



PlantPax Distributed Control System

System Release 5.30



Allen-Bradley

by ROCKWELL AUTOMATION

Selection Guide

The PlantPAX[®] system provides a modern approach to distributed control. The system shares common technology (Integrated Architecture[®] system) with all other automation disciplines in the plant. This approach creates a seamless information flow across the plant for optimization opportunities and enables a Connected Enterprise[®]. Our scalable platform provides you with the flexibility to implement a system appropriate for your application.

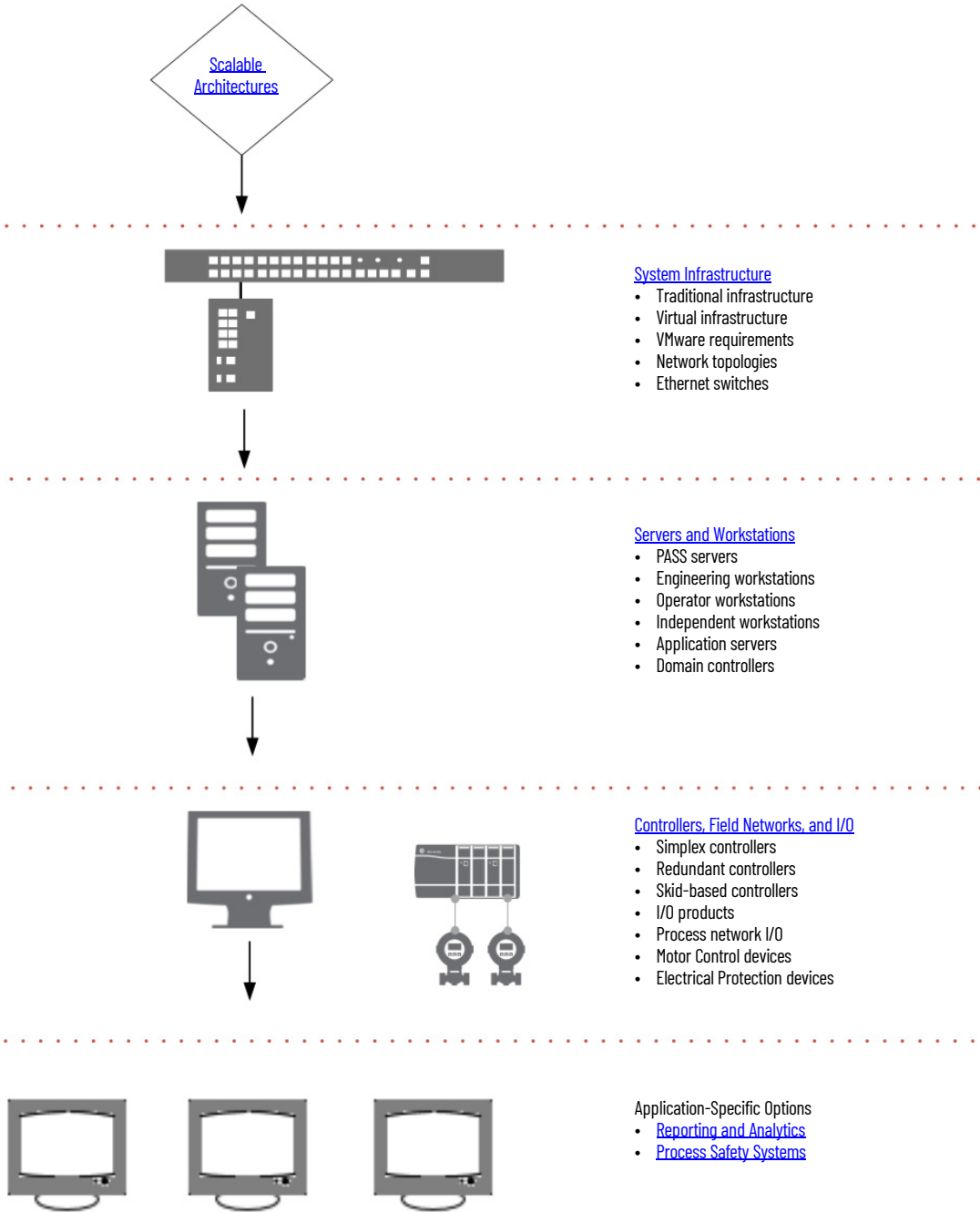
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Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
PlantPAX Distributed Control System Configuration and Implementation User Manual, publication PROCES-UM100	Provides procedures to configure infrastructure components for your PlantPAX system.
Rockwell Automation Library of Process Objects, publication PROCES-RM200	Provides information on how to use the Process library, including the PlantPAX Instructions and display elements.
FLEXHA 5000 I/O System User Manual, publication 5015-UM001	Provides information on how to use FLEXHA 5000 [™] I/O
PlantPAX Hardware Specifications and Certifications, publication PROCES-SR027	Provides information on PlantPAX system hardware specifications and certifications.
Process Automation System Training Curriculum, publication GMST-SP027	Describes the courses that are available for a better understanding of the PlantPAX system.
https://www.rockwellautomation.com	Provides general information about Rockwell Automation process capabilities. From the menu bar, select Products> Distributed Control Systems.
https://www.rockwellautomation.com/en-us/capabilities/process-solutions/process-systems/distributed-control-system-migration.html	Features prerecorded webinars on the DCS migration program and capabilities for process customers.
Product Compatibility and Download Center at https://compatibility.rockwellautomation.com/Pages/home.aspx	Website helps you find product-related downloads including firmware, release notes, associated software, drivers, tools, and utilities.
Infrastructure	
Stratix Ethernet Device Specifications Technical Data, publication 1783-TD002	Contains product specifications, certifications, and catalog numbers for Ethernet switch devices.
Converged Plantwide Ethernet (CPwE) Design and Implementation Guide, publication ENET-TD001	Provides information on Ethernet security and firewalls.
Field Device Integration	
Rockwell Automation Library of Intelligent Electronic Protection Devices, publication PROCES-RM211	This manual describes how to configure the Add-On Instructions and visualization objects to integrate intelligent electronic protection devices by using IEC 61850 or EtherNet/IP [™] connectivity within the PlantPAX [®] System.
Integrate E+H Instruments in a PlantPAX System Integration Document, publication PROCES-SG003	Provides pre-engineered, pre-tested, supported, and maintained integrated solutions for plant-wide diagnostics and lifecycle management.
https://www.endress.com/	Products from Endress+Hauser.
Business partners	Provides a comprehensive listing of searchable Rockwell Automation Business Partners.



A PlantPAx system consists of these system elements.

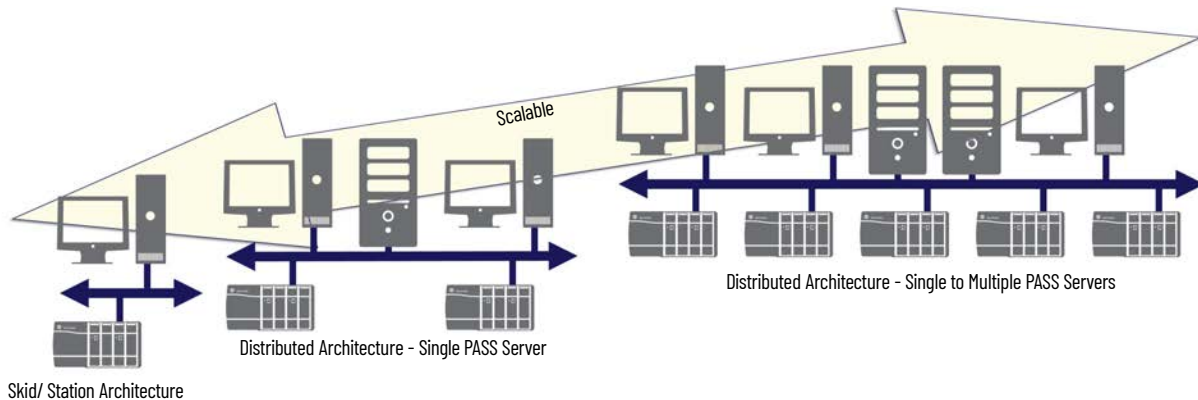
Table 1 - System Element Descriptions

System Element	Description
Process Automation System Server (PASS)	The PASS is a required system element that can host displays, alarms, and data connections to controllers. Multiple PASS servers can be used to provide additional system capacity or to create logical segregation of application content that is based on the process. For smaller systems, the PASS - C (consolidated PASS server) supports functions that otherwise would be hosted on application servers.
Operator workstation (OWS) and Application server (AppServ-OWS)	The OWS and AppServ-OWS provides an interactive graphical interface to monitor and control the process. The AppServ-OWS uses Microsoft® Remote Desktop Services (RDS) technology to serve multiple instances of the OWS as thin clients from one server. The technology provides for FactoryTalk® View SE thin clients that run applications and process data on a remote computer.
Engineering workstation (EWS) and Application server (AppServ-EWS)	The EWS and AppServ-EWS provides a central location for configuring the system and monitoring/maintaining system operation. The AppServ-EWS uses Microsoft Remote Desktop Services (RDS) technology to serve multiple instances of the EWS as thin clients from one server. The technology provides for FactoryTalk View SE thin clients that run applications and process data on a remote computer.
AppServ-Asset management	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 asset inventory, source control, audits, change notifications, reporting, and security.
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.
AppServ-Info	Data management storage can include a Historian or Microsoft SQL server. There are two different types of AppServ-Info servers depending on the function that is being provided: FactoryTalk® Historian software and the Microsoft SQL server.
Controllers	The ControlLogix® and CompactLogix™ controllers support continuous process and batch applications. These controllers also support discrete and motion applications.
Independent workstation (IndWS)	The independent workstation acts as a PASS, EWS, and OWS for single-station systems (independent class).
Domain controller	A domain controller is a server that manages security authentication requests within the Windows® server domain. PlantPAx uses a domain controller to store user account information, authenticate users, and enforce security policies.

Scalable Architectures

Rockwell Automation characterizes the PlantPAx system that is based on its size or architecture class. A 'characterized' (system-tested) classification yields system performance data and recommended hardware and software configurations. The classes of PlantPAx architecture offer system scalability while organizing Integrated Architecture products consistent with process industry expectations.

The architecture classes include the following:

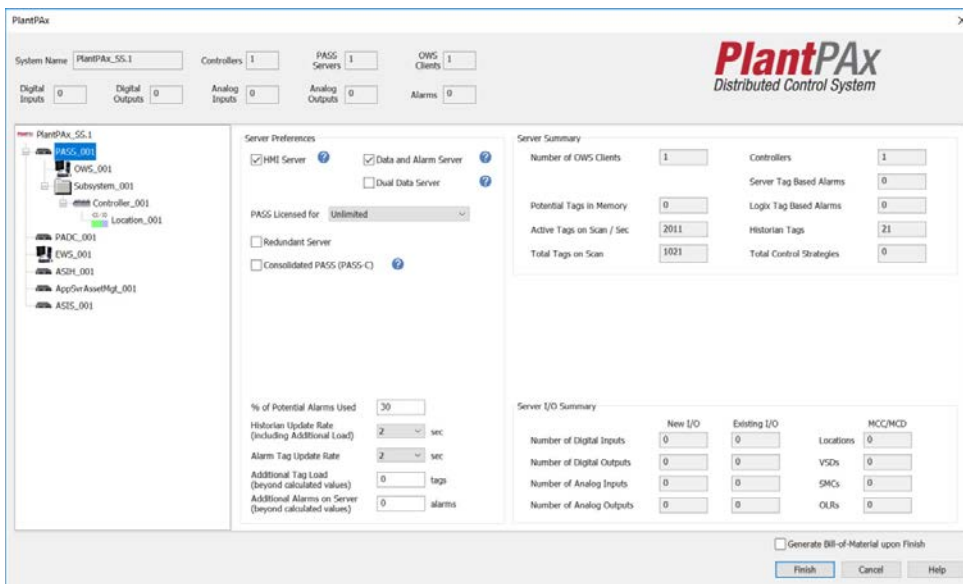


Consideration	Skid Station Architecture (FactoryTalk SE Station) (small <2000 I/O)	Distributed Architecture (single PASS (consolidated)) (small <2000 I/O)	Distributed Architecture (single to multiple PASS servers) (medium= 2,000...10,000 I/O)	Distributed Architecture (single to multiple PASS servers) (large = 10,000+ I/O)
FactoryTalk Directory	The FactoryTalk directory does not require to be placed on a standalone server.	The FactoryTalk directory does not require to be placed on a standalone server.	PlantPax recommends that the FactoryTalk Directory is placed on a standalone server.	PlantPax recommends that the FactoryTalk Directory is placed on a standalone server.
FactoryTalk Activation Server	-	PlantPax recommends that the FactoryTalk Activation server is placed on the FactoryTalk Directory server.	PlantPax recommends that the FactoryTalk Activation server is placed on the FactoryTalk Directory server.	PlantPax recommends that the FactoryTalk Activation server is placed on the FactoryTalk Directory server.
Process Automation System Server (PASS) Note: If redundancy is required, a secondary PASS is needed.	Single SE Station serves as PASS and OWS in an independent workstation. Note: PanelView™ products require PlantPax 4.10 Library or earlier.	For smaller systems, one PASS-C is required that typically includes the following: <ul style="list-style-type: none"> • FactoryTalk Directory server • HMI server • Data server • Alarm and Event server • EWS / OWS The PASS-C supports functions that would otherwise be hosted on separate application servers. The PASS-C single computer also includes the following in a single workstation: <ul style="list-style-type: none"> • FactoryTalk Historian • FactoryTalk AssetCentre • Microsoft SQL Server • FactoryTalk Batch IMPORTANT: An additional PASS-C is required for redundancy. Note: Licensing per application is separate from the PASS-C template.	One PASS required that typically includes the following: <ul style="list-style-type: none"> • HMI server • Data server (Up to 2 Data services per PASS) • Alarm and Event service Note: Optional redundancy is available. Note: Additional PASS Servers can be deployed to accommodate additional data and alarm requirements. No additional FactoryTalk licensing is required.	
Engineering Workstation (EWS)	1 EWS required. Provided separately	Included within PASS-C image	1 EWS required. AppServ-EWS as needed	1 EWS required. Can have as many as 5 active and in use EWSS AppServ-EWS as needed
Operator Workstation OWS (Clients)	Provided separately via independent workstation or thin client. FactoryTalk View SE Station license can transition to FactoryTalk View SE Client for DCS integration. Note: PanelView™ products require PlantPax 4.10 Library or earlier.	Max 10 OWS clients Note: PASS-C requires additional machines outside of PASS-C image.	Can have as many as 120 OWS clients. AppServ-OWS as needed.	
Controllers	1...5 Compact or ControlLogix	1...5 Compact or ControlLogix	ControlLogix Architecture Actual count varies depending on application requirements. There's no hard limit to the number of controllers. The number of controllers that can be supported per PASS (data server) depends on controller selection, controller loading, and number of OWS.	
Application Server - FactoryTalk AssetCentre	Not applicable. If attached to PlantPax DCS, confirm FactoryTalk AssetCentre can access the skid's asset details.	Included within the PASS-C image	AppServ-Asset (FactoryTalk AssetCentre) is a required component for the PlantPax DCS.	
Application servers	Not applicable. In chassis historian and in controller batch capabilities are available. Can be also integrated with a distributed architecture.	Included within the PASS-C image	AppServ-Batch as needed. AppServ-Information Management (FactoryTalk Historian or AppServ-Information Management	AppServ-Batch as needed. AppServ-Information Management (FactoryTalk Historian) as needed.

Consideration	Skid Station Architecture (FactoryTalk SE Station) (small <2000 I/O)	Distributed Architecture (single PASS (consolidated)) (small <2000 I/O)	Distributed Architecture (single to multiple PASS servers) (medium= 2,000...10,000 I/O)	Distributed Architecture (single to multiple PASS servers) (large = 10,000+ I/O)
Application Servers Info - SQL	Not applicable. If attached to PlantPax DCS, confirm that FactoryTalk AssetCentre can access.	Included within PASS-C image	It's recommended that AppServ-Info (SQL) is placed on its own server.	It's recommended that AppServ-Info (SQL) is placed on its own server.
Recommended Reference Architecture	Simplex / DLR	Simplex / DLR (Mix)	Simplex / DLR / PRP (Mix)	Simplex / DLR / PRP (Mix)

PlantPax System Estimator

Rockwell Automation offers the PlantPax System Estimator tool as part of the Integrated Architecture Builder software. The System Estimator tool lets you define your PlantPax system and verifies that your architecture and system elements are sized properly.



The System Estimator tool provides helps you select system elements and size the system. The sizing guidelines are based on the rules and recommendations from PlantPax system characterization to achieve known performance and reliability.

The following items are created based on your inputs:

- Supervisory Ethernet network with all servers, operator, and engineering workstations and controller chassis
- List of required software catalog numbers
- List of network components per subsystem
- List of controllers, I/O, and process devices

After selecting the system elements as defined in this guide, use the PlantPax System Estimator tool to modify their properties. You can then create a bill of materials (BOM) with the Integrated Architecture Builder software. The BOM includes controllers, I/O, networks, drives, devices, and software products that comprise your Distributed Control System.

To access the Integrated Architecture Builder software to use the PlantPax System Estimator tool, download the [Product Selection Toolbox™](#).

Software Release Information

Performance guidelines are based on the use of the software versions listed. For new PlantPax systems, we recommend that you use these versions of software.

- Studio 5000 Logix Designer® application, version 36
- Studio 5000® Application Code Manager, version 4
- FactoryTalk® View software, version 14
- FactoryTalk® Batch software, version 16
- FactoryTalk AssetCentre software, version 13
- FactoryTalk Historian software, version 9

For the latest compatible software information, see the [Product Compatibility and Download Center](#).

Antivirus

PlantPax recommends the installation of antivirus software on servers and workstations running industrial automation software. Although all FactoryTalk software is expected to be compatible with the antivirus protections on the market, PlantPax has been tested with Windows Defender and CrowdStrike antivirus packages. These antivirus packages had no adverse effect on the performance of the PlantPax Distributed Control System when used with the default configurations.

Proper configuration, management, and updating of antivirus software is required. Any antivirus protection can impact operation if the configuration of firewalls, network threat protections, and access controls is too restrictive.

CIP Security

PlantPax recommends the use of CIP Security within the reference architectures for class 3 communications. Use the PlantPax System Estimator to properly size a system with CIP Security. PlantPax tests found that CIP Security has minimal impact on system performance while using Integrity protection for Class 3 communication between the plant servers and controllers.

PlantPax also recommends using the Trusted Slot setting with the controller properties. Communication from the controller to other devices, such as remote I/O modules and other controllers, are not impacted by using the Trusted Slot setting. When using the Trusted Slot setting, configuration changes to the controller can only be made through selected networks (EN4TR with CIP security).

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

Your system integrator uses the Asset Inventory Agent within a FactoryTalk AssetCentre project to generate a system inventory file. Before delivering your system, your system integrator registers your System ID with Rockwell Automation and provides you directions on how to access your MyEquipment portal.

