EtherNet/IP Parallel Redundancy Protocol
Important User Information

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

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

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

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

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

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

| WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss. |
| ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence. |
| IMPORTANT Identifies information that is critical for successful application and understanding of the product. |

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

| SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present. |
| BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures. |
| ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE). |
# Table of Contents

## Preface
- Summary of Changes ................................................. 5
- Additional Resources ............................................... 5

## Chapter 1
- Parallel Redundancy Protocol
  - PRP Network Operation .................................................. 8
  - Comparison of PRP and DLR .............................................. 8
  - PRP Network Topologies .................................................. 8
    - Basic PRP Network Topology ........................................... 9
    - PRP Network Topology with LANs as Clouds ......................... 10
    - PRP Network Topology with SAN and VDANs ......................... 11
    - PRP Network Topology with Device Level Ring for VDANs .......... 12
    - PRP Network Topology with Multiple VLANs ......................... 13
    - PRP Network Topology with VLAN Trunking ........................ 14
    - PRP Network Topology with a ControlLogix Redundancy System ... 15
  - Network Redundancy Between PRP Network and Layer 3 Network .... 16
  - LAN A and LAN B Topologies ........................................... 18
    - Requirements ......................................................... 18
    - Recommendations .................................................... 18
  - LAN A and LAN B Infrastructure Switches ............................ 19

## Chapter 2
- Configure a PRP Network
  - Device IP Addresses .................................................... 22
  - Frame Sizes for LAN A and LAN B Devices .......................... 22
  - Spanning Tree Protocol (STP) ........................................... 23
  - Multicast Traffic and IGMP Querier .................................. 23
  - CIP Sync Time Synchronization (Precision Time Protocol) ........... 24
  - Configuration Example .................................................. 26
    - Configure the Stratix 5400 RedBox ................................ 27
    - Configure the Stratix 5400 Switch in LAN A ........................ 32
    - Configure the Stratix 5400 Switch in LAN B ......................... 37
    - Configure the Stratix 5700 Switch in LAN A ........................ 37
    - Configure the Stratix 5700 Switch in LAN B ........................ 42
    - Assign IP Addresses to the SAN and VDANs ......................... 42
    - Assign IP Addresses to the 1756-EN2TP Devices (DANs) ........... 43
    - Verify Nodes ................................................................... 44

## Chapter 3
- Diagnostics
  - Diagnostic Methods ..................................................... 45
  - Warning Status for LAN A and LAN B ................................. 46
Preface

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 web interface for Stratix® switches

Summary of Changes

This manual contains new and updated information.

Additional Resources

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

<table>
<thead>
<tr>
<th>Resource</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EtherNet/IP Modules Installation Instructions, publication ENET-IN002</td>
<td>Describes how to complete these tasks with EtherNet/IP communication modules in a Logix 5000™ control system: • Install the module • Configure initial application setup • Troubleshoot application anomalies related to EtherNet/IP communication modules</td>
</tr>
<tr>
<td>EtherNet/IP Network Configuration User Manual, publication ENET-UM001</td>
<td>Describes how to configure and use EtherNet/IP communication modules with a Logix5000 controller and communicate with various devices on the Ethernet network.</td>
</tr>
<tr>
<td>Troubleshoot EtherNet/IP Networks Application Technique, publication ENET-AT003</td>
<td>Describes how to assign IP addresses to and how to troubleshoot EtherNet/IP networks and devices.</td>
</tr>
<tr>
<td>Stratix Managed Switches User Manual, publication 1783-UM007</td>
<td>Describes how to configure, monitor, and troubleshoot Stratix managed switches.</td>
</tr>
<tr>
<td>EtherNet/IP Embedded Switch Technology Application Guide, publication ENET-AP005</td>
<td>Describes how to install, configure, and maintain linear and Device Level Ring (DLR) topologies by using EtherNet/IP devices with embedded switch technology.</td>
</tr>
<tr>
<td>Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1</td>
<td>Provides general guidelines for installing a Rockwell Automation industrial system.</td>
</tr>
<tr>
<td>Product Certifications website: rok.auto/certifications</td>
<td>Provides declarations of conformity, certificates, and other certification details.</td>
</tr>
</tbody>
</table>

You can view or download publications at http://www.rockwellautomation.com/global/literature-library/overview.page.
To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.
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, known as LAN A and LAN B.

