that all of the configuration that was done in Application Code Manager is now shown in your Logix Designer ACD file.

Exporting Attachments

Application Code Libraries not only contain Logix code, but also contain Visualization collateral and associated documentation. Every Asset library contains at least a reference manual (RM). Those libraries which have associated Visualization content also have all required global objects (GO), images, static displays and View Designer applications added as attachments. In this manner the user can generate only the necessary visualization and documentation for the objects included in the project.

In Application Code Manager, all of the attachments are associated with the device objects in the *(RA-LIB) Device > Asset-Control* folder. These can be accessed both through the full Application Code Manager software, or via the Studio 5000® Plug-In “Import Library Objects”.

To access the attached files, right click on the objects (e.g. raC_Dvc_Stratix) and select *Extract Attached Files*.



Select the destination folder on your computer, and select OK. An Extract Attachments dialog will show the extraction status.

The extracted folder will contain the following:

- Reference Manual
- Required Images
- View Designer Faceplate Files
- FactoryTalk® View Machine Edition Display
- FactoryTalk® View Machine Edition Global Objects

Using the Network Device Library with Other Application Code Libraries

Application Code Libraries

The Network Device Library is can be used alongside other Application Code Libraries.

The Machine Builder Library and PlantPAx® Process Object Library application-level library objects may be used in the same applications with the device-level objects in the Network Device Library. At this time there are no direct dependencies or interaction points between these libraries. They may be used independently from one another but within the same application.

Other libraries utilize the common device interface UDTs to interact with device level objects. In the case of the Network Device Library you may programmatically reference the Status (Sts) interfaces of the Stratix instructions. This is covered in detail in Interfaces section of this document.

Stratix® Switch (raC_Dvc_Stratix)

Overview

The Stratix® Switch device object (raC_Dvc_Stratix) includes HMI faceplates for each managed Stratix® switch (2500, 5200, 5400, 5410, 5700, 5800) and ArmorStratix™ 5700 switch which displays device information including:

- Port status and diagnostics
- Switch status and diagnostics
- Switch configuration, settings, and port layout
- Fault and alarm status

In the Library there is a folder named *Videos* which contains many How-To and Operational Overview Videos which walk step-by-step through each process. You can refer to the following videos for this section:
"Operational_Overview_Stratix_Managed_Switch_ Faceplates_in_MachineEdition"
"Operational_Overview_Stratix_Managed_Switch_ Faceplates_in_SiteEdition"
"Operational_Overview_Stratix_Managed_Switch_Faceplates_in_ViewDesigner"

Functional Description

The Stratix® Switch pre-configured Device Objects:

- Collect, Process and Deliver Data between managed switches and Application Logic
- Provide Device Status & Diagnostics Faceplates for Machine Startup, Commissioning, Operations, and Maintenance
- Include Common HMI Faceplate Components, Device States, and Control Interfaces providing Application Development and Operation Efficiency

All these features provide quick feedback, shorten recovery time, and simplify implementation.

Required Files

Device Objects include Add-On Instructions (AOIs) and HMI faceplates. The revision number (e.g. 1.01) used in filenames can change as new revisions are created.

Controller Files

Add-On Instructions are reusable code objects that contain encapsulated logic that can streamline implementing your system. This lets you create your own instruction set for programming logic as a supplement to the instruction set provided natively in the ControlLogix®® firmware. An Add-On Instruction is defined once in each controller project, and can be instantiated multiple times in your application code as needed.

The Add-On Instruction must be imported into the controller project to be used in the controller configuration. These can be imported as Add-On Instruction files, or as part of the Rung Import or Import Library Objects wizard.

All Add-On Instruction and Rung Import files can be found in the */Studio 5000 Logix Designer Files - L5X/* folder in the library.

Device	Compatible Device	Add-On Instruction	Rung Import
Stratix® Switch	Stratix® 2500	raC_Dvc_Stratix_12.03_AOI.L5X	raC_Dvc_Stratix_12.03_RUNG.L5X
	Stratix® 5200		
	Stratix® 5400		
	Stratix® 5410		
	Stratix® 5700 ArmorStratix™ 5700		
	Stratix® 5800		

FactoryTalk® View HMI Files

FactoryTalk® View ME applications require importing the desired device faceplates in addition to all Global Object (ggfx) files and all images located in the */HMI FactoryTalk® View Images - png/* folder of the library. FactoryTalk® View ME files are stored in the */HMI - FactoryTalk® View ME/* library folder.

Note that a single Add-On Instruction *raC_Dvc_Stratix®* is common with any of the Stratix® models. The HMI faceplate will automatically display the correct layout for the device type.

Device/Item	Type	Compatible Device	FactoryTalk® View ME Faceplate	FactoryTalk® View SE Faceplate
Stratix® Switch	Display	Stratix® 2500	(raC-12_03-ME) raC_Dvc_S2500-Faceplate.gfx	(raC-12_03-SE) raC_Dvc_S2500-Faceplate.gfx
		Stratix® 5200	(raC-12_03-ME) raC_Dvc_S5200-Faceplate.gfx	(raC-12_03-SE) raC_Dvc_S5200-Faceplate.gfx
		Stratix® 5400	(raC-12_03-ME) raC_Dvc_S5400-Faceplate.gfx	(raC-12_03-SE) raC_Dvc_S5400-Faceplate.gfx
		Stratix® 5410	(raC-12_03-ME) raC_Dvc_S54100-Faceplate.gfx	(raC-12_03-SE) raC_Dvc_S54100-Faceplate.gfx
		Stratix® 5700 ArmorStratix™ 5700	(raC-12_03-ME) raC_Dvc_S5700-Faceplate.gfx	(raC-12_03-SE) raC_Dvc_S5700-Faceplate.gfx
		Stratix® 5800	(raC-12_03-ME) raC_Dvc_S5800-Faceplate.gfx	(raC-12_03-SE) raC_Dvc_S5800-Faceplate.gfx
Graphic Symbols	Global Object	All Stratix	(raC-2-ME) Graphic Symbols - Network Device	(raC-2-SE) Graphic Symbols - Network Device
Toolbox	Global Object	All Stratix	(raC-2-ME) Toolbox -Network Device.ggfx	(raC-2-SE) Toolbox -Network Device.ggfx

Studio 5000 View Designer® HMI Files

All Studio 5000 View Designer® Files can be found in the */HMI - ViewDesigner - vpd/* folder of the library.

Device/Item	Studio 5000 View Designer® Faceplate
All Stratix® Switch	(raC-12_03-VD) raC_Dvc_Stratix.vpd

Studio 5000® Application Code Manager Files

Studio 5000® Application Code Manager (ACM) can be optionally used if it is installed. All devices can be easily registered in the ACM repositories by running the *setup.cmd* file located in the root folder of the library.

Individual HSL4 files are provided as an alternative to running the setup.cmd to allow users to manually register specific implementation objects. Each object has two files - an Asset Control file and a Device file. The Asset Control files include attachments of all required files for that object. The Device files are used to actually add that device into a Studio 5000® project and these reference the Asset Control files.

All Studio 5000® Application Code Manager files can be found in the /*ApplicationCodeManagerLibraries*/ folder of the library. The files included are as follows:

Implementation Object	Compatible Device	Asset Control File (.HSL4)	Device File (.HSL4)
Stratix® Switch	Stratix® 2500	(RA-LIB)_Device_Asset-Control_Network_raC_Dvc_Stratix_(12.3)	(RA-LIB)_Device_Device_Network_raC_LD_Dvc_Stratix_(12.3)
	Stratix® 5400		
	Stratix® 5410		
	Stratix® 5700 ArmorStratix™ 5700		
	Stratix® 5800		

Operations

The Network Device objects provide only physical operation mode. There is no virtual device mode offered.

Execution

The following table explains the handling of instruction execution conditions.

Condition	Description
EnableIn False (false rung)	Processing for EnableIn False (false rung) is handled the same as if the device were taken out of service by Command. The device outputs are de-energized and the device is shown as Program Out of Service on the HMI. All alarms are cleared.
Powerup (prescan, first scan)	On prescan, any commands that are received before first scan are discarded. The device is de-energized. On first scan, the device is treated as if it were returning from Hand command source: the instruction state is set based on the position feedback that is received from the device. If the feedback is valid for one position, the device is set to that position. If the device does not have position feedback or the position feedback is invalid, the device is set to the 'unknown/powerup' state. The command source is set to its default, either Operator or Program (unlocked).

Condition	Description
Postscan	No SFC Postscan logic is provided.

Add-On Instruction I/O Data

InOut Data

InOut	Function / Description	DataType
Ref_Module	Reference to module in I/O tree	MODULE
Ref_Ctrl_Sts	Network Device Status Interface	raC_UDT_ItfAD_ItfAD_Stratix_Sts
Inf_Lookup	Code / Description List Entry	raC_UDT_LookupMember_STR0082[32]
Ref_GetAllMessage	Message used to read complete CIP objects.	MESSAGE
Ref_GetSingleMessage	Message used to read vendor specific attributes.	MESSAGE
Ref_Storage	Stores CIP message data	SINT[300]

Input Data

Input	Function/Description	DataType
EnableIn	Enable Input - System Defined Parameter	BOOL
Inp_Enable	Enable AOI functions. 1 = enabled.	BOOL

Output Data

Output	Function/Descritpion	DataType
EnableOut	Enable Output - System Defined Parameter	BOOL
Sts_EN	AOI Enabled Status; 1 = enabled.	BOOL
Sts_ER	Message error bit; 1= Error	BOOL
Sts_Connected	Device is connected to the Programmable Controller	BOOL
Sts_Available	Device is available for interaction with user code	BOOL
Sts_Warning	Device warning status: 1 = an active alarm or warning exists	BOOL
Sts_Faulted	Device faulted status: 1 = an active fault exists	BOOL
Sts_bNotReady	Bitwise device 'not ready' reason 0: Reserved 1: Device not connected 2: Device not available 3: Device Faulted 4 - 31: Reserved	DINT
raC_Dvc_StratixAll	Unique Parameter Name for auto-discovery	BOOL
Ref_HMI	Alias tag for HMI_Parameters.HMI_Pointer	DINT

Data Types

A number of User-Defined Datatypes (UDT) are used in the Network Device Library. A full list of the UDTs used with the raC_Dvc_StratixAll object follows:

User Defined Datatype	Description
raC_UDT_Event	Event log
raC_UDT_ItfAD_Stratix_Sts	Stratix® Device Status Interface
raC_UDT_LookupMember_STR0082	Warning/Fault Code Look-up table member
raC_UDT_StratixEthernetLink	Stratix® Ethernet Link Details
raC_UDT_StratixEthernetLinkClass	Stratix® Ethernet Link Class Details
raC_UDT_StratixEthernetPort	Stratix® Ethernet Port Details
raC_UDT_StratixHMI	Stratix® HMI Faceplate Information
raC_UDT_StratixInfo	Stratix® Module Information
raC_UDT_StratixInputData	Stratix® Module Input Data
raC_UDT_StratixLocalData	Stratix® Module Local Data
raC_UDT_StratixPortIndicator	Stratix® Port Indicator Status
raC_UDT_StratixPortSelector	Stratix® Port Selector Drop-down Menu
raC_UDT_StratixSwitchParameters	Stratix® Module Parameters
raC_UDT_StratixTab0_Home	Stratix® HMI Faceplate - Home Tab Information
raC_UDT_StratixTab1_Switch	Stratix® HMI Faceplate - Switch Tab Information
raC_UDT_StratixTab1_Switch_Config	Stratix® HMI Faceplate - Switch Tab - Configuration Information
raC_UDT_StratixTab1_Switch_General	Stratix® HMI Faceplate - Switch Tab - General Information
raC_UDT_StratixTab1_Switch_PTPGM	Stratix® HMI Faceplate - Switch Tab - PTPGM Information
raC_UDT_StratixTab1_Switch_PTPLOC	Stratix® HMI Faceplate - Switch Tab - PTPLOC Information
raC_UDT_StratixTab1_Switch_VLAN	Stratix® HMI Faceplate - Switch Tab - VLAN Information
raC_UDT_StratixTab2_Port	Stratix® HMI Faceplate - Port Tab Information
raC_UDT_StratixTab2_Port_Media	Stratix® HMI Faceplate - Port Tab - Media Information
raC_UDT_StratixTab2_Port_PTP	Stratix® HMI Faceplate - Port Tab - PTP Information
raC_UDT_StratixTab2_Port_Stats	Stratix® HMI Faceplate - Port Tab - Stats Information
raC_UDT_StratixTab2_Port_Status	Stratix® HMI Faceplate - Port Tab - Status Information
raC_UDT_StratixTab2_Port_Threshold	Stratix® HMI Faceplate - Port Tab - Threshold Information
raC_UDT_StratixTab3_Alarm	Stratix® HMI Faceplate - Alarm Tab Information
raC_UDT_StratixTab3_AlarmGlobal	Stratix® HMI Faceplate - Alarm Tab - Global Information
raC_UDT_StratixTab3_AlarmPort	Stratix® HMI Faceplate - Alarm Tab - Port - Information
raC_UDT_StratixTCPIPInterface	Stratix® TCP/IP Interface Information
STR0016	String
STR0032	String
STR0064	String
STR0128	String

The primary UDTs which a user may interact with are defined in more detail below.

raC_UDT_ItfAD_Stratix_Sts

This is the Stratix® Common Control interfacing Status tag. By configuring these tags, we can read various status from the device like Ready, Connected, and Available etc. The below table shows detailed information of members used in this UDT tags.

Refer to the Interfaces section for general information on interfaces.

Input	Description	Data Type
eState	Enumerated state value: 0 = Unused 1 = Initializing 2 = Disconnected 3 = Disconnecting 4 = Connecting 5 = Idle 6 = Configuring 7 = Available	DINT
FirstWarning	First Warning Event Data	raC_UDT_Event
FirstFault	First Fault Event Data	raC_UDT_Event
eCmdFail	Enumerated command failure code. 0 = Interface Initialization failure code 1 = Operate as Physical Device failure code 2 = Operate as Virtual Device failure code	DINT
bSts	Status (Bit Overlay)	DINT
Connected	1 = PAC to device connection has been established	BOOL
Available	1 = The device is available for interaction with the user program	BOOL
Warning	1 = A warning is active on the device	BOOL
Faulted	1 = A fault is active on the device	BOOL

raC_UDT_Event

Member	Description	Data Type
Type	Event type: 1 = Status 2 = Warning 3 = Fault 4...n = User	DINT
ID	User definable event ID.	DINT
Category	User definable category (Electrical,Mechanical,Materials,Utility,etc.).	DINT
Action	User definable event action code.	DINT
Value	User definable event value or fault code.	DINT
Message	Event message text.	STRING
EventTime_L	Timestamp (Date/Time format).	LINT
EventTime_D	Timestamp (Y,M,D,h,m,s,us).	DINT[7]

raC_UDT_LookupMember_STR0082

Member	Description	Data Type
Code	Stores the value of device fault code	DINT
Desc	Stores the Messages related to fault code	STRING

Add-On Instructions

A number of embedded Add-On Instructions (AOI) are used within the raC_Dvc_StratixAll instruction. These are used to convert between datatypes and generate values which can be read from the HMI faceplate. The following AOIs are included:

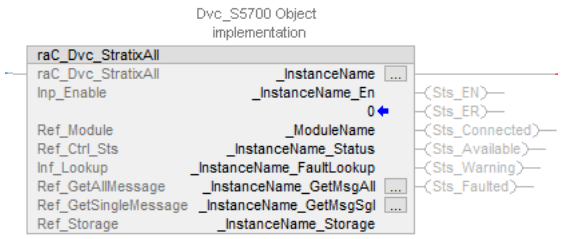
User Defined Datatype	Revision	Description
raC_Tec_DecToHex	12.02	Converts decimal number to hexadecimal String
raC_Tec_IPtoString_NET	12.02	Converts numerical IP address into user-readable string
raC_Tec_PortName_NET	12.02	Dynamically generates Stratix® Switch Port Name
raC_Tec_UDINT_Display	12.02	Converts Unsigned DINT into two tags to display correctly on HMI

Programming Example

Fully configured device on a rung is provided below for reference.

Note that this programming example is the same code that is imported when either importing the supplied rung .L5X files or when using Application Code Manager or the Studio 5000® Import Library Objects wizard plug-in.

The following example uses the Stratix® Switch device object named *Dvc_S5700* connected to Stratix® module named *Mod_Dvc_S5700*.



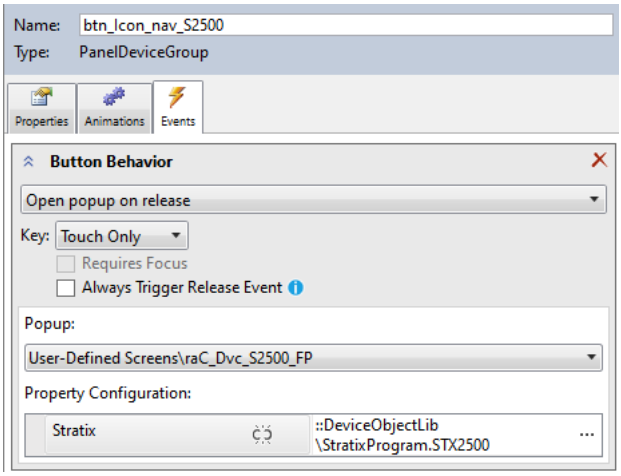
Graphic Symbols

Graphic Symbols are used as launch buttons within HMI applications to open up faceplate displays. See Basic Launch Button Attributes section for details on configuration and indicators.

FactoryTalk® View ME/SE Graphic Symbols

Graphic Symbol Name	Graphic Symbol	Description	Global Object Parameter Values
GO_LaunchFP	S...S	Faceplate navigation button with string tag label. This launch button graphic object allows the user to navigate to the device object faceplate. The text on the button face is set to the parameter #104.	#102: AOI Backing Tag Instance (e.g. {::[PAC]Program::IOLinkProgram._InstanceName}) #104: Navigation Button Label #120: Display's left position (e.g. 100) (optional) #121: Display's top position (e.g. 100) (optional)

Studio 5000 View Designer® Graphic Symbols

Graphic Symbol Name	Graphic Symbol	Description	Property Configuration
Launch	Stratix 2500	The supplied launch button in View Designer is used to navigate to the faceplate in a user application.	

Faceplates

There are basic faceplate attributes that are common across all instructions. See Basic Faceplate Attributes on page 22.

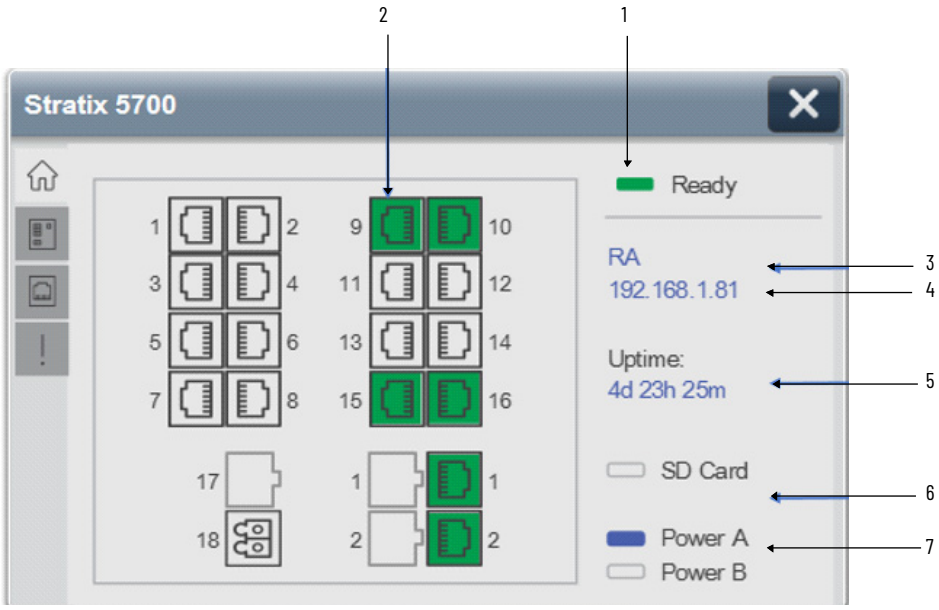
In this document, the faceplate pictures (or snapshots) are of Stratix® 5700 Faceplate in Studio 5000 View Designer®. All other Stratix® faceplates have similar screens, but some faceplates may not have all tabs and pages available depending on the features and port layout supported by the specific model.

The faceplate title is linked to *_InstanceName.@description*, the *.@description* extended tag property of the Add-On Instruction instance. This is user-configurable from controller/program tags in Studio 5000 Logix Designer®.

Name	Value	Description	Data Type
Dvc_S2500	{...}	Dvc_S2500 Object implementation	raC_Dvc_StratixAll
Dvc_S5400A	{...}	Dvc_S5400A Object implementation	raC_Dvc_StratixAll
Dvc_S5400B	{...}	Dvc_S5400B Object implementation	raC_Dvc_StratixAll
Dvc_S5700	{...}	Dvc_S5700 Object implementation	raC_Dvc_StratixAll

Home

The Home tab is the main tab of the faceplate. It provides the status of the Network device along with sensor process data and the Locate button.



Item	Description
1	Banner- Ready Status

Item	Description	
2	Port Status Indicators	
	GREEN = Link Active	
	GREY with dark lines = Link Inactive	
	YELLOW =Port Alarm/Fault	
	GREY with light lines = Port Disabled	
3	Host Name	
4	IP Address	
5	Switch Uptime	
6	SD Card Status ON/Blue LED = SD Card is present OFF/Grey LED = SD Card is not present	
7	Power supply A & B Status ON/Blue LED = Power supply is connected OFF/Grey LED = Power supply is not connected	

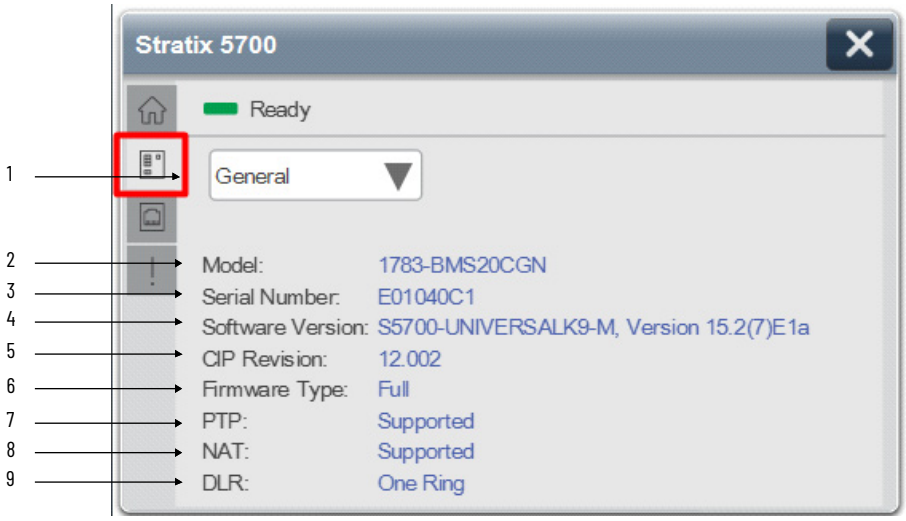
Switch Tab

The Switch tab provides switch details on multiple pages. A drop-down selector is used to navigate between pages of data including:

- General
- Configuration
- VLANs
- Time Sync

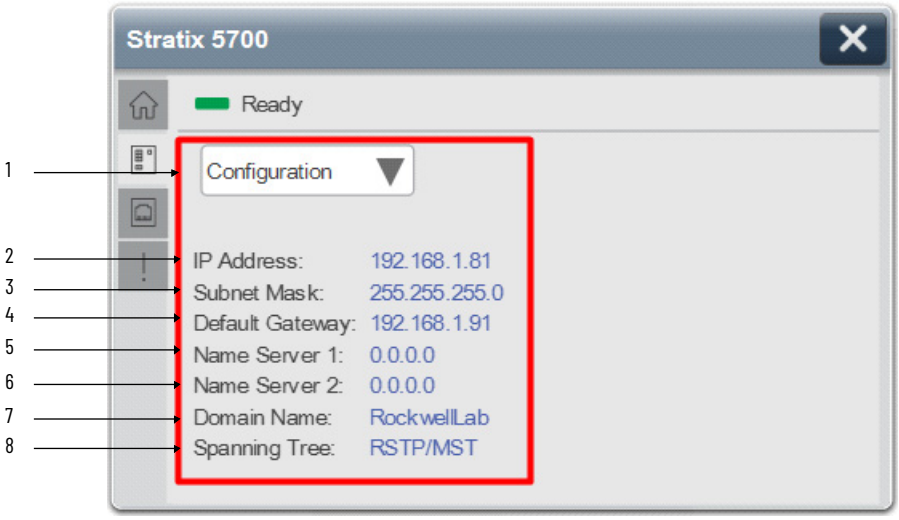
Each selection is described in the following sections

Switch Tab • General



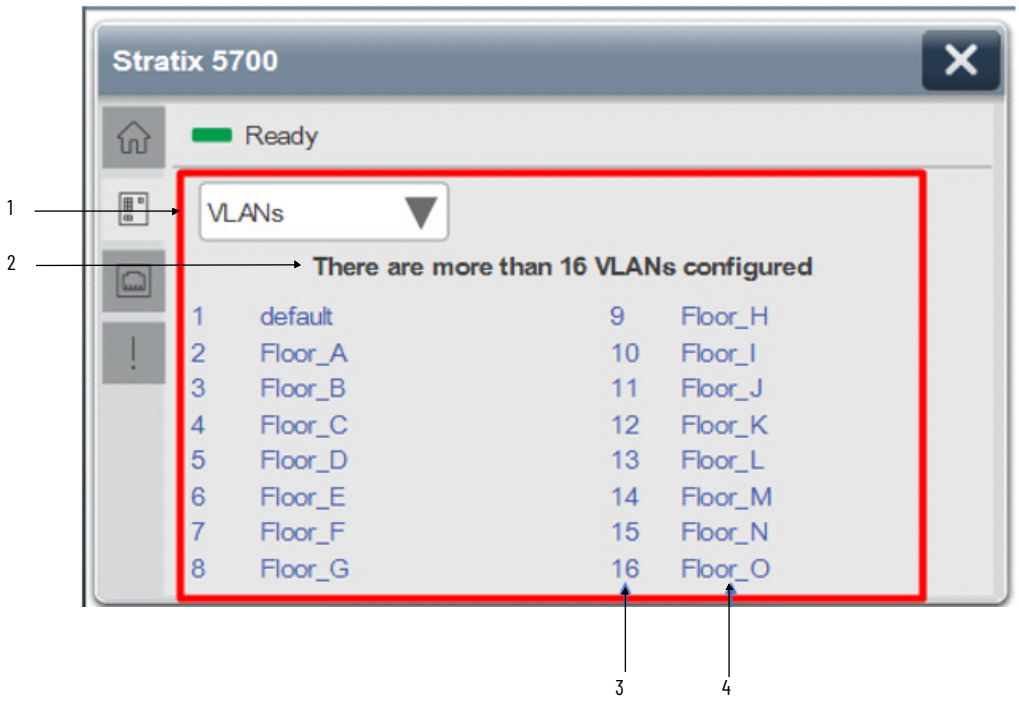
Item	Description
1	Switch Details Drop-Down Menu:
2	Model Number
3	Serial Number
4	Software Version
5	CIP Revision
6	Firmware Type: Full/Lite
7	PTP: Precision Type Protocol Supported/Not Supported
8	NAT: Network Address Translation Supported/Not Supported
9	DLR: Device Level Ring One Ring/Three Ring/Not Supported

Switch Tab • Configuration



Item	Description
1	Switch Details Drop-Down Menu
2	IP Address
3	Subnet Mask
4	Default Gateway
5	Name Server 1: Primary Domain Name System (DNS) Server
6	Name Server 2: Secondary Domain Name System (DNS) Server
7	Domain Name
8	Spanning Tree Mode

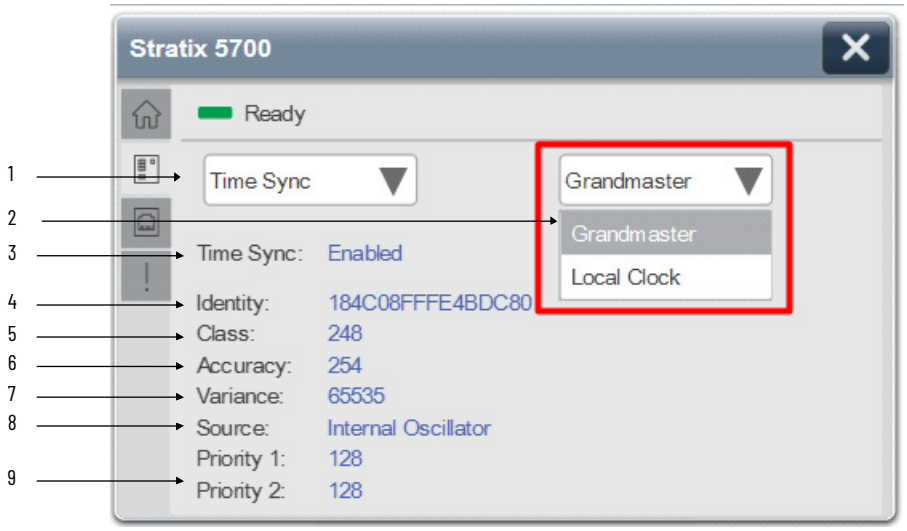
Switch Tab • VLAN



Item	Description
1	Switch Details Drop-Down Menu
2	A maximum of 16 VLANs will be displayed. If the number of VLANs configuration on the switch exceeds 16 then the faceplate will display a message “There are more than 16 VLANs configured”.
3	VLAN Number. Note the switch is pre-configured with a default VLAN which has ID 1.
4	VLAN Name

Switch Tab • Time Sync

The Time Sync section displays current information about the real-time clocks in the network. The data is only displayed if the CIP (Common Industrial Protocol) Sync Time Synchronization feature is enabled and the time sync information is available for Grandmaster & local Clock



Item	Description
1	Switch Details Drop-Down Menu
2	Clock selector: Grandmaster/Local Clock
3	Time Sync: Enabled/Disabled
4	Identity: unique identifier for the grand master clock. The format depends on the network protocol. Ethernet encodes the MAC address into the identifier while DeviceNet and ControlNet encode the Vendor ID and serial number.
5	Class: measure of the quality of the grand master clock. Values are defined from 0 through 255 with zero (0) as the best clock.
6	Accuracy: Indicates the expected absolute accuracy of the grand master clock relative to CIP Sync Time Synchronization epoch (31 December, 1969 23:59:51.99918 UTC).
7	Variance: Displays the measure of inherent stability properties of the grandmaster clock. The value is represented in offset scaled log units. The lower the variance, the better the clock
8	Source: Time source of the clock. Atomic Clock/GPS/Terrestrial Radio/PTP/NTP/HAND Set/Other/Internal Oscillator
9	Priority 1 & 2: relative priority of the grandmaster clock to other clocks in the system. The value is between 0 and 255. The highest priority is zero (0).

Port Tab

The Port Tab screens provide detailed information about selected Switch ports to help troubleshoot connections for a specific port.

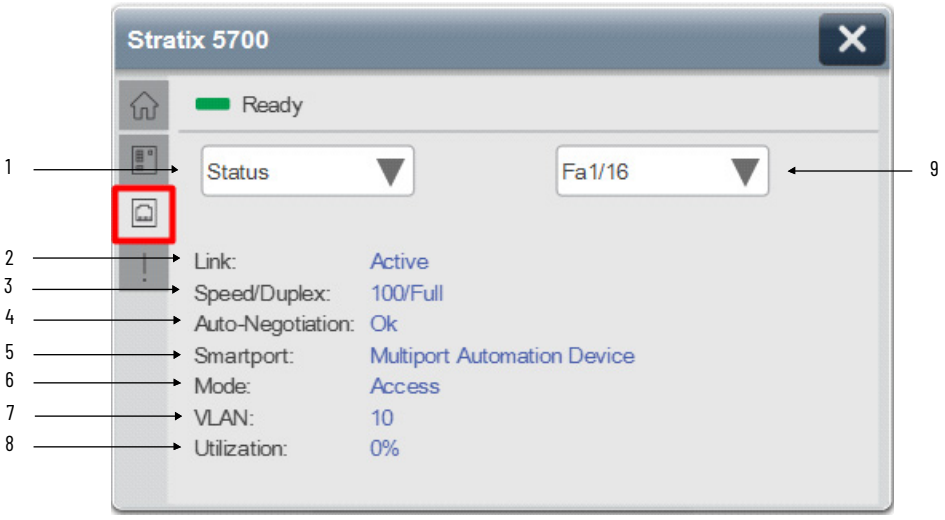
There are two ways to navigate to these screens: Click on the Port button on the left, and then select the port from the drop-down on the right or Click on the desired port icon on the Home Tab.

The drop-down selector in the top left offers the following options:

- Status
- Statistics

- Media Counter
- Thresholds
- Time Sync

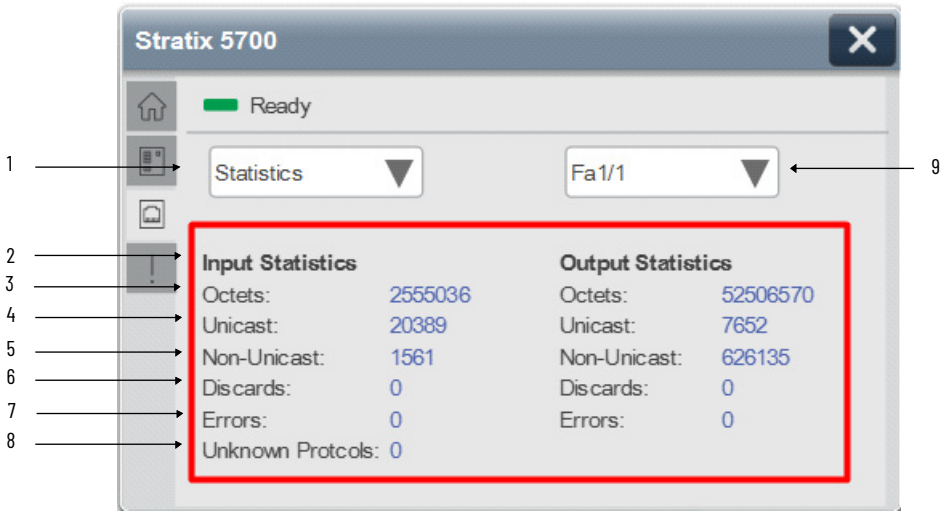
Port • Status



Item	Description
1	Port Details Drop-Down Menu
2	Link: Displays whether the link between the Switch Port and the attached device is Active or Inactive or Disabled or Fault/Alarm
3	Speed/Duplex: Displays operating speed and duplex type of port. Available duplex types are: - Full - Half
4	Auto-Negotiation: Displays current state of Auto-negotiation process. Available Auto-negotiation states are: - In Progress - Failed - Duplex Fail - Ok - Forced
5	Smartport: Displays the Smartport role that will be applied to the connected port, these are preset recommended configurations for the switch ports. These configurations, referred to as port roles, optimize the switch connections and provide security, transmission quality, and reliability for traffic from the switch Ports. The port roles also help prevent port mis-configurations. The available values for each port are: - Automation Device - Port is configured to be connected to a single EtherNet/IP (Ethernet Industrial Protocol) device. This role can be used to manage industrial automation devices, such as logic controllers and I/O - Desktop for Automation - Port is configured to be connected to desktop devices, such as desktop PCs, workstations, notebook PCs, and other client-based hosts - Switch for Automation - Port is configured to be connected to other switches that support Spanning Tree, such as, Stratix® 8000, Stratix® 6000 release 3, or Cisco switches - Router for Automation - Port is configured to be connected to Cisco routers or Layer 3 switches with routing service capabilities. Use this role if the port will connect to devices that connect to the WAN or the Internet - Phone for Automation - Port is configured to be connected to Cisco IP phones. A desktop device, such as a PC, can be connected to the IP phone. Both the IP phone and the connected PC would have access to the network and the Internet through the switch port - Wireless for Automation - Port is configured to be connected to Cisco Wireless Access Point - Multiport Automation Device - Port is configured to be connected to multiport EtherNet/IP (Ethernet Industrial Protocol) devices - Virtual Desktop for Automation - Port is configured to be connected to PCs running virtualization software. This can be used with devices running up to two MAC addresses - None - Apply this role to ports if you do not want a specialized Smartport role on the port

Item	Description
6	Mode: Displays Administrative Mode of selected port, available modes for each port are: - Dynamic Auto - Access - Trunk - Dynamic Desirable - Tunnel - Routed Port
7	VLAN: Displays the VLAN ID for configured VLANs. The default VLAN ID, 1, cannot be edited or deleted
8	Utilization: Displays current port utilization
9	Drop-down selector for desired port number.

