

User Manual

# ECU-P1524PE HSR/PRP Module

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## Product Warranty (2 years)

Advantech warrants to you, the original purchaser, that each of its products will be free from defects in materials and workmanship for two years from the date of purchase.

This warranty does not apply to any products which have been repaired or altered by persons other than repair personnel authorized by Advantech, or which have been subject to misuse, abuse, accident or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

Because of Advantech's high quality-control standards and rigorous testing, most of our customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, you will be billed according to the cost of replacement materials, service time and freight. Please consult your dealer for more details.

If you think you have a defective product, follow these steps:

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any onscreen messages you get when the problem occurs.
2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, obtain an RMA (return merchandise authorization) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a fully-completed Repair and Replacement Order Card and a photocopy proof of purchase date (such as your sales receipt) in a shippable container. A product returned without proof of the purchase date is not eligible for warranty service.
5. Write the RMA number visibly on the outside of the package and ship it prepaid to your dealer.

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## Product Warranty (2 years)

### CE

This product has passed the CE test for environmental specifications. Test conditions for passing included the equipment being operated within an industrial enclosure. In order to protect the product from being damaged by ESD (Electrostatic Discharge) and EMI leakage, we strongly recommend the use of CE-compliant industrial enclosure products.

### FCC Class A

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

## Technical Support and Assistance

1. Visit the Advantech web site at [www.advantech.com/support](http://www.advantech.com/support) where you can find the latest information about the product.
2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before you call:
  - Product name and serial number
  - Description of your peripheral attachments
  - Description of your software (OS, version, application software, etc.)
  - A complete description of the problem
  - The exact wording of any error messages

# Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. **DO NOT COVER THE OPENINGS.**
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:
  - The power cord or plug is damaged.
  - Liquid has penetrated into the equipment.
  - The equipment has been exposed to moisture.
  - The equipment does not work well, or you cannot get it to work according to the user's manual.
  - The equipment has been dropped and damaged.
  - The equipment has obvious signs of breakage.
15. **DO NOT LEAVE THIS EQUIPMENT IN AN ENVIRONMENT WHERE THE STORAGE TEMPERATURE MAY GO BELOW -20° C (-4° F) OR ABOVE 60° C (140° F). THIS COULD DAMAGE THE EQUIPMENT. THE EQUIPMENT SHOULD BE IN A CONTROLLED ENVIRONMENT.**



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# Chapter 1

Introduction

For smart substations, keeping the communication network reliable is important so redundancy becomes critical. Two redundant communication standards, High-availability Seamless Redundancy (HSR) and Parallel Redundancy Protocol (PRP) provide seamless failover from a single point of failure. These two unified standards are necessary for communication networks in real-time substation automation application. HSR and PRP protocols are technologies under IEC 62439-3 Clause 5/Clause 4.

Advantech ECU-P1524PE is a PCIe expansion card with HSR/PRP protocol validation which can be inserted into UNO-4673A/4683, ECU-4784 expansion slots for power & energy automation applications.

Advantech ECU-P1524PE is also equipped with two Intel i210 Gigabit LAN Network controllers, which are compliant with the IEEE802.3u 1000 Base-X SFP Interface. LED indicators on the front panel show its Link and Active status.



**Figure 1.1 ECU-P1524PE**

## **1.1 The HSR/PRP Advantage**

High-availability Seamless Redundancy (HSR) is defined in IEC 62439-3 Clause 5 Standard, which provides zero-loss redundancy, zero-time recovery. Parallel Redundancy Protocol (PRP) is IEC 62439-3 Clause 4 standard, which provides zero downtime, no single point of failure, and no package loss.

IEC-62439-3 PRP/HSR (IEC-61850 edition 2) protocols are for high-availability networks and provide redundancy for critical communication networks in real-time substation automation applications. Any device can be replaced/disconnected without breaking network connectivity with zero-time recovery advantage over Rapid Spanning Tree Protocol (RSTP) and variants. IEC 62439-3PRP/HSR supports IEEE1588 PTP compatible with IEEE 802.3 Ethernet technology.

## 1.2 The SFP Advantage

ECU-P1524PE's four SFP fiber slots provide a lot of flexibility when planning and implementing a network. The slots can accept any SFP-type fiber transceivers and these transceivers are designed for transmitting over distances of either 500m (multi-mode), 10km, 30km, 50km, 70km or 110km (single-mode) - and the slots support SFP transceivers for WDM single-fiber transmissions. This means that you can easily change the transmission mode and distance of the switch by simply pulling out the SFP transceiver and plugging in a different one. The SFP transceivers are hot-swappable and plug-and-play. Also, the fact that the switch has four of these slots, means that the network manager can, for example, have one 10km transceiver in one slot and one 110km in the other.