A PRP network includes the following components.

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAN A and LAN B</td>
<td>Redundant, active Ethernet networks that operate in parallel.</td>
</tr>
<tr>
<td>Double attached node (DAN)</td>
<td>An end device with PRP technology that connects to both LAN A and LAN B.</td>
</tr>
<tr>
<td>Single attached node (SAN)</td>
<td>An end device without PRP technology that connects to either LAN A or LAN B. A SAN does not have PRP redundancy.</td>
</tr>
<tr>
<td>Redundancy box (RedBox)</td>
<td>A switch with PRP technology that connects devices without PRP technology to both LAN A and LAN B.</td>
</tr>
<tr>
<td>Virtual double attached node (VDAN)</td>
<td>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.</td>
</tr>
<tr>
<td>Infrastructure switches</td>
<td>Switches connected to either LAN A or LAN B that are not configured as a RedBox.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>DLR</th>
<th>PRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standards organization</td>
<td>Open DeviceNet® Vendors’ Association (ODVA)</td>
<td>International Electrotechnical Commission (IEC)</td>
</tr>
<tr>
<td>Fault tolerance</td>
<td>Single-fault tolerance</td>
<td>Multiple-fault tolerance, depending on topology or single-fault tolerance in the worst case</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Duplication of infrastructure not required</td>
<td>Duplication of infrastructure required</td>
</tr>
<tr>
<td>Switches</td>
<td>No minimum requirement</td>
<td>Twice as many switches as a single network</td>
</tr>
<tr>
<td>Topology</td>
<td>Ring topology</td>
<td>Any topology</td>
</tr>
<tr>
<td>Switchover time</td>
<td>Fast recovery time</td>
<td>Zero recovery time</td>
</tr>
</tbody>
</table>

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
- 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 at a later time.
PRP Network Topology with LANs as Clouds

Each LAN can be more complex than a single 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 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, shown below with dotted lines.
**PRP Network Topology with Device Level Ring for VDANs**

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.

Note that the 1756-EN2TP module does not have DLR protocol and cannot operate as part of a ring.
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.
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 carrying traffic for both VLANs 1 and 2, and access ports carrying 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 redundancy systems, see the ControlLogix Redundancy System User Manual, publication 1756-UM535.
Network Redundancy Between PRP Network and Layer 3 Network

In this example, the Layer 2 PRP network achieves redundancy with the outside Layer 3 network through the following configurations:

- The Layer 2 PRP network is connected to the Layer 3 network via two Stratix 5400 switches. The switches are configured as RedBoxes.

- Hot Standby Router Protocol (HSRP) is configured on each RedBox, which provides a shared IP address. With HSRP, both RedBoxes act as a virtual router that allows a seamless changeover if a network fault occurs.

- All devices in the PRP network are configured to use the HSRP shared address as their default gateway address.

- Routing is enabled on each RedBox, either with static routes defined or an active routing protocol enabled.

- The PRP channel group on each RedBox is set to Routed mode and IP addresses from the PRP VLAN are assigned to the routed interfaces.

- All links to the Layer 3 network and between the two RedBoxes are configured as STP point-to-point routed interfaces.

- The VLAN for the PRP network is a routed connection only and cannot exist within the RedBoxes.
Layer 3 Network

HSRP Shared IP Address: 192.168.1.1

Stratix 5400 RedBox 1
Routed PRP IP Address: 192.168.1.2
Routed Point-to-Point IP Address: 10.10.10.0

Stratix 5400 RedBox 2
Routed PRP IP Address: 192.168.1.3

Layer 3
LAN A
LAN B
LAN A and LAN B Topologies

LAN A and LAN B can have different topologies 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:

- LAN A and LAN B must be on the same subnet. 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 the same switch.

Recommendations

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

- Keep both LANs similar in topology, 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 using 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.