The System ID is **only** available if you purchase a PlantPax PASS Bundle. The PlantPax PASS Activation serial number is the System ID.

PlantPax Bundles

PlantPax PASS Large 25 Client

This software bundle provides everything that you need to run a PlantPax DCS system with 25 HMI client stations. Included in the bundle is an HMI server with unlimited displays, 25 client stations, and unlimited browser-based HTML client connections. Core asset management and a PlantPax System ID are integrated into the bundle. Additional assets can be added under recommended products.

Support / License Options	Catalog Number
8 x 5 Support / Subscription License	9528C-PASS25T11
8 x 5 Support / Perpetual License	9528M-PASS25T11
24 x 7 Support / Subscription License	9528C-PASS25T12
24 x 7 Support / Perpetual License	9528M-PASS25T12



The catalog numbers in the previous table are for Electronic Software Delivery. To order software in media format, append the catalog number with "M".

For example: 9528C-PASS25T11M

Included in the Bundle

Description	Subscription License	Perpetual License
FactoryTalk View SE Large Bundle: Unlimited Display Server™ with 25 Clients	9701-VWSVBDL25T1T	9701-VWSVBDL25T1TPE
FactoryTalk View SE Large Bundle: Unlimited Display Server with 25 Clients Update	9701U-VWSVBDL25T1T	9701MU-VWSVBDL25T11
FactoryTalk View SE Large Bundle: Unlimited Display Server with 25 Clients Support	RSSPN-VWSVBDL25T11 (8 x 5 Support) RSSPN-VWSVBDL25T12 (24 x 7 Support)	RSSPM-VWSVBDL25T11 (8 x 5 Support) RSSPM-VWSVBDL25T11 (24 x 7 Support)
FactoryTalk AssetCentre Base	9515-FTACT2T	9515-FTACBASEPE
FactoryTalk AssetCentre Base Update	9515U-FTACT2T	9515MU-FTACT2T
FactoryTalk AssetCentre Base Support	RSSPN-FTACT21 (8 x 5 Support) RSSPN-FTACT22 (24 x 7 Support)	RSSPM-FTACT21 (8 x 5 Support) RSSPM-FTACT22 (24 x 7 Support)
FactoryTalk AssetCentre Inventory Agent	9515-FTACTIAENT	9515-FTACTIAENTP
FactoryTalk AssetCentre Inventory Agent Update	9515U-FTACT7T	9515MU-FTACT7T
FactoryTalk AssetCentre Inventory Agent Support	RSSPN-FTACT71 (8 x 5 Support) RSSPN-FTACT72 (24 x 7 Support)	RSSPM-FTACT71 (8 x 5 Support) RSSPM-FTACT72 (24 x 7 Support)
My Equipment Portal Subscription	9300-MYEQUIP	
Activation	9528-PAXPASSCLI	9528-PAXPASSCLIP

PlantPax PASS Medium 10 Client

This software bundle provides everything that you need to run a PlantPax DCS system with 10 HMI client stations. Included in the bundle is an HMI server with unlimited displays, 10 client stations, and unlimited browser-based HTML client connections. Core asset management and a PlantPax System ID are integrated into the bundle. Additional assets can be added under recommended products.

Support / License Options	Catalog Number
8 x 5 Support / Subscription License	9528C-PASS10T21
8 x 5 Support / Perpetual License	9528M-PASS10T21
24 x 7 Support / Subscription License	9528C-PASS10T22
24 x 7 Support / Perpetual License	9528M-PASS10T22



The catalog numbers in the previous table are for Electronic Software Delivery. To order software in media format, append the catalog number with "M".

For example: 9528C-PASS10T21M

Included in the Bundle

Description	Subscription License	Perpetual License
FactoryTalk View SE Medium Bundle: Unlimited Display Server with 10 Clients	9701-VWSVBDL10T2T	9701-VWSVBDL10T2TPE
FactoryTalk View SE Medium Bundle: Unlimited Display Server with 10 Clients Update	9701U-VWSVBDL10T2T	9701MU-VWSVBDL10T21
FactoryTalk View SE Medium Bundle: Unlimited Display Server with 10 Clients Support	RSSPN-VWSVBDL10T21 (8 x 5 Support) RSSPN-VWSVBDL10T22 (24 x 7 Support)	RSSPM-VWSVBDL10T21 (8 x 5 Support) RSSPM-VWSVBDL10T22 (24 x 7 Support)
FactoryTalk AssetCentre Base	9515-FTACT2T	9515-FTACBASEPE
FactoryTalk AssetCentre Base Update	9515U-FTACT2T	9515MU-FTACT2T
FactoryTalk AssetCentre Base Support	RSSPN-FTACT21 (8 x 5 Support) RSSPN-FTACT22 (24 x 7 Support)	RSSPM-FTACT21 (8 x 5 Support) RSSPM-FTACT22 (24 x 7 Support)
FactoryTalk AssetCentre Inventory Agent	9515-FTACTIAENT	9515-FTACTIAENTP
FactoryTalk AssetCentre Inventory Agent Update	9515U-FTACT7T	9515MU-FTACT7T
FactoryTalk AssetCentre Inventory Agent Support	RSSPN-FTACT71 (8 x 5 Support) RSSPN-FTACT72 (24 x 7 Support)	RSSPM-FTACT71 (8 x 5 Support) RSSPM-FTACT72 (24 x 7 Support)
My Equipment Portal Subscription	9300-MYEQUIP	
Activation	9528-PAXPASSCLI	9528-PAXPASSCLIFE

PlantPax PASS Small 5 Client

This software bundle provides everything that you need to run a PlantPax DCS system with five HMI client stations. Included in the bundle is an HMI server with unlimited displays, five client stations, and unlimited browser-based HTML client connections. Core asset management and a PlantPax System ID are integrated into the bundle. Additional assets can be added under recommended products.

Support / License Options	Catalog Number
8 x 5 Support / Subscription License	9528C-PASS05T31
8 x 5 Support / Perpetual License	9528M-PASS05T31
24 x 7 Support / Subscription License	9528C-PASS05T32
24 x 7 Support / Perpetual License	9528M-PASS05T32



The catalog numbers in the previous table are for Electronic Software Delivery. To order software in media format, append the catalog number with "M".

For example: 9528C-PASS05T31M

Included in the Bundle

Description	Subscription License	Perpetual License
FactoryTalk View SE Small Bundle: Unlimited Display Server with 5 Clients	9701-VWSVBDL05T3T	9701-VWSVBDL05T3TPE
FactoryTalk View SE Small Bundle: Unlimited Display Server with 5 Clients Update	9701U-VWSVBDL05T3T	99701MU-VWSVBDL05T31
FactoryTalk View SE Small Bundle: Unlimited Display Server with 5 Clients Support	RSSPN-VWSVBDL05T31 (8 x 5 Support) RSSPN-VWSVBDL05T32 (24 x 7Support)	RSSPM-VWSVBDL05T31 (8 x 5 Support) RSSPM-VWSVBDL05T32 (24 x 7Support)
FactoryTalk AssetCentre Base	9515-FTACT2T	9515-FTACBASEPE
FactoryTalk AssetCentre Base Update	9515U-FTACT2T	9515MU-FTACT2T
FactoryTalk AssetCentre Base Support	RSSPN-FTACT21 (8 x 5 Support) RSSPN-FTACT22 (24 x 7Support)	RSSPM-FTACT21 (8 x 5 Support) RSSPM-FTACT22 (24 x 7Support)
FactoryTalk AssetCentre Inventory Agent	9515-FTACTIAENT	9515-FTACTIAENTP
FactoryTalk AssetCentre Inventory Agent Update	9515U-FTACT7T	9515MU-FTACT7T
FactoryTalk AssetCentre Inventory Agent Support	RSSPN-FTACT71 (8 x 5 Support) RSSPN-FTACT72 (24 x 7 Support)	RSSPM-FTACT71 (8 x 5 Support) RSSPM-FTACT72 (24 x 7 Support)
My Equipment Portal Subscription	9300-MYEQUIP	
Activation	9528-PAXPASSCLI	9528-PAXPASSCLIFE

PlantPax PASS Upgrade

This software bundle provides a pathway for existing customers to get a PlantPax System ID when modernizing their existing PlantPax systems. The PlantPax System ID is integrated into this bundle with the same lifecycle management available in the standard PASS bundles. Additionally, it provides a subscription to asset management software.

Support Options	Catalog Number
8 x 5 Support	9528C-PAXUPGT11
24 x 7 Support	9528C-PAXUPGT12



The catalog numbers in the previous table are for Electronic Software Delivery. To order software in media format, append the catalog number with "M".

For example: 9528C-PAXUPGT11M

Included in the Bundle

Description	Subscription License
FactoryTalk AssetCentre Base	9515-FACT2T
FactoryTalk AssetCentre Base Update	9515U-FACT2T
FactoryTalk AssetCentre Base Support	RSSPN-FACT21 (8 x 5 Support) RSSPN-FACT22 (24 x 7Support)
FactoryTalk AssetCentre Inventory Agent	9515-FACTIAENT
FactoryTalk AssetCentre Inventory Agent Update	9515U-FACT7T
FactoryTalk AssetCentre Inventory Agent Support	RSSPN-FACT71 (8 x 5 Support) RSSPN-FACT72 (24 x 7Support)
My Equipment Portal Subscription	9300-MYEQUIP
Activation	9528-PAXPASSUPGE

Notes:

Virtual Infrastructure

The necessary server elements in a PlantPAx installation are typically deployed as virtual machines. There are a range of means to deploy and manage a virtual machine infrastructure. This section provides guidance on requirements when deploying a VMware vCenter environment for a PlantPAx system.

Table 2 - Virtual Infrastructure Components

Model Type	Description
<p>Industrial Data Center</p> <ul style="list-style-type: none"> • E-2000 supports 2 host servers • E-3000 supports 3 host servers 	<p>The Industrial Data Center (IDC) is a centralized hub for hosting virtual servers and workstations. The IDC pre-assembled unit includes on-site commissioning of your system by a Rockwell Automation representative.</p> <p>Each IDC is in a cabinet (19 in.) that includes host servers and the following:</p> <ul style="list-style-type: none"> • Rockwell Automation support • 1 management server • Software defined storage • VMware vSphere standard • VMware vCenter standard • Redundant server access switches • Virtual machine backup solution <p style="text-align: right;">Optional items:</p> <ul style="list-style-type: none"> • Expands up to 10 physical servers • UPS or redundant UPS • Thin clients <p>For purchase information, contact your local distributor or Rockwell Automation sales representative. Provide the representatives with a list of applications that you plan to deploy in an IDC.</p> <p>For more information, see the Industrial Data Center Product Profile, publication GSMN-PP001.</p>
<p>VersaVirtual™ Appliance</p> <ul style="list-style-type: none"> • VersaVirtual 1000 supports 1 host server • VersaVirtual 2000 supports 2 host servers 	<p>The VersaVirtual Appliance is a hyperconverged (computing, networking, and storage) appliance for entry-level virtualization in a managed environment. One server can run multiple operating systems. The appliance can support as many as 15 applications.</p> <p>Each application includes the host servers and the following:</p> <ul style="list-style-type: none"> • Rockwell Automation support • Pre-engineered and configured virtualization software • 1 management server (VersaVirtual 2000 only) • Software defined storage (VersaVirtual 2000 only) • VMware vSphere standard • VMware vCenter foundation • 2x10G copper uplink ports <p>For more information, see VersaVirtual Appliance.</p>
<p>Stratus ztC Edge</p> <ul style="list-style-type: none"> • Stratus ztC Edge 250i 	<p>ztC Edge from Stratus brings the benefits of virtualization and fault-tolerant computing to the industrial edge. Rugged, hot-swappable nodes can deploy on DIN rails inside the control cabinet. Run a PASS-C with additional capabilities on the ztC Edge to form a solution-in-a-box for smaller locations.</p> <p>For purchase information, contact your distributor.</p> <p>For more information, see ztC Edge.</p>

If you're considering virtualization, we suggest that you visit the [Rockwell Automation Industrial Networks website](#).

VMware Component Requirements

The VMware vCenter server provides a centralized platform for managing your VMware vSphere environments. The virtual desktop and virtual server require resources from the physical infrastructure to operate. When you purchase hardware, consider future expansion plans by adding an additional 20...30% of resources. VMware makes it simple to scale the system size upward by adding servers in the future to provide additional resources.

Remember to divide the total system requirements by the minimum number of servers that are required to run the system at any given time. For example, with a three-server system that uses VMware fault tolerance or high availability, you divide by two. This type of calculation makes sure that the system can continue to run with two servers if one server fails.

VMware Sizing

Virtual Machines are limited by the CPU megahertz of the physical core. A common misconception is that a VM can use as much CPU megahertz as needed from the combined total available. One vCPU VM never uses more megahertz than the maximum of one CPU/core. If a VM has two vCPUs, it never uses more megahertz than the maximum of each CPU/core.

Table 3 - CPU and PlantPAx Resource Requirements

Server and Workstation Type	vCPU	vRAM (GB)	vHardDisk (GB)
Process Automation Domain Controller (PADC)	1	4	40
Process Automation System Server (PASS)	8	16	60
Process Automation System Server - Consolidated (PASS-C)	16	32	120
Operator Workstation (OWS)	2	4	40
Engineering Workstation (EWS)	4	8	100
Operator Workstation Application Server (AppServ-OWS)	8	16	60
Engineering Workstation Application Server (AppServ-EWS)	8	16	100
Information Management Application Server Historian (AppServ-Info Historian)	8	8	120
Information Management Application Server SQL (AppServ-Info SQL)	2	4	120
Asset Management Server (AppServ-Asset)	4	16	60
Batch Management Server (AppServ-Batch)	2	8	60
VMware vCenter Server ⁽¹⁾	2	14	600

(1) These requirements are for vCenter version 8.0. Depending on the version of vCenter used, these requirements may change. Verify the requirements with VMWare.

Reference Network Topologies

PlantPAx reference topologies take advantage of converged architectures, that support:

- Access to device webpages throughout the architecture
- Access to the data in smart process devices from outside the local network

These reference topologies include:

- [Example 1: Redundant PRP Topology](#)
- [Example 2: Resilient DLR Topology](#)
- [Example 3: Simplex - Star Topology](#)
- [Example 4 A: PRP Skid and MCC Lineup](#)
- [Example 4 B: DLR Skid and MCC Lineup](#)
- [Example 4C: Simplex Skid and MCC Lineup](#)

Example 1: Redundant PRP Topology

Redundant PRP topology is used for critical operations, and includes infrastructure duplication, multiple fault tolerance capability, zero recovery time within the PRP zone, and minimal recovery time for traffic leaving the PRP zone. Redundant PRP recommendations include:

- 10 controllers per topology (pair of redundant Redboxes)
- In a redundant Redbox configuration, do not connect anything other PRP and uplink ports
- Ports in the PRP channel group can't be configured for other resiliency protocol, such as DLR or Resilient Ethernet Protocol (REP).

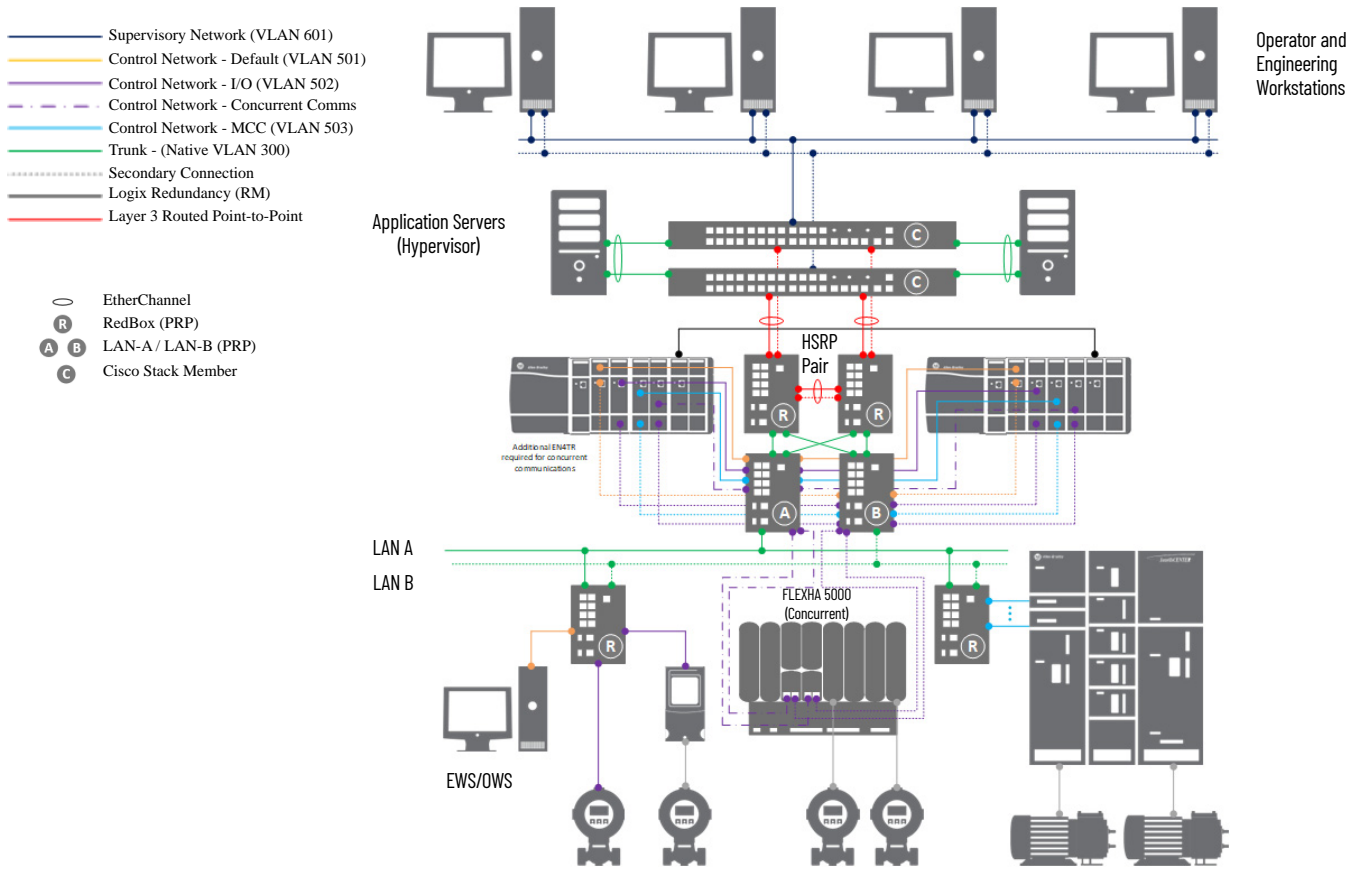


Table 4 - Properties of Example 1 Architecture

Redundant PRP Topology	
Why would I select this architecture?	Most robust option for operations that require high availability. PRP requires double the cabling and components to establish no single point of failure. For a true no single point of failure capabilities, PlantPAx recommends redundant power sources along with separate physical paths for media.
What protocols does it use?	<ul style="list-style-type: none"> • Implementation of EtherChannel for hardware redundancy between servers and workstations • 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) is a switch with PRP technology that connects devices without PRP technology to both LAN A and LAN B
What components do I need?	<ul style="list-style-type: none"> • Cisco® Catalyst® 9300 switch • Redundant application servers via physical or virtualized environments • Pair of Layer 3 PRP enabled Stratix® switches: <ul style="list-style-type: none"> - Stratix 5800 • Duplicate LAN A/B Layer 2 infrastructure switches: <ul style="list-style-type: none"> - Stratix 5800 - Stratix 5200 • 1756, 5015 and 5094 I/O families support PRP

