Application Technique

Original Instructions



EtherNet/IP Parallel Redundancy Protocol





Summary of Changes

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

Торіс	Page
Added FLEX 5000 I/O to topology drawings	throughout
Revised topology example for redundancy between a PRP network and Layer 3 network	15
Specified port type for infrastructure switch ports that connect to RedBoxes	16
Added unsupported topologies	1719
Added configuration requirement for LAN A and LAN B infrastructure switches	16, 33, 38
Revised guidance for infrastructure switches in PRP systems using Precision Time Protocol (PTP)	23
Add CLI configuration for UTC offset value in certain PTP configurations	24
Added publications to Additional Resources table	43

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About This Publication

This manual describes how you can configure a Parallel Redundancy Protocol (PRP) network with a compatible device or switch.

Be sure to understand these concepts and tools:

- EtherNet/IP[™] network design
- Studio 5000 Logix Designer® application
- Linx-based software
- Device Manager or WebUI for Stratix® switches

Download Firmware, AOP, EDS, and Other Files

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

Notes:

Parallel Redundancy Protocol

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

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

A PRP network includes the following components.

PRP Network Operation

A device with PRP technology has two ports that operate in parallel and attach to LAN A and LAN B. This end device is known as a double attached node (DAN). During normal network operation, a DAN simultaneously sends and receives duplicate Ethernet frames through both LAN A and LAN B ports. The receiving node accepts whichever frame arrives first and discards the subsequent copy. If a failure occurs in one of the paths, traffic continues to flow through the other path uninterrupted with no recovery time.

Unlike other redundancy protocols, such as Spanning Tree Protocol (STP), PRP does not require network reconfiguration.

Comparison of PRP and DLR

PRP is distinct from Device Level Ring (DLR) protocol. The following table summarizes some of the differences between the protocols.

Attribute DLR		PRP		
Standards organization	ODVA	International Electrotechnical Commission (IEC)		
Fault tolerance	Single-fault tolerance	Multiple -fault tolerance, depending on topology or single-fault tolerance in the worst case		
Infrastructure	Duplication of infrastructure not required	Duplication of infrastructure required		
Switches No minimum requirement		Twice as many switches as one network		
Topology	Ring topology	Any topology		
Switchover time	Fast recovery time	Zero recovery time		

PRP Network Topologies

A PRP network can have many topologies. This section shows examples of PRP network topologies with these features:

- Basic PRP topology with two switches
- LANs as clouds
- SAN and VDANs
- Device Level Ring for VDANs
- Multiple VLANs
- VLAN trunking
- ControlLogix[®] redundancy system
- Network redundancy between PRP and a Layer 3 network

Basic PRP Network Topology

The most basic network topology is the same as a star topology, but adds these components:

• End nodes with PRP technology, such as 1756-EN2TP modules and FLEX 5000™ EtherNet/IP™ adapters

IMPORTANT Be sure to configure all devices for PRP before connecting them to the PRP network. For example, FLEX 5000 adapters have different modes for DLR and PRP and must be manually set to PRP mode.

• A second, independent LAN

You can use the 1756-EN2TP in a standard star topology and add a second local area network (LAN) for redundancy later.



PRP Network Topology with LANs as Clouds

Each LAN can be more complex than one switch. In the following topology, LAN A and LAN B are clouds to show that they can have different infrastructures. For example, one LAN can have a few switches in series. The other LAN can have a ring of switches.



PRP Network Topology with SAN and VDANs

The following network example shows that you can connect devices without PRP technology to either one or both LANs:

• The HMI device is a SAN that connects only to LAN A.

A SAN does not have PRP network redundancy.

 The I/O, drive, and HMI devices are VDANs that connect to both LAN A and LAN B through a Stratix[®] 5400 switch that is configured as a RedBox.

In a star topology, VDANs have PRP network redundancy from the RedBox to both LANs, but not from themselves to the RedBox, as shown with dotted lines in the following example.



PRP Network Topology with VDANs in a Device Level Ring

The following network example shows that you can connect a DLR topology to the VDAN side of the RedBox. Each node in the ring becomes a VDAN.

By using a Stratix 5400 switch as a RedBox, you can configure as many as three rings that can have redundancy through the RedBox.

The 1756-EN2TP module does not have DLR protocol and cannot operate as part of a ring.



PRP Network Topology with Multiple VLANs

You can segment your PRP network into multiple VLANs. Be sure that both PRP ports of a DAN are connected to the same VLAN. For example, in the following topology, both PRP ports on the 1756-EN2TP module on the left are on VLAN 1. Both PRP ports of the 1756-EN2TP module on the right are on VLAN 2.



LAN B

PRP Network Topology with VLAN Trunking

A VLAN trunk is a connection between two devices that carries traffic for multiple VLANs. The following example shows a Stratix 5400 RedBox with PRP ports configured as trunk ports that carry traffic for both VLANs 1 and 2, and access ports that carry traffic for either VLAN 1 or 2.



PRP Network Topology with a ControlLogix Redundancy System

With redundancy firmware bundle version 31.051, you can use partnered 1756-EN2TP modules in a ControlLogix redundancy system with PRP. In the following illustration, both LAN A and LAN B are connected to a redundant chassis pair.

For more information about ControlLogix redundancy with PRP networks, see the High Availability Systems Reference Manual, publication <u>HIGHAV-RM002</u>.



LAN B

Network Redundancy Between PRP Network and Layer 3 Network

The topology example in Figure 1 uses Layer 3 RedBoxes that are configured for first hop redundancy protocol (FHRP) and routing. This configuration provides the resilient connectivity between the Layer 2 PRP segment and the higher-level network. In this type of topology, follow these guidelines:

- To avoid a single point of failure, do not use RedBoxes that are configured for FHRP to create VDANs with other end devices.
- Connections between the RedBoxes and PRP segments carry a system size limitation. Be sure to limit the use of these connections.

For details about how to configure this type of topology, see the following publications:

- PlantPAx DCS Configuration and Implementation User Manual, publication PROCES-UM100
- Deploying Parallel Redundancy Protocol within a Converged Plantwide Ethernet Architecture, ENET-TD021

Figure 1 - PRP and Layer 3 Network





LAN A and LAN B Topologies

LAN A and LAN B can have different topologies that are comprised of different network components. Optimal results depend on many factors, such as network bandwidth, network speed, switch performance, and the rate of transfer for PRP packets.

Requirements

IMPORTANT To maintain network redundancy, never connect LAN A and LAN B directly to each other. A PRP network converges only at a DAN or a RedBox.



Be sure that your LAN A and LAN B topologies follow these requirements:

- A DAN must be connected to the same IP subnet in LAN A and LAN B. For example, you cannot use the two ports on the 1756-EN2TP as two NICs connected to two different subnets.
- LAN A and LAN B must have separate, independent infrastructures. For example, both LANs cannot share a switch.

Recommendations

As a best practice, follow these recommendations for LAN A and LAN B topologies:

- Keep both LANs similar in topology, network speed, network latency, and hops.
- Use either wired or wireless networks for both LANs. For example, do not use a wired network for LAN A and wireless network for LAN B.
- If you use a DLR topology within LAN A or LAN B, be sure to validate your DLR topology within the larger network before production use. Depending on your network architecture, DLR topology limitations can exist.