As a best practice, use managed switches as infrastructure switches for their network diagnostic and configuration capabilities. For example, you must be able to configure the maximum transmission size (MTU) on infrastructure switches.
Chapter 2

Configure a PRP Network

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device IP Addresses</td>
<td>22</td>
</tr>
<tr>
<td>Frame Sizes for LAN A and LAN B Devices</td>
<td>22</td>
</tr>
<tr>
<td>Spanning Tree Protocol (STP)</td>
<td>23</td>
</tr>
<tr>
<td>Multicast Traffic and IGMP Querier</td>
<td>23</td>
</tr>
<tr>
<td>CIP Sync Time Synchronization (Precision Time Protocol)</td>
<td>24</td>
</tr>
<tr>
<td>Configuration Example</td>
<td>26</td>
</tr>
</tbody>
</table>
A PRP network has specific requirements and considerations for the following:

- Device IP addresses
- Frame sizes
- Spanning Tree Protocol (STP)
- Multicast traffic and IGMP querier
- CIP Sync™ time synchronization (Precision Time Protocol)

**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.
Spanning Tree Protocol (STP)

You must enable the following STP features:

- Enable BPDU Filtering on the RedBox.
  
  When you configure PRP ports on the RedBox via Device Manager, BPDU Filtering is automatically enabled.

- Enable PortFast on downlink ports for all infrastructure switches in LAN A and LAN B and the RedBox. PortFast is not recommended on ports that are connected to other switches.

  Certain Smartport roles on Stratix managed switches automatically enable PortFast. If the port is configured for one of these Smartport roles, you do not need to enable PortFast manually:
  - 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.
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.
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**—Infrastructure switches in LAN A and LAN B that support CIP Sync must be configured as transparent clocks rather than boundary clocks. A break in the network to a switch configured as a boundary clock can cause the switch to become the Grandmaster for a segment of the network. This results in two Grandmaster clocks for the system, which can cause time to drift apart.

- **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.

- **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.
Chapter 2  Configure a PRP Network

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 PROCES-UM001.
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 the devices.

**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 26 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>
<thead>
<tr>
<th>Port</th>
<th>Connected Device</th>
<th>VLAN</th>
<th>IP Address with Subnet Mask</th>
<th>Native VLAN(1)</th>
<th>Administrative Mode</th>
<th>Smartport Role</th>
<th>PortFast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gi1/1</td>
<td>Stratix 5400 switch, LAN A</td>
<td>501</td>
<td>192.168.10.14/24</td>
<td>301</td>
<td>Trunk</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>502</td>
<td>192.168.20.24/24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gi1/2</td>
<td>Stratix 5400 switch, LAN B</td>
<td>501</td>
<td>192.168.10.12/24</td>
<td>301</td>
<td>Trunk</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>502</td>
<td>192.168.20.22/24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fa1/5</td>
<td>I/O, VDAN</td>
<td>501</td>
<td>192.168.10.101/24</td>
<td>—</td>
<td>Access</td>
<td>Automation Device</td>
<td>Enabled</td>
</tr>
<tr>
<td>Fa1/6</td>
<td>Drive, VDAN</td>
<td>502</td>
<td>192.168.20.201/24</td>
<td>—</td>
<td>Access</td>
<td>Automation Device</td>
<td>Enabled</td>
</tr>
</tbody>
</table>

(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.
2. 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.

3. Add VLANs 301 and 502.

VLAN 502 has a unique IP address of 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).