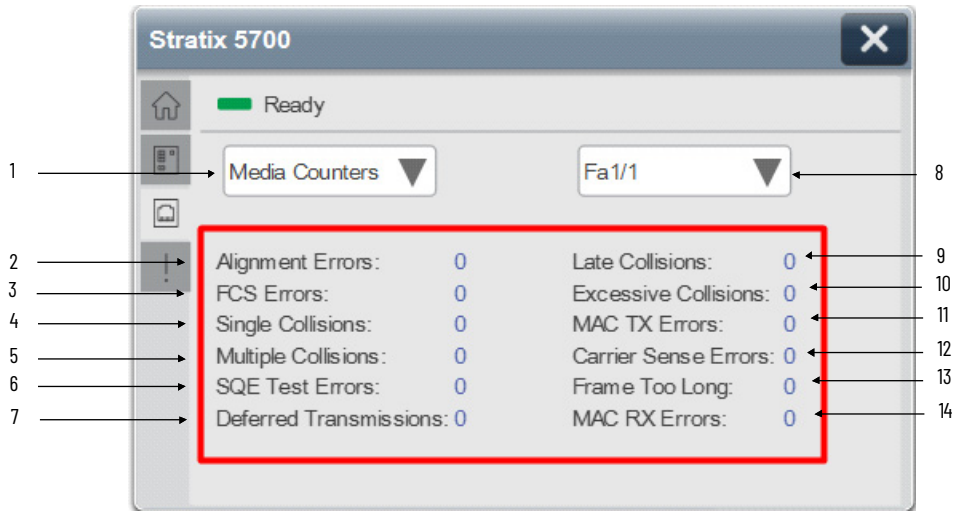
Port • Statistics



Item	Description
1	Port Details Drop-Down Menu
2	Statistics type - Input Statistics: packets received/inbound packets - Output Statistics: packaged transmitted/outbound packets
3	Octets: The number of octets that are received/transmitted by the port
4	Unicast: The total number of well-formed unicast packets received/transmitted by a port. It excludes packets received with errors, with multicast or broadcast destination addresses, undersize packets, discarded packets, or packets without a destination
5	Non-Unicast: The total number of well-formed multicast packets received/transmitted by a port. It excludes packets received with errors, with unicast or broadcast destination addresses, oversized or undersized packets, discarded packets, or packets without a destination
6	Discards: The number of inbound/outbound packets that have been discarded
7	Errors: The number of inbound/outbound packets that contain errors
8	Unknown Protocols: The number of inbound/outbound packets with unknown protocols
9	Drop-down selector for desired port number.

Port • Media Counter

The Media Counters page displays the number of errors and collisions on a selected port.



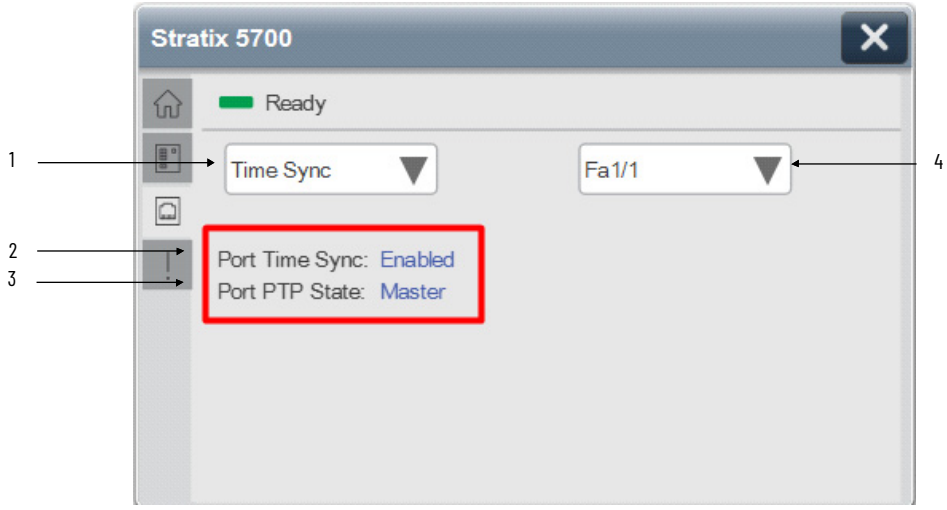
Item	Description
1	Port Details Drop-Down Menu
2	Alignment Errors: The number of frames received that are not an integral number of octets in length
3	FCS (Frame Check Sequence) Errors: The number of frames received that do not pass the Frame, check Sequence test
4	Single Collisions: The number of single (multiple, late) frame collisions detected by the interface.
5	Multiple Collisions: The number of multiple collisions detected by the interface
6	SQE Test Errors: The number of times that the SQE TEST ERROR is generated
7	Deferred Transmissions: The count of transmissions that are deferred by busy network
8	Drop-down selector for desired port number.
9	Late Collisions: The number of late collisions detected by the interface
10	Excessive Collisions: The number of frames for which transmission fails due to excessive collisions
11	MAC TX Errors: The number of frames that failed to transmit due to an internal MAC sublayer transmit error
12	Carrier Sense Errors: The number of times the carrier sense condition was lost or never asserted when attempting to transmit a frame
13	Frame Too long: The number of frames received that exceed the maximum permitted frame size
14	MAC RX Errors: The number of frames that failed to be received due to an internal MAC sublayer receive error

Port • Thresholds

The Thresholds screen displays packets passing from an interface to the switching bus. The switch counts the number of packets of a specified type that is received within the 1-second time interval and compares the measurement with a predefined suppression-level threshold.

Port • Time Sync

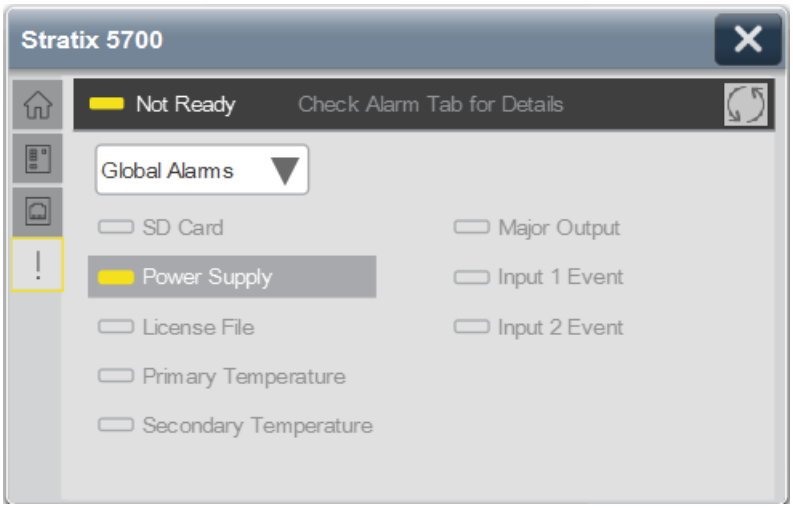
The Time Sync screen displays port Precision Time Protocol (PTP) synchronization status (Enable/Disable) and current state of the Time Synchronization port on the device.



Item	Description
1	Port Details Drop-Down Menu
2	Port Time Sync Status: Enabled/Disabled
3	Port PTP State: - Unknown - Initializing: The switch port is waiting while a parent or grand master clock is selected - Faulty: Either PTP is not operating properly on that switch port or nothing is connected to the port - Forward: This switch passes PTP packets as normal multicast traffic. All switch ports are enabled by default - Listening: The switch port is waiting while a parent or grand master clock is selected - Pre-Master: The switch port is transitioning to change to Master state - Master: The switch is acting as a parent clock to the devices connected to that switch port - Passive: The switch has detected a redundant path to a parent or grand master clock. For example, two different switch ports claim the same parent or grand master clock. To prevent a loop in the network, one of the ports changes to Passive state - Uncalibrated: The switch port cannot synchronize with the parent or grand master clock - Slave: The switch port is connected to and synchronizing with the parent or grand master clock
4	Drop-down selector for desired port number.

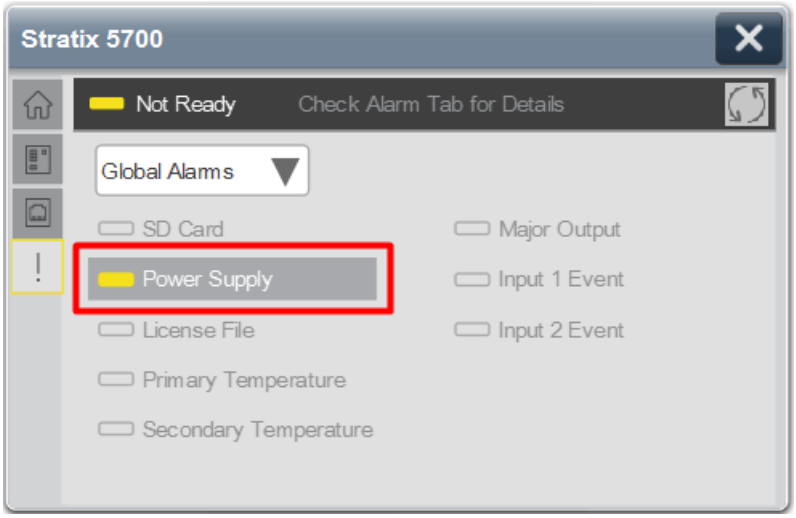
Alarm Tab

The Alarm Tab screens provide details for global switch alarms and individual Port alarms Click on the tab with exclamation icon, then select Global or Port Screens using left drop-down selector.

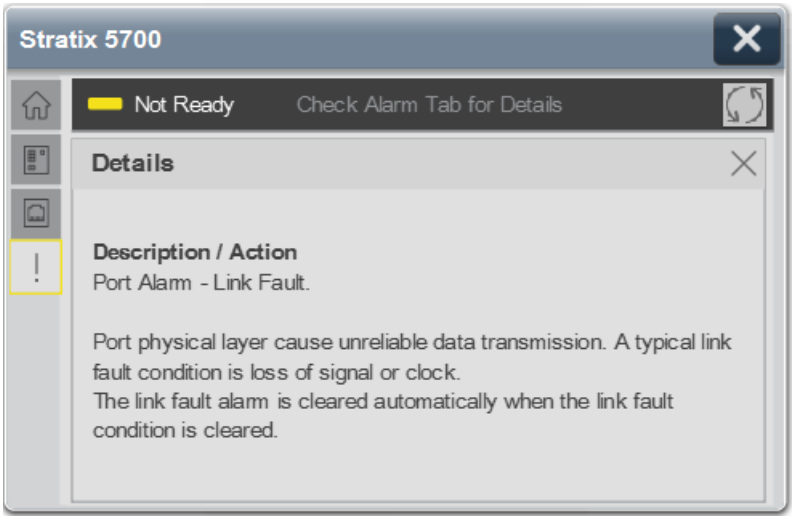


There are multiple way to get to these screens:

- Click on the banner if alarm text appears or click on individual port.
- An Active Alarm is indicated by a yellow rectangle button.



Clicking on the yellow button will launch the Alarm Details screen providing an alarm description and recommended actions, click on the X on the upper right corner to close the alarm details screen.



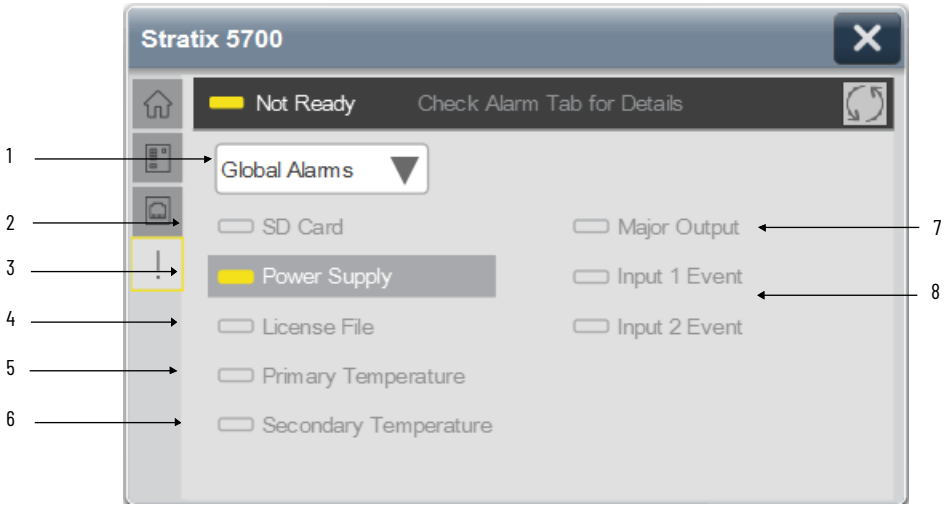
There are two type of alarms will be displayed on the alarm tab:

- Global Alarms
- Port Alarms

Global Alarms

Set the drop-down selector to **Global Alarms** to display global switch alarms.

Active alarms are shown with a yellow LED icon and a darker gray background. You can click on the active alarm to see more details.

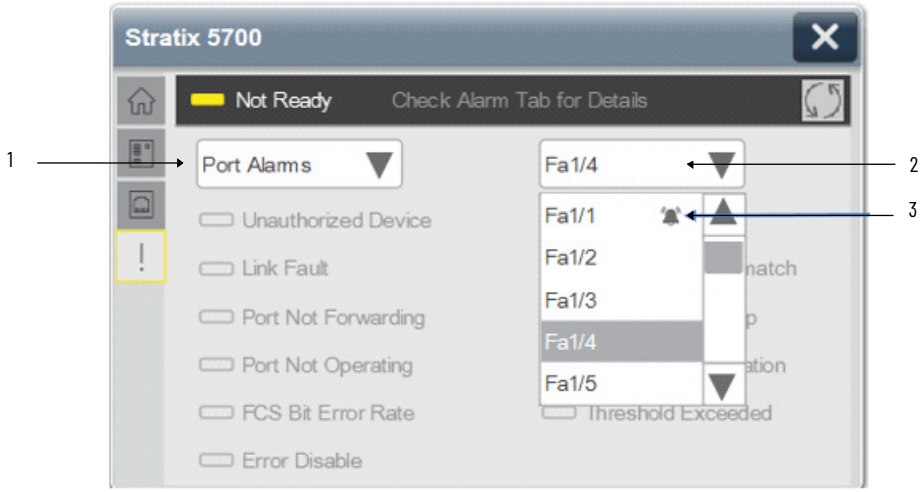


Item	Description
1	Drop-down selector Global Alarms/Port Alarms
2	SD Card: Indicates Alarms generated by a faulted SD card.
3	Power Supply: The switch monitors DC power supply levels. If the system is configured to operate in a dual power mode, an alarm is triggered if a power supply fails or is missing. The alarm is automatically cleared when the power supplies are present or working.
4	License File: An alarm is triggered when the license file is corrupt.
5	Primary Temperature: These alarms are triggered when the system temperature is higher or lower than the configured thresholds. By default, the primary temperature alarm is associated with the major relay.
6	Secondary Temperature: These alarms are triggered when the system temperature is higher or lower than the configured thresholds.
7	Major Output: User can configure the switch to trigger an external alarm device. The switch software is configured to detect faults that are used to energize the relay coil and change the state.
8	Input 1/2/3/4 Event: An alarm is triggered based on an external input 1/2/3 alarm. Input 3 and 4 visibility depends on switch type.

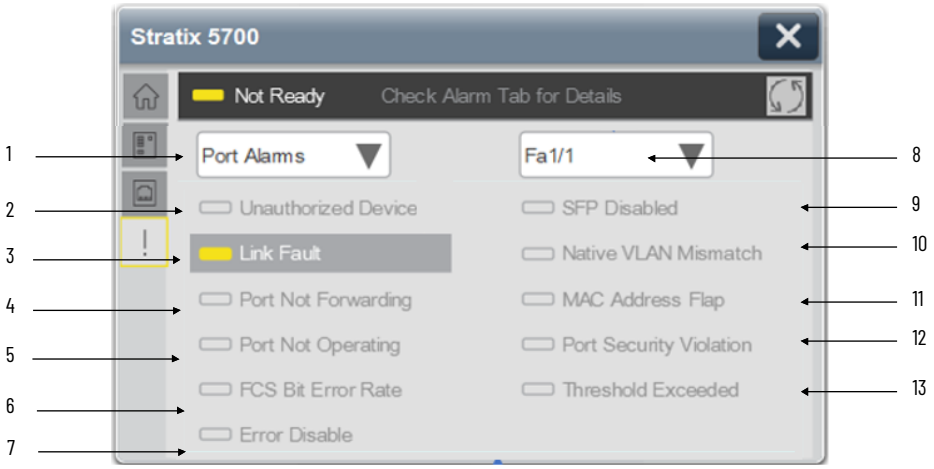
Port Alarms

Click on left drop-down menu and select **Port Alarms** option. This will allow you to view and use the right drop-down menu to navigate between specific port alarms.

Active alarms are shown with a yellow LED icon and a darker gray background. You can click on the active alarm to see more details.



Item	Description
1	Drop-down selector - Global Alarms/Port Alarms
2	Drop-down selector - Port Selection
3	Ports with an active alarm display an alarm bell icon in the drop-down menu



Item	Description
1	Drop-down selector - Global Alarms/Port Alarms
2	Unauthorized Device: Indicates that an unauthorized MAC ID has attempted to communicate on a specific port.
3	Link Fault: Connection Fault detected on a specific port, including disconnected cable.
4	Port Not Forwarding: The switch generates a port not-forwarding alarm when a port is not forwarding packets.
5	Port Not Operating: The switch generates a port not-operating alarm when a port fails during the startup self-test.
6	FCS Bit Error Rate: The switch generates an FCS bit error-rate alarm when the actual FCS bit error-rate is close to the configured rate.
7	Error Disable
8	Drop-down selector - Port Selection
9	SFP Disabled: Software placed the SFP interface in an error-disabled state.

Item	Description
10	Native VLAN Mismatch: Connected switches the native VLAN numbers differ.
11	MAC Address Flap: Switch detected that a MAC address is being learned on alternating switch ports.
12	Port Security Violation: A security violation occurred on a selected port
13	Port Threshold Exceeded: Port traffic exceeded a preset threshold

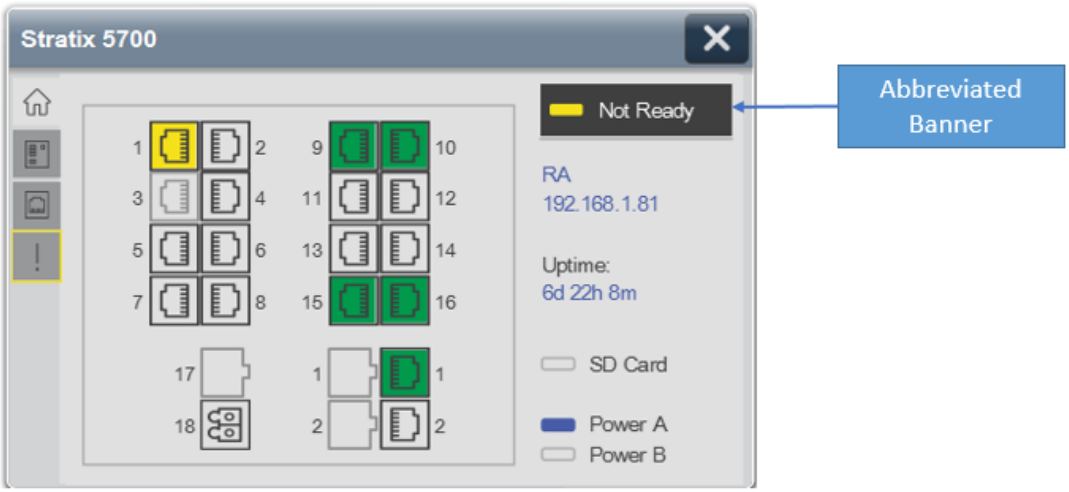
Banner

A banner will be displayed at the top of each screen to provide the following information of the device:

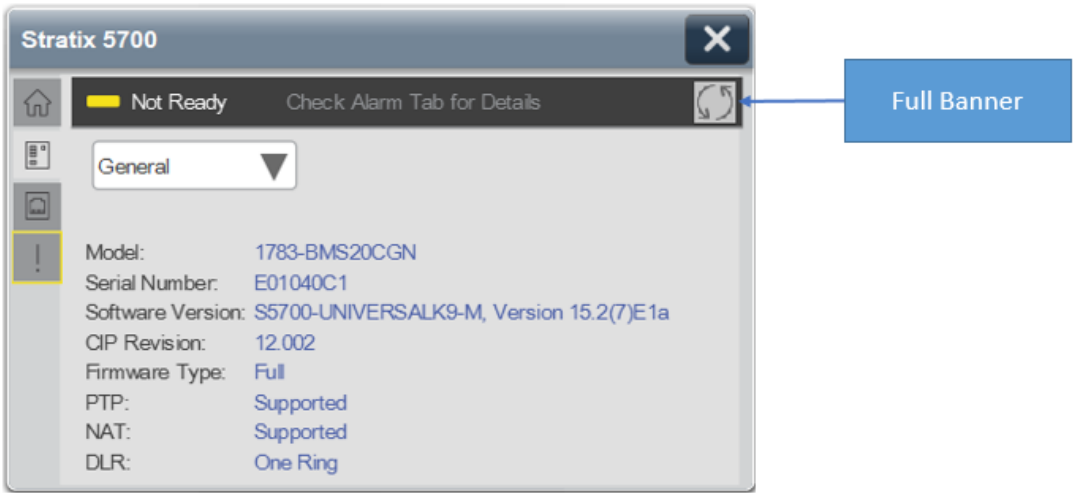
- Ready
- Not Ready (device will show Not Ready and fault message)
- AOI Not Enabled

There are two types of banner available that provides the overall status of the switch.

- **Abbreviated version of the banner**: Only available on Home tab



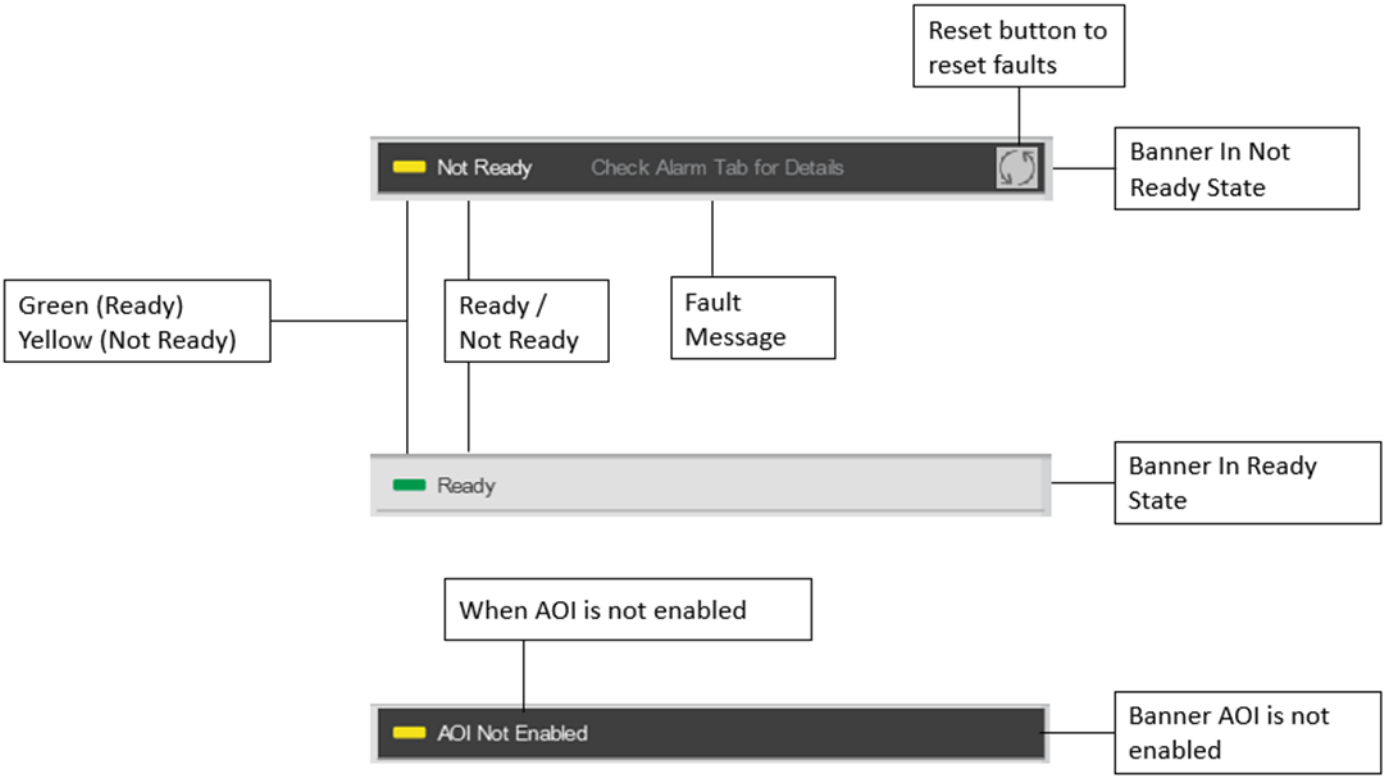
- **Full version of banner :** Available on Switch, Port & Alarm tab



The full banner will be visible when there is any alarm or fault present on switch or on any port, or when AOI is not enabled.

When an alarm or fault is preset a reset button is visible on banner to reset alarms or faults.

When the device is healthy and no alarms are present then ready with green LED will be shown on banner.



Application Code Manager

Network Device Library objects can be set-up and configured using Studio 5000® Application Code Manager.

Refer to the section Using Application Code Manager for complete details.

Definition Objects: raC_Dvc_Stratix

This Asset-Control object contains the Add-On Instruction definition and required data types. It is used as a linked library to the device implement object. This gives users the flexibility to choose to instantiate only definition and create custom implement code. A user may also create their own implement library and link with this definition library object.

Implementation Objects: raC_LD_Dvc_Stratix

The Device Implementation Object is the rung that is instantiated when generating controller code using Application Code Manager. This implementation object includes a reference to the Asset-Control Add-On Instruction definition, along with any required controller tags, programs, modules, and HMI objects.

The Stratix® implementation has the following configuration parameters.

Parameter Name	Default Value	Instance Name	Definition	Description
RoutineName	{ObjectName}	{RoutineName}	Routine	Enter Routine name. Routine will be created and Object implement rung(s) inserted. A JSR will be inserted in MainRoutine. If routine name already exists, then object will be inserted into existing routine. By default, parameter is set to Object Name.
TagName	{ObjectName}	{TagName}	Backing Tag	Enter the backing tag of the main AOI. This will serve as the base tag name for other tags in this object that are derived from the base.
TagDescription	{ObjectDescription}	{TagDescription}		Tag Description of the main AOI backing tag
ModuleName	Mod_[ObjectName]	[ModuleName]		Enter the Module Name. This is the name for the module that appears in the Controller Organizer tree.
IncludeHW	True			Allow ACM to create the Hardware Module. If the module already exists in the Controller Organizer, select False or existing module properties will be overwritten.
ModuleType	Stratix® 2500			Select hardware module type: Stratix® 2500 Stratix® 5400 Stratix® 5410 Stratix® 5700 Stratix® 5800
CatalogNo				Select Stratix® hardware module type

Parameter Name	Default Value	Instance Name	Definition	Description
IPAddress	192.168.1.0			Enter a valid network address for the hardware module. It must be of form X.X.X.X
ParentModule	Local		Module	Select the Parent Module. This represents the name of the communications adapter this module will communicate through. If connecting to a non-library object module enter the name of the module only. If the module is connected directly to the controller Ethernet port, enter "Local". Note: entering non-library object modules will result in the parameter displaying a red 'X'. This will still generate properly as long as the entered name exists in the project.
NavigationButton	Icon			Select navigation button type. Icon/Text. See FactoryTalk® View ME/SE Graphic Symbols for more information.

Note that if the tag names are manually entered or not linked to ParentModule tags a red 'X' will be shown beside the parameter. This is acceptable and the program can still be generated.

Linked Libraries

Link Name	Catalog Number	Revision	Solution	Category
raC_Dvc_Stratix	raC_Dvc_Stratix	12.2	(RA-LIB) Device	Network

Configured HMI Content

HMI Content	Instance Name	Description
Launch Button	{ObjectName}_GO_LaunchFP_Text	Global Object launch button using basic text label.
Launch Button	{ObjectName}_GO_LaunchFP_Icon	Global Object launch button using schematic style device icon.

Attachments

Name	Description	File Name	Extraction Path
V12_raC_Dvc_Globall	Graphic Symbols ME	(raC-12-ME) Graphic Symbols - Network Device.ggfx	{ProjectName}\Visualization\FTViewME\GlobalObjects
V12_raC_Dvc_Stratix® Switch	Faceplate ME	(raC-12_xx-ME) raC_Dvc_S2500-Faceplate.gfx	{ProjectName}\Visualization\FTViewME\Displays
V12_raC_Dvc_Stratix® Switch	Faceplate ME	(raC-12_xx-ME) raC_Dvc_S5400-Faceplate.gfx	{ProjectName}\Visualization\FTViewME\Displays
V12_raC_Dvc_Stratix® Switch	Faceplate ME	(raC-12_xx-ME) raC_Dvc_S5410-Faceplate.gfx	{ProjectName}\Visualization\FTViewME\Displays
V12_raC_Dvc_Stratix® Switch	Faceplate ME	(raC-12_xx-ME) raC_Dvc_S5700-Faceplate.gfx	{ProjectName}\Visualization\FTViewME\Displays
V12_raC_Dvc_Stratix® Switch	Faceplate ME	(raC-12_xx-ME) raC_Dvc_S5800-Faceplate.gfx	{ProjectName}\Visualization\FTViewME\Displays
V12_raC_Dvc_Globall	Graphic Symbols SE	(raC-12-ME) Graphic Symbols - Network Device.ggfx	{ProjectName}\Visualization\FTViewSE\GlobalObjects
V12_raC_Dvc_Stratix® Switch	Faceplate SE	(raC-12_xx-SE) raC_Dvc_S2500-Faceplate.gfx	{ProjectName}\Visualization\FTViewSE\Displays

V12_raC_Dvc_Stratix® Switch	Faceplate SE	(raC-12_xx-SE) raC_Dvc_S5400-Faceplate.gfx	{ProjectName}\Visualization\FTViewSE\Displays
V12_raC_Dvc_Stratix® Switch	Faceplate SE	(raC-12_xx-SE) raC_Dvc_S5410-Faceplate.gfx	{ProjectName}\Visualization\FTViewSE\Displays
V12_raC_Dvc_Stratix® Switch	Faceplate SE	(raC-12_xx-SE) raC_Dvc_S5700-Faceplate.gfx	{ProjectName}\Visualization\FTViewSE\Displays
V12_raC_Dvc_Stratix® Switch	Faceplate SE	(raC-12_xx-SE) raC_Dvc_S5800-Faceplate.gfx	{ProjectName}\Visualization\FTViewSE\Displays
V12_raC_Dvc_SDtratix	View Designer	(raC-12_xx-VD) raC_Dvc_Stratix.vpd	{ProjectName}\Visualization\ViewDesigner
V12_RM_raC_Dvc_Network	Reference Manual	DEVICE-RM400B-EN-P.pdf	{ProjectName}\Documentation
V12_Network_Images	HMI Image Set	HMI FactoryTalk® View Images - png.zip	{ProjectName}\Visualization\Images
V12_raC_Dvc_Network_Global	Toolbox ME	(raC-12-ME) Toolbox - Network Device.ggfx	{ProjectName}\Visualization\FTViewME\GlobalObjects
V12_raC_Dvc_Network_Global	Toolbox SE	(raC-12-SE) Toolbox - Network Device.ggfx	{ProjectName}\Visualization\FTViewSE\GlobalObjects

Single Device Level Ring (raC_Opr_NetDLR1, raC_Opr_NetDLR1_Lite)

Overview

The Single Device Level Ring device objects (raC_Opr_NetDLR1 and raC_Opr_NetDLR1_Lite) include HMI faceplates for single Device Level Ring (DLR) networks which displays network information including:

- Automatically generated network topology
- Detailed ring network data and statistics
- Network fault monitoring including graphical identification and location of faulted network links
- Ring supervisor, ring participant, and redundant gateway information

The standard object (raC_Opr_NetDLR1) can be used for DLR networks containing up to 56 nodes. The smaller Lite version of the instruction (raC_Opr_NetDLR1_Lite) can be used with smaller networks up to 12 nodes.

In the Library there is a folder named *Videos* which contains many How-To and Operational Overview Videos which walk step-by-step through each process. You can refer to the following videos for this section:

"Operational Overview of DLR Object Faceplates"

Functional Description

The Single Device Level Ring pre-configured Device Objects:

- Collects and processes data from the Active Ring Supervisor and participant node devices and delivers data to the status and diagnostic faceplates.
- Provides enhanced DLR network and node status and diagnostic information simplifying network maintenance and reducing network downtime.

All these features provide quick feedback, shorten recovery time, and simplify implementation.

Required Files

Device Objects include Add-On Instructions (AOIs) and HMI faceplates. The revision number (e.g. 1.01) used in filenames can change as new revisions are created.

Controller Files

Add-On Instructions are reusable code objects that contain encapsulated logic that can streamline implementing your system. This lets you create your own instruction set for programming logic as a supplement to the instruction set provided natively in the ControlLogix® firmware. An Add-On Instruction is

defined once in each controller project, and can be instantiated multiple times in your application code as needed.

The Add-On Instruction must be imported into the controller project to be used in the controller configuration. These can be imported as Add-On Instruction files, or as part of the Rung Import or Import Library Objects wizard.

All Add-On Instruction and Rung Import files can be found in the */Studio 5000 Logix Designer Files - L5X/* folder in the library.

Object	Compatible Network Configuration	Add-On Instruction	Rung Import
raC_Opr_NetDLR1	Single ring up to 56 nodes	raC_Opr_NetDLR1_12.02_AOI.L5X	raC_Opr_NetDLR1_12.02_RUNG.L5X
raC_Opr_NetDLR1_Lite	Single ring up to 12 nodes	raC_Opr_NetDLR1_Lite_12.02_AOI.L5X	raC_Opr_NetDLR1_Lite_12.02_RUNG.L5X

FactoryTalk® View HMI Files

FactoryTalk® View ME and FactoryTalk® View SE applications require importing the desired device faceplates in addition to all Global Object (ggfx) files and all images located in the */HMI FactoryTalk® View Images - png/* folder of the library. FactoryTalk® View ME files are stored in the */HMI - FactoryTalk® View ME/* library folder and FactoryTalk® View SE files are stored in the */HMI - FactoryTalk® View SE/* library folder.

Note that the Add-On Instruction *raC_Opr_NetDLR1* can be used with either the 24 Node or 56 Node displays depending on the size of the network. The HMI faceplate will automatically display the correct layout for connected network.

Device/Item	Compatible Network Configuration	Type	FactoryTalk® View ME Faceplate	FactoryTalk® View SE Faceplate
raC_Opr_NetDLR1_Lite	Single ring up to 12 nodes	Display	(raC-12_02-ME) raC_Opr_NetDLR1_12Node-Faceplate.gfx	(raC-12_02-SE) raC_Opr_NetDLR1_12Node-Faceplate.gfx
raC_Opr_NetDLR1	Single ring up to 24 nodes	Display	(raC-12_02-ME) raC_Opr_NetDLR1_24Node-Faceplate.gfx	(raC-12_02-SE) raC_Opr_NetDLR1_24Node-Faceplate.gfx
	Single ring up to 56 nodes	Display	(raC-12_02-ME) raC_Opr_NetDLR1_56Node-Faceplate.gfx	(raC-12_02-SE) raC_Opr_NetDLR1_56Node-Faceplate.gfx
Graphic Symbols	All DLR	Global Object	(raC-12-ME) Graphic Symbols - Network Device	(raC-12-SE) Graphic Symbols - Network Device
Toolbox	All DLR	Global Object	(raC-12-ME) Toolbox -Network Device.ggfx	(raC-12-SE) Toolbox -Network Device.ggfx

Studio 5000 View Designer® HMI Files

All Studio 5000 View Designer® Files can be found in the */HMI - ViewDesigner - vpd/* folder of the library.

Device/Item	Studio 5000 View Designer® Faceplate
All Device Level Ring Objects	(raC-12_02-VD) raC_Opr_NetDLR.vpd

Studio 5000® Application Code Manager Files

Studio 5000® Application Code Manager (ACM) can be optionally used if it is installed. All devices can be easily registered in the ACM repositories by running the *setup.cmd* file located in the root folder of the library.

