



PlantPax Distributed Control System

PlantPax
Distributed Control System



Selection Guide

Original Instructions

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.

What's Inside

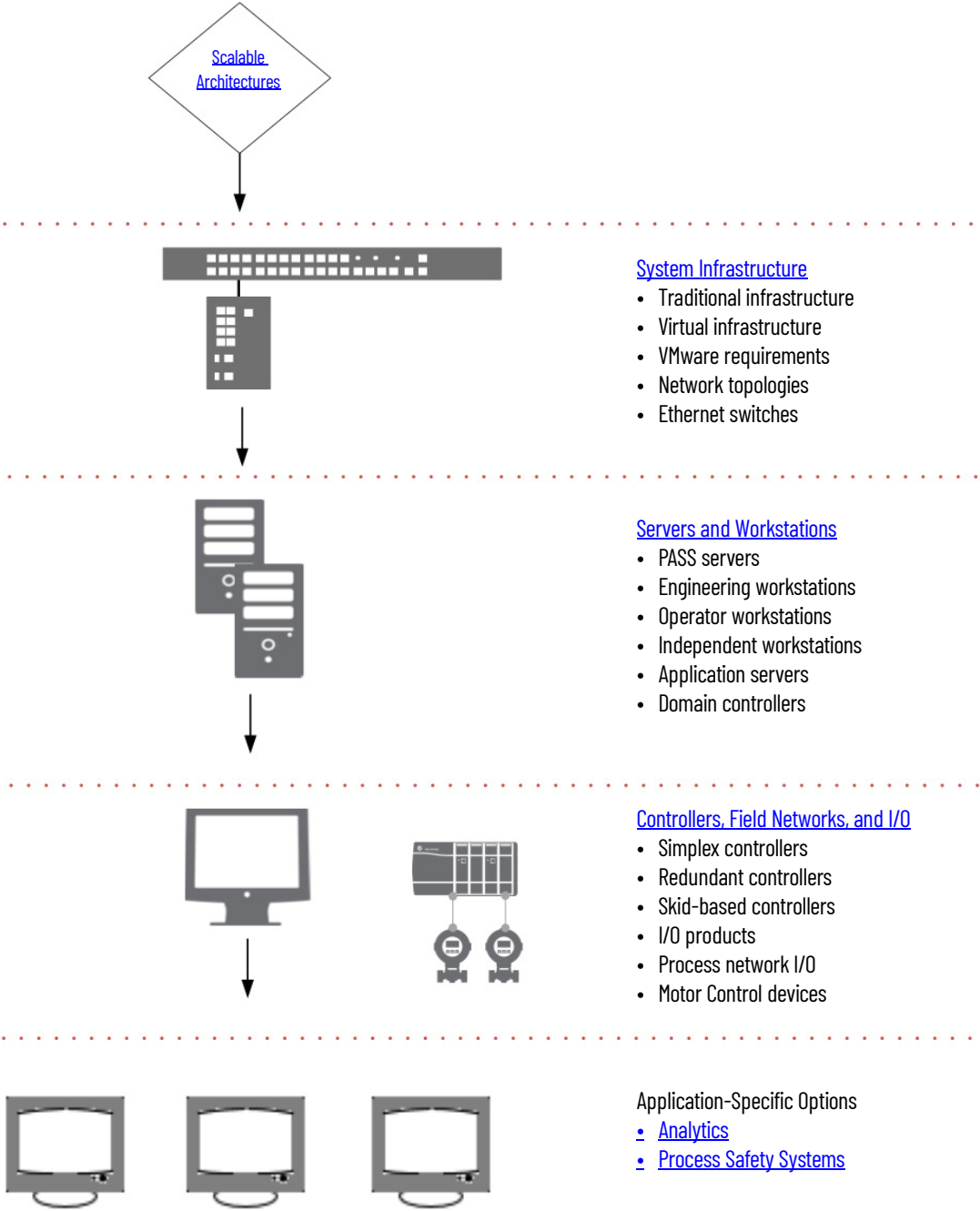
This revision of the PlantPAx Selection Guide updates system rules to support the latest characterized products.

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Additional Resources

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

Resource	Description
System Core	
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.
PlantPAx Hardware Specifications and Certifications, publication PROCES-SR027	Provides information on PlantPAx system hardware specifications and certifications.
Process Automation System Training Curriculum, publication PROCES-CA001	Describes the courses that are available for a better understanding of the PlantPAx system.
http://www.rockwellautomation.com/solutions/process	Provides general information about Rockwell Automation process capabilities. From the menu bar, select Support> Modernization Support for DCS migration information.
http://www.migratemyprocess.com/webinars	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	
PlantPAx Template User Manual, publication 9528-UM001	Describes the catalog numbers and details for using virtual image templates to configure virtual machines.
Stratix Ethernet Device Specifications Technical Data, publication 1783-TD001	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.
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.
Field Device Integration	
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.
http://www.endress.com	Products from Endress+Hauser.
Encompass™ partners	Provides information on connected cabling systems and infrastructure management from Encompass™ partners.



Welcome and thank you for choosing the PlantPax Distributed Control System. The PlantPax system is an integrated control and information solution that provides plantwide optimization for a wide range of industries. This single-platform system is built on open industry standards to help support the seamless integration of system components, and to provide connectivity to high-level business systems.

A PlantPAx system consists of these system elements.

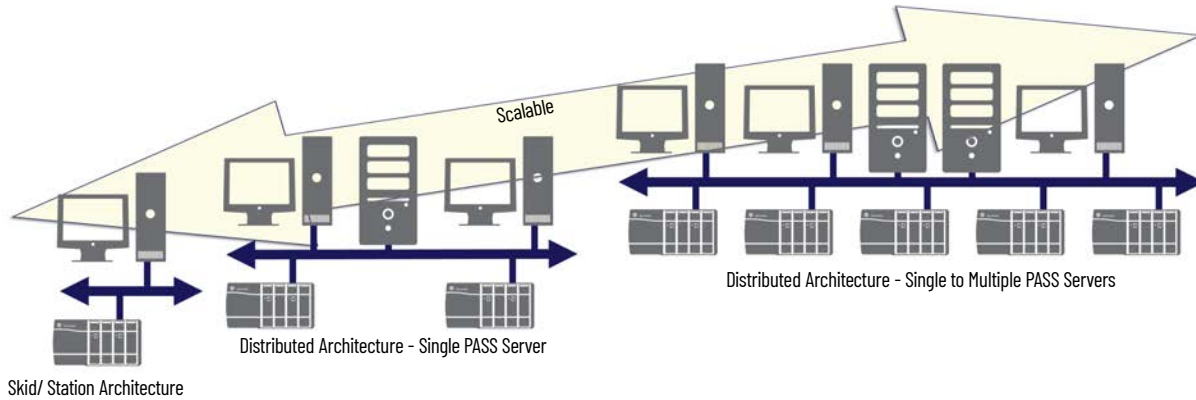
Table 1 - System Element Descriptions

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 (Historian, VantagePoint®, SQL)	Data management storage can include a Historian or SQL server. There are three different types of AppServ-Info servers depending on the function that is being provided: FactoryTalk® Historian software, FactoryTalk® VantagePoint® software, and the 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:

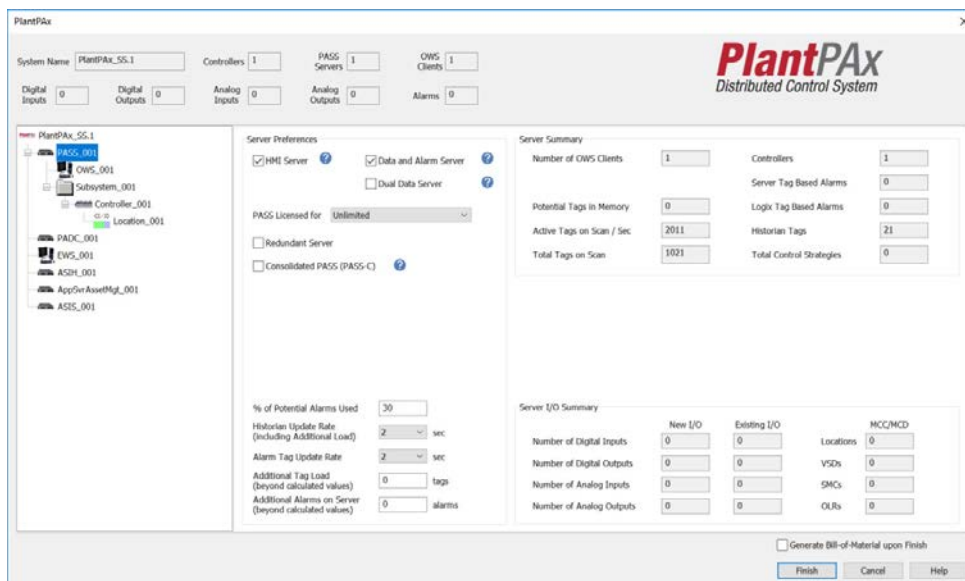


Consideration	Skid or Station Architecture (small < 2000 I/O)	Distributed Architecture PASS-C (small < 2000 I/O)	Distributed Architecture Single or Multiple PASS (medium= 2,000...10,000 I/O)	Distributed Architecture Single or Multiple PASS (large = 10,000+ I/O)
FactoryTalk® Directory	Place FactoryTalk Directory on the station	Place FactoryTalk Directory on the PASS-C	Place FactoryTalk Directory on its own PASS	Place FactoryTalk Directory on its own PASS
PASS	Single station serves as PASS and OWS in an independent workstation.	One PASS-C that includes: <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 hosts: <ul style="list-style-type: none"> • FactoryTalk Historian • AppServ-Asset Management • AppServ-VantagePoint • AppServ-Info (SQL) 	One PASS that includes: <ul style="list-style-type: none"> • HMI server • Data server (as many as 2 per PASS) • Alarm and Event server Additional PASS, as needed (as many as 10 servers or redundant server pairs).	One PASS that includes: <ul style="list-style-type: none"> • HMI server • Data server (as many as 2 per PASS) • Alarm and Event server Additional PASS as needed (as many as 10 servers or redundant server pairs)
EWS	1 EWS required; provided separately	Included within PASS-C image	<ul style="list-style-type: none"> • 1 EWS required • Can have as many as 5 EWS that are active and in use • Additional AppServ-EWS as needed 	<ul style="list-style-type: none"> • 1 EWS required • Can have as many as 5 EWS that are active and in use • Additional AppServ-EWS as needed
OWS (clients)	Provided separately via independent workstation	Maximum 10 OWS clients	<ul style="list-style-type: none"> • Can have as many as 120 OWS clients • Additional AppServ-OWS as needed 	<ul style="list-style-type: none"> • Can have as many as 120 OWS clients • Additional AppServ-OWS as needed
Controller	1...5 CompactLogix or ControlLogix	1...5 CompactLogix or ControlLogix	ControlLogix Architecture Actual count varies depending on application requirements. There is 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 load, and number of OWS.	
Application Servers	Not applicable <ul style="list-style-type: none"> • In-chassis historian and in-controller batch are available. • Can be integrated into a distributed architecture. 	Included within PASS-C image	<ul style="list-style-type: none"> • AppServ-Batch as needed • AppServ-Info (FactoryTalk Historian or FactoryTalk VantagePoint®) as needed 	<ul style="list-style-type: none"> • AppServ-Batch as needed • AppServ-Info (FactoryTalkHistorian or FactoryTalkVantagePoint) as needed

Consideration	Skid or Station Architecture (small < 2000 I/O)	Distributed Architecture PASS-C (small < 2000 I/O)	Distributed Architecture Single or Multiple PASS (medium= 2,000...10,000 I/O)	Distributed Architecture Single or Multiple PASS (large = 10,000+ I/O)
AppServ-Asset	Not applicable. If attached to a PlantPax DCS, make sure FactoryTalk® AssetCentre can access the skid assets	Included within PASS-C image	AppServ-Asset (FactoryTalk AssetCentre) is required	AppServ-Asset (FactoryTalk AssetCentre) is required
AppServ-Info (SQL)	Not applicable. If attached to a PlantPax DCS, make sure FactoryTalk AssetCentre can access the skid assets	Included within PASS-C image	Place the AppServ-Info (SQL) on its own computer	Place the AppServ-Info (SQL) on its own computer
Recommended Compute Platform	<ul style="list-style-type: none"> VersaView® 6181 or similar compact personal computer Stratus zTC 100i 	<ul style="list-style-type: none"> Traditional physical infrastructure hardware Stratus zTC 110i- Virtual 	<ul style="list-style-type: none"> VersaVirtual™ 2000 Appliance E-2000 or E-3000 Industrial Data Center 	<ul style="list-style-type: none"> VersaVirtual 2000 Appliance E-2000 or E-3000 Industrial Data Center

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 33
- Studio 5000® Application Code Manager, version 4
- FactoryTalk® View software, version 12
- FactoryTalk® Batch software, version 14
- FactoryTalk AssetCentre software, version 10
- FactoryTalk VantagePoint software, version 8
- FactoryTalk Historian software, version 7

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

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 PASS Large Bundle (Perpetual)

This software bundle provides the core software for PlantPAx DCS systems. The PlantPAx System ID is integrated into the bundle. Additional assets can be added under recommended products. To support large systems, this bundle has an unlimited HMI server and asset management included.

