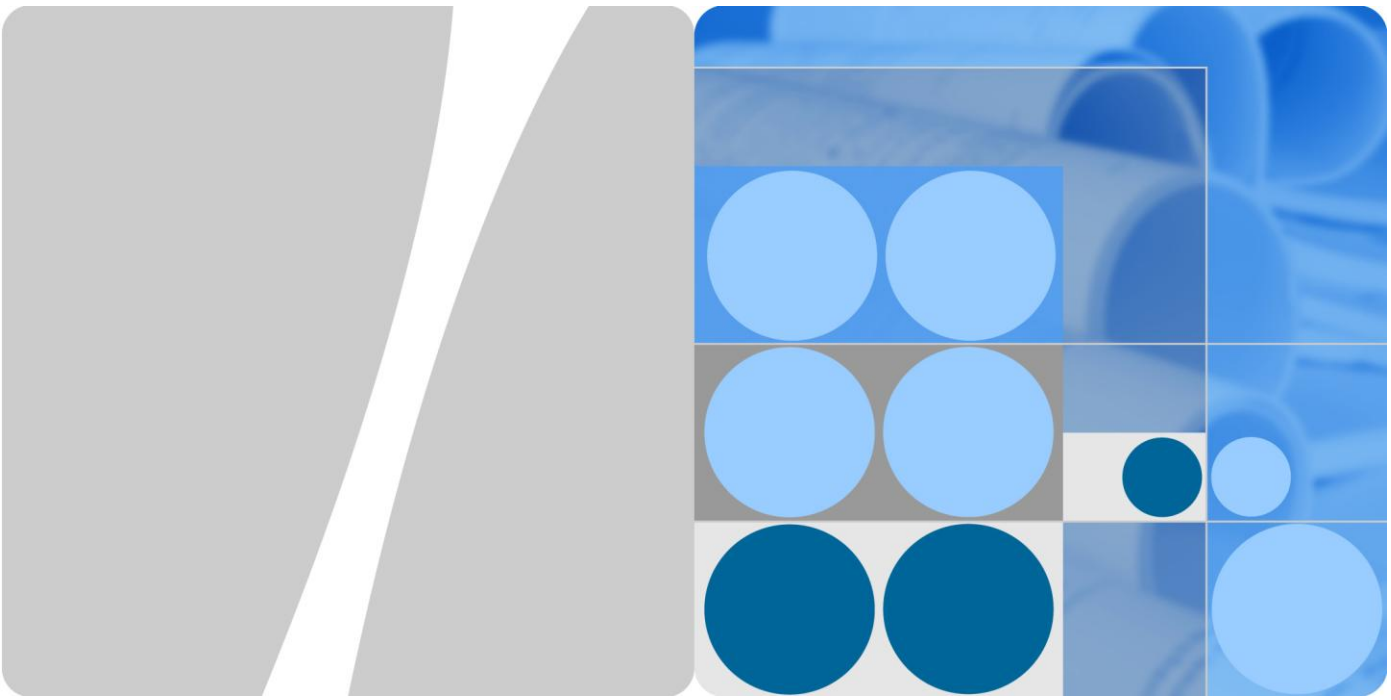

## SmartAX MA5800 Multi-service Access Module

# Hardware Description


**Issue** 03

**Date** 2015-04-30



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# About This Document

## Intended Audience

This document describes the hardware used in the MA5800 , including the cabinet, service subrack, board, optical module, and cable.

This document is intended for:

- Network planning engineers
- Hardware installation engineers
- Installation and commissioning engineers
- Field maintenance engineers
- Data configuration engineers
- System maintenance engineers

## Symbol Conventions

The symbols that may be found in this document are defined as follows.

| Symbol | Description |
| --- | --- |
| DANGER | Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. |
| WARNING | Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. |
| NOTICE | Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. |
| CAUTION | Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results.<br>NOTICE is used to address practices not related to personal injury. |
| NOTE | Calls attention to important information, best practices and tips.<br>NOTE is used to address information not related to |


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| Symbol | Description |
| --- | --- |
| | personal injury, equipment damage, and environment deterioration. |

# Update History

Updates between document issues are cumulative. Therefore, the latest document issue contains all updates made in previous issues.

# Updates in Issue 03 (2015-04-30)

Based on issue 02 (2015-01-19), the document is updated as follows:

| Position | Description |
| --- | --- |
| 3 MA5800-X7 Service Subrack | Added the MA5800-X7 service subrack. |
| 4 Board | Added 4.7.2 H901GPSF Board and 4.9.1 H901EDSH Board. |
| 6 Cable | Added 6.3 E1 Trunk Cable. |

Included the V100R016C00 updates.

## Updates in Issue 02 (2015-01-19)

Based on issue 01 (2014-11-30), the document is updated as follows:

| Position | Description |
| --- | --- |
| 2 MA5800-X17 Service Subrack | "MA5800 service subrack" is modified to "MA5800-X17 service subrack". |

## Updates in Issue 01 (2014-11-30)

This issue is the first official release.


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# Contents




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# 1 N63E-22 Cabinet

## About This Chapter

The N63E-22 cabinet complies with the ETSI standard. This topic provides the appearance, and specification of the N63E-22 cabinet, and describes the configuration, cable holes, air filter, and ventilation of the cabinet.

1.1 Appearance

This topic provides the appearance of the N63E-22 cabinet.

1.2 Specification

This topic provides the dimensions, weight and power parameters of the N63E-22 cabinet.

1.3 Configuration

This topic describes the subrack configuration of the N63E-22 cabinet.

1.4 Cable Hole

The power cables and subscriber cables are led into the N63E-22 cabinet from the top and the bottom of the cabinet. This topic describes the positions of cable holes at the top and the bottom of the N63E-22 cabinet.

1.5 Air Filter

The air filters are installed on the inner side of the front door and at the bottom of the cabinet. This topic provides the appearance and dimensions of the air filters, and describes the material and function of the air filters.

1.6 Cable Manager

This topic describes the appearance and functions of the cable manager.

1.7 Grounding

This topic describes the grounding principle of the N63E-22 cabinet and the position of the ground point.

1.8 Ventilation

This topic describes the ventilation of the N63E-22 cabinet.

1.9 DPD60-4-4 DC PDU


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The DPD60-4-4 DC PDU supports 2+2 DC power inputs (the 2 input groups backing up each other) and provides 4 DC power outputs for devices inside the cabinet.

# 1.1 Appearance

This topic provides the appearance of the N63E-22 cabinet.

The N63E-22 cabinet is an ETSI 300 mm front standing pillar cabinet of NC purple grey.

The N63E-22 cabinet uses a rack as the main frame. The cabinet has a single front door that can be opened. The back panel and side panels of the cabinet are secured to the rack with screws and cannot be opened.

The door of the N63E-22 cabinet is removable.


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**Figure 1-1** Appearance of the N63E-22 cabinet

# 1.2 Specification

This topic provides the dimensions, weight and power parameters of the N63E-22 cabinet.


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## Installation Size

**Figure 1-2** Dimensions of the N63E-22 cabinet

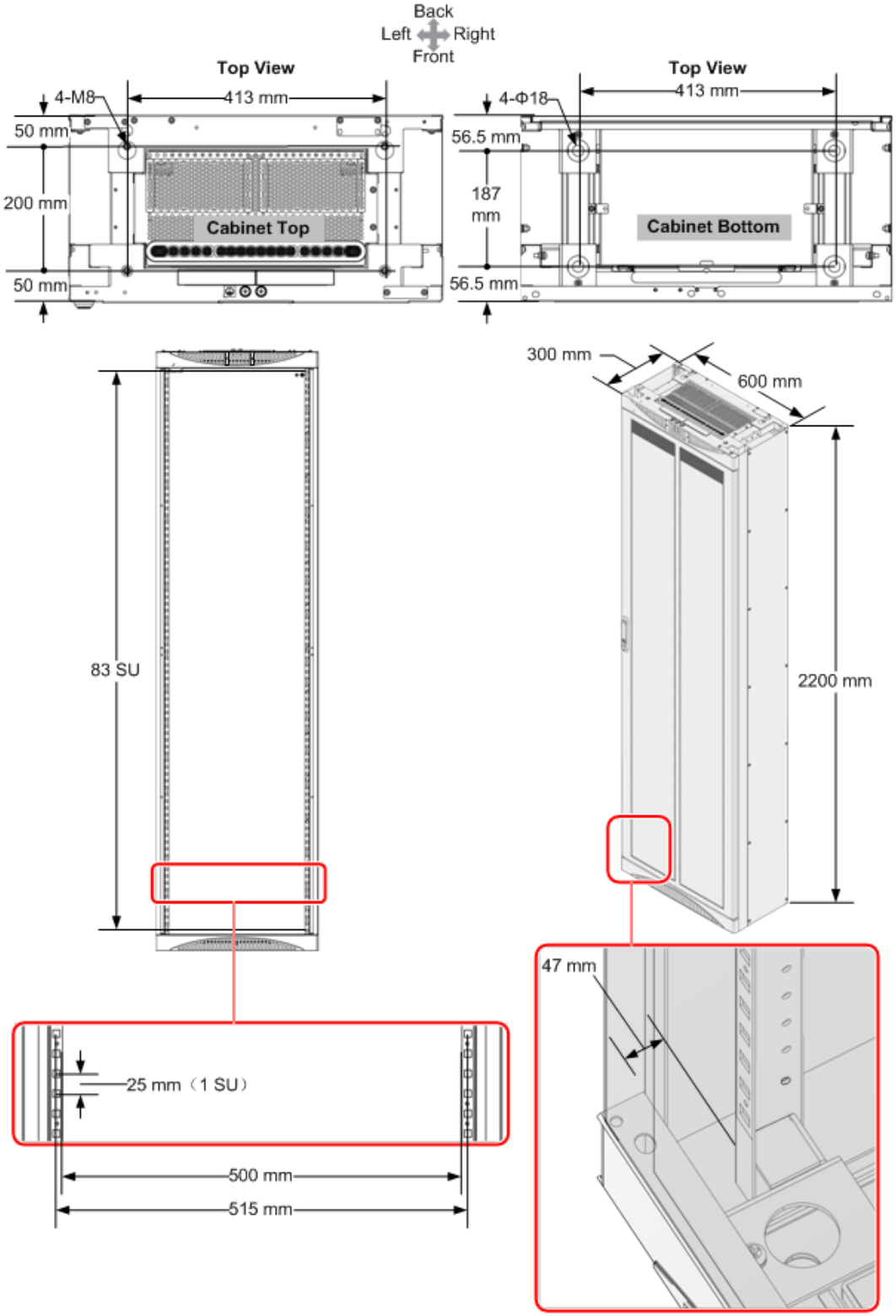



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**Table 1-1** Dimensions and weight of the N63E-22 cabinet

| Parameter | Specification |
| --- | --- |
| Standard compliance | ETSI cabinet (21-inch): ETSI 300 119-3 |
| Weight (empty cabinet) | 45 kg |
| Dimensions (W x D x H) | 600 mm x 300 mm x 2200 mm |
| Installation dimensions of the cabinet top | Installation interface<br>• Hole positions: 413 mm x 200 mm (W x D)<br>• Nut specifications: four M8 nuts |
| Installation dimensions of the cabinet bottom | Installation interface<br>• Hole positions: 413 mm x 187 mm (W x D)<br>• Bolt specifications: four M12 expansion bolts |
| Distance between mounting bar holes | 1 SU = 25 mm. (SU: System Unit.) |
| Available space | 83 SU |
| Angle opening width | 500 mm |
| Fixing centres | 515 mm |
| Distance between the installation surface of the mounting bar and the inner side of the air filter on the cabinet front door | 47 mm |

## Power Parameters

**Table 1-2** Power parameters of the N63E-22 cabinet

| Parameter | Specification |
| --- | --- |
| Power supply mode | DC |
| Rated voltage | -48 V / -60 V |
| Working voltage range | -38.4 V to -72 V |
| Maximum input current | 60 A |

# 1.3 Configuration

This topic describes the service subrack configuration of the N63E-22 cabinet.


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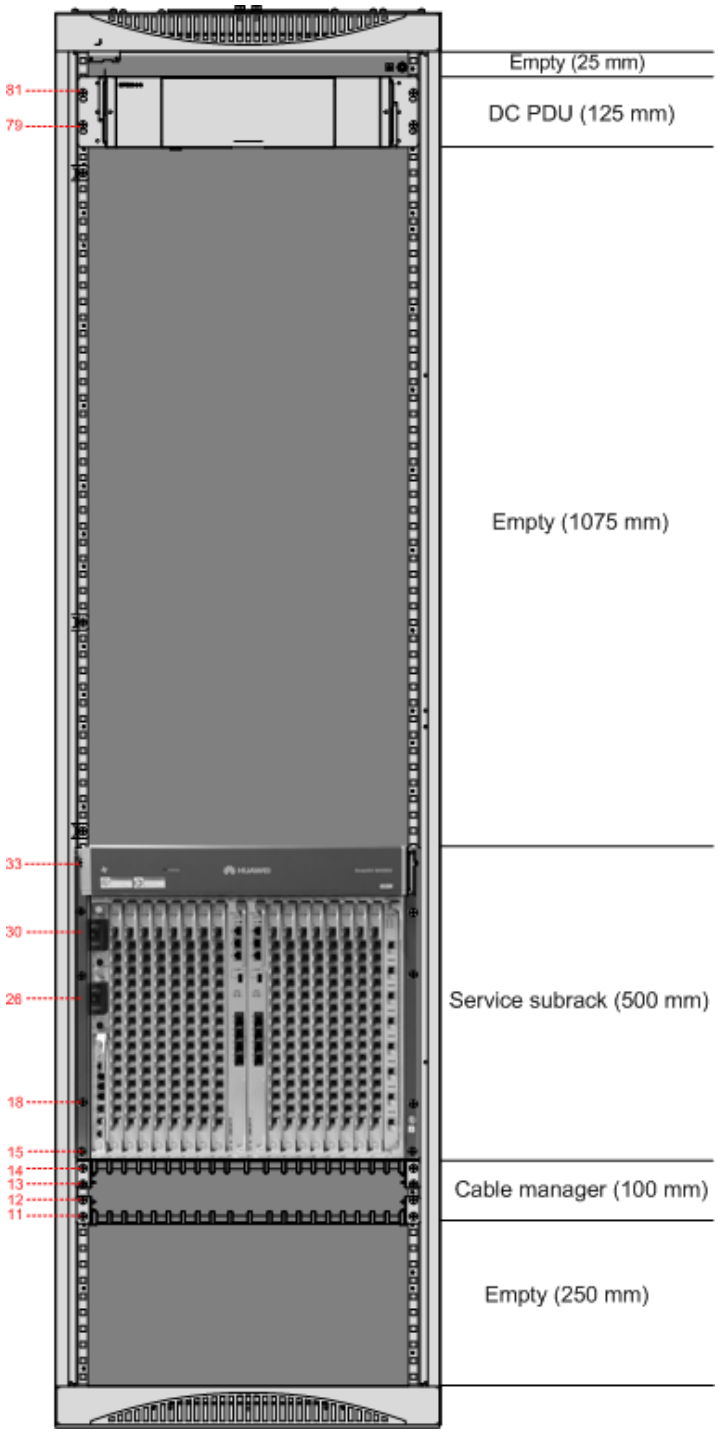
## Configuration of One MA5800-X17 Subrack

**Figure 1-3** Configuration of the N63E-22 cabinet installed with one MA5800-X17 subrack




**NOTE**

- The filled holes are for floating nuts to fasten subracks.
- The cabinet can also support an additional service subrack.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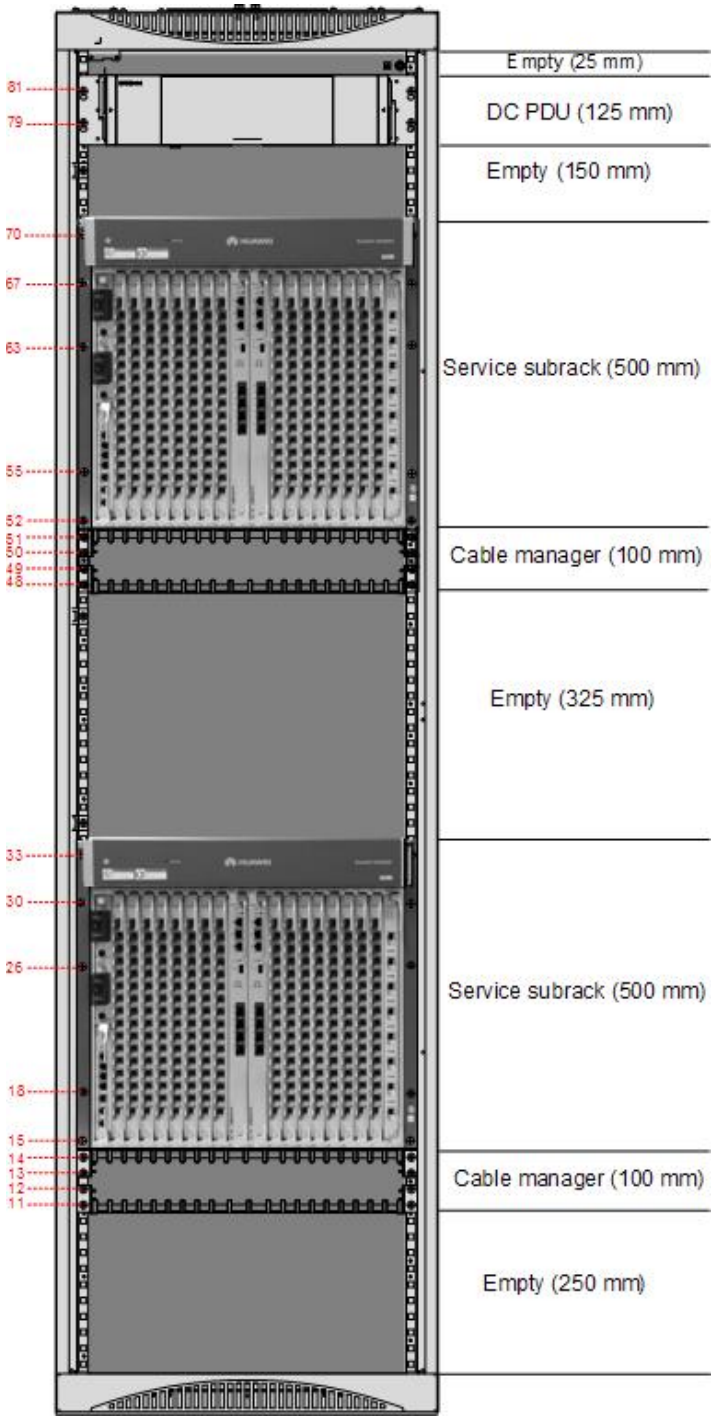
## Configuration of Two MA5800-X17 Subracks

**Figure 1-4** Configuration of the N63E-22 cabinet installed with two MA5800-X17 subracks




**NOTE**

The filled holes are for floating nuts to fasten subracks.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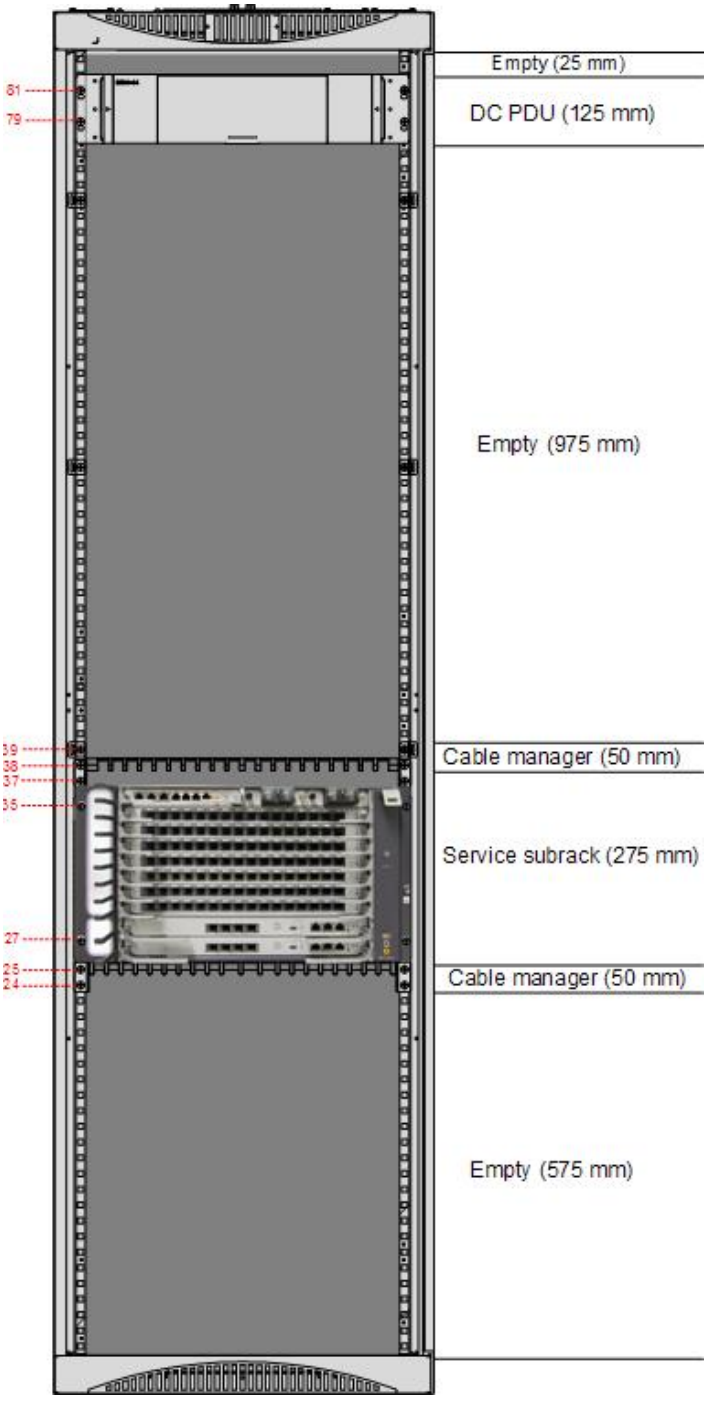
## Configuration of One MA5800-X7 Subrack

**Figure 1-5** Configuration of the N63E-22 cabinet installed with one MA5800-X7 subrack




**NOTE**
The filled holes are for floating nuts to fasten subracks.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# 1.4 Cable Hole

The power cables and subscriber cables are led into the N63E-22 cabinet from the top and the bottom of the cabinet. This topic describes the positions of cable holes at the top and the bottom of the N63E-22 cabinet.

The cables of the N63E-22 cabinet can be routed in the overhead cabling mode or the underfloor cabling mode.

- In the overhead cabling mode, external cables are led into the cabinet through the top of the cabinet. Figure 1-6 shows the positions of cable holes at the top of the cabinet.
- In the underfloor cabling mode, external cables are led into the cabinet through the bottom of the cabinet. Figure 1-7 shows the positions of cable holes at the bottom of the cabinet.

**Figure 1-6** Cable holes at the top of the cabinet (top view)

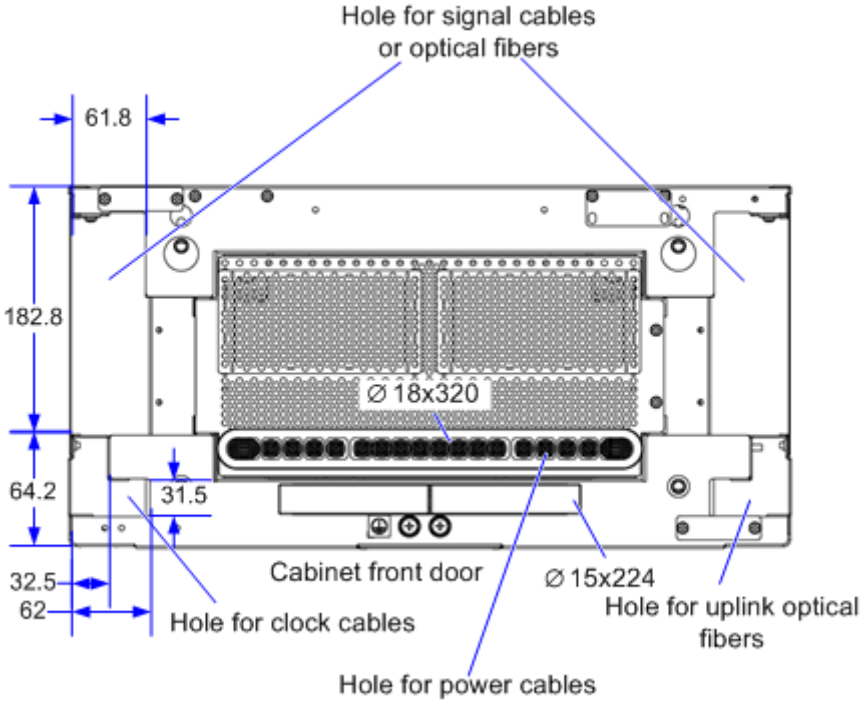



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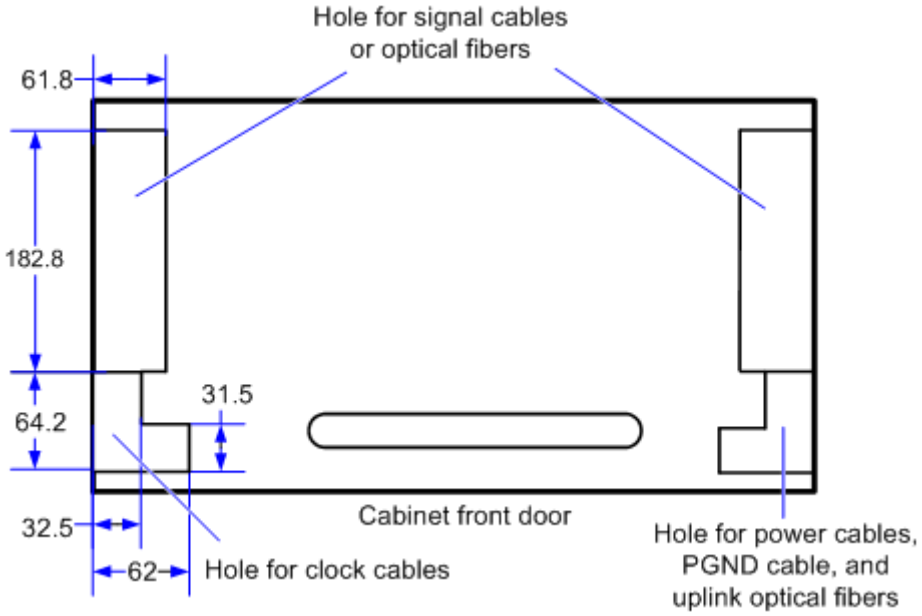
**Figure 1-7** Cable holes at the bottom of the cabinet (top view)




**NOTE**
The unit for figures in this topic is mm, unless otherwise stated.

# 1.5 Air Filter

The air filters are installed on the inner side of the front door and at the bottom of the cabinet. This topic provides the appearance and dimensions of the air filters, and describes the material and function of the air filters.