LAN A and LAN B Infrastructure Switches

An infrastructure switch is part of either LAN A or LAN B, but not both. Unlike a RedBox, an infrastructure switch does not require built-in PRP technology. Follow these guidelines:

- On switch downlink ports, enable the PortFast feature for Spanning Tree Protocol (STP) to improve recovery time.
- As a best practice, use managed switches as infrastructure switches for their network diagnostic and configuration capabilities.
- You must use infrastructure switches that support the maximum transmission time (MTU) of 1506 bytes or greater.

Unsupported Topologies

IMPORTANT Depending on your network architecture, PRP topology limitations can exist. Be sure to validate your PRP topology within the larger network before production use.

Invalid Connections Between LAN A and LAN B

Only connect LAN A and LAN B with the following:

- DAN devices configured for PRP
- RedBoxes on PRP-enabled ports

Figure 2 illustrates three types of invalid connections between LAN A and LAN B:

- Do not connect a switch in LAN A to a switch in LAN B.
- Do not use a non-RedBox switch or non-PRP ports on a RedBox switch to connect LAN A and LAN B.
- Do not use an EtherNet/IP device that does not support PRP, such as an Ethernet tap or 1756-EN2TR device, to connect LAN A and LAN B.

Figure 2 - Invalid Connections between LAN A and LAN B





Invalid Layer 2 Connections

Figure 3 shows unsupported Layer 2 connections. If RedBoxes connect either directly or through additional infrastructure via Layer 2, your network can experience uncontrollable loop and broadcast storms.





Single Points of Failure Between Adjacent PRP Networks

Figure 4 shows two PRP networks that are connected to the same ControlLogix chassis. To avoid single points of failure in a redundant system, be aware of these communication limitations:

- Allow the ControlLogix chassis that is connected to both PRP networks to originate, but not bridge traffic between PRP networks.
- Do not allow devices in PRP network 1 communicate with devices in PRP network 2.

Figure 4 - Avoid Single Points of Failure with Adjacent PRP Networks



Notes:

Configure a PRP Network

A PRP network has requirements and restrictions for the following:

- Device IP addresses
- Frame sizes
- LAN A and LAN B infrastructure switches
- Spanning Tree Protocol (STP)
- Multicast traffic and IGMP querier
- CIP Sync[™] time synchronization (Precision Time Protocol)

IMPORTANT Be sure that all Stratix[®] switches in your PRP network follow the network guidelines that are described in the user manual for the switches.

Device IP Addresses

To enable devices to communicate with each other across a PRP network, device IP addresses must meet these requirements:

- To communicate with each other, double attached nodes (DANs) and single attached nodes (SANs) must have unique IP addresses
 within the same subnet.
- Devices in LAN A and LAN B, including SANs and infrastructure switches, must have unique IP addresses within and between each LAN.

Unique IP address assignments also enable you to access each device for monitoring and diagnostics.

Frame Sizes for LAN A and LAN B Devices

PRP adds to the size of Ethernet frames that flow through devices in LAN A and LAN B. If PRP causes frames to exceed the size limit on a device, the frames are dropped. To accommodate a full-sized packet with the PRP trailer attached, set the maximum transmission unit (MTU) size on all infrastructure devices to at least 1506 bytes. This MTU value is not required for a switch that is configured as a RedBox.

If you cannot configure the MTU for an infrastructure device, we recommend that you exclude the device from the path of PRP traffic.

Configuration for LAN A and LAN B Infrastructure Switches

On all ports of LAN A and LAN B infrastructure switches that are in the possible path to the IGMP querier, you must specify the multicast router VLAN ID and the interface to the multicast router.

To configure this information on a switch, use the Cisco® command-line interface (CLI) to run the following command:

switch(config)#ip igmp snooping vlan <vlan id> mrouter interface <port name>

Spanning Tree Protocol (STP)

You must enable the following STP features:

- Enable BPDU Filtering on the RedBox ports that belong to the PRP channel. When you configure PRP ports on the RedBox, BPDU Filtering is automatically enabled.
- Enable PortFast on the following ports:
 - On downlink ports that connect to end devices (not switches)
 - On ports that connect RedBoxes to infrastructure switches

PortFast is not recommended on ports between infrastructure switches.

PortFast is enabled by default on Stratix managed switches. Also, the following Smartport roles on Stratix managed switches automatically enable PortFast:

- Automation Device
- Multiport Automation Device
- Desktop for Automation
- Virtual Desktop for Automation
- Router for Automation
- Phone for Automation

Multicast Traffic and IGMP Querier

For PRP networks with multicast traffic, follow these guidelines:

- If your PRP network includes a RedBox and you want to enable multicast traffic filtering on both LANs, configure IGMP querier on the RedBox.
- To avoid one point of failure with the loss of a querier, configure at least two queriers in the PRP network.
- Disable IGMP querier on each infrastructure switch in LAN A and LAN B. This requirement applies to PRP networks with or without a RedBox.

IMPORTANT After a LAN in a PRP network encounters a fault and is then repaired, there is a delay in multicast traffic redundancy. The delay lasts until the IGMP querier reinstates the multicast traffic. Multicast traffic redundancy is typically restored within 2 minutes after the LAN is repaired.

CIP Sync Time Synchronization (Precision Time Protocol)

EtherNet/IP™ networks configured for Parallel Redundancy Protocol (PRP) support CIP Sync. CIP Sync devices implement the doubly attached clock model with Layer 3 End-to-End protocol, as specified in IEC 62439-3, Annex A and C.

In the following illustration, two 1756-EN2TP modules operate as doubly attached clocks operating on LAN A and LAN B redundant networks:

- In the 1756-EN2TP module at the top, both ports A and B are paired and function as CIP Sync master ports. For master operation, both ports A and B operate as master ports as defined by the IEEE-1588 PTP protocol.
- In the 1756-EN2TP module at the bottom, both ports A and B are paired and function as CIP Sync slave ports. For slave operation, one port is the active port and operates as defined by the IEEE-1588 Precision Time Protocol (PTP). The active port tunes the clock and reports its state as SLAVE. The other port is passive and reports its state as PASSIVE_SLAVE. The passive port also measures path delay and maintains close synchronization to the active port. A network failure on the active port results in a smooth clock transition from passive to active slave.



Note	Port PTP Role
1	Master
2	Master
3	Slave active
4	Slave passive

For PRP systems with CIP Sync time synchronization, follow these guidelines:

- Grandmaster—The Grandmaster for a PRP network can be one of the following:
- A DAN that functions as a doubly attached clock
- A controller that accesses the PRP network via a DAN
- A VDAN that connects to a RedBox
- A switch that is configured as a DAN or RedBox
- For time sync critical applications, consider adding redundant Grandmasters.
- Infrastructure switches—Set the PTP clock mode on infrastructure switches in LAN A and LAN B that support CIP Sync as follows:
 - For a single VLAN, use Transparent mode.
 - For multiple VLANs, use Boundary mode. Also, make the PTP priority lower (higher numerical value) than any other dual connected device.
- RedBox switch—On each switch you configure as a RedBox, be sure that the PTP mode is set to Boundary or NTP-PTP Clock mode. These modes are the only PTP modes that are supported on a switch that is configured as a RedBox. Typically, NTP-PTP mode is configured on the Layer 3 RedBox switches that are connected to the plant-wide network.