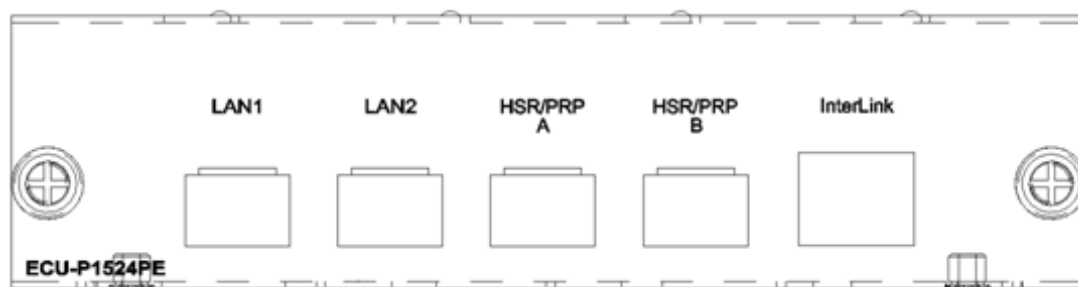
## 1.3 Hardware Specification

**Table 1.1: Basic Specification**

|                              |  |
|------------------------------|--|
| <b>Connector</b>             | 120-pin connector for UNO- 4673A/4683/ECU-4784   |
| <b>BUS Interface</b>         | PCI Express (Not-Universal Interface)  |
| <b>Power Consumption</b>     | 5V $\pm$ 5% @ 1000mA typical;<br>5V $\pm$ 5% @ 1300mA max;<br>3.3V $\pm$ 5% @ 600mA typical;<br>3.3V $\pm$ 5% @ 1300mA max;  |
| <b>Ethernet</b>              | 2 x 1000 Base-X SFP Interface  |
| <b>HSR/PRP</b>               | DIP Switch for protocol mode selection<br>2 x 1000 Base-X SFP Interface (ECU-P1524PE-GAE)<br>2 x 100 Base-FX SFP Interface (ECU-P1524PE-AE)<br>1 x 10/100/1000 Base-T(InterLink) |
| <b>LED</b>                   | 5x Link/ ACT on UNO- 4673A/4683/ECU-4784front panel  |
| <b>Operating Temperature</b> | -25~ 70°C (-13 ~ 158°F)  |
| <b>Storage Temperature</b>   | -40~85°C   |
| <b>Operating Humidity</b>    | 5 ~ 95% RH non-condensing  |
| <b>Storage Humidity</b>      | 5 ~ 95% RH non-condensing  |

## 1.4 Appearance

### 1.4.1 Connectors Assignments



**Figure 1.2 Panel for ECU-P1524PE**

**Table 1.2: Connectors Assignments**

| Name      | Function         | Interface   |
|-----------|------------------|---|
| LAN1      | Ethernet         | 1000M Base-X SFP Interface  |
| LAN2      | Ethernet         | 1000M Base-X SFP Interface  |
| HSR/PRP A | RedBox A         | 100M Base-FX SFP Interface (ECU-P1524PE-AE)<br>1000M Base-X SFP Interface (ECU-P1524PE-GAE) |
| HSR/PRP B | RedBox B         | 100M Base-FX SFP Interface (ECU-P1524PE-AE)<br>1000M Base-X SFP Interface (ECU-P1524PE-GAE) |
| InterLink | RedboxInter-Link | 10/100/1000 Mbps Base-T   |

### 1.4.2 LED Indicators

There are few LEDs display the work status and network status located on the front panel of Power & Energy Automation Computer, each of them has its own specific meaning shown as below.