Example 2: Resilient DLR Topology

Resilient DLR topology helps prevent communication loss between devices if a fault occurs. Multiport devices (embedded EtherNet/IP™ ports) equipped with DLR technology connect directly to neighboring nodes and form a ring topology at the end devices. If a break in the network is detected, the network provides an alternate forwarding path for the data to help recover the network. DLR recommendations include:

- 10 controllers per topology
- In a dual gateway configuration, do not connect anything other DLR and uplink ports
- Maximum of 50 switch nodes per ring
- Single VLAN per ring
- PlantPAx does not recommend DLR trunking or DLR DHCP
- Place at least 1 meter of cable between each DLR device
- Additional EN4TR required for concurrent communications

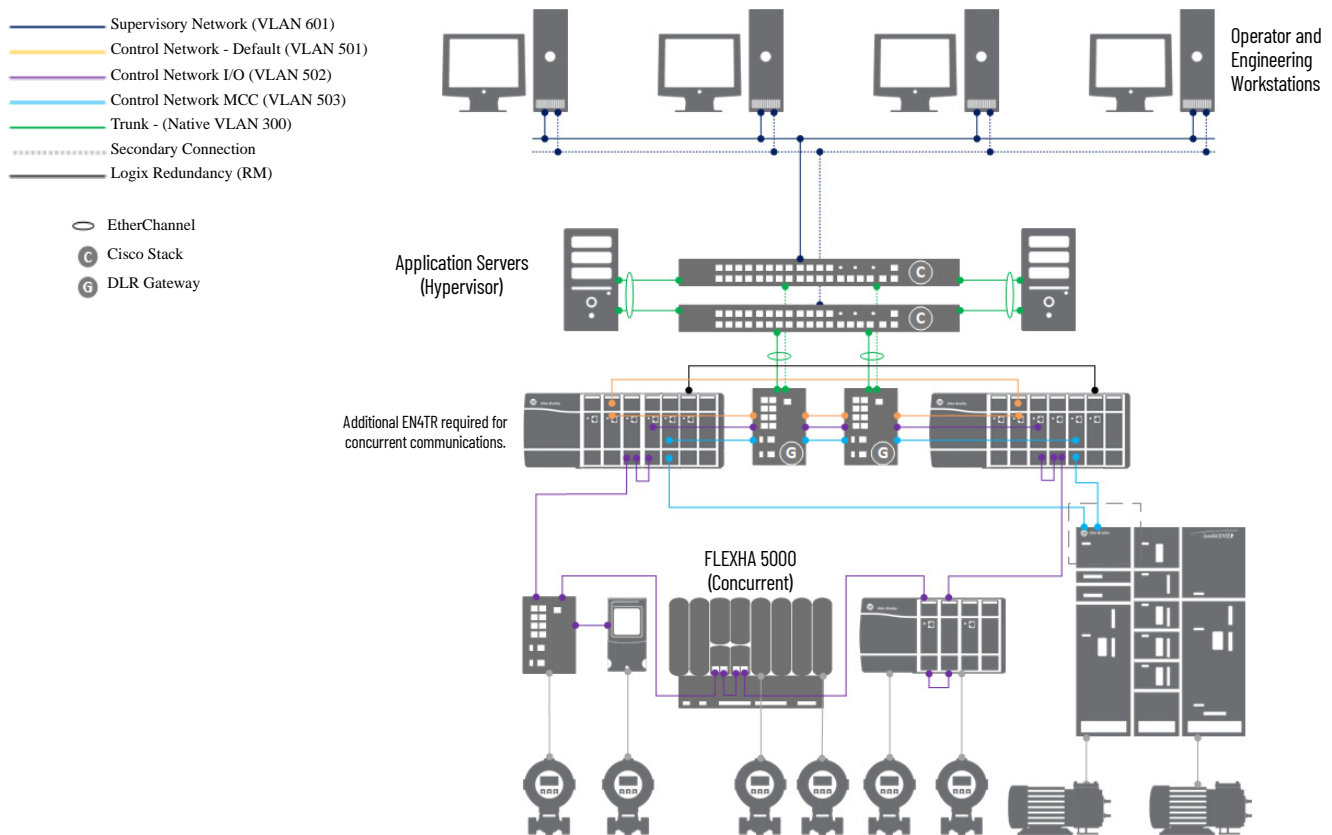


Table 5 - Properties of Example 2 Architecture

Resilient DLR Topology	
Why would I select this architecture?	This architecture provides a means to detect, monitor, manage, and recover from one fault ring-based network. You can use redundant gateways to provide DLR network resiliency to the rest of the network.
What protocols does it use?	<ul style="list-style-type: none"> • Implementation of EtherChannel for hardware redundancy between servers and workstations • EIGRP (Enhanced Interior Gateway Routing Protocol) provides Layer 3 routing capabilities; this protocol is used within the Cisco® Catalyst® switches • DLR is a ring topology that recovers after one point of failure (3 msec or less)
What components do I need?	<ul style="list-style-type: none"> • Cisco Catalyst 9300 switch • Redundant application servers via physical or virtualized environments • DLR gateway capable switches • DLR capable Stratix switches • DLR capable Ethernet modules <p>Check I/O device specifications to verify DLR support.</p>

Example 3: Simplex - Star Topology

Simplex - Star topology features single network connections throughout the topology. There's no redundancy so connected nodes can't communicate on the network if there's a network failure.

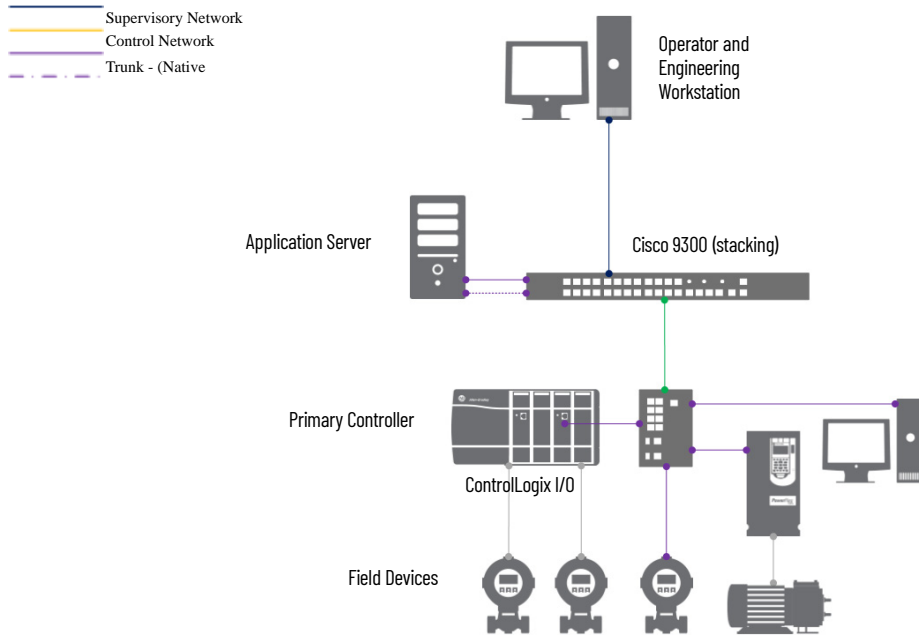
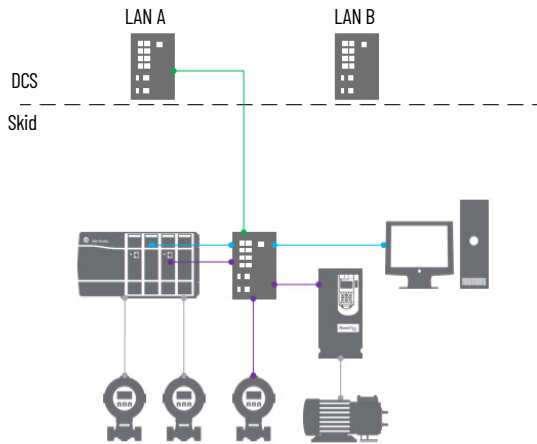


Table 6 - Properties of Example 3 Architecture

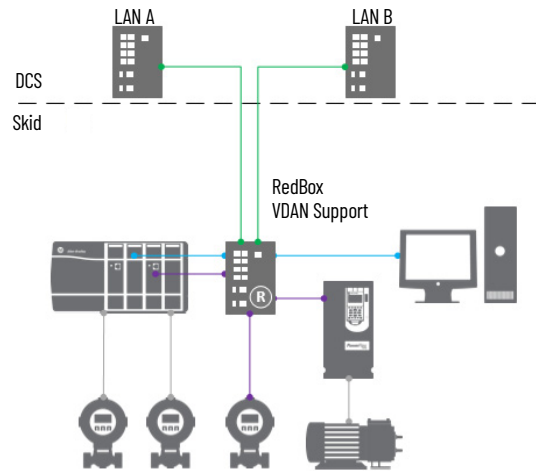
Simplex - Star Topology	
Why would I select this architecture?	This architecture provides a basic network configuration. You can monitor and control non-critical equipment. However, there's no ability to recover from an architectural fault.
What protocols does it use?	<ul style="list-style-type: none"> • EtherNet/IP™ backbone between devices in a star topology • EtherChannel is optional • NIC teaming is optional.
What components do I need?	<ul style="list-style-type: none"> • Layer 2 Stratix switches • Ethernet capable devices

Example 4 A: PRP Skid and MCC Lineup

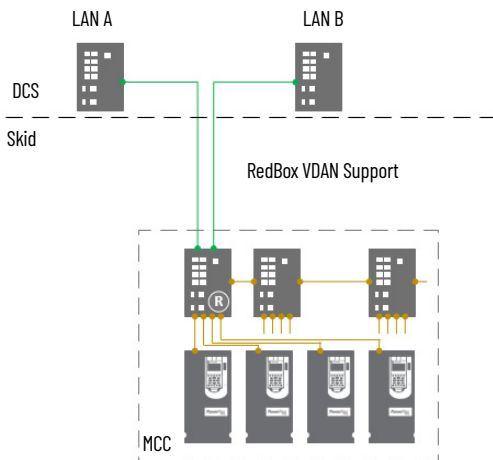
PRP Simplex Connection to Either LAN A/B



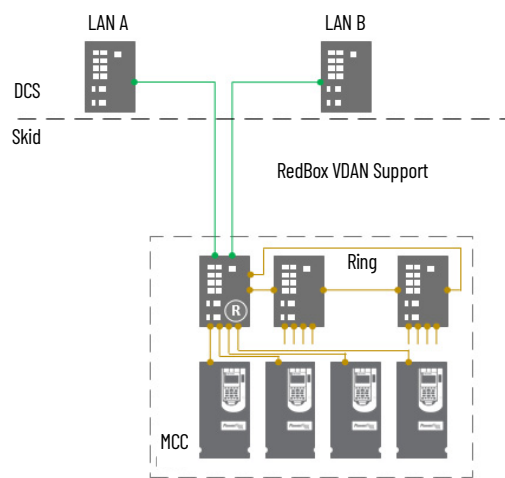
PRP DCS LAN A/B Infrastructure



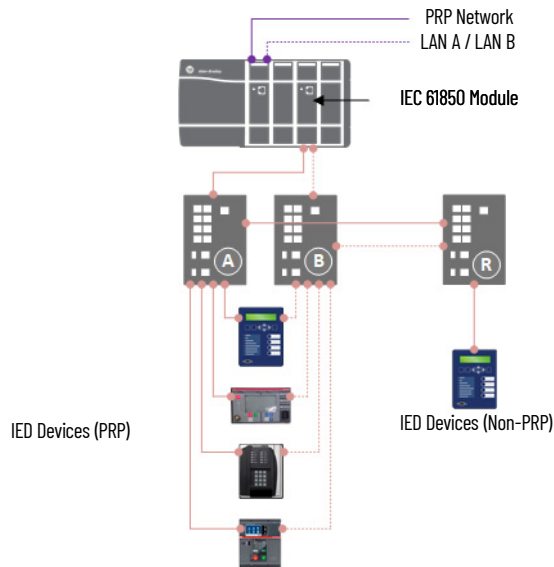
PRP MCC RedBox Connected to LAN A and LAN B



PRP MCC Connected to LAN A/B with DLR Ring

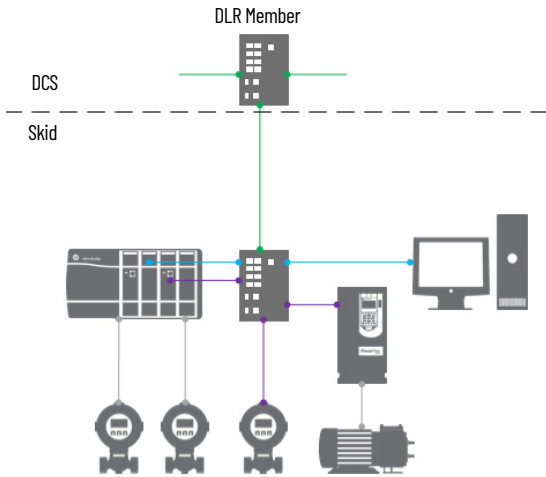


Redundant-PRP IEC 61850

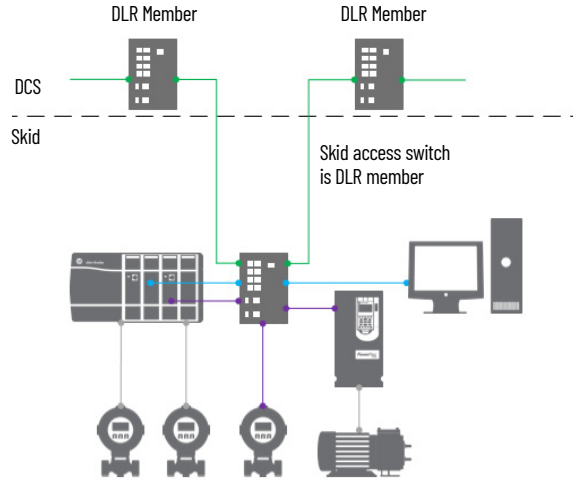


Example 4 B: DLR Skid and MCC Lineup

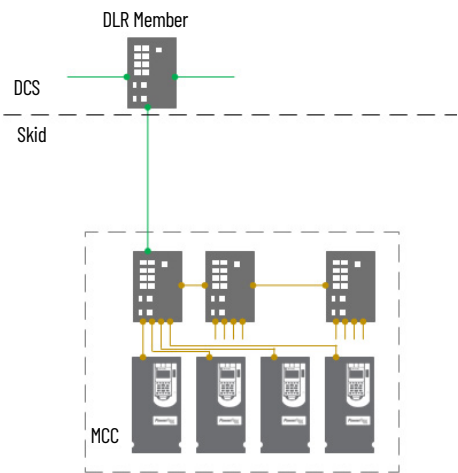
DLR Simplex Connection to Either LAN A/B



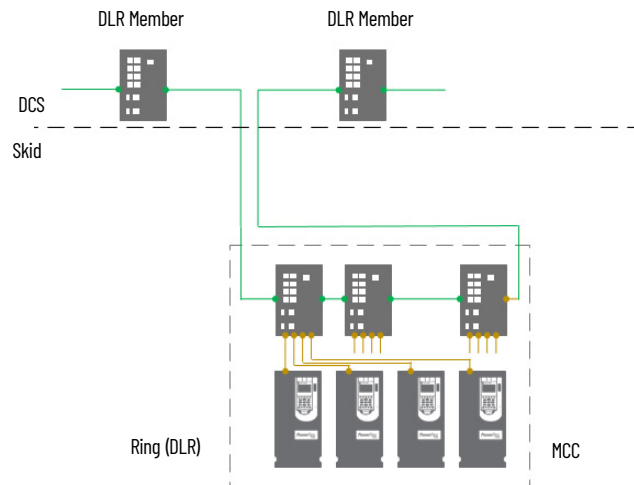
DLR DCS Integration



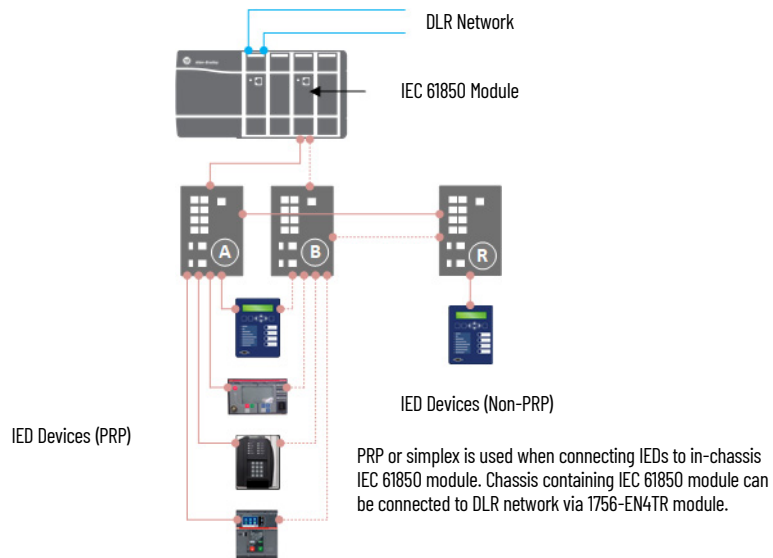
DLR Simplex/MCC Connection to DLR Ring Switch



DLR MCC Lineup as part of the DCS DLR Ring

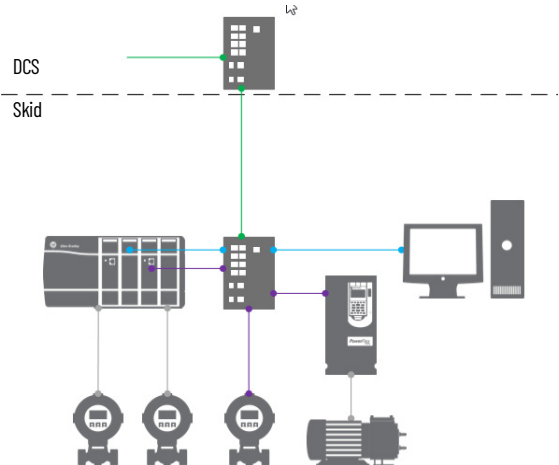


Resilient-DLR IEC 61850

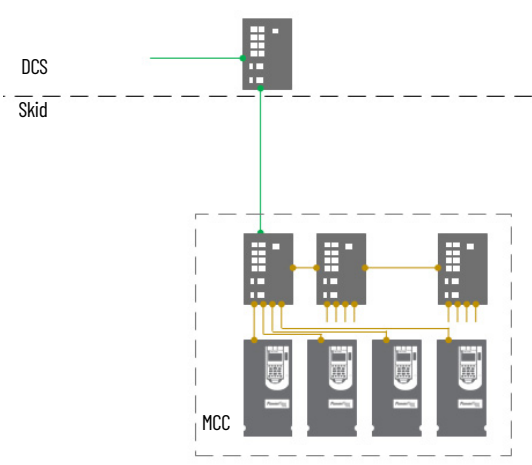


Example 4C: Simplex Skid and MCC Lineup

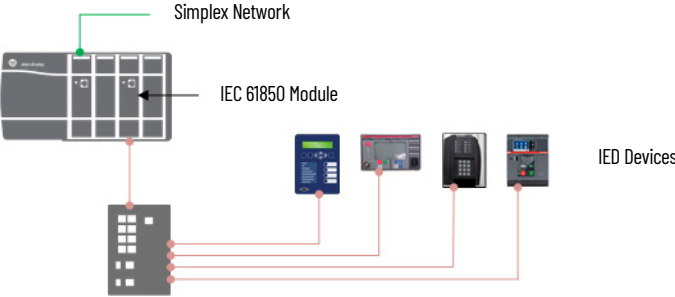
Simplex Connection to Simplex DCS



Simplex MCC Connection to Simplex DCS



Simplex IEC 61850



The supervisory layer of the PlantPAx system can include several servers and workstations. This section explains the server and workstation system elements to help you define a bill of materials.