If the PTP mode on the RedBox is NTP-PTP Clock mode, use the Cisco command-line interface (CLI) to configure the UTC offset value to 37 seconds: switch(config)#utc-offset 37

- Time Sync object—Additional support for PRP is provided by the CIP™ Time Sync object:
 - A port in the PASSIVE_SLAVE state is reported as enumeration 10 in attribute 12 of the Time Sync Object.
 - A doubly attached clock on the PRP network reports the profile identity in attribute 24 as 00-15-4e-00-01-50.

Configuration Example

This configuration example shows you how to configure the PRP system shown in the following illustration:

- The system includes DANs, a SAN, a RedBox, VDANs, and multiple VLANs.
- Because a drive is part of the PRP system, PTP is required.

This example shows the simplest method for configuring PRP trunking with two VLANs. For details on how to configure management interfaces, native VLANs, and data VLANs, see the PlantPAx Distributed Control System Infrastructure Configuration User Manual, publication <u>PROCES-UM001</u>.



To configure the example PRP network, complete the following procedures. For more configuration details, see these publications:

- EtherNet/IP Network Configuration User Manual, ENET-UM001
- Stratix Managed Switches User Manual, publication 1783-UM007

IMPORTANT Before you connect cables between devices in a PRP system, complete the configuration of all devices. For example, if your system includes a FLEX 5000 EtherNet/IP adapter, make sure that the adapter is in PRP mode.

IMPORTANT Before you begin, be sure to update the devices with the latest firmware.

Configure the Stratix 5400 RedBox

The RedBox in the example on page 25 uses the port configurations that are shown in the following table. Also, because the RedBox is connected to a drive, PTP must be enabled and set to Boundary mode.

Table 1 -

Port	Connected Device	VLAN	IP Address with Subnet Mask	Native VLAN ⁽¹⁾	Administrative Mode	Smartport Role	PortFast
Gi1/1	Stratix 5400 switch, LAN A	501 502	192.168.10.14/24 192.168.20.24/24	301	Trunk	-	_
Gi1/2	Stratix 5400 switch, LAN B	501 502	192.168.10.12/24 192.168.20.22/24	301	Trunk	-	-
Fa1/5	I/O, VDAN	501	192.168.10.101/24	-	Access	Automation Device	Enabled
Fa1/6	Drive, VDAN	502	192.168.20.201/24	_	Access	Automation Device	Enabled

(1) All trunk ports require the same native VLAN.

To configure this example, follow these steps.

1. Run Express Setup in Short Press mode and assign a default IP address of 192.168.10.11.

Allen-Bradley	Stratix 5400 Solution Device Manager - Switch Express Setup
Select device initial setup mode:	Express Setup *
 Network Settings 	
Host Name:	REDBOX_1
Management Interface (VLAN):	501
IP Assignment Mode:	● Static ○ DHCP
IP Address:	192.168.10.11 / 255.255.255.0
Default Gateway:	
NTP Server:	
User:	admin Password: •••••• Confirm Password: ••••••
Advanced Settings Submit	

 Assign the Automation Device Smartport role to the switch ports connected to the VDANs (Fa1/5 and Fa1/6). The Smartport role enables PortFast on the ports. PortFast is required to be enabled on ports that are connected to end devices.

Allen-Bra	adley	Stratix 5400 Solution Device Manager - Switch	🚠 Dashboard	Configure 🔻					
S Network Smartports									
Smartport Role	Custom S	imartports							
Smartport Role									
🖊 Edit									
Port Name		Role							
Gi1/1		None							
Gi1/2		None							
Gi1/3		None							
Gi1/4		None							
🗌 Fa1/5		Automation Device							
Fa1/6		Automation Device							
🗌 Fa1/7		None							
Fa1/8		None							
Fa1/9		None							
Fa1/10		None							
🗌 Fa1/11		None							
Fa1/12		None							

3. Add VLANs 301 and 502.

VLAN 502 has a unique IP address of 192.168.20.21.

4	Allen-Br	adley	Stratix 5400 Solution Device Manager - Switch	🔬 Dashboard	- Configure 🄻	Monitor 🔻	Admin	Au				
G	Network VLAN Management											
To a VTP	To add or edit ports in a VLAN, use the Physical Port Settings page. VTP Mode :Server											
	VLAN ID	Name	Ports			VL	AN Status	IP address				
0	1	default				Ac	tive					
Ο	301	VLAN301				Ac	tive					
0	501	VLAN501	Gi1/1, Gi1/2, Gi1/3, Gi1/4, Fa1/5, Fa1	/6, Fa1/7, Fa1/8, Fa1/9, Fa	1/10, Fa1/11, Fa1	L/12 Ac	tive	192.168.10.11				
۲	502	VLAN 502				Ac	tive	192.168.20.21				

4. Assign VLAN 501 to port Fa1/5 connected to the I/O (VDAN) and assign VLAN 502 to port Fa1/6 connected to the drive (VDAN).

Allen-Bradley	Stratix : Device M	5400 Solution Ianager - Switch		🔦 Dashboard Confi	gure y Monitor y	Admin 💌				
Network Port Settings										
Physical Port Table										
/ Edit										
Port Name Description	Port Status	Speed	Duplex	Media Type	Operational Mode	Access VLAN	Administrative Mode			
O Gi1/1	0	Auto	Auto	AUTO-SELECT Not Pr	Down	501	Dynamic auto			
O Gi1/2	0	Auto	Auto	AUTO-SELECT Not Pr	Down	501	Dynamic auto			
O Gi1/3	0	Auto	Auto	AUTO-SELECT Not Pr	Down	501	Dynamic auto			
O Gi1/4	0	Auto	Auto	AUTO-SELECT Not Pr	Down	501	Dynamic auto			
O Fa1/5	0	Auto	Auto	10/100BaseTX	Down	501	Dynamic auto			
O Fa1/6	0	Auto	Auto	10/100BaseTX	Down	502	Dynamic auto			
O Fa1/7	0	Auto	Auto	10/100BaseTX	Down	501	Dynamic auto			
O Fa1/8	0	Auto	Auto	10/100BaseTX	Down	501	Dynamic auto			
O Fa1/9	0	Auto	Auto	10/100BaseTX	Down	501	Dynamic auto			
O Fa1/10	۲	Auto-100Mb/s	Auto-Full	10/100BaseTX	Static access	501	Dynamic auto			
O Fa1/11	0	Auto	Auto	10/100BaseTX	Down	501	Dynamic auto			
O Fa1/12	0	Auto	Auto	10/100BaseTX	Down	501	Dynamic auto			

5. Choose Boundary mode for PTP.

Allen-Bradley		Stratix 5400 Soluti c Device Manager - Swi	n	🏦 Dashboard	Configure 🔻
🔇 Network PTP					
Mode Priority1 Priority2	Bound 128 128	ary) 💌			
Clock Identity: Offset From Master(ns): Submit					

- 6. Add a PRP channel group with this configuration:
 - Choose Trunk as the Administrative mode because the ports carry traffic for VLANs 501 and 502.
 - Choose 301 as the native VLAN.