PlantPAx Catalog Number	Component Catalog Number	Description	Support Options
9528M-PAXPASST11	9701-VWSS000PE	FT View SE Server Unlimited	8x5 Support 24x7 Support Electronic Media or Physical Media
	9515-FTACBASEPE	AssetCentre Base Perpetual	
	9515-FTACTIAENTP	FT AssetCentre InventAgent	
	9528-PAXPASSPE	PlantPAx PASS Activation (System ID)	

PlantPAx PASS Medium Bundle (Perpetual)

This software bundle provides the core software for PlantPAx DCS systems. The PlantPAx System ID is integrated into the bundle. Additional assets can be added under recommended products. To support mid-sized systems, the HMI server is capable of supporting 250 displays and asset management is included.

PlantPAx Catalog Number	Component Catalog Number	Description	Support Options
9528M-PAXPASST21	9701-VWSS250PE	FT View SE Server 250	8x5 Support 24x7 Support Electronic Media or Physical Media
	9515-FTACBASEPE	AssetCentre Base Perpetual	
	9515-FTACTIAENTP	FT AssetCentre InventAgent	
	9528-PAXPASSPE	PlantPAx PASS Activation (System ID)	

PlantPAx PASS Small Bundle

This software bundle provides the core software for PlantPAx DCS systems. PlantPAx System ID is integrated into the bundle. Additional assets can be added under recommended products. To support smaller sized systems, the HMI server is capable of supporting 100 displays and asset management is included.

PlantPAx Catalog Number	Component Catalog Number	Description	Support Options
9528M-PAXPASST31	9701-VWSS000PE	FT View SE Server 100	8x5 Support 24x7 Support Electronic Media or Physical Media
	9515-FTACBASEPE	AssetCentre Base Perpetual	
	9515-FTACTIAENTP	FT AssetCentre InventAgent	
	9528-PAXPASSPE	PlantPAx PASS Activation (System ID)	

Recommended Products

8x5 Support		24x7 Support	
Catalog Number	Description	Catalog Number	Description
9515M-FTACRT11	FactoryTalk AssetCentre 100 Assets Add On	9515M-FTACRT12	FactoryTalk AssetCentre 100 Assets Add On
9515M-FTACRT101	FactoryTalk AssetCentre Disaster Recovery - Rockwell Automation	9515M-FTACRT102	FactoryTalk AssetCentre Disaster Recovery - Rockwell Automation
9518M-HSERT11	FactoryTalk Historian SE 1,000 Tag Add-On	9518M-HSERT12	FactoryTalk Historian SE 1,000 Tag Add-On
9701M-VWSDRT11	FactoryTalk View SE Client	9701M-VWSDRT12	FactoryTalk View SE Client
9701M-VWSDRT41	FactoryTalk SE Unlimited Redundant Server Option	9701M-VWSDRT42	FactoryTalk SE Unlimited Redundant Server Option
9701M-VWSDRT51	FactoryTalk SE 250 Redundant Server Option	9701M-VWSDRT52	FactoryTalk SE 250 Redundant Server Option
9701M-VWSDRT61	FactoryTalk SE 100 Redundant Server Option	9701M-VWSDRT62	FactoryTalk SE 100 Redundant Server Option

When building your system, you must decide whether your server and client workstations are in a virtual or traditional environment. Traditional, for our purposes, means one operating system (OS) that is natively on one computer. Virtual machines are hardware independent; not tied directly to a specific hardware or OS.

Traditional Infrastructure

In a traditional infrastructure, each server and workstation is installed on its own physical machine. Software and hardware updates are performed on each server and workstation individually. In addition, there is a conventional relationship between switch ports and servers ports and a standard network management.

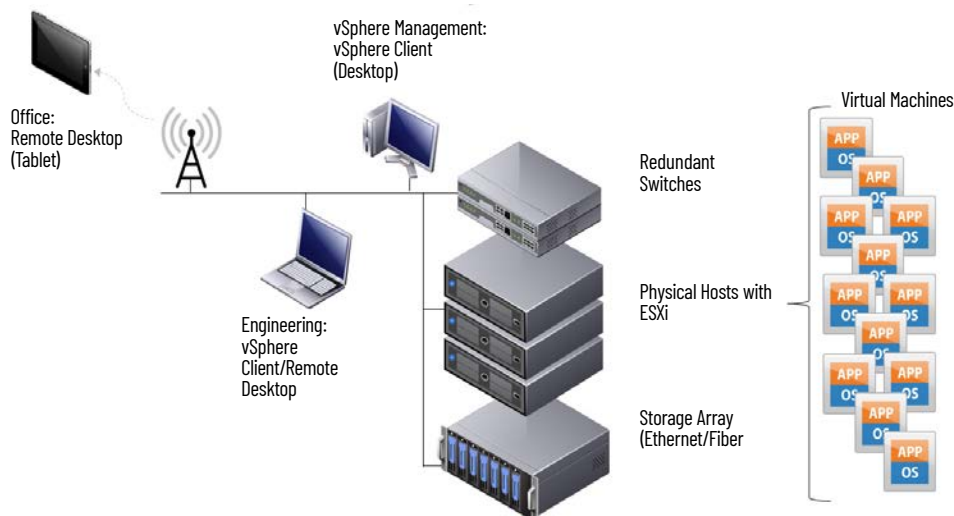
Rockwell automation offers the following traditional templates. For all other system elements, you install your operating system and software directly on the physical computer.

Table 2 - Installation Files on USB Devices

System Element	Cat. No.	Description
PASS - C (consolidated)	9528-PASSCENM	USB device contains a bootable image to install a consolidated PASS on a physical machine. The PASS-C includes Historian, VantagePoint, Asset Management, OWS, and EWS. The end user is responsible for acquiring the appropriate Microsoft OS license for Server 2016. A Rockwell Automation license is required for software activation.
OWS ISO	9528-OWSISOENM	USB device contains a bootable image to install an operator workstation on a physical machine. The end user is responsible for acquiring the appropriate Microsoft OS license for Windows 10. A Rockwell Automation license is required for software activation.

Virtual Infrastructure

Virtualization breaks the dependency between operating system and physical hardware. Multiple virtual machines (VMs) can run different operating systems and applications from various locations on the same server. You can upgrade hardware without stopping your operation or replacing the operating system on the server or workstation system elements, thus reducing downtime and maintenance costs.



A VM behaves exactly like a physical computer because the VM contains its own 'virtual' CPU, RAM, hard disk drive, and network interface card. The VM runs as an isolated guest OS installation.

Table 3 - Virtual Infrastructure Components

Model Type	Description
Industrial Data Center <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>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>
VersaVirtual Appliance <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 (compute, 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 server(s) 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>
Stratus ztC Edge <ul style="list-style-type: none"> Stratus ztC Edge 110i Stratus ztC Edge 100i 	<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 and ThinManager® 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>

Rockwell Automation offers virtual image templates as an option to deploy the PlantPAx distributed control system. The PlantPAx Virtual Image Templates deliver the core system elements as pre-configured, drop-in templates. For ease of operation and to help reduce cost, each single virtual image template can be reused.

Table 4 - Virtual Image Templates on USB Devices

Virtual Template	Cat. No.	Description
PASS	9528-PASSVTENM	USB device contains the virtual image template for the PASS. The end user is responsible for acquiring the appropriate Microsoft OS license for Server 2016. All required Rockwell Automation software is pre-installed but not activated.
EWS	9528-EWSVTENM	USB device contains the virtual image template for the EWS. The end user is responsible for acquiring the appropriate Microsoft OS license for Windows 10. All required Rockwell Automation software is pre-installed but not activated.
OWS	9528-OWSVTENM	USB device contains the virtual image template for the OWS. The end use is responsible for acquiring the appropriate Microsoft OS license for Windows 10. All required Rockwell Automation software is pre-installed but not activated.
AppServ-OWS, AppServ-EWS	9528-APPXWSENM	USB device contains the virtual image template for AppServ-OWS and AppServ-EWS. The end user is responsible for acquiring the appropriate Microsoft OS license for Server 2016. All required Rockwell Automation software is pre-installed but not activated. You must purchase the appropriate Windows CAL from a Microsoft distributor. IMPORTANT: Each client needs an RDS CAL license.
AppServ-Info (Historian)	9528-APPHISENM	USB device contains the virtual image template for AppServ-Info (Historian). The end user is responsible for acquiring the appropriate Microsoft OS license for Server 2016. All required Rockwell Automation software is pre-installed but not activated.
AppServ-Asset	9528-APPASMENM	USB device contains the virtual image template for AppServ-Asset. The end user is responsible for acquiring the appropriate Microsoft OS license for Server 2016. All required Rockwell Automation software is pre-installed but not activated.

Table 4 - Virtual Image Templates on USB Devices

Virtual Template	Cat. No.	Description
AppServ-Info (SQL)	9528-APPSQLENM	USB device contains the virtual image template for AppServ-Info (SQL). The end user is responsible for acquiring both the appropriate Microsoft OS license for Server 2016 and Microsoft SQL Server.
AppServ-Info (VantagePoint)	9528-APPVTPENM	USB device contains the virtual image template for AppServ-Info (VantagePoint). The end user is responsible for acquiring the appropriate Microsoft OS license for Server 2016. Most required Rockwell Automation software is pre-installed but not activated. The FactoryTalk VantagePoint software is not pre-installed for your convenience.
AppServ-Batch	9528-APPBATENM	USB device contains the virtual image template for AppServ-Batch. The end user is responsible for acquiring the appropriate Microsoft OS license for Server 2016. Most required Rockwell Automation software is pre-installed but not activated. The FactoryTalk Batch software is not pre-installed for your convenience.
Domain controller	9528-PADCVTENM	USB device contains the virtual image template for a Domain controller. The end user is responsible for acquiring the appropriate Microsoft OS license for Server 2016. You must purchase the appropriate quantity of Windows CALs from a Microsoft distributor.

Each template USB device includes one OS system for each applicable type. If you are considering virtualization, we suggest that you visit the Rockwell Automation Industrial Networks website, at https://www.rockwellautomation.com/en_NA/capabilities/industrial-networks/overview.page?

Template Distribution

Obtain PlantPAX virtual image templates by the following methods:

Media -- Order a physical copy of the virtual image template. Only the latest virtual image templates are available via physical media. The end user is responsible for acquiring the appropriate Microsoft OS license for Server 2016 or Windows 10.

Electronic Software Delivery (ESD) -- You must purchase licensed media before downloading an electronic copy of the virtual image template from the Product Compatibility and Download Center (PCDC) website. The latest and previous versions of the virtual image templates are available for download from the PCDC.

For additional information, see the PlantPAX Template User Manual, publication [9528-UM001](#).

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 5 - 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)	4	16	60
Operator Workstation (OWS)	2	4	40
Engineering Workstation (EWS)	2	8	100
Operator Workstation Application Server (AppServ-OWS)	8	16	60
Engineering Workstation Application Server (AppServ-EWS)	4	16	100
Information Management Application Server Historian (AppServ-Info Historian)	2	4	120
Information Management Application Server VantagePoint (AppServ-Info VantagePoint)	2	4	60
Information Management Application Server SQL (AppServ-Info SQL)	2	4	120
Asset Management Server (AppServ-Asset)	2	4	60
Batch Management Server (AppServ-Batch)	2	4	60
VMware vCenter Server	2	4	40
System Reservation (specify percent to be reserved)	10	—	

Reference Network Topologies

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

- Access to device webpages throughout the architecture
- Full visibility to the network via tools such as FactoryTalk® Network Manager™
- 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 4A: PRP Skid and MCC Lineup](#)
- [Example 4B: 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 cannot be configured for other resiliency protocol, such as DLR or Resilient Ethernet Protocol (REP).