PASS Servers

The Process Automation System Server (PASS) is a required system element that hosts essential software components to run the system. The essential software components include the data server, HMI server, and alarm server.

You must determine how many PASS servers are needed for your architecture. If your system requires multiple servers, acquaint yourself with the following descriptions of the data, HMI, and alarm servers.

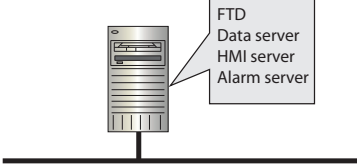
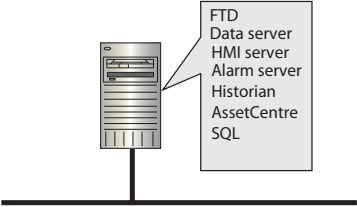
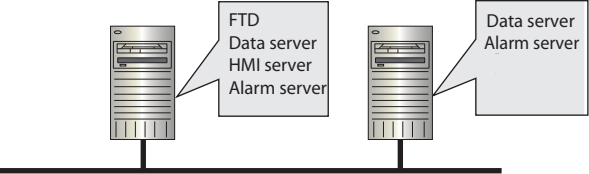
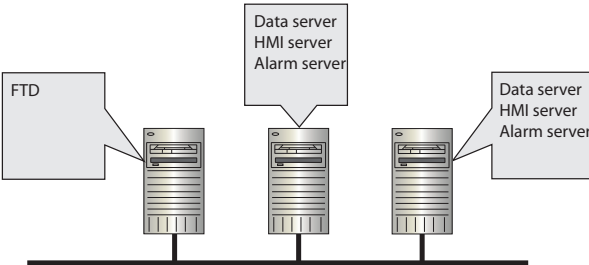
Table 7 - PASS Server Software Components

Software Components	Description
FactoryTalk® Directory (FTD) server ⁽¹⁾	Secures information from multiple Rockwell Automation software components across multiple computers and allows central administration throughout the PlantPAx system. Application components, such as display and security settings, can be stored in their original environments and made available to the entire PlantPAx system without the need for duplication.
FactoryTalk Activation server ⁽¹⁾	The FactoryTalk Activation server is part of the FactoryTalk® Services Platform. The server is used for FactoryTalk-enabled software products to be activated via files generated by Rockwell Automation over the Internet. This server essentially manages the files that are required to license Rockwell Automation products on the PlantPAx system.
FactoryTalk View HMI server	The human machine interface (HMI) server is configured within your FactoryTalk View SE application. The HMI server stores HMI project components, such as graphic displays, and serves these components to OWSs upon request. The HMI server can also manage tag databases and log historical data. Multiple HMI servers can exist on the PlantPAx system. Each HMI server must be on a separate PASS. The HMI server includes DataLogPro Edge Historian that can store up to 50,000 tag values.
FactoryTalk View Data server (FactoryTalk Linx)	The Data server component provides access to information from the process controllers to servers and workstations on the PlantPAx system. The Data server that is mentioned in PlantPAx documentation generally refers to the Rockwell Automation Device servers. Data servers are configured within your FactoryTalk View SE application. A single PASS can host up to 2 instances of FactoryTalk Linx.
FactoryTalk View Data server (OPC UA connector)	The OPC UA connector provides access to data and alarms from OPC UA servers and devices. The OPC UA connector is configured within your FactoryTalk View SE application. No additional licensing is required to use the OPC UA data connector. PlantPAx recommends hosting the OPC UA connector on a dedicated PASS with no more than 50,000 OPC UA tags and 5,000 OPC UA alarms and conditions.
FactoryTalk View Alarm and Event server	The Alarm and Event server publishes information from controllers and servers available to all subscribing OWSs. Alarm and Event servers are configured within your FactoryTalk View SE application. You can install only one Alarm and Event server on a PASS. <ul style="list-style-type: none"> PlantPAx System Release 5. supports Logix tag-based alarms. These device level, tag-based alarms monitor a tag value to determine the alarm condition. Tag-based alarms aren't part of the logic program and do not increase the scan time for a project. The controller caches information, such as time stamps, alarm states, and associated tag values in a buffer. The controller transmits the information to subscribing FactoryTalk Alarm & Event servers. For server tag-based alarms a FactoryTalk® Alarms and Events server monitors controllers for alarm conditions through data servers and publishes event information that can be displayed and logged.
Optional	
FactoryTalk Batch client software	If a Batch Application server is being used on the system, FactoryTalk Batch client components are required to support replication of batch-related objects on the displays to the OWS.

(1) In redundant PASS configurations, this component is included on the primary PASS only.

Determine the Number of PASS Servers

Table 8 - Non-redundant Server Options

Server Options	Description
<p>Option 1 - One PASS System Server</p> 	<p>This option has all essential software components that are housed in one PASS server. The components are FTD, Data server, HMI server, and alarm and event server. There are additional system elements, such as batch management, asset management, and FactoryTalk Historian. You can deploy these elements on separate servers or you can deploy elements on the same server as detailed in Option 2.</p> <p>One HMI server license is required.</p>
<p>Option 2 - One PASS Consolidated Server (small systems)</p> 	<p>The PASS - C option is for valid small systems with fewer than 2000 I/O points. With this option, you can locate multiple system elements on the same virtual machine.</p> <p>One HMI server license is required.</p>
<p>Option 3 - Multiple PASS Servers (additional data capacity)</p> 	<p>This option contains all software components in one server as shown in Option 1. Option 3 also adds another server for extra data and alarm capacity without adding another HMI server. If the PASS server is being used as a data server, and additional capacity is needed, you can add more PASS servers. Use the PSE to determine if more PASS servers are needed. We recommend that you have an HMI server on the PASS if you're segregating the application into individual operational areas. See Option 4.</p> <p>One HMI server license is required.</p>
<p>Option 4 - Multiple PASS Servers (logically segregated plant)</p> 	<p>Place the FTD on its own server to manage applications that exist on multiple client servers. If an area must be shut down, the other separate areas aren't affected because the FTD is on its own server. For example, you can perform maintenance on one area without affecting another operational area of the plant. FTD can be a workstation class machine.</p> <p>An HMI server license is required for each PASS that contains an HMI server.</p> <p>The benefits of placing the FactoryTalk Directory on a dedicated server include:</p> <ul style="list-style-type: none"> • System Startup: It's best if the FTD is the first component to start and the last to stop. Because most FactoryTalk software products rely on the various services that are provided by the FTD, the lowest risk scenario is to have it available as these products are initializing. • Compatibility: While all versions are generally compatible, the FTD is occasionally required to be at the highest version of FTSP installed in the system. This requirement can interfere with another FactoryTalk component if the FTD is co-located with another product. • Patching/Upgrading: Patching an FTD hosted on a dedicated computer translates to minimum system downtime, as it isn't affecting the operation of other FactoryTalk components while rebooting. • Redundancy: In redundant systems (for example, FactoryTalk View SE, FactoryTalk® Linx, FactoryTalk Alarms and Events), it's best if the FTD remains available during any failover scenarios. While the redundant server pair can function without the presence of the FTD, the lowest risk scenario is keeping it available.

Redundancy can be added to be sure of the availability of critical operations. For PASS servers, you can choose the level of redundancy that you need. When a PASS is made redundant, typically all above elements that are hosted on the PASS are made redundant.

Table 9 - PASS Requirements

Category	Requirement⁽¹⁾
Virtual	vCPU: 8 @ 2.4 GHz minimum vRAM: 16 GB minimum vHardDisk: 60 GB minimum
Physical (Non-Virtual)	CPU: 4 cores/8 threads @ 2.4 GHz minimum RAM: 16 GB minimum HardDisk: 60 GB minimum
Operating system	Windows® Server 2022 operating system, 64 bit

(1) All numbers and figures are referenced for initial sizing only. If needed, adjust these values for system performance.

Table 10 - PASS-C Requirements

Category	Requirement
Virtual	vCPU: 16 @ 2.4 GHz minimum vRAM: 32 GB minimum vHardDisk: 120 GB minimum
Physical (Non-Virtual)	CPU: 8 cores/16 threads @ 2.4 GHz minimum RAM: 32 GB minimum HardDisk: 120 GB minimum
Operating system	Windows Server 2022 operating system, 64 bit

The PASS requires that you purchase an HMI server license. If the PASS server isn't being used as an HMI server, then no license purchase is required. Make sure to account for process displays, faceplates, and navigation devices in your display count. All displays of the Rockwell Automation Library of Process Objects count against your display count license.

Whether you deploy a PASS system element in a traditional or virtual architecture, you must purchase the proper activations.

Table 11 - PASS Software and Licenses

Category	Cat. No.
Rockwell Automation software licenses	<p>Select the following for the first/main PASS in your system when the PASS is used as an HMI server:⁽¹⁾⁽²⁾</p> <ul style="list-style-type: none"> 9528x-PASS05T3y (PlantPax PASS Small 5-Client) 9528x-PASS10T2y (PlantPax PASS Medium 10-Client) 9528x-PASS25T1y (PlantPax PASS Large 25-Client) <p>Select the following for a PASS that will be a redundant/secondary HMI Server:</p> <ul style="list-style-type: none"> 9701x-VWRSVRT3y (Redundant Server Unlimited Display)
Rockwell Automation software licenses (for PASS-C) ⁽³⁾	<p>Select one copy per project of the following:⁽¹⁾⁽²⁾</p> <ul style="list-style-type: none"> 9528x-PASS05T3y (PlantPax PASS Small 5-Client) 9528x-PASS10T2y (PlantPax PASS Medium 10-Client) <p>Select any quantity of the following up to 60,000 tags total:⁽³⁾</p> <ul style="list-style-type: none"> 9518x-HSTT1y (FactoryTalk Historian SE 1,000 Tags) 9518x-HST5KT4y (FactoryTalk Historian SE 5,000 Tags) 9518x-HST10KT5y (FactoryTalk Historian SE 10,000 Tags) 9518x-HST20KT6y (FactoryTalk Historian SE 20,000 Tags) 9518x-HST50KT7y (FactoryTalk Historian SE 50,000 Tags) <p>FactoryTalk Batch when required:</p> <ul style="list-style-type: none"> 9358x-FTBT1y (FactoryTalk Batch Server - 1 Unit) 9358x-FTBT5y (FactoryTalk Batch Server - 3 Units) 9358x-FTBT2y (FactoryTalk Batch Server - 10 Units) 9358x-FTBT6y (FactoryTalk Batch Server - 30 Units) 9358x-FTBT3y (FactoryTalk Batch Server - 60 Units)

(1) When your system has two or more PASS servers that are HMI servers, purchase the FactoryTalk View SE software licenses.

(2) Where: x = M (perpetual use license) or C (subscription license) and y = 1 (8x5 support) or 2 (24x7 support)

(3) If necessary, the end user is responsible for acquiring the Microsoft SQL Server license.

Engineering Workstation (EWS)

The engineering workstation (EWS) supports system configuration, application development, and maintenance functions. The EWS is the central location for monitoring and maintaining the systems operation. The recommended limit is five EWS per system.

Table 12 - EWS Requirements

Category	Requirement ⁽¹⁾
Virtual	vCPU: 4 @ 2.4 GHz minimum vRAM: 8 GB minimum vHardDisk: 100 GB minimum
Physical (Non-Virtual)	CPU: 2 cores/4 threads @ 2.4 GHz minimum RAM: 8 GB minimum HardDisk: 100 GB minimum
Operating system	Windows 10 or 11 operating system, 64 bit

(1) All numbers and figures are referenced for initial sizing only. If needed, adjust these values for system performance.

Whether you deploy an EWS system element in a traditional or virtual architecture, you must purchase the proper activations.

Table 13 - EWS Software License

Category	Cat. No.
Rockwell Automation software license	<p>The following licenses enable the software tools that are deployed on the EWS:^{(1) (2)}</p> <ul style="list-style-type: none"> 9324x-RLDT3y 9701x-VWSSPT3y 9701x-VWSDRT1y

(1) Where: x = M (perpetual use license) or C (subscription license)

(2) Where: y = 1 (8x5 support), y = 2 (24x7 support)

Engineering Workstation Application Server (AppServ-EWS)

The AppServ-EWS uses ThinManager® or Microsoft Remote Desktop Services (RDS) technology to serve multiple instances of the EWS as thin clients from one server. Thin clients can run applications and process data on a remote computer. The recommended limit is five active and connected RDS client connections per AppServ-EWS. The application server can host up to 10 clients, but only five are to be actively configuring the system at one time.

Table 14 - AppServ-EWS Requirements

Category	Requirement ⁽¹⁾
Virtual	vCPU: 8 @ 2.4 GHz minimum vRAM: 16 GB minimum vHardDisk: 100 GB minimum
Physical (Non-Virtual)	CPU: 4 cores/8 threads @ 2.4 GHz minimum RAM: 16 GB minimum HardDisk: 100 GB minimum
Thin client	We recommend a maximum of five active and connected FactoryTalk View SE clients per application server.
Operating system	Windows Server 2022 operating system, 64 bit

(1) All numbers and figures are referenced for initial sizing only. If needed, adjust these values for system performance.

Whether you deploy an AppServ-EWS system element in a traditional or virtual architecture, you must purchase the proper activations.

Table 15 - AppServ-EWS Automation System Software and License

Category	Cat. No.
Rockwell Automation software license IMPORTANT: The identified set of Rockwell Automation licenses must be purchased for each client that is connected to the AppServ-EWS.	The following licenses enable the software tools that are deployed on an EWS client: ^{(1) (2)} <ul style="list-style-type: none"> • 9324x-RLDT3y • 9701x-VWSSPT3y • 9701x-VWSDRT1y

(1) Where: x = M (perpetual use license) or C (subscription license)

(2) Where: y = 1 (8x5 support), y = 2 (24x7 support)

Operator Workstations (OWS)

The operator workstation (OWS) provides the graphical view and interface into the process. The OWS supports operator interaction and isn't meant to support development or maintenance activities, although these activities are possible if desired.

Table 16 - OWS Requirements

Category	Requirement ⁽¹⁾
Virtual	vCPU: 2 @ 2.4 GHz minimum vRAM: 4 GB minimum vHardDisk: 40 GB minimum
Physical (Non-Virtual)	CPU: 1 core/2 threads @ 2.4 GHz minimum RAM: 4 GB minimum HardDisk: 40 GB minimum
Operating system	Windows 10 or 11 operating system, 64 bit

(1) All numbers and figures are referenced for initial sizing only. If needed, adjust these values for system performance.

Whether you deploy an OWS system element in a traditional or virtual architecture, you must purchase proper activations.

Table 17 - OWS Software License

Category	Cat. No.
Rockwell Automation software license	For each OWS: ^{(1) (2)} <ul style="list-style-type: none"> • 9701x-VWSDRT1y

(1) Where: x = M (perpetual use license) or C (subscription license)

(2) Where: y = 1 (8x5 support), y = 2 (24x7 support)

Operator Workstation Application Servers (AppServ-OWS)

The AppServ-OWS uses Microsoft Remote Desktop Services (RDS) technology to serve multiple instances of the OWS 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. The AppServ-OWS is only configured to run FactoryTalk View SE clients and the recommended limit is 10 clients per application server.

Table 18 - AppServ-OWS Requirements

Category	Requirement ⁽¹⁾
Virtual	vCPU: 8 @ 2.4 GHz minimum vRAM: 16 GB minimum vHardDisk: 60 GB minimum
Physical (Non-Virtual)	CPU: 4 cores/8 threads @ 2.4 GHz minimum RAM: 16 GB minimum HardDisk: 60 GB minimum
Operating system	Windows Server 2022 operating system, 64 bit
Thin client	We recommend a maximum of 10 FactoryTalk View SE clients per application server.
Additional third-party software	Antivirus software

(1) All numbers and figures are referenced for initial sizing only. If needed, adjust these values for system performance.

Whether you deploy an AppServ-OWS system element in a traditional or virtual architecture, you must purchase the proper activations.