## Appearance and Dimensions

Figure 1-8 and Table 1-3 lists the materials and dimensions of the air filter on the inner side of the front door of the N63E-22 cabinet.


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**Figure 1-8** Dimensions of the air filter on the inner side of the front door of the N63E-22 cabinet

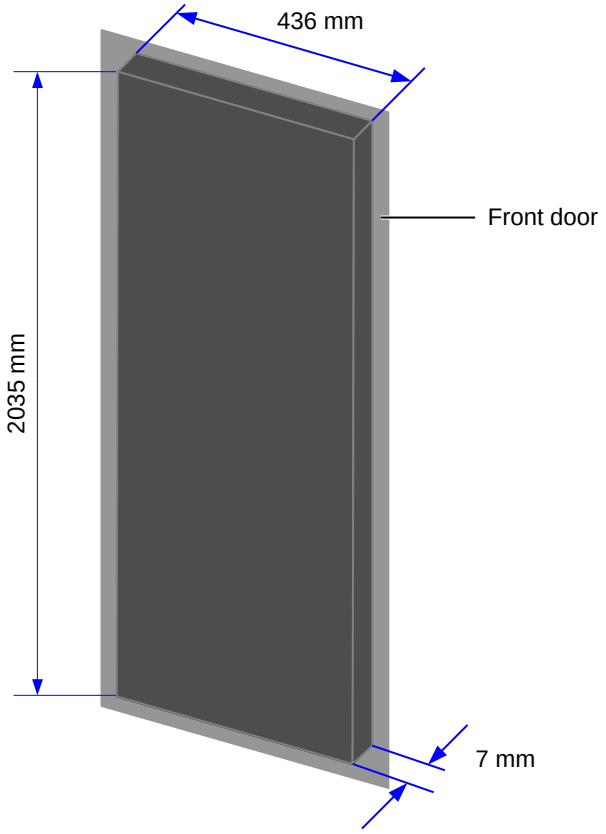


**Table 1-3** Material and dimensions of the air filter on the inner side of the front door of the N63E-22 cabinet

| Cabinet | Material |
|---|---|
| N63E-22 | 50PPI (50 sponge picks per inch) black sponge |

Figure 1-9 shows the air filter at the bottom of the N63E-22 cabinet.

**Figure 1-9** Appearance of the air filter at the bottom of the N63E-22 cabinet

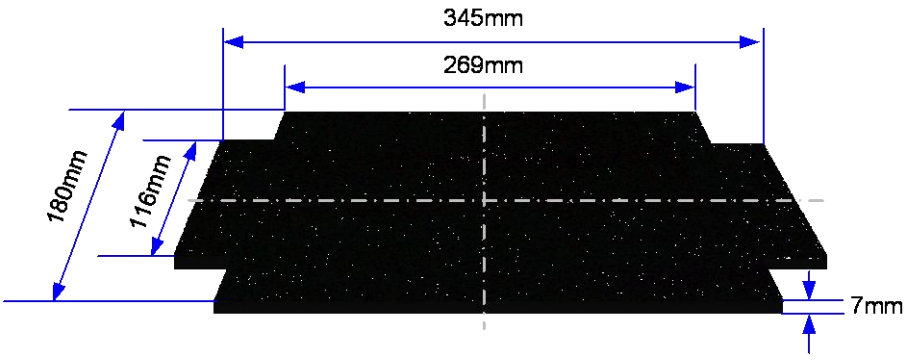



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Table 1-4 lists the materials and dimensions of the air filter at the bottom of the N63E-22 cabinet.

**Table 1-4** Materials and dimensions of the air filter at the bottom of the N63E-22 cabinet

| Cabinet | Material |
| --- | --- |
| N63E-22 | 50PPI (50 sponge picks per inch) black sponge |

## Function

The air filter on the inner side of the front door prevents dust from entering the cabinet.

During the ventilation, cool air enters the cabinet through the air intake vent at the bottom of the cabinet. The air filter at the bottom of the cabinet prevents dust from entering the cabinet.

# 1.6 Cable Manager

This topic describes the appearance and functions of the cable manager.

## Appearance

Figure 1-10shows the appearance of the cable manager.

**Figure 1-10** Appearance of the cable manager


## Functions

The cable manager is configured under the service subrack.

The cable manager supports the following functions:

- The main function of the upper cable manager is to clearly separate cables of each slot from each other so that cables can be routed in order and cables in one slot do not affect the insertion or removal of the board in the neighboring slot.
- The main function of the lower cable manager is to bear optical fibers.


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# 1.7 Grounding

This topic describes the grounding principle of the N63E-22 cabinet and the position of the ground point.

**NOTICE**

Connect the ground cables properly to guarantee protection against lightening and interference for the N63E-22 cabinet.

The power input end of the N63E-22 cabinet has a noise filter. The center ground of the noise filter connects to the cabinet, called the cabinet ground, that is, the protection ground. Ground the cabinet securely so that the influence electricity, leakage electricity can flow to the ground, improving the protection against electromagnetic interference.

Use a ground cable to connect the ground point of the cabinet to the ground bar of the telecommunications room or to the ground directly. It is recommended that the grounding resistance of the telecommunications room should be less than 10 ohms. Refer to the local standards to ground the cabinet.

The ground point of the cabinet is on the top of the cabinet, as shown in Figure 1-11.


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**Figure 1-11** Grounding of the N63E-22 cabinet


# 1.8 Ventilation

This topic describes the ventilation of the N63E-22 cabinet.

The N63E-22 cabinet has a fan tray at the top of the service subrack to exhaust hot air for heat dissipation.

The ventilation of the N63E-22 cabinet is as follows: Cool air enters the cabinet through the cable space at the bottom of the service subrack. The air is exhausted by the fans upward through the service subracks. The air exits from the top of the cabinet, as shown in Figure 1-12.


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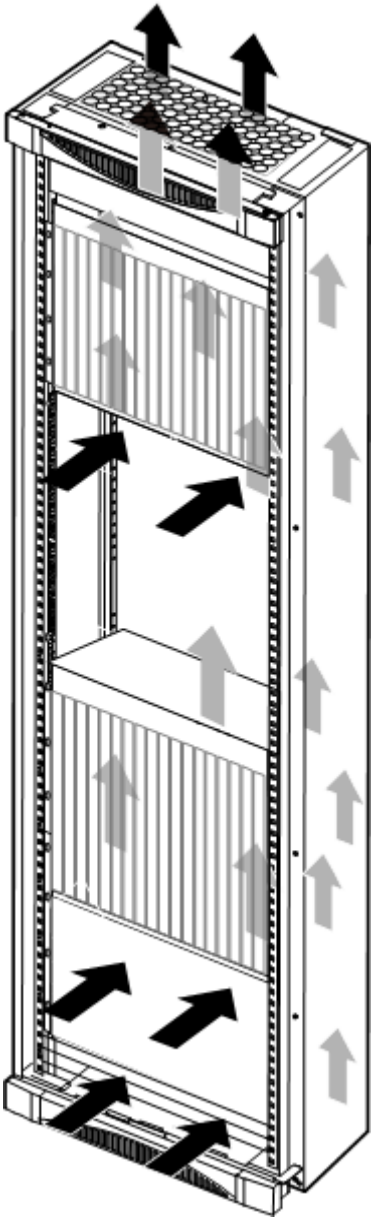
**Figure 1-12** Ventilation of the N63E-22 cabinet installed with two service subracks



# 1.9 DPD60-4-4 DC PDU

The DPD60-4-4 DC PDU supports 2+2 DC power inputs (the 2 input groups backing up each other) and provides 4 DC power outputs for devices inside the cabinet.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## Appearance

**Figure 1-13** Appearance of the DPD60-4-4 DC PDU (with cover)

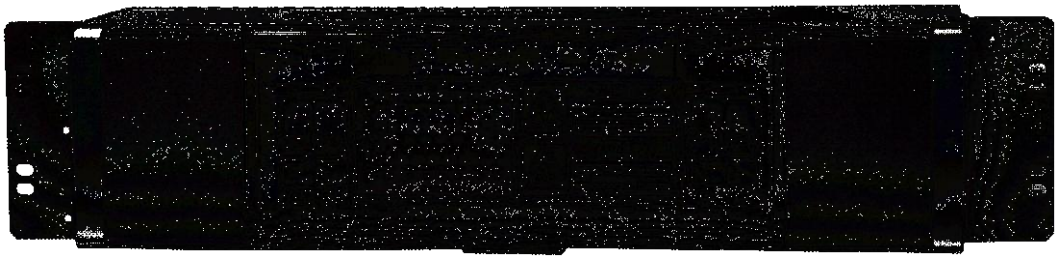

**Figure 1-14** Appearance of the DPD60-4-4 DC PDU (without cover)

**NOTE**

The appearance of DPD60-4-4 DC PDU presented here is only for reference, which may differ from the delivered DC PDU.

## Function

The DPD60-4-4 DC PDU provides the following functions:

- Short-circuit protection and overload protection
- The functions such as over-voltage protection, lightning proof, and filter are not provided.


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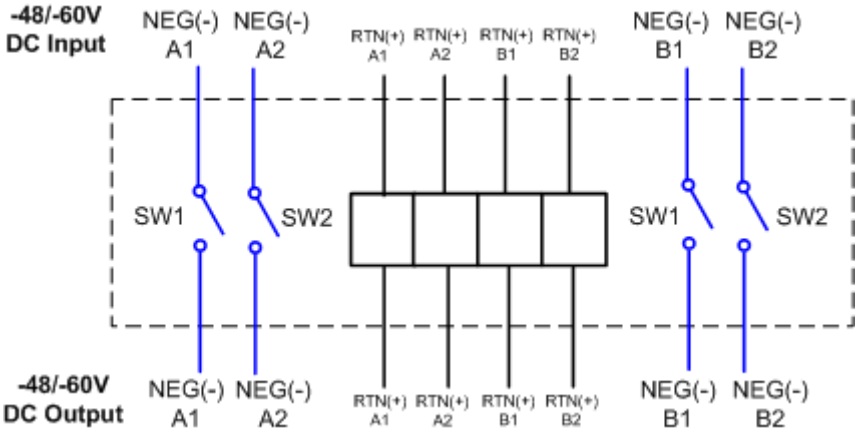
## Power Distribution Principle

**Figure 1-15** Diagram of the power distribution principle of the DPD60-4-4 DC PDU




The DPD60-4-4 DC PDU provides 2 input groups (groups A and B) to receive 4 channels of -48 V/-60 V DC power. The 2 input groups back up each other.

The DPD60-4-4 DC PDU provides four -48 V/-60 V DC power outputs. Table 1-5 lists the mapping between the output terminals, control switches and service subracks.

**Table 1-5** Mapping between the output terminals, control switches and service subracks

| Output Terminal | Control Switch | Load |
|---|---|---|
| SW1/A1 | SW1/A | The first service subrack (from bottom to top) |
| RTN(+)/A1 | | |
| SW2/A2 | SW2/A | The second service subrack (from bottom to top) |
| RTN(+)/A2 | | |
| SW1/B1 | SW1/B | The first service subrack (from bottom to top) |
| RTN(+)/B1 | | |
| SW2/B2 | SW2/B | The second service subrack (from bottom to top) |
| RTN(+)/B2 | | |

## Specification

**Table 1-6** Main performance specifications of the DPD60-4-4 DC PDU

| Item | | Performance Specification |
|---|---|---|
| Input | Rated input voltage | -48 V to -60 V DC |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| Item | | Performance Specification |
|---|---|---|
| feature | Input voltage | -38.4 V to -72 V DC |
| | Mode of input power | 2+2 DC inputs (the 2 input groups backing up each other) |
| | Maximum input current | Maximum input current of each channel is 60 A. |
| | Input terminal | Bare crimping terminal (used for 16–35 $mm^2$ cables) |
| Output feature | Rated output voltage | -48 V to -60 V DC |
| | output voltage | -38.4 V to -72 V DC |
| | Output channel | Four channels of output power, controlled by four air breakers |
| | Fixed current of the air breaker | 60 A |
| | Output protection feature | Over-current protection. You need to restore the circuit manually. |
| | Output terminal | Bare crimping terminal (used for 10–16 $mm^2$ cables) |
| Environment | Working temperature | -25 ℃ to 55 ℃ |
| | Storage temperature | -40 ℃ to 70 ℃ |
| | Relative humidity | < = 95% |
| | Standard atmospheric pressure | 70-106 kPa |
| Dimensions | | 110 mm x 442 mm x 97.2 mm (Height x Width x Depth) |


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# 2 MA5800-X17 Service Subrack

## About This Chapter

This topic describes the appearance, structure, functions, dimensions, weight, power consumption parameters, subrack configurations, and fan tray of an MA5800-X17 service subrack.



## 2.1 Appearance

The MA5800-X17 service subrack provides 22 slots, and has a fan tray at the top. The subrack is installed in the cabinet through the mounting brackets.


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## Appearance

**Figure 2-1** Appearance of the MA5800-X17 service subrack


# 2.2 Specifications

This topic provides the dimensions and weight of the MA5800-X17 service subrack.

## Specifications

**Table 2-1** Specifications of the MA5800-X17 service subrack

| Item | Specification |
| --- | --- |
| Dimensions (W x D x H, including mounting brackets) | 535 mm x 287 mm x 486 mm |
| Dimensions (W x D x H, excluding mounting brackets) | 493 mm x 287 mm x 486 mm |


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| Item | Specification |
| --- | --- |
| Maximum weight (including mounting brackets) | 45 kg |

# 2.3 Configuration

An MA5800-X17 service subrack provides 22 slots, including 2 slots for control boards, 2 slots for power boards, 1 slot for the general purpose input/output (GPIO) board, and 17 slots for service boards.

## Configuration

H901BPLB is the backplane supported by the MA5800-X17 service subrack.

**Figure 2-2** Configuration of boards in the MA5800-X17 service subrack

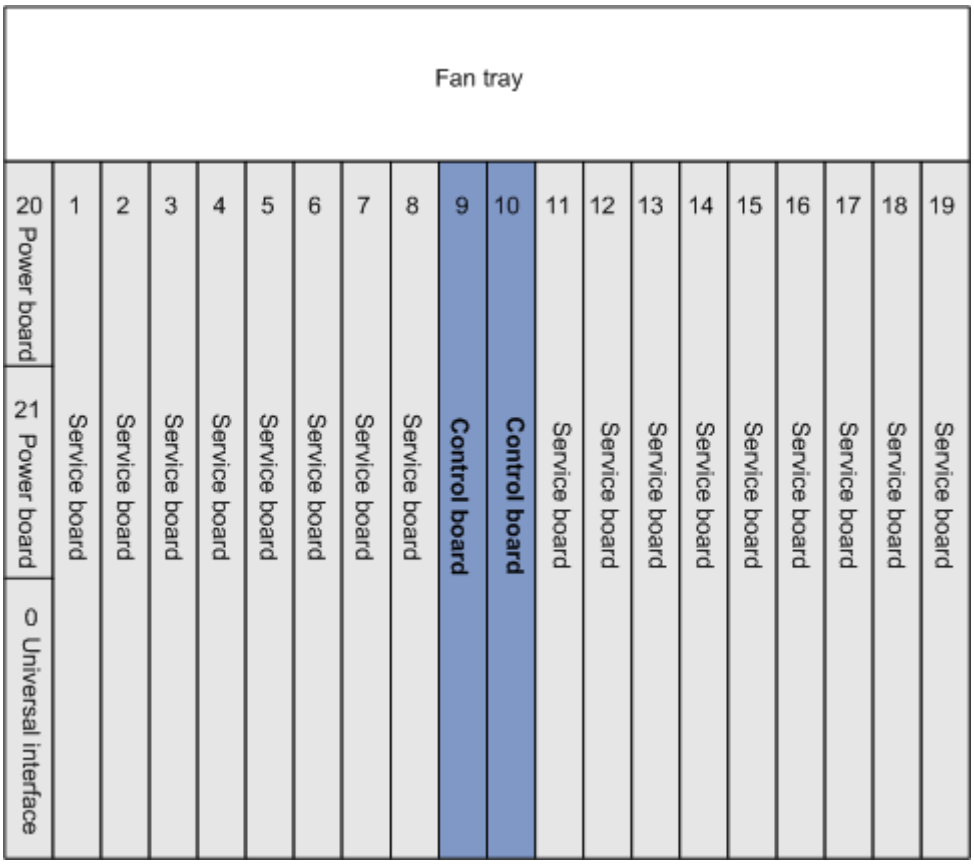


Table 2-2 lists the configuration of boards in the MA5800-X17 service subrack.


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**Table 2-2** Boards in the MA5800-X17 service subrack

| Slot Type | Slot | Supported Board | Remarks |
|---|---|---|---|
| Control board slot | 9,10 | Control board | Two slots must be configured with the same control board. |
| Power board slot | 20,21 | Power board | - |
| Universal interface board slot | 0 | Universal interface board | - |
| Service board slot | 1-8,11-19 | • Service board<br>– Ethernet service access board<br>– P2P interface board<br>– GPON service board<br>– 10G GPON service board<br>• Uplink interface board | • Mixed configuration of service boards is supported.<br>• Mixed configuration of upstream interface boards is supported; however, it is recommended to use the same upstream interface board in the configuration.<br>• Both control board and upstream interface board can be used for upstream transmission. Using the control board for upstream transmission is recommended. |

# 2.4 Fan Tray

A fan tray functions heat dissipation, monitoring, and fan speed adjustment, which ensures that the device works at a stable temperature.

## Appearance

Eight fans are configured in the fan tray of the MA5800-X17.



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## Specification

| Item | Specification |
|---|---|
| Dimensions (W x D x H) | 503 mm x 284 mm x 76 mm |
| Weight | 4.5 kg |
| Power consumption | • Static: 20 W<br>• Maximum: 139 W |

## Function

The functions of the fan tray are as follows:

- **Heat dissipation**

  The fan tray is at the top of the service subrack and exhausts hot air for heat dissipation. The cool air flows to the subrack from the bottom of the subrack and then is exhausted from the top of the subrack after passing the boards.
- **Monitoring**

  The fan tray is configured with the fan monitoring board to detect whether the fans are working in the normal state. The fan monitoring board also provides the port for communication with the control board. The detected information is transmitted to the control board through the fan monitoring board periodically.
- **Speed adjustment**

  The rotating speed of the fans can be adjusted according to the detected temperature automatically or be adjusted by setting the related data manually.

## Indicator

| Indicator | Status | Meaning | Operation Description |
|---|---|---|---|
| STATUS | Yellow: blinks every 0.125s | The fan tray is not registered, is being loaded, or fails to communicate with the control board. | • If the fan tray is not registered or is being loaded, no action is required.<br>• If the fan tray fails to communicate with the control board, check the communication connection between the fan tray and the control board. |
| | Green: blinks | The fan tray works in the normal state. | No action is required. |
| | Yellow: blinks every 1s | The fan tray generates alarms that do not affect services. | Handle it based on the corresponding alarm. |


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| Indicator | Status | Meaning | Operation Description |
|---|---|---|---|
| | Red: blinks | The fan tray is faulty or the fan tray generates an over-temperature alarm. | • Replace the faulty fan tray.<br>• Increase the fan speed to lower the temperature. |

### Fan Speed Adjustment

Set the fan speed adjustment mode to "automatic" or "manual" in the command line interface (CLI). After the fans are installed, they work in automatic mode by default.

- Automatic mode
  - Control-system-triggering: The control system automatically adjusts the fan speed according to the board temperatures for energy conservation.
  - Monitoring-board-triggering: The control system adjusts the fan speed according to the temperature information collected by the monitoring board.

**NOTE**
The automatic mode has two variants (automatically selected by the system): control-system-triggering and monitoring-board-triggering.

- Manual mode

  Commands are executed to adjust the fan speed. The levels range from 0 to 6, level 0 being the lowest speed and level 6 being the highest speed. Alternatively, the fan speed can be set from 20% to 100%.

## 2.5 ESD Jack

The ESD jack of the MA5800-X17 subrack is on the left of the fan tray, which is used to connect the ESD wrist strap to prevent device damage caused by electrostatic discharge.

The position of the MA5800-X17 subrack ESD jack, as shown in Figure 2-3.


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**Figure 2-3** Position of the MA5800-X17 subrack ESD jack

# 2.6 Grounding

This topic describes the grounding principle of the MA5800-X17 subrack and the position of the ground point.

**NOTICE**

Connect the ground cables properly to guarantee protection against lightening and interference for the MA5800-X17 subrack.

The power input end of the MA5800-X17 subrack has a noise filter. The center ground of the noise filter connects to the subrack, called the subrack ground, that is, the protection ground. Ground the subrack securely so that the influence electricity, leakage electricity can flow to the ground, improving the protection against electromagnetic interference.

Use a ground cable to connect the ground point of the subrack to the ground bar of the telecommunications room or to the ground directly. It is recommended that the grounding resistance of the telecommunications room should be less than 10 ohms. Refer to the local standards to ground the subrack.

The MA5800-X17 subrack has 2 ground points. One is on the side panel and the other is in the front of the subrack, as shown in Figure 2-4.


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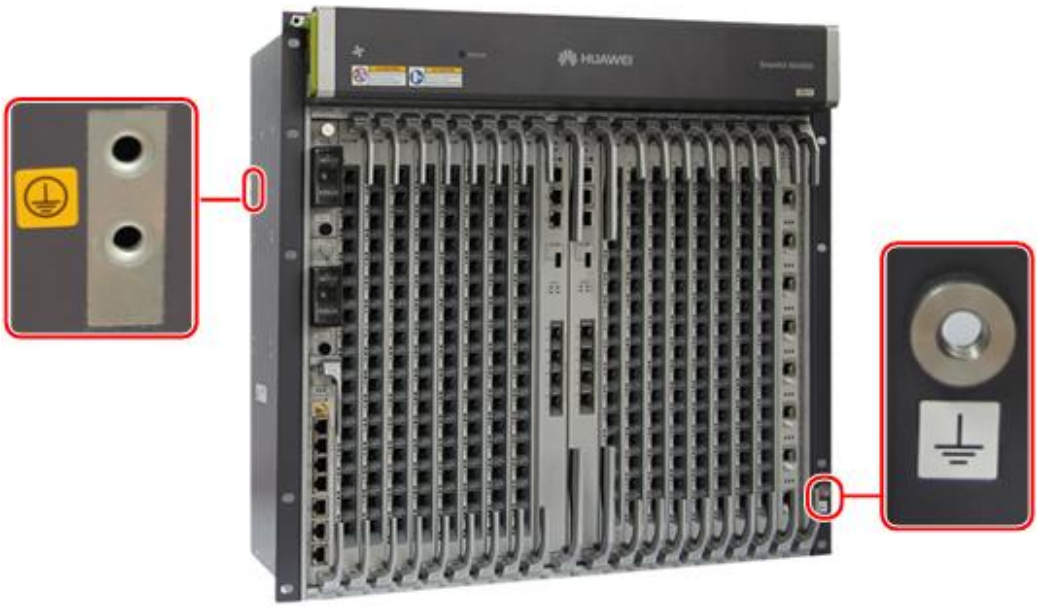
**Figure 2-4** Ground points of the MA5800-X17 subrack

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# 3 MA5800-X7 Service Subrack

## About This Chapter

This topic describes the appearance, dimensions, weight, subrack configurations, and fan tray of an MA5800-X7 service subrack.



## 3.1 Appearance

The MA5800-X7 service subrack is 6 U high, and has a fan tray at the right. The subrack is installed in the cabinet through the ETSI or IEC mounting brackets.


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**Figure 3-1** Appearance of the MA5800-X7

# 3.2 Specifications

This topic provides the dimensions, weight, and power parameters of the MA5800-X7 service subrack.

**Table 3-1** Dimensions and weight of the MA5800-X7

| Item | Specification |
| --- | --- |
| Dimensions (W x D x H, excluding mounting brackets) | 442.0 mm x 242.2 mm x 263.9 mm |
| Dimensions (W x D x H, including mounting brackets of IEC standard) | 482.6 mm x 242.2 mm x 263.9 mm |
| Dimensions (W x D x H, including mounting brackets of ETSI standard) | 535.0 mm x 242.2 mm x 263.9 mm |
| Maximum weight (including mounting brackets) | 26 kg |

**Table 3-2** Power parameters of the MA5800-X7

| Parameter | Specification |
| --- | --- |
| Power supply mode | DC |
| Rated voltage | -48 V / -60 V |


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| Parameter | Specification |
| --- | --- |
| Working voltage range | -38.4 V to -72 V |
| Maximum input current | 40 A |

# 3.3 Configuration

An MA5800-X7 service subrack provides 12 slots, including 2 slots for control boards, 2 slots for power boards, 1 slot for the Universal interface board, and 7 slots for service boards.

H901BPMB is the backplane supported by the MA5800-X7.

**Figure 3-2** Configuration of boards in the MA5800-X7

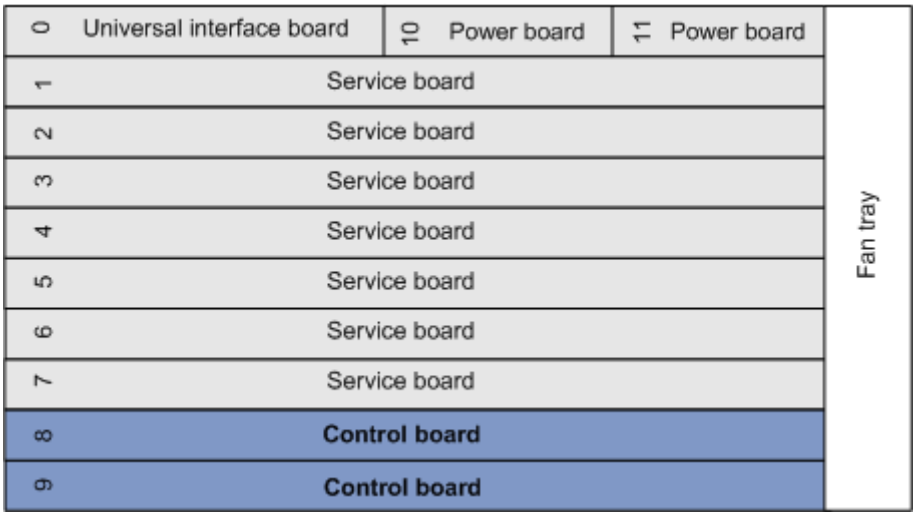


Table 3-3 lists the configuration of boards in the MA5800-X7.