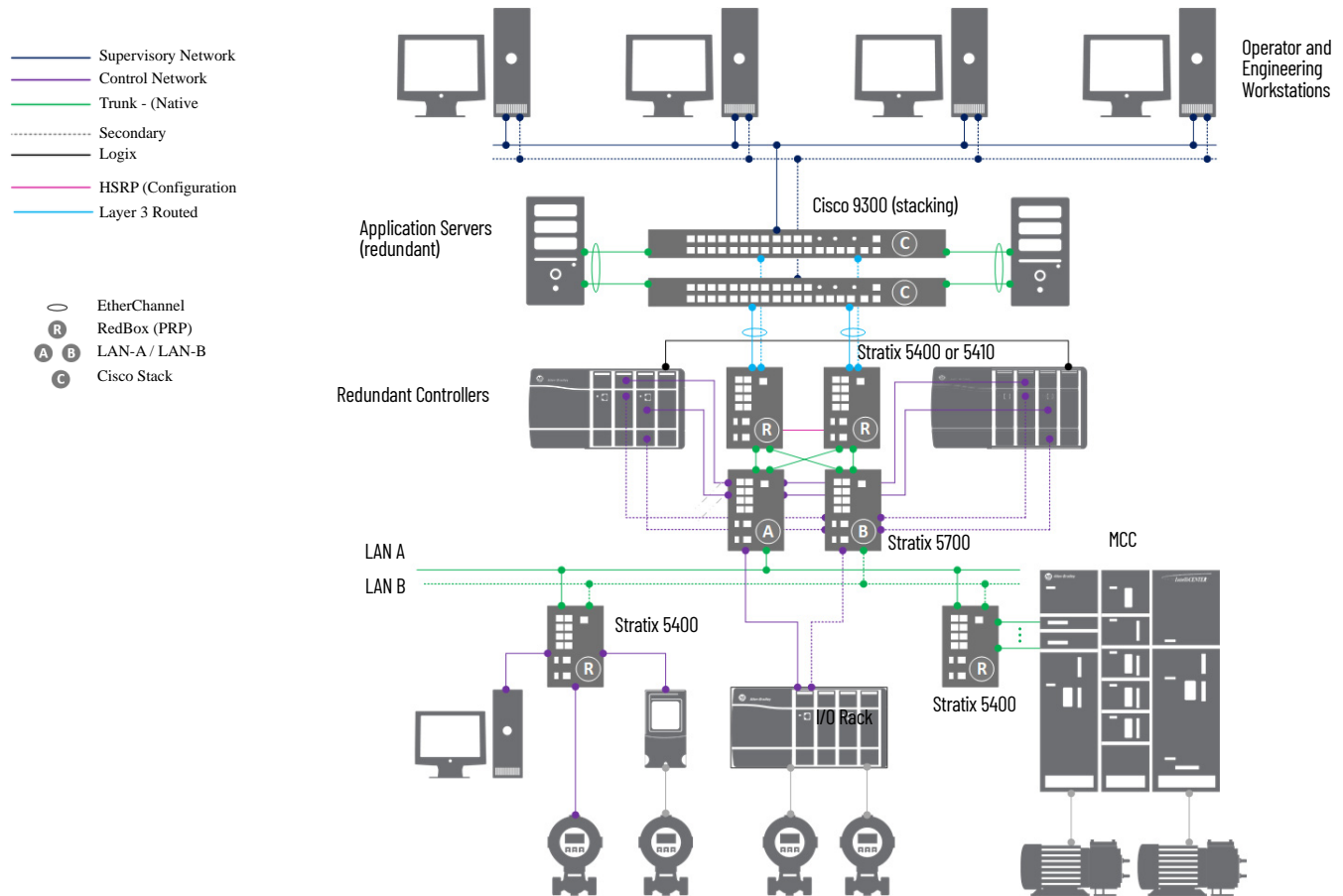


Table 6 - Properties of Example 1 Architecture

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 or 3850 stack switches • Redundant application servers via physical or virtualized environments • Pair of Layer 3 PRP enabled Stratix® switches: <ul style="list-style-type: none"> - Stratix 5410 (used if GPS, multiple PRP channels, rack-mount format, or AC power is required) - Stratix 5400 • Duplicate LAN A/B Layer 2 infrastructure switches: <ul style="list-style-type: none"> - Stratix 5400 - Stratix 5700 • Non-PRP devices require Stratix 5400 switch to enable VDAN support • 1756 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

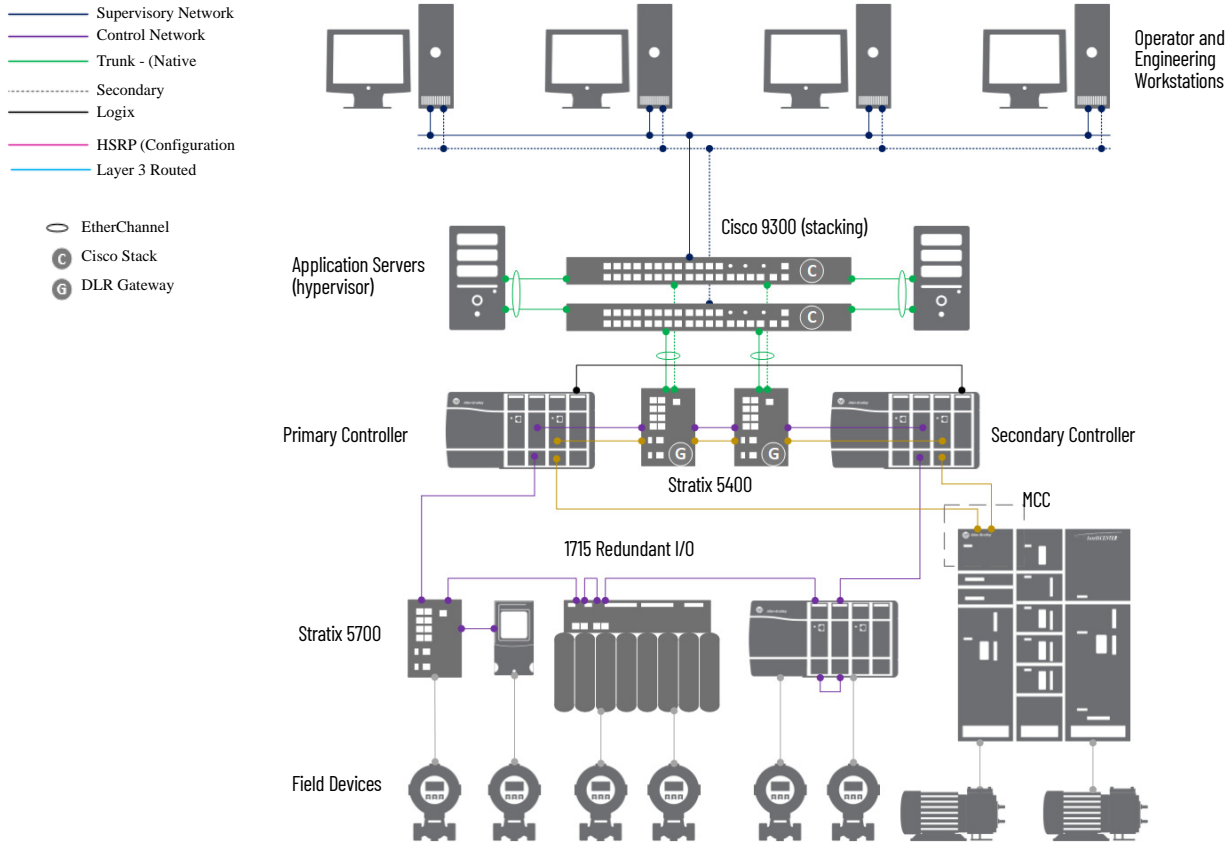


Table 7 - Properties of Example 2 Architecture

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 3850, 9300 stack switches • Redundant application servers via physical or virtualized environments • DLR gateway capable switches (if you need multiple rings, use a Stratix 5400 or 5410 switch) • 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 is no redundancy so connected nodes cannot communicate on the network if there is a network failure.

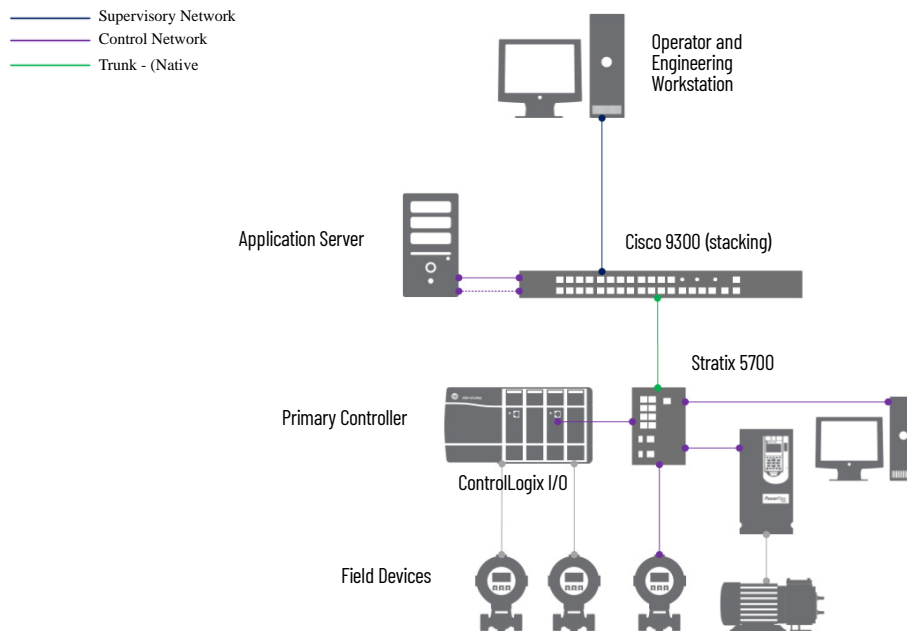
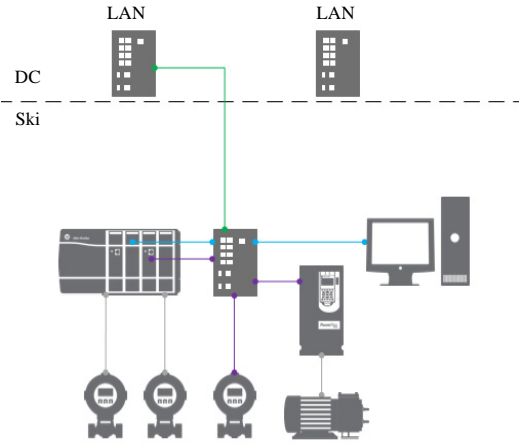


Table 8 - Properties of Example 3 Architecture

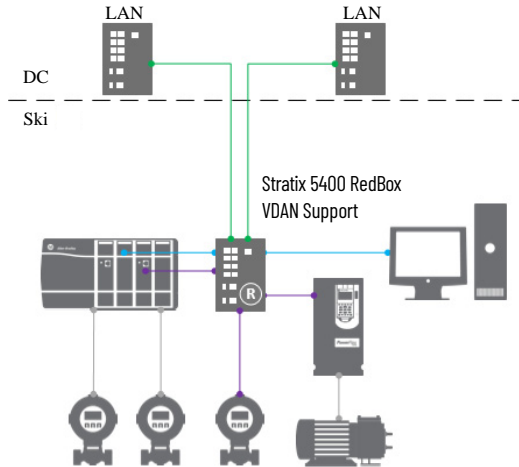
Simplex - Star Topology	
Why would I select this architecture?	This architecture provides a basic network configuration. You can monitor and control non-critical equipment. However, there is no ability to recover from an architectural fault.
What protocols does it use?	<ul style="list-style-type: none"> • 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 4A: PRP Skid and MCC Lineup

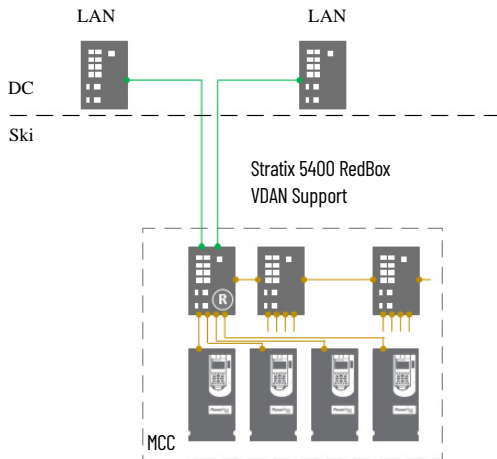
PRP Simplex Connection to Either LAN A/B



