

FusionModule5000 Smart Modular Datacenter Solution

Technical Proposal

FusionModule5000 Smart Modular Data Center(DC) Solution
for xx Project in xx Country

Issue 01-(20170220)

Date 2017-02-20

Commented [L1]: Please modify the above title based on the real project

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1 Preface

Data Center is core parts for customer, which can provide the place for all of the core devices, servers and storages, and protect them to keep running properly and to provide the good services for the end users. Data Center plays a key part for the success of the client and this document provides the design and solutions of Huawei's Modular Data Center. Normally to make the data center design it is need to do the site survey and collect a lot of information, but at this moment this information is not available, so this document just makes an idealized design. And in the future when the data center site is decided, the new design should be made and replace this one.

1.1 Design Principles

A team of professionals and experts in various fields will contribute to the success & completion of the project by considering the following:

High Availability

Data center requires high availability to run the business. But not all data centers can meet the availability criteria. According to ANSI/TIA-942 standards, data center can be classified to four tiers.

Table 1-1 Availability Tiers

Availability Tiers	Tier I	Tier II	Tier III	Tier IV
Redundant Components	N	N+1	N+1	2(N+1)
Annual IT Downtime due to Site	28.8 hrs	22.0 hrs	1.6 hrs	0.8 hrs
Site availability	99.67%	99.75%	99.98%	99.99%

[NOTE] For this project, Huawei's solution complied with Tier 2 or Tier 3 standard.

Security

Commented [L(2)]: Give the availability standard by the real project

Because of critical business, data center is important. Physical security is necessary to be built up for data center protection. It should be able to prevent unauthorized people entering data center.

Flexible Expansion

Datacenter should be flexibly expanded with business grows at the cloud computing era.

Greener

Saving energy, is not only to get greener, new datacenter should be more efficient, less capital expenditure.

Low Cost

As energy consumption increasing continually and energy being more and more expensive, power consumption of data center is the biggest part of operation cost. Reducing power consumption is one important consideration during data center design.

Intelligent Management

Data center is an integrated project with all kinds of subsystems. Modular design allows ~~XX~~ to create highly complex systems to smaller, more manageable building blocks. These smaller units are more easily defined and can be more easily managed.

Commented [L(3)]: Project name

1.2 International Standards

International standards are very important reference for data center design. We designed the data center referred to the following international standards.

ANSI/TIA-942-2005: Telecommunications Infrastructure Standard for Data Centers

ANSI/TIA/EIA-568-B.1: Commercial Building Telecommunications Cabling Standard; Part 1 General Requirements

ANSI/TIA/EIA-568-B.2: Commercial Building Telecommunications Cabling Standard; Part 2 Balanced Twisted-Pair Cabling Components

ANSI/TIA/EIA-568-B.3: Optical Fiber Cabling Components Standard

ANSI/TIA-569-B: Commercial Building Standard for Telecommunications Pathways and Spaces

ANSI/TIA/EIA-606-A: Administration Standard for Commercial Telecommunications Infrastructure

ANSI/TIA/EIA-J-STD-607, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

ANSI/TIA-758-A: Customer-Owned Outside Plant Telecommunications Cabling Standard

IEEE C2-2002: National Electrical Safety Code

NFPA 70: National Electrical Code

IEEE Std. 1100: Recommended Practice for Powering and Grounding Electronic Equipment

IEEE Std. 446: Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications

2 Scope of Work

2.1 Assumption and Prerequisite

Based on the understanding of **XXX** requirements, Huawei prepares this Data Center proposal based on the following assumptions:

Commented [L(4)]: Project name

Datacenter building

(1) The building itself should meet **Tier 3** Standard, such as enough floor loading, headroom of building, building type is stand-alone.

Commented [L(5)]: According to the real situation

(2) There should be enough space outside the building, in order to construct an add-on data center room and place generator and outdoor unit of air-condition etc.

(3) The resistance of grounding system should not exceed 5 ohms.

(4) The height of room should be at least **2.6m**. The load of computer room floor is no less than 600kg/m2.

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Electrical System

(1) **XXX** should provide the general capacity of special transformer lead-in in data center.

Commented [L(7)]: According to the real situation

2.2 Scope of Work

This scope of work description is based on the main responsibility of related parties.