**Table 3-3** Boards in the MA5800-X7

| Slot Type | Slot | Supported Board | Remarks |
| --- | --- | --- | --- |
| Control board slot | 8,9 | Control board | Two slots must be configured with the same control board. |
| Power board slot | 10,11 | Power board | - |
| Universal interface board slot (GPIO) | 0 | Universal interface board | - |
| Service board slot | 1-7 | • Service board<br>– Ethernet service | Mixed configuration of service boards is supported. |


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| Slot Type | Slot | Supported Board | Remarks |
|---|---|---|---|
| | | access board<br>– P2P interface board<br>– GPON service board<br>– 10G GPON service board<br>• Uplink interface board | |

# 3.4 Fan Tray

A fan tray functions heat dissipation, monitoring, and fan speed adjustment, which ensures that the device works at a stable temperature.

## Appearance

Six fans are configured in the fan tray of the MA5800-X7.~~~


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## Specification

| Item | Specification |
|---|---|
| Dimensions (W x D x H) | 43.6 mm x 275.5 mm x 260.4 mm |
| Weight | 1.7 kg |
| Power consumption | • Static: 14 W<br>• Maximum: 70 W |

## Function

The functions of the fan tray are as follows:

- **Heat dissipation**

  The fan tray is at the right of the service subrack and exhausts hot air for heat dissipation. The cool air flows to the subrack from the left of the subrack and then is exhausted from the right of the subrack after passing the boards.
- **Monitoring**

  The fan tray is configured with the fan monitoring board H901FMMA to detect whether the fans are working in the normal state. The fan monitoring board also provides the port for communication with the control board. The detected information is transmitted to the control board through the fan monitoring board periodically.
- **Speed adjustment**

  The rotating speed of the fans can be adjusted according to the detected temperature automatically or be adjusted by setting the related data manually.

## Indicator

| Indicator | Status | Meaning | Operation Description |
|---|---|---|---|
| STATUS | Yellow: blinks every 0.125s | The fan tray is not registered, is being loaded, or fails to communicate with the control board. | • If the fan tray is not registered or is being loaded, no action is required.<br>• If the fan tray fails to communicate with the control board, check the communication connection between the fan tray and the control board. |
| | Green: blinks | The fan tray works in the normal state. | No action is required. |
| | Yellow: blinks every 1s | The fan tray generates alarms that do not affect services. | Handle it based on the corresponding alarm. |


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| Indicator | Status | Meaning | Operation Description |
|---|---|---|---|
| | Red: blinks | The fan tray is faulty or the fan tray generates an over-temperature alarm. | • Replace the faulty fan tray.<br>• Increase the fan speed to lower the temperature. |

### Fan Speed Adjustment

Set the fan speed adjustment mode to "automatic" or "manual" in the command line interface (CLI). After the fans are installed, they work in automatic mode by default.

- Automatic mode
  - Control-system-triggering: The control system automatically adjusts the fan speed according to the board temperatures for energy conservation.
  - Monitoring-board-triggering: The control system adjusts the fan speed according to the temperature information collected by the monitoring board.

**NOTE**
The automatic mode has two variants (automatically selected by the system): control-system-triggering and monitoring-board-triggering.

- Manual mode

  Commands are executed to adjust the fan speed. The levels range from 0 to 6, level 0 being the lowest speed and level 6 being the highest speed. Alternatively, the fan speed can be set from 20% to 100%.

## 3.5 ESD Jack

The ESD jack of the MA5800-X7 service subrack is on the bottom of the fan tray, which is used to connect the ESD wrist strap to prevent device damage caused by electrostatic discharge.


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**Figure 3-3** Position of the MA5800-X7 service subrack ESD jack

# 3.6 Grounding

This topic describes the grounding principle of the MA5800-X7 service subrack and the position of the ground points.

**NOTICE**

Connect the ground cables properly to guarantee protection against lightening and interference for the MA5800-X7.

The power input end of the MA5800-X7 has a noise filter. The center ground of the noise filter connects to the subrack, called the chassis shell ground, that is, the protection ground. Ground the subrack shell securely so that the influence electricity, leakage electricity can flow to the ground, improving the protection against electromagnetic interference.

Use a ground cable to connect the ground point of the subrack shell to the ground bar of the telecommunications room or to the ground directly. It is recommended that the grounding resistance of the telecommunications room should be less than 10 ohms. Refer to the local standards to ground the subrack.

The MA5800-X7 subrack has 2 ground points. One is on the side panel and the other is in the right mounting bracket of the subrack, as shown in Figure 3-4.


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**Figure 3-4** Grounding of the chassis


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# 4 Board

## About This Chapter

This topic describes the function, front panel, port, daughter board, and lists the specification of the boards.

4.1 Board Overview

This manual describes the supply of boards supported by the product. However, the availability of the boards is subject to the PCNs. For the availability of the boards, contact product mangers at Huawei representative offices.

4.2 Power Consumption and Maximum Frame Size of Boards

You can query power consumption, maximum frame size, and normal operating temperature of all boards.

4.3 Control Board

A control board, as the control and management unit of the system, configures, manages, and controls the device and also implements simple routing protocol functions.

4.4 Upstream Interface Board

Upstream interface boards provide upstream or cascading ports for the system.

4.5 Universal Interface Board (GPIO)

Universal interface boards (installed in the GPIO slot) receive the clock signals and ESC parameters. GPIO is short for general purpose input/output.

4.6 Power Board

Power boards lead in DC power for supplying power to the device MA5800.

4.7 Service Board

MA5800-X17 supports GPON service boards and Ethernet service boards.

4.8 10G GPON Service Board

10G GPON service boards work with ONUs to provide 10G GPON access service.

4.9 TDM Service Processing Board

TDM service processing boards include H901EDSH.


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# 4.1 Board Overview

This manual describes the supply of boards supported by the product. However, the availability of the boards is subject to the PCNs. For the availability of the boards, contact product mangers at Huawei representative offices.

## 4.1.1 Board Structure

A board mainly consists of the printed circuit board (PCB) and the front panel.

Figure 4-1 shows the structure of a board (using the H901MPLB board as an example).


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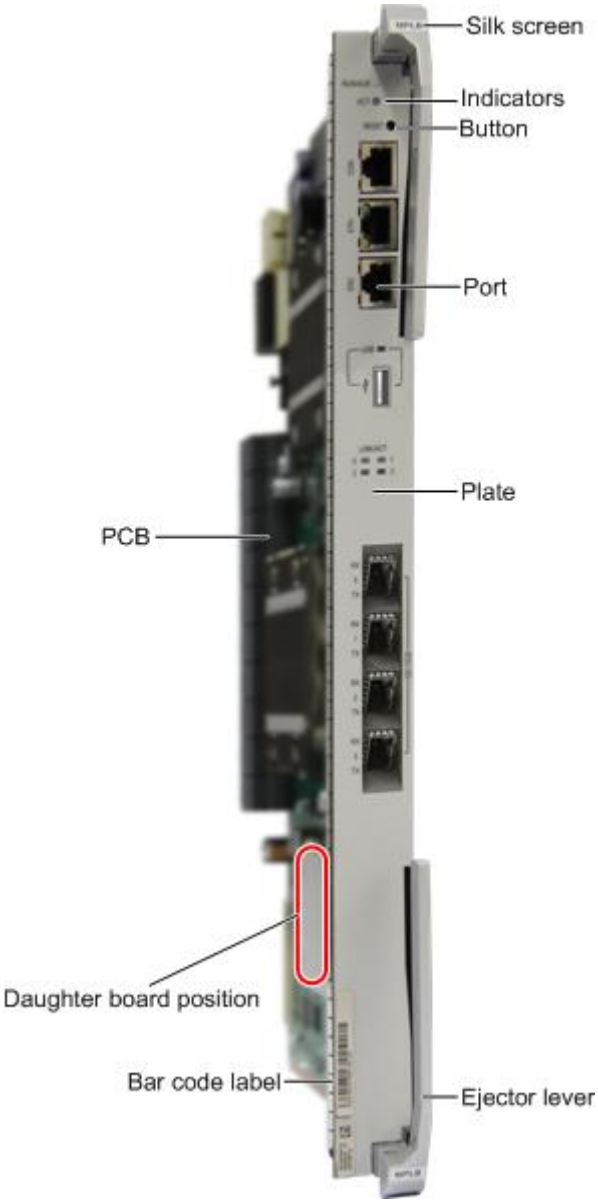
**Figure 4-1** Board structure




A board mainly consists of the following parts:

- PCB

  The PCB houses various functional chips of the board and is the most important part of the board. Through the front panel, the PCB provides indicators, buttons, and ports. For some boards, the PCB also provides a position for installing a daughter board.

**NOTE**

Different boards provide different indicators, buttons, and ports; not all boards support a daughter board. For details, see the description of each board.

- Front panel, including ejector levers and plate.
  - Ejector levers: used for inserting or removing the board.
  - Plate: connects the PCB and the ejector levers. The plate also provides a surface for attaching some labels (such as the bar code label).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## 4.1.2 Board Dimensions

This topic describes the dimensions of each type of board.

Figure 4-2 illustrates the dimensions of a board (using a service board as an example).

**Figure 4-2** Board structure

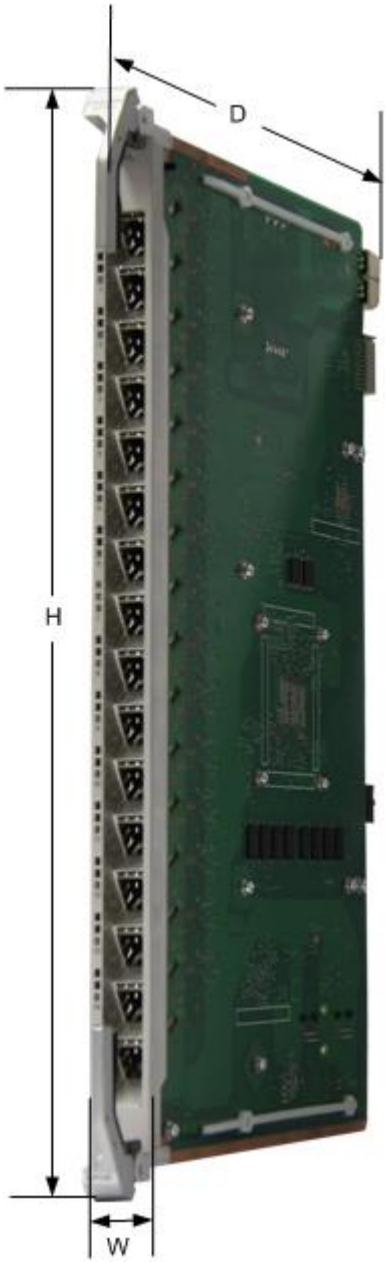


Table 4-1 lists the dimensions of the boards supported by the product.


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**Table 4-1** Board dimensions

| Board Type | Dimensions (W x D x H) |
|---|---|
| Control board | 31.00 mm * 258.90 mm * 399.10 mm |
| Universal interface board | 25.40 mm * 257.90 mm * 195.20 mm |
| Upstream interface board | 23.30 mm * 257.90 mm * 399.20 mm |
| Service board | 23.30 mm * 257.90 mm * 399.20 mm |
| Power board | 25.40 mm * 253.00 mm * 97.50 mm |

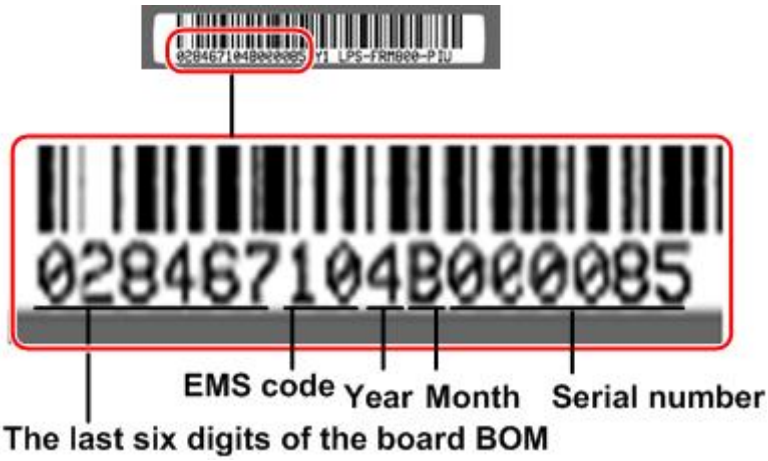
## 4.1.3 Board Label

This topic describes the meanings of the labels attached to the board front panel.

### Bar Code Label

The bar code label is the first 16 digits of a generally board label, as shown in Figure 4-3.

**Figure 4-3** Board bar code




| Position | Name | Introduction |
|---|---|---|
| 1-6 | The last six digits of the board BOM. | The first two digits of the board BOM is 03. The BOM is used to identify the board. |
| 7, 8 | EMS code | Codes for differentiating different vendors. |
| 9 | Year | The year of production date, the last digit is used. For example, year 2004 is recorded as 4. From 2010, letters are used, A to Z indicate years starting from 2010. |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| Position | Name | Introduction |
|---|---|---|
| 10 | Month | The month of production date, in hexadecimal notation. For example, October is displayed as A. |
| 11-16 | Serial number | The serial number (SN) of a board. It is updated every month and ranges from 000001 to 999999. |

# 4.2 Power Consumption and Maximum Frame Size of Boards

You can query power consumption, maximum frame size, and normal operating temperature of all boards.

Table 4-2 lists the power consumption and maximum frame size of boards. "-" indicates N/A. The board power consumption is measured at -53.5 V and 25°C. The board power consumption slightly varies with the power module configured for the board and discreteness of components.

The operating temperature of all the boards is -40°C to +65°C. The lowest board startup temperature is -25°C.

**Table 4-2** Power consumption and maximum frame size of boards

| Board | Power Consumption | Maximum Frame Size |
|---|---|---|
| **Control board** | | |
| H901MPLB | • Static: 62 W<br>• Maximum: 117 W | 2052 bytes. After the jumbo frame function is enabled, a maximum of 9216 bytes can be supported. |
| **Daughter board of Control board** | | |
| H901CKUA | • Static: 2 W<br>• Maximum: 2 W | - |
| **Upstream interface board** | | |
| H901NXED | • Static: 40 W<br>• Maximum: 53 W | 2052 bytes. After the jumbo frame function is enabled, a maximum of 9216 bytes can be supported. |
| **Universal interface board** | | |
| H901CIUA | • Static: 6 W<br>• Maximum: 7 W | - |
| **Power interface board** | | |
| H901PILA | • Static: 0.5 W<br>• Maximum: 4 W | - |


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| Board | Power Consumption | Maximum Frame Size |
|---|---|---|
| **GPON Service Board** | | |
| H901GPHF | • Static: 25 W<br>• Maximum: 50 W | 2004 bytes. After the jumbo frame function is enabled, a maximum of 9216 bytes can be supported. |
| H901GPSF | • Static: 25 W<br>• Maximum: 50 W | 2004 bytes. After the jumbo frame function is enabled, a maximum of 9216 bytes can be supported. |
| **10G GPON Service Board** | | |
| H901XGHD | • Static: 42 W<br>• Maximum: 61 W | 2004 bytes. After the jumbo frame function is enabled, a maximum of 9216 bytes can be supported. |
| **TDM Service Processing Board** | | |
| H901EDSH | • Static: 26 W<br>• Maximum: 28 W | - |
| **P2P Interface Board** | | |
| H901OGHK | • Static: 42 W<br>• Maximum: 75 W | 2004 bytes. After the jumbo frame function is enabled, a maximum of 9216 bytes can be supported. |
| **Ethernet Service Access Board** | | |
| H901OXHD | • Static: 37 W<br>• Maximum: 50 W | 2004 bytes. After the jumbo frame function is enabled, a maximum of 9216 bytes can be supported. |
| **FAN monitoring board** | | |
| H901FMLA | • Static: 20 W<br>• Maximum: 139 W | - |
| H901FMMA | • Static: 14 W<br>• Maximum: 70 W | - |

# 4.3 Control Board

A control board, as the control and management unit of the system, configures, manages, and controls the device and also implements simple routing protocol functions.

## 4.3.1 H901MPLB Board

The H901MPLB board is a control board. It is the core of the system control and service switching and aggregation. The H901MPLB board can also function as the management and control core of the integrated network management system (NMS). It communicates with


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service boards about the key management and control information through the master/slave serial port and inband GE/10GE channel. In this manner, the H901MPLB board configures, manages, and controls the device, and also implements the simple route protocol functions.

## Feature and Specifications

- System control and management unit
- Active/standby switchover
- Local and remote maintenance through maintenance serial port CON or maintenance Ethernet port ETH
- Environmental monitoring through environment monitoring serial port ESC
- Load sharing
- Ethernet synchronization
- 1588v2

## Parameters

Please refer to "Power Consumption and Maximum Frame Size of Boards".


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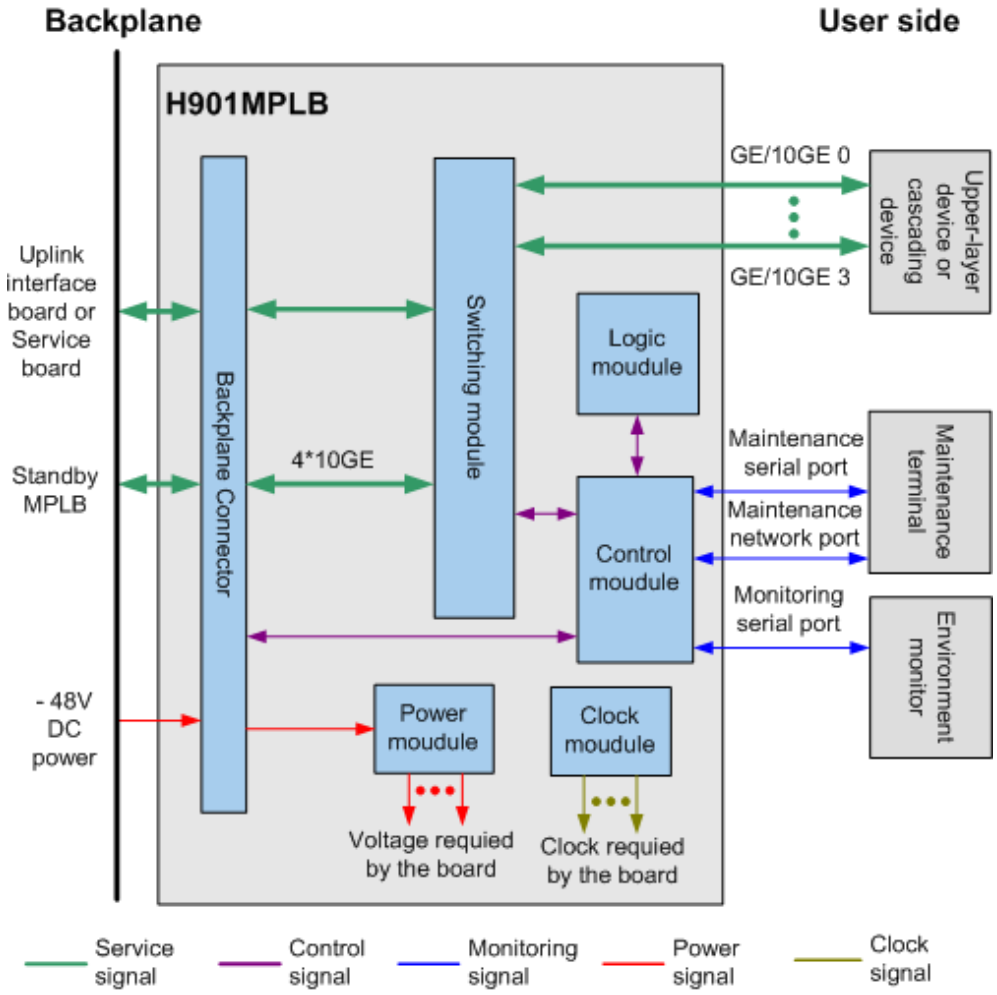
## Working Principle

**Figure 4-4** Working principle of the H901MPLB board




The basic working principle of the H901MPLB board is as follows:

- The control module manages the entire board and the service boards, and communicates with the fan tray through the extended serial port.
- The power module supplies power to other functional modules of the board.
- The clock module provides clock signals for other functional modules of the board.
- The switching module provides 10GEports to switch and aggregate services at Layer 2 or Layer 3.
  - Providing four GE/10GE ports for upstream transmission using ports on the front panel.
  - Providing four 10GE ports for load sharing with the standby control board.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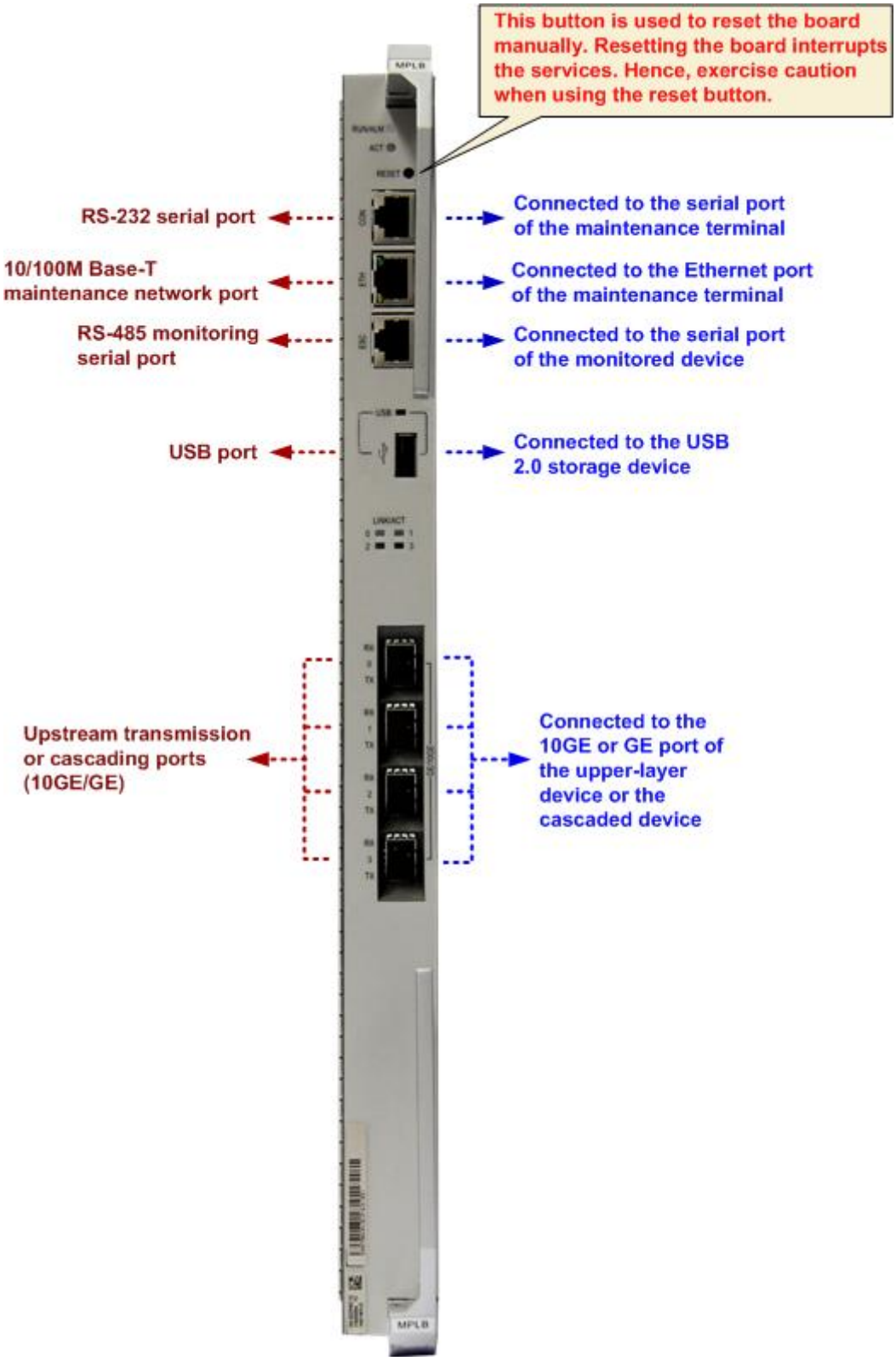
## Front Panel Port




For details about supported optical module, see 5.1 GE Optical/Electrical Module.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### Indicator

| Indicator | Name | Status | Meaning |
|---|---|---|---|
| RUN ALM | Running status indicator | Green: blinks every 1s | The board functions properly |
| | | Green: blinks every 0.25s | The board is starting up |
| | | Orange: blinks | A high-temperature alarm is generated |
| | | Red: on | The board is faulty |
| ACT | Active indicator | Green: on | In active/standby mode, the board is active |
| | | Green: off | In active/standby mode, the board is standby |
| USB | Status indicator of the USB port | Green: steady on | The USB device is recognized normally. |
| | | Green: blinks | The USB device exchanges data with the control board. |
| | | Off | No USB device is connected or the connection between the USB device and the control board is faulty. |
| LINK | Link/data status indicator | Green: on | A connection is set up on the port |
| | | Green: blinks | Data is being transmitted |
| | | Yellow: off | No connection is set up on the port |

## 4.3.2 H901CKUA Daughter Board

The H901CKUA is a stratum-3 clock daughter board. It works with the control board to implement stratum-3 clock functions.

**Table 4-3** Daughter board list

| Daughter Board | Corresponding MPL Board | Function |
|---|---|---|
| H901CKUA | H901MPLB | Implements clock processing and provides the stratum-3 clock for the system. |


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# 4.4 Upstream Interface Board

Upstream interface boards provide upstream or cascading ports for the system.

## 4.4.1 H901NXED-8-port Optical Uplink Interface Card

The H901NXED board is a 8-port Optical Uplink Interface Card that provides upstream optical ports.

### Feature and Specifications

The H901NXED board supports the following features and specifications:

- 8 ETH SFP ports that support 10GE/GE optical modules
- Line clock used as the system clock
- A maximum of 80 Gbit/s non-convergence upstream bandwidth
- Ethernet clock synchronization
- High-temperature protection
- Board power-off for energy conservation

### Parameters

Please refer to "Power Consumption and Maximum Frame Size of Boards".