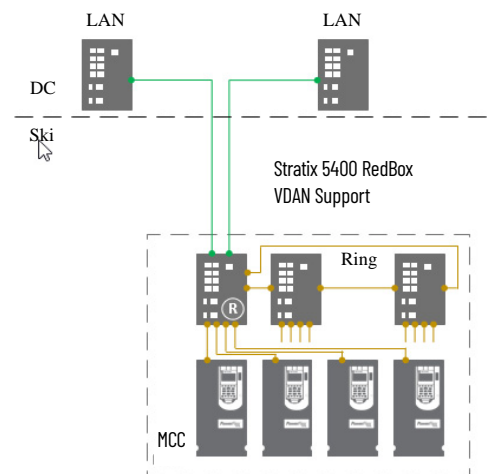
PRP DCS LAN A/B Infrastructure



PRP MCC RedBox Connected to LAN A and LAN B

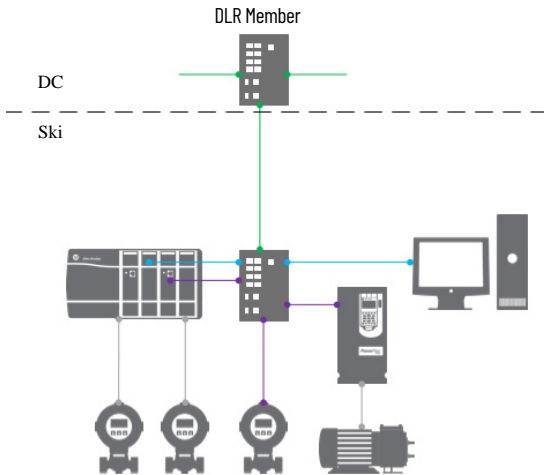


PRP MCC Connected to LAN A/B with DLR Ring

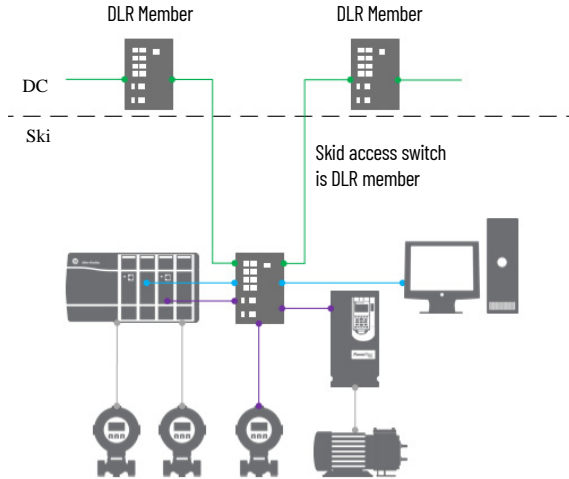


Example 4B: DLR Skid and MCC Lineup

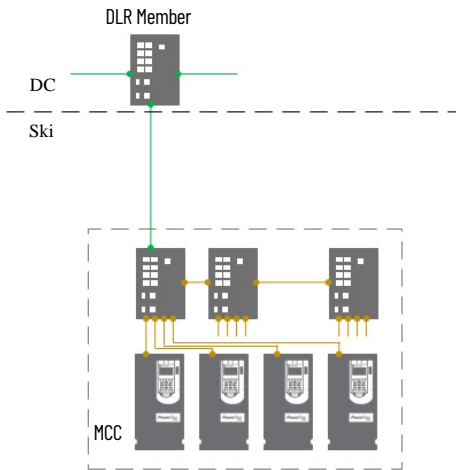
DLR Simplex Connection to Either LAN A/B



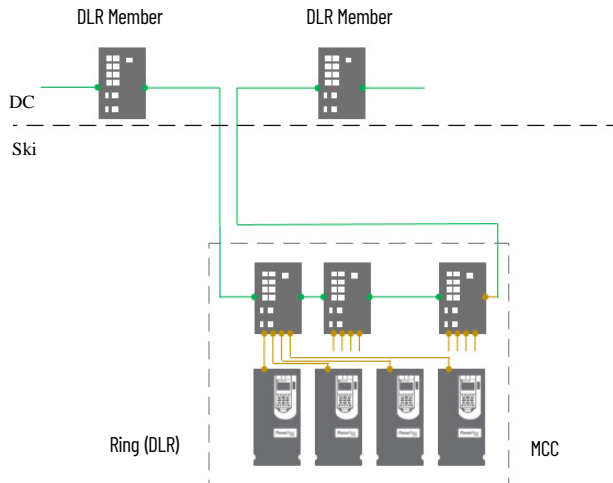
DLR DCS Integration



DLR Simplex/MCC Connection to DLR Ring Switch

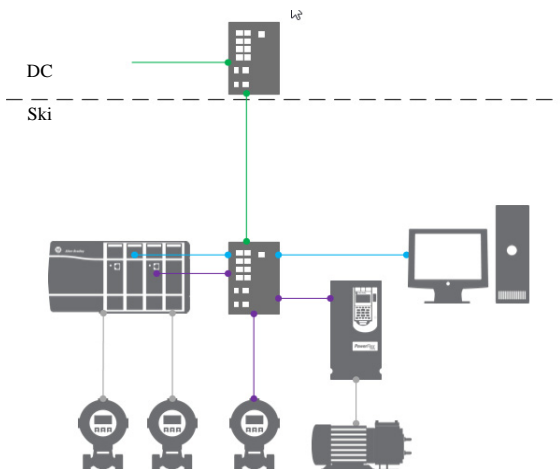


DLR MCC Lineup as part of the DCS DLR Ring

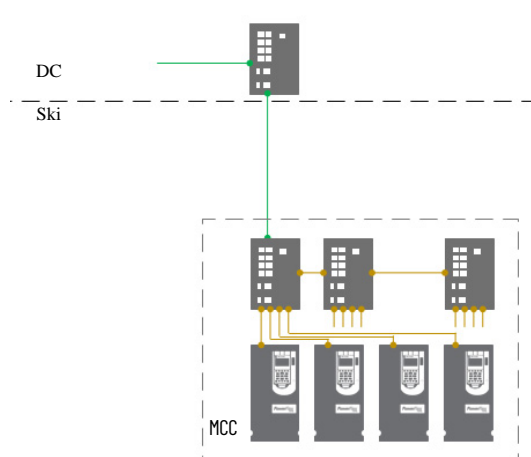


Example 4C: Simplex Skid and MCC Lineup

Simplex Connection to Simplex DCS



Simplex MCC Connection to Simplex DCS



FactoryTalk Network Manager Software

Use FactoryTalk Network Manager to view your network topology and manage switch-level alarms. Monitor the health of network devices and reduce downtime to improve overall efficiency. FactoryTalk Network Manager:

- Discovers network and end devices, including devices across a controller backplane
- Generates an overall topology and a device-centric view of plant floor assets for increased network visibility
- Captures managed switch-level alarms and events for troubleshooting
- Manages configuration backup s and firmware revisions of Stratix managed switches to simplify deployment and maintenance

PlantPax recommendations include:

- Install FactoryTalk Network Manager on the AppServ-Assert server for consistent monitoring of the network infrastructure.
- You can use an EWS to access the web client for troubleshooting purposes.
- When the network is fully implemented and configured, run the scan of the network.
- The current version of FactoryTalk Network Manager software does not support PRP networks; this will be in a future release.

Table 9 - Requirements

Category	Requirement
Hardware	Required: <ul style="list-style-type: none"> • Quad Core 1.8 Ghz CPU (or greater) • 8 GB RAM min • 50 GB free storage space min
Operating system	64-bit versions of these operating systems: <ul style="list-style-type: none"> • Windows 10 • Windows 7 Enterprise or Professional with SP2 • Windows Server 2012 R2 • Windows Server 2016
Web browser	<ul style="list-style-type: none"> • Google Chrome browser version 50.0.2661.102 or later • Mozilla Firefox version 55.0.3 or later

Table 10 - Software and Licenses

Category	Cat. No.
FactoryTalk Network Manager software	Available as a no charge download from Product Compatibility and Download Center
Rockwell Automation software licenses	Select a license for each device to manage: <ul style="list-style-type: none"> • 9313C-NMMS01T11 (8x5 support) • 9313C-NMMS01T12 (24x7 support) Each of these device types requires a license to be accessible by the software: <ul style="list-style-type: none"> • Stratix switches • Controllers • CIP Sync™ device • ETAP modules

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 11 - PASS Server Software Components

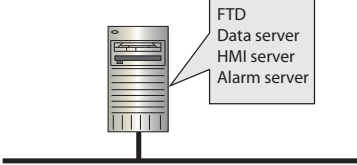
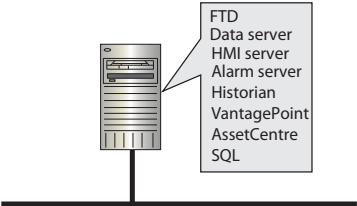
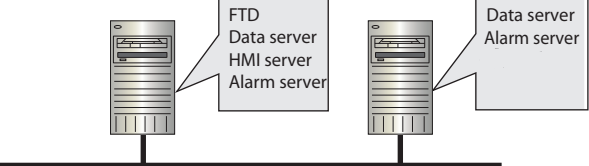
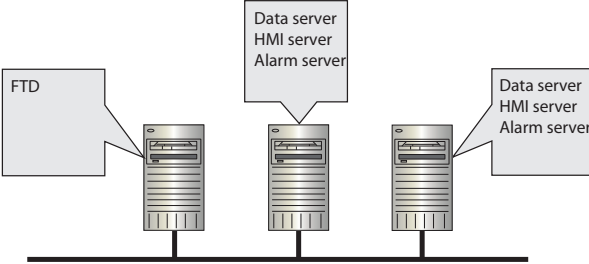
Software Components	Description
FactoryTalk Directory (FTD) server ⁽¹⁾	Secures information from multiple Rockwell Automation software components across multiple computers and allows central administration throughout the PlantPAx system. Application components, such as display and security settings, can 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.
FactoryTalk View Data server	The Data server component provides access to information from the process controllers to servers and workstations on the PlantPAx system. FactoryTalk View software supports two types of data servers: Rockwell Automation Device servers (FactoryTalk® Linx software) and OPC Data servers. 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. Multiple data servers can exist on the PlantPAx system.
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 are not part of the logic program and do not increase the scan time for a project. The controller caches information, such as timestamps, alarm states, and associated tag values in a 1000 KB buffer. The controller transmits the information to subscribing FactoryTalk 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

The following graphics illustrate how many servers are needed when you are not considering redundancy options.

Table 12 - 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.</p> <p>There are additional system elements, such as batch management, asset management, FactoryTalk Historian, and FactoryTalk VantagePoint. 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 physical computer.</p> <p>A bootable USB device contains the system elements that are shown in the illustration for Option 2.</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.</p> <p>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.</p> <p>We recommend that you have an HMI server on the PASS if you are 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 are not 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 is 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 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 is not 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 is 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.

The PASS-C can be made redundant by duplicating the hardware as well. Redundant data servers impact controller memory and communication bandwidth.

Table 13 - PASS Requirements

Category	Requirement ⁽¹⁾
Hardware - virtual infrastructure	Required: <ul style="list-style-type: none"> • 4 vCPU • 16 GB vRAM min • 60 GB vHardDisk Recommended CPU and memory allocation: <ul style="list-style-type: none"> • High priority Resource pool
Hardware - traditional infrastructure	The PASS must be installed on server-class hardware. The following are sample specifications that are based on PlantPAx system characterization: <ul style="list-style-type: none"> • Intel® Xeon Multicore processor (4 cores or greater) • 2.40 GHz CPU min • 16 GB RAM min • Ethernet card that supports redundant media if NIC-teaming is used (If you plan to use a motherboard-NIC make sure it supports redundant media)
Operating system	Windows Server 2016 operating system, 64 bit
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.

