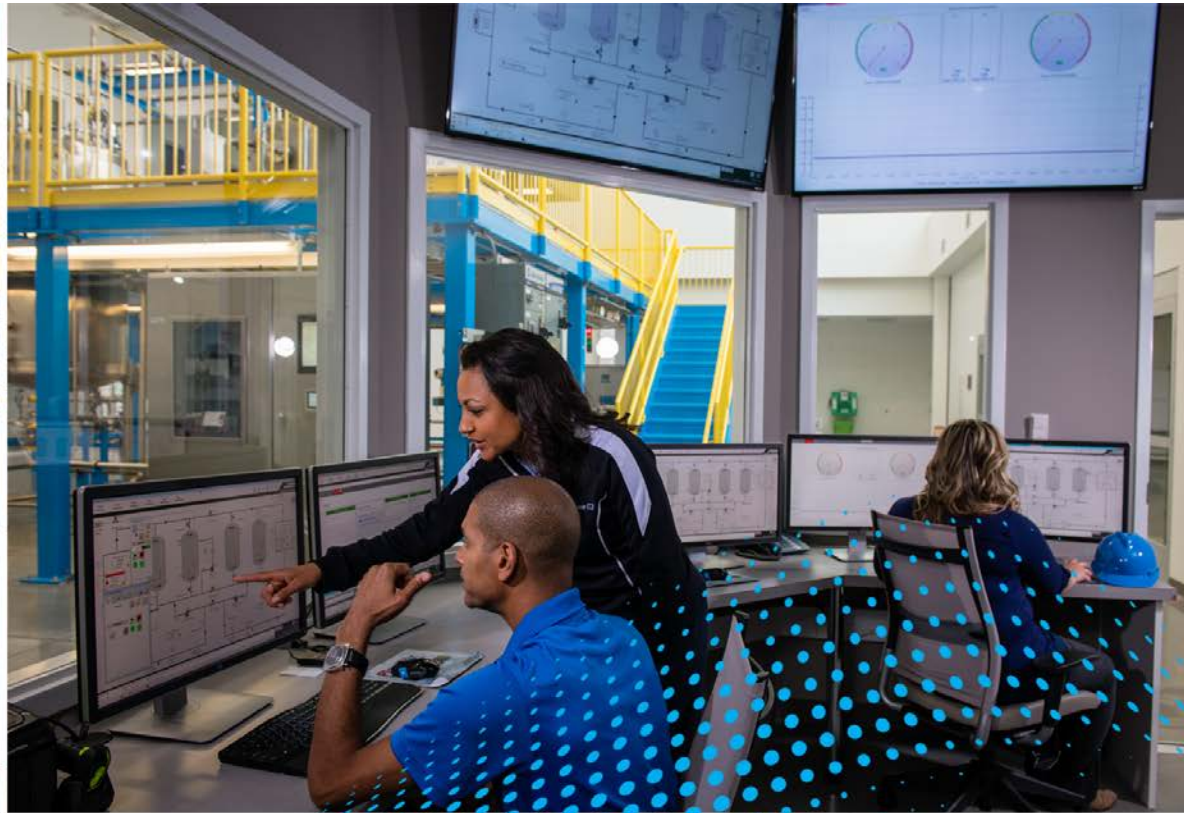




This manual links to Knowledgebase Technote, [\*PlantPAx System Release 5.0 Configuration and Implementation Tools\*](#), for multiple tools; download now for offline access.



# PlantPAx Distributed Control System Configuration and Implementation

System Release 5.0

**PlantPAx**  
Distributed Control System



**Allen-Bradley**  
by ROCKWELL AUTOMATION



**FactoryTalk**  
by ROCKWELL AUTOMATION



**Rockwell  
Automation**

User 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.

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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.

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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).

---

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**Notes:**

## About This Publication

Welcome to the PlantPax® system, a modern DCS platform that is designed to provide the right data to the right person at the right time.

This manual helps you implement process control where controllers, HMI, and I/O are located in different areas of the plant. The PlantPax system offers flexibility for using the latest technology and scalability to build only what you need to help reduce development time, downtime, and operational cost.

## Download Firmware, AOP, EDS, and Other Files

Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes from the Product Compatibility and Download Center at [rok.auto/pcdc](http://rok.auto/pcdc).

## 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
Group added for e-signature use.	<a href="#">67</a>
Area based security added.	<a href="#">69</a>
Line of Sight based security added.	<a href="#">77</a>
PRP Diagram updated.	<a href="#">87</a>
DLR Diagram updated.	<a href="#">91</a>
Time Synchronization section updated.	<a href="#">97</a>

The following table lists the documentation resources that are available to help procure, configure, and maintain a PlantPax system.

**Table 1 - PlantPax System Release 5.0 Documentation**

Stage	Publication	Description
Define and Procure	Selection Guide, publication <a href="#">PROCES-SG001</a>	Helps you understand the elements of the PlantPax system to make sure that you buy the proper components.
Install	Template User Manual, publication <a href="#">9528-UM001</a>	Provides direction on how to install and deploy PlantPax virtual templates.
Develop and Operate	Configuration and Implementation User Manual, publication <a href="#">PROCES-UM100</a>	Provides system guidelines and instructions to assist with the development of your PlantPax system.
	Rockwell Automation Library of Process Objects Reference Manual, publication <a href="#">PROCES-RM200</a>	Describes the Add-On Instructions, PlantPax instructions, and associated faceplates that are available to develop applications.

You can view or download publications at [rok.auto/literature](http://rok.auto/literature).

## 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 an upgrade with the other software and operating systems in use in your PlantPax 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
- Process support at a systems-level that is provided by process engineers
- Use of online remote diagnostic tools
- Access to otherwise restricted TechConnect<sup>SM</sup> 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>.



## System Workflow

The PlantPAx® distributed control system is an integrated control and information solution that helps manufacturers achieve plant-wide optimization in a wide range of industries. This single platform can run your entire plant and integrates all HMI, controls, optimization, engineering, information, and inputs/outputs into one common system architecture.

The following workflow shows the steps for how to size, design, and implement a scalable PlantPAx system. Click the links for the information related to each step.

1. Use the PlantPAx System Estimator (part of the Integrated Architecture® Builder tool) to size your application.

2. Manage servers and security policies.

- Smaller systems = Work Group
- Larger systems = Domain Controllers

See Configure System Security Features User Manual, [SECURE-UM001](#), for security configurations

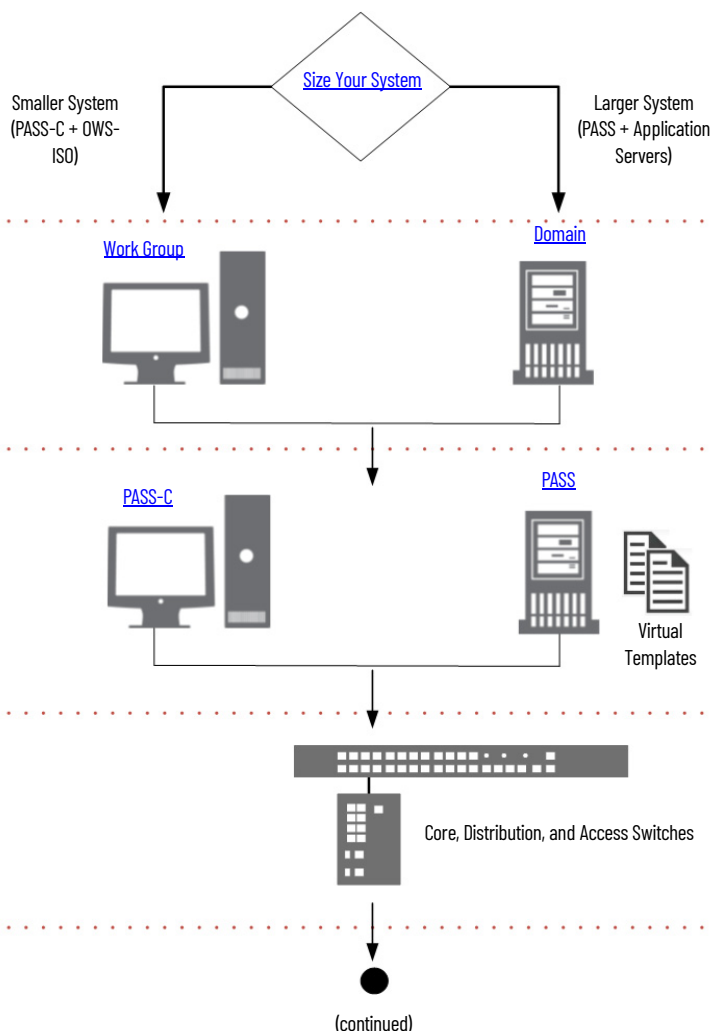
3. Configure the Process Automation System Server (PASS).

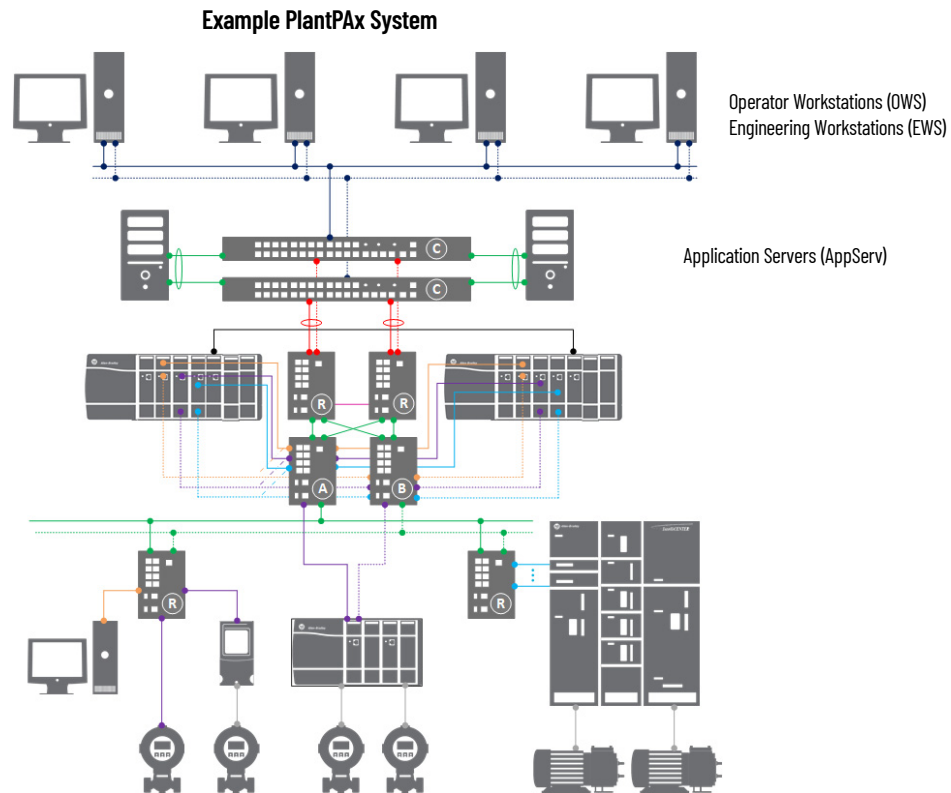
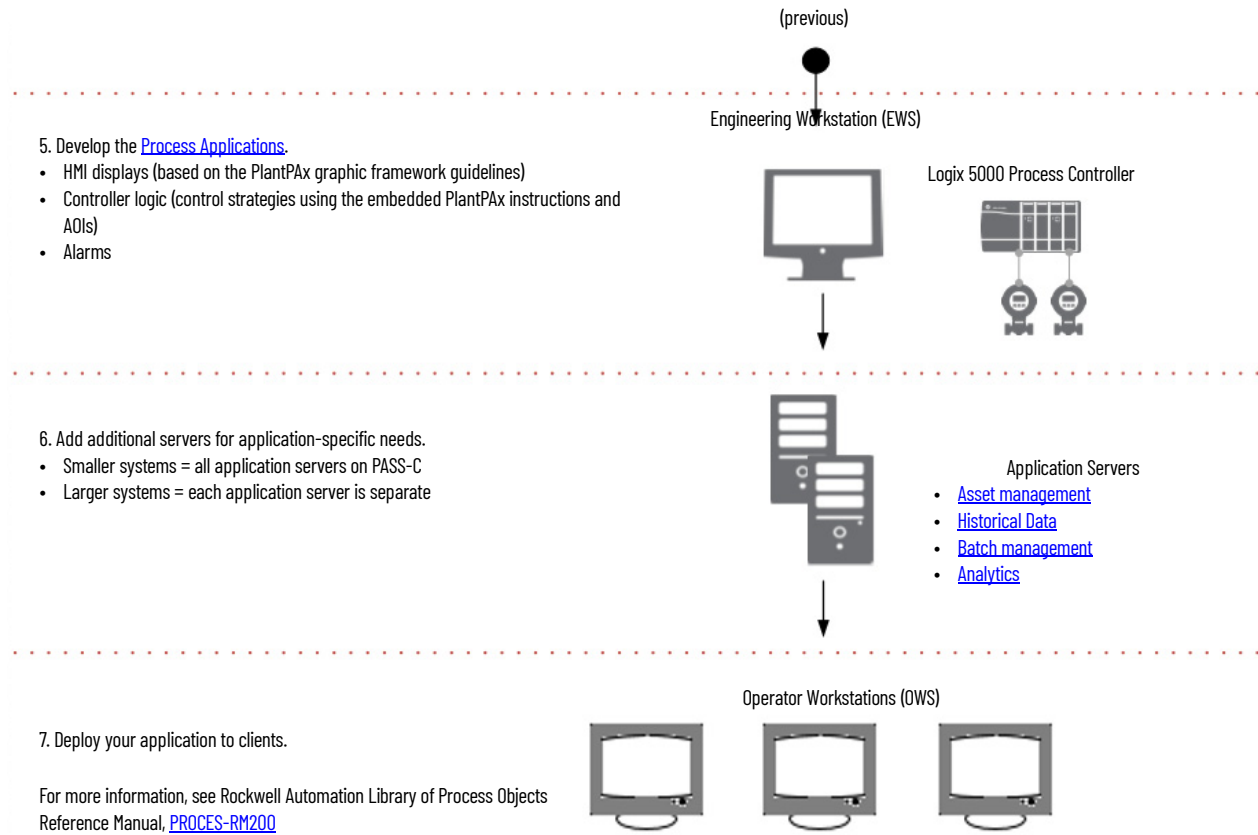
- Smaller systems = PASS-C + OWS-ISO
- Larger systems = Virtual templates

See PlantPAx Virtualization User Manual, [9528-UM001](#), for template details

4. Design the [Network Infrastructure](#)

- Select network topologies
- Configure switches





## Size Your System

Rockwell Automation includes the PlantPAx System Estimator (PSE) tool as part of the Integrated Architecture® Builder software. The PSE Estimator tool helps define your PlantPAx system and verifies that your architecture and system elements are sized properly. The PSE includes online help that can assist you as you use the tool.

The PSE employs sizing guidelines that are based on the rules and recommendations from PlantPAx system characterization to achieve known performance and reliability. The PSE focuses on the critical system attributes of a PlantPAx system so you can verify that your system does not exceed system recommendations.

Before you run the PSE, you need to plan the scope of your project so you know I/O requirements. This could be an equipment list or project database of devices. For more information, see Chapter 5, Process Applications.

Make sure your PSE project has no errors. As much as possible, the project should accurately represent the physical layout of the system, such as the controllers, I/O, HMI, and data servers. The I/O locations and control rooms must align with your architectural drawings.

- If you size based on I/O counts, the PSE makes assumptions as to the devices that I/O is connected to and assigns the I/O to control strategies.
- If you know the devices, the PSE results are more accurate if you size based on control strategies.
- Make sure the logic execution rates accurately represent the requirements of the process.
- Reserve memory and CPU use in the controller for auxiliary logic (such as logic for batch applications).
- Accurately account for the process and device networks defined in the PSE. Also account for any networks not defined in the PSE.
- Make sure your final controller programs execute at the same rate as entered in to the PSE to make sure the system performs as expected.

The final PSE project only accounts for devices, not the programming that automates the devices. Extra programming can include batch, recipe control, or sequencing of any other logic used in the system. Make sure to consider any extra programming so that the system does not overload the controller.

---

**IMPORTANT**

The PSE, along with the IAB, gives you a high-level Bill of Materials. You need to complete your own panel design to house, mount, and power the equipment for your environmental needs. Pre-engineered enclosures for PlantPAx systems are available from Rockwell Automation.

---

## Select the Process Automation System Server

Use the sizing results from the PSE, the amount of I/O points, and the overall size of the process to determine the Process Automation System Server (PASS) that best suits your PlantPAx system.

The PASS is the main component for PlantPAx computing. A PASS supports an HMI server, displays, alarms, and data connections to controllers. A PASS contains the following:

- FactoryTalk® Directory and Activation server
- FactoryTalk® View SE HMI server
- FactoryTalk® Alarms and Events server
- FactoryTalk® Linx Data server
- FactoryTalk® Historian node interface

A PASS is scalable from a single stand-alone server to multiple distributed servers. You can deploy a PASS directly to a host computer or run as a virtual guest on a host server.

The sizing recommendations help determine how to best deploy the software for your PlantPAx system:

- Smaller systems (typically less than 2000 I/O points) place all system software on a consolidated Process Automation System Server (PASS-C) with multiple operator workstations (OWS-ISO)

Examples include skid, station, and distributed architectures where a single PASS-C supports the system.

- Larger systems use a Process Automation System Server (PASS), in addition to individual application servers (AppServ), engineering workstations (EWS), and operator workstations (OWS).

Larger systems are typically distributed architectures with multiple PASS servers.

### Consolidated Process Automation System Server (PASS-C)

The consolidated Process Automation System Server (PASS-C) supports smaller systems, such as skids or stations, where the system software runs on only a few computers. The PASS-C offers reduced complexity and cost.

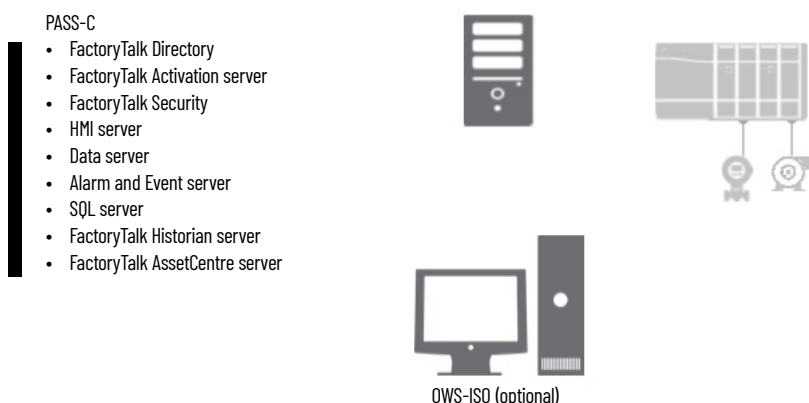
A PASS-C computer can be manually installed and configured or is available as a pre-configured .ISO image. The .ISO image installs a server-based Windows® operating system and contains pre-installed FactoryTalk server software. The PASS-C is intended to support up to 10 OWS clients

Similar to the PASS-C, an operating workstation OWS-ISO image is also available. This image installs a client-based Windows operating system that contains the required FactoryTalk client software.

Figure 1 illustrates a small PlantPAx system with a PASS-C that runs all of the FactoryTalk software and an OWS-ISO that provides a client interface.



Figure 1 - Smaller PlantPAx Systems with Single PASS-C Server



For more information, see the PASS-C chapter in the PlantPAx Template User Manual, publication [9528-UM001](#).

## Process Automation System Server (PASS)

The Process Automation System Server (PASS) supports larger, distributed systems or customer-defined, critical processes. Whenever possible, use virtualization to provide greater computing efficiency, enhanced backup and recovery capability, and to offer high availability with server redundancy.

PlantPAx virtual images are available for PASS and application servers to run on server-based computer hardware with a hypervisor, such as VMware ESXi. The PlantPAx virtual images are deployed from templates and contain a Windows operating system along with pre-installed FactoryTalk software. The virtual images help:

- Reduce installation time and increase consistency with drop-in virtual machines with pre-configured system elements
- Enable the consolidation of computing resources that multiple operating systems and applications can share a single physical server
- Support flexibility and portability across hardware platforms

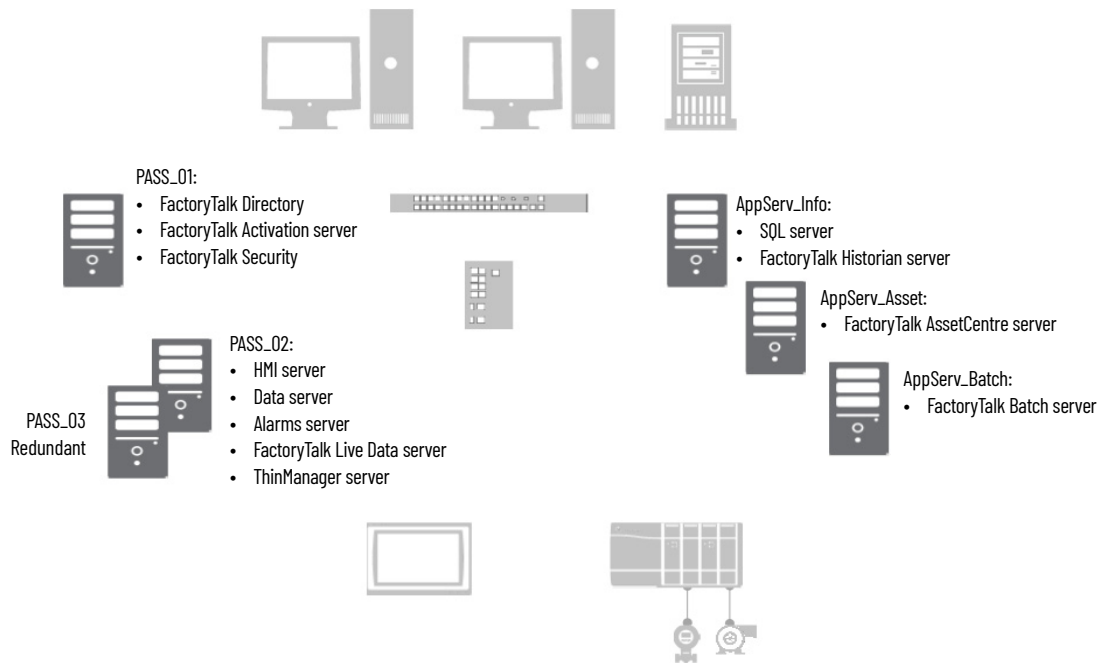
For configuration details, see the PlantPAx Template User Manual, publication [9528-UM001](#).

Figure 2 illustrates a larger PlantPAx system, with two PASS computers and supporting application servers, in a network distributed architecture.

- **PASS\_01** server contains the FactoryTalk Network Directory, Security configuration and often hosts FactoryTalk® Activation licenses.
- **PASS\_02** server contains FactoryTalk® View SE (HMI server, data server, and alarms server) and optional ThinManager® server.
- An optional **PASS\_03** server could be a secondary (HMI, data and alarms server) that would switch over if PASS\_02 was unreachable.
- **AppServ\_Info** server contains a Factory Historian SE server and a local Historian database.
- An optional **AppServ\_Info2** server could be a redundant FactoryTalk® Historian SE server, as part of a collective. In this configuration, the Historian database would be hosted on a separate computer that both could access.

- **AppServ\_Asset** server contains FactoryTalk® AssetCentre for system tracking and verification.
- **AppServ\_Batch** server contains FactoryTalk® Batch software to handle large batching processes.

Figure 2 - Large PlantPax Systems with Multiple Servers



## Next Steps

Once you have sized your system and decided on whether to use a PASS-C or PASS, complete the following:

1. Manage Servers and Security Policies

A Domain Controller is recommended for most PlantPax systems, however, in smaller systems a Workgroup can be sufficient.

For more information, see [Chapter 2, Domain or Workgroup](#)

2. Configure the Process Automation System Server

For more information, see [Chapter 3, Process Automation System Server](#)

3. Design Network Topologies and Configure Switches

The PlantPax system supports several network topologies to meet a variety of system requirements. Each topology is based on system characterization tests to help ensure system performance.

For more information, see [Chapter 4, Network Infrastructure](#)

#### 4. Develop Process Applications

Process applications implement control strategies that encompass control logic and HMI displays.

Execute control logic on Logix 5000™ process controllers. The process controller comes with a default task model and embedded PlantPax instructions that improve design and deployment efforts. The process controller is also conformal-coated for protection from dust and corrosive pollutants.

Deploy HMI displays for operators and maintenance personnel so they can monitor and maintain the system.

For more information, see [Chapter 5, Process Applications](#)

#### 5. Add Application Servers

PlantPax application servers (AppServ) manage system software that is required for your application. There can be multiple servers depending on the size and structure of your application.

**Table 2 - System Server Descriptions**

AppServ Elements	Description
AppServ-Asset	The asset management server acts as a centralized tool for managing automation-related asset information (both Rockwell Automation and third-party assets). The asset management application server includes capabilities for source control, audits, change notifications, reporting, and security. For more information, see <a href="#">Chapter 6, Asset Management</a> .
AppServ-Info (Historian, SQL)	Data management storage can include a Historian or SQL server. These two servers depend on the function that is being provided: FactoryTalk Historian software or a SQL server. For more information, see <a href="#">Chapter 7, Historical Data</a> .
AppServ-Batch	The batch application server provides comprehensive batch management, including unit supervision, recipe management, process management, and material management. The batch application server can be linked with visualization elements on the OWS and configuration clients on the EWS. For more information, see <a href="#">Chapter 8, Batch Management</a> .

### Guidelines for Servers and Workstations

The following guidelines for servers and workstations are already implemented in the PlantPax templates. If you create custom VMs, follow these guidelines to align with PlantPax configurations.

- Install the latest software patches for all Rockwell Automation software.

The Patch File Validator utility verifies software versions on your system and installs a patch roll-up. To download, see the Knowledgebase Technote [Patch File Validator Utility](#).

- Disable power-saving for the Network Interface Card (NIC).

The NIC card connects a workstation to other devices on the network. The power-saving feature turns off the network card when not in use, which can interfere with network throughput.

- Disable power-saving for the Windows operating system.

The power-saving feature turns off Windows features when not in use, which can interfere with network throughput.

- Enable Remote Desktop Server (RDS) functionality on application servers that need remote access, such as the AppServ-EWS or AppServ-OWS (available via templates).

RDS enables multiple instances of the OWS and EWS as thin clients from one server. Thin clients can run applications and process data on a remote computer to minimize the amount of information on a network.

Enable Adjust for Best Performance so that Windows features that are not in use are turned off, which yields more memory and performance for the system.

- Make sure the user is never notified by the User Account Control.
- Disable automatic Windows updates.

This helps prevent updates that have not been qualified by Rockwell Automation from being installed on the workstation or server.

The only exception is if your organization has a controlled patching process to verify updates on a non-production system, or when a facility is non-active, to ensure that there are no unexpected results or side effects.

## PlantPax System ID

The PlantPax system ID is a unique identifier that helps simplify the management of your system over its lifecycle. The System ID creates a record of the installed products in your system and provides a dashboard that shows the hardware lifecycle status, notifications of updates and patches, and compatibility information. Use this information to:

- Plan spare and replacement parts to better size inventory
- Define the boundaries of the system
- Plan when and where to implement system upgrades



The system ID is **only** available if you purchase a PlantPax catalog number. The catalog number determines an activation string for the software products on the bundle. This activation string (serial number) is the system ID.

The System Integrator uses an Asset Inventory Agent in a FactoryTalk AssetCentre project to generate an inventory file (.raai file). The System ID is gathered via the license number of FactoryTalk AssetCentre via FactoryTalk Activation Manager. The System Integrator registers your System ID with



Rockwell Automation and provides you directions on how to access your MyEquipment portal.

## System Verification

A critical system attribute is a visible performance indicator of a system-wide characteristic. Critical system attributes do the following:

- Determine system limits
- Establish system rules
- Establish system recommendations
- Measure system element and system infrastructure performance

The following critical system attributes are used to verify PlantPAx system characterization.

**Table 3 - CSA Performance Indicators**

Critical System Attribute	Performance
Display callup (paint time)	A noncached display is called up by the operator and ready for operator use within 2 seconds.
Display update	The display updates control information within 1 second.
Steady state alarm time	Steady state alarms occurring at 20 per second are timestamped within 1 second.
Alarm burst time	All alarms in a burst of 2000 alarms are timestamped within 3 seconds.
Recovery	A system element returns to full operation within 5 minutes of the restoration after a failure or loss.
Operator-initiated control	Operator-initiated actions are loaded into the controller and the feedback for the operator action is within 2 seconds.
Batch server: operator action time	An operator batch command has been acted on by the controller in 1 second.
Batch server: server action time	A server batch command has been acted on by the controller in 1 second.
Batch server: controller action time	Batch status events display on the operator workstation within 1 second.

For a more complete system verification, use the guidelines in [Appendix C, PlantPAx Deployment Recommendations and Verification Tool](#).

**Notes:**

## Domain or Workgroup

PlantPAX® systems require computer management, from either a domain controller or workgroup configuration, for secure interaction.

- A Windows domain is a collection of computers that share rules and procedures. These computers comprise a central directory database, which is the active directory. The sharing of network objects creates a unified base to manage users, groups, and security settings
- A Windows workgroup computer is independently configured. Workgroups are only suitable in smaller systems with 10 or fewer computers.

### Quick Start

This is the recommended work flow to configure a domain controller or workgroup. For experienced users, each step outlines requirements. For more detailed information, follow the referenced links.

**1**

#### Configure the Domain Controller or a Workgroup

In larger systems, create a dedicated domain controller for the PlantPAX system. If your control system contains an existing domain controller, add the configuration recommended for a PlantPAX system. Domain controller components include:

- Microsoft Windows Server operation system
- Active Directory Domain Services, DHCP, and DNS Server Roles.
- Parent and child domains
- Reverse DNS Lookup Zone.
- Configure DHCP server options and authorize server.

For more information, see [Primary Domain Controller](#).

Windows Workgroups are available for small systems that do not require complex security controls. Considerations when using a workgroup include:

- There are typically no more than 10 computers.
- All computers must be on the same local network or subnet.
- All computers are peers; no computer has control over another computer.
- Each computer has a set of user accounts. To log on to any computer in the workgroup, you must have an account on that computer.
- A workgroup is not protected by a centrally- managed password.

For more information, see [Windows Workgroup](#).

**2**

#### Configure a Redundant Domain Controller

If needed, create a redundant domain controller for high availability. Considerations for the redundant domain controller include:

- The redundant domain controller has a unique name and IPv4 address.
- Install the Active Directory Domain Services role and promote to domain controller.
- Add the Directory Services Restore Mode (DSRM) password.

For more information, see [Additional Domain Controller](#).

3

**Create Roles, Areas, and Users**

There are required roles for a PlantPAx system. Areas and users depend on your application. Assign users to Roles and Areas.

The PlantPAx Roles are:

- PlantPAx Administrator
- PlantPAx Engineering
- PlantPAx Maintenance
- PlantPAx Maintenance Supervisor
- PlantPAx Manager
- PlantPAx Operator
- PlantPAx Operator Supervisor

Name areas based on access, for example:

- Area01\_Advanced (engineering access)
- Area01\_Basic (non-engineering access)

Replace 'Area01' with the name of your process area.

For more information, see [Create Roles, Areas, and Users](#).

4

**Configure Group Policies**

Configure recommended group policies for a PlantPAx system, such as:

- Windows NTP client
- Windows time service

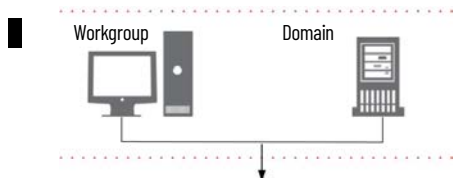
For more information, see [Configure Group Policy Management](#).

Configure recommended security policies, such as password strength, account lockout, Kerberos, and interactive logon.

For more information, see [Configure Group Policies](#).

Create a PlantPAx user policy that limits access to USB drives, portable devices, and other software.

For more information, see [PlantPAx Users Policy Object](#).

**Prerequisites**

Following the [System Workflow](#), configure a domain controller or a workgroup, depending on the size of your system.

The PlantPAx architecture assumes that there is a Microsoft Windows® forest in place to host supervisory and/or control domain network.

- You need at least one domain controller per each parent/root/child domain.
- The domain controllers are separate computers.
- You need at least two domain controllers for fault tolerance.
- Do not load any application software on a domain controller.
- The domain controllers must be local (within firewall) to the PlantPAx system.

We recommend that PlantPAx servers and workstations be members of a Windows domain. However, workgroups are supported for systems with 10 or fewer workstations and servers.

Configuration	Details
<b>Workgroup</b> - decentralized administration (allowed if 10 or fewer computers)	<p>Workgroup advantages:</p> <ul style="list-style-type: none"> <li>• No domain controller (Windows Server OS) to purchase or maintain.</li> <li>• Recommended for small PlantPAx applications only where user accounts do not change often</li> </ul> <p>Workgroup rules:</p> <ul style="list-style-type: none"> <li>• All workstation and server system elements in a single PlantPAx system must be members of the same workgroup</li> <li>• All users participating in the workgroup must be members of the Administrators group</li> <li>• Create the same set of user accounts and passwords on every computer in a FactoryTalk® View application</li> </ul>
<b>Domain</b> - centralized administration (recommended)	<p>Domain advantages:</p> <ul style="list-style-type: none"> <li>• No domain controller (Windows Server OS) to purchase or maintain.</li> <li>• Recommended for small PlantPAx applications only where user accounts do not change often</li> </ul> <p>Domain rules:</p> <ul style="list-style-type: none"> <li>• All workstation and server system elements in a single PlantPAx system must be members of the same domain</li> <li>• PlantPAx server system elements must not be used as domain controllers.</li> <li>• Required for systems with more than 10 computers</li> <li>• The domain controller must be its own independent computer with no other application software.</li> </ul>

For more information, see this additional resource.

Resource	Description
Windows Operating System and domain references	Microsoft® online libraries, for example TechNet, provide detailed guidelines for all aspects of the Windows and Windows domains. Examples of detailed guidelines are design, deployment, maintenance, security, disaster recovery, and so on. PlantPAx documentation provides best practice critique to certain Windows roles, features, and such where a typical PlantPAx DCS is hosted.

## Primary Domain Controller

The domain controller manages:

- IP address scheme for the computer network
- DNS and reverse lookup zone
- DHCP server
- Assigned roles, areas, and users
- Group policies

If your company has an existing domain infrastructure, in which the PlantPAx system interacts with, please consult with your local IT resources before continuing.

## Create the Primary Domain Controller

Starting with a new installation of Windows Server 2016 operating system, login as local administrator. The computer is initially assigned a random 15-character computer name, which looks something like this: WIN-VPLC4SD9KWG.

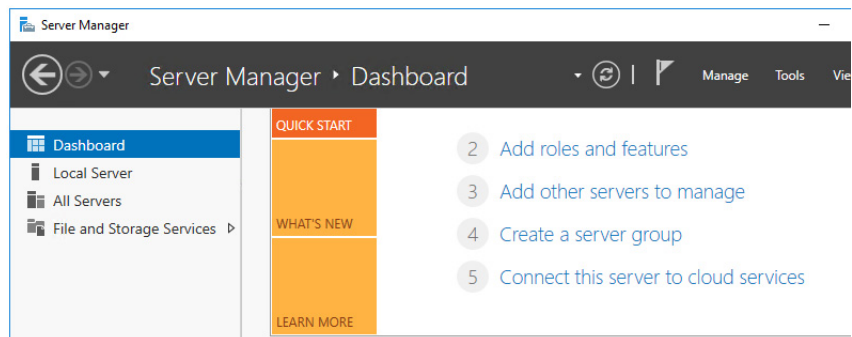
1. Change the computer name to comply with your company naming guidelines. Or, in this example, to reflect it as being a process automation domain controller (PADCA, PADCB, and so forth).
2. Next assign the Windows server a fixed IP address (TCP/IPv4), within the subnet designated for the given network architecture.

For example: 172.18.1.10

## Install Active Directory Services, DHCP, and DNS Roles

Before a Windows server can function as a domain controller, additional roles and features must be installed.

1. Launch the Server Manager.



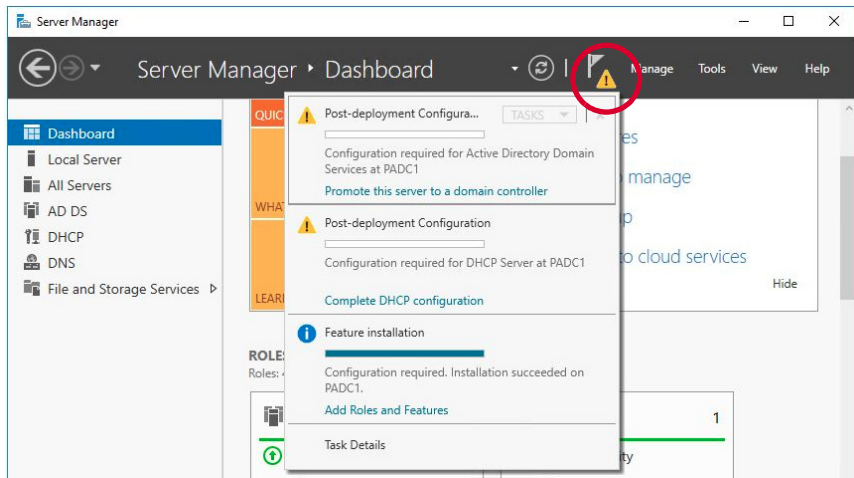
2. From the Dashboard, click the second option to 'Add roles and features'. Use the following table to complete the configuration.

Roles and Features Wizard	Configure
Before You Begin	Read and click next
Installation Type	Check 'Role-based or feature-based installation.'
Server Selection	Select a server from the server pool. Select the local computer PADCA in the Server Pool list
Server Roles	In the Roles dialog, select the following: <ul style="list-style-type: none"> <li>• Active Directory Domain Services</li> <li>• DHCP Server</li> <li>• DNS Server</li> </ul>
Pop up dialog. Add features that are required for Active Directory Domain Services.	Check the option to Include management tools (if applicable) and then select Add Features.
Features	Select the available .NET Framework features to be installed on the domain controller. Check 'Group Policy Management.'
AD DS	Active Directory Domain Services requires a DNS server. If selected for the Server Role, click Next.
Confirmation	Check 'Restart the destination server automatically if required', and select Install.
Results	Once the installation process completes, close the wizard and restart the server if required.

## Promote the Primary Domain Controller

On the Server Manager management console, complete these steps for the active domain computer.

1. Select the Alert flag on the header.



2. Select 'Promote this server to a domain controller'.
3. Using the Active Directory Domain Services Configuration Wizard, use the following for guidance on your deployment.

- IMPORTANT** Take careful consideration when specifying a new root domain name.
- Understand domain naming conventions so they make sense given your system, owner, or location.
  - Do not use any reserved words or characters, and use caution if adding a period, which must not be used in later versions of Windows.
  - See Microsoft Support for more information on naming conventions in Active Directory for computers, domains, sites, and organizational units.

Topic	Configure
Deployment Configuration	<p>Select to 'Add a new forest'. Specify the domain information for this operation. Enter a Root Domain Name.</p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• PlantPax.Company.Local</li> <li>• DCS.PlantPaxMfg.com</li> <li>• PlantPax.RockwellAutomation.com</li> </ul>
Domain Controller Options	<p>Select Windows Server 2016 as the Forest functional level. Select Windows Server 2016 as the Domain functional level. Check 'Domain Name System (DNS).' Check 'Global Catalog (GC).' Enter a Directory Services Restore Mode password</p> <p><b>IMPORTANT:</b> You use this password when you configure a redundant domain controller and for any subsequent DC recovery efforts. Record this password in a safe/secure place.</p>
DNS Options	Do not specify 'DNS Delegation options.'
Additional Options	Make sure that the domain name is used for the NetBIOS Domain Name. Accept defaults for the remaining options.
Paths	Use the default folder locations.
Review Options	Review your selection options.
Prerequisites Check	Validate all prerequisites and Install if no errors. The server restarts.



## Additional Domain Controller

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<b>IMPORTANT</b>	For each additional domain controller, you must have a fresh installation of Windows Server 2016 operating system before repeating the <a href="#">'Create the Primary Domain Controller'</a> procedure.
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### Create an Additional Domain Controller

To reduce disruptions during unplanned and planned downtime, add another Domain controller for backup as well as scalability later.

1. Change the computer name to comply with your company naming guidelines. Or, in this example, to reflect it as being a process automation domain controller (PADCB, and so forth).
2. Next assign the Windows Server a fixed IP address (TCP/IPv4), within the subnet designated for the given network architecture. For example, 172.20.1.11, and supply the DNS address from the initial domain controller: 172.20.1.10
3. Repeat [Create the Primary Domain Controller](#) steps. Name, address, and install Active Directory roles for the additional domain controller.
4. Install the 'Active Directory Domain Services' role.

### Install Active Directory Services, DHCP, and DNS Roles

Just like creating the primary domain controller, repeat these steps.

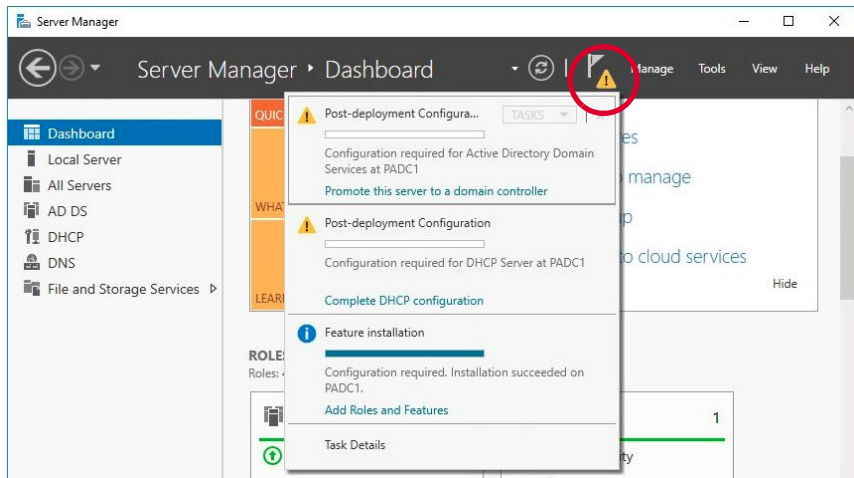
1. Install Active Directory, DHCP and DNS roles used on creating the primary domain controller.
2. Install the 'Active Directory Domain Services' role.

Refer back to primary domain controller instructions if you need help using the roles wizard.

## Promote the Additional Domain Controller

On the Server Manager management console, complete these steps for the standby domain computer.

1. Select the Alert flag on the header.



2. Select 'Promote this server to a domain controller'.
3. Using the Active Directory Domain Services Configuration Wizard, use the following for guidance on your deployment.

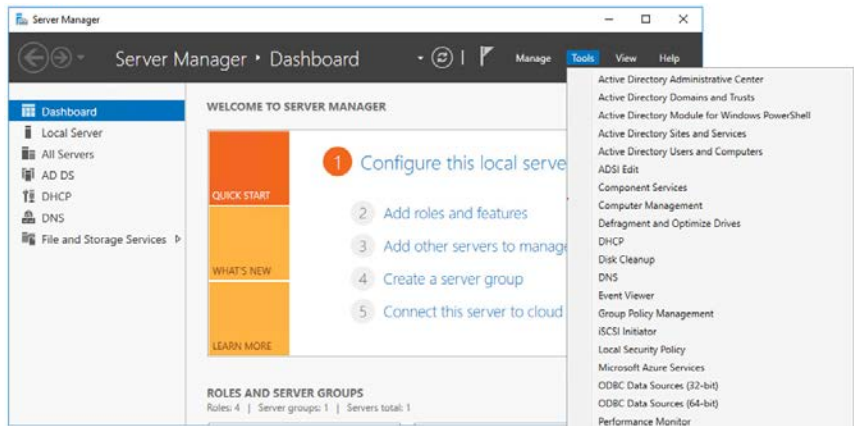
AD DS Configuration Wizard	Configure
Deployment Configuration	Select to 'Add a domain controller to an existing domain.' Select the Domain: Select the forest:
Domain Controller Options	Select Windows Server 2016 as the Forest functional level. Select Windows Server 2016 as the Domain functional level. Check 'Domain Name System (DNS).' Check 'Global Catalog (GC).' Enter a Directory Services Restore Mode password.  <b>IMPORTANT:</b> You use this password when you configure a redundant domain controller and for any subsequent DC recovery efforts. Record this password in a safe/secure place.
DNS Options	Do not specify 'DNS Delegation options.'
Additional Options	Replicate from: 'your domain name'
Paths	Use the default folder locations.
Review Options	Review your selection options.
Prerequisites Check	Validate all prerequisites and Install if no errors. The server restarts.

## Configure Domain Controllers

On the primary and additional domain controller, now you can implement and configure the new features and roles that were added, such as: Active Directory, DHCP, and DNS.

### Server Manager Tools Menu

The Windows 'Server Manager' contains a Tools menu that provides quick access to many of the management consoles required for the following configurations.

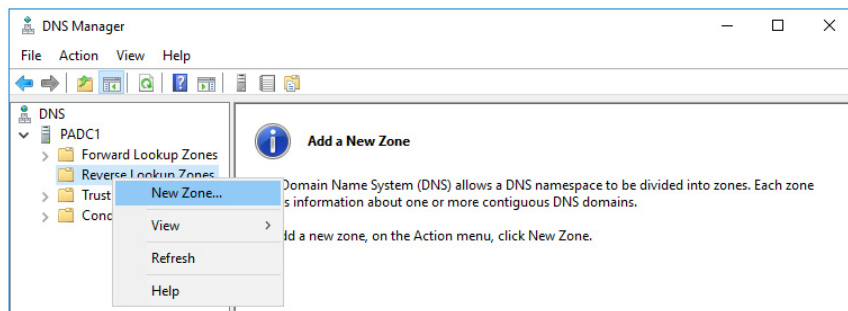


### Create a Reverse DNS Lookup Zone

Reverse lookup zones are used to resolve IP addresses to host names, rather than host names to IP addresses, as is the case with forward lookup zones. You must program a special domain namespace (in-addr.arpa) as a reverse lookup zone.

On your initial domain controller, use the Server Manager to access the DNS Manager console window.

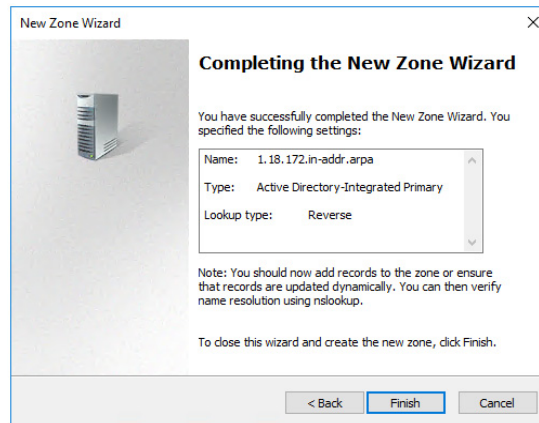
1. To access the DNS Manager, right-click Reverse Lookup Zone New Zone.



2. Configure the New Zone wizard as shown in the following table.

Basic Step	Configure
Zone Type	Select 'Primary zone.'
Active Directory Zone Replication Scope	Check 'To all DNS servers running on domain controllers in this domain <your target domain>'. For example: PlantPax.MyCompany.Local.
Reverse Lookup Zone Name	Check 'IPv4 Reverse Lookup Zone.'
Network ID	Enter the network ID portion of the IP address of the domain controller (omit the last number). For example, enter 172.20.1.
Dynamic Update	Check 'Allow only secure dynamic updates (recommended for Active Directory).'

A successful configuration displays details of the lookup zone.

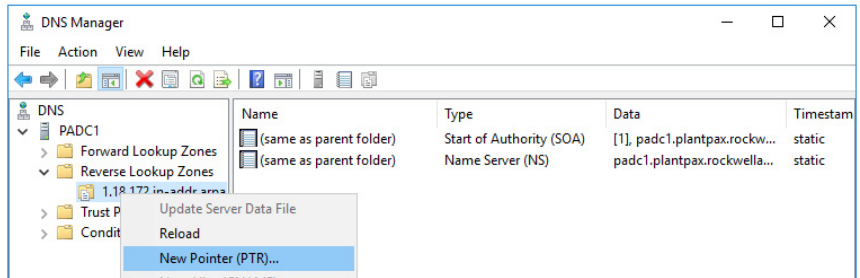


## Map the Host Name to the IP Address

Create a pointer (PTR) record that associates the DNS name to the IP address. During a search, the IP address is reversed to find the associated DNS name.

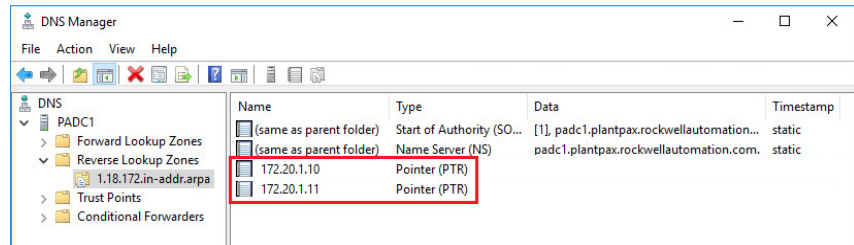
From the Server Manager, use the DNS Manager to create the New Pointer (PTR).

1. Go to Tools > DNS > Reverse Lookup Zone > Zone > New Pointer



2. Enter the IP address of the domain controller and browse for the host name.

Successful configuration shows pointers for both a primary and secondary domain controller.

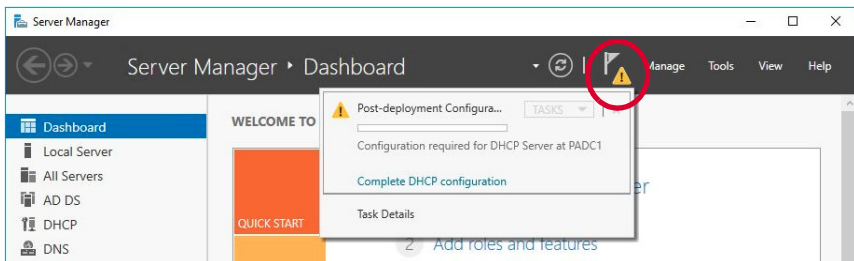


## Add DHCP Features

A DHCP server is a network server that automatically provides and assigns IP addresses, default gateways, and other network parameters to client devices that request the information.

On the Server Manager management console, complete these steps to add a DHCP server.

1. Select the Alert flag on the header.



2. Click to 'Complete DHCP configuration'

3. Open the DHCP management console and right click IPv4 > New Scope and configure the following for the control network.

Basic Step	Configure
Scope Name	Enter a name (such as Control Network) and a description (such as PlantPax Control Network).
IP Address Range	Enter the start and end of the IP address range. Example: Start IP Address: 172.20.1.128 End IP Address: 172.20.1.254 Length: 24 Subnet Mask: 255.255.255.0
Add Exclusions and Delay	Optional: Exclusions are address or a range of addresses that are not distributed by the server. A delay is the time duration by which the server delays the transmission of a DHCP OFFER message.
Lease Duration	The lease specifies how long a client can use and IP address from this scope. Default values: Days: 8 Hours: 0 Minutes: 0
Configure DHCP Options	You have to configure the most common DHCP options before clients can use the scope. Select: 'Yes, I want to configure these options now'.
Router (Default Gateway)	Enter the gateway IP address. Example: 172.20.1.1
Domain name and DNS servers	Parent Domain: 'your domain name' Server IP addresses. Example: 172.20.1.10 and 172.20.1.11
WINS	Optional: Computers running Windows can use WINS servers to convert NetBIOS computer names to IP addresses.
Activate Scope	Select 'Yes, I want to activate this scope now'.

## Configure Failover

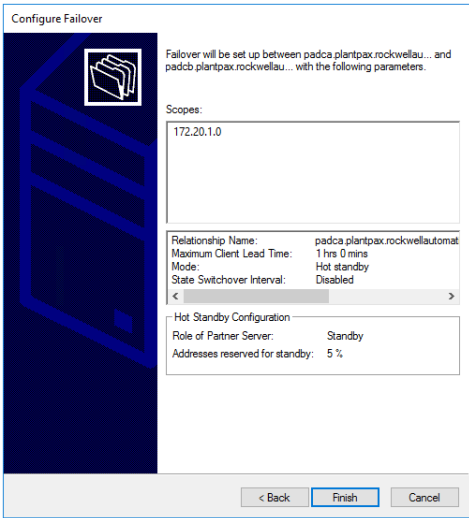
This DHCP option provides high availability by synchronizing IP address information between two DHCP servers.

1. Go to Tools > DHCP > primary domain > IPv4 > Configure Failover and configure the following.

Basic Step	Configure
Configure Failover	Click Add Server and locate the secondary domain controller. Example: PADCB
Create New Failover Relationship	<p>Select 'Hot standby' for mode.</p> <p>You can also choose to require authentication (a shared secret password) to secure communications between failover partners.</p> <p>Enter a 'Shared Secret', which can be passwords, pass phrases, or random numbers.</p>

2. Repeat [step 1](#) to configure a second DHCP server.

A successful configuration displays details of the failover configuration.

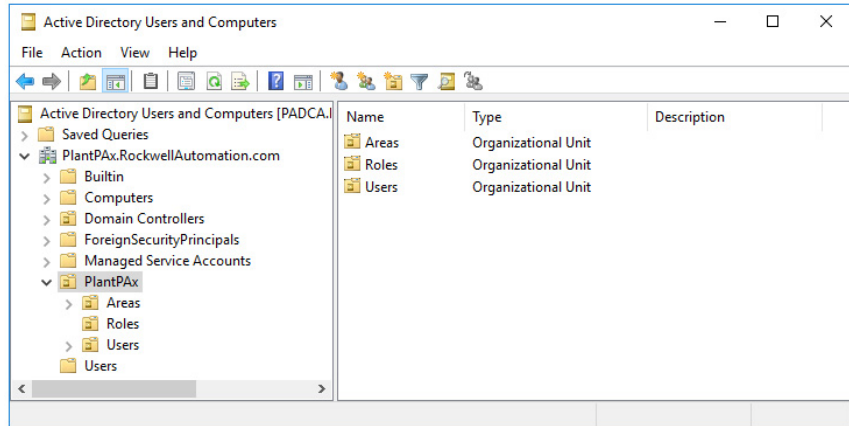




## Create Roles, Areas, and Users

From operators and maintenance personnel to engineers, the domain controller manages groups in the Active Directory. Use the Server Manager to configure the roles, areas, and users.

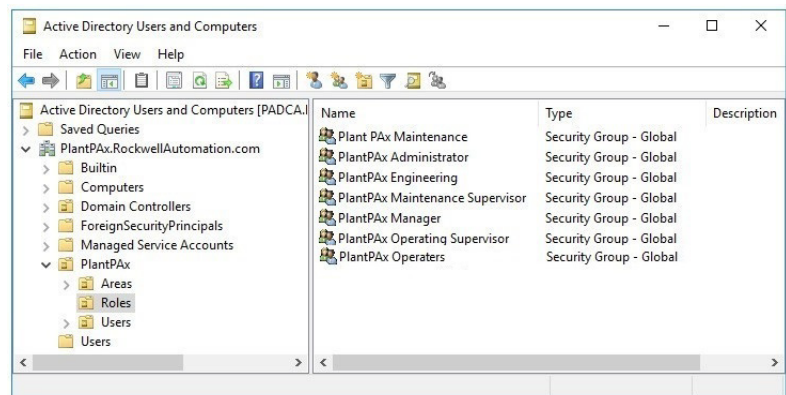
1. Use the Windows Server Manager Tools menu to launch the 'Active Directory Users and Computers' console.
2. From your domain, right-click, select New> Organizational Unit and type the name PlantPAX.
3. Under the PlantPAX group, right-click and select New > Organization Unit to create folders for Users, Areas, and Roles.



## Add Groups for Role Based Security

Roles define different security access for areas of a plant. We recommend the following roles:

- PlantPAX Operators
- PlantPAX Operating Supervisor
- PlantPAX Maintenance
- PlantPAX Maintenance Supervisor
- PlantPAX Manager
- PlantPAX Engineering
- PlantPAX Administrator
- HMI Approver



## Add Groups for Area Based Security

We recommend the following areas that are based on a group:

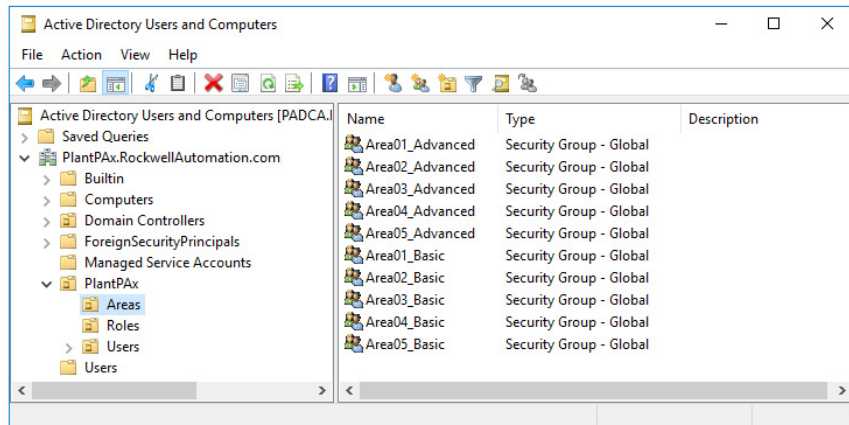
- **Basic** – Allows access to non-engineer functions, such as Maintenance, Operator, on process library faceplates.
- **Advanced** – Allows access to engineering modifications on process library faceplates

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**IMPORTANT** Even though the examples show generic area names, such as Area01, we recommend that you use more specific names, such as Packaging, or Molding. And create two types for each area – Basic and Advanced—for each area.

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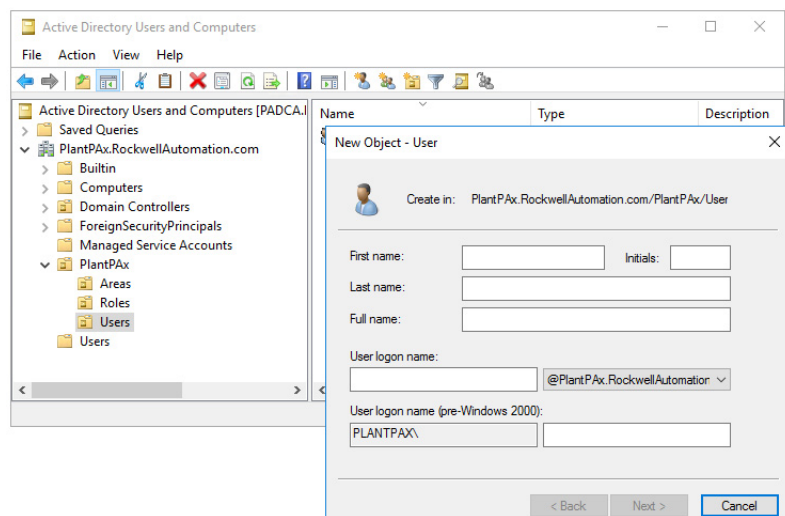
Create as many areas as needed for the system.



## Assign Users

Users are unique to each system.

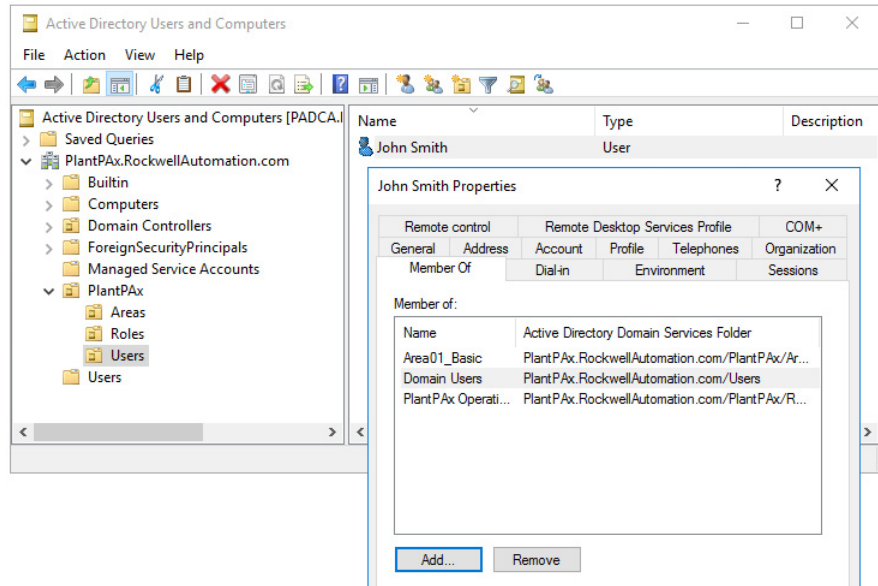
1. Create users and assign them to the Member tab on the Properties for the associated Role.



- Once the user name and password are created, configure the following properties as shown in the table for each user.

On This Page	Configure
Properties	Select the domain on the 'Member of' tab
Select Groups	Type Area as the object name and select the appropriate Area

The successful configuration of a user shows both their domain and area.



## Configure Group Policy Management

Group policies help reduce the maintenance and complexity when you add new users and computers into the PlantPax system. The group policies determine what users can and cannot do, such as password maintenance or to restrict folder access. The same approach applies for how to define server maintenance.

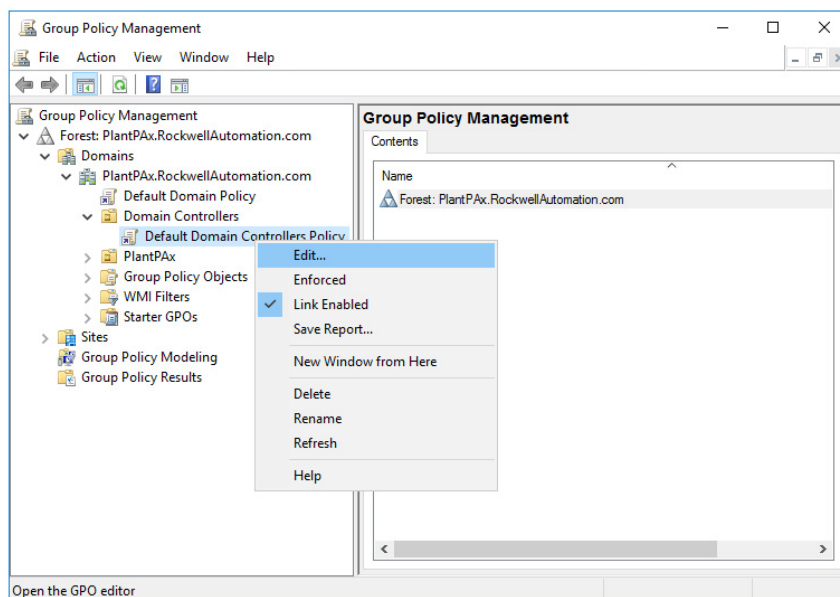
The settings that are outlined are baseline recommendations. Individual business, IT, and security requirements could require additional policies.

## Configure the Windows NTP Client

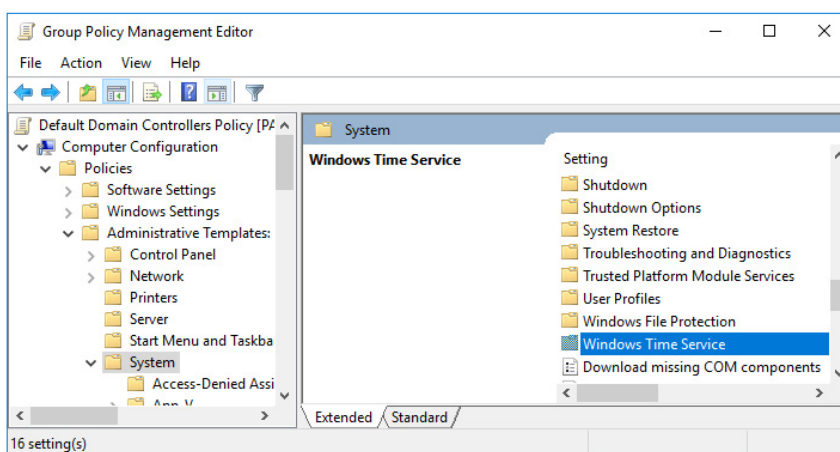
The domain is responsible to propagate and enforce the clock time to the domain computers. Use the Server Manager to configure the Windows NTP client so that the domain controller is in sync with the Windows NTP server.

- Go to Tools > Group Policy Management.

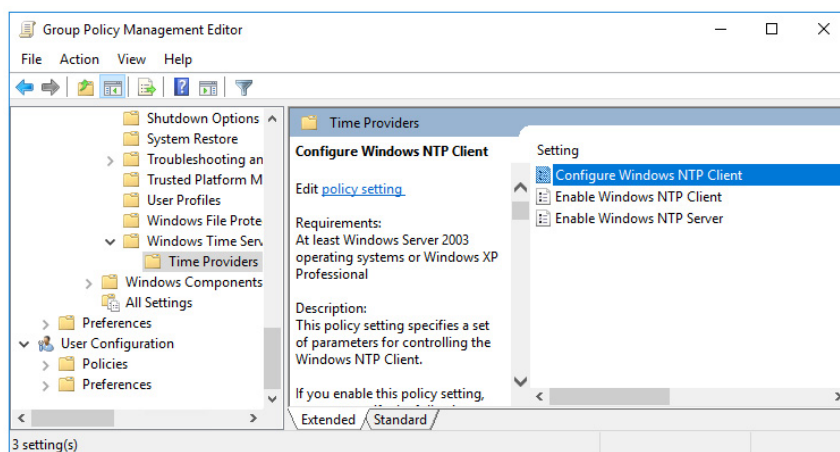
2. Select the Default Domain Controllers Policy to edit.



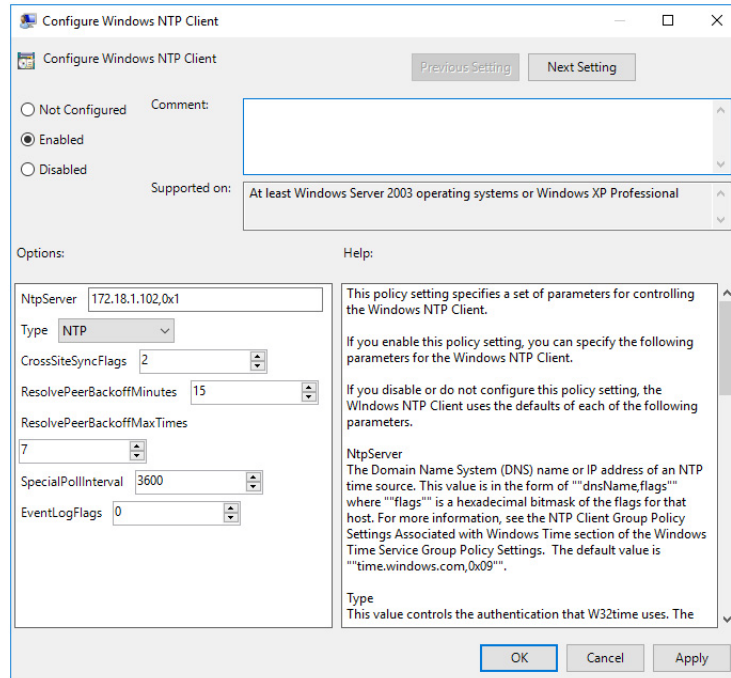
3. In the Group Policy Management Editor, select Policies > System > Windows Time Service.



4. Go to Time Providers > Configure Windows NTP Client.



5. Select 'Enable' and configure the 'Options' with your NtpServer: IP address and use Type: NTP.

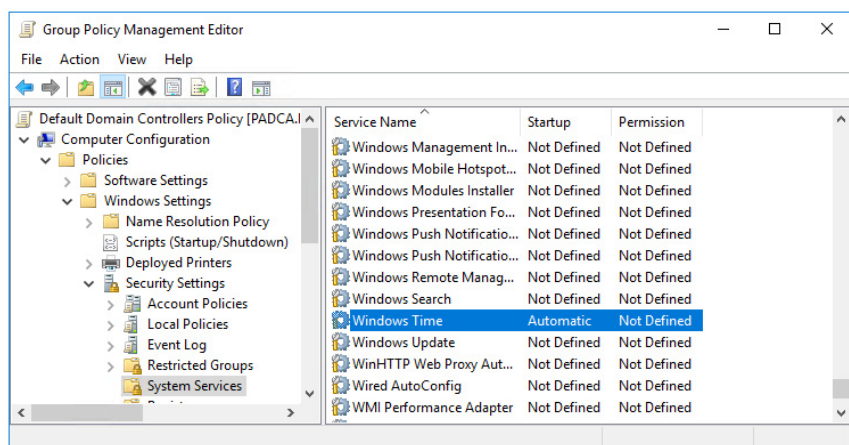


6. Go to Time Providers > Enable Windows NTP Client and check 'Enabled.'

## Configure Windows Time Service

Enable the NTP server to initiate automatically upon startup.

1. In the Group Policy Management Editor, go to Policies > Windows Settings > Name Resolution Policy > System Services > Windows Time.

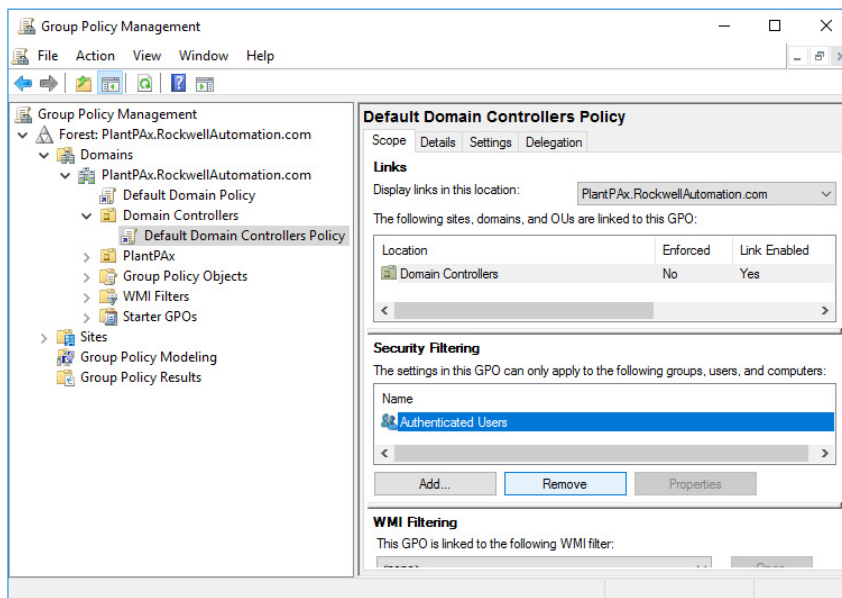


2. In the Windows Time Properties, select the following:
  - Check 'Define this policy setting.'
  - Check 'Automatic' for service startup mode.

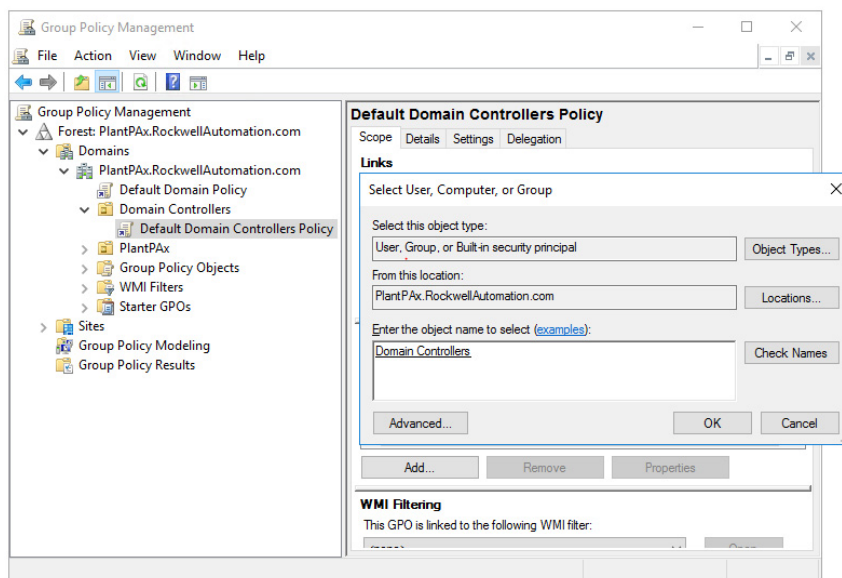
## Enforcing the Domain Controller Policy

Policy enforces the domain controllers to use the NTP server settings.

1. In the Group Policy Management Editor, select the Default Domain Controllers Policy and remove 'Authenticated Users' from Security Filtering.

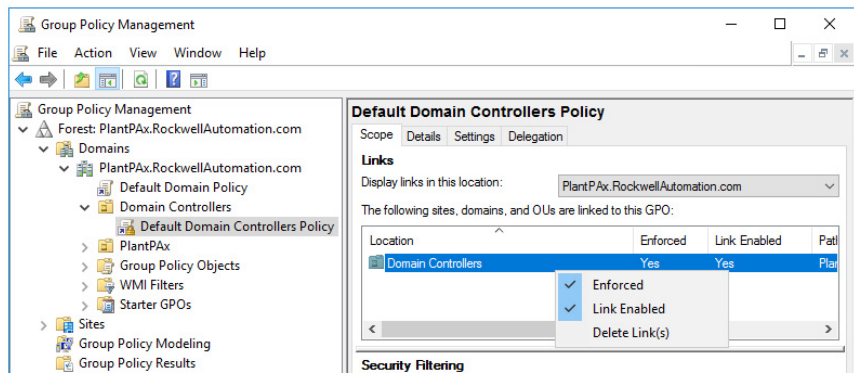


2. Add Domain Controllers from the PlantPAX domain to Security Filtering.





### 3. Right-click Domain Controllers and select Enforced.



## Configure Group Policies

These group policies are recommended:

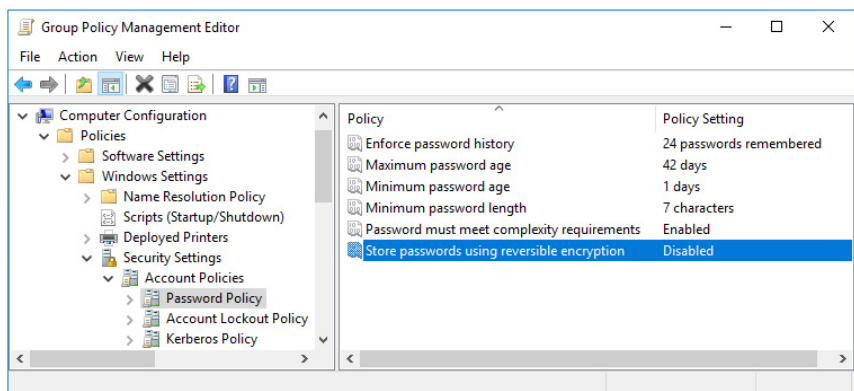
- Password strength
- Account lockout
- Kerberos
- Interactive logon

Use the specifications for your PlantPax system to set the values for these policies. If you configure any of these policies, you **must** enforce the policies on the domain controller for them to take effect.

## Configure the Password Strength Policy

This policy makes sure that security settings are enforced to help protect the system from unauthorized users upon entering the system.

1. In the Group Policy Management Editor, select the Default Domain Policy to edit and select Password Policy.

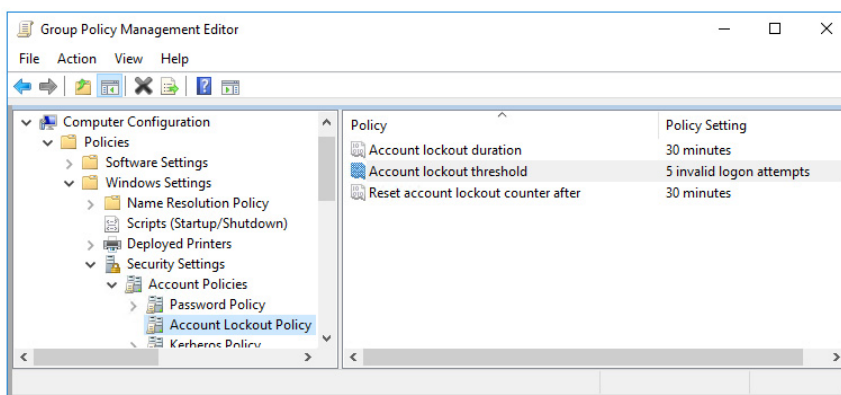




## Configure the Account Lockout Policy

This policy configures the number of password attempts and how an administrator resolves a user lockout situation.

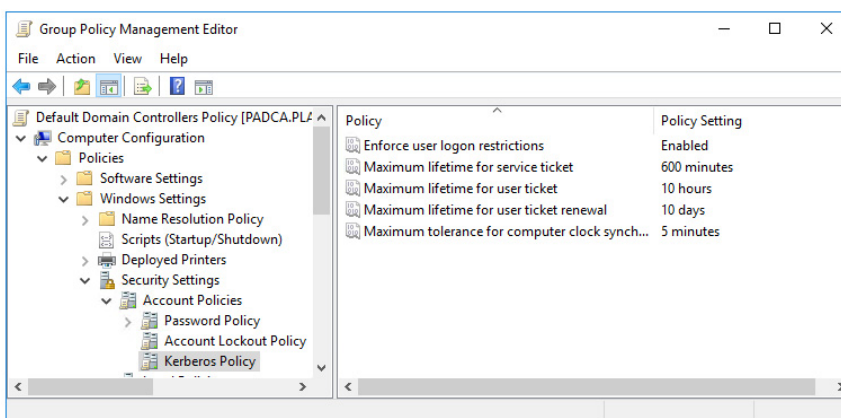
1. In the Group Policy Management Editor, select the Default Domain Policy to edit and select Account Lockout Policy.



## Configure the Kerberos Policy

This policy helps administer network authentication.

1. In the Group Policy Management Editor, select the Default Domain Policy to edit and select Kerberos Policy.
2. Enable the default options or modify if desired.

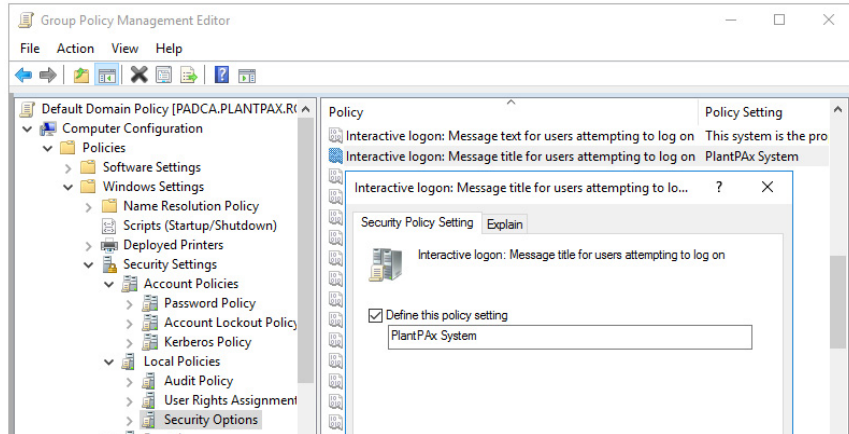


## Configure the Interactive Logon Policy

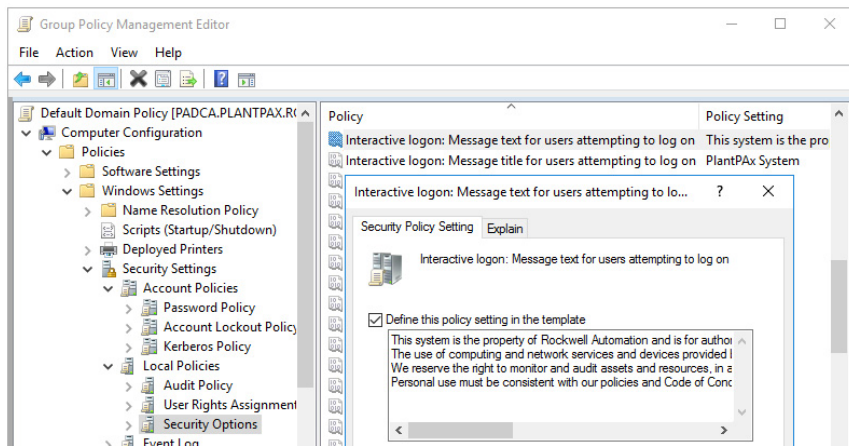
This policy configures a warning message to users of the consequences for misusing company information.

1. In the Group Policy Management Editor, select the Default Domain Policy to edit and select Interactive Logon Policy.
2. In the tree configuration of the Group Policy Management Editor dialog box, Go to Computer Configuration > Policies > Windows Settings > Security Settings > Local Policies.

3. Select the Security Options folder and select the Interactive logon: Message Title option. Enter the name of the group that receives the interactive message.



4. Select the Interactive Logon: Message text option. Enter the message that appears to users during login.



## PlantPax Users Policy Object

You can create a PlantPax Users Policy to restrict privileges and site access. Recommended policies include access for the following:

- USB drive
- Portable device
- Software

Use the specifications for your PlantPax system to set the values for these policies. If you configure any of these policies, you must enforce the policies on the domain controller for them to take effect.

For how to configure recommended FactoryTalk Security settings, see *Configure System Security Features User Manual*, publication [SECURE-UM001](#).



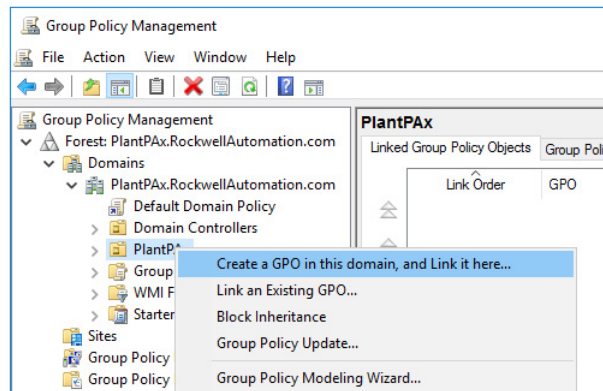
Knowledgebase Technote, [PlantPax System Release 5.0 Configuration and Implementation Tools](#), contains recommended FactoryTalk Security policy settings for PlantPax systems. Download the spreadsheet from this public article.

You may be asked to log in to your Rockwell Automation web account or create an account if you do not have one. You do not need a support contract to access the article.

## Create the PlantPax Users Policy Object

You can select a group and set restrictions. For example, a group of users cannot use USB drives as a layer of system security.

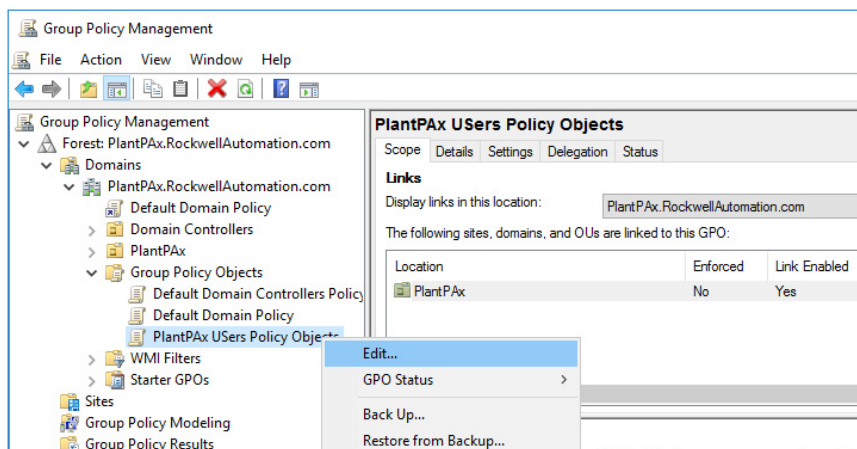
1. In the Group Policy Management Editor, select the PlantPax Domain and select 'Create a GPO in this domain and link it here...'



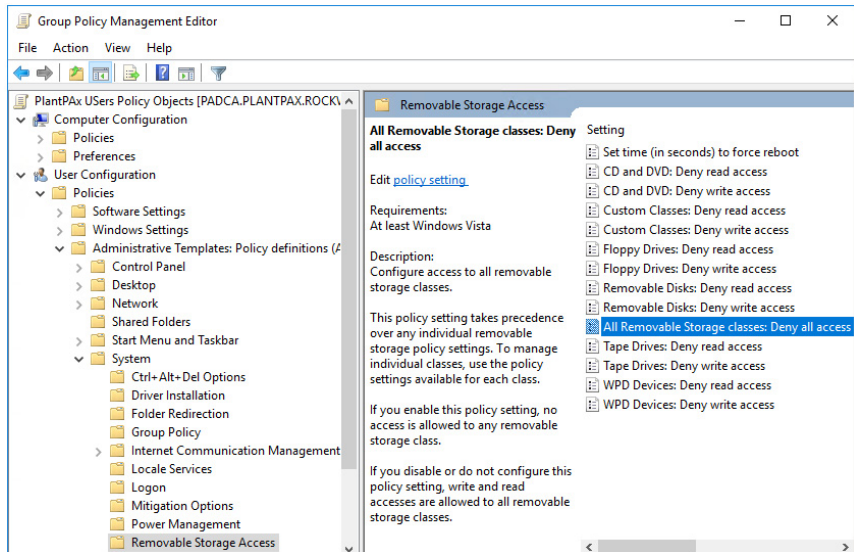
## Configure the USB Drive Policy

A group of users can be restricted from using a USB drive.

1. In the Group Policy Management Editor, select the PlantPax Users Policy Object to edit and select Removable Storage Access.



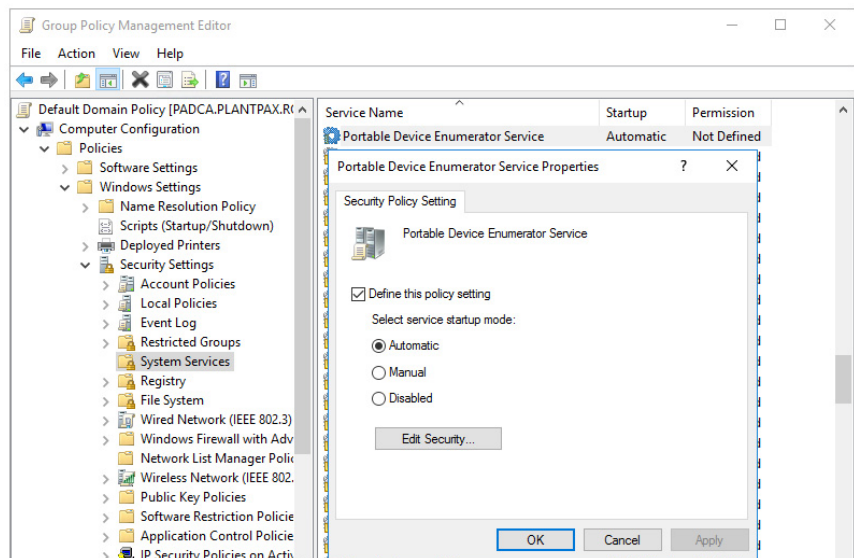
2. Go to Computer Configuration > User Configuration > Policies > Administrative Templates > System.
3. Select Removable Storage Access and choose All Removable Storage classes: Deny all access.
4. Select Enabled.



## Configure the Portable Device Enumeration Policy

This policy enforces Group Policy Objects for connected mass storage devices.

1. In the Group Policy Management Editor, select the PlantPax Users Policy Object to edit and select Portable Device Enumeration Policy.

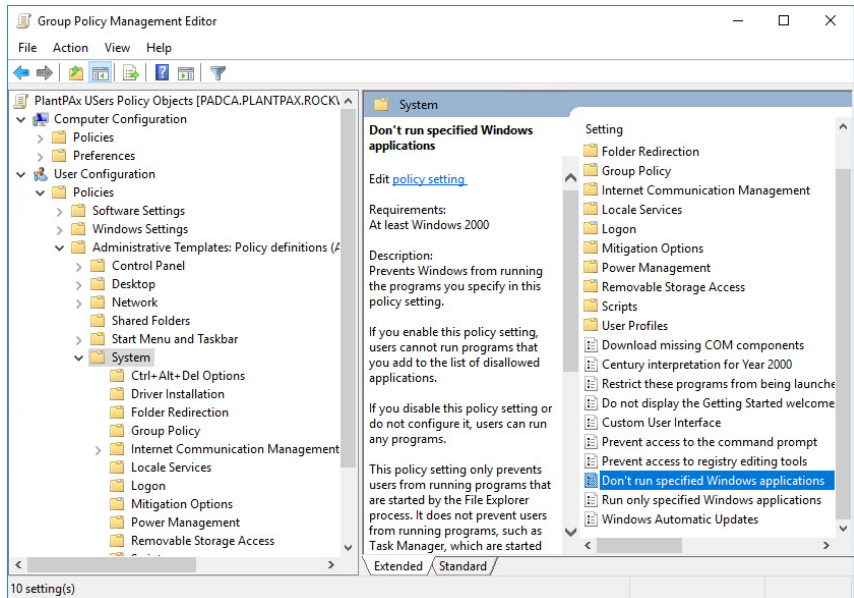


## Configure the Software Access Policy

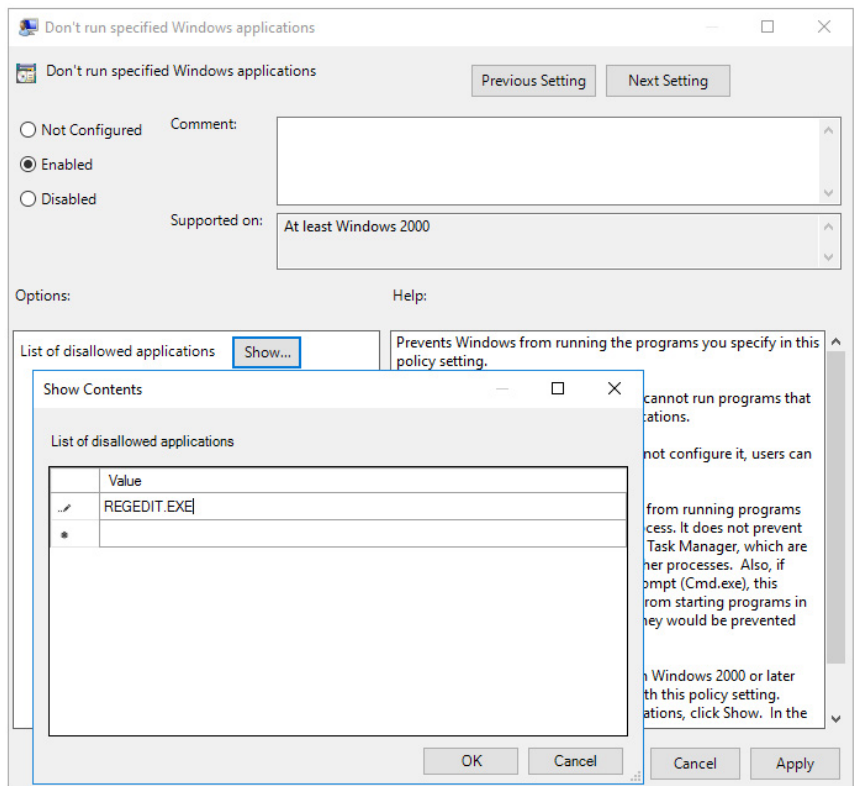
This policy helps protect against the use of non-approved system software.

1. In the Group Policy Management Editor, select the PlantPax Users Policy Object to edit and select Software Access Policy.

2. Go to Computer Configuration > User Configuration > Policies > Administrative Templates.
3. In the System folder, select 'Don't run specified Windows applications.'