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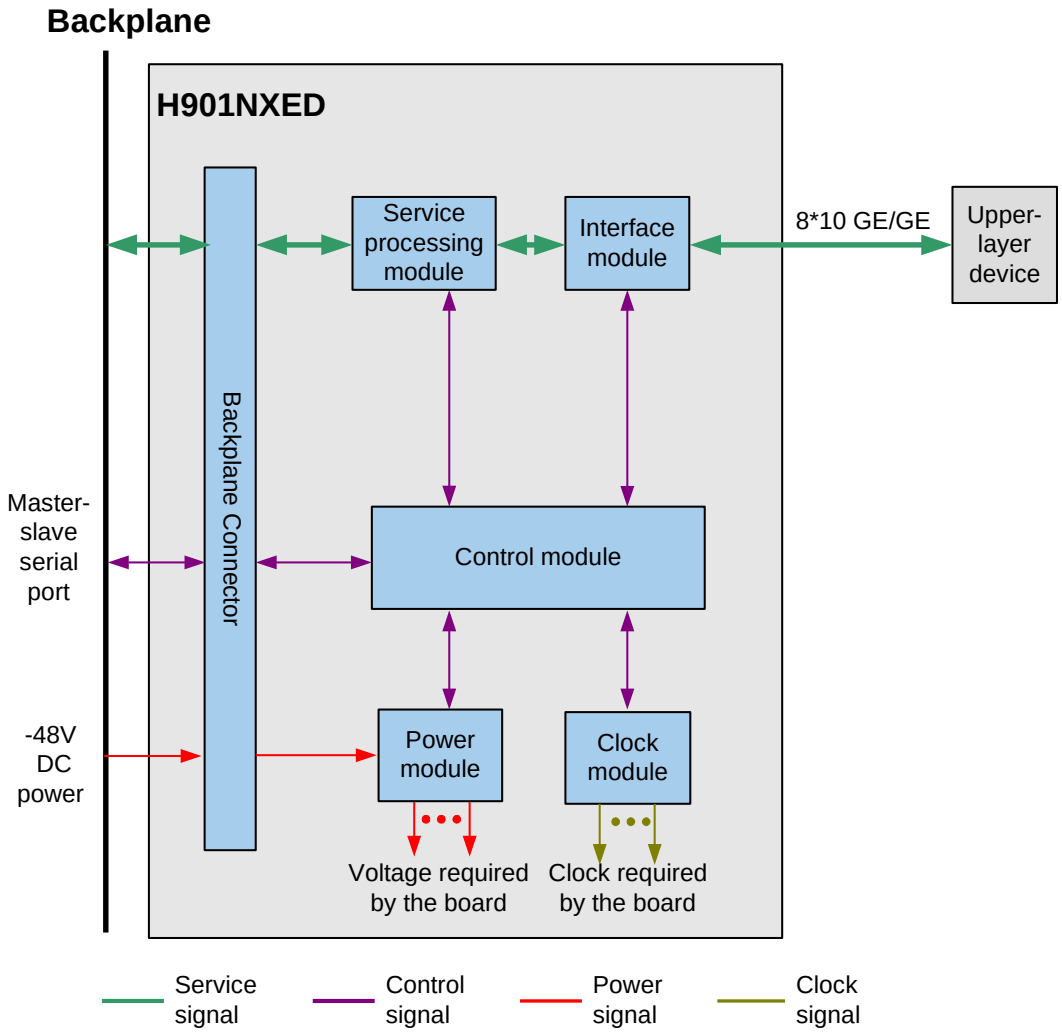
## Working Principle

**Figure 4-5** Working principles of the H901NXED board




The basic working principle of the H901NXED board is as follows:

- The control module loads the board software, controls the running of the board, and manages the entire board.
- The interface module provides 8 SFP ETH ports.
- The service processing module supports ETH upstream transmission and the line clock can be used as the system clock.
- The power module supplies power to other functional modules of the board.
- The clock module provides clock signals for each functional module of the board.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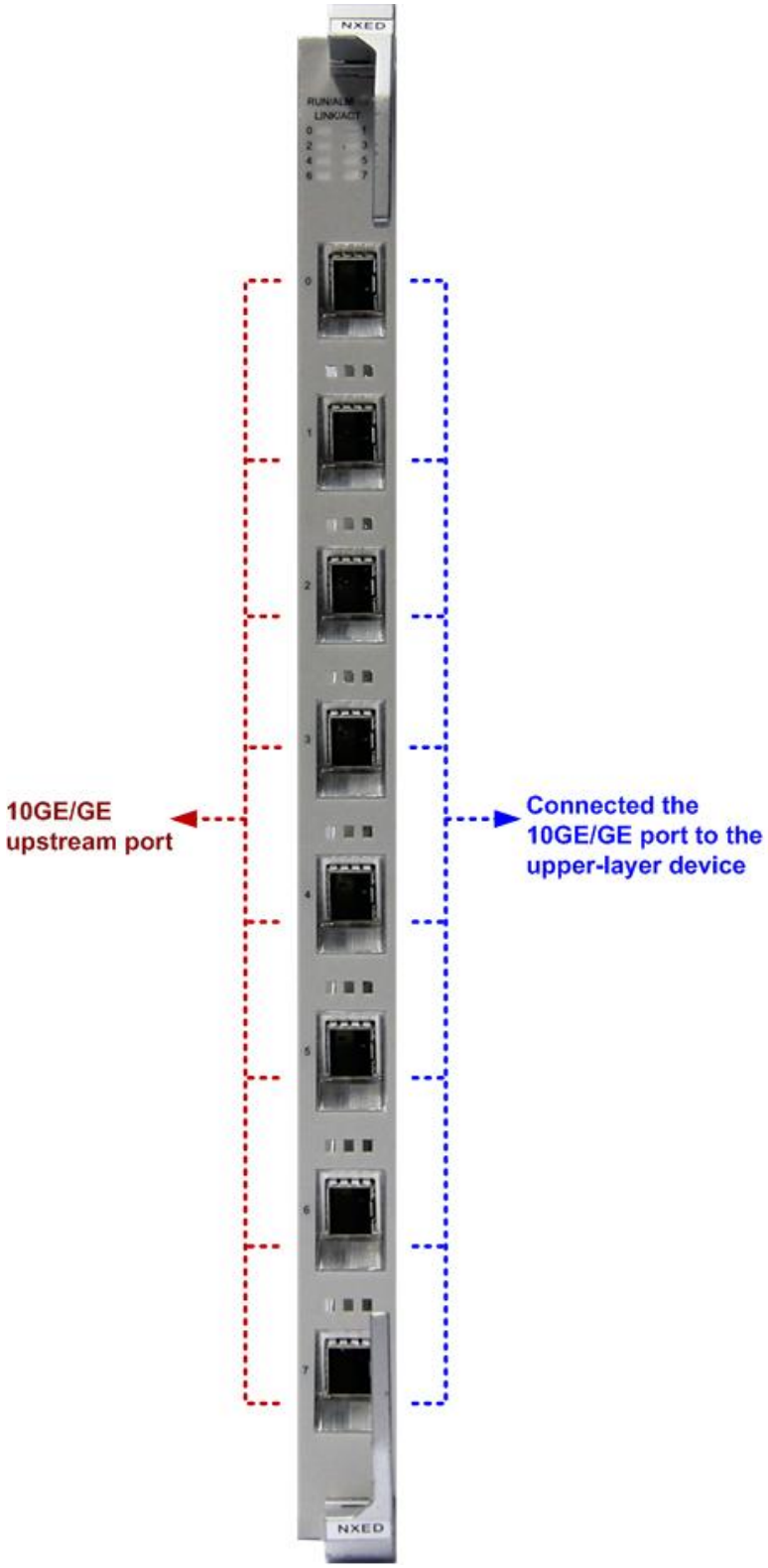
## Front Panel Port




For details about supported optical module, see 5.2 10GE Optical Module and 5.1 GE Optical/Electrical Module.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### Indicator

| Indicator | Name | Status | Operation Description |
|---|---|---|---|
| RUN/ALM | Running status indicator | Red: blinks | The board enters the APP start phase during the board startup |
| | | Green: blinks every 0.25s | The board enters the phase of communication with the control board during its startup |
| | | Green: blinks every 1s | The board works in the normal state |
| | | Orange: blinks | A high-temperature alarm is generated |
| | | Red: on | The board is faulty |
| LINK/ACT 0-7 | Ethernet link status indicator | Green: on | The link is normal |
| | | Green: blinks | Data is being transmitted |
| | | Yellow: off | No data is being transmitted |

# 4.5 Universal Interface Board (GPIO)

Universal interface boards (installed in the GPIO slot) receive the clock signals and ESC parameters. GPIO is short for general purpose input/output.

## 4.5.1 H901CIUA Board

The H901CIUA board is a General Interface Board. It provides the input and output clock source for the system and supports functions such as input and output of alarm digital parameters.

### Feature and Specifications

The H901CIUA board supports the following functions:

- Seven inputs of alarm digital parameters and one output of digital controlling parameters
- Two inputs of 2 Mbit/s or 2 MHz BITS clock signals
- Two inputs of 1 PPS+TOD time signals
- One output of 2 Mbit/s or 2 MHz clock signals
- One output of 1PPS time signals
- External monitoring Ethernet port to transparently transmit monitored data
- RS485 port to transparently transmit data
- Multiple working modes, such as tracing, holdover, and free-run


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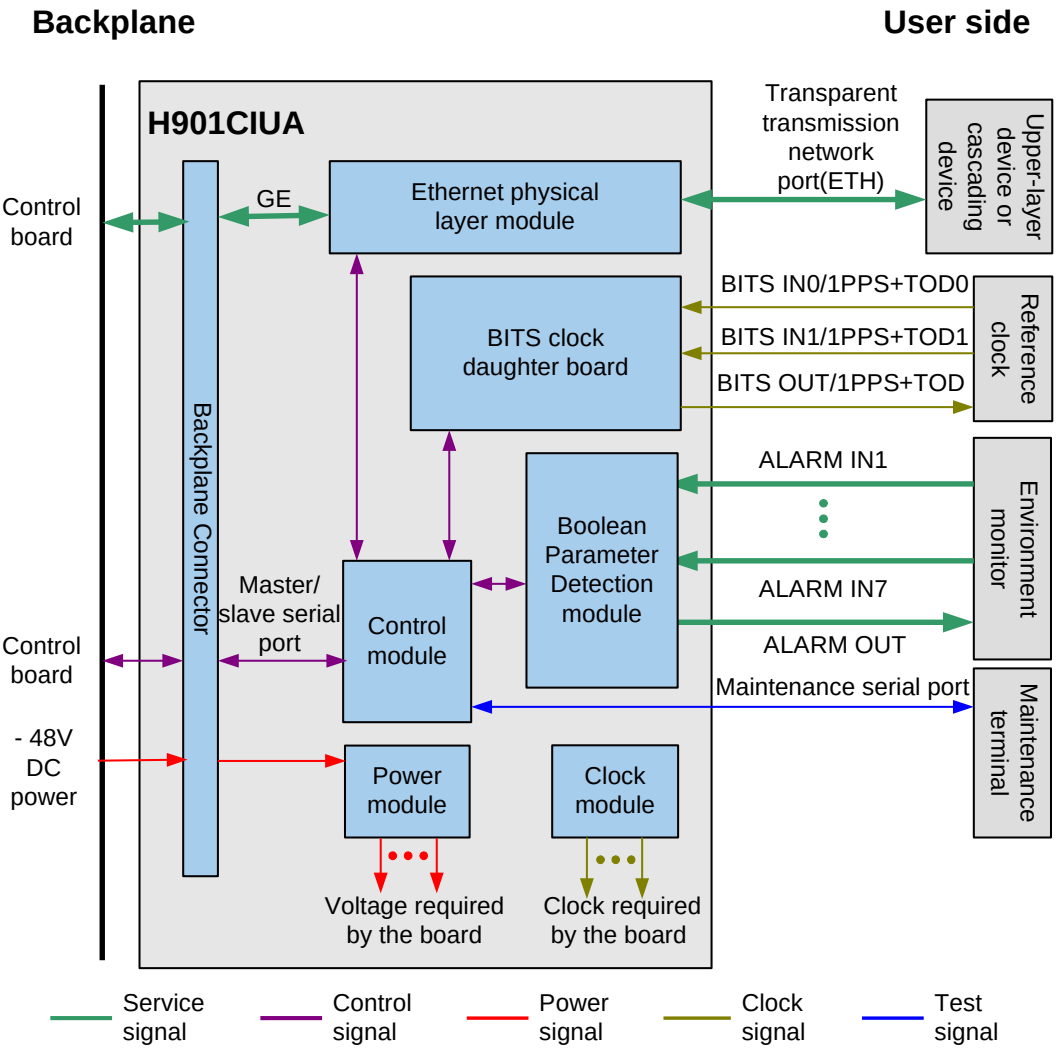
## Parameters

Please refer to "Power Consumption and Maximum Frame Size of Boards".

## Working Principle

**Figure 4-6** Working principle of the H901CIUA board




The H901CIUA board consists of the control module, interface module, power module, and clock module. The basic working principle of the H901CIUA board is as follows:

- The control module controls each functional module of the board and reads the vendor information about the power board, service board, and BITS daughter board.
- The interface module provides the BITS clock port, time port, GE transparent transmission port, alarm port, and SPM serial port.
- The BITS clock daughter board recovers the 2 Mbit/s clock signals or shapes the 2 MHz clock signals, which can function as the system clock source.
- The power module supplies power to each functional module of the board and +5 V DC power to the backplane and the power board.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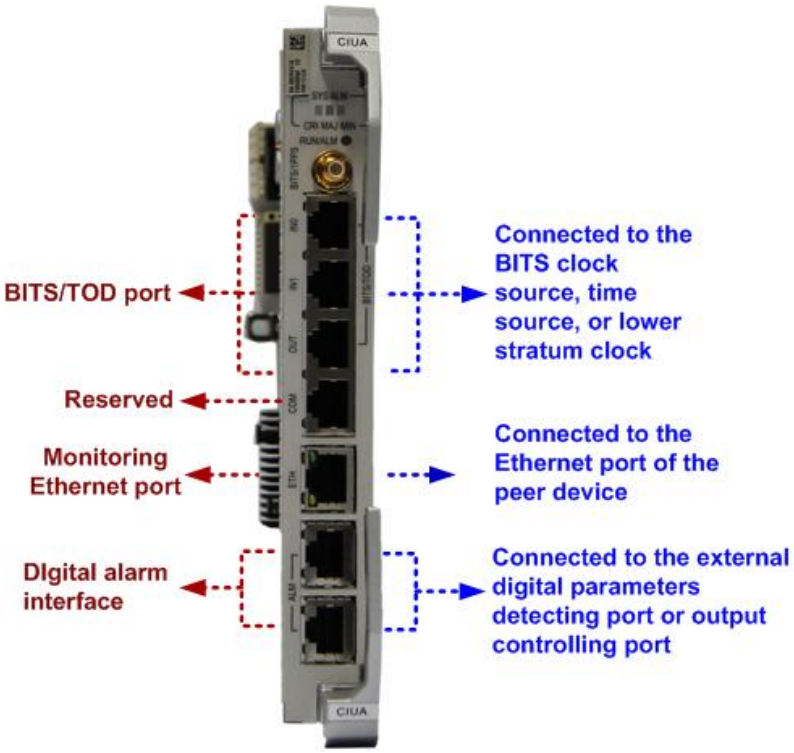
- The clock module provides clock signals for each functional module of the board.

## Front Panel Port




## Indicator

| Indicator | name | Status | Operation Description |
|---|---|---|---|
| RUN/ALM | Running status indicator | Green: blinks every 1s | The board works in the normal state |
| | | Green: blinks every 0.25s | The board is being registered |
| | | Red: on | The board is faulty |
| SYSALM: CRI, MAJ, MIN | Alarm indicators | CRI (red): on | The system has generated a critical alarm |
| | | MAJ (red): on | The system has generated a major alarm |
| | | MIN (red): on | The system has generated a minor alarm |
| ETH | Link/data status indicator | Green: on | The link is normal |
| | | Orange: blinks | Data is being transmitted |
| | | Green: off | No data is being transmitted |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## Pin Assignments

**Table 4-4** Pin assignments of the BITS/TOD IN0 port

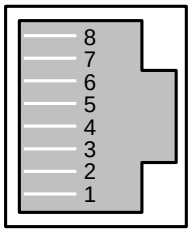
| Port | Pin | Signal | Remarks |
|---|---|---|---|
|  | 1 | BITS0_IN- | Input B of channel 0 BITS clock signals |
| | 2 | BITS0_IN+ | Input A of channel 0 BITS clock signals |
| | 3 | PPS0_IN- | Negative polarity of channel 0 PPS time signals |
| | 4 | TOD0_IN- | Negative polarity of channel 0 TOD time signals |
| | 5 | TOD0_IN+ | Positive polarity of channel 0 TOD time signals |
| | 6 | PPS0_IN+ | Positive polarity of channel 0 PPS time signals |
| | 7 | - | - |
| | 8 | GND | Grounding |

**Table 4-5** Pin assignments of the BITS/TOD IN1 port

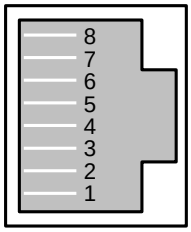
| Port | Pin | Signal | Remarks |
|---|---|---|---|
|  | 1 | BITS1_IN- | Negative polarity of channel 1 BITS clock signals |
| | 2 | BITS1_IN+ | Positive polarity of channel 1 BITS clock signals |
| | 3 | PPS1_IN- | Negative polarity of channel 1 PPS time signals |
| | 4 | TOD1_IN- | Negative polarity of channel 1 TOD time signals |
| | 5 | TOD1_IN+ | Positive polarity of channel 1 TOD time signals |
| | 6 | PPS1_IN+ | Positive polarity of channel 1 PPS time signals |
| | 7 | - | - |
| | 8 | GND | Grounding |


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**Table 4-6** Pin assignments of the BITS OUT port

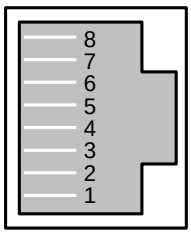
| Port | Pin | Signal | Remarks |
|---|---|---|---|
|  | 1 | TOD_OUT- | Negative polarity of TOD time signals |
| | 2 | TOD_OUT+ | Positive polarity of TOD time signals |
| | 3 | PPS_OUT- | Negative polarity of 1PPS time signals |
| | 4 | BITS_OUT- | Negative polarity of the BITS clock signals |
| | 5 | BITS_OUT+ | Positive polarity of the BITS clock signals |
| | 6 | PPS_OUT+ | Positive polarity of the 1PPS time signals |
| | 7 | GND | Grounding |
| | 8 | - | - |

**Table 4-7** Pin assignments of the ETH port

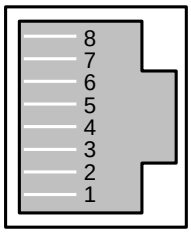
| Port | Pin | Signal | Remarks |
|---|---|---|---|
|  | 1 | GE1_MDI_T0+ | GE electrical port |
| | 2 | GE1_MDI_T0- | |
| | 3 | GE1_MDI_T1+ | |
| | 4 | GE1_MDI_T2+ | |
| | 5 | GE1_MDI_T2– | |
| | 6 | GE1_MDI_T1- | |
| | 7 | GE1_MDI_T3+ | |
| | 8 | GE1_MDI_T3- | |


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**Table 4-8** Pin assignments of the COM port

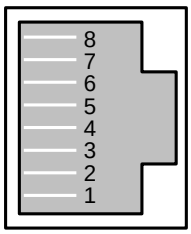
| Port | Pin | Signal | Remarks |
| --- | --- | --- | --- |
|  | 1 | RP(B_SPM_485_RX+) | 485 serial port of the control board |
| | 2 | RN(B_SPM_485_RX-) | 485 serial port of the control board |
| | 3 | - | - |
| | 4 | TP(B_SPM_485_TX+) | 485 serial port of the control board |
| | 5 | TN(B_SPM_485_TX-) | 485 serial port of the control board |
| | 6 | - | - |
| | 7 | - | - |
| | 8 | - | - |

**Table 4-9** Pin assignments of the ALM port (upper)

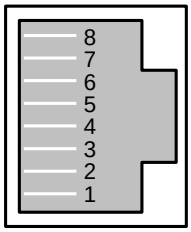
| Port | Pin | Signal | Remarks |
| --- | --- | --- | --- |
|  | 1 | ALM_IN0_+ | Signal + of channel 0 alarm digital parameter |
| | 2 | ALM_IN0_- | Signal - of channel 0 alarm digital parameter |
| | 3 | ALM_IN1_+ | Signal + of channel 1 alarm digital parameter |
| | 4 | ALM_IN2_+ | Signal + of channel 2 alarm digital parameter |
| | 5 | ALM_IN2_- | Signal - of channel 2 alarm digital parameter |
| | 6 | ALM_IN1_- | Signal - of channel 1 alarm digital parameter |
| | 7 | ALM_IN3_+ | Signal + of channel 3 alarm digital parameter |
| | 8 | ALM_IN3_- | Signal - of channel 3 alarm digital parameter |


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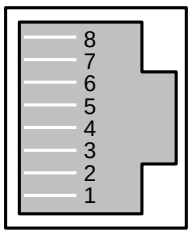
**Table 4-10** Pin assignments of the ALM port (lower)

| Port | Pin | Signal | Remarks |
|---|---|---|---|
|  | 1 | ALM_IN4_+ | Signal + of channel 4 alarm digital parameter |
| | 2 | ALM_IN4_- | Signal - of channel 4 alarm digital parameter |
| | 3 | ALM_IN5_+ | Signal + of channel 5 alarm digital parameter |
| | 4 | ALM_IN6_+ | Signal + of channel 6 alarm digital parameter |
| | 5 | ALM_IN6_- | Signal - of channel 6 alarm digital parameter |
| | 6 | ALM_IN5_- | Signal - of channel 5 alarm digital parameter |
| | 7 | ALM_OUT_+ | Output + of the alarm control signals |
| | 8 | ALM_OUT_- | Output - of the alarm control signals |

# 4.6 Power Board

Power boards lead in DC power for supplying power to the device MA5800.

## 4.6.1 H901PILA Board

The H901PILA is a Connect Power Board. It leads in the -48 V DC power supply for the device.

### Features and Specifications

The H901PILA board supports the following features and specifications:

- One -48 V DC power input
- Filtering and current-limiting for the power input port
- Power input detection and protection fuse fault detection
- Reporting of the protection alarm and board online signal

### Parameters

Please refer to "Power Consumption and Maximum Frame Size of Boards".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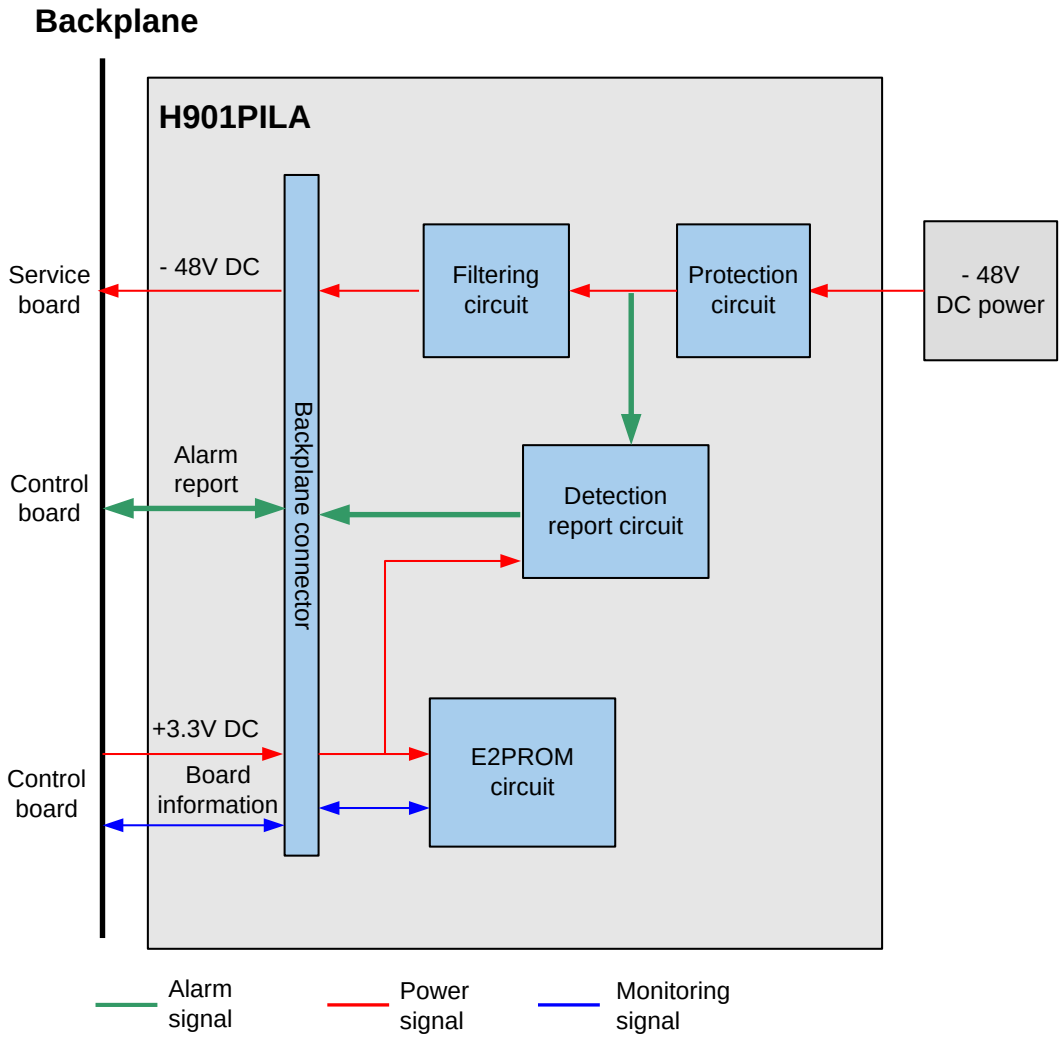
## Working Principle

**Figure 4-7** Working principle of the H901PILA board




The basic working principle of the H901PILA board is as follows:

- The H901PILA board leads in one -48 V DC power through two 100 A OT terminals, and transfers the power to the protection circuit, then to the filter circuit, and finally to the backplane, supplying power to the subrack and other boards.
- The detection circuit checks the protection fuse for any faults and detects power input and the board ready status. It reports the detected results to the control board through the backplane.
- The E2PROM circuit stores the vendor information of the board.
- The +3.3 V DC power led from the backplane is used to supply some chips of the board.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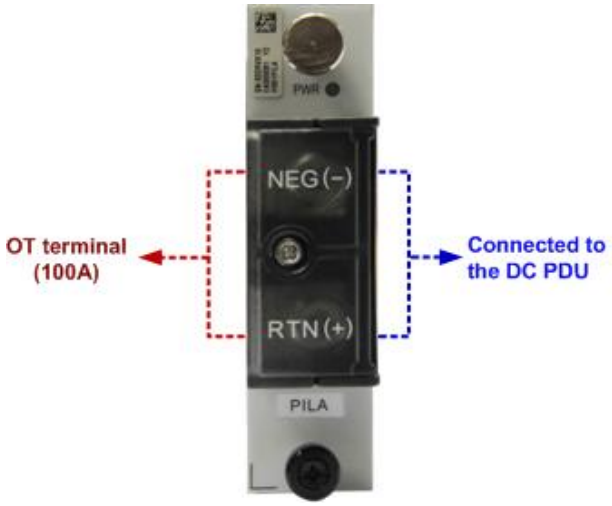
### Front Panel Port




### Indicator

| Indicator | name | Status | Operation Description |
|---|---|---|---|
| PWR | Running status indicator | Green: on | The input voltage and the protection fuse are normal. |
| | | Red: on | The input voltage is normal but the protection fuse is faulty. |
| | | Off | There is no power input or power system is faulty. |

# 4.7 Service Board

MA5800-X17 supports GPON service boards and Ethernet service boards.