Individual HSL4 files are provided as an alternative to running the setup.cmd to allow users to manually register specific implementation objects. Each object has two files - an Asset Control file and a Device file. The Asset Control files include attachments of all required files for that object. The Device files are used to actually add that device into a Studio 5000® project and these reference the Asset Control files.

All Studio 5000® Application Code Manager files can be found in the /*ApplicationCodeManagerLibraries*/ folder of the library. The files included are as follows:

Implementation Object	Compatible Network Configuration	Asset Control File (.HSL4)	Device File (.HSL4)
DLR1 Lite	Single ring up to 12 nodes	(RA-LIB)_Device_Asset-Control_Network_raC_Opr_NetDLR1_Lite_(12.3)	(RA-LIB)_Device_Device_Network_raC_LD_Opr_NetDLR1_Lite_(12.3)
DLR1	Single ring up to 56 nodes	(RA-LIB)_Device_Asset-Control_Network_raC_Opr_NetDLR1_(12.3)	(RA-LIB)_Device_Device_Network_raC_LD_Opr_NetDLR1_(12.3)

Operations

The Network Device objects provide only physical operation mode. There is no virtual device mode offered.

Execution

The following table explains the handling of instruction execution conditions.

Condition	Description
EnableIn False (false rung)	Processing for EnableIn False (false rung) is handled the same as if the device were taken out of service by Command. The device outputs are de-energized and the device is shown as Program Out of Service on the HMI. All alarms are cleared.
Powerup (prescan, first scan)	On prescan, any commands that are received before first scan are discarded. The device is de-energized. On first scan, the device is treated as if it were returning from Hand command source: the instruction state is set based on the position feedback that is received from the device. If the feedback is valid for one position, the device is set to that position. If the device does not have position feedback or the position feedback is invalid, the device is set to the 'unknown/powerup' state. The command source is set to its default, either Operator or Program (unlocked).
Postscan	No SFC Postscan logic is provided.

Add-On Instruction I/O Data

InOut Data

InOut	Function / Description	DataType
Ref_Path_to_DLR	CIP path to DLR network	STRING
Ref_Msg_Get_All	Message used to read complete CIP objects.	MESSAGE
Ref_Msg_Get_Single	Message used to read vendor specific attributes.	MESSAGE
Ref_Msg_Get_Member	Message used to read member attributes	MESSAGE
Ref_Msg_Rst_SignOn	Message used to sign on to switch	MESSAGE
Ref_Storage	Stores CIP message data	SINT[520]

Input Data

Input	Function/Description	DataType
EnableIn	Enable Input - System Defined Parameter	BOOL
Inp_Enable	Enable AOI functions. 1 = enabled.	BOOL
Inp_RefreshInhibit	Inhibit data refresh	BOOL

Output Data

Output	Function/Descritpion	DataType
EnableOut	Enable Output - System Defined Parameter	BOOL
Sts_EN	AOI Enabled Status; 1 = enabled.	BOOL
Sts_ER	Message error bit; 1= Error	BOOL
Sts_Connected	Device is connected to the Programmable Controller	BOOL
Sts_Available	Device is available for interaction with user code	BOOL
Sts_Faulted	Device faulted status: 1 = an active fault exists	BOOL
Ref_HMI	Alias tag for HMI_Parameters.Tab_Active	DINT

Data Types

A number of User-Defined Datatypes (UDT) are used in the Network Device Library. A full list of the UDTs used with the raC_Opr_NetDLR1 and raC_Opr_NetDLR1_Lite objects follows:

User Defined Datatype	Description
raC_UDT_DLRActive_Node	DLR Active Node Address
raC_UDT_DLRCapture_Error	DLR Error Information
raC_UDT_DLRDropdowns	DLR Drop-down menu
raC_UDT_DLRFaults	DLR HMI Faceplate Information - Faults
raC_UDT_DLRHMI/raC_UDT_DLRLiteHMI	DLR HMI Faceplate Information
raC_UDT_DLRHome/raC_UDT_DLRLiteHome	DLR HMI Faceplate Information - Home Tab
raC_UDT_DLRLast_Node	DLR Last Node Information
raC_UDT_DLRLocalData/raC_UDT_DLRLiteLocalData	DLR HMI local data
raC_UDT_DLRMAC	DLR Mac Address
raC_UDT_DLRNode/raC_UDT_DLRLiteNode	DLR HMI Faceplate Information - Node
raC_UDT_DLRNode_Info/raC_UDT_DLRLiteNode_Info	DLR Node Information
raC_UDT_DLRRedGateway	DLR Redundant Gateway information
raC_UDT_DLRRing	DLR HMI Faceplate Information - Ring
raC_UDT_DLRTakeover_Order	DLR Takeover Precedence order
STR0002	String
STR0016	String
STR0032	String

Add-On Instructions

A number of embedded Add-On Instructions (AOI) are used within the raC_Opr_NetDLR1 and raC_Opr_NetDLR1_Lite instructions. These are used to convert between datatypes and generate values which can be read from the HMI faceplate. The following AOIs are included:

User Defined Datatype	Revision	Description
raC_Tec_DecToHex	12.02	Converts decimal number to hexadecimal String
raC_Tec_DLRClearNodeInfo/ raC_Tec_DLRClearNodeInfo_Lite	12.02	Clears node information
raC_Tec_DLRIcon	12.02	Determines device icon used in DLR network schematic
raC_Tec_IPMACtoString_NET	12.02	Converts numerical IP/MAC address into user-readable string
raC_Tec_MACCompare	12.02	Compares two MAC addresses
raC_Tec_PathSplit	12.02	Strips and separates the last IP address from the path
raC_Tec_PathToHex	12.02	Converts a comma separated string (as typed in "Path" of MSG) to Hex Path string as used in MSG.Path element

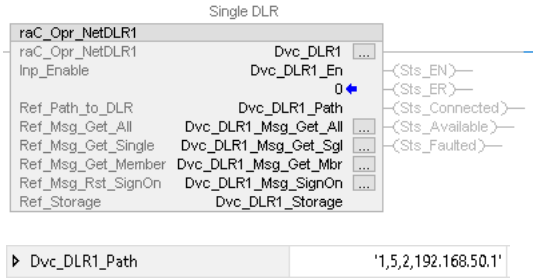
Programming Example

Fully configured device on a rung is provided below for reference.

Note that this programming example is the same code that is imported when either importing the supplied rung .L5X files or when using Application Code Manager or the Studio 5000® Import Library Objects wizard plug-in.

The following example uses the Single Device Level Ring device object named *Dvc_DLR1*. The *Ref_Path_to_DLR* points to the STRING variable called *Dvc_DLR1_Path* which is set to '1,5,2,192.168.50.1'. See Message Paths for more information and examples on assigning this string. This path is defined as follows:

Item	Description
1	This controller 1756-L8x
5	Slot 5 - 1756-EN2TR Ethernet module connected to DLR network
2	Ethernet Network
192.168.50.1	IP Address of 1756-EN2TR ethernet module



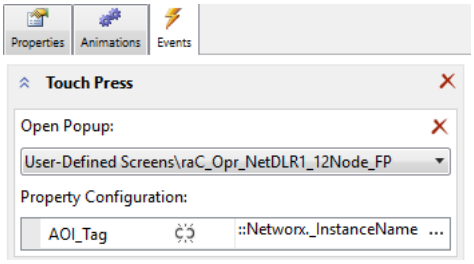
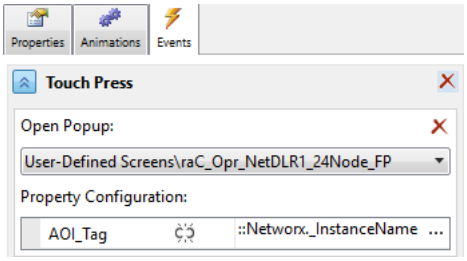
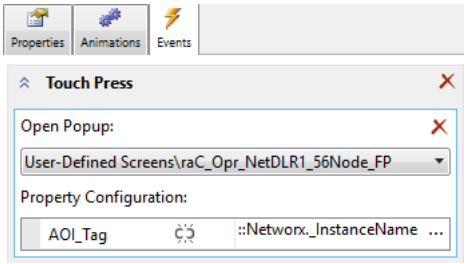
Graphic Symbols

Graphic Symbols are used as launch buttons within HMI applications to open up faceplate displays. See Basic Launch Button Attributes section for details on configuration and indicators.

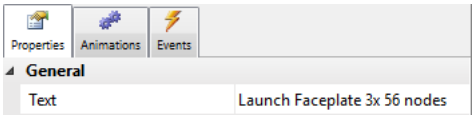
FactoryTalk® View ME/SE Graphic Symbols

Graphic Symbol Name	Graphic Symbol	Description	Global Object Parameter Values
GO_LaunchFP	S...S	Faceplate navigation button with string tag label. This launch button graphic object allows the user to navigate to the device object faceplate. The text on the button face is set to the parameter #104.	#102: AOI Backing Tag Instance (e.g. {::[PAC]._InstanceName}) #104: Navigation Button Label #120: Display's left position (e.g. 100) (optional) #121: Display's top position (e.g. 100) (optional)

Studio 5000 View Designer® Graphic Symbols

Graphic Symbol Name	Graphic Symbol	Description	Property Configuration
btn_nav_NetDLR1_12Node_FP	Launch Faceplate 1x 12 nodes	Navigate to 12 Node Single DLR Faceplate Pop-Up Screen	
btn_nav_NetDLR1_24Node_FP	Launch Faceplate 1x 24 nodes	Navigate to 24 Node Single DLR Faceplate Pop-Up Screen	
btn_nav_NetDLR1_56Node_FP	Launch Faceplate 1x 56 nodes	Navigate to 56 Node Single DLR Faceplate Pop-Up Screen	

Text displayed in the launch buttons can be modified from the *Properties* tab using the *General* > *Text* parameter.

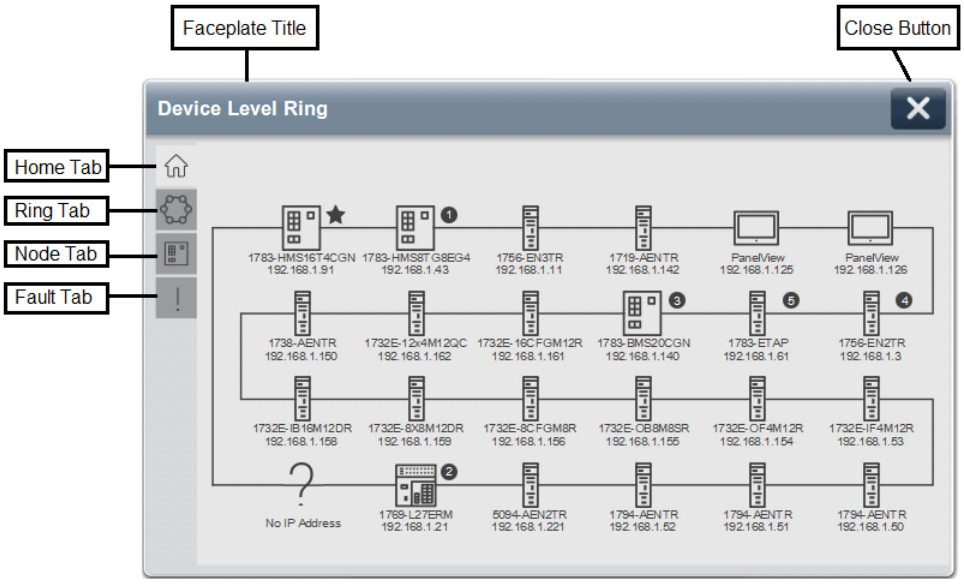


Faceplates

There are basic faceplate attributes that are common across all instructions. See Basic Faceplate Attributes on page 22.

In this document, the faceplate pictures (or snapshots) are of 24-node faceplate, although the 56-node screens and 12-node screens operate identically with only Home Tab difference displaying up to 56 nodes and 12-nodes respectively instead of 24. Also the Redundant Gateway option is not applicable for 12-node DLR Network irrespective of 24-node and 56-node Network.

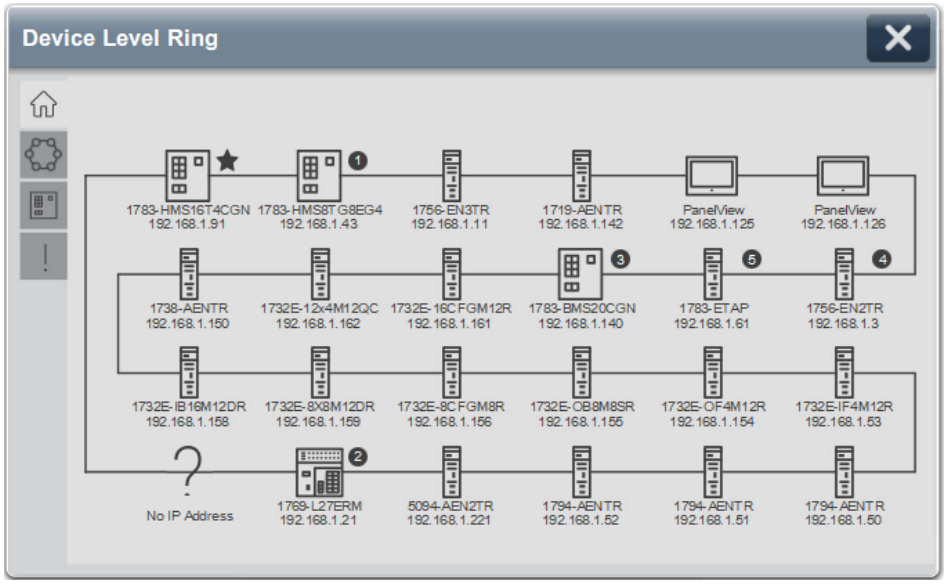
Faceplate Navigation



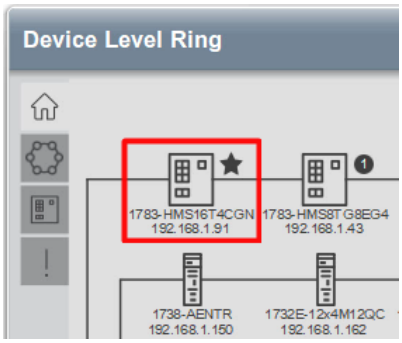
- The **Home** tab provides connected ring network layout and node icons with device information (Catalog Number, IP Address).
- The **Ring** tab provides the Active Ring Supervisor details, Active Redundant Gateway details.
- The
- **Node** tab provides details for all connected nodes.
- The **Fault** tab provides network fault information and location.

Home

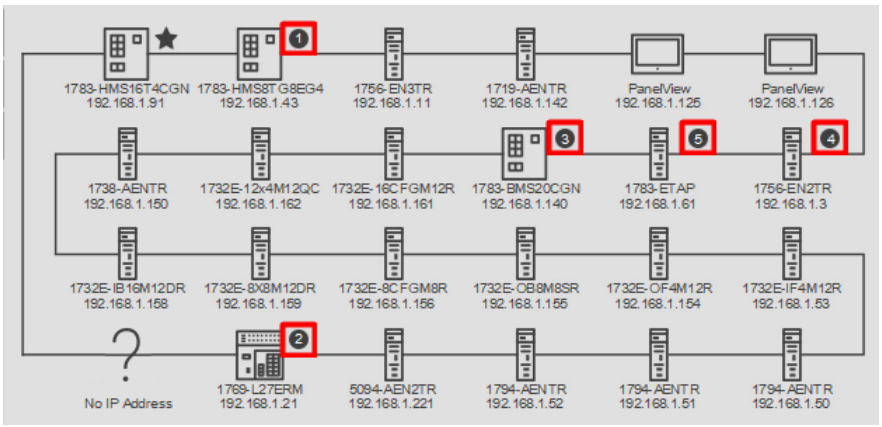
The Home screen is visible when the Home tab button is selected in the tab control object on the left side of the screen. The Home tab screen displays an auto-generated network layout. This example is displaying 24-node network. The number and sequence of nodes are based on the information provided by the Active Ring Supervisor.



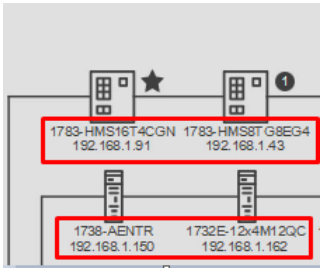
The Active Ring Supervisor is always located on the upper left position of the screen and it is identified by the star icon at the upper right corner of the node.



If the Backup Supervisor is configured, then it is identified by numerical icons at the upper right corner of the nodes. The numerical order indicates the order taken over by the supervisor, if the initial Active Ring Supervisor and subsequent Backup Supervisor cannot perform functions any longer.

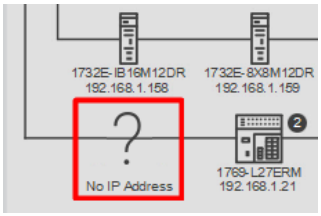


In addition, each node will display its catalog number and IP address as reported by the device.



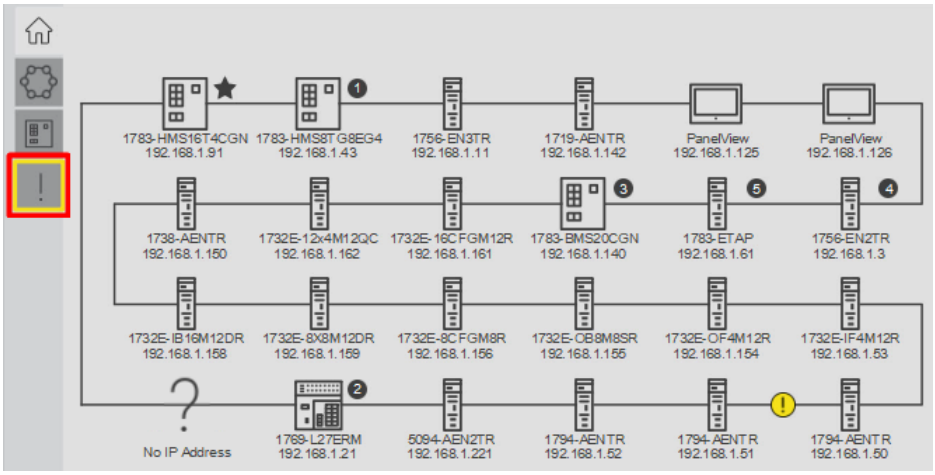
Detailed node information can be accessed by pressing the individual device Icons.

Devices without IP addresses can participate in the DLR and will be identified with a question mark. Device catalog number will be shown only if node responds to Identity request by the Add-On Instruction (AOI), otherwise a question mark icon will be shown.



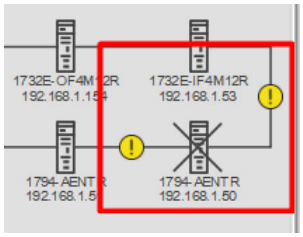
If a network connection fault is detected, a Link Fault indicator represented by the round yellow circle with an exclamation mark will appear on the network layout at the point or points of failure. In addition, a yellow border will appear on the network fault tab navigation button. Once the failed connection is restored, the Link Fault indicator will disappear.

Note: Refer the Fault tab section for more information on the faults detected



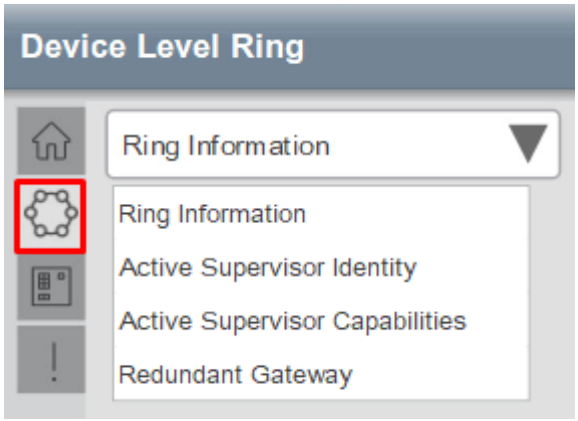
If a node is no longer responding, for example, if node power turned off, then missing node will be shown with “X” sign over the device icon.

Once the node functionality and connections are restored, the node and the associated link appearance will be restored to the normal state.



Ring Tab

The Ring Tab provides more information about the Device Level Ring network. The drop-down menu next to the Ring selector allows users to select the detailed Ring Information, Active Supervisor Identity, Active Supervisor Capabilities or Redundant Gateway information.

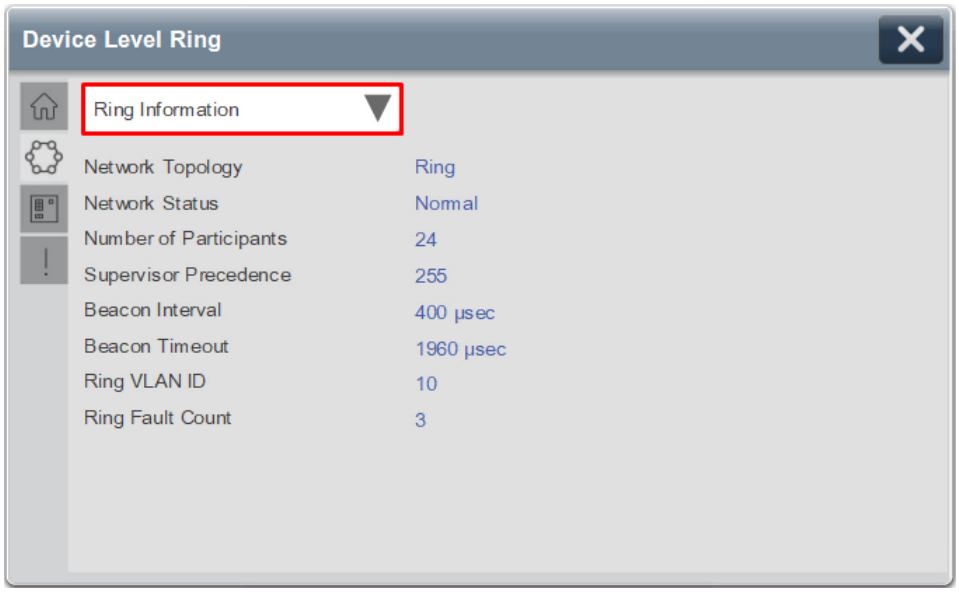


Ring Information

The Ring information provides basic network configuration, status and diagnostic information to assist in troubleshooting potential network problems.

Network Topology “Ring” state indicates that at least one node has the Active Ring Supervisor function enabled. The faceplate will be suspended if network is transitioned from the ring to the linear topology.

Network “Normal” state indicates that the ring is functioning correctly and no link faults are present. Otherwise, network status will indicate the various type of faults as reported by the Active Ring Supervisor.



In addition, this display shows currently active DLR configuration parameters that can be used for DLR network configuration, maintenance and troubleshooting.

Please refer to the DLR user guides for more information.

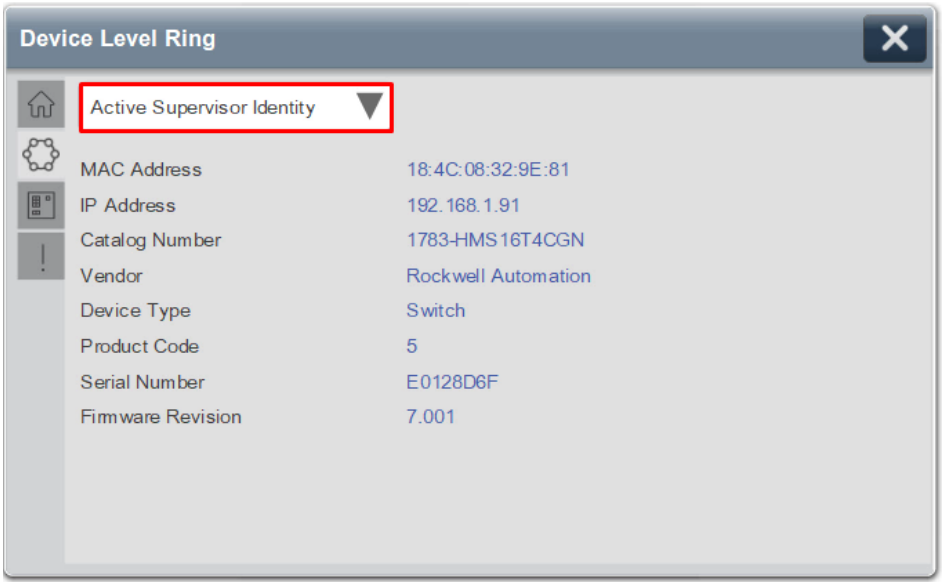
https://literature.rockwellautomation.com/idc/groups/literature/documents/at/enet-at007_-en-p.pdf

https://literature.rockwellautomation.com/idc/groups/literature/documents/td/enet-td015_-en-p.pdf

Active Supervisor Identity

The Active Ring Supervisor is automatically determined based on the precedence value and MAC address. The Active Supervisor identity information helps the user to identify the device that is currently acting as the Active Ring Supervisor. This information includes the MAC address, IP address, Catalog Number, Vendor, Device Type, Product Code and Serial Number. Firmware Revision helps with troubleshooting to determine if the device firmware is current.

This information is updated in real time and will reflect any changes in the Active Ring Supervisor.



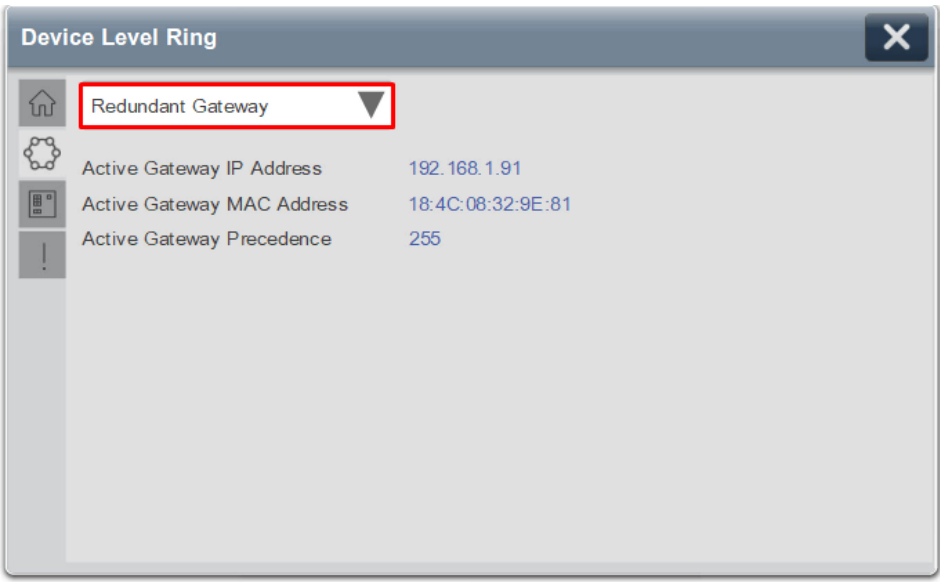
Active Supervisor Capabilities

The Active Supervisor capability information provides the configuration and device capabilities of the Active Ring Supervisor which helps with device configuration and troubleshooting. See Node Capabilities for details.

Redundant Gateway

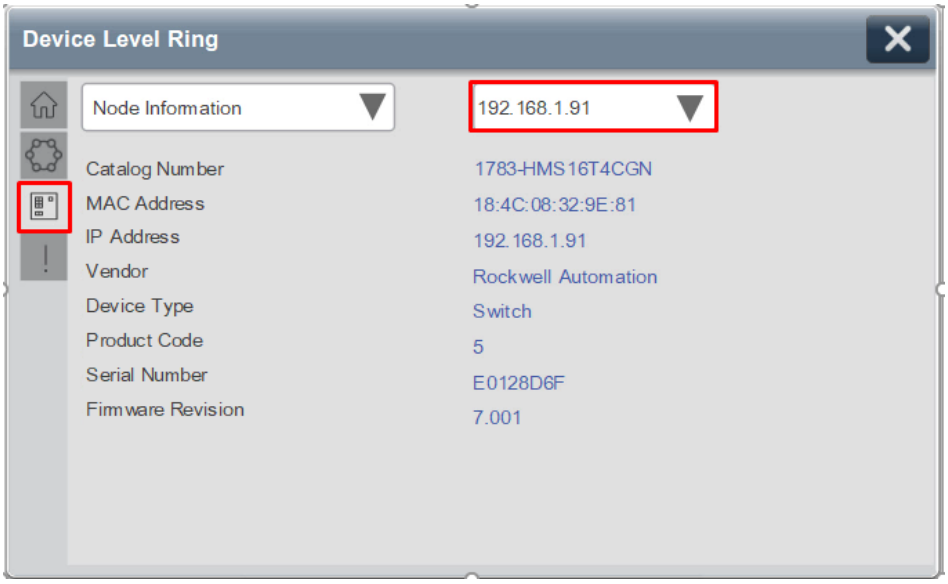
If Redundant Gateway functionality is enabled on the DLR network, then this screen will display information about the device that acts as an Active Redundant Gateway, including IP address, MAC address and Gateway Precedence value.

Redundant Gateway option is not applicable for 12-node DLR Network.



Node Tab

The DLR faceplate also allows user to display information about all DLR participant nodes. For specific node information, select the Node Tab navigation button.

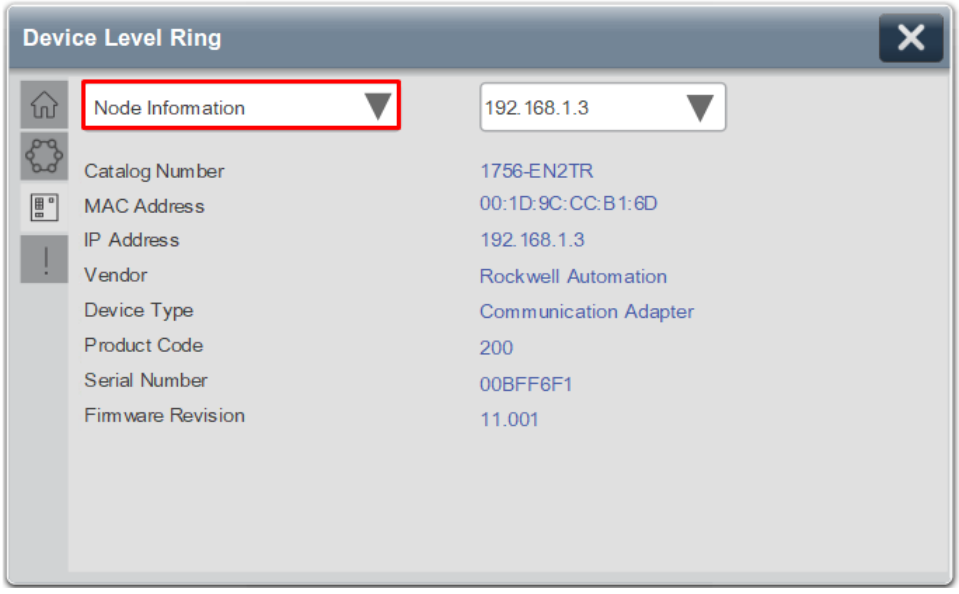


The node selection dropdown at the top right side of the node tab display allows user to access a specific node based on the IP or MAC address.

Node Information

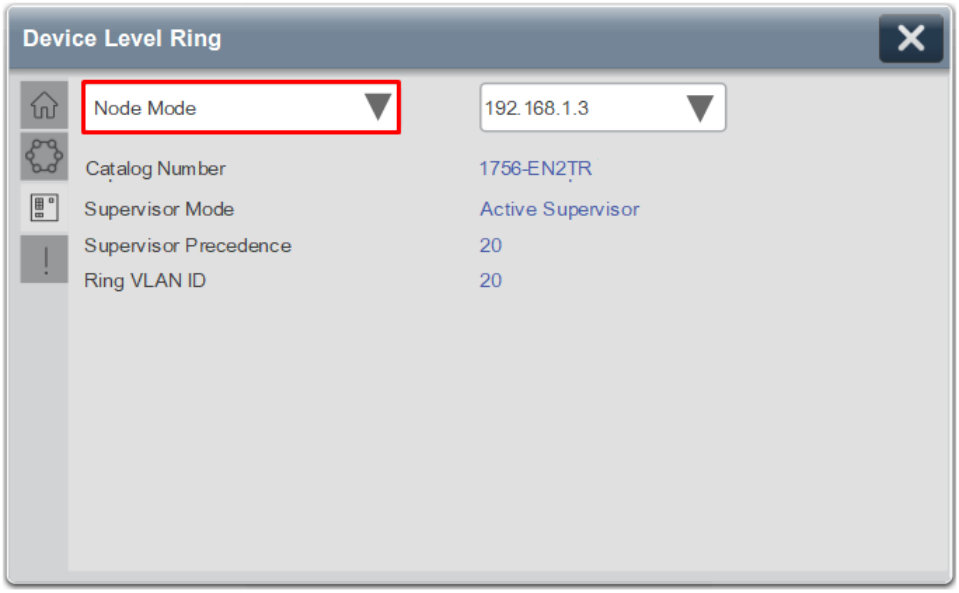
The Node Information display helps users to associate the specific node by one or more of its identity parameters:

Catalog Number, MAC address, IP address, Vendor, Device Type, Product Code, Serial number. It also allows to verify if firmware revision meets the user requirements.



Node Mode

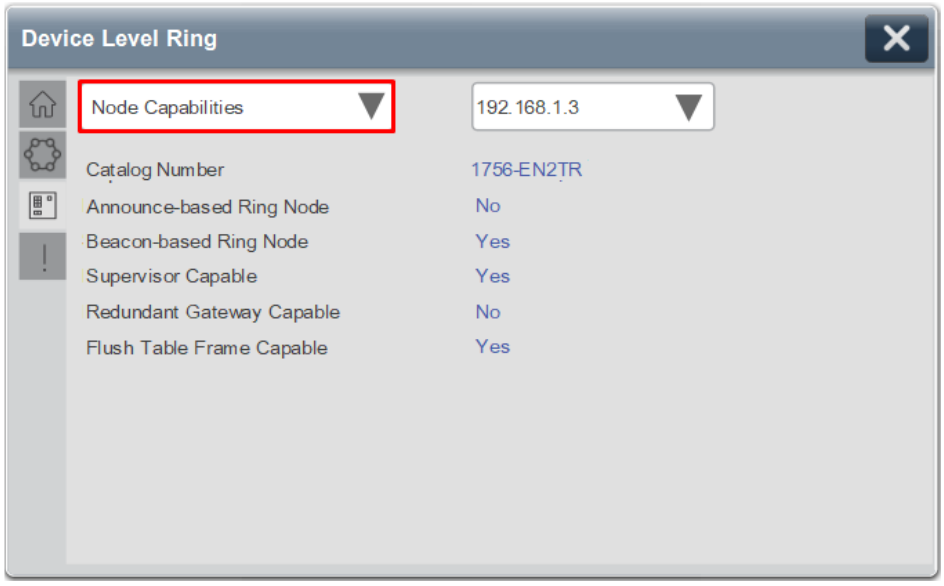
The Node Mode information provides the role of a specific node on the network, either normal node, Active Supervisor, or Backup Supervisor.



Please note that Supervisor Precedence **is not the same** as the Takeover Order shown on the Home screen. The Takeover order is calculated by the Add-On Instruction and is based on the precedence value and individual MAC addresses.

Node Capabilities

The Node Capabilities provide the information that potentially helps with node configuration and troubleshooting.



The first two fields identify if the node's DLR implementation is done in software **(Announce-Based)** or in Hardware (**Beacon Based**).

Supervisor Capability indicates that a specific device can be configured as a supervisor.

Some Supervisor capable devices can act as **Redundant Gateway** allowing multiple uplink connections to the distribution layer switches.

The **Flush Table** capability is required for all nodes that are present on the DLR network where a Redundant Gateway is enabled.

Redundant Gateway

The Redundant Gateway Display will provide detailed node configuration parameters, if the node is configured for Redundant Gateway. It will also indicate the Redundant Gateway status for selected node.