**Table 1.3: LED Indicators**

| LED No. | LED Name | Color | Description   |
|---------|----------|-------|---|
| 1       | Link     | White | Lighting, LAN1 is linked                                  |
| 2       | Act      | White | Blinking, Ethernet data being transmitted                 |
| 3       | Link     | White | Lighting, LAN2 is linked                                  |
| 4       | Act      | White | Blinking, Ethernet data being transmitted                 |
| 5       | Link     | White | Lighting, ECU-P1524 card insert into ECU-4784             |
| 6       | Act      | White | Blinking, Data transmitted between ECU-P1524 and ECU-4784 |
| 7       | Link     | White | Lighting, HSR/PRP_port A is linked                        |
| 8       | Act      | White | Blinking, HSR/PRP_port A data transmitted                 |
| 9       | Link     | White | Lighting, HSR/PRP_port B is linked                        |
| 10      | Act      | White | Blinking, HSR/PRP_port B data transmitted                 |
| 11      | Link     | White | Lighting, InterLink port is linked                        |
| 12      | Act      | White | Blinking, InterLink port data being transmitted           |
| 13      | HSR      | White | Lighting, HSR function is on                              |
| 14      | PRP      | White | Lighting, PRP function is on                              |
| 15      | 100M     | White | Lighting, HSR/PRP is 100M Base-FX SFP Interface           |
| 16      | 1000M    | White | Lighting, HSR/PRP is 1000M Base-X SFP Interface           |

## 1.5 Package Checklist

The expansion module is shipped with the following items:

- ECU-P1524PE expansion module
- ROHS Notice (printed)
- Startup Manual (printed)

## 1.6 Dimensions

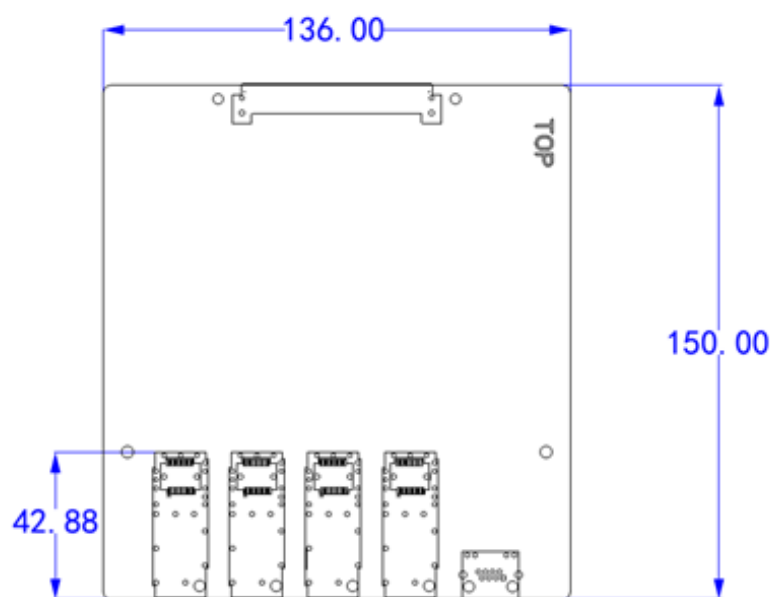
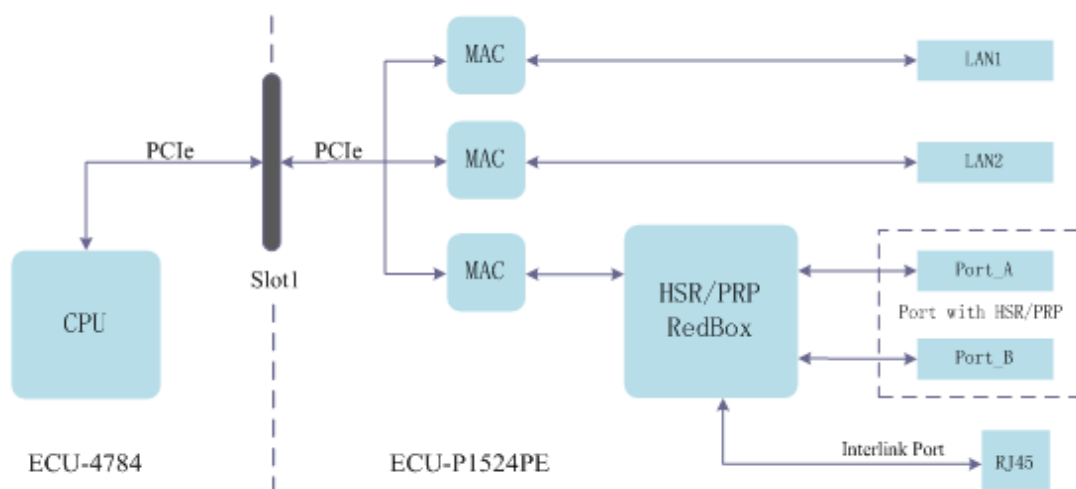


Figure 1.3 Dimension for ECU-P1524PE

## 1.7 Function Block



To support Redundancy box (Redbox) in a device at least three port, Port\_A and Port\_B for HSR/PRP protocol, InterLink port for Normal network.