4. Select Enabled, Show, and then type any application software to create an access restriction. Example: Regedit.exe



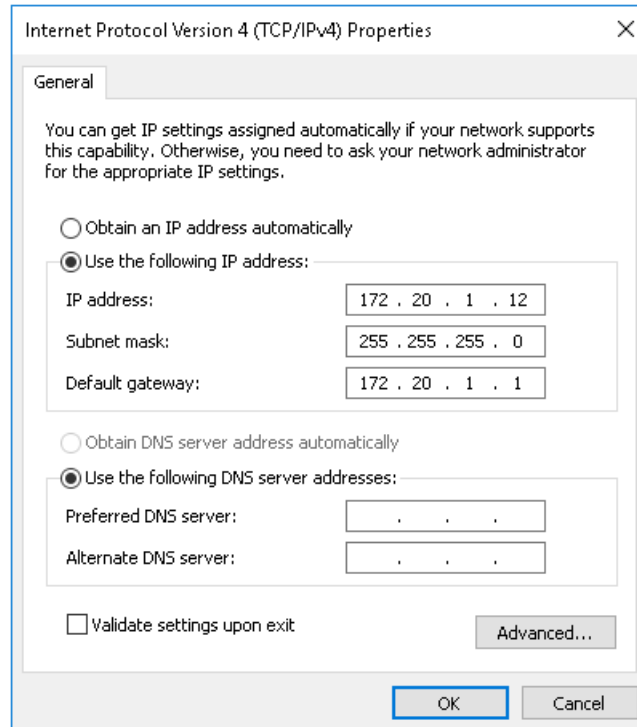
## Windows Workgroup

For small PlantPAX systems, you can use a Windows Workgroup where complexity and security controls are kept to a minimum. An example might be a PASS-C server for a Process skid.

### Assign Static IP Addresses

Without a domain controller, there is no DHCP server to assign IP addresses. The workgroup requires all workstations and servers to contain manually set (static) IP address assignments.

1. On each workstation, access the Network Adapter TCP/IPv4 properties and assign a unique IP address.




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**IMPORTANT** Stratix® managed switches can be set to operate as a DHCP server and provide DHCP persistence. Refer to the switch user manual if using DHCP for workgroup computers.

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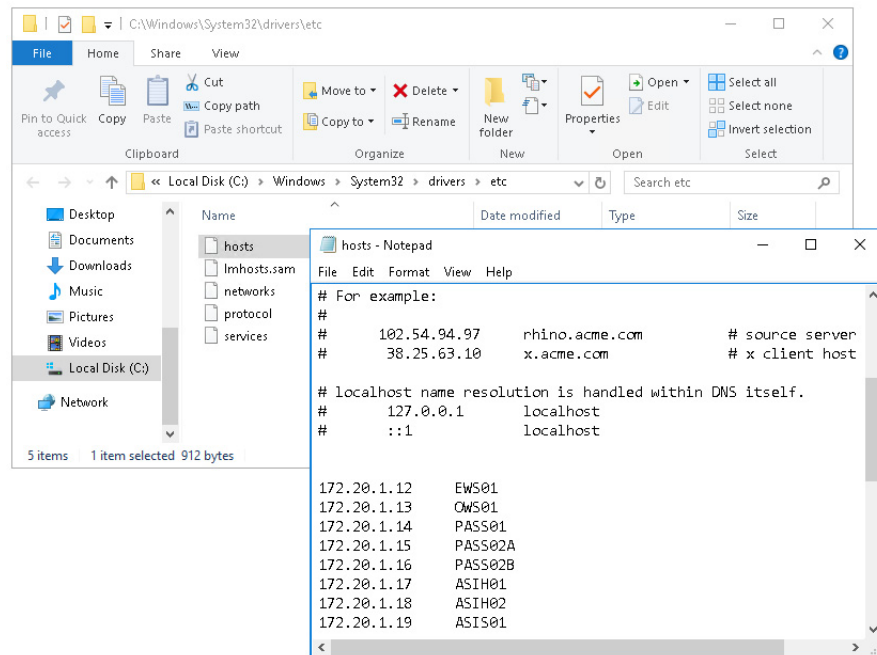
### Map Computer IP Addresses

Without a domain controller, there is no DNS server to provide name resolution, meaning the computers can only communicate by IP address. To communicate by using a computer host name, mapping is required. All Windows computers contain a HOSTS plain text file that maps IP addresses to host names.

1. Locate the HOSTS file in C:\Windows\System32\Drivers\etc directory and specify to open with Notepad.



2. Create a list of your workgroup computers, starting with each IP address followed by the corresponding computer name. Use a tab to delimit space between each mapping.



3. Copy the HOSTS file to all other computers in the workgroup.

---

**IMPORTANT** Any time a change or new computer is added, all workgroup computers must receive the updated HOSTS file.

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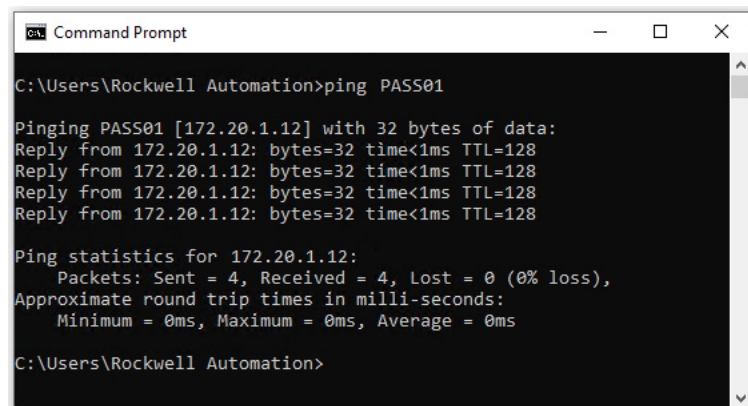
## Test Communication by Host Name

You can verify that each workgroup computer responds to a PING command from another workgroup computer, referencing the remote computers host name.

1. Open a Command Prompt and type PING followed by a host name.

For example: CMD: PING PASS01

2. Verify a reply from the remote computer is returned with the correct IP address.





## Create Local Users

While not required, increased security is achieved when using local user accounts of varying privilege.

Use the most restrictive account to help protect from security threats that could otherwise use elevated privileges to exploit the operating system. Only log into an administrative account as needed.

1. Open Computer Management. (Run > compmgmt.msc)
2. Select Local Users and Groups in the left window pane.
3. Right-click the Users folder and select New User.
4. Enter a user name, password, and select 'password never expires'.
5. After the user is created, right-click user and select Properties.
6. Go to the Member Of tab and Add the local group as desired.

### Local Users and Groups Example

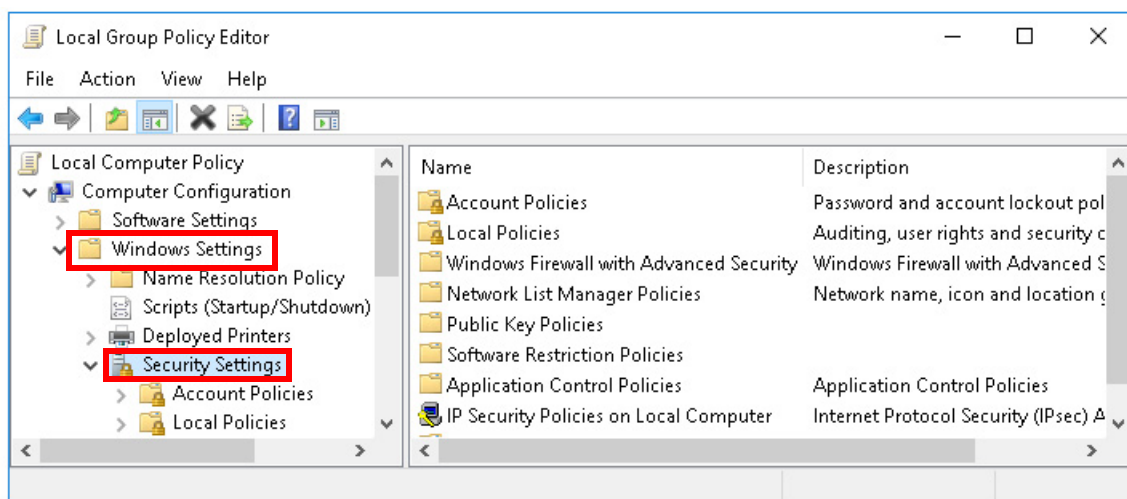
User Name	Local Group
PlantPAX Engineering	Administrators
PlantPAX Operators	Power users

**IMPORTANT** Local user accounts must be duplicated on all workstations with shared credentials for seamless access.

## Create Local Security Policies

While not required, if you have various levels of local users you can set local security policies that the more restricted accounts will not be able to modify.

1. Log on to the highest privilege local account with administrator access.
2. Open the Local Group Policy Editor (Run > gpedit.msc).
3. Expand Computer Configuration and go to Windows Settings > Security Settings.



4. Expand Computer Configuration and go to Windows Settings > Security Settings > Account Policies.

You can configure a lockout policy for several failed login attempts of unauthorized users.

5. Expand Computer Configuration and go to Windows Settings > Security Settings > Local Policies.

You can configure User Rights Assignment and Security Options. You can limit actions such as who can shut down the computer, change the system time, access the computer from a network, and so on.

---

**IMPORTANT** Local Policies must be duplicated on all workstations for seamless operation. This can be tedious and is why a domain controller with the ability to push domain policies is recommended over a workgroup.

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## FactoryTalk DeskLock Utility (Optional)

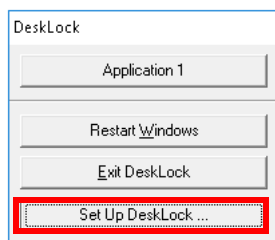
DeskLock is a FactoryTalk® View tool for the Windows operating system. DeskLock provides control options for smaller systems that do not use policy or domain management.

Use the DeskLock tool to:

- Choose setting so that an operator using FactoryTalk View cannot gain access to functionality not expressly configured by the system administrator.
- Hide items on the Windows Explorer desktop, including the Taskbar and Start menu.
- Disable key combinations that are used to perform specific Windows actions, such as accessing the Task Manager.

Launch the DeskLock tool on computers with FactoryTalk Views SE, FactoryTalk® Studio, server, or client components.

1. Go to Rockwell Software > FactoryTalk View > Tools > DeskLock
2. Select Set Up DeskLock.



3. Explore each of the four tabs (Logon, Desktop, Password, Behavior).

The screenshot shows the 'DeskLock Setup' dialog box with the 'Logon' tab selected. The dialog has four tabs: 'Logon', 'Desktop', 'Password', and 'Behavior'. The 'Logon' tab contains two sections: 'Windows Logon' and 'Options'. The 'Windows Logon' section has a checkbox for 'Automatically Logon to Windows' (unchecked), and four text input fields: 'Default Domain Name' (containing 'PASS01'), 'Default User Name' (containing 'Administrator'), 'Default Password' (empty), and 'Confirm Password' (empty). The 'Options' section has a checkbox for 'Go to the background when it starts' (unchecked). At the bottom of the dialog are four buttons: 'Defaults', 'OK', 'Cancel', and 'Help'.

4. Use the Help button for information on how to configure and use the DeskLock utility.

**Notes:**

## Process Automation System Server

The Process Automation System Server (PASS) can be configured after joining an active domain or workgroup. The configuration steps described here cover larger system implementations.

### Quick Start

This is the recommended work flow to configure a Process Automation System Server. For experienced users, each step outlines requirements. For more detailed information, follow the referenced links.

1

#### Determine FactoryTalk Components

The PASS hosts the FactoryTalk® Services Platform that provides a set of common services (such as diagnostic messages, health monitoring services, and access to real-time data).

- FactoryTalk® Administration Console
- FactoryTalk® Directory
- FactoryTalk® Activation
- FactoryTalk® Security
- FactoryTalk® Diagnostics
- FactoryTalk® Alarms and Events

For more information, see [FactoryTalk Components](#).

2

#### Configure the PASS

Configure the PASS for stand-alone or distributed connectivity.

- Specify FactoryTalk Directory
- Configure the FactoryTalk Directory
- Run the Windows® Firewall Configuration Utility
- Configure FactoryTalk Activation servers

For more information, see [Configure the PASS](#)

For redundant PASS considerations, see [Redundant Server Considerations](#)

3

#### Configure Servers on the PASS

A FactoryTalk® View SE application is required to create the three major server components that run on the PASS.

- HMI server – Stores HMI project components, such as graphic displays, and provides these components to Operator Workstations (OWS) upon request
- Data server – Accesses information from the process controllers and provides information to servers and workstations in the PlantPax® system
- Tag Alarm and Event server – Provides alarm information from the controllers and servers to each OWS upon request

Large distributed systems may require multiple servers running remotely in a more elaborate architecture.

For more information, see [Configure Servers on the PASS](#)

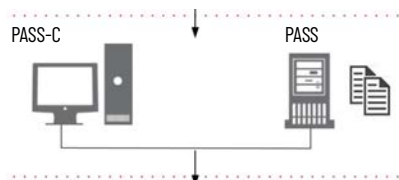


## 4 Configure the Runtime Security

Runtime security must be set up to provide each account or user group with the correct FactoryTalk View security codes. The security codes verify that operators, maintenance personnel, and engineers have permission to run secured commands, open secured graphic displays, or write to secured tags at runtime.

For more information, see [Configure Runtime Security](#)

## Prerequisites



Following the [System Workflow](#), configure a PASS or PASS-C, depending on the size of your system. Your results from the PSE determine the size of the system.

- The PASS server or servers must be deployed before doing the procedures in this section.
  - For templates based on your system requirements, see the PlantPAx Template User Manual, publication [9528-UM001](#).
- PASS servers can be configured as redundant for HMI servers, data servers, and/or alarm servers.

## FactoryTalk Components

The PASS hosts the FactoryTalk® Services Platform that provides a set of common services (such as diagnostic messages, health monitoring services, and access to real-time data). FactoryTalk software products and applications depend on these services in a PlantPAx system.

FactoryTalk Service Platform components for the PASS include:

Component	Description
FactoryTalk Administration Console	<p>FactoryTalk Administration Console is a stand-alone tool for developing, managing, and securing multiple FactoryTalk View applications. On the Administration Console, delete old computer names from the FactoryTalk Directory. By deleting old computer names, the FactoryTalk Directory contains current computer names only. Deletions also make sure that applications do not attempt to communicate with computers that are no longer in the FactoryTalk Directory.</p> <p><b>Required:</b> Yes; a prerequisite on every PlantPAx computer containing FactoryTalk software.</p>
FactoryTalk Directory	<p>FactoryTalk Directory provides a central lookup service for a PlantPAx system so all definitions do not have to exist in a single physical project file. References saved by FactoryTalk Directory are used by FactoryTalk-enabled products and FactoryTalk services to locate definitions when they are needed. It allows clients to locate key configuration information such as system organization, server locations, and policy information. FactoryTalk Directory provides a common address or phone book of factory resources that are shared among FactoryTalk-enabled applications in a distributed system.</p> <p><b>Required:</b> Yes; install as FactoryTalk Network Directory type</p>
FactoryTalk Activation	<p>FactoryTalk Activation services provide a secure, software-based system for activating Rockwell Software® products and managing software activation files.</p> <p><b>Required:</b> Yes; a prerequisite on every PlantPAx computer containing FactoryTalk software. Activation file access is required for continuous use of FactoryTalk software otherwise a 7-day grace period is started.</p> <p><b>Placement:</b> A PASS is recommended location to bind and place the license files. Other servers and workstations can refer to the PASS location for floating or time borrowed activations. For more robust applications, activate each server locally to remove the dependency of remote license access.</p>

Component	Description
FactoryTalk® Security	<p>FactoryTalk Security centralizes user authentication and authorization at the FactoryTalk Directory. The users and groups are very similar in their management to active directory and can be linked to the active directory. This centralized authentication and access control allows for a 'single user sign-in' experience when using FactoryTalk enabled products.</p> <p><b>Required:</b> Yes, for PlantPAx system release 5.0 and earlier.</p> <p><b>Placement:</b> Same server that is hosting the FactoryTalk Directory.</p>
FactoryTalk® Diagnostics	<p>FactoryTalk Diagnostics collects and provides access to activity, status, warning, and error messages generated throughout a FactoryTalk system.</p> <p><b>Required:</b> Yes, for PlantPAx system release 5.0 and earlier.</p> <p><b>Placement:</b> Yes; a prerequisite on every PlantPAx computer containing FactoryTalk software.</p>
FactoryTalk Alarms and Events	<p>FactoryTalk Alarms and Events provides system-wide alarm monitoring and control centralized at the FactoryTalk Directory.</p> <p><b>Required:</b> Yes, for PlantPAx system release 5.0 and earlier.</p> <p><b>Placement:</b> Alarm and Events Server on the PASS</p>

## Configure the PASS

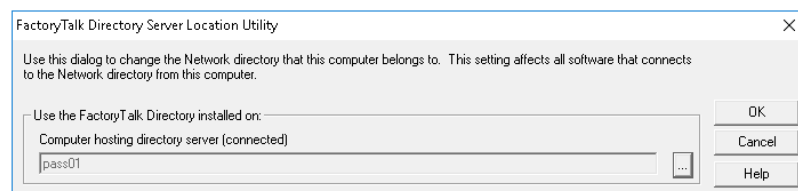
To configure the PASS:

- Specify the location of the FactoryTalk Directory
- Configure the FactoryTalk Directory
- Run the Windows Firewall Configuration Utility
- Configure FactoryTalk Activation servers

### Specify FactoryTalk Directory Location

Every computer needs to know whether to use its own local directory or to use a network directory on a remote computer. Do the following for each computer in the system.

1. Go to Rockwell Software > FactoryTalk Tools > FactoryTalk Directory Server Location Utility and specify the location.
  - For a PASS-C, specify the LOCAL directory and for each OWS client specify the PASS-C directory.
  - For distributed PASS system, specify that PASS01 hosts the directory, and for all other servers and workstations specify PASS01.

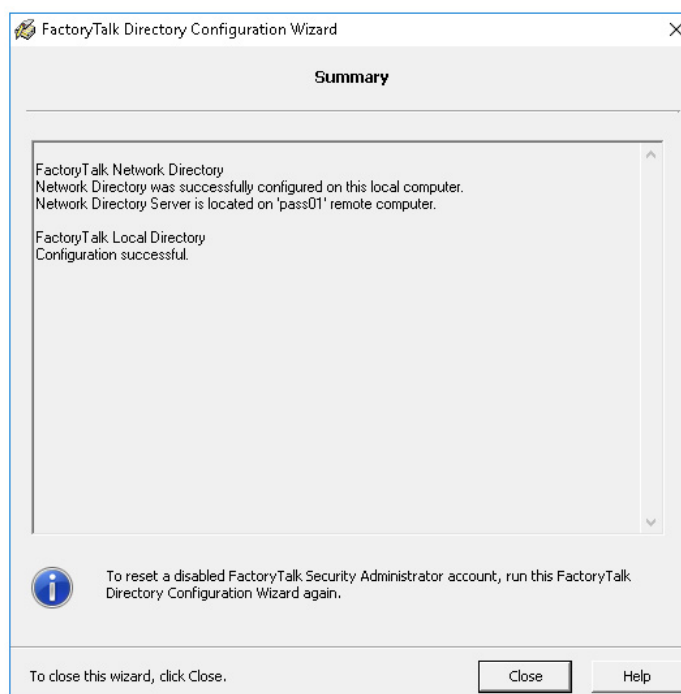


2. Reboot each computer after specifying its directory location.

## Configure the FactoryTalk Directory

Once you specify the FactoryTalk Directory location and reboot the computer, configure the FactoryTalk Network Directory or Local Directory on each computer.

1. Go to Rockwell Software > FactoryTalk Tools > FactoryTalk Directory Configuration and select Network or Local or both, depending upon the perspective of the computer being configured.
2. Enter the Windows Administrative account user name and password.
3. In the Summary, verify the configuration was successful.



## Run Firewall Configuration Utility

The FactoryTalk Services Platform includes a Windows Firewall Configuration Utility (WFCU) to provide firewall port exceptions to incoming and outgoing processes that require remote access. Run this utility on every computer that has installed FactoryTalk software.

1. Go to Rockwell Software > FactoryTalk Tools > Windows Firewall Configuration Utility.

And process-related exceptions are displayed at the bottom.

2. If needed, save a list of exceptions for future reference and the WFCU activity is logged to C:\ProgramData\WFCU\WFCULog.txt
3. If no exceptions are needed, click Exit.



It is recommended to enable Windows Defender Firewall notifications in order to inform you of any additional applications that would be blocked.

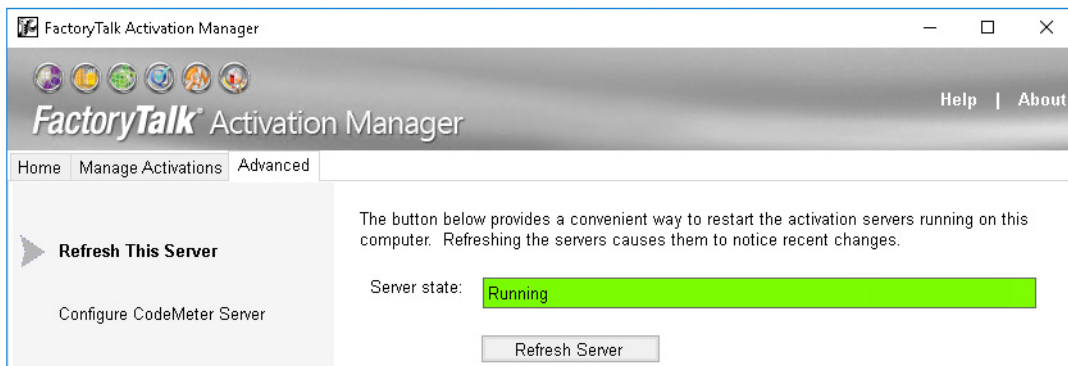


## Configure FactoryTalk Activation Servers

The FactoryTalk Activation Manager (FTAM) software is a prerequisite that is automatically installed on every PlantPAx computer that contains FactoryTalk software.

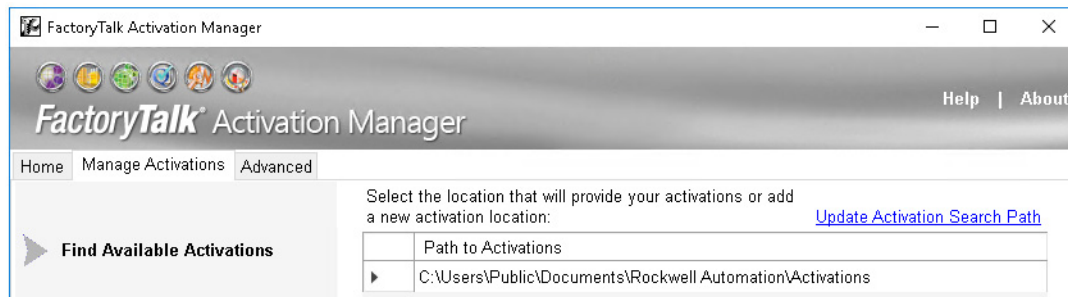
For a PlantPAx system, the computer that hosts the FactoryTalk Directory, such as the PASS, hosts the license files.

1. Go to Rockwell Software > FactoryTalk Activation > FactoryTalk Activation Manager and select new activations, as needed.
2. After all new activations are generated, go to the Advanced Tab and click 'Refresh Server'.



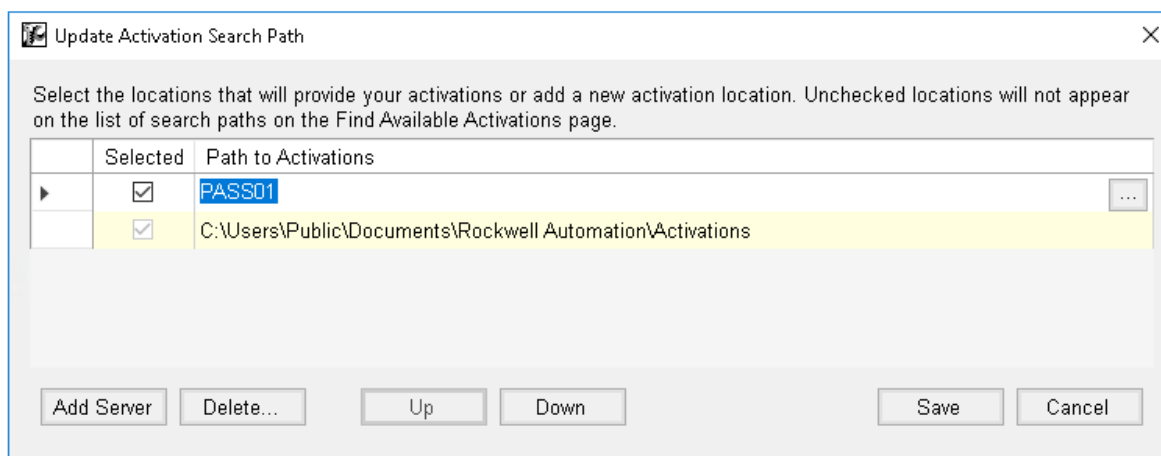
Configure all other computers to reference the PASS location.

1. Go to Rockwell Software > FactoryTalk Activation > FactoryTalk Activation Manager and select Update Activation Search Path.



2. Select Add a server and enter the name or IP address of the license server (PASS01).

3. If there are no local activations, move PASS01 to the top as the first location to search for activations.



4. Update the search path on all computers that require an activation.

## Configure Servers on the PASS

A FactoryTalk View SE application is required to create the three major server components that run on the PASS.

- HMI server – Stores HMI project components, such as graphic displays, and provides these components to Operator Workstations (OWS) upon request.
- Data server – Accesses information from the process controllers and provides information to servers and workstations in the PlantPax system.
- Tag Alarm and Event server – Provides alarm information from the controllers and servers to each OWS upon request.

The number of servers and how they are configured can impact the speed of system communication. Servers can be simplex or redundant.

- A single HMI server is sufficient for most PlantPax systems.
- Multiple data servers are common. By locating each in separate areas, tag lookup performance is improved as an HMI server knows specifically which data server to browse and can ignore others.

The following steps provide basic server creation on a single PASS. Large distributed systems can require multiple servers running remotely in a more elaborate architecture.

## Create a New HMI Project

This section provides a method to create your own project and then import the components from the PlantPax Graphic Framework.

1. Go to FactoryTalk® View Studio software > New and select an application type of View Site Edition.

The application types are Local Station, Network Station, or Network Distributed.



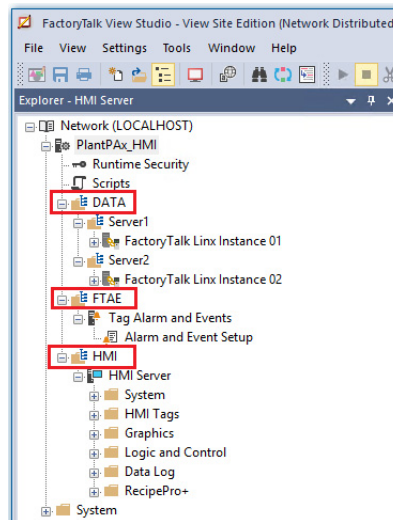
PlantPax systems are Network Distributed applications, even when server components are consolidated on a stand-alone computer (PASS-C). The exception is a process skid, where a Local Station application provides sufficient functionality.

You now have a default application.

## Define Areas

Areas organize and subdivide applications in a network directory into logical and physical divisions. Areas can be created for different processes within a manufacturing facility or to group each server type. This name hierarchy can be visible externally, such as in the historian or alarm database.

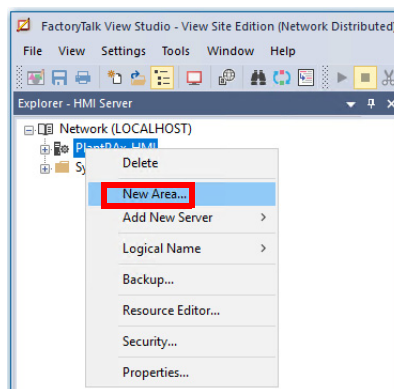
Server segregation helps optimize performance. To help prevent unpredictable search results, do **not** insert a server into the application root path. Each server must be in its own area.



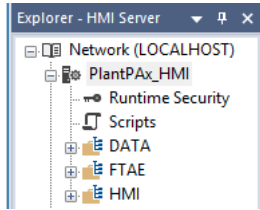
- Alarm area folder stores the Alarm and Event server.
- Data area folder contains the data server.
- HMI area folder stores FactoryTalk® View tags and displays.

Use the Explorer window in FactoryTalk View Studio to add areas.

1. Go to the application and select New Area.



2. Create three Areas, one for each of the three main server types (DATA, FTAE, and HMI).

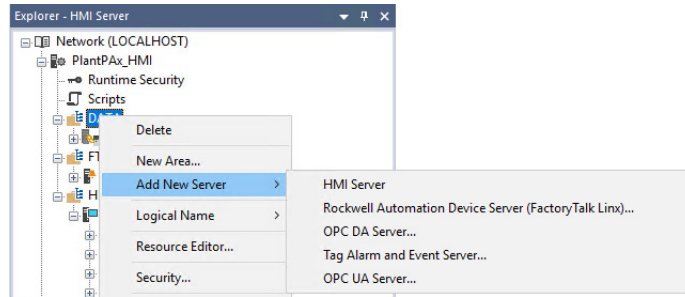


**IMPORTANT** Once you create an area, you cannot change the name. You must delete and recreate if you need to modify the name.  
Do not use spaces in the Area name to ensure proper HMI functionality.  
Do not put more than one server in the root location of an area.

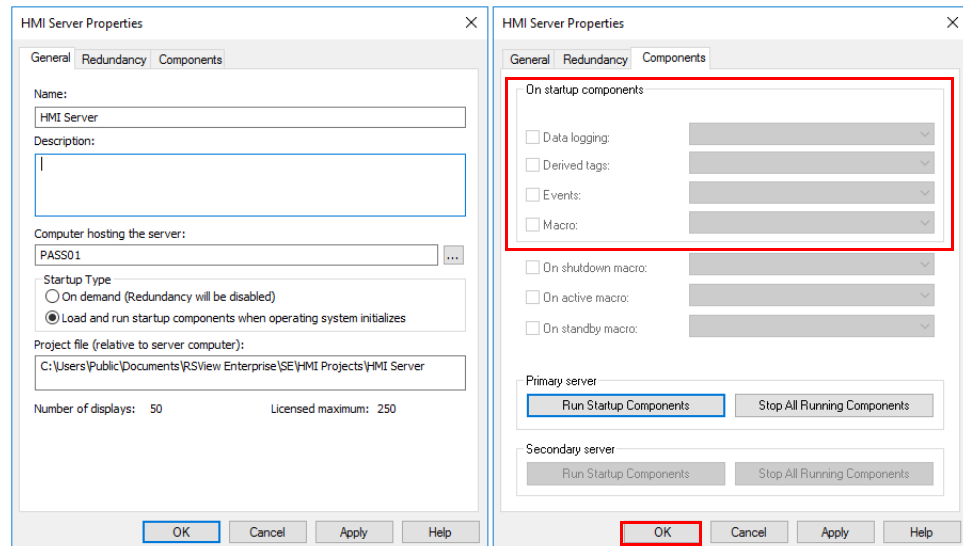
## Add an HMI Server

All PlantPax systems require an HMI server.

1. Go to the HMI area and select Add New Server> HMI Server. Each area can only contain one HMI server.



2. Enter a name, startup type, and specify the computer that hosts the service (for example, PASS01).
3. (optional) Click the Redundancy tab to specify a secondary PASS.
4. Select startup items on the Components tab, such as data logging, derived tags, events, and macros.

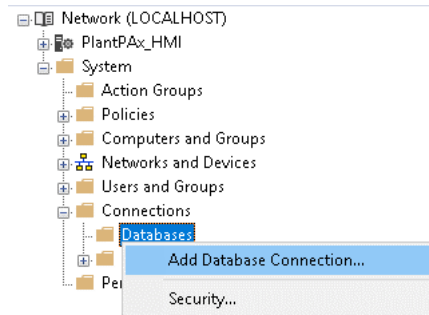


5. Click OK.

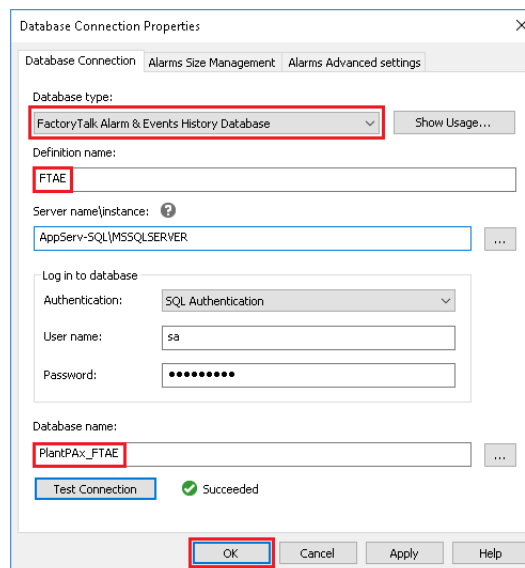
## Add the Alarms and Events Database

The data servers and the alarms and events servers can log alarm and event history to a SQL database. You must create this database before you can enable logging to the servers.

1. Use either FactoryTalk View SE Studio or the FactoryTalk Administrative Console to add a database connection.



2. Configure the database connection properties.
  - Type: FactoryTalk Alarm & Events History Database
  - Definition name: (new or existing)
  - Server that hosts your SQL database: (local or remote)
  - SQL database authentication
  - Database a name (new or existing)

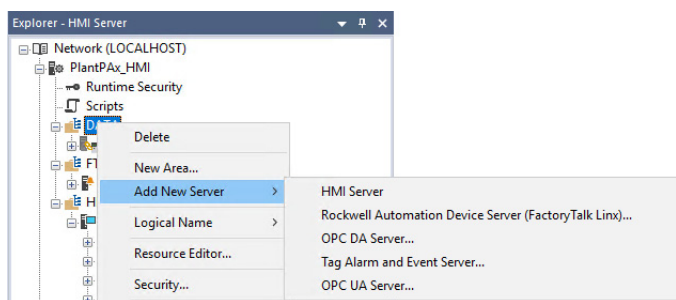


If the database does not already exist, you get a prompt when you click OK. Click YES to create the database.

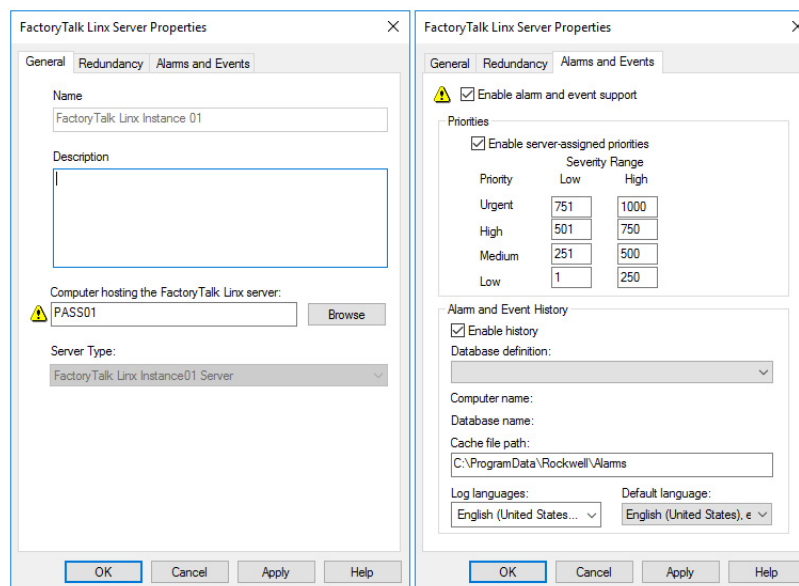
## Add a Data Server

A data server is required to communicate to controllers. This server type supports Logix Tag-based and Logix Instruction-based alarm subscriptions.

1. Go to the Data area and select Add New Server > Rockwell Automation Device server (FactoryTalk® Linx).



2. Enter a name, startup type, and specify the computer that hosts the service (for example, PASS01).
3. Create a first or second instance Data server (FactoryTalk Linx), each in its own area.
4. Enter a name, startup type, and specify the computer that hosts the service (for example, PASS01).
5. (optional) Click the Redundancy tab to specify a secondary PASS.
6. On the Alarm and Events tab, enable alarm and event support and enable history.
7. Enable server-assigned priorities and configure as required.
8. Enable history to configure alarm and event logging.



### IMPORTANT

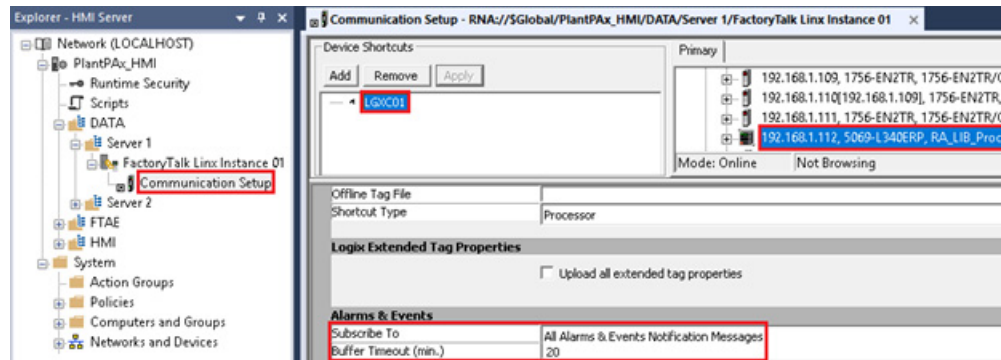
FactoryTalk Linx Instance02 is a separate independent service on the Windows operating system that is designed to allow applications to have more tags, data clients, and/or controllers without affecting the first instance.

Instance02 is not supported on FactoryTalk View SE local station and is limited to an Ethernet driver.

For information on verifying the data server, see [Appendix C, PlantPAX Deployment Recommendations and Verification Tool](#).

Once the data server is created, name and configure device shortcuts to controllers and subscribe to the data server. Select All Alarms & Events

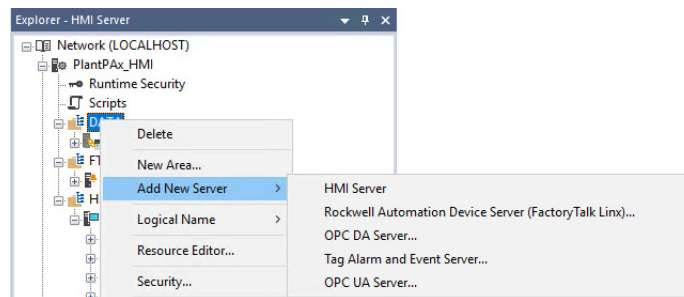
Notification Messages to support Logix tag-based alarms and automatic diagnostic messages.



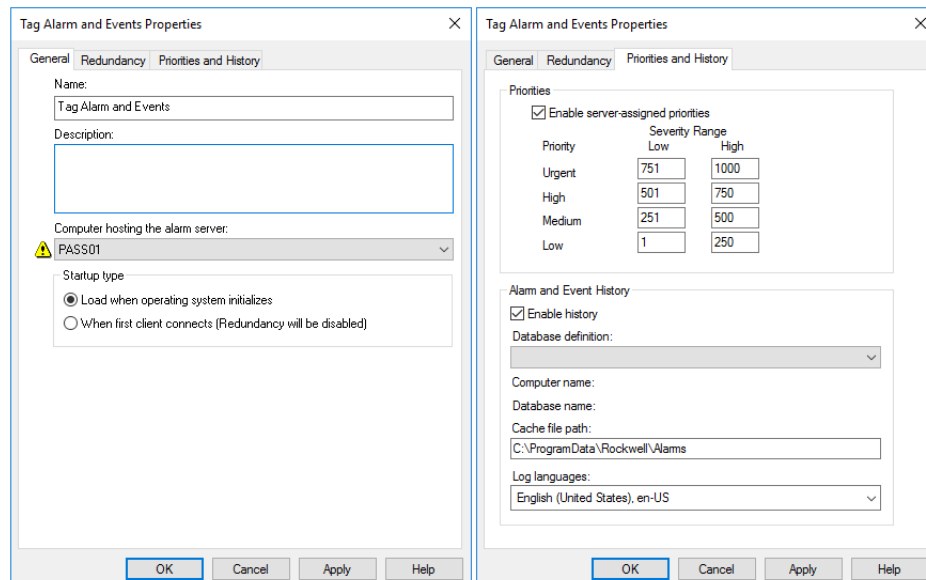
## Add an Alarm Server

An alarms and events server is required for server tag-based alarms.

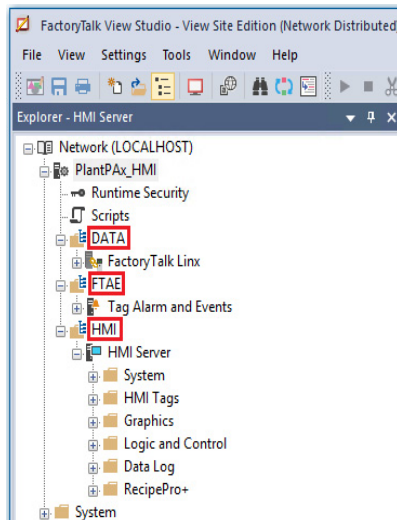
1. Go to the FTAE area and select Add New Server > Tag Alarm and Event Server.



2. Enter a name, startup type, and specify the computer that hosts the service (for example, PASS01).
3. (optional) Click the Redundancy tab to specify a secondary PASS.
4. Click the Priorities and History tab and enable server-assigned priorities.
5. Enable history to configure alarm and event logging.



Now that your servers are organized into areas, you are ready to start developing your HMI application.



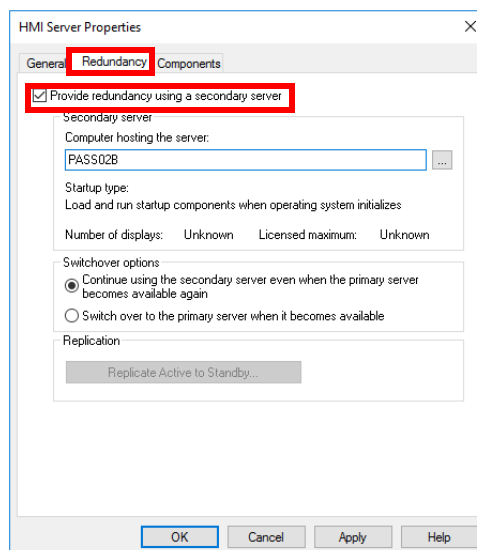
For details on building an HMI template, see the Rockwell Automation Library of Process Objects Reference Manual, publication [PROCES-RM200](#).

## Redundant Server Considerations

Redundant HMI, Data, and Alarm servers provide higher availability on a network distributed architecture. Primary and secondary servers are hosted on different PASS servers where control can be switched between them.

When implementing a primary and secondary server (PASS02A and PASS02B), we recommend that you use a single PASS01 (non-redundant) to host the FactoryTalk Network Directory and FactoryTalk Activations. By using the PASS01, these common components still are accessible in the event that one of the redundant servers is unreachable.

Access the Redundancy tab of each servers' properties to enable redundancy and specify the secondary server.





## Configure Runtime Security

Configuration and command execution can be secured in Process Library by user role, user training or qualification, and by workstation location. Role based security uses user roles such as 'Operator' or 'Engineer' to allow access to configuration changes and command execution. Area security restricts access to users who have the proper training or qualifications by assigning users to area user groups that correspond to the area configured for a device. Finally, line of sight security may be implemented to restrict operation to specific computers. All three of these security methods may be implemented concurrently. Refer to [Security Example on page 80](#) for an example implementation.

### Role Based Security

See the link on the front cover of this manual to access the security information spreadsheet.



The images in this section depict a single application with both FactoryTalk User Groups and Domain User Groups together. However, it is not recommended to use both types of user groups in a single application

Runtime security must be set up to provide each account or user group with the correct FactoryTalk View security codes. The security codes verify that operators, maintenance personnel, and engineers have permission to run secured commands, open secured graphic displays, or write to secured tags at runtime.

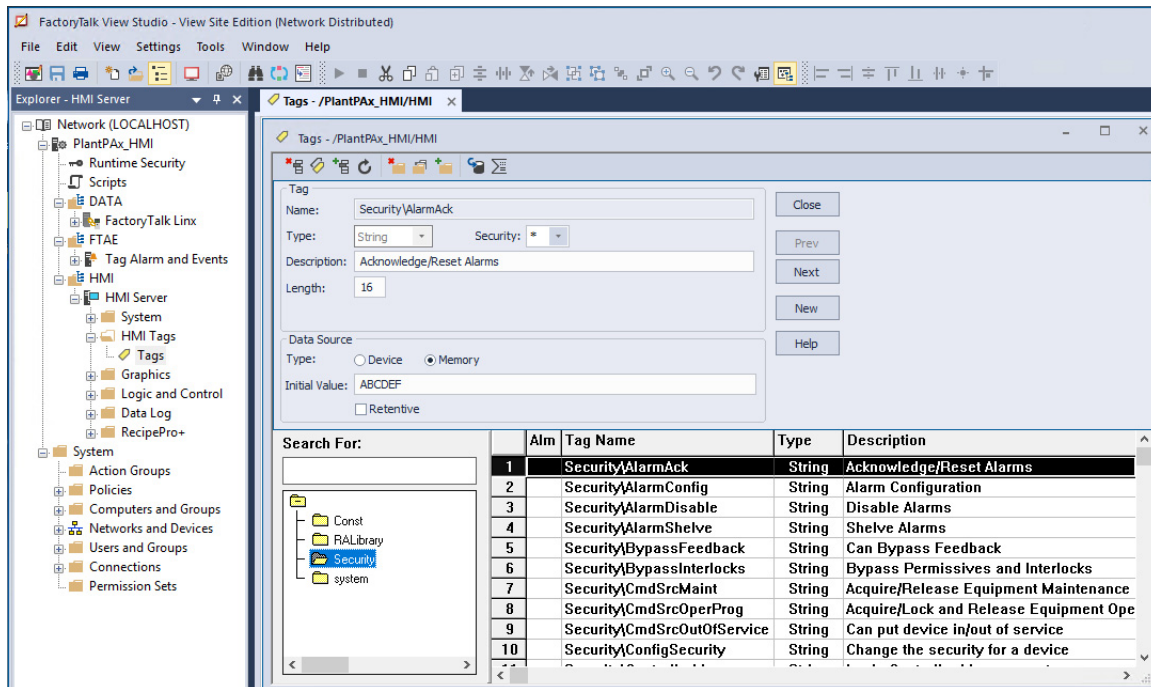
1. On the PASS, go to Rockwell Software > FactoryTalk View > Tools > Tag Import and Export Wizard.

Page	Action
Tag Import and Export Wizard Operations field	From the Operation pull-down menu, select Import FactoryTalk View tag CSV files and click Next.
	From the pull-down menu, select Site Edition and click Browse (ellipsis '...').
	Select the path of SE > HMI Projects > HMI Server.
	Select HMI Server.sed and click Open.
	Click Next and Browse (ellipsis '...') for the FTViewSE_ProcessLibrary_Tags_5_00_xx.CSV file; where xx = the service release number. This file is distributed with the PlantPAx Library of Process Objects Library.
	Click Open, click Next twice, and then Finish. The import results appear on the Database Import window.

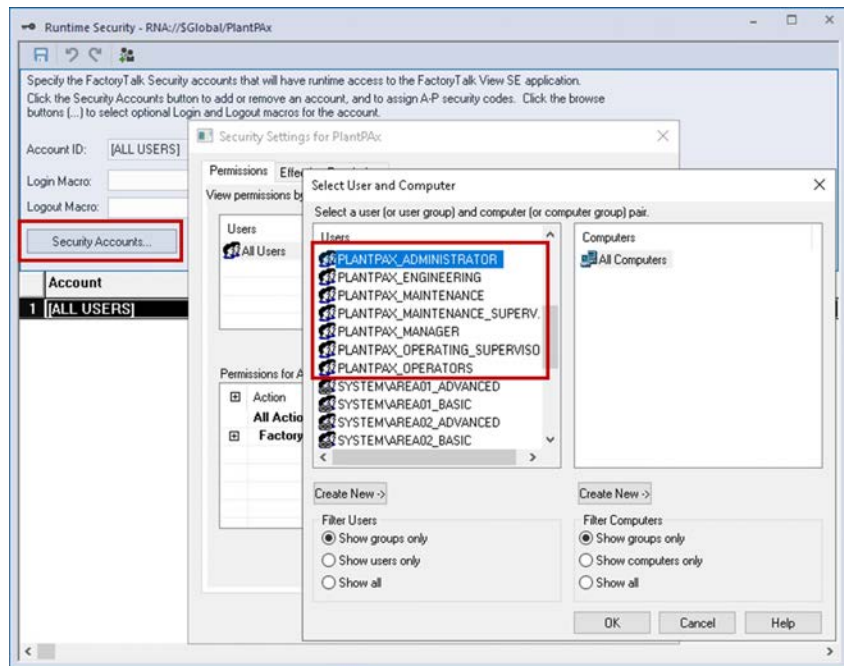
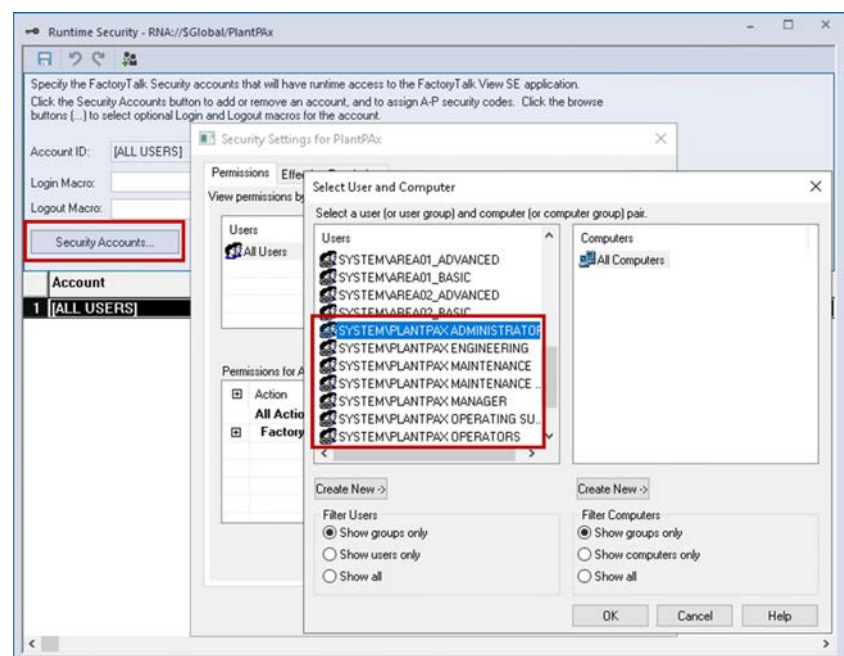
To set security permissions to groups on the workstation, complete these steps.

1. Open the HMI application with FactoryTalk View Studio software.

2. Verify that the security tags have been imported by expanding the HMI Area and viewing HMI Tags folders. (Const, RALibrary, and Security)



3. Select Runtime Security from the Explorer window or top menu bar under Settings.
4. Within Runtime Security, click the Security Accounts button.
5. From the Security Settings dialog box, select 'All Users' and click Remove.
6. Click Add.
7. From the Select Users and Computer dialog box, select a PlantPAX group and click OK.

For **FactoryTalk** user groups:For **Domain** user groups:

8. Repeat adding users until all PlantPax groups are selected.
9. You can assign security to each PlantPax group based on letters (A...G).
10. If you are using e-signature with approval, add the group HMI\_Approver. A-P codes are not required for HMI\_Approver.
11. Select a group from the Users list.

The default is that all FactoryTalk View Security Codes are checked Allow.

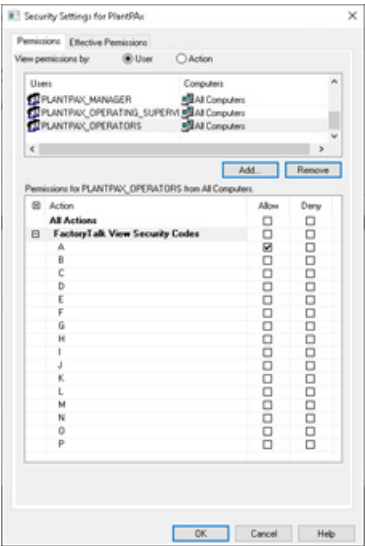
12. Click the Allow box beside each FactoryTalk View Security Code that you want to allow permission for the selected account.

For example, allow security of 'A' for an Operator.

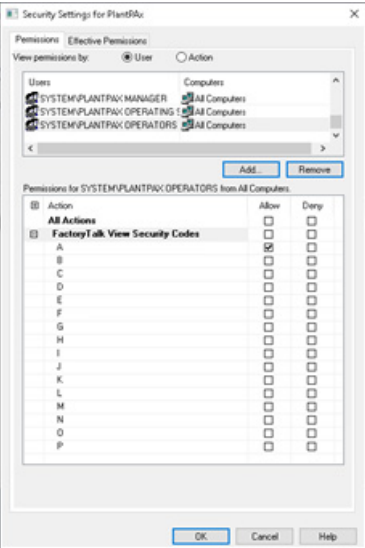
Table 4 - Recommended Group Security Codes

Group	Security Code
Operators	A
Operating Supervisor	B
Maintenance	C
Maintenance Supervisor	D
Engineering	E
Manager	F
Administrator	G

For **FactoryTalk** user groups:



For **Domain** user groups:



13. Repeat the steps for each user or group account that you want to set up with runtime security.

## Area Based Security

Complete these steps to create area **FactoryTalk** user groups for each secure area of a production facility.

1. From the FactoryTalk Administration Console, click '+' to expand System and then click '+' to expand Users and Groups.



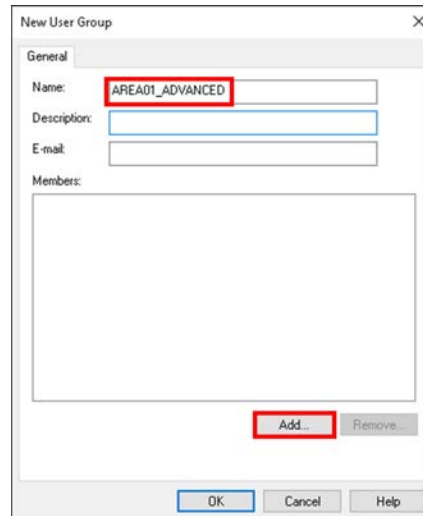
2. Right-click User Groups and choose New>User Group.

On the New User Group dialog box, you must add two groups: 'area01\_Advanced,' 'area01\_Basic'. These groups define which Area01 Users have basic functions on the faceplate or advanced functions (engineering, maintenance).

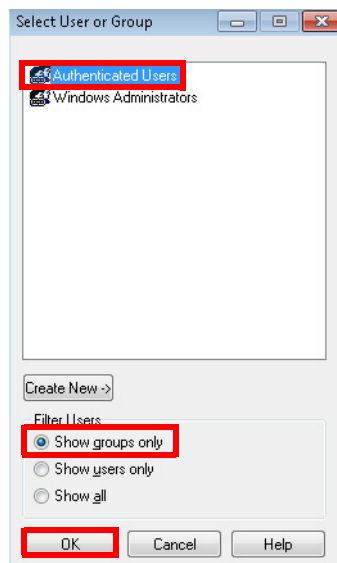


The instructions default to Area01. You may modify the area name in the instruction and group names to meet your needs.

3. To add groups, type the name (example, AREA01\_ADVANCED) and click Add.

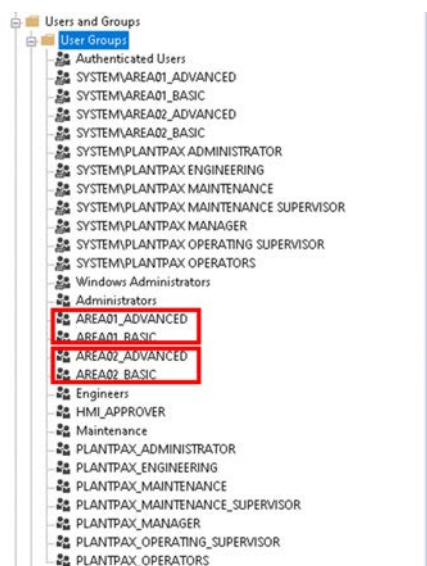


4. Select Authenticated Users and use the default 'Show groups only' and click OK.



5. Click OK again.

Your two groups for AREAO1 look like the example.



6. Repeat [step 3](#) and [step 4](#) to add groups for additional areas.

Complete these steps to import area **Domain** user groups for each secure area of a production facility.

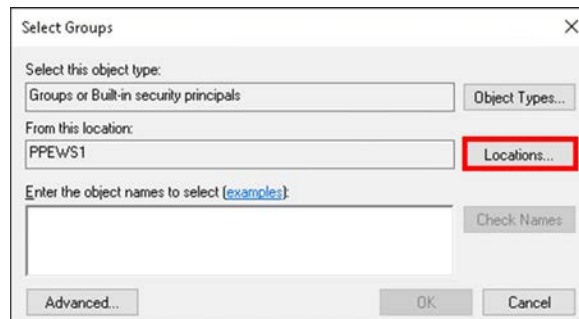
1. From the FactoryTalk Administration Console, click '+' to expand System and then click '+' to expand Users and Groups.
2. Right-click User Groups and choose New>Windows-Linked Group.



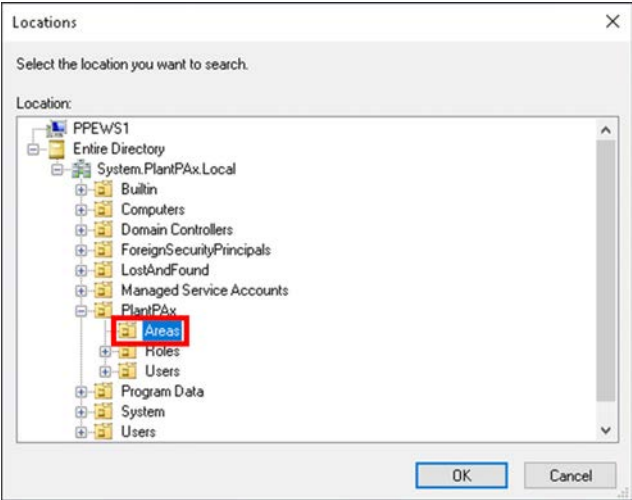
3. Select Add.



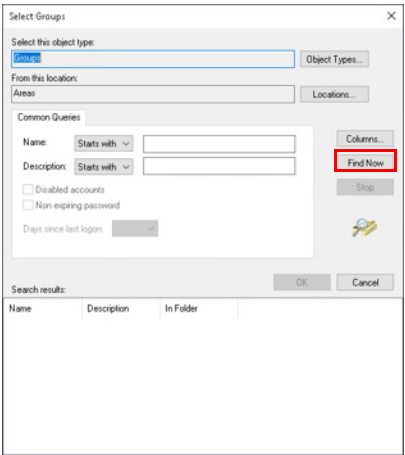
4. Select Locations.



5. Browse to your domain directory where you created areas. For this example System.PlantPAx.Local\PlantPAx\Areas

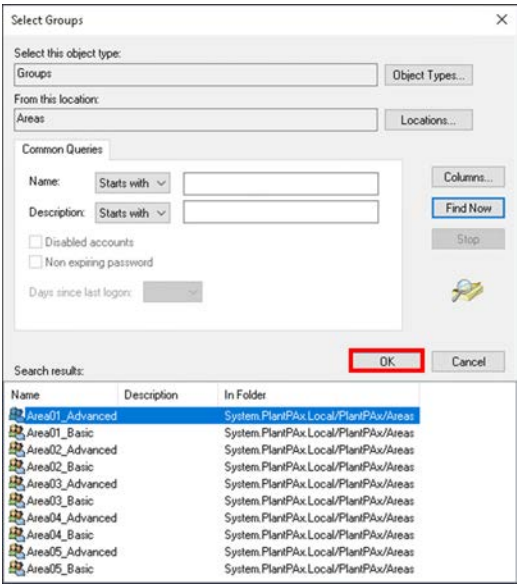


6. Select Find Now.



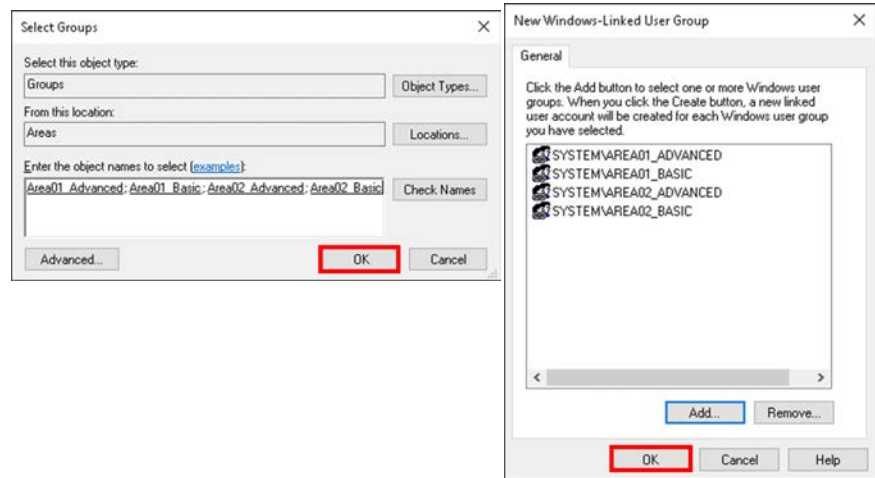
7. Select all the areas from the search results you want to import.

For this example Area01\_Basic, Area01\_Advanced, Area02\_Basic, Area02\_Advanced. Click OK.





8. Select OK on the next two displays.




The domain areas are added to User Groups and look as follows:



Configure an Area

For each object instance in controller code, it is required to configure an area using the instruction dialog box (PlantPax instructions) or extended tag property area (Add-On Instructions). Configuring each instruction with the specified area name will grant or deny permissions on the faceplates for these objects. The following displays use the default value “Areaor”.

 To grant permission on faceplates, the Area name in the controller must match the area created within HMI application (without \_Basic \ \_Advanced).

For **FactoryTalk** user groups:

Figure 3 - PlantPax Instruction Dialog Box

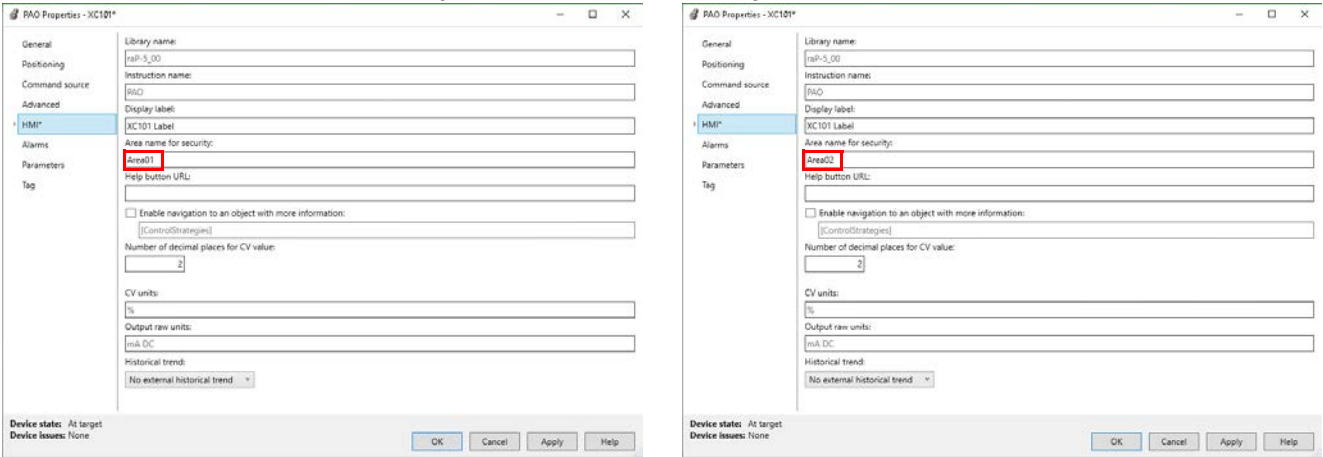
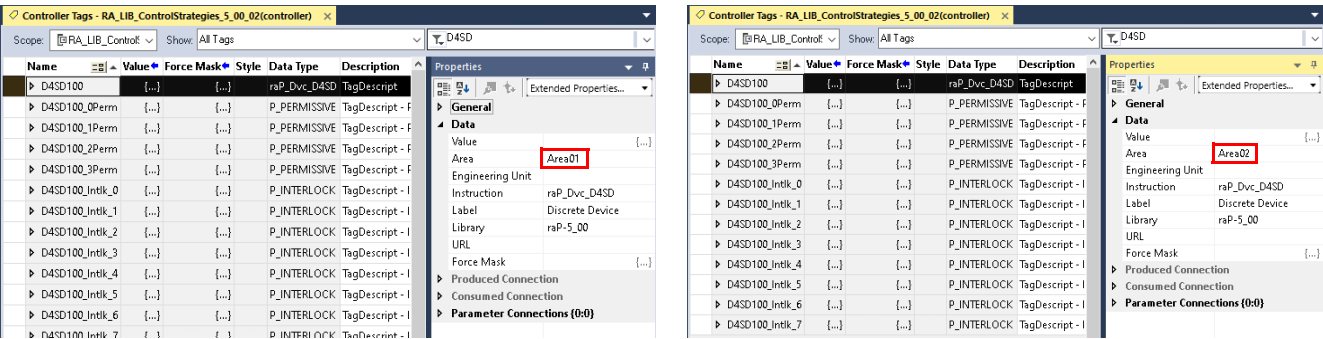


Figure 4 - Add-On Instruction Extended Tag Property



For **Domain** user groups:

Figure 5 - PlantPAx Instruction Dialog Box

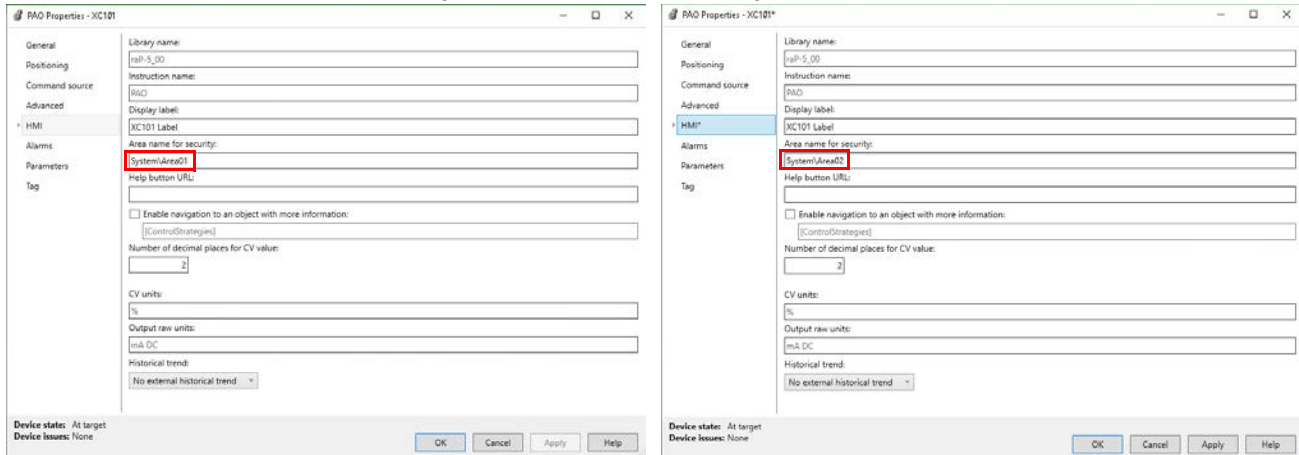
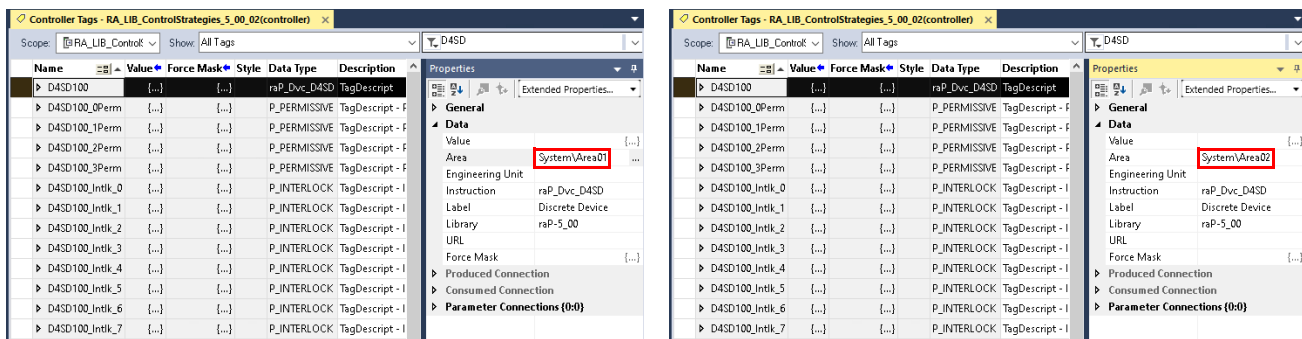


Figure 6 - Add-On Instruction Extended Tag Property



## Adding Users to Groups

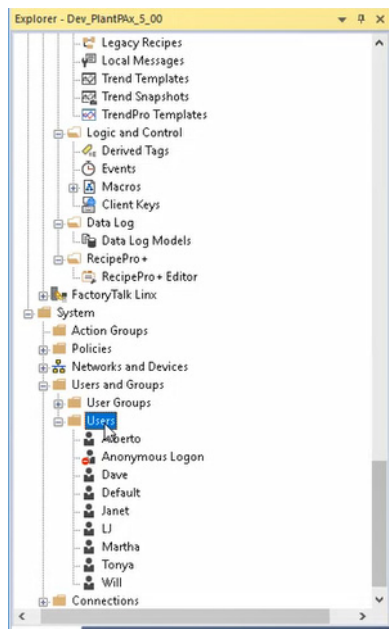
Assign each user to the appropriate user group. Only FactoryTalk users need to be added to Users. No need to add Windows-Linked Users.

With multiple process areas defined (example Area01, Area02), note that each user needs to be assigned not only to the HMI\_{group} (example HMI\_Operator) but also the “area” group. Operators will be assigned to the HMI\_Operator group and then also to the Area01\_Basic group. This limits operator access to only the faceplate operator controls for devices assigned to Area01. Engineers will be assigned to the HMI\_Engineering group and also to the Area01\_Advanced and Area01\_Basic groups. This allows the engineer access to also the advanced engineering features on the faceplates for devices assigned to Area\_01.

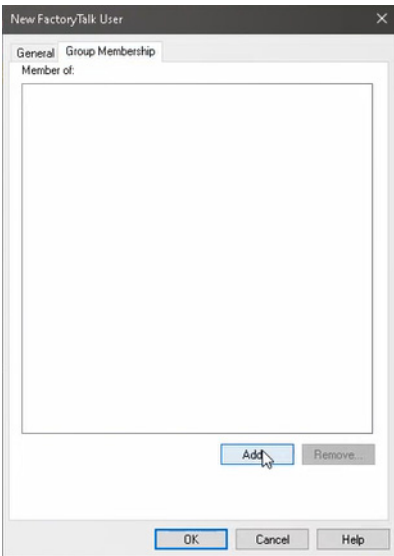
**IMPORTANT** Users assigned to “Advanced” groups must also be assigned to the corresponding “Basic” groups

1. Open the HMI application with FactoryTalk View Studio software.

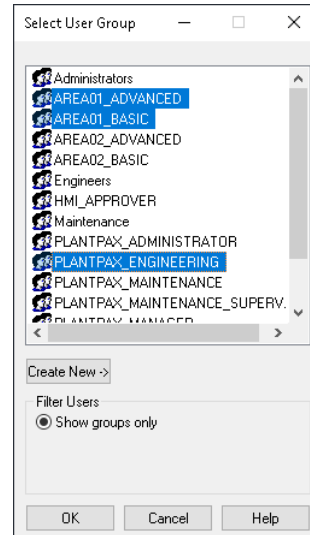
2. Select Users from the menu.



- 3. Right-click on a user to select that user’s properties.
- 4. Select the Group Membership tab and select Add.

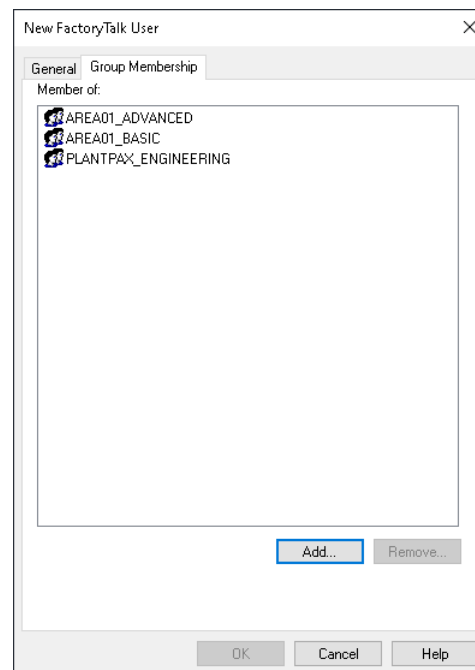


5. Select the groups to assign to the user. (Multiple groups can be selected by holding down the Ctrl key.)



It is recommended that users that belong to the HMI\_Engineer and HMI\_Maintenance\_Supervisor group also be added to both the area01\_Basic and area01\_Advanced groups.

6. Once added, the groups will appear assigned to the user.



## Line of Sight Based Security

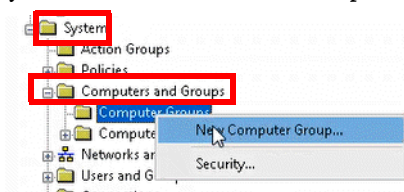
The procedures for this functionality require a distributed system. This section describes how to add a desired computer to a group ('Computer Group') and to an area of the plant.

---

**IMPORTANT** The macro 'NavToDisplay with line of sight' must be added to the project and renamed 'NavToDisplay' to replace the existing 'NavToDisplay'.

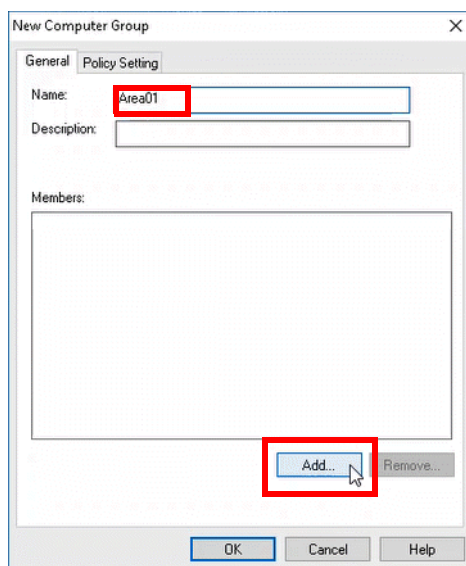
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1. From the FactoryTalk View Distributed application, click '+' to expand System and then click '+' to expand Computers and Groups.

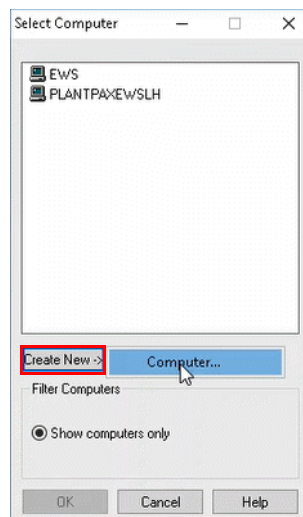


2. Right-click Computer Groups and choose New Computer Group.
3. Enter the area name and click Add.

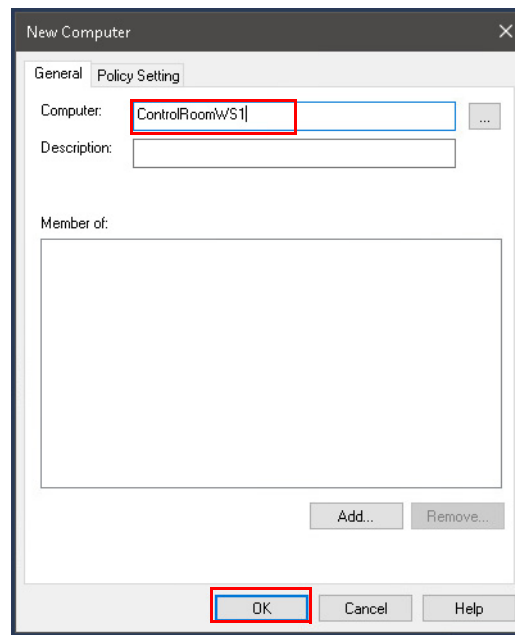
The area name is the same name as the area name configured in the controller. The computer area name does not have the 'Basic' or 'Advanced' suffix.



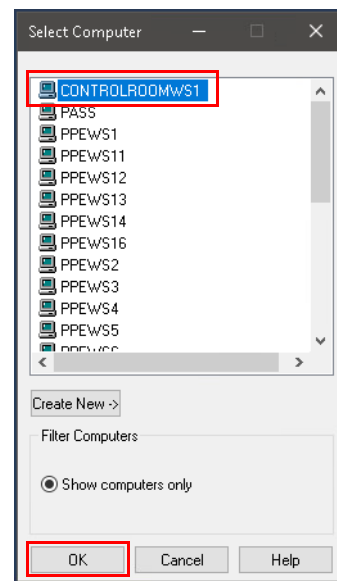
4. On the Select Computer window, select Create New and choose Computer.



5. Enter a desired computer name.



6. Select the name of the desired computer.





7. To add the computer group to the area, click OK.

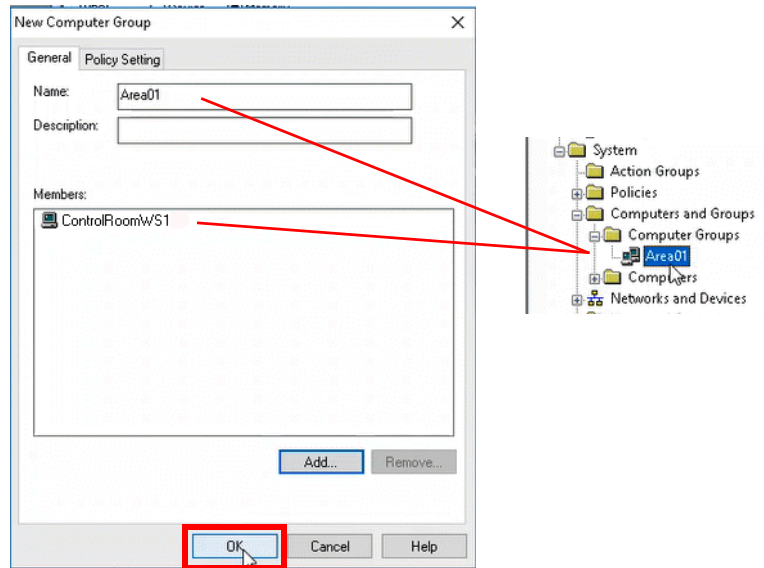
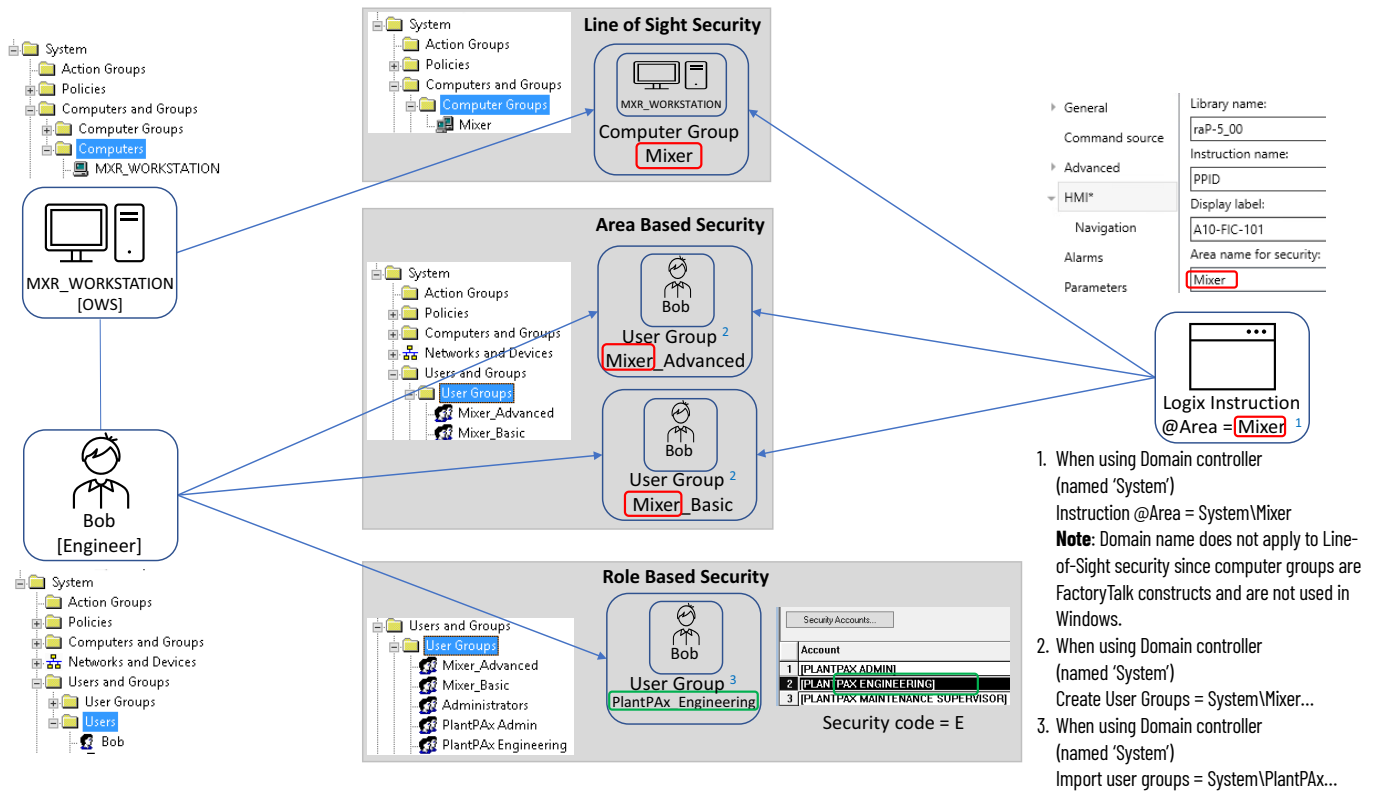


Figure 7 - Security Example



## Network Infrastructure

The PlantPax® system supports several network topologies to meet your network application requirements.

### Quick Start

These are recommended topologies for your PlantPax system. For experienced users, each section summarizes a topology. For more detailed information, follow the referenced links.

1

#### Redundant PRP Topology

This architecture helps prevent downtime by the duplication of infrastructure for the most critical process operations:

- NIC teaming for dual connections between PASS servers and supervisory controllers
- EIGRP (Enhanced Interior Gateway Routing Protocol) provides Layer 3 routing capabilities
- HSRP provides redundant PRP 'RedBox' functionality
- PRP provides dual connectivity between two devices
- RedBox (redundancy box) connects devices without PRP technology to both LAN A and LAN B
- Cisco® Stackwise provides redundancy at core switches

For more information, see [Redundant PRP Topology](#).

2

#### Resilient DLR Topology

This architecture provides a means to detect, manage, and recover from a single fault in a ring-based network. You can use redundant gateways to provide DLR network resiliency to the rest of the network. This architecture also includes the following:

- NIC teaming for dual connections between PASS servers and supervisory controllers
- EIGRP (Enhanced Interior Gateway Routing Protocol) provides Layer 3 routing capabilities
- Redundant DLR gateway functionality
- DLR is a ring topology that recovers after a single point of failure
- Cisco® Stackwise provides redundancy at core switches

For more information, see [Resilient DLR Topology](#).

3

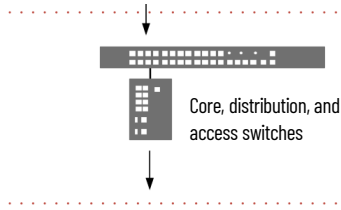
#### Simplex-Star Topology

This architecture provides a basic network configuration. You can monitor and control non-critical equipment.

- No disruptions to the network when you connect or remove devices.
- **IMPORTANT:** If a connecting network device fails, there is no redundancy and connected nodes cannot communicate on the network.
- EtherNet/IP™ backbone between devices in a STAR topology
- NIC teaming is optional.

For more information, see [Simplex - Star Topology](#).

## Prerequisites



Following the [System Workflow](#), design the network infrastructure. You need to know which of the following are in your system:

- Domain controller or workgroup
- PASS or PASS-C

Before you design and implement a PlantPax network infrastructure, we expect the following:

- Have experience with VLAN and IP schemes.
- Have a network design that defines the requirements for the supervisory and control networks in the PlantPax system.
- Be familiar with how to use the Express Setup and Device Manager utilities to set up and configure Stratix® switches.
- Be familiar with the Cisco IOS command-line interface (CLI).
- Verify that no fixed IP is assigned to the workstation that is being used to configure the switch. You want the switch to manage the IP address configuration in your computer.

For more information, see these additional resources.

Resource	Description
Stratix Managed Switches User Manual, publication <a href="#">1783-UM007</a>	Describes how to set up, configure, and troubleshoot Stratix switches.
Converged Plantwide Ethernet (CPwE) Design and Implementation Guide, publication <a href="#">ENET-TD001</a>	Describes tested and validated industrial network architectures, recommendations and best practices, including network resiliency and security.
EtherNet I/P Parallel Redundancy Protocol Application Technique, publication <a href="#">ENET-AT006</a>	Describes how you can configure a PRP network with a compatible device or switch.
EtherNet I/P Device Level Ring Application Technique, publication <a href="#">ENET-AT007</a>	Describes DLR network operation, topologies, configuration considerations, and diagnostic methods.
Deploying a Resilient Converged Plantwide Ethernet Architecture, Publication <a href="#">ENET-TD010</a>	Describes how to design and deploy a resilient plant-wide or site-wide LAN architectures for IACS applications.
Deploying Device Level Ring within a CPwE Architecture, publication <a href="#">ENET-TD015</a>	Describes how to design and deploy DLR technology with IACS device-level, switch-level, and mixed device/switch-level ring topologies across OEM and plant-wide or site-wide IACS applications.
Scalable Time Distribution within a Converged Plantwide Ethernet Architecture, publication <a href="#">ENET-TD016</a>	Describes how to design and deploy Scalable Time Distribution technology throughout a plant-wide Industrial Automation and Control System (IACS) network infrastructure.
Deploying Parallel Redundancy Protocol within a CPwE Architecture, publication <a href="#">ENET-TD021</a>	Describes how to design and deploy PRP technology with redundant network infrastructure across plant-wide or site-wide IACS applications.

## Network Configuration Preparation

Smart devices on PlantPax system architectures communicate on the EtherNet/IP network via Stratix and Cisco switches. These managed switches provide a secure switching infrastructure for harsh environments. You can connect the switches to network devices such as servers, routers, and other switches. In industrial environments, you can connect Ethernet-enabled industrial communication devices, including controllers, human machine interfaces (HMIs), drives, sensors, and I/O.

The Ethernet network provides the communication backbone for the supervisory network for the workstations, servers, and the controllers:

- Configure all communication interfaces to operate at the fastest speed possible for your hardware configuration, full-duplex for 100/1000 network adapters. See Important for autonegotiate settings.

---

**IMPORTANT** Use of autonegotiate settings is recommended to reduce chance of mis-configuration and failures. However, it is desirable to operate at the fastest speed possible at full-duplex. We recommend verifying your switch settings during commissioning to make sure that the system was able to autonegotiate properly. The speed and duplex settings for the devices on the same Ethernet network must be the same to avoid transmission errors.

---

- Select the cable type based on environmental conditions.

Type	Details
Fiber-optic	<ul style="list-style-type: none"> <li>• Long distances</li> <li>• Near high magnetic fields, such as induction-heating processes</li> <li>• For extreme high-noise environments</li> <li>• For poorly grounded systems</li> <li>• For outdoor applications</li> </ul>
Shielded twisted-pair	<ul style="list-style-type: none"> <li>• Use Category 5e, 6, or 6a cables and connectors</li> <li>• Use termination sequence 568A for industrial applications</li> </ul>

- If multiple DCOM protocols are installed and set up on a workstation, to make sure that DCOM communication functions correctly, and remove all protocols other than TCP/IP.

Follow these guidelines for devices on the EtherNet/IP network:

- Make sure that an I/O module RPI is two times faster than the periodic task that you are using.
- The number of devices can affect the CIP/TCP count differently. Never use more than 80% of the available connections for the communication modules.
- Consider packets per second for performance if you use many devices.
  - I/O packets per second (pps) describes an implicit message rate (Class 1). An I/O communication use approaching or above 80% can necessitate an adjustment to the RPI.
  - HMI packets per second (pps) describes an explicit message rate (Class 3). RSLinx® connections and message instructions generate CIP™ traffic. HMI traffic is TCP-based, not UDP-based.
  - The combination of implicit and explicit messaging provides the total use for a device. If you add implicit messaging (I/O), it takes bandwidth from the HMI because it has higher priority than HMI messaging. The combination of CIP implicit (highest priority) and CIP explicit (second priority) cannot exceed 100% use.
- Use compatible keying on communication modules. In a validated environment, you can use an exact match for keying.

## Recommended VLANs

Subnets segment the devices in a network into smaller groups. The IP address and associated subnet mask are unique identifiers for the switch in a network.

The following table of recommended VLANs segments the system and recommends IP address ranges. Use these recommendations with the topology worksheet to segment your system.



---

Knowledgebase Technote, [\*PlantPAx System Release 5.0 Configuration and Implementation Tools\*](#), contains the recommended topology and switch settings. Download the spreadsheet from this public article and use the tab referenced in each step.

You may be asked to log in to your Rockwell Automation web account or create an account if you do not have one. You do not need a support contract to access the article.

---

Table 5 - Descriptions for VLANs and Ethernet Address Ranges<sup>(1)</sup>

VLAN ID (Name)	EtherNet/IP Address Range		Description
1	N/A	N/A	Not used
300 (Native VLAN) <sup>(2)</sup>	N/A		Not to have any assigned IP addresses Native for Control and Supervisory
500 (Control network management VLAN)	172.18.0.1		Default gateway
	172.18.0.2	172.18.0.9	VLAN routing – switch addresses (to be utilized for Layer 3 switches)
	172.18.0.10	172.18.0.253	Application – switch addresses
501 (Control network – Default)	172.18.1.1	N/A	Default gateway
	172.18.1.2	172.18.1.9	VLAN routing
	172.18.[2...].10	172.18.[...9].253	Ethernet interface between controllers and system applications.
502...509 (Additional Control network VLANs for IO and MCC)	172.18.[2...].1	172.18.[...9].1	Default gateway
	172.18.[2...].2	172.18.[...9].9	VLAN routing
	172.18.[2...].10	172.18.[...9].253	Ethernet interface between controllers, I/O modules, and MCCs (fixed)
600 (HMI Control + Supervisory management VLAN)	172.20.0.1	N/A	Default gateway
	172.20.0.2	172.20.0.9	VLAN routing – switch addresses (to be used for Layer 3 switches)
	172.20.0.10	172.20.0.253	Application – switch addresses
601 (HMI Control network + Supervisory network – wired network)	172.20.1.1	N/A	Default gateway
	172.20.1.10	N/A	Domain/DNS primary server
	172.20.1.11	N/A	Domain/DNS secondary server
	172.20.1.12	172.20.1.99	Servers and workstations (DHCP)
	172.20.1.2	172.20.1.9	VLAN routing
	172.20.1.1	172.20.1.25	Workstation interface
602 (Supervisory network – wireless network)	172.20.2.1	N/A	Default gateway
	172.20.2.2	172.20.2.9	VLAN routing – switch addresses (to be used for Layer 3 switches)
	172.20.2.10	172.20.2.253	Mobile interface
603 (External – untrusted network) <b>Note:</b> From IDMZ (industrial demilitarized zone)	172.20.3.1	N/A	Default gateway
	172.20.3.2	172.20.3.9	VLAN routing – switch address (to be used for Layer 3 switches)
	172.20.3.10	172.20.3.253	External interface

(1) The referenced IP Addresses can be changed for your system requirements.