Allen-Bradley Stratix 5	400 Solution	🟦 Dashboard Configure 🔻 Monitor 🔻 Admin 🔻
Spanning Tree PRP		
Channel Table Vdan Table Nor PRP Channel Table Add	Add PRP Channel Channel Group Number Port 1 Port 2 Administrative Administrative Mode Description Access VLAN Allowed VLAN Native VLAN	1 GigabitEthernet1/1 GigabitEthernet1/2 GigabitEthernet1/2 Enable Trunk Trunk • Enable (Range: 1-200 Characters) default-1 • All VLANs • VLAN IDs (e.g., 2,4) VLAN301-301 • Cancel

7. Verify that the Automation Device Smartport role automatically enabled PortFast on the ports that are connected to end devices.

AB Allen-	Bradlev	Stratix 5400 Solution			
9	Drauloy	Device Manager - Switch	t.	🗟 Dashboard	Configure 🔻
Spanning Tr	ee STP Settin	gs			
Clabal					
Giobal	POIL Fast				
BPDU Filtering	Enable				
BPDU Guard	Enable				
Cubmit					
Submic					
Per-Interface F	Port Fast Table	Fachle Dark Fack			
Port Name	Port Type	Enable Port Fast			
GII/I	Trunk				
Gi1/2	Trunk				
Gi1/3	Dynamic auto				
Gi1/4	Dynamic auto				
Fa1/5	Access	\checkmark			
Fa1/6	Access	\checkmark			
Fa1/7	Dynamic auto				
Fa1/8	Dynamic auto				
Fa1/9	Dynamic auto				
Fa1/10	Dynamic auto				
Fa1/11	Dynamic auto				
Fa1/12	Dynamic auto				

8. Enable IGMP querier.

AB Allen-Bradley	Stratix 5400 Solution				
g minor producty	Device Manager - Switch	🏦 Dashboard	Configure 🔻	Monitor 🔻	Admin 🔻
Security IGMP Snooping					
IGMP Snooping 🗹 Enable					
IGMP Querier I Enable					
Extended Flood 🗌 Enable	seconds after multicast router detecte	d (Range 1-300, Default v	value is 10 secon	ds)	
Submit					

Configure the Stratix 5400 Switch in LAN A

The Stratix 5400 switch in LAN A in the example on page 25 uses the port configurations that are shown in the following table. Also, the system and jumbo MTU values on the switch must be set to 1506. PTP must be enabled and set to End to End Transparent mode.

Table 2 -

Port	Connected Device	VLAN	IP Address with Subnet Mask	Native VLAN ⁽¹⁾	Administrative Mode	Smartport Role	PortFast
Gi1/1	Stratix 5400 RedBox	501 502	192.168.10.11/24 192.168.20.21/24	301	Trunk	_	-
G1/2	Stratix 5700 switch, LAN A	501 502	192.168.10.15/24 192.168.20.25/24	301	Trunk	-	-
Gi1/5	1756-EN2TP as DAN	501	192.168.10.102/24	-	Access	Automation Device	Enabled
Gi1/6	HMI as SAN	501	192.168.10.103/24	-	Access	Automation Device	Enabled

(1) All trunk ports require the same native VLAN.

To configure this example, follow these steps.

1. Run Express Setup in Short Press mode and assign a default IP address of 192.168.10.14.

Allen-Bradley	Stratix 5400 Solution Device Manager - Switch	Express Setup
 Network Settings 		
Host Name:	LAN_A_SW_1	
Management Interface (VLAN):	501	
IP Assignment Mode:	● Static ○ DHCP	
IP Address:	192.168.10.14 / 255.255.255.0	
Default Gateway:		
NTP Server:		
User:	admin Pass	word: •••••• Confirm Password: ••••••
Advanced Settings		
Submit		

2. Assign the Automation Device Smartport role to the switch ports connected to end devices (Gi1/5 and Gi1/6). The Smartport role enables PortFast on the ports. PortFast must be enabled on ports that are connected to end devices.

Allen-Bra	dley	Stratix 5400 Solution Device Manager - Switch	🔬 Dashboard	Configure 🔻	Monitor 🔻	Admin 🔻
🔇 Network Smar	tports					
Smartport Role	Custom S	Smartports				
Smartport Role			Smartports: Customize		1	×
/ Edit		p.l.				
		Kole	Interface Name: Gi1/5,Gi1/6			
Gi1/2		None	Role: Automation	Device	-	
Gi1/3		None				
Gi1/4		None		sub	mit Cancel	
✓ Gi1/5		None		_		
Gi1/6		None				
Gi1/7		None				

3. Add VLANs 301 and 502.

VLAN 502 has a unique IP address of 192.168.20.24.

4	Allen-Bi	adley	Stratix 5400 Solution Device Manager - Switch	€	Dashboard	Configure	v 1	Monitor 🔻	Admin 🔻
G	Network VLA								
To a	ndd or edit ports i Mode :Server	n a VLAN, use	e the Physical Port Settings page.						
요즘 4	ldd 🥖 Edit 🗙 🛛	elete	~						
	VLAN ID	Name				×		V	LAN Status
0	1	default	Create a single VLAN					A	ctive
0	301	VLAN301	VLAN ID 502					A	ctive
0	501	VLAN501	Name VLAN502					A	ctive
0	790	VLAN0790	IP Assignment Mode: O No IP Addres IP Address: 192.168.20.24	ess 💿 4	Static 🔿 D	HCP 5.255.0		A	ctive
			 Create a range of VLANs VLAN Range 	-	OK	Cancel			

- 4. For ports Gi1/1 and Gi1/2, configure these settings:
 - Choose Trunk as the Administrative mode because the ports carry traffic for VLANs 501 and 502.
 - Choose 301 as the native VLAN.

A	Allen	-Bradley	Stratix Device I	5400 Sol Manager -	l ution Switch	🔬 Dashboard	- Configure =	Monitor • Admin •	
0	Network	Port Settings							
Dh.									
Phy	SICAL POIL TA	able							
1	Edit				Edit Physical Por	t		×	
	Port Name	Description	Port Status	Speed	Dest Name	C11/1 -			Administrative Mode
\odot	Gi1/1		0	Auto	Port Name	GII/I *		_	Dynamic auto
0	Gi1/2		0	Auto	Description			(Range: 1-200 Characters)	Dynamic auto
0	Gi1/3		0	Auto	Administrative	🗹 Enable			Dynamic auto
0	Gi1/4		0	Auto	Speed	Auto 💌			Dynamic auto
0	Gi1/5		0	Auto					Dynamic auto
0	Gi1/6		0	Auto	Duplex	Auto			Dynamic auto
0	Gi1/7		0	Auto	Auto MDIX	🗹 Enable			Dynamic auto
0	Gi1/8		0	Auto	Media Type	Auto 💌			Dynamic auto
0	Gi1/9		0	Auto					Dynamic auto
0	Gi1/10		0	Auto	Administrative Mode	Trunk	-		Dynamic auto
0	Gi1/11		0	Auto					Dynamic auto
0	Gi1/12		0	Auto	Access VLAN	VLAN501-501	•		Dynamic auto
0	Gi1/13		0	Auto	Allowed VLAN	All VLANs			Dynamic auto
0	Gi1/14		0	Auto		O VLAN IDs	(e.g.	, 2,4)	Dynamic auto
0	Gi1/15		0	Auto	Native VLAN	VLAN301-301	•		Dynamic auto
0	Gi1/16		۲	Auto-100				OK Cancel	Dynamic auto
								Cancer	

5. Verify that the Automation Device Smartport role automatically enabled PortFast on the ports that are connected to end devices.