Table 19 - AppServ-OWS Software License

Category	Cat. No.
Rockwell Automation software license IMPORTANT: The identified set of Rockwell Automation licenses must be purchased for each client that is connected to the AppServ-OWS.	Purchase a license for each client that the AppServ-OWS servers: ⁽¹⁾ ⁽²⁾ <ul style="list-style-type: none"> • 9701x-VWSDRT1y

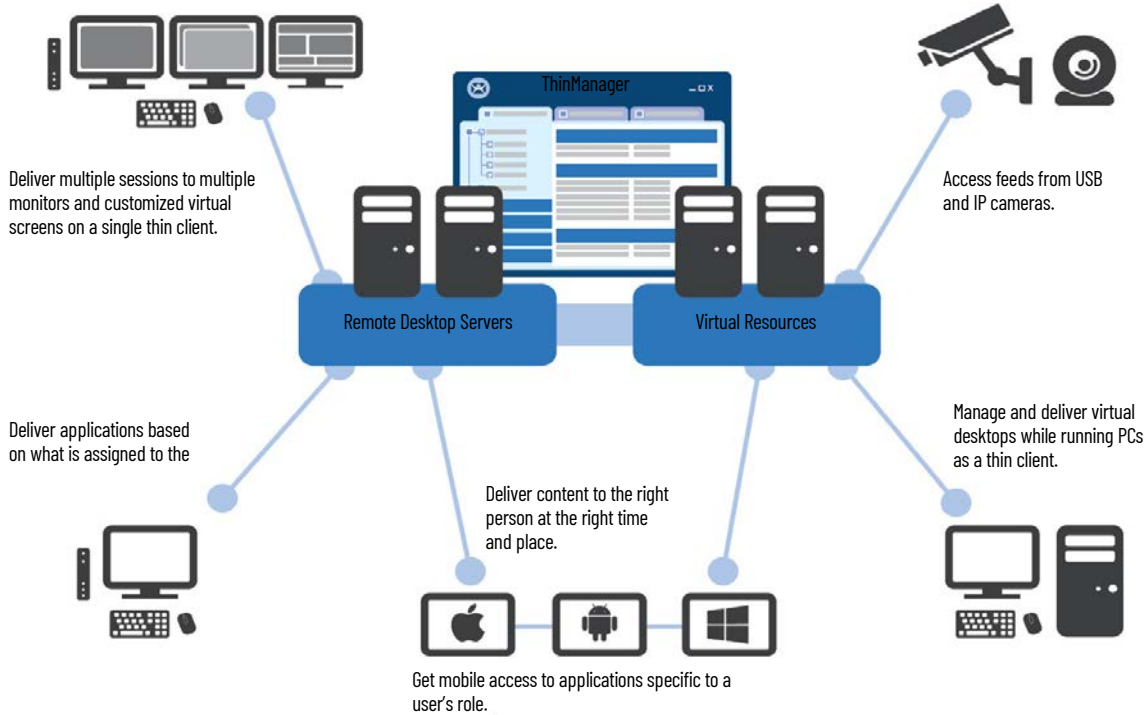
(1) Where: x = M (perpetual use license) or C (subscription license)

(2) Where: y = 1 (8x5 support), y = 2 (24x7 support)

ThinManager Server Options

The AppServ-OWS can be configured as your ThinManager Server and deploy up to 10 OWS sessions to simplify the management of all devices and users.

ThinManager increases your productivity, visualization, mobility, and security from a centralized, and scalable management platform.



Safely and securely deliver your content to any combination of device, user, and location with the following features:

- Boost productivity by reducing the time that is spent in managing computers
- Enhance visualization by delivering your content to where you need it and the way you want it to be shown
- Extend security through encrypted communications, Active Directory, and secure thin clients
- Smart mobility where QR Codes, Bluetooth, Wi-Fi, and GPS make sure that devices receive content in authorized areas

For more information, see [Thin Client Management Software](#).

Independent Workstations (IndWS)

The independent workstation (IndWS) combines the roles of the PASS, EWS, and OWS in one computer. This workstation can be used as a backup control system for emergency purposes.

Table 20 - IndWS Requirements

Category	Requirement
Physical	CPU: 4 cores/8 threads @ 2.4 GHz minimum RAM: 16 GB minimum HardDisk: 100 GB minimum
Operating system	Windows 10, 11, or Server 2022 operating system, 64 bit

If you deploy an IndWS system element, you must purchase the proper activations.

Table 21 - IndWS Software Licenses

Category	Cat. No. ⁽¹⁾ ⁽²⁾
Rockwell Automation software licenses	One per IndWS if being used as EWS: <ul style="list-style-type: none"> 9324x-RLDT3y (Studio 5000 Professional Edition Design Environment Software) Select one of the following: <ul style="list-style-type: none"> - 9701x-VWSTNBDLT4y (FactoryTalk View SE Station Bundle: Unlimited Displays)

(1) Where: x = M (perpetual use license) or C (subscription license)

(2) Where: y = 1 (8x5 support), y = 2 (24x7 support)

Information Management Application Servers (AppServ-Info)

Information management application servers (AppServ-Info) represent a broad category of servers and software that provides value to the PlantPAx system by offering data management and decision support functionalities. Except where specifically noted, all options that are listed must be installed on their own servers to maximize performance.

Table 22 - Data Management Options

Category	Requirement	Option
Time series	<ul style="list-style-type: none"> High-speed, on-machine data collection < 2500 tags 	Information Management server is optional because you can use an embedded historian module for the ControlLogix chassis (FactoryTalk Historian ME). If the Factory Talk Historian ME module is collecting 2500 points per second, the duration of history that is stored is approximately 14 hours. <ul style="list-style-type: none"> 1756-HIST2G (2 GB)
	<ul style="list-style-type: none"> Longer term data storage > 2500 tags 	An Information Management server is required with FactoryTalk Historian SE software for up to 60,000 tags. Additionally, the DataLogPro Edge Historian included as part of the HMI server can be used up to 50,000 tags.
Event based	Relational database	An additional AppServ-Info server can be considered for the storage of transactional data. You can select a Microsoft SQL server database to act as the central collection point for event-based data: <ul style="list-style-type: none"> FactoryTalk Alarm and Event data FactoryTalk Batch data This database can be installed on an Information Management server or another server on your system.

AppServ-Info (Historian)

One of the ways to configure the AppServ-Info is as a historian to collect data. Follow these guidelines if you're adding a Historian server to your PlantPAx system.

Table 23 - AppServ-Info (Historian) Requirements

Category	Requirement ⁽¹⁾
Virtual	vCPU: 8 @ 2.4 GHz minimum vRAM: 8 GB minimum vHardDisk: 120 GB minimum
Physical (Non-Virtual)	CPU: 4 cores/8 threads @ 2.4 GHz minimum RAM: 8 GB minimum HardDisk: 120 GB minimum
Operating system	Windows Server 2022 operating system, 64 bit

(1) All numbers and figures are referenced for initial sizing only. If needed, adjust these values for system performance.

Whether you deploy a Historian system element in a traditional or virtual architecture, you must purchase the proper activations.

Table 24 - FactoryTalk Historian Software and Licenses

Category	Cat. No. ^{(1)(2) (3)}
Rockwell Automation software license	Select one of the licenses: <ul style="list-style-type: none"> 9518x-HSTT1y (FactoryTalk Historian SE - 1,000 tags) 9518x-HTS5KT4y (FactoryTalk Historian SE - 5,000 tags) 9518x-HST10KT51y (FactoryTalk Historian SE - 10,000 tags) 9518x-HST20KT6y (FactoryTalk Historian SE - 20,000 tags) 9518x-HST50KT7y (FactoryTalk Historian SE - 50,000 tags) <p>Note: order these in quantities to meet your need not to exceed a total of 60,000 tags.</p>
FactoryTalk PI Vision Client	Select for each client that is using FactoryTalk Historian Vision Client: <ul style="list-style-type: none"> 9518x-HSTRT4y (FactoryTalk Historian Vision Client - Single User)
Excel® Add-in	<ul style="list-style-type: none"> 9518x-HSTRT3y (Historian SE, DataLink Client, 5 Users)

(1) If you plan to use redundant Historian for high availability, you must license an equivalent number of tags for the redundant Historian.

(2) Where: x = M (perpetual use license) or C (subscription license)

(3) Where: y = 1 (8x5 support), y = 2 (24x7 support)

AppServ-Info (SQL)

Another way to configure AppServ-Info is as a Microsoft SQL Server relational database. Software such as FactoryTalk AssetCentre, and FactoryTalk Batch use a SQL Server database to store and access process data. The FactoryTalk Alarm and Event server uses a SQL Server database to store information.

The process library includes standard reports that support basic and advanced alarm and event reports along with per process object reporting.

Table 25 - AppServ-Info (SQL) Requirements

Category	Requirement ⁽¹⁾
Virtual	vCPU: 2 @ 2.4 GHz minimum vRAM: 4 GB minimum vHardDisk: 120 GB minimum
Physical (Non-Virtual)	CPU: 1 core/2 threads @ 2.4 GHz minimum RAM: 4 GB minimum HardDisk: 120 GB minimum
Operating system	Windows Server 2022 operating system, 64 bit

(1) All numbers and figures are referenced for initial sizing only. If needed, adjust these values for system performance.

Microsoft SQL Server is licensed in one of two ways: Server + CAL or Per Core. 'CAL' is an abbreviation for client access license. Server+CAL licensing is recommended for fewer clients. Every additional client requires a CAL license. Per Core licensing provides unlimited number of CALs.

Whether you deploy a Microsoft SQL Server system element in a traditional or virtual architecture, you must purchase the proper licensing. The End User is responsible for acquiring the appropriate Microsoft SQL Server licensing.

Asset Management Servers (AppServ-Asset)

An asset management server (AppServ-Asset) is an extension to the PlantPAX system that adds maintenance and plant operations to the system with FactoryTalk AssetCentre software. This server provides controller data backup for disaster recovery, diagnostics, and real-time monitoring. The server also audits assets and monitors network health to improve overall resource availability.

The asset management server provides centralized system management for Rockwell Automation and third-party field assets.

Table 26 - AppServ-Asset Requirements

Category	Requirement ⁽¹⁾
Virtual	vCPU: 4 @ 2.4 GHz minimum vRAM: 16 GB minimum vHardDisk: 60 GB minimum
Physical (Non-Virtual)	CPU: 2 cores/4 threads @ 2.4 GHz minimum RAM: 16 GB minimum HardDisk: 60 GB minimum
Operating system	Windows Server 2022 operating system, 64 bit

(1) All numbers and figures are referenced for initial sizing only. If needed, adjust these values for system performance.

Whether you deploy an AppServ-Asset system element in a traditional or virtual architecture, you must purchase the proper activations.

Table 27 - AppServ-Asset Software and Licenses

Category	Cat. No. ⁽¹⁾ ⁽²⁾
Rockwell Automation software license	<ul style="list-style-type: none"> 9515x-FTACT2y (FactoryTalk AssetCentre Base) A license for AssetCentre Base isn't required when the system included a PASS licensed using a SystemID bundle as it is already included.
Asset licenses	Select one or more of the following so that the sum of licenses is equal to or greater than the number of assets that is to be managed by the Asset Management server: ⁽³⁾ <ul style="list-style-type: none"> 9515x-FTACRT9y (FactoryTalk AssetCentre 25 Assets) 9515x-FTACRT1y (FactoryTalk AssetCentre 100 Assets)
Virtual server disaster recovery licenses	If disaster recovery is to be used, select from the following: <ul style="list-style-type: none"> 9515x-FTACRT10y (Disaster recovery for Rockwell Automation) 9515x-FTACRT2y (Disaster recovery for remote computers)

(1) Where: x = M (perpetual use license) or C (subscription license)

(2) Where: y = 1 (8x5 support), y = 2 (24x7 support)

(3) The server license, included with the System ID bundle, includes 10 assets.

Batch Management Servers (AppServ-Batch)

PlantPAX systems support scalable options for batch management that are based on ISA88 standards:

Feature	Logix Batch & Sequence Manager	SequenceManager™	FactoryTalk® Batch
Deployment	Logix controller code	Firmware-based controller feature	Server-based application (AppServ-Batch)
Supported controllers	ControlLogix 5580 CompactLogix 5380 ControlLogix 5570 CompactLogix 5370	ControlLogix 5570 CompactLogix 5370 ControlLogix 5580 CompactLogix 5380	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
FactoryTalk Batch integration	No	Yes	Na
Dynamic unit binding	No	No	Yes
Unit arbitration	No	No	Yes

The batch management server (AppServ-Batch) offers equipment-independent recipe management, batch-independent equipment control, and regulatory compliance.

Table 28 - AppServ-Batch Requirements

Category	Requirement ⁽¹⁾
Virtual	vCPU: 2 @ 2.4 GHz minimum vRAM: 8 GB minimum vHardDisk: 60 GB minimum
Physical (Non-Virtual)	CPU: 1 core/2 threads @ 2.4 GHz minimum RAM: 8 GB minimum HardDisk: 60 GB minimum
Operating system	Windows Server 2022 operating system, 64 bit

(1) All numbers and figures are referenced for initial sizing only. If needed, adjust these values for system performance.

Whether you deploy an AppServ-Batch in a traditional or virtual architecture, you must purchase the proper activations.

Table 29 - AppServ-Batch Software and Licenses

Category	Cat. No. (1) (2)
Batch unit software licenses	Purchase multiple licenses to obtain the desired number of batch units. <ul style="list-style-type: none"> • 9358x-FTBT1y (FactoryTalk Batch Server - 1 Unit) • 9358x-FTBT5y (FactoryTalk Batch Server - 3 Units) • 9358x-FTBT2y (FactoryTalk Batch Server - 10 Units) • 9358x-FTBT6y (FactoryTalk Batch Server - 30 Units) • 9358x-FTBT3y (FactoryTalk Batch Server - 60 Units)
Batch backup software licenses	If a back-up server is required, obtain the equivalent number of units of back-up keys. <ul style="list-style-type: none"> • 9358x-FTBRT1y (FactoryTalk Batch Back-up Key - 1 Unit) • 9358x-FTBRT4y (FactoryTalk Batch Back-up Key - 3 Units) • 9358x-FTBRT2y (FactoryTalk Batch Back-up Key - 10 Units) • 9358x-FTBRT5y (FactoryTalk Batch Back-up Key - 30 Units) • 9358x-FTBRT3y (FactoryTalk Batch Back-up Key - 60 Units)
eProcedure® software licenses	eProcedure is included with Batch licenses that are listed. These catalog numbers are to order software separately. <ul style="list-style-type: none"> • 9358x-FTBEPT1y (FactoryTalk Batch eProcedure- 3 Units) • 9358x-FTBEPT2y (FactoryTalk Batch eProcedure- 10 Units) • 9358x-FTBEPT3y (FactoryTalk Batch eProcedure- 30 Units) • 9358x-FTBEPT4y (FactoryTalk Batch eProcedure- 60 Units)
eProcedure backup software licenses	eProcedure is included with Batch licenses that are listed. These catalog numbers are to order software separately. <ul style="list-style-type: none"> • 9358x-FTBEPT1y (FactoryTalk Batch eProcedure Back-up Key - 3 Units) • 9358x-FTBEPT2y (FactoryTalk Batch eProcedure Back-up Key - 10 Units) • 9358x-FTBEPT3y (FactoryTalk Batch eProcedure Back-up Key - 30 Units) • 9358x-FTBEPT4y (FactoryTalk Batch eProcedure Back-up Key - 60 Units)
Batch View Clients	Each license enables one concurrent user to access FactoryTalk Batch from a remote browser. <ul style="list-style-type: none"> • 9358x-FTBT4y (FactoryTalk Batch View Standard)

(1) Where: x = M (perpetual use license) or C (subscription license)

(2) Where: y = 1 (8x5 support), y = 2 (24x7 support)

Batch high availability options depend on the hardware and software options in the system:

- For the application server in a system where a bump in the process cannot be tolerated, FactoryTalk Batch software helps support a real-time, uninterrupted high availability option. This option leverages Stratus servers or VMware virtualization.
- Standard FactoryTalk Batch software supports a warm back-up option that allows a Batch server to start up and rebuild the active batches from the Event Journals and Logs and places them on the batch list in a held state.
- A redundant ControlLogix system with PhaseManager software provides protection so that the control platform continues to execute during a hardware failure.

Domain Controllers

PlantPAX uses a domain controller to store user account information, authenticate users, and enforce security policies. Follow these guidelines for the domain controller:

- A domain controller is required if there are 10 or more workstations or servers.
- A domain controller is a separate computer. Do not load any application software on a domain controller. Load all system application software on the other computers, such as the PASS, application server, OWS, and EWS.
- The domain controller must be local to the system workstations and servers (within the local firewall) and not remote to the system.

Table 30 - Domain Requirements

Category	Requirement ⁽¹⁾
Virtual	vCPU: 1 @ 2.4 GHz minimum vRAM: 4 GB minimum vHardDisk: 40 GB minimum
Physical (Non-Virtual)	CPU: 1 core/1 thread @ 2.4 GHz minimum RAM: 4 GB minimum HardDisk: 40 GB minimum
Operating system	Windows Server 2022 operating system, 64 bit

(1) All numbers and figures are referenced for initial sizing only. If needed, adjust these values for system performance.

Notes:

The optimal number of controllers for the PlantPax system depends on the size of your application, physical layout of your plant, and the design of your process. Consider segregating non-related process equipment into separate controllers so that maintenance activities in one area do not impact the operation of another area.

PlantPax system release 5.0 adds process controllers to the Logix 5000® family of controllers. The process controller is an extension of the Logix 5000 controller family that focuses on plant-wide process control. The process controller is preconfigured with a default process tasking model and dedicated PlantPax process instructions that are optimized for process applications to improve design and deployment efforts.

Regardless of which type of controller that you use, controllers are capacity limited. This capacity can be roughly estimated based on I/O count, but is also greatly impacted by the design of your application. These limitations can include the amount of automation code that is required, the amount of information being read by supervisory applications, and the number of alarms configured in your system.

Table 31 - Process and Standard Controller Hardware

Category	Cat. No.
Process controllers	<ul style="list-style-type: none"> ControlLogix 1756-L81EP, 1756-L83EP, 1756-L85EP CompactLogix 5069-L320ERP, 5069-L340ERP
Standard controllers	<ul style="list-style-type: none"> ControlLogix 1756-L71, 1756-L72, 1756-L73, 1756-L74, 1756-L75, 1756-L81E, 1756-L82E, 1756-L83E, 1756-L84E, 1756-L85E CompactLogix 1769-L24ER-Q, 1769-L33ER, 1769-L36ERM, 1769-L37ERM, 1769-L38ERM
Standard Ethernet interfaces (ControlLogix)	<ul style="list-style-type: none"> For direct PRP connection: 1756-EN4TR, 1756-EN2TP For direct DLR connection: 1756-EN4TR, 1756-EN2TR

Simplex Controllers

Non-redundant controllers are referred to as simplex controllers.

Table 32 - Simplex - Process Controllers

Category ⁽¹⁾	1756-L81EP	1756-L83EP	1756-L85EP
User memory	3 MB	10 MB	40 MB
PID loop control strategies @ 100 ms max	185	570	
PID loop control strategies @ 250 ms max		625	1425
PID loop control strategies @ 500 ms max			2000
PID loop control strategies @ 1000 ms max			
Tags/sec delivered to data server max	50,000		
Logix tag based alarms max	7500		

(1) These values are recommended maximum limits and are not intended for detailed system design or proposals. Limits can vary depending on the overall design of a system. For more detailed sizing, please use the PlantPax System Estimator included in the Integrated Architecture Builder software.

Table 33 - Simplex - Standard Controllers

Category ⁽¹⁾	1756-L71	1756-L72	1756-L73	1756-L74	1756-L75	1756-L81E	1756-L82E	1756-L83E	1756-L84E	1756-L85E
User memory	2 MB	4 MB	8 MB	16 MB	32 MB	3 MB	5 MB	10 MB	20 MB	40 MB
PID loop control strategies @ 100 ms max	75	85			235	425	500			
PID loop control strategies @ 250 ms max		175	215				910	1250		
PID loop control strategies @ 500 ms max			380	430				1875	2000	
PID loop control strategies @ 1000 ms max				800						860
Tags/sec delivered to data server max	10,000	20,000				50,000				

(1) These values are recommended maximum limits and are not intended for detailed system design or proposals. Limits can vary depending on the overall design of a system. For more detailed sizing, please use the PlantPAx System Estimator included in the Integrated Architecture Builder software.