Power & Energy Automation Computer (UNO-4673A/4683, ECU-4784) can be attached to the HSR/PRP network as an End Node without extra Ethernet switch or cable.

## 1.8 Selection Table

Advantech offers a complete set of products to support the ECU-P1524PE. These products include:

### ECU-P1524PE

| Part Number     | Description  |
|-----------------|--|
| ECU-P1524PE-GAE | 2-port SFP Gigabit Base-X Ethernet Card with HSR/PRP |
| ECU-P1524PE-AE  | 2-port 100Mbps Base-FX Ethernet Card with HSR/PRP    |

### Platform

ECU-4784 Series

ECU-4673A Series

ECU-4683 Series

### SFP Module

| Part Number    | Description                                |
|----------------|--|
| SFP-FXM/LC     | 100Base-FX Multi-mode SFP module           |
| SFP-FXS/LC-30E | 100Base-FX Single-mode SFP module          |
| SFP-GSX/LC     | 1000Base-SX Multi-mode SFP module          |
| SFP-GLX/LC-10E | 1000Base-LX Single-mode SFP module (10 km) |
| SFP-GLX/LC-20E | 1000Base-LX Single-mode SFP module (20 km) |
| SFP-GLX/LC-40E | 1000Base-LX Single-mode SFP module (40 km) |
| SFP-GXD/LC-50E | 1000Base-XD Single-mode SFP module (50 km) |
| SFP-GZX/LC-70E | 1000Base-ZX Single-mode SFP module (70 km) |
| SFP-GTX/RJ45   | 1000Base RJ45 SFP module                   |

# Chapter 2

## Hardware Installation

## 2.1 Installing ECU-P1524PE

The ECU-P1524PE is an expansion card for the UNO-4673A, 83 and ECU-4784. The ECU-P1524PE can only be plugged into slot 1 of the three expansion slots in UNO-4673A/4683, while both slots of ECU-4784 can support ECU-P1524PE. Follow these steps to integrate into the UNO-4673A/4683 and ECU-4784:

1. Unscrew the two screws on the blanking panel of slot then remove the blanking plate.
2. Plug the ECU-P1524PE into slot 1 of the UNO-4673A/4683 carefully and fix it by the two screws on the panel.

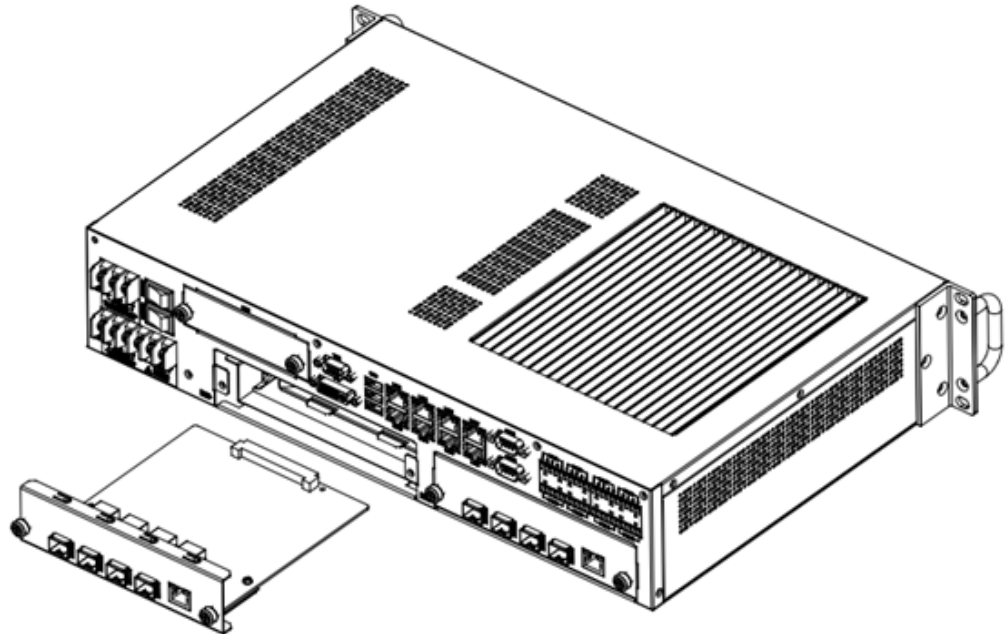
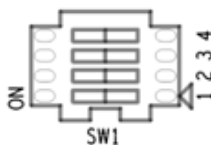


Figure 2.1 Installing ECU-P1524PE

## 2.2 DIP Switch Setting

ECU-P1524PE supports either HSR or PRP protocol; you can select HSR or PRP by hardware switch. The position meanings are shown below.