AB Allon	Bradley	Stratix 5400 Solution	on		
- Alleli	Diauty	Device Manager - Switch		🏦 Dashboard	Configure 🔻
🔇 Spanning Tr	ee STP Setting	js			
Global	Dort East				
Global	FUTTASC				
BPDU Filtering	Enable				
BPDU Guard	I Enable				
Submit					
Sabilit					
Per-Interface	Port Fast Table				
Port Name	Port Type	Enable Port Fast			
Gi1/1	Trunk				
Gi1/2	Trunk				
Gi1/3	Dynamic auto				
Gi1/4	Dynamic auto				
Gi1/5	Access	\checkmark			
Gi1/6	Access	\checkmark			
Gi1/7	Dynamic auto				
Gi1/8	Dynamic auto				
Gi1/9	Dynamic auto				
Gi1/10	Dynamic auto				
Gi1/11	Dynamic auto				
Gi1/12	Dynamic auto				
Gi1/13	Dynamic auto				

6. Set the system and jumbo MTU value to 1506, and when prompted, restart the switch.

Allen-Bradley	Stratix 5400 Solution Device Manager - Switch	🏠 Dashboard	Configure 🔻	Monitor 🔻	Admin 🔻
Oevice Management MTU					
System MTU : 1506 (Sets th Jumbo MTU : 1506 (Overrie	e MTU value for all interfaces. Range: 1500-199 des System MTU on GigabitEthernet and TenGiga	8 bytes.) abitEthernet Interfaces	. Range 1500-919	98 bytes.)	
Submit					

7. Choose End to End Transparent mode for PTP over one VLAN.

To support PTP over multiple VLANs, you can configure a LAN switch in Boundary clock mode. In Boundary clock mode, the PTP priority must be lower (higher numerical value) than any other DAN or RedBox.

Allen-Brad	llov St	ratix 5400 Solution		
Alicii-Diau	De	vice Manager - Switch	🏦 Dashboard	Configure 🔻
🔇 Network PTP				
Mode Submit	End to End Tr	ansparent 💌		
PTP Device Type: E	End to End tran	sparent clock		

8. Disable IGMP querier.



9. On all ports that are in the possible path to the IGMP querier, specify the multicast router VLAN ID and the interface to the multicast router with the following CLI command:

switch(config)#ip igmp snooping vlan <vlan id> mrouter interface <port name>

Configure the Stratix 5400 Switch in LAN B

The Stratix 5400 switch in LAN B in the example on <u>page 25</u> uses the port configurations that are shown in the following table. Also, the system and jumbo MTU values on the switch must be set to 1506. PTP must be enabled and set to End to End Transparent mode.

To configure this example, use the same procedure as described in <u>Configure the Stratix 5400 Switch in LAN A on page 30</u> with these port configurations.

Table 3 -

Port	Connected Device	VLAN	IP Address with Subnet Mask	Native VLAN ⁽¹⁾	Administrative Mode	Smartport Role	PortFast
Gi1/1	Stratix 5400 RedBox	501 502	192.168.10.11/24 192.168.20.21/24	301	Trunk	_	-
G1/2	Stratix 5700 switch, LAN B	501 502	192.168.10.13/24 192.168.20.23/24	301	Trunk	_	-
Gi1/5	1756-EN2TP as DAN	501	192.168.10.102/24	-	Access	Automation Device	Enabled

(1) All trunk ports require the same native VLAN.

Configure the Stratix 5700 Switch in LAN A

The Stratix 5700 switch in LAN A in the example on page 25 uses the port configurations that are shown in the following table. Also, the system and jumbo MTU values on the switch must be set to 1506. PTP must be enabled and set to End to End Transparent mode.

Table 4 -

Port	Connected Device	VLAN	IP Address with Subnet Mask	Native VLAN ⁽¹⁾	Administrative Mode	Smartport Role	PortFast
Gi1/2	Stratix 5400 switch, LAN A	501 502	192.168.10.14/24 192.168.20.24/24	301	Trunk	_	-
Fa1/4	1756-EN2TP as DAN	502	192.168.20.202/24	-	Access	Automation Device	Enabled

(1) All trunk ports require the same native VLAN.

To configure this example, follow these steps.

1. Run Short Press mode Express Setup and assign an IP address of 192.168.10.15.

Allen-Bradley	Stratix 5700 Solution Device Manager - Switch Express Setup
Select device initial setup mode:	Express Setup *
▼ Network Settings	
Host Name:	LAN_A_SW_2
Management Interface (VLAN):	501
IP Assignment Mode:	● Static ○ DHCP
IP Address:	192.168.10.15 / 255.255.255.0
Default Gateway:	
NTP Server:	
User:	admin Password: ••••••• Confirm Password: •••••••
Advanced Settings Submit	

 Assign the Automation Device Smartport role to the switch port connected to the 1756-EN2TP module (Fa1/4). The Smartport role enables PortFast on the ports. PortFast must be enabled on all ports that are connected to end devices.

Allen-Bra	dley	Stratix 5700 Solution				
		Device Hanager - Owicen	🏦 Dashboard	Configure 🔻		
🔇 Network Smart	ports					
Smartport Role	Custom S	Smartports				
Smartport Role						
/ Edit						
Port Name		Role				
□ Fa1/1		None				
Fa1/2		None				
Fa1/3		None				
Fa1/4		Automation Device				
Fa1/5		None				
Fa1/6		None				
□ Fa1/7		None				
Fa1/8		None				
Fa1/9		None				
Fa1/10		None				
🗌 Fa1/11		None				
Fa1/12		None				

3. Add VLANs 502 and 301.

VLAN 502 has a unique IP address of 192.168.21.25.

4	Allen-Bi	-Bradley Stratix 5700 Solution Device Manager - Switch		🏦 Dashboard	Configure 🔻	Monitor	▼ Admin ▼
6	Network VLA	AN Manageme	nt				
	add or edit ports i ? Mode :Server Add 🧳 Edit 🗙 🛙	n a VLAN, use t Delete	he Physical Port Settings page.				
00000	VLAN ID 1 2 301 501 790	Name default VLAN0002 VLAN301 VLAN501 VLAN0790	 Create a single VLAN VLAN ID 502 Name VLAN IP Assignment Mode: O No IP Address: 192. Create a range of VLANs VLAN Range 	↓502 ⊃ IP Address ● Static 168.20.25 / 2 -	O DHCP 255.255.255.0 OK Cance	× 1	VLAN Status Active Active Active Active Active