(2) All networks do not use a dedicated management VLAN, but it is a good practice. Many times, a supervisory VLAN is the same VLAN as the management VLAN.

## Command Line Interface (CLI)

Along with Device Manager and Logix Designer, you can use the Cisco IOS command-line interface (CLI) to manage the switch. This interface enables executes Cisco IOS commands by using a router console or terminal, or by using remote access methods. You can:

- Connect directly to the switch console port
- Enable Secure Shell (SSH) or Telnet in Device Manager

For more information about how to use the CLI, see [www.cisco.com](http://www.cisco.com).

# Redundant PRP Topology

Parallel Redundancy Protocol (PRP) is defined in international standard IEC 62439-3 and provides high-availability in Ethernet networks. PRP technology creates seamless redundancy by sending duplicate frames to two independent network infrastructures, which are known as LAN A and LAN B.

A PRP network includes the following components.

Component	Description
LAN A and LAN B	Redundant, active Ethernet networks that operate in parallel.
Double attached node (DAN)	An end device with PRP technology that connects to both LAN A and LAN B.
Single attached node (SAN)	An end device without PRP technology that connects to either LAN A or LAN B. A SAN does not have PRP redundancy.
Redundancy box (RedBox)	A switch with PRP technology that connects devices without PRP technology to both LAN A and LAN B.
Virtual double attached node (VDAN)	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.
Infrastructure switch	A switch that connects to either LAN A or LAN B and is not configured as a RedBox.

Redundancy uses Hot Standby Router Protocol (HSRP). HSRP lets you configure two or more routers as standby routers, but only one router is active at a time.

## Additional Resources for PRP Topology

For more information, see these additional resources.

Resource	Description
Design Guide, Deploying Parallel Redundancy Protocol within a CPWe Architecture, publication <a href="#">ENET-TD021</a> .	Highlights key IACS application requirements, technology, and supporting design considerations to help with the successful design and deployment of PRP applications.
EtherNet/IP Parallel Redundancy Protocol, publication <a href="#">ENET-AT006</a>	Describes how you can configure a Parallel Redundancy Protocol (PRP) network with a compatible device or switch.
EtherNet/IP Network Configuration, publication <a href="#">ENET-UM001</a>	Explains Logix 5000™ tools that are used in EtherNet/IP topologies and network operation.
Cisco Catalyst® 9300 Series Switches	Describes the <a href="#">hardware installation</a> .
	Describes how to <a href="#">update firmware</a> .
	Lists the recommended <a href="#">firmware downloads</a> .
	Describes how to <a href="#">configure the switch</a> .





1. Configure the Cisco stack switches.

See the '1 PRP Cisco Stack Switch' tab in the topology worksheet.xlsx.

- a. Connect to distribution switches
- b. Connect to application servers

For stacking guidelines and cabling considerations, see Cisco user documentation.

2. Configure the HSRP distribution switches.

See the '2 PRP HSRP Switch' tab in the topology worksheet.xlsx.

- a. Connect distribution switches to the core stack
- b. Configure PRP

3. Configure the LAN A/B access switches.

See the '3 PRP LAN A B' tab in the topology worksheet.xlsx.

4. Configure the Redbox switches.

See the '4 PRP Redbox Infrastructure' tab in the topology worksheet.xlsx.

5. Add PRP devices or skids.

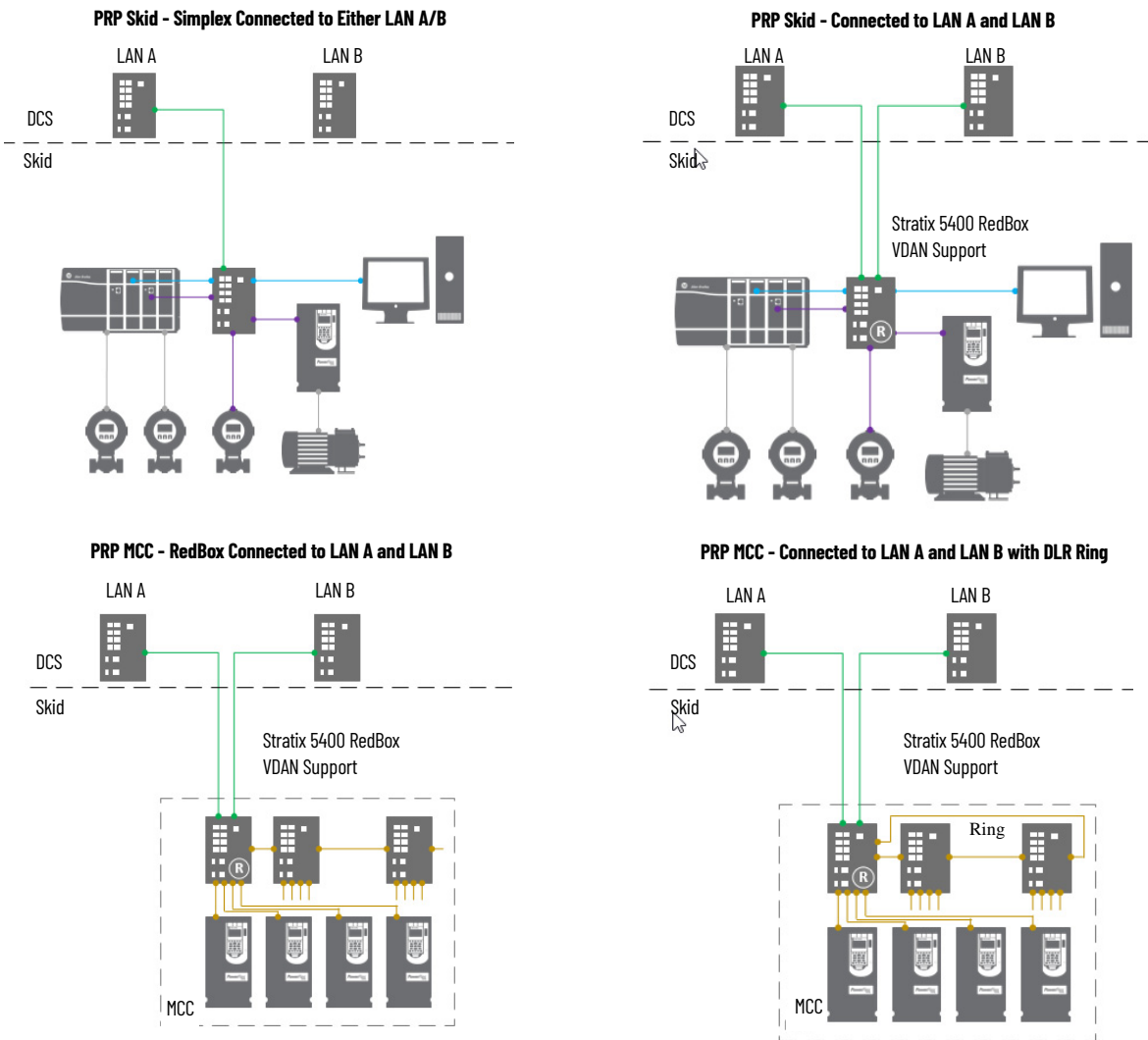
See the user documentation for your devices on how to configure PRP settings.

For examples, see [Figure 9](#).

6. Verify the PRP configuration.

See the '5 PRP Verification' tab in the topology worksheet.xlsx.

Figure 9 - PRP Skid and MCC Lineup



## Resilient DLR Topology

Device Level Ring (DLR) is an EtherNet/IP protocol defined by the Open DeviceNet® Vendors' Association (ODVA). DLR provides a means to detect, manage, and recover from single faults in a ring-based network.

A DLR network includes the following types of ring nodes.

Node	Description
Ring supervisor	<p>A ring supervisor provides these functions:</p> <ul style="list-style-type: none"> <li>Manages traffic on the DLR network</li> <li>Collects diagnostic information for the network</li> </ul> <p>A DLR network requires at least one node to be configured as ring supervisor. By default, the supervisor function is disabled on supervisor-capable devices.</p>
Ring participants	<p>Ring participants provide these functions:</p> <ul style="list-style-type: none"> <li>Process data that is transmitted over the network.</li> <li>Pass on the data to the next node on the network.</li> <li>Report fault locations to the active ring supervisor.</li> </ul> <p>When a fault occurs on the DLR network, ring participants reconfigure themselves and relearn the network topology.</p>
Redundant gateways (optional)	<p>Redundant gateways are multiple switches connected to a single DLR network and also connected together through the rest of the network. Redundant gateways provide DLR network resiliency to the rest of the network.</p>

Consider the following if you choose this topology:

- Depending on firmware capabilities, both devices and switches can operate as supervisors or ring nodes on a DLR network. Only switches can operate as redundant gateways.
- Multiport EtherNet/IP devices equipped with DLR technology connect directly to neighboring nodes and form a ring topology at the end devices. If a break in the line is detected, the network provides an alternate routing of the data to help recover the network at fast rates.
- All end devices that are tightly coupled to a controller must be a part of the same embedded switch topology. This peer-to-peer architecture reduces the physical amount (and therefore cost) of cabling.
- Enhanced diagnostics built into DLR-enabled products identify the point of failure, helping to speed maintenance and reduce mean time to repair.
- The DLR ring supervisor maintains a loop-free topology by blocking port 2 of the embedded-switch device. If the supervisor detects a fault in the network it unblocks port 2 until the fault is corrected. It is important to remember to enable a ring supervisor before closing the DLR ring. If the ring closed before the supervisor is enabled, a bridge loop results, which generates a broadcast storm.

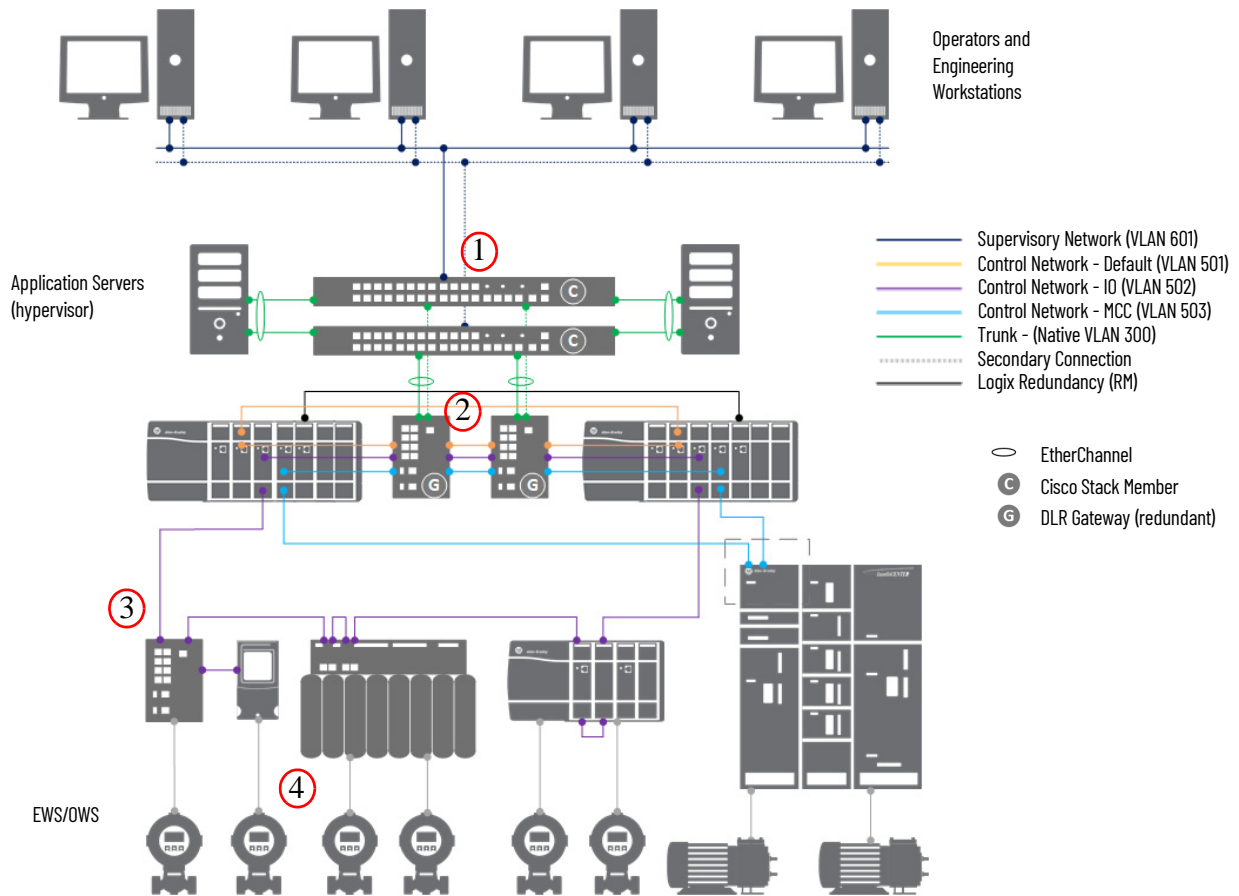
Additional Resources for DLR Topology

For more information, see these additional resources.

Resource	Description
EtherNet/IP Device Level Ring, publication <a href="#">ENET-AT007</a>	Describes DLR network operation, topologies, configuration considerations, and diagnostic methods
EtherNet/IP Network Configuration, publication <a href="#">ENET-UM001</a>	Explains Logix 5000 tools that are used in EtherNet/IP topologies and network operation.

[Figure 10](#) shows an example DLR topology. The numbers circled in red match the sequential instructions below the example.

Figure 10 - Resilient DLR Topology Example



## Switch Configuration in a Resilient DLR Topology

Switch configuration in a DLR topology follows the work flow shown in [Figure 10](#).



Knowledgebase Technote, [PlantPAx System Release 5.0 Configuration and Implementation Tools](#), contains the recommended topology and switch settings. Download the spreadsheet from this public article and use the tab referenced in each step.

You may be asked to log in to your Rockwell Automation web account or create an account if you do not have one. You do not need a support contract to access the article.



**WARNING:** Do not connect switches together before the network is fully configured.

1. Configure the Cisco stack switches.

See the '1 DLR Cisco Stack Switch' tab in the topology worksheet.xlsx.

- a. Connect to distribution switches
- b. Connect to application servers

For stacking guidelines and cabling considerations, see the Cisco user documentation.

2. Configure the gateways.

See the '2 DLR Gateway Switch' tab in the topology worksheet.xlsx.

3. Configure the ring access switches.

See the '3 DLR Ring Switch' tab in the topology worksheet.xlsx.

4. Add DLR devices or skids.

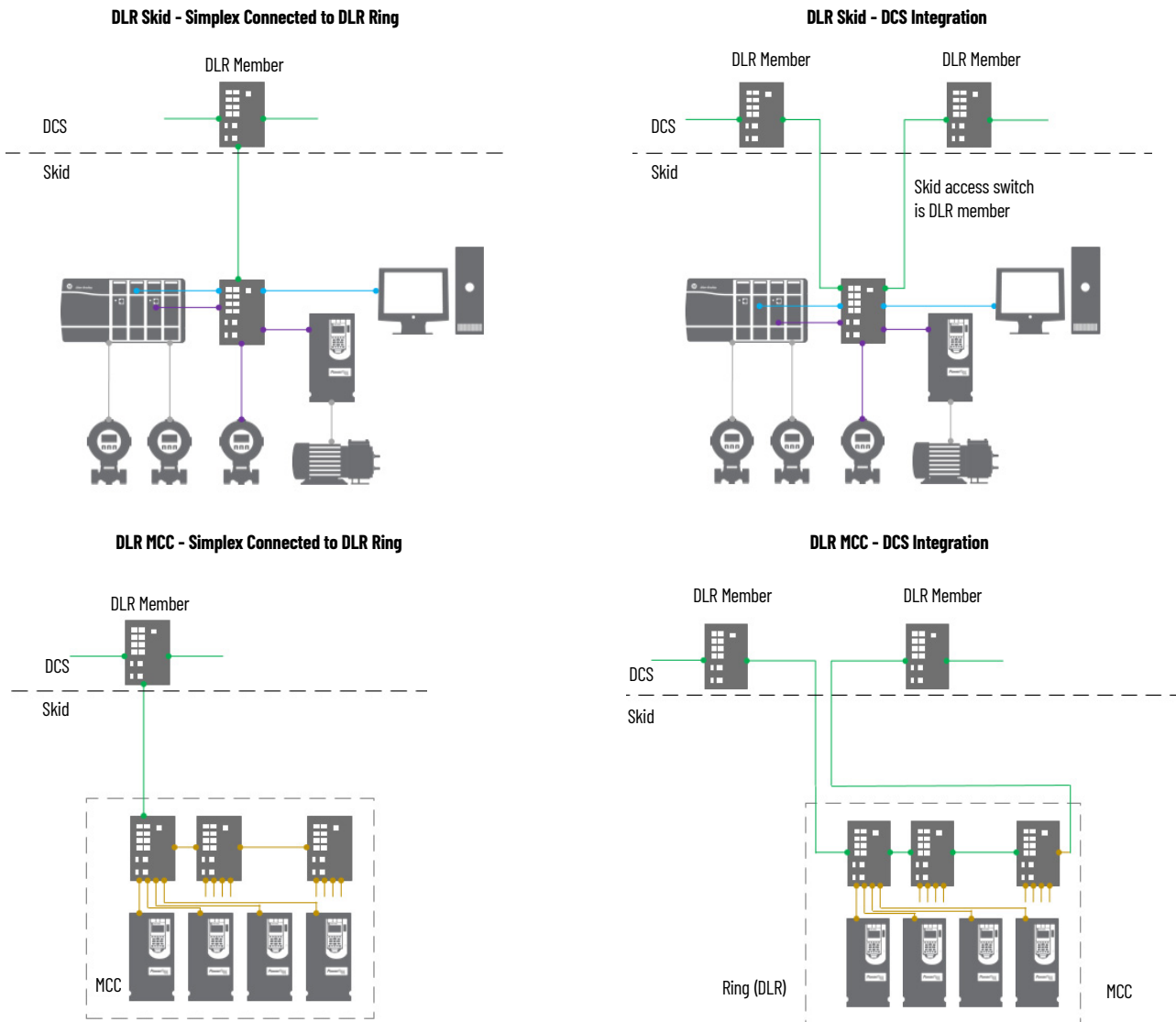
See the user documentation for your devices on how to configure DLR settings.

For examples, see [Figure 11](#).

5. Verify the DLR configuration.

See the '4 DLR Verification' tab in the topology worksheet.xlsx.

Figure 11 - DLR Skid and MCC Lineup

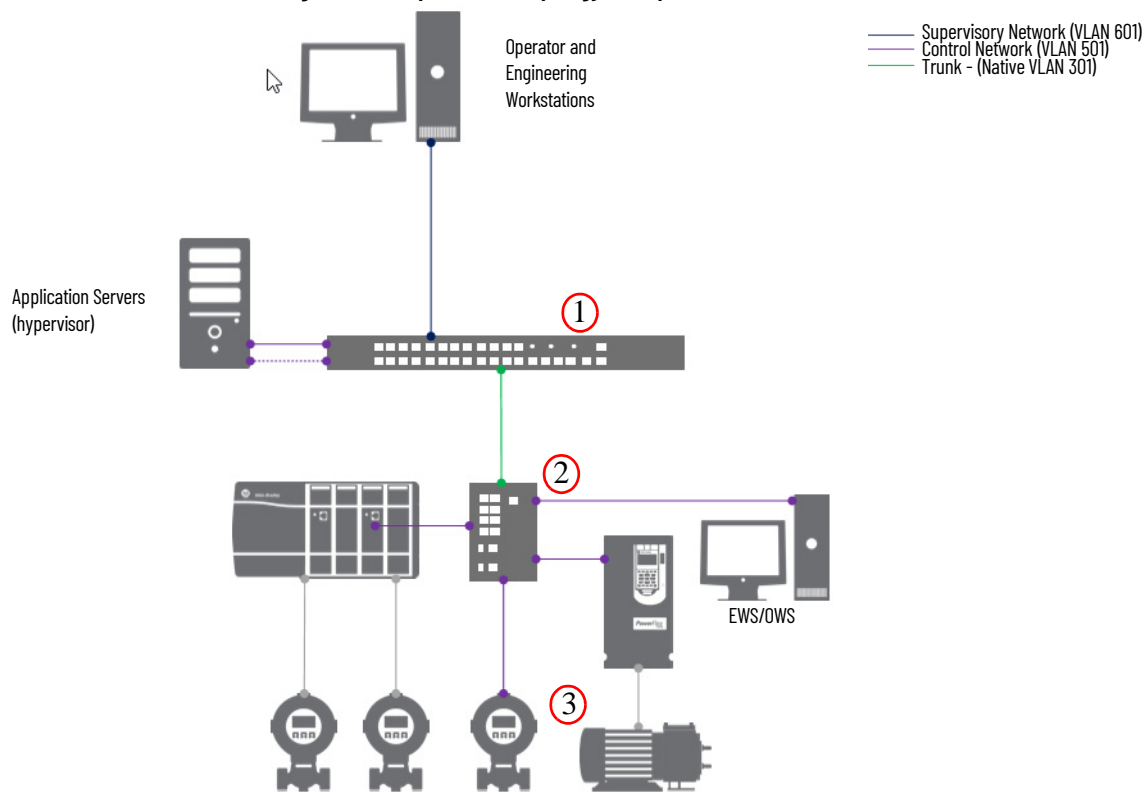


## Simplex - Star Topology

In a star topology, access switches serve as an uplink from the servers to the workstations. Layer 2 switches also send information packets at the controller level from the end devices. With multiple network levels, access switches control the flow of information to make sure that packets are delivered to the correct network level.

[Figure 12](#) shows an example simplex star topology. The numbers circled in red match the sequential instructions below the example.

Figure 12 - Simplex - Star Topology Example



Consider the following if you choose this topology:

- The first switch that Rockwell Automation equipment touches must have IGMP snooping enabled. IGMP snooping enables switches to forward multicast packets to ports that are only part of a particular multicast group.

Additional Resources for Simplex Star Topology

For more information, see these additional resources.

Resource	Description
Stratix Managed Switches User Manual, publication <a href="#">1783-UM007</a>	Describes the embedded software features and tools for configuring and managing the Stratix 5410, Stratix 5400, and the Stratix 5700 Ethernet managed switches.
Stratix Infrastructure Product Family Quick Reference Drawing, publication <a href="#">IASIMP-QR029</a>	Illustration that shows options for connecting your plant network by using standard Ethernet technology.

## Switch Configuration in a Simplex Topology

Switch configuration in a simplex topology follows the work flow shown in [Figure 12](#).



**WARNING:** Do not connect switches together before the network is fully configured.



Knowledgebase Technote, [PlantPax System Release 5.0 Configuration and Implementation Tools](#), contains the recommended topology and switch settings. Download the spreadsheet from this public article and use the tab referenced in each step.

You may be asked to log in to your Rockwell Automation web account or create an account if you do not have one. You do not need a support contract to access the article.

1. Configure the Cisco stack switches switch.

See the '1 Simplex Cisco Stack Switch' tab in the topology worksheet.xlsx.

For stacking guidelines and cabling considerations, see the Cisco user documentation.

2. Configure the access switches.

See the '2 Simplex Access Switch' tab Simplex Switches tab in the topology worksheet.xlsx.

3. Add simplex devices.

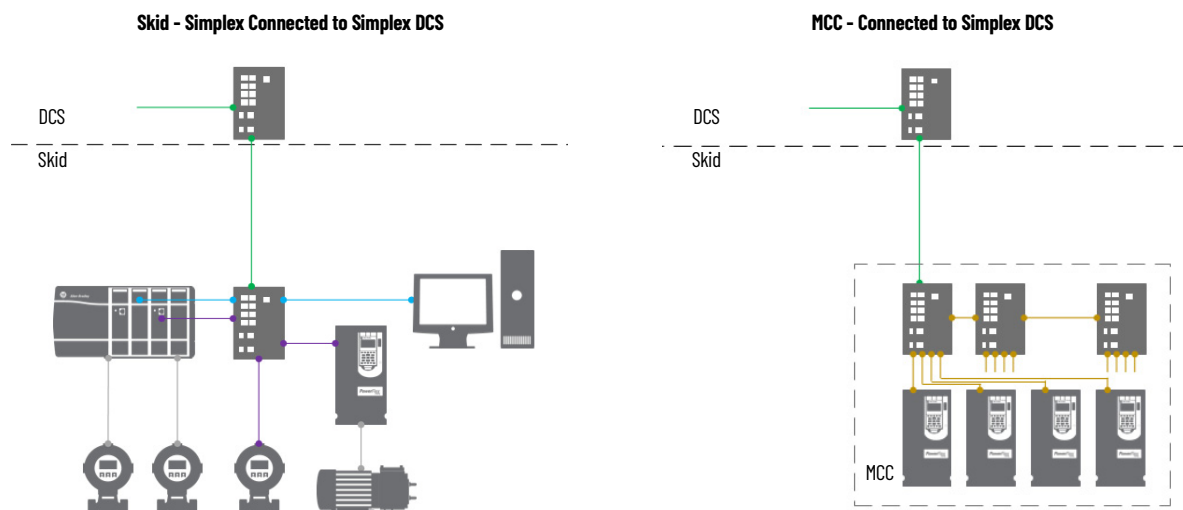
See the user documentation for your devices on how to configure network settings.

For examples, see [Figure 13](#).

4. Verify the Simplex configuration.

See the '3 Simplex Verification' tab in the topology worksheet.xlsx.

**Figure 13 - Simplex Skid and MCC Lineup**





## Perimeter Network Considerations

The Perimeter Network (Microsoft®) is a buffer that enforces data security policies between a trusted network (Industrial Zone) and an untrusted network (Enterprise Zone).

For secure data sharing, the Perimeter Network contains assets that act as brokers between the zones. Consider these methods:

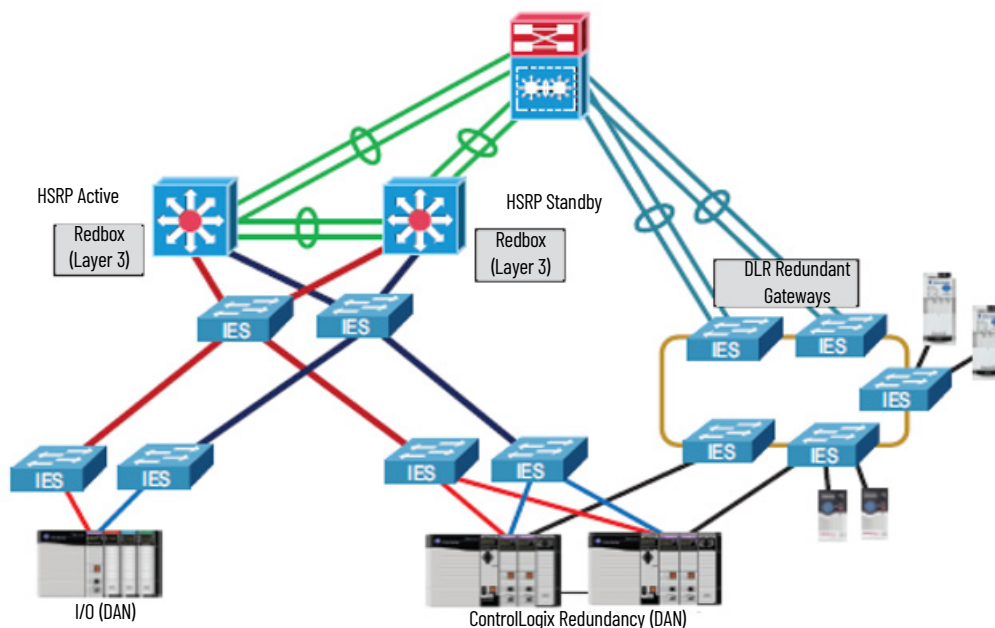
- Use an application mirror, such as a PI-to-PI interface for FactoryTalk® Historian
- Use Microsoft Remote Desktop Gateway services
- Use a reverse proxy server

## Interoperability Between Topologies

The flexibility and scalability of the PlantPAx system architecture supports multiple field device integration options and enables process communication for ease of integration.

Interoperability tests focus on not only device testing, but also on system testing of all the components, interface devices and tools from a variety of suppliers. These tests reduce start-up cost and help save up to an estimated 2...4 days per device during integration.

Figure 14 - Topology Interoperability Example



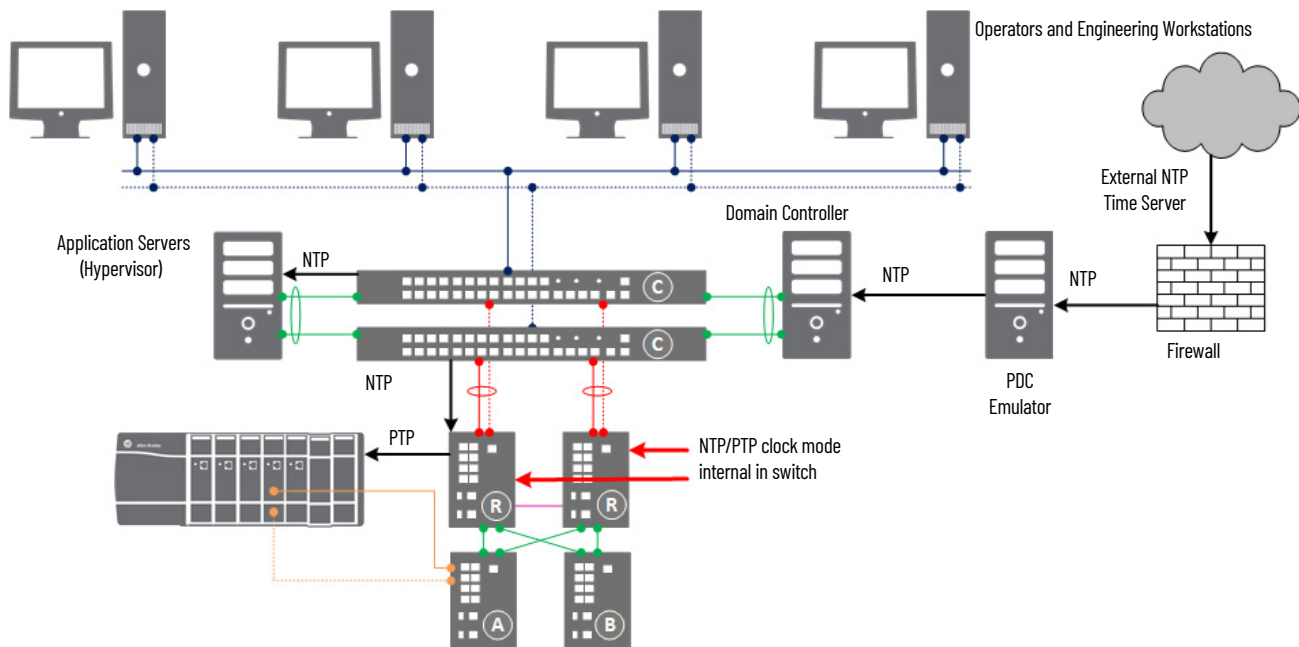
## Time Synchronization

System time synchronization is important so that the internal clocks in the controllers, workstations, and servers reference the same time for any event or alarm that occurs. Configure the PASS, application servers, OWS, and EWS to use a single server (for example, a domain controller) as their time reference and keep their clocks tightly synced to it.

This chapter describes procedures for configuring time-sync applications by using two common protocols:

- Network Time Protocol (NTP)
- Precision Time Protocol (PTP)

NTP synchronizes time over the plant floor on an Ethernet network as shown in the following figure. NTP sources Coordinated Universal Time (UTC) as the universal standard for current time. Typically for Windows, a domain controller sources UTC time and becomes the Reliable Time Server for the domain.



Two methods are described to use UTC time in your domain:

- Via your local network (intranet) or the Internet (previous diagram)
- Via GPS

The Internet can introduce more propagation delays than GPS that can cause inaccuracies in your system. Although the NTP system affords algorithms to calculate accurate time for either method, the GPS method provides better accuracy.

The Stratix switch is responsible for converting network time protocol (NTP) to precision time protocol (PTP). This functionality is available only in the Stratix 54x0 family.

GPS uses a global positioning system for high precision time accuracy. All components with real-time clocks follow the same reference. However, a

1756HP-TIME module propagates directly to computers, controllers, and other devices via Ethernet switches.

For more information on time synchronization and CIP Sync, see the Integrated Architecture® and CIP Sync Configuration manual, publication [IA-AT003](#).

Considerations

Consider the following suggestions before starting this chapter:

- Decide which network time source, external NTP or GPS reference, that you are going to use.
- To enable CIP Sync functionality in a ControlLogix® controller, select Time Synchronization in Ethernet adapters by using Studio 5000 Logix Designer® software.

Configure UTC Time Source

UTC is independent of time zones and enables NTP to be used anywhere in the world regardless of time zone settings.

Use a domain controller



PADC

Configure Internet Time Synchronization

This section describes how to configure the Windows Time Service (w32Time) to use the Internet as a medium for sourcing a UTC time. Use the Windows time utility from an elevated command prompt.

Complete these steps by using the domain controller that is hosting the PDC emulator role (PADCA).

1. Open an elevated Command session and click the Windows Key.

The Start Menu appears.

2. Choose Command Prompt (admin).
3. From within this Command session, type the following while substituting for the <pool> argument per your requirements:

w32tm /Config /ManualPeerList:<pool> /SyncFromFlags:Manual /Reliable:yes /Update

**IMPORTANT** <pool> is a place holder for the URL or URLs of multiple time servers (for example, atomic clocks). If you cannot access the Internet, those URLs could be of your parent domain controller. You can research UTC sources for your proximity, the following table has examples that work for the U.S.

Example	Purpose
us.pool.ntp.org,0x8	URL specifies a single server
0.us.pool.ntp.org,0x8 1.us.pool.ntp.org,0x8 1.us.pool.ntp.org,0x8 2.us.pool.ntp.org,0x8	URLs specify the use of 4 unique servers

There are (at least) four server pools of pool.ntp.org. But, the preferred assignment for <pool> is the first one (us.pool.ntp.org,ox8). Windows Event Viewer can log errors for URLs that do not respond.

The ox8 qualifier specifies Client Mode packets for server communication. For more information, Microsoft Knowledgebase 875424.

You can specify a list of URLs that are <space> separated and enclosed in quotes. Make sure to append a type identifier for the URLs identifier as shown in the previous table. For example, ox8 (client mode).

The illustration shows an example that sources the U.S. pool.

```
Administrator: Cmd
Microsoft Windows [Version 6.3.9600]
(c) 2013 Microsoft Corporation. All rights reserved.
C:\Windows\system32>w32tm /Config /ManualPeerList:us.pool.ntp.org,0x8 /SyncFromFlags:Manual /Reliable:yes /Update
```

If your system cannot access the Internet, <pool> can be a single target such as your parent or local Domain controller. Your domain time might not be within tolerable differences of other domains in your enterprise.

Example	Purpose
.	Uses the current computer (PADCA) as the time source
PADCA	Specifies a network time server on your local network

- After you have commanded the w32tm utility by using the new configuration in [step 3](#), use the Net utility to stop and then start the Windows Time Service from the same command session.

```
C:\Windows\system32>net stop w32time
The Windows Time service is stopping.
The Windows Time service was stopped successfully.

C:\Windows\system32>net start w32time
The Windows Time service is starting.
The Windows Time service was started successfully.
```

## NTP to PTP Clock Conversion

This section illustrates how to configure a Stratix 5400 to convert Network Time Protocol (NTP) to Precision Time Protocol (PTP),

1. From the Device Manager of the switch, click Configure and choose PTP.
2. From the Mode pull-down, select NTP-PTP Clock.
3. Type a priority value for Priority1 and Priority2.
4. Click Submit.



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Knowledgebase Technote, [PlantPAx System Release 5.0 Configuration and Implementation Tools](#), contains the recommended topology and switch settings. Download the spreadsheet from this public article and use the tab referenced in each step.

You may be asked to log in to your Rockwell Automation web account or create an account if you do not have one. You do not need a support contract to access the article.

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## Configure PTP Time Synchronization for Ethernet Bridges

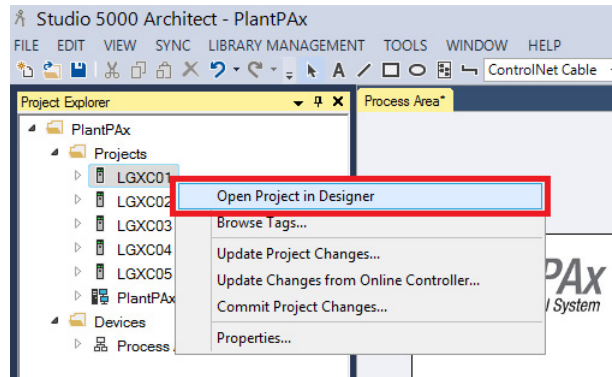
Precision Time Protocol (PTP) enables precise synchronization of clocks in measurement and control systems. PTP generates a Master-Slave relationship among the clocks in the system. Clocks, which are synchronized over the EtherNet/IP network, derive their time from a clock that is selected as the Grandmaster clock. The Time Sync and Motion option **must** be enabled for Ethernet bridge modules to propagate time through the network via switches.

1. In the Architect application, right-click a controller and choose Open Project in Designer.

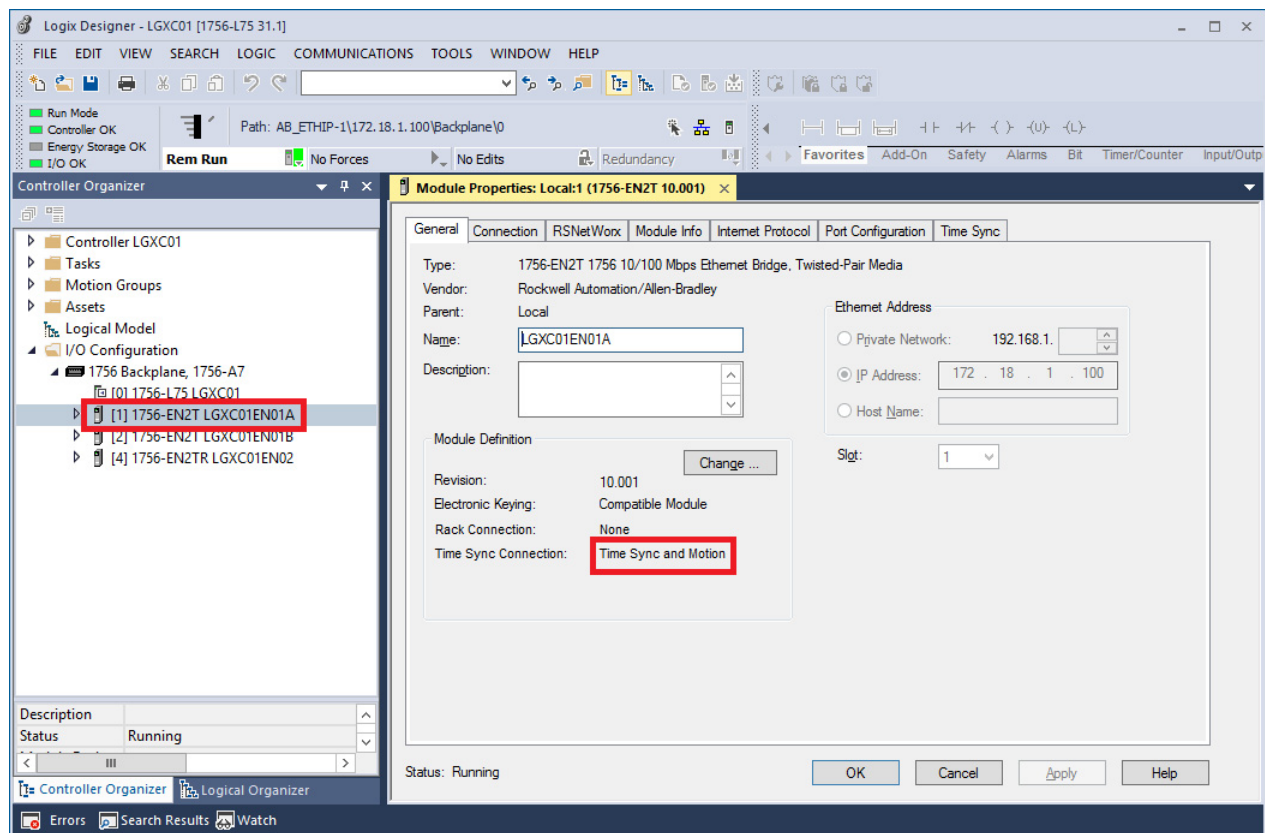
Use an Engineering Workstation with these procedures.



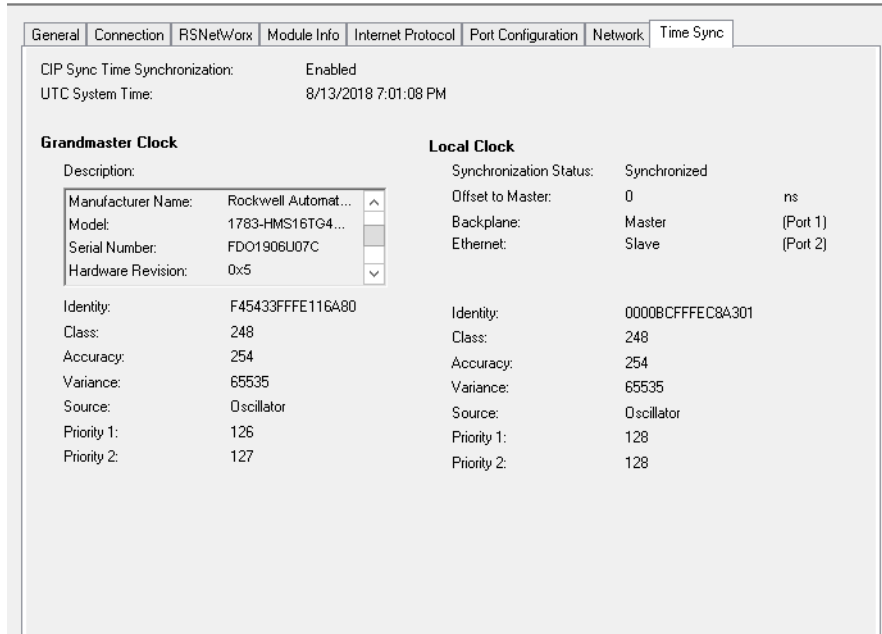
EWS



2. On the General tab of the Module Properties dialog box, make sure that 'Time Sync and Motion' is selected for the connection.



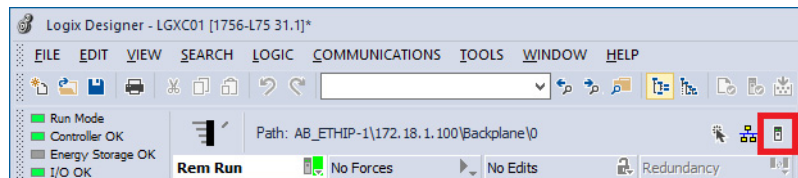
3. If online, select the Time Sync tab to confirm Grandmaster clock settings.



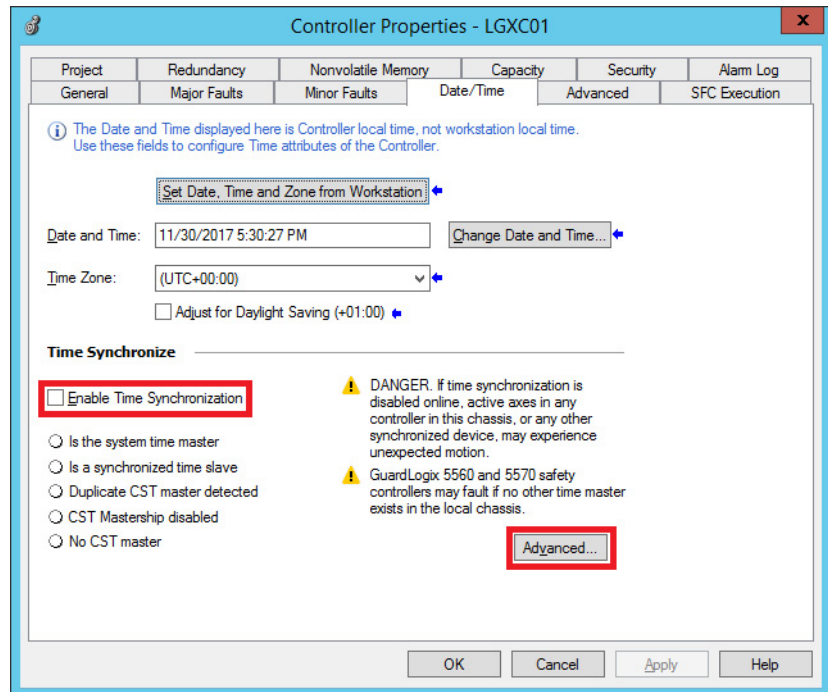
## Configure PTP Time Synchronization for Controllers

A Logix controller that is CIP Sync enabled and designated the Grandmaster clock is the real-time source for the control system. The controller synchronizes with the PTP between the controllers and networks. Complete these steps.

1. Using the Logix Designer application, click the Open Controller™ Properties symbol.



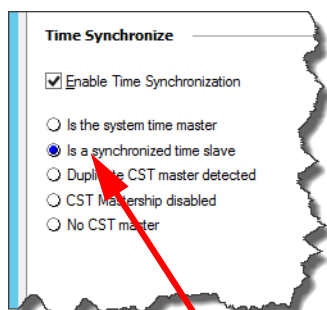
The Controller Properties dialog box appears.



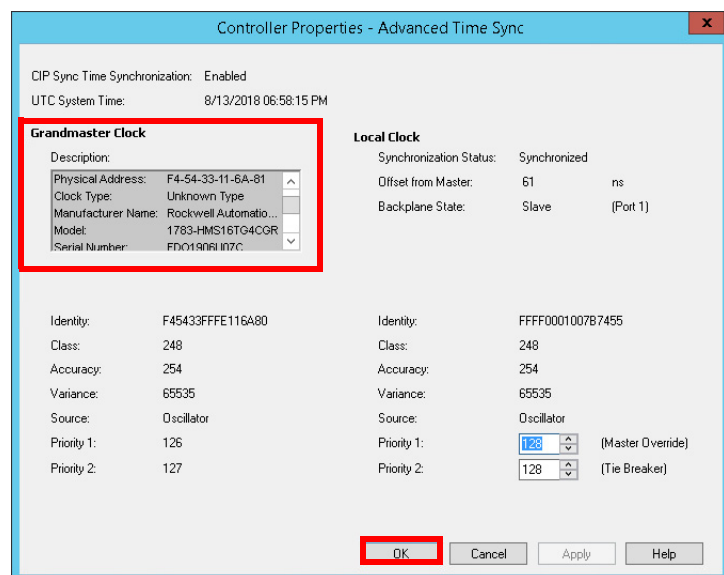
2. On the Date/Time tab, select Enable Time Synchronization.

**IMPORTANT** Use your local time to configure the Time Zone and Adjust for Daylight Saving.

3. Select Advanced.
4. Select OK on the Controller Properties dialog box.



The status 'Is a synchronized slave' appears when the controller is synchronized.



The Grandmaster clock reference can be confirmed.



**Notes:**

## Process Applications

The process controller is a member of the Logix 5000™ family that provides out-of-box process functionality. Embedded PlantPAx® instructions, graphical work flows, and tag-based alarms streamline code development for your system.

### Quick Start

This is the recommended work flow to develop process applications. For experienced users, each step outlines requirements. For more detailed information, follow the referenced links.

1

#### Develop a Project Plan

---

Based on the system requirements and PSE results, plan the scope of the process application. Use a spreadsheet or other tracking tool to define the details for each controller in the project.

Determine when and which tools to use to help with project development

- Application Code Manager software
- Studio 5000® Design software
- PlantPAx Configuration tool

For more information, see [Develop a Project Plan](#).

2

#### Develop Control Logic

---

The process controller is an extension of the Logix 5000 controller family that focuses on plantwide process control. The process controller comes configured with a default process tasking model and dedicated PlantPAx process instructions optimized for process applications and that improve design and deployment efforts.

- Use the new features of the process controller
- Use the Controller Organizer to define the execution model
- Use the Logical Organizer to group equipment
- Follow guidelines to configure modules and devices.

The process controller supports PlantPAx instructions that offer enhanced functionality, including tag-based alarms, that can simplify programming applications.

- Build and monitor control strategies
- Define controller-to-controller communication

For more information, see [Develop Control Logic](#).

3

**Integrate Field Devices**

The components required to integrate field devices vary depending upon the communication protocol and PlantPAx library version. You can integrate devices via:

- HART I/O modules
- EtherNet/IP™ communication modules
- PROFIBUS PA linking device
- Foundation Fieldbus linking device

For more information, see [Integrate Field Devices](#).

4

**Develop Alarms**

Develop alarms for your system. The type of alarm depends on the control logic:

- Logix tag-based alarms
- Server tag-based alarms (FactoryTalk® Alarms and Events)
- Logix instruction-based alarm instructions

For more information, see [Alarm Types](#).

5

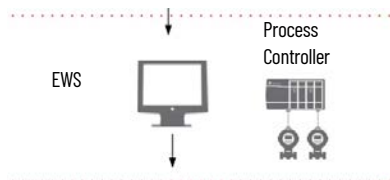
**Create HMI Displays**

Use FactoryTalk® View Studio to develop HMI displays. Use the HMI template that comes with the process library. You can:

- Import global objects and graphic framework displays from the process library.
- Import ACM-generated displays.
- Create system-specific HMI screens.

For more information, see [Create HMI Displays](#).

For information about graphic framework displays, see Rockwell Automation Library of Process Objects Reference Manual, [PROCES-RM200](#).

**Prerequisites**

Following the [System Workflow](#), develop your process application, including graphical displays and controller logic. To develop your controller program, you must be familiar with how to do the following:

1. Gather system requirements, such as:
  - User requirement specifications
  - Instrument index or database
  - P&ID diagrams
  - Network architecture requirements
  - I/O requirements
  - Produced/consume and message requirements
  - Product specifications
2. Use the PlantPAx System Estimator tool that comes with Integrated Architecture® Builder utility, to:
  - Size your PlantPAx system
  - Generate a bill of materials
3. Build your PlantPAx system:
  - Use the Virtual Image Templates to build system elements (recommended)
  - Install and configure process controllers (recommended)
  - Make sure the HMI server and requirements are configured (required)

For more information, see these additional resources.

Resource	Description
ControlLogix 5580 and GuardLogix 5580 Controllers, publication <a href="#">1756-UM543</a>	Provides information about designing a system, operating a ControlLogix® 5580 or GuardLogix® 5580 controllers system, and developing applications.
High Availability Systems Reference Manual, <a href="#">HIGHAV-RM002</a>	Provides guidelines for high availability systems, including redundant system components, networks, and other hardware and software considerations.
CompactLogix 5380 and Compact GuardLogix 5380 Controllers, publication <a href="#">5069-UM001</a>	Provides information about designing a system, operating a CompactLogix® 5380 or Compact GuardLogix 5380 controllers system, and developing applications.
Rockwell Automation Library of Process Objects Reference Manual, publication <a href="#">PROCES-RM200</a>	Describes how to build and use library components that comprise the Rockwell Automation Library of Process Objects.
Logix 5000 Controllers Produced and Consumed Tags, publication <a href="#">1756-PM011</a>	Details how, with a Logix 5000 controller, to produce and consume standard tags and produce a large array.
Logix 5000 Controllers Import/Export Programming Manual, publication <a href="#">1756-PM019</a>	Describes how to import and export logic components to and from a controller project.
Application Code Manager User Manual, publication <a href="#">LOGIX-UM003</a>	Provides details on a modular, object-based approach to the creation of ACD controller code, FactoryTalk® View SE /ME display content, FactoryTalk® Historian Tag and FactoryTalk® Alarms and Events (FTAE) import configuration.

## Develop a Project Plan

Based on the system requirements and PSE results, start by planning the scope of the process application. Use a spreadsheet or other tracking tool to define the details for each controller in the project, such as:

- Controller name
- Task name
- Program name
- Description
- I/O type
- Control strategy name
- Minimum and maximum values and units of measure
- Alarm values (LoLo, Low, High, and HiHi)
- HMI display name

This level of detail helps you organize the actual programs and tasks in the application. For example:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	NAME	CONTROLLER	TASK	PROGRAM	DESCRIPTION	I/O	Control Strategy	Min	Max	Unit	LOLO	LOW	HIGH	HIHI
11	FT0120	Water	Task_D_500ms	Polymer_TaskD	Flow to Large Storage #2	AI	P_Aln	0	10000	GPM	-1.50E+38	-1.50E+38	1.50E+38	1.50E+38
12	FT200	Water	Task_D_500ms	Canals_TaskD	Flow Offsite #1	AI	P_Aln	0	100	GPM	5	10	90	99
13	FT201	Water	Task_D_500ms	Canals_TaskD	Flow Offsite #2	AI	P_Aln	0	100	GPM	5	10	90	99

## Determine Which Libraries to Use

Rockwell Automation provides libraries to simplify application development.

Table 6 - Library Descriptions

Item	Description
Process Library	<p>Rockwell Automation Library of Process Objects provides sample projects, application templates, Endress + Hauser library objects, Application Code Manager library objects, and tools and utilities.</p> <p>Includes the following:</p> <ul style="list-style-type: none"> <li>• Graphics for built-in instructions</li> <li>• HMI images and Help files</li> <li>• Logix diagnostic objects</li> <li>• Process objects</li> <li>• Control strategies</li> <li>• Sequencer object</li> <li>• PlantPAx Configuration Tools for Tags, Alarms and Historian</li> <li>• Color Change utility</li> <li>• Historian -- Asset Framework template and objects</li> </ul>
I/O Device Library	<p>Provides objects for Rockwell Automation 1756, 1769, 1734, 1794, 1738, 1732E, 1719, 5069, 5094 I/O modules.</p> <p>Provides preconfigured status and diagnostic faceplates sets for Rockwell Automation digital and analog I/O devices. You can use these objects with Machine Builder, Process, and Packaged Libraries, or as standalone components.</p>
IO-Link Device Library	<p>Provides IO-Link master and sensor objects.</p> <p>Provides preconfigured status and diagnostic faceplates.</p>
Electrical Protection Device Library	Provides a standard to represent protection devices within your electrical distribution system
Machine Builder Libraries	<p>Library objects for use with Application Code Manager.</p> <ul style="list-style-type: none"> <li>• Independent Cart Technology Libraries, includes ICT Libraries for iTRAK® and MagneMotion®</li> <li>• Studio 5000 Application Code Manager</li> <li>• Power Device Library, including objects for E300, ArmorStart®, PowerFlex®, and Kinetix®</li> </ul>
Network Device Library	Provides objects for Stratix® switch and Device Level Ring network objects.
Power Device Library	Provides objects for E300, ArmorStart, SMC™-50, PowerFlex, and Kinetix.

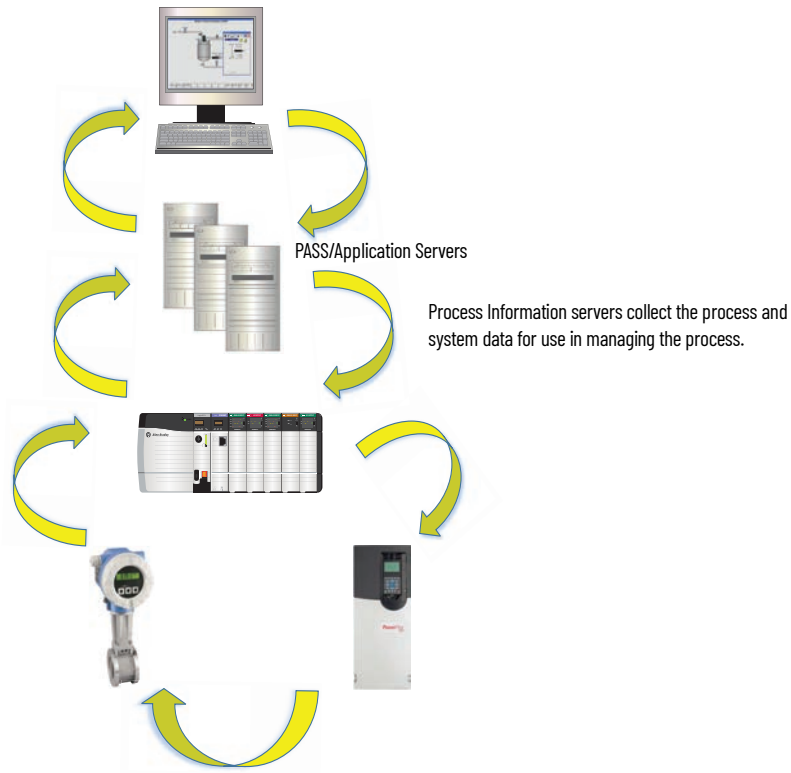
## Build Application Content

A control strategy encompasses all of the application code required to implement a specific control function. The application code includes the I/O, controller code, display elements, and faceplates. The process library contains example control strategies for I/O processing, device control, and regulatory control.

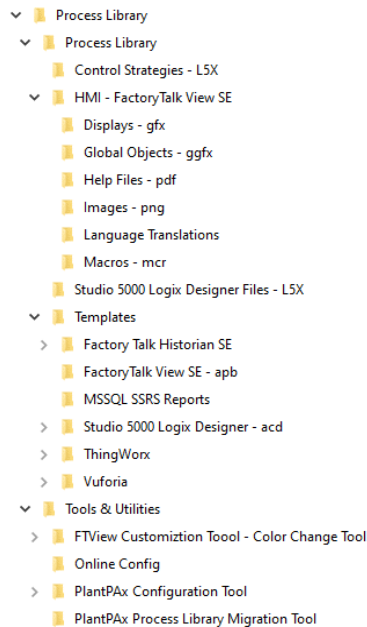
By using the control strategy model, you can estimate the following:

- Potential alarms
- Visualization tags (affecting controller and server memory)
- Controller memory usage
- Controller execution time

Operator interface presents system information to the user.



The Process library is key to building your process application content. In addition to the PlantPAx instructions embedded in the process controller, the library provides additional elements in both export and library formats.



Which library elements to use depends on whether you:

- Modify an existing application
- Create a new application based on a sample template
- Import library elements into a project
- Generate library elements into code by tools

For more information about the process library, see the Rockwell Automation Library of Process Objects Reference Manual, publication [PROCES-RM200](#).

Your project plan can list the library elements and the software you plan to use. Select the tool based on the current state of project development and your programming preference.

Project State	Tool	Description
New	Application Code Manager software	<p>Application Code Manager (ACM) software is an optional, productivity tool you can use to manage multiple libraries and build these components for your control strategies.</p> <ul style="list-style-type: none"> <li>• HMI components</li> <li>• Alarms</li> <li>• I/O assignments</li> </ul> <p>ACM is best suited for new process applications or when wanting to generate or reuse modular project components from standard and custom libraries.</p> <p>ACM can use the process library to generate:</p> <ul style="list-style-type: none"> <li>• Controller project .ACD files</li> <li>• Controller program and routine .L5X files</li> <li>• HMI display and alarm .XML files</li> <li>• Historian point type and tag .CSV files</li> </ul>
New or existing	Studio 5000 Logix Designer® and FactoryTalk® View SE software	<p>Studio 5000 Logix designer and FactoryTalk® View SE software can open templates to start new projects or import library elements directly into existing projects. Both software products are required throughout the application development process,</p> <p>Open and import library elements:</p> <ul style="list-style-type: none"> <li>• Controller project template .ACD files</li> <li>• Controller Add-on Instruction and rung .L5X files</li> <li>• HMI project template .APA files</li> <li>• HMI global object and graphic display .GFX files</li> <li>• HMI image .PNG files</li> </ul>
Existing	PlantPAx Configuration Tool for Tags, Alarms, and Historian	<p>The PlantPAx Configuration Tool helps define controller .ACD files with associated HMI applications. The PlantPAx Configuration Tool is best suited for modifying the output from an ACM project, an existing controller project, or a template project from the process library.</p> <p>Use the PlantPAx Configuration Tool to:</p> <ul style="list-style-type: none"> <li>• Organize parameter files for use the code, tags, and HMI displays into a process tree (builds the Logical Organizer)</li> <li>• Create FactoryTalk Alarms and Events alarm groups</li> <li>• Create Historian Asset Framework elements</li> <li>• Edit controller tag data with import and export</li> <li>• Build HMI parameters for use with tag search and navigation graphics</li> </ul>

## Application Code Manager

ACM can reduce the development time for PlantPAx applications. The process library provides components to help create process controller projects, HMI content for FactoryTalk View SE displays, and tags for FactoryTalk® Historian SE applications

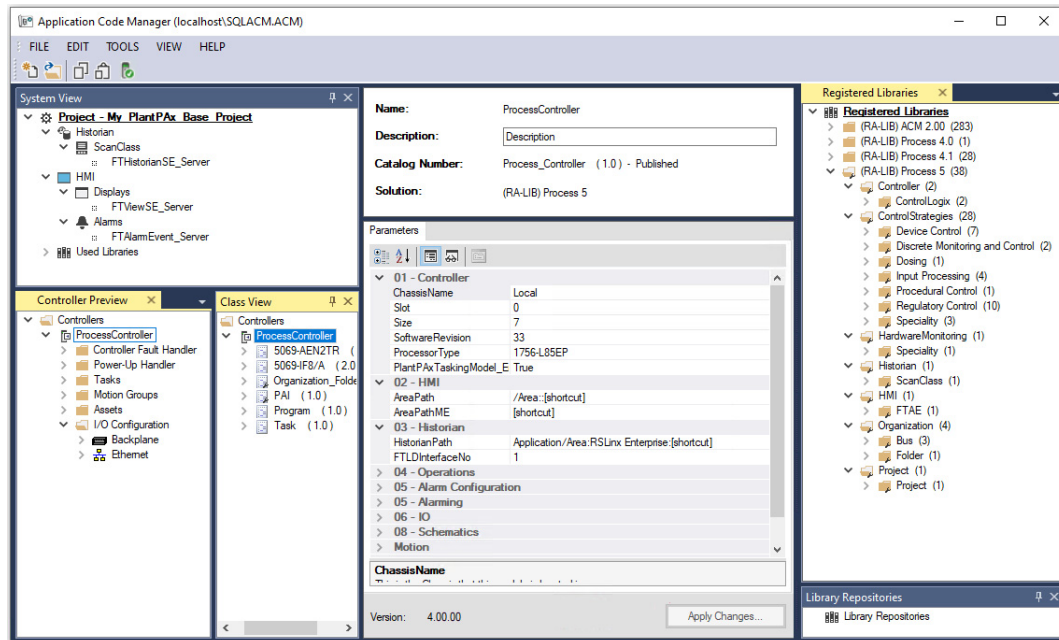
For more information, see Application Code Manager User Manual, publication [LOGIX-UM003](#).

## Create a Project

Before you begin, download the libraries you want to use and register them in ACM software.



1. Create a new ACM project and add a process controller object from the library.



2. Configure the controller parameters:
  - Set Controller properties and enable PlantPAX Tasking Model
  - Add HMI and Historian communication paths
  - Operations – specify if Redundant, has Change Detection, has Event Logging, or uses Organization Ownership Arbitration Propagation.
  - Choose Alarm Configuration and Alarming Type
  - Configure IO – HWBus size, Skip I/O references or Generate I/O references
  - Schematics - Main Panel
  - Ethernet Port1 enabled (non-redundant controllers)
  - Enable and prioritize Time Synchronization
3. Select an I/O Map Strategy base on your preference.

Value	I/O Map Strategy	Description
0	Standard Mapping in ACM	Physical IO address tied to object
1	Use Aliases for IO	Tag to Alias IO tied to the object
2	Use IO Mapping tags in Mapping Routines	I and O routines connect the alias to the physical IO
3	Use IO Mapping Tags and Diagnostics in Mapping Routines	I and O routines connect the alias to the physical IO plus fault detection mapping
4	Map IO Directly in Mapping Routines	I and O routines connect to the physical IO (no alias)
5	Use Program Connections (recommended)	Program-scoped tags connect to the physical IO (binding can be done now or later when online with a controller)



For each IO map strategy, you can generate a different .ACD file and preview the output in Studio 5000 Logix Designer® software.

## Add Control Strategies

The ACM process library includes a comprehensive set of control strategies for you to use in your controller projects. Follow your project plan (the spreadsheet with your devices and tags) as you add control strategies for devices (i.e. motors, valves, drives, etc.) to the ACM project.

Object Configuration Wizard					
Select a library					
Filter:		<input type="checkbox"/> Show All Revisions		<input checked="" type="checkbox"/> Show All Libraries	
Solution	LibraryType	Category	CatalogNumber	Family	ContentType
⊞ (RA-LIB) Process 4.1 (26 items)					
⊞ (RA-LIB) Process 5 (29 items)					
(RA-LIB) Process 5	ControlStrategies	Speciality	CC (1.0)	Logix	Task
(RA-LIB) Process 5	ControlStrategies	Device Control	D4SD (1.0)	Logix	Task
(RA-LIB) Process 5	HardwareMonitoring	Speciality	Hardware_Module_Status (1.0)	Logix	Task
(RA-LIB) Process 5	ControlStrategies	Regulatory Control	IMC (1.0)	Logix	Task
(RA-LIB) Process 5	ControlStrategies	Speciality	MMC (1.0)	Logix	Task
(RA-LIB) Process 5	ControlStrategies	Device Control	NPO (1.0)	Logix	Task
(RA-LIB) Process 5	Organization	Folder	Organization_Folder (1.0)	Logix	Task
(RA-LIB) Process 5	ControlStrategies	Input Processing	PAI (1.0)	Logix	Task
(RA-LIB) Process 5	ControlStrategies	Device Control	PAO (1.0)	Logix	Task
(RA-LIB) Process 5	ControlStrategies	Discrete Monitoring and Control	PBL (1.0)	Logix	Task
(RA-LIB) Process 5	ControlStrategies	Regulatory Control	PDBC (1.0)	Logix	Task
(RA-LIB) Process 5	ControlStrategies	Input Processing	PDI (1.0)	Logix	Task



As you add objects to the project, enter unique names for each instance so you do not overwrite the original files.

Review all options on the parameter tab to complete the configuration of the control strategy.

- A True or False option means the item is enabled when True and ACM modifies the code and tags to reflect your choice.
- Many of the control strategies have different types to choose. For example, the PAI strategy has Single, Dual, and Multi-channel types, under the oo – Selection category.

<b>Name:</b>	XT100
<b>Description:</b>	Description
<b>Catalog Number:</b>	PAI (1.0) - Published
<b>Solution:</b>	(RA-LIB) Process 5
<b>Parameters</b>	
<div> <div>00 - Selection</div> <div> <div>ACM_Type</div> <div>PAI(Single_channel)</div> </div> </div> <div> <div>00.1 - Data - Common</div> <div> <div>Area</div> <div>Instruction</div> <div>Instruction_D</div> <div>Instruction_M</div> <div>Instruction_H</div> <div>Label</div> </div> <div> <div>PAI(Single_channel)</div> <div>PAID(Dual_channel)</div> <div>PAIM(Multi_channel)</div> <div>PAH</div> <div>{fn_Label}</div> </div> </div>	



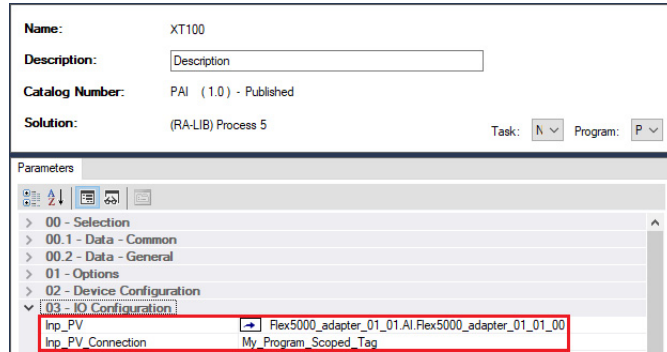
Create one control strategy for each type and export those control strategies to an Excel file. Open the export with Excel and copy/paste additional control strategies as needed. Then import the Excel back into ACM.

## Map I/O

ACM supports several I/O map strategies. PlantPAx recommends that you use Program Connections, where program-scoped tags are linked to I/O modules physical addresses. Program connections are similar to alias tags, but have the advantage of being modifiable when online with a controller.

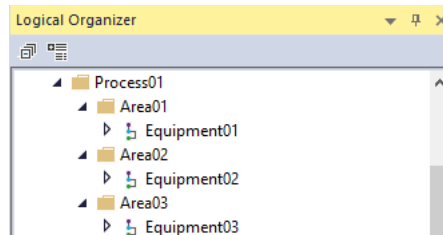
Define the I/O module physical address in ACM, in Excel®, or in Studio5000 Logix Designer.

- Enter the I/O module channel address, or leave it blank.
- Enter a name for a program-scoped tag that connects to the physical address. ACM will generate this tag.



## Develop a Logical Organization

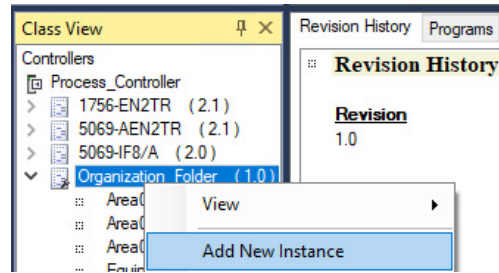
The ACM process library contains an Organization Folder object designed to create a Logical Organizer within a Studio5000 Logix Designer project. ACM generates the Logical Organizer based on folder and program parent/child assignments.



For more information about the Logical Organizer, see [Develop Control Logic](#).

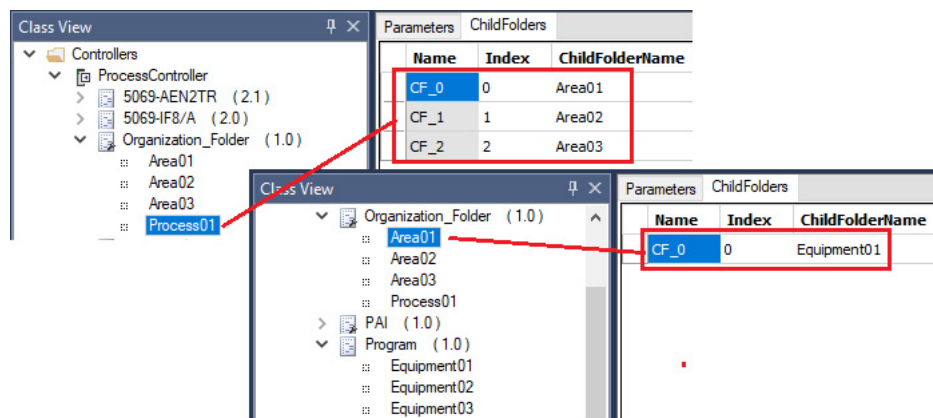
1. Add the Organization Folders object to your project to build levels of areas, as required.

- To create additional folders, select the Organization Folder object and select Add New Instance



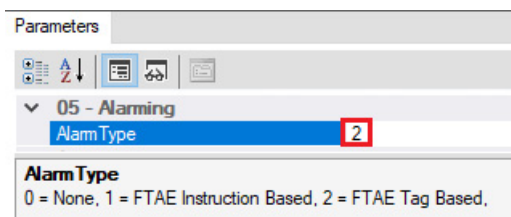
- Build your folder hierarchy by assigning child folders.
- Assign programs to the child folders.

For example:



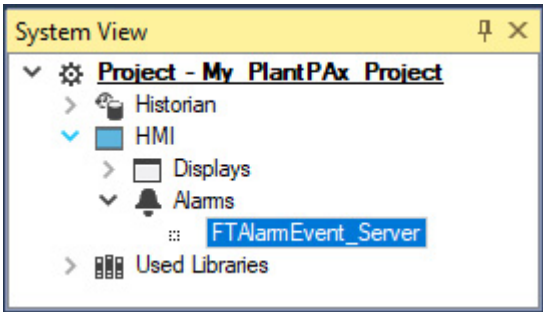
## Add Alarm Groups

ACM can create alarm groups and you can assign alarms within control strategies to those groups based on organization. Specify the type of alarms that ACM generates in the controller parameters.

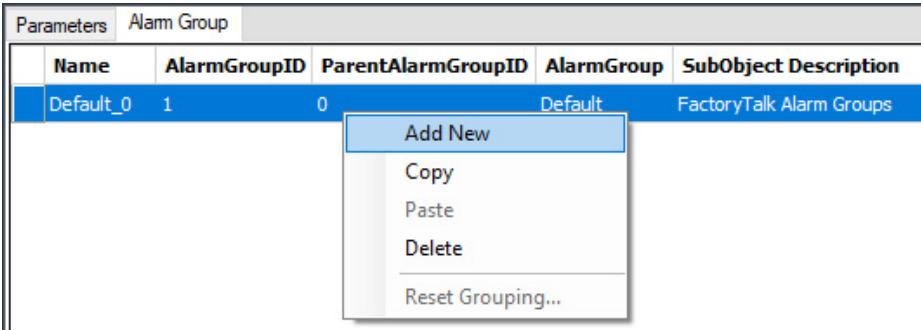


- Go to ACM System View > HMI > Alarms and add a FTAlarmEvent object from the library.

The default name is FTAlarmEvent\_Server.



- 2. Select the FTAlarmEvent\_Server object to access the Alarm Group Tab and select Add New.



- 3. Add groups for your areas and assign the Parent Alarm Group ID to represent the parent/child hierarchy.

Parameters		Alarm Group			
Name	AlarmGroupID	ParentAlarmGroupID	AlarmGroup	SubObject Description	
Area01_0	2	1	Area01	FactoryTalk Alarm Groups	
Area02_0	3	1	Area02	FactoryTalk Alarm Groups	
Area03_0	4	1	Area03	FactoryTalk Alarm Groups	
Process01_1	1	1	Process01	FactoryTalk Alarm Groups	

Once you have alarm groups, you can enable alarms in your control strategies and link each alarm to the desired group.

- 4. For each control strategy, access the parameters tab and expand o4 - Alarm Configuration. Enable the alarms you need. (such as, Hi Hi, Hi, Lo, or Lo Lo)
- 5. Expand an enabled alarm (such as, Hi Hi Alarm) and select the Group parameter (such as, Cfg\_HiHiAlarmGroup).

- Click the ellipse button and use the Select a Reference dialog to choose the alarm group.

**Name:** XT100  
**Description:** Description  
**Catalog Number:** PAI (1.0) - Published  
**Solution:** (RA-LIB) Process 5  
**Task:** N **Program:** P

**Parameters**

04 - Alarm Configuration

Cfg_HasHiHiAlm	True
Cfg_HasHiAlm	False
Cfg_HasLoAlm	False
Cfg_HasLoLoAlm	False
Cfg_HasFailAlm	False
AlmClass	0
AlmCommand	NavToDisplay [ControlStrategies]XT100 x "Faceplate" "/RP"
Cfg_AlmMessgae Type	False

04.02 - Hi Hi Alarm

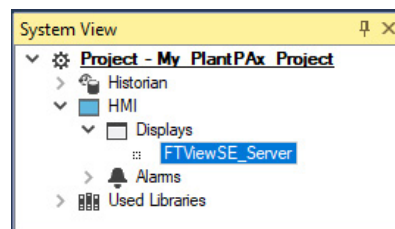
Cfg_HiHiDeadband	1
Cfg_HiHiOnDly	0
Cfg_HiHiOffDly	0
Cfg_HiHiAckReqd	True
Cfg_HiHiResetReqd	False
Cfg_HiHiSeverity	750
Cfg_HiHiMaxShelveDuration	480
Cfg_HiHiAlarmGroup	FTAlarmEvent_Server.AlarmGroups.Area01_1
Cfg_HiHiAlarmSetoperations	True

## Add HMI Graphic Displays

ACM software can create graphic displays for control strategies. They are generated in .XML format that you can import into to a FactoryTalk View SE application.

- Go to ACM System View > HMI > Displays and add a FTViewSE object from the process library.

The default name is FTViewSE\_Server.



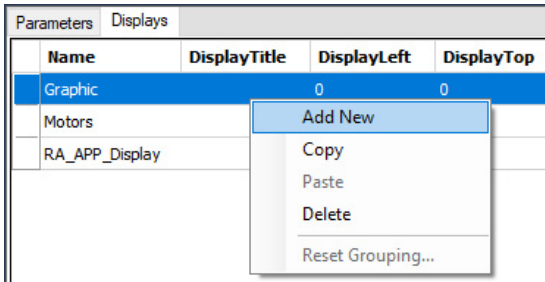
- On the parameters tab, select a Display Template and a Batch Import Template from the library.

**Parameters** **Displays**

01 - HMI Configuration

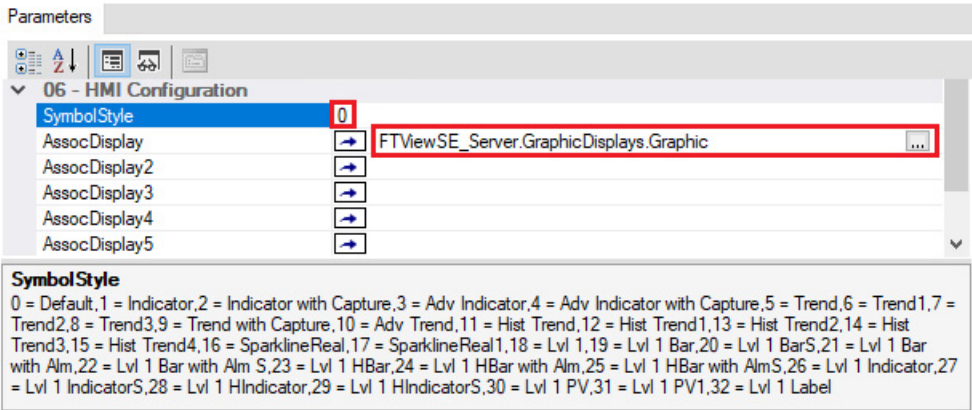
DisplayTemplate	(RA-TPL)_ACM_2.00_HMI_Display_FTViewSE_11.0_(2.0).xml
BatchImportTemplate	(RA-TPL)_ACM_2.00_HMI_Display_FTViewSE_BatchImport_(1.0).xml
MaxSymbolWidth	240
MaxSymbolHeight	410

- 3. On the Display tab, add new graphics.



Now you associated displays to your control strategies.

- 4. For each control strategy, access the parameters tab and expand 06 - HMI Configuration category.
- 5. Choose the desired symbol style, as described in the caption.
- 6. Choose the associated displays where the object is placed.



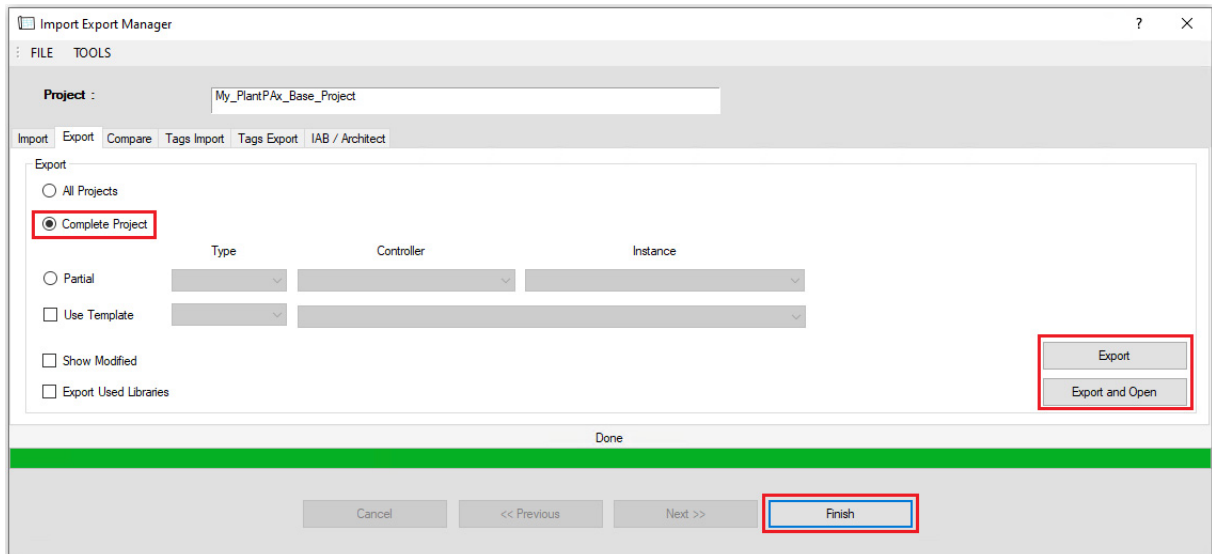


## Import/Export Manager

Use the Tools > Import/Export Manager to create additional devices (for motors, valves, drives) with your configured strategies. You export the control strategy to a .xlsx file, add additional devices to the file, and then import the modified .xlsx file back into the control strategy.

This example creates additional Process Analog Input objects.

1. Export a configured control strategy.



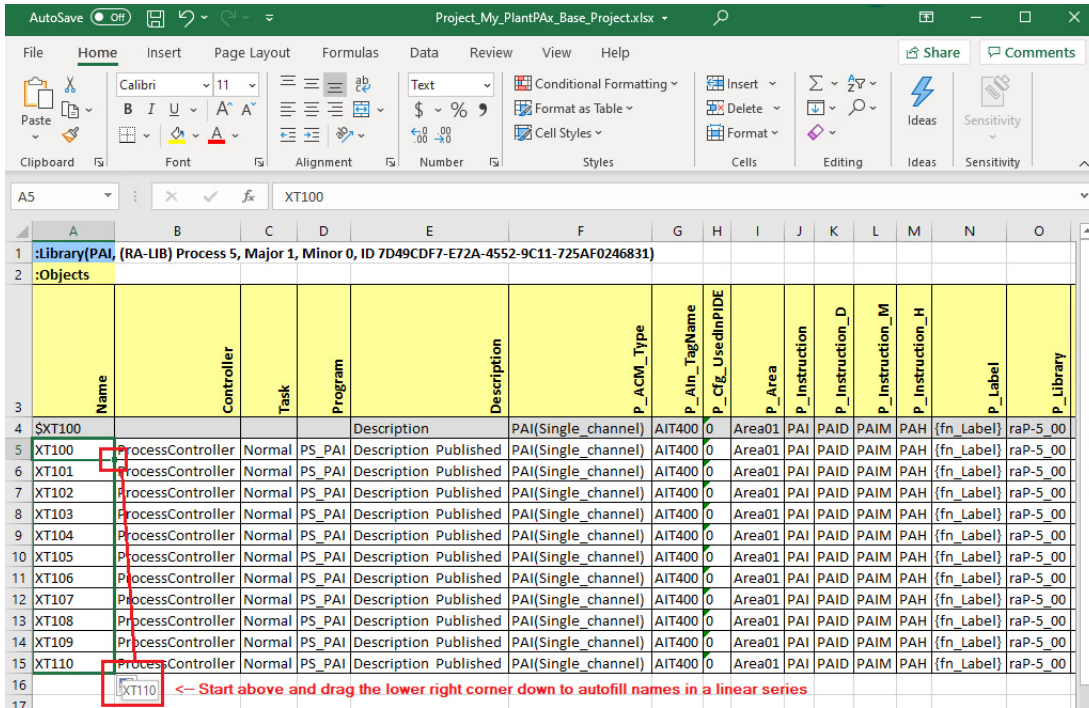
2. Open the .XLSX export file in Excel and find the tab of the object you want to duplicate.

A complete project .XLSX file can contain many tabs of various project components, which you can also modify.

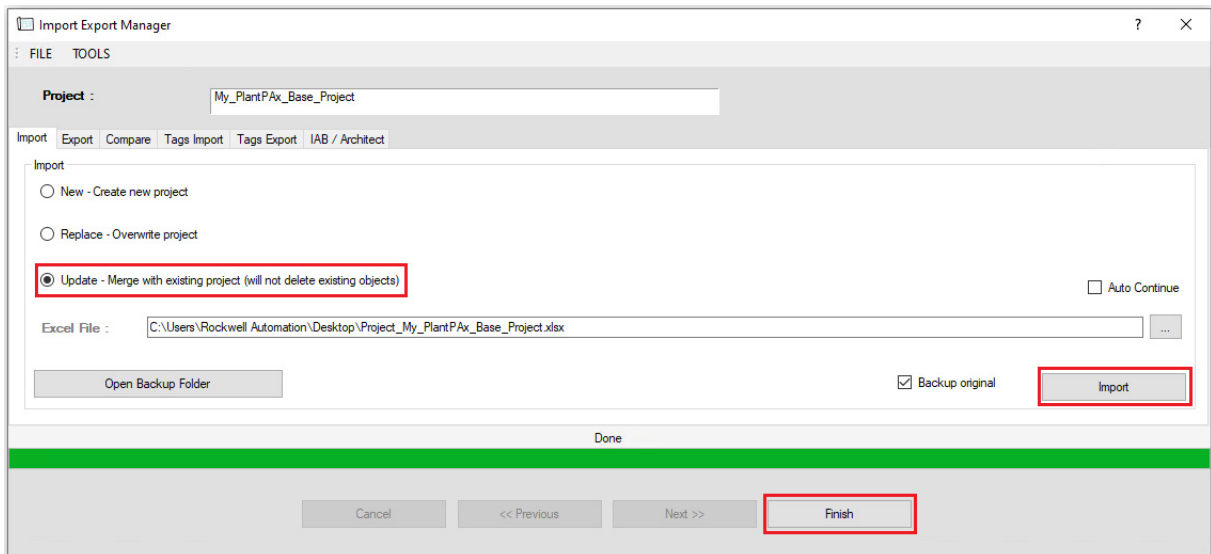
3. To duplicate an object, locate the row and insert empty rows below for however many new objects you need.
4. Copy the original row and select the empty rows and paste.
5. The new objects require unique names. (such as, XT100 – XT110)
6. Select the cell of the first row, where the names start, and hover the lower right corner.



7. Click the + and drag it down the column to the bottom of the new row. Excel's auto fill feature renames all of the selected names in a linear series.



8. Modify names in other columns as needed, such as the column for program connections or the column to specify the I/O module channel.
9. Save the file import it back into the control strategy.



Your ACM project now contains several objects, with the same control strategy, to use throughout your project.

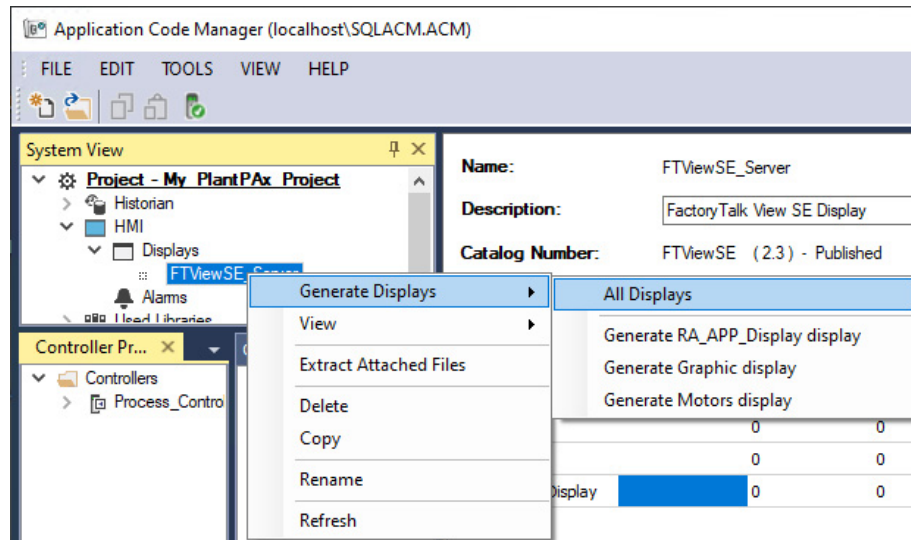
## Generate HMI Displays

When the control strategies and displays are configured and associated you can generate the displays.

1. Verify that the controller parameters contain the correct communication path of your HMI server and device shortcut.

You create device shortcuts on the PASS using a FactoryTalk View SE application or the FactoryTalk® Administration Console.

2. Select HMI > Displays > FTViewSE\_Server and select Generate Displays > All Displays



3. Browse to where you want to save the generated.XML file.

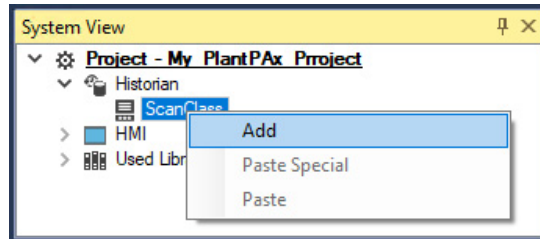
ACM generates one batch import .XML file and all of the individual displays .XML files.

The graphic displays are now ready to be imported into a FactoryTalk View SE application.

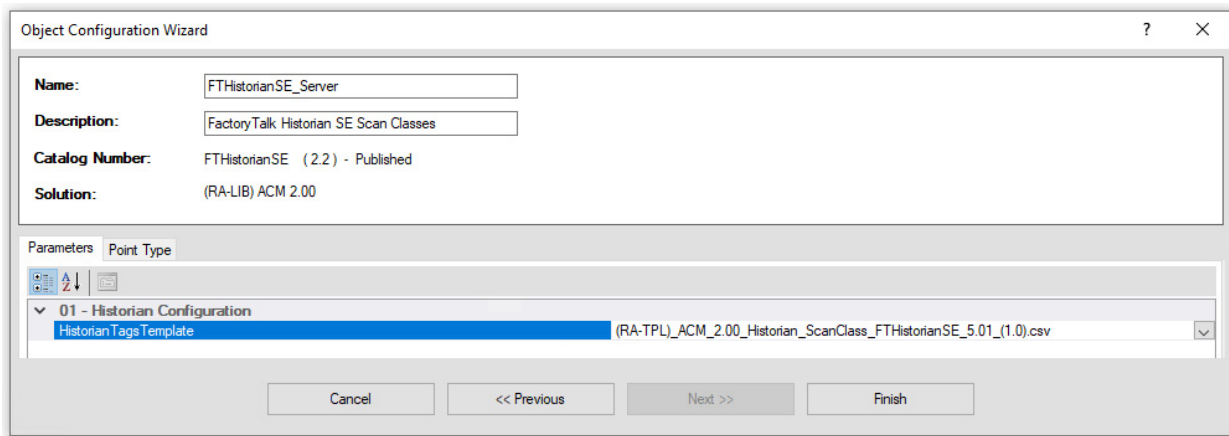
## Develop Historian Tags

The process library objects reference multiple Historian digital sets. Digital points can be used to enumerate the process states, thus creating a relationship between the value and the text state name. For example: 1 = Good.

