

AN6001-G16

Optical Line Terminal Equipment

Product Overview

Version: A

Code: MN000003548

FiberHome Telecommunication Technologies Co., Ltd.

June 2018

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1 Documentation Guide

Document Orientation

Product Overview gives a general introduction to the orientation, features, functions, application, structure and hardware composition of the AN6001-G16 to help users get an overall knowledge about the product.

Intended Readers

- ◆ Marketing personnel
- ◆ Commissioning engineers
- ◆ Operation and maintenance engineers

Version Information

Version	Version Information
A	Initial version, corresponding to the equipment version V1R1.

Content

Chapter	Content
Product Introduction	◆ Product appearance ◆ Product positioning ◆ Power supply mode
Product Highlights	Product highlights
Product Application	Product application
Product Specification	◆ List of functions and features ◆ Major technical specifications ◆ Interface specifications
Product Structure	◆ Logical architecture ◆ Hardware structure ◆ Software architecture
Matching Cables	Functions, model numbers, structures, connections and parameters of wires and cables
Indoor Cabinets	Overview, appearance and dimensions of the indoor cabinets

Chapter	Content
Detailed Technical Specifications	◆ Requirements for operating environment ◆ Card dimensions ◆ GPON performance ◆ Reliability
Standards and Protocols	Standards and protocols that the equipment complies with
Panel and Terminals of the PDP	Model numbers, panels and terminals of the PDPs

Related Documentation

Document	Applied to
<i>AN6001-G16 Optical Line Terminal Equipment Product Overview</i>	Network planning phase
<i>AN6001-G16 Optical Line Terminal Equipment Quick Installation Guide</i>	Network deployment phase / network maintenance phase
<i>AN6001-G16 Optical Line Terminal Equipment UNM2000 Configuration Guide</i>	Network deployment phase / network maintenance phase
<i>AN6001-G16 Optical Line Terminal Equipment CLI Configuration Guide</i>	Network deployment phase / network maintenance phase

2 Product Introduction

☒ Product Appearance

☒ Product Positioning

☒ Power Supply Mode

2.1 Product Appearance

The AN6001-G16 is a small-sized cassette-shaped optical line access equipment developed by FiberHome. It is designed with pluggable modularized power cards, fan unit, core switch service cards and optical modules for easy installation, deployment and maintenance. It provides GPON access, carrier-class reliability, sound security mechanism and selective QinQ functions. The UNM2000 is used as the network management system to enable centralized management, maintenance and monitoring of the equipment.

The AN6001-G16 supports three power supply schemes: DC-AC, dual-DC, and dual-AC. The figures below show the appearance of the equipment.



Figure 2-1 AC-DC Power Supply Scheme



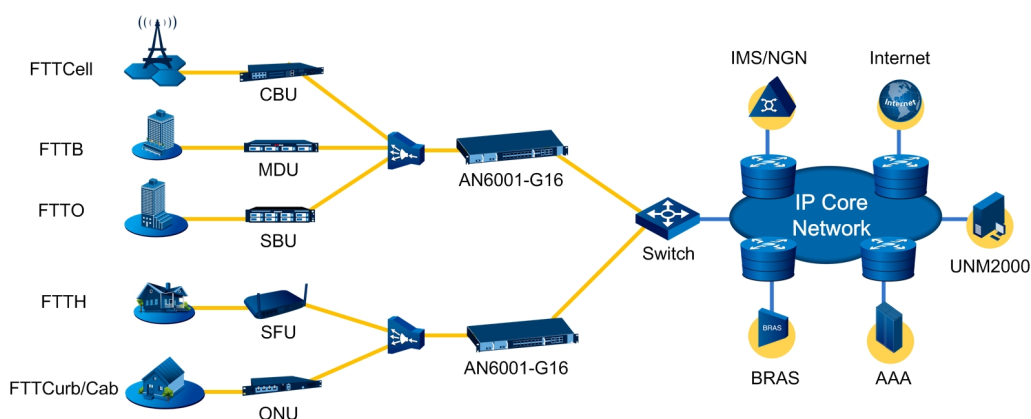
Figure 2-2 Dual-DC Power Supply Scheme



Figure 2-3 Dual-AC Power Supply Scheme

2.2 Product Positioning

The AN6001-G16 mainly serves for telecommunications, radio and television operators, and provides the last-mile fiber access solution. The small-sized (1U) cassette-shaped OLT can be deployed in outdoor cabinets and applied to sparsely-populated villages, towns, and urban villages which have insufficient equipment rooms and harsh outdoor environment. It caters to the demand of multiple service scenarios including home access, enterprise access and mobile backhauling. Generally, the equipment is located at the edge of the access network and connected to the terminal equipment directly. That is, it lies between the user equipment and the distribution layer equipment.



2.3 Power Supply Mode

The AN6001-G16 provides three power supply schemes: dual-DC, dual-AC and DC-AC hybrid schemes. All these schemes support 1+1 redundancy backup.

AC Power Supply

The AN6001-G16 supports 110 V / 220 V active-standby AC power supply featuring lightning protection, filtering, lightning protection failure alarm and input voltage detection.

DC Power Supply

The AN6001-G16 supports -48 V active-standby DC power supply featuring voltage monitoring, failure alarm reporting and protection switching.

The table below describes the model numbers, appearance and input / output specifications of the PDPs for the DC power supply scheme of the AN6001-G16.

Item	PDP260B	PDP296B
Model number	3000063-1FA 3000063-2FA	3000068-1FA 3000068-2FA
Appearance		
Range of input voltage	-38 V to -60 V	-38 V to -60 V
Input channels	Two channels of power (one active and one standby)	Two channels of power (one active and one standby)
Input current	The maximum current of a single channel is 96 A.	The maximum current of a single channel is 96 A.
Range of output voltage	-38 V to -60 V	-38 V to -60 V
Output channels	Six channels of output power	Six channels of output power
Output current	The maximum current of a single channel is 32 A.	The maximum current of a single channel is 32 A.



Note:

The AN6001-G16 is equipped with the PDP260B (3000063) by default. When lightning protection is required, use the PDP296B (3000068) instead.

3 Product Highlights

High-density Modularized Integration

- ◆ 1U high, designed with modularized core switch service card, fan card and power card for easy installation and replacement.
- ◆ Supports 16 GPON ports, two 10GE uplink ports (SFP+), two GE uplink optical ports (SFP) and two GE uplink electrical ports to allow access of 1024 ONUs.

Flexible Deployment

Supports mounting in 19-inch / 21-inch cabinets or outdoor cabinets and mounting on the wall. Suitable for long-haul broadband access applications in villages, towns and factories. Provides users with access to multiple services such as broadband, voice and IPTV services; caters to various access demands of telecommunications, radio and television operators as well as the customer premises network; and saves the backbone optical fiber resources.

Carrier-class Reliability

- ◆ Supports 1+1 redundancy protection for PON ports, uplink ports and power interfaces. All the slots meet the requirement of fault tolerance.
- ◆ Supports Type B PON protection, detection of rogue ONUs and detection of optical links.
- ◆ Supports service switching with the WTR time less than 50 ms.

Abundant Ethernet Functions

- ◆ Provides versatile VLAN processing functions, including selective QinQ, VLAN translation and VLAN aggregation.
- ◆ Provides overall QoS functions, including dynamic bandwidth allocation, priority control, multiple traffic classification mechanisms, and queue scheduling to meet the QoS demand of different services such as VoIP, IPTV and Internet access.
- ◆ Provides sound ACL functions, including L2, L3 and user-defined ACLs.

- ◆ Supports IGMP Snooping and Proxy, IGMPv3 and MLDv2 source address filtering, and rate control for multicast packets.
- ◆ Supports STP/MSTP, link aggregation, DHCP and port isolation.
- ◆ Supports both IPv4 and IPv6 to enable smooth migration to the next-generation IP network.

Remote Management and Easy Maintenance

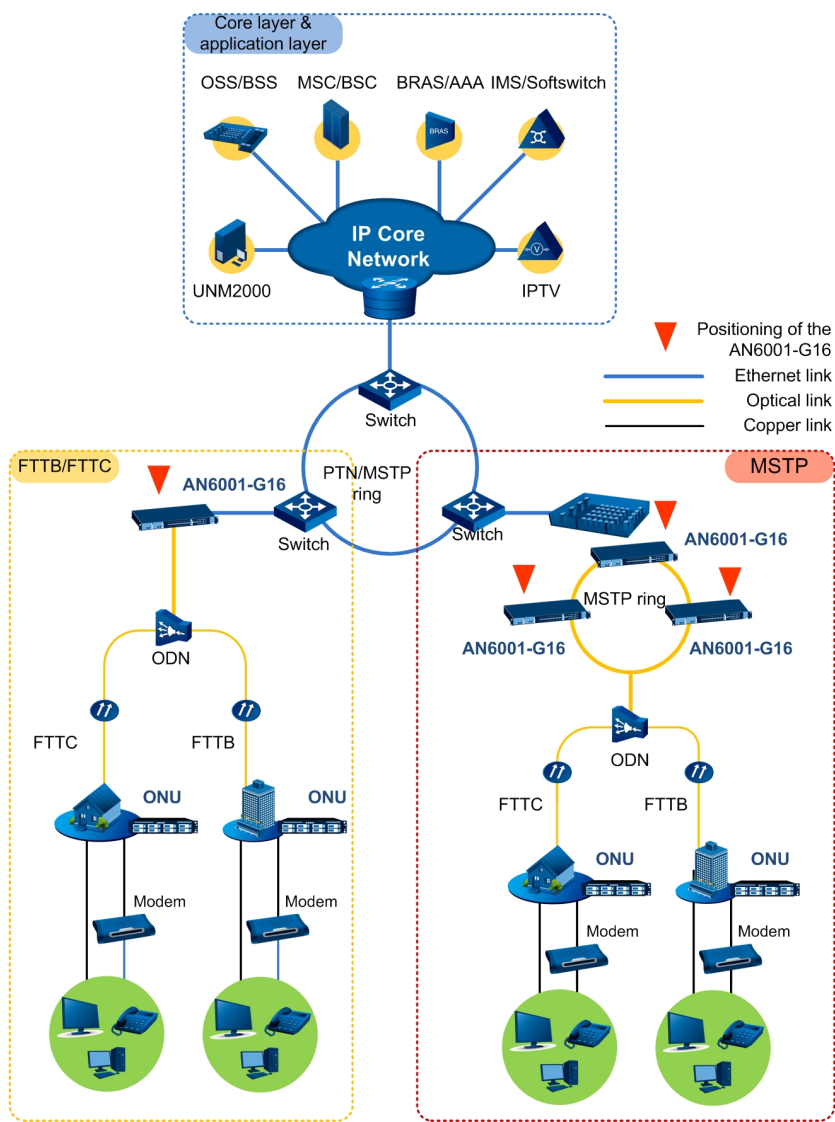
- ◆ Provides visualized management based on GUI EMS, which covers configuration, alarm and performance monitoring, data statistics, user management and so on.
- ◆ Supports management based on command lines with downward compatibility.
- ◆ Supports remote software upgrade, which simplifies operation and saves man power.

4 Product Application

The AN6001-G16 can be deployed on the wall in the hallway of a building or in an outdoor cabinet to provide the Last Mile fiber access and cater to the broadband access demand in sparsely-populated areas.