Table 2-1 The scope of work description

Description	Responsibility	
	Huawei	XXX
Architectural		
Data Center site selection	S	R
Water supply, Sewage pipe		R
Secured warehouse		R
Data Center Building grounding grid and lightning protection		R
Data Center Building exterior wall decoration		R

Data Center Building exterior wall Perimeter guard		R
Data Center Building Interior decoration	R	
Shipping and receiving area		R
Data center Redesign and transformation	R	
Internal Doors of computer room and power room	R	
NOC room(wall display system)	R	
Power room	R	
Generator and fuel storage areas	S	R
Electrical System		
Main power (utility power,380V lead-in to building)		R
Power transformer		R
Generator	R	
Automatic transfer switch	R	
UPS	R	
Grounding and bonding	R	
Batteries system	R	
PDF / PDU / MCB	R	
Mechanical		
Precision Air Conditioning	R	
Telecommunication		
Telecom cable lead-in to building		R
Cabling system(computer room, power room, NOC)	R	
Fire Suppression		
Fire Suppression System of Equipment Room, Power Room		R
Fire Suppression System of Office ,Training Room, Meeting		R

3

Solution Design

3.1 Positioning

The FusionModule5000 is designed for small- and medium-sized data center facilities with an area of 300 m² or more. It mainly applies to small- and medium-sized data centers for bank offices, governmental agencies, small- and medium-sized enterprises (SMEs), education, and medical organizations

3.2 Features

The FusionModule5000 features high integration, outstanding security and reliability, space saving, energy efficiency, quick installation, optimal compatibility, fast and flexible deployment, and excellent monitoring. It is a new-generation intelligent micro-modular data center.

Integration

- The FusionModule5000 integrates a cabinet system, power supply and distribution system, cooling system, facility management system, surge protection and grounding system, fire extinguishing system, and integrated cabling system. It provides an overall solution.

NOTE

You are advised to deploy batteries independently when the input power is 380 V or 208 V and more than three battery cabinets are configured or when the input power is 480 V.

Security and Reliability

- The FusionModule5000 supports optional aisle and cabinet access control, which prevents unauthorized personnel from entering the FusionModule5000 and improves security.
- The FusionModule5000 supports two power inputs.
- Each integrated UPS is equipped with a manual maintenance bypass switch. When the FusionModule5000 is working properly, the switch is locked to prevent disoperation.
- Modular integrated UPSs work in N+1 redundancy mode to improve the reliability of the FusionModule5000.
- Strong current and weak current cables, optical fibers, and network cables are routed from different holes to minimize electromagnetic interference.

- The electronic expansion valve has a backup power module which ensures that the electronic expansion valve can be closed when the system is powered off.
- The PTC electric heater of the air conditioner provides dual protection functions: automatic reset and auto-recovery disabling.

Space Saving and Energy Efficiency

- The FusionModule5000 can be placed in a room of an office building.
- The FusionModule5000 can be directly installed on a concrete floor in a building, which simplifies engineering.
- Equipment room area ≥ 300 m².
- Aisle lighting is available, saving electric energy.
- The FusionModule5000 is delivered within a few days and can be quickly installed onsite, which reduces cost.

Quick Installation

- No raised floor is required, avoiding the engineering design.
- The standardized installation procedures reduce the installation time and workload.

Optimal Compatibility

- Modular power distribution allows for flexible expansion.

Fast and Flexible Deployment

- The integrated design supports relocation of communications equipment with offices.
- Single-row cabinets or dual-row cabinets are deployed based on the equipment room size, power consumption of a single cabinet, and expansion requirements.
- IT cabinets are flexibly configured with servers, and storage and network equipment to meet enterprise requirements for web application and internal services.

Excellent Monitoring

- Various sensors monitor modules in the FusionModule5000 in real time.
- The web-based monitoring system enables remote management of modules.

Stable Cooling

The NetCol5000-C features efficient cooling, effective energy saving, high reliability, wide working conditions, wide power range, high compatibility, intelligent monitoring, and easy maintenance.

3.3 Solution design

[Note] Please select following sketch map or draw a new one according to the project.

Huawei intelligent modular data center solution integrates cabinets, a power supply and distribution system, a cooling system, a monitoring system, an integrated cabling system, and a fire extinguishing system. The intelligent data center contains

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maximum 36 IT cabinets, 48 cabinets position, consumes maximum 160kVA loading, and occupies an area of 100 m².