## 4.7.1 H901GPHF Board

The H901GPHF board is a 16-port GPON Interface Board. It works together with the optical network terminal (ONT) to provide GPON access services.

### Feature and Specifications

The H901GPHF board supports the following features and specifications:

- 16 GPON SFP ports
- A maximum of 1:128 split ratio
- Class B+/C+ one-fiber bi-directional optical modules
- Received signal strength indicator (RSSI) detection and optical signal transmission control of the optical module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- ONU-based traffic shaping
- Temperature reading and high-temperature alarm
- Automatic power-off in case of high temperature
- Upstream and downstream forward error correction (FEC)
- Type B/Type C protection
- A maximum of 20 km transmission distance
- Rogue ONU detection
- Optical power budget of the GPON port
  - Class B+ optical module with a 28.5 dB power budget (used in most cases)
  - Class C+ optical module with a 32 dB budget (used for long-distance transmission)

## Parameters

Please refer to "Power Consumption and Maximum Frame Size of Boards".


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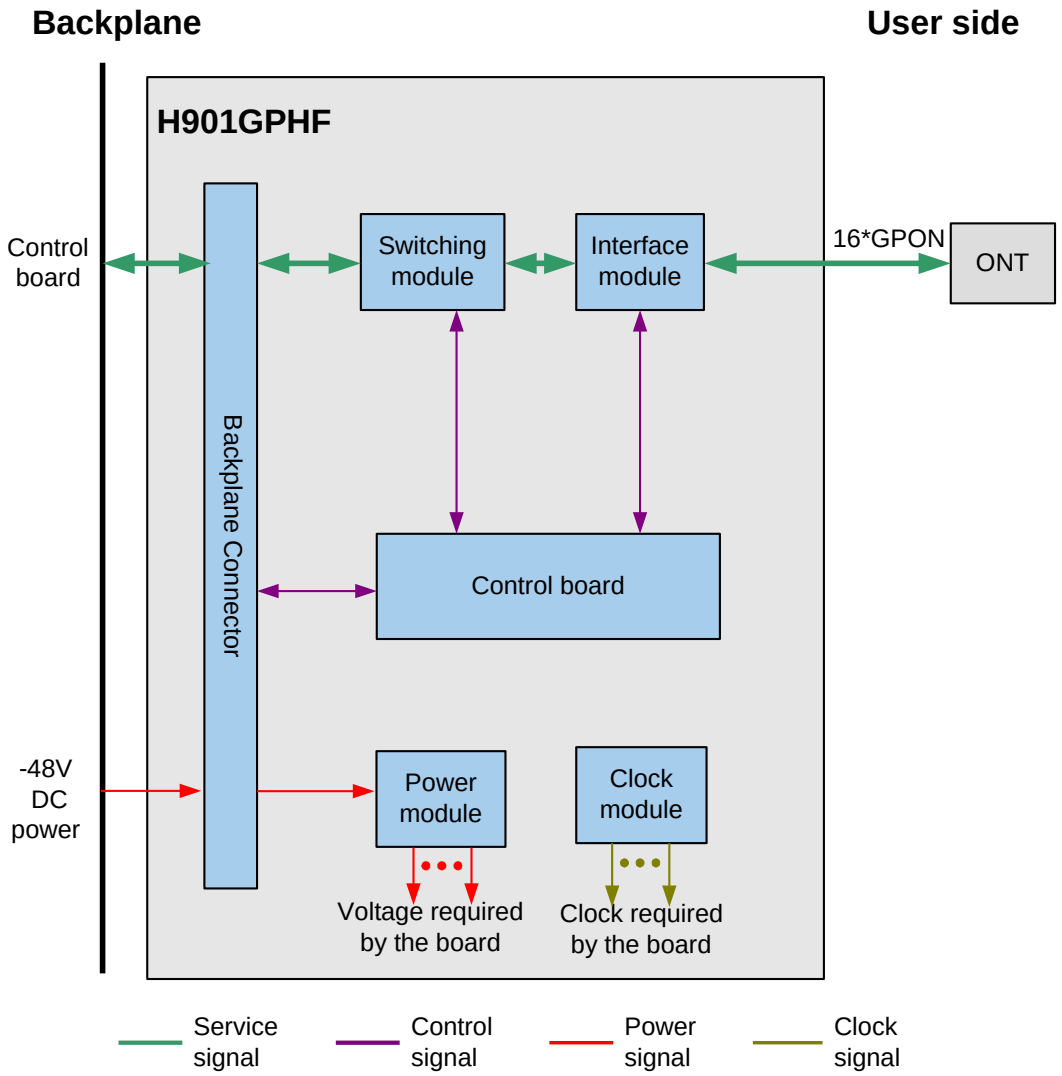
## Working Principle

**Figure 4-8** Working principle of the H901GPHF board




The basic working principle of the H901GPHF board is as follows:

- The control module loads the board software, controls the running of the board, and manages the entire board.
- The switching module aggregates and forwards the signals from 16 GPON ports.
- The interface module performs conversion between GPON optical signals and Ethernet packets.
- The power module supplies power to each functional module of the board.
- The clock module provides clock signals for each functional module of the board.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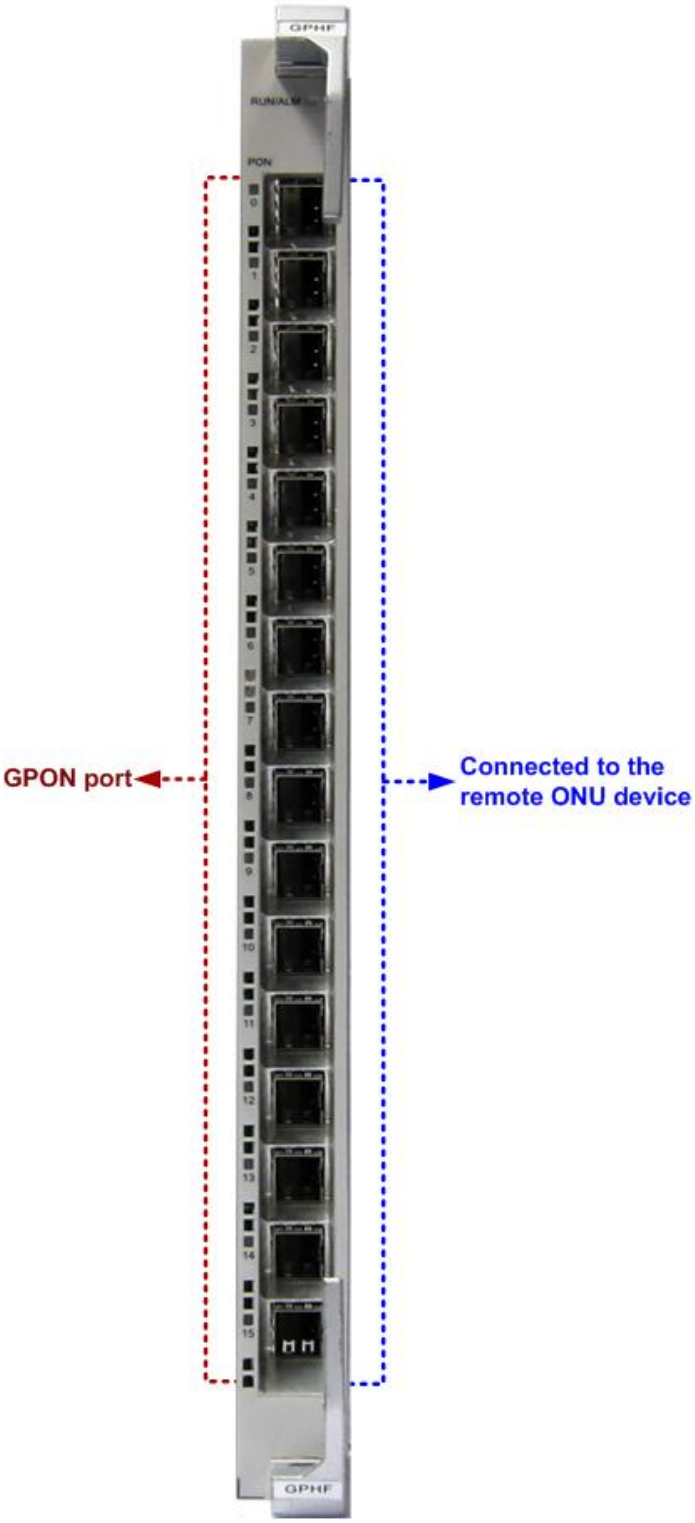
## Front Panel Port




For details about supported optical module, see 5.4 PON Optical Module.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### Indicator

| Indicator | Name | Status | Operation Description |
|---|---|---|---|
| RUN/ALM | Running status indicator | Red: blinks | The board enters the APP start phase during the board startup |
| | | Green: blinks every 0.25s | The board enters the phase of communication with the control board during its startup |
| | | Green: blinks every 1s | The board works in the normal state |
| | | Orange: blinks | A high-temperature alarm is generated |
| | | Red: on | The board is faulty |
| PON<br>0-15 | PON port indicator | Green: on | The ONT of the related PON port is online |
| | | Green: blinks | The optical module does not take effect |
| | | Green: off | The ONT of the related PON port is offline |

## 4.7.2 H901GPSF Board

The H901GPSF board is a 16-port GPON Interface Board. It works together with the optical network terminal (ONT) to provide GPON access services.

### Feature and Specifications

The H901GPSF board supports the following features and specifications:

- 16 GPON SFP ports
- A maximum of 1:128 split ratio
- Class B+/C+ one-fiber bi-directional optical modules
- Received signal strength indicator (RSSI) detection and optical signal transmission control of the optical module
- ONU-based traffic shaping
- Temperature reading and high-temperature alarm
- Automatic power-off in case of high temperature
- Upstream and downstream forward error correction (FEC)
- Type B/Type C protection
- A maximum of 20 km transmission distance
- Rogue ONU detection
- Optical power budget of the GPON port
  - Class B+ optical module with a 28.5 dB power budget (used in most cases)


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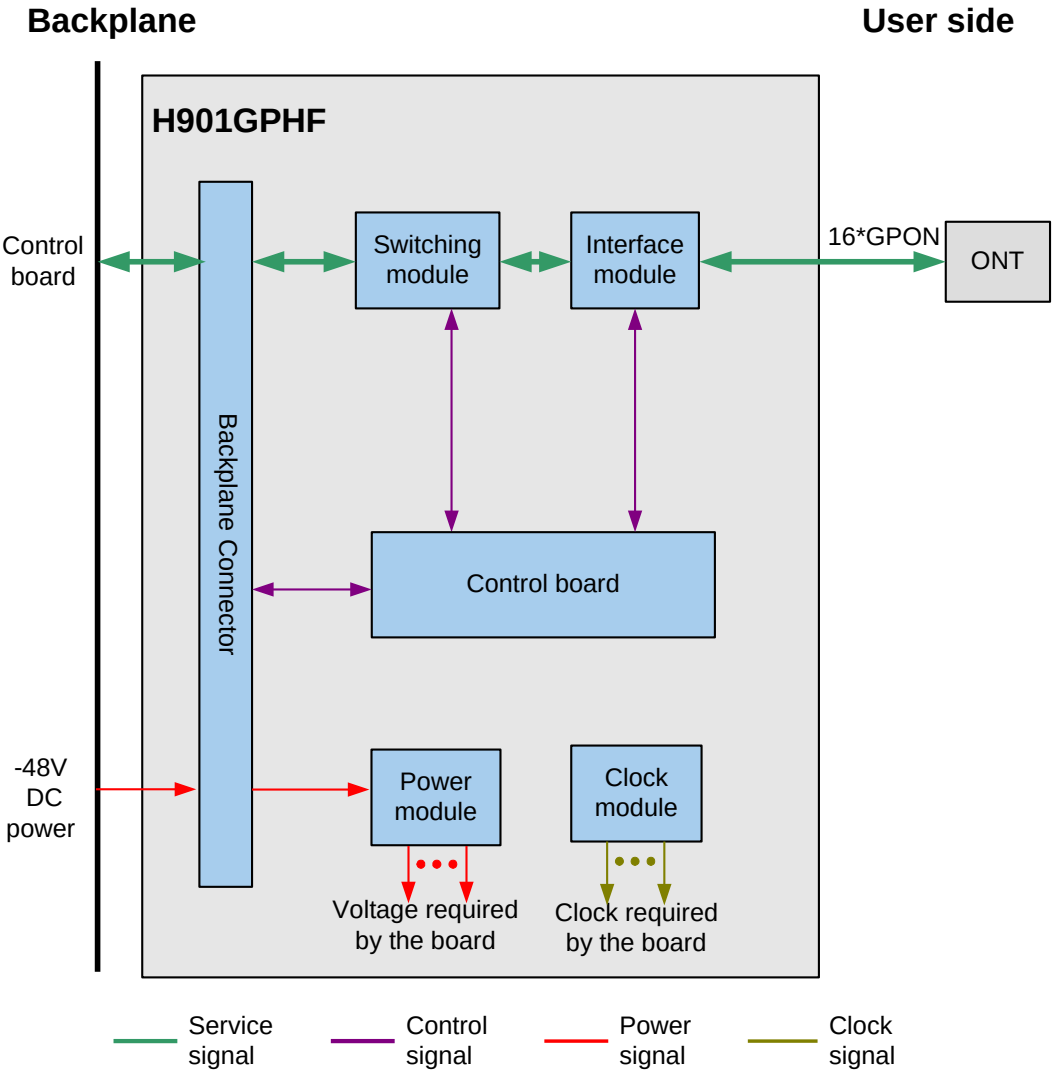
– Class C+ optical module with a 32 dB budget (used for long-distance transmission)

## Parameters

Please refer to "Power Consumption and Maximum Frame Size of Boards".

## Working Principle

**Figure 4-9** Working principle of the H901GPSF board




The basic working principle of the H901GPSF board is as follows:

- The control module loads the board software, controls the running of the board, and manages the entire board.
- The switching module aggregates and forwards the signals from 16 GPON ports.
- The interface module performs conversion between GPON optical signals and Ethernet packets.
- The power module supplies power to each functional module of the board.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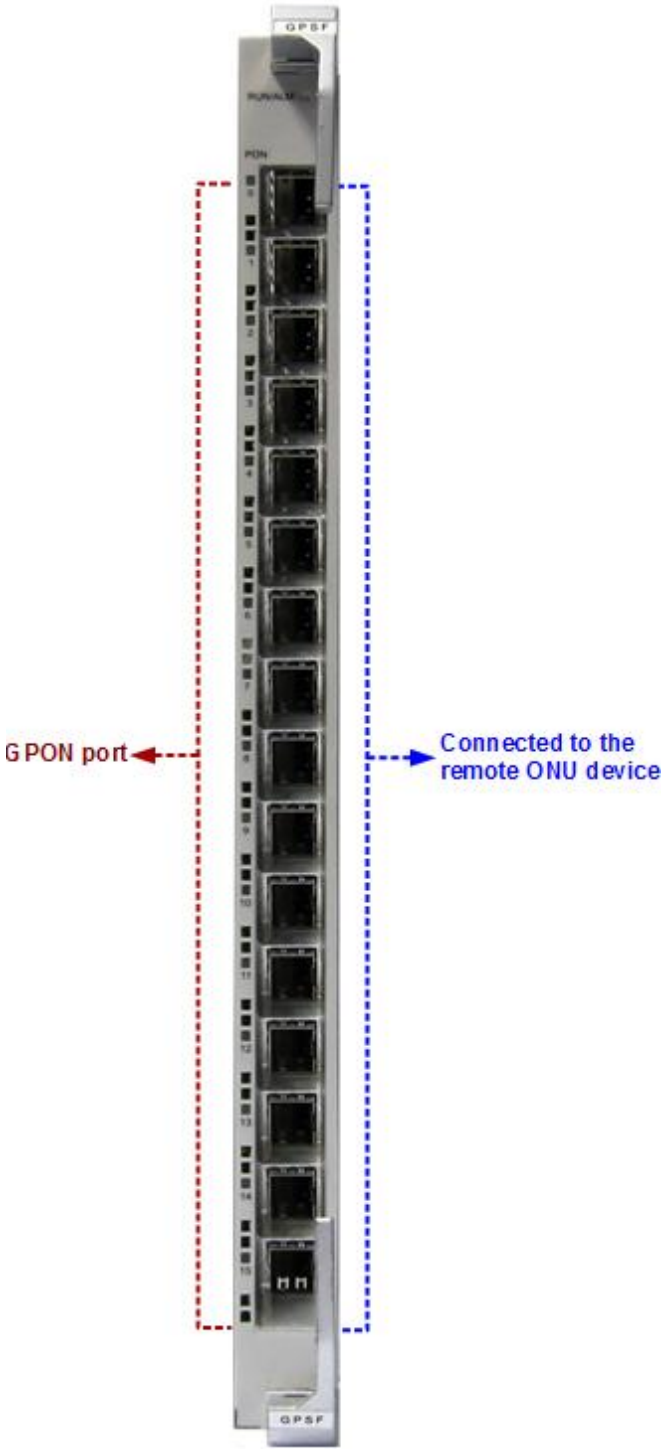
- The clock module provides clock signals for each functional module of the board.

## Front Panel Port




For details about supported optical module, see 5.4 PON Optical Module.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### Indicator

| Indicator | Name | Status | Operation Description |
|---|---|---|---|
| RUN/ALM | Running status indicator | Red: blinks | The board enters the APP start phase during the board startup |
| | | Green: blinks every 0.25s | The board enters the phase of communication with the control board during its startup |
| | | Green: blinks every 1s | The board works in the normal state |
| | | Orange: blinks | A high-temperature alarm is generated |
| | | Red: on | The board is faulty |
| PON<br>0-15 | PON port indicator | Green: on | The ONT of the related PON port is online |
| | | Green: blinks | The optical module does not take effect |
| | | Green: off | The ONT of the related PON port is offline |

# 4.8 10G GPON Service Board

10G GPON service boards work with ONUs to provide 10G GPON access service.

## 4.8.1 H901XGHD Board

The H901XGHD board is a 8-port 10G GPON Interface Board. It works together with the optical network terminal (ONT) to provide 10G GPON access services.

### Feature and Specifications

The H901XGHD board supports the following features and specifications:

- Eight 10G GPON SFP ports
- A maximum of 1:128 split ratio
- One-fiber bi-directional optical module
- Received signal strength indicator (RSSI) detection and optical signal transmission control of the optical module
- ONU-based traffic shaping
- Temperature reading and high-temperature alarm
- Automatic power-off in case of high temperature
- Upstream and downstream forward error correction (FEC)
- Type B/Type C protection


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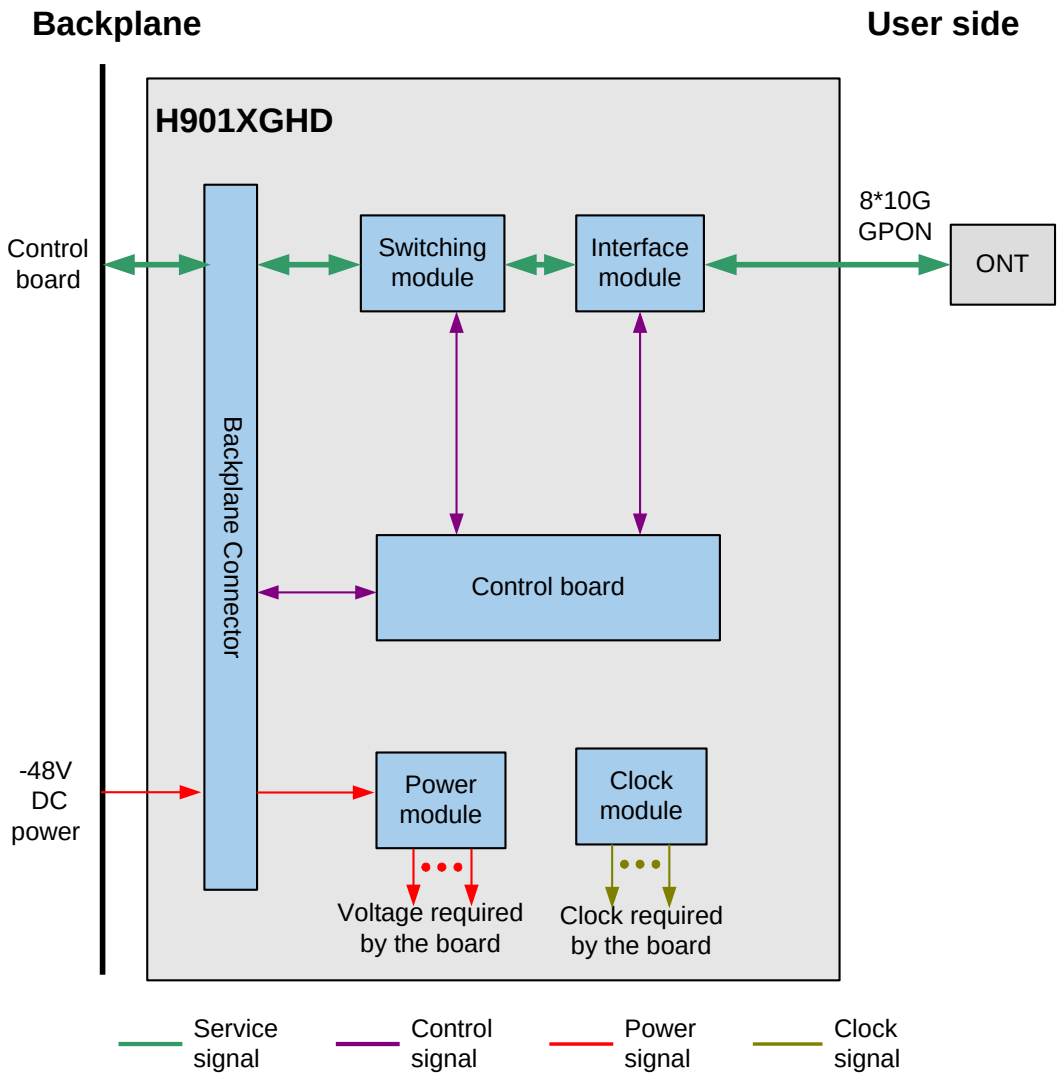
- A maximum of 40 km transmission distance
- Rogue ONU detection

## Parameters

Please refer to "Power Consumption and Maximum Frame Size of Boards".

## Working Principle

**Figure 4-10** Working principle of the H901XGHD board




The basic working principle of the H901XGHD board is as follows:

- The control module loads the board software, controls the running of the board, and manages the entire board.
- The switching module aggregates and forwards the signals from 8 10G GPON ports.
- The interface module performs conversion between 10G GPON optical signals and Ethernet packets.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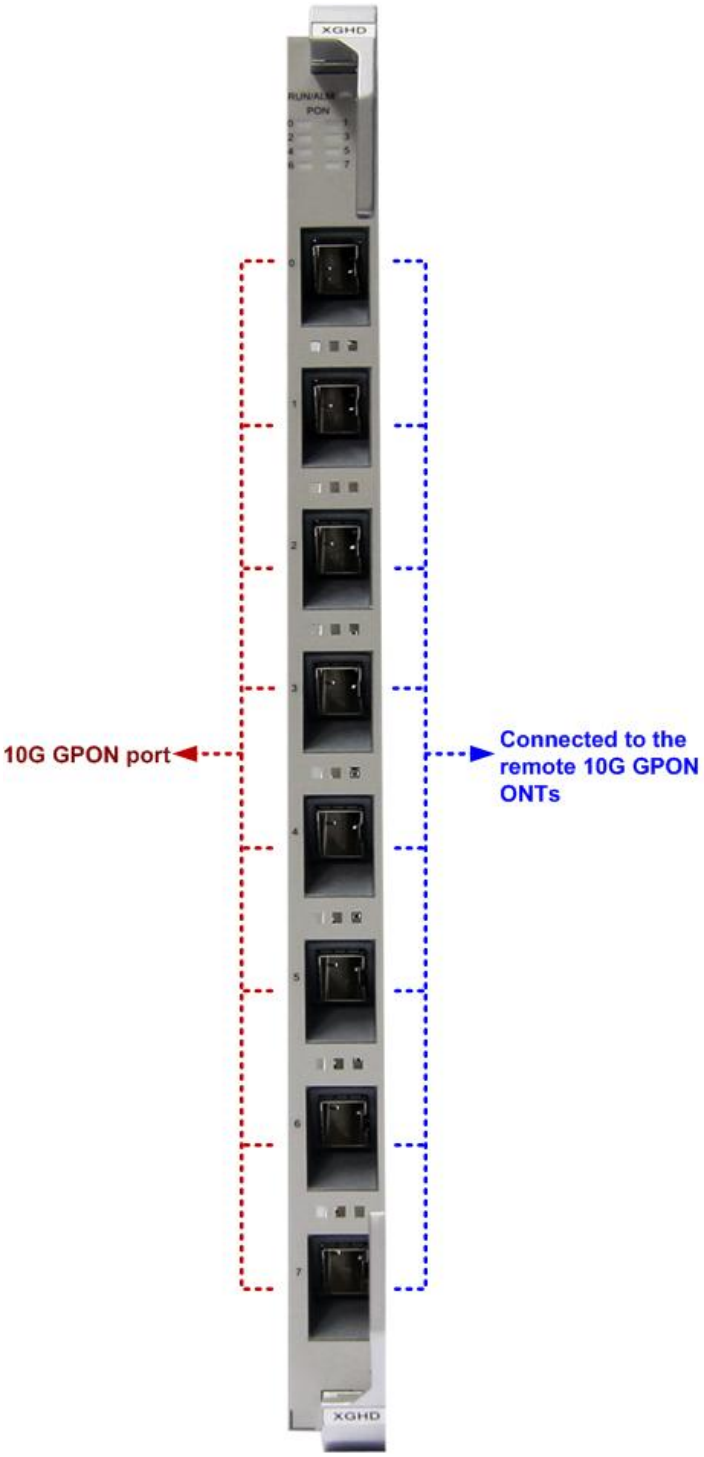
- The power module supplies power to each functional module of the board.
- The clock module provides clock signals for each functional module of the board.