In this scenario, the AN6001-G16, used together with various ONUs, provides integrated user interfaces and abundant service functions to aggregate, merge, and forward user data to meet various service access demands of telecommunications, radio and television operators as well as the customer premises network.

Through uplink ports, the AN6001-G16s can be cascaded to make up an MSTP ring, so as to provide redundancy protection and enhance network reliability



5 **Product Specification**

- ☒ List of Functions and Features
- ☒ Major Technical Specifications
- ☒ Interface Specifications

5.1 List of Functions and Features

Classification	Function
Access features	GPON access
Layer 2 switching functions	Supports 802.1Q VLAN.
	Supports selective QinQ (VLAN Stacking).
	Supports independent learning of MAC addresses.
	Supports shared learning of MAC addresses.
	Clears Layer 2 forwarding table globally.
	Allows the OLT to forward data based on the MAC address.
	Supports configuring the MAC address aging time for the OLT and ONU.
	Supports Layer 2 port dynamic aggregation and implements the LACP.
Port mirroring	Supports ingress and egress mirroring.
	Supports flow mirroring.
Port aggregation	Supports the IEEE 802.3ad protocol.
	Supports static or LACP dynamic port aggregation.
Port isolation	Supports isolation of GPON ports.
	Supports isolation of uplink ports.
QoS functions	Supports 4-level HQoS functions.
	Supports IPv4 / IPv6 QoS.
Multicast functions	Supports IGMP Proxy / Snooping and MLD Proxy.
	Supports the IGMP V1 / V2 / V3 and MLD V1 / V2 protocols.
	Supports multicast VLAN.
	Supports multicast copy broadcast.
	Supports multicast information statistics.
	Supports multicast user management.
	Supports multicast program management.
Voice functions	Supports VoIP voice service.
	Supports H.248 and SIP protocols.
	Supports PPPoE configuration.
	Supports DHCP configuration.
	Supports query of NGN statistics information.
	Supports query of NGN resource status.

Classification	Function
	Supports voice intercommunication inside the PON.
Layer 3 functions	Supports VLAN Layer 3 interface.
	Supports ARP proxy.
	Supports DHCP Relay, DHCP Snooping or DHCP Server.
	Isolates illegal DHCP Server.
	Supports dynamic routing based on OSPF.
	Supports static routing.
Line identification function	Supports relay agent Option18 / Option37 function of DHCPv6.
	Supports DHCP option82 and PPPoE+.
Network features	Supports cascading over Ethernet networks.
	Supports bidirectional forwarding detection (BFD).
	Supports the STP protocol (IEEE802.1D), RSTP protocol (IEEE 802.1w) and MSTP protocol (IEEE 802.1s).
	Supports the ERPS function.
Operation and maintenance	Supports remote operation and user management.
	Supports operation authority classification.
	Supports exception handling for the equipment.
	Supports version and data management.
	Supports saving and querying the performance statistics and historical data.
	Supports remote upgrade of the software.
	Supports automatic rollback during software upgrade.
	Synchronizes equipment configuration with EMS configuration.
	Supports the License function.
Clocks	Clock in the system
	1588v2 clock
	Adaptive clock recovery
	Synchronous Ethernet clock
System redundancy	Supports 1+1 protection for PON ports.
	Supports 1+1 protection for uplink ports.
	Supports 1+1 protection for DC or AC power interfaces.
Security features	Each uplink port supports up to 120 ACL rules.
	Authenticates ONU terminals and reports illegal ONU registration events.

Classification	Function
	Supports limit on maximum number of MAC addresses learned to prevent attacks by users' MAC addresses.
	Supports filtering MAC addresses.
	Supports filtering packets and binding ports based on the source MAC address, destination MAC address, Ethernet type, VLAN, CoS, source IP address, destination IP address, IP port and protocol type.
	Prevents DoS attacks.

5.2 Major Technical Specifications

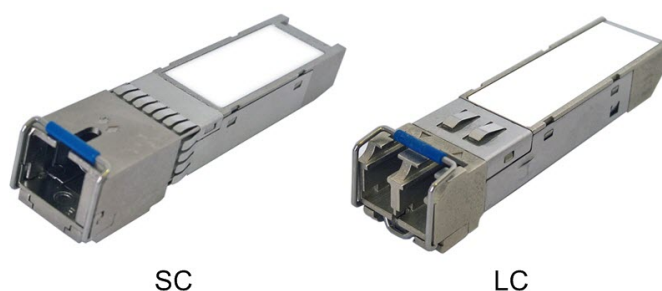
Item	Description
Dimensions of the subrack without mounting ears (H × W × D)	44.4 mm × 443 mm × 220 mm (1U)
Dimensions of the subrack with mounting ears for 19-inch cabinet (H × W × D)	44.4 mm × 480 mm × 225 mm
Dimensions of the subrack with mounting ears for 21-inch cabinet (H × W × D)	44.4 mm × 530 mm × 233 mm
Overall weight	4.5 kg
Power	DC voltage range: -38.4 V _{DC} to -57.6 V _{DC}
	AC voltage range: 90 V _{AC} to 290 V _{AC}
Overall power consumption ^{Note 1}	Maximum power consumption: 90 W Static power consumption: 57 W
System switching capability	44 G
Slot bandwidth	20 G
Management and monitoring interface	CONSOLE/ESC: RS232 local debugging serial port / RS485 environment monitoring port
	1PPS/TOD: clock interface
	ETH: out-of-band network management interface
	DC1-7: dry contact interface
PON port	16 GPON ports
Uplink interface	10GE1/10GE2: 10GE uplink port (SFP+)
	GE3/GE4: GE uplink optical port (SFP)
	GE5/GE6: GE uplink electrical port
Working temperature ^{Note 2}	Long-term operating temperature: 0°C to 45°C
	Short-term operating temperature: -10°C to 55°C

Item	Description
Working humidity	Long-term operating humidity: 5% to 85% (no condensation)
	Short-term operating humidity: 5% to 90% (no condensation)
Note 1: The overall power consumption is measured under the following conditions: ◆ Maximum power consumption: all the ports are 100% loaded. ◆ Static power consumption: all the ports are unloaded, and the optical ports are not plugged with optical modules. Note 2: The working temperature is measured within an altitude of 1800 m. The ambient temperature of the equipment will reduce by 1°C for each altitude rise of 220 m.	

5.3 Interface Specifications

The pluggable optical modules applied to the AN6001-G16 have two encapsulation formats: SFP and SFP+.

There are two types of module interfaces: LC and SC, as shown in the figure below.



The table below describes the mappings between the modules and the equipment interfaces.

Equipment Interface	Module Type	Application Code	Module Code
1 to 16	GPON optical module	CLASS C+	2.5/1.25G-20km-GPON OLT-SFP (CLASS C+)
		CLASS C++	2.5/1.25G-20km-GPON OLT-SFP (CLASS C++)
10GE1/10GE2	10GE optical module	10GBASE-LR	10G-10km-TDM-SFP+ (10GBASE-LR)
		10GBASE-ER	10G-40km-TDM-SFP+ (10GBASE-ER)
		10GBASE-ZR	10G-80km-TDM-SFP+ (10GBASE-ZR)
GE3/GE4	GE optical module	1000BASE-LX	1.25G-10km-TDM-SFP (1000BASE-LX)
		1000BASE-EX	1.25G-40km-TDM-SFP (1000BASE-EX)
		1000BASE-ZX1	1.25G-80km-TDM-SFP (1000BASE-ZX1)

The AN6001-G16 also provides four network ports for RJ-45 connectors. The table below describes the mapping between the ports and the cables connected.

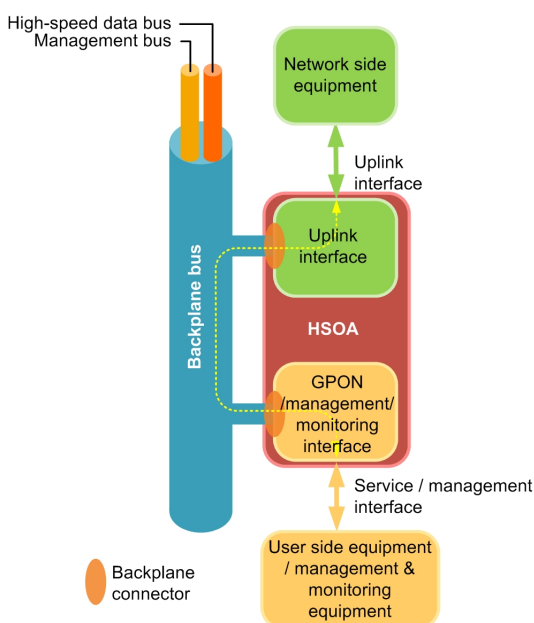
Equipment Interface	Interface Description	Cable Connected
CONSOLE/ESC	◆ RS232 local debugging serial port (CONSOLE) ◆ RS485 environment monitoring interface (ESC)	◆ Serial Port Line ◆ Environment Monitoring Unit Connection Cable
1PPS/TOD	External clock device interface	Network Cable
ETH	Out-of-band network management interface	Network Cable
DC1-7	Dry contact interface	Dry Contact Cable

6 Product Structure

- ☒ Logical Architecture
- ☒ Hardware Structure
- ☒ Software Architecture

6.1 Logical Architecture

The figure below shows the logical architecture of the AN6001-G16.



The AN6001-G16 implements the switching based on IP packet core. The core switch service card communicates via the backplane buses (combination of the data bus and management bus) interconnected at high speed to exchange service data or management information.

The table below describes the interfaces of the AN6001-G16.

Classification	Interface	Description
Uplink interface	10GE1/10GE2	10GE uplink port, using SFP+ encapsulation
	GE3/GE4	GE uplink optical port, using SFP encapsulation
	GE5/GE6	GE uplink electrical port
Management and monitoring interface	CONSOLE/ESC	RS232 local debugging serial port and RS485 environment monitoring port
	1PPS/TOD	Clock interface
	ETH	Out-of-band network management interface
	DC1-7	Seven dry contact ports
GPON port	1 to 16	16 GPON ports
Power interface	PWRA	AC power input interface; 110 V / 220 V; supporting 1+1 protection switching

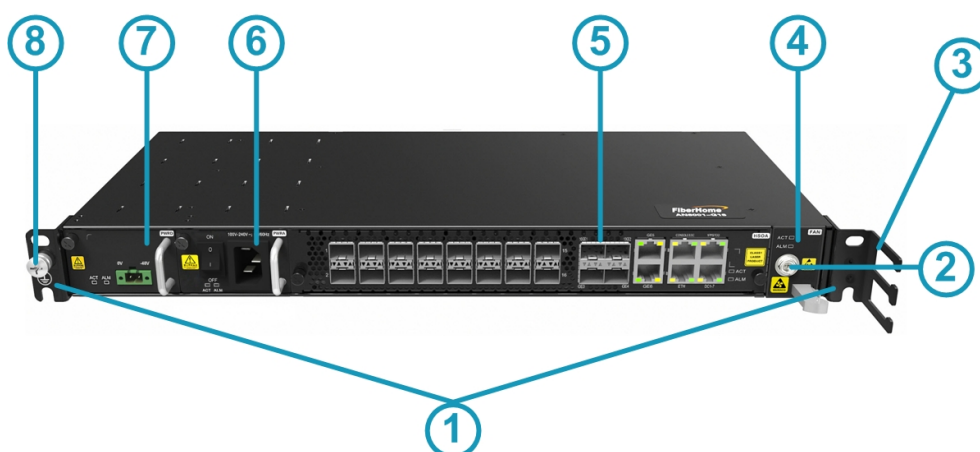
Classification	Interface	Description
	PWRD	DC power input interface; -48 V; supporting 1+1 protection switching

6.2 Hardware Structure

This section introduces the subrack structure, functional modules, indicator LEDs and air cooling mode for the AN6001-G16.