Commented [L(9)]: According to the project

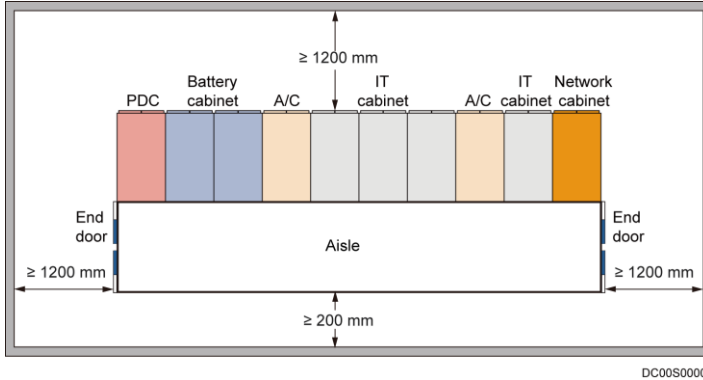
Aisles alongside single-row cabinets and dual-row cabinets adopt confined based on data center dimensions and power consumption of each cabinet.

3.3.1 Single-Row 1200 mm Wide Aisle Containment

Figure 3-1 Single-row 1200 mm wide aisle containment effect drawing



Figure 3-2 Floor plan of the single-row 1200 mm wide aisle containment



Notes:
The PDF refers to the integrated UPS cabinet or the integrated PDF

0 lists the key technical specifications of the single-row 1200 mm wide aisle containment.

Key technical specifications

Figure 3-3

Item	Specifications
Number of IT	6 to 24 cabinets

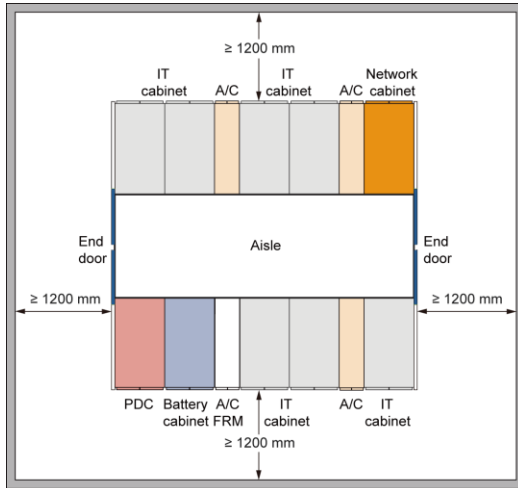
Item	Specifications
cabinets	
Equipment room space	<ul style="list-style-type: none"> In the scenario where the new main way is deployed, the minimum floor height is 3.0 m when 2.0 m high IT cabinets are deployed and is 3.2 m high when 2.2 m high IT cabinets are deployed. In the scenario where the new main way is not deployed, the minimum floor height is 2.6 m when 2.0 m high IT cabinets are deployed and is 2.8 m high when 2.2 m high IT cabinets are deployed.
Cooling	NetCol5000-C 30 kW chilled water in-row precision air conditioner
Power distribution	<ul style="list-style-type: none"> Smart module A: integrated UPS cabinet Smart module B: precision PDC or new main way
Aisle	1200 mm wide single-row cold or hot aisle containment

3.3.2 Dual-Row 1200 mm Wide Aisle Containment

Figure 3-4 Dual-row 1200 mm wide aisle containment effect drawing



Figure 3-5 Floor plan of the dual-row 1200 mm wide aisle containment



Notes:

The PDF refers to the integrated UPS cabinet or the integrated PDF

Table 3-1 lists the key technical specifications of the dual-row 1200 mm wide aisle containment.

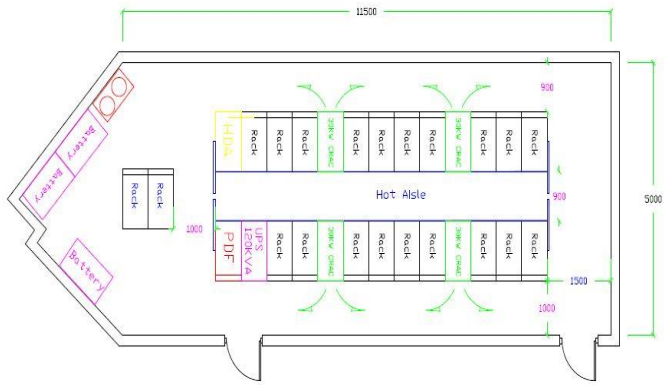
Table 3-1 Key technical specifications

Item	Specifications
Number of IT cabinets	6 to 48 cabinets (max. 24 cabinets in the N+1 system; max. 48 cabinets in the 2N system; max. module length: 15 m)
Equipment room space	<ul style="list-style-type: none"> In the scenario where the new main way is deployed, the minimum floor height is 3.0 m when 2.0 m high IT cabinets are deployed and is 3.2 m high when 2.2 m high IT cabinets are deployed. In the scenario where the new main way is not deployed, the minimum floor height is 2.6 m when 2.0 m high IT cabinets are deployed and is 2.8 m high when 2.2 m high IT cabinets are deployed.
Cooling	NetCol5000-C 30 kW chilled water in-row precision air conditioner
Power distribution	<ul style="list-style-type: none"> Smart module A: integrated UPS cabinet Smart module B: precision PDC or new main way
Aisle	1200 mm wide dual-row cold or hot aisle containment