## Front Panel Port




For details about supported optical module, see 5.4 PON Optical Module.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### Indicator

| Indicator | Name | Status | Operation Description |
|---|---|---|---|
| RUN/ALM | Running status indicator | Red: blinks | The board enters the APP start phase during the board startup |
| | | Green: blinks every 0.25s | The board enters the phase of communication with the control board during its startup |
| | | Green: blinks every 1s | The board works in the normal state |
| | | Orange: blinks | A high-temperature alarm is generated |
| | | Red: on | The board is faulty |
| PON<br>0-7 | PON port indicator | Green: on | The ONT of the related PON port is online |
| | | Green: blinks | The optical module does not take effect |
| | | Green: off | The ONT of the related PON port is offline |

# 4.9 TDM Service Processing Board

TDM service processing boards include H901EDSH.

## 4.9.1 H901EDSH Board

The H901EDSH is a 32-channel TDM E1 upstream board, it provides TDM service upstream ports.

### Overview

The H901EDSH board supports the following functions:

- Native TDM function
- CESoP function
- Temperature query and high-temperature alarm
- Automatic power shutdown in case of a high temperature

### Parameters

Please refer to "Power Consumption and Maximum Frame Size of Boards".


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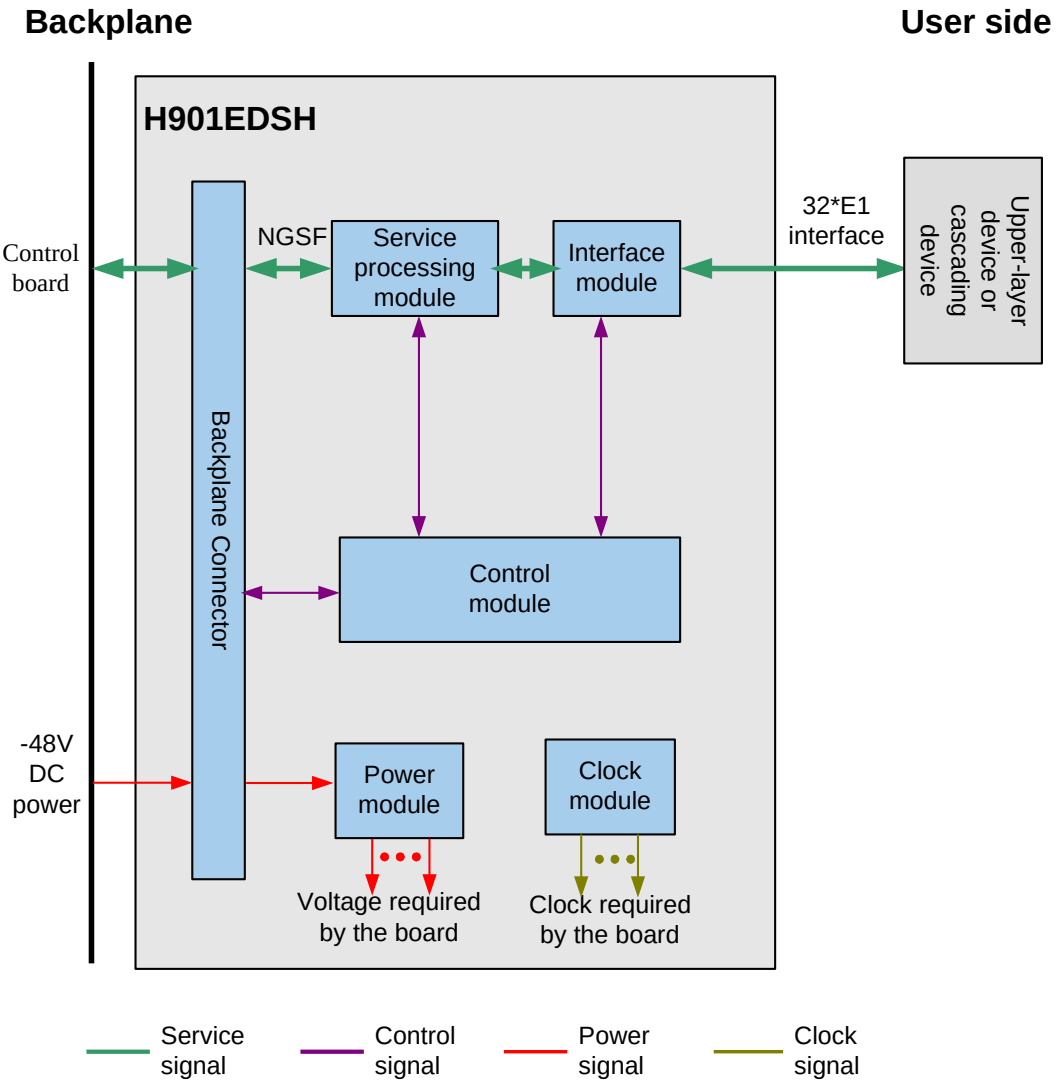
## Working Principle

**Figure 4-11** Working principle of the H901EDSH board




The basic working principle of the H901EDSH board is as follows:

- The control module loads the board software, controls, and manages the entire board.
- The service processing module allocates the GE bus of the backplane and processes signals.
- The interface module converts signals.
- The power module supplies power to each functional module of the board.
- The clock module provides clock signals for each functional module of the board.

The service process is as follows:

- In the upstream direction, after passing the interface module, the GE signals from the backplane are converted into the TDM frames. Then, the TDM frames are transmitted upstream.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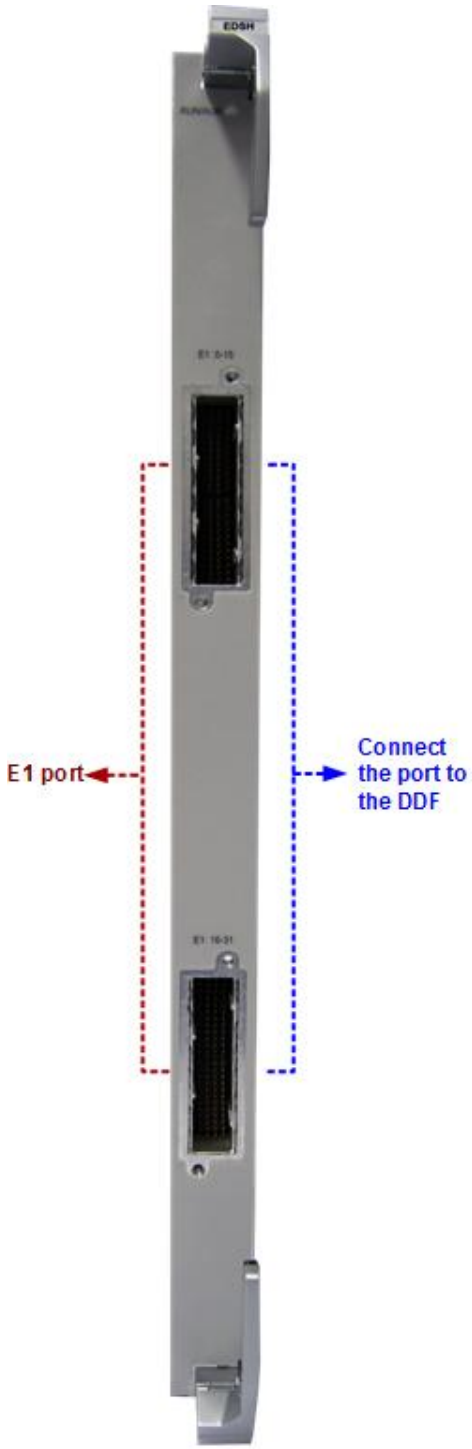
- In the downstream direction, the interface module receives the signals from the TDM line, and converts and encapsulates the signals into GE packets. After being transmitted to the backplane bus through the service processing module, the GE packets are transmitted to the control board. Then, the control board forwards the GE packets to the related service boards.

## Front Panel Port





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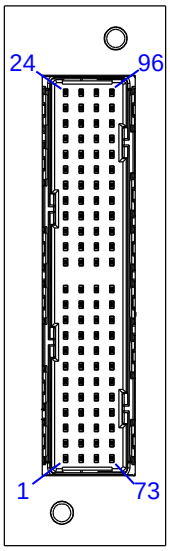
## Indicator

| Indicator | Name | Status | Operation Description |
|---|---|---|---|
| RUN/ALM | Running status indicator | Red: blinks | The board enters the APP start phase during the board startup |
| | | Green: blinks every 0.25s | The board enters the phase of communication with the control board during its startup |
| | | Green: blinks every 1s | The board works in the normal state |
| | | Orange: blinks | A high-temperature alarm is generated |
| | | Red: on | The board is faulty |

## Pin Assignments of the EDSH Board

Table 4-11 describes the pin assignments of the E1 port on the front panel of the H901EDSH board.

**Table 4-11** Pin assignments of the E1 port

| Pin | Signal | | Pin | Signal | Port | Pin | Signal | | Pin | Signal |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | RT0 | | 25 | TT0 |  | 49 | RT12 | | 73 | TT12 |
| 2 | RR0 | | 26 | TR0 | | 50 | RR12 | | 74 | TR12 |
| 3 | RT1 | | 27 | TT1 | | 51 | RT13 | | 75 | TT13 |
| 4 | RR1 | | 28 | TR1 | | 52 | RR13 | | 76 | TR13 |
| 5 | RT2 | | 29 | TT2 | | 53 | RT14 | | 77 | TT14 |
| 6 | RR2 | | 30 | TR2 | | 54 | RR14 | | 78 | TR14 |
| 7 | RT3 | | 31 | TT3 | | 55 | RT15 | | 79 | TT15 |
| 8 | RR3 | | 32 | TR3 | | 56 | RR15 | | 80 | TR15 |
| 9 | RT4 | | 33 | TT4 | | 57 | / | | 81 | / |
| 10 | RR4 | | 34 | TR4 | | 58 | / | | 82 | / |
| 11 | RT5 | | 35 | TT5 | | 59 | / | | 83 | / |
| 12 | RR5 | | 36 | TR5 | | 60 | / | | 84 | / |
| 13 | RT6 | | 37 | TT6 | | 61 | / | | 85 | / |
| 14 | RR6 | | 38 | TR6 | | 62 | / | | 86 | / |
| 15 | RT7 | | 39 | TT7 | | 63 | / | | 87 | / |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| Pin | Signal | | Pin | Signal | Port | Pin | Signal | | Pin | Signal |
|---|---|---|---|---|---|---|---|---|---|---|
| 16 | RR7 | | 40 | TR7 | | 64 | / | | 88 | / |
| 17 | RT8 | | 41 | TT8 | | 65 | / | | 89 | / |
| 18 | RR8 | | 42 | TR8 | | 66 | / | | 90 | / |
| 19 | RT9 | | 43 | TT9 | | 67 | / | | 91 | / |
| 20 | RR9 | | 44 | TR9 | | 68 | / | | 92 | / |
| 21 | RT10 | | 45 | TT10 | | 69 | / | | 93 | / |
| 22 | RR10 | | 46 | TR10 | | 70 | / | | 94 | / |
| 23 | RT11 | | 47 | TT11 | | 71 | / | | 95 | / |
| 24 | RR11 | | 48 | TR11 | | 72 | / | | 96 | / |

**NOTE**

- The first letter "R" and "T" in the above table is on behalf of "receive of E1 signal" and "transmit of E1 signal", respectively.
- The second letter "R" and "T" in the above table is on behalf of "ring of E1 75 ohm coaxial cable" and "tip of E1 75 ohm coaxial cable" respectively, which corresponds to the signal "+" and "–" for E1 120 ohm coaxial cable.

## Jumper Settings for the EDSH Board

Whether the cable is grounded on the EDSH board can be set through the jumpers. The EDSH board has eight sets of jumpers: J23, J26, J28, J29 (corresponding to the 0-15 channels of E1 ports),and J30, J31, J32, J33 (corresponding to the 16-31 channels of E1 ports), Each four sets of jumpers should be set together. Table 4-12 describes the settings of jumpers.

**Table 4-12** Jumper settings for the EDSH board

| Status | Description |
|---|---|
| ON (jumper caps are installed) | The jumper caps should be installed (which means grounded) if the transmit and receive resistance is 75 ohms. |
| OFF (jumper caps are removed) | The jumper caps should be removed (which means ungrounded) if the transmit and receive resistance is 120 ohms. |

**NOTE**

Generally, the coaxial cables connected to the E1 port are unbalanced cables with the resistance of 75 ohms; the twisted pairs connected to the E1 port are balanced cables with the resistance of 120 ohms. The interference source can affect the transmission of analog signals to a great extent. Therefore, the connection mode and grounding mode must be correct and reliable; otherwise, bit error or error message about signal loss may occur.


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# 4.10 P2P Interface Board

Point-to-point (P2P) interface boards work with Ethernet optical network terminals (for example the ONT supporting GE upstream, MxU and lanswitch) to provide P2P optical access services for users.

## 4.10.1 H901OGHK Board

The H901OGHK board is a 48-port GE/FE Optical Interface Board, providing Ethernet optical access. It supports up to 48 channels of GE/FE P2P access services, and is applicable to Ethernet access.

### Feature and Specifications

The H901OGHK board supports the following features and specifications:

- 48-channel (CSFP) or 24-channel (SFP) GE/FE P2P optical access
- Cascading and aggregation
- Two-channel one-fiber bidirectional CSFP optical modules, one-channel two-fiber bidirectional SFP modules, and one-channel one-fiber bidirectional SFP modules
- GE port issuing synchronous Ethernet clock signals
- Temperature reading and high-temperature alarm
- Automatic power-off in case of high temperature
- In-service upgrade
- Reading of optical module status (such as optical power and temperature)
- Board power-off for energy conservation

### Parameters

Please refer to "Power Consumption and Maximum Frame Size of Boards".


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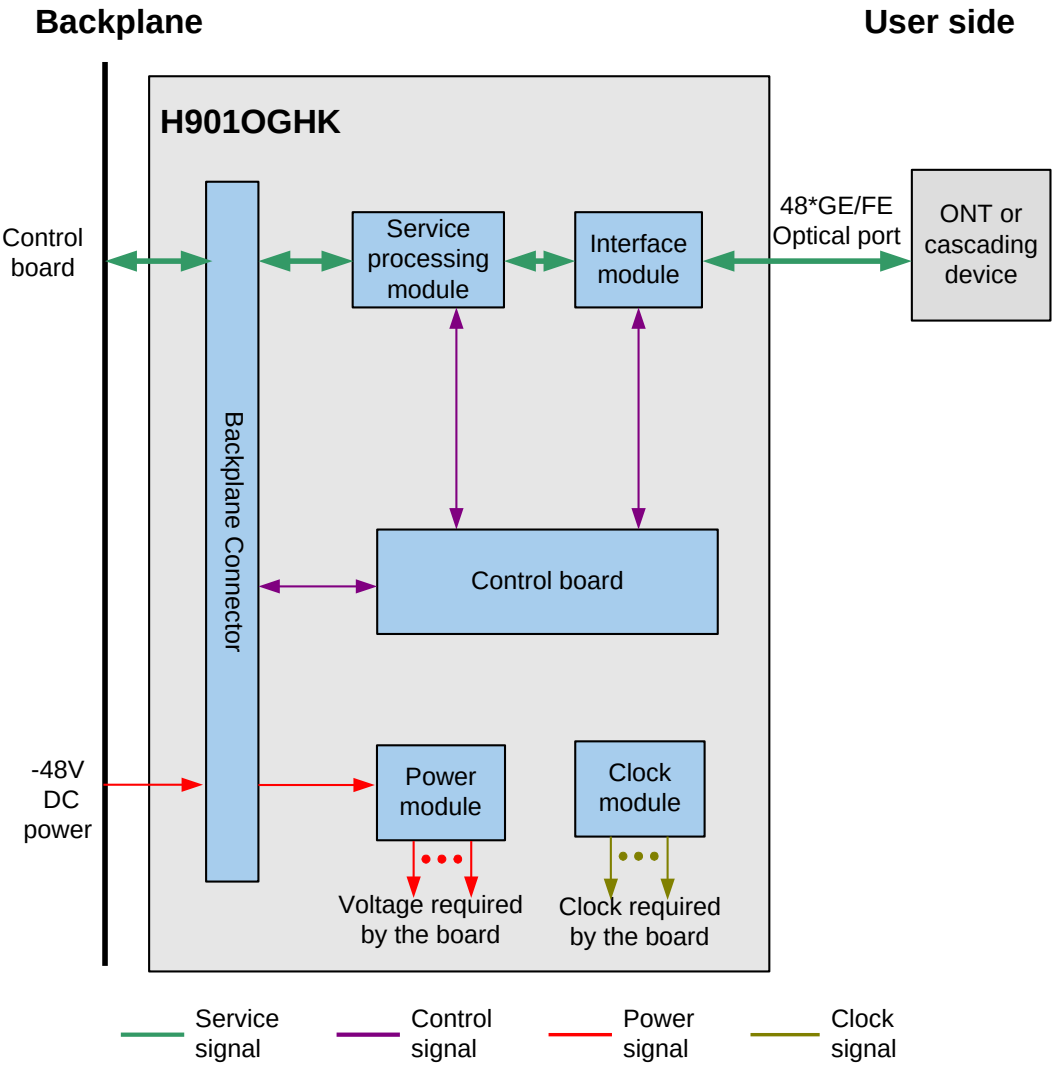
## Working Principle

**Figure 4-12** Working principle of the H901OGHK board




The basic working principle of the H901OGHK board is as follows:

- The control module controls the board software loading and board running, and manages the board.
- The interface module transmits and receives signals.
- The switching module aggregates and forwards signals, and then transmits the signals to the control board through the FIC bus of the backplane.
- The power module supplies power to each functional module of the board.
- The clock module provides the working clock for each functional module of the board, and supports synchronous clock issuing.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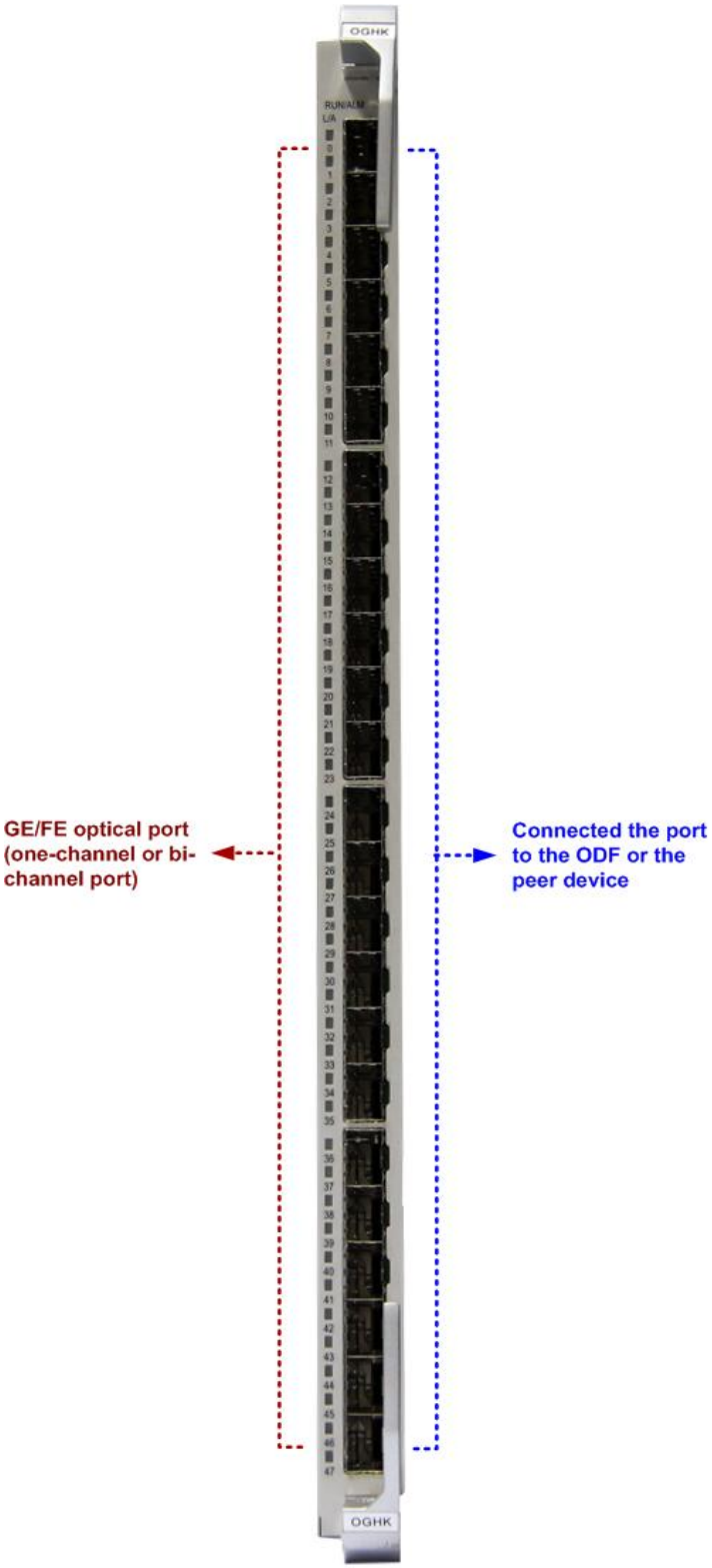
## Front Panel Port




For details about supported optical module or electrical module, see 5.1 GE Optical/Electrical Module and 5.3 FE Optical Module.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## Cable

The LC optical connector used in H901OGHK is shorter than the average LC optical connector.


## Indicator

| Indicator | Name | Status | Operation Description |
|---|---|---|---|
| RUN/ALM | Running status indicator | Red: blinks | The board enters the APP start phase during the board startup |
| | | Green: blinks every 0.25s | The board enters the phase of communication with the control board during its startup |
| | | Green: blinks every 1s | The board works in the normal state |
| | | Orange: blinks | A high-temperature alarm is generated |
| | | Red: on | The board is faulty |
| L/A<br>0-47 | Optical link status indicator | Green: on | The link is normal |
| | | Green: blinks | Data is being transmitted |
| | | Green: off | No data is being transmitted |


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# 4.11 Ethernet Service Access Board (ETH)

Ethernet service access boards provide Ethernet service cascading or upstream transmission.

## 4.11.1 H901OXHD Board

The H901OXHD board is a 8-port 10GE Optical Interface Board.

### Feature and Specifications

The H901OXHD board supports the following features and specifications:

- 8 channels of optical access
- Cascading and aggregation
- 10GE/GE optical modules
- Port issuing synchronous Ethernet clock signals
- Temperature reading and high-temperature alarm
- Automatic power-off in case of high temperature

### Parameters

Please refer to "Power Consumption and Maximum Frame Size of Boards".