Table 14 - PASS-C Requirements

Category	Requirement
Hardware - virtual infrastructure	The PASS-C was tested in a virtual environment using the Stratus zTC Edge 110i with{ <ul style="list-style-type: none"> • Intel i7-8700T (or greater) • 2.4GHz GHz CPU min • 32 GB RAM min • Redundant Ethernet media
Hardware - traditional infrastructure	For systems with fewer than 2000 I/O points, the PASS - Consolidated contains HMI, data collection, decision-making, and asset management servers. These combined tools form a basic PlantPAx system in one server, referred to as consolidated. The PASS must be installed on a server-class computer. The following are sample specifications that are based on PlantPAx system characterization: <ul style="list-style-type: none"> • Intel® Xeon E3-1270 v5 (or greater) • 3.60 GHz CPU min • 32 GB RAM min • Ethernet card that supports redundant media if NIC-teaming is used (If you plan to use a motherboard-NIC make sure it supports redundant media)
Operating system	Windows Server 2016 operating system, 64 bit
Additional third-party software	Antivirus software

The PASS requires that you purchase an HMI server license. If the PASS server is not 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 15 - PASS Software and Licenses

Category	Cat. No.
Virtual Image Template	<ul style="list-style-type: none"> 9528-PASSVTENM <p>USB device contains a virtual image template that has pre-installed applications that are required on the PASS.</p>
Rockwell Automation software licenses	<p>Select the following per PASS when the PASS is used as an HMI server:⁽¹⁾</p> <ul style="list-style-type: none"> 9528-PASS100ENE (100-display license for PASS) 9528-PASS250ENE (250-display license for PASS) 9528-PASSUNLENE (unlimited display license for PASS) 9528-PASSLICENE (unlimited display license for PASS + 10 OWS licenses) 9528-PASS25LICENE (unlimited display license for PASS + 25 OWS licenses) <p>Select the following per PASS when the PASS on the HMI server is a redundant/secondary option:</p> <ul style="list-style-type: none"> 9528-PASS100SECENE (100-display license for secondary PASS) 9528-PASS250SECENE (250-display license for secondary PASS) 9528-PASSUNLSECENE (unlimited display license for secondary PASS) 9528-PASS100SECENM (100-display license for secondary PASS for virtual image template)⁽²⁾ 9528-PASS250SECENM (250-display license for secondary PASS for virtual image template)⁽²⁾ 9528-PASSUNLSECENM (unlimited display license for secondary PASS for virtual image template)⁽²⁾
Disk Image (for PASS-C)	<p>Select one copy per project of the following if you use virtualization and virtual image templates:</p> <ul style="list-style-type: none"> 9528-PASSCENM <p>USB device contains a bootable image that contains a consolidated PASS that can be installed on a physical machine. The device has pre-installed applications that are required on the PASS.</p>
Rockwell Automation software licenses (for PASS-C) ⁽⁴⁾	<p>Select one copy per project of the following:⁽¹⁾</p> <ul style="list-style-type: none"> 9528-PASS100ENE (100-display license for PASS) 9528-PASS250ENE (250-display license for PASS) 9528-PASSUNLENE (unlimited display license for PASS) 9528-PASSLICENE (unlimited display license for PASS + 10 OWS licenses) <p>Select any of the following:^{(3) (4)}</p> <ul style="list-style-type: none"> 9528-HSE5KM (5000 FactoryTalk Historian SE tags, 1 VantagePoint server license, and 1 named user are included) 9528-ASTSRVRENM (FactoryTalk AssetCentre server)

(1) You can use either the PlantPAx or FactoryTalk View SE software license with the PASS server.

(2) The end user is responsible for acquiring the appropriate Microsoft OS license for Server 2016 or Windows 10.

(3) You can use either the PlantPAx or FactoryTalk View SE software license with the PASS-C server.

(4) 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 16 - EWS Virtual Requirements

Category	Requirement ⁽¹⁾
Hardware	<p>Required:</p> <ul style="list-style-type: none"> 2 vCPU 8 GB vRAM min 100 GB vHardDisk <p>Recommended CPU and memory allocation:</p> <ul style="list-style-type: none"> Normal priority Resource pool
Operating system	Windows 10 operating system, 64 bit
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.

Table 17 - EWS Traditional Requirements

Category	Requirement
Hardware	The EWS must be installed on workstation-class hardware. The following are sample specifications that are based on PlantPAX system characterization: <ul style="list-style-type: none"> • Intel Core 2 Duo (or greater) • 2.40 GHz CPU min • 8 GB RAM min • Ethernet card that supports redundant media if NIC-teaming is used (If you plan to use a motherboard-NIC make sure that it supports redundant media)
Operating system	Windows 10 operating system, 64 bit
Additional third-party software	Antivirus software

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

Table 18 - EWS Automation System Software and License

Category	Cat. No.
Virtual Image Template	<ul style="list-style-type: none"> • 9528-EWSTENM USB device contains a virtual image template that has pre-installed all applications that are required on the EWS.
Rockwell Automation software license	For each client that is served by the AppServ-EWS: <ul style="list-style-type: none"> • 9528-EWSLICENE⁽¹⁾

(1) This EWS software license is equivalent to a FactoryTalk® View Studio license (9701-VWSTENE), FactoryTalk View SE Client license (9701-VWSCWAENE), and Studio 5000 Logix Designer application license (9324-RLD700NXENE). You can use the PlantPAX or FactoryTalk and Logix Designer Logix Designer application licenses with the EWS.

Engineering Workstation Application Servers (AppServ-EWS)

The AppServ-EWS uses 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 five only are to be active at one time.

Table 19 - AppServ-EWS Virtual Requirements

Category	Requirement ⁽¹⁾
Hardware	Required: <ul style="list-style-type: none"> • 4 vCPU • 16 GB vRAM min • 100 GB vHardDisk Recommended CPU and memory allocation: Normal priority Resource pool
Thin client	We recommend a maximum of five active and connected FactoryTalk View SE clients per application server.
Operating system	Windows Server 2016 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 20 - AppServ-EWS Automation System Software and License

Category	Cat. No.
Virtual Image Template	<ul style="list-style-type: none"> • 9528-APPXWSENM USB device contains a virtual image template that has pre-installed all applications that are required on the EWS.
Rockwell Automation software license IMPORTANT: A Rockwell Automation license must be purchased for each client that is connected to the AppServ-EWS.	For each AppServ-EWS: <ul style="list-style-type: none"> • 9528-EWSLICENE⁽¹⁾

(1) This EWS software license is equivalent to a FactoryTalk View Studio license (9701-VWSTENE), FactoryTalk View SE Client license (9701-VWSCWAENE), and Studio 5000 Logix Designer application license (9324-RLD700NXENE). You can use the PlantPAX or FactoryTalk and Logix Designer Logix Designer application licenses with the EWS.

Operator Workstations (OWS)

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

Table 21 - OWS Virtual Requirements

Category	Requirement ⁽¹⁾
Hardware	Required: <ul style="list-style-type: none"> • 2 vCPU • 4 GB vRAM min • 40 GB vHardDisk Recommended CPU and memory allocation: <ul style="list-style-type: none"> • High priority Resource pool
Operating system	Windows 10 operating system, 64 bit
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.

Table 22 - OWS Traditional Requirements

Category	Requirement
Hardware	The OWS must be installed on workstation-class hardware. The following are sample specifications that are based on PlantPax system characterization: <ul style="list-style-type: none"> • Intel Core 2 Duo (or greater) • 2.40 GHz CPU min • 4 GB RAM min • Ethernet card that supports redundant media if NIC-teaming is used (If you plan to use a motherboard-NIC make sure that it supports redundant media)
Operating system	Windows 10 operating system, 64 bit
Additional third-party software	Antivirus software

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

Table 23 - OWS Automation System Software and License

Category	Cat. No.
Virtual image template	<ul style="list-style-type: none"> • 9528-OWSVTENM USB device contains a virtual image template that has pre-installed all applications that are required on the OWS.
OWS ISO	<ul style="list-style-type: none"> • 9528-OWSISOENM USB device contains a bootable image to install an operator workstation on a physical machine. The end user is responsible for acquiring the appropriate Microsoft OS license for Windows 10. A Rockwell Automation license is required for software activation.
Rockwell Automation software license	For each OWS: <ul style="list-style-type: none"> • 9528-OWSLICEN⁽¹⁾

(1) This PlantPax software license is equivalent to a FactoryTalk View SE Client license (9701-VWSCWAENE). You can use either a PlantPax or FactoryTalk View SE software license with the OWS.

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 24 - AppServ-OWS Virtual Requirements

Category	Requirement ⁽¹⁾
Hardware	Required: <ul style="list-style-type: none"> • 8 vCPU • 16 GB vRAM min • 60 GB vHardDisk Recommended CPU and memory allocation: <ul style="list-style-type: none"> • High priority Resource pool
Operating system	Windows Server 2016 operating system, 64 bit
Thin client	We recommend a maximum of 10 FactoryTalk View SE clients per application server.
Additional third-party software	Microsoft Internet Explorer™ 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 25 - AppServ-OWS Automation System Software and License

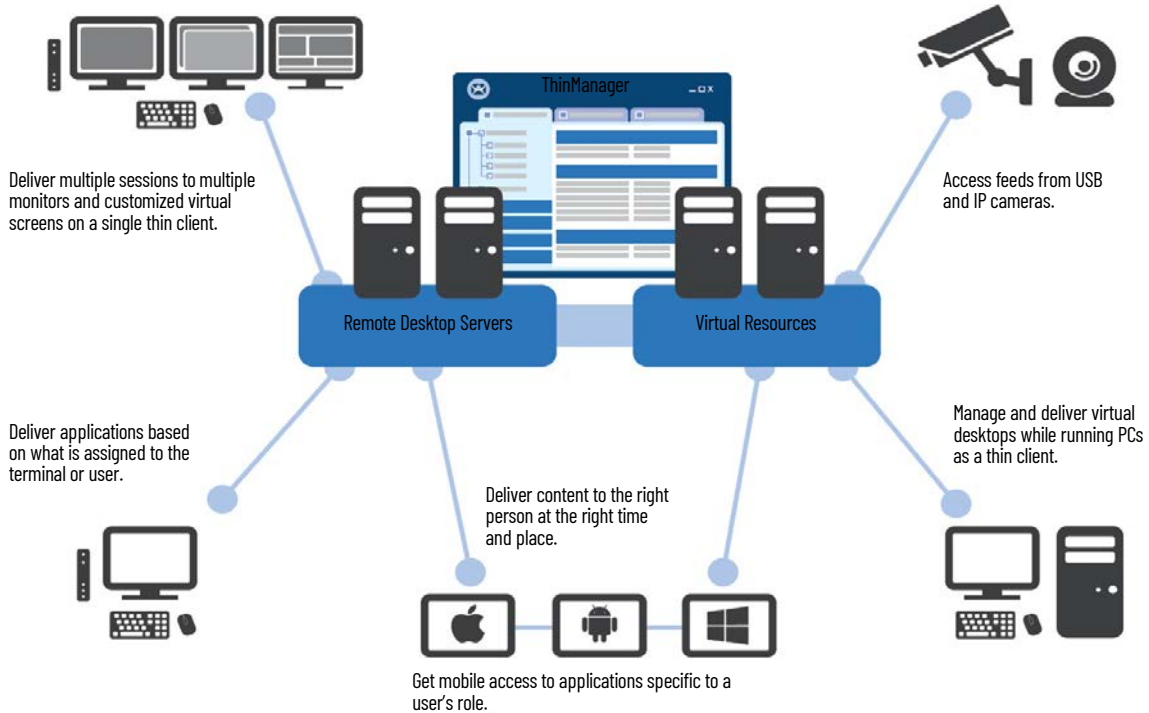
Category	Cat. No.
Virtual image template	<ul style="list-style-type: none"> • 9528-APPXWSENM USB device contains a virtual template for the AppServ-OWS.
Rockwell Automation software license	Purchase a license for each client that the AppServ-OWS serves: <ul style="list-style-type: none"> • 9528-OWSLICENSE⁽¹⁾

(1) This PlantPax software license is equivalent to a FactoryTalk View SE Client license (9701-VWSCWAENE). You can use either a PlantPax or FactoryTalk View SE software license with the OWS.

ThinManager Server Options

The AppServ-OWS system element virtual-image template is pre-configured with Remote Desktop Services (RDS). The AppServ-OWS includes the ThinManager Server installation file. You can configure the AppServ-OWS 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 'shadow system' for emergency purposes.