3.3.3 Space Layout

[Note] Please revise and add the space layout in this part according to the project

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4 System Architecture

4.1 System Architecture

4.1.1 Components of the Single-Row 1200 mm Wide Aisle Containment

Overview

The single-row 1200 mm wide aisle containment can be a cold or hot aisle containment that involves the following components: IT cabinet, network cabinet, PDC (refer to the precision PDC or integrated UPS cabinet), air conditioner, battery cabinet, skylight, end door, and cable trough. Figure 4-1 shows the components of a cold aisle containment.

Figure 4-1 Components of the single-row 1200 mm wide cold aisle containment (power supply and distribution cabinet)



Figure 1

- | | | |
|------------------|-------------------------------|---------------------------|
| (1) End door | (2) Flat or rotating skylight | (3) Control skylight |
| (4) Cable trough | (5) Smart ETH gateway | (6) Cabinet |
| (7) Alarm beacon | (8) Pad | (9) Access control device |

DE00000184

Figure 4-2 Components of the single-row 1200 mm wide cold aisle containment (new main way)

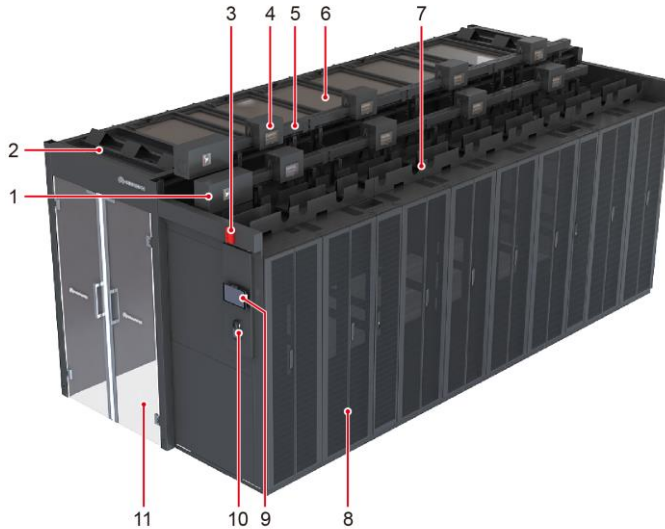


Figure 2

DC02W00094

- | | | |
|-----------------------------|--------------------------|-------------------------------|
| (1) General input unit | (2) Control skylight | (3) Alarm beacon |
| (4) Power distribution unit | (5) Busbar trunking unit | (6) Flat or rotating skylight |
| (7) Cable trough | (8) Cabinet | (9) Pad |
| (10) Access control device | (11) End door | |

4.1.2 Components of the Dual-Row 1200 mm Wide Aisle Containment

Overview

The dual-row 1200 mm wide aisle containment can be a cold or hot aisle containment that involves the following components: IT cabinet, network cabinet, PDC (refer to the precision PDC or integrated UPS cabinet), air conditioner, battery cabinet, skylight, end door, and cable trough. **Error! Reference source not found.** shows the components of a cold aisle containment.

Figure 4-3 Components of the dual-row 1200 mm wide cold aisle containment (power supply and distribution cabinet)

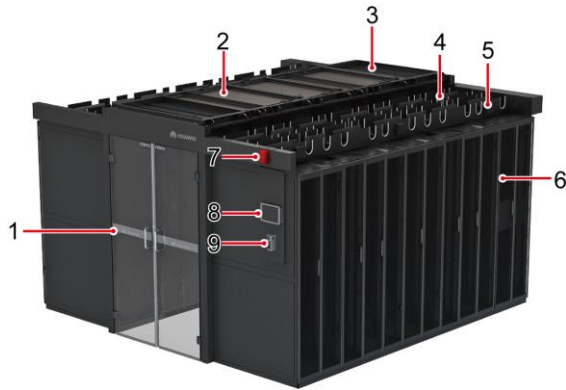


Figure 3

DE00000185

- | | | |
|------------------|-------------------------------|---------------------------|
| (1) End door | (2) Flat or rotating skylight | (3) Control skylight |
| (4) Cable trough | (5) Smart ETH gateway | (6) Cabinet |
| (7) Alarm beacon | (8) Pad | (9) Access control device |