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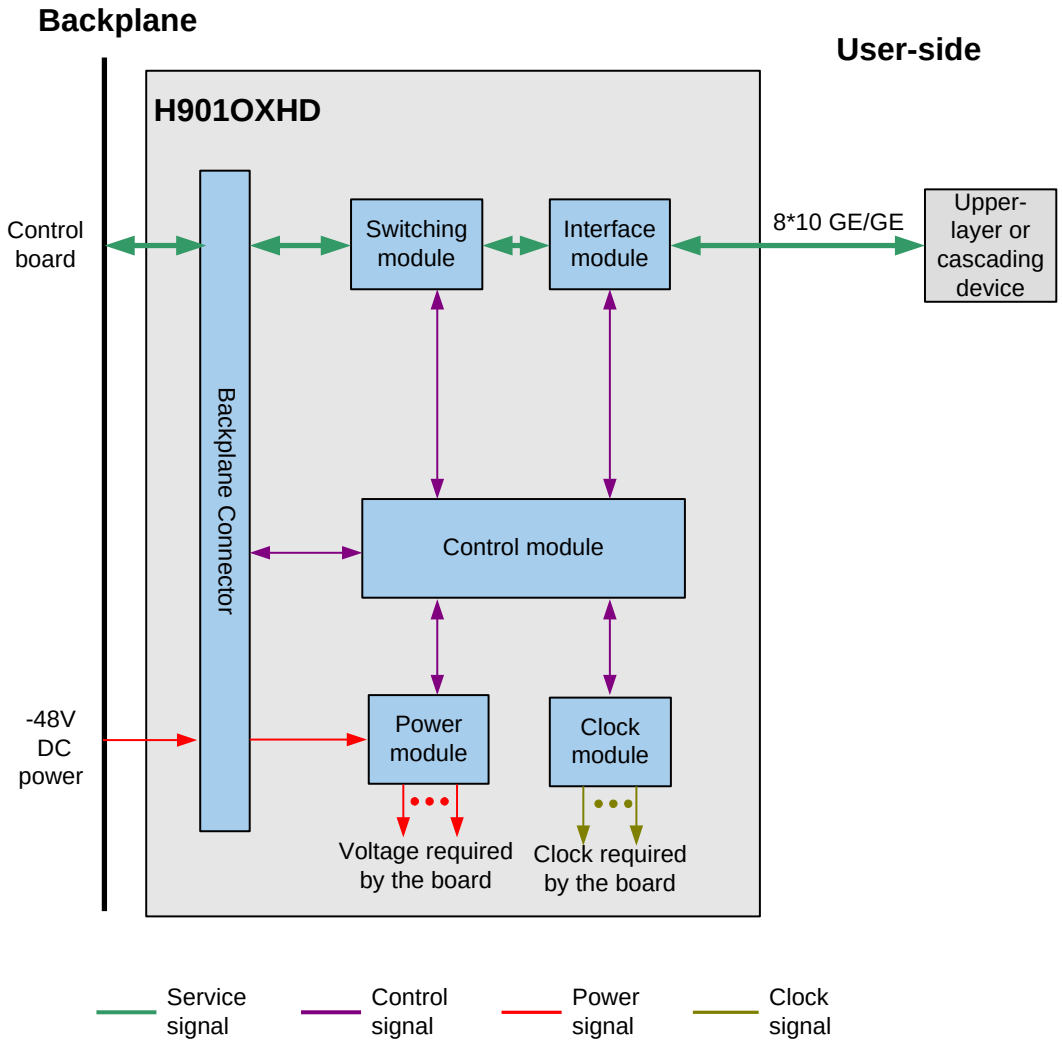
## Working Principle

**Figure 4-13** Working principle of the H901OXHD board




The basic working principle of the H901OXHD board is as follows:

- The control module loads the board software, controls the running of the board, and manages the entire board.
- The interface module transmits and receives signals.
- The switching module aggregates and forwards signals.
- The power module supplies power to other functional modules of the board.
- The clock module provides clock signals for each functional module of the board.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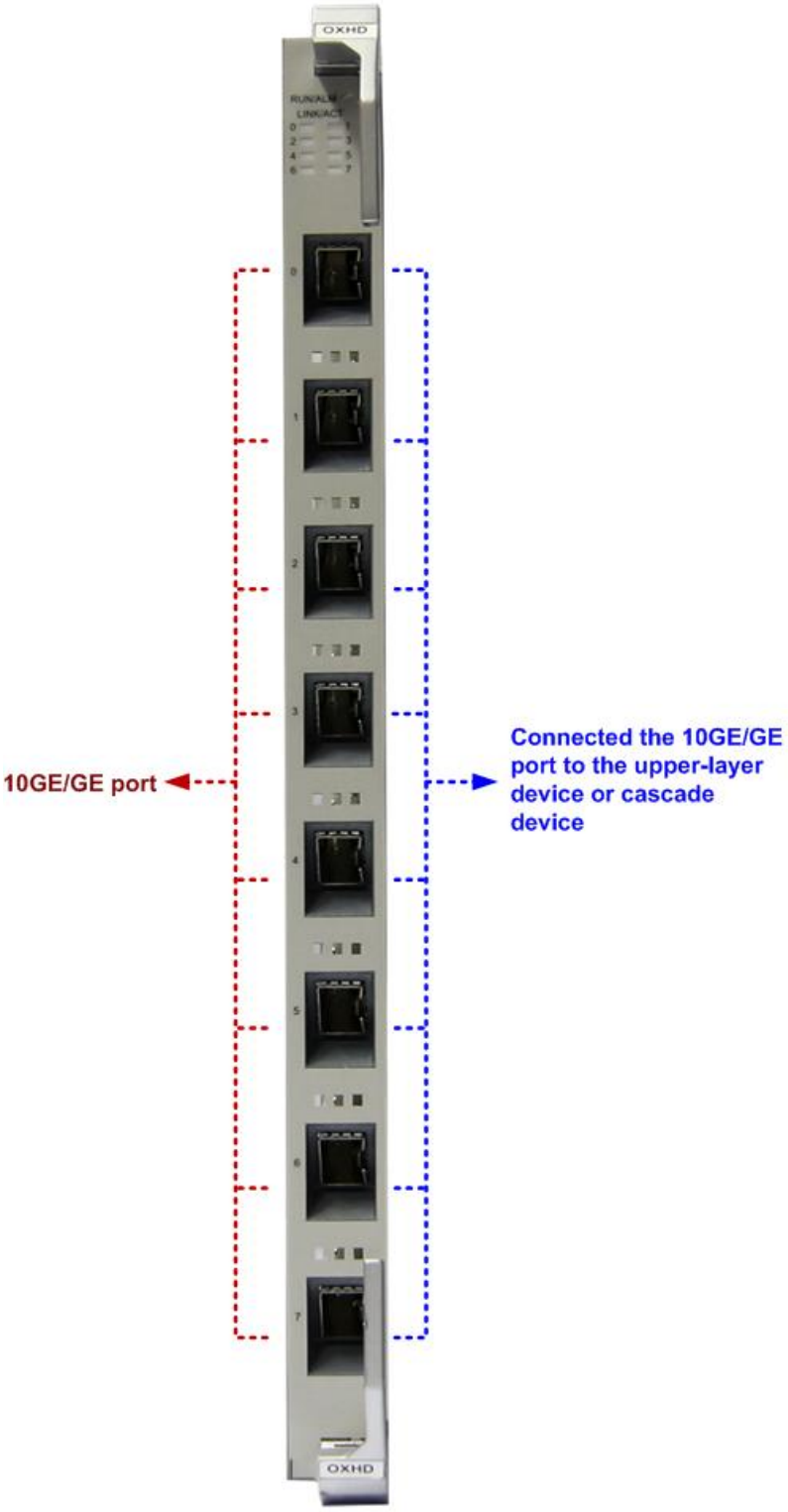
## Front Panel Port




For details about supported optical module, see 5.2 10GE Optical Module and 5.1 GE Optical/Electrical Module.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## Indicator

| Indicator | Name | Status | Operation Description |
|---|---|---|---|
| RUN/ALM | Running status indicator | Red: blinks | The board enters the APP start phase during the board startup |
| | | Green: blinks every 0.25s | The board enters the phase of communication with the control board during its startup |
| | | Green: blinks every 1s | The board works in the normal state |
| | | Orange: blinks | A high-temperature alarm is generated |
| | | Red: on | The board is faulty |
| LINK/ACT 0-7 | Optical link status indicator | Green: on | The link is normal |
| | | Green: blinks | Data is being transmitted |
| | | Green: off | No data is being transmitted |


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# 5 Optical Module

## About This Chapter

This topic describes the types and parameters.

The devices supports optical modules with their encapsulation modes as SFP, eSFP, CSFP, and SFP+, and port types as LC, SC, and RJ45 (modules with RJ45 ports are electrical modules). Figure 5-1 shows the appearance of an optical module.

**Figure 5-1** Appearance of an optical module


**NOTE**

- The appearances of SFP, eSFP and CSFP optical modules are the same.
- SFP, eSFP and CSFP optical modules use the SFP connector.
- Unlike SFP optical modules, eSFP optical modules support performance reporting.


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- A CSFP optical module is a multi-channel optical module. Huawei devices use two-channel CSFP optical modules.
- The SFP module with an RJ45 port is an electrical module.
- SFP+ optical modules are 10GE optical modules. The size of an SFP+ optical module is the same as that of an SFP optical module.



# 5.1 GE Optical/Electrical Module

This topic describes the types, parameters, and relation with boards of GE optical/electrical modules.

## One-channel Two-fiber Bi-directional GE Optical Module

A one-channel two-fiber bi-directional GE optical module is connected to two LC optical fibers (one for transmission and the other for reception) to provide one GE channel. Table 5-1 lists the specifications of one-channel two-fiber bi-directional GE optical modules.

**Table 5-1** Specifications of one-channel two-fiber bi-directional GE optical modules

| **Type** | One-channel two-fiber bi-directional optical module | | | | | | |
|---|---|---|---|---|---|---|---|
| **No.** | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| **Operating Wavelength** | 850 nm | 850 nm | 1310 nm | 1310 nm | 1310 nm | 1550 nm | 1550 nm |
| **Encapsulation Type** | eSFP | SFP | eSFP | eSFP | eSFP | eSFP | eSFP |
| **Port Rate** | 2.13 Gbit/s<br>1.25 Gbit/s<br>1.06 Gbit/s | 1.25 Gbit/s | 1.25 Gbit/s | 1.25 Gbit/s | 1.25 Gbit/s | 1.25 Gbit/s | 1.25 Gbit/s |
| **Minimum Output Optical Power** | -9.50 dBm | -9.50 dBm | -9.50 dBm | -9.00 dBm | -5.00 dBm | -5.00 dBm | -2.00 dBm |
| **Maximum** | -2.50 dBm | 0 dBm | -3.00 dBm | -3.00 dBm | 0 dBm | 0 dBm | 5.00 dBm |


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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Output Optical Power** | | | | | | | |
| **Maximum Receiver Sensitivity** | -17.00 dBm | -17.00 dBm | -20.00 dBm | -20.00 dBm | -23.00 dBm | -22.00 dBm | -23.00 dBm |
| **Optical Connector Type** | LC | LC | LC | LC | LC | LC | LC |
| **Optical Fiber Type** | Multi-mode | Multi-mode | Single-mode | Single-mode | Single-mode | Single-mode | Single-mode |
| **Reach** | 0.50 km | 0.55 km | 10.00 km | 10.00 km | 40.00 km | 40.00 km | 80.00 km |
| **Overload Optical Power** | -3.0 dBm | -3.0 dBm | -3.0 dBm | -3.0 dBm | -3.0 dBm | -3.0 dBm | -3.0 dBm |
| **Extinction Ratio** | 9.0 dB | 9.0 dB | 9.0 dB | 9.0 dB | 9.0 dB | 8.5 dB | 9.0 dB |

## One-channel One-fiber Bi-directional GE Optical Module

A one-channel one-fiber bi-directional GE optical module is connected to one LC optical fiber (for both transmission and reception) to provide one GE channel. Table 5-2 lists the specifications of one-channel one-fiber bi-directional GE optical modules.

**Table 5-2** Specifications of one-channel one-fiber bi-directional GE optical modules

| **Type** | One-channel one-fiber bi-directional optical module | | | | |
|---|---|---|---|---|---|
| **No.** | 1 | 2 | 3 | 4 | 5 |
| **Operating Wavelength** | Tx: 1310 nm<br>Rx: 1490 nm | Tx: 1490 nm<br>Rx: 1310 nm | Tx: 1310 nm<br>Rx: 1490 nm | Tx: 1490 nm<br>Rx: 1310 nm | Tx: 1570nm<br>Rx: 1490nm |
| **Encapsulation Type** | eSFP | eSFP | eSFP | eSFP | eSFP |
| **Port Rate** | 1.25 Gbit/s | 1.25 Gbit/s | 1.25 Gbit/s | 1.25 Gbit/s | 1.25 Gbps |
| **Minimum Output Optical Power** | -9.00 dBm | -9.00 dBm | -2.00 dBm | -2.00 dBm | -2 dBm |
| **Maximum Output Optical Power** | -3.00 dBm | -3.00 dBm | 3.00 dBm | 3.00 dBm | 4 dBm |


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| | | | | | |
|---|---|---|---|---|---|
| **Maximum Receiver Sensitivity** | -19.50 dBm | -19.50 dBm | -23.00 dBm | -23.00 dBm | -26 dBm |
| **Optical Connector Type** | LC | LC | LC | LC | LC |
| **Optical Fiber Type** | Single-mode | Single-mode | Single-mode | Single-mode | Single-mode |
| **Reach** | 10.00 km | 10.00 km | 40.00 km | 40.00 km | 80 km |
| **Overload Optical Power** | -3.0 dBm | -3.0 dBm | -3.0 dBm | -3.0 dBm | -3 dBm |
| **Extinction Ratio** | 6.0 dB | 6.0 dB | 9.0 dB | 9.0 dB | 9 dB |

## Two-channel One-fiber Bi-directional GE Optical Module

A two-channel one-fiber bi-directional GE optical module is connected to two LC optical fibers (each for both transmission and reception) to provide two GE channels. Table 5-3 lists the specifications of a two-channel one-fiber bi-directional GE optical module.

**Table 5-3** Specifications of a two-channel one-fiber bi-directional GE optical module

| | |
|---|---|
| **Type** | Two-channel one-fiber bi-directional optical module |
| **Operating Wavelength** | Tx: 1490 nm<br>Rx: 1310 nm |
| **Encapsulation Type** | CSFP |
| **Port Rate** | 1.25 Gbit/s |
| **Minimum Output Optical Power** | -9.00 dBm |
| **Maximum Output Optical Power** | -3.00 dBm |
| **Maximum Receiver Sensitivity** | -19.50 dBm |
| **Optical Connector Type** | LC |
| **Optical Fiber Type** | Single-mode |
| **Reach** | 10.00 km |


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| | |
|---|---|
| **Overload Optical Power** | -3.0 dBm |
| **Extinction Ratio** | 6.0 dB |

## One-channel Two-fiber Bi-directional GE CWDM Optical Module

A GE CWDM optical module is connected to two LC optical fibers (one for transmission and the other for reception) to provide one GE channel. Table 5-4 lists the specifications of GE CWDM optical modules.

**Table 5-4** Specifications of one-channel two-fiber bi-directional GE CWDM optical modules

| | |
|---|---|
| **Type** | One-channel two-fiber bi-directional optical module |
| **Operating Wavelength** | 1471 nm, 1491 nm, 1511 nm, 1531 nm, 1551 nm, 1571 nm, 1591 nm, 1611 nm |
| **Encapsulation Type** | eSFP |
| **Port Rate** | 100 M ~ 2.67 Gb/s |
| **Minimum Output Optical Power** | 0 dBm |
| **Maximum Output Optical Power** | -5.0 dBm |
| **Maximum Receiver Sensitivity** | -28.0 dBm |
| **Optical Connector Type** | LC |
| **Optical Fiber Type** | Single-mode |
| **Reach** | 80.0 km |
| **Overload Optical Power** | -9.0 dBm |
| **Extinction Ratio** | 8.5 dB |

**NOTE**

There are different types of GE CWDM optical modules, and these types of optical modules vary with the operating wavelength.


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### Standards Compliance of the GE Optical Module

| Standard ID | Description |
|---|---|
| IEEE 802.3z | 1000BASE-X Gbit/s Ethernet over Fiber-Optic at 1 Gbit/s |
| SFF-8472 | Specification for Diagnostic Monitoring Interface for Optical Transceivers |

## 5.2 10GE Optical Module

This topic describes the types and parameters.

### 10GE Optical Module (SFP+)

A 10GE optical module (SFP+) is connected to two LC optical fibers to provide one GE channel. Table 5-5 lists the specifications of 10GE optical modules (SFP+).

**Table 5-5** Specifications of 10GE optical modules (SFP+)

| Type | One-channel two-fiber bi-directional optical module | | | |
|---|---|---|---|---|
| **No.** | 1 | 2 | 3 | 4 |
| **Operating Wavelength** | 850 nm | 1310 nm | 1550 nm | 1550 nm |
| **Encapsulation Type** | SFP+ | SFP+ | SFP+ | |
| **Port Rate** | 10 Gbit/s | 10 Gbit/s | 9.95-11.10 Gbit/s | 9.95-11.10 Gbit/s |
| **Minimum Output Optical Power** | -7.30 dBm | -8.20 dBm | -4.70 dBm | 0 dBm |
| **Maximum Output Optical Power** | -1.00 dBm | 0.50 dBm | 4.00 dBm | 4.00 dBm |
| **Maximum Receiver Sensitivity** | -11.10 dBm | -12.60 dBm | -14.10 dBm | -24.00 dBm |
| **Optical Connector Type** | LC | LC | LC | LC |
| **Optical Fiber Type** | Multi-mode | Single-mode | Single-mode | Single-mode |
| **Reach** | 0.30 km | 10.00 km | 40.00 km | 80.00 km |


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| | | | | |
|---|---|---|---|---|
| **Overload Optical Power** | -1.0 dBm | 0.5 dBm | 0.5 dBm | -7.0 dBm |
| **Extinction Ratio** | 3.0 dB | 3.5 dB | 3.5 dB | 9.0 dB |

## One-channel Two-fiber Bi-directional 10GE CWDM Optical Module

A 10GE CWDM optical module is connected to two LC optical fibers (one for transmission and the other for reception) to provide one 10GE channel. Table 5-6 lists the specifications of 10GE CWDM optical modules.

**Table 5-6** Specifications of one-channel two-fiber bi-directional 10GE CWDM optical modules

| | |
|---|---|
| **Type** | One-channel two-fiber bi-directional optical module |
| **Operating Wavelength** | 1471 nm, 1491 nm, 1511 nm, 1531 nm, 1551 nm, 1571 nm, 1591 nm, 1611 nm |
| **Encapsulation Type** | SFP+ |
| **Port Rate** | 9.95 Gb~11.1 Gb/s |
| **Minimum Output Optical Power** | 0 dBm |
| **Maximum Output Optical Power** | 4.0 dBm |
| **Maximum Receiver Sensitivity** | -23.0 dBm |
| **Optical Connector Type** | LC |
| **Optical Fiber Type** | Single-mode |
| **Reach** | 70.0 km |
| **Overload Optical Power** | -7.0 dBm |
| **Extinction Ratio** | 8.2 dB |

**NOTE**

There are different types of 10GE CWDM optical modules, and these types of optical modules vary with the operating wavelength.


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### Standards Compliance of the 10GE Optical Port

| Standard ID | Description |
|---|---|
| IEEE 802.3ae | 10 Gbit/s (1,250 MB/s) Ethernet over fiber |
| SFF-8431 | Specifications for Enhanced Small Form Factor Pluggable Module SFP+ |
| INF-8432 | Specification for SFP+ Module and Cage |

## 5.3 FE Optical Module

This topic describes the types and parameters.

### One-channel One-fiber Bi-directional FE Optical Module

A one-channel one-fiber bi-directional FE optical module is connected to one LC optical fiber to provide one FE channel. Table 5-7 lists the specifications of an FE optical module.

**Table 5-7** Specifications of one-channel one-fiber bi-directional FE optical modules

| Type | One-channel one-fiber bi-directional optical module | |
|---|---|---|
| No. | 1 | 2 |
| Operating Wavelength | Tx: 1550 nm<br>Rx: 1310 nm | Tx: 1310 nm<br>Rx: 1550 nm |
| Encapsulation Type | eSFP | eSFP |
| Port Rate | STM-1 | 155 Mbit/s |
| Minimum Output Optical Power | -15.00 dBm | -15.00 dBm |
| Maximum Output Optical Power | -8.00 dBm | -8.00 dBm |
| Maximum Receiver Sensitivity | -32.00 dBm | -32.00 dBm |
| Optical Connector Type | LC/PC | LC/PC |
| Optical Fiber Type | Single-mode | Single-mode |
| Reach | 15.00 km | 15.00 km |
| Overload Optical Power | -8.0 dBm | -8.0 dBm |
| Extinction Ratio | 8.5 dB | 8.5 dB |


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## Two-channel One-fiber Bi-directional FE Optical Module

A two-channel one-fiber bi-directional FE optical module is connected to two LC optical fibers to provide two FE channels. Table 5-8 lists the specifications of an FE optical module.

**Table 5-8** Specifications of Two-channel One-fiber Bi-directional FE optical modules

| | |
|---|---|
| **Type** | Two-channel one-fiber bi-directional optical module |
| **Operating Wavelength** | Tx: 1550 nm<br>Rx: 1310 nm |
| **Encapsulation Type** | CSFP |
| **Port Rate** | 125-155 Mbit/s |
| **Minimum Output Optical Power** | -14.00 dBm |
| **Maximum Output Optical Power** | -8.00 dBm |
| **Maximum Receiver Sensitivity** | -28.2 dBm |
| **Optical Connector Type** | LC |
| **Optical Fiber Type** | Single-mode |
| **Reach** | 10.00 km |
| **Overload Optical Power** | -8.0 dBm |
| **Extinction Ratio** | 8.2 dB |

## Standards Compliance of the FE Optical Modules

| Standard ID | Description |
|---|---|
| IEEE 802.3 | 100BASE-BX Fast Ethernet at 100 Mbit/s |
| SFF-8472 | Specification for Diagnostic Monitoring Interface for Optical Transceivers |


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# 5.4 PON Optical Module

This topic describes the types and parameters.

## GPON Optical Module

A GPON optical module is connected to one SC optical fiber to provide GPON access service. Table 5-9 lists the specifications of GPON optical modules.

**Table 5-9** Specifications of GPON optical modules

| No. | 1 | 2 | 3 |
|---|---|---|---|
| **Type** | One-fiber bi-directional optical module, class B+ | One-fiber bi-directional optical module, class C+ | eOTDR One-fiber bi-directional optical module, class B+ |
| **Operating Wavelength** | Tx: 1490 nm<br>Rx: 1310 nm | Tx: 1490 nm<br>Rx: 1310 nm | Tx: 1490 nm<br>Rx: 1310 nm |
| **Encapsulation Type** | SFP | SFP | SFP |
| **Port Rate** | Tx: 2.49 Gbit/s<br>Rx: 1.24 Gbit/s | Tx: 2.49 Gbit/s<br>Rx: 1.24 Gbit/s | Tx: 2.49 Gbit/s<br>Rx: 1.24 Gbit/s |
| **Minimum Output Optical Power** | 1.50 dBm | 3.00 dBm | 1.50 dBm |
| **Maximum Output Optical Power** | 5.00 dBm | 7.00 dBm | 5.00 dBm |
| **Maximum Receiver Sensitivity** | -28.00 dBm | -32.00 dBm | -28.00 dBm |
| **Optical Connector Type** | SC/PC | SC/PC | SC/UPC |
| **Optical Fiber Type** | Single-mode | Single-mode | Single-mode |
| **Overload Optical Power** | -8.0 dBm | -12.0 dBm | -8.0 dBm |
| **Extinction Ratio** | 8.2 dB | 8.2 dB | 8.2 dB |


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## 10G-GPON Optical Module

A 10G-GPON optical module is connected to one SC optical fiber to provide 10G-GPON access service. Table 5-10 lists the specifications of 10G-GPON optical modules.

**Table 5-10** Specifications of 10G-GPON optical modules

| | |
|---|---|
| **No.** | 2 |
| **Type** | One-fiber bi-directional optical module |
| **Operating Wavelength** | Tx: 1577 nm<br>Rx: 1270 nm |
| **Encapsulation Type** | SFP+ |
| **Port Rate** | Tx: 9.95 Gbit/s<br>Rx: 2.49 Gbit/s |
| **Minimum Output Optical Power** | 2 dBm |
| **Maximum Output Optical Power** | 6 dBm |
| **Maximum Receiver Sensitivity** | -27.5 dBm |
| **Optical Connector Type** | SC/PC |
| **Optical Fiber Type** | Single-mode |
| **Overload Optical Power** | -7 dBm |
| **Extinction Ratio** | 8.2 dB |

## Standards Compliance of the GPON Port

| Standard ID | Description |
|---|---|
| ITU-T G.984.1 | Gigabit-capable Passive Optical Networks (GPON) General Characteristics |
| ITU-T G.984.2 | Gigabit-capable Passive Optical Networks (GPON) Physical Media Dependent (PMD) Layer Specification |
| ITU-T G.984.3 | Gigabit-capable Passive Optical Networks (GPON) Transmission Convergence Layer Specification |


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| Standard ID | Description |
| --- | --- |
| ITU-T G.984.4 | Gigabit-capable Passive Optical Networks (GPON) ONU Management and Control Interface Specification |

## Standards Compliance of the 10G GPON Port

| Standard ID | Description |
| --- | --- |
| ITU-T G.987.1 | 10Gigabit-capable Passive Optical Networks (XG-PON) General Requirements |
| ITU-T G.987.2 | 10Gigabit-capable Passive Optical Networks (XG-PON) Physical Media Dependent (PMD) Layer Specification |
| ITU-T G.987.3 | 10Gigabit-capable Passive Optical Networks (XG-PON) Transmission Convergence Layer Specification |
| ITU-T G.988 | 10Gigabit-capable Passive Optical Networks (XG-PON) ONU Management and Control Interface Specification |


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# 6 Cable

## About This Chapter

This topic covers the appearance, pin assignments, applications, and technical specifications of the cables used by the device.

6.1 Power Cable and Ground Cable

Power cable supplies power and ensures that the load works in the normal state, and ground cable is used to protect devices from lightning strike and interference.

6.2 Clock Cable

This topic covers the applications, appearances, and technical specifications of Clock cables.

6.3 E1 Trunk Cable

This topic covers the applications, appearances, pin assignments, and technical specifications of E1 trunk cables.

6.4 Network Cable

A network cable is used for equipment cascading, communication between the device and the network, and local maintenance and remote access of the device.

6.5 Optical Fiber

An optical fiber connects an optical port to an upstream device or optical network terminal.

6.6 Local Maintenance Serial Cable

A local maintenance serial cable is used for debugging devices or maintaining devices at the local end.

## 6.1 Power Cable and Ground Cable

Power cable supplies power and ensures that the load works in the normal state, and ground cable is used to protect devices from lightning strike and interference.


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# 6.1.1 DC Power Cable (Cabinet)

The DC power cable is used to transmit the DC power to loads and enable the loads to work in the normal state.

## Application

The DC power cable (cabinet) connects the DC PDU to the external power supply. It is connected as follows:

- One end of the DC power cable is connected to the output port of the DC power supply.
- The other end of the DC power cable is connected to the input port on the DC PDU.

**NOTE**

The black cable is the -48 V return ground cable, which is connected to the RTN(+) terminal of the DC PDU and external power supply. The blue cable is the -48 V power cable, which is connected to the NEG(-) terminal of the DC PDU and external power supply.

## Appearance and Structure

Figure 6-1 and Figure 6-2 show the appearances of a -48 V return ground cable and a -48 V power cable.

**Figure 6-1** Appearance of a -48 V return ground cable


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**Figure 6-2** Appearance of a -48 V power cable

## Technical Specifications

The technical specifications of a -48 V return ground cable and a -48 V power cable are the same, as listed in Table 6-1.

**Table 6-1** Technical specifications of a -48 V return ground cable and a -48 V power cable

| Parameter | Description |
|---|---|
| Cable type | Electrical cable |
| Color | Black (-48 V return ground cable); blue (-48 V power cable) |
| Maximum current | 110 A |
| DC resistance of the inner conductor | 0.78 ohms/km |
| Cross-sectional area of the conductor | 16 $mm^2$ or 25 $mm^2$<br>**NOTE**<br>The diameter and length of the DC power cable affect the power supply of the device.<br>• The XPLE DC power cable, whose length is shorter than 20 m and whose cross-sectional area is 16 $mm^2$, can meet the device voltage requirement.<br>• The XPLE or PVC DC power cable, whose length is in the range of 20 m (excluded) to 32 m (included) must have a cross-sectional area of 25 $mm^2$ to meet the device voltage requirement. |

# 6.1.2 PGND Cable (Cabinet)

PGND cable is used for protect devices from lightning strike and interference.


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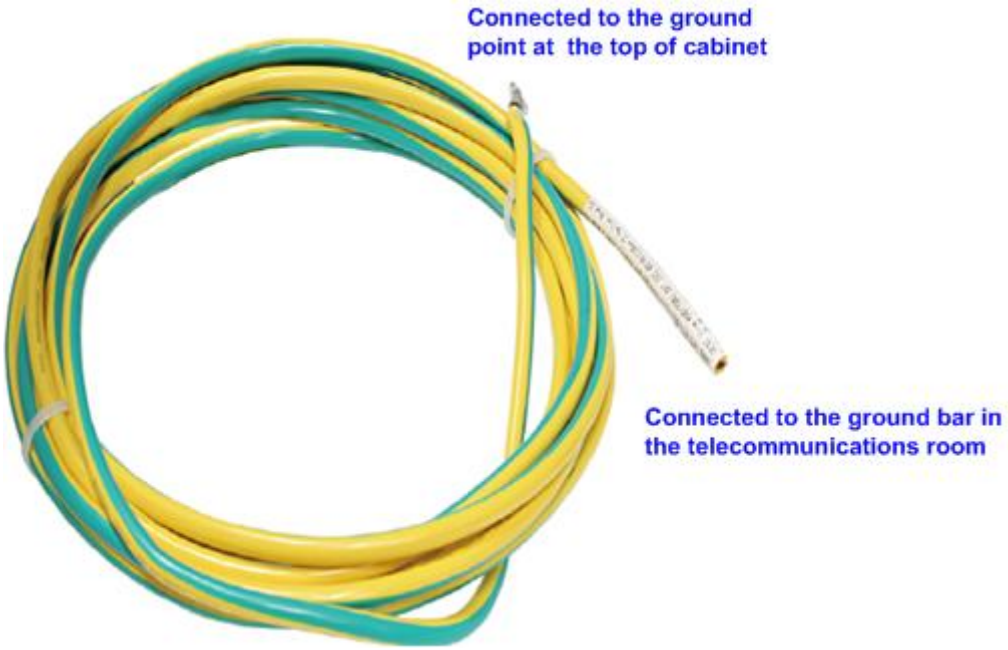
### Cable Connector




### Parameter

| Parameter | Description |
|---|---|
| Type | Electric power cable |
| Color | Yellow and green |
| DC resistance of the inner conductor | 0.78 ohms/km |
| Maximum current | 110 A |
| Cross-sectional area of the conductor | 25 $mm^2$ |

## 6.1.3 DC Power Cable (Device)

DC power cable supplies power and ensures that the load works in the normal state.