Redundant Controllers

ControlLogix controllers support redundancy on EtherNet/IP networks. For a PlantPAx system, you need these components:

Table 34 - Redundant Process and Standard Controller Hardware

Category	Cat. No.
Process redundant controllers	ControlLogix 1756-L81EP, 1756-L83EP, 1756-L85EP
Standard redundant controllers	<ul style="list-style-type: none"> ControlLogix 1756-L73, 1756-L74, 1756-L75⁽¹⁾ ControlLogix 1756-L81E, 1756-L82E, 1756-L83E, 1756-L84E, 1756-L85E
Redundancy module	1756-RM2 ⁽²⁾
Standard Ethernet interfaces	<ul style="list-style-type: none"> For direct PRP connection: 1756-EN4TR, 1756-EN2TP For direct DLR connection: 1756-EN4TR, 1756-EN2TR <p>PlantPAx recommends a dedicated Ethernet module for Supervisory communications (Non-Swapping IP addresses) and one or more Ethernet modules for I/O / MCC communications (Swapping IP addresses).</p> <p>For more information, see the ControlLogix 5580 Redundant Controller user manual, publication 1756-UM015.</p>

(1) ControlLogix 1756-L71 and 1756-L72 controllers are not recommended for PlantPAx systems due to memory constraints.

(2) The PlantPAx system recommendation is to use only one redundant controller in a chassis with a 1756-RM2 redundancy module.

Table 35 - Redundant - Process Controllers

Category ⁽¹⁾	1756-L81EP	1756-L83EP	1756-L85EP
User memory	3 MB	10 MB	40 MB
PID loop control strategies @ 100 ms max	125		
PID loop control strategies @ 250 ms max	190	325	325
PID loop control strategies @ 500 ms max		625	650
PID loop control strategies @ 1000 ms max			1300
Tags/sec delivered to data server max	50,000		
Logix alarms max	7500		

(1) These values are recommended maximum limits and are not intended for detailed system design or proposals. Limits can vary depending on the overall design of a system. For more detailed sizing, please use the PlantPAx System Estimator included in the Integrated Architecture Builder software.

Table 36 - Redundant - Standard Controllers

Category ⁽¹⁾	1756-L73	1756-L74	1756-L75	1756-L81E	1756-L82E	1756-L83E	1756-L84E	1756-L85E
User memory	8 MB	16 MB	32 MB	3 MB	5 MB	10 MB	20 MB	40 MB
PID loop control strategies @ 100 ms max	40			65				
PID loop control strategies @ 250 ms max	100			155				
PID loop control strategies @ 500 ms max	150	195		240	315			
PID loop control strategies @ 1000 ms max		315	400		430	625		
Tags/sec delivered to data server max	10,000	20,000		50,000				

(1) These values are recommended maximum limits and are not intended for detailed system design or proposals. Limits can vary depending on the overall design of a system. For more detailed sizing, please use the PlantPAx System Estimator included in the Integrated Architecture Builder software.

Controllers for Skid-based Equipment

The CompactLogix controller platform offers a solution for skid-based equipment to be part of the overall PlantPAx system if the application requires the following:

- Control of multiple loops for temperature, pressure, flow, or level
- Operating as a subsystem with sequencing and automation
- Controlled as part of the overall process, accepting reference inputs and delivering process variables to a supervisory controller

Table 37 - Skid-based Controllers

Category ⁽¹⁾	CompactLogix 1769-L24ER-Q	CompactLogix 1769-L33ER	CompactLogix 1769-L36ERM	CompactLogix 1769-L37ERM	CompactLogix 1769-L38ERM	CompactLogix 5069-L320ERP (Process Controller)	CompactLogix 5069-L340ERP (Process Controller)
User memory	0.75 MB	2 MB	3 MB	4 MB	5 MB	2 MB	4 MB
PID Loop Control Strategies @ 100 ms max	12	35	50	65	65	125	250
PID Loop Control Strategies @ 250 ms max					80		
PID Loop Control Strategies @ 500 ms max							
PID Loop Control Strategies @ 1000 ms max							
Tags/sec delivered to data server max	3000					50,000	
Logix alarms max	-					7500	

(1) These values are recommended maximum limits and are not intended for detailed system design or proposals. Limits can vary depending on the overall design of a system. For more detailed sizing, please use the PlantPAx System Estimator included in the Integrated Architecture Builder software.

Logix Embedded OPC UA

Logix 5380 and 5580 simplex controllers now support OPC UA natively via the embedded Ethernet ports. The controller can act as either an OPC UA server or client. The PlantPax Process controllers support the following number of OPC UA nodes:

- 5069-L320ERP: 300 OPC UA nodes
- 5069-L340ERP: 600 OPC UA nodes
- 1756-L81EP: no OPC UA nodes
- 1756-L83EP: 1200 OPC UA nodes
- 1756-L85EP: 15,000 OPC UA nodes

PlantPax recommends no more than 50,000 nodes/sec of OPC UA data when a controller is acting as an OPC UA server. PlantPax also recommends that only OPC UA data should utilize the embedded port on 5580 controllers. All other data (HMI,I/O) should use an in-chassis communication module such as the 1756-EN4TR.

Process Controller Emulation

FactoryTalk Logix Echo (FTLE) is a controller emulation software platform that emulates ControlLogix 5580 controllers. The platform also provides workflows designed to make emulation and program testing more accessible and flexible.

FactoryTalk Logix Echo is available as a subscription on the Rockwell Automation Software Portal. The license is a single node license.

I/O Products

Field networks and I/O components connect process instrumentation and field devices to the PlantPax system for real-time data acquisition and control. The PlantPax system supports several families of I/O.

Table 38 - I/O Communication Interfaces

Chassis-based I/O modules	1756 ControlLogix I/O	<ul style="list-style-type: none"> • 1756-EN2T, 1756-EN2TP, 1756-EN2TR, 1756-EN3TR, 1756-EN2F, 1756-EN2TX For more information, see the ControlLogix System Selection Guide, publication 1756-SG001 .
	5069 Compact 5000™ I/O	<ul style="list-style-type: none"> • 5069-AENTR dual-port EtherNet/IP adapter • 5069-AENTRK dual-port EtherNet/IP adapter, conformal coated • 5069-AEN2TR dual-port EtherNet/IP adapter with display diagnostics, integrated USB port, and SD card For more information, see Compact 5000 I/O Modules and EtherNet/IP Adapters Specifications Technical Data, publication 5069-TD001
	1769 Compact I/O™	<ul style="list-style-type: none"> • 1769-AENTR For more information, see the CompactLogix Communication Modules Specifications Technical Data, publication 1769-TD007 .
Distributed I/O, low-channel density	1734 POINT I/O™	<ul style="list-style-type: none"> • 1734-AENT, 1734-AENTR EtherNet/IP adapters • 1734-ADN, 1734-ADNX, 1734-PDN DeviceNet® adapters For more information, see the POINT I/O Modules Selection Guide, publication 1734-SG001 .
Distributed I/O, high-channel density	5094 FLEX 5000™ I/O	<ul style="list-style-type: none"> • 5094-AENTR, 5094-AENTRXT • 5094-AEN2TR, 5094-AEN2TRXT • 5094-AENSFPR, 5094-AENSFPRXT • 5094-AEN2SFPR, 5094-AEN2SFPRXT For more information, FLEX 5000 Modules Specifications Technical Data, see publication 5094-TD001
	1794 FLEX™ I/O	<ul style="list-style-type: none"> • 1794-AENT, 1794-AENTR, 1794-AENTRXT EtherNet/IP adapters • 1794-ADN, 1794-ADNK DeviceNet adapters For more information, see the FLEX I/O, FLEX I/O-XT, and FLEX Ex Selection Guide, publication 1794-SG002 .
Distributed I/O, no cabinet enclosure	1738 ArmorPOINT® I/O	<ul style="list-style-type: none"> • 1738-AENT, 1738-AENTR EtherNet/IP adapters • 1738-ADN12, 1738-ADN18, 1738-ADN18P, 1738-ADNX DeviceNet adapters For more information, see the ArmorPoint I/O Selection Guide, publication 1738-SG001 .

Table 38 - I/O Communication Interfaces

Condition monitoring module	1444 Dynamix™ I/O	Built-in Ethernet connectivity with 1444-DYN04-01RA module For more information, see the Dynamix -1444 Series Monitoring System User Manual, publication 1444-UM001 .
Redundant I/O	5015 FLEXHA 5000™ I/O	5015-AENFTXT Redundant EtherNet/IP adapter. For more information, see the FLEXHA 5000 I/O System Specifications Technical Data, publication 5015-TD001 .
	1715 Redundant I/O	1715-AENTR Redundant EtherNet/IP adapter For more information, see the 1715 Redundant I/O System Specifications Technical Data, publication 1715-TD001 .
Intrinsically Safe I/O	1719 Class 1, Div 2 I/O	1719-AENTR Intrinsically safe EtherNet/IP adapter For more information, see the 1719 Ex I/O Technical Data, publication 1719-TD001 .

Table 39 - Online Addition of Module and Connection Types

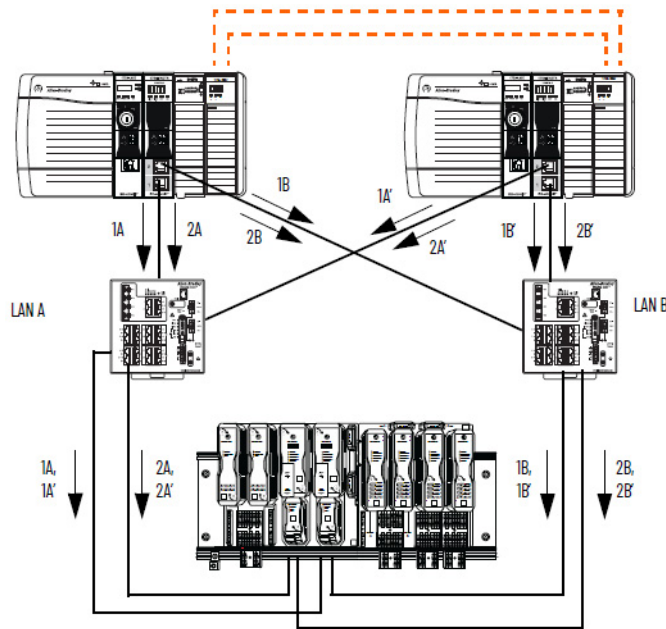
Module Type and Connection Method	In Local Chassis		Remote via an EtherNet/IP Network		Remote via a ControlNet® Network				Configure Hold Last Output State
	Offline	Runtime	Offline	Runtime	Offline		Runtime		Offline only
					Scheduled	Unscheduled	Scheduled	Unscheduled	
Digital - direct	Yes	Yes	Yes	Yes	Yes	Yes	–	Yes	Yes - 1756 I/O digital output modules
Digital - rack-optimized	–	–	Yes	Yes	Yes	–	Yes	–	Yes - 1756 I/O digital output modules
Analog - direct	Yes	Yes	Yes	Yes	Yes	Yes	–	Yes	Yes
Generic third-party - direct	Yes	Yes	Yes	Yes	Yes	Yes	–	Yes	–
1715 Redundant I/O	–	–	Yes	Yes	–	–	–	–	–
1718/1719 I/O	–	–	Yes	Yes	–	–	–	–	Yes - Both analog and digital modules
1756-ENx - no connection	Yes	Yes	Yes	Yes	–	–	–	–	–
1756-ENx - rack-optimized	–	–	Yes	Yes	–	–	–	–	–
Generic EtherNet/IP third-party - direct	–	–	Yes	Yes	–	–	–	–	–
1794 FLEX I/O	–	–	Yes	–	Yes	Yes	–	–	Yes - Analog output modules only
1734 POINT I/O	–	–	Yes	–	Yes	Yes	–	–	Yes
1734 POINT Guard I/O™	Yes	–	Yes	–	–	–	–	–	–
5069 Compact 5000 I/O	Yes	–	Yes	Yes ⁽¹⁾	–	–	–	–	Yes
5069 Compact 5000 I/O Safety Modules	Yes	–	Yes	–	–	–	–	–	–
5094 FLEX 5000	–	–	Yes	Yes	–	–	–	–	Yes
5094 FLEX 5000 I/O Safety Modules	–	–	Yes	–	–	–	–	–	Yes
5015 FLEXHA 5000 I/O	–	–	Yes	Yes	–	–	–	–	–

(1) Only supported if adding an entire rack of Compact 5000 I/O modules.

Concurrent Communication

Concurrent communication provides for seamless failover for any redundant pair of hardware components.

With concurrent communication, data transmission between the ControlLogix 5580 controllers and the FLEXHA 5000 I/O modules can be completely redundant at the logical and physical levels.



Remember the following:

- Each 1756-EN4TR EtherNet communication module in the redundant chassis pair sends duplicated data on each LAN at the same time.
- Data with the similar designations, for example, 1A and 1A', are the same but from different controllers with the only difference being a small identifier. In this case, it is the prime (') designation.
- All data transmission starts at the same time. The duplicated data that reaches the adapters first is what's used in the FLEXHA 5000 I/O system. The other data is disregarded.

Logical Level

Concurrent communication uses one logical CIP connection to transmit duplicate copies of I/O data to redundant devices. There is one I/O packet for each redundant device.

Via a 1756-EN4TR EtherNet/IP communication module, ControlLogix 5580 controllers operate in parallel and open the concurrent communication path to the FLEXHA 5000 I/O modules.

Each duplicate is targeted for one of the FLEXHA 5000 I/O modules in the redundant pair. The paired I/O modules receive duplicate data, compare the data, and establish one signal value that is set on the terminal screws.

A similar pattern is followed for input data that is transmitted from the paired FLEXHA 5000 I/O modules to the redundant ControlLogix 5580 controllers.

Physical Level

During transmission, the duplicated data passes along physical connections from the 1756-EN4TR EtherNet/IP communication modules and the FLEXHA 5000 EtherNet/IP adapter. Physical network redundancy is provided whether the system is operating in a PRP or DLR topology. Thus, the system has increased resiliency.

The physical network redundancy is achieved via redundant path between the 1756-EN4TR EtherNet/IP communication module and the FLEXHA 5000 EtherNet/IP adapter as follows:

- PRP network - Duplicated data at the physical level for each path.
- DLR network - Providing redundant paths.

Process Network Devices

PlantPAx leverages smart instrumentation to provide the right information to the right personnel at the right time. In a PlantPAx system, controllers are connected to field devices via field device components and communicate seamlessly through EtherNet/IP, DeviceNet, FOUNDATION Fieldbus, and PROFIBUS PA networks or by using HART protocol.

EtherNet/IP Devices

In a PlantPAx system, the EtherNet/IP™ network provides the communication backbone for the supervisory network for the workstations, servers, and the controllers. The EtherNet/IP network also supports controller downlinks and connections to remote I/O and field device interfaces.

The EtherNet/IP network technology is owned and managed by ODVA, a global association of member companies that advance open, interoperable information, and communication technologies in industrial automation.

Field instruments that support a direct connection to EtherNet/IP networks include the following:

- Endress+Hauser, Promass 83 and compact Promass 100 Coriolis flowmeters for liquid and gas flows
- Endress+Hauser, Promag 53 electromagnetic flowmeter for conductive liquids
- Endress+Hauser, Liquiline CM444 Multiparameter transmitter for monitoring and controlling processes
- Endress+Hauser, Proline Promag 100 Electromagnetic flowmeter for conductive liquids
- Endress+Hauser, Proline Promag L 400 Electromagnetic flowmeter for conductive liquids

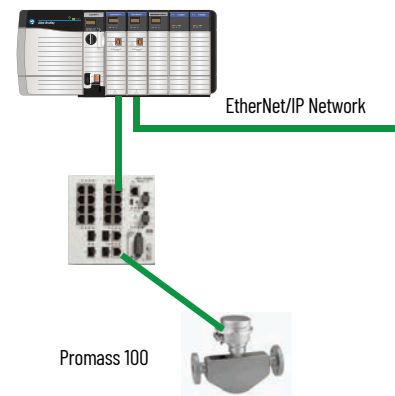


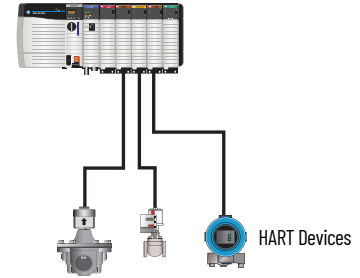
Table 40 - EtherNet/IP Interface

Category	Cat. No.	Description
ControlLogix EtherNet/IP interface	1756-EN2T, 1756-EN2TP, 1756-EN2TR, 1756-EN3TR, 1756-EN4TR, 1756-EN2F	ControlLogix EtherNet/IP bridge
Time Synchronization Ethernet Device	Aparian A-TSM/B	The Time Sync module provides Precision Time Protocol (PTP - Grand Master) and NTP Time services. This enables precision time synchronization for Logix Controllers and HMI systems. It can also provide GPS position data.

HART Devices

HART is an open communication protocol that is designed to connect analog devices to the controller and system.

The PlantPax system interfaces with HART devices both directly and via remote I/O modules. The HART protocol creates one termination point to gather analog process variables and the additional HART digital data.



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

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

Table 41 - HART Interface

Category	Cat. No.	Description
Chassis-based I/O modules	1756-IF8H, 1756-IF16H, 1756-OF8H	Allen-Bradley® analog I/O with the following: <ul style="list-style-type: none"> • 8-channel HART analog input module • 16-channel HART analog input module • 8-channel HART analog output module
	1756-IF8IH, 1756-IF16IH, 1756-OF8IH	Allen-Bradley isolated analog I/O with the following: <ul style="list-style-type: none"> • 8-channel isolated HART analog input module • 16-channel isolated HART analog input module • 8-channel isolated HART analog output module
	5069-IF4IH, 5069-OF4IH	Allen-Bradley isolated analog Compact 5000 I/O modules with HART: <ul style="list-style-type: none"> • 4-channel isolated HART analog input module • 4-channel isolated HART analog output module
Distributed I/O, high-channel density	1794-IF8IH, 1794-OF8IH	Allen-Bradley FLEX isolated analog I/O modules with the following: <ul style="list-style-type: none"> • 8-channel isolated HART analog input module • 8-channel isolated HART analog output module
	1794-IF8IHNFXT	Allen-Bradley FLEX I/O module with the following: <ul style="list-style-type: none"> • Extended temperature, noise filtering 8-channel isolated HART analog input module
	5094-IF8IH, 5094-IF8IHXT 5094-OF8IH, 5094-OF8IHXT	Allen-Bradley HART I/O with the following: <ul style="list-style-type: none"> • 8-channel isolated HART • 8-channel isolated HART extreme temperature
Distributed I/O, low-channel density	1734sc-IE2CH, 1734sc-IE4CH	Spectrum Controls, analog input module for the POINT I/O system <ul style="list-style-type: none"> • 2-channel HART analog input module • 4-channel HART analog output module
	1734sc-OE2CIH	Spectrum Controls, isolated analog input module for the POINT I/O system <ul style="list-style-type: none"> • 2-channel isolated HART analog output module
	1769sc-IF4IH, 1769sc-OF4IH	Spectrum Controls, isolated analog Compact I/O modules with HART: <ul style="list-style-type: none"> • 4-channel isolated HART analog input module • 4-channel isolated HART analog output module See the Encompass website for Spectrum Controls for product offerings.
Distributed I/O, intrinsically safe	1718-CF4H, 1718-IF4HB 1719-CF4H, 1719-IF4HB	Allen-Bradley EX I/O chassis-based design for Zone 2 or Class I, Div 2., via EtherNet/IP: <ul style="list-style-type: none"> • 4-channel configurable HART analog module • 4-channel HART analog input module • 4-channel HART analog input-wide module

Table 41 - HART Interface

Category	Cat. No.	Description
Redundant I/O Modules	5015-UHIFHTXT	Allen-Bradley redundant I/O with the following: <ul style="list-style-type: none">• 8-channel Universal I/O module
	1715-IF16 1715-OF8I	Allen-Bradley redundant I/O with the following: <ul style="list-style-type: none">• 16-channel HART analog input module• 8-channel isolated HART analog output module
Wireless HART	<ul style="list-style-type: none">• SWA70• SWG70• RSG4	Endress+Hauser wireless HART: <ul style="list-style-type: none">• WirelessHART adapter• WirelessHART fieldgate• Data manager
	<ul style="list-style-type: none">• WHA-ADP• WHA-BLT• WHA-GW	Pepperl+Fuchs wireless HART: <ul style="list-style-type: none">• WirelessHART adapter• WirelessHART bullet adapter• Wireless HART gateway

FOUNDATION Fieldbus Devices

The FOUNDATION Fieldbus network is a protocol that is designed for robust, distributed process application control. Devices that are connected by a FOUNDATION Fieldbus network can be used for sophisticated process control with seamless data distribution from the H1 device-level network. PlantPax systems communicate with FOUNDATION Fieldbus devices through EtherNet/IP linking devices as shown in the examples. Other configurations are available for simplex and redundant topologies.