Table 26 - IndWS Traditional Requirements

Category	Requirement
Hardware	<p>The IndWS must be installed on workstation-class hardware. The following are sample specifications that are based on PlantPAx system characterization:</p> <ul style="list-style-type: none"> • Intel Multicore processor (4 cores or greater) • 2.40 GHz CPU min • 16 GB RAM min • Ethernet card that supports redundant media if NIC-teaming is used (If you plan to use a motherboard-NIC make sure that it supports redundant media) <p>There is no virtual template for the IndWS.</p>
Operating system	Windows 10 operating system, 64 bit
Additional third-party software	Antivirus software

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

Table 27 - IndWS Automation System Software and Licenses

Category	Cat. No.
Rockwell Automation software licenses	<p>One per IndWS if being used as EWS:</p> <ul style="list-style-type: none"> • 9324-RLD700NXENE (Studio 5000 Logix Designer) <p>Select one of the following:</p> <ul style="list-style-type: none"> • 9701-VWSB100AENE (100 display license with FactoryTalk View SE Station) • 9701-VWSB250AENE (250 display license with FactoryTalk View SE Station) • 9701-VWSB000AENE (unlimited display license FactoryTalk View SE Station)

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 28 - Data Management Options

Category	Requirement	Option
Time series	<ul style="list-style-type: none"> • High-speed, on-machine data collection • < 2500 tags 	<p>Information Management server is optional because you can use an embedded historian module for the ControlLogix chassis (FactoryTalk Historian ME). If the historian ME module is collecting 2500 points per second, the duration of history that is stored is approximately 14 hours.</p> <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.
Event based	Relational database	<p>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:</p> <ul style="list-style-type: none"> • FactoryTalk Alarm and Event data • FactoryTalk Batch data <p>This database can be installed on an Information Management server or another server on your system.</p>

Additional tools to support your information management strategies include:

Table 29 - Decision Support Options

Category	Description
FactoryTalk VantagePoint software	An Information Management server is required to host this web-based reporting software that brings all data together into one decision-support system: <ul style="list-style-type: none"> All manufacturing data is accessible in real time Published reports, current dashboards, and real-time KPIs viewable via web browser Pre-configured reports, trends, and dashboards Enhanced HMI trends available by using FactoryTalk VantagePoint Trend Active X with FactoryTalk View SE
FactoryTalk Historian ProcessBook software	An Information Management server is required to enable ProcessBook content (standard ProcessBook displays, SQC view, batch view, alarm view). The content is to be hosted and displayed from within FactoryTalk View SE by using the ProcessBook Runtime.

AppServ-Info (Historian)

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

Table 30 - AppServ-Info (Historian) Virtual Requirements

Category	Requirement ⁽¹⁾
Hardware	Required: <ul style="list-style-type: none"> 2 vCPU 4 GB vRAM min 120 GB vHardDisk Recommended CPU and memory allocation: <ul style="list-style-type: none"> Normal priority Resource pool
Operating system	Windows Server 2016 operating system, 64 bit
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.

Table 31 - AppServ-Info (Historian) Traditional Requirements

Category	Requirement
Hardware	The Information Management server must be installed on server-class hardware: <ul style="list-style-type: none"> Intel Xeon Multicore processor (4 cores or greater) 2.40 GHz CPU min 4 GB RAM min Ethernet card that supports redundant media if NIC-teaming is used (If you plan to use a motherboard-NIC make sure that it supports redundant media)
Operating system	Windows Server 2016 operating system, 64 bit
Additional third-party software	Antivirus software

Table 32 - AppServ-Info (Historian) Software

Category	Requirement
Virtual image template	<ul style="list-style-type: none"> 9528-APPHISENM USB device contains a virtual template for the AppServ-Info (Historian).

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

Table 33 - FactoryTalk Historian Licenses

Category	Cat. No. ⁽¹⁾
FactoryTalk Historian software includes a FactoryTalk VantagePoint software license and one named user client. The number of users is cumulative, and can be a mixed number of named users and concurrent users. If you choose concurrent on the PSE, you must purchase a license for the server based on the number of active CPUs on the server.	
Virtual server license	Select one of the licenses: ⁽²⁾ <ul style="list-style-type: none"> 9528-HSE250 (250 tags for the Historian server) 9528-HSE500 (500 tags for the Historian server) 9528-HSE1K (1000 tags for the Historian server) 9528-HSE2K5 (2500 tags for the Historian server) 9528-HSE5K (5000 tags for the Historian server) 9528-HSE10K (10,000 tags for the Historian server)
ProcessBook	Select for each client that is using ProcessBook: <ul style="list-style-type: none"> 9518-HPBENE (FactoryTalk Historian ProcessBook - Single User)
Excel® Add-in	Select one of the following: <ul style="list-style-type: none"> 9518-HDLENE (FactoryTalk Historian DataLink Excel Add-In - Single User) 9518-HDLENFE (FactoryTalk Historian DataLink Excel Add-In - Concurrent User)

(1) If you plan to use redundant Historian for high availability, you must duplicate the number of licenses. Licenses on the backup Historian must mirror the licenses on the primary Historian.

(2) These Historian server licenses are equivalent to a FactoryTalk Historian software license: 9518-HSE250, 9518-HSE500, 9518-HSE1K, 9518-HSE2K5, 9518-HSE5K, and 9518-HSE10K. You can use either the PlantPAx or FactoryTalk Historian software license.

AppServ-Info (VantagePoint)

AppServ-Info can be configured as a decision support tool by using FactoryTalk VantagePoint software.

Table 34 - AppServ-Info (VantagePoint) Virtual Requirements

Category	Requirement ⁽¹⁾
Hardware	Required: <ul style="list-style-type: none"> 2 vCPU 4 GB vRAM min 60 GB vHardDisk Recommended CPU and memory allocation: <ul style="list-style-type: none"> Normal priority Resource pool
Operating system	Windows Server 2016 operating system, 64 bit
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.

Table 35 - AppServ-Info (VantagePoint) Traditional Requirements

Category	Requirement
Hardware	The Information Management server must be installed on server-class hardware: <ul style="list-style-type: none"> Intel Xeon Multicore processor (4 cores or greater) 2.40 GHz CPU min 4 GB RAM min Ethernet card that supports redundant media if NIC-teaming is used (If you plan to use a motherboard-NIC make sure that it supports redundant media)
Operating system	Windows Server 2016 operating system, 64 bit
Additional third-party software	Antivirus software

Table 36 - AppServ-Info (VantagePoint) Software

Category	Requirement
Virtual image template	<ul style="list-style-type: none"> 9528-APPVTPENM USB device contains a virtual template for the AppServ-Info (VantagePoint).

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

Note: FactoryTalk VantagePoint software licenses consist of user clients. The number of users is cumulative, and can be a mixed number of named users and concurrent users. If you choose concurrent on the PSE, you must purchase a license for the server based on the number of active CPUs on the server.

Table 37 - FactoryTalk VantagePoint Licenses

Category	Cat. No.
Virtual server license	<ul style="list-style-type: none"> 9528-VPSEVERENE
Virtual server named user licenses	Select one or more of the following for FactoryTalk VantagePoint Client named users: <ul style="list-style-type: none"> 9528-VPNLO1ENE (1 named user) 9528-VPNLO3ENE (3 named users) 9528-VPNLO5ENE (5 named users) 9528-VPNLO10ENE (10 named users)
Virtual server named user licenses	Select one or more of the following for FactoryTalk VantagePoint Client concurrent users: <ul style="list-style-type: none"> 9528-VPCL01ENE (1 concurrent user) 9528-VPCL03ENE (3 concurrent users) 9528-VPCL05ENE (5 concurrent users) 9528-VPCL010ENE (10 concurrent users)
Virtual server concurrent user licenses	If VantagePoint is being used for concurrent users, select one for each CPU of the hosting server: <ul style="list-style-type: none"> 9528-VPCLPENE
Virtual server data connector licenses	Select the following: <ul style="list-style-type: none"> 9528-VPHSCENE

AppServ-Info (SQL)

Another way to configure AppServ-Info is as a Microsoft SQL Server relational database. Software such as FactoryTalk AssetCentre, FactoryTalk VantagePoint, 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 38 - AppServ-Info (SQL) Virtual Requirements

Category	Requirement ⁽¹⁾
Hardware	Required: <ul style="list-style-type: none"> 2 vCPU 4 GB vRAM min 120 GB vHardDisk Recommended CPU and memory allocation: <ul style="list-style-type: none"> Normal priority Resource pool
Operating system	Windows Server 2016 operating system, 64 bit
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.

Table 39 - AppServ-Info (SQL) Traditional Requirements

Category	Requirement
Hardware ⁽¹⁾	The Information Management server must be installed on server-class hardware: <ul style="list-style-type: none"> Intel Xeon Multicore processor (4 cores or greater) 2.40 GHz CPU min 4 GB RAM min Ethernet card that supports redundant media if NIC-teaming is used (If you plan to use a motherboard-NIC make sure that it supports redundant media)
Operating system	Windows Server 2016 operating system, 64 bit
Additional third-party software	Microsoft SQL Server Antivirus software

(1) A Microsoft Excel software license is required.

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.

Category	Requirement
Virtual image template	<ul style="list-style-type: none"> 9528-APPSQLENM USB device contains a virtual template for the AppServ-Info (SQL).

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 40 - AppServ-Asset Virtual Requirements

Category	Requirement ⁽¹⁾
Hardware	Required: <ul style="list-style-type: none"> 2 vCPU 4 GB vRAM min 60 GB vHardDisk Recommended CPU and memory allocation: <ul style="list-style-type: none"> Normal priority Resource pool
Operating system	Windows Server 2016 operating system, 64 bit
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.

Table 41 - AppServ-Asset Traditional Requirements

Category	Requirement
Hardware	The Asset Management server must be installed on server-class hardware: <ul style="list-style-type: none"> Intel Xeon Multicore processor (4 cores or greater) 2.40 GHz CPU min 4 GB RAM min Ethernet card that supports redundant media if NIC-teaming is used (If you plan to use a motherboard-NIC make sure that it supports redundant media)
Operating system	Windows Server 2016 operating system, 64 bit
Additional third-party software	Antivirus software

Table 42 - AppServ-Asset Software

Category	Requirement
Virtual image template	<ul style="list-style-type: none"> 9528-APPASMENM USB device contains a virtual template for the AppServ-Asset.

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

Table 43 - AppServ-Asset Licenses

Category	Cat. No.
Virtual server licenses	<ul style="list-style-type: none"> 9528-ASTSRVRENE
Virtual server 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: ⁽¹⁾ <ul style="list-style-type: none"> 9528-ASTCAPO005E (5 additional assets) 9528-ASTCAPO025E (25 additional assets) 9528-ASTCAPO100E (100 additional assets) 9528-ASTCAPO500E (500 additional assets)
Virtual server disaster recovery licenses	If disaster recovery is to be used, select all following: <ul style="list-style-type: none"> 9528-ASTDRROKENE (Disaster recovery for Rockwell Automation) 9528-ASTDRRCENE (Disaster recovery for remote computers)

(1) The Virtual server licenses are equivalent to FactoryTalk AssetCentre licenses that start with 9515. You can use a virtual server or a FactoryTalk AssetCentre software license with an Asset Management system element.

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 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 44 - AppServ-Batch Virtual Requirements

Category	Requirement ⁽¹⁾
Hardware	Required: <ul style="list-style-type: none"> • 2 vCPU • 4 GB vRAM min • 60 GB vHardDisk Recommended CPU and memory allocation: <ul style="list-style-type: none"> • Normal priority Resource pool
Operating system	Windows Server 2016 operating system, 64 bit
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.

Table 45 - AppServ-Batch Traditional Requirements

Category	Requirement
Hardware	The Batch Management server must be installed on server-class hardware: <ul style="list-style-type: none"> • Intel Xeon Multicore processor (4 cores or greater) • 2.40 GHz CPU min • 4 GB RAM min • Ethernet card that supports redundant media if NIC-teaming is used (If you plan to use a motherboard-NIC make sure that it supports redundant media)
Operating system	Windows Server 2016 operating system, 64 bit
Additional third-party software	Antivirus software

Table 46 - AppServ-Batch Software

Category	Requirement
Virtual image template	<ul style="list-style-type: none"> • 9528-APPBATENM USB device contains a virtual template for the AppServ-Asset.

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

Table 47 - AppServ-Batch Licenses

Category	Cat. No.
Batch unit software licenses	Purchase multiple licenses to obtain the desired number of batch units. <ul style="list-style-type: none"> • 9358-FTB01ENE (1 unit) • 9358-FTB03ENE (3 units) • 9358-FTB10ENE (10 units) • 9358-FTB30ENE (30 units) • 9358-FTB60ENE (60 units)
Batch backup software licenses	If a back-up server is enabled on the PlantPAX System Estimator, an additional server is added to the BOM with an equal number of back-up server unit licenses. <ul style="list-style-type: none"> • 9358-FTBKY01ENE (1 unit) • 9358-FTBKY03ENE (3 units) • 9358-FTBKY10ENE (10 units) • 9358-FTBKY30ENE (30 units) • 9358-FTBKY60ENE (60 units)
eProcedure® software licenses	eProcedure is included with Batch licenses that are listed above. These catalog numbers are to order software separately. <ul style="list-style-type: none"> • 9358-EPO3ENE (3 units) • 9358-EP10ENE (10 units) • 9358-EP30ENE (30 units) • 9358-EP60ENE (60 units)

Table 47 - AppServ-Batch Licenses

eProcedure backup software licenses	eProcedure is included with Batch licenses that are listed above. These catalog numbers are to order software separately. <ul style="list-style-type: none"> • 9358-EPBKY03ENE (3 units) • 9358-EPBKY10ENE (10 units) • 9358-EPBKY30ENE (30 units) • 9358-EPBKY60ENE (60 units)
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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 computers. 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 48 - Domain Virtual Requirements

Category	Requirement ⁽¹⁾
Hardware	Required: <ul style="list-style-type: none"> • 1 vCPU • 4 GB vRAM min • 40 GB vHardDisk Recommended CPU and memory allocation: <ul style="list-style-type: none"> • Low-priority Resource pool
Operating system	Windows Server 2016 operating system, 64 bit
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.