6.2.1 Subrack Structure

The figure below shows the components of the AN6001-G16 subrack using the AC-DC hybrid power supply scheme as an example.



No.	Name	Function
①	Mounting ear	Secures the subrack in the cabinet.
②	ESD protection earth ground fastener	Connects to the ESD protection device.
③	Fiber passage unit	Facilitates routing and arranging of fibers and cables.
④	Fan card	Facilitates air cooling for the equipment.
⑤	Core switch service card	Provides access to GPON services; provides GE / 10GE uplink ports, and interfaces for management, monitoring and debugging.
⑥	AC power card	Inducts 110 V / 220 V AC power supply. Here it can be replaced by a DC power card to provide 1 +1 DC power protection.

No.	Name	Function
⑦	DC power card	Inducts -48 V DC power supply. Here it can be replaced by an AC power card to provide 1+1 AC power protection.
⑧	Subrack earth ground point	Connects with the subrack earth ground cable.

6.2.2 Functional Modules and Indicators

Module Allocation

Three module allocation schemes are available to the AN6001-G16, corresponding to the power supply modes used.

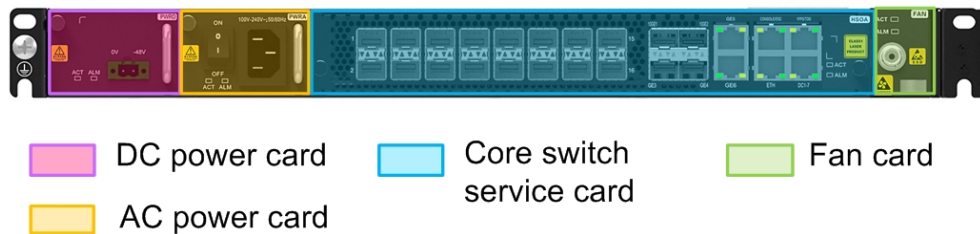


Figure 6-1 AC-DC Power Supply Scheme

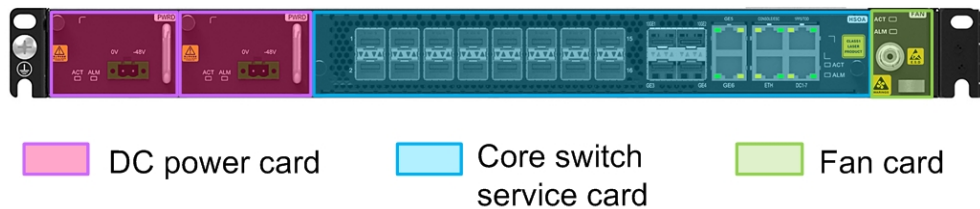


Figure 6-2 Dual-DC Power Supply Scheme

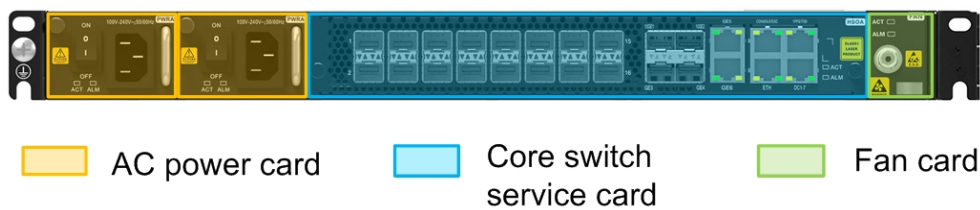
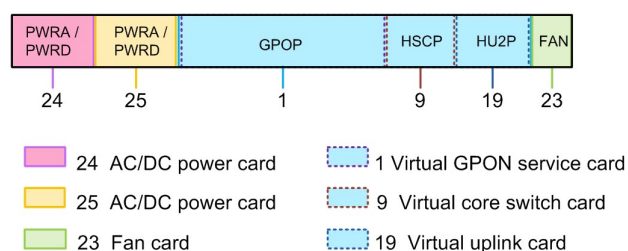


Figure 6-3 Dual-AC Power Supply Scheme

Virtual Card

The AN6001-G16 implements the upper-layer management in the virtual card mode. The core switch service card (HSOA) integrates three virtual cards: GOP, HSCP and HU2P. The virtual cards are integrated with the subrack and cannot be plugged / unplugged or replaced.

The figure below illustrates the allocation of virtual slots in the AN6001-G16 subrack.



Indicator LEDs

The table below describes the indicator LEDs of the AN6001-G16.

Identifier	Meaning		Color	Status	Description
ACT ^{Note 1}	Working indicator LED		Green	ON	The card is working normally.
				Blinking slowly	The card is being initialized.
				OFF	The card is not powered on or is not working normally.
ALM	Alarm indicator LED		Red	ON	The card has alarms.
				OFF	The card has no alarms.
	GPON port	LINK: link status indicator ^{Note 2}	Green	ON	The port is connected to an ONU at the far end, and the ONU has been authorized.
				OFF	The port is not connected to an ONU at the far end, or the far-end ONU is not authorized.

Identifier	Meaning		Color	Status	Description
	Uplink optical interface	LINK: link status indicator ^{Note 3}	Green	ON	The port is connected with the upper-layer device.
				Blinking	The port is transmitting data to or receiving data from the upper-layer device.
				OFF	The port is not connected with the upper-layer device.
	Uplink electrical interface	LINK: link status indicator	Green	ON	The port is connected to the upper-layer device without data transmission between them.
				OFF	The port is not connected with the upper-layer device.
		ACT: data status indicator	Yellow	Blinking	The port has data flow.
				OFF	The port has no data flow.

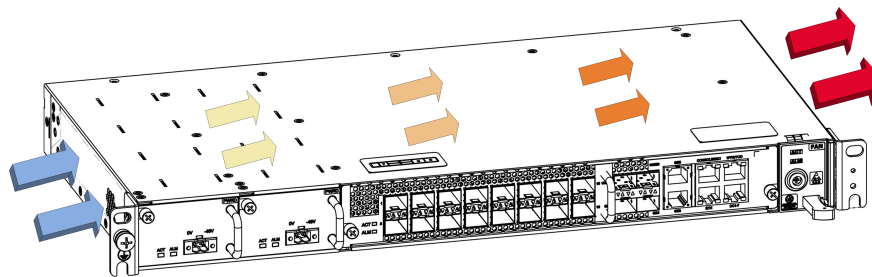
Note 1: The ACT indicators of the power card and fan card do not have the **Blinking Slowly** status.

Note 2: The left and right LINK indicators correspond to the upper and lower GPON ports respectively.

Note 3: The left and right LINK indicators correspond to the upper and lower uplink optical ports respectively.

6.2.3 Air Cooling Mode

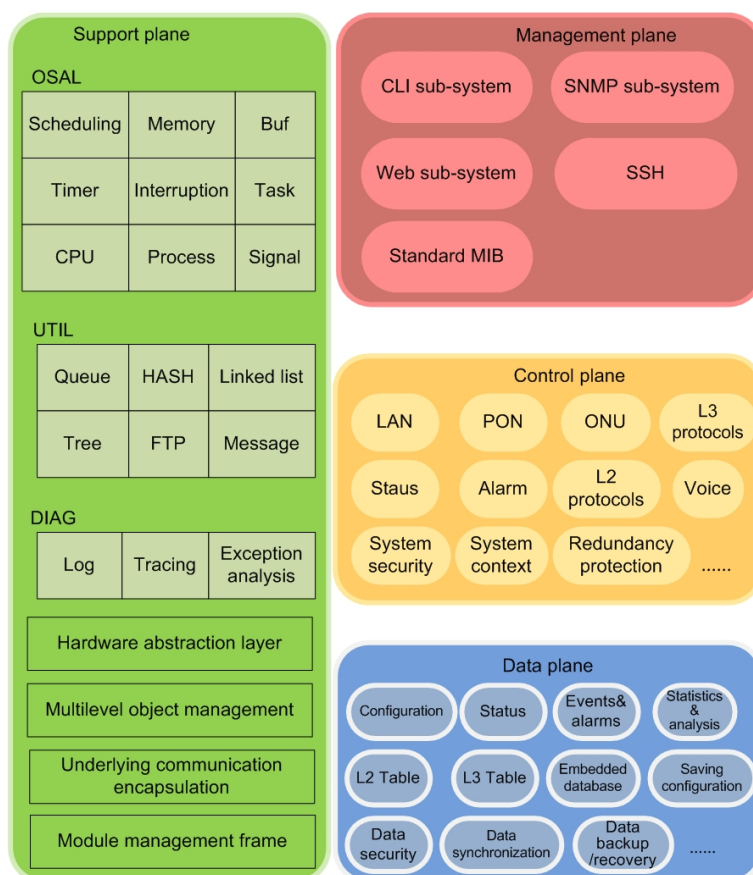
The AN6001-G16 is designed with forced air cooling. The fan card is located at the right side of the subrack (front view). The cool air is drawn from the left side to the right side of the subrack to take away the heat, as illustrated in the figure below.



6.3 Software Architecture

Software Architecture of the Core Switch Module

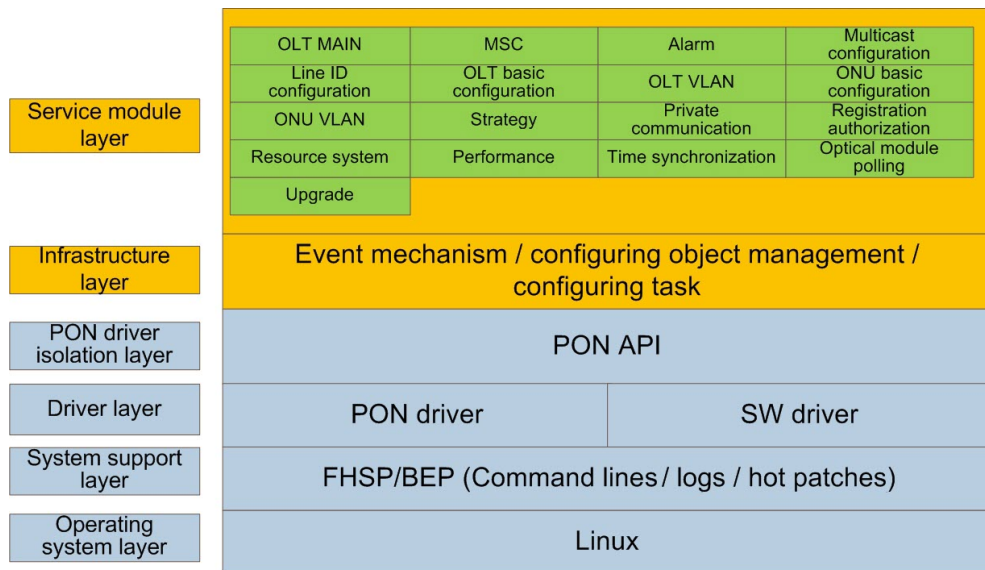
The figure below illustrates the core switch software architecture of the AN6001-G16.