4. Assign VLAN 502 to port Fa1/4 connected to the 1756-EN2TP module.

AB	All	en-Brad	lley	Strati Device	x 5700 S Manager	olution - Switch		🏦 Dashboard	Configure 7	Monitor -	Admin 🔻	
() N	Network Port Settings											
	Phy	/sical Port Ta	able									
	/ 1	Edit										
		Port Name	Descriptio	on Po	ort Status	Speed	Duplex	Media Type	e C	perational Mode	Access VLAN	Administrative Mode
	0	Fa1/1			•	Auto-100Mb/s	Auto-Full	10/100Base	eTX T	runk		Trunk
	\bigcirc	Fa1/2			0	Auto	Auto	10/100Base	eTX D	lown	501	Dynamic auto
	0	Fa1/3			0	Auto	Auto	10/100Base	eTX D	lown	501	Dynamic auto
	Ο	Fa1/4			0	Auto	Auto	10/100Base	eTX D	lown	502	Dynamic auto
	0	Fa1/5			0	Auto	Auto	10/100Base	eTX D	lown	501	Dynamic auto
	\odot	Fa1/6			0	Auto	Auto	10/100Base	eTX D	lown	501	Dynamic auto
	0	Fa1/7			0	Auto	Auto	10/100Base	eTX D	lown	501	Dynamic auto
	Ο	Fa1/8			0	Auto	Auto	10/100Base	eTX D	lown	501	Dynamic auto
	0	Fa1/9			0	Auto	Auto	10/100Base	eTX D	lown	501	Dynamic auto
	Ο	Fa1/10			0	Auto	Auto	10/100Base	eTX D	lown	501	Dynamic auto
	0	Fa1/11			0	Auto	Auto	10/100Base	eTX D	lown	501	Dynamic auto
	\bigcirc	Fa1/12			0	Auto	Auto	10/100Base	eTX D	lown	501	Dynamic auto

- 5. For port Gi1/2, configure these settings:
 - Choose Trunk as the Administrative mode because the port carries traffic for VLANs 501 and 502.
 - Choose 301 as the native VLAN.

V	AN501-501	- <i>ы аш</i> су	Stratix Device M	570 Iana	0 Solution ger - Switch	🏦 Dashboard 🛛 Configure 💌	Monitor × Admin ×
G	Network	Port Settings					
Phy	sical Port Ta	able					
1	Edit				Edit Physical Port		×
	Port Name	Description	Port Status	Sp	Port Name	Gi1/2	5
0	Fa1/1		0	Au		011/2	
0	Fa1/2		0	Au	Description		(Range: 1-200 Characters)
0	Fa1/3		0	Au	Administrative	✓ Enable	
0	Fa1/4		0	Au	Speed	Auto 👻	
0	Fa1/5		0	Au	Dunlay	Auto	
0	Fa1/6		0	Au	Duplex	Auto	
0	Fa1/7		0	Au	Auto MDIX	✓ Enable	
0	Fa1/8		0	Au	Media Type	Auto 👻	1
0	Fa1/9		0	Au			
0	Fa1/10		0	Au	VLAN-0	Enable	1
0	Fa1/11		0	Au	Administrativo Modo	Trunk	1
0	Fa1/12		0	Au	Authinistrative mode	TIUIK	1
0	Fa1/13		0	Au	Access VLAN	VLAN501-501 💌	1
0	Fa1/14		0	Au	Allowed VLAN	All VLANs	1
0	Fa1/15		0	Au		○ VLAN IDs	
0	Fa1/16			Au		(
0	Fa1/17		0	10		(e.g., 2,4)	
0	Fa1/18		0	10	Native VLAN	VLAN301-301 💌	
0	Gi1/1		0	Au			OK Cancel
۲	Gi1/2		0	Au			

6. Verify that the Automation Device Smartport role automatically enabled PortFast on the port that is connected to an end device.

Allen-Bra	dlev	Stratix 5700 Solution				
•		Device Manager - Switch	🏦 Dashboard	Configure 🔻		
🔇 Network Smart	tports					
Smartport Role	Custom 9	Smartports				
Cmartnert Bala						
🥖 Edit						
Port Name		Role				
🗌 Fa1/1		None				
Fa1/2		None				
Fa1/3		None				
Fa1/4		Automation Device				
Fa1/5		None				
Fa1/6		None				
Fa1/7		None				
Fa1/8		None				
Fa1/9		None				
Fa1/10		None				
□ Fa1/11		None				
Fa1/12		None				

7. Set the system MTU value to 1506, and then prompted, restart the switch.

Allen-Bradley	Stratix 5700 Solution				
Allell-Diauley	Device Manager - Switch	🏦 Dashboard	Configure 🔻	Monitor 🔻	Admin 🔻
🔇 Device Management MTU					
System MTU : 1506 (Sets the	MTU value for all interfaces. Range: 1500-199	8 bytes.)			
Submit					

8. Disable IGMP querier.

AB Allen-Bradley	Allen-Bradley Stratix 5700 Solution Device Manager - Switch					
			Dashboard	Configure 🔻	Monitor 🔻	Admin 🔻
Security IGMP Snooping						
IGMP Snooping 🗹 Enable						
IGMP Querier Enable						
Extended Flood Enable	seconds after multicast router detected (Ra	nge 1-	300, Default v	alue is 10 secon	ds)	
Submit						

9. Choose End to End Transparent mode for PTP over one VLAN.

To support PTP over multiple VLANs, you can configure a LAN switch in Boundary clock mode. In Boundary clock mode, the PTP priority must be lower (higher numerical value) than any other DAN or RedBox.

Allen-Bra	dley	Stratix 5700 Solution Device Manager - Switch	🙃 Dashboard	_ Configure 🔻
🔇 Network PTP				
Mode Submit	End to E	ind Transparent 💌		
PTP Device Type:	End to End	l transparent clock		

10. On all ports that are in the possible path to the IGMP querier, specify the multicast router VLAN ID and the interface to the multicast router with the following CLI command:

switch(config)#ip igmp snooping vlan <vlan id> mrouter interface <port name>

Configure the Stratix 5700 Switch in LAN B

The Stratix 5700 switch in LAN B in the example on <u>page 25</u> uses the port configurations that are shown in the following table. Also, the system and jumbo MTU values on the switch must be set to 1506. PTP must be enabled and set to End to End Transparent mode.

To configure this example, use the same procedure as described in <u>Configure the Stratix 5700 Switch in LAN A on page 34</u> with these port configurations.

Table 5 -

Port	Connected Devices	VLAN	IP Address with Subnet Mask	Administrative Mode	Smartport Role	PortFast
Gi1/2	Stratix 5400 switch, LAN B	501 502	192.168.10.12/24 192.168.20.22/24	Trunk	_	_
Fa1/4	1756-EN2TP as DAN	502	192.168.20.202/24	Access	Automation Device	Enabled

Assign IP Addresses to the SAN and VDANs

The SAN and VDAN devices in the example on page 25 use the configurations that are shown in the following table.

Assign IP addresses to the devices. No further configuration is required.

Table 6 -

Device	IP Address with Subnet Mask	Connected Device	VLAN
HMI as SAN	192.168.10.103/24	Stratix 5400 switch, LAN A	501
I/O as VDAN	192.168.10.101/24	Stratix 5400 RedBox	501
Drive as VDAN	192.168.20.201/24	Stratix 5400 RedBox	502

Assign IP Addresses to the 1756-EN2TP Devices (DANs)

The 1756-EN2TP devices in the example on page 25 use the port configurations shown in the following tables.

Assign IP addresses to the devices. No further configuration is required.