Table 49 - Domain Traditional Requirements

Category	Requirement
Hardware	The Information Management server must be installed on server-class hardware: <ul style="list-style-type: none"> • Intel Xeon Multicore processor (4 cores or greater) • 2.40 GHz CPU min • 4 GB RAM min • Ethernet card that supports redundant media if NIC-teaming is used (If you plan to use a motherboard-NIC make sure it supports redundant media)
Operating system	Windows Server 2016 operating system, 64 bit
Additional third-party software	Antivirus software

Table 50 - Domain Software

Category	Requirement
Virtual image template	<ul style="list-style-type: none"> • 9528-PADCVTENM USB device contains a virtual template for the AppServ-Asset.

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 plantwide process control. The process controller is preconfigured with a default process tasking model and dedicated PlantPAx process instructions 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 51 - 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
Standard Ethernet interfaces (ControlLogix)	<ul style="list-style-type: none"> For direct DLR connection: 1756-EN2TR For direct PRP connection: 1756-EN2TP For secure connections: 1756-EN2TSC Otherwise: 1756-EN2T, 1756-EN2F

Simplex Controllers

Non-redundant controllers are referred to as simplex controllers.

Table 52 - 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 alarms max	7500		

(1) These values are recommended maximum limits. It's possible that achieving all of these values in one controller is not doable. For more detailed sizing, you can use the PSE.

Table 53 - 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. It's possible that achieving all of these values in one controller is not doable. For more detailed sizing, you can use the PSE.

Redundant Controllers

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

Table 54 - 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 DLR connection: 1756-EN2TR For direct PRP connection: 1756-EN2TP Otherwise: 1756-EN2T, 1756-EN2F

(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 55 - 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. It's possible that achieving all of these values in one controller is not doable. For more detailed sizing, you can use the PSE.

Table 56 - 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. It's possible that achieving all of these values in one controller is not doable. For more detailed sizing, you can use the PSE.

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 57 - Skid-based Controllers

Category ⁽¹⁾	CompactLogix 1769-L24ER-Q	CompactLogix 1769-L33ER	CompactLogix 1769-L36ERM	CompactLogix 5069-L320ERP (Process Controller)	CompactLogix 5069-L340ERP (Process Controller)
User memory	0.75 MB	2 MB	3 MB	2 MB	4 MB
PID Loop Control Strategies @ 100 ms max	12	35	50	125	250
PID Loop Control Strategies @ 250 ms max					
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. It is possible that some controllers might not achieve all of these values. For more detailed sizing, use the PSE.

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 58 - I/O Communication Interfaces

Category	Family	Communication Interface Cat. No.
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-EN2TXT, 1756-EN2TSC 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 .
Condition monitoring module	1444 Dynamix™ I/O	<ul style="list-style-type: none"> 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	1715 Redundant I/O	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 1719-AENTR Intrinsically safe EtherNet/IP adapter For more information, see the 1719 Ex I/O Technical Data, publication 1719-TD001 .

Table 59 - 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	–	–	–	–	–
1788-EN2FFR or 1788-EN2PAR	–	–	Yes	Yes	–	–	–	–	–
1788-CN2FFR or 1788-CN2PAR	–	–	–	–	No	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

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

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

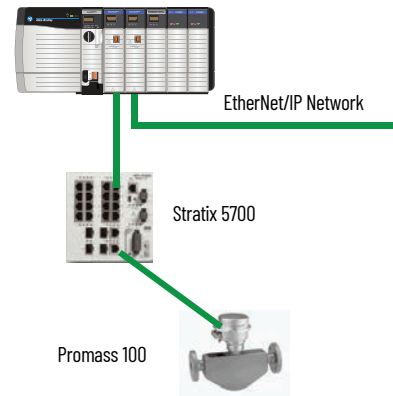


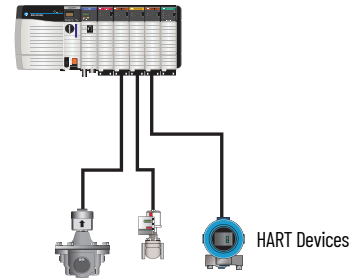
Table 60 - EtherNet/IP Interface

Category	Cat. No.	Description
ControlLogix EtherNet/IP interface	1756-EN2T, 1756-EN2TP, 1756-EN2TR, 1756-EN3TR, 1756-EN4T, 1756-EN4TR, 1756-EN2F	ControlLogix EtherNet/IP bridge
ControlLogix time synchronization	1756-TIME	Provides time synchronization by acting as a gateway between different time synchronization methods and standards

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 modules:

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

Table 61 - 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
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.

Table 61 - HART Interface

Category	Cat. No.	Description
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
1715 Redundant I/O Modules	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 • WHA-ADP • WHA-BLT • WHA-GW 	Endress+Hauser wireless HART: <ul style="list-style-type: none"> • WirelessHART adapter • WirelessHART fieldgate • Data manager 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.

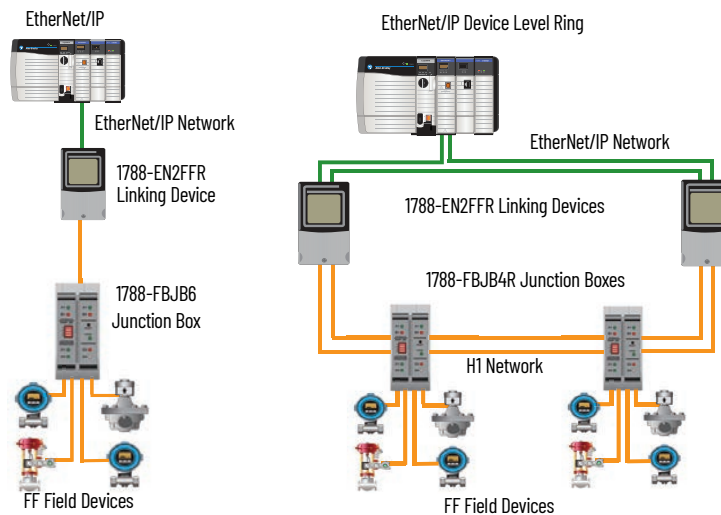


Table 62 - FOUNDATION Fieldbus Interface

Category	Cat. No.	Description
EtherNet/IP interface	1788-EN2FFR	Bridge from an Ethernet network to an H1 network. Supports redundant media and DLR-capable Ethernet network. Linking devices have built-in termination.

Table 62 - FOUNDATION Fieldbus Interface

Category	Cat. No.	Description
FOUNDATION Fieldbus network components	Power conditioning	Included in the 1788-EN2FFR and 1788-CN2FFR linking devices.
	1788-FB4R	Intelligent junction box supports redundancy, includes four drop ports and four trunk ports.
	1788-FB6	Intelligent junction box with six drop ports and two trunk ports.
	Additional components	Pepperl+Fuchs, FOUNDATION Fieldbus components, such as valve couplers, surge protectors, and distributors. See the Encompass website for Pepperl+Fuchs product offerings.
	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.

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.

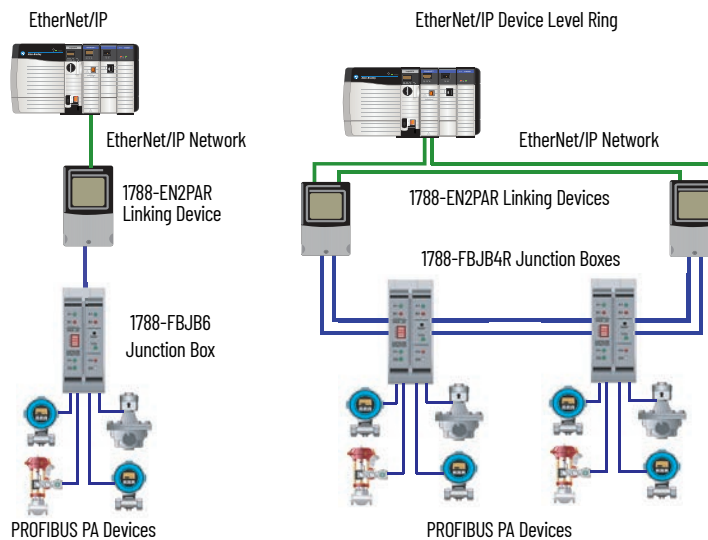


Table 63 - PROFIBUS PA Interface

Category	Cat. No.	Description
PROFIBUS interface	1788-EN2PAR	EtherNet/IP to PROFIBUS PA linking device. Supports redundant PROFIBUS PA media and DLT-capable Ethernet network. Linking devices have built-in terminators.

Table 63 - PROFIBUS PA Interface

Category	Cat. No.	Description
PROFIBUS network components	Power conditioning	Included in the 1788-EN2PAR and 1788-CN2PAR linking devices.
	1788-FB4R	Intelligent junction box supports redundancy, includes four drop ports and four trunk ports.
	1788-FB6	Intelligent junction box with six drop ports and two trunk ports.
	Additional components	Pepperl+Fuchs ⁽¹⁾ , PROFIBUS components, such as valve couplers, surge protectors, and distributors. See the Encompass website for Pepperl+Fuchs product offerings.
	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.

(1) For more information on Encompass third-party products, see <http://www.rockwellautomation.com/encompass>.

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.

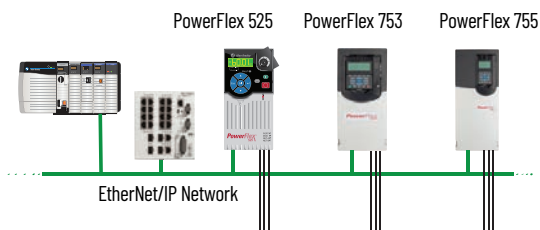


Table 64 - PowerFlex Drives and Communication Modules

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.

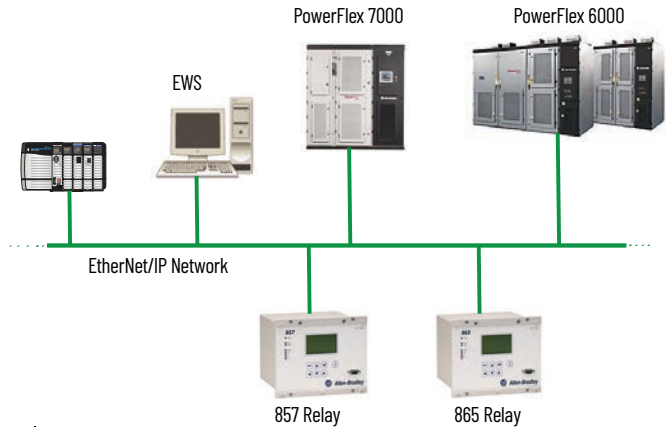


Table 65 - Medium Voltage Drives and Relays

Drive Cat. No. ⁽¹⁾	Description	Available Communication Modules ⁽¹⁾	
		Cat. No.	Description
PF-6000	PowerFlex 6000	<ul style="list-style-type: none"> Anybus-AB7007 USB-RS-232 	<ul style="list-style-type: none"> Third-party, EtherNet/IP gateway Configuration adapter (order code 019570)
PF-7000	PowerFlex 7000	<ul style="list-style-type: none"> 20-750-ENETR 20-COMM-E 	<ul style="list-style-type: none"> Dual-port EtherNet/IP option module EtherNet/IP communication adapter
Bulletin 857	857 relay	Embedded with product; depends on application requirement	See the Product Configuration Assistant or contact your Rockwell Automation representative
Bulletin 865	865 relay	Embedded with product; depends on application requirement	See the Product Configuration Assistant or contact your Rockwell Automation representative

(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.