- ◆ **Support plane:** Serves the entire system, available for all the layers and modules in the system; provides universal operating system and supports hardware transplantation; provides complete software tool set, session management, and IPC encapsulation.
- ◆ **Management plane:** Manages equipment based on Telnet, WEB, SSH, SNMP, RMON and so on; intervenes in the operation of the control plane when necessary.
- ◆ **Control plane:** Controls the operation of all network protocols; supports flexible configuration of functional modules to cater to various application scenarios.
- ◆ **Data plane:** Manages the configuration data, status data, alarm time data and operation data of functional modules and protocol modules in the system collectively.

Software Architecture of the Service Module

The figure below illustrates the service software architecture of the AN6001-G16.



- ◆ Operating system layer: Works based on the Linux operating system.
- ◆ System support layer: Provides system support and fault diagnosis functions such as the operating system abstract layer (OSAL), command lines, logs and hot patches.
- ◆ Driver layer: Provides the PON MAC and SW chip driver.
- ◆ PON driver isolation layer: Defines the universal PON_API interface and shields the difference in underlying hardware schemes so that the upper-layer software can make use of the OLT underlying hardware functions.
- ◆ Infrastructure layer: Provides the infrastructure module to set up the service card architecture.
- ◆ Service logic layer: Defines the service model and the service modules based on it.

7 Matching Cables

- ☒ Cable Overview
- ☒ Power Cable
- ☒ Protection Earth Ground Cable
- ☒ Fiber Jumper
- ☒ Network Cable
- ☒ Environment Monitoring Unit Connection Cable
- ☒ Serial Port Line
- ☒ Dry Contact Cable

7.1 Cable Overview

Cable	Model	Applied to
Cabinet Power Cable	-48 V power cable: 3696234 (16 mm ²) / 3696231 (25 mm ²)	PDP260B (3000063)
	0 V power cable: 3696235 (16 mm ²) / 3696232 (25 mm ²)	
	-48 V power cable: 408000076 (16 mm ²) / 408000021 (25 mm ²)	PDP296B (3000068)
	0 V power cable: 408000075 (16 mm ²) / 408000020 (25 mm ²)	
Subrack DC Power Cable	408000062	The PWRD card of the equipment
Subrack AC Power Cable	WX00219	The PWRA card of the equipment
Cabinet Protection Earth Ground Cable	408000041 (16 mm ²), 408000019 (25 mm ²)	Connecting the earth ground point on the top of the cabinet and the ground busbar in the equipment room
Subrack Protection Earth Ground Cable	3696084	The equipment subrack
PDP Protection Earth Ground Cable	3696239	PDP260B (3000063)
	408000018	PDP296B (3000068)
Fiber Jumper	LC/PC-type optical fiber jumper: OFC-LC/PC-LC/PC-S-20	The 10GE1 / 10GE2 port or GE3 / GE4 port of the HSOA card
	SC/PC-type optical fiber jumper: OFC-SC/PC-SC/PC-S-20	Ports 1 to 16 of the HSOA card
Network Cable	3695095	The GE5 / GE6 port, 1PPS/TOD interface or ETH interface of the HSOA card
Environment Monitoring Unit Connection Cable	409000159	The CONSOLE/ESC interface of the HSOA card
Serial Port Line	3695341	The CONSOLE/ESC interface of the HSOA card
Dry Contact Cable	3695452	The DC1-7 interface of the HSOA card

7.2 Power Cable

The power cables supply electric energy to loads so that the loads can work normally.

7.2.1 Cabinet Power Cable

Function

The cabinet power cables, including the -48 V power cable and the 0 V power cable, are used to induct the power source for the equipment room to the PDP inside the cabinet.

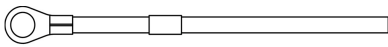
Model

The AN6001-G16 can use the PDP260B (3000063) or PDP296B (3000068). The cabinet power cables vary with the PDP used. Table 7-1 describes the mappings between the cabinet power cables and the PDPs. Please refer to this table and select appropriate cabinet power cables for the PDP.

Table 7-1 Model Numbers of Cabinet Power Cables

PDP Model	Cable Type	Cable Model	Cable Color
PDP260B (3000063)	-48 V power cable	3696234 (16 mm ²) 3696231 (25 mm ²)	Blue
	0 V power cable	3696235 (16 mm ²) 3696232 (25 mm ²)	Black
PDP296B (3000068)	-48 V power cable	408000076 (16 mm ²) 408000021 (25 mm ²)	Blue
	0 V power cable	408000075 (16 mm ²) 408000020 (25 mm ²)	Black

Structure

Cable Model	Description	Illustration
3696231, 3696232, 3696234 and 3696235	M10 uninsulated ring terminal + bare wire	
408000020, 408000021, 408000075 and 408000076	M6 uninsulated ring terminal + bare wire	

Connection

PDP Model	Cable Type	Internal Connector	External Connector
PDP260B (3000063)	-48 V power cable (blue)	-48V1 connector (active) -48V2 connector (standby)	External -48 V connector
	0 V power cable (black)	GND1 connector (active) GND2 connector (standby)	External 0 V connector
PDP296B (3000068)	-48 V power cable (blue)	-48V_A connector (active) -48V_B connector (standby)	External -48 V connector
	0 V power cable (black)	0V_A connector (active) 0V_B connector (standby)	External 0 V connector

Technical Specifications

Item	Specification
Cable type	Double-sheathed, heat-resistant (withstanding a temperature up to 105°C), and single-core soft cable
Maximum rated current	◆ 16 mm ² power cable: 80 A ◆ 25 mm ² power cable: 100 A

7.2.2 Subrack DC Power Cable

Function

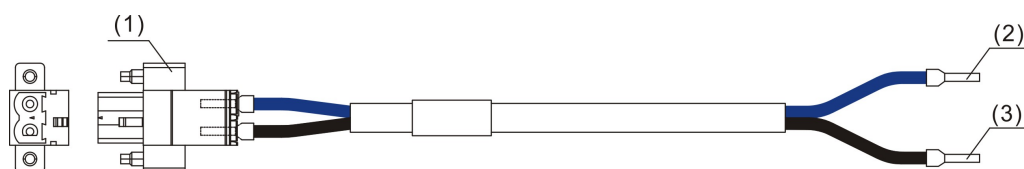
The subrack DC power cable connects the PDP and the equipment's DC power card (PWRD) to induct a set of redundant branch power rails from the PDP to the subrack.

Model

The model number of the subrack DC power cable for the AN6001-G16 is 408000062.

Structure

The subrack DC power cable has a two-conductor power plug on one end and two cord end terminals on the other end, as illustrated in the figure below.



(1) Two-conductor power plug (2) -48 V cord end terminal (3) 0 V cord end terminal

Connection

No.	Cable Connector	Connection Description	
		PDP260B (3000063)	PDP296B (3000068)
(1)	Two-conductor power plug	Connected to the power input interface of the DC power card (PWRD).	
(2)	Cord end terminal (-48 V, blue)	Connected to the -48 V connector on the PDP.	Connected to the -48V_A_1 to -48V_A_3 / -48V_B_1 to -48V_B_3 connectors on the PDP.
(3)	Cord end terminal (0 V, black)	Connected to the 0 V connector on the PDP.	Connected to the 0V_A_1 to 0V_A_3 / 0V_B_1 to 0V_B_3 connectors on the PDP.

Technical Specifications

Item	Specification
Cable type	Sheathed two-conductor cable
Color	Blue (-48 V), black (0 V)
Maximum current	16 A
Cross-sectional area of the conductor	2 × 1.5 mm ²

7.2.3 Subrack AC Power Cable

Function

The subrack AC power cable is used to connect the external AC power supply and the AC power card (PWRA) of the equipment, inducing the external AC power into the subrack.

Model

The model number of the AN6001-G16 subrack AC power cable is WX00219.

Structure

As shown in the figure below, the subrack AC power cable has a three-conductor power plug on one end and a three-conductor power jack on the other end.



Connection

Cable	Cable Connector	Connection Description
Subrack AC power cable	Tree-conductor plug	Connected to the external power supply unit.
	Tree-conductor jack	Connected to the power input interface of the AC power card (PWRA).

7.3 Protection Earth Ground Cable

The protection earth ground cables (including the cabinet protection earth ground cable and the subrack protection earth ground cable) protect the equipment from lightning and interference.

7.3.1 Cabinet Protection Earth Ground Cable

Function

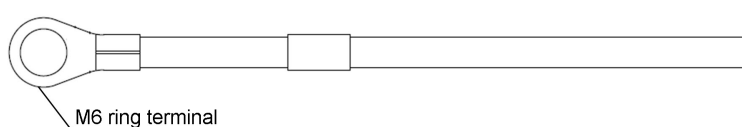
The cabinet protection earth ground cable is used to connect the earth ground point on the top of the cabinet and the ground busbar in the equipment room.

Model

The AN6001-G16 can use the cabinet protection earth ground cables with the model numbers 408000041 (16 mm²) and 408000019 (25 mm²).

Structure

As shown in the figure below, the yellow- / green cable has an M6 uninsulated ring terminal on one end for connection with the cabinet. You need to make a grounding terminal on the other end of the cable for connection with the busbar.



Connection

Cable Connector	Description
M6 uninsulated ring terminal	Connected to the earth ground point on the top of the cabinet.
Bare wire terminal	Prepared according to the earth ground point on the busbar.

Technical Specifications

Item	Specification
Cable type	Single core soft cable
Color	Yellow- / green
Maximum rated current	◆ 16 mm² protection earth ground cable: 80 A ◆ 25 mm² protection earth ground cable: 100 A

7.3.2 Subrack Protection Earth Ground Cable

Function

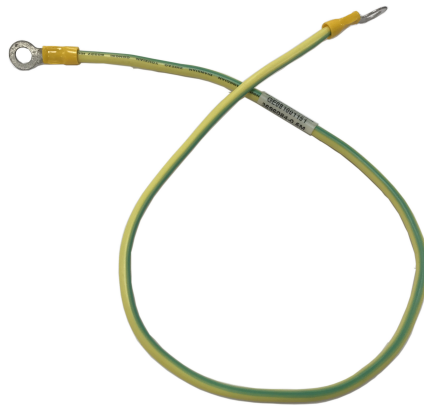
The subrack protection earth ground cable is used to connect the subrack and the protection earth ground terminal of the cabinet to provide ground protection for the subrack.

Model

The model number of the subrack protection earth ground cable used by the AN6001-G16 is 3696084.

Structure

The figure below shows the subrack protection earth ground cable. Both ends of the cable are M6 pre-insulation terminals, and between them is a yellow- / green cable.



Connection

Cable Connector	Connection Description
M6 pre-insulation ring terminal	Connects to the cabinet earth ground point.
M6 pre-insulation ring terminal	Connects to the subrack earth ground point.

Technical Specifications

Item	Specification
Cable type	Single-sheathed heat-resistant (withstanding a temperature up to 90°C) single-core soft cable
Color	Yellow- / green
Maximum current	32 A
Cross-sectional area of the conductor	4 mm ²

7.3.3 PDP Protection Earth Ground Cable

Function

The PDP protection earth ground cable is used to connect the protection ground of the PDP and the earth ground point on the top of the cabinet. Before delivery, this cable has been connected to the PE terminal of the PDP.