### Cable Connector



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### Parameter

| Parameter | Description |
|---|---|
| Type | Electric power cable |
| Color | • Blue (-)<br>• Black (+) |
| DC resistance of the inner conductor | 3.3 ohms/km |
| Maximum current | 40 A |
| Cross-sectional area of the conductor | 6 $mm^2$ |

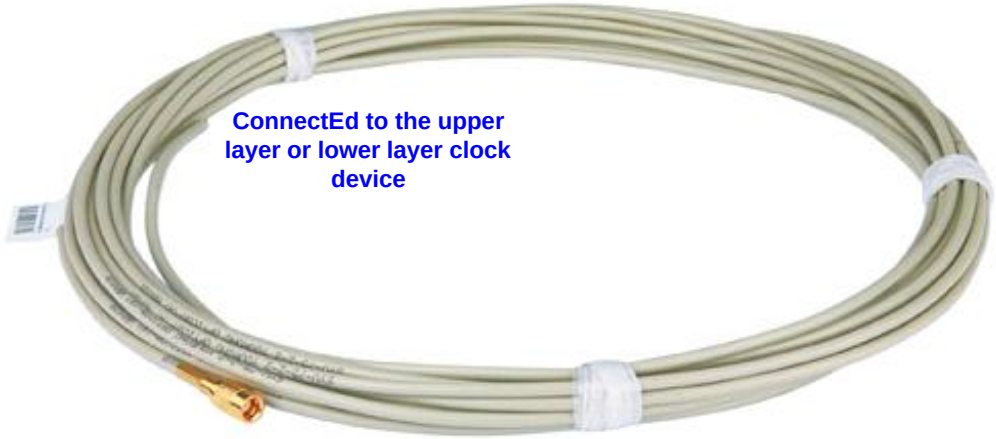
## 6.2 Clock Cable

This topic covers the applications, appearances, and technical specifications of Clock cables.

## 6.2.1 75-ohm Clock Cable

A 75-ohm clock cable is used to transmit clock signals.

### Cable Connector




### Parameter

| Parameter | Description |
|---|---|
| Connector | Coaxial connector-SMB connector-75 ohms, straight, female |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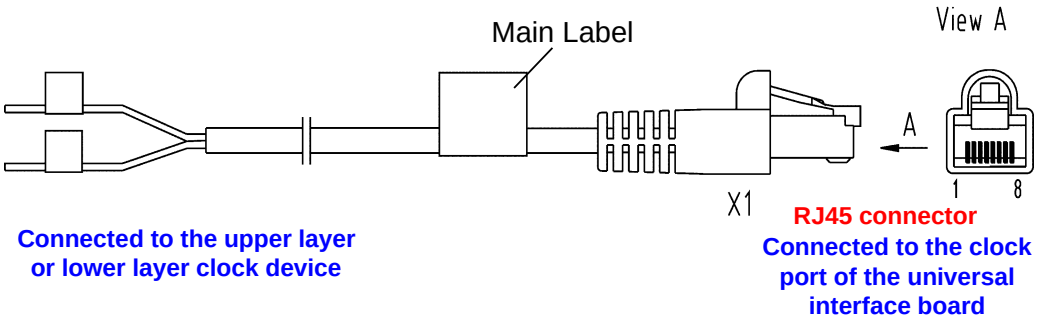
| Parameter | Description |
|---|---|
| Type | Coaxial cable-75 ohms-3.9 mm-2.1 mm-0.34 mm-shielded |
| Characteristic impedance | 75.0 ohms |
| Diameter of the cable | 3.9 mm |
| Diameter of the inner conductor | 0.34 mm |
| DC resistance of the inner conductor | 224.0 ohms |
| Frequency attenuation | 3 dB/100 m @2 MHz |
| Capacitance | 69 pF/m |

## 6.2.2 120-ohm Clock Cable

A 120-ohm clock cable is used to transmit clock signals.

### Cable Connector




### Parameter

| Parameter | Description |
|---|---|
| Connector | RJ45 connector |
| Type | Symmetric twisted pair cable-120 ohms-two pairs-0.40 mm-shielded |
| Characteristic impedance | 120.0 ohm |
| Diameter of the cable | 4.60 mm |
| Diameter of the inner conductor | 0.40 mm |
| DC resistance of the inner conductor | 145.0 ohm |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| Parameter | Description |
|---|---|
| Frequency attenuation | 2.8 dB/100 m @1.024 MHz |
| Capacitance | 56 nF/km |

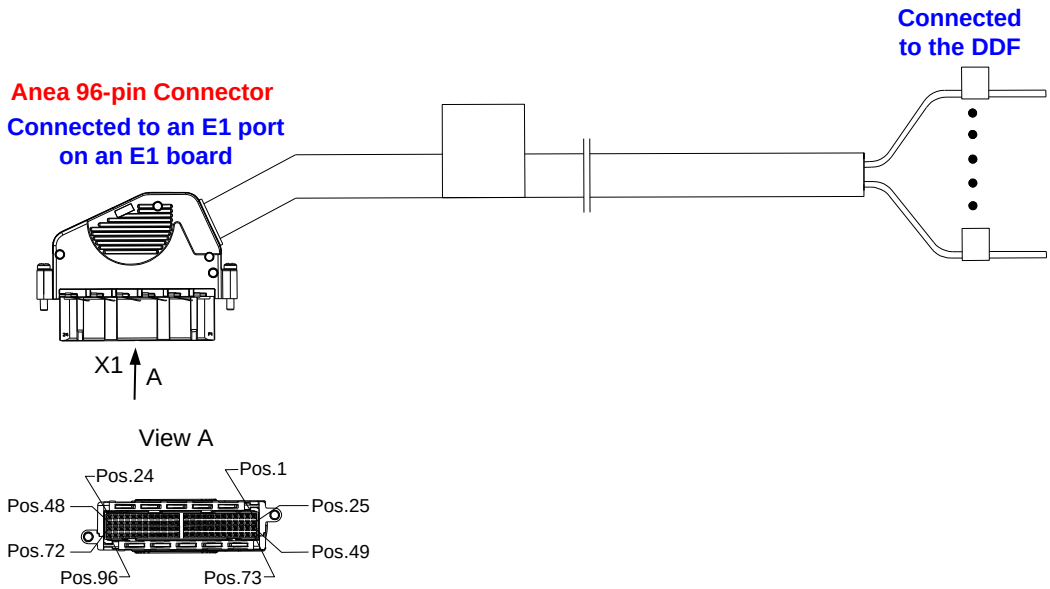
# 6.3 E1 Trunk Cable

This topic covers the applications, appearances, pin assignments, and technical specifications of E1 trunk cables.

## 6.3.1 75-ohm E1 Trunk Cable

A 75-ohm E1 trunk cable is a communication cable used for transmitting E1 trunk signals.

### Cable Connector




### Pin Assignments

**NOTE**

"SN" in "Cable and SN" is the print on the cable sheath.

A 75-ohm E1 trunk cable consists of the shield layer and wire.

In the following table, "Rx/Tx Channel" indicates that the transmitting is from the board and the receiving is to the board.

- R0: receive end of channel 0 E1 signals
- T0: transmit end of channel 0 E1 signals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| X1 Pin | Cable and SN | | Rx/Tx Channel | | X1 Pin | Cable and SN | | Rx/Tx Channel |
|---|---|---|---|---|---|---|---|---|
| 1 | Shield layer | 1 | R0 | | 17 | Shield layer | 18 | R8 |
| 2 | Wire | | | | 18 | Wire | | |
| 25 | Shield layer | 2 | T0 | | 41 | Shield layer | 19 | T8 |
| 26 | Wire | | | | 42 | Wire | | |
| 3 | Shield layer | 3 | R1 | | 19 | Shield layer | 6 | R9 |
| 4 | Wire | | | | 20 | Wire | | |
| 27 | Shield layer | 4 | T1 | | 43 | Shield layer | 8 | T9 |
| 28 | Wire | | | | 44 | Wire | | |
| 5 | Shield layer | 5 | R2 | | 21 | Shield layer | 10 | R10 |
| 6 | Wire | | | | 22 | Wire | | |
| 29 | Shield layer | 6 | T2 | | 45 | Shield layer | 12 | T10 |
| 30 | Wire | | | | 46 | Wire | | |
| 7 | Shield layer | 7 | R3 | | 23 | Shield layer | 14 | R11 |
| 8 | Wire | | | | 24 | Wire | | |
| 31 | Shield layer | 8 | T3 | | 47 | Shield layer | 16 | T11 |
| 32 | Wire | | | | 48 | Wire | | |
| 9 | Shield layer | 9 | R4 | | 49 | Shield layer | 25 | R12 |
| 10 | Wire | | | | 50 | Wire | | |
| 33 | Shield layer | 11 | T4 | | 73 | Shield layer | 26 | T12 |
| 34 | Wire | | | | 74 | Wire | | |
| 11 | Shield layer | 12 | R5 | | 51 | Shield layer | 27 | R13 |
| 12 | Wire | | | | 52 | Wire | | |
| 35 | Shield layer | 13 | T5 | | 75 | Shield layer | 28 | T13 |


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| X1 Pin | Cable and SN | | Rx/Tx Channel | | X1 Pin | Cable and SN | | Rx/Tx Channel |
|---|---|---|---|---|---|---|---|---|
| 36 | Wire | | | | 76 | Wire | | |
| 13 | Shield layer | 14 | R6 | | 53 | Shield layer | 29 | R14 |
| 14 | Wire | | | | 54 | Wire | | |
| 37 | Shield layer | 15 | T6 | | 77 | Shield layer | 30 | T14 |
| 38 | Wire | | | | 78 | Wire | | |
| 15 | Shield layer | 16 | R7 | | 55 | Shield layer | 31 | R15 |
| 16 | Wire | | | | 56 | Wire | | |
| 39 | Shield layer | 17 | T7 | | 79 | Shield layer | 32 | T15 |
| 40 | Wire | | | | 80 | Wire | | |

### Technical Specifications

| Parameter | Description |
|---|---|
| Connector | Anea 96-pin connector |
| Cable type | Coaxial cable |
| Characteristic impedance | 75.0 ohms |
| Cable diameter | 1.6 mm |

## 6.3.2 120-ohm E1 Trunk Cable

A 120-ohm E1 trunk cable is a communication cable used for transmitting E1 trunk signals.


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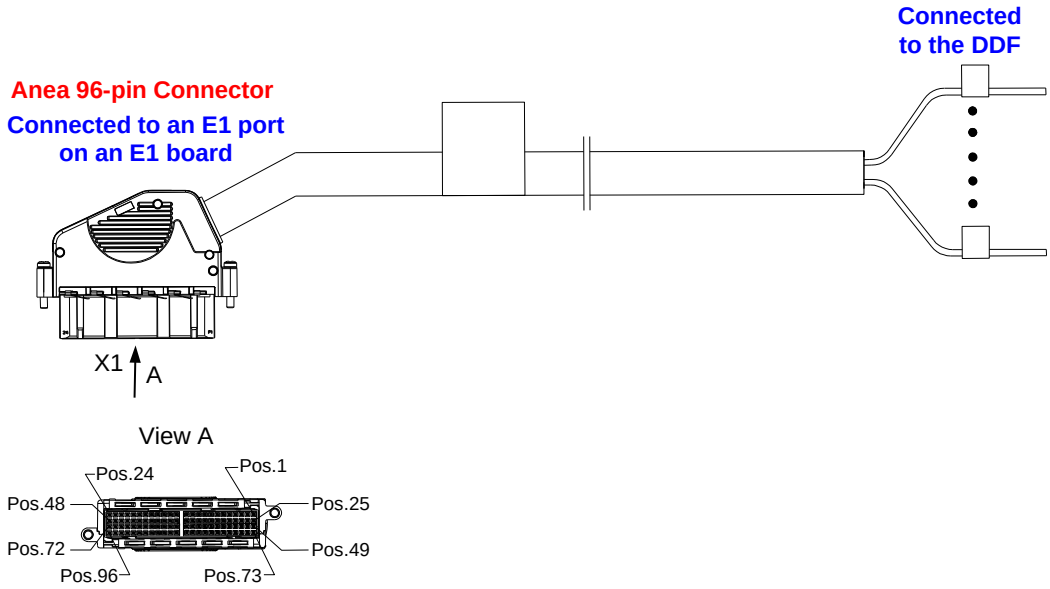
## Cable Connector




## Pin Assignments

**NOTE**

A 120-ohm E1 trunk cable is a twisted pair cable consisting of two wires.

| X1 Pin | Wire Color | Rx/Tx Channel | Tape Color | | X1 Pin | Wire Color | Rx/Tx Channel | Tape Color |
|---|---|---|---|---|---|---|---|---|
| 1 | White | R0 | Blue | | 17 | White | R8 | Orange |
| 2 | Blue | | | | 18 | Blue | | |
| 25 | White | T0 | | | 41 | White | T8 | |
| 26 | Orange | | | | 42 | Orange | | |
| 3 | White | R1 | | | 19 | White | R9 | |
| 4 | Green | | | | 20 | Green | | |
| 27 | White | T1 | | | 43 | White | T9 | |
| 28 | Brown | | | | 44 | Brown | | |
| 5 | White | R2 | | | 21 | White | R10 | |
| 6 | Gray | | | | 22 | Gray | | |
| 29 | Red | T2 | | | 45 | Red | T10 | |
| 30 | Blue | | | | 46 | Blue | | |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| X1 Pin | Wire Color | Rx/Tx Channel | Tape Color | | X1 Pin | Wire Color | Rx/Tx Channel | Tape Color |
|---|---|---|---|---|---|---|---|---|
| 7 | Red | R3 | | | 23 | Red | R11 | |
| 8 | Orange | | | | 24 | Orange | | |
| 31 | Red | T3 | | | 47 | Red | T11 | |
| 32 | Green | | | | 48 | Green | | |
| 9 | Red | R4 | Blue | | 49 | Red | R12 | Orange |
| 10 | Brown | | | | 50 | Brown | | |
| 33 | Red | T4 | | | 73 | Red | T12 | |
| 34 | Gray | | | | 74 | Gray | | |
| 11 | Black | R5 | | | 51 | Black | R13 | |
| 12 | Blue | | | | 52 | Blue | | |
| 35 | Black | T5 | | | 75 | Black | T13 | |
| 36 | Orange | | | | 76 | Orange | | |
| 13 | Black | R6 | | | 53 | Black | R14 | |
| 14 | Green | | | | 54 | Green | | |
| 37 | Black | T6 | | | 77 | Black | T14 | |
| 38 | Brown | | | | 78 | Brown | | |
| 15 | Black | R7 | | | 55 | Black | R15 | |
| 16 | Gray | | | | 56 | Gray | | |
| 39 | Yellow | T7 | | | 79 | Yellow | T15 | |
| 40 | Blue | | | | 80 | Blue | | |

## Technical Specifications

| Parameter | Description |
|---|---|
| Connector | Anea 96-pin connector |
| Cable type | Symmetrical twisted pair |
| Characteristic impedance | 120.0 ohms |
| Core diameter of the inner conductor | 0.4 or 0.50 mm |


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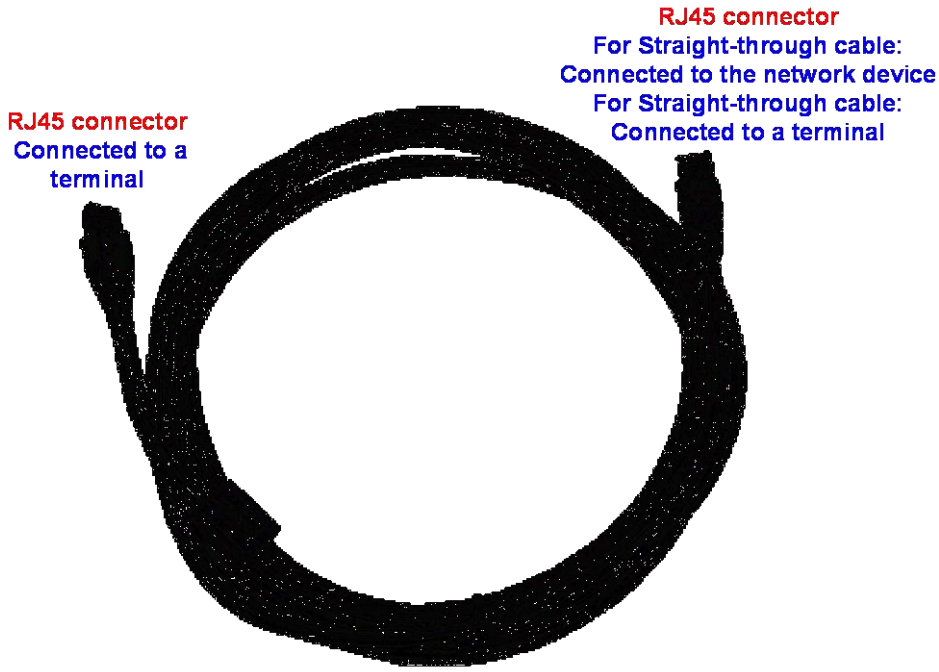
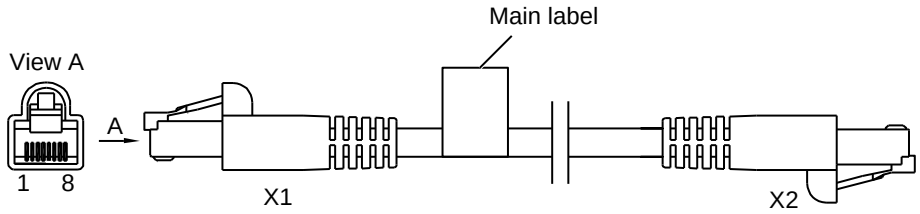
# 6.4 Network Cable

A network cable is used for equipment cascading, communication between the device and the network, and local maintenance and remote access of the device.

## Cable Connector




## Cable Structure




## Pin Assignments

**Table 6-2** Pin assignments of a straight-through cable

| X1 Pin | Wire Color | X2 Pin |
|---|---|---|
| 1 | White and orange | 1 |
| 2 | Orange | 2 |
| 3 | White and green | 3 |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| X1 Pin | Wire Color | X2 Pin |
|---|---|---|
| 4 | Blue | 4 |
| 5 | White and blue | 5 |
| 6 | Green | 6 |
| 7 | White and brown | 7 |
| 8 | Brown | 8 |

**Table 6-3** Pin assignments of a crossover cable

| X1 Pin | Wire Color | X2 Pin |
|---|---|---|
| 1 | White and orange | 3 |
| 2 | Orange | 6 |
| 3 | White and green | 1 |
| 4 | Blue | 4 |
| 5 | White and blue | 5 |
| 6 | Green | 2 |
| 7 | White and brown | 7 |
| 8 | Brown | 8 |

**NOTE**

To achieve the optimum electrical transmission performance, make sure that the wires connected to pins 1 and 2 and to pins 3 and 6 are twisted pairs.

## Technical Specifications

| Parameter | Description |
|---|---|
| Connector (X1/X2) | RJ45 connector |
| Type | Category-3 and category-5 unshielded twisted pairs (UTP-3 and UTP-5) or shielded twisted pairs (STP) |
| Color | Dark gray |
| Characteristic impedance | 100.0 ohms |
| Wire diameter of the inner conductor | 0.510 mm |
| Breakdown voltage | 500.0 V |
| DC resistance of the inner conductor | 93.8 ohms/km |


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| Parameter | Description |
| --- | --- |
| Number of wires | 8 |
| Frequency range | 0-100 MHz |
| Frequency attenuation | 22 dB/100 m@100 MHz |

# 6.5 Optical Fiber

An optical fiber connects an optical port to an upstream device or optical network terminal.

## Application

An optical fiber carries optical signals. It is connected as follows:

- One end of the optical fiber is connected to an optical port of a board.
- The other end of the optical fiber is connected to the optical distribution frame (ODF), optical port of the upper layer device, or optical port of other devices.

## Appearance

The appearances of a single-mode optical fiber and a multi-mode optical fiber are the same, but their colors are different. The single-mode optical fiber is yellow, and the multi-mode optical fiber is orange.

Figure 6-3 and Figure 6-4 show the appearances of single-mode optical fibers with different connectors.


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**Figure 6-3** Appearance of a single-mode optical fiber with LC/PC connectors

**Figure 6-4** Appearance of a single-mode optical fiber with SC/PC connectors

## Fiber Selection Criterion

Table 6-4 lists the criteria for selecting optical fibers. Table 6-5 lists common optical connectors.

**Table 6-4** Criteria for selecting optical fibers

| Determine ... | According to ... |
| --- | --- |
| Length | Survey result |
| Single-mode or multi-mode | Optical module type |


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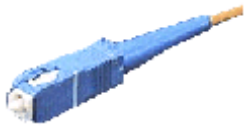
| Determine ... | According to ... |
| --- | --- |
| Optical connector type | • Square connector: SC/PC and LC/PC<br>• Round connector: FC/PC |

**Table 6-5** Common optical connectors

| | |
| --- | --- |
|  <br>SC/PC connector |  <br>LC/PC connector |
|  <br>FC/PC connector | |

# 6.6 Local Maintenance Serial Cable

A local maintenance serial cable is used for debugging devices or maintaining devices at the local end.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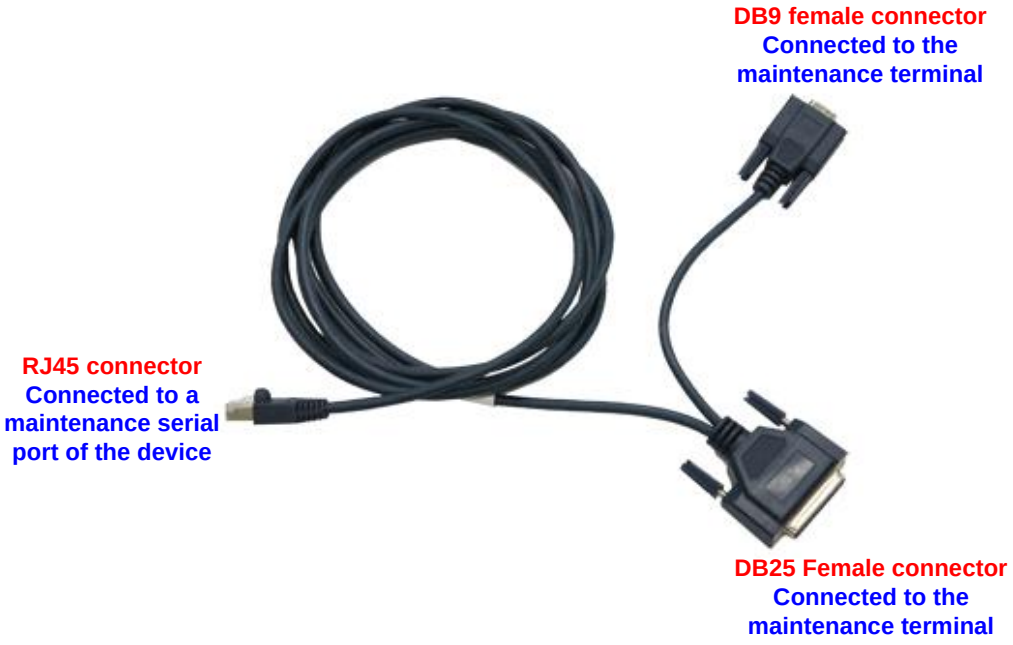
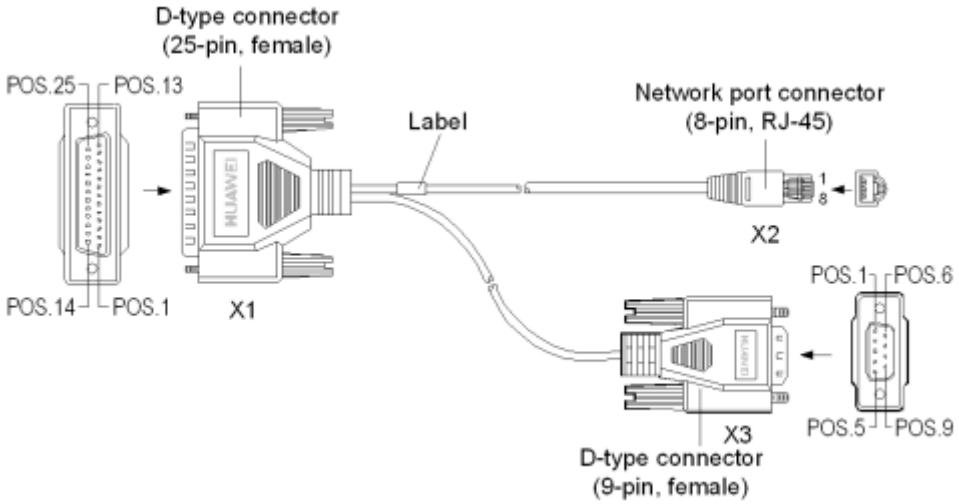
## Cable Connector




## Cable Structure




## Pin Assignments

| Connector | Pin Mapping | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| X2 (RJ45) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| X1 (DB-25) | 5 | 6 | 3 | 1 | 7 | 2 | 20 | 4 |
| X3 (DB-9) | 8 | 6 | 2 | 5 | 5 | 3 | 4 | 7 |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## Technical Specifications

| Parameter | Description |
|---|---|
| Connector type | DB-9 female + Ethernet port 8-pin/DB-25 female |
| Cable type | Symmetrical twisted pair |
| Color | Dark blue |
| Wire diameter of the inner conductor | 0.38 mm |
| Wire gauge of the inner conductor | 28 AWG (cross-sectional area ≈ 0.08 $mm^2$) |
| Number of wires | 8 |


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