The Aparian FF Link is a module that links FOUNDATION Fieldbus devices via an EtherNet/IP connection. This module combines an Ethernet/IP linking device with an internal isolated power conditioner and bus terminator.

The FF Link module supports redundancy by allowing two modules to be connected to the same H1 segment. The module has two Ethernet ports and natively supports Linear and Device Level Ring (DLR) topologies. Parallel Redundancy Protocol (PRP) is supported via a REDBOX.

Refer to the [Aparian website](#) for more information.

Basic Network Drawings

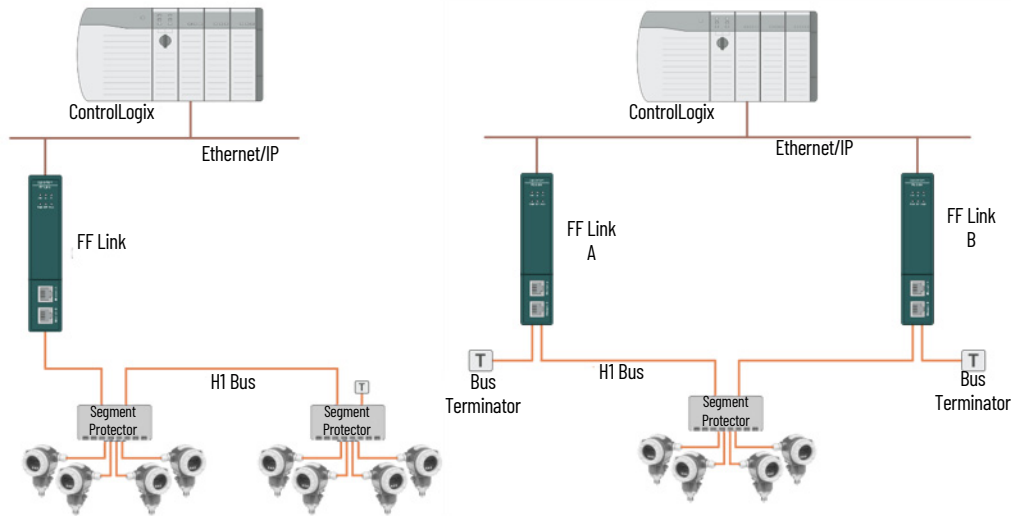


Table 42 - FOUNDATION Fieldbus Interface

Category	Cat. No.	Description
Ethernet/IP Linking Device	Aparian A-FFL/B	Aparian Foundation Fieldbus Link Module
Foundation Fieldbus network components	Segment Protection	Helps protect against device or line faults with short- and open-circuit protection. Pepperl+Fuchs, intrinsic safety components, such as isolated barrier systems, hazardous area enclosures, and equipment. See the Encompass™ website for Pepperl+Fuchs product offerings.
	Additional components	Pepperl+Fuchs, FOUNDATION Fieldbus components, such as valve couplers, surge protectors, and distributors. See the Encompass website for Pepperl+Fuchs product offerings

PROFIBUS PA Devices

The PROFIBUS PA network connects automation systems and process control systems with field devices such as flow, level, pressure, and temperature transmitters. PlantPAx systems communicate with PROFIBUS PA fieldbus devices through EtherNet/IP linking devices. Other configurations are available for simplex and redundant topologies.

The Aparian PA Link is a module that links PROFIBUS PA devices via an EtherNet/IP connection. This module combines an EtherNet/IP linking device with an internal isolated power conditioner and bus terminator.

The PA Link module supports redundancy by allowing two modules to be connected to the same PROFIBUS PA segment. The module has two Ethernet ports and natively supports Linear and Device Level Ring (DLR) topologies. Parallel Redundancy Protocol (PRP) is supported via a REDBOX.

Refer to the [Aparian website](#) for more information.

Basic Network Drawings

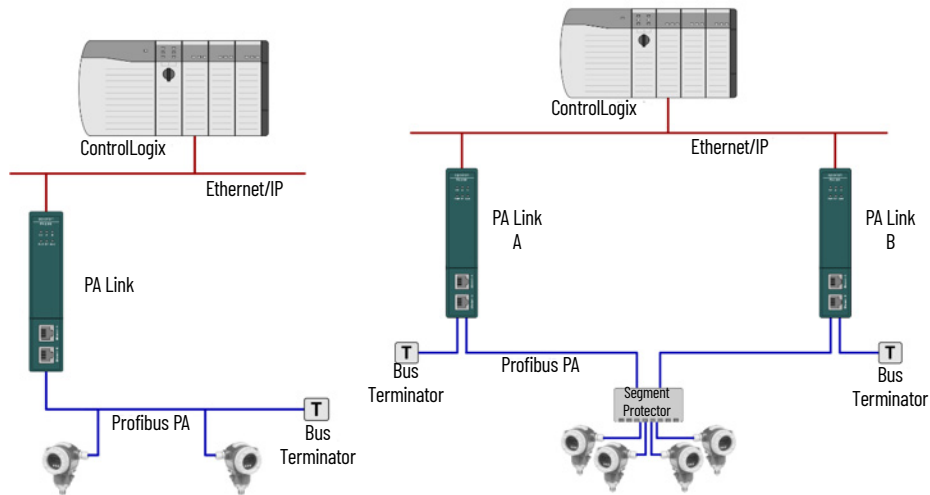


Table 43 - PROFIBUS PA Interface

Category	Cat. No.	Description
Ethernet/IP Linking Device	Aparian A-PAL/B	Aparian PROFIBUS PA Link Module
PROFIBUS network components	Segment Protection	Helps protect against device or line faults with short- and open-circuit protection. Pepperl+Fuchs, intrinsic safety components, such as isolated barrier systems, hazardous area enclosures, and equipment. See the Encompass website for Pepperl+Fuchs product offerings
	Additional components	Pepperl+Fuchs, PROFIBUS components, such as valve couplers, surge protectors, and distributors. See the Encompass website for Pepperl+Fuchs product offerings.

Motor Control Devices

Rockwell Automation offers a broad range of motor control solutions to complement various application requirements. The portfolio of motor control devices includes simplified programming and configuration along with safety features to help protect personnel and assets that help to reduce downtime.

Low Voltage Drives

PowerFlex® Low Voltage AC drives provide scalable motor control solutions and are designed to deliver more powerful performance and flexibility for process applications. As part of a PlantPax system, PowerFlex drives offer seamless integration into your process control system for simplified development, use, and maintenance.

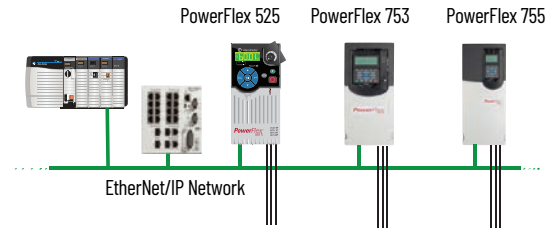


Table 44 - PowerFlex Drives and Communication Modules

Drive Cat. No. ⁽¹⁾	Description	Available Communication Modules ⁽¹⁾	
		Cat. No.	Description
25B-	PowerFlex 525 AC drive with an embedded EtherNet/IP port and an embedded Safe Torque Off (STO).	<ul style="list-style-type: none"> • 25-COMM-E2P • 25-COMM-D 	<ul style="list-style-type: none"> • Dual-port EtherNet/IP, supports DLR functionality • DeviceNet
20F-	PowerFlex 753 AC drive	<ul style="list-style-type: none"> • 20-750-BNETIP • 20-750-DNET • 20-750-ENETR • 20-750-PBUS • 20-COMM-D • 20-COMM-E • 20-COMM-P 	<ul style="list-style-type: none"> • BACnet/IP option modules • DeviceNet option module • Dual-port EtherNet/IP option module • PROFIBUS DPV1 option module • DeviceNet communication adapter • EtherNet/IP communication adapter • PROFIBUS DP communication adapter
20G-	PowerFlex 755 drive		
20G-	PowerFlex 755TL/755TR	<ul style="list-style-type: none"> • 20-750-DNET • 20-750-ENETR • 20-750-PBUS 	<ul style="list-style-type: none"> • DeviceNet option module • Dual-port EtherNet/IP option module • PROFIBUS DPV1 option module

(1) For a complete list of catalog numbers, see the PowerFlex Low Voltage AC Drives Selection Guide, publication [PFLEX-SG002](#).

Medium Voltage Drives and Relays

PowerFlex medium voltage AC drives and relays provide scalable motor control solutions and electrical protection. Standalone drives control speed, torque, direction, starting, and stopping of standard asynchronous or synchronous AC motors. As part of a PlantPax system, PowerFlex drives incorporate leading-edge technology, embedded communications, and significant commonality across multiple platforms, networks, operator interface programming and hardware. The benefits of this exceptional level of integration between the drives and Logix controllers provides distinctive time-saving features for the PowerFlex 6000 and 7000 drives.

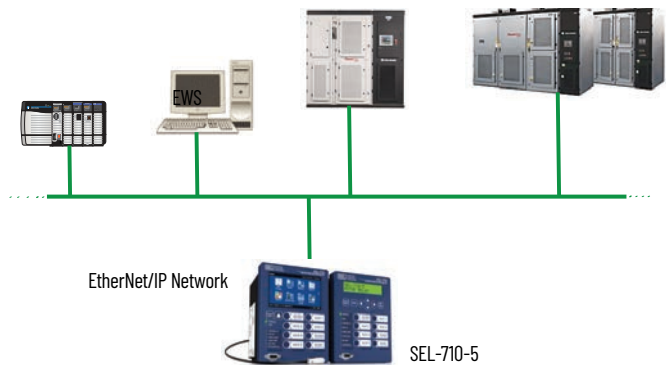


Table 45 - Medium Voltage Drives and Relays

Drive Cat. No. ⁽¹⁾	Description	Available Communication Modules ⁽¹⁾	
		Cat. No.	Description
PF-6000G	PowerFlex 6000	<ul style="list-style-type: none"> • 13MLXE • 13MLXP • 13TMLXH, 13TMLXM, 13TMLXMP 	<ul style="list-style-type: none"> • EtherNet/IP • PROFIBUS RS-485 • Modbus Communication Adapters

Table 45 - Medium Voltage Drives and Relays

Drive Cat. No. ⁽¹⁾	Description	Available Communication Modules ⁽¹⁾	
		Cat. No.	Description
PF-6000T	PowerFlex 6000	<ul style="list-style-type: none"> 13TCOMME 13TCOMMP 13TCOMMPN1, 13TCOMMPN2 13TMLXH, 13TMLXM, 13TMLXMP 	<ul style="list-style-type: none"> EtherNet/IP PROFIBUS DPV1 PROFINET Communication Adapters Modbus Communication Adapters
PF-7000 / PF-7000A / PF-7000L	PowerFlex 7000	<ul style="list-style-type: none"> 13COMMER 13COMME 13COMMP 13COMMH, 13COMM 	<ul style="list-style-type: none"> Dual EtherNet/IP EtherNet/IP PROFIBUS Modbus Communication Adapters
SEL-710-5	Motor Protection Relay	See the SELwebsite or your Rockwell Automation representative or more information.	

(1) For a complete list of catalog numbers, see the PowerFlex Medium Voltage AC Drives Selection Guide, publication [PFLEX-SG003](#).

Soft Starters

SMC™ Soft Starters are designed to help minimize cost by reducing overall system power requirements and wear and tear on equipment. Our soft starters can be easily integrated into your process control system to offer higher productivity and shorter downtimes.

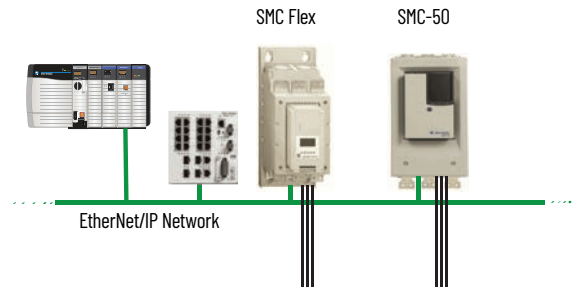


Table 46 - SMC Soft Starters and Communication Modules

Cat. No. ⁽¹⁾	Description	Available Communication Modules ⁽¹⁾	
		Cat. No.	Description
150-F	SMC™ Flex Smart Motor Controllers	<ul style="list-style-type: none"> 20-COMM-D 20-COMM-E 20-COMM-ER 	<ul style="list-style-type: none"> DeviceNet communication adapter EtherNet/IP communication adapter Dual-port EtherNet/IP communication adapter
150-S	SMC™-50 Solid-state Smart Motor Controllers	<ul style="list-style-type: none"> 20-COMM-D 20-COMM-E 20-COMM-ER 	<ul style="list-style-type: none"> DeviceNet communication adapter EtherNet/IP communication adapter Dual-port EtherNet/IP communication adapter

(1) For additional product information, see the Smart Motor Controllers – SMC™-3, SMC™ Flex, and SMC-50 Soft Starters Family Brochure, publication [150-BR144](#).

Across-the-line Starters

Our light industrial IEC starters are environmentally friendly, versatile, and flexible. Our heavy-duty NEMA starters are renowned for a more-rugged construction, more dependable performance, and longer electrical life. In addition, this portfolio offers Electronic Overload Relays that provide integration between the starters and Logix controllers. The diagnostic capabilities of the overload relays help maximize uptime for motor control in an automation system.

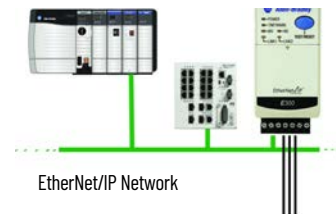


Table 47 - Electronic Overload Relays and Communication Modules

Cat. No. ⁽¹⁾	Description	Available Communication Modules ⁽¹⁾	
		Cat. No.	Description
193/592-E300	E300™ Electronic Overload Relays	193-ECM-ETR	EtherNet/IP communication module

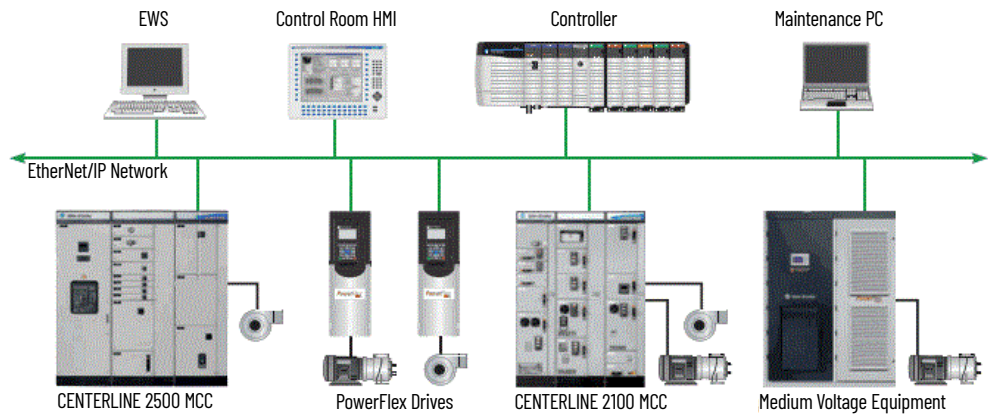
(1) For additional product information, see the Motor Protection Solutions Brochure, publication [193-BR029](#).

Motor Control Centers

As an alternative to wiring each device individually, Rockwell Automation offers low-voltage motor control centers (MCC). The MCCs feature a rugged, high-performance packaging solution for all your motor control needs that integrate control and power in one centralized location.

CENTERLINE® MCCs are available with safety options that help reduce exposure to electrical hazards and arc flash mitigation and containment.

Table 48 - Low Voltage Motor Control Centers



Category ⁽¹⁾	Cat. No.	Description
CENTERLINE 2100 MCC	2100	<ul style="list-style-type: none"> • Designed to meet UL and NEMA standards • Allen-Bradley motor control devices: starters, soft-starters, and drives • Available with SecureConnect™ units • ArcShield™ arc-resistant enclosures available • EtherNet/IP and DeviceNet networking • IntelliCENTER® software
CENTERLINE 2500 MCC	2500	<ul style="list-style-type: none"> • Designed to meet IEC standards • Allen-Bradley motor control devices: starters, soft-starters, and drives • ArcShield™ arc-resistant enclosures available • EtherNet/IP and DeviceNet networking • IntelliCENTER software

(1) For more information, see [Low Voltage Motor Control Centers](#).