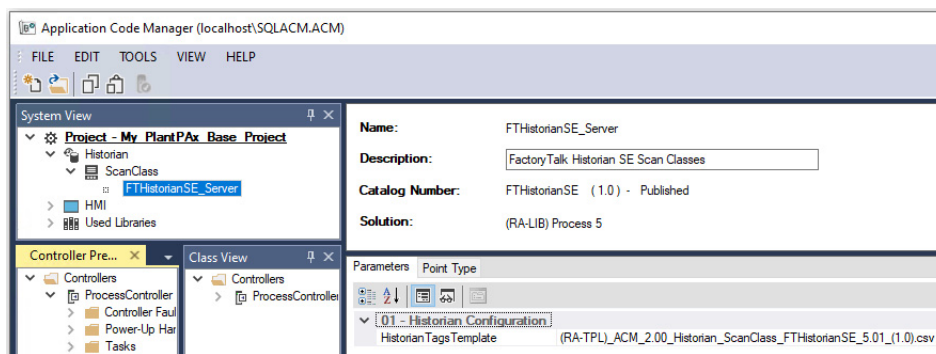
1. Add a Historian object to your ACM project.
2. Got to Historian > ScanClass and select Add.



3. Use the Object Configuration Wizard to select and create the desired Historian digital sets.



The ScanClass now contains the FTHistorianSE\_Server object.



4. Select the Point Type tab to view the available digital sets.

Name:

FTHistorianSE\_Server

Description:

FactoryTalk Historian SE Scan Classes

Catalog Number:

FTHistorianSE (1.0) - Published

Solution:

(RA-LIB) Process 5

Parameters

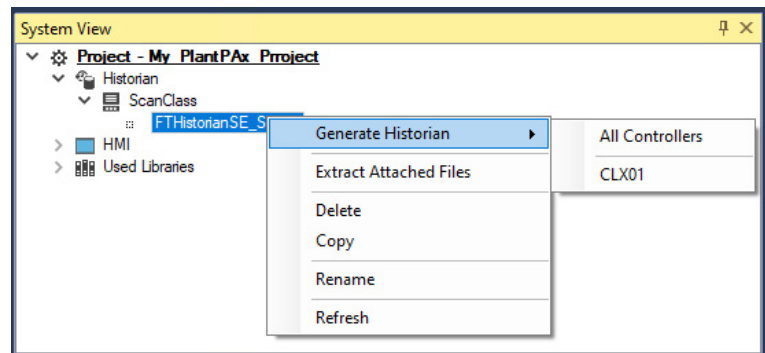
Point Type

Name	ScanClassNo	ExcDev	ExcDevPercent	ExcMax	ExcMin	CompDev	CompDevPercent	CompMax
BatchAct	1	0	0	600	0	0	0	28800
Float32	1	0.25	0.25	600	0	0.5	0.5	28800
P_AIn_V...	1	0	0	600	0	0	0	28800
P_AOut_...	1	0	0	600	0	0	0	28800
P_AOut_...	1	0	0	600	0	0	0	28800
P_D4SD_...	1	0	0	600	0	0	0	28800
P_D4SD_...	1	0	0	600	0	0	0	28800
P_DIn_V...	1	0	0	600	0	0	0	28800

## Generate Historian Tags

Use ACM to generate the Historian tags to a .CSV file that corresponds to the configured control strategy.

1. Go to ACM System View > Historian > Scan Class > FTHistorianSE\_Server and select to Generate Historian



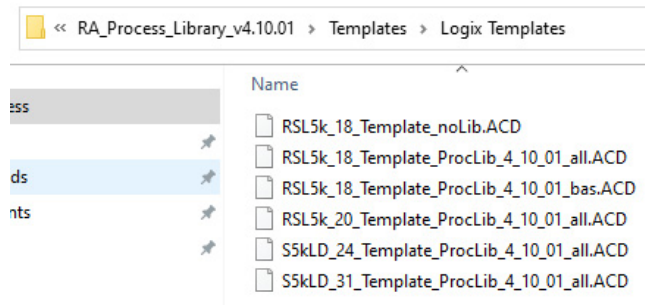
2. Save the Historian tags .CSV file to the computer that has the PI Builder Add-in for Microsoft® Excel.

## Studio 5000 Logix Designer and FactoryTalk View SE Software

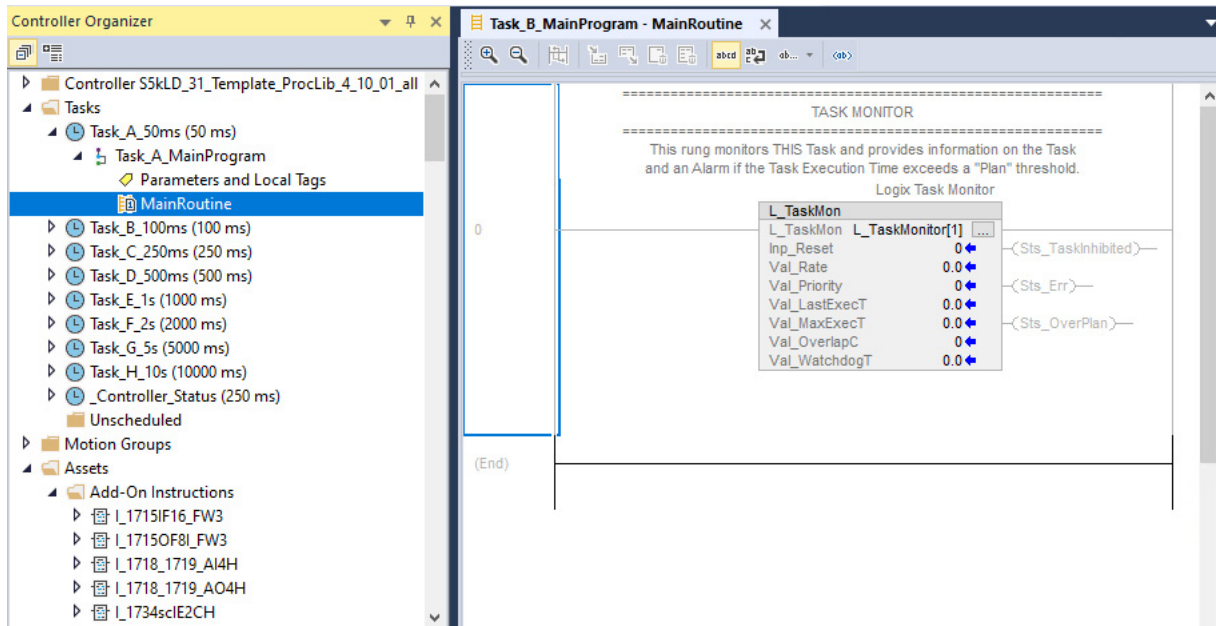
The process library includes templates of controller and HMI applications. These templates are designed to get you started if you are not using ACM software or do not have an existing project.

### Logix Designer Templates

Controller templates have the library instructions and task model already defined. They also have a basic IO configuration that you can modify according to your project plan.



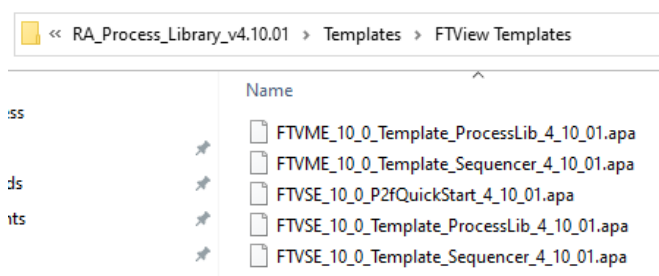
Open a Logix Designer project and browse to the template directory and select the template to open.



For more information, see [Develop Control Logic](#).

## FactoryTalk View SE templates

HMI templates contain pre-defined components such as, Displays, Global Objects, Libraries, Images, Macros, and basic configurations for FactoryTalk View SE applications.



If you have already an HMI project, on your PASS, you can:

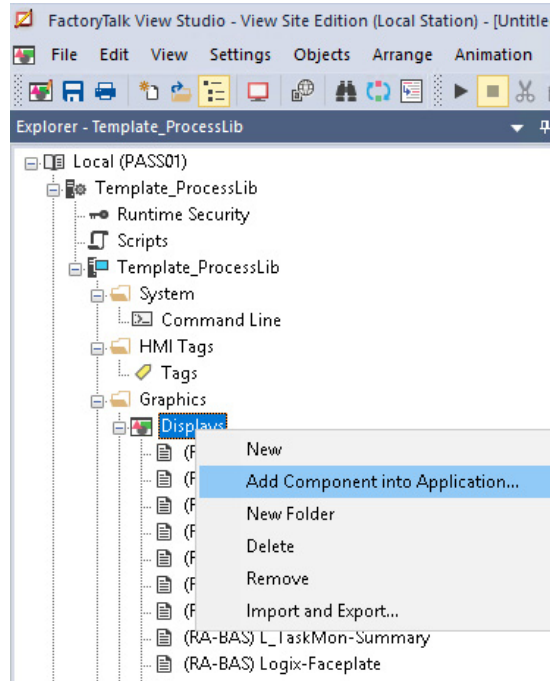
- Use the template application as a new HMI, then recreate your Areas, HMI server, data server and alarms and events server, such as you do when you configure a PASS.
- Use the existing HMI application, on the PASS, and add library components into the application.

You need to restore the template so you can access the application and its components.

1. Go to the FactoryTalk View SE Application Manager and select to restore a local station archive.
2. Browse to the .APB file in the templates folder in the process library and open the application.
  - If you choose to make this template your new HMI application, see [Chapter 3, Process Automation System Server](#) for how to create areas and servers.
  - If you choose to maintain your existing HMI application, export the Displays, Global Objects, Libraries, Images, Macros from the template and import them into your application.

You can use the Add Components in Application method to add Displays, Global Objects, Libraries, Images, directly from the library.

1. In your application, select the component (such as Displays) and select Add Component in Application.



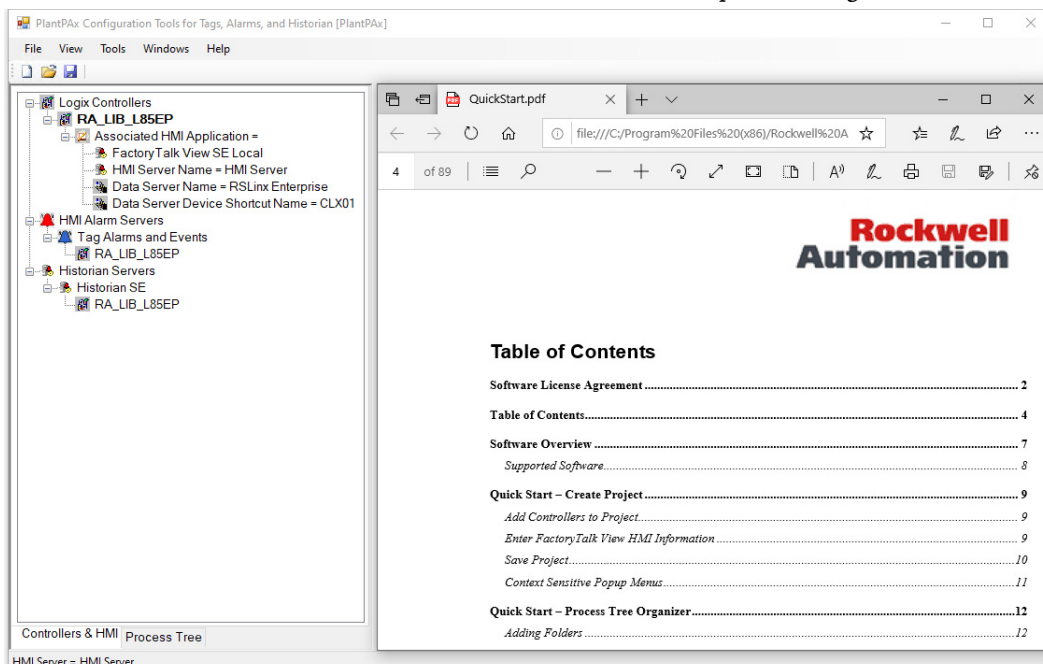
2. Browse to the .GFX files in the library folders and select those to open.

## PlantPax Configuration Tool for Tags, Alarms, and Historian

The process library includes the PlantPax Configuration Tool. This tool performs a variety of functions to help you create or modify an existing PlantPax project. To use this tool you must have a controller project (.ACD) file, which can be:

- Generated from ACM
- Existing controller project
- Sample controller project from the process library

For more information, see the quick start guide that comes with the tool.





With the PlantPax Configuration Tool, you can:

Task	Details
Edit an existing project	<ul style="list-style-type: none"> <li>Define a project that has multiple controller .ACD files and associated FactoryTalk® View HMI applications.</li> <li>Organize controller logic, tags, and HMI displays in a Process Tree organizer. You can then use the tree structure to create FactoryTalk Alarms and Events alarm groups and Historian Asset Framework elements.</li> <li>Edit tags and data in off-line controller .ACD files.</li> <li>Export and import tag data to and from text files.</li> <li>Create Microsoft Excel workbooks for online OPC tag data reads and writes.</li> <li>Create FactoryTalk Alarms and Events .XML import files using tag data from controller files.</li> </ul>
Develop displays	<p>Two utilities help build specially-formatted FactoryTalk View SE parameter files.</p> <ul style="list-style-type: none"> <li>One utility builds a parameter file containing a list of controller tags with associated HMI faceplate displays. Users can search for tags using tag names and tag descriptions. The user can open tag faceplates from the returned search results.</li> <li>The other utility creates a navigation tree from the project Process Tree structure.</li> </ul>
Develop Historian tags	<ul style="list-style-type: none"> <li>Bulk configure OSI PI Asset Framework (AF) databases with Logix tag AF elements. This includes automatic configuration of related PI points in the FactoryTalk® Historian data server (PI data server).</li> <li>For systems without Asset Framework, a separate utility provides bulk configuration of PI points in the Historian data server. The utility provides the option of generating a bulk import file, or adding the PI points directly if a Historian data server connection is available. The bulk import file can be used with the PI Point Builder Excel AddIn to create points in the data server.</li> </ul> <p>For more information about Historian tags, see <a href="#">Chapter 7, Historical Data</a></p>

## Process Controller

PlantPax system release 5.0 adds process controllers to the Logix 5000 family of controllers. The process controllers offer additional capabilities targeted for DCS applications.

Controller	Catalog Numbers
ControlLogix 5580 process controller	<ul style="list-style-type: none"> <li>1756-L81EP</li> <li>1756-L83EP</li> <li>1756-L85EP</li> </ul>
CompactLogix™ 5380 process controller	<ul style="list-style-type: none"> <li>5069-L320ERP</li> <li>5069-L340ERP</li> </ul>

For standard use information, see:

- ControlLogix 5580 and GuardLogix 5580 Controllers, publication [1756-UM543](#)
- CompactLogix 5380 and Compact GuardLogix 5380 Controllers, publication [5069-UM001](#)

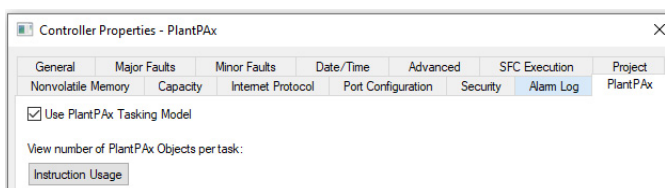
To best use controller resources:

- Use periodic tasks **only**, with minimum number of tasks that are used to define execution speed, faster tasks getting higher priority (lower number).
- Use the L\_CPU Add-On Instruction to monitor controller use.

## Configure Controller Properties

Use Studio5000 Logix Designer software to configure the controller.

- From the Controller Properties dialog box, click the PlantPax tab.





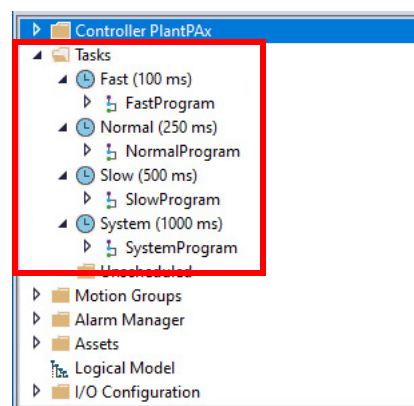
2. If you are using a process controller, leave the check for Use PlantPax Tasking Model box (checked by default).
3. Click the Date/Time tab and check the Enable Time Synchronization box.
4. Enable Automatic Diagnostics on the Advanced tab.

Automatic Diagnostics is a mechanism to detect and present device descriptive events with no programming required. Diagnostics based on the device definition (such as fault or open wire) are sent to the HMI and displayed on the Automatic Diagnostic Event Summary object.

State	Assess...	Event Time	Area	Device Name	Catalog	Message
<all>	<all>	<all>	<all>	<all>	<all>	<all>
		10/1/2020 4:16:16 PM	/RSLEArea	[CLX01]EN2TR_PPAX	1756-EN2TR	Connection Lost with Device

## PlantPax Task Model

The Task folder contains a project structure that consists of four pre-defined periodic tasks.



- **Fast (100 ms)** – For control fast loops, such as liquid flow or pressure with related transmitters and pump drives
- **Normal (250 ms)** – For discrete control, such as motors, pumps, and valves
- **Slow (500 ms)** – For level, temperature, analysis loops, phases, and batch sequencing
- **System (1000 ms)** – For slow change temperature control and general controller operations, such as messaging or status

The ControlLogix 5580 and CompactLogix 5380 controllers (including the process controllers) have simplified task management from previous controllers. The controller runs control, communication, and packet processing on separate cores within the controller. You no longer have to reserve CPU time for communication or overhead.

## Create the Logical Organizer

The Logical Organizer is a graphical representation of the logical organization of your project called the logic model. It enables you to create and organize hierarchies of the programs and folders in your project, independent of the execution model.

A process controller contains tasks of various rates. Each task contains programs and routines of code based on the priority of execution. The Logical Organizer helps you create an understandable organization, such as based on areas and equipment.

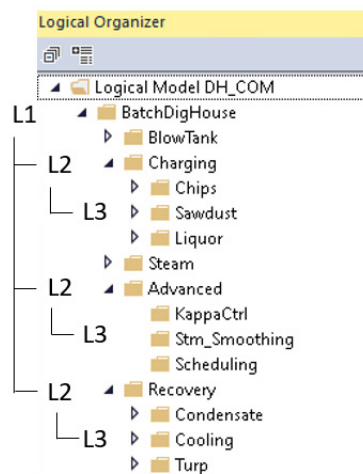
- Server-based alarms are often based on area organization within Logical Organizer and built using the PlantPAx configuration tool.
- Organize batch applications following the ISA-S88 physical model.

---

**IMPORTANT** Several components in a PlantPAx system depend on the organization and hierarchy of the system:

- HMI application
  - Alarms
  - User roles and responsibility
  - Security
- 

You can generate the Logical Organizer from an ACM project or create the Logical Organizer in Logix Designer project. This example shows a process cell that contains two sub areas. Each sub areas contains two pieces of equipment.



## Add Modules and Devices to the Controller Organizer

All Logix 5000 controllers require module connections (analog, communication, digital, specialty) to be defined in the I/O Configuration list.

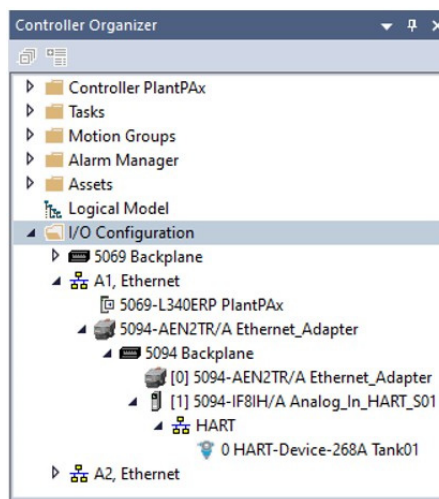
PlantPAx systems typically contain more input devices than output devices. Inputs monitor everything from signals, temperatures, pressures, and flow. Discrete outputs control fans or pumps and valve operations.

Follow these guidelines for I/O module properties in a PlantPAx system.

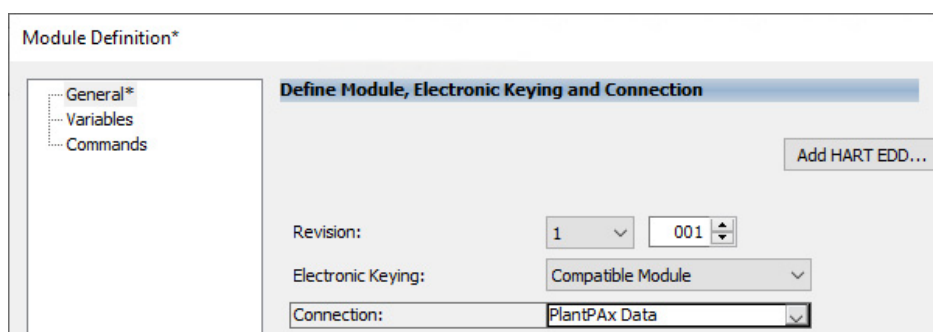
**Table 7 - Guidelines for Module Configuration**

Item	Description
Electronic keying	<p>Electronic Keying reduces the possibility that you use the wrong device in a control system. It compares the device that is defined in your project to the installed device. If keying fails, a fault occurs.</p> <ul style="list-style-type: none"> <li>Use Exact Match for keying in a validated environment. This makes sure that only the same series and revision device can be used.</li> <li>Use Compatible Module for keying in environments where a newer series or revision device can be used without requiring changes to the definition.</li> </ul> <p>For more detailed information on Electronic Keying, see Electronic Keying in Logix 5000 Control Systems Application Technique, publication <a href="#">LOGIXAT001</a>.</p>
Requested Packet Interval (RPI)	<p>The RPI value is the rate at which the controller attempts to communicate with the module. RPI is often defined by the inherent properties of the signal being measured. For example, a temperature measurement changes slower than pressure, so a larger RPI could be used to a device that measures the temperature. We recommend that you specify an RPI that is two times faster than task period. For example:</p> <ul style="list-style-type: none"> <li>A device used within a 250 ms task requires a 125 ms RPI.</li> <li>A device used within a 100 ms task requires a 50 ms RPI.</li> </ul> <p>Use NONE for the Connection Format to remote communication modules used as bridged adapters. For modules that support Precision Time Protocol (PTP) synchronization, it is recommended to use Time Sync and Motion.</p>
Connection tab options	<ul style="list-style-type: none"> <li>If inhibited, the controller does not attempt to make a connection. This is used as placeholder for a device not yet implemented or installed.</li> <li>Major Fault On Controller If Connection Fails While in Run Mode. This is used on critical connections, where controller execution cannot continue if a problem is detected.</li> </ul>
Integrated HART device connection	<p>FLEX 5000™ I/O with 5094 HART modules support two device connections types. The PlantPAx data format is recommended and is pre-defined for the PAH instruction.</p> <ul style="list-style-type: none"> <li>PlantPAx Data: Input data includes basic input from the HART device used by PlantPAx for the four dynamic variables and semi static data. Also includes the configured device variables and commands.</li> <li>Data: Input data includes basic input from the HART device for the dynamic and device variables configured plus the configured commands.</li> </ul>

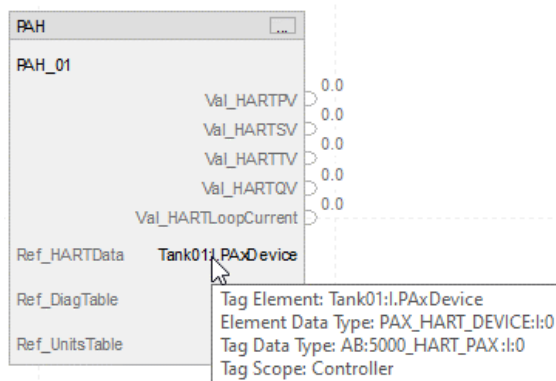
FLEX 5000 I/O HART integration lets you directly add field devices to the I/O Configuration list.



Configure the variables and commands for the HART devices within the Module Definition. You can add HART EDD files if additional device descriptions are required.

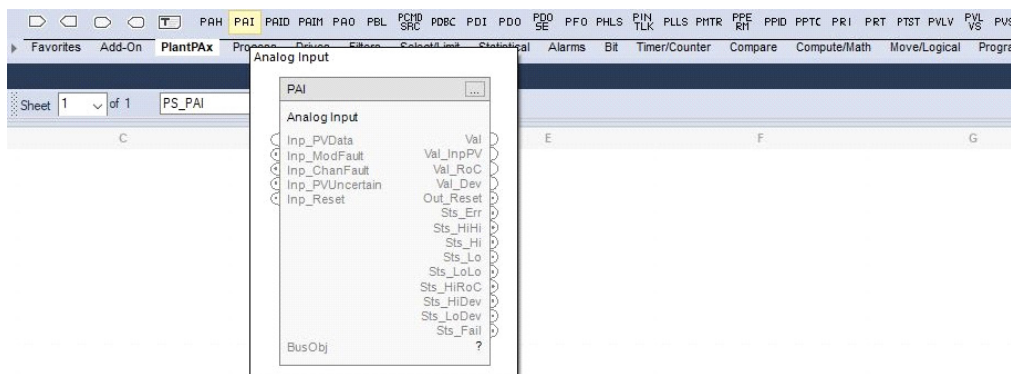


The PlantPax Data connection creates a PAX\_HART\_DEVICE:I:O structure that is formatted for direct use in the Process Analog HART (PAH) instruction.



## Develop Control Logic

Process controllers support an exclusive set of embedded PlantPax process objects, listed as PlantPax instructions.

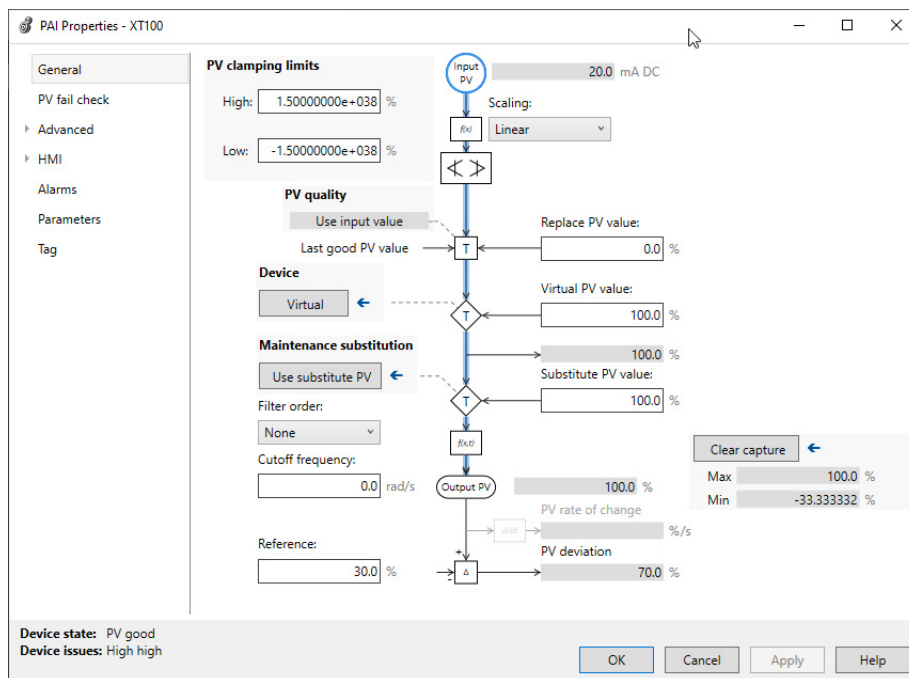


The PlantPax instructions offer enhanced functionality, including tag-base alarms, and can reduce the number of steps to configure control strategies. For more information about the instructions, see:

- Studio 5000 Logix Designer online help
- Logix 5000 Advanced Process Control and Drives and Equipment Phase and Sequence Instructions Reference Manual, [1756-RMO06](#)

Each PlantPax instruction features an intuitive design-time configuration interface. It is based on the SAMA (Scientific Apparatus Makers Association) diagram interface, which focuses on the flow of information.

The example shows the PAI - Process Analog Input Object.



This interface improves upon prior releases of the process library, in where the underlying elements of an Add-On Instructions can be viewed but do not illustrate how it functions.

The blue animation line adjusts depending on the instruction execution. In the example above, see the Maintenance substitution option. If you select 'Use substitute PV,' the blue animation line shows a new execution path.

## Import Add-On Instructions

There are additional libraries of Add-On Instructions that you can use to supplement the PlantPax embedded instructions. Studio 5000 Logix Designer can import a single AOI or a Program/Routine containing multiple AOIs, such as a control strategy generated with ACM software.

- AOI backing tags can be controller scoped, however for a process controller used in a redundant configuration.

Add-On Instructions are used when the following functionality is required:

Feature	Description
Organization, ownership, and arbitration	<ul style="list-style-type: none"> <li>Allows the organization of devices into groups from HMI</li> <li>Manages and prioritizes ownership of equipment groups</li> <li>Propagates command and status through equipment groups</li> </ul>
Process Instructions from prior libraries	Non-process controllers use the A0Is from the process library, release 4.1 or earlier
Device A0Is for supported network devices	The purpose of device A0Is is to reshape the data structure of similar but disparate equipment to a common structure that can be used by a single common PlantPax instruction. For example, a device A0I for a Variable Speed Drive (VSD) is used to reshape the disparate VSD source data so that a common PlantPax instruction (PVSD) can be used to control all these VSDs. This also means a common control strategy can be used to control all those same VSDs

## Controller-to-Controller Communication

There are two main options to communicate between controllers:

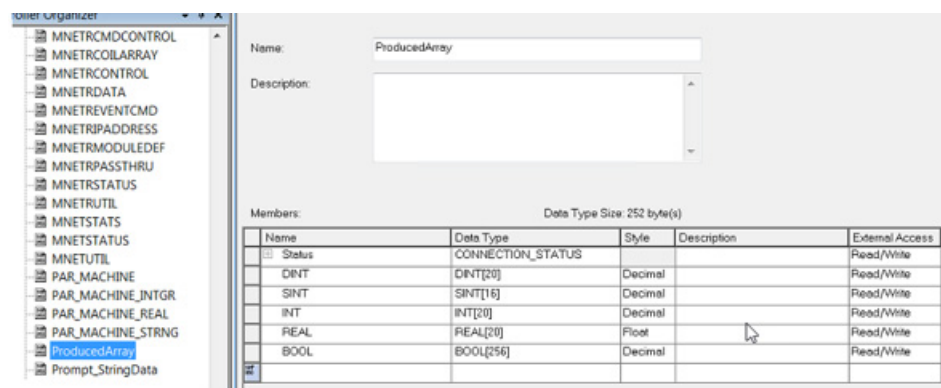
Produced and Consumed Tag	Message (MSG) Instruction
Consumed tag data is automatically received from a producer controller, at a requested packet interval (RPI), without the need for logic programming.	Read or Write messages are programmatically initiated on condition (False to True transition).
Ideal for exchanging critical data that changes frequently; use for higher priority communication.	Ideal for exchanging non-critical data that changes less frequently; use for lower priority communication.
Data is constantly sent regardless of change of state. This does not impact the scan of the controller, but it can impact network bandwidth.	Communication and network resources used when needed only, however, a delay can occur if controller resources are not available when needed.
Tag size is limited to 500 bytes over the backplane and 480 bytes over a network.	Supports larger data payloads, up to 32,767 elements, using multiple data packets.
Supports tags of mixed data types (UDT).	CIP™ Generic messages to third party devices.
You cannot modify or create produced/consumed tags online in Run mode.	You can modify and create MSG instruction online in Run mode.
Routing of traffic across subnets depends upon the transmission type (Unicast or Multicast).	Message traffic can be routed across subnets and across slots of a 1756 chassis.

For more information on controller communication options, see Logix 5000 Controllers Design Considerations Manual, publication [1756-RM094](#).

## Configure Produced and Consumed Tags

Group produced and consumed tags as members in user-defined structures. This technique helps monitor connection status between controllers without increasing execution time, such as using a GSV instructions to detect status.

1. In Logix Designer, define a user-defined structure of a tag to be used in all controllers.



2. Name the first member Status and a data type of CONNECTION\_STATUS.

This data type provides two BOOL bits (RunMode & ConnectionFaulted) in the Status member for each controller consuming the tag.

MyTag.Connection\_Status.RunMode



- Value of 1 when Producer is in Run mode.
- Value of 0 when Producer is in Program mode.

MyTag.Connection\_Status.ConnectionFaulted

- Value of 0 when Producer connection is good, regardless of mode.
- Value of 1 when Producer Connection is broken.

This is a faster and more efficient method of detecting a connection timeout than using a GSV instruction. The ConnectedFaulted bit is true if a timeout is RPI x4, x8, x16 until result is  $\geq 100\text{ms}$ . Thus, for a RPI of 10ms the timeout is 160ms, RPI of 20ms is 160ms and RPI of 25ms is 100ms

3. Once the UDT is finished, create a tag of that UDT type to be either Produced or Consumed.
4. It's recommended to add a common prefix to each tag instance of the UDT, so you more easily search for those tags.

Scope:	 GRAN	Show:	Interprocessor_Comms	 <i>Y. Enter Name Filter...</i>		
	Name	Value	Force Mask	Style	Data Type	Description
	+ COMMs_from_BMS9275	{ ... }	{ ... }		Interprocessor_Comms	Granulation Dryer BMS P2P Comms
	+ COMMs_from_DISP	{ ... }	{ ... }		Interprocessor_Comms	Dispatch P2P Comms
	+ COMMs_GRAN_Produced	{ ... }	{ ... }		Interprocessor_Comms	Granulation Produced Data

5. Create a Produced tag by simply changing the tag property from base to produced and setting the max number of consumers.
6. Create a Consumed tag by changing the tag property from base to consumed. The Producer controller is selected from the I/O configuration list and the remote data (exact name of produced tag) is entered.
7. Select the RPI rate in which the produce tag is consumed.

For bi-directional P/C tags between two controllers, both consuming controllers have each producer controller in its I/O configuration list. Multiple consumers can receive the same data from a single producer.

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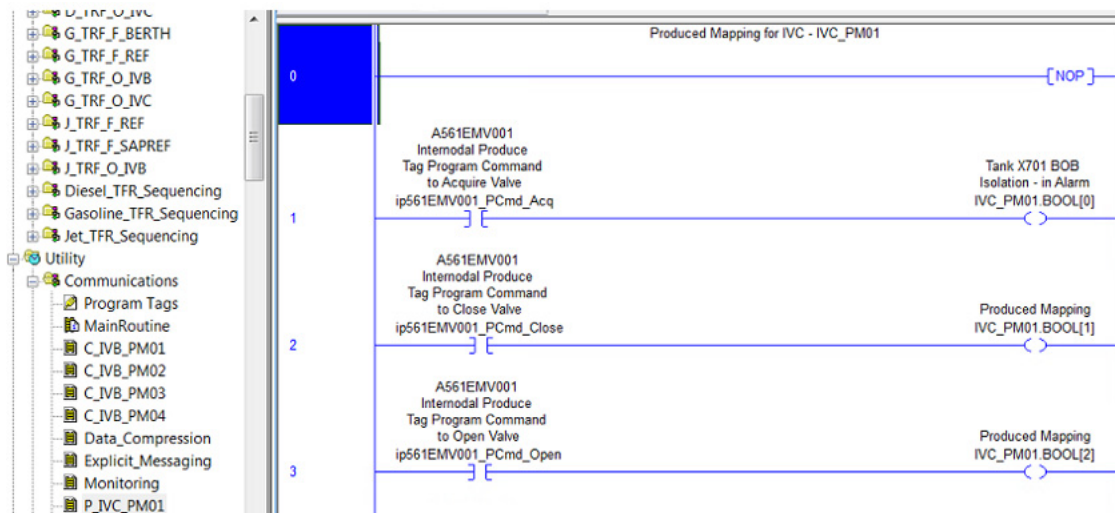
**IMPORTANT** When adding the Producer controller to the I/O configuration list of the Consumer controller, the firmware revision does not have to match. However, the rack size and slot number must be correct.

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Data arrives asynchronous to program scan. Some applications may require a programmatic handshake. Buffering data to or from P/C tags helps to make sure that the user logic executes on that same data before it changes.



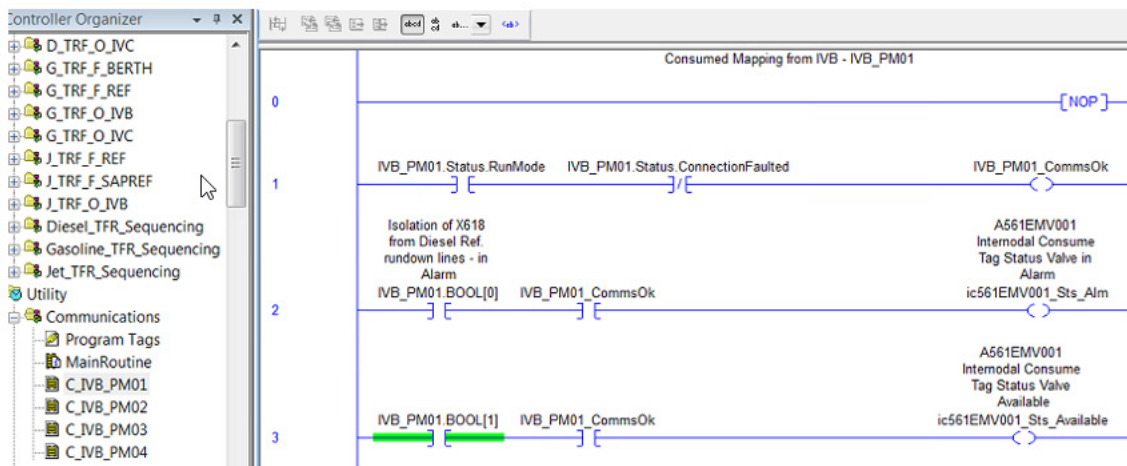
## 8. Create logic that writes values to the Produce tag elements.



## 9. Add corresponding consume tags to each controller that consumes the data.

Note that UDT structures can be exported to L5X format and imported into the other controllers.

## 10. Use Consume tag elements to write to variables in the Consuming controller.



### PlantPax Guidelines for Produced and Consumed Tags

- Produced and consumed (P/C) tags can be a single tag structure or a user-defined structure (UDT) of mixed data types. For example, a UDT tag can contain members up to 120 REALs or 100 REALs and 640 BOOLs.
- Group data in produced and consumed tags into a UDT to reduce the total number of connections.
- Make the first member of the UDT a data type of CONNECTION\_STATUS for connection status.
- Export/Import the same P/C UDT data type amongst controllers to ensure they match exactly.
- Make sure the number of consumers configured, for a produced tag, is the actual number of controllers consuming it to reduce the number of connections to the controller.



- Always use a handshake when transferring data between controllers through health data or manually configured diagnostic.
- We recommend unicast traffic when possible, because it transmits only to an intended destination, which reduces bandwidth. However, redundant controllers require multicast traffic to consume data.

## PlantPax Guidelines for Message Instructions

The MSG instruction asynchronously reads or writes a block of data to another module on a network.

- ControlLogix 5580 and CompactLogix 5380 support up to 256 connections. If you want to enable more than 256 MSGs at one time, use some type of management strategy.
- Use the cached option when the message connection needs to be maintained.
- Use message Reads, instead of Writes. This makes it easier to troubleshoot code by knowing where the incoming data is coming from.
- When messaging between Logix 5000 controllers, use a DINT data type where possible for maximum efficiency.
- Use MSG status flags, such as the .DN and .ER bits for handling fault conditions.
- Data arrives asynchronous to program scan (use a programmatic handshake or insert between a UID/UIE instruction pair for higher priority)
- Use the unconnected option for CIP Generic messages

## Integrate Field Devices

PlantPax systems use specialized field devices that operate on a variety of communication protocols, such as HART, EtherNet/IP™, PROFIBUS PA, and Foundation Fieldbus.

Depending on the controller type and process library version, you need different elements to integrate a field device. These elements use Logix Designer for device control to the corresponding object in FactoryTalk View SE for HMI faceplates.

Most field device integrations require that you instantiate one Add-On module Profile (AOP) and two Add-On Instructions (AOI) per device for end-to-end control and monitoring.

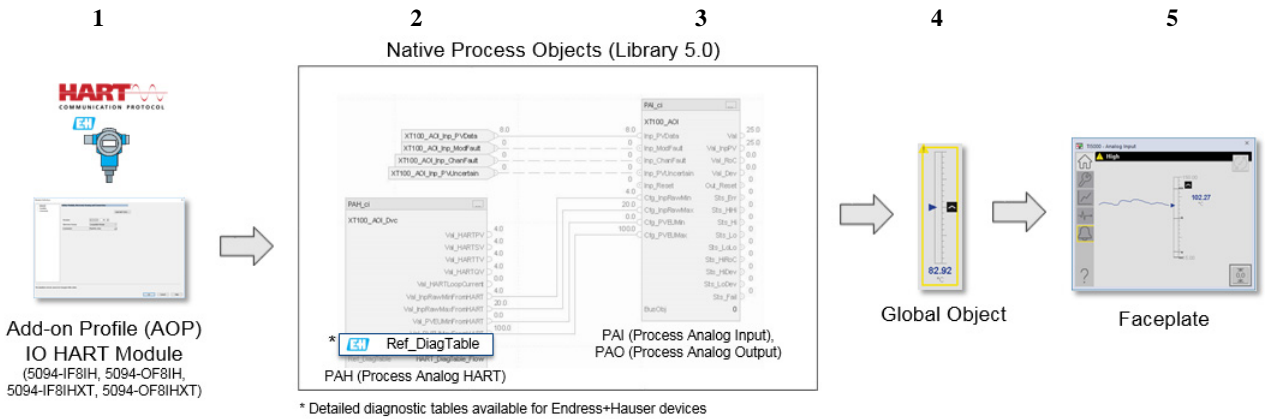
- Module or Device specific AOP for Logix Designer software to create the item or device tags in the I/O Configuration list.
- Device specific AOI to access device tags and prepare the data for use within the controller project.
- Generic AOI to access device data, along with custom-made device diagnostics and unit tables, to enable visibility on an HMI faceplate within the PlantPax system.

# HART Integration

Highly-integrated HART provides a PlantPax data type in the process controller for use with FLEX 5000 modules:

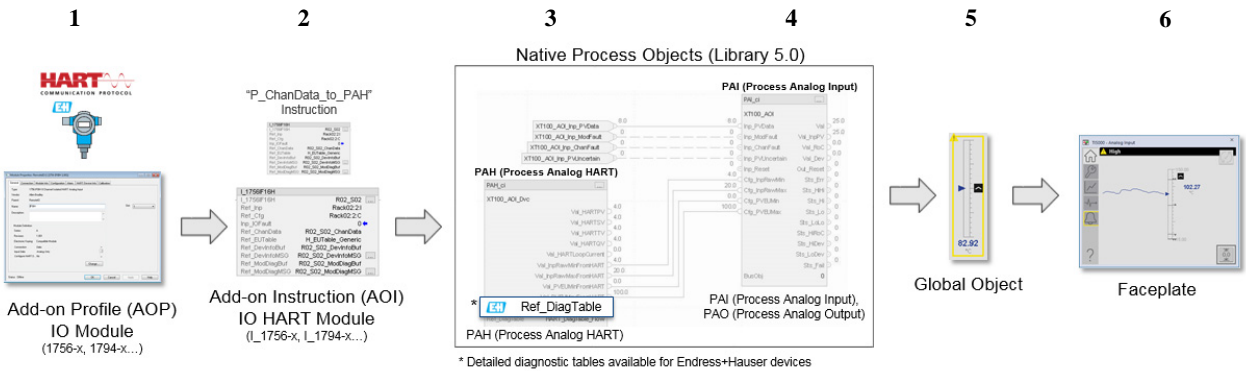
- Configuration of devices within the I/O Configuration tree (no Add-On Instruction needed)
- Device diagnostics automatically propagate to the controller project

Figure 15 - PlantPax 5.0 Library and FLEX 5000™ Highly Integrated HART I/O Modules



Element	Description
1	HART device in Logix Designer I/O Configuration tree for the connection
2	Add-on Profile for module properties provides connection and device tags (connection type: PlantPax Data)
3	PlantPax instructions for application logic/control strategies/alarms
4	Process library global object supports faceplates
5	Process library PAH and PAI faceplates

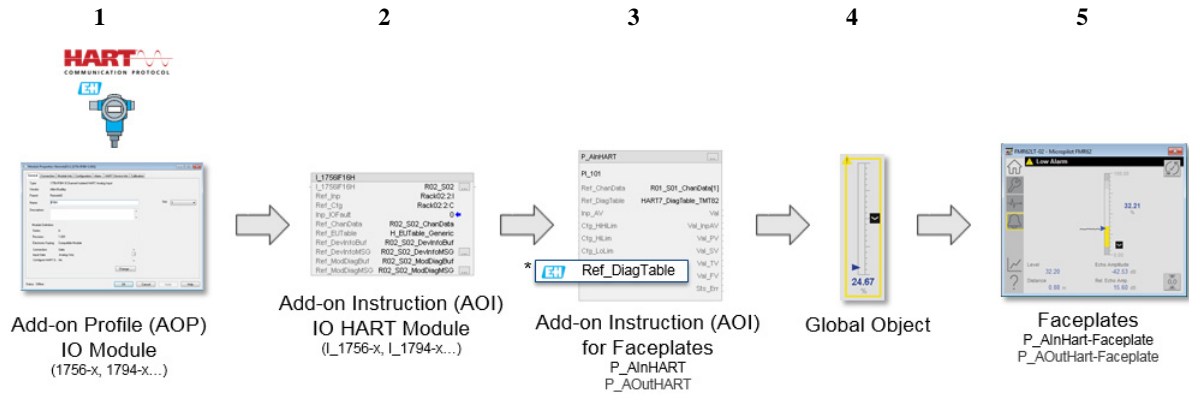
Figure 16 - PlantPax 5.0 Library and 1756, 1794, 1718, 1719, 1734, 1769 or 1715 HART I/O Modules



Element	Description
1	HART device is not added to the I/O Configuration tree
2	Add-on Profile for module properties provides connection and device tags
3	Add-on Instruction accesses the device tags
4	Add-on Instruction interfaces the device with PlantPax Instructions

Element	Description
5	PlantPAx instructions for application logic/control strategies/alarms
6	Process library HMI global object supports faceplates
7	Process library PAH and PAI faceplates

Figure 17 - PlantPAx System Release 4.6 and 1756, 1794, 1718, 1719, 1734, 1769 or 1715 HART I/O Module

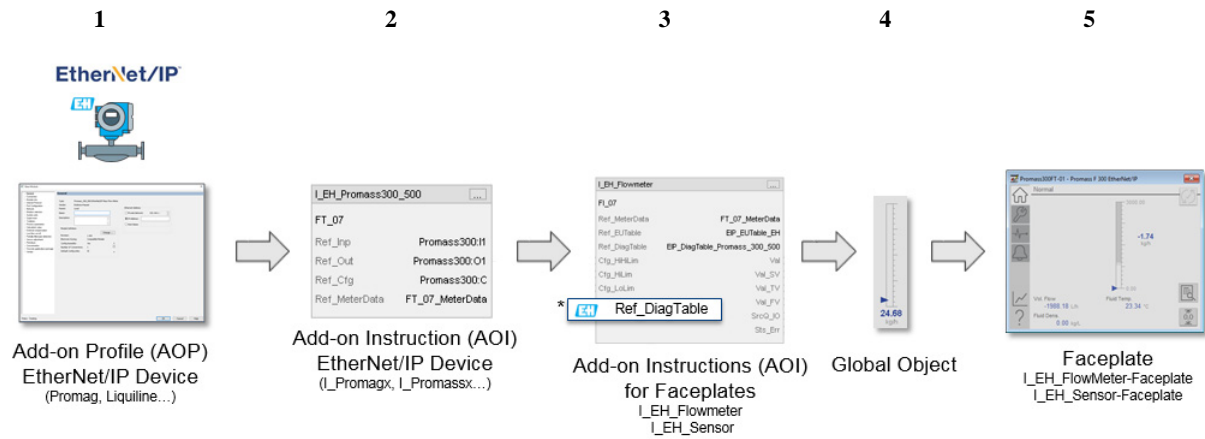


\* Detailed diagnostic tables available for Endress+Hauser devices

Element	Description
1	HART device is not added to the I/O Configuration tree Add-on Profile for module properties provides connection and device tags
2	Add-On Instruction accesses the device tags for use with application logic / control strategies
3	Add-on Instruction for diagnostics and control to the HMI global object
4	Process library HMI global object supports faceplates
5	Process library P_AinHART and P_AOutHART faceplates

Ethernet/IP Integration via Custom Add-On Profile

Figure 18 - PlantPAx System Release 4.6 and 5.0 and EtherNet/IP device with Custom AOP (for example, Endress+Hauser)

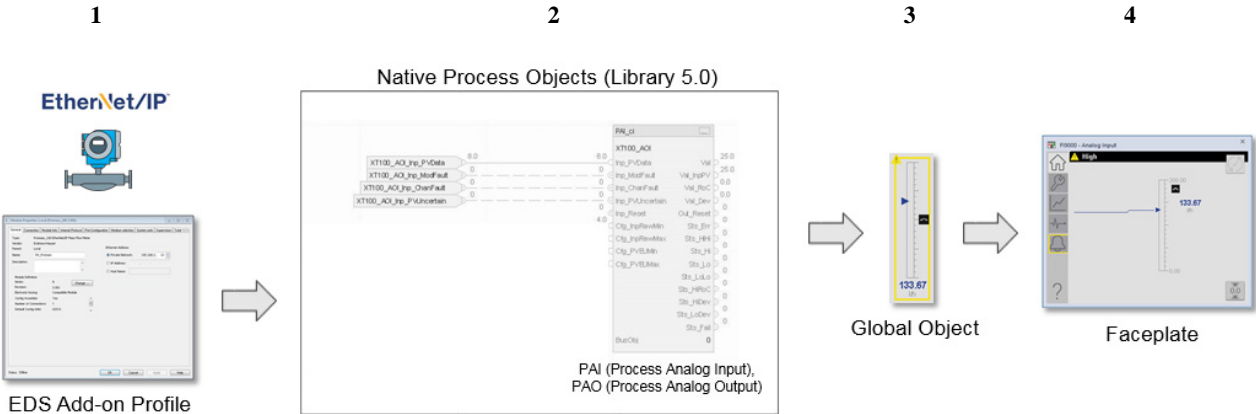


\* Detailed diagnostic tables available for Endress+Hauser devices

Element	Description
1	Endress+Hauser EtherNet/IP device is added to the I/O Configuration tree Add-on Profile for device creation and configuration, such as ProMag or Liquiline
2	Add-on Instruction accesses device tags, such as I_Promagx or I_Promassx for use with application logic / control strategies
3	Add-on Instruction for diagnostics and control to the HMI global object
4	Process library HMI global object supports faceplates
5	Process library I_EH.FlowMeter and I_EH.Sensor faceplates

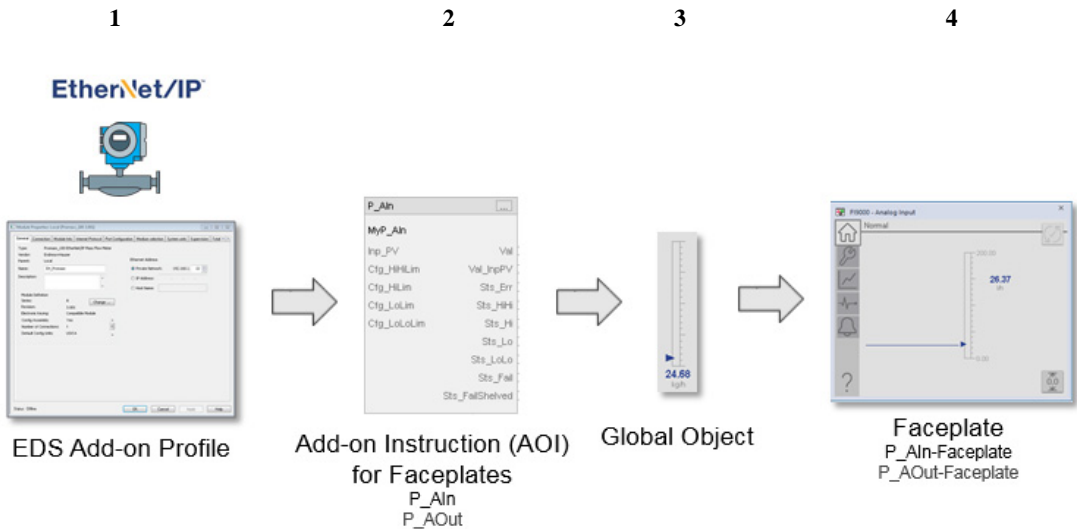
Ethernet/IP Integration via Electronic Data Sheet Add-On Profile

Figure 19 - PlantPax System Release 5.0 and EtherNet/IP device with EDS AOP



Element	Description
1	EtherNet/IP device is added to the I/O Configuration tree Add-on Profile, created via Electronic Data Sheet (EDS) file, for device creation and configuration
2	PlantPax instructions for application logic/control strategies/alarms
3	Process library HMI global object supports faceplates
4	Process library PAI faceplate

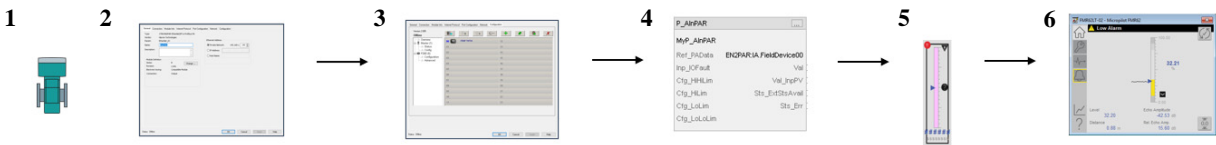
Figure 20 - PlantPax System Release 4.6 and EtherNet/IP device with EDS AOP



Element	Description
1	EtherNet/IP device is added to the I/O Configuration tree Add-on Profile, created via Electronic Data Sheet (EDS) file, for device creation and configuration
2	Add-on Profile for HMI faceplates, such as P_Aln and P_AOut
3	Process library HMI global object supports faceplates
4	Process library P_Aln and P_AOut faceplates

PROFIBUS PA Integration (1788-EN2PAR Linking Device)

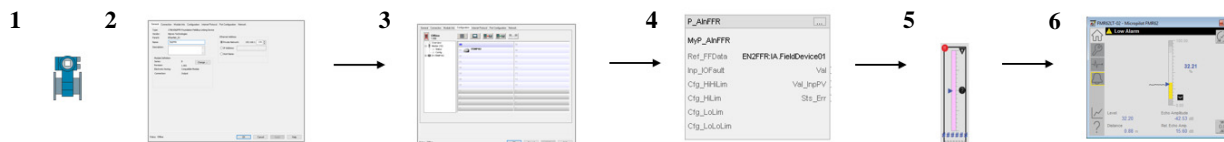
Figure 21 - PlantPax System Release 4.6 and 5.0 and 1788-EN2PAR Linking Device



Element	Description
1	Device is not added to the I/O Configuration tree
2	Add-on Profile for 1788 linking device
3	PROFIBUS PA network configuration
4	Add-on Instruction for HMI Faceplates, such as P_AlnPAR
5	Process library HMI global object supports faceplates
6	Process library P_AlnPAR faceplate

## Foundation Fieldbus Integration (1788-ENFR Linking Device)

Figure 22 - PlantPAx System Release 4.6 and 5.0 and 1788-ENFR Linking Device



Element	Description
1	Device is not added to the I/O Configuration tree
2	Add-on Profile for 1788 linking device
3	Foundation Fieldbus network configuration
4	Add-on Instruction for HMI Faceplates, such as P_AlnFR
5	Process library HMI global object supports faceplates
6	Process library P_AlnFR faceplate

## Alarm Types

Alarms are a critical function of a distributed control system. Alarms monitor conditions that need response, such as a temperature or pressure signal out of range, or device failures such as drives and motors.

The FactoryTalk Alarms and Events server provides a common, consistent view of alarms and events throughout a PlantPAx system. Language-switching alarm messages are also available. When an alarm condition is received, the FTAE server publishes the information to a subscribing Operator workstation via FactoryTalk Alarm and Event services.

- For information on how to configure the FTAE server on a PASS, see [Chapter 3, Process Automation System Server](#).
- For information on how to configure and monitor FTAE alarm components, see the FactoryTalk Alarms and Events System Configuration Guide, publication [FTAE-RM001](#).

The Alarm Banner resides on the Header display.

July 19, 2020 6:14:16 PM		1/10/1998 4:56:50 PM	Alm_HiHi	EMEA Testbed FT222 HiHi	
		6/8/2020 2:43:27 PM	Alm_HiHi	L85EP Testbed FT555 HiHi	
		1/10/1998 4:56:50 PM	Alm_Hi	EMEA Testbed FT222 Hi	

An effective alarm system directs the attention of an operator to improve the productivity, safety, and environment of a process plant.

- A PlantPAx system can use device-level and server-level alarm methods.
- Recommendations are based on the controller type and supported functionality.

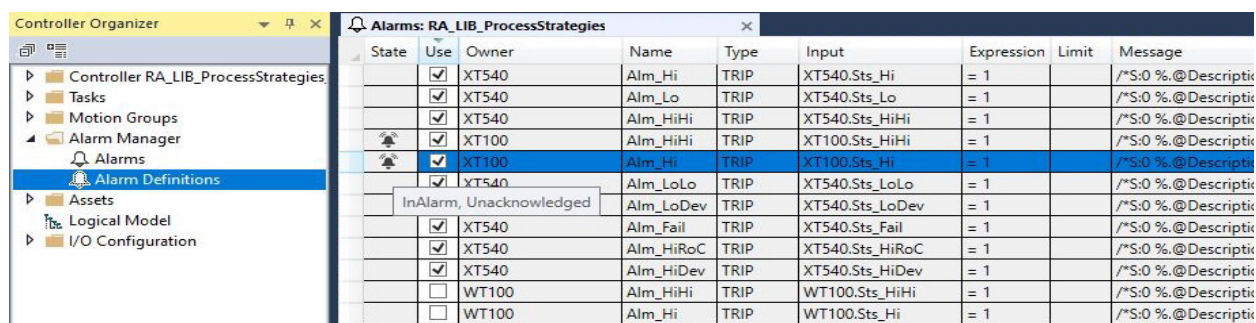
Table 8 - Alarm Types Based on Instructions and Add-On Instructions

If You Have	You Have This Alarm Type	Description
PlantPax 5.0 library	Logix Tag-based	Device level, tag-based alarms monitor a tag value to determine the alarm condition. Tag-based alarms are not part of the logic program and do not increase the scan time for a project. The controller caches information, such as timestamps, alarm states, and associated tag values in a 1000 KB buffer. The controller transmits the information to subscribing FactoryTalk® Alarms and Event servers. <b>Recommended:</b> PlantPax system release 5.0. Requires: ControlLogix 5580 controller, CompactLogix 5380 controller.
PlantPax 4.1 library or earlier	Server Tag-based	A FactoryTalk Alarm and Event server monitors controllers for alarm conditions through data servers and publishes event information that can be displayed and logged. <b>Recommended:</b> PlantPax system release 4.6 and earlier. Server-based alarm monitoring offers the equivalent of HMI tag alarm monitoring, but with an expanded feature set of the FactoryTalk Alarm and Event server.
ALMA or ALMD controller instructions	Logix Instruction-based	These device-level alarm instructions can consume a larger portion of controller memory and increase scan time when executed. When an alarm is detected, it is time stamped and buffered until it is transmitted to subscribing FactoryTalk Alarms and Events servers. <b>Not Recommended</b> in large deployments due to added controller overhead. Requires: ControlLogix 5570, CompactLogix 5370, ControlLogix 5580, CompactLogix 5380 controller. Device level, Logix instruction-based alarms are programmed within the controller program and integrated to the FactoryTalk Alarm and Event server. <ul style="list-style-type: none"> <li>The Digital Alarm (ALMD) instruction detects alarms that are based on Boolean (true/false) conditions.</li> <li>The Analog Alarm (ALMA) instruction detects alarms that are based on the level or rate of change of analog values.</li> </ul>

## Guidelines for Logix Tag-based Alarms

In a PlantPax 5.0 system, we recommend no more than 7500 active tag-based alarms per controller at the 500ms evaluation period.

Create Logix tag-based alarms to send alerts about specific events or conditions. A tag-based alarm is similar to a digital alarm because both monitor a tag value to determine an alarm condition. However, a tag-based alarm is not part of the logic program and does not increase the scan time for a project.



State	Use	Owner	Name	Type	Input	Expression	Limit	Message
	<input checked="" type="checkbox"/>	XT540	Alm_Hi	TRIP	XT540.Sts_Hi	= 1		/S:0 %.@Descripti
	<input checked="" type="checkbox"/>	XT540	Alm_Lo	TRIP	XT540.Sts_Lo	= 1		/S:0 %.@Descripti
	<input checked="" type="checkbox"/>	XT540	Alm_HiHi	TRIP	XT540.Sts_HiHi	= 1		/S:0 %.@Descripti
	<input checked="" type="checkbox"/>	XT100	Alm_HiHi	TRIP	XT100.Sts_HiHi	= 1		/S:0 %.@Descripti
	<input checked="" type="checkbox"/>	XT100	Alm_Hi	TRIP	XT100.Sts_Hi	= 1		/S:0 %.@Descripti
	<input checked="" type="checkbox"/>	XT540	Alm_LoLo	TRIP	XT540.Sts_LoLo	= 1		/S:0 %.@Descripti
	<input checked="" type="checkbox"/>	InAlarm, Unacknowledged	Alm_LoDev	TRIP	XT540.Sts_LoDev	= 1		/S:0 %.@Descripti
	<input checked="" type="checkbox"/>	XT540	Alm_Fail	TRIP	XT540.Sts_Fail	= 1		/S:0 %.@Descripti
	<input checked="" type="checkbox"/>	XT540	Alm_HiRoC	TRIP	XT540.Sts_HiRoC	= 1		/S:0 %.@Descripti
	<input checked="" type="checkbox"/>	XT540	Alm_HiDev	TRIP	XT540.Sts_HiDev	= 1		/S:0 %.@Descripti
	<input type="checkbox"/>	WT100	Alm_HiHi	TRIP	WT100.Sts_HiHi	= 1		/S:0 %.@Descripti
	<input type="checkbox"/>	WT100	Alm_Hi	TRIP	WT100.Sts_Hi	= 1		/S:0 %.@Descripti

Tag-based alarms do not require a FTAE server. A controllers subscription to the HMI can be serviced using a FactoryTalk® Linx data server.

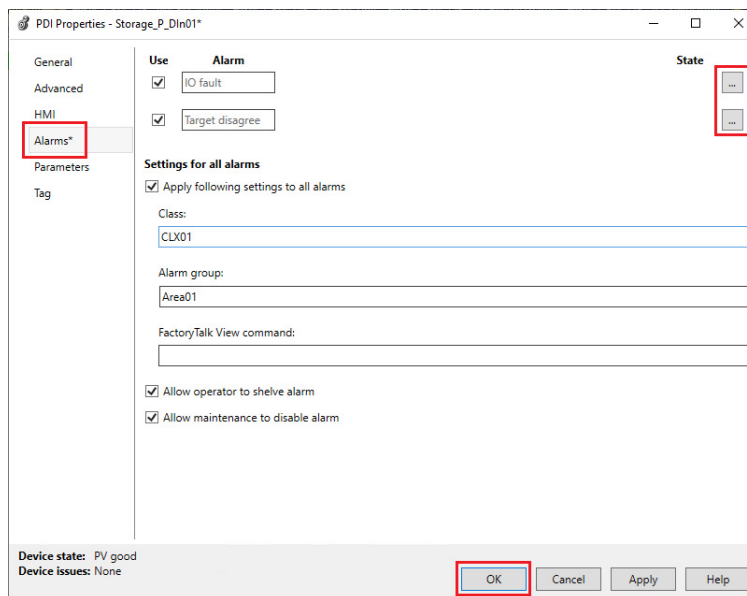
An alarm definition is associated with an Add-On Instruction (AOI) or a defined data type. When a tag is created using a data type or an AOI that has alarm definitions, alarms are created automatically based on the alarm definitions.



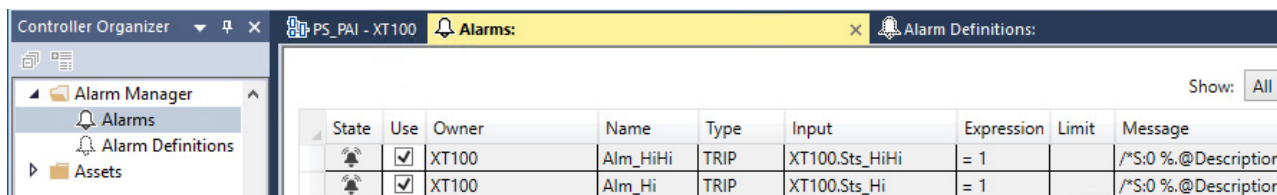
## Embedded Tag-based Alarms in PlantPax Instructions

The PlantPax instructions have embedded tag-based alarms. Configure the states as needed and simply enable the alarms you want to use.

Use the Alarms tab on the instruction properties to assign settings to all pre-defined alarms. There is an option to propagate specified Class/Group settings to all alarms in the instruction.



Alarm settings are also accessible via the Alarm Manager.



## Guidelines for Server Tag-based Alarms (FactoryTalk Alarms and Events)

A FTAE server is required for server tag-based alarms. The server puts these alarm tags on scan, just as it does all other tags it polls for the HMI and Historian. In a PlantPax 5.0 system, we recommend you limit the number of server tag-based alarms to 20,000 per PASS (10,000 per data server instance). There are no hard-coded limitations, however you could experience longer recovery time during system restoration if you exceed the recommendation.

Use the Process System Estimator (PSE) for sizing the number of alarm instructions for a more accurate limit that is based on your specific configuration. Be sure to add for additional memory that is required to maintain the alarm subscription as it is not accounted for in the PSE memory calculations.



- Use alarm groups to organize alarms by operator role.
- Use alarm expressions against user groups to provide rolled up indication of alarms by role or display. For example, `AE_InAlmUnackCount("T1*")` returns a count of unacknowledged alarms within groups that start with T1.

For more information on alarm expressions, see the FactoryTalk View Site Edition User's Guide, publication [VIEWSE-UM006](#).

- Use an alarm class to identify alarms that share common management requirements (for example, testing, training, monitoring, and audit requirements). Do not use alarm class to identify alarms by operator role or display because you cannot retrieve an alarm count by class by using alarm expressions in FactoryTalk® View software. However, you can filter by class on the alarm displays.
- Use the alarm builder feature in the PlantPAx Configuration Tool to help build server tag-based alarms.

## Guidelines for Logix Instruction-based Alarms

The process library does not provide support for Logix instruction-based alarms. Note that the instruction-based alarms can impact controller performance.

Controller scan time and memory usage are variable with the use of the ALMA or ALMD instructions, depending on the states of the controller. Large alarm bursts can have a significant impact on controller CPU utilization. For example: Controller memory used for buffering by each subscriber (topic in the data server) = 100 KB.

Example execution times:

- ALMD in a 1756-L73 controller with no alarm state changes: 7 µs
- ALMD in a 1756-L73 controller with alarm state changes: 16 µs

In redundant controller configurations, cross loading of redundancy can add up to 70 µs per ALMD instruction.

Reserve the use of ALMA and ALMD instructions for the most critical alarms. Although there are no hard-coded limitations, we recommend limiting the number of instructions to the following:

- 250 per redundant controller
- 2000 per simplex controller

## Monitor Alarms

You can use the alarm status explorer in FactoryTalk View SE to browse all of your configured alarms on a server or the entire system. Alarms also are filtered by the Shelved, Suppressed, and Disabled options. The alarm explorer can be preconfigured as a Shelved alarm display to let operators view a list of alarms.

ISA 18.2 provides alarm performance metrics and example target values. Some key metrics include the following:

- Alarm rates: annunciated alarms per operator:
  - < 150...300 alarms per day
  - Average of 6...12 per hour
  - Average 1...2 per 10 minutes
- Contribution of the top 10 most frequent alarms to the overall alarm load: ~<1...5% maximum, with action plans to address deficiencies
- Number of alarms that remain in effect continuously for more than 24 hours (stale alarms): Less than 5, with plans to address

You can use FactoryTalk® VantagePoint® software to generate reports based on these metrics:

- Hourly Alarms Report (active count of alarms over 1- hour samples)
- Alarm Distribution Report (percentage contribution of top 10 most frequent alarms)
- Alarm Frequency Report (top 10 most frequent alarms)
- Standing Alarms Report (top 10 currently active alarms by duration)
- Alarm Duration Report (top 10 alarms by duration)

For more information, see Knowledgebase Technote [FactoryTalk VantagePoint Reporting for FactoryTalk Alarms and Events](#).

## Create HMI Displays

The Process Automation System Server (PASS) is a required system element for the PlantPAx system. The PASS hosts the HMI server, which stores the HMI project components, such as graphic displays, and provides these components to an Operator Workstations (OWS) client upon request.

For more information on how to configure these servers, see [Chapter 3 Process Automation System Server](#).

Follow these guidelines:

- Use FactoryTalk® View Studio software on the EWS to access the application.
- Configure the FactoryTalk View SE servers to start automatically on startup on the PASS. Let the servers fully start up before starting the client computers.
- Do not use more displays than your license allows. If you exceed the license, displays can fail when requested.
- FactoryTalk View SE displays contain expressions for each customized animation that holds simple or complex calculations to accomplish the animations. Each expression consumes memory and requires processing

time to execute. Too many expressions can make the screen animate sluggishly and affect system performance.

- Use global objects to display the status of a control module or device when the information to be displayed is stored in a tag structure within Logix (for example, UDT or Add-On Instruction) and there are many identical instances. A global object is a display element that is created once and can be referenced multiple times on multiple displays in an application. When changes are made to the original (base) object, the instantiated copies (reference objects) are automatically updated.
  - Base global objects are stored in FactoryTalk View in displays (.ggfx files). If you have a large number of base global objects defined, do not put them all in a single display. Limit the number of global object instances on a single display to 60 or less.
  - As global objects can be instantiated multiple times, the performance impact of their design is amplified by their number of instances. Therefore, design global objects carefully to reduce the number of objects, expressions, and animations that are used within the base object.
- Use 'Replace' display types. This display type closes the currently displayed screen when a new screen opens. 'Overlay' display types must be managed because multiple screens open at once consumes memory and CPU resources.
- Only use Cache After Displaying and Always Updating for displays frequently accessed by the operator and not applied generally. Used sparingly on these displays, these settings improve display call-up time for important displays. When displays are cached and always updating, the additional memory load of this display on the view client is persistent after call-up regardless of whether the display remains visible. This action affects system load and can affect system performance.
- We do not recommend the use of data logs. If necessary, use data logs for short-term data retention only.
- Do not create derived tags that depend on the results of other derived tags. Derived tag processing is not sequential.
- Avoid use of VBA when possible. VBA runs as a single-threaded process so it's possible the application written in VB does not allow the HMI to perform predictably.

Use FactoryTalk View Studio software to create or import any system specific graphic displays that your PlantPAx system requires.

For PlantPAx common graphics, you can use ACM-generated displays or graphic framework displays (from the process library).

## Graphic Framework Displays

The process library download contains the following files to use as a starting point to utilize the PlantPAx Graphic Framework:

- FTVSE\_12\_O\_Template\_{version}.APB

Restore the provided Local Station project templates (.APA) by using the FactoryTalk View SE Application Manager.

- FTVSE\_12\_O\_Template\_{version}.zip

Create your own project and import the HMI server or individual files as needed.

For more information on how to develop displays, see the Rockwell Automation Library of Process Objects Reference Manual, publication [PROCES-RM200](#).

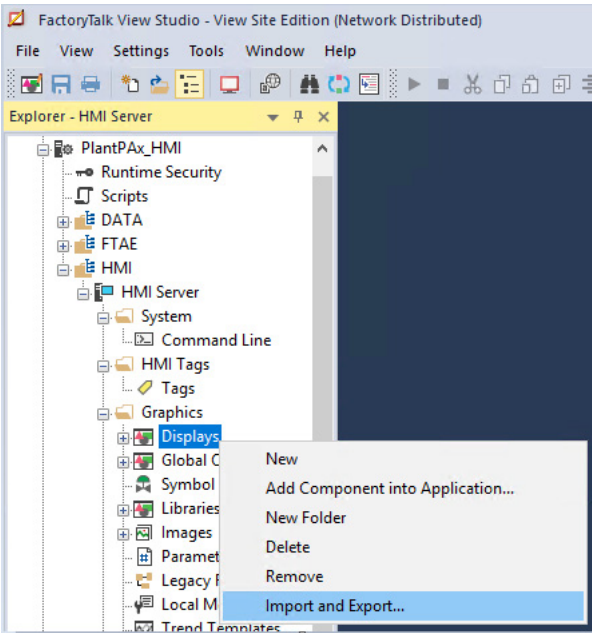
### ACM Generated Displays

**IMPORTANT**

The process library uses Global Objects. They must be imported into the FactoryTalk View SE application prior to the displays.

ACM generated displays can be imported into your HMI application by using FactoryTalk View Studio software.

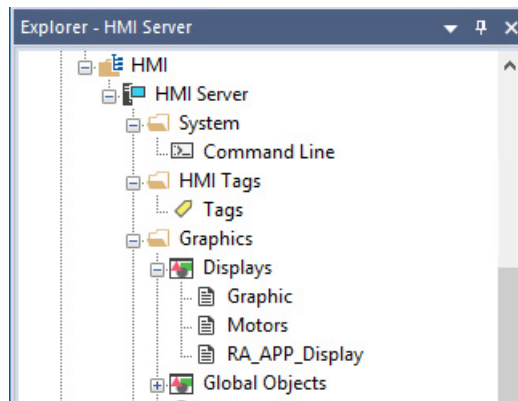
1. In FactoryTalk View SE Studio, import the ACM generated graphics (.XML).



2. Use the Graphics Import Export Wizard to import either a single global object or batch of multiple global objects from an .XML file.

Page	Selection
Select the operation to perform	Import graphic information into displays
Do you want to backup the displays that will be modified by the import?	No
Select the type of file to import	Multiple displays batch import file
Select the multiple display batch import file	Browse to your batch import file (Example: My_PlantPax_Project_FTVIEWSE_Server_BatchImport.xml)
When importing	Create new objects on the display

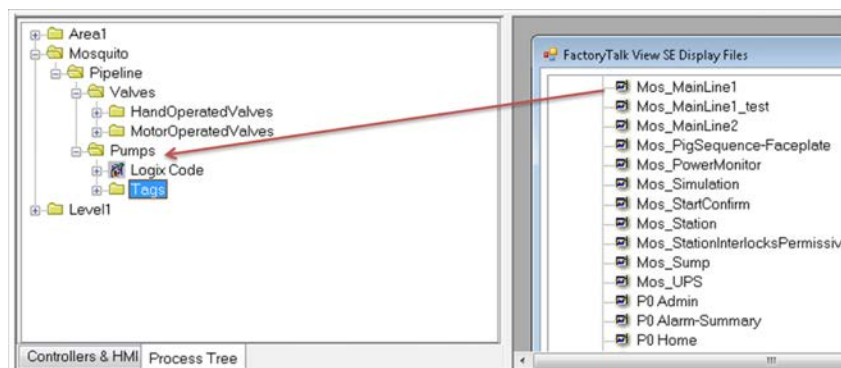
3. Verify that the displays were created successfully.



## PlantPax Configuration Tool Displays

Organize the FactoryTalk View SE HMI displays under process tree folders.

1. Go to Logix Controllers > Open FactoryTalk View SE Displays List... and select the Process Tree tab.
2. Drag a display file from the SE display files window and drop it into the Process Tree folder.

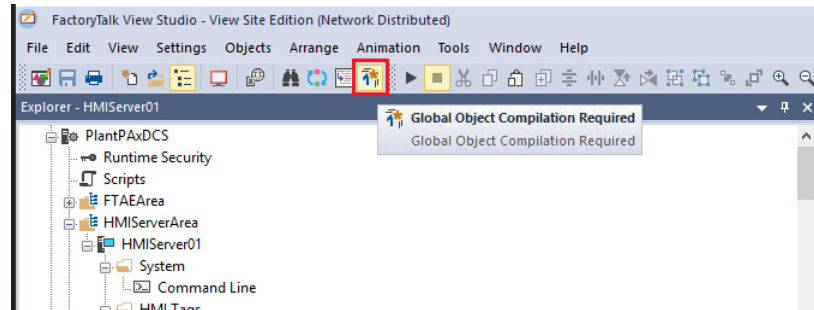


## Optimize Runtime Performance

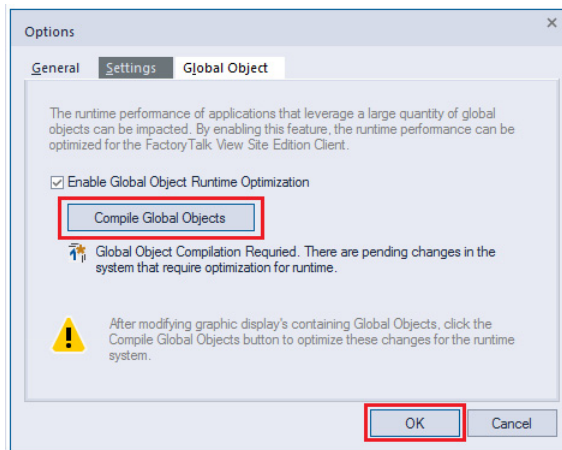
PlantPax guidelines recommend using global objects to display the status of a control module or device when there are multiple, identical instances. Global objects offer consistency; and changes to a global object propagate to all the affected displays.

FactoryTalk View Studio has an Enable Global Object Runtime Optimization features that improves runtime performance.

1. After you modify graphics that contain global objects, select Global Object Compilation Required



2. Select Compile Global Objects to optimize the changes for the runtime system.

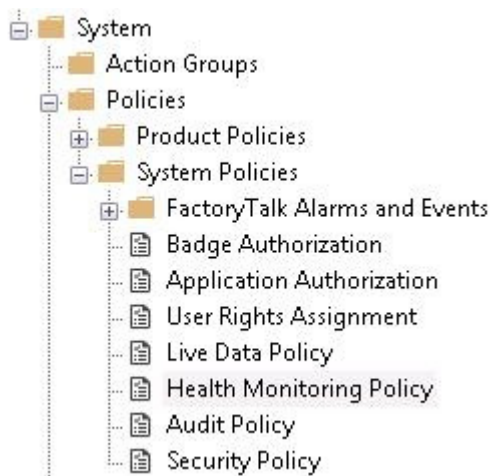


The first time you compile global objects, the process can take an extended amount of time, depending on the number of displays in the application. Subsequent compiles require less time as they only process changes to displays.

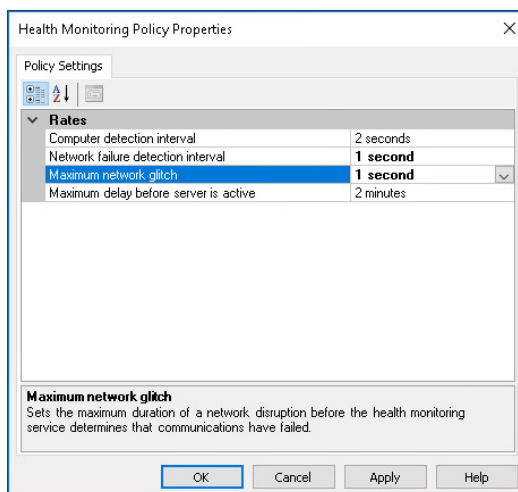
## Optimize HMI Redundancy

For HMI redundancy, change these settings to optimize the fail over speed to ensure proper visibility on the HMI clients.

1. In FactoryTalk View Studio, go to System > Policies > System Policies and select Health Monitoring Policy.



2. Change the following settings:
  - Network failure detection interval: From 2 seconds to 1
  - Maximum network glitch: From 5 seconds to 1 second



# Asset Management

FactoryTalk® AssetCentre software is a centralized tool that helps:

- Maintain inventory assets in the system
- Manage version control to track program changes
- Collect audit logs to track user and system activity
- Schedule backups and verify program integrity

## Quick Start

This is the recommended work flow to configure and implement a FactoryTalk AssetCentre application. For experienced users, each step outlines requirements. For more detailed information, follow the referenced links.

1

### Inventory Plant Assets

FactoryTalk AssetCentre software provides a centralized tool to manage and track asset information as well as protect assets. You can:

- Scan the network for existing devices to create an inventory.
- Manually add individual assets.

Regardless of method, we recommend that you add asset types for controller project, HMI, engineering workstation, and servers.  
For more information, see [Inventory Plant Assets](#).

2

### Configure Audit Logs

There are multiple logs that can be generated to capture asset data. Select the one that you want:

- Audit Log monitors FactoryTalk-enabled software products and logs user actions. For example, who was the last user to change a program.
- Diagnostic Log to monitor system health.
- Event Log to track FactoryTalk AssetCentre events, such as when a backup starts and who generates a report.

Audit data is stored in the SQL server and displayed in the AssetCentre logs. Information collected includes:

- User actions
- Program changes
- Security events

For more information, see [Configure Audit Logs](#).

3

### Schedule System Backups

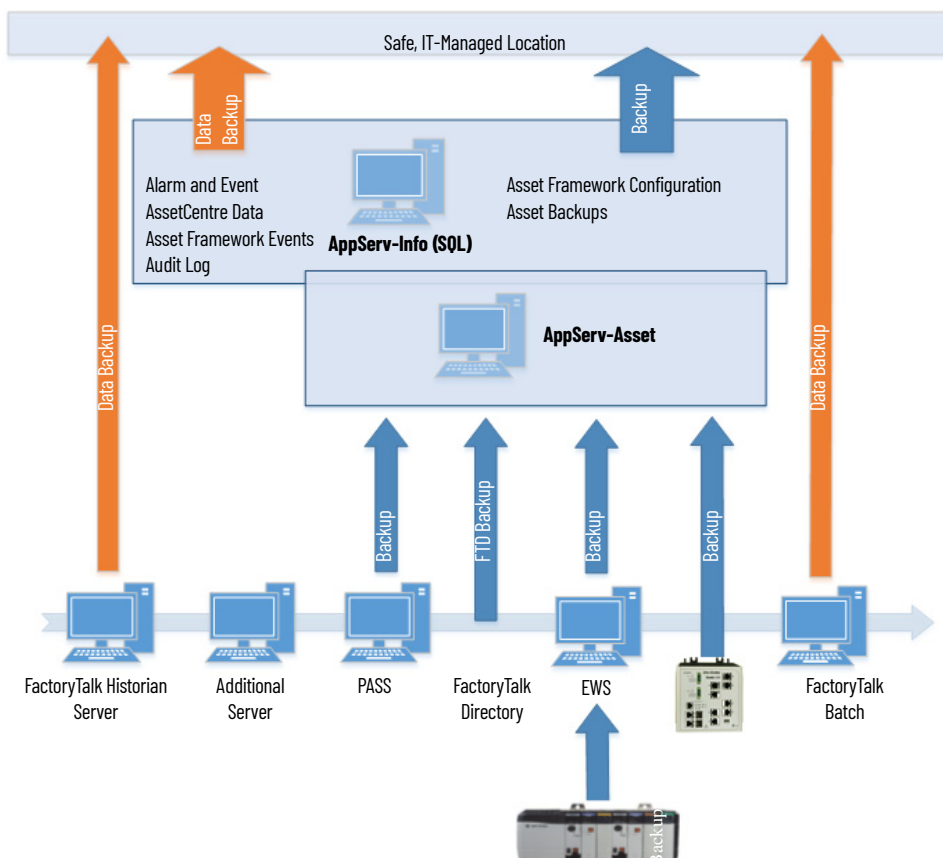
FactoryTalk AssetCentre software stores backup data on an SQL server.

The Disaster Recovery function creates backup files from the running asset on the plant floor. The backup file is compared to the original and archived to a Master version. The Agent service performs these comparisons and can be scheduled to operate at specific times and intervals

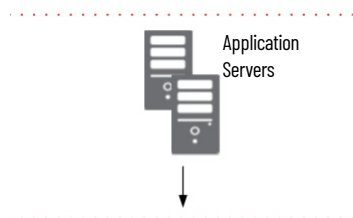
For more information, see [Schedule System Backups](#).



## Example Asset Data Flow



## Prerequisites



Following the [System Workflow](#), configure application servers.

An asset management server (AppServ-Asset) supports maintenance and plant operations to the system with FactoryTalk AssetCentre software.

In most PlantPax® systems, the AppServ-Asset server is on a separate computer and requires these components local or distributed on remote servers:

- FactoryTalk® Directory
- FactoryTalk® Activation server
- FactoryTalk SQL server (can be on the same computer as the AppServ-Asset server or on its own computer)

Install FactoryTalk AssetCentre Client software on the AssetCentre server, the EWS, and the OWS.

If you plan to use the FactoryTalk AssetCentre virtual images, see configuration procedures in [9528-UM001](#).

For more information, see these additional resources.

Resource	Description
FactoryTalk AssetCentre Installation Guide, publication <a href="#">FTAC-IN005</a> .	How to install the FactoryTalk AssetCentre system.
FactoryTalk AssetCentre Getting Results Guide publication <a href="#">FTAC-GR002</a>	How to get started with the FactoryTalk AssetCentre system.
FactoryTalk AssetCentre Utilities User Manual, publication <a href="#">FTAC-UM001</a>	How to use AssetCentre utilities.

For Rockwell Automation tutorials, see these [YouTube videos](#).

- Introduction to Asset Management
- Using the Inventory Agent in AssetCentre
- Getting Started with FactoryTalk AssetCentre
- Introduction to FactoryTalk AssetCentre Disaster Recovery
- FactoryTalk AssetCentre Disaster Recovery to Backup and Compare a FactoryTalk View SE Application

## FactoryTalk AssetCentre

FactoryTalk AssetCentre provides a centralized tool to manage and track asset information as well as protect assets.

To help protect your automated control system, we recommend that you develop a strategy for archiving application data and determine recovery plans. For a tutorial, see the [YouTube video](#) 'Introduction to Asset Management'.

If you plan to configure the FactoryTalk AssetCentre virtual image, see the procedures in the Template User Manual, publication [9528-UM001](#).

## Inventory Plant Assets

An asset inventory lists the connected devices and computers on the network and stores unique identification information about the hardware, firmware, and software in the system.

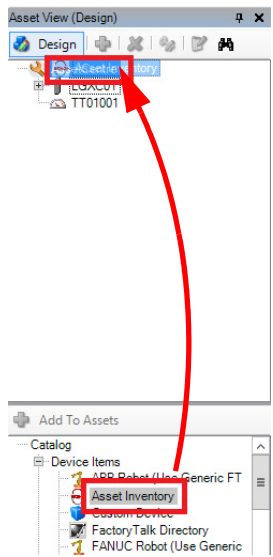
There are multiple ways to build your inventory list of assets with AssetCentre software tools.

### Scan the System for Assets

Drag-and-drop an Asset Inventory asset type into the AssetCentre tree and scan for device information.

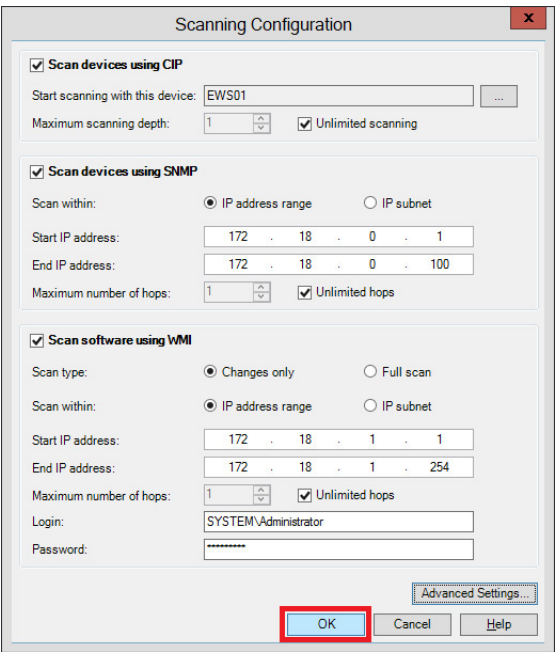
For a tutorial, see the [YouTube video](#) 'Using the Inventory Agent in AssetCentre'.

1. In the FactoryTalk AssetCentre window in Design mode, move the Asset Inventory item into your asset tree.



2. Open the Asset Inventory Properties and select Scanning Configuration to define how to scan the system.

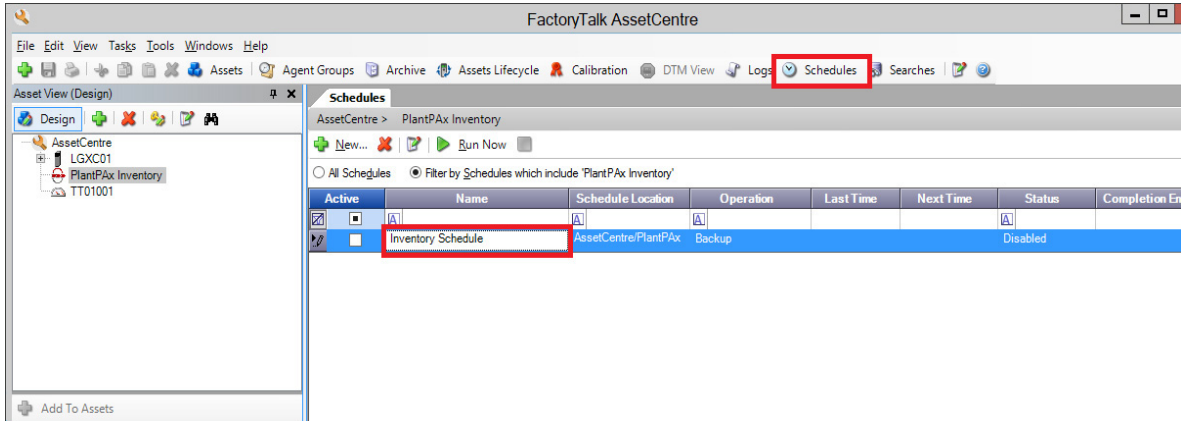
Dialog Box	Action
Scanning Configuration	<p>Select a type of scan from the following options:</p> <p><b>Scan devices using CIP™:</b> Common Industrial Protocol (CIP) scanning browses the network by using FactoryTalk® Linx drivers to return Rockwell Automation Asset Management Program.</p> <p><b>Scan devices using SNMP:</b> Simple Network Management Protocol (SNMP) scanning browses the network for SNMP-enabled devices with a specified IP address range or IP subnet. If a device responds, the AssetCentre service requests available SNMP information.</p> <p><b>Scan software using WMI:</b> Windows® Management Instrumentation (WMI) scanning browses the network within the specified IP address range or IP subnet, and returns software installed on a Windows host.</p> <p>When you have selected a scan type, select Advanced Settings.</p> <p><b>IMPORTANT:</b> Leave the default Unlimited scanning box checked to scan the entire network.</p>
Advanced Settings	Select Community String.