Figure 4-4 Components of the dual-row 1200 mm wide cold aisle containment (new main way)

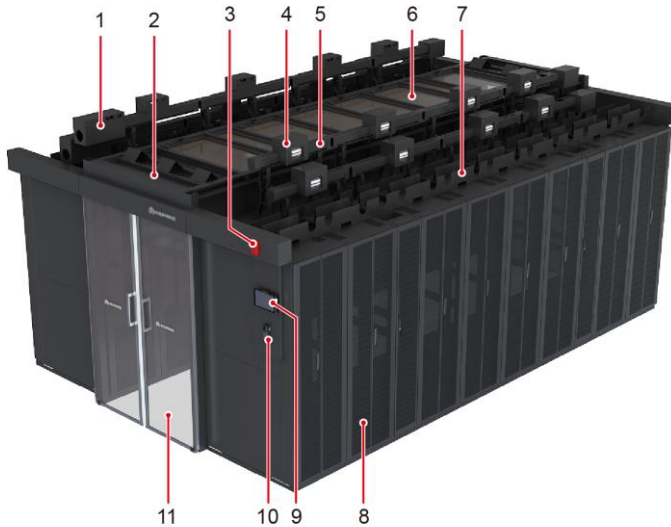


Figure 4

DC02W00091

- | | | |
|-----------------------------|--------------------------|-------------------------------|
| (1) General input unit | (2) Control skylight | (3) Alarm beacon |
| (4) Power distribution unit | (5) Busbar trunking unit | (6) Flat or rotating skylight |
| (7) Cable trough | (8) Cabinet | (9) Pad |
| (10) Access control device | (11) End door | |

4.1.3 IT Cabinet

IT cabinets of the Smart Module comply with the International Electrotechnical Commission (IEC) 60297-1 standard, provide stable installation space for servers in the Smart Module, and ensure secure server running.

The cabinets have the uniform dimensions and provide front and rear ventilation channels. Figure 4-5 shows the cabinet exterior. Table 4-1 lists the technical specifications.

Figure 4-5 IT cabinet appearance



Figure 5

DM14000088

An IT cabinet has the following features:

- The ventilation rate of the front and rear doors is greater than or equal to 70%.
- Two power distribution units (PDU2000s) can be vertically installed at the rear inside the cabinet.
- The position of each U is marked on the vertical mounting bars.
- The front and rear doors of the cabinet can be locked, and can be unlocked only by using dedicated keys.
- The cabinet has a door status sensor or electronic access control.
- Static load: 1500 kg

Table 4-1 Cabinet technical specifications

Item	Specifications
Dimensions (H x W x D)	<ul style="list-style-type: none"> • 2000 mm x 600 mm x 1100 mm • 2000 mm x 600 mm x 1200 mm • 2000 mm x 800 mm x 1100 mm • 2000 mm x 800 mm x 1200 mm

Item	Specifications
	<ul style="list-style-type: none"> • 2200 mm x 600 mm x 1200 mm • 2200 mm x 800 mm x 1200 mm
Color	Black
Materials	High-intensity class A carbon cold rolled steel sheet and zinc-coated steel sheet
Ventilation channel	Front and rear ventilation channels
Installation space	<ul style="list-style-type: none"> • A 2000 mm high cabinet provides 42 U installation space. • A 2200 mm high cabinet provides 47 U installation space. • The distance between the front and rear mounting bars can be adjusted for every 25 mm. <ul style="list-style-type: none"> ◆ For a 1200 mm deep cabinet: The maximum depth for installing devices inside the cabinet is 750 mm and by adjusting the mounting bars the maximum depth is 850 mm. ◆ For a 1100 mm deep cabinet: The maximum depth for installing devices inside the cabinet is 700 mm and by adjusting the mounting bars the maximum depth is 750 mm. • Positions for vertically installing two PDU2000s are provided at the rear of the cabinet.
Installation mode	ESD floor, base, or concrete floor
Door opening mode	The front door is a single door, and the rear door is a double one.
Weight of an empty cabinet	<ul style="list-style-type: none"> • The weight of a 2000 mm x 600 mm x 1200 mm cabinet is 128 kg. • The weight of a 2000 mm x 800 mm x 1200 mm cabinet is 153 kg. • The weight of a 2200 mm x 600 mm x 1200 mm cabinet is 137 kg. • The weight of a 2200 mm x 800 mm x 1200 mm cabinet is 164 kg. • The weight of a 2000 mm x 600 mm x 1100 mm cabinet is 110 kg. • The weight of a 2000 mm x 800 mm x 1100 mm cabinet is 135 kg. <p>(The weight of an empty cabinet includes the weight of the front and rear doors.)</p>
Protection level	IP20