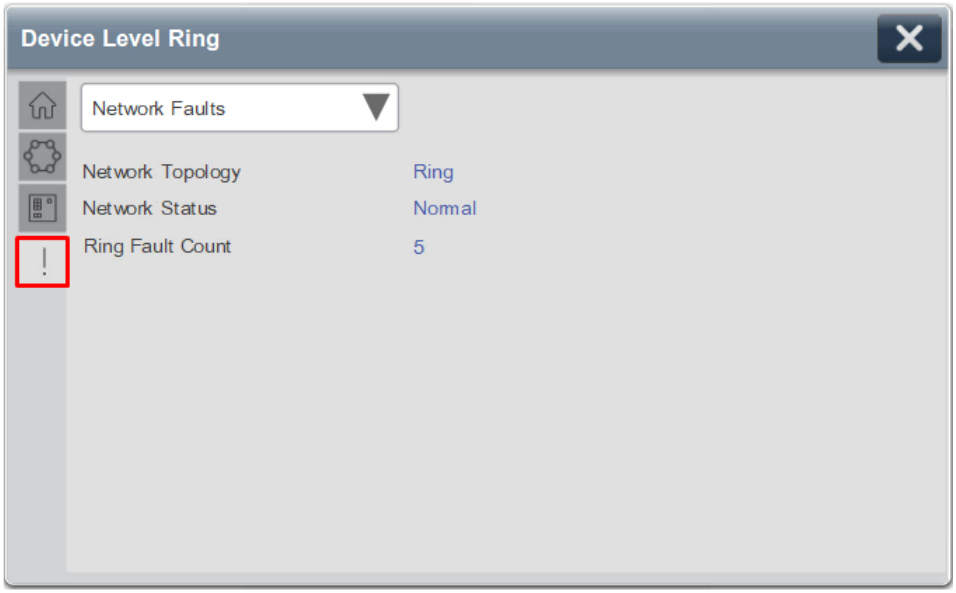
This information allows users to troubleshoot an issue related to the Redundant Gateway connections and loss of data.

Redundant Gateway option is not applicable for 12-node DLR Network.

Fault Tab

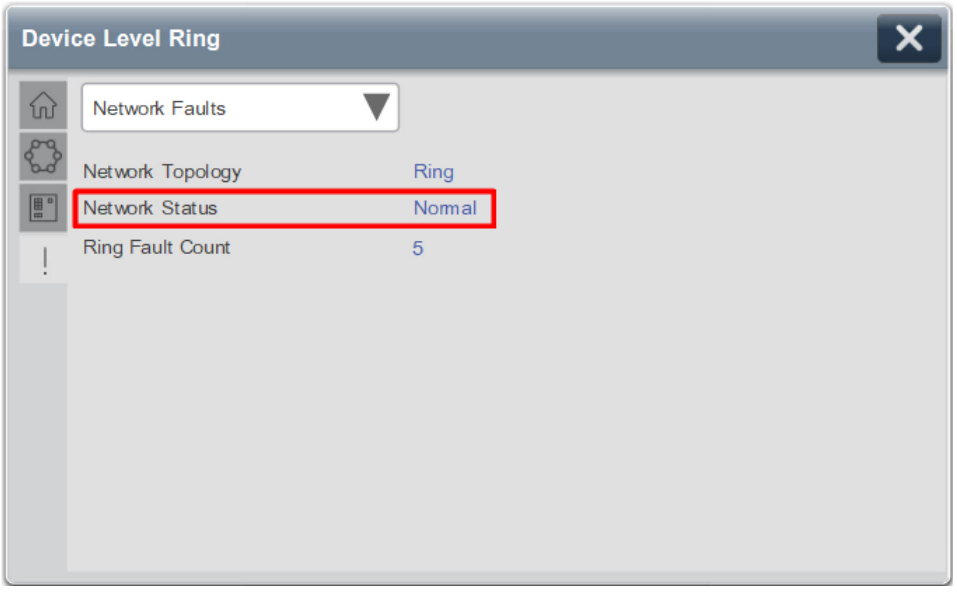
The Network Fault Tab provides details about network health. When a network fault occurs, it will indicate the fault type, fault location. Any fault clear/reset

operations should be performed via advanced user tools like Device Manager or Studio 5000 Logix Designer® Add-On Profile.



Network Fault

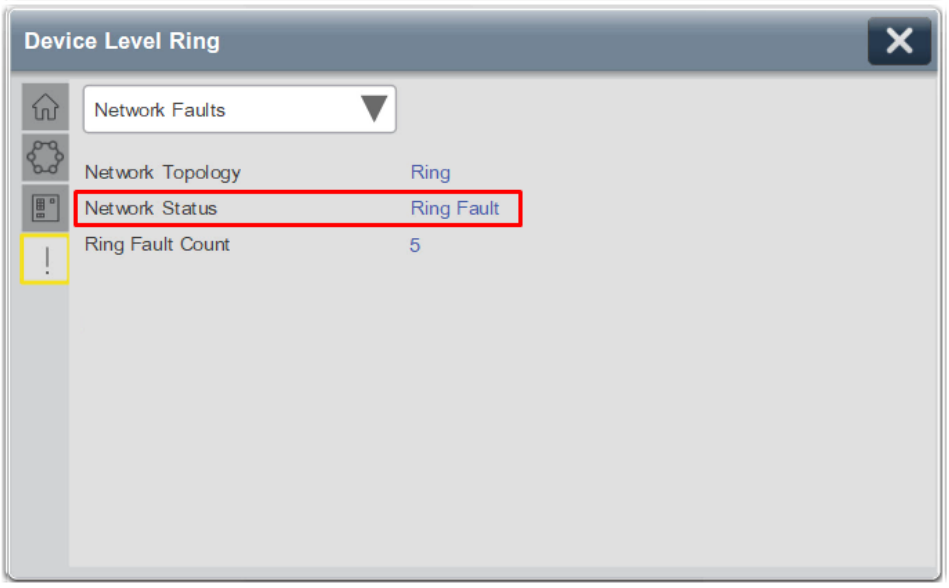
A fully functional DLR network should remain in Normal state.



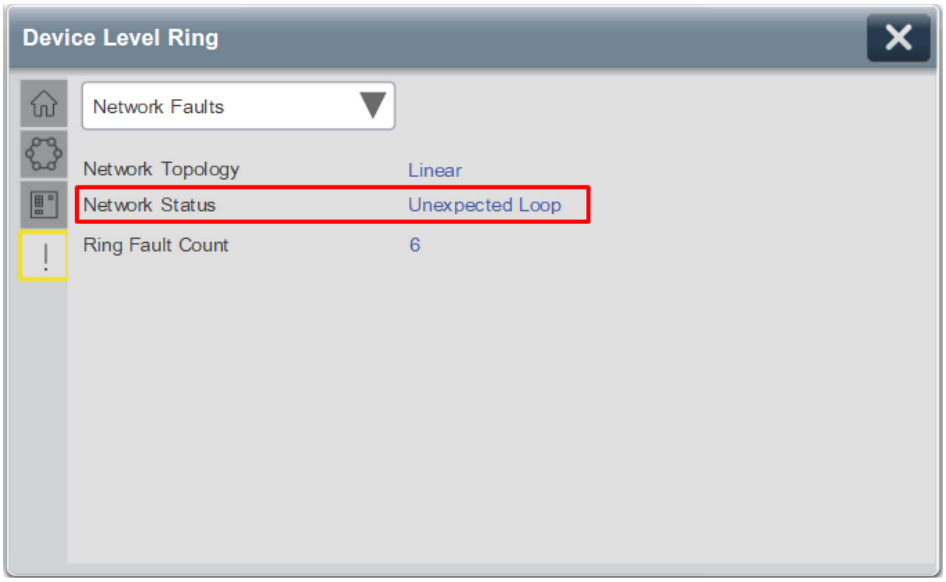
When a network fault occurs, the faceplate will indicate one of the following faults:

- Ring Fault
- Unexpected Loop Detected
- Partial Network Fault
- Rapid Fault/Restore Cycle Fault

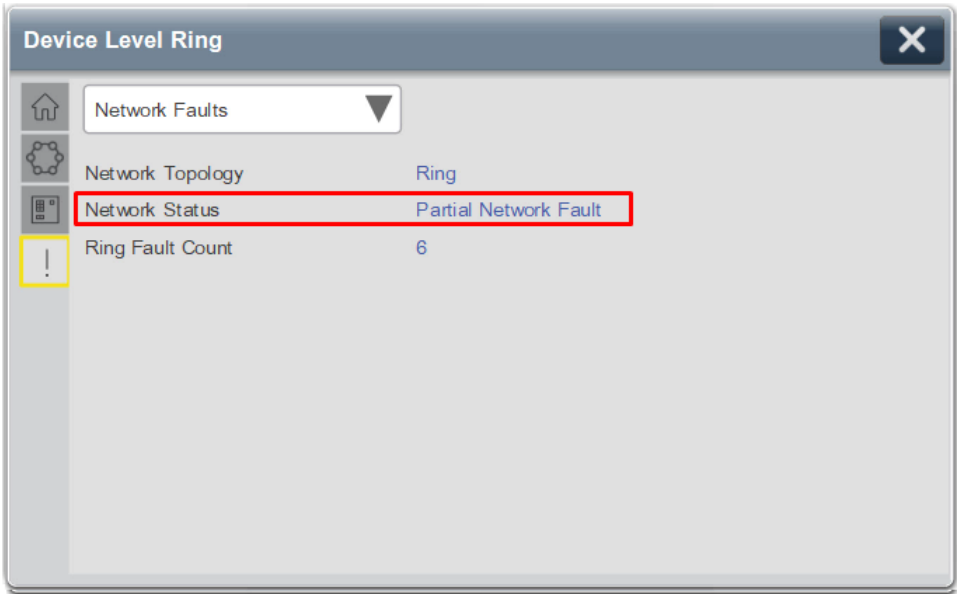
Ring Fault: The most common fault, the Ring Fault – usually occurs when one or more link is broken, or a node is taken off the network.



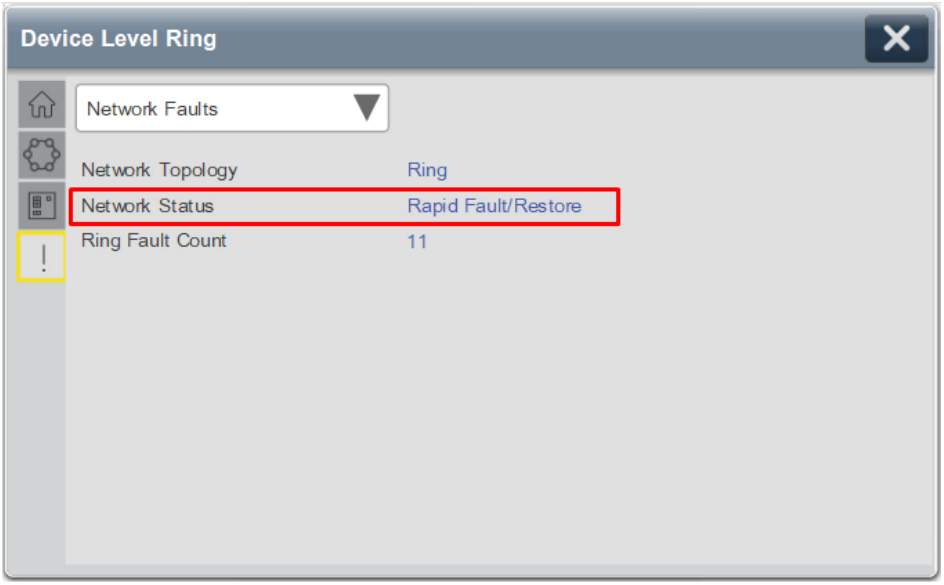
Unexpected Loop Detected: this fault occurs when the network ring was closed without defining at least one node as the Active Ring Supervisor – in Linear topology.



Partial Network Fault: occurs when the Active Ring Supervisor detects network fault in one direction only.



Rapid Fault/Restore Cycle fault: Occurs when there are more than 5 consecutive fault/recovery cycles detected in less than 30 seconds. This usually happens during network commissioning and indicates a severe hardware or cabling issue, or misconfiguration that requires immediate attention. When this fault occurs, it is required to restore normal operations after the fault cause was determined and corrected. Then Rapid Fault/Restore reset should be performed via advanced user tools like Device Manager or Studio 5000 Logix Designer® Add-On profile.



Ring Fault Count indicates number of ring faults since the Active Ring Supervisor's power-up or last fault reset.

Please note that the counter is just a status indicator and does not affect DLR or faceplate operations.

Ring Fault Reset should be performed via advanced user tools like Device Manager or Studio 5000 Logix Designer® Add-On Profile.

Fault Location

The fault location information provides a potential breaking point as reported to the faceplate by the Active Ring Supervisor.

Warning Information

The faceplate also provides a series of warnings, here are few examples:

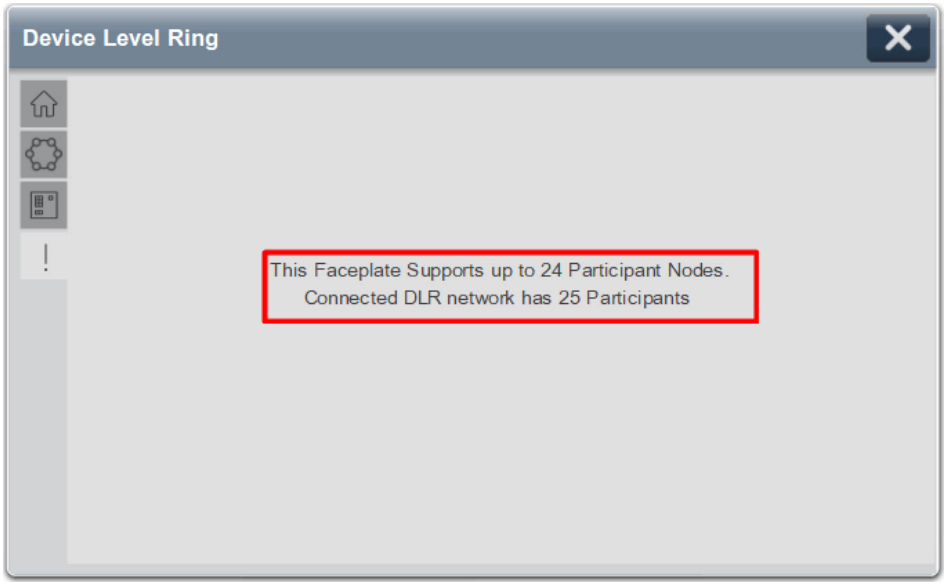
Faceplate Displays rely on the information provided by the Add-On Instruction.

If the Add-On Instruction operation is disabled by the user, then “AOI Not Enabled” warning message is shown and all faceplate operations will be suspended.

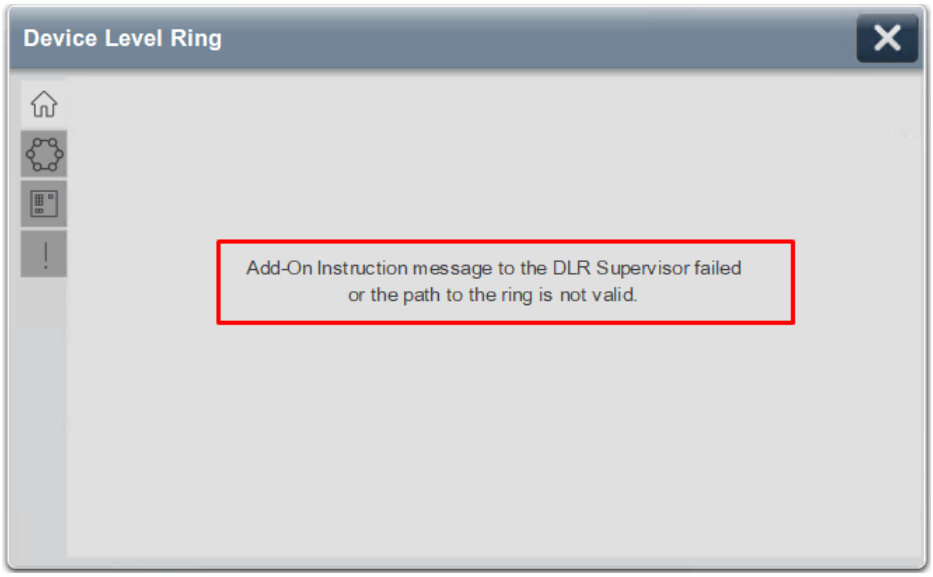
If the detected number of nodes on the connected network exceeds 24 then the below warning will display and all faceplate operations will be suspended.

Likewise, if the number of nodes on a 56-node faceplate exceeds 56, a similar warning will replace the network layout and all faceplate operations will be suspended.

Similarly, if the number of nodes on 12-node faceplate exceeds 12, a warning will replace the network layout and all faceplate operations will be suspended.



The following message indicates that corresponding Logix Add-On Instruction (AOI) message to the DLR Supervisor failed. The incorrect or invalid path defined in the Add-On Instruction parameters is likely the cause of this error.



The following message will be displayed if AOI is pointing to a network that is not a DLR topology.

The initial scan of the network must be performed in “Normal” state where DLR is functioning without a fault or cable break. Otherwise, the following message will be displayed. Once DLR is restored to the Normal state, the faceplate will automatically build the network participant list and display current network topology.

Application Code Manager

Network Device Library objects can be set-up and configured using Studio 5000® Application Code Manager.

Refer to the section Using Application Code Manager for complete details.

Definition Objects: raC_Opr_NetDLR1

This Asset-Control object contains the Add-On Instruction definition and required data types. It is used as a linked library to the device implement object. This gives users the flexibility to choose to instantiate only definition and create custom implement code. A user may also create their own implement library and link with this definition library object.

Implementation Objects: raC_LD_Opr_NetDLR1

The Device Implementation Object is the rung that is instantiated when generating controller code using Application Code Manager. This implementation object includes a reference to the Asset-Control Add-On Instruction definition, along with any required controller tags, programs, modules, and HMI objects.

The DLR1 implementation has the following configuration parameters.

Parameter Name	Default Value	Instance Name	Definition	Description
RoutineName	{ObjectName}	{RoutineName}	Routine	Enter Routine name. Routine will be created and Object implement rung(s) inserted. A JSR will be inserted in MainRoutine. If routine name already exists, then object will be inserted into existing routine. By default, parameter is set to Object Name.

Parameter Name	Default Value	Instance Name	Definition	Description
TagName	{ObjectName}	{TagName}	Backing Tag	Enter the backing tag of the main AOI. This will serve as the base tag name for other tags in this object that are derived from the base.
TagDescription	{ObjectDescription}	{TagDescription}		Tag Description of the main AOI backing tag
Ref_Paths				Enter a valid AOI Path. See Message Paths for more information.
Nodes	24 Nodes			DLR1 Only; Not applicable to DLR1_Lite. Select 56 nodes if there are more than 24 nodes in DLR network.

Linked Libraries

Link Name	Catalog Number	Revision	Solution	Category
raC_Opr_NetDLR1	raC_Opr_NetDLR1	12.2	(RA-LIB) Device	Network
raC_Opr_NetDLR1_Lite	raC_Opr_NetDLR1_Lite	12.2	(RA-LIB) Device	Network

Configured HMI Content

HMI Content	Instance Name	Description
Launch Button	{ObjectName}_GO_Launch_12Node_FP	Global Object launch button to 12Node Faceplate using basic text label.
Launch Button	{ObjectName}_GO_Launch_24Node_FP	Global Object launch button to 24 Node Faceplate using basic text label.
Launch Button	{ObjectName}_GO_Launch_56Node_FP	Global Object launch button to 56 Node Faceplate using basic text label.

Attachments

Name	Description	File Name	Extraction Path
V12_raC_Dvc_Globall	Graphic Symbols ME	(raC-12-ME) Graphic Symbols - Network Device.ggfx	{ProjectName}\Visualization\FTViewME\GlobalObject
V12_raC_Dvc_DLR1_12Node	Faceplate ME	(raC-12_xx-ME) raC_Opr_NetDLR1_12Node-Faceplate.gfx	{ProjectName}\Visualization\FTViewME\Displays
V12_raC_Dvc_DLR1_24Node	Faceplate ME	(raC-12_xx-ME) raC_Opr_NetDLR1_24Node-Faceplate.gfx	{ProjectName}\Visualization\FTViewME\Displays
V12_raC_Dvc_DLR1_56Node	Faceplate ME	(raC-12_xx-ME) raC_Opr_NetDLR1_56Node-Faceplate.gfx	{ProjectName}\Visualization\FTViewME\Displays
V12_raC_Dvc_Globall	Graphic Symbols SE	(raC-12-ME) Graphic Symbols - Network Device.ggfx	{ProjectName}\Visualization\FTViewSE\GlobalObject
V12_raC_Dvc_DLR1_12Node	Faceplate SE	(raC-12_xx-SE) raC_Opr_NetDLR1_12Node-Faceplate.gfx	{ProjectName}\Visualization\FTViewSE\Displays
V12_raC_Dvc_DLR1_24Node	Faceplate SE	(raC-12_xx-SE) raC_Opr_NetDLR1_24Node-Faceplate.gfx	{ProjectName}\Visualization\FTViewSE\Displays
V12_raC_Dvc_DLR1_56Node	Faceplate SE	(raC-12_xx-SE) raC_Opr_NetDLR1_56Node-Faceplate.gfx	{ProjectName}\Visualization\FTViewSE\Displays

V12_raC_Opr_NetDLR	View Designer	(raC-12_xx-VD) raC_Opr_NetDLR.vpd	{ProjectName}\Visualization\ViewDesigner
V12_RM_raC_Dvc_Network	Reference Manual	DEVICE-RM400B-EN-P.pdf	{ProjectName}\Documentation
V12_Network_Images	HMI Image Set	HMI FactoryTalk® View Images - png.zip	{ProjectName}\Visualization\Images
V12_raC_Dvc_Network_Global	Toolbox ME	(raC-12-ME) Toolbox - Network Device.ggfx	{ProjectName}\Visualization\FTViewME\GlobalObjects
V12_raC_Dvc_Network_Global	Toolbox SE	(raC-12-SE) Toolbox - Network Device.ggfx	{ProjectName}\Visualization\FTViewSE\GlobalObjects

3-Ring Device Level Ring (raC_Opr_NetDLR3, raC_Opr_NetDLR3_Lite)

Overview

The 3-Ring Device Level Ring device objects (raC_Opr_NetDLR3) include HMI faceplates for 3-Ring Device Level Ring (DLR) networks and Ring of Switch networks which displays network information including:

- Automatically generated network topology
- Detailed ring network data and statistics
- Network fault monitoring including graphical identification and location of faulted network links for up to three DLR networks
- Ring supervisor, ring participant, and redundant gateway information

The object (raC_Opr_NetDLR3) can be used for DLR networks containing up to 56 nodes or a a ring of switches.

In the Library there is a folder named *Videos* which contains many How-To and Operational Overview Videos which walk step-by-step through each process. You can refer to the following videos for this section:

"Operational Overview of DLR Object Faceplates"

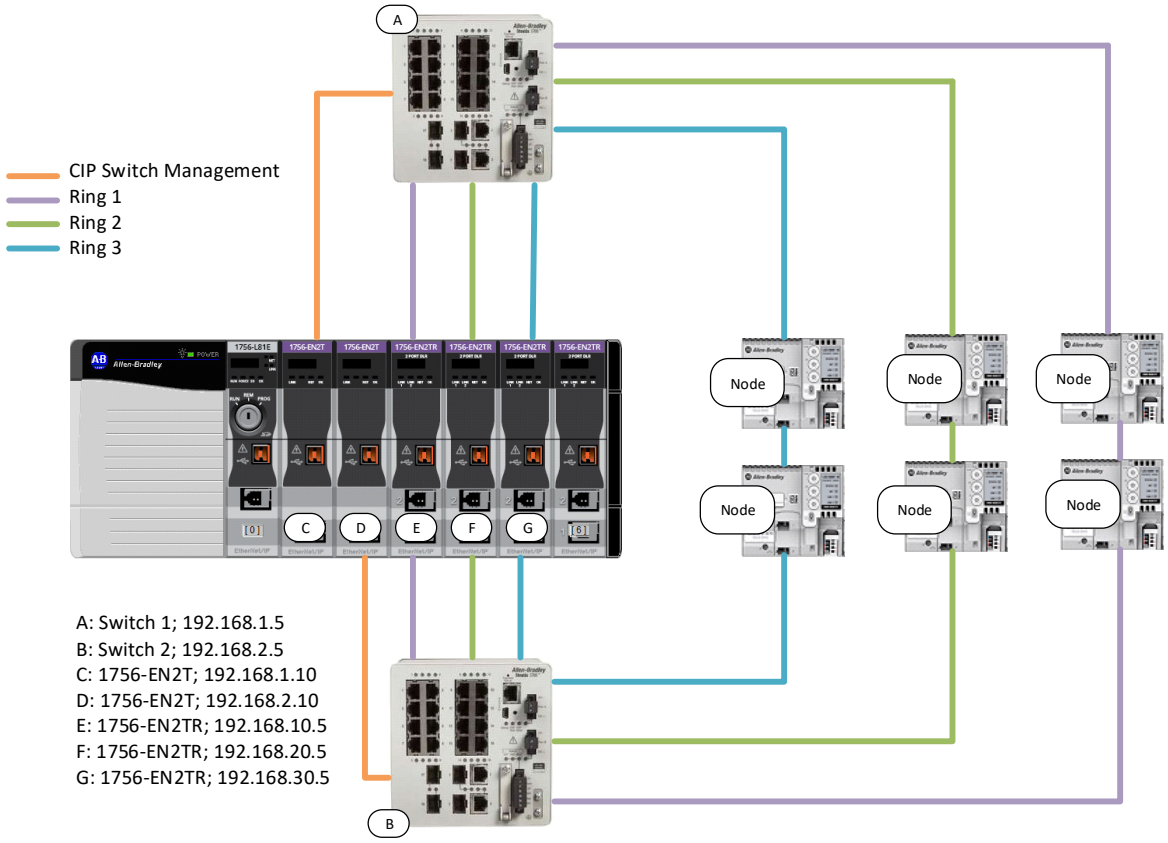
Functional Description

The 3-Ring Device Level Ring pre-configured Device Objects:

- Collects and processes data from the Active Ring Supervisor and participant node devices and delivers data to the status and diagnostic faceplates.
- Provides enhanced DLR network and node status and diagnostic information simplifying network maintenance and reducing network downtime.

All these features provide quick feedback, shorten recovery time, and simplify implementation.

The following diagram shows an example of the type of network that can be supported by this object.



Required Files

Device Objects include Add-On Instructions (AOIs) and HMI faceplates. The revision number (e.g. 1.01) used in filenames can change as new revisions are created.

Controller Files

Add-On Instructions are reusable code objects that contain encapsulated logic that can streamline implementing your system. This lets you create your own instruction set for programming logic as a supplement to the instruction set provided natively in the ControlLogix® firmware. An Add-On Instruction is defined once in each controller project, and can be instantiated multiple times in your application code as needed.

The Add-On Instruction must be imported into the controller project to be used in the controller configuration. These can be imported as Add-On Instruction files, or as part of the Rung Import or Import Library Objects wizard.

All Add-On Instruction and Rung Import files can be found in the */Studio 5000 Logix Designer Files - L5X/* folder in the library.

Object	Compatible Network Configuration	Add-On Instruction	Rung Import
raC_Opr_NetDLR3_RingOfSwitches	Up to 3 Device Level Rings each with up to 56 nodes; Ring of Switches	raC_Opr_NetDLR3_12.03_AOI.L5X	raC_Opr_NetDLR3_12.03_RUNG.L5X

FactoryTalk® View HMI Files

FactoryTalk® View ME and FactoryTalk® View SE applications require importing the desired device faceplates in addition to all Global Object (ggfx) files and all images located in the */HMI FactoryTalk® View Images - png/* folder of the library. FactoryTalk® View ME files are stored in the */HMI - FactoryTalk® View ME/* library folder and FactoryTalk® View SE files are stored in the */HMI - FactoryTalk® View SE/* library folder.

Note that the Add-On Instruction *raC_Opr_NetDLR3* can be used with either the 24 Node or 56 Node displays depending on the size of the network. The HMI faceplate will automatically display the correct layout for connected network.

Device/Item	Compatible Network Configuration	Type	FactoryTalk® View ME Faceplate	FactoryTalk® View SE Faceplate
raC_Opr_NetDLR3	Up to 3 Device Level Rings each with up to 56 nodes; Ring of Switches	Display	(raC-12_02-ME) raC_Opr_NetDLR3_56Node-Faceplate.gfx	(raC-12_02-SE) raC_Opr_NetDLR3_56Node-Faceplate.gfx
Graphic Symbols	All DLR	Global Object	(raC-12-ME) Graphic Symbols - Network Device	(raC-12-SE) Graphic Symbols - Network Device
Toolbox	All DLR	Global Object	(raC-12-ME) Toolbox -Network Device.ggfx	(raC-12-SE) Toolbox -Network Device.ggfx

Studio 5000 View Designer® HMI Files

All Studio 5000 View Designer® Files can be found in the */HMI - ViewDesigner - vpd/* folder of the library.

Device/Item	Studio 5000 View Designer® Faceplate
All Device Level Ring Objects	(raC-12_02-VD) raC_Opr_NetDLR.vpd

Studio 5000® Application Code Manager Files

Studio 5000® Application Code Manager (ACM) can be optionally used if it is installed. All devices can be easily registered in the ACM repositories by running the *setup.cmd* file located in the root folder of the library.

Individual HSL4 files are provided as an alternative to running the setup.cmd to allow users to manually register specific implementation objects. Each object has two files - an Asset Control file and a Device file. The Asset Control

files include attachments of all required files for that object. The Device files are used to actually add that device into a Studio 5000® project and these reference the Asset Control files.

All Studio 5000® Application Code Manager files can be found in the /*ApplicationCodeManagerLibraries*/ folder of the library. The files included are as follows:

Implementation Object	Compatible Network Configuration	Asset Control File (.HSL4)	Device File (.HSL4)
DLR3	Up to 3 Device Level Rings each with up to 56 nodes; Ring of Switches	(RA-LIB)_Device_Asset-Control_Network_raC_Opr_NetDLR3_(12.3)	(RA-LIB)_Device_Device_Network_raC_LD_Opr_NetDLR3_(12.3)

Operations

The Network Device objects provide only physical operation mode. There is no virtual device mode offered.

Execution

The following table explains the handling of instruction execution conditions.

Condition	Description
EnableIn False (false rung)	Processing for EnableIn False (false rung) is handled the same as if the device were taken out of service by Command. The device outputs are de-energized and the device is shown as Program Out of Service on the HMI. All alarms are cleared.
Powerup (prescan, first scan)	On prescan, any commands that are received before first scan are discarded. The device is de-energized. On first scan, the device is treated as if it were returning from Hand command source: the instruction state is set based on the position feedback that is received from the device. If the feedback is valid for one position, the device is set to that position. If the device does not have position feedback or the position feedback is invalid, the device is set to the 'unknown/powerup' state. The command source is set to its default, either Operator or Program (unlocked).
Postscan	No SFC Postscan logic is provided.

Add-On Instruction I/O Data

InOut Data

InOut	Function / Description	DataType
Ref_Paths	UDT Containing CIP Path strings for Ring1, Ring2, Ring3, and up to 10 Stratix Switches	raC_UDT_DLR3Paths10
Ref_Msg_Get_All	Message used to read complete CIP objects.	MESSAGE
Ref_Msg_Get_Single	Message used to read vendor specific attributes.	MESSAGE
Ref_Msg_Get_Member	Message used to read member attributes	MESSAGE
Ref_Msg_Rst_SignOn	Message used to sign on to switch	MESSAGE
Ref_Storage	Stores CIP message data	SINT[520]

Input Data

Input	Function/Description	DataType
EnableIn	Enable Input - System Defined Parameter	BOOL
Inp_Enable	Enable AOI functions. 1 = enabled.	BOOL
Inp_RefreshInhibit	Inhibit data refresh	BOOL

Output Data

Output	Function/Descritpion	DataType
EnableOut	Enable Output - System Defined Parameter	BOOL
Sts_EN	AOI Enabled Status; 1 = enabled.	BOOL
Sts_ER	Message error bit; 1= Error	BOOL
Sts_Connected	Supervisor is responding.	BOOL
Sts_Available	Connected and in Ring Topology (not linear)	BOOL
Sts_Faulted	DLR faulted status: 1 = an active fault exists	BOOL
Sts_Ring1_Faulted	Ring 1 Fault present; 1= Faulted	BOOL
Sts_Ring2_Faulted	Ring 2 Fault present; 1= Faulted	BOOL
Sts_Ring3_Faulted	Ring 3 Fault present; 1= Faulted	BOOL
Sts_PathError	Message Path Error Present; 1 = Error	BOOL
Ref_HMI	Alias tag for HMI_Parameters.Tab_Active	DINT

Data Types

A number of User-Defined Datatypes (UDT) are used in the Network Device Library. A full list of the UDTs used with the raC_Opr_NetDLR3 and

raC_Opr_NetDLR3_Lite objects follows:

User Defined Datatype	Description
raC_UDT_DLR3Dropdowns	DLR Drop-down menu
raC_UDT_DLR3HMI	DLR HMI Faceplate Information
raC_UDT_DLR3LocalData10	DLR HMI local data
raC_UDT_DLR3Paths10	CIP Message Path data for 3 rings and up tot 10 switches.
raC_UDT_DLR3Rings	DLR HMI Faceplate Information - Ring
raC_UDT_DLR3Stratix_Ports	DLR Port 1 and Port 2 status and MAC Address
raC_UDT_DLR3ValidPathsNoIP	DLR Node with no IP address
raC_UDT_DLRActive_Node	DLR Active Node Address
raC_UDT_DLRCapture_Error	DLR Error Information
raC_UDT_DLRFaults	DLR HMI Faceplate Information - Faults
raC_UDT_DLRHome	DLR HMI Faceplate Information - Home Tab
raC_UDT_DLRLast_Node	DLR Last Node Information
raC_UDT_DLRMAC	DLR Mac Address
raC_UDT_DLRNode	DLR HMI Faceplate Information - Node
raC_UDT_DLRNode_Info	DLR Node Information
raC_UDT_DLRRedGateway	DLR Redundant Gateway information
raC_UDT_DLRRing	DLR HMI Faceplate Information - Ring
raC_UDT_DLRTakeover_Order	DLR Takeover Precedence order
STR0002	String
STR0016	String
STR0032	String

Add-On Instructions

A number of embedded Add-On Instructions (AOI) are used within the raC_Opr_NetDLR3 and raC_Opr_NetDLR3_Lite instructions. These are used to convert between datatypes and generate values which can be read from the HMI faceplate. The following AOIs are included:

User Defined Datatype	Revision	Description
raC_Tec_DecToHex	12.02	Converts decimal number to hexadecimal String
raC_Tec_DLRClearNodeInfo	12.02	Clears node information
raC_Tec_DLRIcon	12.02	Determines device icon used in DLR network schematic
raC_Tec_IPMACtoString_NET	12.02	Converts numerical IP/MAC address into user-readable string
raC_Tec_MACCompare	12.02	Compares two MAC addresses
raC_Tec_PathSplit	12.02	Strips and separates the last IP address from the path
raC_Tec_PathToHex	12.02	Converts a comma separated string (as typed in "Path" of MSG) to Hex Path string as used in MSG.Path element
raC_Tec_MACFind_IPReplace	12.02	Finds DLR instance for Stratix 5400 based on the reported MAC and list of MAC addresses from individual Stratix ports involved in DLR, then replaces IP address of the message instruction.

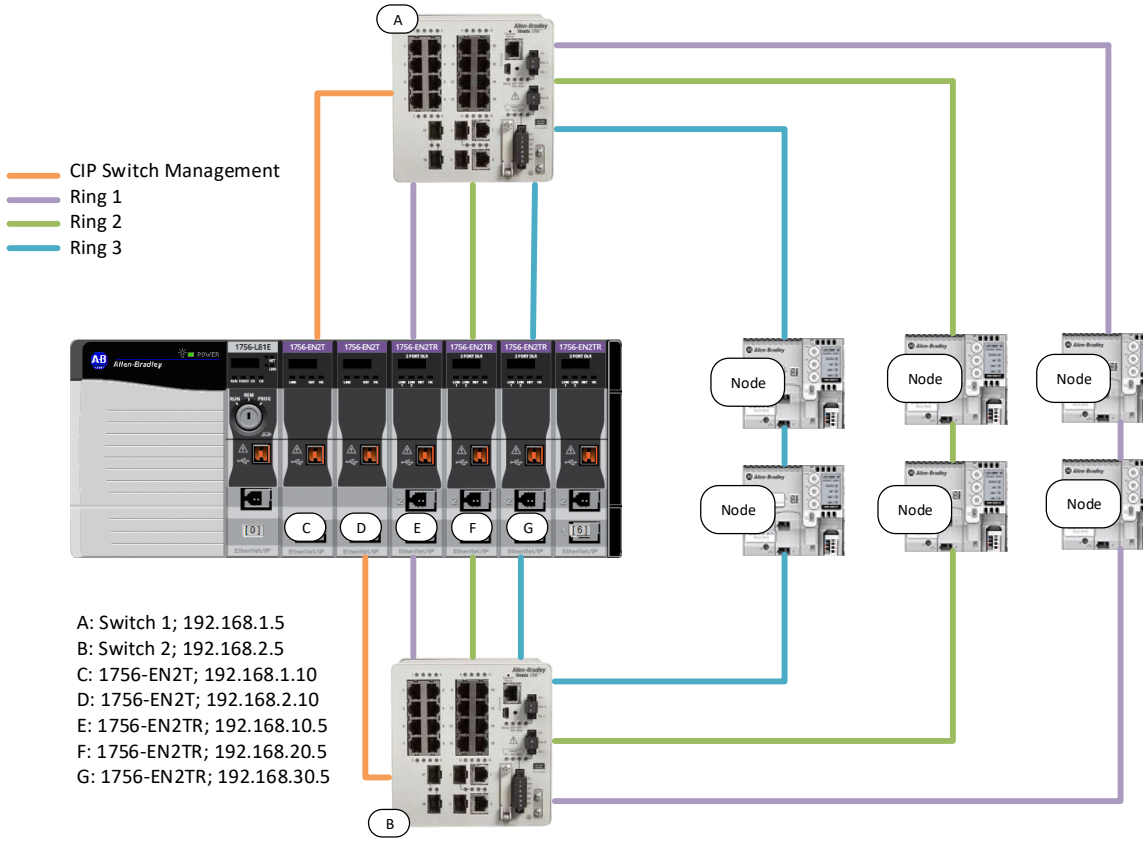
Programming Example

Fully configured device on a rung is provided below for reference.