Table 2.1: DIP Switch


| Picture   | DIP Switch Setting (SW1)  |
|---|---|
|  | For HSR Mode:<br>1: "OFF"<br>2: "ON"<br>3: "any"<br>4: "any"            |
|   | For PRP Mode:<br>1: "ON"<br>2: "ON"<br>3: "any"<br>4: "any"             |
|   | For Normal Switch Mode:<br>1: "OFF"<br>2: "OFF"<br>3: "any"<br>4: "any" |



## 2.3 Connection to a Fiber Optic Network

ECU-P1524PE has 4 SFP slots for connecting to the network segment with single-mode or multi-mode fiber. You can choose appropriate mini-GBIC transceivers to plug into the slot. Make sure the slot is aligned correctly and then slide the transceiver into the SFP slot until a click is heard. You can use proper multi-mode or single-mode fiber according to the inserted SFP transceiver. With fiber optic, it transmits speed up to 1000 Mbps and you can prevent noise interference from the system and transmission distance up to 110 km, depending on the mini-GBIC transceivers.

The small form-factor pluggable (SFP) is a compact optical transceiver used in optical communications for both telecommunication and data communications applications.

**Note!**  The SFP port has the higher priority than copper port; if you insert the 1000M SFP transceiver into the SFP port which is connected to the remote device, the connection of the accompanying copper port will link down.

*If you insert the 100M SFP transceiver into the SFP port even without a fiber connection to the remote, the connection of the accompanying copper port will link down immediately.*

To connect the transceiver and LC cable, please follow the steps shown below:

First, insert the transceiver into the SFP slot. Note that the location of the triangle indicates the bottom of the slot.