4.1.4 Network Cabinet

The network cabinet provides space for integrated cabling and cable management interface for the data center. For the network cabinet exterior, refer to the IT cabinet exterior. Table 4-2 lists the technical specifications of the network cabinet.

Table 4-2 Network cabinet technical specifications

Item	Specifications
Dimensions (H x W x D)	<ul style="list-style-type: none"> • 2000 mm x 600 mm x 1200 mm • 2000 mm x 800 mm x 1200 mm • 2200 mm x 600 mm x 1200 mm • 2200 mm x 800 mm x 1200 mm • 2000 mm x 600 mm x 1100 mm • 2000 mm x 800 mm x 1100 mm
Color	Black
Materials	High-intensity class A carbon cold rolled steel sheet and zinc-coated steel sheet
Ventilation channel	Front and rear ventilation channels
Installation space	<ul style="list-style-type: none"> • A 2000 mm high cabinet provides 42 U installation space. • A 2200 mm high cabinet provides 47 U installation space. • The distance between the front and rear mounting bars can be adjusted for every 25 mm. Positions for vertically installing two PDU2000s are provided at the rear of the cabinet.
Installation mode	ESD floor, base, or concrete floor
Door opening mode	The front door is a single door, and the rear door is a double one.
Weight of an empty cabinet	<ul style="list-style-type: none"> • The weight of a 2000 mm x 600 mm x 1200 mm cabinet is 128 kg. • The weight of a 2000 mm x 800 mm x 1200 mm cabinet is 153 kg. • The weight of a 2200 mm x 600 mm x 1200 mm cabinet is 137 kg. • The weight of a 2200 mm x 800 mm x 1200 mm cabinet is 164 kg. • The weight of a 2000 mm x 600 mm x 1100 mm cabinet is 110 kg. • The weight of a 2000 mm x 800 mm x 1100 mm cabinet is 135 kg. <p>(The weight of an empty cabinet includes the weight of the front and rear doors.)</p>
Protection level	IP20

4.1.5 Skylight

A skylight is used for sealing an aisle containment. There are three types of skylights: control skylight, rotating skylight, and flat skylight. **Error! Reference source not found.** lists the technical specifications of skylights and the mapping between skylights and cabinets.

Table 4-3 Technical specifications of skylights

Name	Dimensions (H x W x D)	Applicable Cabinet Dimensions (H x W x D)
Control skylight	341 mm x 605 mm x 1334 mm	<ul style="list-style-type: none"> • 2000 mm x 600 mm x 1200 mm • 2000 mm x 600 mm x 1100 mm • 2200 mm x 600 mm x 1200 mm
	341 mm x 805 mm x 1334 mm	<ul style="list-style-type: none"> • 2000 mm x 800 mm x 1200 mm • 2000 mm x 800 mm x 1100 mm • 2200 mm x 800 mm x 1200 mm
300 mm wide flat skylight	341 mm x 305 mm x 1334 mm	<ul style="list-style-type: none"> • 2000 mm x 300 mm x 1200 mm • 2000 mm x 300 mm x 1100 mm • 2200 mm x 300 mm x 1200 mm
600 mm wide flat or rotating skylight	341 mm x 605 mm x 1334 mm	<ul style="list-style-type: none"> • 2000 mm x 600 mm x 1200 mm • 2000 mm x 600 mm x 1100 mm • 2200 mm x 600 mm x 1200 mm
800 mm wide flat or rotating skylight	341 mm x 805 mm x 1334 mm	<ul style="list-style-type: none"> • 2000 mm x 800 mm x 1200 mm • 2000 mm x 800 mm x 1100 mm • 2200 mm x 800 mm x 1200 mm

Figure 4-6, Figure 4-7, Figure 4-8, and Figure 4-9 show the skylights.