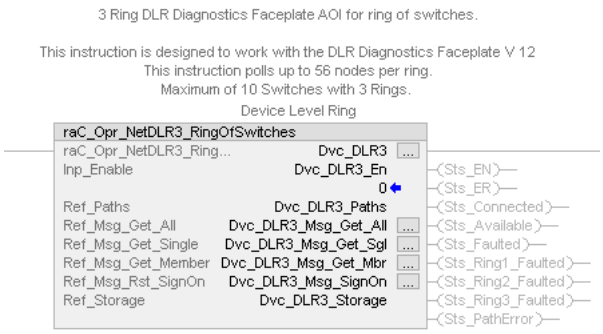
Note that this programming example is the same code that is imported when either importing the supplied rung .L5X files or when using Application Code Manager or the Studio 5000® Import Library Objects wizard plug-in.

A diagram of the example is shown below for reference. This example includes:

- 3 ring networks each connected to a 1756-EN2TR module (E/F/G) in slots 3, 4, and 5
- 2 Stratix 5400 switches (A/B) each with a direct connection back to a 1756-EN2T (C/D) module in slots 1 and 2 for switch management and diagnostics.



The programming for this example uses the 3-Ring Device Level Ring device object named *Dvc_DLR3*.



The *Ref_Paths* points to the UDT variable called *Dvc_DLR_Paths* which contains message paths for 3 DLR rings and up to 10 switches. In this example we have the following strings message path strings configured:

◢ Dvc_DLR3_Paths	{...}	raC_UDT_DLR3Paths10
▶ Dvc_DLR3_Paths.Ref_Ring1_Path	'1,3,2,192.168.10.5'	STRING
▶ Dvc_DLR3_Paths.Ref_Ring2_Path	'1,4,2,192.168.20.5'	STRING
▶ Dvc_DLR3_Paths.Ref_Ring3_Path	'1,5,2,192.168.30.5'	STRING
◢ Dvc_DLR3_Paths.Ref_Switch_Paths	{...}	STRING[10]
▶ Dvc_DLR3_Paths.Ref_Switch_Paths[0]	'1,1,2,192.168.1.5'	STRING
▶ Dvc_DLR3_Paths.Ref_Switch_Paths[1]	'1,2,2,192.168.2.5'	STRING
▶ Dvc_DLR3_Paths.Ref_Switch_Paths[2]	''	STRING
▶ Dvc_DLR3_Paths.Ref_Switch_Paths[3]	''	STRING
▶ Dvc_DLR3_Paths.Ref_Switch_Paths[4]	''	STRING
▶ Dvc_DLR3_Paths.Ref_Switch_Paths[5]	''	STRING
▶ Dvc_DLR3_Paths.Ref_Switch_Paths[6]	''	STRING
▶ Dvc_DLR3_Paths.Ref_Switch_Paths[7]	''	STRING
▶ Dvc_DLR3_Paths.Ref_Switch_Paths[8]	''	STRING
▶ Dvc_DLR3_Paths.Ref_Switch_Paths[9]	''	STRING

See Message Paths for more information and examples on assigning this string.

Graphic Symbols

Graphic Symbols are used as launch buttons within HMI applications to open up faceplate displays. See Basic Launch Button Attributes section for details on configuration and indicators.

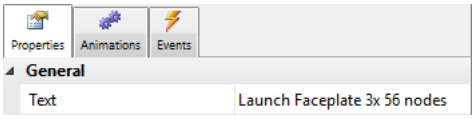
FactoryTalk® View ME/SE Graphic Symbols

Graphic Symbol Name	Graphic Symbol	Description	Global Object Parameter Values
GO_LaunchFP	S...S	Faceplate navigation button with string tag label. This launch button graphic object allows the user to navigate to the device object faceplate. The text on the button face is set to the parameter #104.	#102: AOI Backing Tag Instance (e.g. {::[PAC]._InstanceName}) #104: Navigation Button Label #120: Display's left position (e.g. 100) (optional) #121: Display's top position (e.g. 100) (optional)

Studio 5000 View Designer® Graphic Symbols

Graphic Symbol Name	Graphic Symbol	Description	Property Configuration
btn_nav_NetDLR3_56Node_FP	Launch Faceplate 3x 56 nodes	Navigate to 56 Node 3 Ring DLR Faceplate Pop-Up Screen	Properties / Animations / Events Touch Press Open Popup: User-Defined Screens\raC_Opr_NetDLR3_56Node_FP Property Configuration: AOI_Tag ::Networx._InstanceName

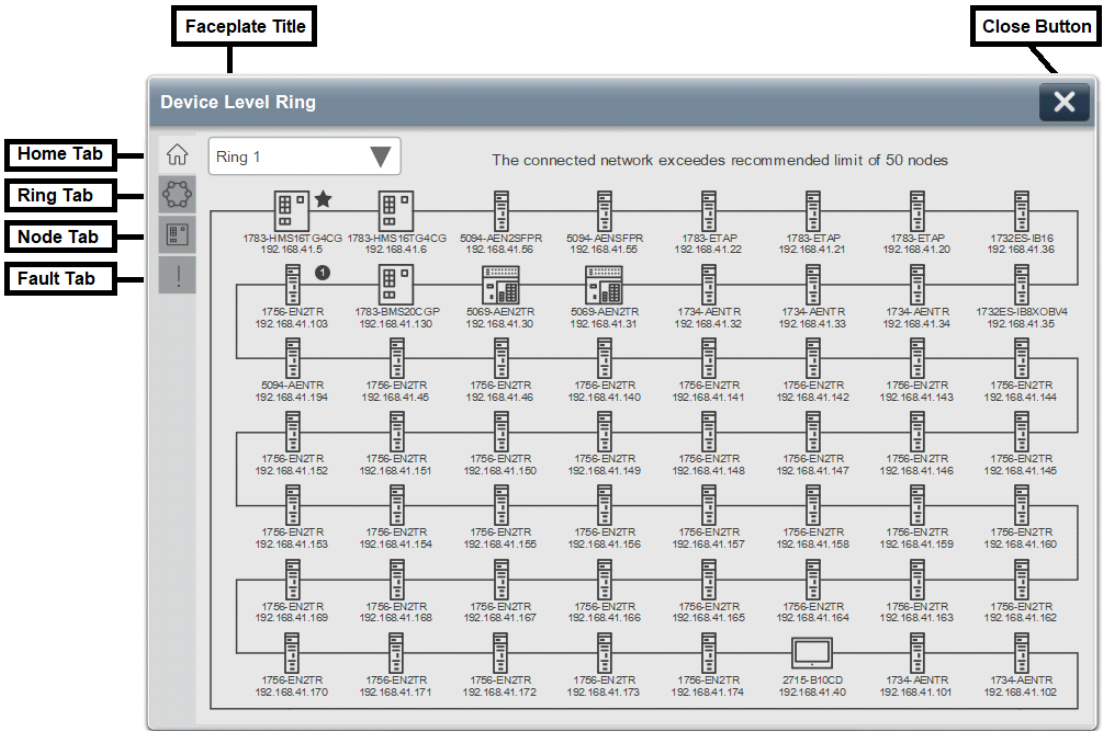
Text displayed in the launch buttons can be modified from the *Properties* tab using the *General* > *Text* parameter.



Faceplates

There are basic faceplate attributes that are common across all instructions. See Basic Faceplate Attributes on page 22.

Faceplate Navigation

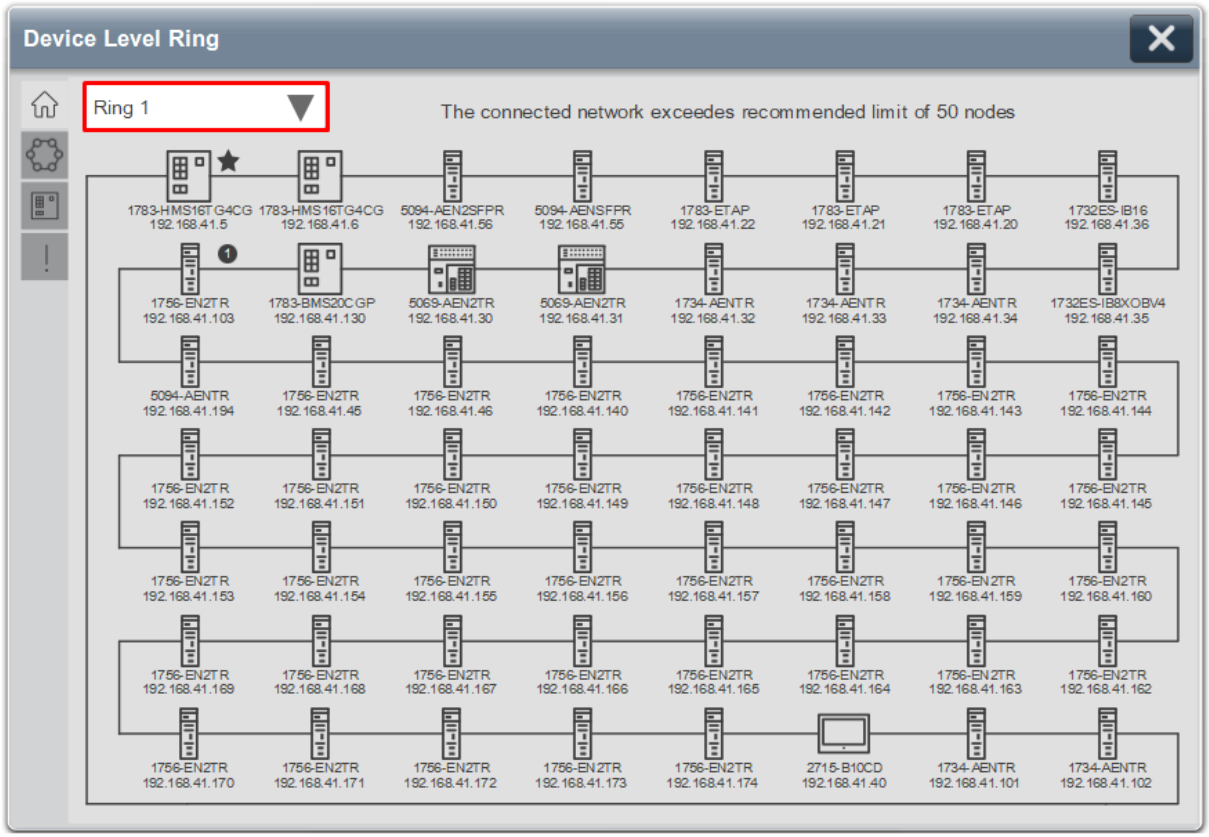


- The **Home** tab provides connected ring network layout and node icons with device information (Catalog Number, IP Address). It also provides Ring 1, Ring 2 and Ring 3 selection using the drop-down menu.
- The **Ring** tab provides the Active Ring Supervisor details, Active Redundant Gateway details.
- The **Node** tab provides details for all connected nodes.
- The **Fault** tab provides network fault information and location.

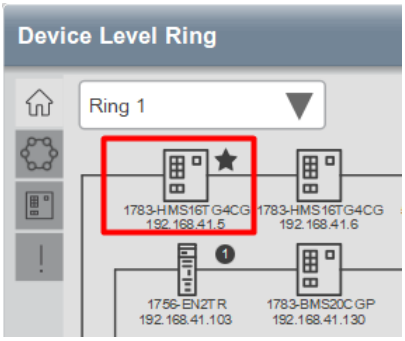
Home

The Home screen is visible when the Home tab button is selected in the tab control object on the left side of the screen. The Home tab screen displays an auto-generated network layout. This example is displaying a 56-node network. The number and sequence of nodes are based on the information provided by the Active Ring Supervisor.

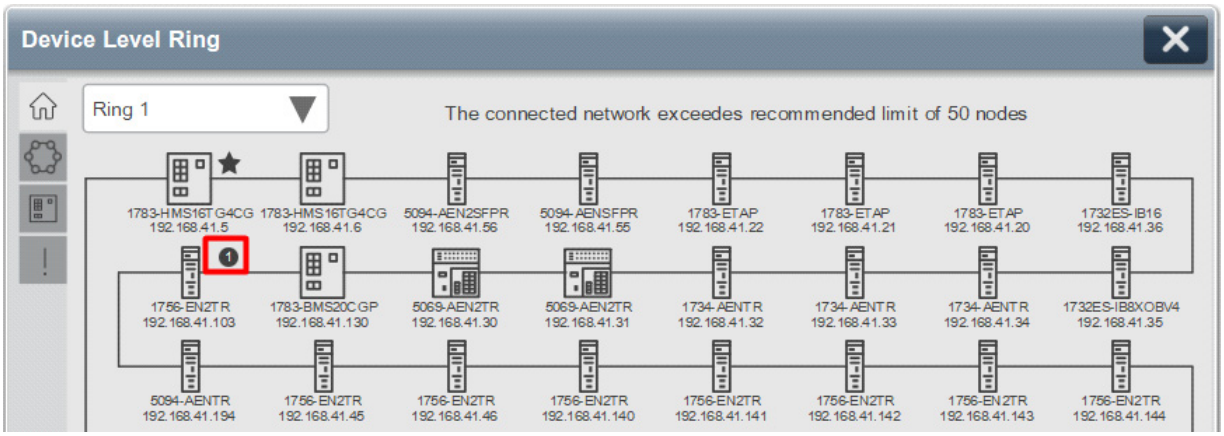
In this screen, a drop-down menu is available for the ring selection.



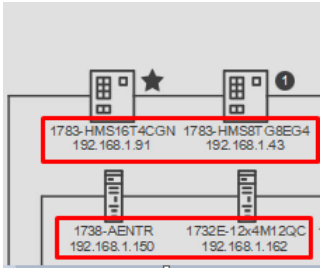
The Active Ring Supervisor is always located on the upper left position of the screen and it is identified by the star icon at the upper right corner of the node.



If the Backup Supervisor is configured, then it is identified by numerical icons at the upper right corner of the nodes. The numerical order indicates the order taken over by the supervisor, if the initial Active Ring Supervisor and subsequent Backup Supervisor cannot perform functions any longer.

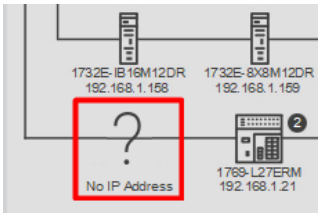


In addition, each node will display its catalog number and IP address as reported by the device.



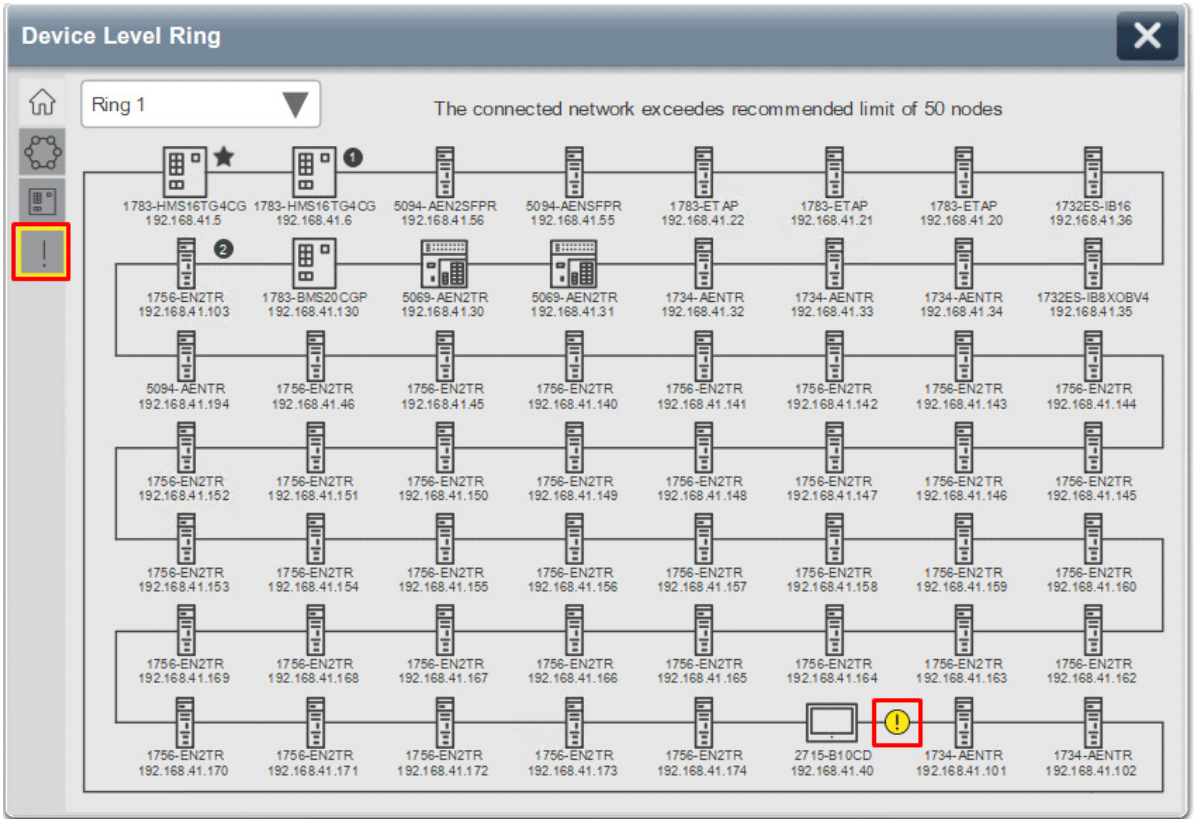
Detailed node information can be accessed by pressing the individual device Icons.

Devices without IP addresses can participate in the DLR and will be identified with a question mark. Device catalog number will be shown only if node responds to Identity request by the Add-On Instruction (AOI), otherwise a question mark icon will be shown.



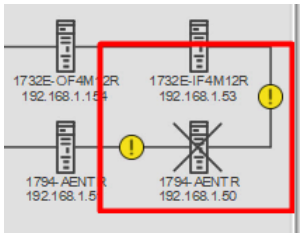
If a network connection fault is detected, a Link Fault indicator represented by the round yellow circle with an exclamation mark will appear on the network layout at the point or points of failure. In addition, a yellow border will appear on the network fault tab navigation button. Once the failed connection is restored, the Link Fault indicator will disappear.

Note: Refer the Fault tab section for more information on the faults detected



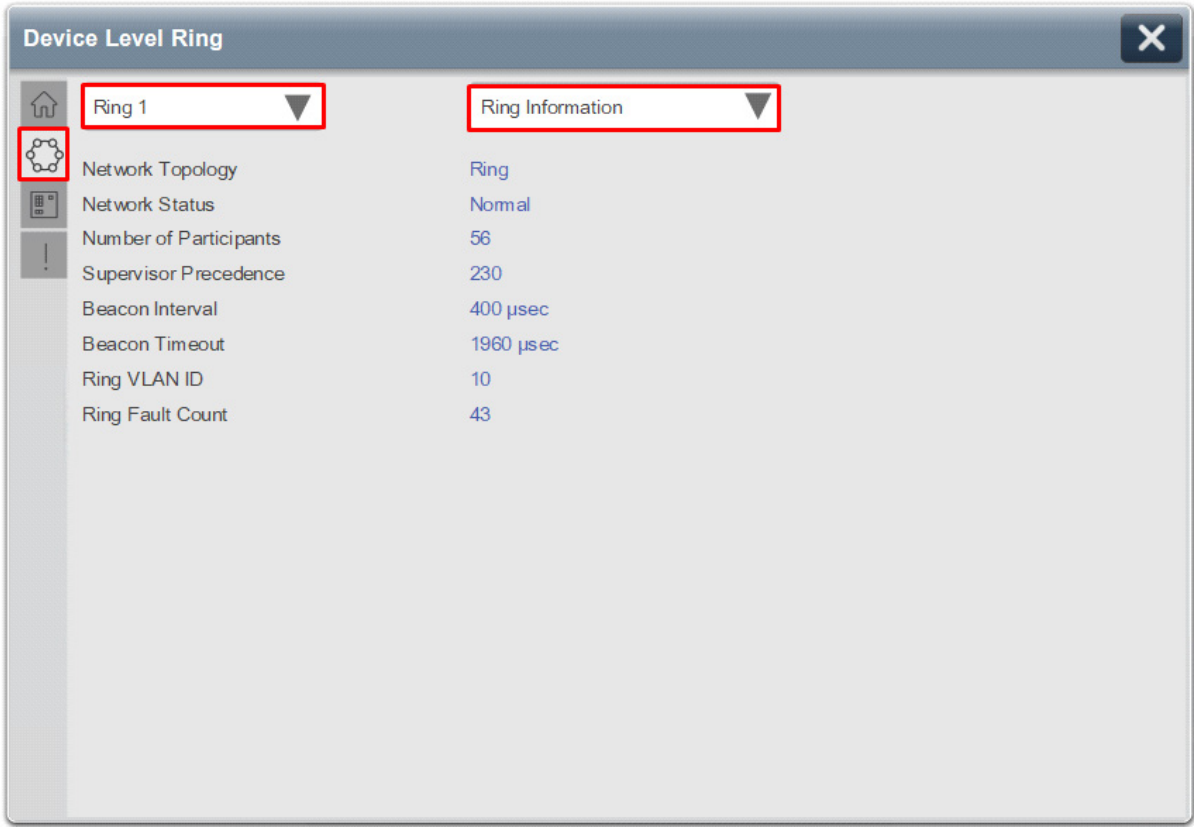
If a node is no longer responding, for example, if node power turned off, then missing node will be shown with “X” sign over the device icon.

Once the node functionality and connections are restored, the node and the associated link appearance will be restored to the normal state.



Ring Tab

The Ring Tab provides more information about the Device Level Ring network. A drop-down menu allows you first to select the desired ring. A second drop-down menu allows users to select the detailed Ring Information, Active Supervisor Identity, Active Supervisor Capabilities or Redundant Gateway information.

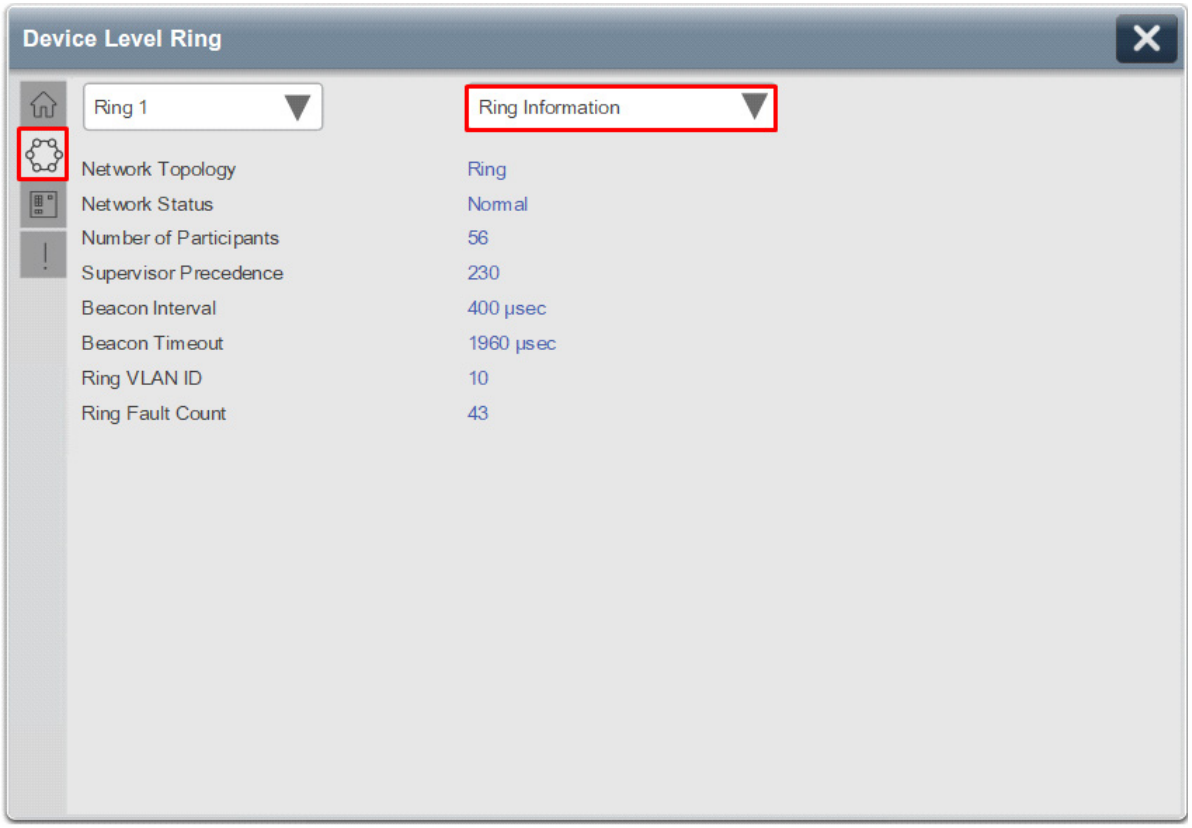


Ring Information

The Ring information provides basic network configuration, status and diagnostic information to assist in troubleshooting potential network problems.

Network Topology “Ring” state indicates that at least one node has the Active Ring Supervisor function enabled. The faceplate will be suspended if network is transitioned from the ring to the linear topology.

Network “Normal” state indicates that the ring is functioning correctly and no link faults are present. Otherwise, network status will indicate the various type of faults as reported by the Active Ring Supervisor.



In addition, this display shows currently active DLR configuration parameters that can be used for DLR network configuration, maintenance and troubleshooting.

Please refer to the DLR user guides for more information.

https://literature.rockwellautomation.com/idc/groups/literature/documents/at/enet-at007_-en-p.pdf

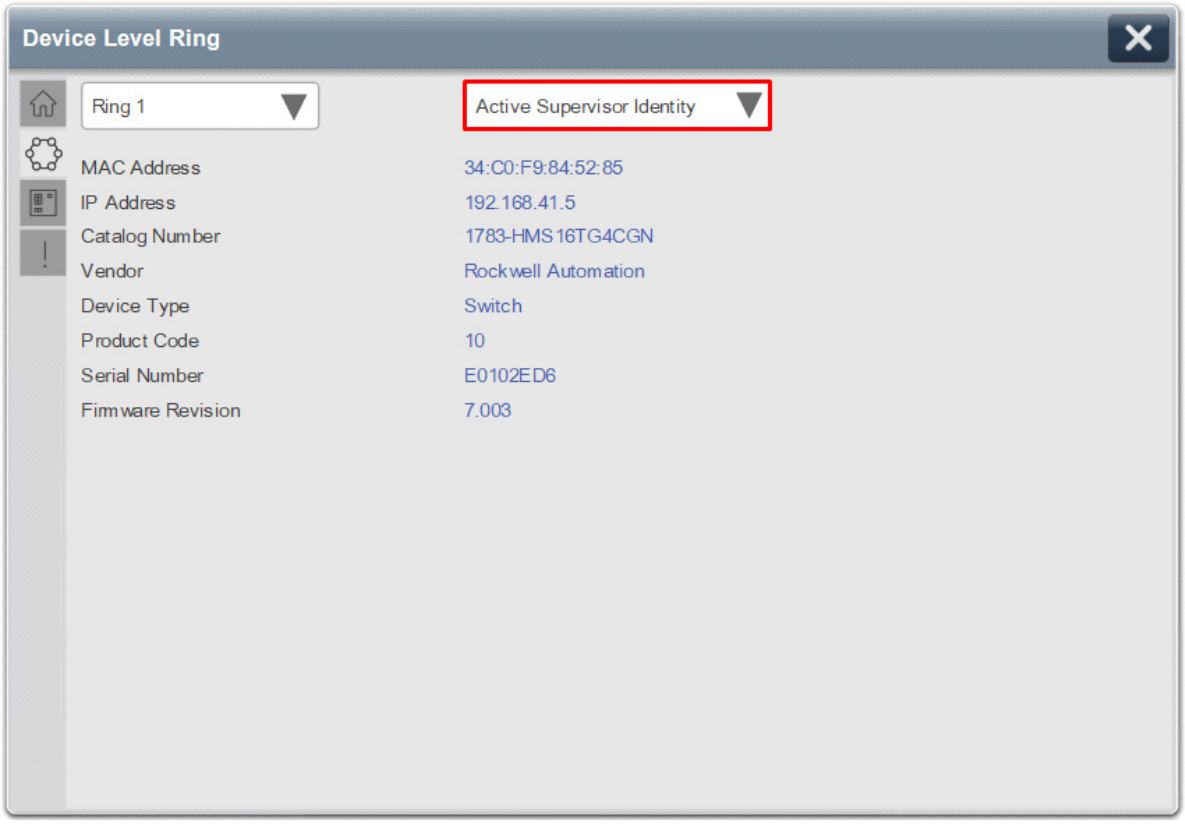
https://literature.rockwellautomation.com/idc/groups/literature/documents/td/enet-td015_-en-p.pdf

Active Supervisor Identity

The Active Ring Supervisor is automatically determined based on the precedence value and MAC address. The Active Supervisor identity information helps the user to identify the device that is currently acting as the Active Ring Supervisor. This information includes the MAC address, IP address, Catalog Number, Vendor, Device Type, Product Code and Serial

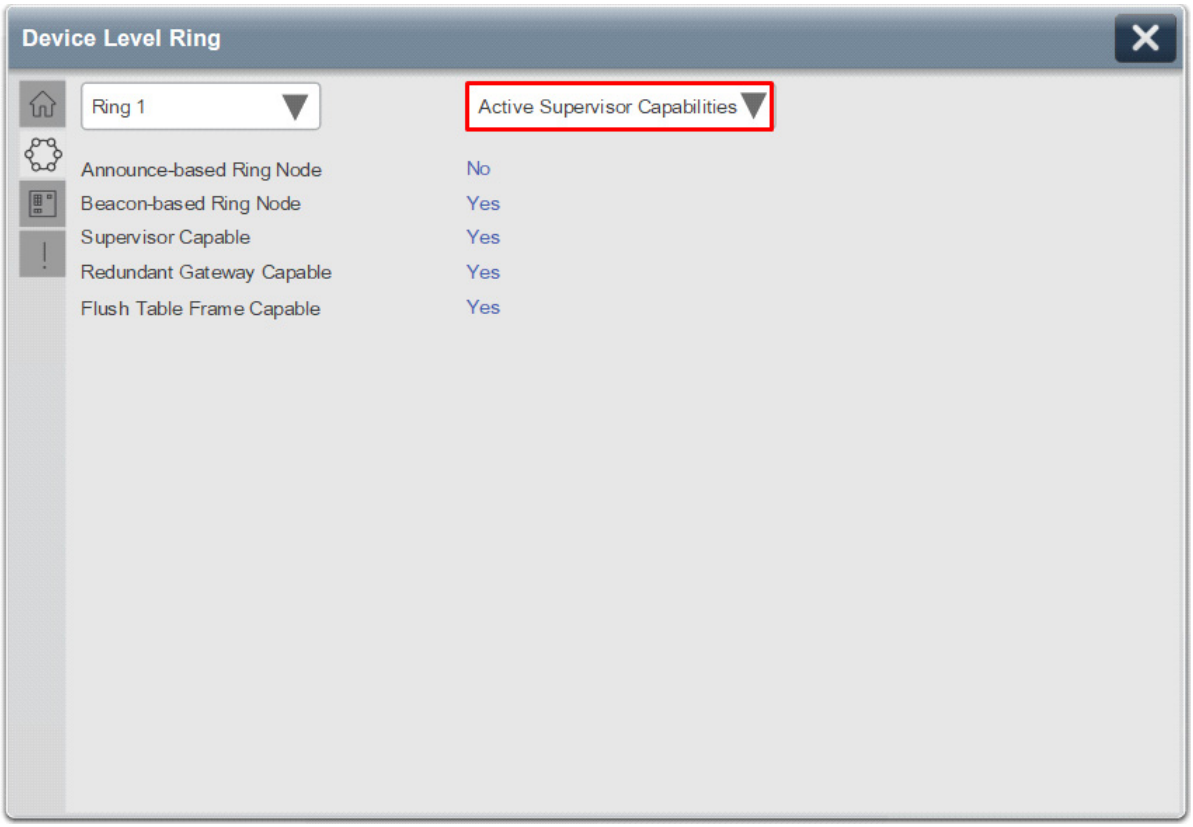
Number. Firmware Revision helps with troubleshooting to determine if the device firmware is current.

This information is updated in real time and will reflect any changes in the Active Ring Supervisor.



Active Supervisor Capabilities

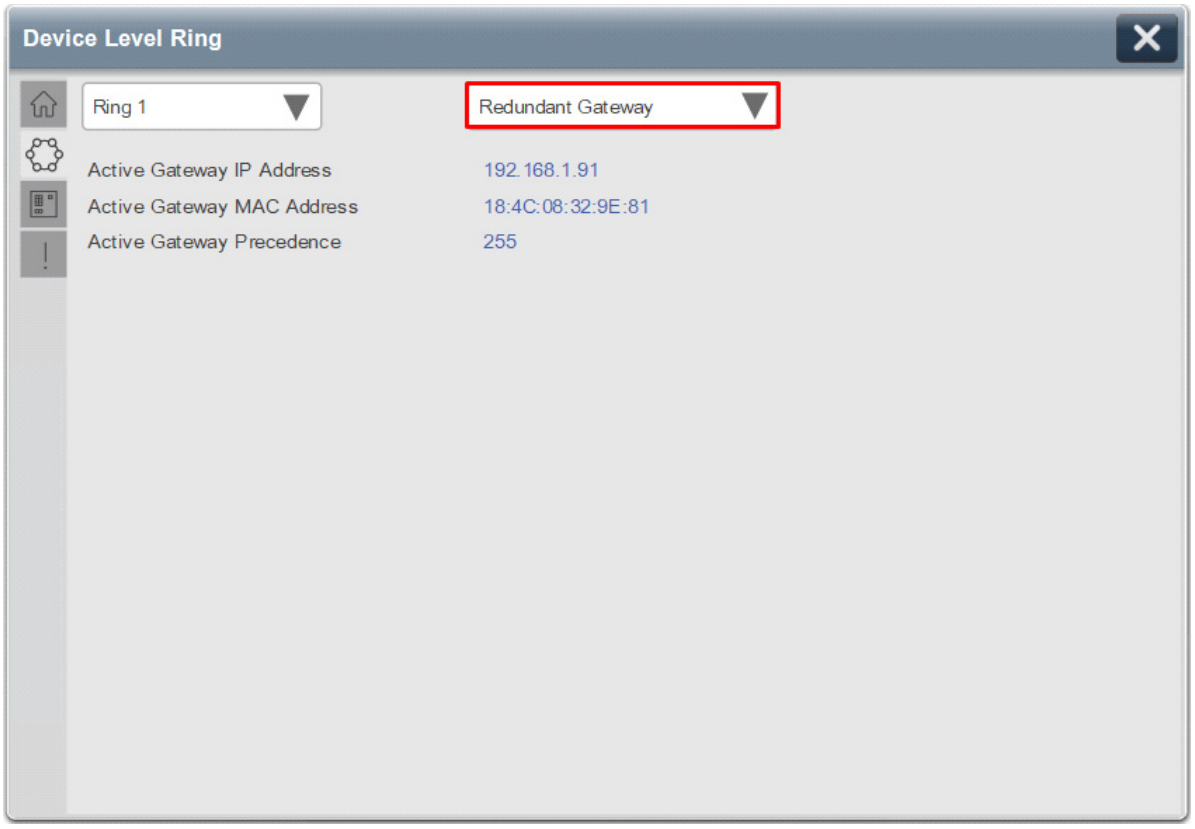
The Active Supervisor capability information provides the configuration and device capabilities of the Active Ring Supervisor which helps with device configuration and troubleshooting. See Node Capabilities for details.