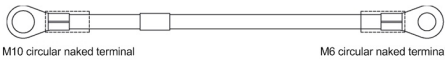
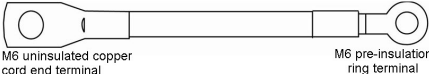
Model

The AN6001-G16 can be equipped with PDP260B (3000063) or PDP296B (3000068). The protection earth ground cables used on the two PDPs are different. See Table 7-2 for the mappings between the PDPs and their protection earth ground cables.

Table 7-2 Protection Earth Ground Cables for the PDPs

PDP Model	Cable Model
PDP260B (3000063)	3696239
PDP296B (3000068)	408000018

Structure

Cable Model	Description	Appearance
3696239	Comprises an M10 uninsulated ring terminal at the PDP side and an M6 uninsulated ring terminal at the cabinet side, with a yellow- / green cable between them.	 M10 circular naked terminal M6 circular naked terminal
408000018	Comprises an M6 uninsulated copper cord end terminal at the PDP side and an M6 pre-insulation ring terminal at the cabinet side, with a yellow- / green cable between them.	 M6 uninsulated copper cord end terminal M6 pre-insulation ring terminal

Connection

PDP Model	Cable Model	Cable Connector	Description
PDP260B (3000063)	3696239	M10 uninsulated ring terminal	Connected to the PE terminal of the PDP.
		M6 uninsulated ring terminal	Connected to the earth ground point on the top of the cabinet.
PDP296B (3000068)	408000018	M6 uninsulated copper cord end terminal	Connected to the PE terminal of the PDP.
		M6 pre-insulation ring terminal	Connected to the earth ground point on the top of the cabinet.



Note:

The PDP protection earth ground cable has been connected to the inner PE connector of the PDP before delivery; therefore, you only need to connect the cable to the earth ground point on the top of cabinet on site.

Technical Specifications

Cable Model	Cable Type	Color	Maximum Current	Cross-sectional Area of Conductor
3696239	Single core soft cable	Yellow- / green	63 A	10 mm ²
408000018			40 A	6 mm ²

7.4 Fiber Jumper

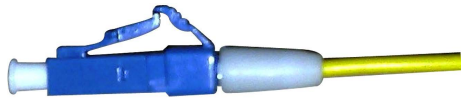
Function

Serving as the transmission carrier of optical signals, the fiber jumper is applied to the short-distance transmission of optical signals. It connects an optical interface of the equipment's card and the ODF.

Model

Classification	Model
LC/PC-type optical fiber jumper	OFC-LC/PC-LC/PC-S-20
SC/PC-type optical fiber jumper	OFC-SC/PC-SC/PC-S-20

Structure

Classification	Connector
LC/PC-type fiber connector	
SC/PC-type fiber connector	

Connection

Cable	Connector	Card Interface Connected	Connection on the ODF Side
Fiber jumper	SC/PC connector	Ports 1 to 16 of the HSOA card	Connected to the remote ONU to provide the GPON downlink channel.
	LC/PC connector	The 10GE1 / 10GE2 port of the HSOA card	Connected to the IP network to provide the GE and 10 GE optical channels.
		The GE3 / GE4 interface of the HSOA card	

Reference for Choosing Fiber Jumpers

Parameter	Basis for Choice
Length	On-site investigation
Single-mode / multi-mode	Type of the optical module
Fiber connector type	Type of the optical module

7.5 Network Cable

Function

The network cable is used to connect the local equipment to the uplink equipment, out-of-band network management system or time synchronization device.

Model

The model number of the network cable (including straight-through network cable and cross-over network cable) is 3695095.

Structure

Both ends of the network cable are equipped with the RJ-45 connectors (also known as crystal heads), as shown in the figure below.



Table 7-3 lists the pin definitions for the straight-through network cable.

Table 7-3 Pin Definitions for the Straight-through Network Cable

Pin of the Local End	Wire Color	Pin of the Opposite End
1	White- / orange	1
2	Orange	2
3	White- / green	3
4	Blue	4
5	White- / blue	5
6	Green	6
7	White- / brown	7
8	Brown	8

Table 7-4 lists the pin definitions for the cross-over network cable.

Table 7-4 Pin Definitions for the Cross-over Network Cable

Pin of the Local End	Wire Color	Pin of the Opposite End
1	White- / orange	3
2	Orange	6
3	White- / green	1
4	Blue	4
5	White- / blue	5

Table 7-4 Pin Definitions for the Cross-over Network Cable (Continued)

Pin of the Local End	Wire Color	Pin of the Opposite End
6	Green	2
7	White- / brown	7
8	Brown	8

Connection

Cable	Card Interface Connected	Connection at the Opposite End
Network cable	The GE5 / GE6 port, ETH interface or 1PPS/TOD interface of the HSOA card	Connected to the uplink equipment, out-of-band network management system or time synchronization device.

Technical Specifications

Item	Specification
Cable type	CAT-5 twisted pair
Connector type	RJ-45
Number of conductors	8
Conductor diameter	AWG24
Breakdown voltage	2000 V

7.6 Environment Monitoring Unit Connection Cable

Function

The environment monitoring unit connection cable is used to connect the CONSOLE/ESC interface of the equipment to the external environment monitoring device.

Model

The model number of the environment monitoring unit connection cable is 409000159.

Structure



The table below defines the pins of the environment monitoring unit connection cable.

Pin of the Local End	Wire Color	Pin of the Opposite End
1	White- / orange	7
2	Orange	8
7	White- / brown	5
8	Brown	6

7.7 Serial Port Line

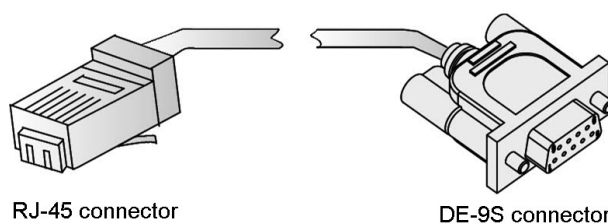
Function

The serial port line is used for debugging or local maintenance. It connects the local debugging serial port of the HSOA card and the serial port of the network management computer.

Model

The model number of the serial port line is 3695341.

Structure



RJ-45 connector

DE-9S connector

Table 7-5 lists the terminal definitions for the serial port line.

Table 7-5 Terminal Definitions for the Serial Port Line

Connected Signal	RJ-45 Connector Pin	DE-9S Connector Pin
Signal transmitted by the equipment	3	2
GND	4/5	5
Signal received by the equipment	6	3

Connection

Cable	Cable Connector	Connection Description
Serial port line	RJ-45 connector	Connected to the CONSOLE/ESC interface of the HSOA card.
	DE-9S connector	Connected to the serial port of the network management computer.

Technical Specifications

Item	Specification
Cable outside diameter	5.2±0.3 mm
Maximum DC resistance of conductor	93.8Ω/km
Characteristic impedance	100±15Ω
Number of conductors	4

7.8 Dry Contact Cable

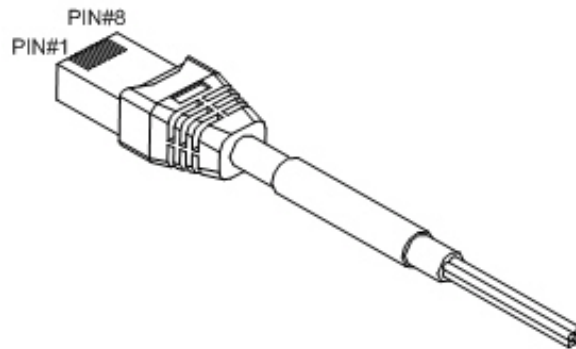
Function

The dry contact cable is used to connect the dry contact interface on a card to an external dry contact device to enable monitoring of infrared detection, smoke, mains supply, humidity, temperature, fans, shake, door access control, etc.

Model

The model number of the dry contact cable is 3695452.

Structure



Connection

Cable	Cable Connector	Connection Description
Dry contact cable	RJ-45 connector	Connected to the DC1-7 interface of the HSOA card.
	Bare wire end	Connected to the dry contact device.

Technical Specifications

Item	Specification
Cable type	CAT-5 twisted pair
Connector type	RJ-45
Number of conductors	8
Conductor diameter	AWG24

8 Indoor Cabinets

- ☒ Overview of Cabinets
- ☒ Detailed Dimensions of the Cabinets

8.1 Overview of Cabinets

Table 8-1 Overview of Cabinet Models

Cabinet Model	4102596 to 4102599	4102589 to 4102592	404000068 to 404000071	404000337 to 404000340
Description	19-inch 600 mm-deep cabinet with anti-dust screen	21-inch 300 mm-deep cabinet without anti-dust screen ^{Note 1}	21-inch 300 mm-deep cabinet with anti-dust screen ^{Note 1}	21-inch 340 mm-deep cabinet without anti-dust screen
Appearance				
Remarks	Note 1: ◆ Among the SC/PC optical fiber connectors, the 55 mm long and 39 mm long ones are most commonly used. The 55 mm ones are called long connectors, and the 39 mm ones are called short connectors. When the equipment is mounted in a 300 mm-deep cabinet, it is advisable to use the 39 mm optical fiber connectors (short connectors). ◆ Among the LC/PC optical fiber connectors, the 48 mm long and 31 mm long ones are most commonly used. The 48 mm ones are called long connectors, and the 31 mm ones are called short connectors. When the equipment is mounted in a 300 mm-deep cabinet, it is advisable to use the 31 mm optical fiber connectors (short connectors).			

Table 8-2 Dimensions and Weight of the Cabinets

Cabinet Type	Cabinet Model	Dimensions (H × W × D) (mm)	Weight (kg)
19-inch 600 mm-deep cabinet with anti-dust screen	4102596	1600 × 600 × 600	94
	4102597	2000 × 600 × 600	109
	4102598	2200 × 600 × 600	117
	4102599	2600 × 600 × 600	134
21-inch 300 mm-deep cabinet without anti-dust screen	4102589	1600 × 600 × 300	56
	4102590	2000 × 600 × 300	61
	4102591	2200 × 600 × 300	66
	4102592	2600 × 600 × 300	76
21-inch 300 mm-deep cabinet with anti-dust screen	404000068	1600 × 600 × 300	58
	404000069	2000 × 600 × 300	69
	404000070	2200 × 600 × 300	74
	404000071	2600 × 600 × 300	85
21-inch 340 mm-deep cabinet without anti-dust screen	404000337	1600 × 600 × 340	57.5
	404000338	2000 × 600 × 340	62.5
	404000339	2200 × 600 × 340	67.5
	404000340	2600 × 600 × 340	77.5

8.2 Detailed Dimensions of the Cabinets

The following introduces the detailed dimensions of the 19-inch and 21-inch cabinets.