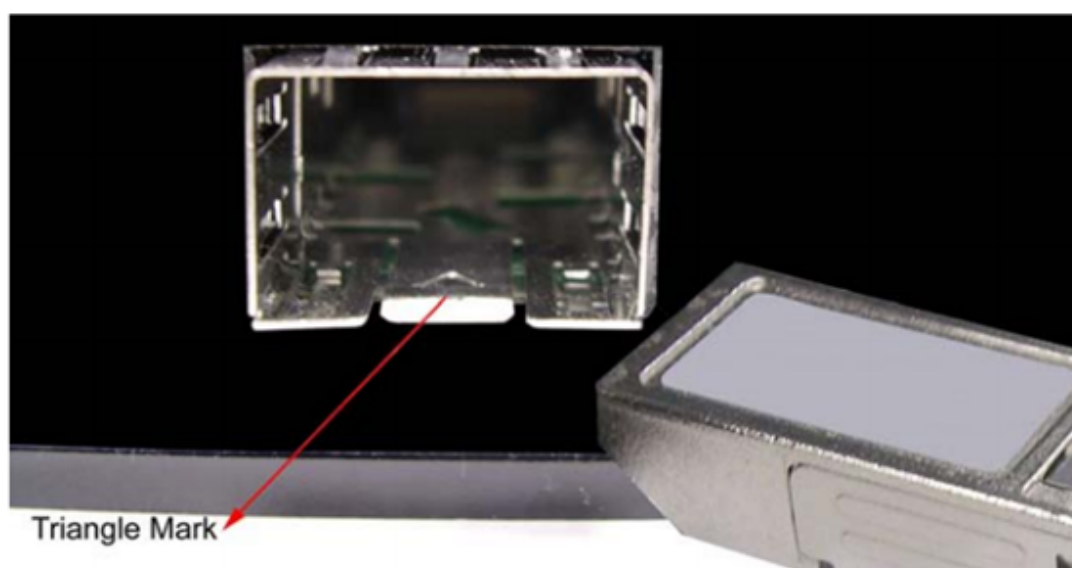
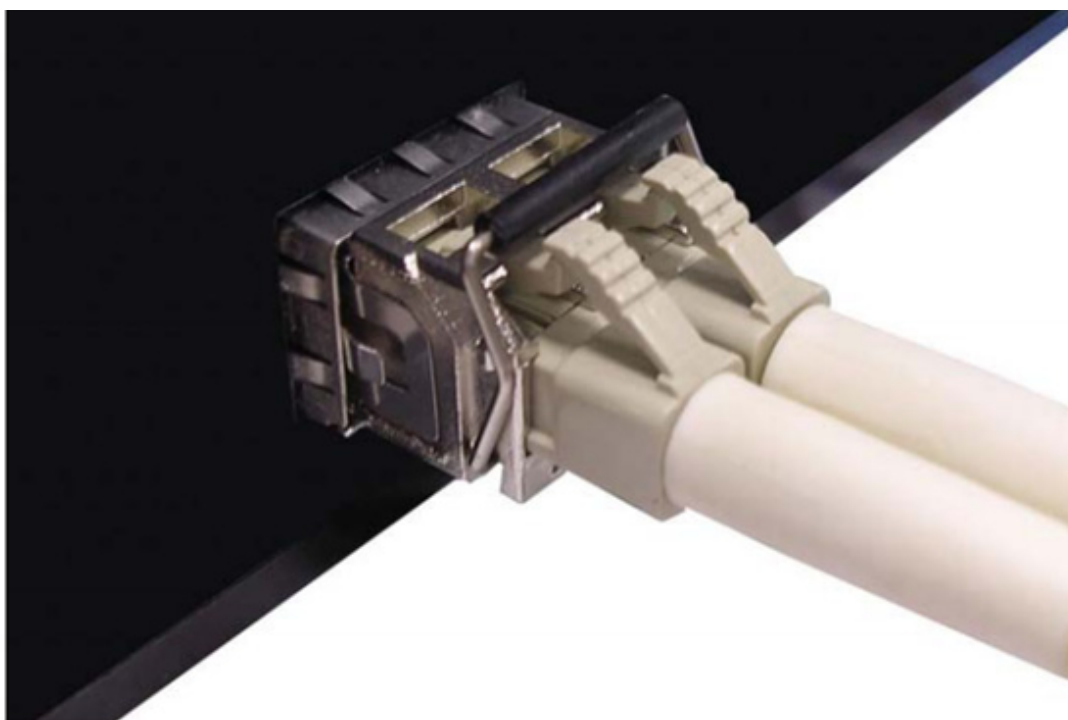