Redundant Gateway

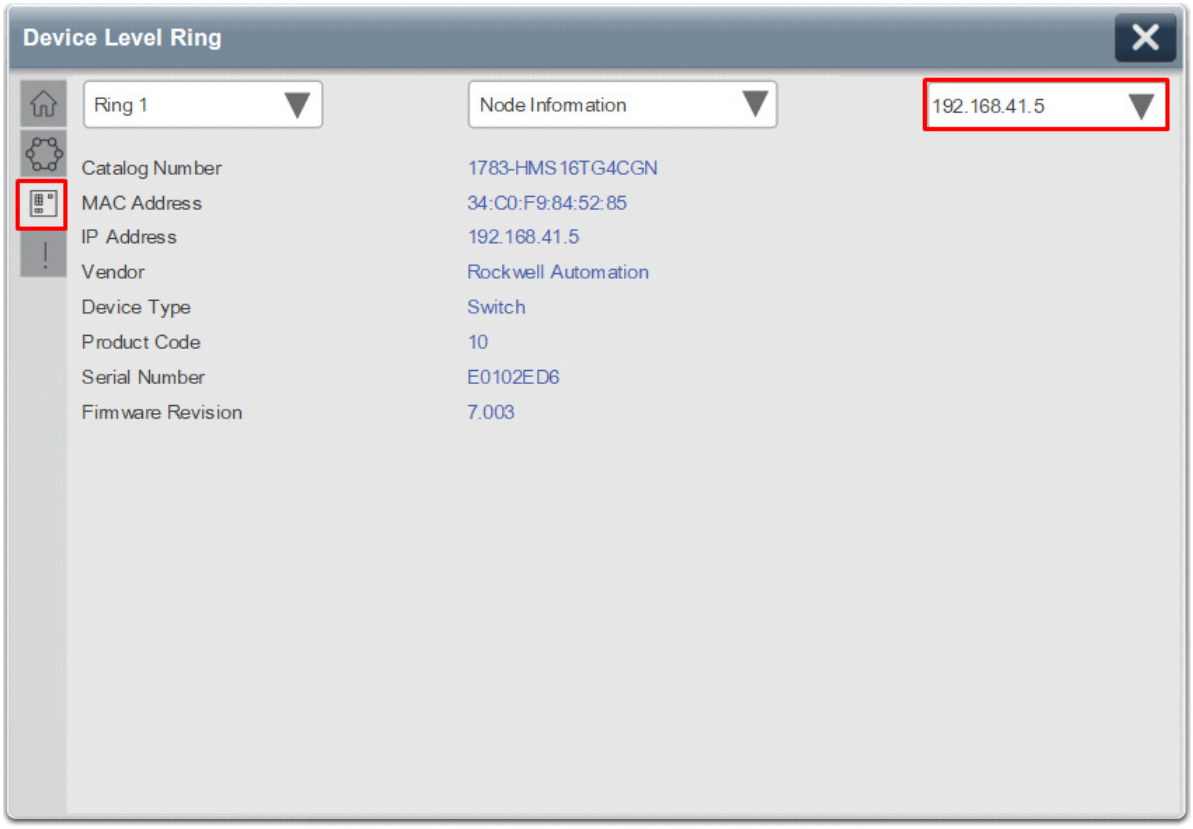
If Redundant Gateway functionality is enabled on the DLR network, then this screen will display information about the device that acts as an Active Redundant Gateway, including IP address, MAC address and Gateway Precedence value.

Redundant Gateway option is not applicable for 12-node DLR Network.



Node Tab

The DLR faceplate also allows user to display information about all DLR participant nodes. For specific node information, select the Node Tab navigation button.

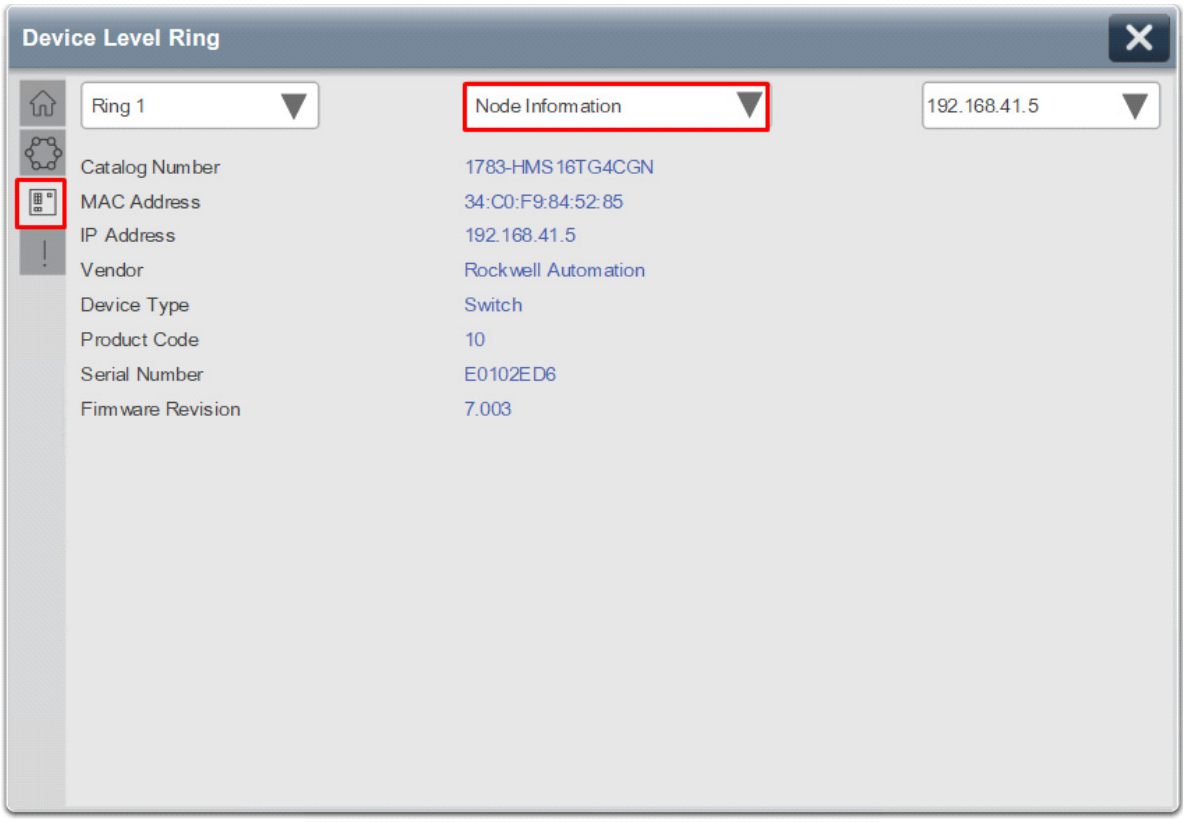


A drop-down menu allows users to select the desired DLR network. The node selection drop-down menu at the top right side of the node tab display allows user to access a specific node based on the IP or MAC address.

Node Information

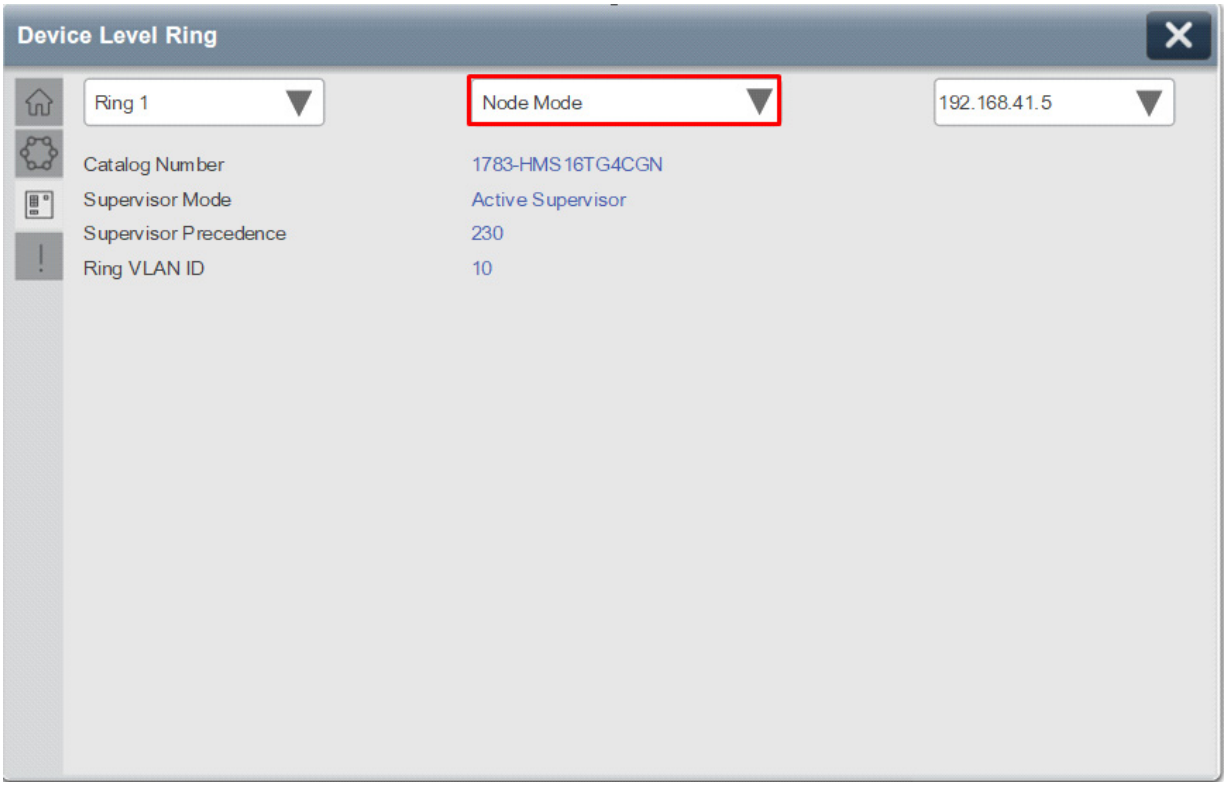
The Node Information display helps users to associate the specific node by one or more of its identity parameters:

Catalog Number, MAC address, IP address, Vendor, Device Type, Product Code, Serial number. It also allows to verify if firmware revision meets the user requirements.



Node Mode

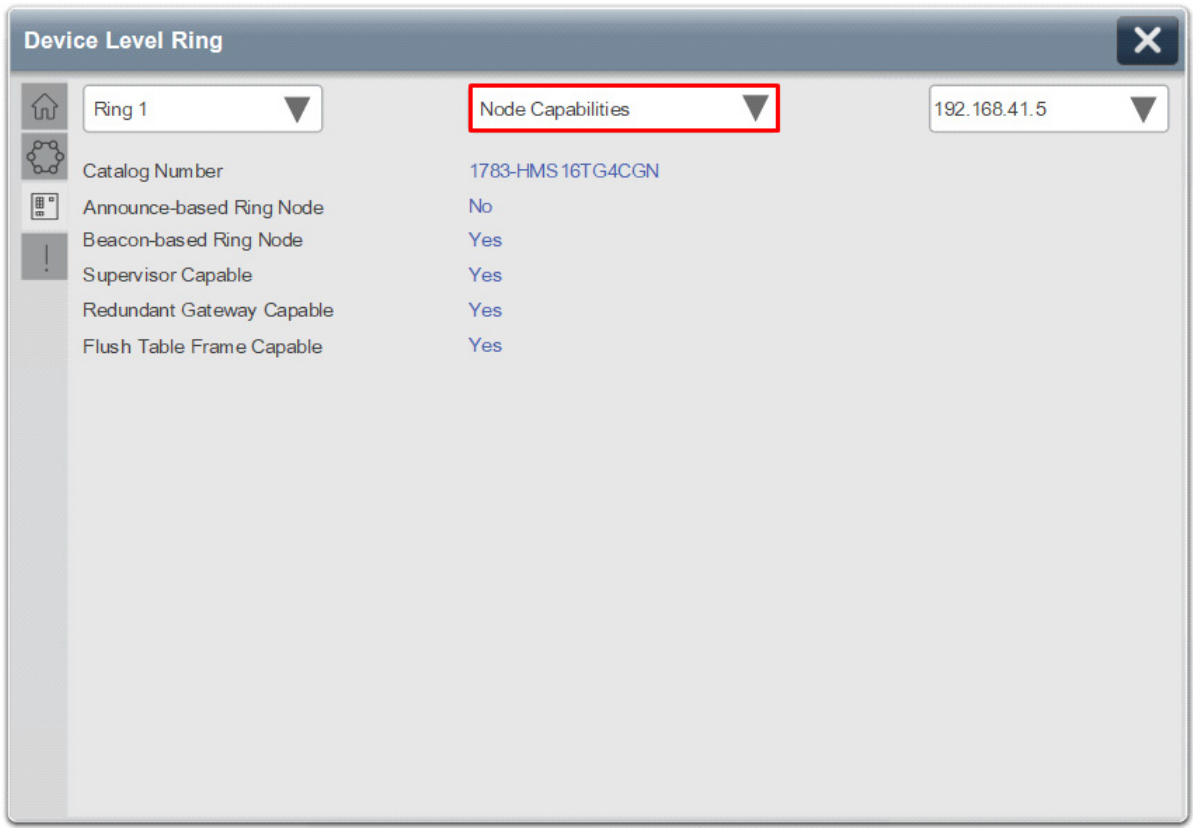
The Node Mode information provides the role of a specific node on the network, either normal node, Active Supervisor, or Backup Supervisor.



Please note that Supervisor Precedence **is not the same** as the Takeover Order shown on the Home screen. The Takeover order is calculated by the Add-On Instruction and is based on the precedence value and individual MAC addresses.

Node Capabilities

The Node Capabilities provide the information that potentially helps with node configuration and troubleshooting.



The first two fields identify if the node's DLR implementation is done in software **(Announce-Based**) or in Hardware (**Beacon Based**).

Supervisor Capability indicates that a specific device can be configured as a supervisor.

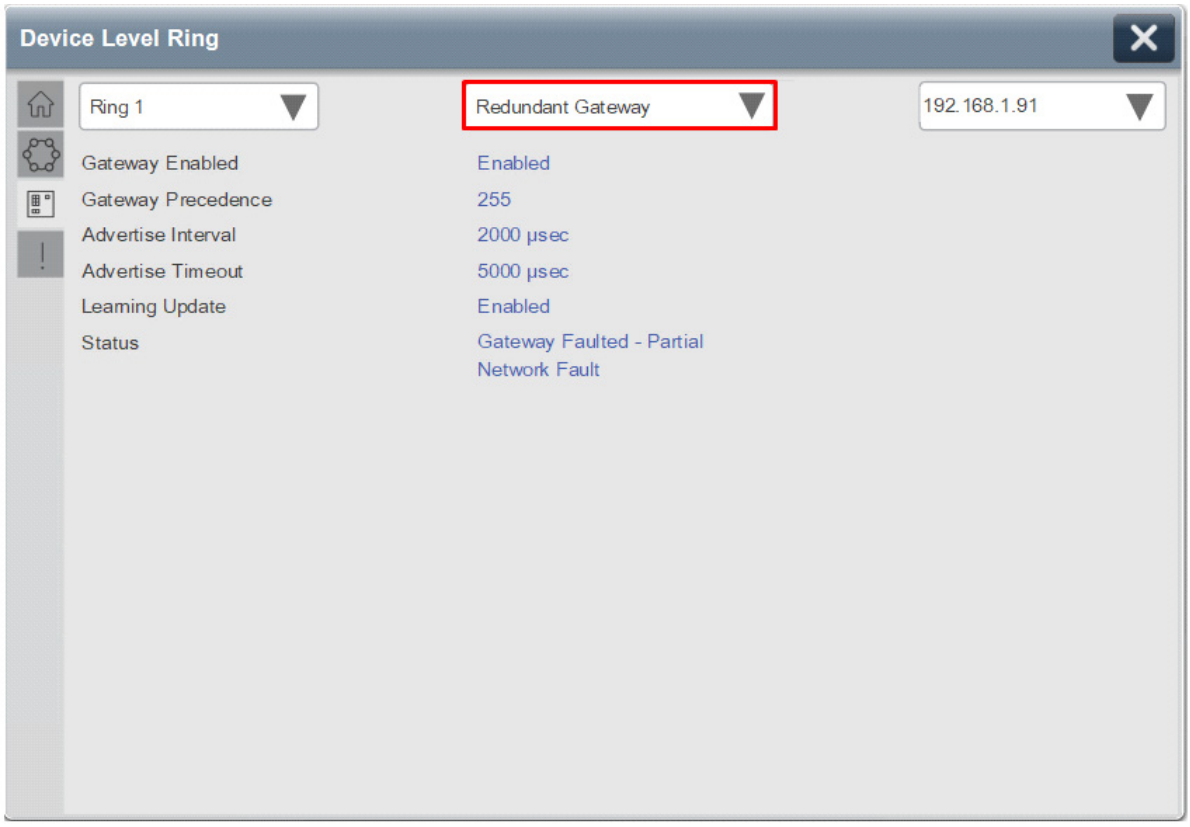
Some Supervisor capable devices can act as **Redundant Gateway** allowing multiple uplink connections to the distribution layer switches.

The **Flush Table** capability is required for all nodes that are present on the DLR network where a Redundant Gateway is enabled.

Redundant Gateway

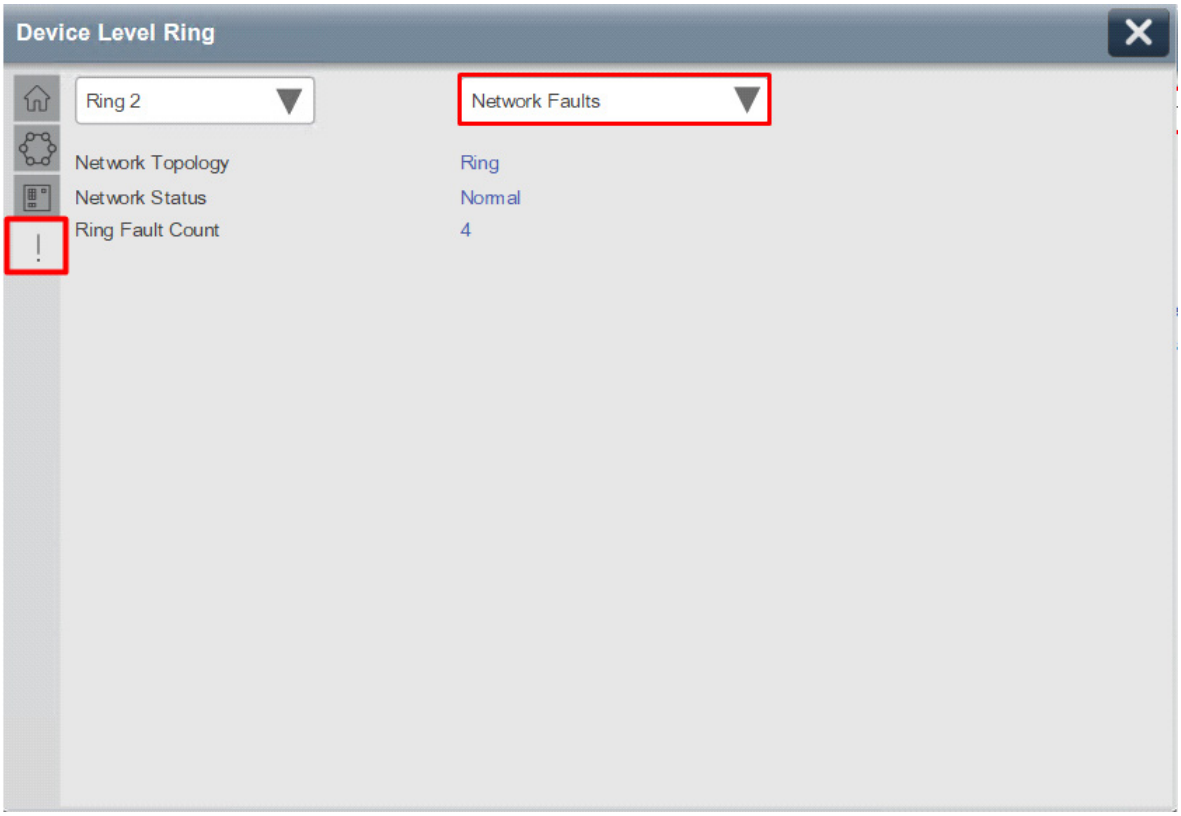
The Redundant Gateway Display will provide detailed node configuration parameters, if the node is configured for Redundant Gateway. It will also indicate the Redundant Gateway status for selected node.

This information allows users to troubleshoot an issue related to the Redundant Gateway connections and loss of data.



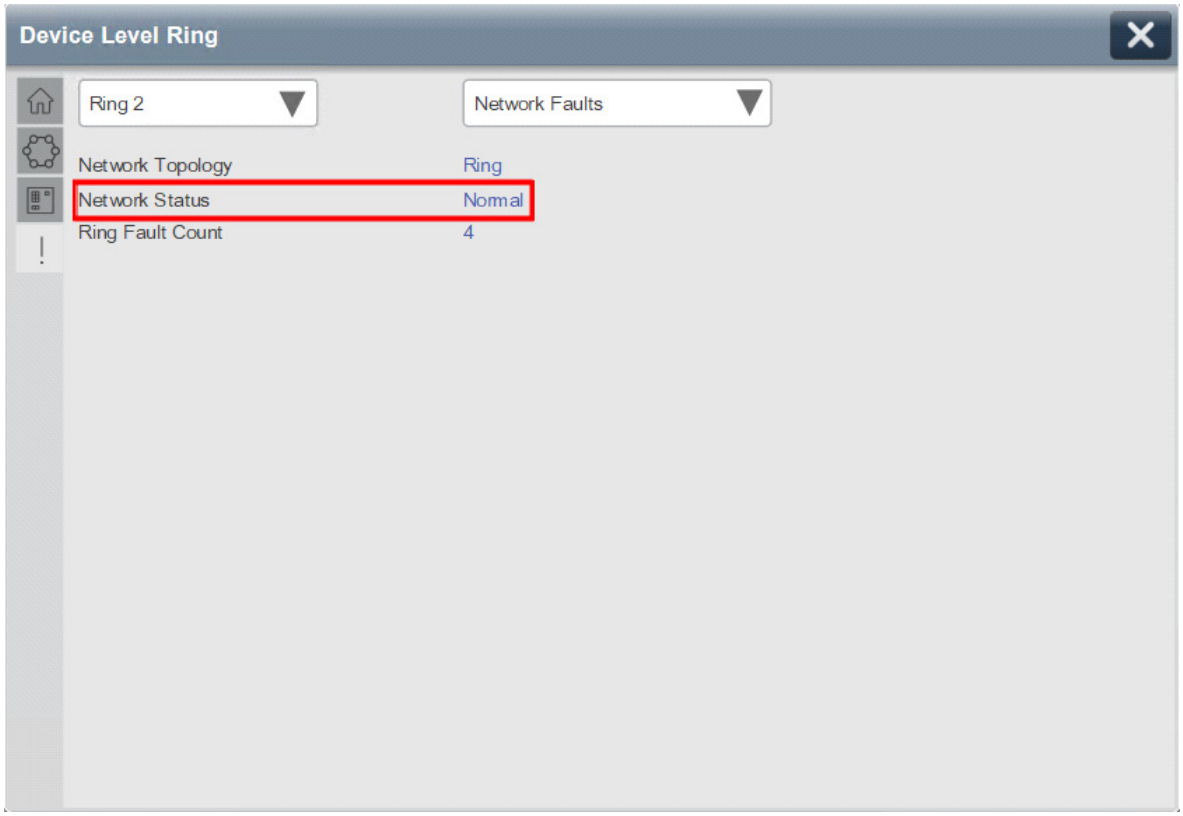
Fault Tab

The Network Fault Tab provides details about network health. When a network fault occurs, it will indicate the fault type, fault location. Any fault clear/reset operations should be performed via advanced user tools like Device Manager or Studio 5000 Logix Designer® Add-On Profile.

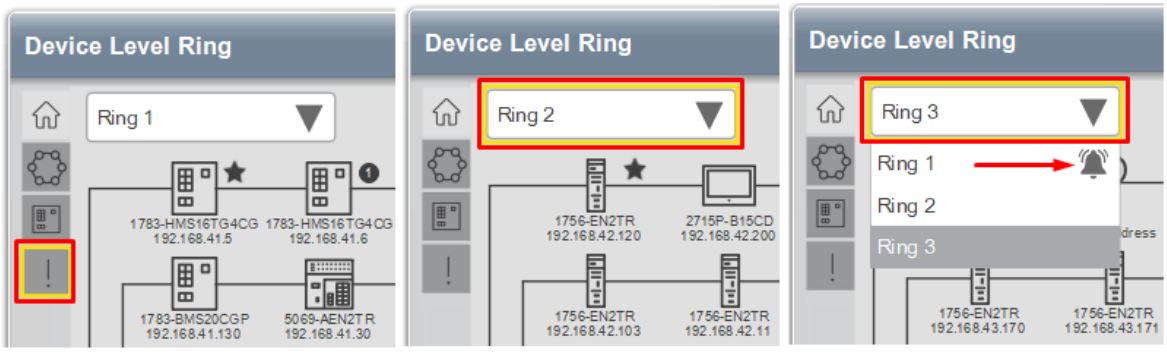


Network Fault

A fully functional DLR network should remain in Normal state.



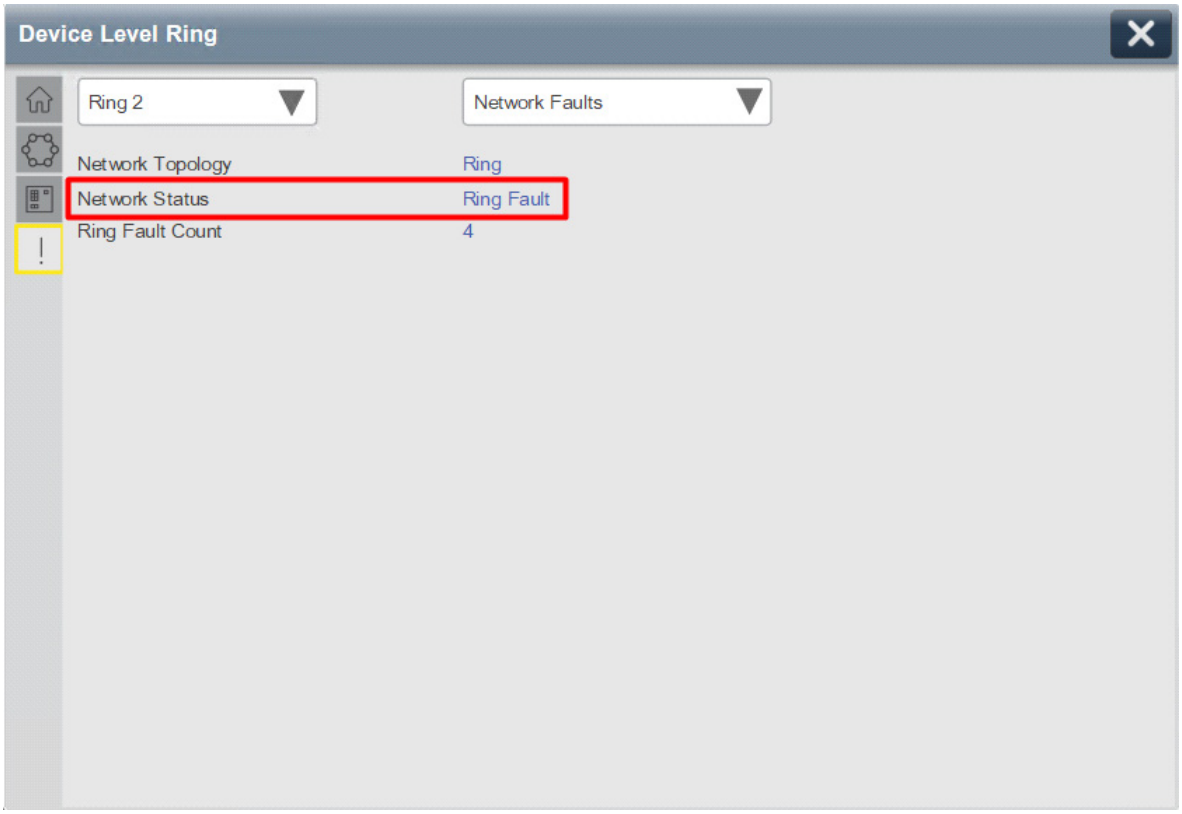
When a network fault is detected, a yellow border will appear on the network fault tab navigation button and alarm symbol is present on faulted ring of dropdown list. Also, yellow border will appear on the ring selector dropdown of the rings (i.e., Ring 2 and Ring 3).



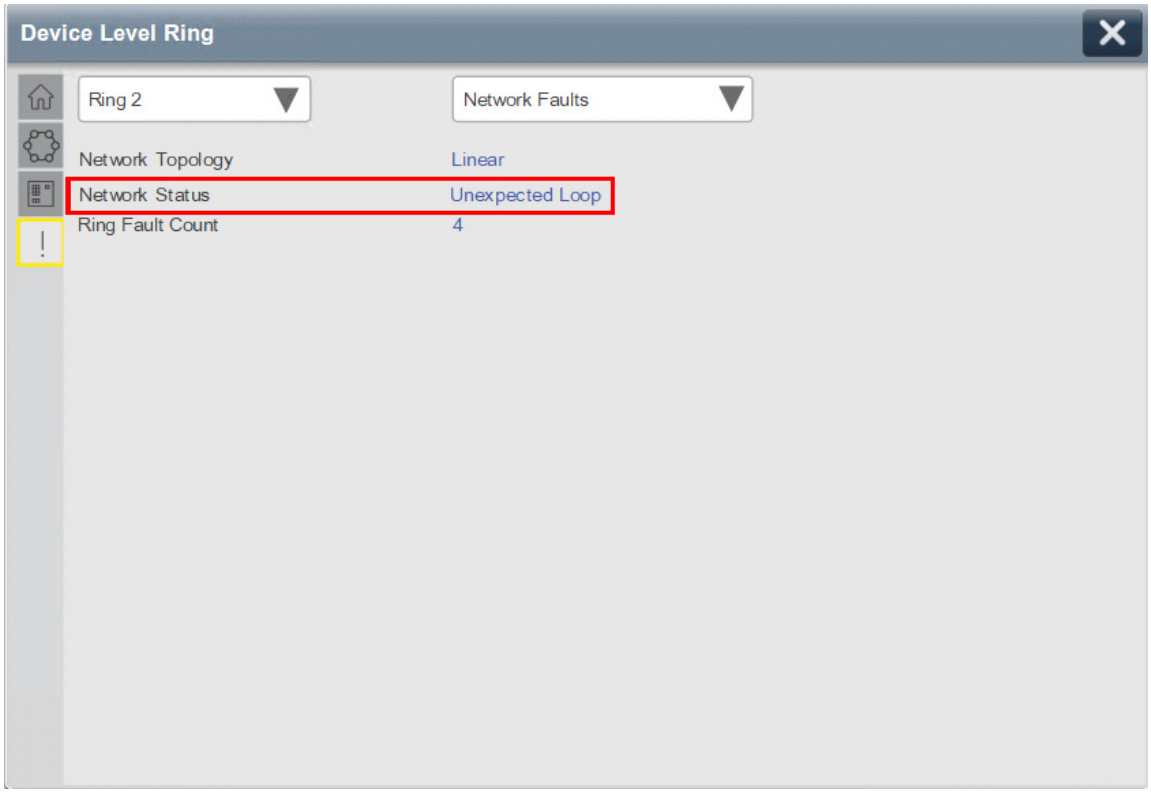
When a network fault occurs, the faceplate will indicate one of the following faults:

- Ring Fault
- Unexpected Loop Detected
- Partial Network Fault
- Rapid Fault/Restore Cycle Fault

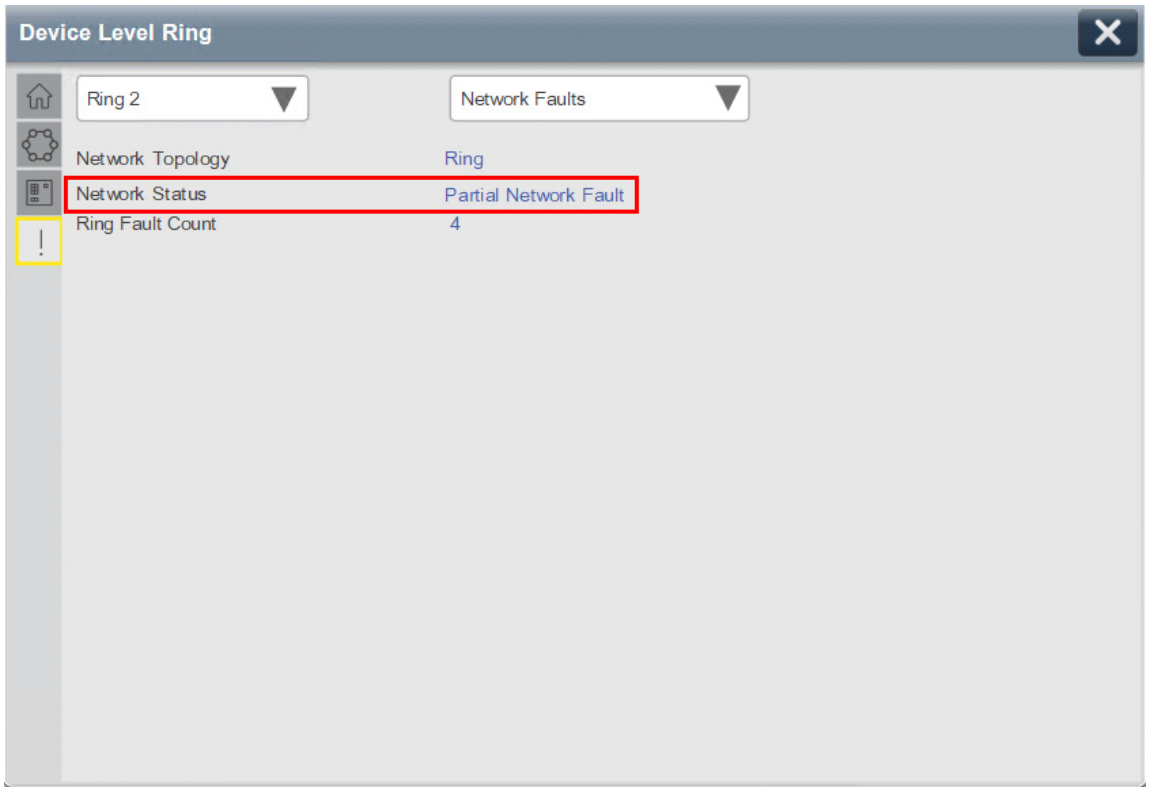
Ring Fault: The most common fault, the Ring Fault – usually occurs when one or more link is broken, or a node is taken off the network.



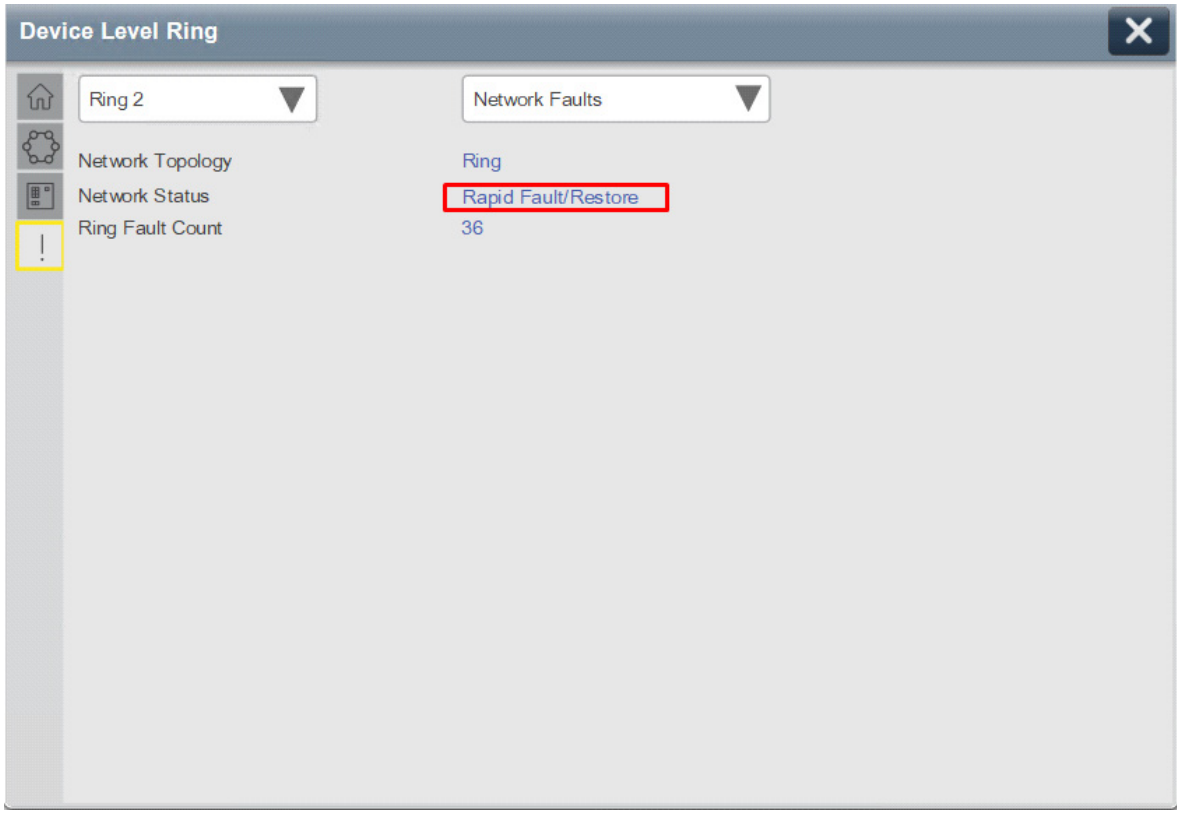
Unexpected Loop Detected: this fault occurs when the network ring was closed without defining at least one node as the Active Ring Supervisor – in Linear topology.