Figure 4-6 300 mm wide skylight

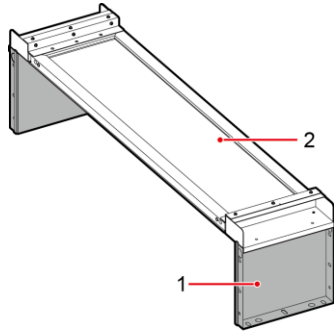


Figure 6

(1) Skylight connective plate

(2) Flat skylight panel

DM24000153

Figure 4-7 800 mm wide control skylight

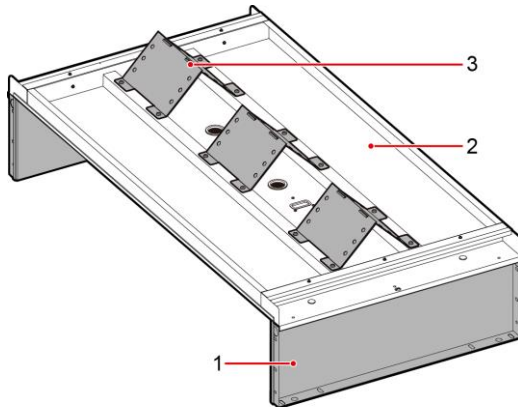


Figure 7

(1) Skylight connective plate

(2) Control skylight panel

(3) Cable separation panel

DM24000152

Figure 4-8 600 mm wide flat or rotating skylight

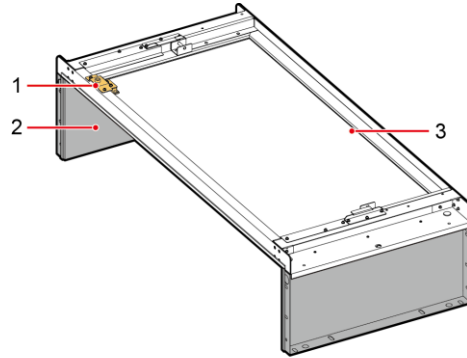


Figure 8

DM24000151

(1) Magnetic lock fixing base (2) Skylight connective plate (3) Flat skylight panel

Figure 4-9 800 mm wide flat or rotating skylight

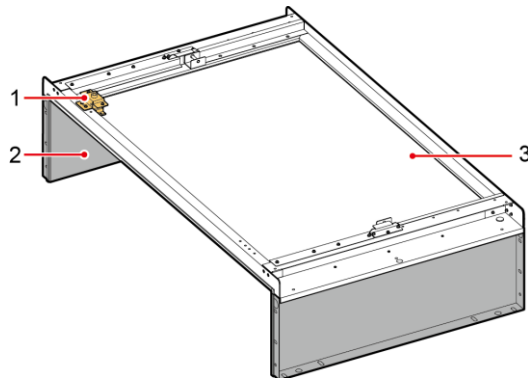


Figure 9

DM24000160

(1) Magnetic lock fixing base (2) Skylight connective plate (3) Flat skylight panel

NOTE

A rotating skylight is designed with an eccentric structure. When the trigger is activated, a rotating skylight falls under gravity. The skylight is triggered by a magnetic lock. If a fire extinguishing system is installed inside a module, select flat skylights. If a module shares the fire extinguishing system of the equipment room, select rotating skylights.

4.1.6 End Doors for Aisles

End doors are classified into sliding doors and revolving doors. End doors are installed on both ends of the aisle containment, which makes the module independent, improves equipment efficiency, and helps onsite personnel or devices move into or out of the aisle containment.

Sliding Door

Figure 4-10 shows a sliding door.

Figure 4-10 Sliding door



Figure 10

DM21000058

The dimensions (H x W x D) of a sliding door are as follows.

For a 2000 mm high cabinet, the dimensions of a sliding door are 2300 mm x 1400 mm x 54 mm.

For a 2200 mm high cabinet, the dimensions of a sliding door are 2500 mm x 1400 mm x 54 mm.

 **NOTE**

Sliding doors can be opened only sideways, and therefore may involve risks in the case of a fire.

Revolving Door

The double revolving door is an outward opening door with an opening angle of 90 degrees. It can ensure that the aisle containment is properly sealed and separated. Figure 4-11 shows a double revolving door.

Figure 4-11 Double revolving door



Figure 11

DM48000104

The dimensions (H x W x D) of a double revolving door are as follows.

For a 2000 mm high cabinet, the dimensions of a double revolving door are 2300 mm x 1400 mm x 80 mm.

For a 2200 mm high cabinet, the dimensions of a double revolving door are 2500 mm x 1400 mm x 80 mm.