Figure 2.2 Transceiver to the SFP slot



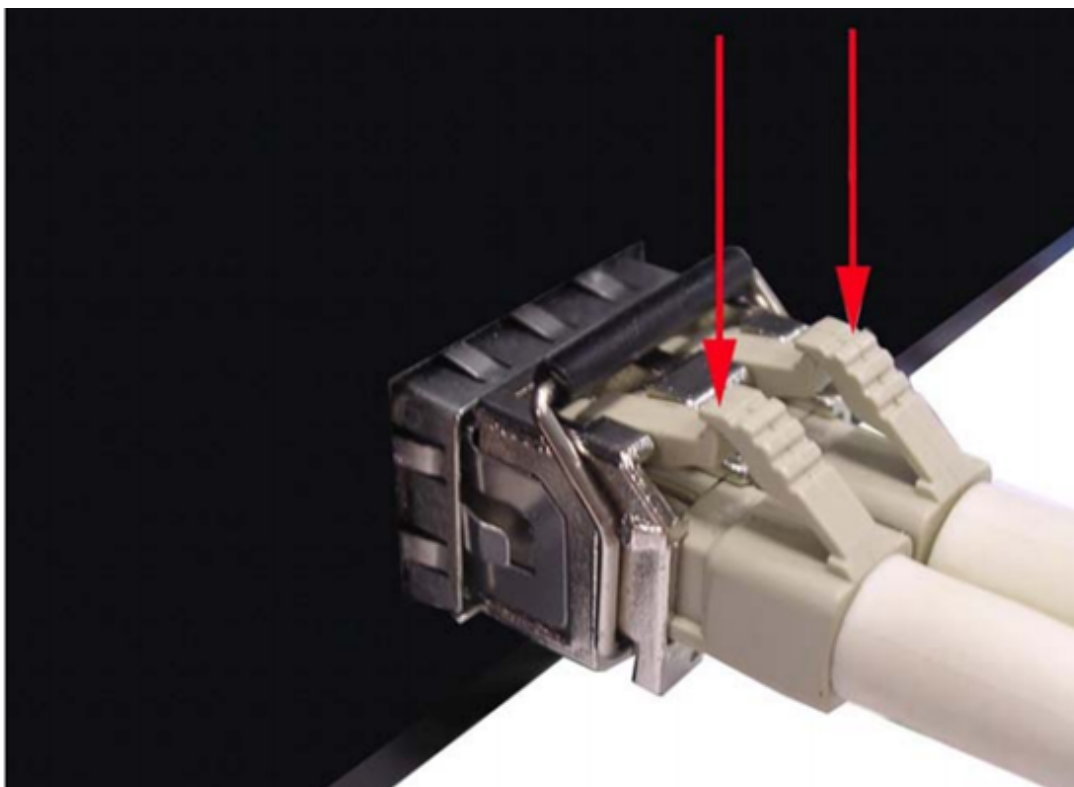
**Figure 2.3 Transceiver Inserted**

Second, insert the fiber cable of LC connector into the transceiver.



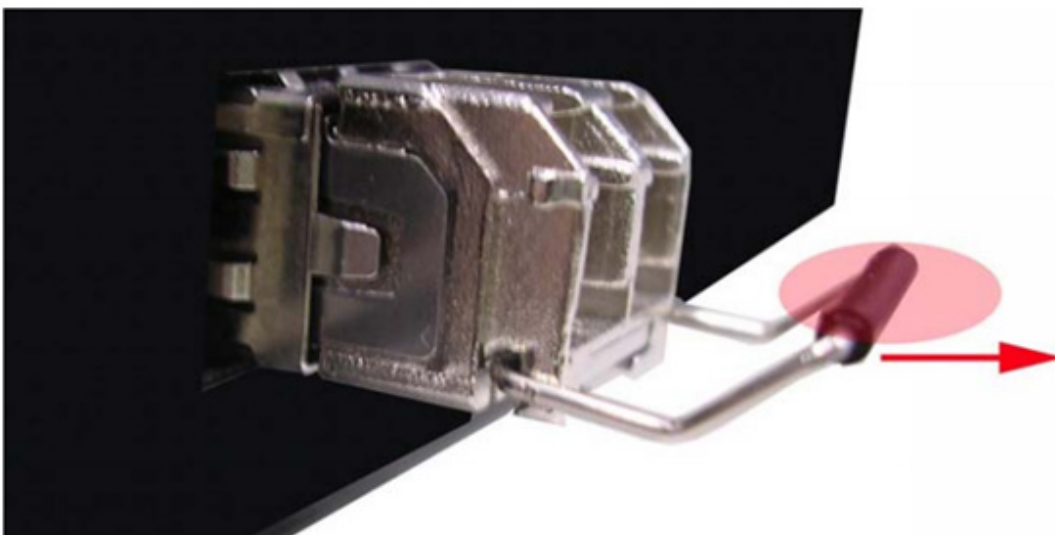
**Figure 2.4 LC connected to the transceiver**

To remove the transceiver from the slot, please follow the steps shown below:  
First, press the upper side of the LC connector to release from the transceiver and pull it out.



**Figure 2.5 Remove LC connector**

Second, push down the metal loop and pull the transceiver out by the plastic handle.



**Figure 2.6 Pull out from the slot**



# Chapter 3

Application

## 3.1 HSR Application

Through the InterLink port of ECU-P1524PE, you can access the internet or communicate with non-HSR devices like Ethernet switches and computers, which means you can expand network nodes or connect to other local networks. ECU-4784 with an inserted ECU-P1524PE works as end node in a HSR ring network.