8.2.1 Detailed Parameters of the 19-inch Cabinets

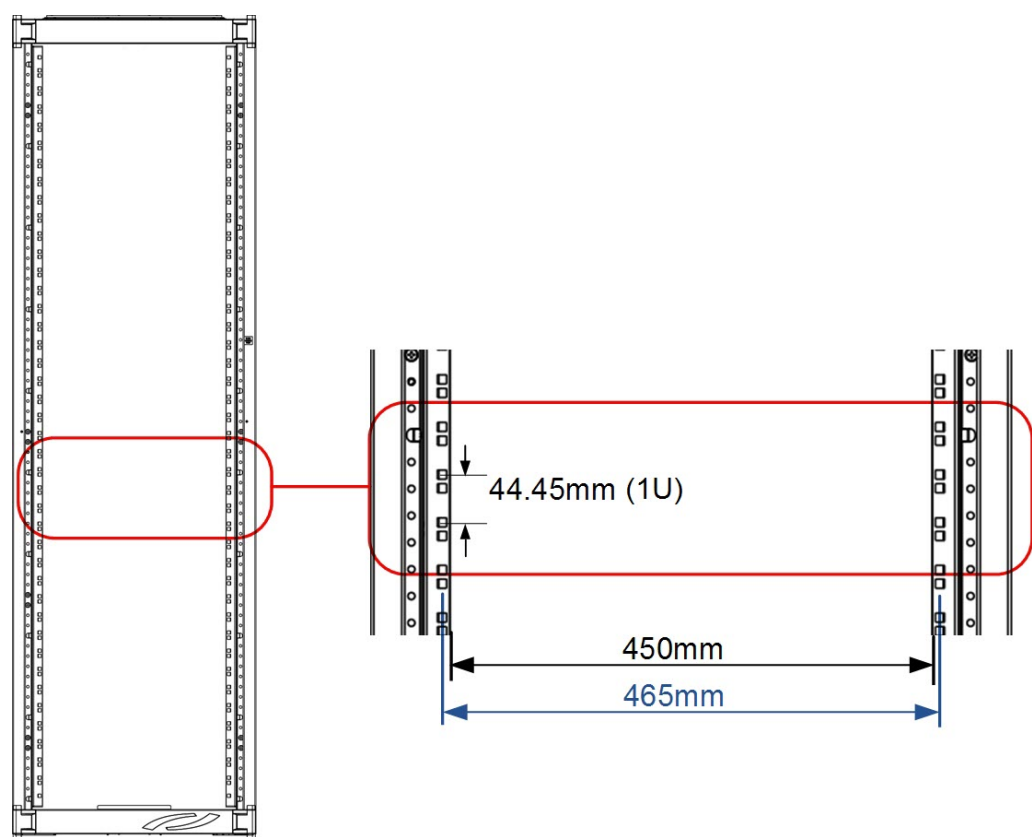


Figure 8-1 Detailed Dimensions of the 19-inch Cabinet

Table 8-3 Detailed Parameters of the 19-inch Cabinet

Item	Specification
Distance between holes on the mounting flange	1 U = 44.45 mm
Angle opening width	450 mm
Fixing centres	465 mm

8.2.2 Detailed Dimensions of the 21-inch Cabinets

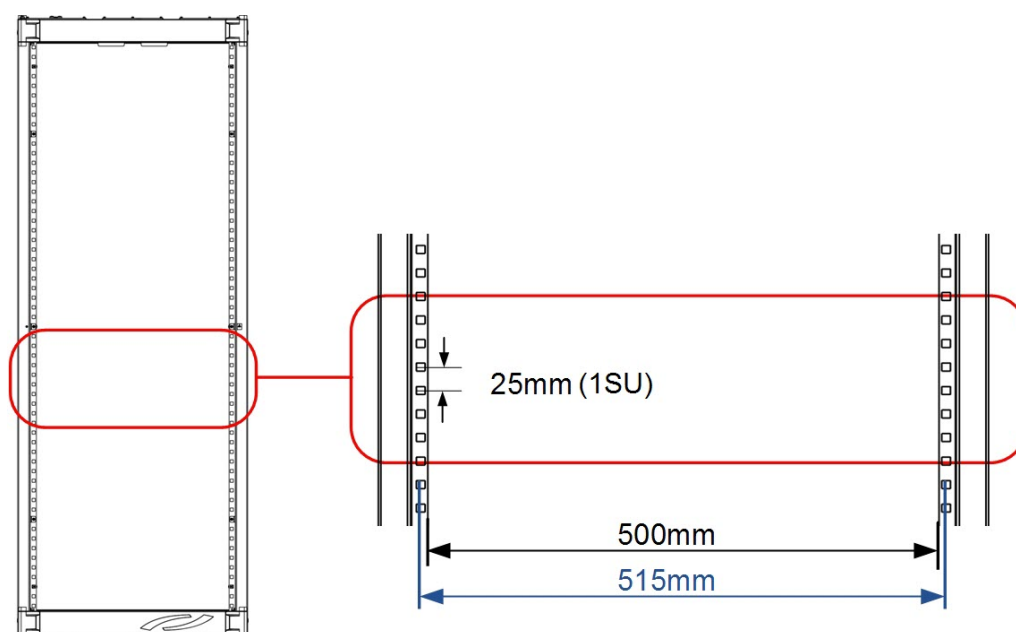


Figure 8-2 Detailed Dimensions of the 21-inch Cabinet

Table 8-4 Detailed Dimensions of the 21-inch Cabinet

Item	Specification
Distance between holes on the mounting flange	1 SU = 25 mm
Angle opening width	500 mm
Fixing centres	515 mm

Appendix A Detailed Technical Specifications

A.1 Requirements for Operating Environment

Item	Requirement
Bearing capacity of the floor in the equipment room	$> 600 \text{ kg/m}^2$
Grounding resistance	$< 10\Omega$
Atmospheric pressure	70 kPa to 106 kPa
Altitude	-60 m to 4000 m
Temperature change rate	$\leq 0.5^\circ\text{C/min}$
Ambient air quality	No corrosive and solvent gas, and no dust; no strong electromagnetic fields nearby.
Solar radiation	$\leq 700 \text{ W/m}^2$
Thermal radiation	$\leq 600 \text{ W/m}^2$
Concentration of mechanical active substances	Suspended dust: $\leq 0.4 \text{ mg/m}^3$
	Deposited dust: $\leq 15 \text{ mg}/(\text{m}^3 \cdot \text{h})$
	Gravel: $\leq 300 \text{ mg/m}^3$
Concentration of chemical substances	$\text{SO}_2 \leq 0.30 \text{ mg/m}^3$
	$\text{H}_2\text{S} \leq 0.10 \text{ mg/m}^3$
	$\text{NO}_x \leq 0.50 \text{ mg/m}^3$
	$\text{NH}_3 \leq 1.00 \text{ mg/m}^3$
	$\text{Cl}_2 \leq 0.10 \text{ mg/m}^3$
	$\text{HCl} \leq 0.10 \text{ mg/m}^3$
	$\text{HF} \leq 0.01 \text{ mg/m}^3$
	$\text{O}_3 \leq 0.05 \text{ mg/m}^3$
Noise standard	$\leq 63 \text{ dBA}$ (measured at a temperature of $23 \pm 2^\circ\text{C}$)

A.2 Card Dimensions

The AN6001-G16 contains the HSOA, PWRA/PWRD and FAN cards. The table below lists the dimensions of the cards.

Card Type	Dimensions (H × W × D)
Core switch service card (HSOA)	40.8 mm × 277 mm × 207.5 mm
AC power card (PWRA)	39.6 mm × 64 mm × 205.5 mm
DC power card (PWRD)	39.6 mm × 64 mm × 205.5 mm
Fan card (FAN)	44.2 mm × 30.8 mm × 209.5 mm

A.3 GPON Performance

Item	Description
GPON performance	Provides 16 GPON ports.
	Supports access of 1024 ONUs.
	Uplink rate: 1.24416 Gbps; downlink rate: 2.48832 Gbps
	Supports Type B protection switching.
	Supports downlink GEM frame encryption.
	Maximum transmission distance: 60 km
	Maximum differential fiber distance: 40 km
	TCONT:1000
	Throughput: 88 Gbps

A.4 Reliability

Equipment Model	Basic Reliability	Task Reliability
AN6001-G16	30 000 h	50 000 h
Note 1: The mean time to repair (MTTR) for the entire system is 0.5 hour.		

Appendix B Standards and Protocols

B.1 Environment Standards

Standard Number	Title
ETSI EN 300 019-1-1	Environmental Engineering (EE) Environmental conditions and environmental tests for telecommunications equipment Part 1-1: Classification of environmental conditions: Storage Class 1.1: Weather-protected, partly temperature-controlled storage locations Class 1.2: Weather-protected, not temperature-controlled storage locations
ETSI EN 300 019-1-2	Environmental Engineering (EE) Environmental conditions and environmental tests for telecommunications equipment Part 1-2: Classification of environmental conditions: Transportation Class 2.1: Very careful transportation Class 2.2: Careful transportation
ETSI EN 300 019-1-3	Environmental Engineering (EE) Environmental conditions and environmental tests for telecommunications equipment Part 1-3: Classification of environmental conditions: Stationary use at weather-protected locations Class 3.1: Temperature-controlled locations Class 3.2: Partly temperature-controlled location
ETSI EN 300 753	Environmental Engineering (EE) Environmental conditions and environmental tests for telecommunications equipment October 1997: Acoustic noise emitted by telecommunications equipment
IEC 60068-2	Basic Environmental Testing Procedures
IEC 60721-2-6	Environmental conditions appearing in nature - Earthquake vibration

Standard Number	Title
IEC 60721-3-1	Amendment 1 - Modular order for the development of mechanical structures for electronic equipment practices - Part 1: Generic standard
IEC 60721-3-3	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 3: Stationary use at weather-protected locations
ETSI EN 300 753	Equipment Engineering (EE) Acoustic noise emitted by telecommunications equipment
NEBS GR-63-CORE	Network Equipment-Building System (NEBS) Requirements: Physical Protection
ROHS	Restriction of the use of certain hazardous substance in electrical and electronic equipment.
IEC 60950-22-2005	Information technology equipment - Safety - Part 22: Equipment to be installed outdoors
IEC 61587-1-2007	Mechanical structures for electronic equipment - Tests for IEC 60917 and IEC 60297 - Part 1: Climatic, mechanical tests and safety aspects for cabinets, racks, subracks and chassis
IEC 61587-2-2000	Mechanical structures for electronic equipment - Tests for IEC 60917 and IEC 60297 - Part 2: Seismic tests for cabinets and racks
IEC 61587-3-2006	Mechanical structures for electronic equipment - Tests for IEC 60917 and IEC 60297 - Part 3: Electromagnetic shielding performance tests for cabinets, racks and subracks
UL 94-1996	UL Standard for Safety Test for Flammability of Plastic Materials for Parts in Devices and Appliances Fifth Edition

B.2 EMC Standards

Standard Number	Title
CISPR 22	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
CISPR 24	Information technology equipment – Immunity characteristics – Limits and methods of measurement
EN 300 386	Electromagnetic compatibility and Radio spectrum Matters (ERM); Telecommunication network equipment; Electromagnetic Compatibility (EMC) requirements
EN 55022	Information technology equipment – Radio disturbance characteristics - Limits and methods of measurement