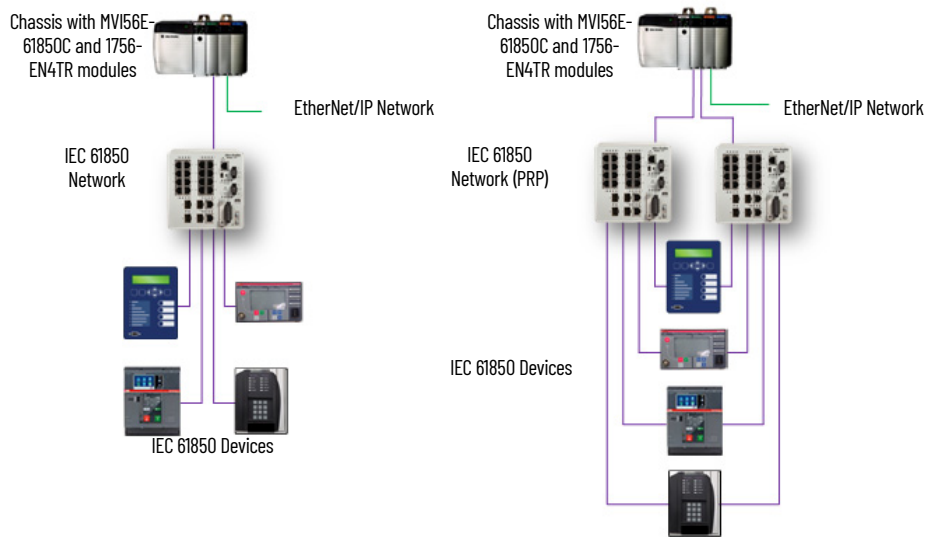
Electrical Protection Devices

The ProSoft MVI56E-61850C is an in-chassis communication module that connects Intelligent Electronic Devices (IEDs) communicating on IEC 61850 to the process automation equipment communicating on EtherNet/IP. The IEC 61850 communication module allows users to have complete control, visualization and reporting across their entire PlantPAx system.

Refer to the [ProSoft website](#) for more information.

Additionally, PlantPAx fully supports the Library of Electronic Protection Devices. The Library of Electronic Protection Devices includes vendors such as Schweitzer Engineering Lab, ABB, GE and Allen-Bradley Intelligent Electronic Devices. The library contains Add-on Instructions, Global Objects and graphics that allows the user to easily integrate the control and visualization of IEDs into a power single line diagram.

Refer to Rockwell Automation Library of Electronic Protection Devices, publication [PROCES-RM211](#) for more information.



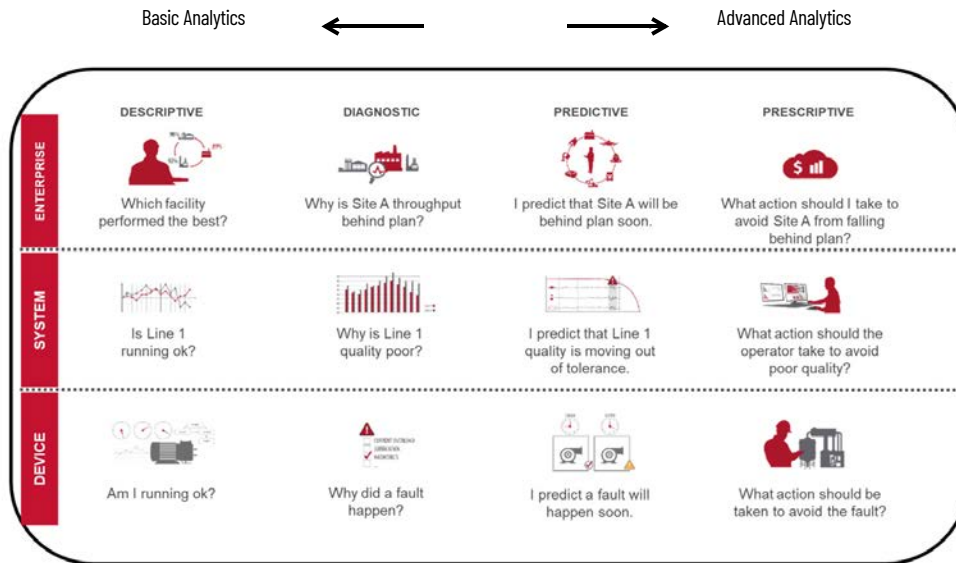
IEC 61850 Module

Category	Cat. No.	Description
IEC 61850 module	ProSoft MVI56E-61850C	Prosoft In-Chassis IEC 61850 Communication Module
IEC 61850 additional components	1756-EN4TR	In-Chassis Ethernet/IP Communication Module
	Stratix 5400/5800	Network switch for IEC 61850 protocol
	ControlLogix 5580	Controller required for IEC 61850 module (v32 or greater)

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 provides methods 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



IIoT Data Enablement Options

To enable IIoT applications with the critical data from the PlantPAx DCS, users need to utilize gateways that can pull data from the various data sources. PlantPAx offers multiple options to enable this data flow.

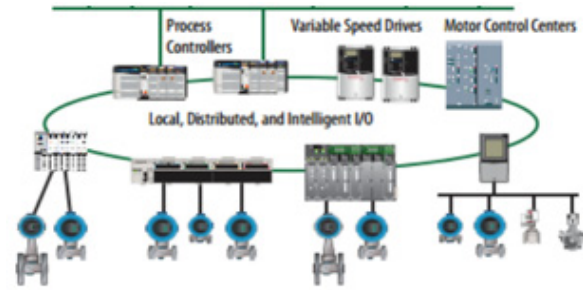
Option	Description
FactoryTalk Optix	While FactoryTalk Optix is known as an HMI solution, PlantPAx support will initially utilize it as a platform to connect, contextualize and egress data. There are many ingress and egress options available including OPC UA. PlantPAx specific support: <ul style="list-style-type: none"> • EventQ Add on enables the capture of controller-based events to be used in Standard PlantPAx report
FactoryTalk Linx Gateway	FactoryTalk Linx Gateway software provides data from the PlantPAx FactoryTalk Linx servers as a OPC UA Server. It integrates with IIoT applications that are configured as a OPC UA Client for live PlantPAx DCS data. PlantPAx specific support: <ul style="list-style-type: none"> • Enables the connection from FactoryTalk Linx to ThingWorx OPC Aggregator for live DCS data.

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.

Device-level analytics provide:

- Streaming analysis
- Runtime deployment
- Device data generation



Products that provide device-level analytics include:

Option	Description	Type: Diagnostic, Predictive
FactoryTalk® Analytics™ LogixAI®	An 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.	Environment: ControlLogix chassis Available via the subscription portal Requirements: <ul style="list-style-type: none"> • 1756M-FTALGXAIT1M FactoryTalk Analytics LogixAI appliance
PlantPax MPC	Model Predictive Control embedded in ControlLogix systems <ul style="list-style-type: none"> • Multi-variable in and multi-variable out • Predictive control • Reduction in variability 	Type: Predictive, Prescriptive Environment: ControlLogix chassis Requirements: <ul style="list-style-type: none"> • 1756-PPMPC or 9529-PPMPCENM module
APC Function Blocks	You can use APC function blocks in place of PID instructions for loops with long dead-times and interacting loops. The APC function blocks are licensed, run on the EWS, and require the Studio 5000 Logix Designer application. <ul style="list-style-type: none"> • Internal model control (IMC) to control one process variable • Coordinated control (CC) to control one process variable with up to three control variables • Modular multivariable control (MMC) to control two process variables with up to three control variables 	Type: Predictive, Prescriptive Environment: Logix 5000 function blocks Requirements: <ul style="list-style-type: none"> • 9324-RLDAPCENE for first controller • 9324-RLDAPCCLENE for subsequent controllers

System Level Options

System-level analytics provide:

- Data management, and transformation
- Model training and deployment
- Pattern extractions



FactoryTalk products that add system-level analytics include:

Option	Description	Type: Predictive, Prescriptive
Pavilion8®	Provides closed-loop, prescriptive analytics to maximize process performance in quality, throughput and efficiency. <ul style="list-style-type: none"> • Model-based advanced, dynamic control drives stable performance • Integrated MPC, calculation, and soft sensor visualization and performance reporting 	Environment: Server based Requirements: <ul style="list-style-type: none"> • Pavilion8 software

Option	Description	
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"> • Helps make decisions as close as possible to the data • Reduce loads on controllers by off-loading data preprocessing • Reduces deployment time costs • Out-of-box connectivity reduces design time 	<p>Type: Predictive</p> <p>Environment: Server based Part of the FactoryTalk Analytics; available via the subscription portal</p> <p>Requirements:</p> <ul style="list-style-type: none"> • FactoryTalk Analytics Edge ML base bundle or • FactoryTalk Analytics Platform base bundle

Enterprise-Level Options

Enterprise-level analytics provide:

- Data visualization
- Data mining
- Enterprise resource planning
- Model training
- Model operationalization
- Pattern extraction



FactoryTalk products that add enterprise-level analytics include:







Option	Description	
FactoryTalk Analytics Edge ML (also applicable at system 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"> • Helps make decisions as close as possible to the data • Reduce loads on controllers by off-loading data preprocessing • Reduces deployment time costs • Out-of-box connectivity reduces design time 	<p>Type: Predictive</p> <p>Environment: Server based Part of the FactoryTalk Analytics; available via the subscription portal</p> <p>Requirements:</p> <ul style="list-style-type: none"> • FactoryTalk Analytics Edge ML base bundle or • FactoryTalk Analytics Platform base bundle
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"> • Work instructions become handsfree and are delivered in real time where assembly or field service take place. • Tribal knowledge of experienced workers is captured and shared with new workers and service technicians. • Remote expertise can be delivered to workers no matter where they are in the world. 	<p>Type: Descriptive, Diagnostic</p> <p>Environment: Cloud-based Part of the FactoryTalk® InnovationSuite Bulletin 95057C; available via the subscription portal</p> <p>Requirements:</p> <ul style="list-style-type: none"> • Vuforia Engine software • Vuforia Studio software • Vuforia Chalk software • Vuforia Expert Capture software

Option	Description	
ThingWorx® Industrial IoT platform	<p>An integrated, secure solution to minimize risk, reduce IT burden, and maximize value from the software investment. 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 one 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 and gas industry formats. ThingWorx industrial connectivity provides one 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>Type: Descriptive, Diagnostic, Predictive, Prescriptive</p> <p>Environment: Cloud-based Part of the FactoryTalk Innovation Suite Bulletin 95057C; available via the subscription portal</p> <p>Requirements:</p> <ul style="list-style-type: none"> • ThingWorx platform software <ul style="list-style-type: none"> - Asset Advisor - Operator Advisor - Production Advisor - ControlAdvisor • ThingWorx Industrial Connectivity software
PlantPax Analytics	<p>PlantPax Analytics is a Rockwell Automation solution built on FactoryTalk DataMosaix. PlantPax Analytics delivers alarm & event KPI dashboards and reports in a single enterprise solution. Combine one or multiple site's data to unlock the full value of your process data.</p>	<p>Requirements: FactoryTalk DataMosaix Standard or Enterprise Subscription PlantPax Analytics Subscription PlantPax 5.0 or later system</p>

A process automation solution often includes the requirement for an integrated safety system as part of the overall Safety Instrumented System (SIS) requirements for a process facility. The SIS logic solver is a separate but integrated technology that can use common or diverse technology to meet the safety integrity needs for any process application.

The SIS logic solver requirements can include fault tolerance, fail-safe, or a mix of architecture and Safety Integrity Level (SIL) requirements. Fault tolerance means that plant operation is maintained if a fault occurs, while fail-safe means that the SIS initiates a shutdown upon detecting a fault.

Table 49 - Typical SIL and Architecture System Requirements

Process Safety Platform	Safety Application	Architecture	Typical SIL Range	Demand	
 <p>Trusted</p> <p>AADvance</p> <p> TÜVRheinland® Precisely Right.</p>	Emergency shutdown/SIS	Fault Tolerant	Up to SIL 3	Low/High	
	Fire and gas		SIL 2	Low	
	High integrity pressure system		SIL 3		
	Chemical processing		Up to SIL 3	High	
	Refining			Low/High	
 <p>AADvance</p> <p> TÜVRheinland® Precisely Right.</p>	Burner management (continuous process)	Fault Tolerant	Up to SIL 3	High	
	Subsea ⁽¹⁾		SIL 2	Low	
	Power generators				
 <p>ControlLogix</p> <p> TÜVRheinland® Precisely Right.</p>	Burner management (power and utilities)	Fail-safe	SIL 2	High ⁽²⁾	
	Turbomachinery				
	Life sciences				
	Mining	Fault Tolerant		Low	
	Power equipment				
	Specialty chemical				
	High Availability control systems			Low/High ⁽²⁾	

(1) The AADvance solution is available in a Eurocard format, qualified for Subsea production applications under ISO13628-6.

(2) ControlLogix controllers are limited to a demand rate not to exceed 10 demands per year. While this is a high demand rate, this solution possibly could not be suitable for high-demand applications.

Safe, reliable systems safeguard people, property, the environment, and company or corporate reputations. Third-party certification for applying technologies in applications up to a specific SIL level significantly reduces complexity when complying with national and international process safety standards worldwide.

Process safety technology selection is based on functional and target SIL requirements, which are defined in the projects Safety Requirements Specification (SRS). For example, if the SRS requirement is for the Safety Instrumented Function to fail safely upon a fault, you can select a fail-safe only technology. If however, some level of fault tolerance is defined for your process safety system, you can select a fault tolerant technology.

There are different levels of fault tolerance available. For example:

- 1oo2d refers to a voting and degradation architecture where diagnostics are used to determine the validity of two values or states. When both values are 'healthy', then either one out of the two (1oo2) available is used in the outcome of the safety instrumented function (SIF). When one of the two values or states is determined to be 'invalid', then that value or state is no longer considered when determining the outcome of the SIF. (The voting degrades to 1oo1, one out of the remaining good one). This dramatically reduces the spurious trip rate of a basic 1oo2 architecture, while maintaining safety performance.
- 2oo3 refers to a voting and degradation architecture where comparison diagnostics are used to determine the outcome of the SIF. Two 'out of the three' (2oo3) available values or states are required to determine the outcome of a SIF. This architecture, often referred to as Triple Modular Redundancy (TMR), lets a failed value or state be ignored when resolving the SIF.



In addition to the comparison diagnostics, active diagnostics are also used to validate states and values that are used in the outcome of the SIF.

ControlLogix SIL 2 Systems

ControlLogix supports process safety applications up to SIL 2 that require fault tolerance and redundancy. ControlLogix supports 1oo2d fault tolerance with the 1715 I/O system. However, ControlLogix redundancy does not use a voting mechanism, rather it acts as a hot standby. The components of the 1715 I/O system comprise a pair of partnered Ethernet adapters that communicate to ControlLogix controllers via an EtherNet/IP network, and digital and analog I/O modules that are configurable in simplex and duplex modes.

The ControlLogix controller complies with the requirements of the relevant standards (SIL 2 according to IEC 61508) and can be used in low demand applications up to SIL 2 according to IEC 61508). The instructions of the associated Safety Reference Manual and User Manuals are to be considered.

ControlLogix SIL 2 systems use the same programming software and data interfaces as used for process control on the PlantPAx system. The hardware that is used for process safety must be dedicated for process safety applications. Specific hardware, firmware revisions, and software versions are required to meet SIL certifications.

AADvance and Trusted SIL 2, SIL 3, and TMR Systems

Diverse SIS logic solvers use different hardware and software platforms for process safety applications than that used for process control on the PlantPAx system. This approach is used to minimize common cause faults from influencing the overall safety integrity. Triple redundancy minimizes the possibility of any single component failure to cause a spurious or spurious trip. Diverse process safety integrates with the basic process control on the PlantPAx system by using CIP™ connectivity including profile support in the Studio 5000 Logix Designer application (AADvance) or via OPC connectivity (AADvance or Trusted®).

Both the Trusted and AADvance systems share a common EtherNet/IP network within a PlantPAx system. In addition, AADvance and Trusted support redundant Ethernet networks, while the AADvance system supports the CIP producer and consumer communication protocol.

Table 50 - Diverse SIL 2 and SIL 3 Products

Category	Description
AADvance system	<ul style="list-style-type: none"> Configurable for SIL 2 and SIL 3 Scalable redundancy for fault tolerance Simplex, duplex, or triplex configuration
Trusted system	Trusted technology uses 3-2-0 (3-2-2-0 optionally) fault-tolerant control to help eliminate spurious trips. Triple modular redundancy (TMR) uses majority voting to identify a source of failure. Available with OPC or CIP integration.

Table 51 - Additional Resources

Resource	Description
AADvance Controller Solutions Handbook, publication ICSTT-RM447	Explains the features, performance, and functionality of the AADvance controller and systems. It sets out some guidelines on how to specify a system to meet your application requirements.
AADvance Controller System Build Manual, publication ICSTT-RM448	Provides experienced panel builders with information on how to assemble a system, switch on and validate the operation of a controller.
AADvance Controller Configuration Guide, publication ICSTT-RM405	Defines how to configure an AADvance controller by using the AADvance Workbench to meet your Safety Instrument Function (SIF) application requirements.
AADvance Controller Safety Manual, publication ICSTT-RM446	Provides mandatory guidance on how to apply AADvance to meet various industry standards and makes recommendations to apply AADvance in SIS applications safely.
AADvance Controller Troubleshooting and Repair Manual, publication ICSTT-RM406	Provides plant maintenance personnel with information on how to trace and repair a fault in an AADvance system and perform routine maintenance tasks.

SIL-rated Instruments

SIL-rated instruments are typically required for process safety loops. Rockwell Automation provides premier integration between ControlLogix systems and Endress+Hauser SIL-rated instruments. For more details, see the Endress+Hauser website at <https://www.endress.com>.

PowerFlex SIL 2 and SIL 3 Systems

PowerFlex AC drives offer SIL ratings up to and including SIL 3. Specifically, the PowerFlex 525 AC drive offers Safe Torque Off (STO) as a standard embedded feature with a safety rating of PLd/SIL2 Cat. 3. The PowerFlex 753 and 755 AC drives are available with optional STO functionality with a safety rating of PLe/SIL3 Cat. 3. In addition, the PowerFlex 753 and 755 offer a Safe Speed Monitor option for applications that can benefit from access to a safety zone while there is limited motion. The Safe Speed Monitor option has a rating of PLe/SIL3 Cat. 4.

PowerFlex STO functionality is designed to help safely remove power from the gate firing circuits of the output power devices (IGBTs). This functionality helps prevent the output power devices from switching in the pattern necessary to generate AC power to the motor. PowerFlex AC drives can be used in combination with other safety devices to satisfy the requirements of IEC 61508, IEC 61800-5-2 SIL 3, ISO 13849-1 PLe, and Category 3 for STO.

For more information, see the PowerFlex Low Voltage AC Drives Selection Guide, publication [PFLEX-SG002](#).

OptiSIS Safety Integrated Systems

The OptiSIS® safety system uses an AADvance safety logic solver for a process safety solution that is ready to install and configure with no programming required. OptiSIS lets you configure safety functions by using an intuitive Cause and Effect interface from the HMI display.

OptiSIS includes options for:

- Fail-safe or fault tolerant architectures
- Indoor or outdoor environments
- Floor and wall mount
- 50 or 100 I/O count

OptiSIS is a great solution for small process safety applications. In addition, if you have an existing process safety system (for example, an older relay or legacy system) that can no longer be maintained, OptiSIS can provide a cost-effective and short delivery replacement.

For more information, see the OptiSIS Packaged Solution Profile, publication [1711-PP006](#).

Notes:

Rockwell Automation Support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, and product notification updates.	rok.auto/support
Knowledgebase	Access Knowledgebase articles.	rok.auto/knowledgebase
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	rok.auto/pcdc

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