Partial Network Fault: occurs when the Active Ring Supervisor detects network fault in one direction only.



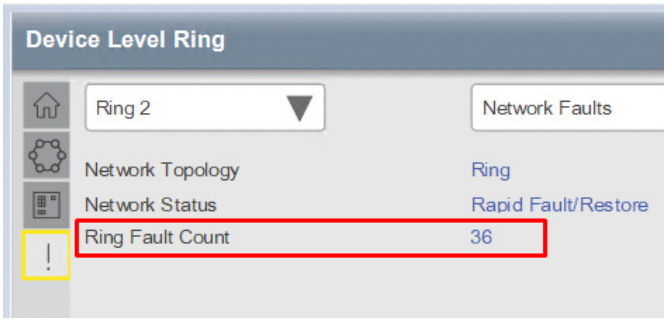
Rapid Fault/Restore Cycle fault: Occurs when there are more than 5 consecutive fault/recovery cycles detected in less than 30 seconds. This usually happens during network commissioning and indicates a severe hardware or cabling issue, or misconfiguration that requires immediate attention. When this fault occurs, it is required to restore normal operations after the fault cause was determined and corrected. Then Rapid Fault/Restore reset should be performed via advanced user tools like Device Manager or Studio 5000 Logix Designer® Add-On profile.



Ring Fault Count indicates number of ring faults since the Active Ring Supervisor's power-up or last fault reset.

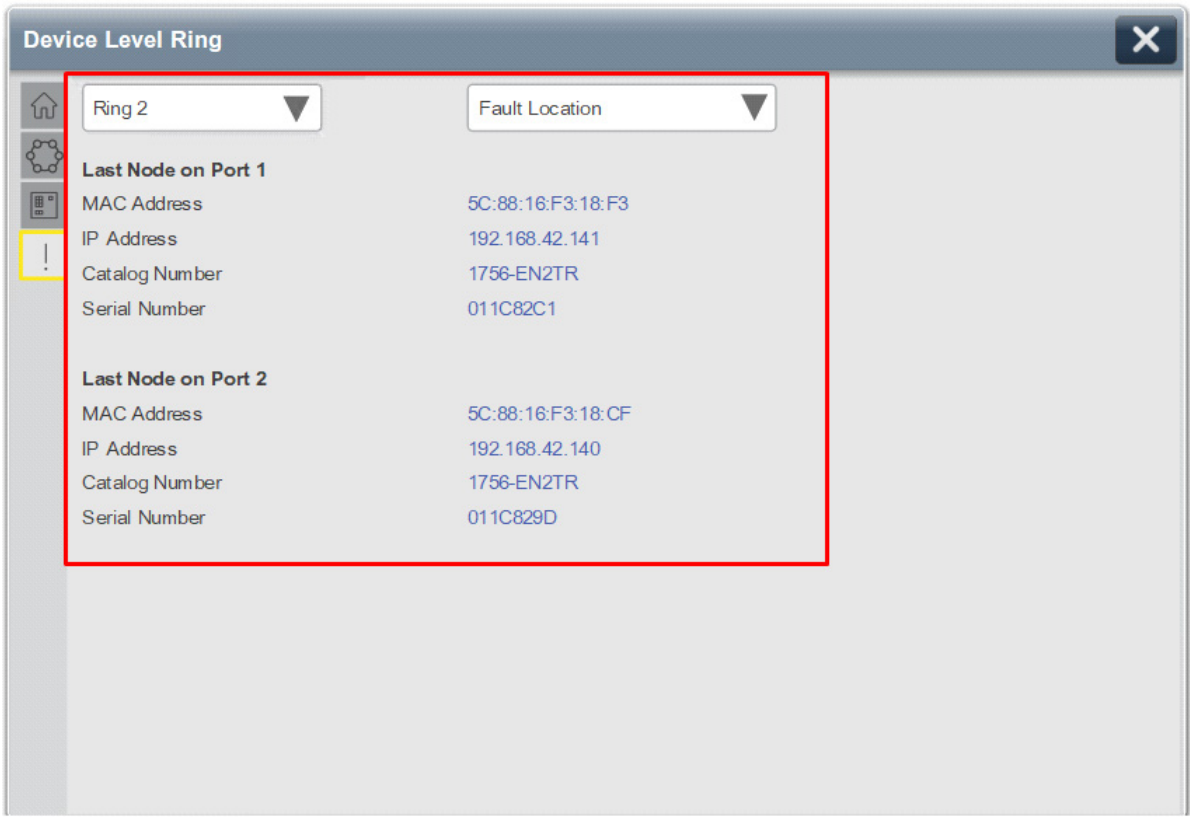
Please note that the counter is just a status indicator and does not affect DLR or faceplate operations.

Ring Fault Reset should be performed via advanced user tools like Device Manager or Studio 5000 Logix Designer® Add-On Profile.



Fault Location

The fault location information provides a potential breaking point as reported to the faceplate by the Active Ring Supervisor.



Warning Information

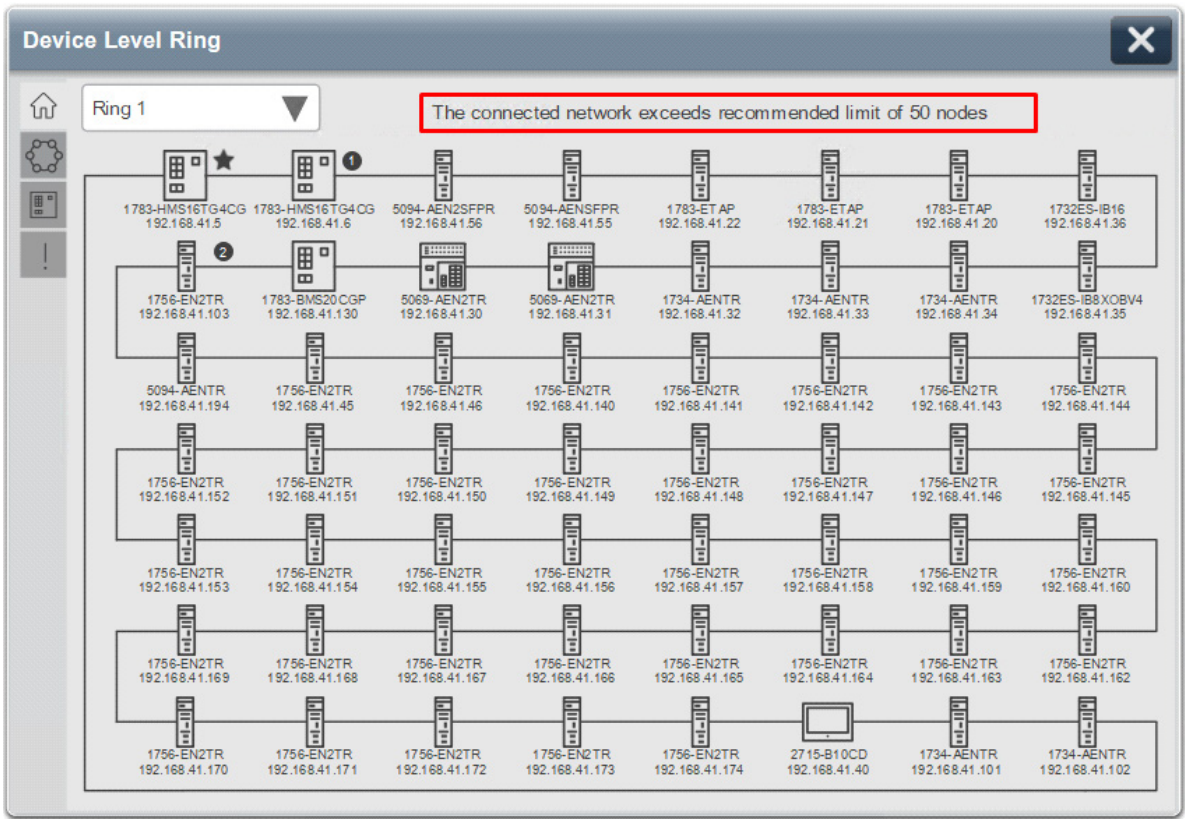
The faceplate also provides a series of warnings, here are few examples:

Faceplate Displays rely on the information provided by the Add-On Instruction.

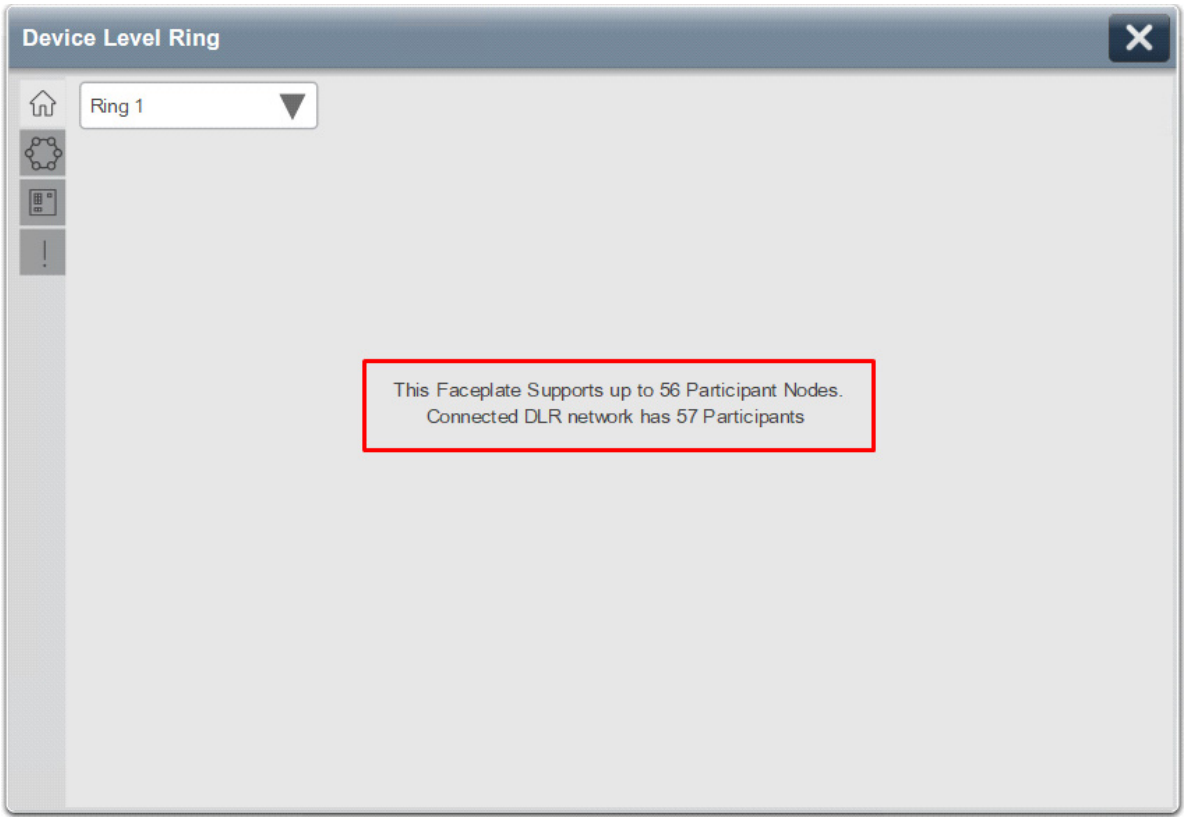
If the Add-On Instruction operation is disabled by the user, then “AOI Not Enabled” warning message is shown and all faceplate operations will be suspended.

If the number of nodes on a 56-node faceplate exceeds the recommended limit of 50 nodes, then this warning will be displayed.

Please note that while DLR does not has a physical node limit, Rockwell Automation recommends not to exceed 50 node limits. The user can disable or delete this message.



If the detected number of nodes on the connected network exceeds 56 then the below warning will display and all faceplate operations will be suspended

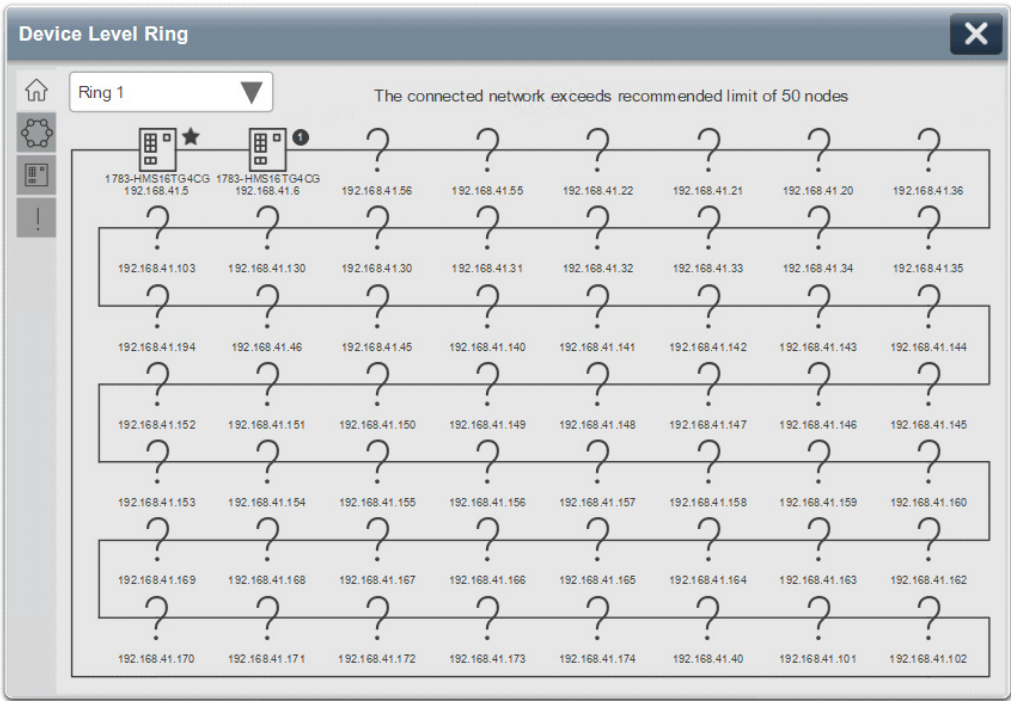


At least one Stratix path must be valid. If both are incorrect then the below warning will be displayed. The incorrect or invalid reference switch path defined in the Add-On Instruction parameters is likely the cause of this error.

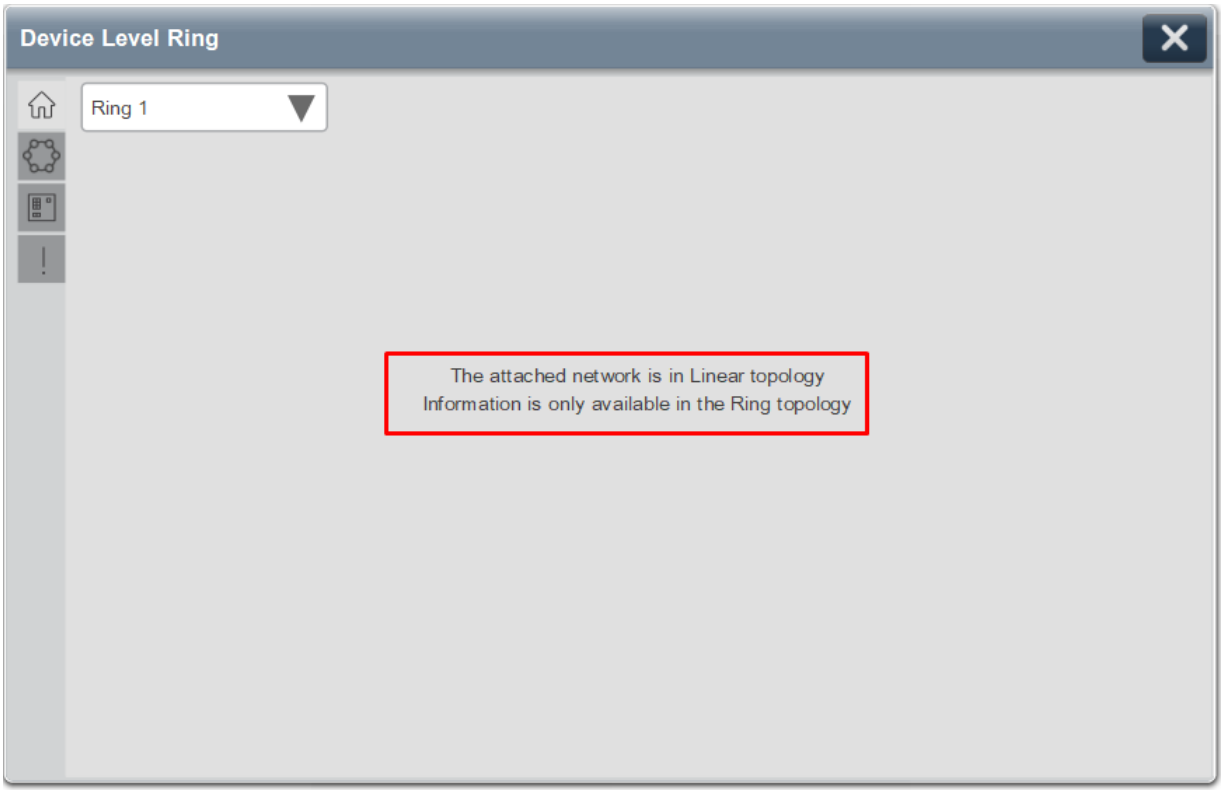
The incorrect or invalid reference ring path defined in the Add-On Instruction parameters is likely the cause of this error.

The following screenshot is applicable for Ring 2 and Ring 3.

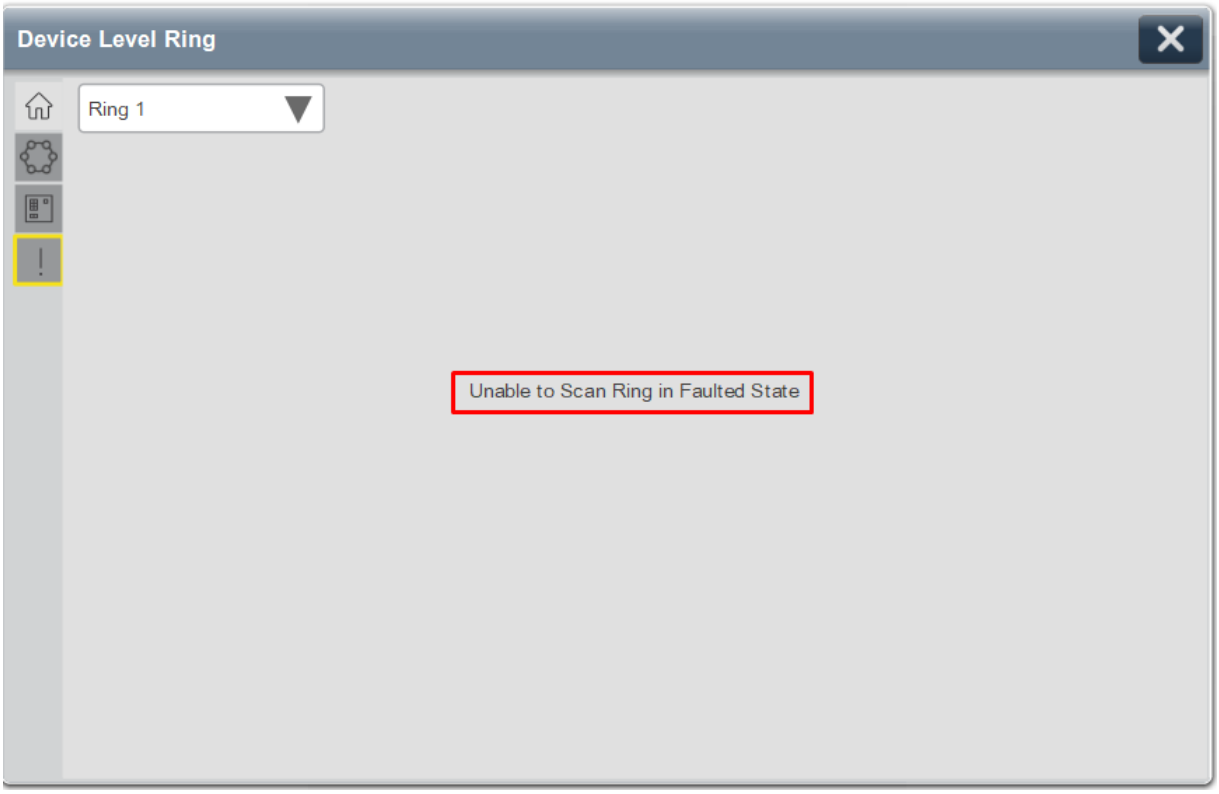
The following screenshot is applicable for Ring 1:



If Ref_Paths contains IP address of a device that is not a part of DLR and has the Active Ring Supervisor function disabled, then the below warning will be displayed.



The initial scan of the network must be performed in “Normal” state where DLR is functioning without a fault or cable break. Otherwise, the following message will be displayed. Once DLR is restored to the Normal state, the faceplate will automatically build the network participant list and display current network topology.



Application Code Manager

Network Device Library objects can be set-up and configured using Studio 5000® Application Code Manager.

Refer to the section Using Application Code Manager for complete details.

Definition Objects: raC_Opr_NetDLR3

This Asset-Control object contains the Add-On Instruction definition and required data types. It is used as a linked library to the device implement object. This gives users the flexibility to choose to instantiate only definition and create custom implement code. A user may also create their own implement library and link with this definition library object.

Implementation Objects: raC_LD_Opr_NetDLR3

The Device Implementation Object is the rung that is instantiated when generating controller code using Application Code Manager. This implementation object includes a reference to the Asset-Control Add-On Instruction definition, along with any required controller tags, programs, modules, and HMI objects.

The DLR3 implementation has the following configuration parameters.

Parameter Name	Default Value	Instance Name	Definition	Description
RoutineName	{ObjectName}	{RoutineName}	Routine	Enter Routine name. Routine will be created and Object implement rung(s) inserted. A JSR will be inserted in MainRoutine. If routine name already exists, then object will be inserted into existing routine. By default, parameter is set to Object Name.
TagName	{ObjectName}	{TagName}	Backing Tag	Enter the backing tag of the main AOI. This will serve as the base tag name for other tags in this object that are derived from the base.
TagDescription	{ObjectDescription}	{TagDescription}		Tag Description of the main AOI backing tag
Ref_Path_Ring1_Path				Enter a valid CIP Message Path to any device on Ring 1. See Message Paths for more information.
Ref_Path_Ring2_Path				Enter a valid CIP Message Path to any device on Ring 2. See Message Paths for more information.
Ref_Path_Ring3_Path				Enter a valid CIP Message Path to any device on Ring 3. See Message Paths for more information.
Ref_Switch_Paths0				Enter a valid CIP Message Path to a switch connected to the DLR networks. See Message Paths for more information.
Ref_Switch_Paths1				Enter a valid CIP Message Path to a switch connected to the DLR networks. See Message Paths for more information.

In Application Code Manager you can configure up to 2 Switch Paths for device monitoring and diagnostics within the DLR faceplate. The Add-On Instruction supports up to 10 switch paths. The remaining paths can be configured directly in the raC_UDT_DLR3Path10 UDT.

Linked Libraries

Link Name	Catalog Number	Revision	Solution	Category
raC_Opr_NetDLR3	raC_Opr_NetDLR3	12.2	(RA-LIB) Device	Network

Configured HMI Content

HMI Content	Instance Name	Description
Launch Button	{ObjectName}_GO_Launch_Three56N	Global Object launch button to DLR3 56 Node Faceplate using basic text label.

Attachments

Name	Description	File Name	Extraction Path
V12_Network_Images	Images	HMI Factory Talk View Images - png.zip	{ProjectName}\Visualization\Images
V12_raC_Dvc_Network_Global	Graphic Symbols ME	(raC-12-ME) Graphic Symbols - Network Device.ggfx	{ProjectName}\Visualization\FTViewME\GlobalObjects
V12_raC_Dvc_Network_Global	Toolbox ME	(raC-12-ME) Toolbox - Network Device.ggfx	{ProjectName}\Visualization\FTViewME\GlobalObjects
V12_raC_Dvc_Network_Global	Toolbox SE	(raC-12-SE) Toolbox - Network Device.ggfx	{ProjectName}\Visualization\FTViewSE\GlobalObjects
V12_raC_Dvc_Network_Global	Graphic Symbols SE	(raC-12-SE) Graphic Symbols - Network Device.ggfx	{ProjectName}\Visualization\FTViewSE\GlobalObjects
RM_raC_Dvc_Network	Reference Manual	DEVICE-RM400B-EN-P.pdf	{ProjectName}\Documentation
V12_raC_Dvc_DLR3_56Node	Faceplate SE	(raC-12_xx-SE) raC_Opr_NetDLR3_56Node-Faceplate.gfx	{ProjectName}\Visualization\FTViewSE\Displays
V12_raC_Dvc_DLR3_56Node	Faceplate ME	(raC-12_xx-ME) raC_Opr_NetDLR3_56Node-Faceplate.gfx	{ProjectName}\Visualization\FTViewME\Displays
V12_raC_Opr_NetDLR	View Designer	(raC-12_xx-VD) raC_Opr_NetDLR.vpd	{ProjectName}\Visualization\ViewDesigner

Parallel Redundancy Protocol (raC_Opr_NetPRP)

Overview

The Parallel Redundancy Protocol (PRP) device object (raC_Opr_NetPRP) includes HMI faceplates for PRP networks which displays network information including:

- PRP Node Table
- PRP Node Diagnostics
- PRP Node Identity

The raC_Opr_NetPRP object can be used for PRP networks containing up to 240 nodes.

In the Library there is a folder named *Videos* which contains many How-To and Operational Overview Videos which walk step-by-step through each process. You can refer to the following videos for this section:
"Operational Overview of PRP Object Faceplates"

Functional Description

The PRP Network objects:

- Collects and processes data from one of the PRP network devices (1756-EN2TP, 1756-EN4TR, 5094-AEN2TR, Stratix switch)
- Provides diagnostic data for PRP Node tables, streamlining network maintenance and minimizing network downtime.

All these features provide quick feedback, shorten recovery time, and simplify implementation.

Required Files

Device Objects include Add-On Instructions (AOIs) and HMI faceplates. The revision number (e.g. 1.01) used in filenames can change as new revisions are created.

Controller Files

Add-On Instructions are reusable code objects that contain encapsulated logic that can streamline implementing your system. This lets you create your own instruction set for programming logic as a supplement to the instruction set provided natively in the ControlLogix® firmware. An Add-On Instruction is defined once in each controller project, and can be instantiated multiple times in your application code as needed.

The Add-On Instruction must be imported into the controller project to be used in the controller configuration. These can be imported as Add-On

Instruction files, or as part of the Rung Import or Import Library Objects wizard.

All Add-On Instruction and Rung Import files can be found in the */Studio 5000 Logix Designer Files - L5X/* folder in the library.

Object	Compatible Network Configuration	Add-On Instruction	Rung Import
raC_Opr_NetPRP	PRP Node Table applicable with 1756-EN2TP, 1756-EN4TR, 5094-AEN2TR And maximum 240 PRP Nodes	raC_Opr_NetPRP_12.03_AOI.L5X	raC_Opr_NetPRP_12.03_RUNG.L5X

FactoryTalk® View HMI Files

FactoryTalk® View ME and FactoryTalk® View SE applications require importing the desired device faceplates in addition to all Global Object (ggfx) files and all images located in the */HMI FactoryTalk® View Images - png/* folder of the library. FactoryTalk® View ME files are stored in the */HMI - FactoryTalk® View ME/* library folder and FactoryTalk® View SE files are stored in the */HMI - FactoryTalk® View SE/* library folder.

Device/Item	Type	FactoryTalk® View ME Faceplate	FactoryTalk® View SE Faceplate
raC_Opr_NetPRP	Display	(raC-12_03-ME) raC_Opr_NetPRP-Faceplate.gfx	(raC-12_03-SE) raC_Opr_NetPRP-Faceplate.gfx
Graphic Symbols	Global Object	(raC-12-ME) Graphic Symbols - Network Device	(raC-12-SE) Graphic Symbols - Network Device
Toolbox	Global Object	(raC-12-ME) Toolbox -Network Device.ggfx	(raC-12-SE) Toolbox -Network Device.ggfx

Studio 5000 View Designer® HMI Files

All Studio 5000 View Designer® Files can be found in the */HMI - ViewDesigner - vpd/* folder of the library.

Device/Item	Studio 5000 View Designer® Faceplate
Network Objects	(raC-12_03-VD) raC_Opr_NetPRP_FP.vpd

Studio 5000® Application Code Manager Files

Studio 5000® Application Code Manager (ACM) can be optionally used if it is installed. All devices can be easily registered in the ACM repositories by running the *setup.cmd* file located in the root folder of the library.

Individual HSL4 files are provided as an alternative to running the setup.cmd to allow users to manually register specific implementation objects. Each object has two files - an Asset Control file and a Device file. The Asset Control files include attachments of all required files for that object. The Device files

are used to actually add that device into a Studio 5000® project and these reference the Asset Control files.

All Studio 5000® Application Code Manager files can be found in the /*ApplicationCodeManagerLibraries*/ folder of the library. The files included are as follows:

Implementation Object	Asset Control File (.HSL4)	Device File (.HSL4)
PRP	(RA-LIB)_Device_Asset-Control_Network_raC_Opr_NetPRP_(12.03)	(RA-LIB)_Device_Device_Network_raC_LD_Opr_NetPRP (12.03)

Operations

The Network Device objects provide only physical operation mode. There is no virtual device mode offered.

Execution

The following table explains the handling of instruction execution conditions.

Condition	Description
EnableIn False (false rung)	Processing for EnableIn False (false rung) is handled the same as if the device were taken out of service by Command. The device outputs are de-energized and the device is shown as Program Out of Service on the HMI. All alarms are cleared.

Add-On Instruction I/O Data

InOut Data

InOut	Function / Description	DataType
Ref_Module	Reference Module	MODULE
Ref_MsgGetSgl	Message used to read vendor specific attributes.	MESSAGE
Ref_MsgGetAll	Message used to read vendor specific attributes.	MESSAGE
Ref_MsgGetMember	Message used to read Member Information vendor specific attributes.	MESSAGE
Ref_MsgGetSglNode	Message used to read vendor specific attributes.	MESSAGE
Ref_MsgGetAllNode	Message used to read vendor specific attributes.	MESSAGE
Ref_MsgData	Message Destination Address.	SINT[503]

Input Data

Input	Function/Description	DataType
EnableIn	Enable Input - System Defined Parameter	BOOL
Inp_Enable	Enable AOI functions. 1 = enabled.	BOOL
Set_SampleInterval	Status and diagnostic information cycle update in second. Default Value - 8 sec.	DINT

Set_SampleInterval value as per the total node count in the PRP Network. Tested with Set_SampleInterval value 6 sec. for 56 nodes in 100ms Periodic Task. (The Set_Sample Interval value depend on Periodic Task where AOI rung imported & Total no. of node count)

Output Data

Output	Function/Descritpion	DataType
EnableOut	Enable Output - System Defined Parameter	BOOL
Sts_EN	AOI Enabled Status; 1 = enabled	BOOL
Sts_ER	Message error bit; 1= Error	BOOL
Sts_Connected	Device is connected to the Programmable Controller	BOOL
Sts_Available	Connected and in the PRP Topology	BOOL
Sts_Faulted	Device faulted status: 1 = LAN A or LAN B not OK	BOOL
Val_MejorRevision	Mejor revision of Device	SINT
Val_MinorRevision	Minor revision of Device	SINT
Val_ProductCode	Product Code	INT
Val_TotalIPDevices	Total Non-zero (0.0.0.0) IP Address Nodes after filter.	DINT

Output	Function/Descritpion	DataType
Val_WarningCountLanA	Warning Count LAN A	DINT
Val_WarningCountLanB	Warning Count LAN B	DINT
Val_WarningLanA	1 = Warning on LAN A	SINT
Val_WarningLanB	1 = Warning on LAN B	SINT
Val_DeviceType	12=Communication Adapter, 14=Progammable Controller, 44=Switch, 24=HMI, 7=Discrete I/O,	INT
Val_MsgErr	CIP Message Error Indicatior	SINT
Val_TotalDevices	Total node count in PRP Table	DINT
Sts_StratixNode	1 = Connected reference module is Stratix Switch	BOOL
Val_NodeType	0=Deprecated (PRP Mode 0), 1=PRP Mode 1, 2=HSR Mode, 3-65535=Reserved for Future use.	INT

Data Types

A number of User-Defined Datatypes (UDT) are used in the Network Device Library. A full list of the UDTs used with the raC_Opr_NetPRP and object follows:

User Defined Datatype	Description
raC_UDT_DLRMAC	Raw MAC
raC_UDT_PRPDuplicateDetectCounter	LRE Duplicate detection counters
raC_UDT_PRPInterfaceCounter	LRE Interface counters
raC_UDT_PRPNodeTableHMI	PRP Node Table Member Information

Add-On Instructions

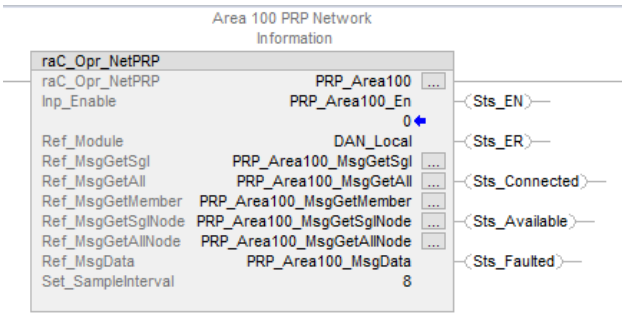
A number of embedded Add-On Instructions (AOI) are used within the raC_Opr_NetPRP instruction. These are used to convert between datatypes and generate values which can be read from the HMI faceplate. The following AOIs are included:

User Defined Datatype	Revision	Description
raC_Tec_IPMACtoString	1.01	Converts numerical IP address into user-readable string
raC_Tec_IPtoString_NET	2.00	Converts numerical IP address into user-readable string
raC_Tec_MsgPathFormation	1.00	Provide Appropriate message path
raC_Tec_GetMembersPRP	1.02	Get Members Service (0x18) for PRP Object (0x57) Instance attributes 2&3
raC_Tec_DecToHex	12.02	Converts Decimal number to Hexadecimal String

Programming Example

Fully configured device on a rung is provided below for reference.

Note that this programming example is the same code that is imported when either importing the supplied rung .L5X files or when using Application Code Manager or the Studio 5000® Import Library Objects wizard plug-in.



In this example *DAN_Local* is the name of a PRP enabled module such as a 1756-EN2TP communications adapter.

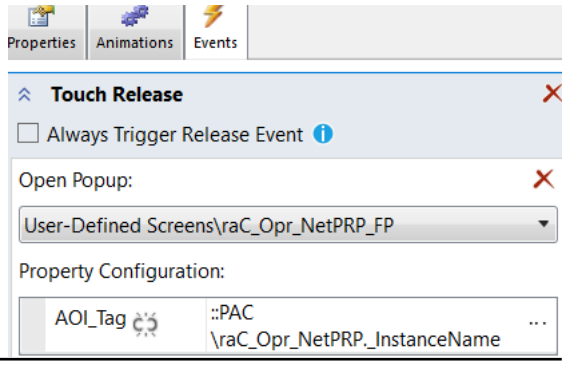
Graphic Symbols

Graphic Symbols are used as launch buttons within HMI applications to open up faceplate displays. See Basic Launch Button Attributes section for details on configuration and indicators.