Table 7 -

Device	IP Address with Subnet Mask	Port	Connected Device	VLAN
1756_EN2TD	102 169 10 102/2/	LAN A	Stratix 5400 switch, LAN A	501
1/56-EN21P	192.168.10.102/24	LAN B	Stratix 5400 switch, LAN B	501

Static	\bigcirc	Dyr	amic							
		-								
Use DHUP to obtain	network co	onhg	juratio c	n.						
	hetwork i	con	ngurati	on.						
IP Address:	192	·	168	÷	10	·	102			
Network Mask:	255		255		255		0			
Gateway Address:	192		168		10		1			
Primary Name Server:	0		0		0		0			
Secondary Name Server:	0		0		0		0]		
Domain Name:										
Host Name:]		
Status: Network Inte	rface Conf	igur	ed							

Device	IP Address with Subnet Mask	Port	Connected Device	VLAN
1756-EN2TP	102 168 20 202/2/	LAN A	Stratix 5700 switch, LAN A	502
	192.168.20.202/24	LAN B	Stratix 5700 switch, LAN B	502

		Uyr	amic					
Use DHLP to obtain r Use BOOTP to obtain	etwork co network i	onng con	guratio figurat	n. ion				
IP Address:	192		168		20	202		
Network Mask:	255		255		255	0		
Gateway Address:	192		168		20	1		
Primary Name Server	0		0		0	0		
Secondary Name Server:	0		0		0	0		
Domain Name:								
Host Name:								
Status: Network Interl	ace Conf	igur	ed					

Verify Nodes

Once your PRP network configuration is complete and cables are connected between the devices, the RedBox automatically learns the MAC IDs of connected devices. You can verify and monitor these connected devices in the Device Manager web interface for the RedBox.

B Allen-Br	adley	Stratix ! Device M	5400 Solu Ianager - S	i tion Gwitch					1. d - d -
					Das	hboard	Configure 🔻	Monitor	Admin 🔻
Status PRP									
Vdan Table	Node Table								
PRP Vdan Table									
Channel Groups	1								
channel Group.	1								
MAC Count:	6								
Static:	0								
Channel Group	MAC Addres	S	TTL		Dynamic				
1	001D.9CC6.	1495	14		Ŷ				
1	E454 2227 4	5401	13		f V				
1	1401 823R 8	858C	35		Y				
1	001D.9CC4.	F269	2		Y				
1	F454 3337 5	5400	21		v				-
B Allen-Br	adlev	Stratix 5	5400 Solut	tion					
Allen-Br	adley	Stratix 5 Device Ma	400 Solu anager - S	t ion witch	Dashl	poard C	onfigure 🔻	Monitor v .	Admin 👻
Allen-Br Status PRP	adley	Stratix 5 Device Ma	400 Solu anager - S	tion witch	n Dashi	poard C	onfigure 🔻	Monitor v ,	Admin 💌
Allen-Br Status pRP	adley	Stratix 5 Device Ma	400 Solu anager - S	tion witch	â≳ Dashl	poard C	onfigure 🔻	Monitor V	Admin 🗸
Allen-Br Status PRP	adley	Stratix 5 Device M	5400 Solut anager - S	t ion witch	n 📩 Dashl	ooard C	onfigure 🔻	Monitor 👻 .	Admin 🔻
Allen-Br Status PRP	radley	Stratix 5 Device M	400 Solut anager - S	tion witch	, ∱ Dashi	poard C	onfigure v	Monitor ᢦ	Admin 👻
Allen-Br Status PRP Vdan Table	radley Node Table	Stratix 5 Device Ma	5400 Solut anager - S	tion witch	Dashl	poard C	onfigure v	Monitor 👻 .	Admin 🔹
Allen-Br Status PRP Vdan Table PRP Node Table	radley Node Table	Stratix 5 Device M	400 Solu anager - S	tion witch	n Dashl	cooard C	onfigure 🔹	Monitor V	Admin 👻
Allen-Br Status PRP Vdan Table PRP Node Table	Node Table	Stratix 5 Device M	400 Solu anager - S	tion witch	, ∱ Dashi	Doard C	onfigure v	Monitor 👻 🦷	Admin V
Allen-Br Status PRP Vdan Table 'RP Node Table Channel Group:	radley Node Table	Stratix 5 Device M	400 Solut anager - S	tion witch	n Dashl	poard C	onfigure v	Monitor 👻 .	Admin 👻
Allen-Br Status PRP Vdan Table PRP Node Table Channel Group: MAC Count:	radley Node Table	Stratix 5 Device M	400 Solut anager - S	tion witch	n Dashl	cooard C	onfigure 🔹	Monitor V	Admin 👻
Allen-Br Status PRP Vdan Table RP Node Table Channel Group: MAC Count: DAN Count:	Node Table	Stratix 5 Device M	400 Solu anager - S	tion witch	â Dashi	Doard C	onfigure v	Monitor v	Admin 👻
Allen-Br Status PRP Vdan Table RP Node Table Channel Group: MAC Count: DAN Count: SAN-A Count:	Node Table	Stratix 5 Device M	400 Solut anager - S	tion witch	Dashl	board C	onfigure v	Monitor 👻 🗌	Admin \vee
Allen-Br Status PRP Vdan Table Vdan Table Channel Group: MAC Count: DAN Count: SAN-A Count: Count: SAN-A Count:	Node Table	Stratix 5 Device M	400 Solut anager - S	tion witch	Dashi	cooard C	onfigure 👻	Monitor V	Admin 🔻
Status PRP Vdan Table Vdan Table Channel Group: MAC Count: DAN Count: SAN-A Count: SAN-B Count:	Node Table	Stratix 5 Device M	400 Solut anager - S	tion witch	n Dashl	Doard C	onfigure v	Monitor V	Admin 👻
Allen-Br Status PRP Vdan Table Vdan Table Channel Group: MAC Count: DAN Count: SAN-A Count: SAN-B Count: Channel Group	Node Table	Stratix 5 Device M	400 Solut anager - S	tion witch	A Dashi	poord C	onfigure v	Monitor V	Admin V
Allen-Br Status PRP Vdan Table Vdan Table Channel Group: MAC Count: DAN Count: SAN-A Count: SAN-A Count: SAN-B Count: Channel Group 1	Node Table	Stratix 5 Device M	tTTL 59	tion witch	Packets Recd A 74	Packet	onfigure v	Monitor V	Admin ×
Allen-Br Status PRP Vdan Table Vdan Table Channel Group: MAC Count: DAN Count: SAN-A Count: SAN-B Count: Channel Group 1 1	Node Table Node Table 1 4 2 1 MAC Address 001D.9CD9.4 001D.9CD9.4	Stratix 5 Device M	the second secon	tion witch	Packets Recd A 74 60	Doard C	onfigure V	Monitor V	Admin ×
Allen-Br Status PRP Vdan Table Vdan Table Channel Group: MAC Count: DAN Count: SAN-A Count: SAN-B Count: Channel Group 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Node Table 1 4 2 1 4 2 1 34C0.F95A.D	Stratix 5 Device M	400 Solut anager - S TTL 59 60 58	tion witch	Packets Recd A 74 60 105	Dooard C	onfigure v	Monitor V	Admin × Admin a view of the second se

Diagnostics

These diagnostic methods are available for a PRP network:

- For a Stratix[®] 5400 or 5410 switch that is configured as a RedBox, the Device Manager web interface provides statistics for PRP nodes. For more information, see the Stratix Managed Switches User Manual, publication <u>1783-UM007</u>.
- For a Stratix 5800 switch that is configured as a RedBox, the WebUI provides statistics for PRP nodes. For more information, see the Stratix 5800 Managed Switches User Manual, <u>1783-UM012</u>.
- For a 1756-EN2TP module operating as a DAN, the diagnostic webpages provide statistics for ports A and B. For more information, see the EtherNet/IP Network Configuration User Manual, publication <u>ENET-UM001</u>.
- For LAN A and LAN B status, you can configure the controller to send a message to the 1756-EN2TP module as described in page 41.