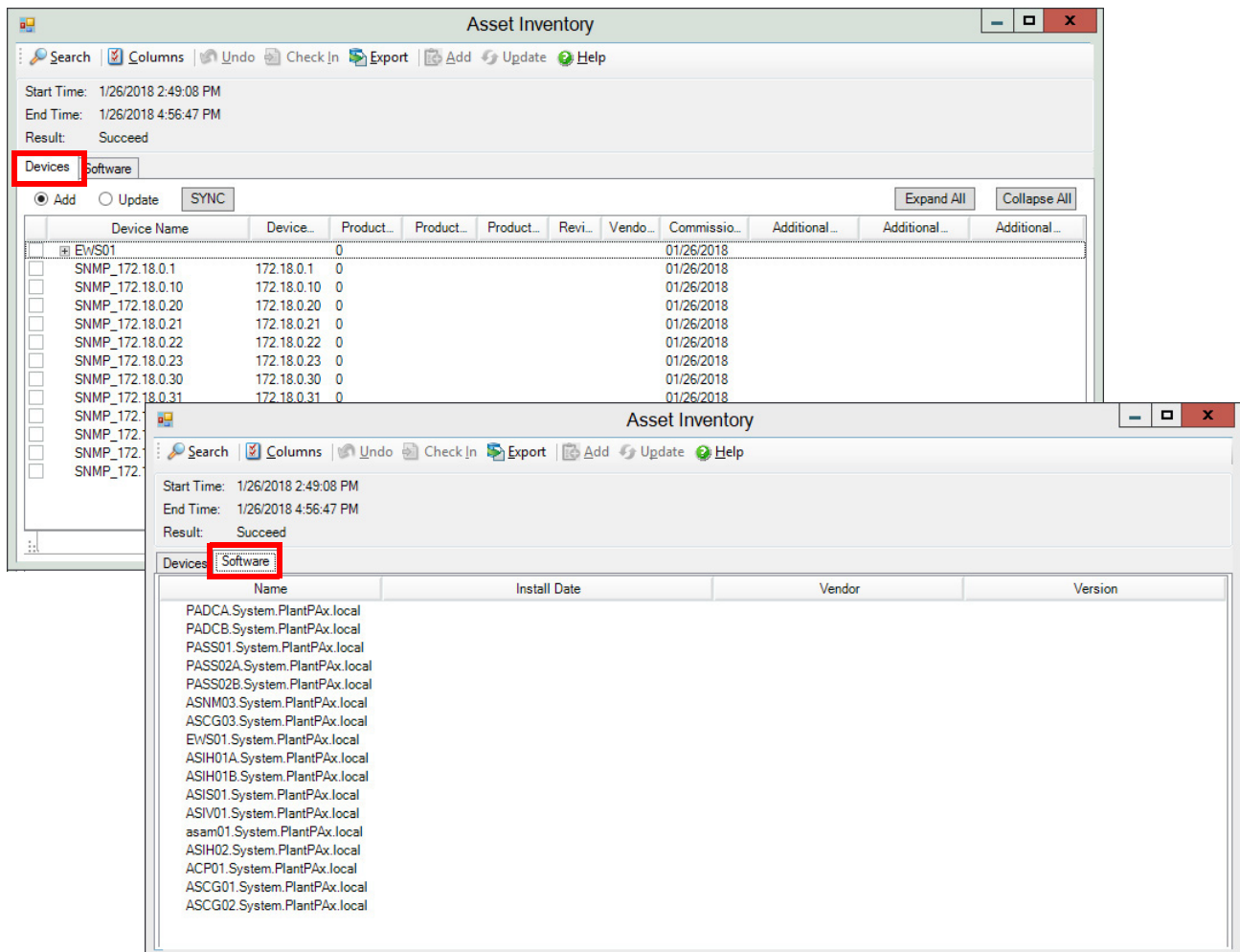
3. Select a device.

The device must have communication paths to any devices that you want to return when the Inventory Agent runs.

4. Select Schedules and create a schedule for the Asset Inventory item. When the schedule runs, an inventory list is generated.



An inventory has a list of devices and a list of software.

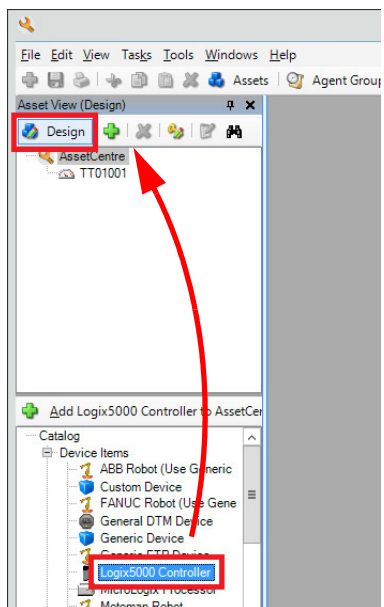


## Manually Add Individual Assets

You can manually add assets.

For a tutorial, see the [YouTube video](#) 'Getting Started with FactoryTalk® AssetCentre'.

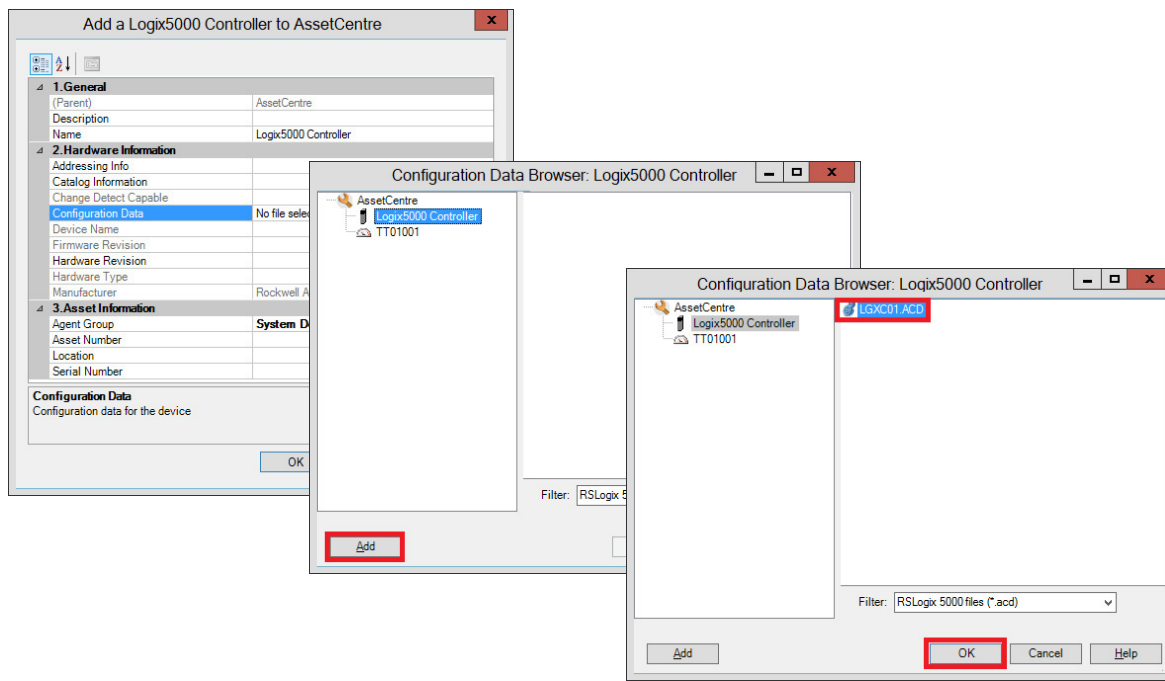
1. While in Design mode, drag-and-drop the asset into your AssetCentre project.



An AssetCentre dialog box appears for the asset you are adding.

2. Select the asset to configure details.

For example, add an .ACD file for a controller.



3. For a controller, select a path to the controller by using the Addressing Info Browser ('...' ellipsis) button.

#### 4. Name the asset.

We recommend that you use the steps to add each of these asset types from the catalog to your inventory:

- Controller project
- HMI
- Engineering workstation
- Servers

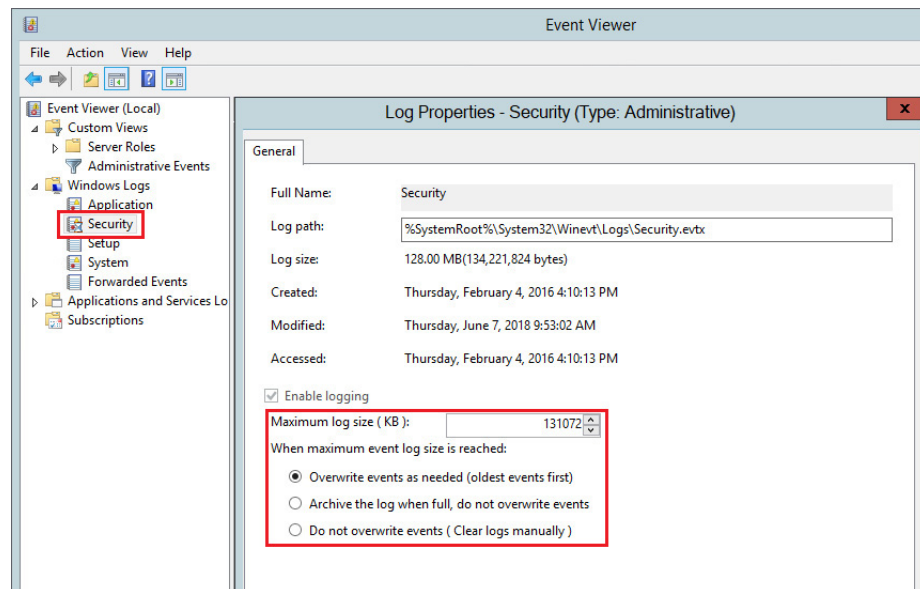
## Configure Audit Logs

There are multiple logs that can be generated to capture asset data.

- Audit Log monitors FactoryTalk-enabled software products and logs user actions. For example, who was the last user to change a program.
- Diagnostic Log to monitor system health.
- Event Log to track FactoryTalk AssetCentre events, such as when a backup starts and who generates a report.

## Security Audit Logs

Microsoft Windows® OS captures security audit records locally for every PlantPAx server and workstation. We recommend that you make sure the log is sized adequately to capture sufficient records to satisfy your retention policy. In Windows Event Viewer adjust the configuration of the security log according to your system requirements.

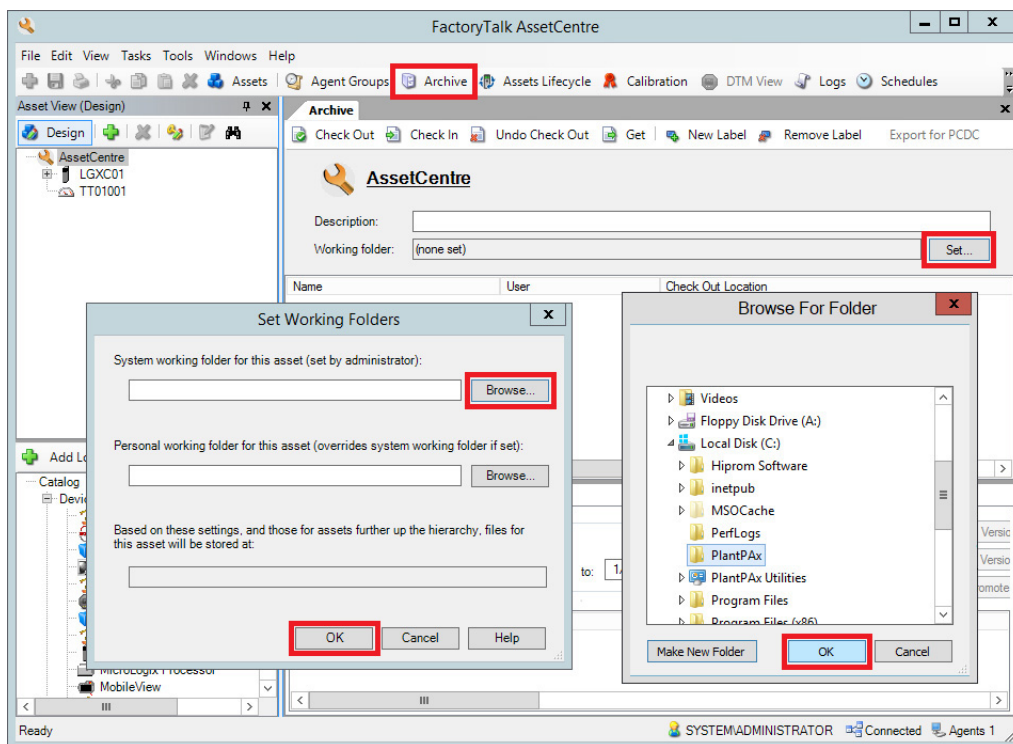


For information about how to configure secure audit logs, see Configure System Security Features User Manual, publication [SECURE-UM001](#).

## Schedule System Backups

Once assets have been added to your system, the assets can be configured from the Archive tab. From the Archive view, you can do the following:

- View the archive of current and previous versions of programs and assets.
- Set a personal working folder to hold Checked-Out files.
- Promote a specific program version to be the master.



## Create a Backup Schedule

1. From the main menu of the FactoryTalk AssetCentre client dialog box, select Schedules.
2. Select New and follow the Wizard instructions at the top of the dialog boxes.

## Configure Disaster Recovery

The Disaster Recovery function creates backup files from the running asset on the plant floor. The backup file is compared to the original and archived to a Master version. The Agent service performs these comparisons and can be scheduled to operate at specific times and intervals.

The Agent service can be co-located with the AssetCentre server, or it can be located with another server. The Agent service performs the background actions of uploading and comparing program files and versions.

For more information about FactoryTalk AssetCentre Agents, see the resources that are listed in the table on [page 152](#).

For a tutorial, see the [YouTube video](#) 'Introduction to FactoryTalk AssetCentre Disaster Recovery'.



## Maintenance Strategy Recommendations

We suggest that you develop a plan to back up your control system configuration and process data on a regular schedule. Consider involving your IT department to develop this plan. An effective backup plan can help protect you from loss of resources and revenue.

---

**IMPORTANT** We recommend that you verify operating system or software updates on a non-production system or when the affected system components are not-active. These precautions help to prevent unexpected results.

For equipment monitoring and safety, we recommend that you follow the procedures of the manufacturer

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The following table summarizes the types of backups and updates for routine and annual maintenance. The time frames are examples and can be modified based on the attributes and risk factors in your plant.

### Maintenance Type Recommendations

Backups	Why?	When?	What?
Application configuration - See <a href="#">page 160</a>	Roll back or file protection	Periodic	Controllers PASS servers <ul style="list-style-type: none"> <li>• FactoryTalk Directory</li> <li>• HMI, FactoryTalk® Linx data servers</li> <li>• FactoryTalk® Alarms and Events servers</li> </ul> Network switches
Data - See <a href="#">page 161</a>	Archive or project protection	Periodic and on-demand	FactoryTalk® Historian FactoryTalk® Batch FactoryTalk AssetCentre

The PlantPax system can be configured to back up control system configuration data automatically. FactoryTalk AssetCentre software stores data in a SQL server. The server stores an Archived copy of both the master files and previous file revisions in a protected database. The Archived files are available if there is a failure.

Database backups for FactoryTalk software packages (Historian, AssetCentre) can occur anytime without system operation impact. We recommend that process backups be routinely scheduled so that data loss is minimized if computer issues occur.

FactoryTalk® Batch uses a SQL server for archiving journal data, storing master recipes, and material database.

Application configurations for PlantPax system servers and workstations are to be backed up separately and more regularly. The frequent backups mitigate the risk of configuration and application information loss between PlantPax system backups. Frequent backups simplify the process of restoring only a portion of your application, if needed.

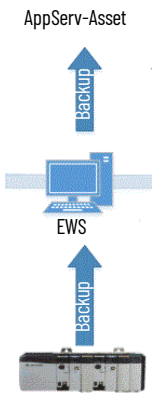


The following table shows examples of project files that are to be backed up regularly. Some files contain configuration scripts and collected data.

Recommended Configuration Backup

Configuration	Host Environment	Tool	Files Backed Up
Controller project file	Studio 5000® application	FactoryTalk AssetCentre Disaster Recovery	.ACD
FactoryTalk Directory	FactoryTalk® Administration Console	Distributed Application Manager	.APB
PASS servers	FactoryTalk® View Studio software		
Network switches	System network	User choice	.TXT (based)

Controller Project File



Use FactoryTalk AssetCentre software on your AppServ-Asset server to back up Logix 5000™ software and Studio 5000 Logix Designer® application project files (.ACD). Logix 5000 assets are created in the AssetCentre project tree for each controller and project files can be associated with those assets and checked into FactoryTalk AssetCentre software.

A schedule can be created to back up the project files at regular intervals. Use an EWS to perform check-out and check-in features to make modifications to the project file.

FactoryTalk AssetCentre software is integrated with the Logix Designer application to let you access files in the Archive without leaving the design environment. Use change tracking on project files to audit modifications.

FactoryTalk Directory



Our recommendation is to back up the FactoryTalk® Directory regularly. The backup includes any FactoryTalk® Security, users, and computers, among other configurations.

The backup is contained in the output .APB file of the Distributed Application Manager, which is installed on the PASS with the FactoryTalk® View software, version 8.1 and later.



PASS Servers

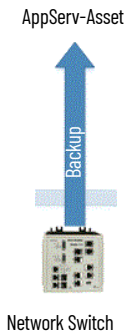
The core servers in the FactoryTalk View application need to be backed up regularly whenever changes are made. The core servers on the PASS consist of the HMI, Data, and Alarm and Event servers.

**IMPORTANT**

AssetCentre software, version 9, includes an asset for FactoryTalk View SE version 11 and later. This new asset can be created to support disaster recovery for a FactoryTalk View SE application. For details see the [YouTube video](#) 'Use FactoryTalk AssetCentre Disaster Recovery to Backup & Compare a FactoryTalk View SE application'.

A FactoryTalk AssetCentre custom asset can be created by following the procedure in Knowledgebase Answer ID [818741](#) 'Building Custom Device assets for FactoryTalk Distributed Application Disaster Recovery'. The project servers store the output .APB file to the FactoryTalk AssetCentre server. Schedule the custom asset to run regularly.

## Network Switches



If using an older version of AssetCentre software, back up the network switch configuration to retain the network architecture by using a custom asset. An export of the switch configuration can be generated by using various tools, including the following:

- Studio 5000 Logix Designer application software
- Third-party applications, for example the Cisco® Network Assistant Tool
- Command-line interface
- Other desired methods of your IT department

The custom asset pulls the contents of the backup into the FactoryTalk AssetCentre server. You specify the file location in the custom asset configuration. Schedule the FactoryTalk AssetCentre software to back up the exported switch configuration regularly.

For more details about the custom device plug-in for FactoryTalk AssetCentre, see the Knowledgebase Answer ID [634595](#) Building Custom Devices for use with FactoryTalk AssetCentre Disaster Recovery.

## Server Back up and System Restore

FactoryTalk® Historian and FactoryTalk® Batch servers produce process system data to document historical production data. The software configurations, which create the system data, must be protected along with the data.

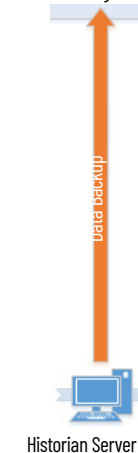
### Recommended Data Backup

Configuration	Host Environment	Tool	Files Backed Up
Historian configuration and data	FactoryTalk® Historian software	Pibackup.bat	Backup folder contents
Batch configuration and data	FactoryTalk® Batch software	Batch system files	System folder contents
AssetCentre data	SQL server	SQL Management Studio	AssetCentre.BAK
SQL server data			[DBName].BAK

Consider the following when using FactoryTalk AssetCentre software:

- No single asset (verification or custom asset) is to exceed 1 GB.
- The system is not to exceed 100 assets that are scheduled in a 12-hour period for one Agent only. Increasing the number of Agents can increase the load capacity of your system.

Safe, IT-Managed Location



Historian Server

## Historian Configuration and Data

The FactoryTalk Historian server contains historian points, configurations, and data that need to be regularly backed up. As a part of the Historian standard installation, a script file `pibackup.bat` is installed on the Historian server. This script is used to back up the Historian server.

The output of this tool is a folder hierarchy that contains all components necessary to back up and recover the Historian server. We suggest that you consider separating the historical data from the configuration for scheduling purposes.

The historical backup data, which is generated by FactoryTalk Historian, is stored on the Historian server. Consult with your IT department to determine the appropriate location to move and store these files outside of the AppServ-Info (Historian) server.

Safe, IT-Managed Location



FactoryTalk Batch Server

## Batch Configuration and Data

There are multiple components of a FactoryTalk Batch system that require a backup plan depending on the implementation of your system. See Knowledgebase Answer ID [538578](#) 'FactoryTalk Batch: How to backup and restore a Batch configuration to a new computer'. Included are files that are to be backed up for each of the following components of a batch system:

- Batch server files
- Batch client files
- eProcedure® files
- Material manager files

The file contents of the various Batch system components need to be separated into two groups: (1) configuration or system files and (2) data files.

The configuration files are all files that comprise the Batch project, such as area models and recipes. The data files are the batch journals that are constantly created by a running Batch server.

The configuration files and data can be backed up at different intervals to a safe, IT-managed location outside of your AppServ-Batch server.

## AssetCentre Data



FactoryTalk AssetCentre software manages the information that is produced by each of its assets and processes the data into a SQL server. When performing a backup of AssetCentre software, nothing must be done within AssetCentre. To back up the AssetCentre configuration and data, back up the AssetCentre database in your SQL server.

For guidelines on how to back up your AssetCentre database in SQL, see the Knowledgebase Answer ID [59541](#) Backing up and Restoring FactoryTalk AssetCentre with Microsoft® SQL Server.

## SQL Server Data

The FactoryTalk Alarm and Event History software is configured to log to a SQL database.

These databases include the following:

- For FactoryTalk Alarm and Event database, go to FactoryTalk® Administration Console and expand System>Connections>Databases. Select the database to view the information on the Alarm and Event Historian Database Properties dialog box.
- For FactoryTalk Historian Asset Framework, the SQL Database 'PIFD' contains the Asset Framework data and configuration content.

## Backup Verification

We recommend that your system use a dedicated, non-production environment that is capable of accepting and validating backups. You need a strategy for how frequently the backups are validated.

## System Restore

We recommend that you consider a strategy for recovering and restoring your PlantPAx system to a known secure state after a disruption or failure.

System recovery and restore to a known secure state means that all system parameters (either default or configurable) are set to secure values. If any security-critical information, such as patches, is installed after the last backup, the information must be reinstalled. For example:

- Security-related configuration settings re-established
- System documentation and operating procedures available
- Application and system software that is reinstalled and configured with secure settings
- Information from the most recent, known secure backup is loaded and the system that is fully tested and functional.

## Retention Policy Considerations

There are two ways to retain data: archived records and a detailed backup policy. While archiving provides historical records, backups are typically not useful unless you can access the data for a restore. You must take the time to design a retention policy for the reuse of dated materials.

For example, a backed up .ACD file from the Studio 5000 Logix Designer application could possibly not be saved in the most current version of Studio 5000 environment. Accessing the contents of this .ACD file could be problematic. But an archived printout of the logic that is stored in PDF format could help restore a system project.

Secure archived data and make sure that you can search for the data if requested. There are numerous reasons to archive data, including, but not limited to, the following:

- Compliance with government regulations
- Retention of production knowledge
- Reduction of backup storage footprint

Consider the following when developing a backup retention policy:

- **Location** – Backup information is only worthwhile if retrievable for a restore. To mitigate risk, duplicate the backup contents to an off-site location if an 'Act of God' renders the on-site copy unusable.
- **Storage** – The type of storage medium that is used to backup data can affect how quickly you are able to restore data. Cloud storage provides scalable backup potential and requires the least amount of on-site hardware. But, the cloud requires additional steps if the process facility is not connected to the enterprise cloud servers. Disk mirroring can provide the fastest time to restore and smaller data loss intervals. This process can cost more than periodic backups to a hard disk drive.
- **Security** – The confidentiality and importance of backup information must be carefully evaluated. Limit access to the retained backup storage devices and locations to help reduce the risk of threats. Password protection and encryption can improve risk mitigation.
- **Cost** – The cost of backing up a process system can be justified with one application configuration restore. The time alone to re-engineer a process configuration can justify the cost of physical media and IT infrastructure. Automated backup policies can reduce time and money for IT to complete regular backups.

## System Storage Rates

The following tables provide an estimate of storage usage for a PlantPAx system. Evaluate your system size and adjust appropriately according to your corporate policy.

### System Operating Assumptions

Description	Small <sup>(1)</sup>	Medium <sup>(2)</sup>	Large <sup>(3)</sup>
Alarms SQL database (alarms/min according to the ISA 18.2 peak alarm rate)	20	50	100
FactoryTalk Historian Event Frames SQL database (event frames per hour)	250	500	1000
FactoryTalk AssetCentre SQL database (commands/min per PlantPAx audit log guidelines)	2	5	10
FactoryTalk Historian points	5000	10,000	20,000

(1) 3000 I/O points and 10 operator workstations

(2) 3000 I/O points and 25 operator workstations

(3) 5000 I/O points and 50 operator workstations

### Storage Rates

Description	Small <sup>(1)</sup>	Medium <sup>(2)</sup>	Large <sup>(3)</sup>
Microsoft SQL server	4 GB/month	5 GB/month	9 GB/month
FactoryTalk Historian server	2 GB/month	3 GB/month	6 GB/month

(1) 3000 I/O points and 10 operator workstations

(2) 3000 I/O points and 25 operator workstations

(3) 5000 I/O points and 50 operator workstations

## Historical Data

FactoryTalk® Historian SE software captures data for reports to help maximize plant-floor objectives and productivity. The software collects historical points in the system to produce analytical data. Analytical data includes process variables, trends, estimations, and statistical reporting.

For a PlantPAx® system, it is recommended to implement more than one historian server to create a collective of historian servers. A collective provides higher availability with continuous access to data during planned and unplanned outages. Adding redundant node interfaces is also recommended to send time-series data to all servers in the collective.

### Quick Start

To streamline the FactoryTalk® Historian SE software configuration, follow this quick start. For experienced users, each step outlines requirements. For more detailed information, follow the referenced links.

1

#### Configure Servers for a Collective

---

A collective is a group of historian servers that pool their data resources for high availability.

- You need two or more historian servers for a collective.
- There are requirements for initial configuration, such as the firewall, trusted connections (certificate), and security settings
- Configure PI SDK connections to the historian server on all computers that access historian data.

For more information, see [Configure Servers for a Collective](#).

2

#### Configure Redundant Node Interfaces

---

The FactoryTalk® Administration Console contains configuration for server connections and node interfaces.

- A Historian server connection specifies the name of a Historian server or Collective.
- A data collection interface is then created to collect data from an end device.
- A node interface is defined by selecting the type and computer (PASS02A in the example) hosting the interface.
- Create a common folder, on the PASS (PASS01 in the example) with the FactoryTalk® Directory, for synchronization of redundant node interfaces.
- Configure the connection between the Node Interface and the Historian server
- Configure the FactoryTalk® Live Data interfaces between the PASS servers and the Historian servers.

For more information, see [Configure Redundant Node Interfaces](#).

3

**Enable Performance Monitor**

An interface (PIPerfMon) is available to log system resources for health and performance.

- Create a PIPerfMon system 'user' on the domain controller.
- Configure the PIPerfMon interface after initiating on the FactoryTalk Directory.
- Create and verify interface health points.
- Enable communication paths.

For more information, see [Configure PI Performance Monitor](#).

4

**Configure PI Buffering**

PI Buffering helps protect data in the event a client loses connection to the Collective.

- For added security, configure a user account on the domain controller to run the PI Buffer Subsystem service.
- Configure security mappings specifically for the user account.

For more information, see [Configure PI Buffering](#).

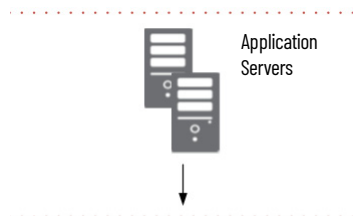
5

**Configure Data Collection**

FactoryTalk Historian software uses historical points (tags) in the system to produce analytical data for reporting.

- Create or Import Digital States.
- Create Historian Points.
- Define digital historical points.
- Configure Asset Framework.
- Finds system faults.
- Generate reports in PI Builder.
- Configure tags with the PlantPAx® Configuration Tool.

For more information, see [Configure Historian Data Collection](#).

**Prerequisites**

Following the [System Workflow](#), configure application servers.

A historian application in a PlantPAx system requires:

- Domain controller
- Process Automation System Server (PASS) hosting the FactoryTalk® Directory (PASS01)
- Process Automation System Servers (PASS) for node interfaces (PASS02A, PASS02B)
- Engineering Workstation (EWS)
- Operator Workstation (OWS)
- SQL standard or SQL Express database server
- Asset Framework server

When you deploy a FactoryTalk Historian application in a PlantPAx system:

- Install FactoryTalk Historian servers as a collective.
- Configure a Performance Monitor interface.

The following software must be available:

- FactoryTalk Historian SE Server
- FactoryTalk Historian Asset Framework Server
- FactoryTalk Historian Asset Framework SQL database
- PI Builder Excel® add-in

You must be familiar with the following utilities:

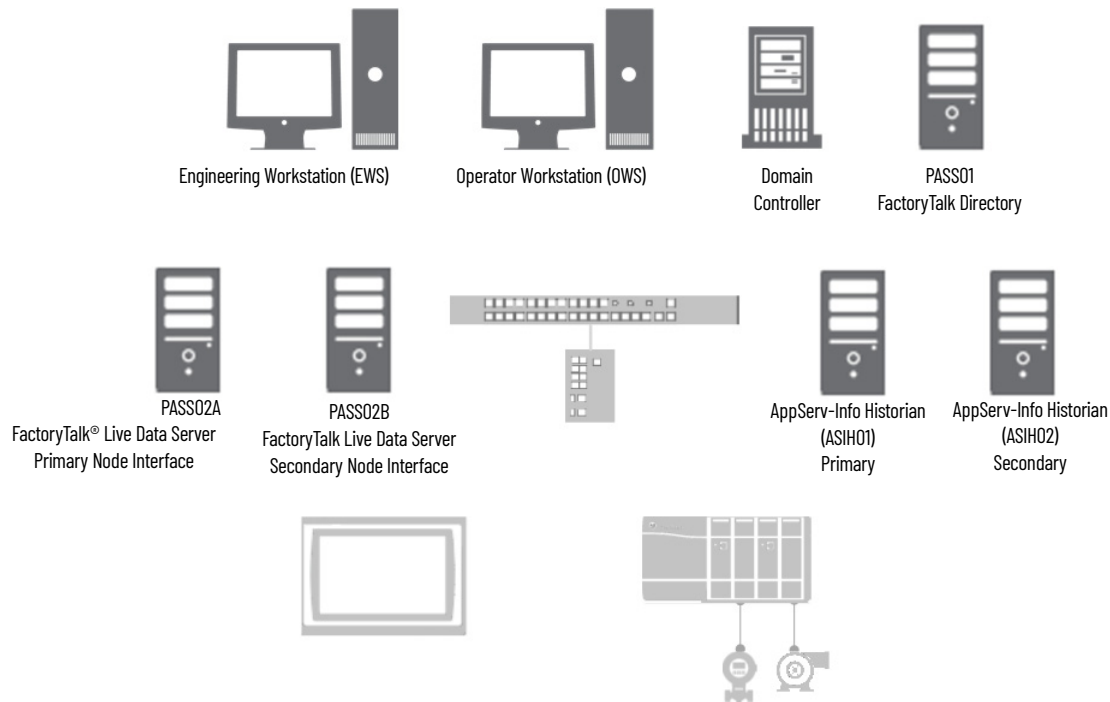
- PI SDK – An object-oriented library that is designed for customizing applications
- Powershell – Command-line shell and scripting language.

For more information, see this additional resource.

Resource	Description
FactoryTalk Historian SE 7.00 Installation and Configuration Guide, publication <a href="#">HSE-IN025</a>	Installation, configuration, and troubleshooting of FactoryTalk Historian Site Edition software.

## Required PlantPax Elements

Configuring historical data collection requires access to the following equipment. All equipment must be physically installed prior to using this document.





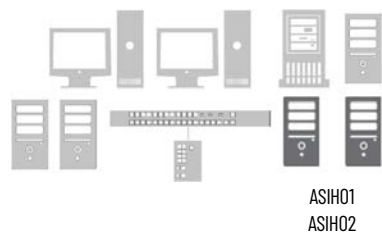
# Historical Data

In a PlantPax system, the FactoryTalk Historian SE software collects, stores, and manages data. The software includes these hardware and software components:

- **Data Sources** - Plant floor devices and instruments that generate data, typically controllers. Other Data Sources can include external databases.
- **Historian SE Interfaces** - The FactoryTalk Historian node interface enables process data to be passed between a FactoryTalk® Live Data Interface (for example, FactoryTalk® Linx) and a FactoryTalk Historian server. Each instance of the interface can provide data to a single FactoryTalk Historian server or collective.
- **Historian SE Server** - Compresses and stores the collected data and acts as a data server for Microsoft® Windows-based clients applications. It is also possible to use the Historian SE server to interact with data that is stored in external systems.
- **Historian SE Clients** - Microsoft Windows-based applications that are used by plant personnel to visualize the Historian SE data.
- **Historian Asset Framework** - Asset Framework replaces the Historian module database (MDB) with a Microsoft SQL server database for improved scripting and reporting.

## Configure Servers for a Collective

A collective is a configuration of multiple servers that act as a logical server in your Historian database to provide high availability (HA), disaster recovery, load distribution, and increased scalability. Each server in a collective is called a member of the collective. When the primary member in a collective becomes unavailable, a secondary collective member continues to collect and provide data access to your Historian clients.



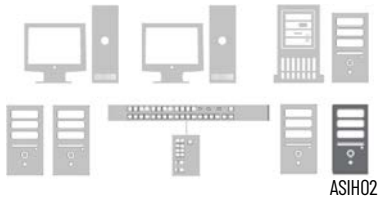
## Create Firewall Rule for Historian Servers

To create a server collective on computers that have the Windows® Firewall turned on, you must manually open the TCP 445 port between the two computers. Perform this section on both the primary and secondary Historian servers.

1. Go to Control Panel > Windows Firewall settings on the Historian Server.
2. In the Advanced Settings, select Inbound Rules and create a New Rule.

For the new rule, specify the following:

On This Page	Configure
Rule Type	Select Port
Protocol and Ports	Configure Specific Local TCP Port as 445
Action	Allow the connection
Profile	Apply the rule to the Domain, Private, and Public
Name	Type a name for this rule (Collective Connection in the example)



## Change the Historian Server Identification

**IMPORTANT** When planning to use a collection of Historian servers, serverIDs must be unique. You must change the serverID on any additional servers, particularly if the server is cloned or sourced from a virtual template.

To change a server ID, complete these steps.

1. Go to c:\Program Files\Rockwell Software®\FactoryTalk Historian\Server\adm
2. Enter 'cmd' in the address bar to open a command prompt window in this directory.
3. Enter the following commands.

Command	Purpose
piconfig	Open the command-line administration tool for the PI Data Archive
table pserver	Open the pserver table
mode edit	Set the required mode of operation to edit
istr name, serverID	Allows you to edit the hostname and serverID
<hostname>, <new serverID>	Specify the new server name. <hostname> = hostname of the Historian server <new serverID> = new server ID
@exit	Saves the information and exits the tool

The serverID is a unique identifier (UID), a 32-character string representing each Historian server identification. You can make up your own arbitrary string.

```

Administrator: Command Prompt
Microsoft Windows [Version 10.0.14393]
(c) 2016 Microsoft Corporation. All rights reserved.

C:\Windows\system32>cd C:\Program Files\Rockwell Software\FactoryTalk Historian\Server\adm
C:\Program Files\Rockwell Software\FactoryTalk Historian\Server\adm>piconfig
* (Ls - ) PIconfig>table pserver
* (Ls - PISERVER) PIconfig>mode edit
* (Ed - PISERVER) PIconfig>istr name, serverID
* (Ed - PISERVER) PIconfig>ASIHO2, 8077c7c-1765-427b-adcf-a2bb8fdbb987
* (Ed - PISERVER) PIconfig>@exit
PIconfig      1 Data lines
              4 Command line
              0 Records in error...

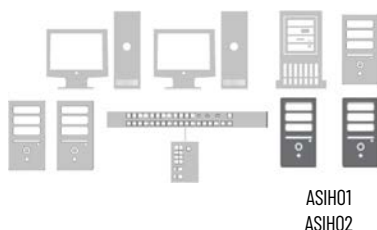
              1 Records Edited

C:\Program Files\Rockwell Software\FactoryTalk Historian\Server\adm>

```

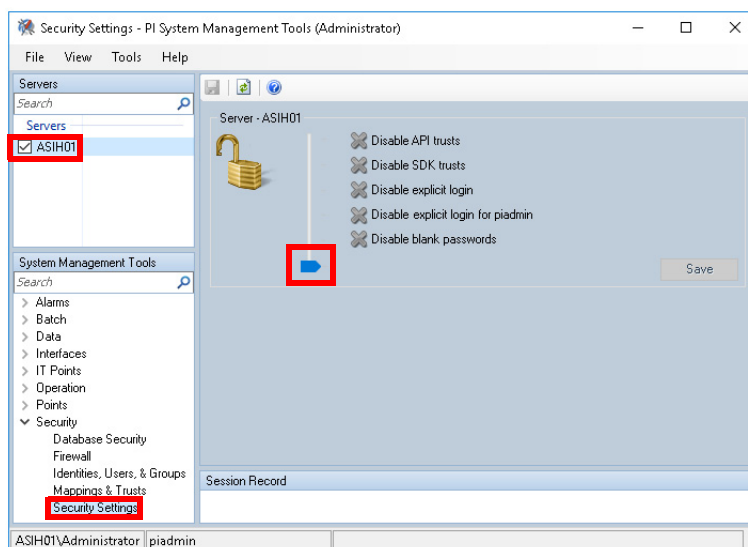
4. The next time you access the secondary Historian server, a Server ID mismatch prompt appears. Select 'Accept the New ID' to continue.

## Set Initial Security Settings



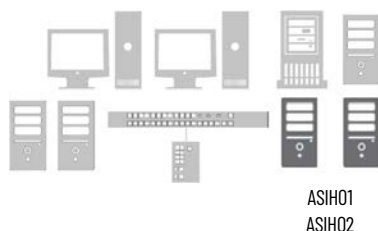
For any Historian server that is going to join a Collective, security settings must be considered for each initial connection. To simplify the connection process, reduce the security levels of both the primary and secondary Historian servers. After the initial connection, the security levels can be modified as needed.

1. Go to Rockwell Software > FactoryTalk Historian SE > System Management Tools.
2. Select the server in the Collectives and Servers section.
3. In the System Management Tools section, select Security > Security Settings.
4. Set the slider to its lowest point and click Save.



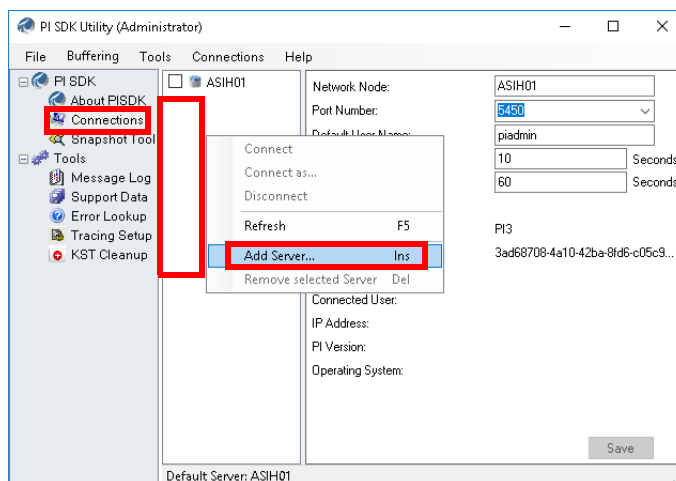
5. Repeat the settings for the secondary server.
6. For the security setting changes to take effect, restart the servers.

## Create Connections Between Historian Servers



The PI SDK Utility is used to create the connection between the Historian servers. This action is required on both servers before creating a collective.

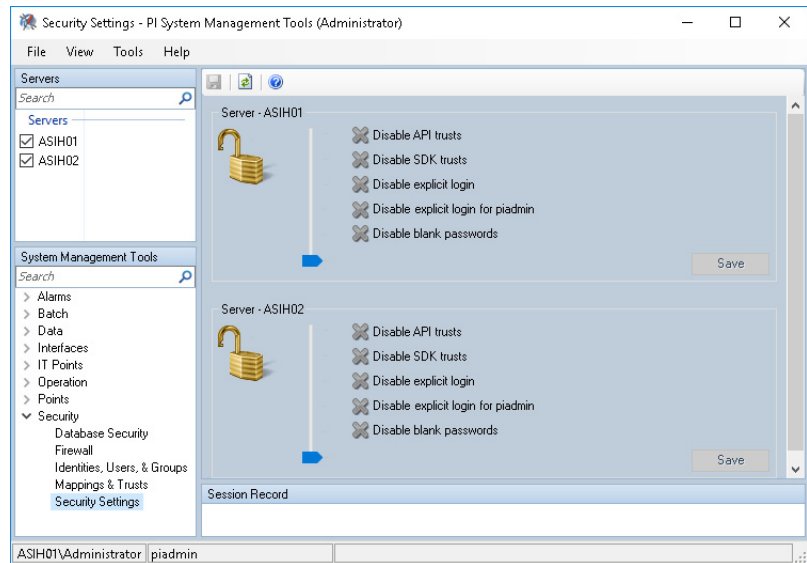
1. Go to Rockwell Software > FactoryTalk Historian SE > FactoryTalk Historian SE System > PISDK Utility.
2. Select Connections and then right-click on the empty area next to the servers.
3. Select Add Server.



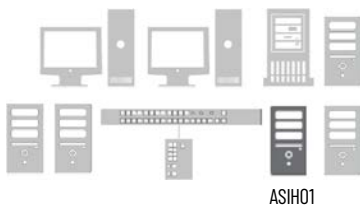
4. Enter the server name in the Network Path dialog box and accept the rest of the default settings.

5. Remove any servers that are not necessary.
6. To verify the connections, go to Security Settings > PI System Management Tools (Administrator.)

This example shows servers ASIHO1 and ASIHO2.



## Create the Historian Collective

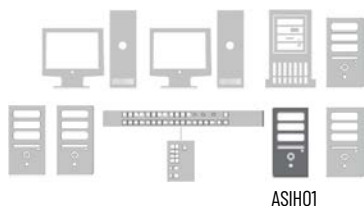


Now that the servers are configured, you can create a Collective by using the PI Collective Manager.

Go to Rockwell Software > FactoryTalk Historian SE> FactoryTalk Historian SE System > PI Collective Manager and complete these steps:

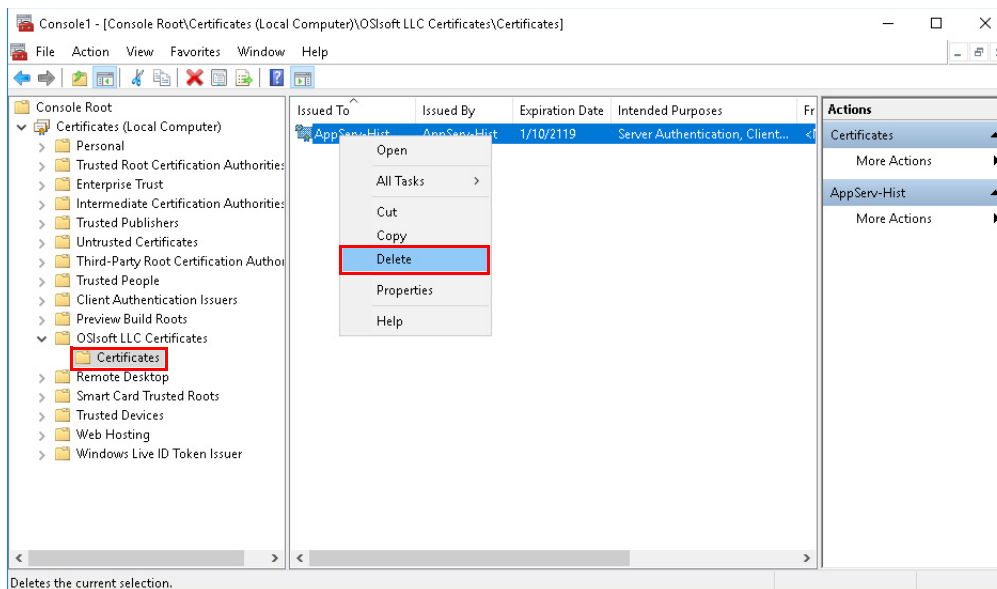
On this Dialog Box	Action
Create New Collective Initial Page	<ul style="list-style-type: none"> <li>Select I have verified my backups are valid</li> <li>Select I have verified my PI interface servers configuration</li> </ul>
Create New Collective - Existing or New Primary	Select a newly installed PI server
Create New Collective - Select Primary and Collective name	Select the Collective Primary server and define the properties.
Create New Collective - Select Secondary Servers	Select the Collective Primary server and define the properties.
Create New Collective - Select Archives	<ul style="list-style-type: none"> <li>Accept the default number of archives to be copies</li> <li>Accept the default location for the temporary backup</li> </ul>
Create New Collective - Verify Selections	Verify the information
Create New Collective - Conversion Progress	Verify the conversion progress is completed
Server ID Mismatch	Select Accept the new ID
Create New Collective - Finished	Acknowledge the creation of the collective

## Delete the Default Security Certificate



Historian Collectives support certificate-based authentication for each server. To verify the system uses a valid security certificate, start by deleting the default or cloned certificate on the Primary Historian server. This is a required step if the server was cloned or sourced from a virtual template.

1. To access Certificate Manager, click Start and type certlm.msc in the search field.
2. Click Enter.
3. Expand the Certificates folder > OSIssoft LLC Certificates > Certificates.
4. Delete the default certificate.



## Generate a New Security Certificate

Code provided by OSIsoft will generate a new security certificate, that afterwards is to be imported on all other Historian servers in the collective to authenticate.

---

**IMPORTANT** Due to the electronic formatting of this user manual, the code may require format corrections if copied from here. Also note the <PlantPAx AppServ-HIST Virtual Template 5.0 VL> virtual template will contain properly formatted code on the user desktop.

---

1. On the Primary Historian server, copy the script as shown and paste into Notepad.

```
$CertStorePathName = "Cert:\LocalMachine\OSIsoft LLC Certificates"

if(!(Test-Path $CertStorePathName))
{
    New-Item -Path $CertStorePathName
}
if( (Get-ChildItem -Path $CertStorePathName | measure).count -eq 0)
{
    $myFQDN=(Get-WmiObject win32_computersystem).DNSHostName+"."+ (Get-WmiObject win32_computersystem).Domain

    $DNSName = @($myFQDN)

    # $NewCert = New-SelfSignedCertificate -CertStoreLocation Cert:\LocalMachine\My -FriendlyName $myFQDN $DNSName -Provider "Microsoft Enhanced RSA and AES Cryptographic Provider" -HashAlgorithm "SHA256"

    $NewCert = New-SelfSignedCertificate -CertStoreLocation Cert:\LocalMachine\My -DnsName $DNSName -NotAfter $(Get-Date).AddYears(100)

    Move-Item $NewCert.PSPath -Destination $CertStorePathName
}
else
{
    Write-Host("Invalid number of certs detected in OSIsoft LLC certificate store -- please ensure there are no certificates already configured in " + $CertStorePathName)
}
```

2. Use Notepad to remove any new lines, where contiguous code is wrapped.

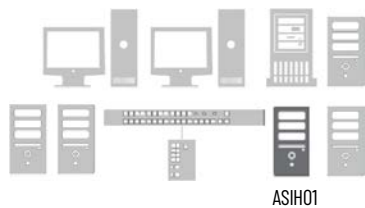
You can backspace new lines to rejoin the prior code statements.  
For example:



```
1 $CertStorePathName = "Cert:\LocalMachine\OSIsoft LLC Certificates"
2 if(!(Test-Path $CertStorePathName))
3 {
4     New-Item -Path $CertStorePathName
5 }
6
7
8 if( (Get-ChildItem -Path $CertStorePathName | measure).count -eq 0)
9 {
10     $myFQDN=(Get-WmiObject win32_computersystem).DNSHostName+"."+ (Get-WmiObject win32_computersystem).Domain
11     $DNSName = @($myFQDN)
12     # $NewCert = New-SelfSignedCertificate -CertStoreLocation Cert:\LocalMachine\My -FriendlyName $myFQDN $DNSName -Provider "Microsoft Enhanced RSA and AES Cryptographic Provider" -HashAlgorithm "SHA256"
13     $NewCert = New-SelfSignedCertificate -CertStoreLocation Cert:\LocalMachine\My -DnsName $DNSName -NotAfter $(Get-Date).AddYears(100)
14     Move-Item $NewCert.PSPath -Destination $CertStorePathName
15 }
16 else
17 {
18     Write-Host("Invalid number of certs detected in OSIsoft LLC certificate store -- please ensure there are no certificates already configured in " + $CertStorePathName)
```

3. After the scripting code is realigned, launch an administrative PowerShell window.
4. Copy the script from Notepad and paste into PowerShell.
5. Click Enter to generate a security certificate.

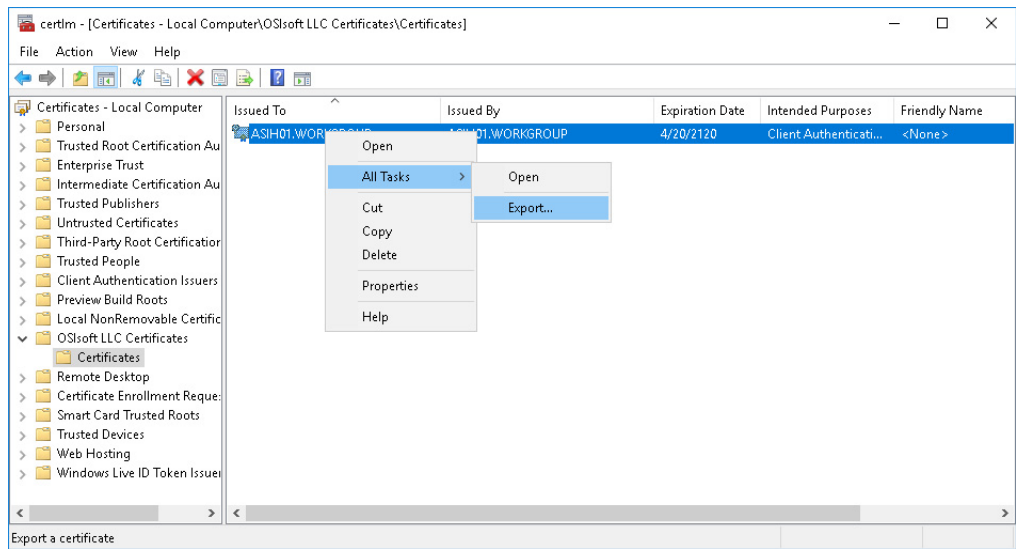
6. Return to the MMC window and refresh the window. To verify the OSIsoft certificate was recreated. The name should represent the computer name and domain.



**Export the Security Certificate**

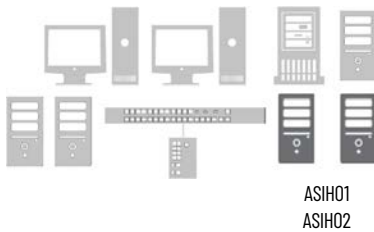
To transfer the new security certificate to all other Historian servers in the Collective, the certificate must be exported as a PFX file.

1. While still on the Primary Historian server, in the MMC window, select the certificate that you have generated and select All Tasks > Export.



2. From the Certificate Export Wizard, complete these steps.

On these Wizard Boxes	Action
Welcome window	<ul style="list-style-type: none"><li>• Select Next</li><li>• Select Yes, export the private key and select Next</li><li>• Leave defaults, and click Next</li></ul>
Security	<ul style="list-style-type: none"><li>• Type a password, confirm, and click Next</li></ul>
File to Export	<ul style="list-style-type: none"><li>• Click Browse and type a name for the storage location on your computer</li><li>• Click Next</li><li>• Select a file name and click Finish</li></ul>

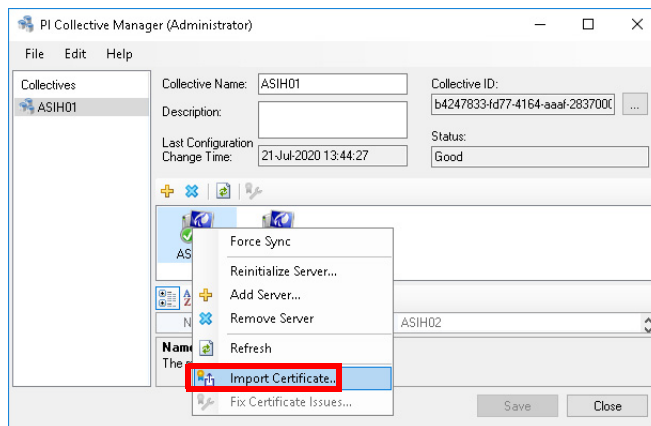


## Import the Security Certificate

The new security certificate must be imported on all other Historian servers in the Collective before it can synchronize. The import can be done using either the PI Collective Manager software or the Windows Certificate Manager.

For each Historian server, you must copy the new security certificate PFX file first before using one of the following procedures. From the PI Collective Manager:

1. Select the Historian server and select Import Certificate.

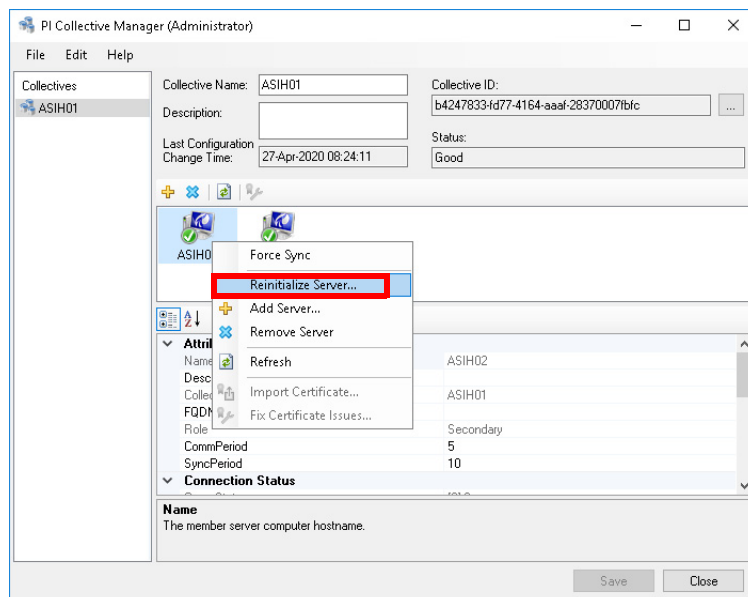
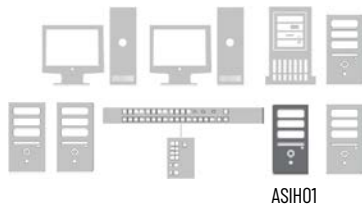


2. Browse for your PFX file.
3. Open the certificate and provide the password for this certificate to import the certificate.

## Reinitialize the Secondary Server

Perform this task from the Primary server to synchronize the certificates of any other Historian servers in the collective.

1. From the Collective Manager, select the Secondary server.
2. Select Reinitialize Server.



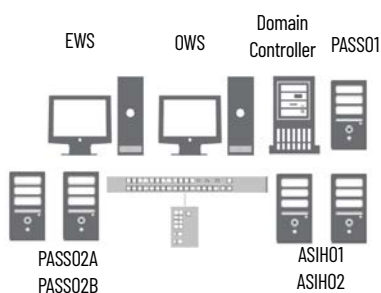


3. From the Archives window, click Next.
4. Verify the backup location and click Next.
5. When the sync process completes, click Finish.
6. If servers show green check boxes, skip step 8, and proceed to [Connect another Computer to Historian Server](#).
7. If the synchronization fails, verify all firewall settings, certificates, and matched server or collective IDs. Then, try again.

If sync problems remain, contact Technical Support.

## Client to Server Connections

For all servers and workstations that require access to Historian data, use the PI SDK Utility to add a connection to a Historian server or Collective of servers. This includes the PASS servers (PASSo1, PASSo2A & PASSo2B), EWS, and OWS workstations.



### Connect another Computer to Historian Server

For each computer that requires a connection to the collective, complete these steps:

1. Go to Rockwell Software > FactoryTalk Historian SE > FactoryTalk Historian SE System > PISDKUtility.
2. Select Connections and then right-click on the empty area next to the servers to add a new server.
3. Maintain the default connection name of 'Production Historian' for library object reference, then select the Server or Collective Name and click Test Server Connection.

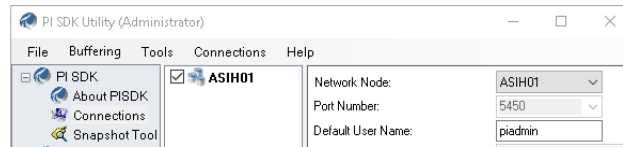
The screenshot shows the 'New Historian Server Connection' dialog box. The 'Name' field is highlighted with a red box and contains the text 'Production Historian'. The 'Description' field contains the text 'Historian for the production area of the plant'. The 'Server or Collective Name' dropdown menu is highlighted with a red box and shows 'ASIHO1' selected. Below the dropdown, the 'Test Server Connection' button is also highlighted with a red box. At the bottom of the dialog, there are buttons for '< Back', 'Next >', 'Finish', and 'Cancel'.



If you are using a collective, enter the primary server.

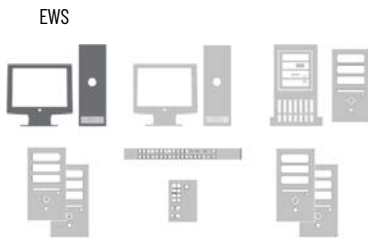
4. Select the box next to the new server.

The server appears in the middle of the utility for a successful connection.



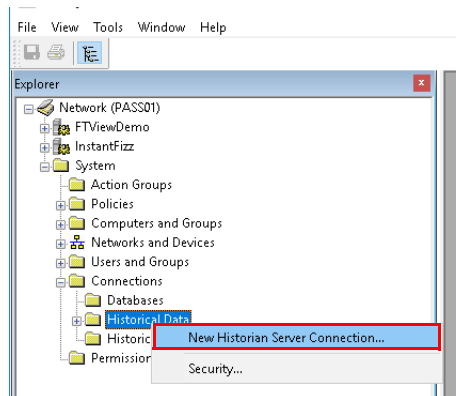
5. Remove any server connections that are not necessary.

## Historian to FactoryTalk Directory Connection



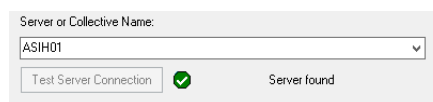
Use the FactoryTalk® Administration Console to add the FactoryTalk Historian server connection to the FactoryTalk Directory.

1. Go to Rockwell Software > FactoryTalk Administration Console and select 'Network' for the directory you want to use.
2. Go to Network > System > Connections > Historical Data and select New Historian Server Connection.

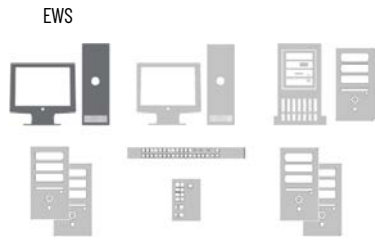


3. Select the Server or Collective Name and click Test Server Connection.

If the connection is good, a green check mark appears along with the text 'Server Found.'



4. In the FactoryTalk Administration Console, go to Network > System > Connections > Historical Data > Production Historian and choose Properties.
5. Select the Licensing tab and enter how many licenses are stored on the server.
  - If one license is stored locally in each collective server, enter '1' in the Assigned column.
  - If both activation licenses are on the activation server, enter '2' in the Assigned column.



## Create a Data Collection Interface

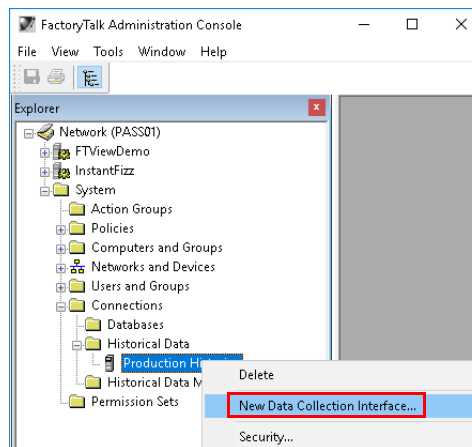
A data collection interface is used to collect data (tags) from data sources, such as Logix 5000™ controllers, and pass it to the FactoryTalk Historian server or collective.

The FactoryTalk Administration Console is used to create and configure the data collection interface.

1. Using an EWS, launch the FactoryTalk Administration Console and expand Historian server connection.

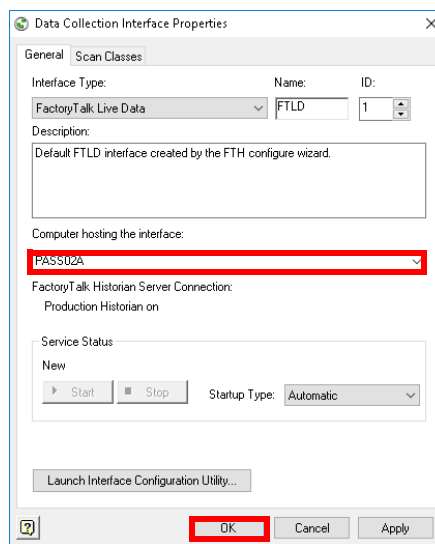
When a new FactoryTalk Historian server is added, a default node interface is created along with a name FTLD and ID 1 (FTLD1).

2. Delete the default node interface FTLD1.
3. Select the Historian server connection and select New Data Collection Interface.



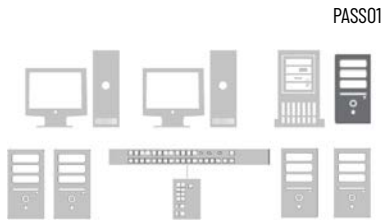
4. Select the Interface Type: (FactoryTalk Live Data), Name: FTLD and ID: 1 and choose the computer hosting the interface.

For example (PASS02A) where the remote FactoryTalk® Linx data server runs.

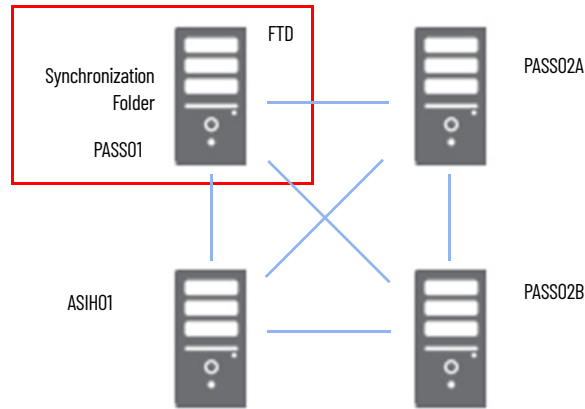


**IMPORTANT** When redundant node interfaces exist (PASS02A & PASS02B), only one data collection interface is required, and it references the primary (PASS02A) node interface.

## Create a Synchronization Path for Redundant Node Interfaces



A common folder is used for files that are used for handshaking and redundancy. This folder is created on the PASS server that hosts the FactoryTalk Directory.

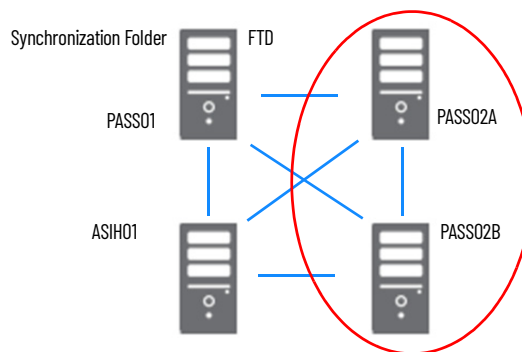


1. On the PASS01, create a new folder on Local Disk (C:) named FTHSE\_Failover.
2. Specify these properties for the folder.

From this Location	Configure
Sharing Tab	Advanced Sharing
Advanced Sharing	<ul style="list-style-type: none"> <li>• Select Share this folder</li> <li>• Select Permissions</li> </ul>
Permissions for FTHSE_Failover	Add the group Everyone
Select Users, Computers, Service Accounts, or Groups	Select Object Types
Object Types	Select Computers
Select Users, Computers, Service Accounts, or Groups	<p>Enter the PASS servers used as Node Interfaces as the object names to select</p>
Permissions for FTHSE_Failover	Allow Full Control, Change, and Read permissions for all Node Interface servers

## Configure Redundant Node Interfaces

A FactoryTalk Historian node interface enables process data to be passed between a FactoryTalk Live Data server and a FactoryTalk Historian server.



A PlantPAx system with redundant data servers requires configuration of the node interface on the primary and secondary servers (PASS02A and PASS02B).

The PI Configuration Utility (PI ICU) is an application that aids in system management by consolidating the setup and configuration options of each node interface. PI ICU allows you to:

- Configure all interface parameters
- Manage, start and stop interface service
- View and configure interface service dependencies
- Configure and run buffering
- Configures the Universal Interface (UniInt)

UniInt provides generic functions required by most interfaces, such as establishing a connection to the Historian Server node and monitoring the Historian Point Database for changes. To minimize data loss during a single point of failure within a system, UniInt provides two failover schemas: (1) synchronization through the data source (Phase 1) and (2) synchronization through a shared file (Phase 2).

Phase 1 UniInt Failover uses the data source itself to synchronize failover operations and provides a hot failover, no data loss solution when a single point of failure occurs.

Phase 2 UniInt Failover uses a shared file to synchronize failover operations and provides for hot, warm, or cold failover. The Phase 2 hot failover configuration provides a no data loss solution for a single point of failure similar to Phase 1.

---

**IMPORTANT** In this section, only Phase 2 UniInt Failover is addressed.

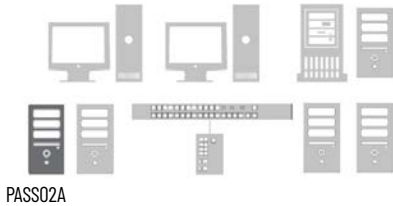
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The UniInt failover scheme requires the data source to be able to communicate and service data to two interfaces simultaneously. Additionally, the failover configuration requires that the interface supports outputs. A redundant solution requires two separate interface nodes communicating with the data source.

In a hot failover configuration, the interface copy that is in a backup role collects and queues data in parallel to the interface that is in the primary role. The interface in the backup role does not send the data that is collected to the

Historian server. However, if a failover occurs, the interface immediately sends its data to the Historian server.

## Configure a FactoryTalk Live Data Primary Interface

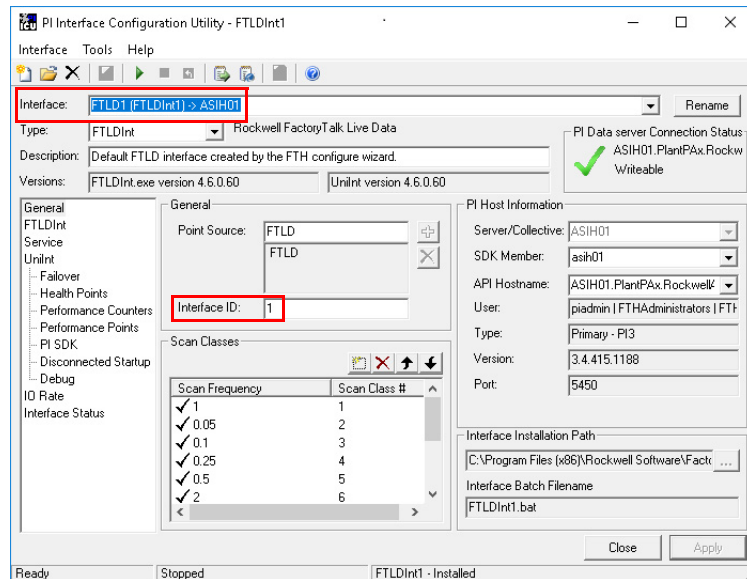


The primary interface goes on PASS02A and connects data servers to the historian database.

1. Go to Rockwell Software > FactoryTalk Historian SE > Interface Configuration Utility and select the interface.

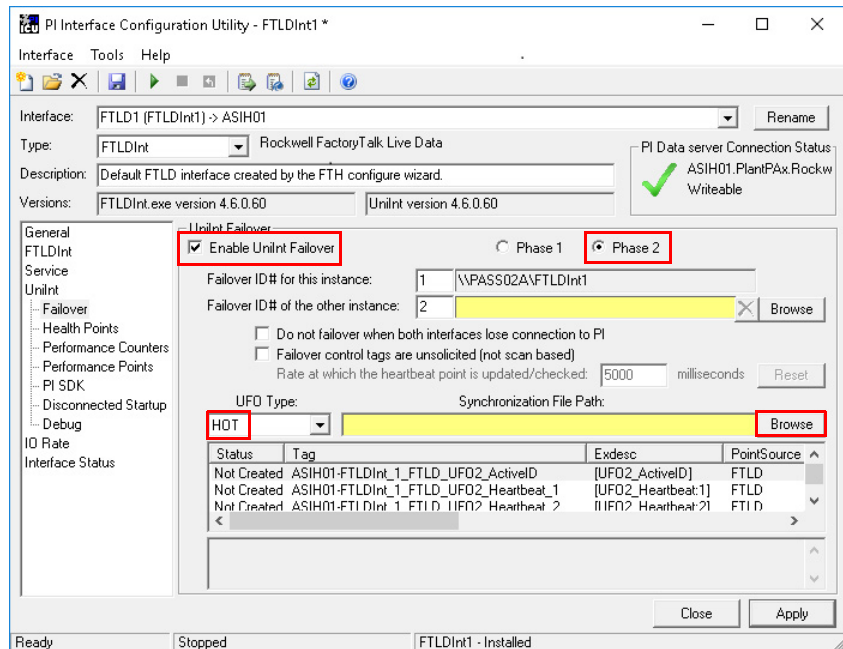
For example, select 'FTLDInt1 (FTLDInt1)->ASIH01.'

2. If the Interface ID is not already '1', change it to '1'.

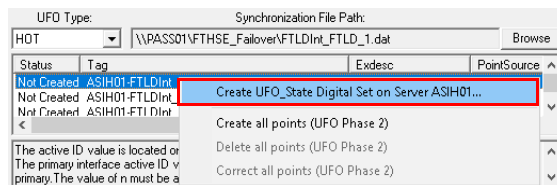


3. Select Service and do one of the following:
  - If prompted, select Yes. The PI ICU sets the PIBufss service to be a dependency of FTLDInt1.
  - If you are not prompted, you must scroll down the Services list and set the PIBufss service to be a dependency of FTLDInt1.
4. Go to UniInit > Failover and select the following:

Location	Action
UniInit Failover	Select Enable UniInit Failover and Phase 2
UFO Type	HOT
Synchronization File Path	Path = Network > pass01 > FTHSE_Failover directory (that was created in the previous section)



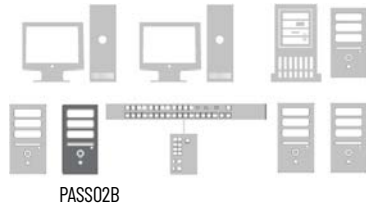
- Right-click the tag area and select 'Create UFO\_State Digital Set on Server ASIH01'.



- In the tag area, select 'Create all points (UFO Phase 2)'
- When the status for FTLDIInt1\_UFO2\_ActionID tags changes to 'Created', select Apply.

The 'UniInt Failover' configuration is not complete until the 'Other' interface is selected' message appears.

## Configure a FactoryTalk Live Data Secondary Interface

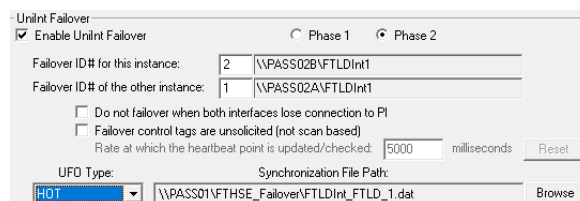


The secondary interface goes on PASS02B and connects data servers to the historian database. The configuration is provided in a .BAT file.

1. Go to Rockwell Software > FactoryTalk Historian SE > Interface Configuration Utility.
2. Select the folder symbol to create a new interface instance from a .BAT file and enter this information.

From Location	Action
Open Interface Configuration File Dialog Box	Select the LDInterface folder
Interfaces > LDInterface directory	Select C:\Program Files (x86)\Rockwell Software\FactoryTalk Historian\PIPC\Interfaces\LDInterface\ directory
The Select Host PI Data server/collective dialog box	Select the host PI Data server/collective and the collective member
Service > Service Configuration > Display name	Enter FTL01
General > General > Interface ID	Enter 1
Unilnit > Failover > Unilnit Failover	Select Enable Unilnit Failover Select Phase 2
Unilnit > Failover > UFO Type	Select HOT
Unilnit > Failover > Synchronization File Path	Path = Network > pass01 > FTHSE_Failover
Unilnit > Failover > Unilnit Failover > Failover ID # for this instance	Enter 2
Unilnit > Failover > Unilnit Failover > Failover ID # for the other instance	Enter 1 Select the interface file (FTLDInt_FTL01.bat.bak) on the secondary server
Synchronize UFO settings dialog box	Select yes to synchronize the UFO settings

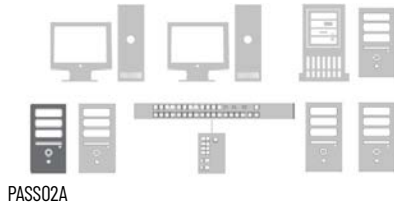
3. The failover and synchronization information appears in the respective fields.



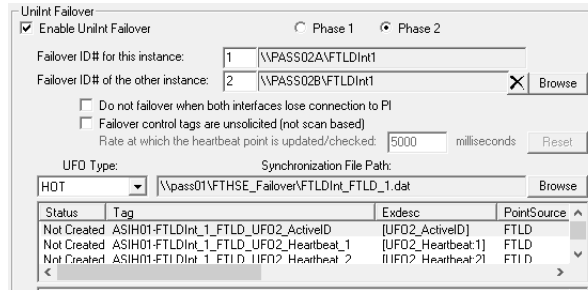
4. In the PI Interface Configuration Utility window, select Apply.



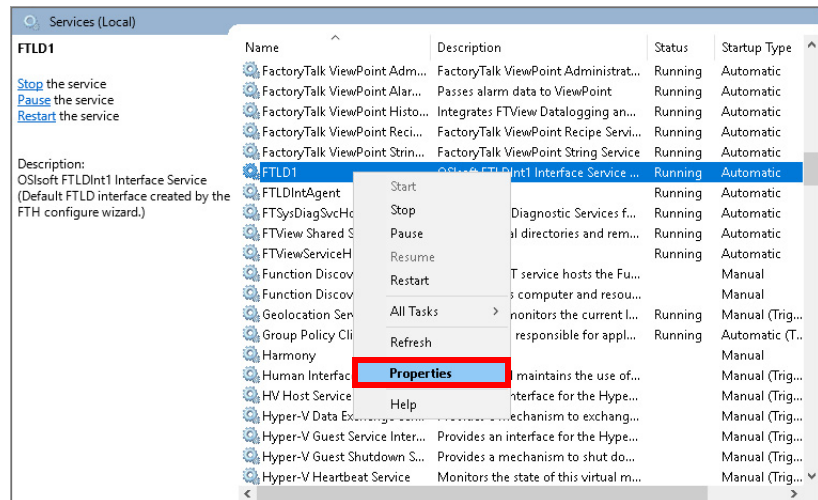
## Return to the Primary PASS (PASS02A)




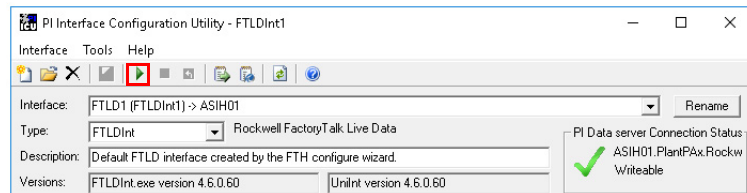
1. Select the interface path for the second interface.



2. Go to Control Panel > Administration Tools > Services and select Properties for FTLD1.

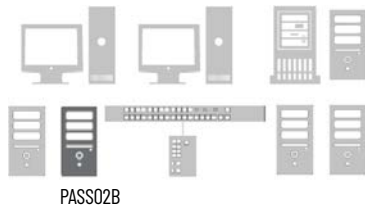



3. From the Log On tab, Select Log on as Local System Account.
4. In the PI Interface Configuration Utility window, select Apply and Play  to start the primary service (if not already running).

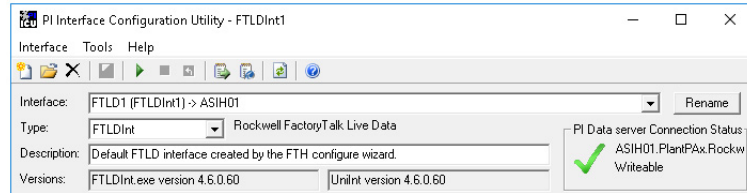


5. Select Yes if asked 'Would you like ICU to start this service for you?'

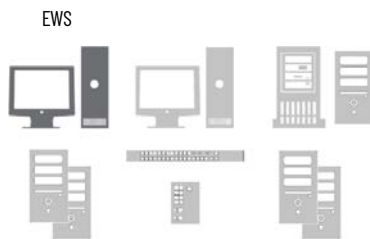
### Return to the Secondary PASS (PASS02B).



1. Select the Interface that was created earlier and click Play  to start the secondary service.




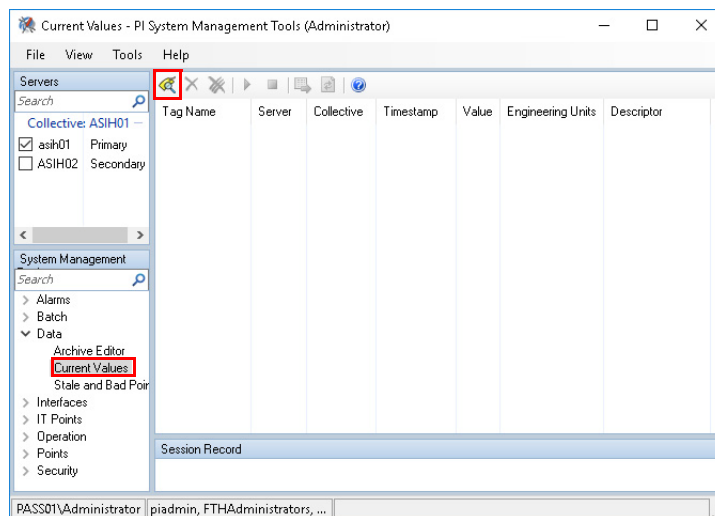
2. Select Yes if asked 'Would you like ICU to start this service for you?'




### Confirm Unit Failover Diagnostics

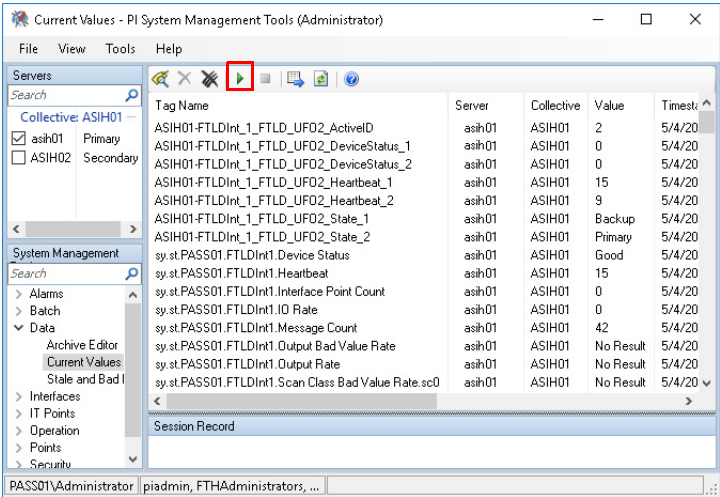
From an EWS, test and confirm the failover diagnostics from the Historian server.

1. Go to Rockwell Software > FactoryTalk Historian SE > System Management Tools.
2. Select Data > Current Values and select the Tag Search  icon.



From Location	Action
Tag Mask field	Enter *FTLD*
Tag Search Dialog Box	Select all tags

3. Select Play  to see the online status.

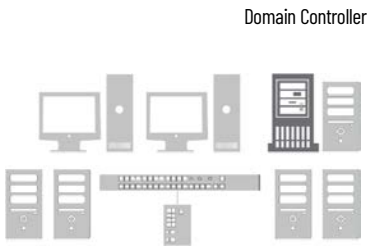


### Configure PI Performance Monitor

The Windows Performance Monitor (PerfMon) is a powerful operating system tool to monitor the health of resource usage and processes on a computer.

The PI Interface for Performance Monitor (PIPerfMon) collects performance counter data from Windows performance data providers, local and remote, and sends this data to the Historian server. It is **recommended** to use PIPerfMon in a PlantPAX system.

### Create Domain User for PIPerfMon Service

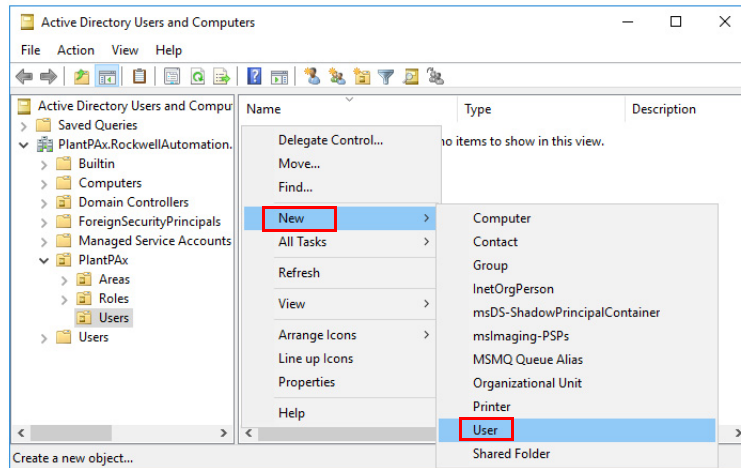


The PIPerfMon service defaults to running in a local account. For PlantPAX systems with a domain, it is recommended running the PIPerfMon service in a domain account. This enhances security and provides access to obtain data for a performance capture among other domain computers.

The domain user account for PIPerfMon service must be created on the domain controller. It is a user account with privileges to run the service on other computers within the domain.

1. From the Server Manager utility on the domain controller, select Tools > Active Directory Users and Computers.

## 2. Add a new user to the Managed Service Accounts.



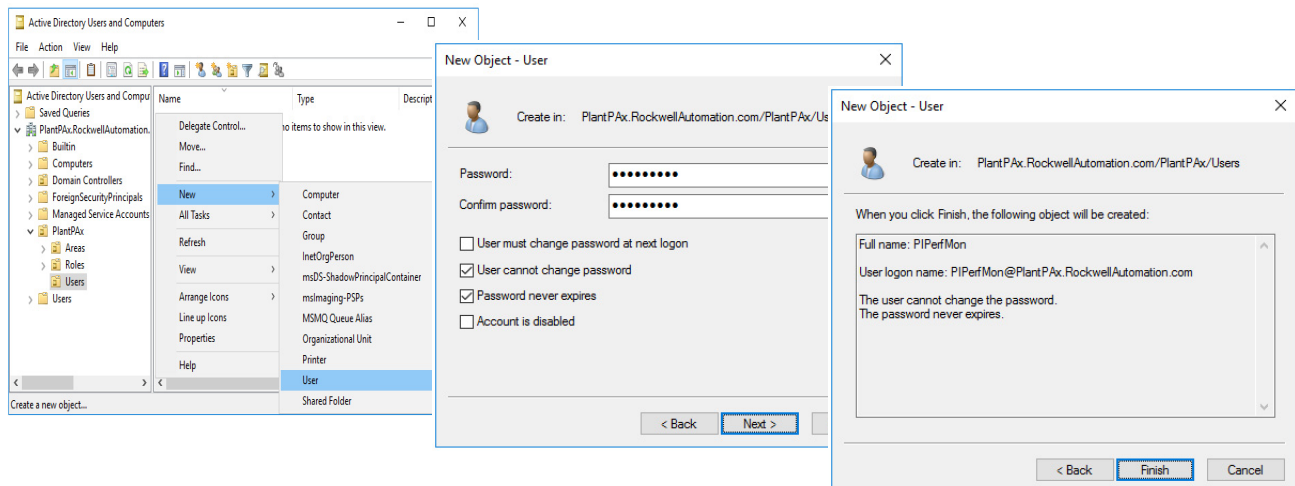
## 3. Specify these properties for the User.

Item	Description
First name	Type a name for the PI PerfMon service. <b>IMPORTANT:</b> The 'PI' preface is the name of the OSISoft product.
Initials	Optional
Full name	Type the same name for the PI PerfMon service.
User login name	Type the same name for the PI PerfMon service and click the pull-down to select your domain folder.

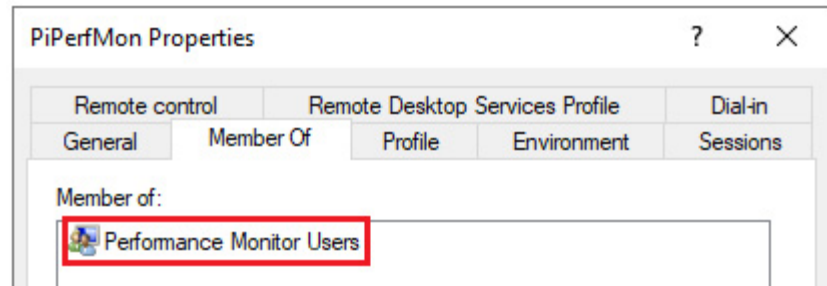
**IMPORTANT** The logon password creates a service user, not a person. The service user grants access to system computers for placing data into memory (buffer).

## 4. Create a password with the following conditions:

- User cannot change password
- Password never expires

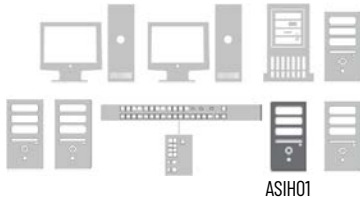


- Assign the PIPerfMon profile as a member of Performance Monitor User.



## Configure the PIPerfMon Interface

To use PIPerfMon, you must configure an interface name and a points value within the FactoryTalk Directory. The points are the limit the interface uses based on the number of computers in your system. Each variable – CPU usage, RAM, disk space – is one point. You can use the number of points up to 20% of your FactoryTalk Historian SE software license.

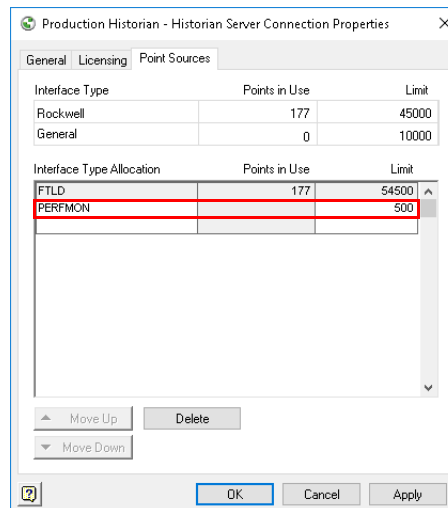


Configure the interface on the primary historian server.

- Go to Rockwell Software > FactoryTalk Administration Console and select 'Network' for the directory you want to use.
- Go to System > Connections > Historical Data folders > Production Historian and select properties.

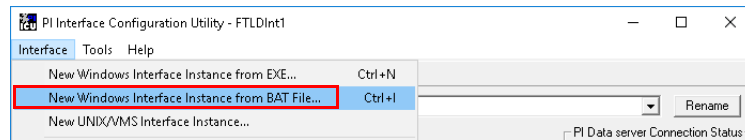
**IMPORTANT** Be patient because this dialog box could take a few minutes to appear.

- On the Point Sources tab, type an interface name (such as PerfMon) and a value for the points limit.

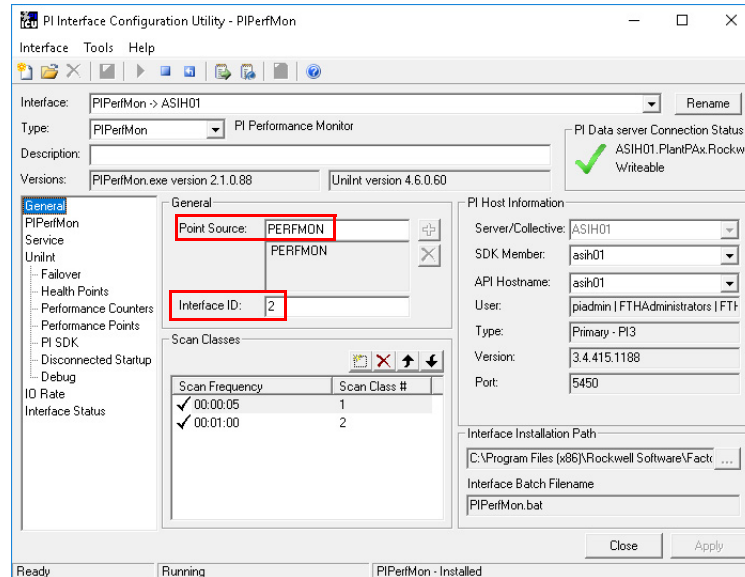


The value is the expected number of performance points in the system.

- Go to Rockwell Software > FactoryTalk Historian SE > Interface Configuration Utility. and select New Windows Interface Instance from BAT file.



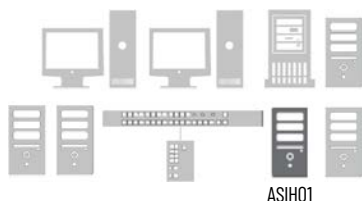
- Select the PiPerMon.bat\_new file from C:\Program Files (x86)\Rockwell Software\FactoryTalk Historian\PIPC\Interfaces\PIPerfMon directory.
- Select the FactoryTalk Historian server as the host PI Data server/collective.
- Enter a Point Source name and an Interface ID number.



**IMPORTANT** The Point Source name **must** match the interface name that you typed in the Historian Production dialog box in [step 3 on page 188](#). The Interface ID number must be unique in the system.

- Restart the interface service.

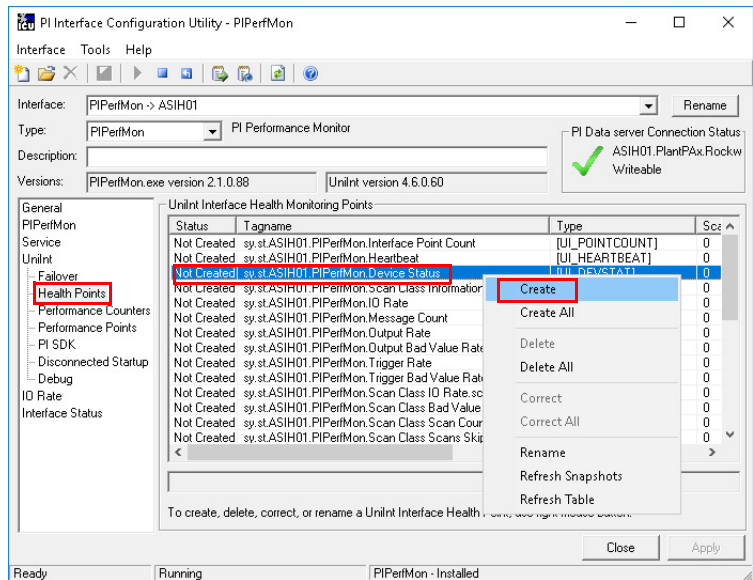
## Create PIPerfMon Diagnostic Health Points



For diagnostics, associate the PIPerfMon interface with the health tags that monitor a device heartbeat. The heartbeat count helps to determine if the system is working efficiently. If there is a stoppage, you can analyze what prompted the fault or device error.

- Go to Rockwell Software > FactoryTalk Historian SE > Interface Configuration Utility and select the PIPerfMon for the interface.