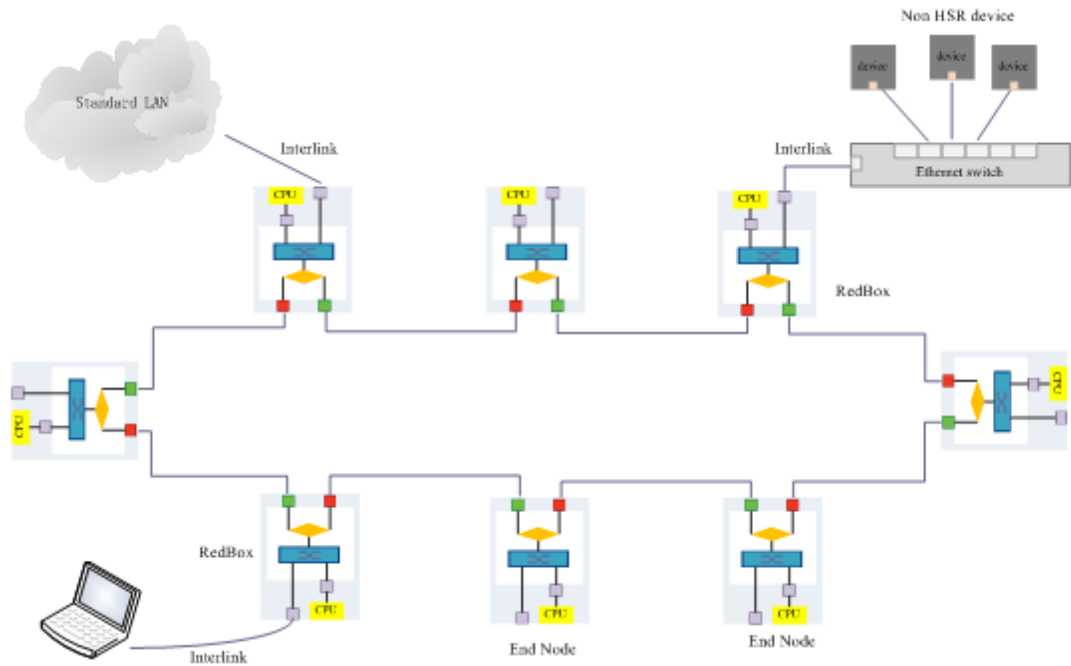


Figure 3.1 HSR Network

## 3.2 PRP Application

Through the Interlink port of ECU-P1524PE, you can expand network node. The network node attached to ECU-P1524PE can communicate with any of end device in two local networks, but the device attached to Ethernet switch can communicate only with device in the same local network. For example, device A can communicate with any device in PRP network, but device B cannot communicate with device B.

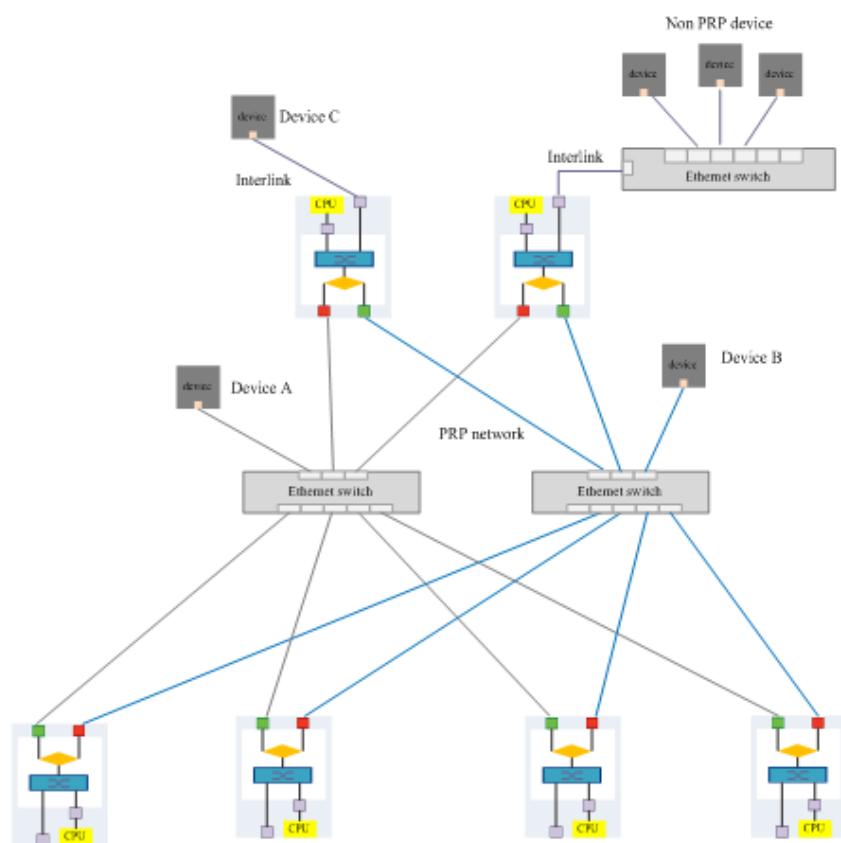


Figure 3.2 PRP Network



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