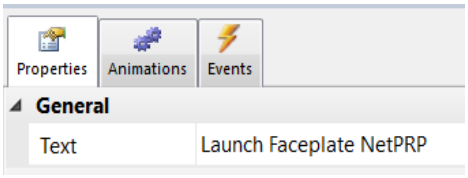
FactoryTalk® View ME/SE Graphic Symbols

Graphic Symbol Name	Graphic Symbol	Description	Global Object Parameter Values
GO_LaunchFP	PRP N/w Information	Faceplate navigation button with string tag label. This launch button graphic object allows the user to navigate to the device object faceplate. The text on the button face is set to the parameter #104.	#102: AOI Backing Tag Instance (e.g. {::[PAC]._InstanceName}) #104: Navigation Button Label #120: Display's left position (e.g. 100) (optional) #121: Display's top position (e.g. 100) (optional)

Studio 5000 View Designer® Graphic Symbols

Graphic Symbol Name	Graphic Symbol	Description	Property Configuration
btn_nav_raC_Opr_NetPRP_FP	Launch Faceplate NetPRP	Navigate to NetPRP Faceplate Pop-Up Screen	

Text displayed in the launch buttons can be modified from the *Properties* tab using the *General* > *Text* parameter.

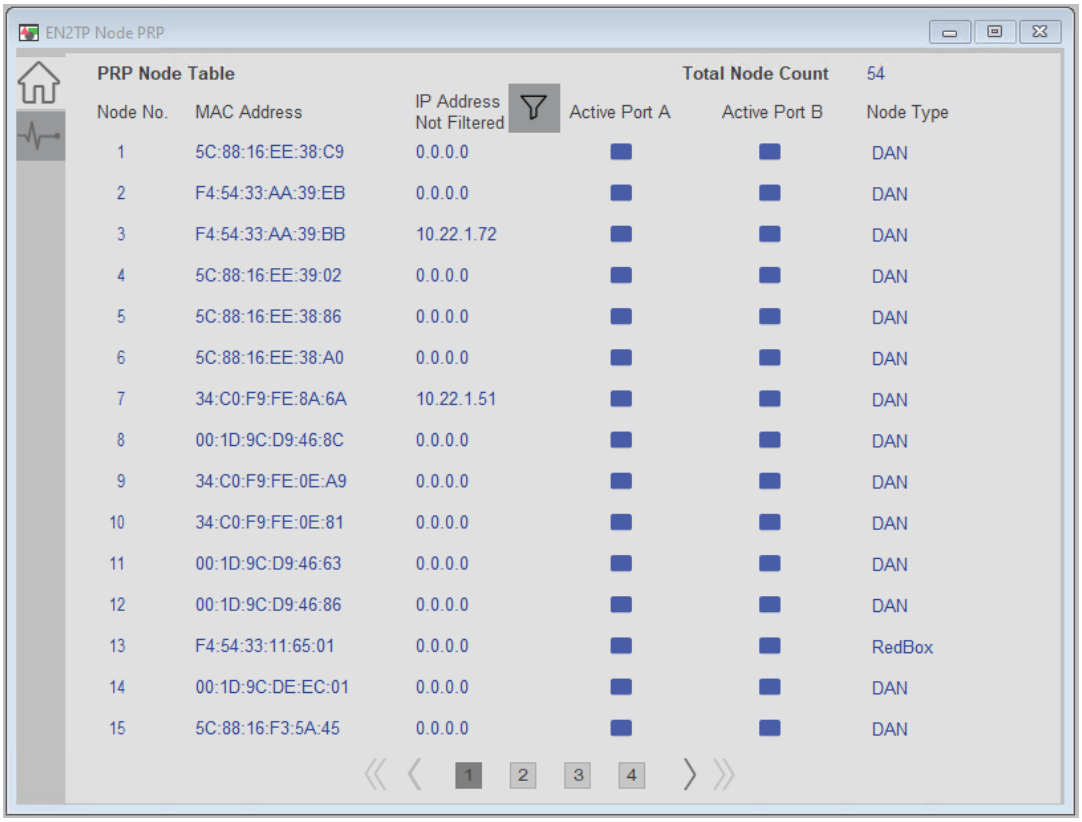


Faceplates

There are basic faceplate attributes that are common across all instructions. See Basic Faceplate Attributes on page 22.

In this document, the faceplate pictures (or snapshots) shows the information of PRP node table of PRP Network.

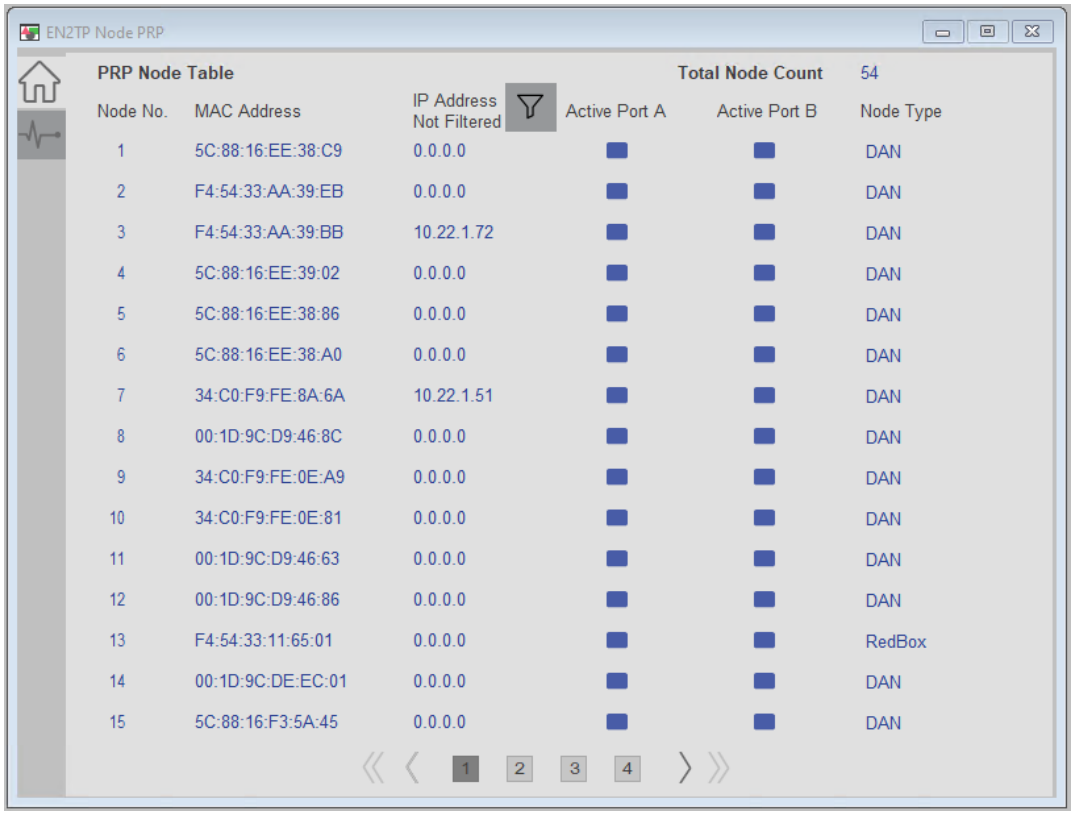
Faceplate Navigation



- The **Home** tab provides PRP Node table information of (MAC Address, IP Address, Active Port A, Active Port B, and Node type).
- The **Diagnostic** tab provides various types of counts for Port A & Port B which used to analysis PRP Network of that node. Also provides the node identity of that node.

Home

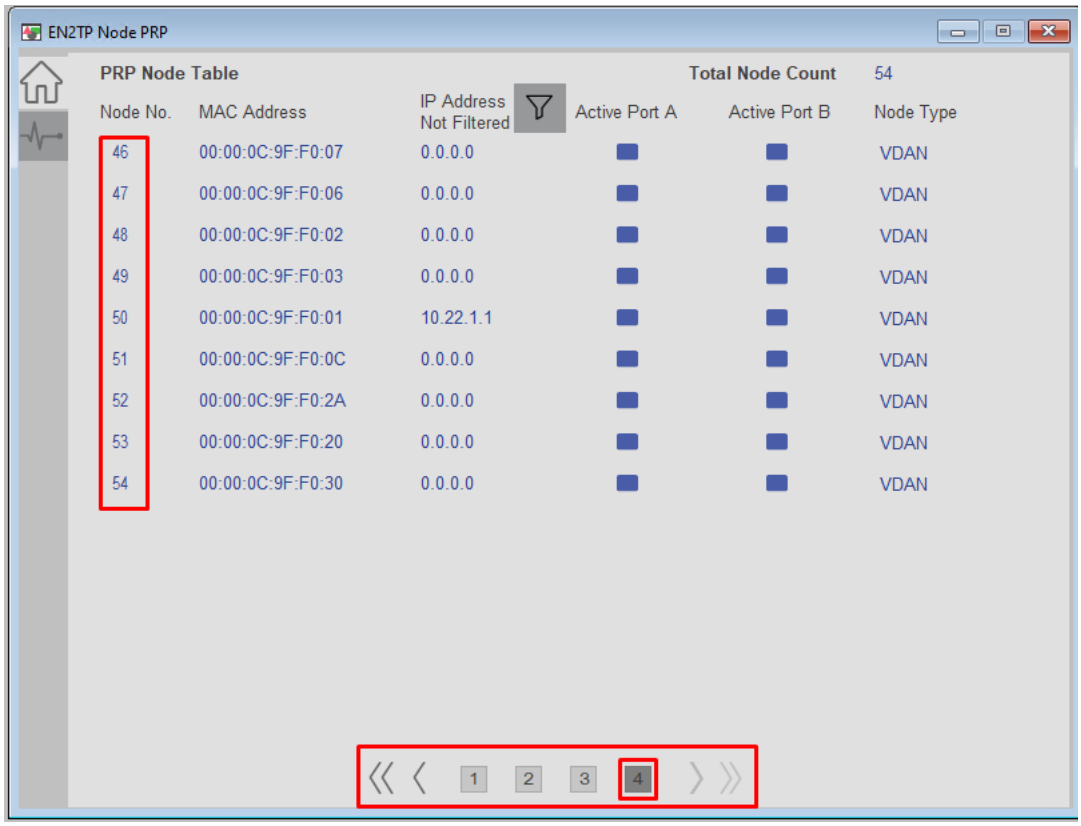
The Home screen is visible when the Home tab button is selected on the left side of the screen. Within the “Home Tab”, you will find information on the PRP Node table, including total node count and a node table of all active nodes. The PRP Node table details contains MAC Address, IP Address, Active Port A status, Active Port B status, and Node type.



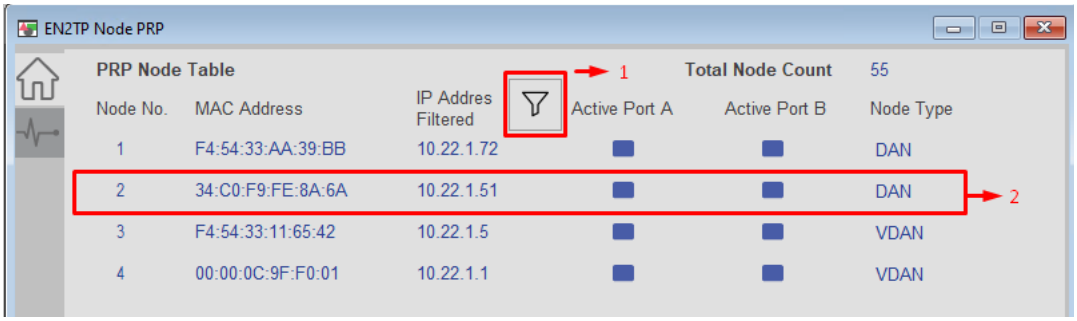
An active (blue) LED indicates the node’s Port A and/or Port B connection status. An inactive (gray) LED indicates that there is no connection on the respective port. The node type is set to one of the following types:

- DAN: Double attached node. An end device with PRP technology that connects to both LAN A and LAN B.
- SAN: Single attached node. An end device without PRP technology that connects to either LAN A or LAN B. A SAN does not have PRP redundancy.
- RedBox: Redundancy box. A switch with PRP technology that connects devices without PRP technology to both LAN A and LAN B.
- VDAN: Virtual double attached node. An end device without PRP technology that connects to both LAN A and LAN B through a RedBox. A VDAN has PRP redundancy and appears to other nodes in the network as a DAN.

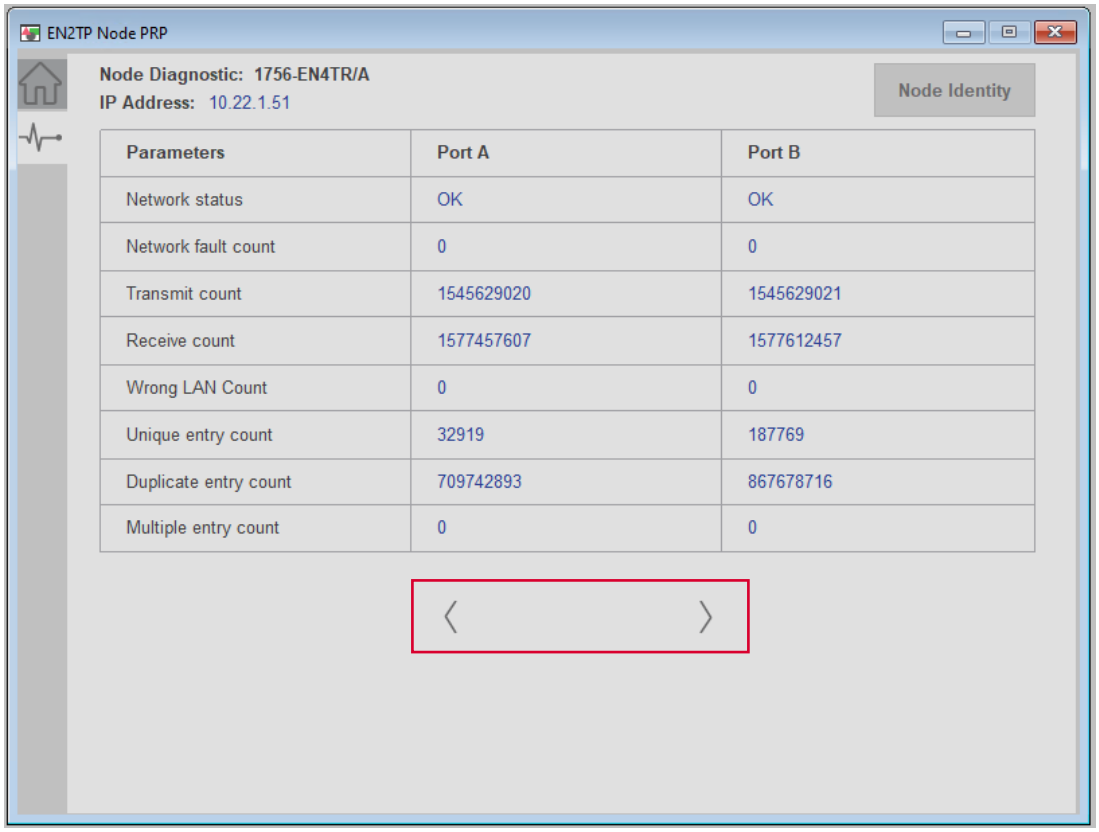
Use the page navigation buttons to view other nodes.



Enable the filter button to filter and display only non-zero (0.0.0.0) IP Address Nodes.



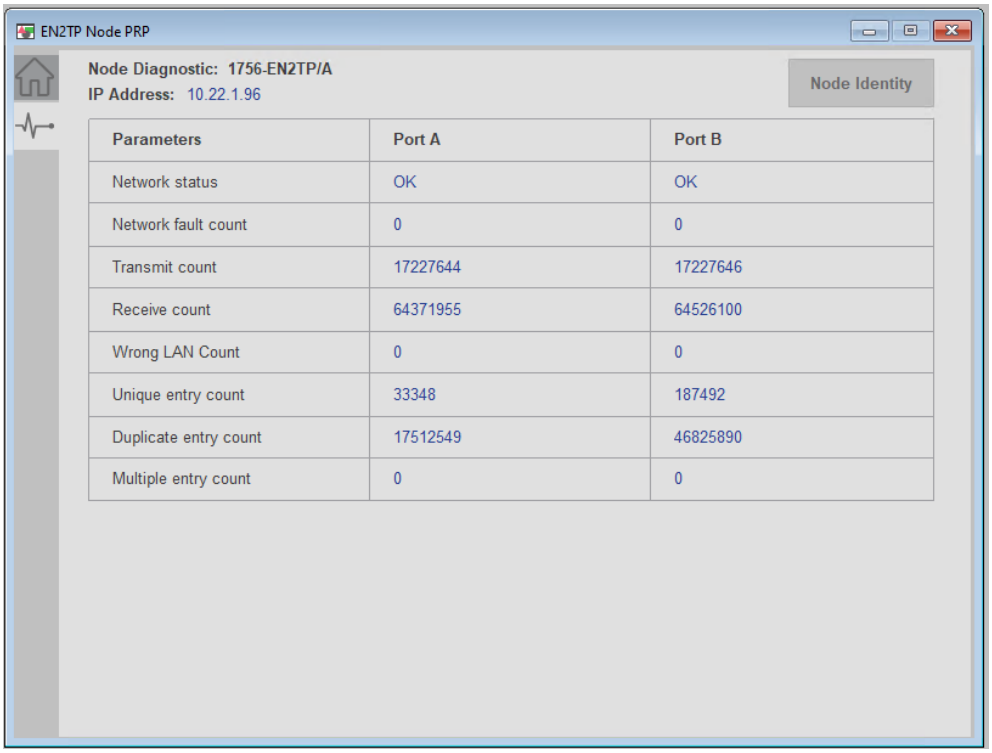
If you select an any filtered IP Address row it will navigate to second tab and displays the Detailed node diagnostic data of that PRP Node.



You can also navigate the other IP Address node information from here by using next or previous arrow button below the Diagnostic of Node table. *This is visible only if the filter is applied*

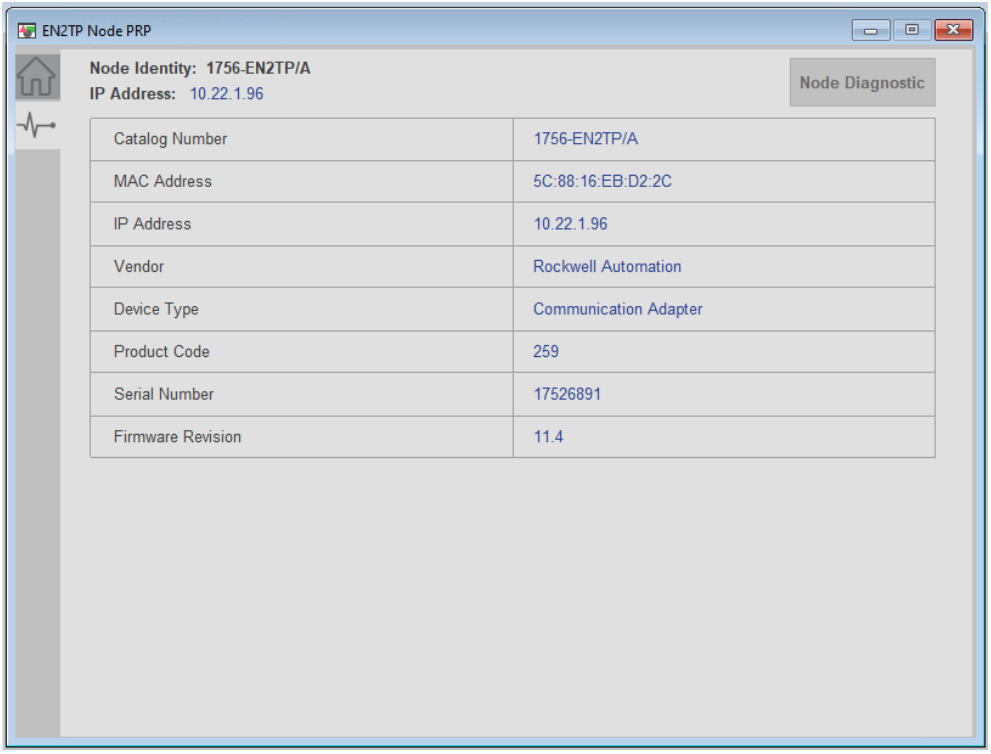
Diagnostic Tab

Within the “Diagnostic tab” you will find a detailed node diagnostic data of the selected node. If the filter is not enabled on the home tab, this will link directly to the reference module assigned to the Add-On Instruction’s *Ref_Module* tag. Users can easily monitor the Network status, Network fault count, Transit & receive count, Wrong LAN Count, Unique entry Count, Duplicate entry count and multiple entry count of PORT A & PORT B to diagnose the PRP network.



The diagnostic tab also allows user to display information of node identity. Click the *Node Identity* button to display the node associated identity parameters catalog number, mac address, IP address, vendor, device type, product code, serial number, firmware revision.

Click the *Node Diagnostic* button to return to the previous page.



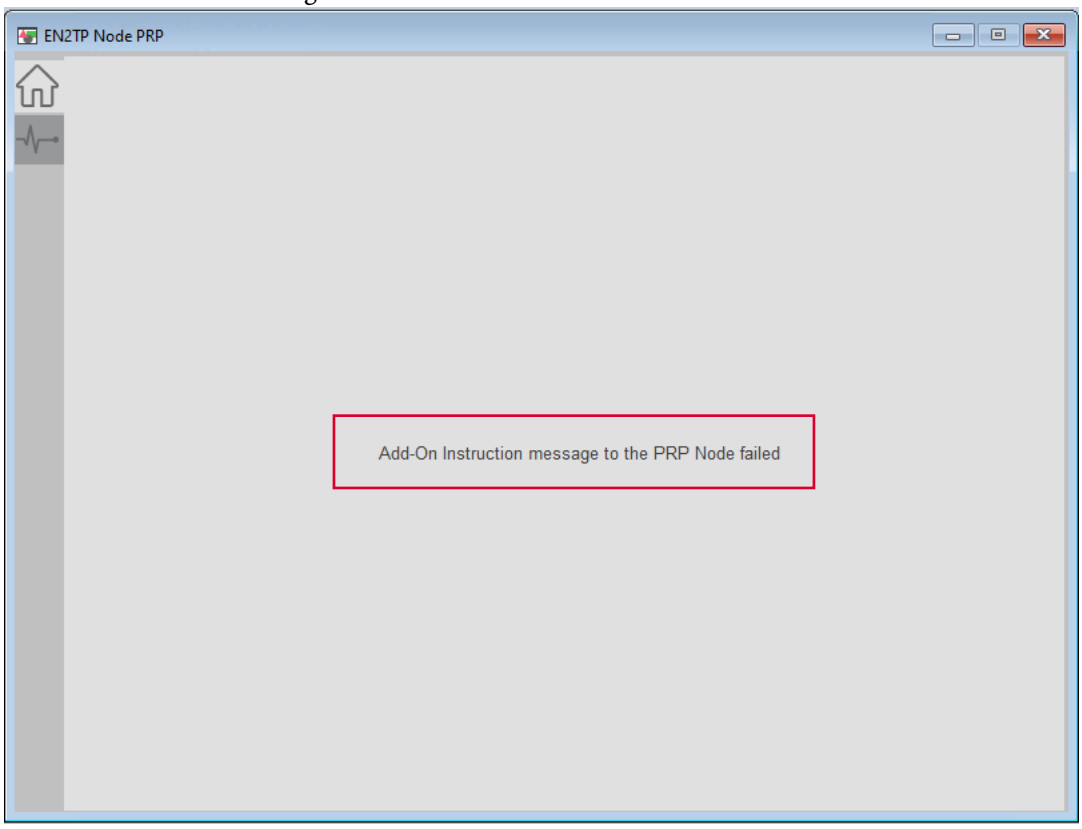
Warning Information

The faceplate also provides a series of warnings, here are few examples:

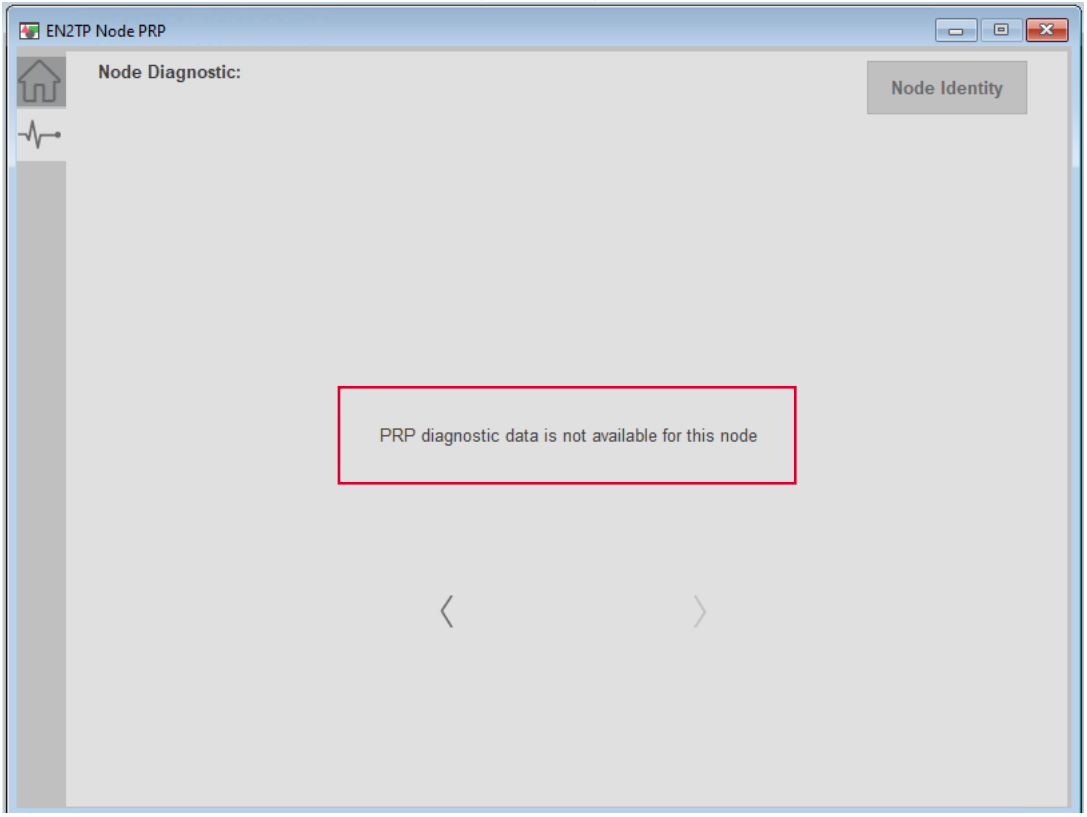
Faceplate Displays rely on the information provided by the Add-On Instruction.

- If the Add-On Instruction operation is disabled by the user, then an “AOI Not Enabled” warning message is shown and all faceplate operations will be suspended.

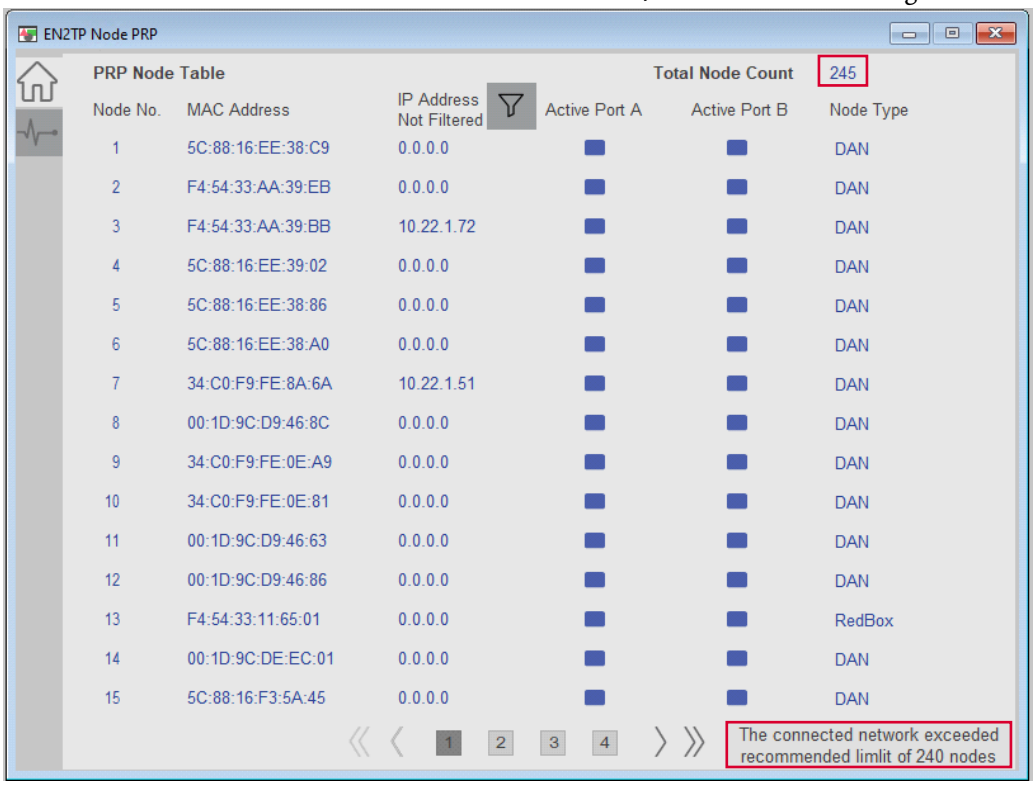
- If the Add-On Instruction message to the Reference module node failed it will display the “Add-On Instruction message to the PRP Node failed” message on all tabs.



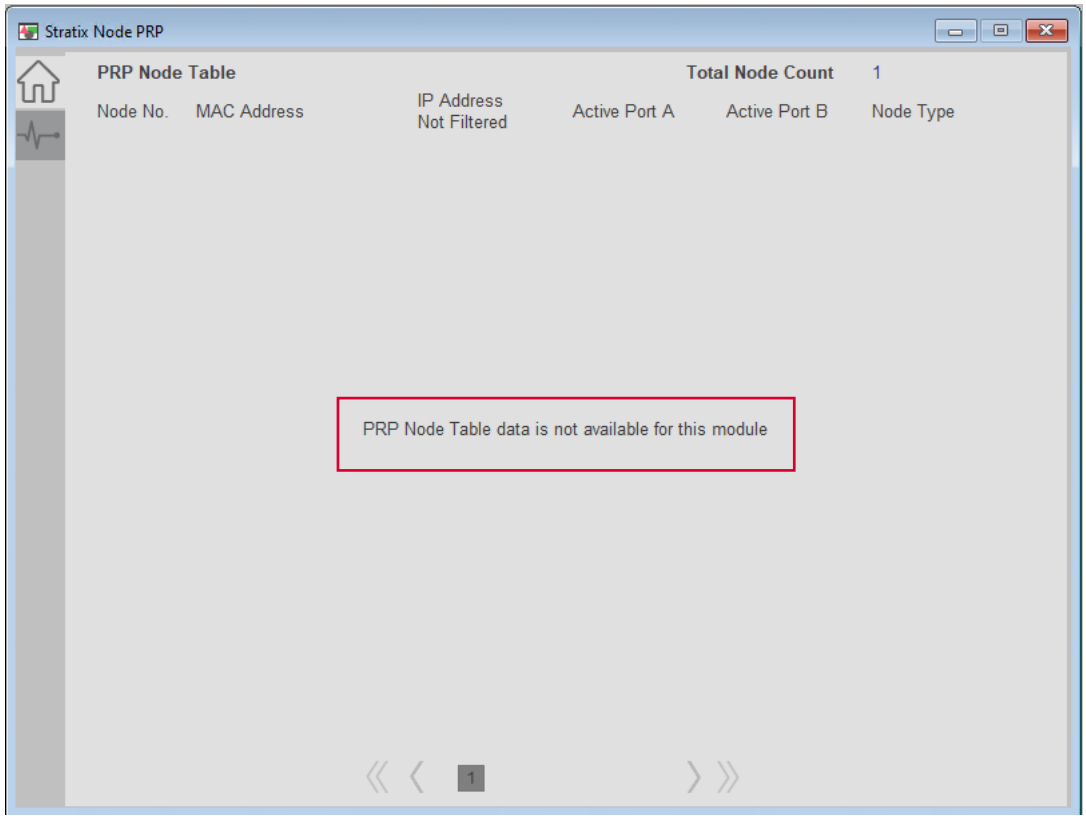
- In the Home Tab if you click on filtered IP address row and the AOI Message failed, it will display the “PRP diagnostic data is not available for this node” message on Diagnostic tab.



- If the connected PRP Network has PRP Node table count more than 240, it will display the warning message “The connected network exceeded recommended limit of 240 nodes” in bottom right home tab.



- If the AOI Reference module connected to Stratix Switch it will display the warning message “PRP Node table data is not available for this module” on home tab.



Application Code Manager

Network Device Library objects can be set-up and configured using Studio 5000® Application Code Manager.

Refer to the section Using Application Code Manager for complete details.

Definition Objects: raC_Opr_NetPRP

This Asset-Control object contains the Add-On Instruction definition and required data types. It is used as a linked library to the device implement object. This gives users the flexibility to choose to instantiate only definition and create custom implement code. A user may also create their own implement library and link with this definition library object.

Implementation Objects: raC_LD_Opr_NetPRP

The Device Implementation Object is the rung that is instantiated when generating controller code using Application Code Manager. This implementation object includes a reference to the Asset-Control Add-On Instruction definition, along with any required controller tags, programs, modules, and HMI objects.

The PRP implementation has the following configuration parameters.

Parameter Name	Default Value	Instance Name	Definition	Description
RoutineName	{ObjectName}	{RoutineName}	Routine	Enter Routine name. Routine will be created and Object implement rung(s) inserted. A JSR will be inserted in MainRoutine. If routine name already exists, then object will be inserted into existing routine. By default, parameter is set to Object Name.
TagName	{ObjectName}	{TagName}	Backing Tag	Enter the backing tag of the main AOI. This will serve as the base tag name for other tags in this object that are derived from the base.
TagDescription	{ObjectDescription}	{TagDescription}		Tag Description of the main AOI backing tag

Linked Libraries

Link Name	Catalog Number	Revision	Solution	Category
raC_Opr_NetPRP	raC_Opr_NetPRP	12.03	(RA-LIB) Device	Network

Configured HMI Content

HMI Content	Instance Name	Description
Launch Button	{ObjectName}_GO_LaunchFP_Text	Global Object launch button using basic text label.

Attachments

Name	Description	File Name	Extraction Path
V12_Network_Images	Images	HMI Factory Talk View Images - png.zip	{ProjectName}\Visualization\Images
V12_raC_Dvc_Network_Global	Graphic Symbols ME	(raC-12-ME) Graphic Symbols - Network Device.ggfx	{ProjectName}\Visualization\FTViewME\GlobalObjects
V12_raC_Dvc_Network_Global	Toolbox ME	(raC-12-ME) Toolbox - Network Device.ggfx	{ProjectName}\Visualization\FTViewME\GlobalObjects
V12_raC_Dvc_Network_Global	Toolbox SE	(raC-12-SE) Toolbox - Network Device.ggfx	{ProjectName}\Visualization\FTViewSE\GlobalObjects
V12_raC_Dvc_Network_Global	Graphic Symbols SE	(raC-12-SE) Graphic Symbols - Network Device.ggfx	{ProjectName}\Visualization\FTViewSE\GlobalObjects
RM_raC_Dvc_Network	Reference Manual	DEVICE-RM400B-EN-P.pdf	{ProjectName}\Documentation
V12_raC_Opr_NetPRP	Faceplate SE	(raC-12_XX-SE) raC_Opr_NetPRP- Faceplate.gfx	{ProjectName}\Visualization\FTViewSE\Displays
V12_raC_Opr_NetPRP	Faceplate ME	(raC-12_XX-ME) raC_Opr_NetPRP- Faceplate.gfx	{ProjectName}\Visualization\FTViewME\Displays
V12_raC_Opr_NetPRP	View Designer	(raC-12_xx-VD) raC_Opr_NetPRP_FP.vpd	{ProjectName}\Visualization\ViewDesigner

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Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, and product notification updates.	rok.auto/support
Knowledgebase	Access Knowledgebase articles.	rok.auto/knowledgebase
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	rok.auto/pcdc

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Waste Electrical and Electronic Equipment (WEEE)

At the end of life, this equipment should be collected separately from any unsorted municipal waste.

Rockwell Automation maintains current product environmental information on its website at rok.auto/pec.

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