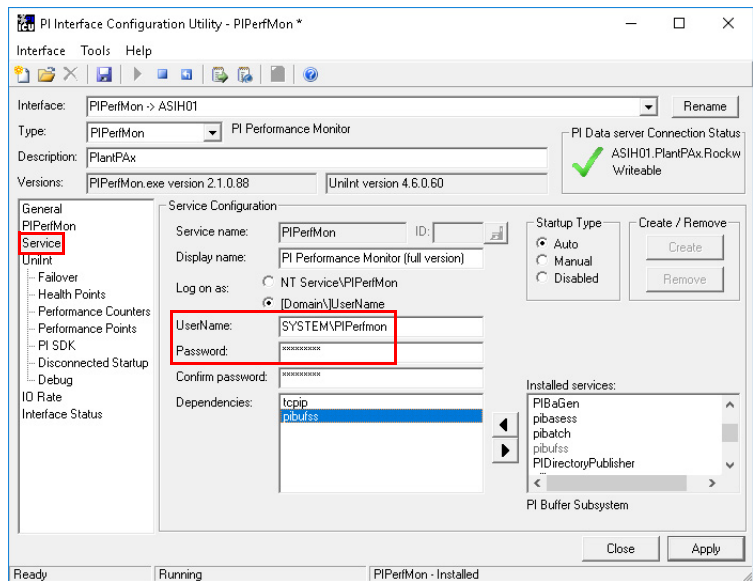
2. Create the Health Points for PIPerfMon.DeviceStatus.



3. Create the Health Points for PIPerfMon.Heartbeat.

4. Go to Service and complete the following information.

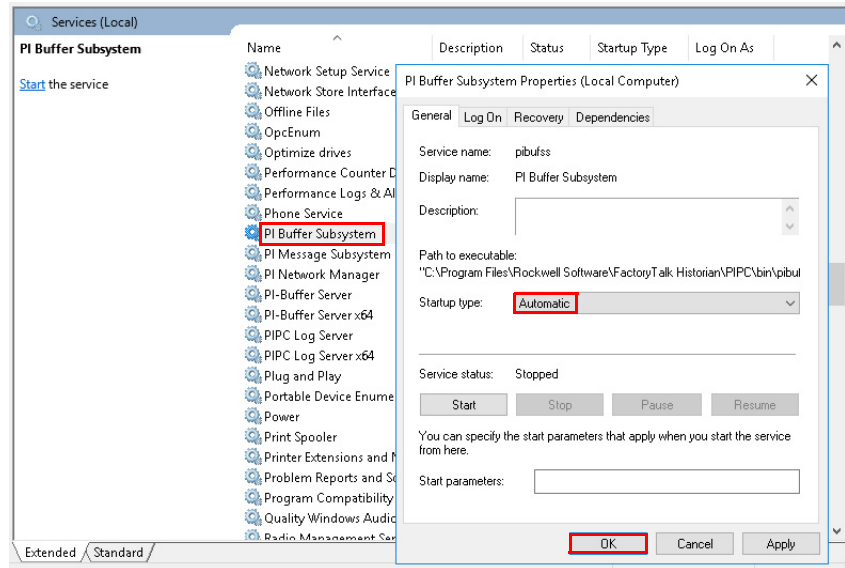
From this Section	Action
Installed Services	Move pibufss to Dependencies
Service Configuration	Select Log on as: Domain\Username
UserName	Enter the same user name and password that you initially created for the service. <a href="#">See Create Domain User for PIPerfMon Service on page 186</a>
Password	



5. Go to Control Panel > Administrative Tools > Services.

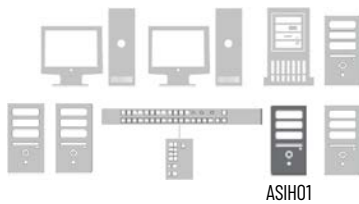


6. Select PI Buffer Subsystem, and set the Startup type to Automatic.



7. Restart the interface service from the dialog box.

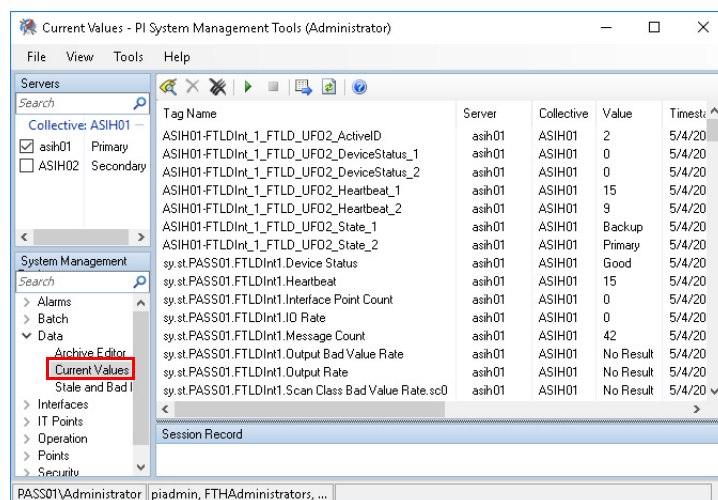
## Test the PIPerfMon Interface



From the primary Historian sever, verify that the PIPerfMon interface has a good working status.

1. Go to Rockwell Software > FactoryTalk Historian SE > System Management Tools.
2. In the left, top pane, select the appropriate server with the interface.
3. In the lower, left pane, go to Data folder > Current Values.

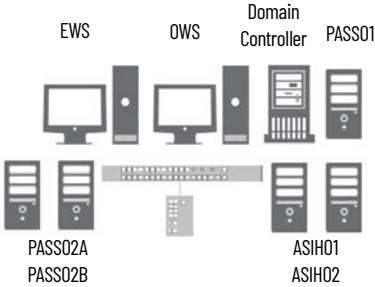
After you search for tags you need, the Value category displays the health state of the interface and the number of seconds between the heartbeat counts.





## Enable the PIPerfMon Interface on other Computers

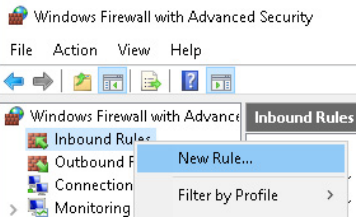
After the PIPerfMon interface is verified to work correctly on the Historian server, you can configure the other servers and workstations that you are collecting data. This requires the domain account to allow PIPerfMon to be added, create a Windows Firewall rule for access and enable the Performance Counter DLL Host service.



1. Go to Control Panel > User Accounts and define this information.

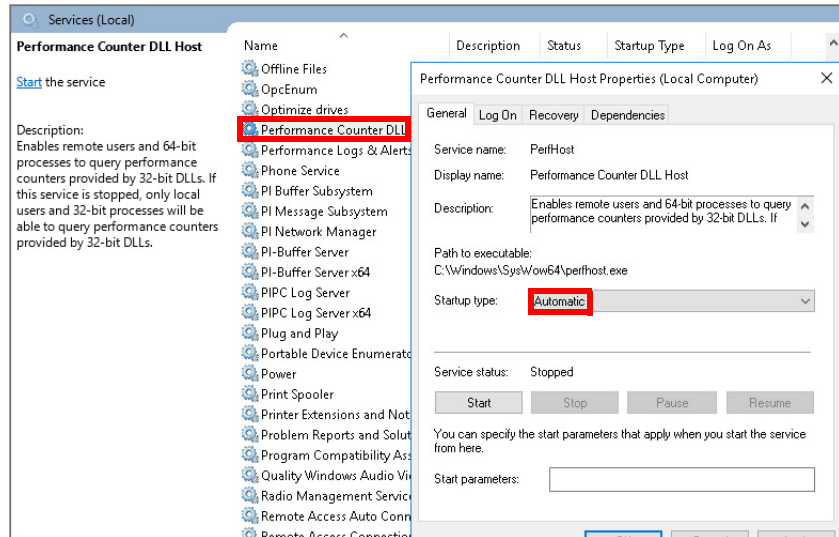
From this Page	Action
Control Panel\User Accounts	Select Manage User Accounts
User Accounts	Select Add
Add a User	Enter the same user name and Domain that you did to grant system access for the PerfMon service. <a href="#">See step 4 on page 190</a>
What level of access do you want to grant this user?	Select Other and choose Performance Monitor Users from the drop down.

2. Go to the Control Panel > Windows Firewall and define this information.

From this Page	Action
Control Panel\Windows Firewall	Select Advanced settings
Advanced Settings	<div>Create a new inbound rule. </div>
New Inbound Rule Wizard: File Type	Select Port
New Inbound Rule Wizard: Protocol and Ports	Select TCP and enter the Specific local ports: 135 and 445
New Inbound Rule Wizard: Action	Select Allow the connection
New Inbound Rule Wizard: Profile	The rule applies to Domain, Private, and Public.
New Inbound Rule Wizard: Name	Enter a name for the rule. For example, Perfmon Connection

3. Go to Control Panel > Administrative Tools > Services and find Performance Counter DLL Host.

4. Right-click Performance Counter DLL Host and select Properties.



5. Select Automatic as the Startup type.

## Configure PI Buffering

PI Buffering helps to protect local data in the event a client loses connection to the Collective.

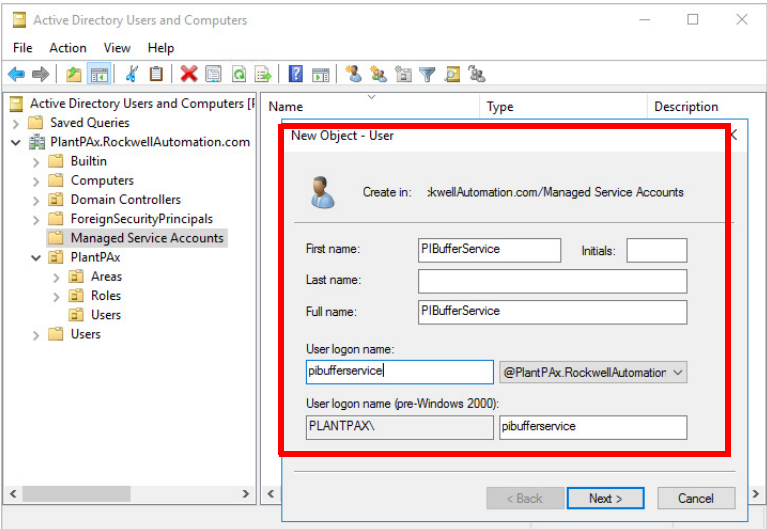
### Create Domain User for PI Buffer Service

The PI Buffer service defaults to running in a local account. For PlantPAx systems with a domain, it is **recommended** running the PI Buffer service in a **domain account**. This enhances security and provides access among other domain computers.

The domain user account for PI Buffer service must be created on the domain controller. It is a user account with privileges to run the service on other computers within the domain.

1. From the Server Manager, click Tools and choose Active Directory Users and Computers.
2. Expand your domain folder, right-click Managed Service Accounts and choose New>User.

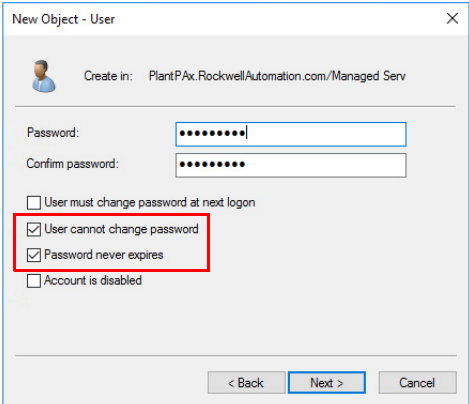
3. Complete the User text boxes.



Item	Description
First name	Type a name for the PI buffering service. <b>IMPORTANT:</b> The 'PI' preface is the name of the OSIsoft product.
Initials	Optional; you can leave blank.
Full name	Type the same name for the PI buffering service.
User login name	Type the same name for the PI buffering service and click the pull-down menu to select your domain folder.
User login name (pre-Windows 2000)	Use the SYSTEM\ default and type the same name for the PI buffering service.

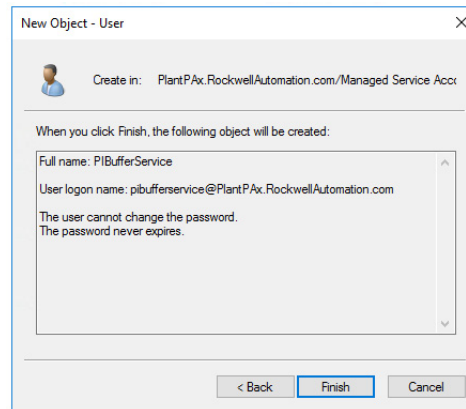
**IMPORTANT** The logon password creates a service user, not a person. The service user grants access to system computers for placing data into memory (buffer).

4. Type your password twice.



5. Make sure the following boxes are checked:
- User cannot change password

- Password never expires (indefinite service for system access)

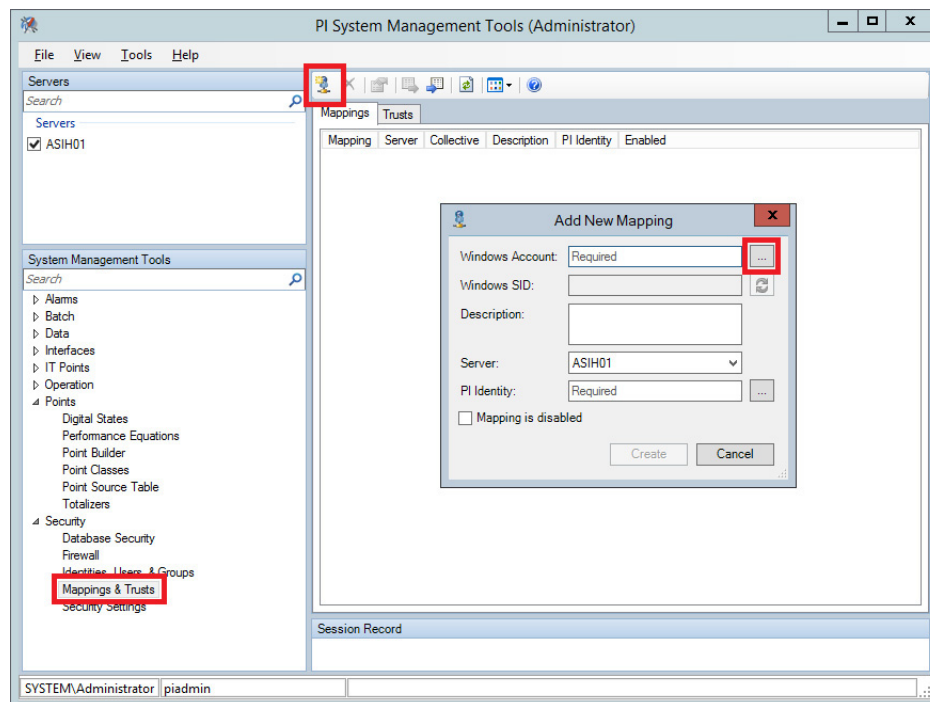


## Create Security Mappings

On the Historian server, associate the service user identity with the Historian mapping and trusts.

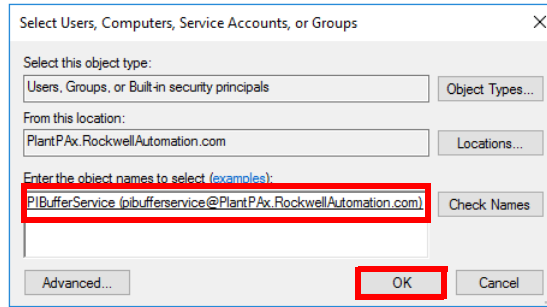
1. Go to Rockwell Software>FactoryTalk Historian SE>System Management Tools.

The PI System Management Tools window appears.

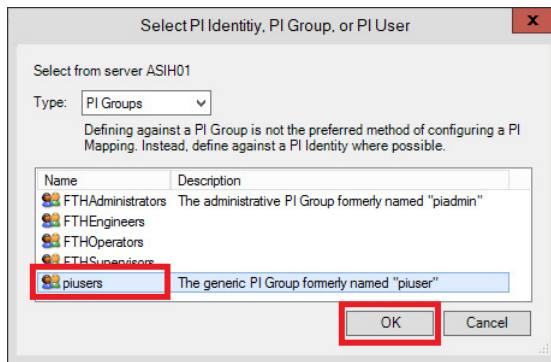
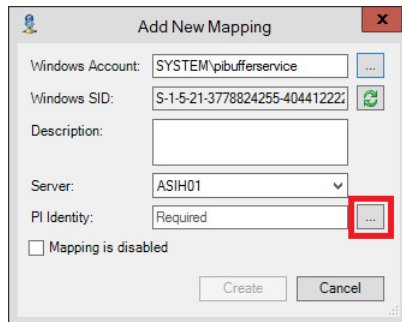


2. Do the following:
  - Under Servers, check the server that you want to set the security settings
  - Under System Management Tools, choose Mappings & Trusts
  - Click Add Mapping icon
  - From the Add New Mapping dialog box (right pane), click Browse (ellipsis '...')

3. Select the PIBufferService user that you created earlier.

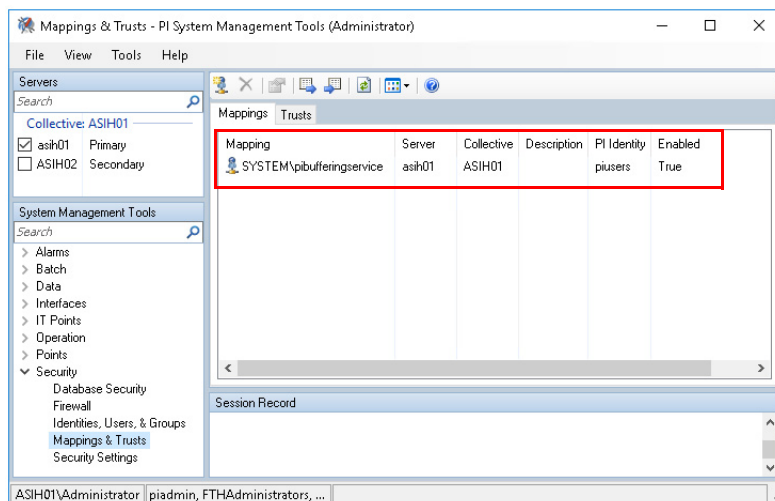


4. On the Add New Mapping dialog box, click Browse and select a group from the Type pull-down menu.
5. Select a desired identity.



6. Click Create.

Your security mapping should look similar to the example.



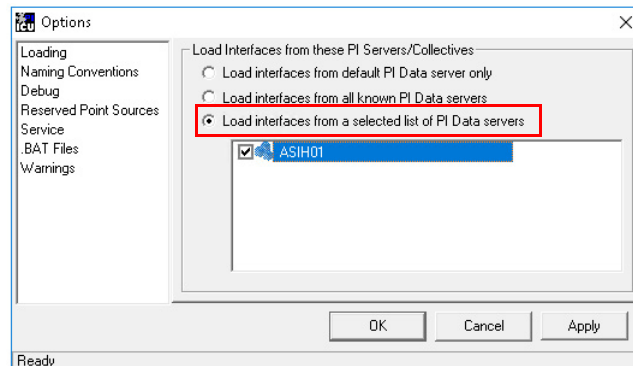
## Configure the Buffering Interface

Configure buffering for the server that you are connected, such as PASSo2A and PASSo2B.

1. Go to Rockwell Software>FactoryTalk Historian SE>Interface Configuration Utility.

The PI Interface Configuration Utility dialog box appears.

2. From the Tools menu, choose Options.
3. Click 'Load interfaces from a selected list of PI Data servers'.

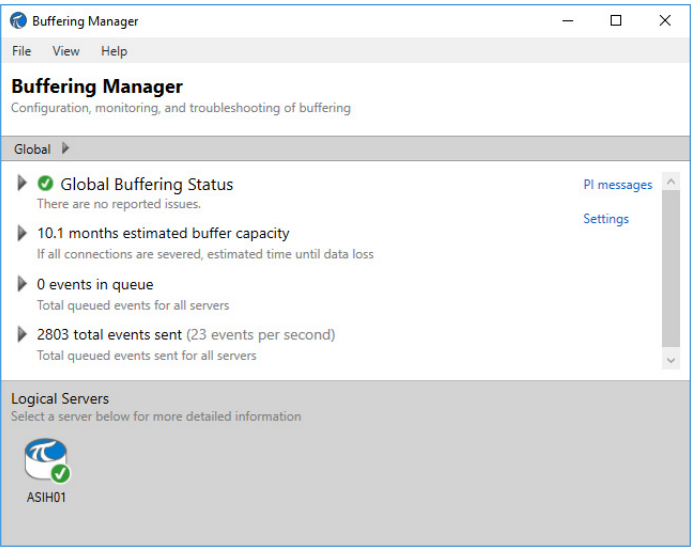


4. Select a server box.
5. From the Tools menu, choose Buffering.
6. Message windows appear.
7. Click Yes, and then 'Continue with configuration' to initiate the Buffering Manager wizard.
8. Complete the Buffering Manager wizard.

Item	Description
Detected PI Interfaces	Select the PI interfaces that you are buffering and click Next.
PI Data Archive security	Click Change, and enter the user name and password that you created earlier. Click Next.
	Click Next twice, and then 'Exit new installation wizard'.
Buffering Manager message windows	Click Yes and OK to confirm PI ICU dependency.

9. From the PI Interface Configuration Utility dialog box, click Tools menu and choose Buffering.

10. Verify that your information matches the dialog box example.



- 11. Close the Buffering Manager dialog box.
- 12. From the PI Interface Configuration Utility dialog box, click Tools menu and choose Options.
- 13. From the Options dialog box, check 'Load interfaces from a selected list of PI servers' and make sure that the server is checked.

**Configure the PI Buffer Service Logon**

The following procedure applies only if the Change Option was not available on the New Install Wizard dialog box.

- 1. On the PASS server, right-click Start menu and choose Computer Management.
- 2. Complete the New Install Wizard dialog box.

Item	Description
Local User and Group (left pane)	Open Local Users and Groups, right-click Groups and choose Administrators.
Add name	Click Add and type SYSTEM\pibufferservice.
	Click Check Names, and click OK.
Assign log on service account	From the Start menu, click Programs and choose Administrative Tools>Services.
	Right-click PIBuffer Subsystem and choose Properties.
	On the Log On tab, click Browse.
	Click Locations, choose 'Entire Directory', and click OK.
	Enter SYSTEM\pibufferservice and click Check Names.
	Click OK.

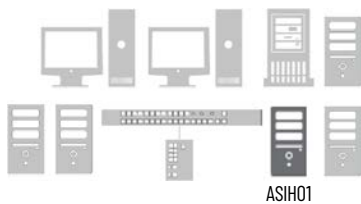
## Configure Historian Data Collection

The procedures in this section use the 'System Management Tool' and PI System Explorer within FactoryTalk Historian software. The tool is available for Historian Asset Framework management computers, such as server, node interface, and EWS.

Microsoft® Excel® software is required to enable the bulk editing capability. An additional license is required to use PI Datalink.

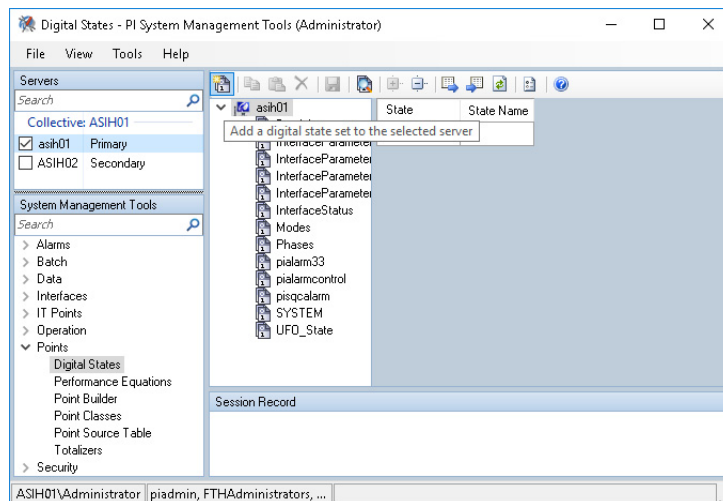
We also document how to manually create Historian tags, digital states, and Asset Framework. We recommend using the section [“Configure Asset Framework Databases with the PlantPAx Configuration Tool” on page 214](#) for creating bulk tags for large process systems.

### Create Digital States



Historian points can be defined as analog or digital. Digital points can be used to enumerate the process states, thus creating a relationship between the value and the text state name. For example: 1 = Good.

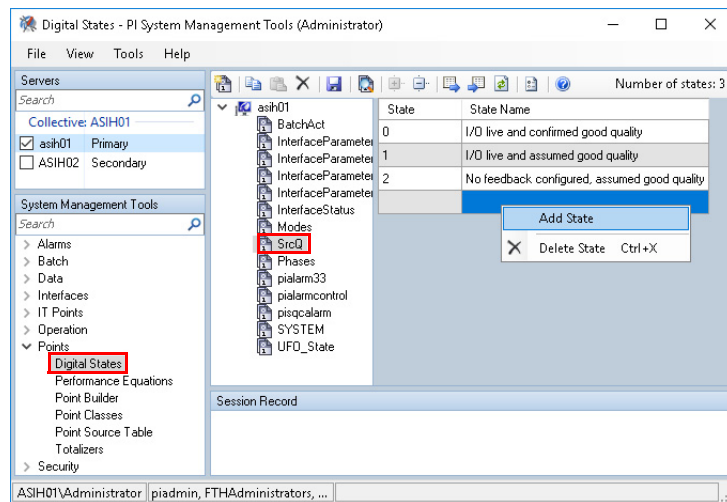
1. Go to Rockwell Software > FactoryTalk Historian SE > System Management Tools and select Points > Digital States
2. Add a Digital State Set to the server.



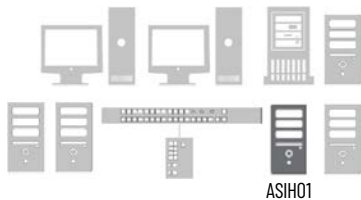


## Source Quality Data Examples

Parameter	Data Type	Description
SrcQ	SINT	Final PV source and quality.
		GOOD 0 = I/O live and confirmed good quality
		1 = I/O live and assumed good quality
		2 = No feedback configured, assumed good quality
		TEST 8 = Device simulated
		9 = Device loopback simulation
		10 = Manually entered value
		UNCERTAIN 16 = Live input, off-specification
		17 = Value substituted at device/bus
		18 = Value substituted by maintenance (Has and not Use)
		19 = Shed, using last good value
		20 = Shed, using replacement value
		BAD 32 = Signal failure (out-of-range, NaN, invalid combination)
		33 = I/O channel fault
		34 = I/O module fault
		35 = Bad I/O configuration (for example, scaling parameters)



## Import Digital Sets and States



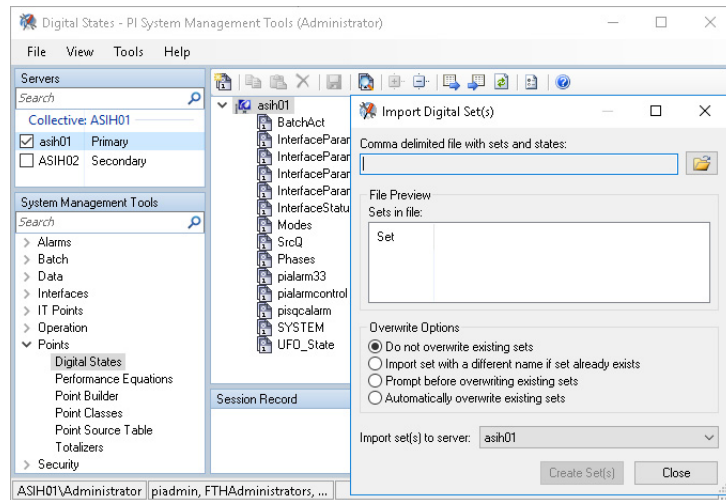
To save time entering common Digital Sets and States, templates are available to import.

A Process Objects Digital Set is available from the PlantPAx Process Library. After downloading the library, the Templates folder contains Historian files.

The PIPermom Digital States are available from a local template in the installation directory.

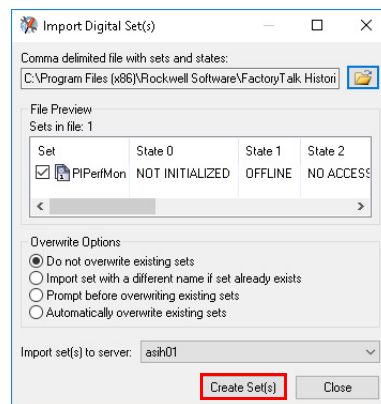
1. Go to Rockwell Software > FactoryTalk Historian SE > System Management Tools and select Points > Digital States

## 2. Select Import.



3. Select the PI\_PIPerfmon\_DS.csv file for the Comma delimited file with sets and states. The file is located in C:\Program Files (x86)\Rockwell Software\FactoryTalk Historian\PIPC\Interfaces\PIPerfMon.
4. Select Create the Set(s).

A minimum number of the recommended Digital Sets is created. This procedure does not create the basic Digital Set file for all Process Objects digital states.

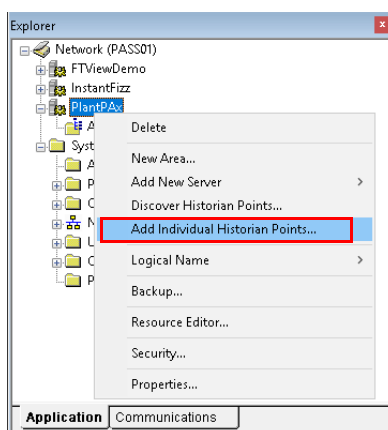


## Create Individual Historian Points

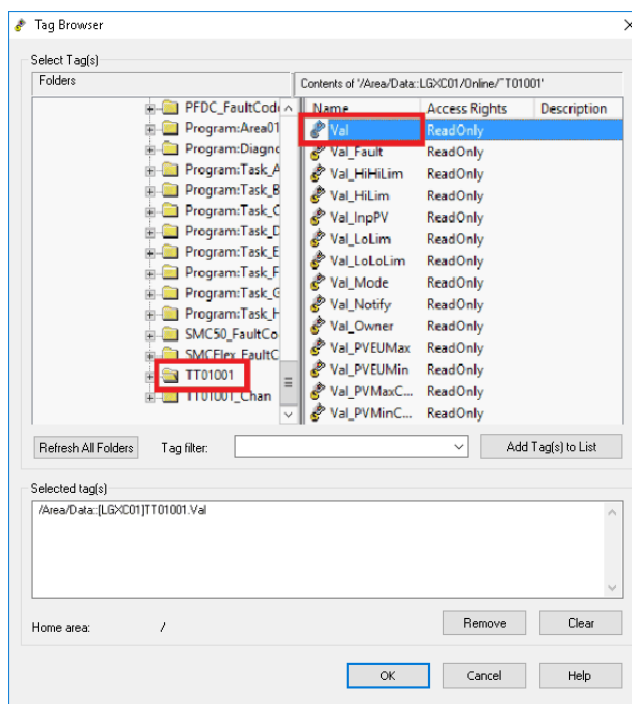


You can create historian points by using the FactoryTalk® Administration Console. Define these points from an engineering workstation or an Historian server. The following is one example.

1. Go to Rockwell Automation Software > FactoryTalk Administration Console and select the network for the type of FactoryTalk directory.
2. In the Explorer pane, select an application (PlantPAx is our example) and choose Add Individual Historian Points.



3. On the Add Historian Points dialog box, select Browse Tags.
4. In the Tag Browser window, select an object tag (TT01001 in the example) in the Folders pane on the left side of the window.

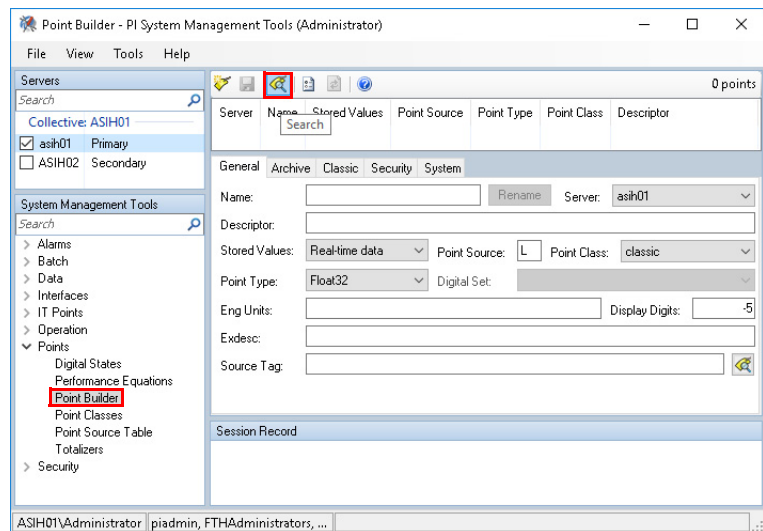


5. In the pane on the right side of the Tag Browser window, double-click the tag to configure as a Historian Point.

Val (Process Variable Value) is the example.

6. Select Add Tags to List and OK to accept the tags in the list.
7. Go to Rockwell Software > FactoryTalk Historian SE > System Management Tools.

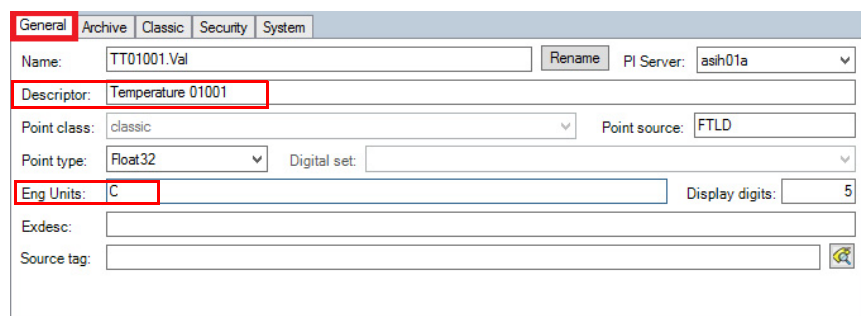
8. In the Servers Pane (or the Servers and Collectives pane if you have a collective), select the historian server.
9. Select Point Builder and search for tags.



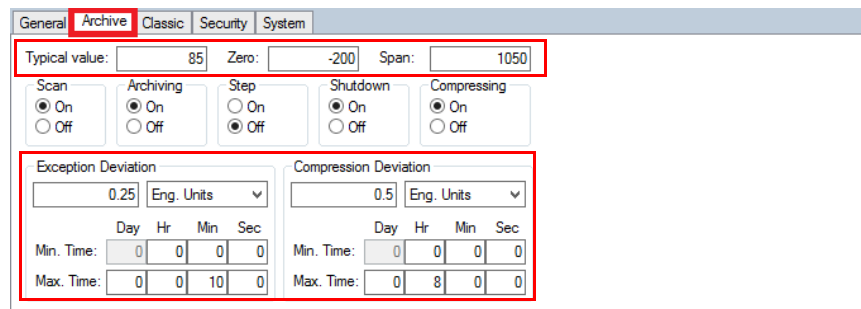
10. In the Tag Search window, type the Tag Mask and select Search.

You can use an asterisk (\*) for a wildcard. The point name and entire path appear on the Point Builder window.

11. Select the tag and select OK.
12. Select the tag and select Rename.
13. Enter a new name in the Rename PI Point dialog box.
14. In the General tab of the Point Builder dialog box, enter a tag description and engineering units.



15. In the Archive tab, configure the range (Zero and Span), typical value, and all exception and compression data for the historical point.



**IMPORTANT** Usually, Minimum Range Value = Zero, Span = Maximum Range Value minus Minimum Range Value. The Typical Value is between the Minimum Range Value and the Maximum Range Value.

16. Select the Classic tab, to view the historical tag path (instrument tag) that includes the Data server name.

This example shows the FactoryTalk® Linx name, PlantPAx\_DAT.

The historical point link is broken if any change is made to the FactoryTalk Linx application name.

The screenshot shows the 'Classic' tab in the FactoryTalk Historian SE configuration window. The 'General' tab is selected, and the 'Classic' sub-tab is active. The configuration includes several input fields for locations, conversion factors, filter codes, square root codes, total codes, and user integers/real numbers. The 'Instrument tag' field is populated with 'PlantPAx/Area/Data:PlantPAx\_DAT:[LGXC01]TT01001.Val'.

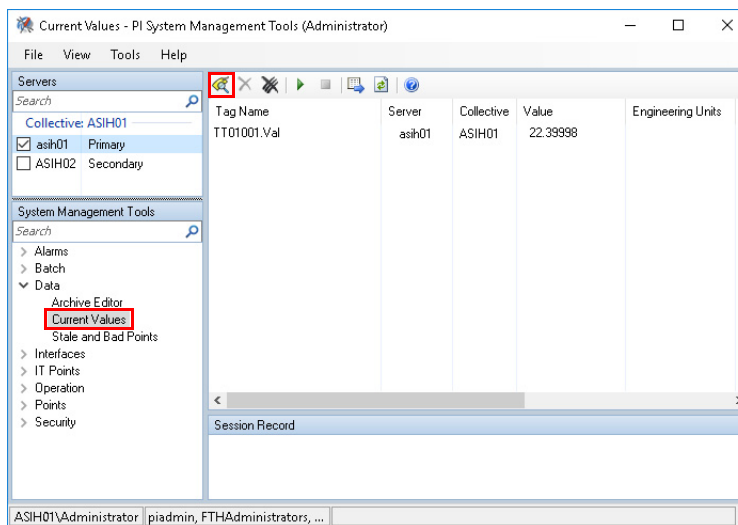
Location	Value	Conversion factor	Value	UserInt	Value
Location1:	1	Conversion factor:	1	UserInt1:	0
Location2:	0	Filter code:	0	UserInt2:	0
Location3:	1	Square root code:	0	UserReal1:	0
Location4:	1	Total code:	0	UserReal2:	0
Location5:	0				

Instrument tag: PlantPAx/Area/Data:PlantPAx\_DAT:[LGXC01]TT01001.Val

## Monitor Historical Data

From the primary Historian sever, use the PI System Management Tool to verify Historical data has good values.

1. Go to Rockwell Software > FactoryTalk Historian SE > System Management Tools and select Current Values and select the search button.

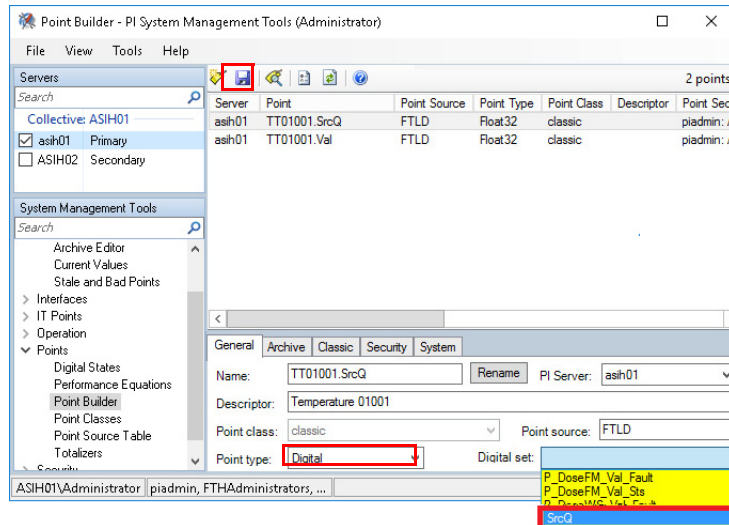



2. Enter a tag mask or an asterisk (\*) for all tags.
3. Select any tags that you wish to monitor.
4. To see values change as they periodically refresh, select the Play button.

## Define Digital Historical Points

The digital set is available only to a digital points type. The FactoryTalk Administration Console automatically creates a Float32 (Real) point type for each new point.

1. Go to Rockwell Software > FactoryTalk Historian SE > System Management Tools
2. To be able to change the digital set, select Digital for the Point type and then select a Digital Set (SrcQ in the example).



3. Select the Save  icon to store the Historian point.

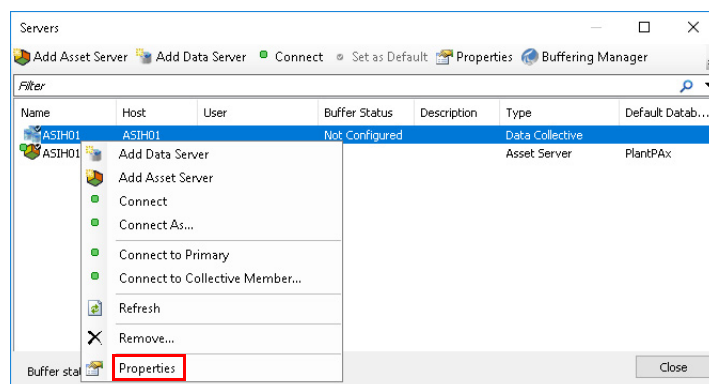
## Historian Asset Framework

Use the FactoryTalk Historian Asset Framework to build and deliver model-driven analysis and reporting solutions.

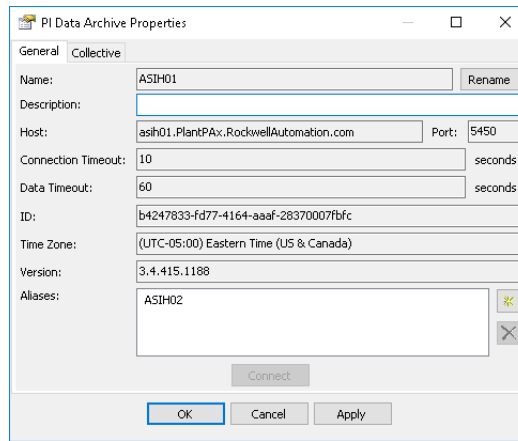
### Configure the Connections to the Servers

When a Historian Collective is used, the Asset Framework server and PI Analysis Service must be installed on a separate computer, such as a dedicated SQL server via the AppServ-SQL virtual template.

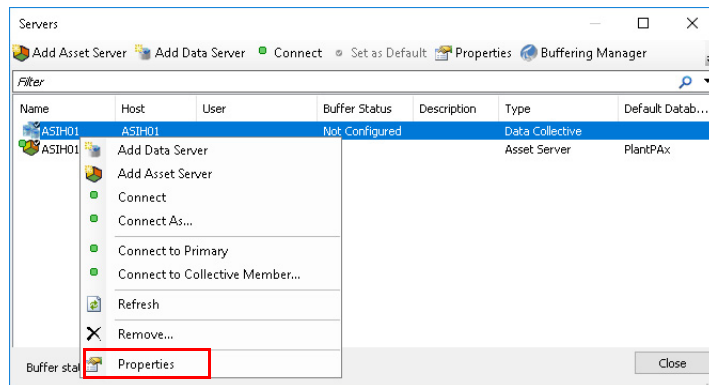
1. Go to Rockwell Software > FactoryTalk Historian SE > System Explorer (64-bit) and select File to choose Connections.
2. Select the data collective (ASIH01) and choose Properties.



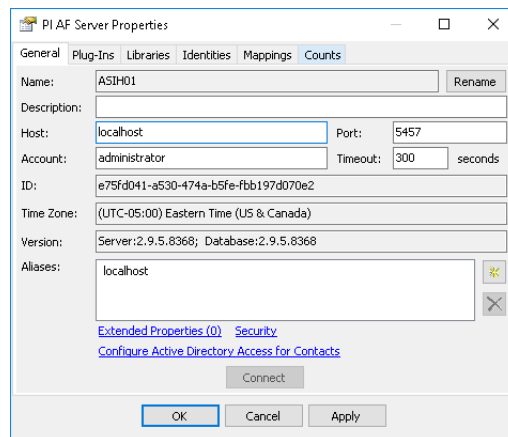
- Rename or configure this connection as necessary for your system.



- Select the Asset Server (ASISo1) and choose Properties.



- Rename or configure this connection as necessary for your system.



## Import Asset Framework Templates

An asset framework provides a means to organize your process equipment assets. Asset Framework Templates are provided in the process library. This download is available online from the Product Comparability and Download Center ([PCDC](#)).

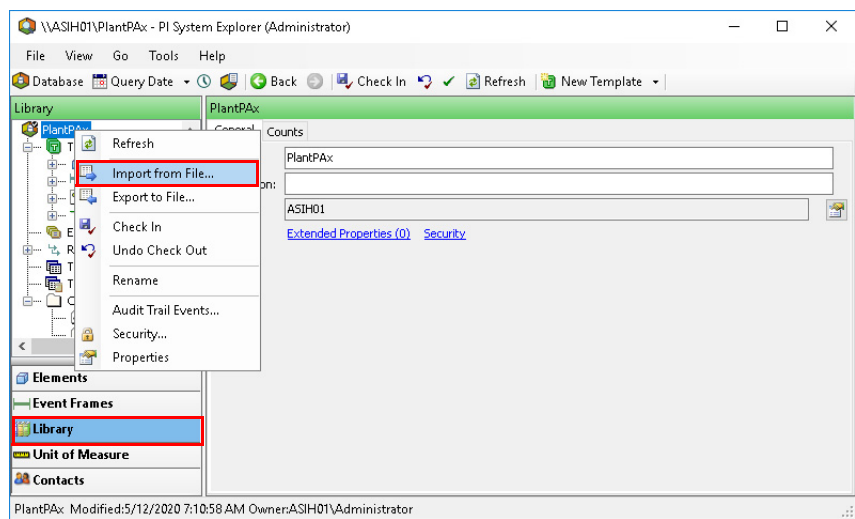
1. Go to Programs > Rockwell Software > FactoryTalk Historian SE > System Explorer (64-bit).

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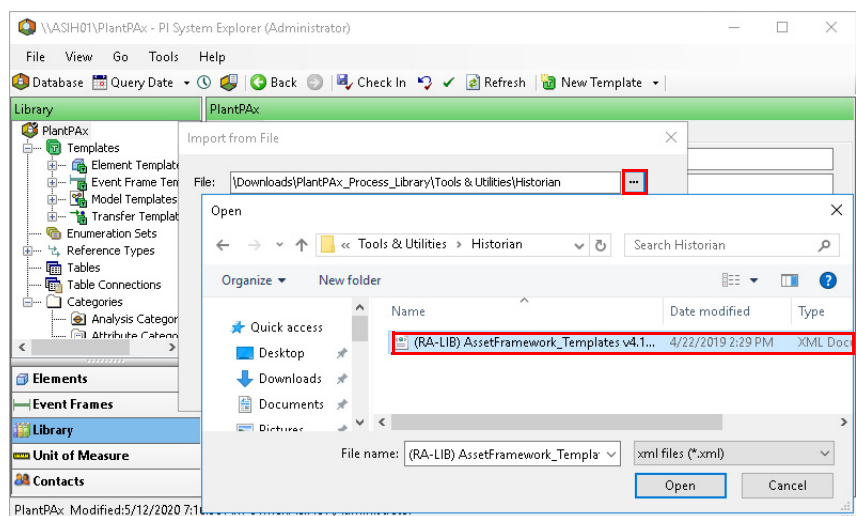
**IMPORTANT** Steps 2 and 3 are only performed the first time you name the database.

---

2. Select Yes from the Create Database dialog box to create a user database.
3. Enter the name of the user database.
4. Select Library in the lower, left pane, select the database name and choose Import from File.



5. Browse in your system files to the (RA-LIB) AssetFramework\_Templates .xml file and open the file.



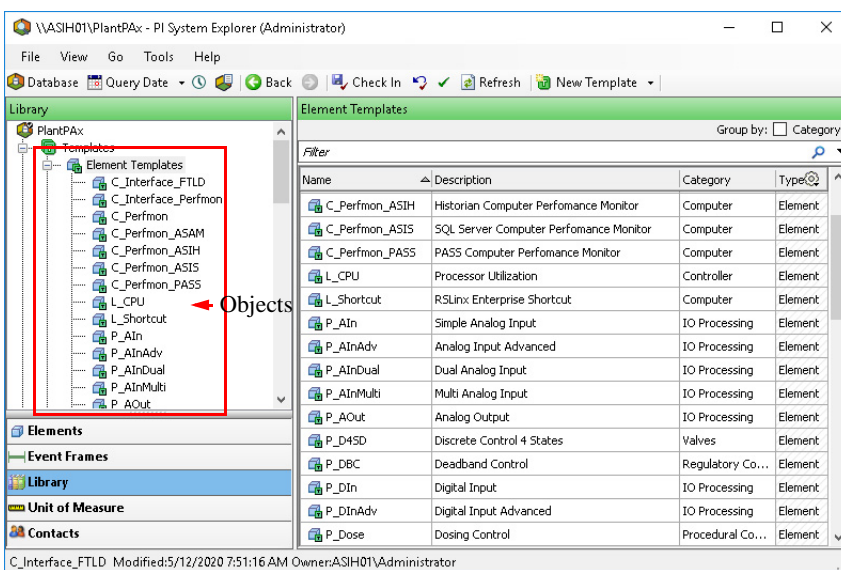
There are these template files:

- Base Asset Framework Template File for standard Asset Framework functionality for the process library, release 4.1 and 5.0.



- Advanced Asset Framework Template File for use with SQL Server Reporting Services reports. These objects use the base template, with additional parameters to enable reporting functionality. For more information, see [PlantPax SQL Process Object and Alarm Reports](#).
- Accept the default import options.

The database now contains the Library object templates.



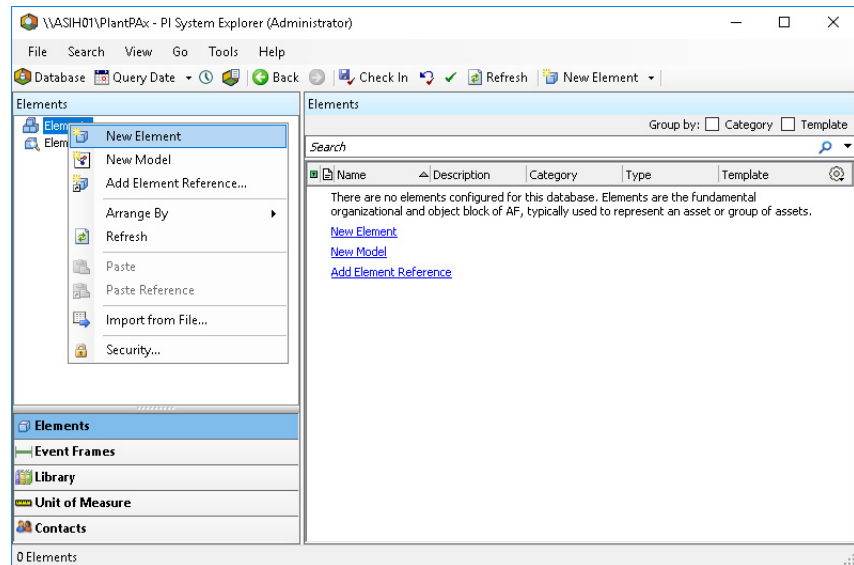
## Configure Asset Framework Elements

Associate the tags with historian elements, which are the Process object templates

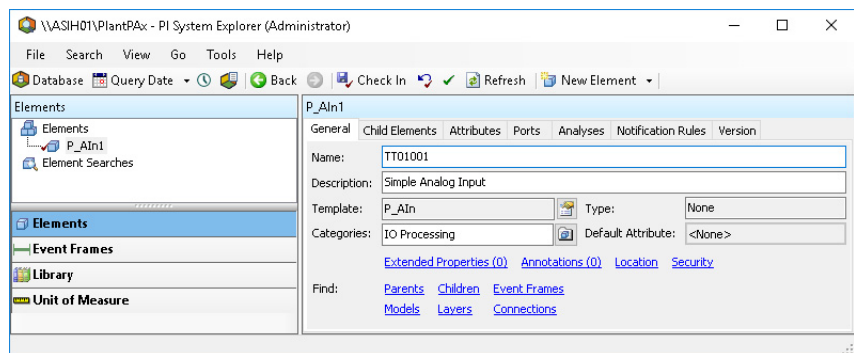
The term 'element' is used in the Asset Framework software. For PlantPax system purposes, 'element' can be considered synonymous with 'objects' in the process library.

- Go to Programs > Rockwell Software > FactoryTalk Historian SE > System Explorer (64-bit).

2. Select Elements in the lower, left pane, select Element and create a New Element.



3. Select P\_AIn in the Choose Element Template dialog box.
4. Type the tag name that is being assigned to the object and check it in.

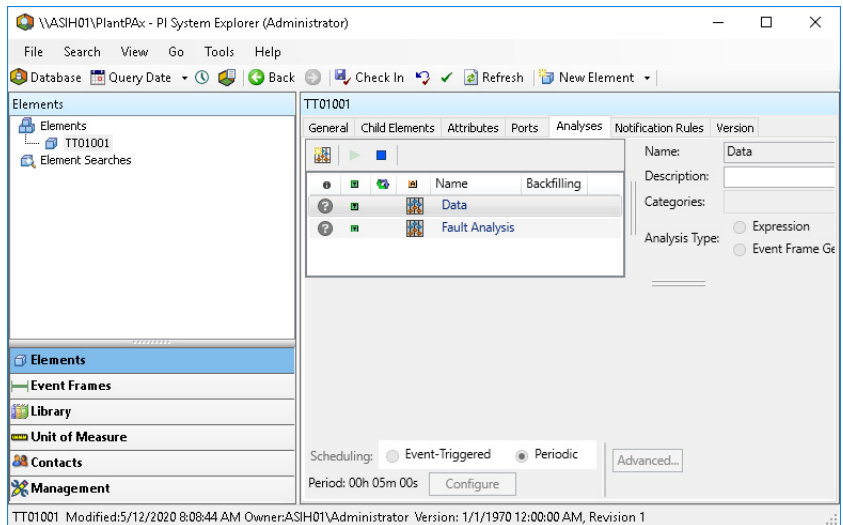


5. Confirm the settings and Check In again to complete the check in process.
6. The current historical value is accessed by selecting the Attributes tab and refreshing.

## Search Event Frames

You can search for event frames, for example, if you want to find abnormal conditions that triggered an event.

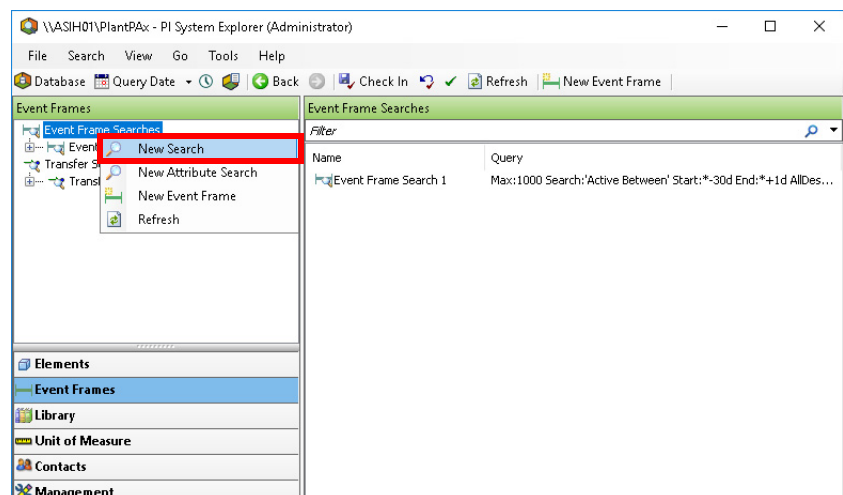
1. Go to Programs > Rockwell Software > FactoryTalk Historian SE > System Explorer (64-bit)
2. Select Elements in the lower, left pane of the PI System Explorer dialog box and then select the Analyses tab.



## Finding Faults for Analysis

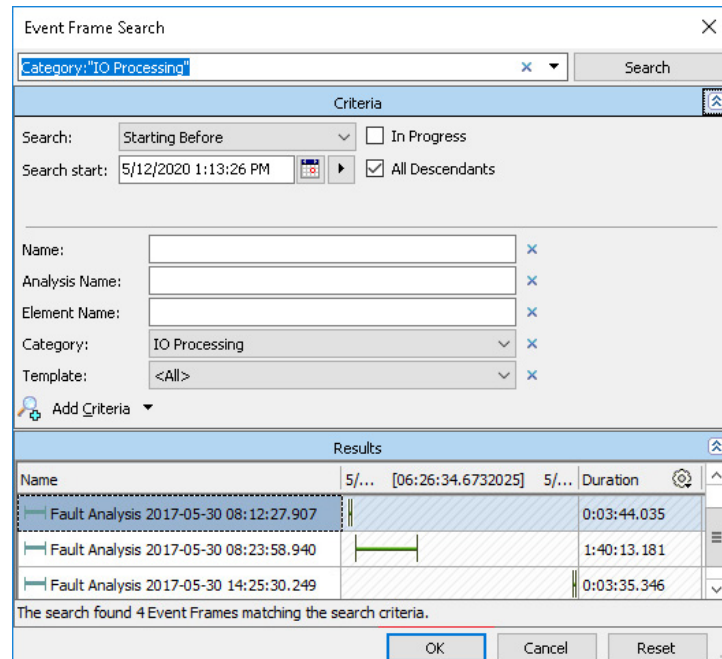
You can also search event frames to assess faults.

1. Go to Programs > Rockwell Software > FactoryTalk Historian SE > System Explorer (64-bit)
2. Select Event Frames in the lower, left pane, select Event Frame Searches and choose New Search.



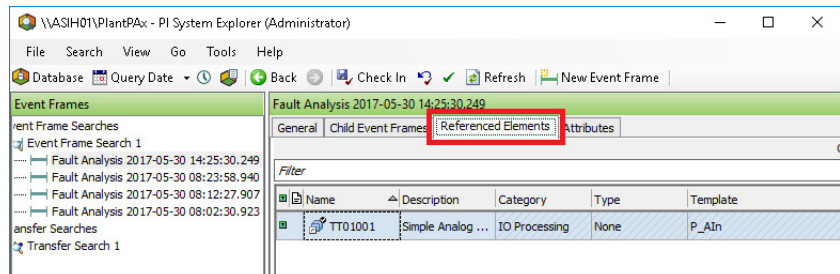
3. Select the desired search criteria and any filters.

The search results for the selected criteria appear at the bottom of the dialog box.



4. To view elements (tags) that are associated with the fault for the selected search criteria, double-click a fault.
5. Select the Referenced Elements tab.

Each tag (and description) that is assigned to the element appears.



6. To view a description of the abnormal condition, select the Attributes tab.

## Tools for Creating Historian Tags

Depending upon how far along you are in your process application build, these can help create tags and other bulk code:

- Application Code Manager software
- PlantPAx Configuration tool
- PI Builder Add-in for Microsoft Excel

### Application Code Manager

Application Code Manager (ACM) software supports a historian library to assist with creating historian tags.

Use ACM to create the historian tags when your control strategies in ACM are in the final stages and ready to generate a Logix 5000 Controller .ACD file.

See [Chapter 5, Process Applications](#) for specific details on ACM.

After ACM generates historian tags, the .CSV file needs to be copied to the computer that has PI Builder Add-in for Microsoft Excel installed to publish the tags into the historian database.

---

**IMPORTANT** If additional control strategies are created using Logix Designer software, then ACM will not be able to generate the new historian tags. In this scenario, the PlantPAx Configuration Tool may be considered to create the historian tags.

---

### PI Builder Add-in for Microsoft Excel

PI Builder is a Microsoft Excel add-in that lets you use Excel to create, view and modify PI points and Asset Framework objects in your Historian database. With PI Builder you can make bulk tag edits by importing and exporting your spreadsheet.

All functionality of the prior PI Tag Configurator has been replaced with PI Builder, which is included with the PI SMT and PI Data Archive setup kits (as part of the PI AF Client installer).

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**IMPORTANT** Microsoft Excel 32-bit software must be installed for these procedures.  
This section uses Microsoft Excel 2013. Your version could be different.

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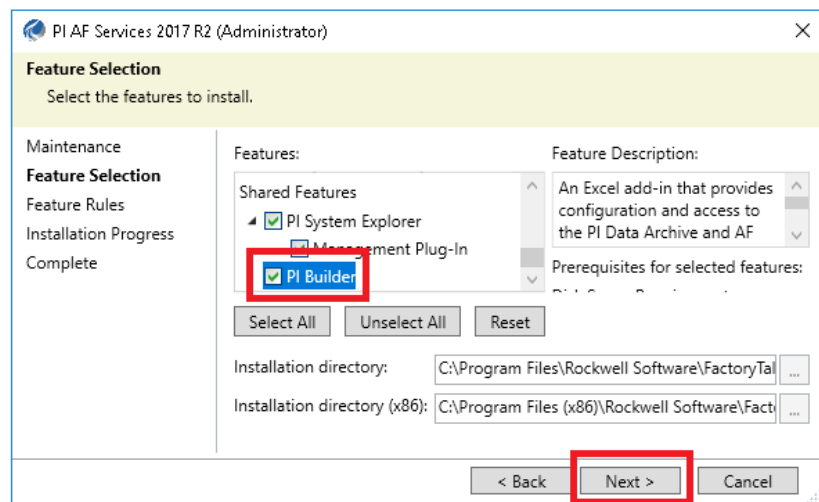
If Microsoft Excel was installed after the Historian software, the PI AF Services will need to be modified to include the PI Builder feature.

1. To start the modification, run file named <PI-AF-Services\_2017-R2A\_.exe> located in the \Redist\PIAFSetup\ directory of the Historian SE software installation media.

A maintenance dialog will prompt to modify, repair or uninstall the PI AF Services 2017 R2 installation.

2. Choose to Modify the installation and click Next.

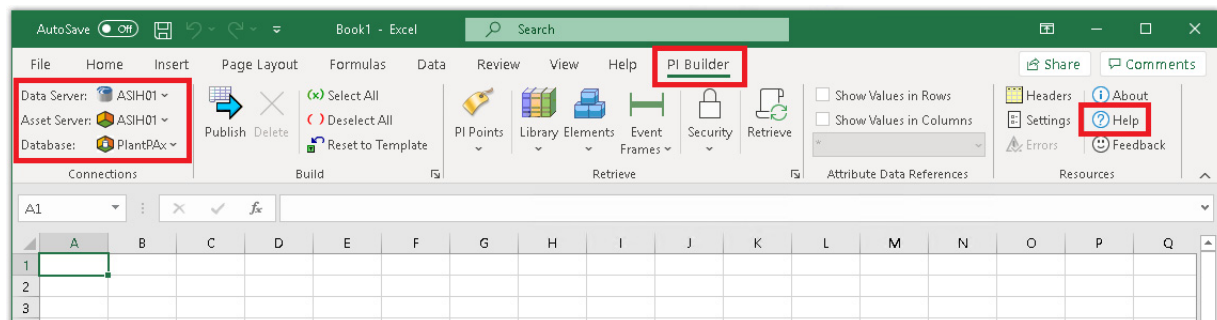
3. Select PI Builder from the list of Features and click Next.



4. Reboot the computer after the installation is complete.

To retrieve and publish PI AF objects, PI Builder must connect to a PI AF database and for PI points a PI Data Archiver server.

1. Open your version of Microsoft Excel and click the PI Builder tab.
2. In the Connections group on the upper left corner. Select your Data Server, Asset Server, and Database as available.



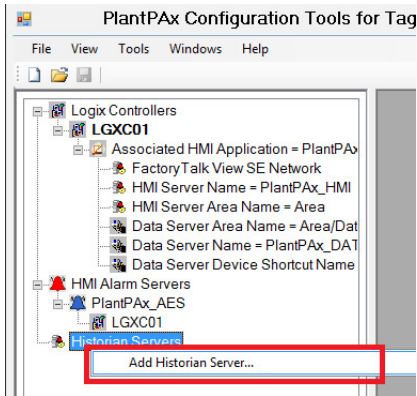
For information on how to publish your historian tags to the historian database, see the PI Builder add-on Help section.

## Configure Asset Framework Databases with the PlantPax Configuration Tool

Use the PlantPax Configuration tool to configure Asset Framework databases with Logix tag elements. This includes the automatic configuration of related PI points in the FactoryTalk Historian data server (PI data server).

This procedure assumes that the controller, HMI server, and the alarm server are configured for using the PlantPax Configuration Tool.

- 1. Open the PlantPax Configuration Tool.
- 2. Add the Historian Server.



From this Page	Action
Add Historian Server	Type the name of the historian server.
Select Controllers for Building Data Points in Historian Server	Enter the server collective name and select the applicable controllers.

Select Controllers for Building Data Points in Historian Server

Name:Production Historian

Description:

FTLD Interface Number:1

Server or Collective Name:ASIH01

Point Source Name:FTLD

Select Controllers and Enter Data Server Information

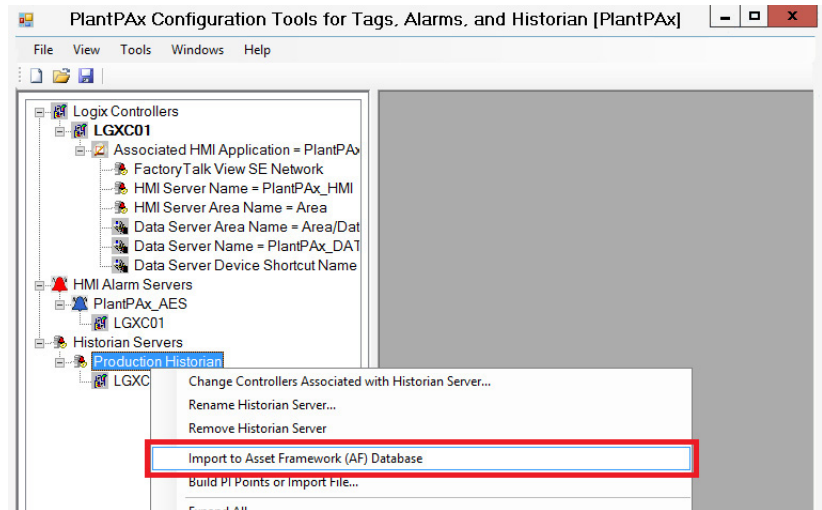
Select	Controller	Application Name	Data Area Full Path	Data Server Name	Device Shortcut Name
<input checked="" type="checkbox"/>	LGXC01	PlantPax	Area/Data	PlantPax_DAT	LGXC01

FactoryTalk Application Name, Data Server Name and Device Shortcut Name must be provided when using FTLD point source.  
Data Server Name is not required when point source is not FTLD.  
The default data server name used by FactoryTalk is "RSLinx Enterprise".  
(Data Area Full Path example: "NorthPlant/Data1")

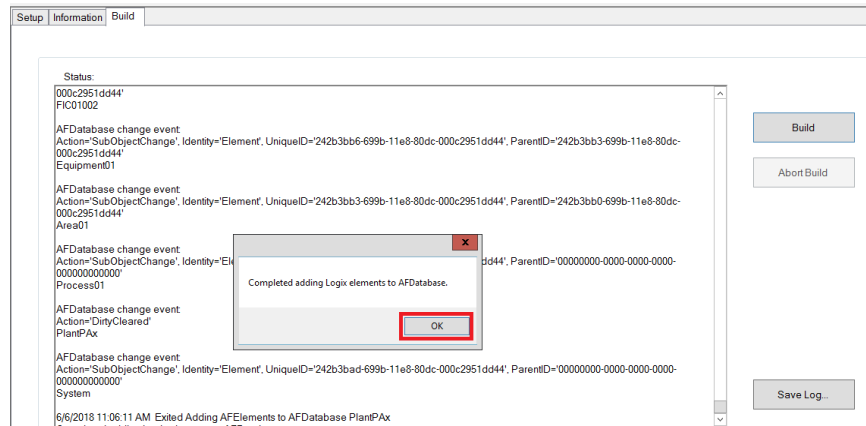
OK

Cancel

3. Select the Historian server that you just created (Production Historian in our example), and select to Import to Asset Framework (AF) Database



From this Location	Action
Build Tags: Setup Tab	Select Connect
Connect dialog Box	Set the PI Server, AF Server, and AF Database
OK Connected dialog box	Verify that you are connected to the PI Server, AF Server, and AF Database
Build Tags: Setup Tab	Select PI Point Builder Options
FactoryTalk Historian Import File Builder Options dialog box: Naming tab	Use the controller name as a prefix to Historian tags. For example, LGXC01.<tagname>
Build Tags: Information Tab	Review and verify the information
Build Tags: Build Tab	Select Build

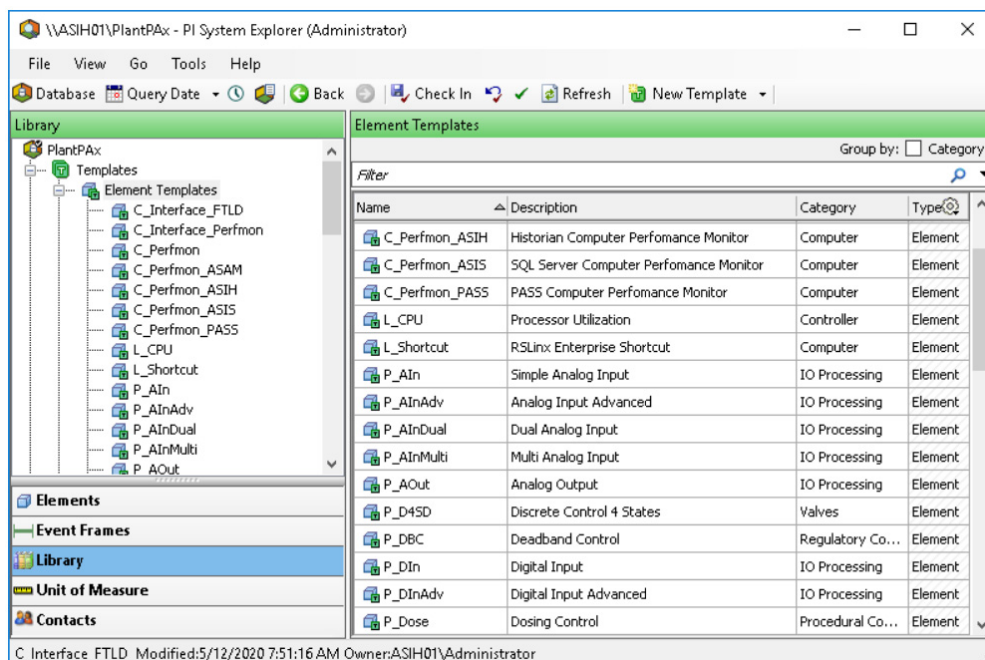




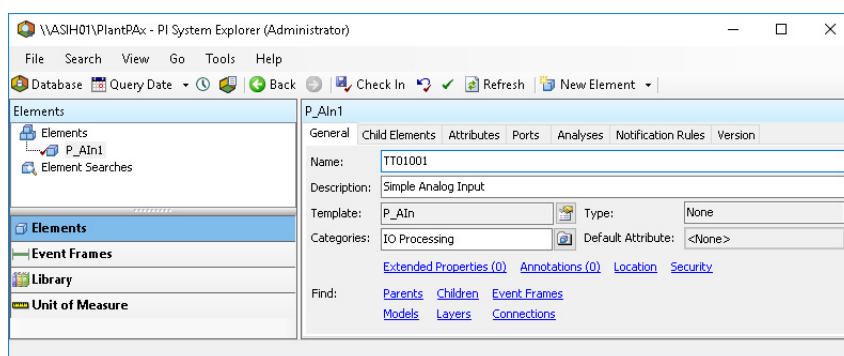
## Verify Asset Framework Library and Elements

After using the PlantPAx Configuration Tool, you must verify that the asset framework library and elements are properly imported into the Asset Framework database.

1. Go to Programs > Rockwell Software > FactoryTalk Historian SE > System Explorer (64-bit).
2. Select Library in the bottom left of the system explorer and verify the contents of the library.



3. Select Elements in the bottom left of the system explorer and verify the elements.



## Historian Tags in FactoryTalk VantagePoint

This section shows how to import FactoryTalk Historian data tags. Data from multiple Historian SE servers can be brought together into a single decision support system by using FactoryTalk® VantagePoint® as the information reporting software.

**IMPORTANT** For installation and configuration steps, refer to the FactoryTalk VantagePoint Getting Results Guide, available on the FactoryTalk VantagePoint installation DVD.

This document assumes that the FactoryTalk VantagePoint server is installed on its own computer. If you have a small application and you want to install the VantagePoint server on the same computer as the Historian SE server, refer to the FactoryTalk Historian SE Installation and Configuration Guide, publication [HSE-IN025](#).

1. Go to Rockwell Software>FactoryTalk VantagePoint>Manager.
2. In the VantagePoint Manager directory tree, expand Sources, right-click FactoryTalk and choose New>Item.

The New FactoryTalk Connector dialog box appears.

The screenshot shows the 'New FactoryTalk Connector' dialog box. It has a title bar with a close button. Below the title bar is a section titled 'Connector Information' with a sub-header 'A FactoryTalk connector gives you access to various FactoryTalk data sources.' and a blue cube icon. The main area is divided into three sections: 'FactoryTalk directory' with a text box for 'Directory host' containing 'pass01'; 'FactoryTalk user' with 'User name' as 'VantagePoint' and 'Password' as '\*\*\*\*\*' (both highlighted with red boxes), and a checkbox for 'This is an existing account. Use it as the FactoryTalk user instead.' which is unchecked; and 'Connector description (optional)' with a text box. At the bottom are three buttons: '< Back', 'Next >' (highlighted with a red box), and 'Cancel'.

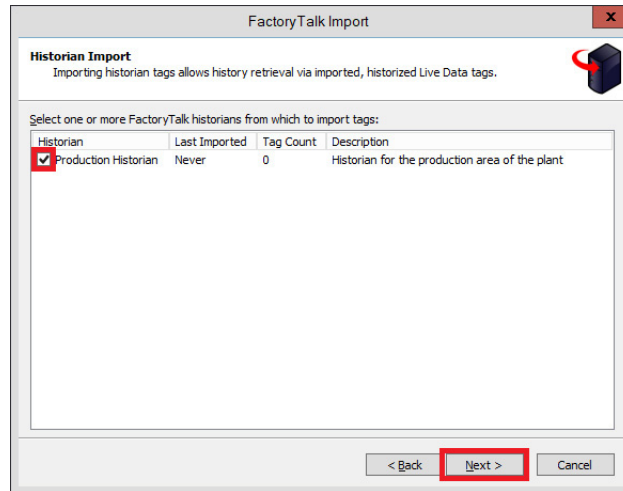
3. Type the VantagePoint user password and click Next.
4. Select 'Yes, please'.

The FactoryTalk Import dialog box appears.

The screenshot shows the 'FactoryTalk Import' dialog box. It has a title bar with a close button. Below the title bar is a section titled 'Import Choices' with a sub-header 'You can choose to import data from various FactoryTalk systems.' and a blue cube icon. The main area is titled 'What would you like to import?' and contains three radio button options: 'I would like to import FactoryTalk Live Data tags', 'I would like to import FactoryTalk Historian tags' (which is selected and highlighted with a red box), and 'I would like to import FactoryTalk Alarms and Events information'.

5. Click 'I would like to import FactoryTalk Historian tags'.

The FactoryTalk Import dialog box reappears.

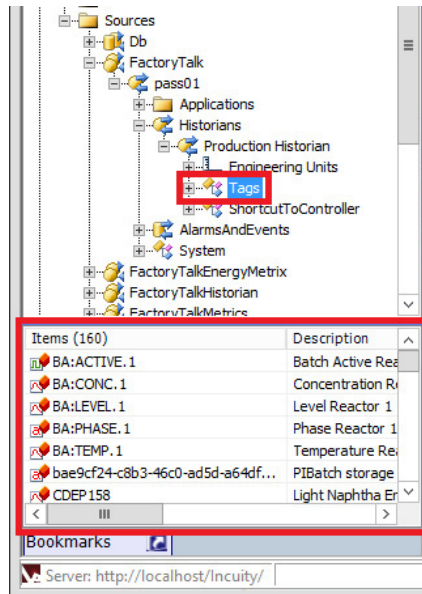


6. Check the Historian that you want to use.
7. If you are not using an ME connector, click Finish.

When the 'Import successfully completed' dialog box appears.

8. To confirm the import, go to System > Sources > FactoryTalk > pass01 > Historians > <Production Historian> and look for 'Tags'

For example Server = pass01 and Historian = Production.




---

**IMPORTANT** Adding new Historian points in the system requires a synchronization action. Synchronizing lets you update the VantagePoint references.

---

9. To synchronize the Historian, select System > Sources > FactoryTalk > <server> > Historians > <yourHistorian> and choose Synchronize.

## Other Reporting and Analytics Options

Third-party reporting packages can connect to FactoryTalk Historian SE via the OLE-DB connector.

For more information, refer to the Knowledgebase Technote [\*FactoryTalk Historian SE and the OSIsoft PI OLEDB Providers\*](#).

**Notes:**

## Batch Management

PlantPAX® systems support scalable options for batch management that are based on ISA88 standards and can help:

- Automate sequences to reduce time-to-market
- Manage recipes and procedures to focus on yield, throughput, and quality
- Provide models to improve traceability, reporting, and approval controls

### Options

The following options exist for batch management in your PlantPAX system. Controller-based solutions are typically for smaller systems; larger systems require FactoryTalk® Batch applications. The reference links provide more details for each option. Not all controller firmware revisions support all batch solutions.

1

#### Select the Batch Solution

Scalable offerings and tools range from controller-based to enterprise-wide solutions.

Feature	Logix Batch & Sequence Manager	SequenceManager™	FactoryTalk® Batch
Deployment	Logix controller code	Firmware-based controller feature	Server-based application
Supported controllers	ControlLogix® 5580 CompactLogix™ 5380 ControlLogix 5570 CompactLogix 5370	ControlLogix 5570 CompactLogix 5370	ControlLogix 5580 CompactLogix 5380 ControlLogix 5570 CompactLogix 5370
Units	Single unit recipes	Single unit recipes	Multiple unit recipes
Phase construction	PhaseManager™ programs	PhaseManager programs	PhaseManager programs
Phase interface	Phase and bit logic	Pull-down menu	Pull-down menu
Max recipes/steps/phases	32	Limited by memory or resources	Limited by memory or resources
Max input/report parameters	4	No max	No max
Parameter expressions	No	Yes	Yes
Parameter data types	BOOL REAL	BOOL INT, INT, DINT REAL	BOOL SINT, INT, DINT REAL
Procedural structure	Sequential Concurrent	Sequential Concurrent Divergent Recurrent	Sequential Concurrent Divergent Recurrent
Recipe design	Tabular HMI configured	SFC like	SFC like
Recipe editing	Runtime via HMI	Import only at runtime	Runtime editing via Recipe Editor
HMI integration	Faceplates	3 Active X	4 Active X API
Batch reporting	Queue controller services	Event client and archive services	Event client and archive services

Feature	Logix Batch & Sequence Manager	SequenceManager™	FactoryTalk® Batch
FactoryTalk Batch integration	No	Yes	Na
Dynamic unit binding	No	No	Yes
Unit arbitration	No	No	Yes

2 Logix Batch and Sequence Manager Requirements

The Logix Batch and Sequence Manager option consists of controller code and visualization elements. You need:

- Logix 5000™ controller
- FactoryTalk® View Studio software
- Logix Batch and Sequence Manager files

For more information, see [Logix Batch and Sequence Manager](#).

3 SequenceManager Requirements

SequenceManager controls direct PhaseManager programs in this controller-based option. You need:

- Logix 5000 controller
- FactoryTalk® View Studio software
- SequenceManager software

For more information, see [SequenceManager Controls](#).

4 FactoryTalk Batch Requirements

A FactoryTalk Batch application is a server-based option.

AppServ-Batch application server with:

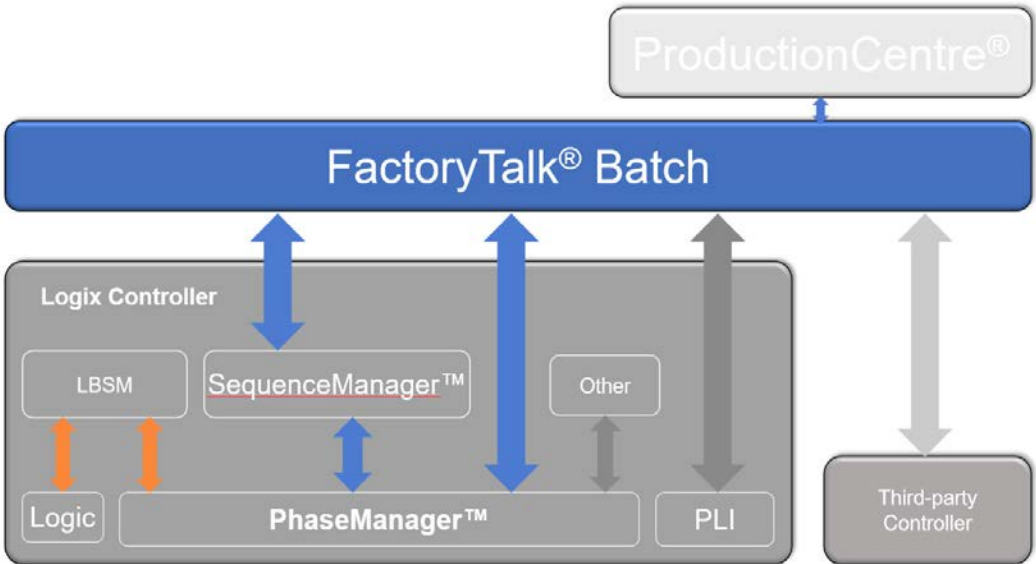
- FactoryTalk Batch server
- FactoryTalk® eProcedure® server
- FactoryTalk® Event Archiver database

AppServ-Info SQL server with:

- SQL server
- FactoryTalk Batch Material server
- Master Recipe storage

For more information, see [FactoryTalk Batch Application](#).

The batch solutions work with each other to provide a comprehensive solution.

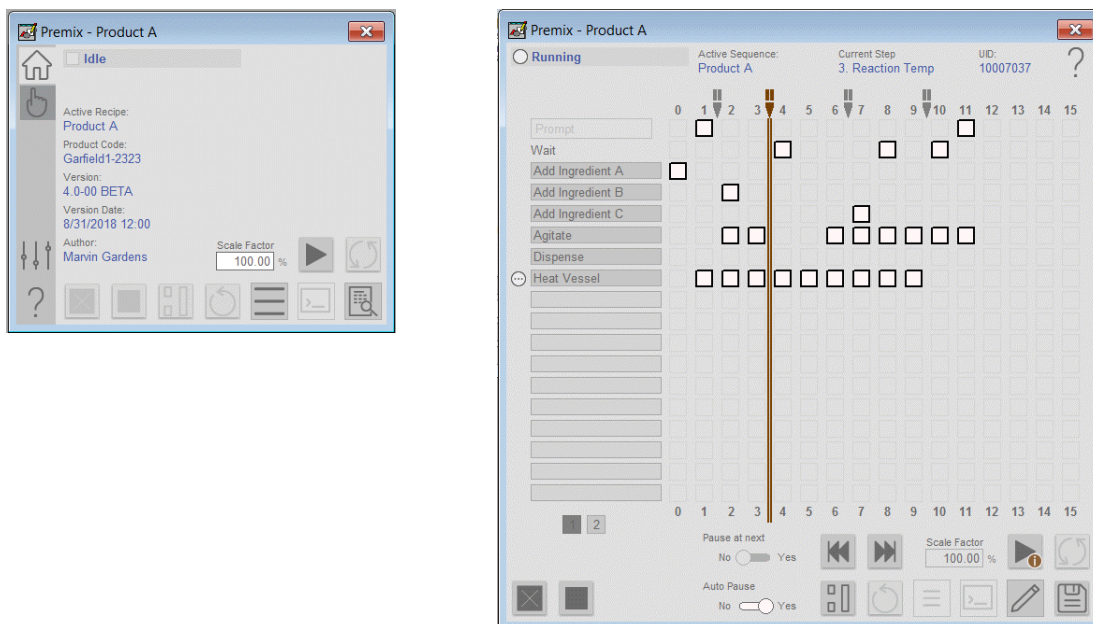


For more information, see these additional resources.

Resource	Description
PlantPAx Logix Batch and Sequence Manager Reference Manual, publication <a href="#">PROCES-RM007</a>	Provides procedures on how to use LBSM to store recipes and sequences equipment and phases to make products.
SequenceManager Controller Reference Manual, publication <a href="#">1756-RM101</a>	Describes how to install, configure, and run SequenceManager Controls.
FactoryTalk Batch User Manual, publication <a href="#">BATCH-UM011</a>	Contains instructions for configuring security and services, and implementing components, such as the FactoryTalk Batch server, simulator, and performance chart.
PlantPAx Batch Design Considerations Reference Manual, publication <a href="#">PROCES-RM008</a>	Provides guidance on selected batch implementation topics in a PlantPAx system.
Batch Application Toolkit Quick Start, publication <a href="#">IASIMP-OS042</a>	Provides a framework for how to use the tasks to complete the components of the Toolkit.
PhaseManager User Manual, publication <a href="#">LOGIX-UM001</a>	Provides instructions on how to configure and use a Logix 5000 controller with equipment phases.
FactoryTalk Batch PhaseManager User Manual, <a href="#">BATCHX-UM011</a>	Provide instructions on how to use phase logic to integrate FactoryTalk Batch software with a Logix Designer application.

## Logix Batch and Sequence Manager

The Logix Batch and Sequence Manager application is controller logic that provides basic batch management for single-unit or multiple-independent unit operations.



An LBSM application is best for:

- Single-unit batch processes, with 5...10 recipes, that can be defined with 4 real and 4 Boolean parameters per phase
- Processes that need frequent recipe changes
- Systems where recipe changes must be made through an HMI
- Process skids
- Pilot plants



## LBSM Details

The LBSM application provides controller logic and HMI objects.

An LBSM application supports:

- PhaseManager programs and custom sequences
- Maximum of 32 recipes per controller
- Maximum of 32 steps per recipe
- Maximum of 4 real and 4 Boolean Parameters/phase
- Recipe changes are made from the HMI

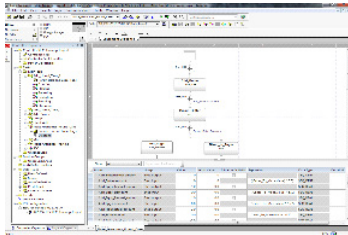
For more information, see PlantPAx Logix Batch and Sequence Manager Reference Manual, publication [PROCES-RM007](#).

## SequenceManager Controls

SequenceManager is a firmware-based feature controls direct PhaseManager programs inside a Logix 5000 controller in an ordered sequence.

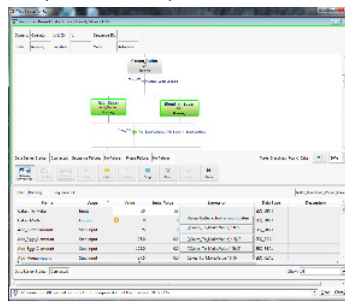
### Editor – Logix Designer application

Define a procedural sequence that coordinates the execution of equipment phases



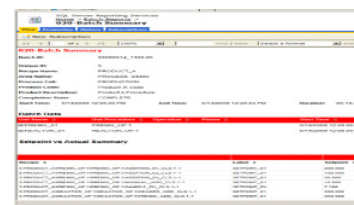
### Operator – FTView SE

Monitor and interact with a running procedural sequence in the HMI



### Data Collection & Reporting Services

Generate events used to produce batch reports and procedural analysis



A SequenceManager application is best for:

- Small batch systems (single unit)
- Systems with no server connectivity
- Process skids
- Modular systems connected into larger FactoryTalk Batch processes
- Fast processes

## SequenceManager Details

The Logix controller must have firmware support to implement a SequenceManager application. Not all controllers support the SequenceManager application.

Use the SequenceManager to model and execute sequential manufacturing processes using the ControlLogix features described in the following tasks:

- Configure the coordination of Equipment Phase execution using the Equipment Sequence Editor.
- Execute Equipment Sequence programs using ControlLogix.

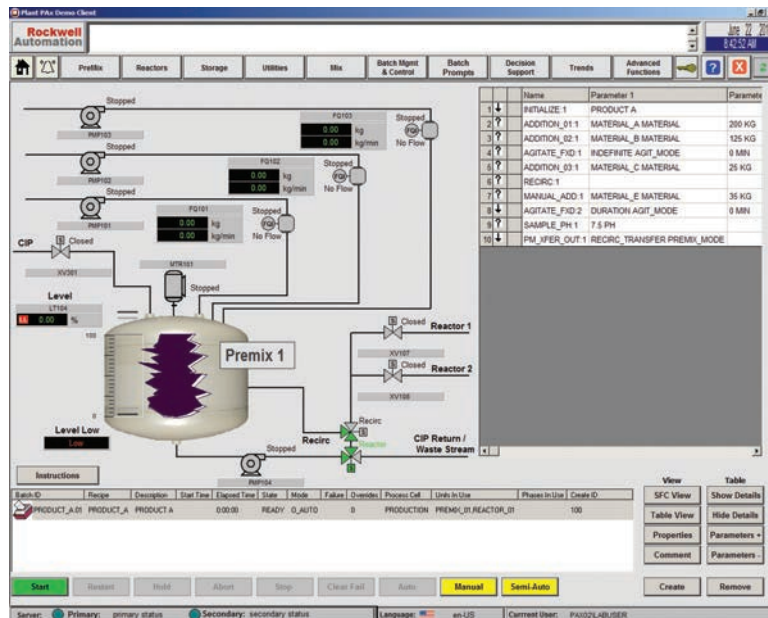
- Monitor and manage running Equipment Sequences using the Logix Designer application.
- Enable operators to monitor and manage running Equipment Sequences and Equipment Phases by adding SequenceManager ActiveX controls to FactoryTalk® View SE displays.
- Subscribe and collect generated sequence events using SequenceManager Event Client Service and SequenceManager Event Archiving Service.

For more information, see SequenceManager Quick Start Guide, publication [1756-QS109](#).

## FactoryTalk Batch Application

A FactoryTalk Batch application is a server-based, comprehensive approach to batch management.

- Handles complex unit coordination, resource arbitration, and optimization of routes
- Manages recipes including formulations, scaling, secure approvals, and versioning
- Includes integrated visualization and reporting



A FactoryTalk Batch application is best for:

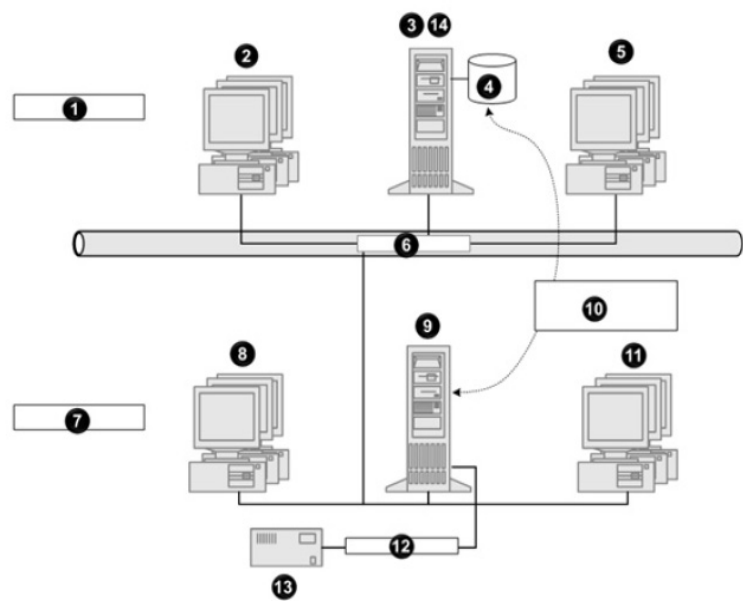
- Multi-unit batch control
- Integration of process skids
- Integration with third-party systems

## FactoryTalk Batch Details

A maximum of 10 FactoryTalk Batch servers can exist in a PlantPAx DCS. Follow these guidelines when you install FactoryTalk Batch on the AppServ-Batch server:

- Install the FactoryTalk® eProcedure® server on the same computer as the FactoryTalk Batch server.
- Install the FactoryTalk Batch Material server on a computer with the SQL server. The computer must be different than the computer that hosts the FactoryTalk Batch server.
- Install the FactoryTalk Event Archiver Database and Management Tool on another server from the FactoryTalk Batch server.