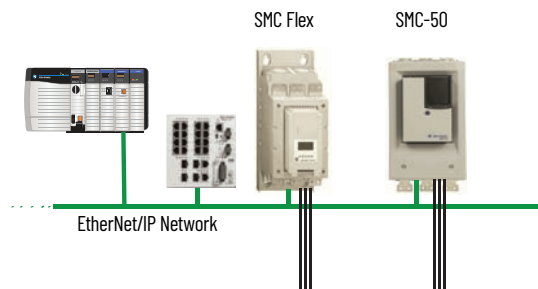


Table 66 - SMC Soft Starters and Communication Modules

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.

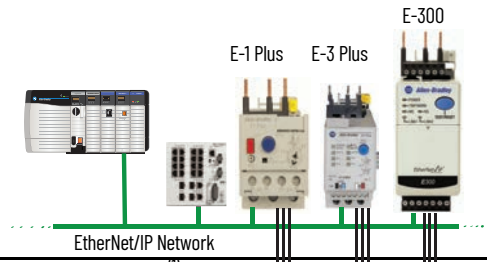


Table 67 - Electronic Overload Relays and Communication Modules

Cat. No. ⁽¹⁾	Description	Available Communication Modules ⁽¹⁾	
		Cat. No.	Description
193/592-EE	E1 Plus™ Electronic Overload Relays	<ul style="list-style-type: none"> 193-ETN 193-EDN 	<ul style="list-style-type: none"> EtherNet/IP module DeviceNet module
193/592-EC	E3 Plus™ Electronic Overload Relays with embedded DeviceNet	193-DNENCAT	EtherNet/IP communication auxiliary DeviceNet to EtherNet/IP linking device, single port
		193-DNENCATR	EtherNet/IP communication auxiliary DeviceNet to EtherNet/IP linking device, dual-port
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.

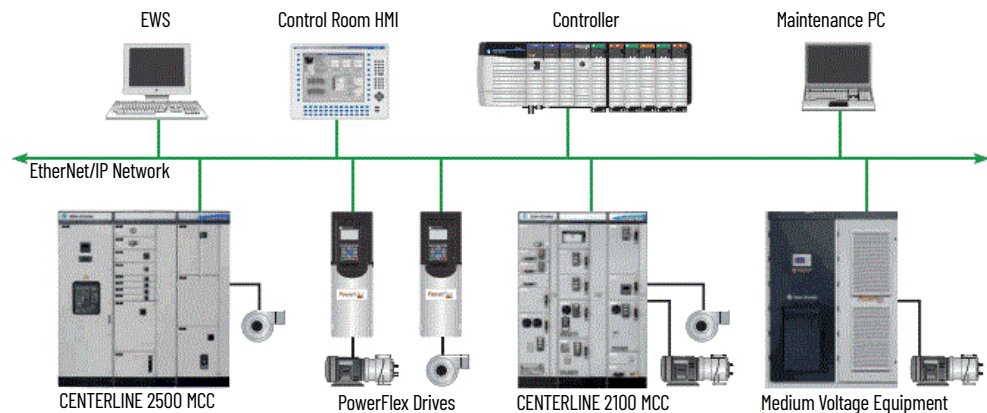


Table 68 - Low Voltage Motor Control Centers

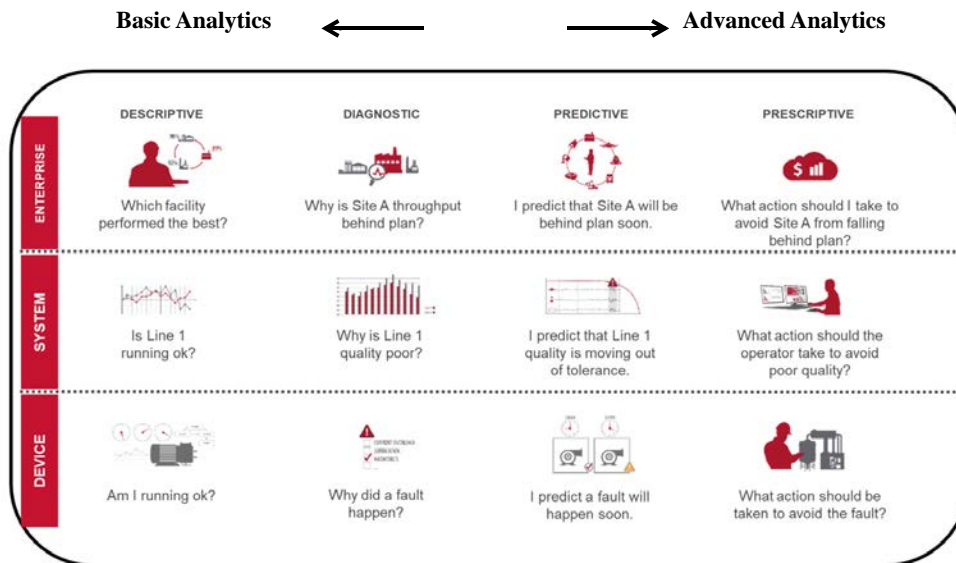
Category ⁽¹⁾	Cat. No.	Description
CENTERLINE 2100 MCC	2100	<ul style="list-style-type: none"> Designed to meet UL and NEMA standards Allen-Bradley motor control devices: starters, soft-starters, and drives Available with SecureConnect™ units ArcShield™ arc-resistant enclosures available EtherNet/IP and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

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

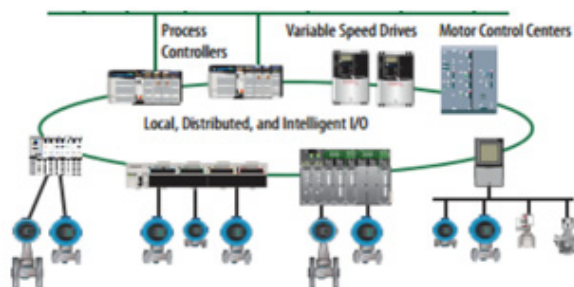


Device Level Options

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	
FactoryTalk® Analytics™ for Devices	An embedded analytics software that lets you implement device level, descriptive and diagnostics analytics to improve maintenance and engineering reliability. Automated device health diagnostics provides data to an information platform with or without cloud connectivity PlantPax specific content: <ul style="list-style-type: none"> • Advanced Process Controller action card • E+H device support • Robust HART diagnostic information. 	Type: Descriptive, Diagnostic Environment: Appliance on EtherNet/IP network Available via the subscription portal Requirements: <ul style="list-style-type: none"> • 6200PC-FTA4DT11M FactoryTalk Analytics for Devices appliance
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.	Type: Diagnostic, Predictive Environment: ControlLogix chassis Available via the subscription portal Requirements: <ul style="list-style-type: none"> • 1756M-FTALGXAIT11M 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 reduction, management, transformation, and harmonization
- Model training and deployment
- Pattern extractions



FactoryTalk products that add system-level analytics include:

Option	Description	
FactoryTalk® Analytics™ Augmented Modeler	<p>Provides an interactive machine learning environment for plant engineers and application domain experts to build analytic applications.</p> <p>System-level analytics provide:</p> <ul style="list-style-type: none"> • Data reduction, management, transformation, and harmonization • Model training and deployment • Pattern extractions <p>Discovers machine, unit, or line anomalies sooner with alerts that indicate unusual states.</p>	<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 Augmented Modeler software <ul style="list-style-type: none"> - Includes FactoryTalk® Analytics™ Data Explorer as a data preparation tool
Pavilion8®	<p>Provides closed-loop, prescriptive analytics to maximize process performance in quality, throughput and efficiency.</p> <ul style="list-style-type: none"> • Model-based advanced, dynamic control drives stable performance • Integrated MPC, calculation, and soft sensor visualization and performance reporting 	<p>Type: Predictive, Prescriptive</p> <p>Environment: Server based</p> <p>Requirements:</p> <ul style="list-style-type: none"> • Pavilion8 software
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
FactoryTalk® Analytics™ DataFlowML (also applicable at enterprise level)	<p>Helps identify data trends and presents insights proactively. Use for expert-driven analytics, but where latency is not a requirement. Use to operationalize models.</p> <ul style="list-style-type: none"> • Corrects anomalies before downtime or quality events occur • Connects multiple types of complex machine learning models with the data from your intelligent assets • Offers data exploration, cleansing, preparation capabilities to empower data scientists <p>Transform and manipulate data (batch/stream)</p> <ul style="list-style-type: none"> • Aggregate, join, slice, thin, and operate on data streams • Ingest high volume/high velocity to low volume/low velocity use cases • Reuse models across the enterprise 	<p>Type: Predictive, Prescriptive</p> <p>Environment: Server based Part of FactoryTalk Analytics; available via the subscription portal</p> <p>Requirements:</p> <ul style="list-style-type: none"> • FactoryTalk Analytics DataFlowML base bundle or • FactoryTalk Analytics Platform base bundle
FactoryTalk® Analytics™ DataView (also applicable at enterprise level)	<p>A visualization tool that lets you access and transform data through storyboards. Gain a business understanding of data to pinpoint opportunities for improvement.</p> <ul style="list-style-type: none"> • Reduces time to value by reducing the dependence on data architects and data scientists • Enables self-service analytics • Minimizes the need for expensive infrastructure that is associated with traditional warehousing 	<p>Type: Descriptive, Diagnostic</p> <p>Environment: Server based Part of FactoryTalk Analytics; available via the subscription portal</p> <p>Requirements:</p> <ul style="list-style-type: none"> • FactoryTalk Analytics DataView 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
FactoryTalk Analytics DataFlowML (also applicable at system level)	<p>Helps identify data trends and presents insights proactively. Use for expert-driven analytics, but where latency is not a requirement. Use to operationalize models.</p> <ul style="list-style-type: none"> • Corrects anomalies before downtime or quality events occur • Connects multiple types of complex machine learning models with the data from your intelligent assets • Offers data exploration, cleansing, preparation capabilities to empower data scientists <p>Transform and manipulate data (batch/stream)</p> <ul style="list-style-type: none"> • Aggregate, join, slice, thin, and operate on data streams • Ingest high volume/high velocity to low volume/low velocity use cases • Reuse models across the enterprise 	<p>Type: Predictive, Prescriptive</p> <p>Environment: Server based Part of FactoryTalk Analytics; available via the subscription portal</p> <p>Requirements:</p> <ul style="list-style-type: none"> • FactoryTalk Analytics DataFlowML base bundle or • FactoryTalk Analytics Platform base bundle
FactoryTalk Analytics DataView (also applicable at system level)	<p>A visualization tool that lets you access and transform data through storyboards. Gain a business understanding of data to pinpoint opportunities for improvement.</p> <ul style="list-style-type: none"> • Reduces time to value by reducing the dependence on data architects and data scientists • Enables self service analytics • Minimizes the need for expensive infrastructure that is associated with traditional warehousing 	<p>Type: Descriptive, Diagnostic</p> <p>Environment: Server based Part of FactoryTalk Analytics; available via the subscription portal</p> <p>Requirements:</p> <ul style="list-style-type: none"> • FactoryTalk Analytics DataView base bundle or • FactoryTalk Analytics Platform base bundle

Option	Description	
Vuforia® Augmented Reality	<p>An industrial augmented reality platform that can improve workforce efficiency and customer satisfaction with real-time, step-by-step work instructions and data.</p> <ul style="list-style-type: none"> • 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>PlantPax specific support:</p> <ul style="list-style-type: none"> • Process strategy experience templates provide users with faceplate-like features within an AR experience. The templates enable users to build additional functionality around the PlantPax information. 	<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
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>PlantPax specific support:</p> <ul style="list-style-type: none"> • Process strategy Thing templates replicate structure and functionality within ThingWorx, which enable users to create an analysis of the objects with Live and Historical Data • ThingWorx mashup templates provide the ability to investigate alarms by area, priority, and other critical alarming criteria. Advanced alarm analysis includes fleeting, chattering, and stale alarm insights. Similar dashboard functionality is also provided for SQL server reporting services. 	<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

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 69 - 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				Low
	Mining	Fault Tolerant			Low/High ⁽²⁾
	Power equipment				
	Specialty chemical				
	High Availability control systems				

(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 70 - 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 71 - 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:

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)	Get help determining how products interact, check features and capabilities, and find associated firmware.	rok.auto/pcdc

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Rockwell Otomasyon Ticaret A.Ş. Kar Plaza İş Merkezi E Blok Kat:6 34752, İçerenköy, İstanbul, Tel: +90 (216) 5698400 EEE Yönetmeliğine Uygundur

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AMERICAS: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

EUROPE/MIDDLE EAST/AFRICA: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

ASIA PACIFIC: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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