5. Choose Boundary mode for PTP.
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.

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

Configure the Stratix 5400 Switch in LAN A

The Stratix 5400 switch in LAN A in the example on page 26 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>
<thead>
<tr>
<th>Port</th>
<th>Connected Device</th>
<th>VLAN</th>
<th>IP Address with Subnet Mask</th>
<th>Native VLAN (1)</th>
<th>Administrative Mode</th>
<th>Smartport Role</th>
<th>PortFast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gi1/1</td>
<td>Stratix 5400 RedBox</td>
<td>501</td>
<td>192.168.10.11/24 192.168.20.21/24</td>
<td>301</td>
<td>Trunk</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>502</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gi1/2</td>
<td>Stratix 5700 switch, LAN A</td>
<td>501</td>
<td>192.168.10.15/24 192.168.20.25/24</td>
<td>301</td>
<td>Trunk</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>502</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gi1/5</td>
<td>1756-EN2TP as DAN</td>
<td>501</td>
<td>192.168.10.102/24</td>
<td>—</td>
<td>Access</td>
<td>Automation Device</td>
<td>Enabled</td>
</tr>
<tr>
<td>Gi1/6</td>
<td>HMI as SAN</td>
<td>501</td>
<td>192.168.10.103/24</td>
<td>—</td>
<td>Access</td>
<td>Automation Device</td>
<td>Enabled</td>
</tr>
</tbody>
</table>

(1) All trunk ports require the same native VLAN.
To configure this example, follow these steps.


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.
3. Add VLANs 301 and 502.

VLAN 502 has a unique IP address of 192.168.20.24.

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.
5. Verify that the Automation Device SmartPort role automatically enabled PortFast on the ports that are connected to end devices.
6. Set the system and jumbo MTU value to 1506, and when prompted, restart the switch.

7. Choose End to End Transparent mode for PTP.

8. Disable IGMP querier.
Configure the Stratix 5400 Switch in LAN B

The Stratix 5400 switch in LAN B in the example on page 26 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 Configure the Stratix 5400 Switch in LAN A on page 32 with these port configurations.

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

(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 26 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>
<thead>
<tr>
<th>Port</th>
<th>Connected Device</th>
<th>VLAN</th>
<th>IP Address with Subnet Mask</th>
<th>Native VLAN(1)</th>
<th>Administrative Mode</th>
<th>Smartport Role</th>
<th>PortFast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gi1/2</td>
<td>Stratix 5400 switch, LAN A</td>
<td>501</td>
<td>192.168.10.14/24 192.168.20.24/24</td>
<td>301</td>
<td>Trunk</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>502</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fa1/4</td>
<td>1756-EN2TP as DAN</td>
<td>502</td>
<td>192.168.20.202/24</td>
<td></td>
<td>Access</td>
<td>Automation Device</td>
<td>Enabled</td>
</tr>
</tbody>
</table>

(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.
2. 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.

3. Add VLANs 502 and 301.

VLAN 502 has a unique IP address of 192.168.21.25.
4. Assign VLAN 502 to port Fa1/4 connected to the 1756-EN2TP module.

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

<table>
<thead>
<tr>
<th>Port Name</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fa1/1</td>
<td>None</td>
</tr>
<tr>
<td>Fa1/2</td>
<td>None</td>
</tr>
<tr>
<td>Fa1/3</td>
<td>None</td>
</tr>
<tr>
<td>Fa1/4</td>
<td>Automation Device</td>
</tr>
<tr>
<td>Fa1/5</td>
<td>None</td>
</tr>
<tr>
<td>Fa1/6</td>
<td>None</td>
</tr>
<tr>
<td>Fa1/7</td>
<td>None</td>
</tr>
<tr>
<td>Fa1/8</td>
<td>None</td>
</tr>
<tr>
<td>Fa1/9</td>
<td>None</td>
</tr>
<tr>
<td>Fa1/10</td>
<td>None</td>
</tr>
<tr>
<td>Fa1/11</td>
<td>None</td>
</tr>
<tr>
<td>Fa1/12</td>
<td>None</td>
</tr>
</tbody>
</table>

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

8. Disable IGMP querier.
9. Choose End to End Transparent mode for PTP.

Configure the Stratix 5700 Switch in LAN B

The Stratix 5700 switch in LAN B in the example on page 26 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 Configure the Stratix 5700 Switch in LAN A on page 37 with these port configurations.