Example FactoryTalk Batch Network



No.	Description	No.	Description
1	Site level	8	FactoryTalk eProcedure clients
2	FactoryTalk Batch Material Manager clients	9	FactoryTalk Batch server (1...10) and FactoryTalk eProcedure server
3, 14	FactoryTalk Batch Material server; FactoryTalk Event Archiver database	10	FactoryTalk Batch server connects to SQL server for Master Recipe storage
4	SQL server	11	FactoryTalk Batch clients
5	FactoryTalk Batch clients	12	Proprietary network
6	TCP/IP	13	Process-connected device
7	Plant floor		

For more information, see:

- PlantPAx Batch Design Considerations Reference Manual, publication [PROCES-RM008](#)
- FactoryTalk Batch User Guide, publication [BATCH-UM011](#)

## FactoryTalk Batch Server with Redundant Controllers

Using a FactoryTalk Batch server with redundant controllers requires an understanding of the batch server hold/failure propagation behaviors.

Redundant ControlLogix 5580 controllers do not support ControlNet® communications. This means a FactoryTalk Batch application with active phases is not a bumpless event when a switchover from primary to secondary controllers occurs.

The phases switch over and remain in their respective state and code executes as expected, but the FactoryTalk Batch server observes a brief momentary communication loss over the EtherNet/IP™ network.

This communication loss is enough for the batch server to issue Hold propagation on all recipes with phase actively running in the controller than switched over. In this circumstance, the transitions in the recipe Held while the phases in the controller are still running.

### Hold Propagation

The Hold Propagation area lets you indicate the hold propagation type to use when the FactoryTalk Batch server detects a failure caused by a watchdog timeout, a handshake timeout, or a phase failure (PHASE\_F > 0).

Hold propagation is a configurable selection that defines how the batch server reacts to failures that affect an active control recipe. Configure the selection in the Equipment Editor, which stores the value in the BATCHSVR.INI.

The screenshot shows the 'Server Options' dialog box with the 'Batch Server' tab selected. The 'Hold Propagation' section has four radio buttons: 'None', 'Phase', 'Operation', and 'Unit'. The 'Batch' radio button is selected. The 'Miscellaneous' section contains two text boxes for 'Maximum Log File Size' and 'Minimum Disk Space', both set to '1000000' Bytes. There is a text box for 'Default Batch ID' set to 'BATCH\_ID' and an unchecked checkbox for 'Enable Event Journal Signatures'. The 'OPC Communications Timeout' section has two text boxes: 'Period (msec)' set to '10000' and 'Allowable Failures' set to '5'.

A Hold command associated with a failure propagates up through the recipe hierarchy as high as the mode and selected option allows.

Hold Propagation Option	Description
None	The batch server does not issue a Hold command to any level of the running procedure for any phase failure. Therefore, the phase logic is solely responsible for putting a failed phase into Hold.
Phase	The batch server issues a Hold command to only the phase in which the phase failure occurred. This includes only the active step within the operation that experienced the failure, and not the active transition that belongs to the operation. Therefore, only the failed phase is commanded to Hold by the batch server and any other level of the batch remains unaffected such as, any running phase, operation, unit procedure, and the procedure itself
Operation	The batch server issues a Hold command to the running operation in which the phase failure occurred. This includes all active steps and transitions within the operation level of the batch. Therefore, all running phases within this operation, and the active operation transitions are commanded to Hold by the batch server. Any other running operation, unit procedure, and the procedure itself are not affected by the Hold command; the batch server does not propagate the Hold command to these other levels of the batch.
Unit	The batch server issues a Hold command to the running unit procedure in which the phase failure occurred. All running phases and operations within this unit procedure, and the unit procedure itself, are commanded to Hold by the batch server. This includes all active steps and transitions within these specific levels of the batch operations and the unit procedure. Any other running unit procedure and procedure itself are not affected by the Hold propagation; the batch server does not propagate the Hold command to these other levels of the batch.
Batch	The batch server issues a Hold command to the entire running procedure in which the phase failure occurred. All running phases, operations, unit procedures, and the procedure itself, are commanded to Hold. This includes all active steps and transitions within all levels of the batch.

The most common event to trigger Hold propagation is an abnormal process condition being continually monitored by the controller.

When an abnormal process events occurs in the system, the controller logic sets phase failure for the appropriate phases actively running in the unit, or units. As a result, the phase failure tags are set with a value greater than zero value by the controller logic. The value corresponds with a known failure condition in the process. The batch server can display the failure to the operators and record the appropriate phase failure event.

## State Composite Evaluation

The Hold propagation configuration determines the highest procedure level within the running recipe for which the Hold command from the batch server is issued when a failure is detected.

The state of each batch level (such as procedure, unit procedure, operation) is continually evaluated by the batch server. Each batch level state is based on the composite states of its underlying steps and transitions.

- In the case of an operation, the composite state is based on the state of all active phases and the state of their underlying active phases transitions.
- In the case of the unit procedure, the composite state is based on the state of all active operation steps and the state of their underlying active operation transitions.

- In the case of the procedure, the composite state is based on the state of all active unit procedure steps and the state of their underlying active unit procedure transitions.

#### Order of Precedence for Batch States

State	Element Type	Priority
RESTARTING	Step'	12 (highest)
HOLDING	Step	11
ABORTING	Step	
RUNNING	Step	9
ARMING	Transition	9
ARMED	Transition	9
FIRING	Transition	9
STARTING	Step	8
STOPPING	Step	8
HELD	Step	6
HELD	Transition	6
IDLE	Step	5
ABORTED	Transition	4
ABORTED	Transition	4
STOPPED	Step	3
STOPPED	Transition	3
COMPLETE	Step	2
NOTCONNECTED	Step	1
UNKNOWN	Step	0 (lowest)

If the owner of the step (a phase) is EXTERNAL then the step is not considered in the calculation.

The determining state for any procedure level (procedure, unit procedure, or operation) is based on the states of the active recipe elements it contains – both, steps and transitions. All these S88 procedure levels are virtual to the PC memory in the batch server, with the exception of SequenceManager operations which reside in the controller, much like most phases.

When a procedure level of a control recipe is connected and commanded by the batch server, the state of each of its procedure levels is derived by a composite state analysis to determine a final state for each procedure level. As the path of recipe execution proceeds through a control recipe, the state of each recipe element object is dynamic, and is continuously updated. The state with the highest priority becomes the state of the procedure level for an operation, unit procedure or procedure.

- In the case of an Operation procedure level, the composite state is based on the state of all active phases e active transitions within the operation.
- In the case of the Unit Procedure level, the composite state is based on the state of all active operation steps and active transitions within the unit procedure.
- In the case of the Procedure level, the composite state is based on the state of all active unit procedure steps and active transitions in the procedure.

## Types of Failures

The batch server translates a phase failure value to an enumeration string that presents a actionable string of text to the operators for the type of failure. A phase failure is the most common type of failure. Other types of failures may occur in the batch system such as, a parameter download failure, a report upload failure, a failed phase request, a request timeout, a command timeout, a quality tag status other than good, a watchdog failure, or a communication failure.

In most cases, the batch server reacts to these failures just as it does for the phase failure event with Hold propagation. An exception occurs whenever a the batch server experiences a communication failure to a controller, a data server, or a phase.

When communication to controller or phase is compromised, the Hold propagation only acts on the components of the control recipe that are without risk, or internal to the batch server memory (procedure, unit procedure, operation). In this case, the risk pertains to those components where the phases or SequenceManager operations reside, so Hold propagation is not executed to the phase level or SequenceManager operations.

If communications are restored quickly so the watchdog in the controller does not time out and place the running phases into a Held state, running phases stay running as if nothing occurred. If communications are restored quickly and the controller phases are not configured to Hold upon communication loss, then running phases also stay running as if nothing occurred.

This momentary communication blip where phases remain running can cause a dynamic when all other levels (procedure, unit procedure, operation) are sent Hold commands upon failure according to the Hold propagation configuration. As a result, these procedure levels are Held but the composite state of a running phase and Held transition is running state for the operation. This traverses up the control recipe where a running operation step and a Held unit procedure transition evaluates as a running state for the unit procedure, and so on one more level to the procedure. With transitions Held, the recipe cannot move transition to other steps, and the recipe could act to an untrained operator as though it is hung, or unresponsive. One solution is to issue a Hold command to the control recipe, then a restart to the control recipe in order to get all steps and transitions in an active and running state as expected.

In the case of redundant systems with newer ControlLogix firmware revisions that do not use ControlNet communication, the switchover of the controllers where active phases are being run by the FactoryTalk Batch application is not a bumpless event. The phases switch over and remain in their perspective state and code executes as expected, but a the FactoryTalk batch server observes a brief momentary communication loss. This loss is enough for the batch server to issue Hold propagation on all recipes with phase actively running in the controller than switched over. In this circumstance, you can find transitions in the recipe Held while the phases in the controller are still running.



## Analytics

Analytics is the discovery, interpretation, and communication of meaningful patterns in data. Analytics relies on the application of statistics, computer programming, and operations research to quantify performance.

Analytics are the methods we use to measure our performance and then provide feedback for continuous improvement. Analytics drive business value, regardless of the industry, by helping to:

- bring a product to market faster
- lower the total cost of ownership because of more effective maintenance
- improve asset utilization by maximizing the throughput
- provide enterprise risk management

## Options

The following options exist for analytics applications in your PlantPAx® system. The reference links provide more details for each option.

1

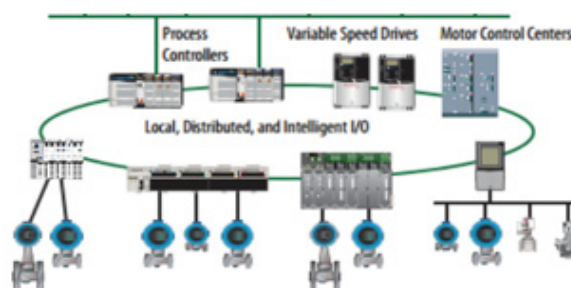
### Device Level Options

Allen-Bradley® products have device-level diagnostics built in, such as fault and alarm codes for use in fault routines. Other products provides predictive and prescriptive analytics at the device-level of the architecture.

In your overall solution, you can add these additional products to gather device-level analytics:

- FactoryTalk® Analytics™ for Devices
- FactoryTalk® Analytics™ LogixAI®
- PlantPAx® MPC

For more information, see [Device Level Analytics](#)





**2**     System Level Options

FactoryTalk® products that add system-level analytics include:

- FactoryTalk® Analytics™ Augmented Modeler
- Pavilion8®
- FactoryTalk® Analytics™ Edge Gateway
- FactoryTalk® Analytics™ DataView
- FactoryTalk® TeamONE™

For more information, see [System Level Analytics](#)



**3**     Enterprise Level Options

FactoryTalk products that add enterprise-level analytics include:

- FactoryTalk Analytics Edge ML
- FactoryTalk Analytics DataView
- FactoryTalk® Analytics™ DataFlowML

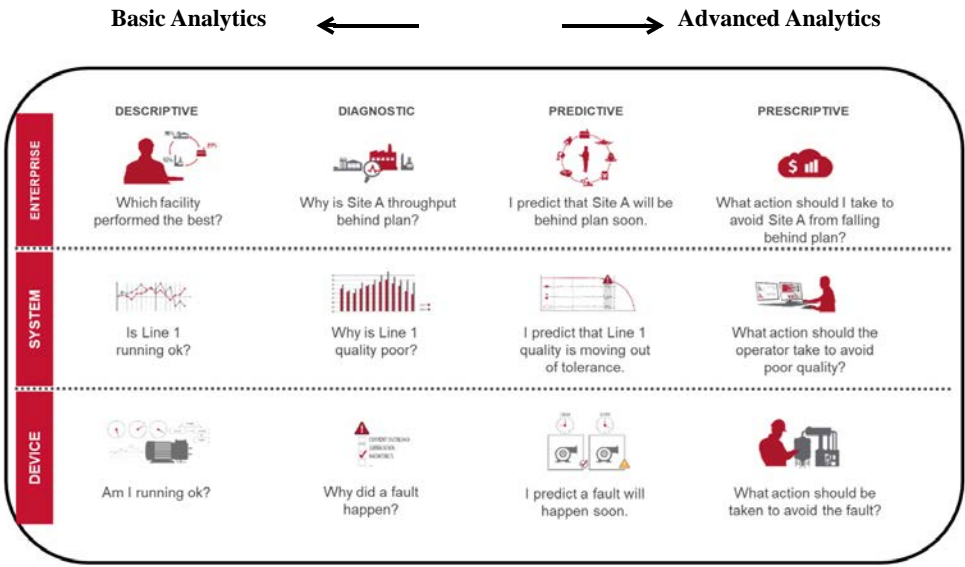
At the Industrial Internet of Things (IIoT) level, you can add:

- Vuforia® Augmented Reality
- ThingWorx® Industrial IoT platform

For more information, see [Enterprise Level Analytics](#)



# Information Enables Outcomes



## Device Level Analytics

The ControlLogix® and CompactLogix™ process controllers display alarm and troubleshooting details for the embedded process instructions on the property pages for the process instructions.

In your control strategy, you can use:

- Tag-based alarms
- Alarm faceplates
- Automatic device descriptive analysis (firmware revision 33 and greater) to display device fault conditions in applications and client devices supported by FactoryTalk® Alarms and Events.

Device-level analytics provide:

- Streaming analysis
- Runtime deployment
- Device data generation

Option	Description	
FactoryTalk Analytics for Devices	<p>Embedded analytics software that lets you implement device level, descriptive and diagnostics analytics to improve maintenance and engineering reliability. Automated device health diagnostics provides data to an information platform with or without cloud connectivity</p> <p><b>PlantPAx specific content:</b></p> <ul style="list-style-type: none"> <li>• Advanced Process Controller action card</li> <li>• E+H device support</li> <li>• Robust HART diagnostic information</li> </ul>	<p><b>Type:</b> Descriptive, Diagnostic</p> <p><b>Environment:</b> Appliance on EtherNet/IP™ network Available via the subscription portal</p> <p><b>Requirements:</b></p> <ul style="list-style-type: none"> <li>• 6200PC-FTA4DT11M FactoryTalk Analytics for Devices appliance</li> </ul>
FactoryTalk Analytics LogixAI	<p>Embedded analytics software that enables controls engineers to apply models to make predictions in ControlLogix applications. Automated modeling capabilities that enable predictive capabilities in the controller.</p>	<p><b>Type:</b> Diagnostic, Predictive</p> <p><b>Environment:</b> ControlLogix chassis Available via the subscription portal</p> <p><b>Requirements:</b></p> <ul style="list-style-type: none"> <li>• 1756M-FTALGXAIT11M FactoryTalk Analytics LogixAI appliance</li> </ul>
PlantPAx MPC	<p>Model Predictive Control embedded in ControlLogix systems</p> <ul style="list-style-type: none"> <li>• Multi-variable in and multi-variable out</li> <li>• Predictive control</li> <li>• Reduction in variability</li> </ul>	<p><b>Type:</b> Predictive, Prescriptive</p> <p><b>Environment:</b> ControlLogix chassis</p> <p><b>Requirements:</b></p> <ul style="list-style-type: none"> <li>• 1756-PPMPC or 9529-PPMPCENM module</li> </ul>

## System Level Analytics

System-level analytics provide:

- Data reduction, management, transformation, and harmonization
- Model training and deployment
- Pattern extractions

Option	Description	
FactoryTalk Analytics Augmented Modeler	<p>Provides an interactive machine-learning environment for plant engineers and application domain experts to build their own analytic applications.</p> <p>Discovers machine, unit, or line anomalies sooner with alerts that indicate unusual states.</p> <p>Includes FactoryTalk® Analytics™ Data Explorer as a data preparation tool</p>	<p><b>Type:</b> Predictive</p> <p><b>Environment:</b> Server based Part of the FactoryTalk Analytics; available via the subscription portal</p> <p><b>Requirements:</b></p> <ul style="list-style-type: none"> <li>• FactoryTalk Analytics Augmented Modeler software</li> </ul>
Pavilion8	<p>Provides closed-loop, prescriptive analytics to continuously maximize process performance in quality, throughput and efficiency.</p> <ul style="list-style-type: none"> <li>• Model-based advanced, dynamic control drives stable performance</li> <li>• Integrated MPC, calculation, and soft sensor visualization and performance reporting</li> </ul>	<p><b>Type:</b> Predictive, Prescriptive</p> <p><b>Environment:</b> Server based</p> <p><b>Requirements:</b></p> <ul style="list-style-type: none"> <li>• Pavilion8 software</li> </ul>
FactoryTalk Analytics Edge ML (also applicable at enterprise-level)	<p>A machine-learning application that provides expert-driven data analytics within the plant, where low latency is a requirement.</p> <ul style="list-style-type: none"> <li>• Helps make decisions as close as possible to the data</li> <li>• Reduce loads on controllers by off-loading data preprocessing</li> <li>• Reduces deployment time costs</li> <li>• Out-of-box connectivity reduces design time</li> </ul>	<p><b>Type:</b> Predictive</p> <p><b>Environment:</b> Server based Part of the FactoryTalk Analytics; available via the subscription portal</p> <p><b>Requirements:</b></p> <ul style="list-style-type: none"> <li>• FactoryTalk Analytics Edge ML base bundle or</li> <li>• FactoryTalk Analytics Platform base bundle</li> </ul>
FactoryTalk Analytics DataFlowML (also applicable at enterprise-level)	<p>Helps identify data trends and presents insights proactively. Use for expert-driven analytics, but where latency is not a requirement. Use to operationalize models.</p> <ul style="list-style-type: none"> <li>• Corrects anomalies before downtime or quality events occur</li> <li>• Connects multiple types of complex machine learning models with the data from your intelligent assets</li> <li>• Offers data exploration, cleansing, preparation capabilities to empower data scientists</li> </ul> <p>Transform and manipulate data (batch/stream)</p> <ul style="list-style-type: none"> <li>• Aggregate, join, slice, thin, and operate on data streams</li> <li>• Ingest high volume/high velocity to low volume/low velocity use cases</li> <li>• Reuse models across the enterprise</li> </ul>	<p><b>Type:</b> Predictive, Prescriptive</p> <p><b>Environment:</b> Server based Part of FactoryTalk Analytics; available via the subscription portal</p> <p><b>Requirements:</b></p> <ul style="list-style-type: none"> <li>• FactoryTalk Analytics DataFlowML base bundle or</li> <li>• FactoryTalk Analytics Platform base bundle</li> </ul>
FactoryTalk Analytics DataView (also applicable at enterprise-level)	<p>A analytics visualization tool that lets you access and transform data through storyboards. Gain a business understanding of data to pinpoint opportunities for improvement.</p> <ul style="list-style-type: none"> <li>• Reduces time to value by reducing the dependence on data architects and data scientists</li> <li>• Enables self service analytics</li> <li>• Eliminates the need for expensive infrastructure associated with traditional warehousing</li> </ul>	<p><b>Type:</b> Descriptive, Diagnostic</p> <p><b>Environment:</b> Server based Part of FactoryTalk Analytics; available via the subscription portal</p> <p><b>Requirements:</b></p> <ul style="list-style-type: none"> <li>• FactoryTalk Analytics DataView base bundle or</li> <li>• FactoryTalk Analytics Platform base bundle</li> </ul>

## Enterprise Level Analytics

Enterprise-level analytics provide:

- Data visualization
- Data mining
- Enterprise resource planning
- Model training
- Model operationalization
- Pattern extraction

Option	Description	
FactoryTalk Analytics Edge ML (also applicable at system-level)	<p>Provides data capture, transformation and analytical capabilities, including predictive machine learning, right on the edge.</p> <ul style="list-style-type: none"> <li>• Pull structured and unstructured data from multiple sources</li> <li>• Access data in intelligent devices</li> <li>• Preprocess data for analytics</li> <li>• Enable bi-directional, transactional type data</li> <li>• Execute closed-loop, Edge-level machine learning</li> <li>• Develop custom applications and connectors</li> </ul>	<p><b>Type:</b> Predictive</p> <p><b>Environment:</b> Server based Part of FactoryTalk Analytics; available via the subscription portal</p> <p><b>Requirements:</b></p> <ul style="list-style-type: none"> <li>• FactoryTalk Analytics Edge ML base bundle or</li> <li>• FactoryTalk Analytics Platform base bundle</li> </ul>
FactoryTalk Analytics DataFlowML (also applicable at system-level)	<p>Helps identify data trends and presents insights proactively. Use for expert-driven analytics, but where latency is not a requirement. Use to operationalize models.</p> <ul style="list-style-type: none"> <li>• Corrects anomalies before downtime or quality events occur</li> <li>• Connects multiple types of complex machine learning models with the data from your intelligent assets</li> <li>• Offers data exploration, cleansing, preparation capabilities to empower data scientists</li> </ul> <p>Transform and manipulate data (batch/stream)</p> <ul style="list-style-type: none"> <li>• Aggregate, join, slice, thin, and operate on data streams</li> <li>• Ingest high volume/high velocity to low volume/low velocity use cases</li> <li>• Reuse models across the enterprise</li> </ul>	<p><b>Type:</b> Predictive, Prescriptive</p> <p><b>Environment:</b> Server based Part of FactoryTalk Analytics; available via the subscription portal</p> <p><b>Requirements:</b></p> <ul style="list-style-type: none"> <li>• FactoryTalk Analytics DataFlowML base bundle or</li> <li>• FactoryTalk Analytics Platform base bundle</li> </ul>
FactoryTalk Analytics DataView (also applicable at system-level)	<p>A analytics visualization tool that lets you access and transform data through storyboards. Gain a business understanding of data to pinpoint opportunities for improvement.</p> <ul style="list-style-type: none"> <li>• Reduces time to value by reducing the dependence on data architects and data scientists</li> <li>• Enables self service analytics</li> <li>• Eliminates the need for expensive infrastructure associated with traditional warehousing</li> </ul>	<p><b>Type:</b> Descriptive, Diagnostic</p> <p><b>Environment:</b> Server based Part of FactoryTalk Analytics; available via the subscription portal</p> <p><b>Requirements:</b></p> <ul style="list-style-type: none"> <li>• FactoryTalk Analytics DataView base bundle or</li> <li>• FactoryTalk Analytics Platform base bundle</li> </ul>

Option	Description	
Vuforia Augmented Reality	<p>An industrial augmented reality platform that can improve workforce efficiency and customer satisfaction with real-time, step-by-step work instructions and data.</p> <ul style="list-style-type: none"> <li>• Work instructions become handsfree and are delivered in real time where assembly or field service take place.</li> <li>• Tribal knowledge of experienced workers is captured and shared with new workers and service technicians.</li> <li>• Remote expertise can be delivered to workers no matter where they are in the world.</li> </ul> <p><b>PlantPax specific content:</b></p> <ul style="list-style-type: none"> <li>• Process strategy experience templates provide users with faceplate-like features within an AR experience. The templates enable users to build additional functionality around the PlantPax information.</li> </ul>	<p><b>Type:</b> Descriptive, Diagnostic</p> <p><b>Environment:</b> Cloud based Part of the FactoryTalk® InnovationSuite Bulletin 95057C; available via the subscription portal</p> <p><b>Requirements:</b></p> <ul style="list-style-type: none"> <li>• Vuforia Engine software</li> <li>• Vuforia Studio software</li> <li>• Vuforia Chalk software</li> <li>• Vuforia Expert Capture software</li> </ul>
ThingWorx Industrial IoT platform	<p>An integrated, secure solution to minimize risk, reduce IT burden, and maximize value from the software investment.</p> <p>ThingWorx industrial connectivity provides data access for client applications such as MES and SCADA and IoT and Big Data analytics software. It leverages OPC and IT-centric communication protocols to provide a single source of industrial data. Supported protocols include proprietary protocols (including GE NIO, SuiteLink/FastDDE, and Splunk), IT protocols (including MQTT, REST, ODBC, and SNMP), and flow measurement export to common Oil &amp; Gas industry formats.</p> <p>ThingWorx industrial connectivity provides a single solution to collect, aggregate, and securely access industrial operations data. Connect, manage, monitor, and control diverse automation devices and software applications through one intuitive user interface</p> <p><b>PlantPax specific content:</b></p> <ul style="list-style-type: none"> <li>• Process strategy Thing templates replicate structure and functionality within ThingWorx, which enable users to create an analysis of the objects with Live and Historical Data</li> <li>• ThingWorx mashup templates provide the ability to investigate alarms by area, priority, and other critical alarming criteria. Advanced alarm analysis includes fleeting, chattering, and stale alarm insights. Similar dashboard functionality is also provided for SQL server reporting services.</li> </ul>	<p><b>Type:</b> Descriptive, Diagnostic, Predictive, Prescriptive</p> <p><b>Environment:</b> Cloud based Part of the FactoryTalk Innovation Suite Bulletin 95057C; available via the subscription portal</p> <p><b>Requirements:</b> ThingWorx platform software</p> <ul style="list-style-type: none"> <li>• Asset Advisor</li> <li>• Operator Advisor</li> <li>• Production Advisor</li> <li>• ControlAdvisor</li> </ul> <p>ThingWorx Industrial Connectivity software</p>

## PlantPax SQL Process Object and Alarm Reports

The process library includes standard reports via SQL Server Report Services that support basic and advanced alarm and event reports, along with per process object reporting.

The standard reports use data collected via FactoryTalk® AssetCentre, FactoryTalk® Alarms and Events, and FactoryTalk® Historian SE. An SQL Asset Framework processes the data from the system historian and consolidates the data into a central database, based on a reporting schedule.

The PlantPax reports include:

Category	Reports
Base	<ul style="list-style-type: none"> <li>Analog In (PAI)</li> <li>Analog Output (PAO)</li> <li>Dead Band Controller (PDBC)</li> <li>Digital In (PDI)</li> <li>Digital Out (PDO)</li> <li>Totalizer(PDOSE)</li> <li>Motor (PMTR)</li> <li>PID Controller (PPID)</li> <li>Valve (PVLV)</li> </ul>
Alarming	<div>Area Based:</div> <ul style="list-style-type: none"> <li>Alarm History</li> <li>Alarm Top</li> <li>Maintenance (Dashboard)</li> <li>Chattering</li> <li>Fleeting</li> <li>Stale</li> </ul> <div>Object Based:</div> <ul style="list-style-type: none"> <li>Alarm Object History</li> </ul>
Traceability	<ul style="list-style-type: none"> <li>Audit All Data</li> <li>Audit Sequence of Events</li> <li>Object Events</li> <li>System Audit</li> </ul>
System	<ul style="list-style-type: none"> <li>Top Logger</li> <li>Top Logger Detailed</li> <li>Database Status</li> <li>Shift Setup</li> </ul>



For more information on how to deploy and utilize the reports, See Knowledgebase Technote, [PlantPax System Release 5.0 Configuration and Implementation Tools](#). Download the PlantPax SQL Process Object and Alarm Reports file from this public article.

You may be asked to log in to your Rockwell Automation web account or create an account if you do not have one. You do not need a support contract to access the article.

**Notes:**

## PlantPax Security Certification

The PlantPax® architecture supports IEC-62443-3-3 SL1 security requirements. To help meet these requirements, reference these publications:

For this information	See
Guidance on how to conduct security assessments, implement Rockwell Automation products in a secure system, harden the control system, manage user access, and dispose of equipment.	System Security Design Guidelines Reference Manual, <a href="#">SECURE-RM001</a>
Network architecture recommendations	Converged Plantwide Ethernet (CPwE) Design and Implementation Guide, publication <a href="#">ENET-TD001</a>
Windows® infrastructure recommendations How to configure and use these Rockwell Automation products: <ul style="list-style-type: none"> <li>• FactoryTalk® Directory</li> <li>• FactoryTalk® Activation Manager</li> <li>• FactoryTalk® Security</li> <li>• FactoryTalk® AssetCentre</li> </ul>	Security Configuration User Manual, publication <a href="#">SECURE-UM001</a> .
How to configure and use CIP Security™ with Rockwell Automation products to improve the security of your industrial automation system	CIP Security™ with Rockwell Automation Products Application Technique, publication <a href="#">SECURE-AT001</a>

### PlantPax Security Architecture

Integrating industrial automation and control systems (IACS) with enterprise-level systems enables better visibility and collaboration, which helps improve efficiency, production, and profitability. But greater connectivity also exposes control systems to additional cyber security risks. Availability is the most crucial aspect of a secure IACS. To meet the needs of industrial environments, Rockwell Automation aligns PlantPax systems developed on our technology with the international standard ISA-99/IEC 62443-3-3. This standard is designed specifically for Industrial Automation and Control Systems and defines procedures to implement an electronically secure system.

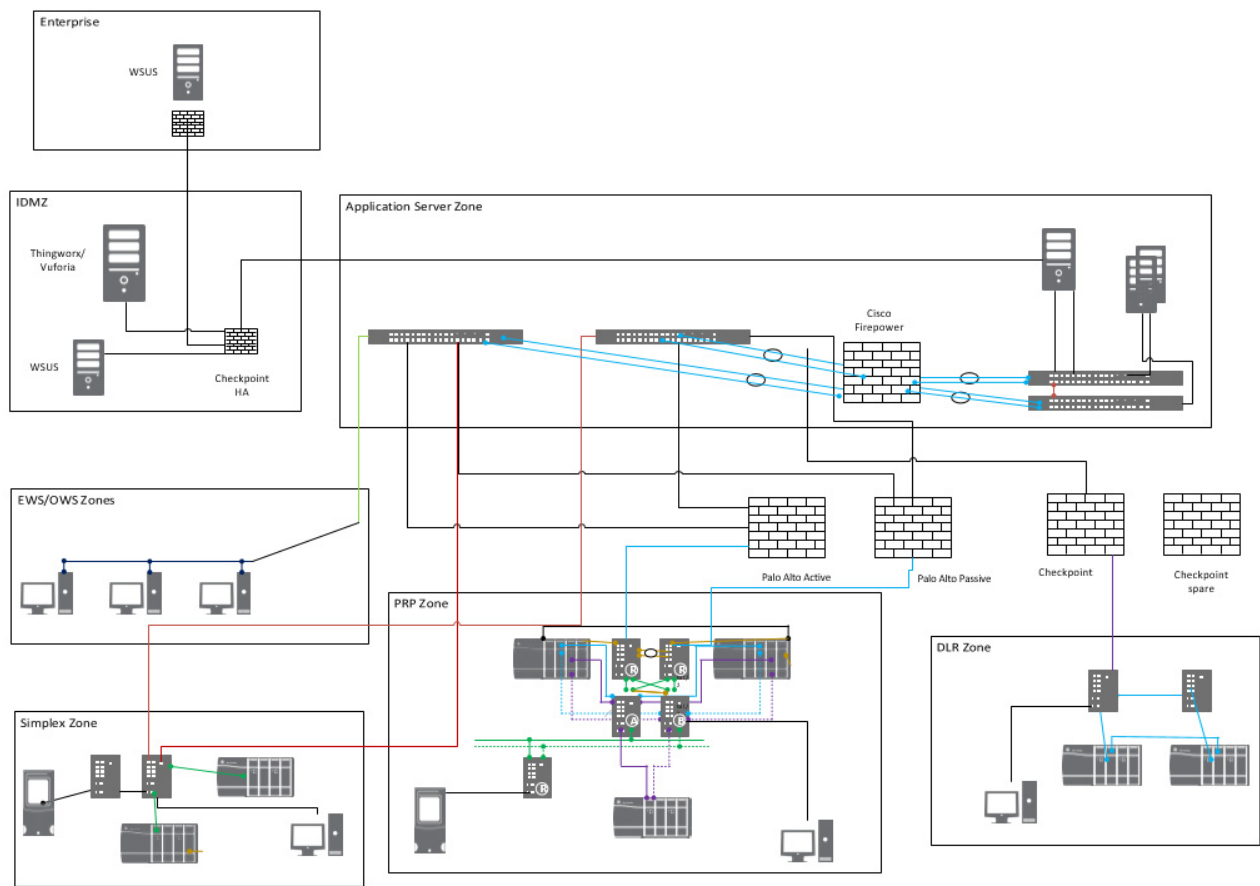
ISA-99/IEC 62443 is based on seven foundational requirements that cover a defense-in-depth approach suited for an IACS. These foundational requirements are:

- FR1: Identification and authentication control (IAC)
- FR2: Use control (UC)
- FR3: System integrity (SI)
- FR4: Data confidentiality (DC)
- FR5: Restricted data flow (RDF)
- FR6: Timely response to events (TRE)
- FR7: Resource availability (RA)

The guidelines and checklists in this appendix present the collective strategy to meet the ISA-99/IEC 62443-3-3 SL1 requirements in conformant PlantPax systems. The intent of a certified architecture is to demonstrate security competency, as well as to provide a standard, prescriptive reference design.



The certified PlantPax architecture relies on zones to segment the system.



Zone	Description
IDMZ	An IDMZ is required to connect to the corporate network. This zone contains a firewall stack, a pivot host, SEP Server and WSUS host. Additional hosts can be added, as needed. Configure the IDMZ to separate untrusted (public) zones from the trusted (private) zones. Communication outside of the IDMZ is considered untrusted.
Application Server	The Application Server zone houses all of the application servers. Each server is deployed on a separate VM. The following mandatory nodes must be deployed: <ul style="list-style-type: none"> <li>• FactoryTalk Directory server</li> <li>• FactoryTalk® View SE HMI server</li> <li>• FactoryTalk View Data server</li> </ul> Other optional servers include: <ul style="list-style-type: none"> <li>• FactoryTalk® Historian server</li> <li>• FactoryTalk® AssetCentre server</li> <li>• FactoryTalk® VantagePoint® server</li> <li>• SQL server</li> </ul>
EWS/OWS	This zone contains the EWS workstations to provide programmer access and the OWS workstations to provide operator access. Each workstation has the necessary software to program or interact with the system. Workstations can be virtualized or they can be ThinManager® clients.  Each EWS has: <ul style="list-style-type: none"> <li>• Studio 5000® environment</li> <li>• FactoryTalk View Enterprise Edition</li> <li>• RSLinx® Classic</li> <li>• FactoryTalk AssetCentre client</li> </ul> Additional software includes: <ul style="list-style-type: none"> <li>• Studio 5000 Application Code Manager,</li> <li>• Microsoft® Office</li> <li>• Putty</li> </ul> Each OWS has the FactoryTalk View runtime client. Additional software includes: <ul style="list-style-type: none"> <li>• FactoryTalk Historian client</li> <li>• FactoryTalk AssetCentre client</li> <li>• Microsoft Office</li> </ul>
PRP	The control system is segmented into process areas. Each process area contains the hardware necessary to run and operate that area. The topology of each area can be: <ul style="list-style-type: none"> <li>• PRP</li> <li>• DLR</li> <li>• Simplex</li> </ul>
DLR	
Simplex	

## Trusted Zones

ISA-99/IEC 62443-3-3 SL1 requires the capability to separate trusted and untrusted zones. You can use a standard firewall implementation to separate trusted traffic and untrusted traffic. Standard implementation creates two basic security zones, known as inside and outside. The inside, or trusted zone, is also referred to as the private zone. The outside, or untrusted zone, is also known as the public zone. The public zone is outside the control of an organization and can be thought of as simply the public Internet.

Rockwell Automation recommends a risk assessment for network security zoning. Your risk assessment and risk posture help determine the trust level of each zone. You can have multiple levels of trust on inside zones with different types of access. For further guidance on risk assessments, see the ISA-99/IEC 62443-3-2 standard.

## Certificate Authority

A trusted certificate authority, also known as a commercial certificate authority, is a third-party entity that issues certificates for organizations that request them. They are not controlled in any way by the person or organization that requests a certificate from them. A trusted CA issues publicly trusted digital certificates that meet at least the minimum regulatory standards (baseline requirements) that are outlined by the CA/Browser Forum (CA/B Forum).

A private certificate authority, also known as private PKI, is an internal CA that exists within a larger organization (typically an enterprise) that issues its own certificates.

- A private CA functions like its public counterparts, but a private CA's certificates are trusted only by its internal users, clients, and IT systems.
- A private CA issues certificates that restrict access to a select group of users.
- You must set up and host the private CA yourself.

For more information about CAs, see Microsoft [Server Certificate Deployment Planning](#) information or the Microsoft documentation for your operating system.

## System Security Feature Checklists

Use the following checklists to secure your system.

Identify and authenticate all users.

### Requirements for Identification and Access Control

✓	Product	Required to Meet IEC-62443-3-3 SL 1	Details
	Windows® infrastructure	Yes	<p>Configure and use the following:</p> <ul style="list-style-type: none"> <li>• Create Active Directory groups and unique users for each zone</li> <li>• Enable 802.1X authentication on all switchports</li> <li>• Implement encryption algorithms for wireless access (such as WPA2 Enterprise, TLS, or IPSEC)</li> <li>• Implement public key infrastructure (PKI) certificates</li> <li>• Authenticate Group membership via a RADIUS server</li> <li>• Enable system notifications</li> <li>• Configure Kerberos</li> <li>• Configure an interactive login policy</li> <li>• Monitor unsuccessful login attempts</li> </ul> <p>For more information, see:</p> <ul style="list-style-type: none"> <li>• Configure System Security Features User Manual, <a href="#">SECURE-UM001</a></li> <li>• System Security Design Guidelines Reference Manual, <a href="#">SECURE-RM001</a></li> <li>• Deploying 802.11 Wireless LAN Technology within a Converged Plantwide Ethernet Architecture Design and Implementation Guide, <a href="#">ENET-TD006</a></li> <li>• Deploying Identity and Mobility Services within a Converged Plantwide Ethernet Architecture Design and Implementation Guide, <a href="#">ENET-TD008</a></li> <li>• Site-to-Site VPN to a Converged Plantwide Ethernet Architecture Design and Implementation Guide, <a href="#">ENET-TD012</a></li> </ul>
	Password strength and recommendations	Yes	<p>Follow standard guidelines for password strength and recommendations</p> <p>For more information, see:</p> <ul style="list-style-type: none"> <li>• <a href="#">NIST Special Publication 800-63B Digital Identity Guidelines</a></li> <li>• Configure System Security Features User Manual, <a href="#">SECURE-UM001</a></li> <li>• System Security Design Guidelines Reference Manual, <a href="#">SECURE-RM001</a></li> </ul>
	Windows domain	Yes	<ul style="list-style-type: none"> <li>• Configure the PlantPax domain controller.</li> <li>• Configure all operating system clients as domain members</li> <li>• Enable multifactor authentication on the domain controller</li> <li>• Create and manage all accounts in the Active Directory</li> <li>• Require administrative credentials to manage account activities</li> </ul> <p>For more information, see:</p> <ul style="list-style-type: none"> <li>• <a href="#">Chapter 2 Domain or Workgroup</a></li> <li>• System Security Design Guidelines Reference Manual, <a href="#">SECURE-RM001</a></li> </ul>
	FactoryTalk Directory software FactoryTalk Security software	Yes	<p>Configure appropriate:</p> <ul style="list-style-type: none"> <li>• Users, groups, roles</li> <li>• Security policies</li> </ul> <p>For more information, see:</p> <ul style="list-style-type: none"> <li>• Configure System Security Features User Manual, <a href="#">SECURE-UM001</a></li> <li>• System Security Design Guidelines Reference Manual, <a href="#">SECURE-RM001</a></li> </ul>
	Wireless access	Optional	<p>Configure and use the following:</p> <ul style="list-style-type: none"> <li>• Implement encryption algorithms for wireless access (such as WPA2 Enterprise, AES Encryption TLS, or IPSEC)</li> <li>• Obtain access to the IACS from an untrusted network through the IDMZ with multifactor authentication and certification-base authentication</li> <li>• Use encryption tunnels (such as VPN &amp; IPSEC) between VLANs</li> <li>• Allow remote access only when necessary to authorized users in the Active Directory</li> </ul> <p><b>Important:</b> Hardwired connections are always preferred. Never use wireless connections for safety functions.</p> <p>For more information, see:</p> <ul style="list-style-type: none"> <li>• System Security Design Guidelines Reference Manual, <a href="#">SECURE-RM001</a></li> </ul>

Define control policies to control the use between users and assets.

### Requirements for Use Control

✓	Product	Required to Meet IEC-62443-3-3 SL 1	Details
	Windows infrastructure	Yes	<p>Configure and use the following:</p> <ul style="list-style-type: none"> <li>• Active Directory Groups for each zone</li> <li>• Group membership authentication via RADIUS server</li> <li>• 802.1X authentication on all switchports</li> <li>• Session lock</li> <li>• Remote session termination</li> <li>• Concurrent session control</li> <li>• Interactive login policy</li> <li>• Notifications for unsuccessful login attempts</li> </ul> <p>For more information, see:</p> <ul style="list-style-type: none"> <li>• Configure System Security Features User Manual, <a href="#">SECURE-UM001</a></li> <li>• System Security Design Guidelines Reference Manual, <a href="#">SECURE-RM001</a></li> <li>• Deploying 802.11 Wireless LAN Technology within a Converged Plantwide Ethernet Architecture Design and Implementation Guide, <a href="#">ENET-TD006</a></li> <li>• Deploying Identity and Mobility Services within a Converged Plantwide Ethernet Architecture Design and Implementation Guide, <a href="#">ENET-TD008</a></li> </ul>
	Windows domain	Yes	<p>Configure all operating system clients as domain members</p> <p>For more information, see:</p> <ul style="list-style-type: none"> <li>• <a href="#">Chapter 2 Domain or Workgroup</a></li> </ul>
	FactoryTalk Directory software FactoryTalk Security software	Yes	<p>Configure appropriate User Groups in each Area to support the segregation of duties and least privilege</p> <p>For more information, see:</p> <ul style="list-style-type: none"> <li>• Configure System Security Features User Manual, <a href="#">SECURE-UM001</a>.</li> </ul>
	ThinManager software	Recommended	<p>Manage mobile and portable device access via a ThinManager server and route through the IDMZ. The ThinManager server limits mobile applications to view only.</p> <p>For more information, see:</p> <ul style="list-style-type: none"> <li>• ThinManager and FactoryTalk View SE Deployment Guide, <a href="#">TM-AT001</a></li> <li>• ThinManager User Manual, <a href="#">TM-UM001</a></li> </ul>
	FactoryTalk AssetCentre software	Yes	<p>Configure and use the following:</p> <ul style="list-style-type: none"> <li>• Auditable events</li> <li>• Audit storage capacity</li> <li>• Diagnostics and health log</li> </ul> <p>For more information, see:</p> <ul style="list-style-type: none"> <li>• System Security Design Guidelines Reference Manual, <a href="#">SECURE-RM001</a></li> </ul>

Protect the integrity of transmitted data. Recognize changes to information during communication.

### Requirements for System Integrity

✓	Product	Required to Meet IEC-62443-3-3 SL 1	Details
	Windows infrastructure	Yes	<p>Configure and use the Active Directory and domain structure to handle authorization.</p> <p>For more information, see:</p> <ul style="list-style-type: none"> <li>• System Security Design Guidelines Reference Manual, <a href="#">SECURE-RM001</a></li> </ul>
	Converged Plantwide Ethernet architecture (CPwE)	Yes	<p>Configure the Industrial Demilitarized Zone (IDMZ) with appropriate firewalls. Use TCP/IP connections between zones.</p> <p>For more information, see:</p> <p>Converged Plantwide Ethernet (CPwE) Design and Implementation Guide, <a href="#">ENET-TD001</a></p>
	Antivirus software	Yes	<p>Use antivirus and antimalware software to harden workstations.</p> <p><b>Important:</b> Ensure that antivirus software does not affect control system processing.</p> <p>For more information, see:</p> <ul style="list-style-type: none"> <li>• System Security Design Guidelines Reference Manual, <a href="#">SECURE-RM001</a></li> </ul>

## Requirements for System Integrity

✓	Product	Required to Meet IEC-62443-3-3 SL 1	Details
	CIP Security	Recommended	Use FactoryTalk® Policy Manager software to define communication between zones. For more information, see : • CIP Security with Rockwell Automation Products Application Technique, <a href="#">SECURE-AT001</a>
	FactoryTalk AssetCentre software	Yes	Configure and use the following: • Change detection and reporting • Scheduled backups For more information, see: • Configure System Security Features User Manual, <a href="#">SECURE-UM001</a> • System Security Design Guidelines Reference Manual, <a href="#">SECURE-RM001</a>
	PlantPax process instructions and object library	Recommended	The process instructions and library objects are designed to work with Rockwell Automation products to provide: • Input validation • Deterministic output • Alarms and error handling For more information, see <a href="#">PROCES-RM200</a>

Protect the confidentiality of communication and data to prevent unauthorized disclosure.

## Requirements for Data Confidentiality

✓	Product	Required to Meet IEC-62443-3-3 SL 1	Details
	Converged Plantwide Ethernet architecture (CPwE)	Yes	Segment the network into the required zones and use firewalls. Use conduits to zone-to-zone connections. Use encrypted hard disk drives in computers. If necessary, use cryptographic algorithms according to industry practices. For more information, see: • Converged Plantwide Ethernet (CPwE) Design and Implementation Guide, <a href="#">ENET-TD001</a> • Deploying Industrial Firewalls within a Converged Plantwide Ethernet Architecture, <a href="#">ENET-TD002</a>
	CIP Security	Recommended	Use FactoryTalk Policy Manager software to define communication between zones. For more information, see CIP Security with Rockwell Automation Products Application Technique, <a href="#">SECURE-AT001</a>
	Wireless access	Recommended	Configure and use the following: • Implement encryption algorithms for wireless access (such as WPA2 Enterprise, AES Encryption TLS, or IPSEC) • Implement the PKI infrastructure to aid device authentication For more information, see: • System Security Design Guidelines Reference Manual, <a href="#">SECURE-RM001</a>

Segment the network into zones and conduits to manage the flow of data.

#### Requirements for Restricted Data Flow

✓	Product	Required to Meet IEC-62443-3-3 SL 1	Details
	Converged Plantwide Ethernet architecture (CPwE)	Yes	Segment the network into the required zones. <ul style="list-style-type: none"> <li>• Use a separate VLAN for each zone.</li> <li>• Firewalls provide additional protection</li> </ul> For more information, see: <ul style="list-style-type: none"> <li>• Converged Plantwide Ethernet (CPwE) Design and Implementation Guide, <a href="#">ENET-ID001</a></li> <li>• System Security Design Guidelines Reference Manual, <a href="#">SECURE-RM001</a></li> </ul>
	Virtualization	Recommended	PlantPax uses virtual templates to support partitioning data. For more information, see: <ul style="list-style-type: none"> <li>• <a href="#">Virtualization on page 247</a>.</li> </ul>
	CIP Security	Recommended	Use FactoryTalk Policy Manager software to define conduits. For more information, see: <ul style="list-style-type: none"> <li>• CIP Security with Rockwell Automation Products Application Technique, <a href="#">SECURE-AT001</a></li> </ul>
	Network Attached Storage (NAS)	Recommended	Use Network Attached Storage (NAS) in a segmented location to store backups of virtual images, system documentation, and related files where aFactoryTalk AssetCentre application is not appropriate.

Collect and access security logs.

#### Requirements for Timely Response to Events

✓	Product	Required to Meet IEC-62443-3-3 SL 1	Details
	FactoryTalk AssetCentre software	Yes	Configure and use the following: <ul style="list-style-type: none"> <li>• Audit log accessibility</li> <li>• Continuous monitoring</li> </ul> For more information, see: <ul style="list-style-type: none"> <li>• Configure System Security Features User Manual, <a href="#">SECURE-UM001</a>.</li> <li>• System Security Design Guidelines Reference Manual, <a href="#">SECURE-RM001</a></li> </ul>
	Individual products in the system	Yes	Protect the internally-stored audit logs in individual products in the system. Configure the FactoryTalk AssetCentre audit log to collect these individual audit logs. For more information, see the user documentation for the individual products.

Maintain the availability of the system against the denial of service events.

### Requirements for Resource Availability

✓	Product	Required to Meet IEC-62443-3-3 SL 1	Details
	Windows infrastructure	Yes	Configure the operating system to prioritize control system functionality over antivirus checks and patching. Network redundancy is highly recommended. Configure virtualization software to manage service limitation. Download software patches from trusted sources.  For more information, see: <ul style="list-style-type: none"> <li>System Security Design Guidelines Reference Manual, <a href="#">SECURE-RM001</a></li> </ul>
	Managed switches	Yes	Configure managed switches for both distribution and access functions. Use QOS and ACLs to configure proper segmentation.  For more information see: <ul style="list-style-type: none"> <li><a href="#">Chapter 4 Network Infrastructure</a></li> <li>Converged Plantwide Ethernet (CPwE) Design and Implementation Guide, <a href="#">ENET-ID001</a></li> </ul>
	FactoryTalk AssetCentre software	Yes	Configure and use the following: <ul style="list-style-type: none"> <li>Asset inventory</li> <li>Control system backup</li> <li>Disaster recovery</li> </ul> For more information, see Configure System Security Features User Manual, <a href="#">SECURE-UM001</a> .
	UPS	Yes	Provide your own UPS with separate battery unit and redundant power supplies. Size the UPS so that it correctly supports the system and provides enough power to properly shut down servers and workstations.

## Virtualization

The PlantPax architecture uses virtual templates, VLANs, and zones to support partitioning data, applications, and services. Virtualization is preferred for all server and client operating systems. The VMWare platform works with all of the Rockwell Automation products in the PlantPax architecture.

The VMWare ESXi hypervisor is on each physical server and configured for management by a central vCenter Standard edition server.

In your VMWare implementation, make sure:

- If you support remote access, the asset owner can terminate any remote connections.
- The control system continues normal operation during a backup.
- To maintain audit logs of all backup and restore activities.



## VLAN Recommendations

Zone		VLAN	IP Address	Gateway	Subnet Mask
PRP	Management	500	192.168.10.0/26	192.168.10.1	255.255.255.192
	Controller	501	192.168.10.64/26	192.168.10.65	255.255.255.192
	Operator	510	192.168.10.128/26	192.168.10.129	255.255.255.192
	Engineering	511	192.168.10.192/36	192.168.10.193	255.255.255.192
DLR	Management	400	192.168.11.0/26	192.168.11.1	255.255.255.192
	Controller	401	192.168.11.64/26	192.168.11.65	255.255.255.192
	Operator	410	192.168.11.128/26	192.168.11.129	255.255.255.192
	Engineering	411	192.168.11.192/36	192.168.11.193	255.255.255.192
Simplex	Management	300	192.168.12.0/26	192.168.12.1	255.255.255.192
	Controller	301	192.168.12.64/26	192.168.12.65	255.255.255.192
	Operator	310	192.168.12.128/26	192.168.12.129	255.255.255.192
	Engineering	311	192.168.12.192/36	192.168.12.193	255.255.255.192
Server	Management	600	192.168.53.0/24	192.168.53.1	255.255.255.0
	Application	601	192.168.52.0/24	192.168.52.1	255.255.255.0
OWS/EWS	OWS	610	192.168.50.0/24	192.168.50.1	255.255.255.0
	EWS	611	192.168.51.0/24	192.168.51.1	255.255.255.0
IDMZ	Management	700	192.168.105.0/24	192.168.105.1	255.255.255.0
	Wireless	702	192.168.104.0/24	192.168.104.1	255.255.255.0
	IDMZ	703	192.168.100.0/24	192.168.100.1	255.255.255.0
	IDMZ	704	192.168.101.0/24	192.168.101.1	255.255.255.0
	IDMZ	705	192.168.102.0/24	192.168.102.1	255.255.255.0
	IDMZ	706	192.168.103.0/24	192.168.103.1	255.255.255.0

- Network Devices first 10 IP addresses start at .2
- Host IP addresses start at .12
- PRP zone devices (10.2 through 10.11) and hosts (10.12 through 10.63)

## Firewall Configurations

### Common Ports

[Table 9](#) shows the most common ports that need to be considered during the firewall configuration.

**Table 9 - Common Firewall Port Descriptions**

Port	Type	Usage
25	TCP	SMTP mail
80	TCP	Standard WWW port
123	UDP	Network Time Protocol
135	TCP	Remote process calls
137	UDP	File and printer sharing
138	UDP	
139	TCP	
445	TCP	Use in the Collective configuration and file and print sharing
1433	TCP	Communication to SQL server
1434	UDP	Browsing for SQL server
21060	UDP	Rockwell Automation® trace diagnostics
21061	UDP	

### Rockwell Automation TCP/UDP Ports

[Table 10](#) shows the TCP/UDP ports for Rockwell Automation® firmware and software products.

For periodic updates, see the Knowledgebase Answer ID 29402 at <http://www.rockwellautomation.custhelp.com>.

**Table 10 - TCP/UDP Port Descriptions**

Port	Type	Protocol	Products	Comments
23	TCP	Telnet	Trusted® AADvance before release 1.3	Diagnostic command-line interface (see also 55555)
25	TCP	SMTP	1769-L35E, 1769-L32E, 1756-ENBT, 1756-EN2T, 1756-EWEB, 1768-ENBT, 1768-EWEB, 1788-ENBT, 1763-L16x 1766-L32x, FactoryTalk® AssetCentre, FactoryTalk® Transaction Manager, FactoryTalk® Integrator	Outbound email only
67...68	UDP	DHCP/BOOTP	1756-ENET, 1756-ENBT, 1756-EWEB, 1756-EN2T, 1794-AENT, 1734-AENT, 1769-L35E, 1769-L32E, 1788-ENBT, 1761-NET-ENI, 1785-LXXE, 1785-ENET, 1791ES, 1763-L16x, 1766-L32x, PowerFlex® Drives, PowerMonitor™ 3000, PanelView™	Client only
69	UDP	TFTP	5820-EI	For binary download, used in conjunction with BOOTP

Table 10 - TCP/UDP Port Descriptions

Port	Type	Protocol	Products	Comments
80	TCP	HTTP	1756-ENET,1756-ENBT,1756-EWEB, 1794-AENT,1734-AENT,1769-L35E, 1769-L32E,1788-ENBT,1761-NET- ENI 1785-LXXE,1785-ENET,1747-L55x, 1763-L16x,1766-L32x, PowerFlex Drives, PowerMonitor 3000, PanelView, FactoryTalk® View SE, FactoryTalk® VantagePoint®, FactoryTalk® ViewPoint	FactoryTalk ViewPoint and VantagePoint EMI server can use any other custom assigned port
123	UDP	NTP	PowerMonitor 3000, AADvance	Network time protocol
135	TCP	RPC/Endpoint Mapper	FactoryTalk, RSMACC™	DCOM endpoint mapper
161	UDP	SNMP	1756-ENET,1756-ENBT,1794-AENT, 1734-AENT, 1769-L35E, 1769-L32E, 1788-ENBT, 1761-NET-ENI, 1785- LXXE, 1785-ENET,1747-L55x,1766- L32x, 5820-EI, PowerFlex Drives, PowerMonitor 3000, PanelView	
300...400	UDP	Proprietary	PowerMonitor 3000	Master/slave configuration
400...402	TCP	RPC	FactoryTalk Transaction Manager	Transaction manager, compression server, and configuration server
443	TCP	HTTPS	FactoryTalk ViewPoint	When using web server with secure certificate
502	TCP	ModbusTCP	AADvance, Trusted®	Master or slave (AADvance), Slave only (Trusted)
1001...1009	UDP	Proprietary	1426 PowerMonitor 5000	Waveform synchronized broadcast
Dynamic (1024...65535+)	TCP	DCOM	FactoryTalk	DCOM dynamic ports
1089	TCP/UDP	ff-annunc	1788-EN2FFR	FOUNDATION Fieldbus
1090		ff-fmx		
1091		ff-sm		
1132	TCP	SNCP	AADvance	Safety Network Control Protocol, used by OPC, workbench debugger, and binding networks
1330	TCP	rnprpc	FactoryTalk	Object RPC
1331	TCP	rnaserv	FactoryTalk	Service control
1332	TCP	rnaserveping	FactoryTalk	Server health
1433	TCP	N/A	FactoryTalk® AssetCentre (server), FactoryTalk VantagePoint RSMACC	SQL server communication (default port)
1434	UDP	N/A	FactoryTalk AssetCentre (server), FactoryTalk VantagePoint	Recommended static destination port for MSSQL to minimize the number of ports open on a firewall See the Knowledgebase Answer ID 287932 at <a href="http://www.rockwellautomation.custhelp.com">http://www.rockwellautomation.custhelp.com</a>
1947	TCP/UDP	N/A	SafeNet Sentinel Local License Manager	Windows® Service installed by Sentinel USB HASP driver. This service is not required for USB dongle to function. See the Knowledgebase Answer ID 570831 at <a href="http://www.rockwellautomation.custhelp.com">http://www.rockwellautomation.custhelp.com</a>
2000	TCP	Modbus RTU	AADvance (Slave only), Trusted (Master or slave, used for OPC and SOE)	RTU packaged in serial stream. Other ports can be assigned
2010...2011	UDP	Discover tool	AADvance	Used to configure systems. The tool sends broadcast to 2010 and systems reply to port 2011
2222	UDP	EtherNet/IP™	1756-ENBT,1794-AENT,1734-AENT, 1769-L35E, 1769-L32E,1788-ENBT	I/O communication that is used by products that only support I/O over EtherNet/IP
2222	TCP	CSP	1785-Lxxe,1785-ENET,1771-DMC(x), 1747-L55x,5820-EI, PowerMonitor II, RSLinx® Classic	This is the source port for connections
3060	TCP	rnadirft	FactoryTalk	Directory server file transfer

Table 10 - TCP/UDP Port Descriptions

Port	Type	Protocol	Products	Comments
3622	TCP/UDP	ff-lr-port	1788-EN2FFR	FOUNDATION Fieldbus
4000	UDP	Peer-to-peer	Trusted	Original simplex protocol
4120	TCP	RPC	RSBizWare™	Production server
4121				Server manager
4122				PlantMetrics™ server
4123				Task manager
4124				Scheduler server
4125				Scheduler CTP server
4446	TCP	TCP/IP	FactoryTalk® Diagnostics (CPR SR3)	See the Knowledgebase Answer ID 68260 at <a href="http://www.rockwellautomation.custhelp.com">http://www.rockwellautomation.custhelp.com</a>
5000	UDP	Peer-to-peer	Trusted, AADvance	Enhanced (new) protocol
5241	TCP	TCP/IP	FactoryTalk Diagnostics (CPR9 SR4 and greater)	See the Knowledgebase Answer ID 68260 at <a href="http://www.rockwellautomation.custhelp.com">http://www.rockwellautomation.custhelp.com</a>
5450	TCP		FactoryTalk® Historian Site Edition	PI network manager
5454				Analysis Framework v1.x
5455				
5456				ACE 2 scheduler
5457				Asset Framework server
5458				PI notifications
5459				Asset Framework to OLEDB Enterprise
6000	TCP	Workbench	Trusted	Online debugger
6543	TCP	rnaalarming	FactoryTalk	Alarming server
7002...7004	TCP		FactoryTalk AssetCentre (default)	FactoryTalk AssetCentre services
7600	TCP		FactoryTalk	Event multiplexor
7700				Event server
7710				Directory server
7720	TCP		FactoryTalk® View SE	HMI server
7721				Server Framework
7722				HMI activation
7723				Historical Data Log reader
8080	TCP	HTTP	RSBizWare	Production server, reports
8081				Server manager
8083	TCP	HTTP	CTP Server	
10001...10006	TCP	Serial data	AADvance	Transparent communication interface, where an Ethernet host can talk through AADvance to a serial port
27000...27009	TCP	TCP/IP	FactoryTalk® Activation Server, FactoryTalk Activation Manager	Four more application required to run FLEXSVR.exe. and LMGRD.exe, see the Knowledgebase Answer ID 35717 and 184922 at <a href="http://www.rockwellautomation.custhelp.com">http://www.rockwellautomation.custhelp.com</a>
44818	TCP/UDP	EtherNet/IP	1756-ENET,1756-ENBT,1756-EWEB, 1794-AENT,1734-AENT,1769-L35E, 1769-L32E,1788-ENBT,1761-NET- ENI, 1785-LXXE,1785-ENET,1747- L55x, 1763-L16x,1766-L32x, PowerMonitor3000, PanelView, RSLinx Classic, FactoryTalk Linx	Messaging, data transfer, upload/download, peer messaging, and so forth; used mainly by RSLinx

Table 10 - TCP/UDP Port Descriptions

Port	Type	Protocol	Products	Comments
49281	TCP	TCP/IP	FactoryTalk® Live Data, FactoryTalk View SE HMI tag server	HMI tag server
55555	TCP	Telnet	AADvance from release 1.3	Diagnostic command-line interface
60093	TCP	TCP/IP	FactoryTalk Diagnostics (CPR9 SR2 and earlier)	See the Knowledgebase Answer ID 68260 at <a href="http://www.rockwellautomation.custhelp.com">http://www.rockwellautomation.custhelp.com</a>
65207	TCP	TCP/IP	FactoryTalk VantagePoint	Incuity® server advertiser

## PlantPAx Deployment Recommendations and Verification Tool

The PlantPAx® verification tool is a Microsoft® Excel® spreadsheet (.xlsx) that helps verify that functionality complies with PlantPAx deployment recommendations.



Knowledgebase Technote, [PlantPAx System Release 5.0 Configuration and Implementation Tools](#), contains the PlantPAx checklist spreadsheet. Download the spreadsheet from this public article and use the tab referenced in each step.

You may be asked to log in to your Rockwell Automation web account or create an account if you do not have one. You do not need a support contract to access the article.

Use the spreadsheet (.xlsx) file as is. There are formulas that correspond to recommended PlantPAx settings. Any edits you make can affect the validity of the results.

Each section in this appendix contains a checklist that corresponds to a tab in the verification tool. Each item (row) in a checklist corresponds to a row in the verification tool.

Checklist	Description
<a href="#">Design Recommendations Tab</a>	System design considerations and best practices
<a href="#">System Infrastructure Tab</a>	System infrastructure elements that are shared across all servers and workstations
<a href="#">Server or Workstation Tab</a>	Loading and configuration of each individual server and workstation
<a href="#">System Architecture Tab</a>	Design and configuration of your system components
<a href="#">PASS Tab</a>	Design and configuration of the applications that PASS servers host
<a href="#">Controller 5x80 Tab</a>	Application and load on a ControlLogix® 5580 or CompactLogix™ 5380 controller
<a href="#">Controller 5x70 Tab</a>	Application and load on a ControlLogix 5570 or CompactLogix 5370 controller

# Design Recommendations Tab

The Design Recommendations tab lists best practices to follow when you design a PlantPax system.

## System ID

### Design Recommendation Tab: Overall Considerations

Row	Guidelines	Description
4	PlantPax Core Software bundle	Catalog number of the PlantPax Core Software bundle
5	Inventory agent	The System Integrator generated the .raai file via the FactoryTalk® AssectCentre inventory agent The .raai file contains the System ID serial number There could be multiple .raai files, for example, one for each subnet accessible by the FactoryTalk AssetCentre server
6	MyEquipment portal	The System Integrator registered to the system, and provided directions on how to access the MyEquipment portal

The PlantPax System ID is a unique identifier that helps simplify the management of your application over its lifecycle. The System ID creates a record of the installed hardware and software in the system and provides a dashboard that shows the hardware lifecycle status, notifications of updates and patches, and compatibility information.

The System Integrator uses an Asset Inventory Agent in a FactoryTalk AssetCentre project to generate the System ID and .raai file. The System Integrator registers your System ID with Rockwell Automation and provides you directions on how to access your MyEquipment portal.



Knowledgebase Technote, [PlantPax System Release 5.0 Configuration and Implementation Tools](#), contains the System ID instructions for System Integrators **only** to generate and register a PlantPax System ID.

You may be asked to log in to your Rockwell Automation web account or create an account if you do not have one. You do not need a support contract to access the article.

## Controller Considerations

### Design Recommendation Tab: Controller Considerations

Row	Guidelines	Description
7	Controller name	Keep the shortcut, ACD file name, and controller name similar (intuitive). Follow a systematic naming structure to help identify each controller in all system components. Inconsistent naming can create confusion in a production environment.
8	Routine / Tag Names	Follow ISA standards for control strategy and instrument naming schemes. Keep in mind devices that are already labeled in the field and the wire/cable numbers that are in place. Existing names can mean less flexibility for future field device names. ISA tag naming is an industry standard which design firms often follow when developing P&IDs. Link tags in the controller to the P&IDs to help link the process (P&IDs) to the programming within the control system.
9	Controller Organizer	Organize control programs to contain logic based on required execution rates. Organize code in a programs within the desired task that aligns with the process area. If code for a given process area needs to execute at different rates, create multiple programs in different tasks related to the same process area. Program names should be the same in the different tasks but with an indication embedded within the program name that indicates the task. This helps identify which task the program resides in when the programs are organized in the Logical Organizer.
10	Logical Organizer	In the Logical Organizer, folder names should be the same as the primary graphic display names. The Logical Organizer contains folders which contain the programs for specific process areas. Each folder contains the code that supports the HMI display for a single process area and is aligned with alarm groups. The alarm groups provide navigation to identify which HMI displays contain active alarms.  The folders in the Logical Organizer should match the graphical hierarchy (L1, L2 & L3) so that the alarm builder tool creates alarms in the appropriate alarm groups and populates the navigation bars correctly.
11...14	Controller Routines	Have one routine per device to help ensure that online edits only affect that specific device. Name each routine the same as the device name to help identify routines and their devices in the Controller Organizer. Each device (such as motor, valve, PID) should use a standard PlantPAx control strategy programmed in Function Block diagram. Keep supervisory or device control logic external to the device control strategies. This reduces variability among strategies and minimizes the risk of replicating modified control strategies.
15	Controller Programs	Align programs with graphic displays (typically L3 displays) so that the routines in a program have the same primary HMI display. <ul style="list-style-type: none"> <li>Alarm annunciation breadcrumbs highlight the associated navigation bar button.</li> <li>If you add a devices to a display, the device is also added to the associated program and alarm group.</li> </ul>

## Library Considerations

### Design Recommendation Tab: Library Considerations

Row	Guidelines	Description
16	Process Library Objects	Do not modify process library Add-On Instructions or graphic objects.

## Alarm Considerations

### Design Recommendation Tab: Alarm Considerations

Row	Guidelines	Description
17	Standards	Follow ISA 18.2 standards for alarm management
18	ALMA / ALMD Alarm Instructions	Avoid extensive use of ALMA and ALMD instructions. These instructions provide a high-resolution time stamp, but they also use considerable data server bandwidth. Minimize ALMA and ALMD use to only those alarms that require high-resolution time stamps. Instead use tag-based alarms and FactoryTalk® Alarms and Events alarms.



## I/O Considerations

### Design Recommendation Tab: I/O Considerations

Row	Guidelines	Description
19	RPI	Ideally, the I/O RPI equals half of the task execution time ( $0.5 * \text{associated task period}$ ). The I/O update sampling frequency should be twice the frequency of the logic execution. More frequent sampling over uses I/O communication bandwidth. Less frequent I/O sampling can result in poor control.
20	Consistent I/O Methodology	Select an I/O connection method: I/O mapping, direct I/O connection, aliasing, or program parameters. Choose a method that works best for your installation and consistently apply this method throughout your application.

## HMI Considerations

### Design Recommendation Tab: HMI Considerations

Row	Guidelines	Description
21	Graphical Framework	Use the Graphic Framework that comes with the process library. This framework helps ensure a consistent delivery of HMI displays.
22	Follow ISA 101 Style Guide	The standards help ensure a consistent delivery of HMI displays. The standards also help draw attention to information that requires attention.
23	Naming Conventions	The naming of graphic displays follows the Logical Organizer hierarchy. This alignment helps locate associated programming for future additions and changes.
24	No Spaces in Display Object Names	Avoid spaces in names of Area, Server, Graphic, Macro, and Parameter names. A space can sometimes be mistaken by a FactoryTalk View application as part of a command.
25	Design for the Future	Name applications and Areas with future development in mind.

## System Infrastructure Tab

The System Infrastructure checklist assumes:

- Your PlantPax system is operable (for example, the HMI application is running and the latest operating system patches are installed).
- The FactoryTalk® Network Manager™ is available to generate network switch information.

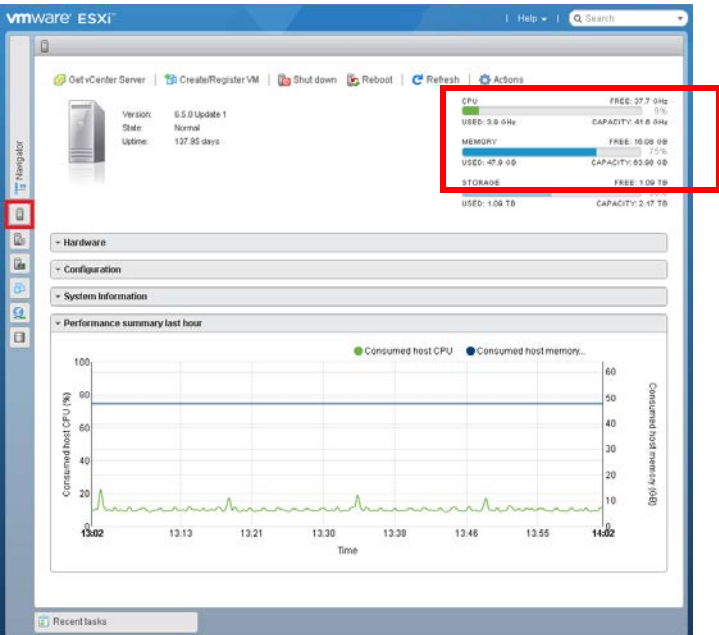
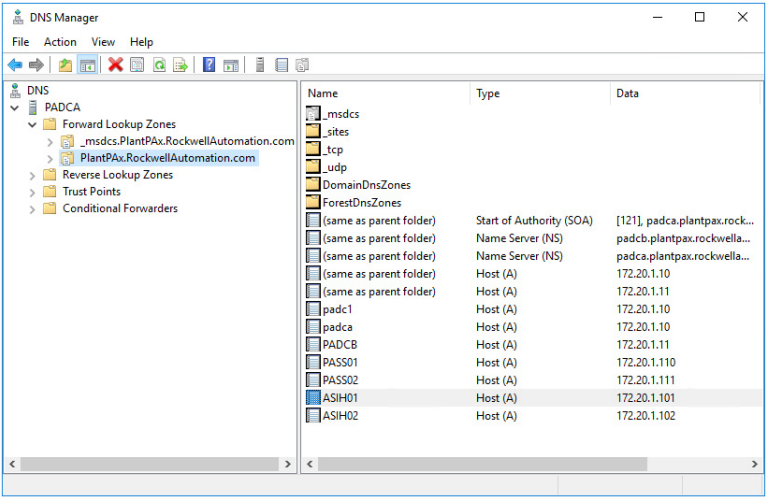
Your system infrastructure has been configured such that:

- You have defined a range of IP addresses for the DHCP server in the domain, if applicable for your system.
- You have created groups and assigned users in the domain controller.
- If you are using virtualization, the VMware vSphere Client software is installed and connected to a vCenter server or ESXi (hypervisor) host.

### System Infrastructure Tab

Row	Guidelines	Description
4	Hardware	BIOS Power Saving Options Disabled? From the computer BIOS, specify whether the BIOS power-saving options are disabled. Power-saving options reduce computer resources for your system elements.
5	Virtualization	Using Virtualization? Specify whether your system uses virtualization. We recommend use of VMware due to the extensive testing and development of PlantPax virtual templates. VMware also simplifies maintenance, backup, and disaster recovery.

## System Infrastructure Tab

Row	Guidelines	Description																																																									
6-13	Hypervisor	<p>If you are using virtualization, enter the percentage of CPU use and memory use for each computer.</p> <ul style="list-style-type: none"> <li>CPU use recommended to be within 50% of resources</li> <li>Memory use recommended to be within 50% of resources</li> </ul> <p>From the web browser (Firefox recommended), enter the IP address of the vCenter server and log into the web client.</p> <p>If a group of ESXi hosts is available in the selected context, select the host or group of hosts from the Source list to generate an HTML output. Print the output and store with the verification tool.</p> 																																																									
14	Domain	<p>All servers and workstations are in the same domain Specify whether all servers and workstations are on a Windows® Domain.</p> <p>On the domain controller, go to Server Manager &gt; Tools &gt; DNS and verify that all servers and workstations are listed in the DNS Manager dialog box.</p>  <table border="1"> <thead> <tr> <th>Name</th> <th>Type</th> <th>Data</th> </tr> </thead> <tbody> <tr> <td>_msdcs</td> <td></td> <td></td> </tr> <tr> <td>_sites</td> <td></td> <td></td> </tr> <tr> <td>_tcp</td> <td></td> <td></td> </tr> <tr> <td>_udp</td> <td></td> <td></td> </tr> <tr> <td>DomainDnsZones</td> <td></td> <td></td> </tr> <tr> <td>ForestDnsZones</td> <td></td> <td></td> </tr> <tr> <td>(same as parent folder)</td> <td>Start of Authority (SOA)</td> <td>[121] padca.plantpax.rock...</td> </tr> <tr> <td>(same as parent folder)</td> <td>Name Server (NS)</td> <td>padcb.plantpax.rockwella...</td> </tr> <tr> <td>(same as parent folder)</td> <td>Name Server (NS)</td> <td>padca.plantpax.rockwella...</td> </tr> <tr> <td>(same as parent folder)</td> <td>Host (A)</td> <td>172.20.1.10</td> </tr> <tr> <td>(same as parent folder)</td> <td>Host (A)</td> <td>172.20.1.11</td> </tr> <tr> <td>padc1</td> <td>Host (A)</td> <td>172.20.1.10</td> </tr> <tr> <td>padca</td> <td>Host (A)</td> <td>172.20.1.10</td> </tr> <tr> <td>PADCB</td> <td>Host (A)</td> <td>172.20.1.11</td> </tr> <tr> <td>PASS01</td> <td>Host (A)</td> <td>172.20.1.110</td> </tr> <tr> <td>PASS02</td> <td>Host (A)</td> <td>172.20.1.111</td> </tr> <tr> <td>ASIH01</td> <td>Host (A)</td> <td>172.20.1.101</td> </tr> <tr> <td>ASIH02</td> <td>Host (A)</td> <td>172.20.1.102</td> </tr> </tbody> </table> <p>In the Notes, document any clients that are not in the domain and why.</p>	Name	Type	Data	_msdcs			_sites			_tcp			_udp			DomainDnsZones			ForestDnsZones			(same as parent folder)	Start of Authority (SOA)	[121] padca.plantpax.rock...	(same as parent folder)	Name Server (NS)	padcb.plantpax.rockwella...	(same as parent folder)	Name Server (NS)	padca.plantpax.rockwella...	(same as parent folder)	Host (A)	172.20.1.10	(same as parent folder)	Host (A)	172.20.1.11	padc1	Host (A)	172.20.1.10	padca	Host (A)	172.20.1.10	PADCB	Host (A)	172.20.1.11	PASS01	Host (A)	172.20.1.110	PASS02	Host (A)	172.20.1.111	ASIH01	Host (A)	172.20.1.101	ASIH02	Host (A)	172.20.1.102
Name	Type	Data																																																									
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ASIH01	Host (A)	172.20.1.101																																																									
ASIH02	Host (A)	172.20.1.102																																																									

## Network

To collect the network data, you can do either of the following:

- Use the FactoryTalk Network Manager to access Stratix® and Cisco® network switches to diagnose the health of the network. For more information, see FactoryTalk Network Manager Quick Start Guide, publication [FTNM-QS001](#).
- Collect the network data manually from the web pages of each switch.

See [Chapter 4, Network Infrastructure](#) for details.

### System Infrastructure Tab: Network

Row	Guidelines	Description
15	Bandwidth Utilization %	Verify bandwidth < 50%.
16	Packet Error Rate	Verify there are no packet errors.
17	Temperature OK	Verify that all devices are not reporting high temperature readings.
18	CPU Utilization %	Verify CPU use < 50%.
19	Memory Utilization %	Verify memory use < 50%.

## Servers and Workstations

List the following for each server and workstation in the system (rows 20-93). The Server or Workstation tab is where you record data regarding each server and workstation:

- Computer name
- System role (select from pull down)

### Server or Workstation Tab

The Server or Workstation Name checklist assumes:

- Your PlantPAx system is operable (for example, the HMI application is running and the latest operating system patches are installed).
- The Performance Monitor (PerfMon) utility is connected to the servers and workstations that are being verified

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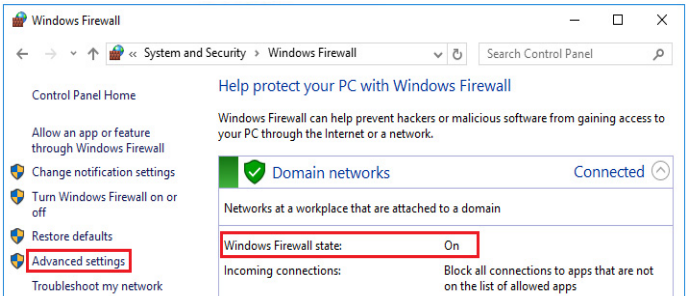
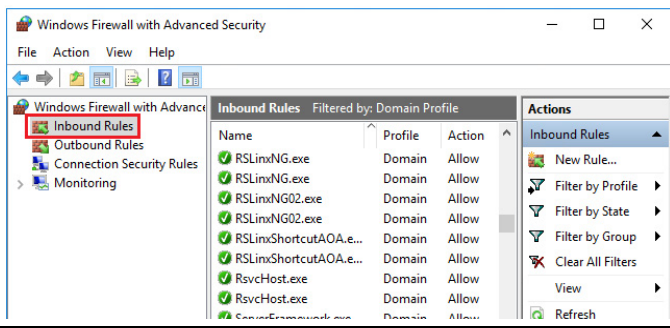
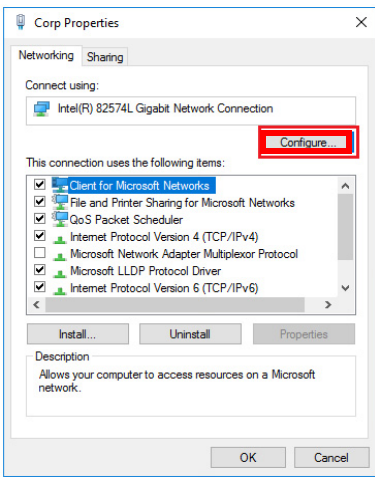
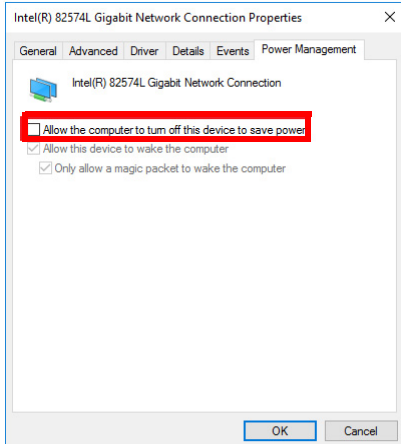
**IMPORTANT**    Make a copy of this worksheet for each computer (server or workstation) in your system.

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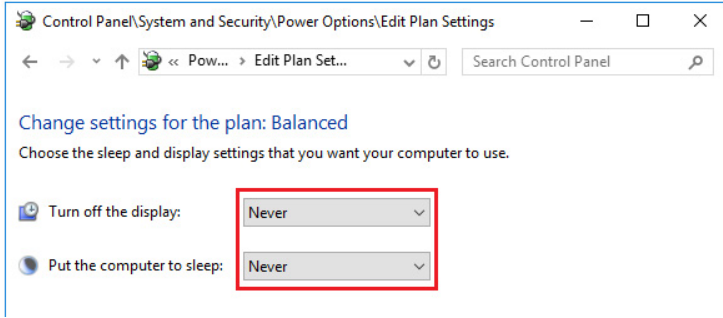
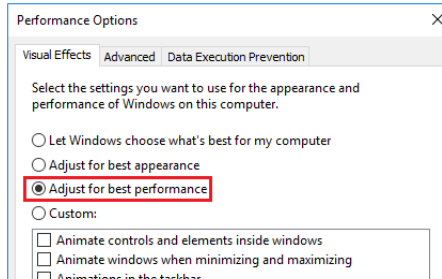
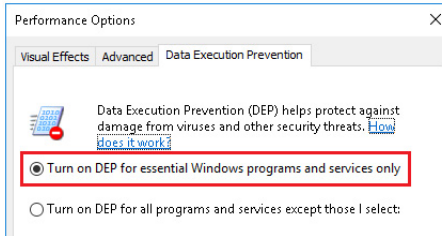
## Operating System

Verify these operating system requirements.

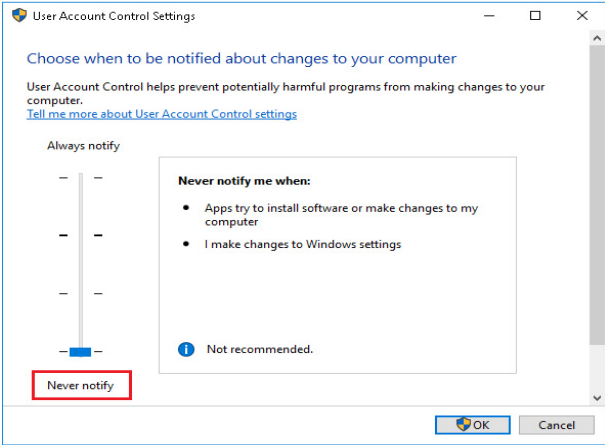
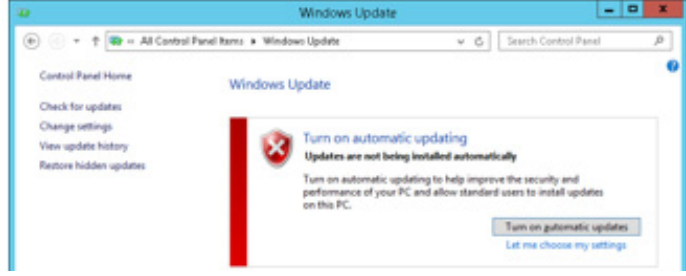
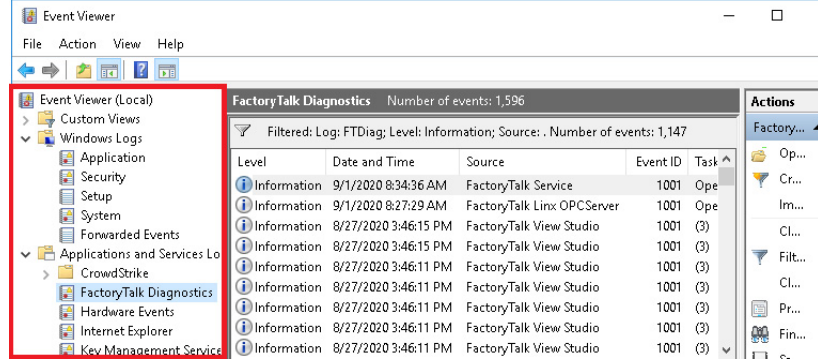
### Server or Workstation Tab: Operating System

Row	Guidelines	Description
4	Windows Firewall Being Used	<p>Specify whether the Windows firewall is enabled. For each computer, go to Control Panel &gt; Windows Firewall &gt; Advanced Settings.</p>  <p>Inbound rules allow or block inbound network traffic. Verify that Rockwell Automation software is allowed so that data and information is not blocked between application servers.</p> 
5	Operating System Valid	<p>Specify whether the server or workstation operating system that you are using matches PlantPax system recommendations. See the PlantPax Distributed Control System Selection Guide, <a href="#">PROCES-SG001</a>.</p>
6	Rockwell Software® Patches Applied	<p>Specify whether you installed the latest software patches for the Rockwell Automation software that is in the PlantPax system. All servers and clients in the system must have the same FactoryTalk® patch updates to avoid unexpected results.</p>
7	NIC Power Saving Options Disabled	<p>Specify whether you disabled power-saving for the Network Interface Card (NIC). For each computer, go to Control Panel &gt; Network and Sharing Center &gt; Properties &gt; Power Management.</p> <p>Make sure the 'Allow the computer to turn off this device to save power' is disabled (no check mark).</p>  

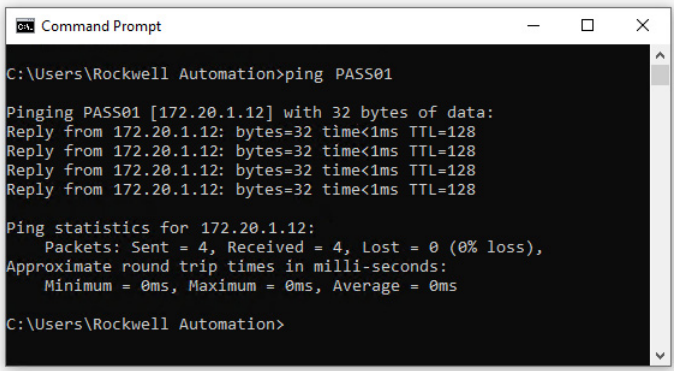
## Server or Workstation Tab: Operating System

Row	Guidelines	Description
8	Windows Power saving Options Disabled	<p>Specify whether you disabled power-saving for the Windows operating system. For each computer, go to Control Panel &gt; Power Options and verify the Change when computer sleeps field is set to Never.</p> 
9	Desktop Experience Enabled in RDS Servers	<p>Windows Server 2016 and newer have Remote Desktop Server (RDS) functionality enabled by default. Windows Server 2012 and prior, RDS is disabled by default and you need to enable the functionality. For each computer, go to Server Manager &gt; Local Server and review the Roles and Features listings.</p>
10	Adjust for Best Performance Is Selected	<p>Specify whether Windows settings are enabled for best performance. When Adjust for Best Performance is selected, enhanced features that are not used are turned off, which yields more memory and performance for the system. For each computer, go to Control Panel &gt; System &gt; Advanced System Settings &gt; Advanced tab &gt; Settings and on the Visual Effects tab, make sure Adjust for best performance is enabled.</p> 
11	Data Execution Prevention Windows Only	<p>Specify whether Data Execution Prevention is enabled for essential Windows programs and services. For each computer, go to Control Panel &gt; System &gt; Advanced System Settings &gt; Advanced tab &gt; Settings and on the Data Execution Prevention tab, make sure 'Turn on DEP ...' is enabled.</p> 

## Server or Workstation Tab: Operating System

Row	Guidelines	Description
12	User Account Control Never Notify	<p>Specify whether a user is never notified by the User Account Control. For each computer, open the User Account Control settings and make sure Never Notify is enabled.</p> 
13	Windows Automatic Update Is Disabled	<p>This step is for computers not internally managed by a Windows System Update Server (WSUS). Verify that Windows automatic update is disabled. Disabling this functionality helps prevent updates that have not been qualified by Rockwell Automation from being installed on the workstation or server.</p> <p>For Windows 10, Windows Server 2016, Windows Server 2019 operating systems:</p> <ol style="list-style-type: none"> <li>1. Open the Run command (Win + R) and enter: services.msc</li> <li>2. Select the Windows Update service from the Services list.</li> <li>3. On the General tab and change the Startup Type to Disabled.</li> <li>4. Restart the computer.</li> </ol> <p>For Windows Server 2012 and prior:</p> <ol style="list-style-type: none"> <li>1. For each computer, go to Control Panel &gt; Windows Update and make sure the update option is disabled.</li> <li>2. Restart the computer.</li> </ol> 
14	Event Viewer Is Not Presenting Errors	<p>Verify that the Event Viewer is not showing errors in the logs. For each computer, go to Administrative Tools &gt; Event Viewer and verify each log does not contain errors.</p> 

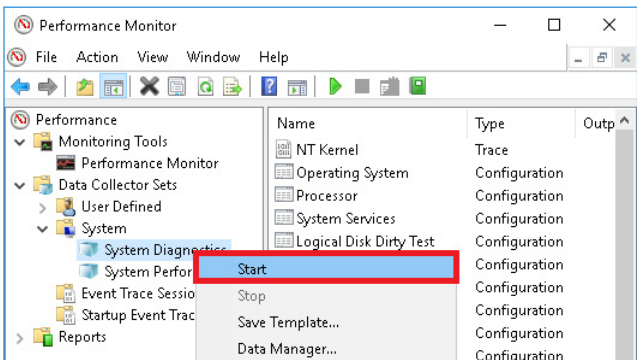
Server or Workstation Tab: Operating System

Row	Guidelines	Description
15	NSLookup Resolved	<div>Verify the mappings of IP addresses to host names</div> <div></div>

Performance

The Windows Performance Monitor (PerfMon) utility provides a snapshot of the current performance of a computer. To generate a performance report, do the following for each server and workstation:

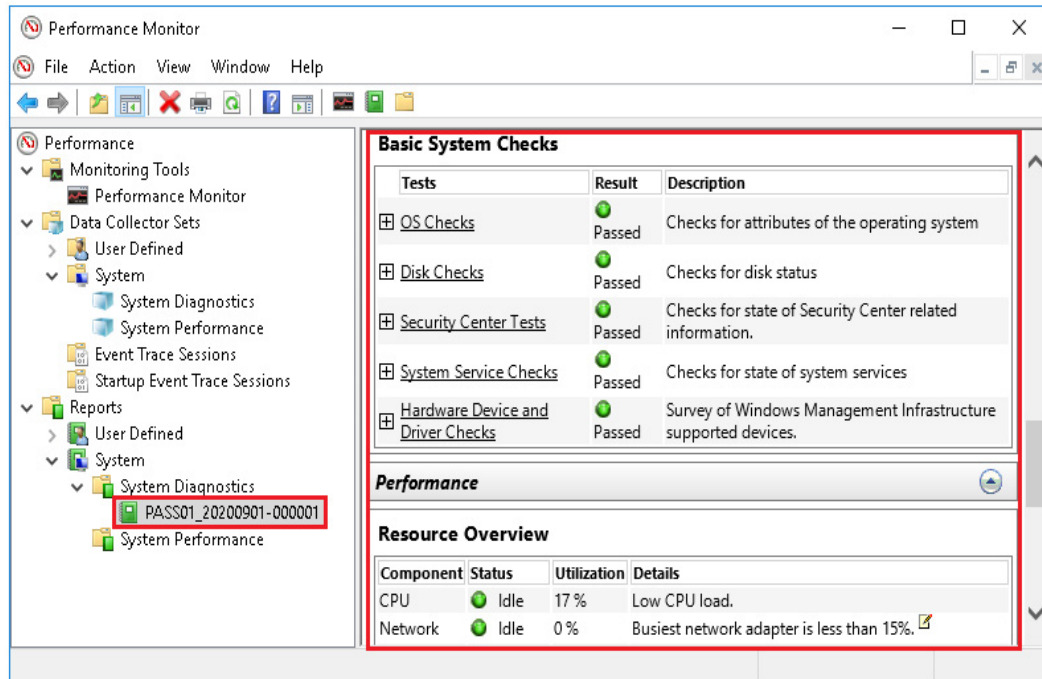
- 1. From the Performance Monitor utility, go to Data Collector Sets > System > System Diagnostics and select Start.



The system diagnostics procedure takes about 1 minute.



2. To view the report, go to Reports > System > System Diagnostics.



## Basic System Checks

Use the performance report from the Performance Monitor utility to verify the basic system checks.

### Server or Workstation Tab: Basic System Checks

Row	Guidelines	Description
17	Operating Systems Checks	Verify that the attributes of the operating system conform to PlantPax system recommendations. Use of not-recommended operating systems can affect system performance.
18	Disk Checks	Verify the status of the disks in the operating system.
19	Security Center Tests	Verify system security-related information.
20	System Service Checks	Verify the state of system services.
21	Hardware Device Driver Checks	Verify the Windows management of supported devices in your PlantPax system.

## Resource Overview

Use the performance report from the Performance Monitor utility to verify the resources.

### Server or Workstation Tab: Resource Overview

Row	Guidelines	Description
22	CPU (%)	Verify that the CPU load complies with PlantPax system recommendations. In a virtual system, the chip set on the host machine (server) can affect CPU capacity.
23	Network (%)	Verify that the busiest network adapter is < 50%.
24	Disk (/sec)	Verify the operations per second performed by the hard disk drive.
25	Memory (%)	Verify the memory capacity of the server or workstation.