Standard Number	Title
EN 55024	Information technology equipment – Immunity characteristics – Limits and methods of measurement
EN 61000-4-2	Electromagnetic compatibility (EMC) – Part 4 – 2: Electrostatic discharge immunity test
EN 61000-4-3	Electromagnetic compatibility (EMC) – Part 4 – 3: Testing and measurement techniques-Radiated, radio-frequency, electromagnetic field immunity test
EN 61000-4-4	Electromagnetic compatibility (EMC) – Part 4 – 4: Testing and measurement techniques-Electrical fast transient/burst immunity test
EN 61000-4-5	Electromagnetic compatibility (EMC) – Part 4 – 5: Testing and measurement techniques-Surge immunity test
EN 61000-4-6	Electromagnetic compatibility (EMC) – Part 4 – 5: Testing and measurement techniques-Immunity to conducted disturbances, induced by radio-frequency fields
ETSI EN 300132-2	Power supply interface at the input telecommunications equipment; Part 2: Operated by direct current (DC)
ETSI EN 300386 V 1.4.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Telecommunication network equipment; Electromagnetic Compatibility (EMC) requirements
IEC 61000-3-2	Electromagnetic compatibility - Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)
IEC 61000-3-3	Electromagnetic compatibility- Limits - Limitation of voltage changes, voltage fluctuation and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection
IEC 61000-4-2	Electromagnetic compatibility (EMC) – Part 4 – 2: Testing and measurement techniques-Electrostatic discharge immunity test
IEC 61000-4-3	Electromagnetic compatibility (EMC) – Part 4 – 3: Testing and measurement techniques-Radiated, radio-frequency, electromagnetic field immunity test
IEC 61000-4-4	Electromagnetic compatibility (EMC) - Part 4 - 4: Testing and measurement techniques-Electrical fast transient/burst immunity test
IEC 61000-4-5	Electromagnetic compatibility (EMC) – Part 4 – 5: Testing and measurement techniques-Surge immunity test
IEC 61000-4-6	Electromagnetic compatibility (EMC) – Part 4 – 6: Testing and measurement techniques-Immunity to conducted disturbances, induced by radio-frequency fields

Standard Number	Title
IEC 61000-4-8	Electromagnetic compatibility - Testing and measurement techniques - Power frequency magnetic field immunity test
IEC 61000-4-11	Electromagnetic compatibility - Testing and measurement techniques - Voltage dips, short interruption and voltage variations immunity tests
ITU-T K.20	Resistibility of telecommunication equipment installed in a telecommunications centre to overvoltages and overcurrents
ITU-T K.43	Immunity requirements for telecommunication equipment
ITU-T K.48	EMC requirements for telecommunication equipment - Product family Recommendation
EN 300 386	Electromagnetic compatibility requirement for telecommunication network equipment
CISPR 22 (EN55022)	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
CISPR 24 (EN55024)	Information technology equipment - Immunity characteristics - Limits and methods of measurement

B.3 Safety Standards

Standard Number	Title
EN 60825-1	Safety of laser products - Part 1: Equipment classification and requirements
EN 60825-2	Safety of laser products - Part 2: Safety of optical fibre communication
EN 60950-1	Information technology equipment - Safety - Part 1: General Requirements
IEC 60950-1	Safety of Information Technology Equipment. Including Electrical Business Equipment
IEC 60825-1	Safety of laser products - Part 1: Equipment classification and requirements
IEC 60825-2	Safety of laser products - Part 2: Safety of optical fibre communication
IEC 60950-2001	Safety of Information technology equipment including Electrical Business Equipment
UL 60950-1:2003	Information Technology Equipment - Safety - Part 1: General Requirements
CAN/CSA-C22.2 No 60950-1	Safety of Information Technology Equipment Including Electrical Business Equipment

Standard Number	Title
UL 60950-1	Safety of Information Technology Equipment Including Electrical Business Equipment (3rd edition)
IEC Publication 479-1	Guide on the effects of current passing through the human body
IS 8437 {1993}	Guide on the effects of current passing through the human body
IS 13252 {1993}	Safety of information technology equipment including electrical business equipment

B.4 GPON Access Standard

Standard Number	Title
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 (G-PON): Transmission convergence layer specification
ITU-T G.Imp984.3	Implementers' Guide for ITU-T Rec. G.984.3 (02/2004)
ITU-T G.984.4	Gigabit-capable passive optical networks (G-PON): ONT management and control interface specification
ITU-T G.Imp.984.4	Implementor's Guide for ITU-T Rec. G.984.4
ITU-T G.984.5	Enhancement band for gigabit capable optical access networks
ITU-T G.984.6	Gigabit-capable passive optical networks (GPON): Reach extension
ITU-T G.988	ONU management and control interface (OMCI) specification

B.5 Standards and Protocols for Services

Protocols for NGN Voice Service

Standard Number	Title
ITU-T G.711	Pulse code modulation (PCM) of voice frequencies
ITU-T G.711.1	Wideband embedded extension for G.711 pulse code modulation
ITU-T G.723.1	Dual rate speech coder for multimedia communications transmitting at 5.3 and 6.3 kbit/s
ITU-T G.729	Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear prediction (CS-ACELP)

Standard Number	Title
ITU-T G.729.1	G.729 based Embedded Variable bit-rate coder: An 8-32 kbit/s scalable wideband coder bitstream interoperable with G.729
ITU-T G.1mp 729	Implementers' Guide for G.729 Annexes B, F, G, I and C+ (Coding of speech at 8 kbit/s using CS-ACELP)
RFC3261	SIP: Session Initiation Protocol
RFC3261	SIP: Session Initiation Protocol
RFC2327	SDP: Session Description Protocol
RFC3262	Reliability of Provisional Responses in the Session Initiation Protocol (SIP)
RFC4028	Session Timers in the Session Initiation Protocol (SIP)
RFC3525	Gateway Control Protocol Version 1
RFC3015	Megaco Protocol Version 1.0
ITU-TH.248.1	Gateway control protocol: Version 3
RFC3389	Real-time Transport Protocol (RTP) Payload for Comfort Noise (CN)
ITU-TT.30	Procedures for document facsimile transmission in the general switched telephone network
ITU-TT.38	Procedures for real-time Group 3 facsimile communication over IP networks
RFC3550	A Transport Protocol for Real-Time Applications
RFC3611	RTP Control Protocol Extended Reports (RTCPXR)
ITU-TQ.23	Technical features of push-button telephone sets
ITU-TQ.24	Multifrequency push-button signal reception
ITU-TE.180	Technical characteristics of tones for the telephone service
RFC2833	RIP Payload for DTMF Digits, Telephony Tones and Telephony Signals
RFC2198	RTP Payload for Redundant Audio Data
ITU-TG.168	Digital network echo cancellers

Protocols for Multicast Service

Standard Number	Title
IETF RFC 1112	Host Extensions for IP Multicasting
IETF RFC 2236	Internet Group Management Protocol, Version 2
IETF RFC 3376	Internet Group Management Protocol, Version 3
IETF RFC 2710	Multicast Listener Discovery (MLD) for IPv6
IETF RFC 3810	Multicast Listener Discovery Version 2 (MLDv2) for IPv6

Time Standards

Standard Number	Title
IEEE 1588-2008	IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems
IETF RFC 1305	Network Time Protocol (Version 3) Specification, Implementation and Analysis
IETF RFC 2030	Simple Network Time Protocol (SNTP) Version 4 for IPv4, IPv6 and OSI
G.984.3-Amendment 2	Time-of-day distribution and maintenance updates and clarifications

Ethernet Protocols

Standard Number	Title
IEEE 802-2001	IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture
IEEE 802.1ad	IEEE Standard for Local and Metropolitan Area Networks - Virtual Bridged Local Area Networks - Amendment 4: Provider Bridges
IEEE 802.1ag-2007	IEEE Standard for Local and Metropolitan Area Networks Virtual Bridged Local Area Networks Amendment 5: Connectivity Fault Management
IEEE 802.1w-2001	Local and metropolitan area networks - Common specifications - Part 3: Media access control (MAC) bridges; Amendment 2: Rapid reconfiguration
IEEE 802.1x-2004	IEEE Standard for Local and Metropolitan Area Networks Port-Based Network Access Control
IEEE 802.1D-2004	IEEE Standard for Local and metropolitan area networks: Media Access Control (MAC) Bridges
IEEE 802.1Q-2005	IEEE Standard for Local and Metropolitan Area Networks - Virtual Bridged Local Area Networks - Amendment 4: Provider Bridges
IEEE 802.3ah	IEEE Standard for Information technology- Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications Amendment: Media Access Control Parameters, Physical Layers, and Management Parameters for Subscriber Access Networks
IEEE 802.1s-2002	IEEE Standards for Local and metropolitan area networks - Virtual Bridged Local Area Networks - Amendment 3: Multiple Spanning Trees

Standard Number	Title
ITU-T Y.1291	An architectural framework for support of Quality of Service in packet networks
ITU-T Y.1730	Requirements for OAM functions in Ethernet-based networks and Ethernet services
TR-101	Migration to Ethernet-Based DSL Aggregation
ITU-T Y.1731	OAM functions and mechanisms for Ethernet-based networks
IEEE 802.1ag	Connectivity Fault Management, IEEE Standard for Local and Metropolitan Area Networks Virtual Bridged Local Area Networks Amendment 5

B.6 Standards for Network Protection

Reference Standard for Ethernet Link Aggregation

Standard Number	Title
IEEE 802.1AX-2008	IEEE Standard for Local and metropolitan area networks - Link Aggregation

Reference Standard for MSTP

Standard Number	Title
IEEE Std 802.1d	1998 Edition, Spanning Tree Protocol
IEEE Std 802.1w-2001	Rapid Spanning Tree Protocol
IEEE Std 802.1s-2002	Multiple Spanning Tree Protocol

Reference Standard for ERPS

Standard Number	Title
ITU-T G.8032 V1	Ethernet ring protection switching. The Edition 1 supports the single ring protection, single instance, and revertive mode.
ITU-T G.8032 V2	Ethernet ring protection switching. In Edition 2, multi-ring protection, multi-instance, and non-revertive mode are developed, the FDB (Forwarding Database) flush mechanism is optimized, and forced switch, manual switch and the Clear command are supported.

B.7 Standards for Layer 3 Functions

Reference Standard for ARP

Standard Number	Title
IETF RFC 826	An Ethernet Address Resolution Protocol or Converting Network Protocol Addresses to 48.bit Ethernet Address for Transmission on Ethernet Hardware

Reference Standard for ARP Proxy

Standard Number	Title
IETF RFC1027	Using ARP to Implement Transparent Subnet Gateways

Reference Standard for DHCP Relay

Standard Number	Title
RFC 2131	Dynamic Host Configuration Protocol

Reference Standard for DHCP Proxy

Standard Number	Title
dsl2006[1].127.00	Proposals of DHCP relay improvements

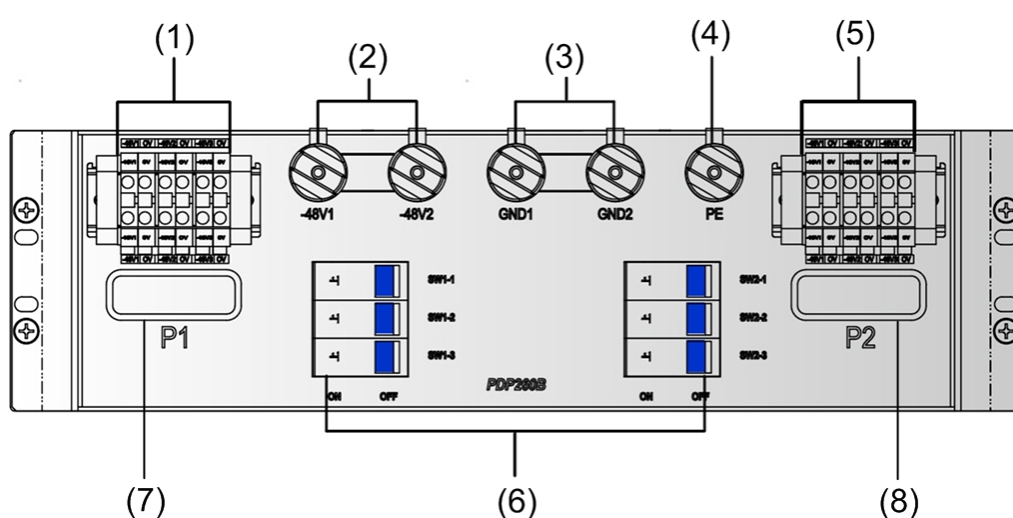
B.8 Other Standards

Standard Number	Title
IETF RFC 2284	PPP Extensible Authentication Protocol (EAP)
SFF-8472	Specification for Diagnostic Monitoring Interface for Optical Transceivers (Rev 10.3 Dec.1, 2007)
ITU-T Rec L.40	Optical fibre outside plant maintenance support, monitoring and testing system
ITU-T Rec L.53	Optical fibre maintenance criteria for access networks
IETF RFC 2362	Protocol Independent Multicast-Sparse Mode
IETF RFC 1723	RIP Version 2 Carrying Additional Information
IETF RFC 2453	RIP Version 2

Appendix C Panel and Terminals of the PDP

The following introduces the terminal board and power connectors of the PDP260B (3000063).