<table>
<thead>
<tr>
<th>Port</th>
<th>Connected Devices</th>
<th>VLAN</th>
<th>IP Address with Subnet Mask</th>
<th>Administrative Mode</th>
<th>Smartport Role</th>
<th>PortFast</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1/2</td>
<td>Stratix 5400 switch, LAN B</td>
<td>501 502</td>
<td>192.168.10.12/24 192.168.20.22/24</td>
<td>Trunk</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Fa1/4</td>
<td>1756-EN2TP as DAN</td>
<td>502</td>
<td>192.168.20.202/24</td>
<td>Access</td>
<td>Automation Device</td>
<td>Enabled</td>
</tr>
</tbody>
</table>

Assign IP Addresses to the SAN and VDANs

The SAN and VDAN devices in the example on page 26 use the configurations that are shown in the following table.

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

<table>
<thead>
<tr>
<th>Device</th>
<th>IP Address with Subnet Mask</th>
<th>Connected Device</th>
<th>VLAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMI as SAN</td>
<td>192.168.10.103/24</td>
<td>Stratix 5400 switch, LAN A</td>
<td>501</td>
</tr>
<tr>
<td>I/O as VDAN</td>
<td>192.168.10.101/24</td>
<td>Stratix 5400 RedBox</td>
<td>501</td>
</tr>
<tr>
<td>Drive as VDAN</td>
<td>192.168.20.201/24</td>
<td>Stratix 5400 RedBox</td>
<td>502</td>
</tr>
</tbody>
</table>
Assign IP Addresses to the 1756-EN2TP Devices (DANs)

The 1756-EN2TP devices in the example on page 26 use the port configurations shown in the following tables.

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

<table>
<thead>
<tr>
<th>Device</th>
<th>IP Address with Subnet Mask</th>
<th>Port Connected Device VLAN</th>
<th>VLAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1756-EN2TP</td>
<td>192.168.10.102/24</td>
<td>LAN A Stratix 5400 switch, LAN A 501</td>
<td>501</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LAN B Stratix 5400 switch, LAN B</td>
<td></td>
</tr>
</tbody>
</table>

![Image of configuration interface]

<table>
<thead>
<tr>
<th>Device</th>
<th>IP Address with Subnet Mask</th>
<th>Port Connected Device VLAN</th>
<th>VLAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1756-EN2TP</td>
<td>192.168.20.202/24</td>
<td>LAN A Stratix 5700 switch, LAN A 502</td>
<td>502</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LAN B Stratix 5700 switch, LAN B</td>
<td></td>
</tr>
</tbody>
</table>

![Image of configuration interface]
Chapter 2  Configure a PRP Network

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.
Chapter 3

Diagnostics

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic Methods</td>
<td>45</td>
</tr>
<tr>
<td>Warning Status for LAN A and LAN B</td>
<td>46</td>
</tr>
</tbody>
</table>

Diagnostic Methods

These diagnostic methods are available for a PRP network:

- For a Stratix® 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 1783-UM007.

- For a 1756-EN2TP module operating as a DAN, the diagnostic web pages provide statistics for ports A and B. For more information, see the EtherNet/IP Network Configuration User Manual, publication ENET-UM001.

- 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 46.

For more diagnostic attributes, see the ODVA documentation at www.odva.org.
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** Be aware that 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.
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.

<table>
<thead>
<tr>
<th>Field</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>CIP Generic</td>
</tr>
<tr>
<td>Service Type</td>
<td>Get Attribute Single</td>
</tr>
<tr>
<td>Class</td>
<td>56 (Hex)</td>
</tr>
<tr>
<td>Instance</td>
<td>1</td>
</tr>
<tr>
<td>Attribute</td>
<td>11 (Hex) for LAN A</td>
</tr>
<tr>
<td></td>
<td>12 (Hex) for LAN B</td>
</tr>
</tbody>
</table>

**Figure 1 - LAN A Warning Message**

**Figure 2 - LAN B Warning Message**
Notes:
Rockwell Automation Support

Use the following resources to access support information.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Dial Codes</td>
<td>Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.</td>
<td><a href="http://www.rockwellautomation.com/global/support/direct-dial.page">http://www.rockwellautomation.com/global/support/direct-dial.page</a></td>
</tr>
</tbody>
</table>

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www.rockwellautomation.com