For more diagnostic attributes, see the ODVA documentation at <u>www.odva.org</u>.

Warning Status for LAN A and LAN B

In the Studio 5000 Logix Designer[®] application, you can configure a controller message to determine a warning status for these conditions in LAN A and LAN B:

- Loss of communication for 3 seconds on one LAN, but not the other. This condition applies to traffic from all nodes. The condition is cleared once communication is restored for 3 seconds.
- Node status is active on one LAN but not the other. This condition indicates that no packets were received from one of the nodes on one of the LANs for 3 seconds. The condition is cleared once packets are received again within 3 seconds.
- Packets from a wrong LAN were received on one of the ports in the past second. The condition is cleared once no wrong packets are
 received for 1 second.

IMPORTANT Cycling power to a device can trigger a PRP warning on the network or the device until the connections to all Ethernet ports are re-established and packets are exchanged for 3 seconds.

When the warning status is active for one of the LANs, the Warning Active indicator displays True in the 1756-EN2TP web interface.

1756-EN2TP/A			
Expand Minimize	Diagnostic Overview Network	Settings Applicatio	on Connections 🗸 Bridge Connections
Home			
Diagnostics	Counters	Port A	Port B
Diagnostic Overview	Transmit Count	639	603
Network Settings	Receive Count	1270	0
Application Connections	Wrong Port Count	0	0
Bridge Connections	Unique Entries Count	1270	0
Ethernet Statistics	Duplicate Entries Count	0	0
PRP Statistics BRP Nodes	Multiple Entries Count	0	0
Advanced Diagnostics	Warning Count	0	1
Browse Chassis	Warning Active	False	True
			Seconds Between Refresh: 15
	Copyright © 2017 Rockwell Automa	tion, Inc. All Rights Re	eserved.

To obtain a warning status for LAN A and LAN B, configure a controller message to send to the 1756-EN2TP module. Use the following parameters. The data type for this CIP™ message is DINT.

Field	Parameter	
Message Type	CIP Generic	
Service Type	Get Attribute Single	
Class	56 (Hex)	
Instance	1	
Attribute	11 (Hex) for LAN A 12 (Hex) for LAN B	

Figure 5 - LAN A Warning Message

essage Cor Configuratio	nfigurat n Com	ion - LANAWar	ningMSG		
Message	Type:	CIP Generi	c	-	
Service Type:	Get Att	ribute Single	•	Source Element:	· · · · · · · · · · · · · · · · · · ·
Service		(Hey) Class:	EC (Hev)	Source Length:	0 🖨 (Bytes)
Code:	e	(nex) Class:	50 (nex)	Destination Element:	LANAWarningStatus 👻
instance.	1	Attribute.	II (iex)		New Tag
O Enable	() Er	nable Waiting	O Start	Oone	Done Length: 1
) Error Coo Error Path: F Error Text:	de: PRP	Extende	d Error Code:	[🗌 Timed Out 🔸
			OK	Cancel	Apply

Figure 6 - LAN B Warning Message

Message Configuration - LANBWarningMSG Configuration Communication Tag Message Type: CIP Generic	
Service Type: Get Attribute Single Service Code: e (Hex) Class: 56 (Hex) Instance: 1 Attribute: 12 (Hex)	Source Element: Source Length: O (Bytes) Destination Element: New Tag
C Enable C Enable Waiting C Start C Error Code: Extended Error Code: Error Path: PRP Error Text: OK	Cancel Apply Help

Additional Resources

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

Resource	Description
Stratix Ethernet Device Specifications Technical Data, 1783-TD001	Provides specifications for Stratix [®] Ethernet switches and other devices.
High Availability Systems Reference Manual, <u>HIGHAV-RM002</u>	Provides guidelines for high availability systems, including redundant system components, networks, and other hardware and software considerations.
Deploying Parallel Redundancy Protocol within a Converged Plantwide Ethernet Architecture, <u>ENET-TD021</u>	Highlights key application requirements, technology, and supporting design considerations to help with the successful design and deployment of specific use cases within the Converged Plantwide Ethernet (CPwE) framework. CPwE PRP was architected, tested, and validated by Cisco® Systems and Rockwell Automation with assistance by Panduit.
EtherNet/IP Device Level Ring Application Technique, publication ENET-AT007	Describes Device Level Ring (DLR) topologies, configuration considerations, and diagnostic methods.
PlantPAx DCS Configuration and Implementation User Manual, publication PROCES-UM100	Provides guidelines and procedures for the implementation and configuration of a PlantPAx® distributed control system, including PRP topologies.
Stratix Managed Switches User Manual, <u>1783-UM007</u>	Describes how to configure, monitor, and troubleshoot Stratix® 5400, 5410, 5700, 8000, 8300, and ArmorStratix™ 5700 managed switches.
Stratix 5800 Managed Switches User Manual, <u>1783–UM012</u>	Describes how to configure, monitor, and troubleshoot Stratix 5800 managed switches.
FLEX 5000 EtherNet/IP Adapter User Manual, publication 5094-UM005	Provides information on how to configure and operate FLEX 5000 EtherNet/IP adapters.
ControlLogix EtherNet/IP Network Devices User Manual, <u>ENET-UM004</u>	Describes how to configure and use EtherNet/IP devices to communicate on the EtherNet/IP network.
EtherNet/IP Network Devices User Manual, <u>ENET-UM006</u>	Describes how to configure and use EtherNet/IP devices to communicate on the EtherNet/IP network.
Ethernet Reference Manual, publication ENET-RM002	Describes basic Ethernet concepts, infrastructure components, and infrastructure features.
Troubleshoot EtherNet/IP Networks Application Technique, publication ENET-AT003	Describes troubleshooting techniques for Integrated Architecture products on EtherNet/IP networks.
System Security Design Guidelines Reference Manual, <u>SECURE-RM001</u>	Provides guidance on how to conduct security assessments, implement Rockwell Automation products in a secure system, harden the control system, manage user access, and dispose of equipment.
EtherNet/IP Media Planning and Installation Manual This manual is available from the Open DeviceNet® Vendor Association (ODVA) at <u>http://www.odva.org.</u>	Describes the required media components for an EtherNet/IP network and how to plan, install, verify, troubleshoot, and certify your network.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general installation guidelines for a Rockwell Automation industrial system.
Product Certifications website, rok.auto/certifications.	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at rok.auto/literature.

Rockwell Automation Support

Use these resources to access support information.

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

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

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