Terminal Board



- | | | |
|--|--|--|
| (1) Branch power rail output connector 1 | (2) External power -48 V input connector | (3) External power 0 V input connector |
| (4) Protection earth ground cable connector | (5) Branch power rail output connector 2 | (6) Automatic circuit breaker |
| (7) Branch power rail 0 V output connector 1 | (8) Branch power rail 0 V output connector 2 | |

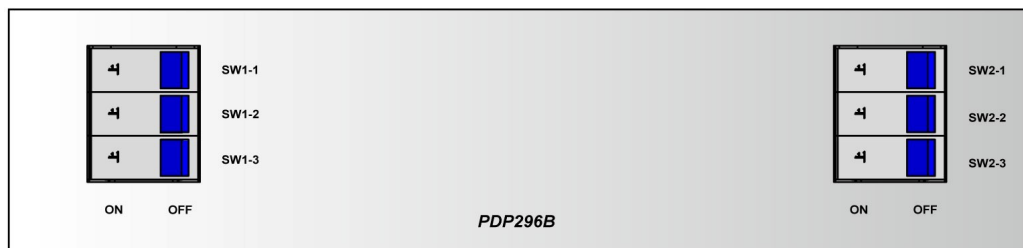
Power Connectors

Connector Type	No.	Connector	Description
External power input (2 × 1 channels)	(2)	-48V1, -48V2	-48 V external power input connectors. The two connectors back up each other.
	(3)	GND1, GND2	0 V external power input connectors. The two connectors back up each other.
	(4)	PE	Connected to the earth ground point on the top of the cabinet.

Connector Type	No.	Connector	Description
Branch power rail output (2 × 3 channels)	(1)	-48V1 to -48V3 (on P1)	Power automatic circuit breakers. The outer connectors act as the -48 V branch power output connectors, corresponding to P1.
	(5)	-48V1 to -48V3 (on P2)	Power automatic circuit breakers. The outer connectors act as the -48 V branch power output connectors, corresponding to P2.
	(7)	0V (on P1)	0 V branch power output connector, corresponding to P1.
	(8)	0V (on P2)	0 V branch power output connector, corresponding to P2.

The following introduces the front panel, terminal board, power / alarm connectors, jumper pins and lightning protection module of the PDP296B (3000068).

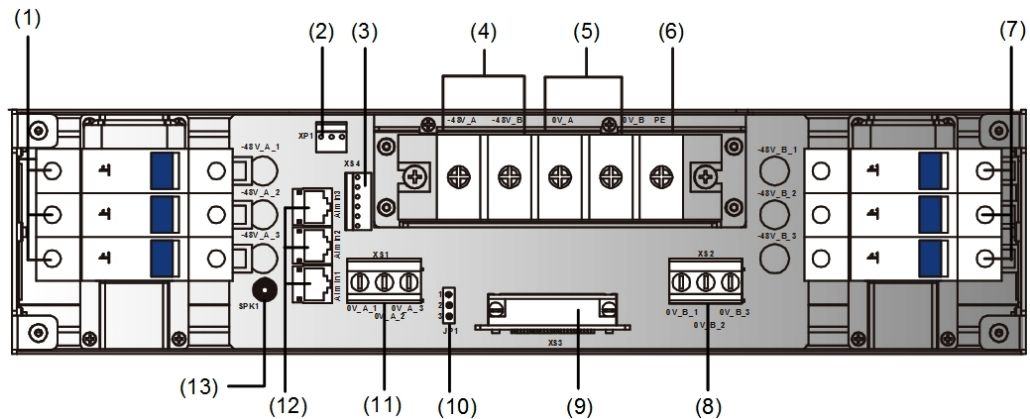
Front Panel



The PDP296B (3000068) has six air automatic circuit breakers on its front panel to control the power supply outputs. Among which:

- ◆ The ACBs SW1-1 to SW1-3 control the branch power rails -48V_A_1 to -48V_A_3 respectively .
- ◆ The ACBs SW2-1 to SW2-3 control the branch power rails -48V_B_1 to -48V_B_3 respectively .

Terminal Board



- | | | |
|---|---|---|
| (1) Branch power rail -48V output connector A | (2) Alarm connector for the head of row cabinet | (3) Cabinet top indicator LED alarm connector |
| (4) External power -48V input connector | (5) External power 0V input connector | (6) Protection earth ground cable connector |
| (7) Branch power rail -48V output connector B | (8) Branch power rail 0V output connector B | (9) Lightning protection module |
| (10) Jumper pin for selecting the working status indicator LED of the PDP | (11) Branch power rail 0V output connector A | (12) Subrack alarm convergence connector |
| (13) Buzzer | | |

Power Connectors

Connector Type	No.	Connector	Description
External power input (2 × 1 channels)	(4)	-48V_A, -48V_B	-48 V external power input connectors. The -48V_A and -48V_B connectors back up each other.
	(5)	0V_A, 0V_B	0 V external power input connectors. The 0V_A and 0V_B connectors back up each other.
	(6)	PE	Connected to the earth ground point on the top of the cabinet.
Branch power rail output (2 × 3 channels)	(1)	-48V_A_1 to -48V_A_3	Automatic circuit breakers (ACBs). The outer connectors are -48 V branch power rail output connectors corresponding to -48V_A.
	(7)	-48V_B_1 to -48V_B_3	Automatic circuit breakers (ACBs). The outer connectors are -48 V branch power rail output connectors corresponding to -48V_B.
	(11)	0V_A_1 to 0V_A_3 (XS1)	0 V branch power rail output connectors, corresponding to 0V_A.

Connector Type	No.	Connector	Description
	(8)	0V_B_1 to 0V_B_3 (XS2)	0 V branch power rail output connectors, corresponding to 0V_B.

Alarm Connector

Connector Type	No.	Connector	Description
Subrack alarm convergence connector	(12)	AlmIn1 to AlmIn3	RJ-45 sockets receiving the alarm information from the equipment inside the cabinet
Alarm output connector for the head of row cabinet	(2)	XP1	XP6 is a three-conductor D-type socket, which can output the alarm information to the head of row cabinet.
Alarm output connector for indicator LEDs	(3)	XS4	XP7 is a six-conductor D-type socket, which can output the alarm indicator triggering signal to the cabinet-top indicator LEDs.

Jumper Pin

JP1 is the jumper pin for selecting the operating status indicator LED of the PDP. It is located as indicated by (10) in the figure, and can be set in either of the following two ways:

- ◆ Short pin1 and pin2 of JP1, and the green indicator LED on the top of the cabinet will indicate the working status of the PDP.
- ◆ Short pin2 and pin3 of JP1, and the green indicator LED on the top of the cabinet will be controlled by the CALL (order wire call) signal.



Note:

Pin2 and pin3 of JP1 have been shorted by default before delivery of the PDP.

Lightning Protection Module

The lightning protection module is plugged into the base of XS3, as indicated by (9) in the figure.

The lightning protection module, using the standard DB-25 plug, can withstand the surge of 2 kV (1.2/50 us - 8/20 us combination wave) in the common mode and the surge of 1 kV (1.2/50 us - 8/20 us combination wave) in the differential mode, so as to guarantee the normal operation of the equipment.

Appendix D Abbreviations

AAA	Authentication, Authorization and Accounting
ACL	Access Control List
ARP	Address Resolution Protocol
BFD	Bidirectional Forwarding Detection
BLV	Basics Level Vectoring
BRAS	Broadband Remote Access Server
BSS	Base Station Subsystem
BSC	Base Station Controller
Buf	Buffer
CoS	Class of Service
DHCP	Dynamic Host Configuration Protocol
DoS	Denial of Service
FMC	Fixed Mobile Convergence
FTTB	Fiber To The Building
FTTC	Fiber To The Curb
FTTH	Fiber To The Home
FTTO	Fiber To The Office
FTP	File Transfer Protocol
GEM	GPON Encapsulation Mode
GPON	Gigabit-capable Passive Optical Network
HASH	HASH
HQoS	Hierarchical Quality of Service
IGMP	Internet Group Management Protocol
IMS	IP Multimedia Subsystem
IP	Internet Protocol
IPTV	Internet Protocol Television
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
LACP	Link Aggregation Control Protocol
MAC	Medium Access Control
MDU	Multi-Dwelling Unit

MGC	Media Gateway Controller
MGCP	Media Gateway Control Protocol
MIB	Management Information Base
MLD	Multicast Listener Discover
MOS	Mean Opinion Score
MSAN	MultiService Access Node
MSC	Media Server Controller
MSTP	Multiple Spanning Tree Protocol
MTBF	Mean Time Between Failure
MTTR	Mean Time To Repair
NGN	Next Generation Network
OAM	Operation, Administration And Maintenance
ODN	Optical Distribution Network
ONU	Optical Network Unit
OSAL	Operating System Abstraction Layer
OSPF	Open Shortest Path First
OSS	Operations Support System
OLT	Optical Line Termination
PDP	Power Distribution Panel
PON	Passive Optical Network
POTS	Plain Old Telephone Service
ppm	parts per million
PPPoE	Point to Point Protocol over Ethernet
PSTN	Public Switched Telephone Network
PTN	Public Telecommunications Network
QinQ	802.1Q-in-802.1Q
QoS	Quality of Service
RADIUS	Remote Authentication Dial In User Service
RMON	Remote Network Monitoring
RSTP	Rapid Spanning Tree Protocol
RTP	Real-time Transport Protocol
SBU	Single Business Unit
SFP	Small Form-factor Pluggable transceiver
SFU	Single Family Unit

SHDSL	Symmetric High bit rate Digital Subscriber Line
SIP	Session Initiation Protocol
SLV	System Level Vectoring
SNI	Service Node Interface
SNMP	Simple Network Management Protocol
SSH	Secure Shell
STB	Set Top Box
STP	Straight-Through Processing
TCP	Transmission Control Protocol
VLAN	Virtual Local Area Network
VoIP	Voice over Internet Protocol

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