## System Architecture Tab

The System Architecture checklist assumes:

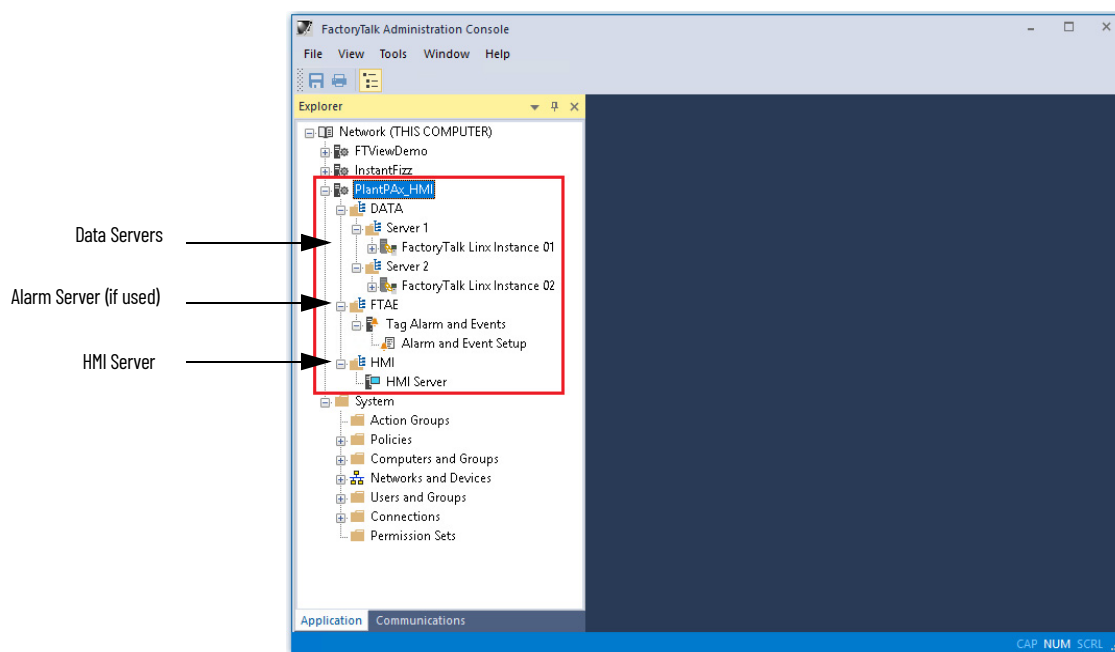
- Your PlantPax system was based on sizing recommendations from a PlantPax System Estimator project.

See [Chapter 1, System Workflow](#).

- Your PlantPax system is operable (for example, the HMI application is running and the latest operating system patches are installed).
- You have configured the following FactoryTalk software you need for your application servers.

## FactoryTalk View Application Design

To verify these attributes, use the FactoryTalk® Administration Console or the FactoryTalk® View Studio software.



Server segregation helps optimize performance. To help prevent unpredictable search results, do **not** insert a server into the application root path.

---

**IMPORTANT** Each server must be in its own area. This creates a unique path for each server so that clients don't need to look at every server.

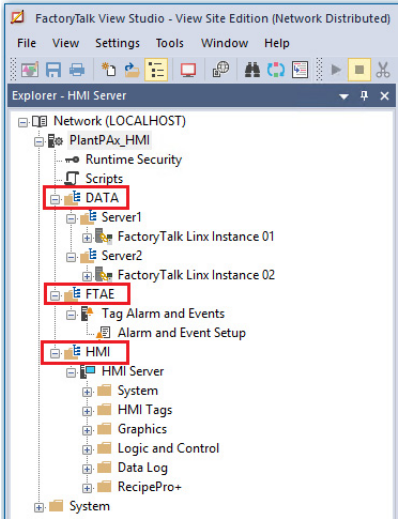
---

Design the system with of future growth in mind. Future growth can affect area names and how you segregate server by controllers within an area.

To improve performance, place:

- Data servers, alarm servers (if used), and Historian interface connectors on the same image
- HMI and other application servers on separate images

## System Architecture Tab: FactoryTalk View Application Design

Row	Guidelines	Description
4	Number of HMI Servers	<p>The system supports 10 HMI servers, whether they are redundant or not (you can have 10 redundant pairs). The number of servers and how they are configured can impact the speed of system communication. Use the application tree in the FactoryTalk Administration Console and select the project to be analyzed.</p> <ul style="list-style-type: none"> <li>Reference, identify, and count all HMI servers in your system.</li> <li>If a server is secondary, do <b>not</b> add the secondary HMI server to the count.</li> </ul>
5	Number of Alarms Servers	<p>The system supports 10 alarm servers, whether they are redundant or not (you can have 10 redundant pairs). Use the application tree in the FactoryTalk Administration Console and select the project to be analyzed.</p> <ul style="list-style-type: none"> <li>Reference, identify, and count all alarm servers in your system.</li> </ul> <p>FactoryTalk® Linx (data server) processes tag-based alarms and do not require a dedicated alarm server. The data server supports 10,000 tag-based alarms.</p>
6	Number of Data Servers	<p>The system supports 10 data servers, whether they are redundant or not (you can have 10 redundant pairs). Use the application tree in the FactoryTalk Administration Console and select the project to be analyzed.</p> <ul style="list-style-type: none"> <li>Reference, identify, and count all alarm servers in your system.</li> </ul>
7	Each Server Is In Its Own Area	<p>Each server must be in its own area. This creates a unique path for each server so that clients don't need to look at every server before they find the data they need. Server segregation helps optimize performance. To help prevent unpredictable search results, do <b>not</b> insert a server into the application root path.</p>  <p>For more information see, Knowledgebase Technote <a href="#">FactoryTalk View SE Area Best Practices</a>.</p>

## FactoryTalk View HMI Servers

Verify that the HMI servers on the PASS comply with system recommendations.

Table 11 – System Architecture Tab: FactoryTalk View HMI Servers (PASS)

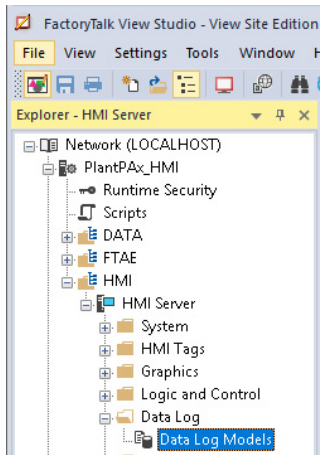
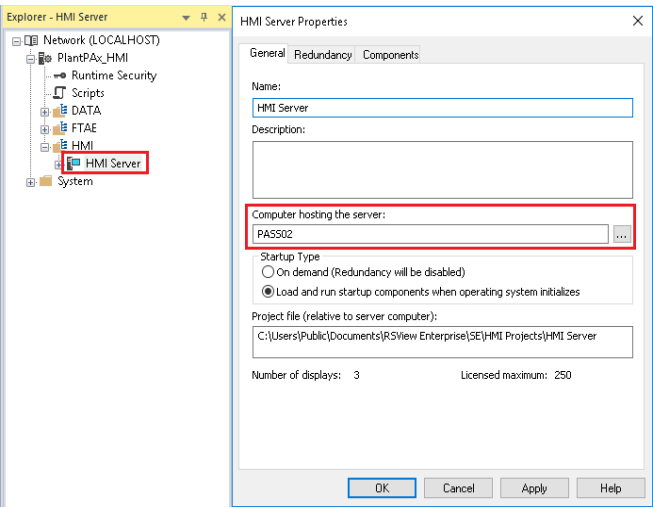
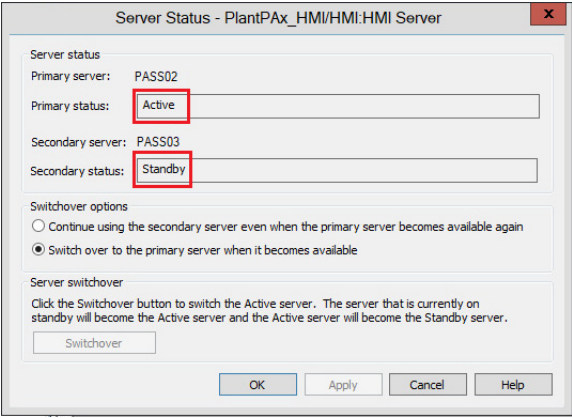
Row	Guidelines	Description
8	Uses Data Logging	<p>We recommend the use of FactoryTalk® Historian software rather than FactoryTalk View SE data logs to collect and analyze system data.</p> <p>To check if data logs are used in a FactoryTalk View SE project, open a Data Log folder in the HMI server. Verify the data log model is empty.</p> 
9	Dedicated Servers	<p>You can have only 1 HMI server and 1 alarm server on one computer. FactoryTalk® Linx supports 2 data server instances on one computer.</p> <p>In FactoryTalk® View Studio software, open Properties for each server and confirm the computer host name.</p> 

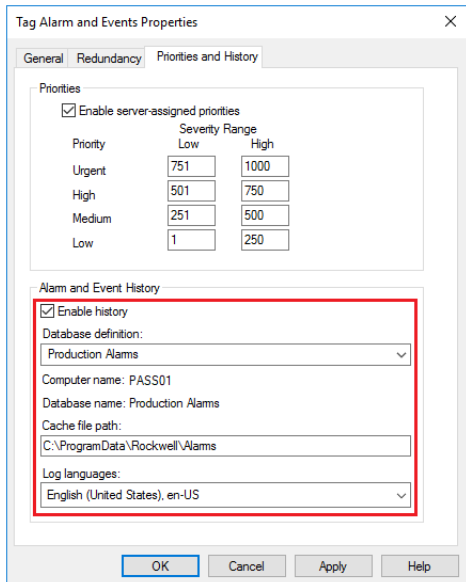
Table 11 – System Architecture Tab: FactoryTalk View HMI Servers (PASS)

Row	Guidelines	Description
10	Redundancy Status	<p>In the FactoryTalk Administration Console, select the HMI server &gt; Server Status.</p>  <p>In the verification tool:</p> <ul style="list-style-type: none"> <li>• If the status for one server is 'Active' and the other server is 'Standby', record Synched.</li> <li>• If you have different results, choose 'Not Synched' and identify the servers that are 'Not Synched' in the Notes.</li> </ul>

## FactoryTalk Alarm and Event Servers

Verify that the alarm servers on the PASS comply with system recommendations.

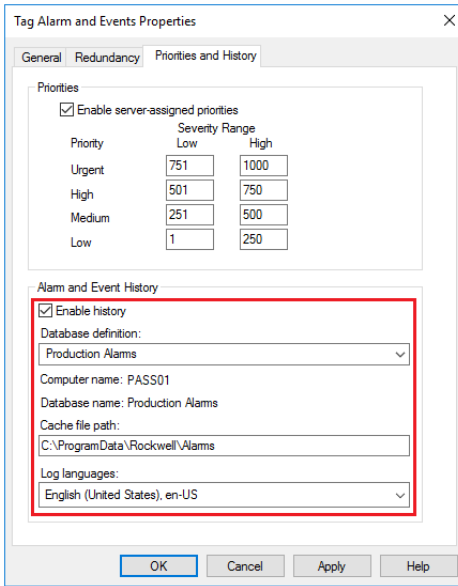
### System Architecture Tab: FactoryTalk Alarm and Event Servers (PASS)

Row	Guidelines	Description
11	Dedicated Servers	<p>You can have only 1 HMI server and 1 alarm server on one computer. FactoryTalk Linx supports 2 data server instances on one computer.</p> <p>In FactoryTalk View Studio software, open Properties for each server and confirm the computer host name.</p>
12	Redundancy Status	<p>Use the FactoryTalk Administration Console to select the alarm server &gt; Server Status.</p> <p>In the verification tool:</p> <ul style="list-style-type: none"> <li>• If the status for one server is 'Active' and the other server is 'Standby', record Synched.</li> <li>• If you have different results, choose 'Not Synched' and identify the servers that are 'Not Synched' in the Notes</li> </ul>
13	Alarm & Event History	<p>In the FactoryTalk Administration Console, open the Properties for the alarm server and check Enable History to log alarm history.</p> 

## FactoryTalk View Data Servers

Verify that the data servers on the PASS comply with system recommendations.

### System Architecture Tab: FactoryTalk View Data Servers

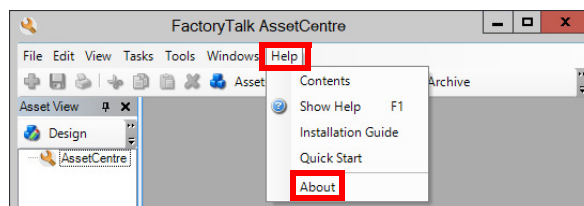
Row	Guidelines	Description
14	Number of Instances	FactoryTalk Linx supports 2 data server instances on one computer. You can have only 1 HMI server and 1 alarm server on one computer.  In FactoryTalk View Studio software, open Properties for each server and confirm the computer host name.
15	Redundancy Status	Use the FactoryTalk Administration Console to select the data server > Server Status. In the verification tool: <ul style="list-style-type: none"> <li>If the status for one server is 'Active' and the other server is 'Standby', record Synched.</li> <li>If you have different results, choose 'Not Synched' and identify the servers that are 'Not Synched' in the Notes</li> </ul>
16	Alarm & Event History	In the FactoryTalk Administration Console, open the Properties for the alarm server and check Enable History to log alarm history.  

## FactoryTalk AssetCentre Configuration

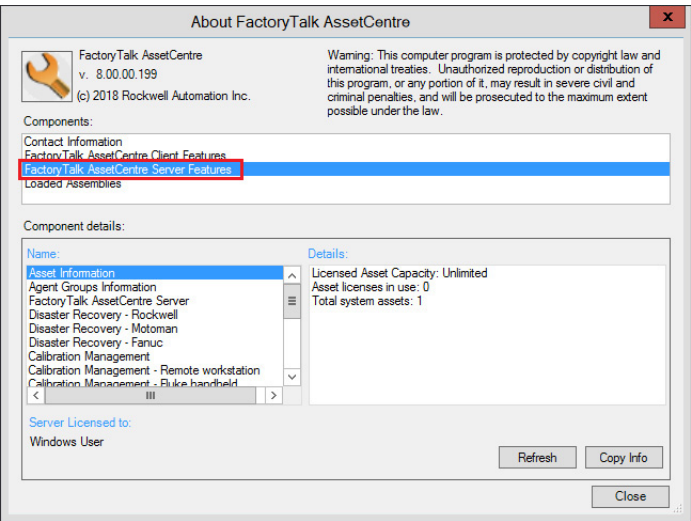
As a general rule, do not to exceed 100 assets over a 12-hour period per agent.

To verify the FactoryTalk AssetCentre configuration:

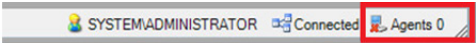
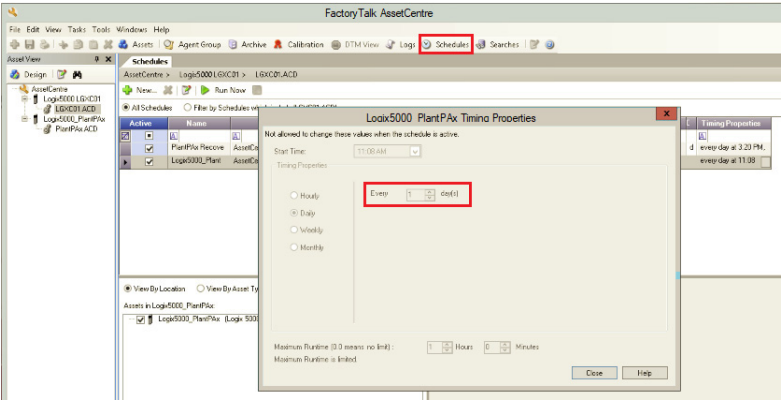
1. On the AssetCentre menu bar, select Help > About.



2. In the Components box, select FactoryTalk AssetCentre Server Features.



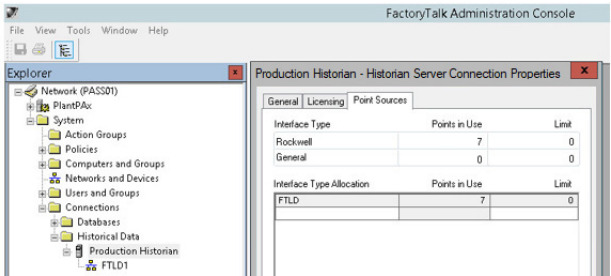
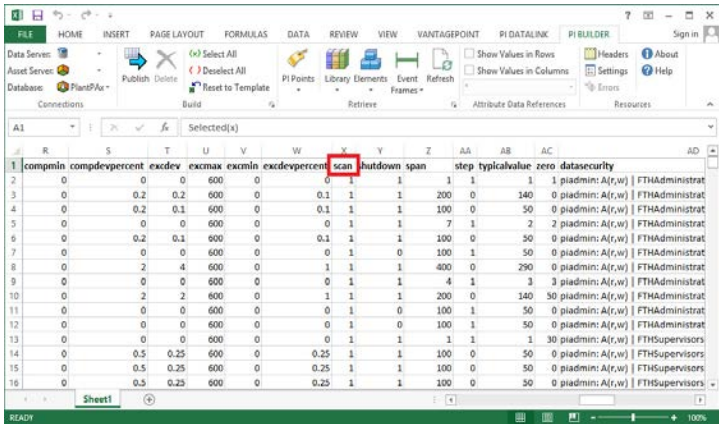
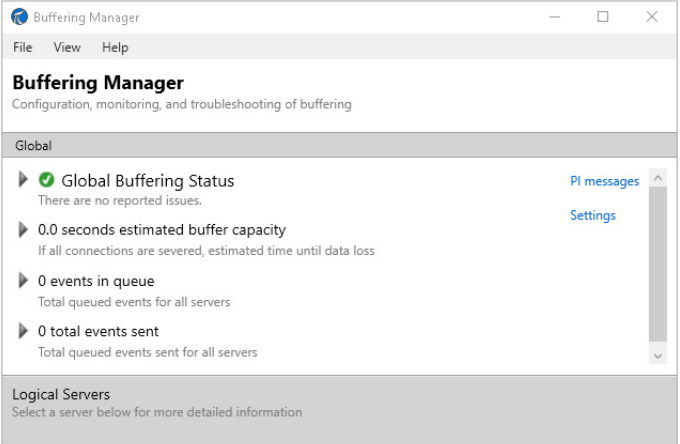
System Architecture Tab: FactoryTalk AssetCentre (AppServ-Asset Mgmt)

Row	Guidelines	Description
17	Number of Assets	Licensing determines the allowable number of assets. A base license includes 10 assets. From the Details pane of the FactoryTalk AssetCentre dialog box, verify the number of total system assets.
18	Number of Disaster Recovery (DR) Assets	Specify the number of controllers that are configured for Disaster Recovery (requires a Disaster Recovery license). Select Disaster Recovery - Rockwell in the FactoryTalk AssetCentre dialog box.
19	Number of Agents	Agents are programs that communicate with the FactoryTalk AssetCentre server and perform server tasks, such as disaster recovery. By using agents, work is distributed and shared among computers to help spread processing load. View the number of agents in the bottom-right corner of the FactoryTalk AssetCentre dialog box. 
20	How Often DR Assets Configured to Upload	Determine the frequency that the assets are scheduled to upload. Enter the number of days between asset uploads from the Schedules > Timing properties dialog box. 

FactoryTalk Historian SE Configuration

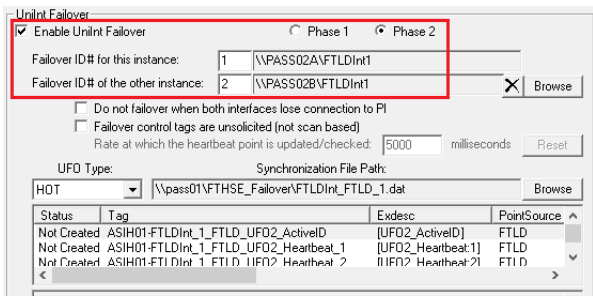
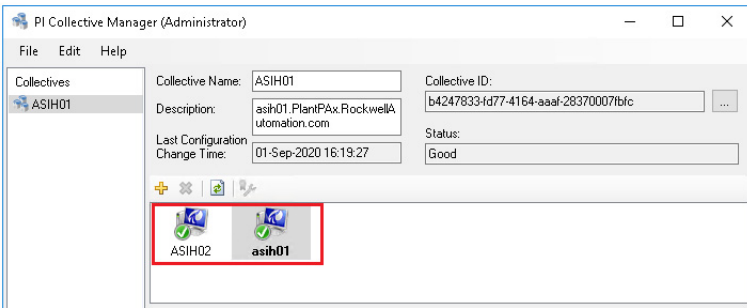
Verify that the following FactoryTalk View Historian SE design attributes comply with system recommendations.

## System Architecture Tab: FactoryTalk Historian SE (AppServ-Info)

Row	Guidelines	Description
21	Points In Use	<p>Verify the number of points that are in use. To view the number of points on the FactoryTalk Administration Console dialog box, go to System &gt; Connections &gt; Historical Data and select the Historian SE server.</p> 
22	Points Limit	<p>The limit depends on the points in use and the license limit. This value sets a benchmark that can be compared to future server results. The comparison can identify a potential issue with too many points per license.</p>
23	Fastest Scan Class	<p>Verify the scan rate that is used in FactoryTalk® Live Data to send controller information to the Historian server. To view this information, you must have the FactoryTalk® Historian SE Excel Add-in tool configured.</p> <p>From the PI Builder tab, select PI Points &gt; All PI Points and use the defaults. Select the scan rate that matches the smallest number you observed in the list of points in the Scan column.</p>  <p>Typically, a scan class of 1 sec is sufficient. Some tags can require a scan class of 0.5 sec. Exception reporting and compression reporting for tuning parameters are important for data collection and server loading.</p>
24	Number of Interfaces	Specify the number of FactoryTalk Live Data interfaces in your Historian configuration.
25	Buffering Enabled and Running	<p>Buffering is recommended to maintain data collection in the event the connection to the server is lost.</p> 



System Architecture Tab: FactoryTalk Historian SE (AppServ-Info)

Row	Guidelines	Description																
26	Unit Fail Over Enabled and Running	<p>On the Interface Configuration Utility, verify that failover is configured properly.</p>  <table><tr><th>Status</th><th>Tag</th><th>Exdesc</th><th>PointSource</th></tr><tr><td>Not Created</td><td>ASIH01-FTLIDInt_1_FTLID_UFD02_ActiveID</td><td>[UFD02_ActiveID]</td><td>FTLID</td></tr><tr><td>Not Created</td><td>ASIH01-FTLIDInt_1_FTLID_UFD02_Heartbeat_1</td><td>[UFD02_Heartbeat-1]</td><td>FTLID</td></tr><tr><td>Not Created</td><td>ASIH01-FTLIDInt_1_FTLID_UFD02_Heartbeat_2</td><td>[UFD02_Heartbeat-2]</td><td>FTLID</td></tr></table>	Status	Tag	Exdesc	PointSource	Not Created	ASIH01-FTLIDInt_1_FTLID_UFD02_ActiveID	[UFD02_ActiveID]	FTLID	Not Created	ASIH01-FTLIDInt_1_FTLID_UFD02_Heartbeat_1	[UFD02_Heartbeat-1]	FTLID	Not Created	ASIH01-FTLIDInt_1_FTLID_UFD02_Heartbeat_2	[UFD02_Heartbeat-2]	FTLID
Status	Tag	Exdesc	PointSource															
Not Created	ASIH01-FTLIDInt_1_FTLID_UFD02_ActiveID	[UFD02_ActiveID]	FTLID															
Not Created	ASIH01-FTLIDInt_1_FTLID_UFD02_Heartbeat_1	[UFD02_Heartbeat-1]	FTLID															
Not Created	ASIH01-FTLIDInt_1_FTLID_UFD02_Heartbeat_2	[UFD02_Heartbeat-2]	FTLID															
27	Collective Enabled and Running	<p>Verify that a collective is properly configured in a redundant Historian systems</p> 																

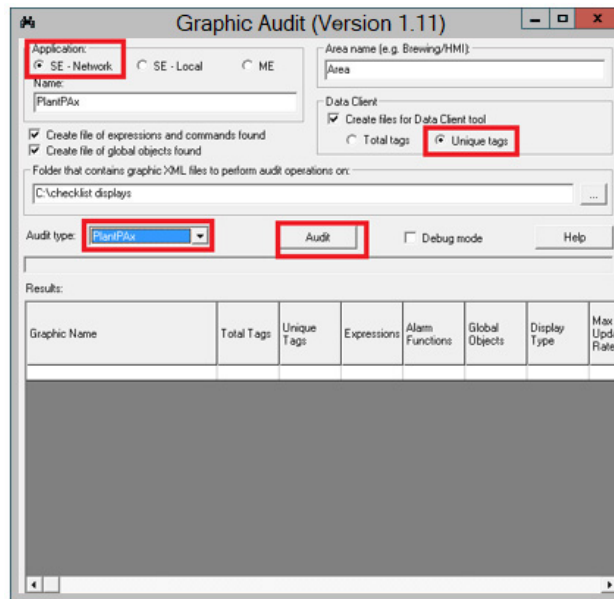
## PASS Tab

The PASS tab records details about the HMI elements in your application.

**IMPORTANT** Make a copy of this worksheet for each PASS in your system.

To verify your FactoryTalk® View Site Edition (SE) HMI design elements, use the Rockwell Automation Graphic Audit Tool. The audit tool analyzes exported HMI displays.

Before you run the audit tool, export the HMI application graphic files to an XML format. Then run the audit tool on the XML file.



The process displays are listed in the Results pane.

Color-coded cells indicate threshold issues.

**Graphic Audit (Version 1.11)**

Application:

☒ SE - Network    ☐ SE - Local    ☐ ME

Name:

PlantPAx

Area name (e.g. Brewing/HMI):

Area

Data Client

☒ Create files for Data Client tool

☐ Total tags    ☒ Unique tags

☒ Create file of expressions and commands found

☒ Create file of global objects found

Folder that contains graphic XML files to perform audit operations on:

C:\Users\Administrator\Desktop\Exported displays

Audit type: PlantPAx    Audit    ☐ Debug mode    Help

Results:

Graphic Name	Total Tags	Unique Tags	Expressions	Alarm Functions	Global Objects	Display Type	Max Tag Update Rate	Allow Multiple Running Copies	Cache After Displaying	Always Updating
[APP] Buttons	0	0	0	0	0	replace	1	false	false	false
[APP] Display	1590	1012	861	0	56	replace	0.25	false	false	false
[APP] Motors	2127	1584	1076	0	87	replace	1	false	false	false
[APP] PID	809	568	518	0	32	replace	1	false	false	false
[APP] Tank	57	24	24	0	1	replace	1	false	false	false
[APP] Tank.2	25	19	13	0	1	replace	1	false	false	false
[APP] Tank.3	30	19	15	0	2	replace	1	false	false	false
[APP] Valves	680	459	334	0	22	replace	1	false	false	false
[FRAME] P11 Description	0	0	0	0	0	replace	1	false	false	false
[FRAME] P11 Footer	0	0	1	0	4	replace	1	false	false	false
[FRAME] P11 Header	9	6	15	0	5	replace	1	false	false	false
[FRAME] P11 Help	0	0	0	0	0	replace	1	false	false	false
P11 HButtonBar	0	0	0	0	0	overlay	1	false	false	false
P11 Home	0	0	0	0	0	replace	1	false	false	false
TOTAL	5327	3653	2857	0	210					

These guidelines apply to HMI applications developed via FactoryTalk View SE software. Make sure:

- The FactoryTalk View SE system is correctly installed and configured (software version, operating system, computer requirements) according to the PlantPax system characterized architecture.
- Design the FactoryTalk View SE system to accommodate future additions.
- Develop your HMI screens according to ISA 101 standards

## FactoryTalk View SE System

Verify that the HMI server attributes comply with these recommendations.

### PASS Tab: FactoryTalk View SE (HMI)

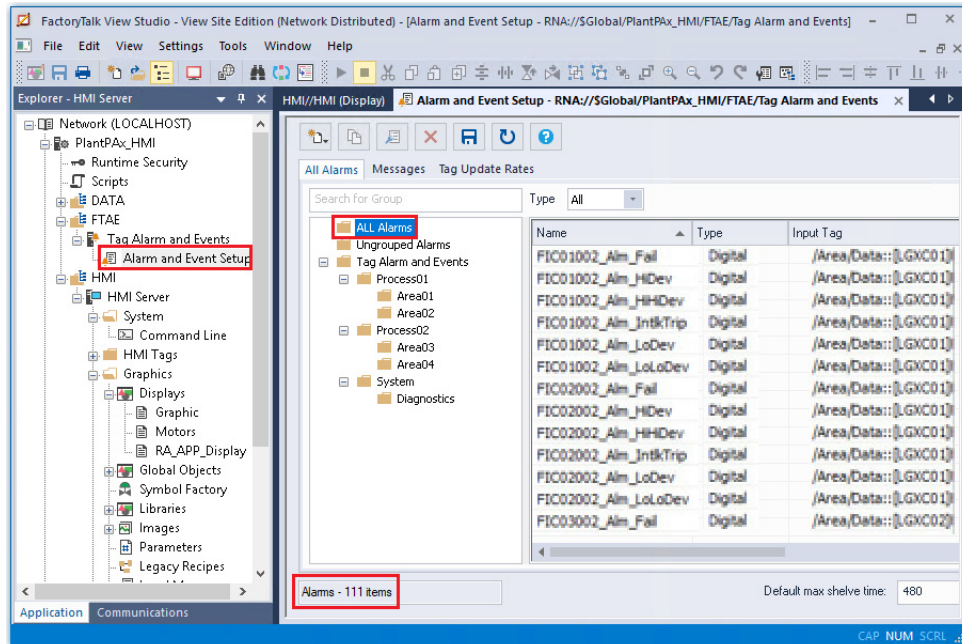
Row	Guidelines	Description
4	Number of Displays	The total number of displays does not exceed the display license.
5	Server	Only 1 server per Area in the Logical Organizer.
	Total Tags on Server Unique Tags Expressions Global Objects	Verify there are no more than 1000 tags per graphic on scan. More than 1000 tags affects loading on the HMI server and affects operator experience. This count includes: <ul style="list-style-type: none"> <li>• Unique tags</li> <li>• Expressions</li> <li>• Global objects</li> </ul>
6-16	Display Settings Display Type Display Cache Graphic Update Rate	For display settings, specify: <ul style="list-style-type: none"> <li>• Display Type = Replace</li> <li>• Display Cache = No</li> <li>• Always Updating + not checked</li> </ul> Verify that the update rate is within recommendation of 0.5 seconds. Any faster rate has a possible impact on the server and controller.

## FactoryTalk Alarms and Events Server

There are two possible types of alarms on the PASS:

- Server-based alarms that are defined within the FactoryTalk Alarms and Events server (default for earlier PlantPax system releases)

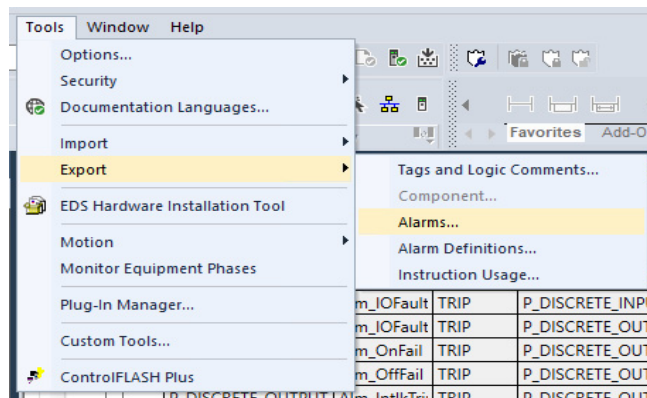
The FactoryTalk Alarm and Event Setup dialog box provides the data.



- Tag-based alarms that are processed by the FactoryTalk Linx data server (new to PlantPax system release 5.0)

To determine the number of tag-based alarms:

- In Logix Designer, export the alarms for each of the controllers on the data server to XML.
- Open in Excel and filter on Use = True to total the number of alarms.



Verify that the alarm server attributes comply with these recommendations.

### PASS Tab: FactoryTalk Alarms and Events

Row	Guidelines	Description
17	Number of Alarms (FactoryTalk Alarms and Events)	The FactoryTalk Alarms and Events server supports 20,000 alarms
18	Number of Alarms (FactoryTalk Linx Instance 1)	FactoryTalk Linx instance 1 supports 10,000 alarms
19	Number of Alarms (FactoryTalk Linx Instance 2)	FactoryTalk Linx instance 2 supports 10,000 alarms
20	Total Alarms	The total number of alarms does not exceed 20,000 per PASS server
21	Total Items	Informational field provides a total number of items on the Tag Update Rates of the FactoryTalk Alarm and Event Setup dialog box
22	Fastest Update Rate	Update rate recommendation is 1 second. Default is 2 seconds to help reduce load on the system.
23	All tags addressed from the local data server	<p>The alarm server references the data server hosted on the same computer. Move non-compliant alarms to the appropriate alarm server associated with the data server.</p> <p>Build alarms in groups that follow the Logical Organizer hierarchy or Process Tree within the Alarm Builder.</p>

## FactoryTalk Linx Data Server

FactoryTalk Linx software acts as a data server to access tags in a controller. You can have two instances of the this data server on the PASS, Verify that each instance of the data server complies with these recommendations.

Virtual Memory is a real-time indicator of the internal memory resources that FactoryTalk Linx software consumes. This value increases in proportion to the loading on the data server. This loading can increase because of the following:

- Number of controllers
- Number of tags on scan on HMI displays
- Demand for RSLinx® Gateway OPC server, alarms, historical polling and data logs
- Display update rate of HMI displays
- Number of active HMI clients

We recommend that this value is kept under approximately 3 GB. Values beyond 3 GB indicate a heavily-loaded data server and can affect system performance. Go to the Task Manager > More Details, and, from the Details tab, review the memory usage for the TagSrv.exe and RSLinxNG.exe files. Evaluate the load balance and consider adding another server.

To gather information for this checklist, you can use:

- L\_CPU Add-On Instruction faceplates

For examples of diagnostic faceplates, see the L\_CPU section in the Rockwell Automation® Library of Logix Diagnostic Objects Reference Manual, publication [PROCES-RM003](#).

- FactoryTalk View controller report, which also uses the L\_CPU Add-On Instruction

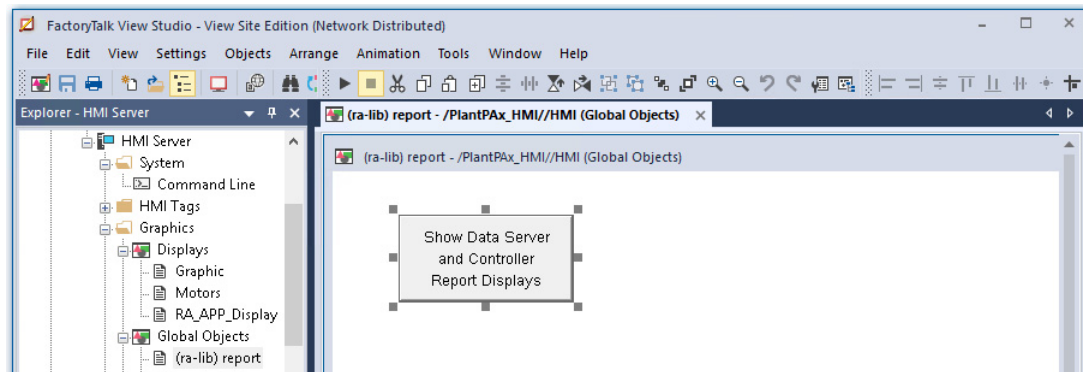
For the FactoryTalk View Graphic Audit Tool, see Knowledgebase Technote [FactoryTalk View Graphic Audit Tool](#).

**IMPORTANT** The provided global object, display files, and images in the checklist file must be installed in the HMI before printing the report. The display files include the following:  
 Images: icon\_gray.png, icon\_green.png, icon\_yellow.png, icon\_red.png  
 Global object: (RA-LIB) Report.ggfx  
 Displays: (RA-LIB) Report RSLinxE.gfx, (RA-LIB) Report Controller.gfx, (RA-LIB) Report Controller 5x80.gfx  
 In addition to FactoryTalk View SE software files, the checklist file includes verification tools and instructions.

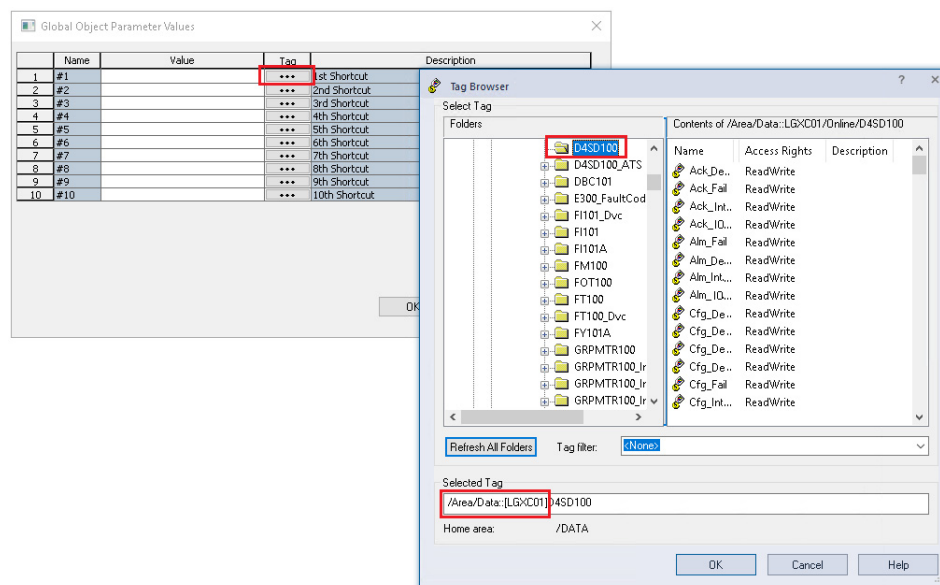
## Generate the FactoryTalk View Report

To generate the FactoryTalk Linx report

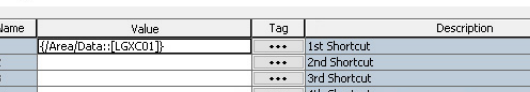
1. In FactoryTalk View Studio, go to Global Objects file (RA-LIB) Report and select the Short Data Server and Controller Report Display button.



2. Place the button any screen.
3. Select the button and open the Global Object Parameter Values.
4. Under Tag on the Global Objects Parameter Values dialog box, click Browse (ellipsis '...') to select a controller shortcut.



5. Enter a backing tag and path.



	Name	Value	Tag	Description
1	#1	{{Area/Data::[LGC01]}}	...	1st Shortcut
2	#2		...	2nd Shortcut
3	#3		...	3rd Shortcut
4	#4		...	4th Shortcut
5	#5		...	5th Shortcut
6	#6		...	6th Shortcut
7	#7		...	7th Shortcut
8	#8		...	8th Shortcut
9	#9		...	9th Shortcut
10	#10		...	10th Shortcut

OK Cancel Help

6. Run a FactoryTalk View Client session and click the Show Data Server and Controller Report Displays button to generate a report.

(RA-LIB) Report RSLinx - /PlantPax//Area

**Data Servers**

Controller Shortcut	Controller Path	Press to Show Shortcut Report Display	Notes		
/Area/Data:.[LGXC01]	RSLinx 5000 Emulator in slot 2 of the virtual backplane	...			
/Area/Data:.[PlantPax]	RSLinx 5000 Emulator in slot 3 of the virtual backplane	...			
/Area/Data:.[LGXC01B]	RSLinx 5000 Emulator in slot 4 of the virtual backplane	...			
/Area/Data:.[PlantPaxB]	RSLinx 5000 Emulator in slot 5 of the virtual backplane	...			
<b>Virtual Memory</b>	<b>559172</b>				
Controller Shortcut	# Polled Data Items	Avg Packets per Second	Avg Packet Response Time	Results	Notes
/Area/Data:.[LGXC01]	3	9	0	✓	
/Area/Data:.[PlantPax]	25233	75	2	✓	
/Area/Data:.[LGXC01B]	0	0	0	✓	
/Area/Data:.[PlantPaxB]	25230	0	0	✓	
<b>Press to Refresh Totals</b>	<b>50466</b>	<b>43</b>	<b>2</b>		
<b>Name:</b>	<b>Signature:</b>			<b>Date:</b>	

Controller Verification.

Use the information in this section to complete the Checklist.

For each shortcut, verify:

**Table 12 - PASS Tab: Data Server (FactoryTalk Linx Instance 1 and Instance 2)**

Row	Guidelines	Description
24 & 38	Virtual Memory	Specify if you are using a data server.
25-51	Number of Polled Data Items	The number of tags that are scanned from the controller.
25-51	Average packets per Second	<p>The communication speed of data flow between the controller and data server.</p> <ul style="list-style-type: none"> <li>ControlLogix 5580 controllers and CompactLogix 5380 controllers support 1000 packets per second.</li> <li>ControlLogix 5570 controllers and CompactLogix 5370 controllers support 400 packets per second.</li> </ul> <p>If your controller consistently exceeds the maximum packets per second, it is possible your controller is overloading. Consider reducing the number of HMI data points referenced by your HMI displays from that controller. You can also lower the screen update rate if you are experiencing performance issues.</p> <p>The more controllers in your system that exceed 800 packets per second of communication, the greater your chance of overloading your data server.</p>
25-51	Average Packet Response Time	<p>The average response time of messages to the controller.</p> <p>If your average packet response time consistently exceeds 200 milliseconds then it is possible that your communication adapter has a potential bottleneck. Consider the following troubleshooting guidelines if your performance is not satisfactory:</p> <ul style="list-style-type: none"> <li>Examine your network architecture and network hardware. You could be exceeding your switch capacity or capabilities that can cause slow network performance.</li> <li>You could be using an outdated communication adapter in the path to your controller. Or, you could be exceeding the capabilities of the communication adapter.</li> </ul>

## Controller 5x80 Tab

The Controller tab records controller properties.

---

**IMPORTANT** Make a copy of this worksheet for each 5x80 controller in your system.

---

To gather information for the checklist, you can use:

- L\_CPU Add-On Instruction faceplates

For examples of diagnostic faceplates, see the L\_CPU section in the Rockwell Automation Library of Logix Diagnostic Objects Reference Manual, publication [PROCES-RM003](#).

- FactoryTalk View controller report, which also uses the L\_CPU Add-On Instruction

For the FactoryTalk View Graphic Audit Tool, see Knowledgebase Technote [FactoryTalk View Graphic Audit Tool](#).

---

**IMPORTANT** The provided global object, display files, and images in the checklist file must be installed in the HMI before printing the report. The display files include the following:

Images: icon\_gray.png, icon\_green.png, icon\_yellow.png, icon\_red.png

Global object: (RA-LIB) Report.ggfx

Displays: (RA-LIB) Report RSLinxE.gfx, (RA-LIB) Report Controller.gfx, (RA-LIB) Report Controller 5x80.gfx

In addition to FactoryTalk View SE software files, the checklist file includes verification tools and instructions.

---



For more information, see [Generate the FactoryTalk View Report](#).

Controller Shortcut	Controller Path	Press to Show Shortcut Report Display
/Area/Data::[LGXC01]	RSLogix 5000 Emulator in slot 2 of the virtual backplane	...
/Area/Data::[PlantPax]	RSLogix 5000 Emulator in slot 3 of the virtual backplane	...
/Area/Data::[LGXC01B]	RSLogix 5000 Emulator in slot 4 of the virtual backplane	...
/Area/Data::[PlantPaxB]	RSLogix 5000 Emulator in slot 5 of the virtual backplane	...

## Controller Properties

Verify that the controller properties comply with these recommendations.

### Controller 5x80 Tab: Properties

Row	Guidelines	Description
4	Shortcut	Keep the shortcut, ACD file reference, and controller name similar (intuitive).
5	Firmware	Verify the firmware revision.
6	Module	The controller is indicated as available in the PSE. The controllers in the PSE have been characterized for use within a PlantPax system.
7	Redundancy	Indicate whether you are using a redundant controller (Yes/No).

## CPU Use

Verify that the CPU use complies with these recommendations.

### Controller 5x80 Tab: CPU Use

Row	Guidelines	Description
8	Logix Engine	At least 25% free for Redundant 5580 controllers. Non-redundant 5x80 controllers can utilize up to 100% of the Logix Engine.
9	Communications Core	At least 40% free.
10	Packet Processing Engine	At least 25% free.

## Faults

Verify that the fault handling complies with these recommendations.

### Controller 5x80 Tab: Faults

Row	Guidelines	Description
11	Minor Faults Count	Number of minor faults that have occurred within the controller. After clearing the minor faults, monitor for a period of time (at least several controller scans) before reverifying.
12	Task Overlap	Whether a task overlap occurs. A task overlap must be resolved. Use the predefined task model in the process controller or simplify the program. Lengthening the period or raising the relative priority of important tasks disables the predefined task model in a process controller.

## Capacity

Verify that the controller capacity complies with these recommendation..

### Controller 5x80 Tab: Capacity

Row	Guidelines	Description
13 & 14	Program Memory (blocks)	Reserve at least 20%.
15 & 16	Nodes	Reserve at least 20%.

## Connections

Verify that the total number of connections is 75% or less of the controller maximum.

### Controller 5x80 Tab: Connections

Row	Guidelines	Description
17-25	Total I/O	Total number of connections includes: <ul style="list-style-type: none"> <li>• I/O</li> <li>• Produced tags</li> <li>• Consumed tags</li> <li>• Messages</li> <li>• Incoming</li> <li>• Unconnected buffers</li> <li>• Message cache</li> </ul>

## Time Synchronization

Verify that the controller is configured for time synchronization.

### Controller 5x80 Tab: Time Synchronization

Row	Guidelines	Description
26	Controller is time synchronized	Denotes if the controller is configured for time synchronization (Yes/No).

## Task Structure

Verify the controller program uses only periodic tasks.

### Controller 5x80 Tab: Task Structure

Row	Guidelines	Description
27	Only periodic task used	Use only periodic tasks and remove any unused tasks The process controller enforces 4 periodic tasks: Slow, Normal, Fast, and System.

## Controller 5x70 Tab

The Controller tab records controller properties.

---

**IMPORTANT** Make a copy of this worksheet for each 5x70 controller in your system.

---

To gather information for the checklist, you can use:

- L\_CPU Add-On Instruction faceplates

For examples of diagnostic faceplates, see the L\_CPU section in the Rockwell Automation Library of Logix Diagnostic Objects Reference Manual, publication [PROCES-RM003](#).

- FactoryTalk View controller report, which also uses the L\_CPU Add-On Instruction





For the FactoryTalk View Graphic Audit Tool, see Knowledgebase Technote [FactoryTalk View Graphic Audit Tool](#).

---

**IMPORTANT** The provided global object, display files, and images in the checklist file must be installed in the HMI before printing the report. The display files include the following:  
 Images: icon\_gray.png, icon\_green.png, icon\_yellow.png, icon\_red.png  
 Global object: (RA-LIB) Report.ggfx  
 Displays: (RA-LIB) Report RSLinxE.gfx, (RA-LIB) Report Controller.gfx, (RA-LIB) Report Controller 5x80.gfx  
 In addition to FactoryTalk View SE software files, the checklist file includes verification tools and instructions.

---

For more information, see [Generate the FactoryTalk View Report](#).

Controller Shortcut	Controller Path	Press to Show Shortcut Report Display
/Area/Data::[LGXC01]	RSLinx 5000 Emulator in slot 2 of the virtual backplane	 ←
/Area/Data::[PlantPAx]	RSLinx 5000 Emulator in slot 3 of the virtual backplane	
/Area/Data::[LGXC01B]	RSLinx 5000 Emulator in slot 4 of the virtual backplane	
/Area/Data::[PlantPAxB]	RSLinx 5000 Emulator in slot 5 of the virtual backplane	

## Controller Properties

Verify that the controller properties comply with these recommendations.

### Controller 5x70 Tab: Properties

Row	Guidelines	Description
4	Shortcut	Keep the shortcut, ACD file reference, and controller name similar (intuitive).
5	Module	The controller is indicated as available in the PSE. The controllers in the PSE have been characterized for use within a PlantPAx system.
6	Naming Schemes	Follow ISA 5.1 standards for control strategy and Instrument naming schemes. ISA tag naming is an industry standard most often used in P&ID diagrams. Link tags in the controller to the P&ID diagrams to help match the process (P&ID) to the programming within the control system.
7	Redundancy	Denotes if you are using a redundant controller (Yes/No).

## CPU Use

We recommend CPU load in a production environment to be 75% or less. Keep 25% CPU capacity as reserve to handle online edits, data server switchover, and so on.

Verify that the CPU use complies with these recommendations.

### Controller 5x70 Tab: CPU Use

Row	Guidelines	Description
9	Free	At least 50% of free for redundant controllers At least 25% for simplex controllers.
11	Total Used: Periodic Tasks	The percentage of CPU use to run all the application code in the controller. Periodic tasks are the only predictable task type on performance and utilization. Keep the number of tasks to 3 or 4 and do not use to organize code into process areas.
12	Total Used: Communication	The percentage of CPU use that is needed to respond to communication requests.
13	Total Used: Motion	The percentage of CPU use that is needed to execute motion.
14	Total Used: Messages	The percentage of CPU use that is needed to process messages.
15	Total Used: Safety	The percentage of CPU use that is needed to execute safety tasks.
165	Total Used: Redundancy	The percentage of CPU use that is needed to process redundancy.
17	Total Used: System	The percentage of system resources

## Faults

Verify that the fault handling complies with these recommendations.

### Controller 5x70 Tab: Faults

Row	Guidelines	Description
18	Minor Faults Count	Number of minor faults that have occurred within the controller. After clearing the minor faults, monitor for a period of time (at least several controller scans) before reverifying.
19	Task Overlap	Whether a task overlap occurs. A task overlap must be resolved. Make changes such as simplifying programs, lengthening the period, or raising the relative priority of important tasks.

## Memory Use

The PlantPax system requires the free I/O memory to be a minimum of 25% for simplex controllers. We recommend greater than 50% free memory for redundant controllers.

### Controller 5x70 Tab: Memory Use

Row	Guidelines	Description
20 & 21	I/O Memory (bytes)	Reserve: <ul style="list-style-type: none"> <li>At least 50% for redundant controllers</li> <li>At least 25% for simplex controllers</li> </ul> If the amount exceeds the recommendations, reduce the number of I/O modules that are scanned by this controller, make system changes.
22 & 23	Data and Logic (bytes)	Reserve: <ul style="list-style-type: none"> <li>At least 50% for redundant controllers</li> <li>At least 25% for simplex controllers</li> </ul> If the amount exceeds the recommendations, upgrade controller for more memory or make changes to reduce load

## Connections

Verify that the total number of connections is 50% or less of the controller maximum.

### Controller 5x70 Tab: Connections

Row	Guidelines	Description
24-32	Total I/O	Total number of connections includes: <ul style="list-style-type: none"> <li>I/O</li> <li>Produced tags</li> <li>Consumed tags</li> <li>Messages</li> <li>Incoming</li> <li>Unconnected buffers</li> <li>Message cache</li> </ul>

## Time Synchronization

Verify that the controller is configured for time synchronization.

### Controller 5x70 Tab: Time Synchronization

Row	Guidelines	Description
33	Controller is time synchronized	Denotes if the controller is configured for time synchronization (Yes/No).

## Task Structure

Verify the controller program uses only periodic tasks.

### Controller 5x70 Tab: Task Structure

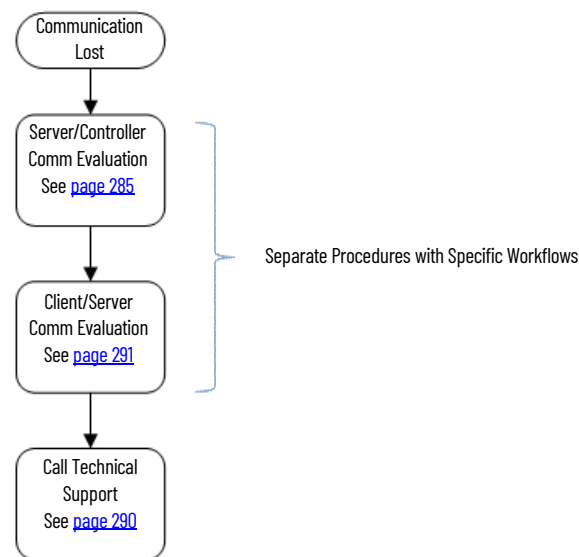
Row	Guidelines	Description
34	Only periodic task used	Use only periodic tasks and remove any unused tasks Use only 2-3 periodic tasks (slow, normal & fast) for logic and remove any unused tasks

## PlantPax Troubleshooting Scenarios

### HMI Communication Lost

[Figure 23](#) shows a basic workflow to correct lost communication. To target the root cause, follow this workflow:

**Figure 23 - Resolve Lost Communication**



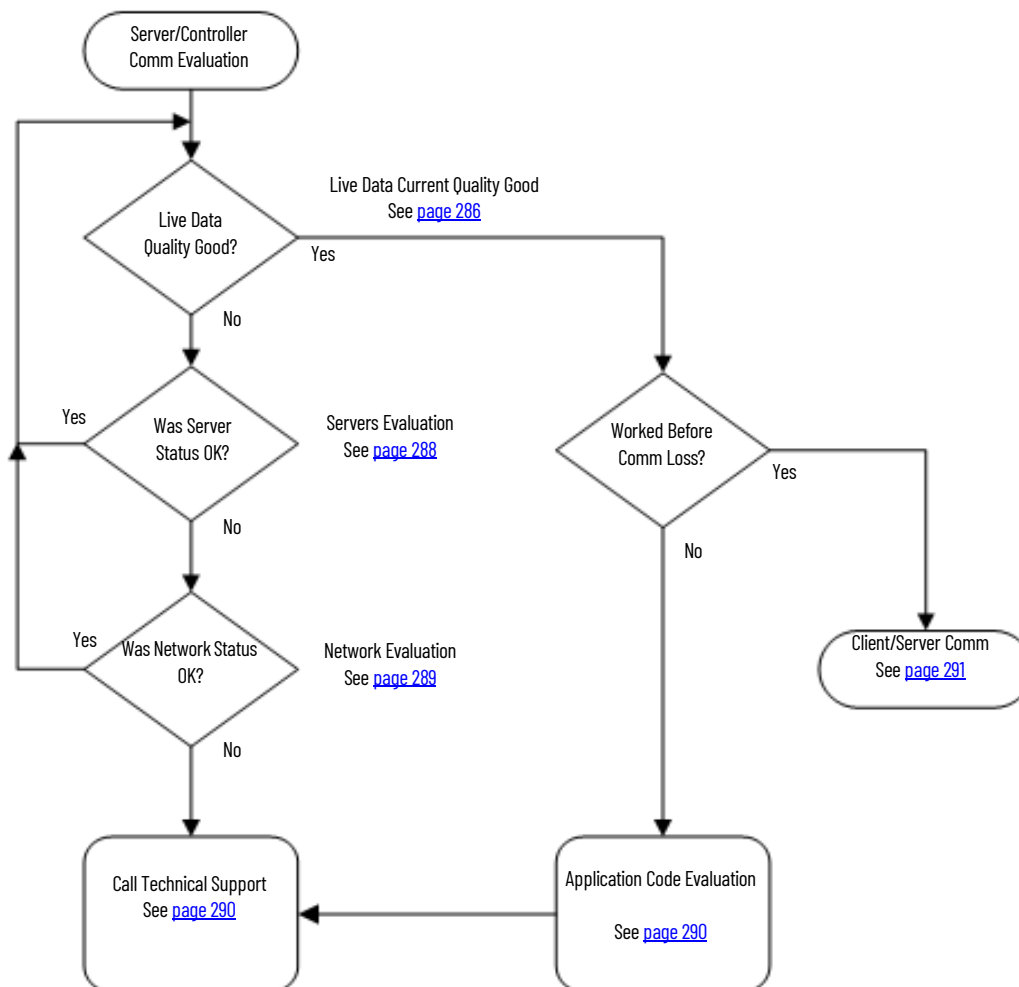
If you cannot open a FactoryTalk® View SE client application on your OWS, go directly to the Client/Server Communication Evaluation section on [page 291](#).

### Server and Controller Communication Evaluation

[Figure 24](#) shows how to diagnose a loss of communication between the (PASS) server and the controller. Make sure that the server has good quality communication with the controller and follow down the workflow to rule out any network issues.

Click the link or go to the respective page for specific information on each topic. If the server checks out okay, then you have the option to go to the client computer for additional troubleshooting or to call Technical Support.

Figure 24 - Resolve Server to Controller Communication

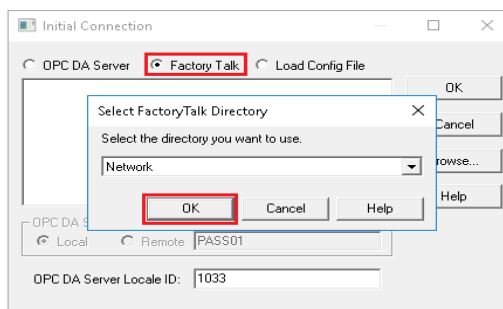


### Live Data Current Quality Good

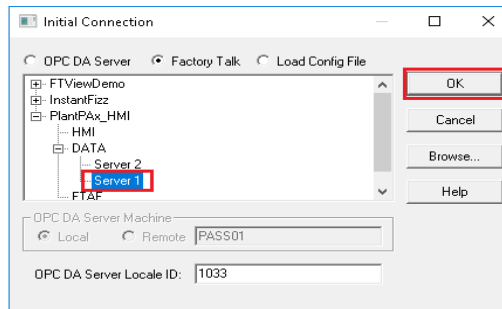
This procedure examines whether the controller communication is available at the server level. If the current quality is 'good', then you can rule out that the server is not talking to the controller.

1. Go to FactoryTalk Tools > FactoryTalk Live Data Test Client and select FactoryTalk and Network as the Initial Connection.

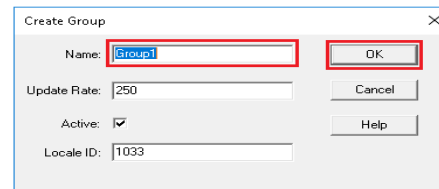
The Initial Connection dialog box appears.



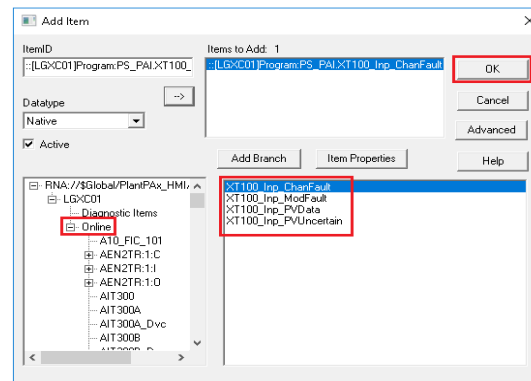
2. Browse to the data server area and click OK.



3. The Create Group dialog box appears.
4. Use the default or type your own group name and click OK.

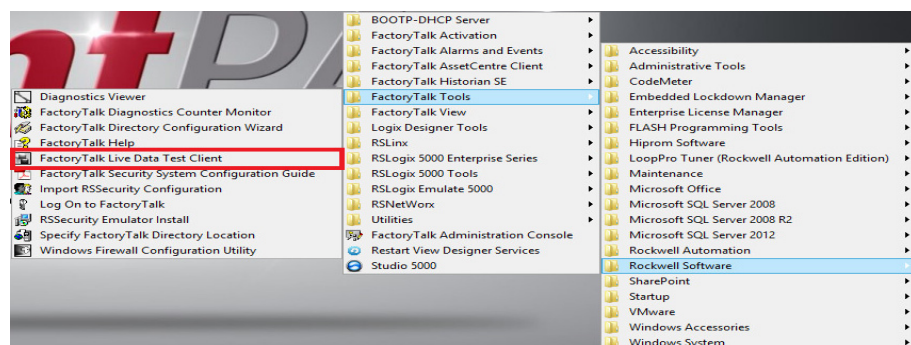


5. In the lower, left pane of the Add Item dialog box, browse to the controller, and select Online.



6. In the right pane, if no tags appear then proceed to [Servers Evaluation on page 288](#). Otherwise, click any tag in the controller and add the item.

The FactoryTalk Live Data Test Client dialog box appears.



7. Check that the Current Quality is 'Good'.

The 'Good' status indicates that you have communication from the server to the controller.

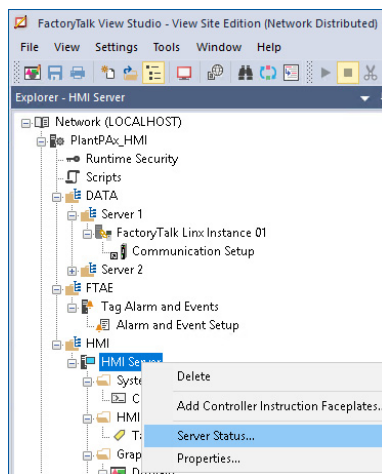
If the status is 'Bad', then proceed to [Servers Evaluation](#).



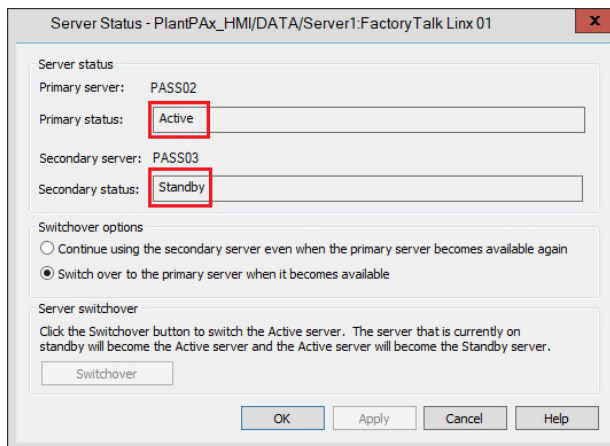
## Servers Evaluation

This procedure verifies that at least one server has active status. Complete these steps for the Data server and HMI server.

1. In the FactoryTalk Administration Console or FactoryTalk View Studio, right-click the Data server and choose Server Status.



The Data server status dialog box appears.



2. Make sure that the status is 'Active' for at least one of the servers.
3. Repeat for the HMI server.

## Was Modification Made?

If you found an issue and made a correction, go back and redo the Live Data procedure. Reverify that communication has been established between the server and controller.

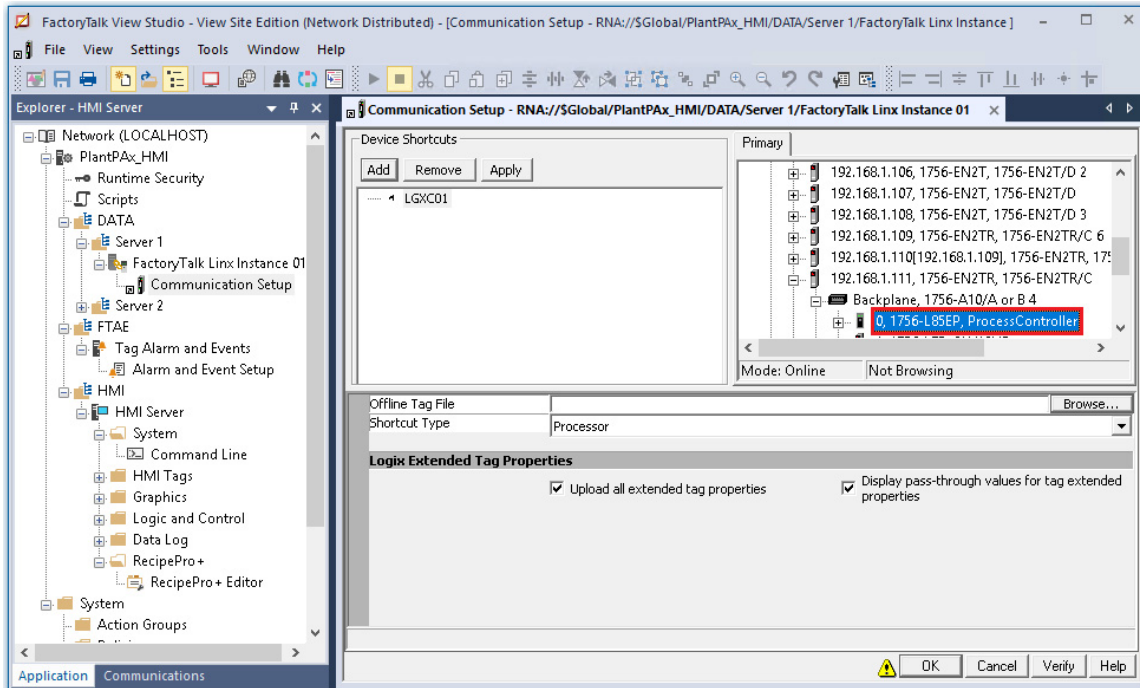
## Network Evaluation

Now you are analyzing whether the shortcut to the controller is valid. An incorrect path affects the controller communication to the server.



In a redundant system, perform these steps for the Primary and Secondary servers.

1. In the FactoryTalk Administration Console or FactoryTalk View Studio, open the Communications Setup.



2. Select the controller shortcut.

If the shortcut does not highlight the correct controller, then select the correct controller and save the shortcut.

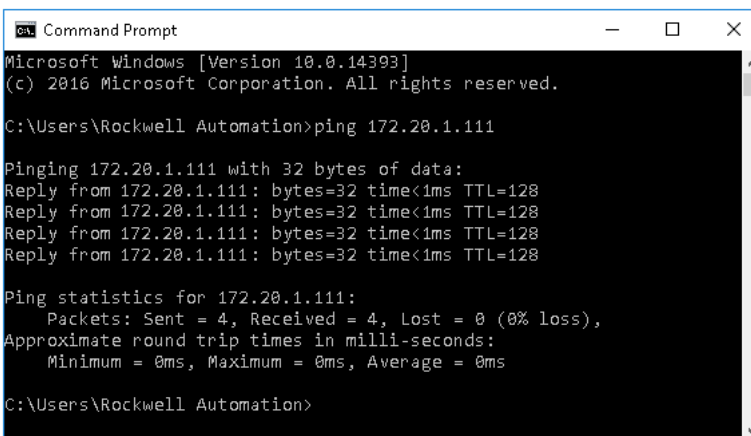
3. With the correct shortcut selected, expand the backplane.

If you can browse, then you have communication to the controller. Proceed to [Was Modification Made? on page 290](#).

If you cannot browse, then try to ping the controller from the PASS.

4. To ping the controller, do the following:
  - a. Click Start and type CMD into the Search text box.  
A command prompt opens.
  - b. Type 'Ping xxx.yyy.zzz.aaa', where the letters represent the IP address of the communication adapter.

- If the adapter responds, a similar display appears as shown.



```

Command Prompt
Microsoft Windows [Version 10.0.14393]
(c) 2016 Microsoft Corporation. All rights reserved.

C:\Users\Rockwell Automation>ping 172.20.1.111

Pinging 172.20.1.111 with 32 bytes of data:
Reply from 172.20.1.111: bytes=32 time<1ms TTL=128
Reply from 172.20.1.111: bytes=32 time<1ms TTL=128
Reply from 172.20.1.111: bytes=32 time<1ms TTL=128
Reply from 172.20.1.111: bytes=32 time<1ms TTL=128

Ping statistics for 172.20.1.111:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Users\Rockwell Automation>

```

- If your device does not respond, a 'Request Timed Out' message appears.

If the ping is successful, proceed to the next diagnostic action.

- Repeat steps [2...6](#) if you are using a redundant Data server.

### *Was Modification Made?*

If you found an issue and made a correction, go back and redo the Live Data procedure. Reverify that communication has been established between the server and controller.

### *Review Application Code Formatting*

If the server and controller are communicating and the problem still exists, we recommend that you check the project application code. Project components could be incorrectly configured.

Verify proper Live Data syntax for the following project elements:

- FactoryTalk View SE or FactoryTalk View ME:
  - Display parameter files
  - Display values, expressions, and animations
  - Global object parameters
  - Command buttons and macros
  - Data logger
  - Event detector
  - Derived tags

### *Contact Technical Support*

Call a Rockwell Automation Technical Support representative if the problem still exists after checking the following:

- Server communication status
- Controller shortcut
- Application code syntax

Email technical support the most recent data that is compiled from the PlantPAx checklists.

---

**IMPORTANT** If the size of the information packet cannot be sent via email, a technical support representative can help you post your information to the Rockwell Automation FTP site.

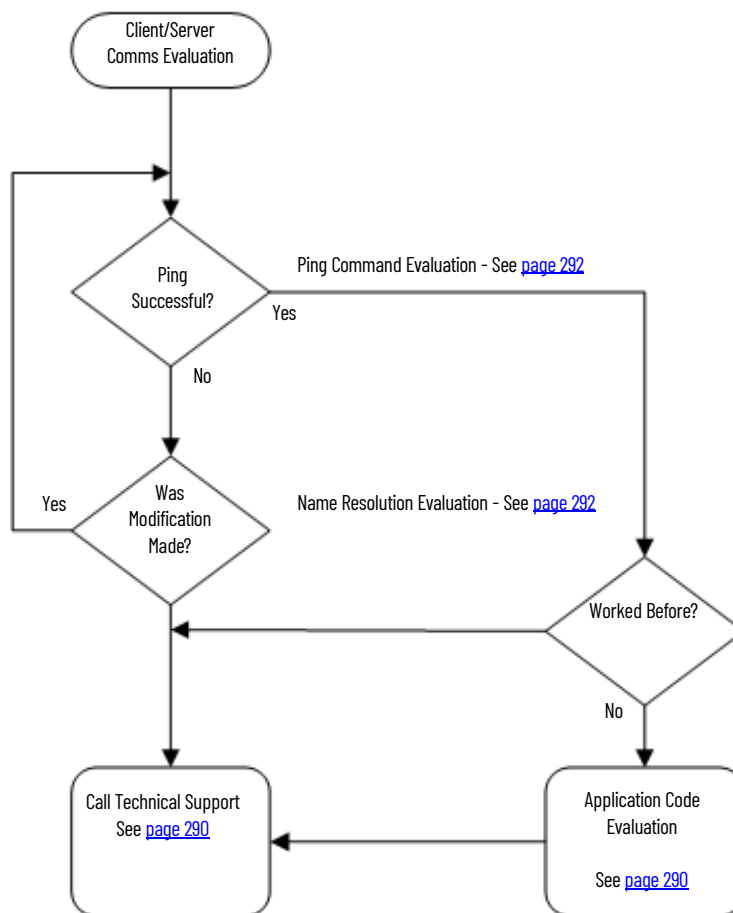
---

## Client and Server Communication Evaluation

[Figure 25](#) shows a workflow to resolve lost communication between a (PASS) server and a client. Work through the diagnostic activities until you identify an issue.

Click the link or go to the respective page for specific information on each topic. If the issue still exists, contact Technical Support with the details you have compiled to help with a resolution.

**Figure 25 - Resolve Server to Client Communication**



### *Ping Command Evaluation*

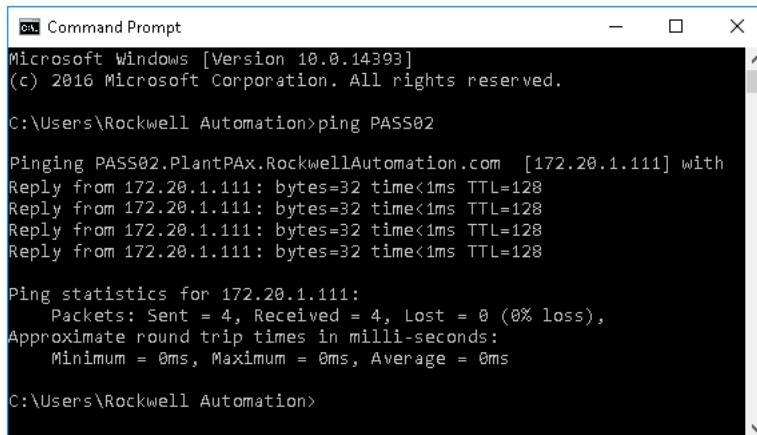
To check if the client computer is communicating with the server, start by pinging the computer.

Complete these steps.

1. Click Start and type CMD into the Search text box.

A command prompt opens.

2. Type 'Ping (and server name)'.
3. If the controller responds, a display appears similar to the following:



```
Command Prompt
Microsoft Windows [Version 10.0.14393]
(c) 2016 Microsoft Corporation. All rights reserved.

C:\Users\Rockwell Automation>ping PASS02

Pinging PASS02.PlantPax.RockwellAutomation.com [172.20.1.111] with
Reply from 172.20.1.111: bytes=32 time<1ms TTL=128
Reply from 172.20.1.111: bytes=32 time<1ms TTL=128
Reply from 172.20.1.111: bytes=32 time<1ms TTL=128
Reply from 172.20.1.111: bytes=32 time<1ms TTL=128

Ping statistics for 172.20.1.111:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Users\Rockwell Automation>
```

4. If your device does not respond, a 'Request Timed Out' message appears.

If the ping is successful, check your application code for proper syntax. See [page 290](#).

Also, make sure the firewall rules are not blocking the communication.

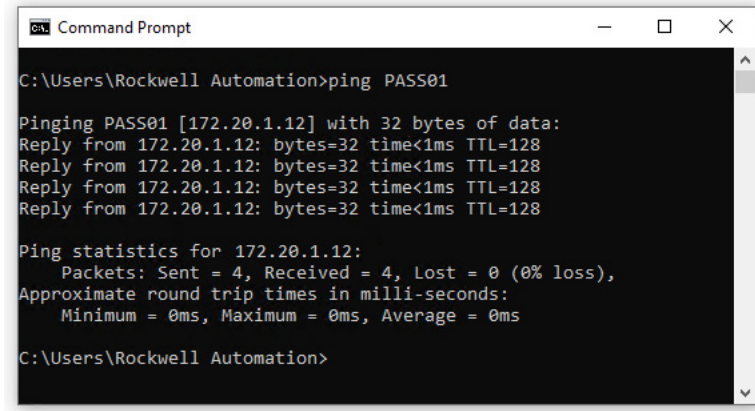
### *Name Resolution Evaluation*

This procedure verifies the mappings of IP addresses to host names. The steps apply if you are using a domain or a work group, with the latter explained last.

1. At the Command Prompt, type the NSLookup and server name and press Enter.
2. Type the name of the server that is being pinged.

If you receive the message 'DNS Request Timed Out', you typically do not have the Reverse Lookup Zone configured.

If the NSLookup ping provides the server name and IP address (as shown in the example), the server communication issue still exists.



```

C:\Users\Rockwell Automation>ping PASS01

Pinging PASS01 [172.20.1.12] with 32 bytes of data:
Reply from 172.20.1.12: bytes=32 time<1ms TTL=128
Reply from 172.20.1.12: bytes=32 time<1ms TTL=128
Reply from 172.20.1.12: bytes=32 time<1ms TTL=128
Reply from 172.20.1.12: bytes=32 time<1ms TTL=128

Ping statistics for 172.20.1.12:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

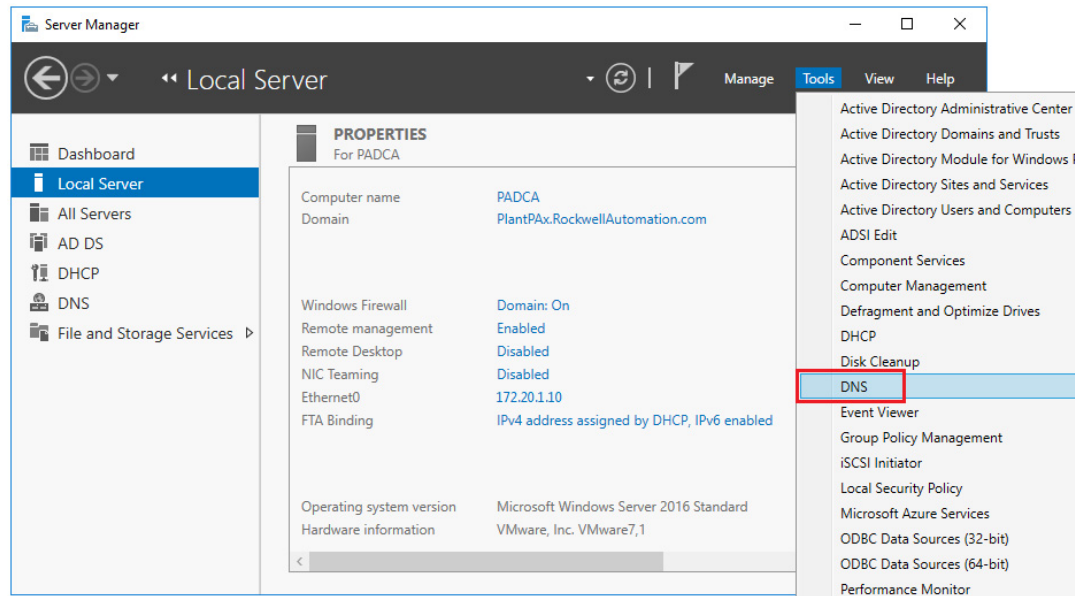
C:\Users\Rockwell Automation>

```

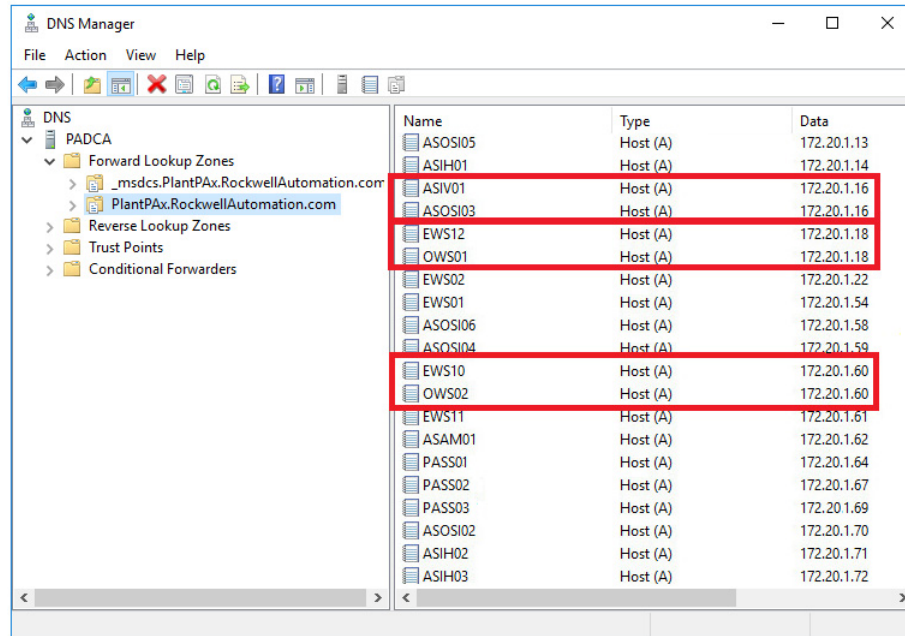
If the NSLookup ping does not provide a server name and IP address, then proceed with the following instructions on [page 293](#).

To verify that components do not have duplicate IP addresses, complete these steps.

1. From a DNS server, click Tools on the main menu and choose DNS.



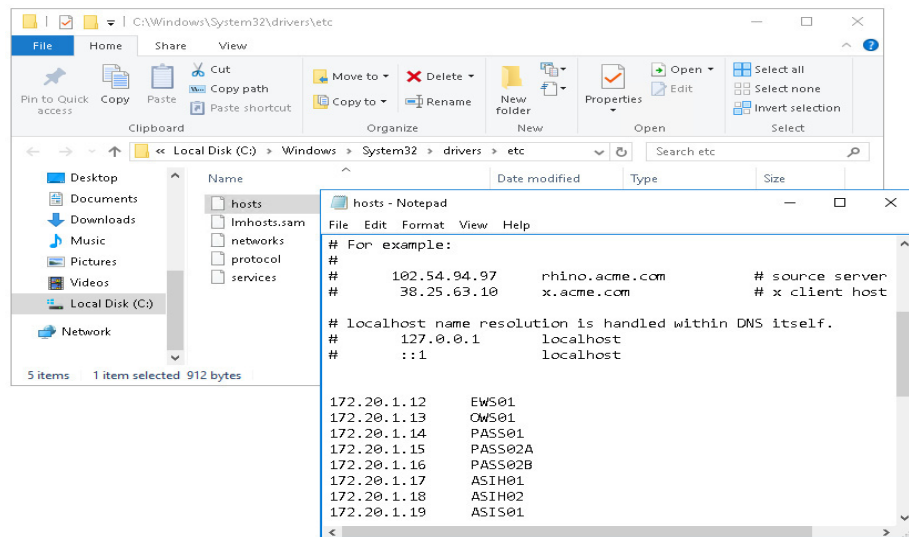
The DNS Manager display appears.



2. Verify each name has its own IP address to make sure that you are pinging the correct server via the client.

The example DNS Manager display shows several 'bad' computer names with the same IP address.

3. If you are using a workgroup, open the hosts folder in your Windows local hard disk drive.
4. Using Notepad, open the hosts file.



5. Verify each name has its own IP address to make sure that you are pinging the correct server via the client.

### Was Modification Made?

If you found an issue and made a correction, go back and ping the client computer again.

### *Review Application Code Formatting*

If the server and controller are communicating and the problem still exists, we recommend that you check the project application code. See [page 290](#).

### *Contact Technical Support*

Call a Rockwell Automation technical support representative if the problem still exists. See [page 290](#).

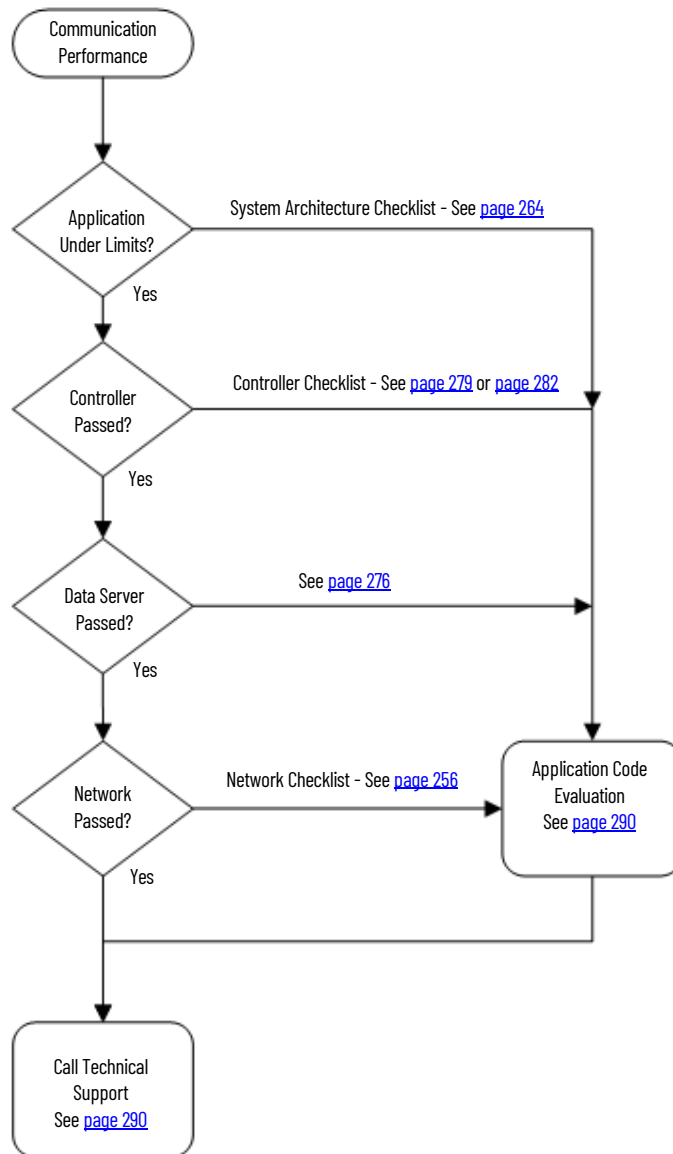


## Troubleshooting Scenario: HMI Display Access is Slow

[Figure 26](#) shows a workflow to resolve sluggish HMI displays. To target the root cause, work through the diagnostic activities until you identify an issue.

If the issue still exists, contact Technical Support with the details that you have compiled to help with a resolution.

**Figure 26 - Resolve Slow HMI Display Callup**



Action	Description
Application Under Limits?	A good starting point is to verify that your system design is within the sizing recommendations for a PlantPax system. Design attributes include the number of servers, number of assets, and so forth. To verify design attributes, see the <a href="#">System Architecture Tab on page 264</a> .
Controller Passed?	The next step is to check whether your controllers have the CPU and memory usage as prescribed by the PlantPax guidelines. These percentages vary depending on whether your application uses simplex or redundant controllers. For details, see the <a href="#">Controller 5x80 Tab on page 279</a> or <a href="#">Controller 5x70 Tab on page 282</a> .
Data Server Passed?	If the application design and controller setup are properly configured, check the Data server. Verify that the server is communicating data from the controllers to the HMI server and operator workstation. For details, see the FactoryTalk Linux worksheet section on <a href="#">page 276</a> .
Network Passed?	The health of the network is critical whether you are using a virtual or traditional operating system. There is a tool for analyzing network infrastructure. For details, see the <a href="#">System Infrastructure Tab on page 256</a> .
Review Application Code Formatting	For details, see <a href="#">page 290</a> .

**Notes:**

The following terms and abbreviations are used throughout this manual. For definitions of terms not listed here, refer to the Allen-Bradley Industrial Automation Glossary, publication [AG-7.1](#).

- Add-On Instruction** Add-On Instructions are reusable code objects that contain encapsulated logic that can streamline the implementation of your system. The objects let 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.
- alarm** An audible and/or visible means of indicating to the operator an equipment malfunction, process deviation, or abnormal condition that requires a response.
- alarm event** A push notification from the alarm object to the alarm subscriber that indicates a change in alarm state.
- alarm management** The processes and practices for determining, documenting, designing, operating, monitoring, and maintaining alarm systems.
- alarm object** The alarm system element that owns the alarm; it is responsible to identify an alarm, managing the state, and generating an alarm event.
- alarm priority** An attribute of In-Alarm event that informs you of the salience of the event.
- alarm system** The collection of hardware and software that detects an alarm state, communicates the indication of that state to the operator, and records changes in the alarm state.
- application server** The application server (AppServ) is a server on the Process Automation System Server (PASS), which is typically a FactoryTalk® Directory client of the PASS. Examples are AppServ-Batch for a FactoryTalk® Batch application or AppServ-Info for a Historian application.
- architecture** An architecture is a representation of a control and software system, as well as the process and discipline for effectively implementing the designs for such a system. An architecture conveys the information content of the related elements comprising a system, the relationships among those elements, and the rules governing those relationships.
- characterization** A characterization is the operation and collection of performance data for a representative process system to determine scalability, stability, and usability of a specific system configuration. A characterization is the following:
- Aimed at defining a complete system
  - Used to determine if the system is performing at specified level
  - Used to identify usability issues
  - Used to check and create rules, relationships, limits, and recommendations for system elements
- client** A client is hardware (personal computer) and software that provides an interface with a link into a system server application. In the Rockwell

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Automation® architecture, a client is a computer that is loaded with runtime software.

**control strategy** A control strategy is a system footprint to show the complexity of the following:

- Data servers
- Information storage
- Operator interface (graphics, faceplates)
- Control code (sequence, procedure, phases)
- I/O

These footprints establish a representative system loading that can be measured to identify the boundaries and limitations (implementation rules) of a process system.

**critical system attribute (CSA)** A critical system attribute (CSA) is a customer-facing characteristic that defines or identifies whether the system is performing as expected. CSAs are specific, visible indicators of overall system performance and usability.

CSAs have specified parameters that must be maintained and that set the base operational requirements for the system. There are many other attributes that are associated with system elements such as controller loading, computer loading, and network settings that must be configured properly to maintain system CSAs.

**display object** A display object is a functional group of display elements with animations.

**engineering workstation (EWS)** The engineering workstation (EWS) provides system configuration, development, and maintenance functions of the PlantPAX® system. The EWS contains development software, including FactoryTalk® View SE Studio and Studio 5000 Logix Designer®.

**global object** An object that is created once and can be referenced multiple times on multiple displays in an application.

**historian** A historian is a data collection system with the following components: collection, storage, compression, retrieval, reports, and analysis. Historian functions include raw sampling, compression, storage, retrieval, reconstitute, analyze, summarize, and present (reports and displays).

**historical data** Historical data is data that is used for the long-term analysis of past operation.

**host machine** A computer on which a hypervisor runs one or more virtual machines is called a host machine.

**Integrated Architecture® (IA)** Integrated Architecture® (IA) is the identifying name of Rockwell Automation group of products that use Rockwell Automation core-enabling technologies. The PlantPAX® system is a defined set of IA products that are configured in a prescribed way to provide optimal performance as a distributed control system.

**operator workstation (OWS)** The operator workstation (OWS) provides the graphical view and interface into the process. The workstation is a client of either a PASS or AppServ-HMI.

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<b>PlantPax distributed control system</b>	The PlantPax system has all the core capabilities that are expected in a world-class distributed control system (DCS). The system is built on a standards-based architecture by using Integrated Architecture components that enable multi-disciplined control and premier integration with the Rockwell Automation® intelligent motor control portfolio.
<b>Process Automation System Server (PASS)</b>	The Process Automation System Server (PASS) is the core PlantPax system server that provides central administration throughout the PlantPax system. The PASS is a required component.
<b>server</b>	Software component that serves data to an application (for example, data server). Typically, server software components are installed on server-class computers.
<b>system attribute</b>	A system attribute is an operational functionality that can be manipulated or measured and is used to establish the operational boundaries or system capability. For example workstation memory, number of parameters on a screen, and number of control loops. A system attribute can be independent or dependent.
<b>system element</b>	A system element is a distinctive system entity that is made up of a combination of hardware and software products that support an identifiable system function or role. A system element can be manipulated to vary system operation or capability. For example, engineering workstation (EWS), operator workstation (OWS), process automation system server (PASS), and controller.
<b>system infrastructure</b>	System infrastructure is the commercial off-the-shelf hardware and software that is required to enable system elements to work together as a system. For example, network switches, computers, and so forth.
<b>system server</b>	A system server expands the scope of a system by providing support for additional system capacity or optional system functions. For example, the Process Automation System Server (PASS) is a required component for all centralized and distributed process systems. The PASS provides central name resolution and system-wide, FactoryTalk® services. The PASS provides the capability to distribute information to the OWS and add to optional application servers to increase the scope of the process system.
<b>user-defined data type (UDT)</b>	Tag types that you create once and reuse in multiple tag templates, multiple times.
<b>workstation</b>	A workstation is a computer running development, configuration, and optional maintenance software. A workstation is not a server.

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**Notes:**





# Rockwell Automation Support

Use these resources to access support information.

<b>Technical Support Center</b>	Find help with how-to videos, FAQs, chat, user forums, and product notification updates.	<a href="http://rok.auto/support">rok.auto/support</a>
<b>Knowledgebase</b>	Access Knowledgebase articles.	<a href="http://rok.auto/knowledgebase">rok.auto/knowledgebase</a>
<b>Local Technical Support Phone Numbers</b>	Locate the telephone number for your country.	<a href="http://rok.auto/phonesupport">rok.auto/phonesupport</a>
<b>Literature Library</b>	Find installation instructions, manuals, brochures, and technical data publications.	<a href="http://rok.auto/literature">rok.auto/literature</a>
<b>Product Compatibility and Download Center (PCDC)</b>	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	<a href="http://rok.auto/pcdc">rok.auto/pcdc</a>

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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](http://rok.auto/pec).

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