4.1.7 Cable Trough

Cabinet cable troughs are classified into signal cable troughs and power cable troughs, which are used to route signal cables and power cables respectively. This ensures that weak current cables are separated from strong current cables.

Cable troughs are clamped onto the cabinet top cover. A cable trough is assembled using two brackets, a pallet, and a baffles (used to separate weak current optical fibers from weak current network cables and strong current route A from strong current route B). Figure 4-12 shows a 300 mm wide cable trough, and Figure 4-13 shows a 600 mm/800 mm wide cable trough.

Figure 4-12 300 mm wide cable trough

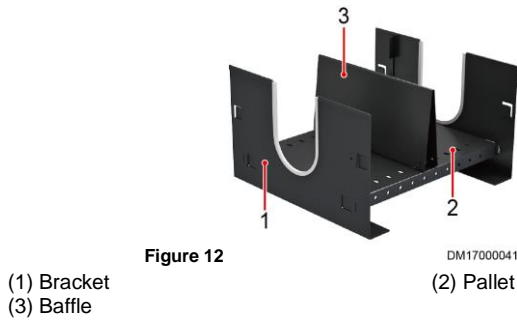
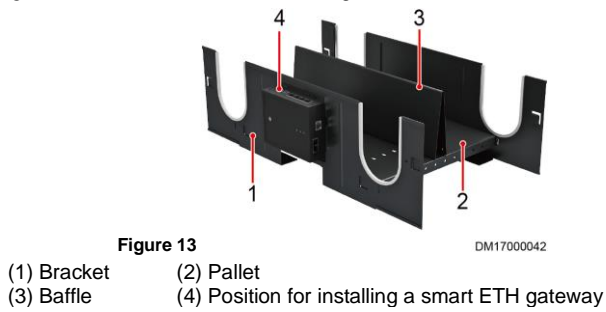


Figure 4-13 600/800mm wide cable trough



4.1.8 (Optional) Adaptive Frame

To meet requirements for cabinet height and depth in different scenarios, tail frames, top frames, and air conditioner adaptive frames can be installed to ensure that all cabinets in the smart module have the same height and depth and that the two rows of cabinets have the same length. **Error! Reference source not found.** describes the frame specifications.

Table 4-4 Adaptive frame specifications

Component	Width (mm)	Depth (mm)	Height (mm)	Remarks
PDC tail frame	600	100	2000/2200	Adapt to 1200 mm deep cabinets.
300 mm wide air conditioner top frame	300	1200	200	Adapt to 2200 mm high cabinets.
PDC top frame	600	1200	200	
300 mm air conditioner	300	1100	2000	Adapt to 1200 mm

Component	Width (mm)	Depth (mm)	Height (mm)	Remarks
adaptive frame	300	1200	2000	or 1100 mm deep cabinets. When there is an odd number of 300 mm air conditioners, use the adaptive frame to supplement the opposite position to ensure that the two rows of cabinets have the same length.

4.1.9 (Optional) Base

Adjustable Bases

The widths of adjustable bases for a Smart Module include 300 mm, 600 mm, and 800 mm. The minimum adjustment range is 1 mm.

Table 4-5 lists base specifications.

Table 4-5 Base specifications

Type	Dimensions	Description
600 mm wide base	Width: 600 mm; height: 270 mm $\leq H \leq 410$ mm (adjustable); depth: 1000 mm, 1100 mm, or 1200 mm (adjustable)	Used to support an IT cabinet, network cabinet, battery cabinet, and PDC that are all 600 mm wide.
	Width: 600 mm; height (adjustable): 410 mm $\leq H \leq 700$ mm; depth (adjustable): 1000 mm, 1100 mm, or 1200 mm	
300 mm wide base	Width: 300 mm; height: 270 mm $\leq H \leq 410$ mm (adjustable); depth: 1000 mm, 1100 mm, or 1200 mm (adjustable)	Used to support a 300 mm wide air conditioner.
	Width: 300 mm; height: 410 mm $\leq H \leq 700$ mm (adjustable); depth: 1000 mm, 1100 mm, or 1200 mm (adjustable)	
800 mm wide base	Width: 800 mm; height: 270 mm $\leq H \leq 410$ mm (adjustable); depth: 1000 mm, 1100 mm, or 1200 mm (adjustable)	Used to support an 800 mm wide IT cabinet and 800 mm wide network cabinet.
	Width: 800 mm; height: 410 mm $\leq H \leq 700$ mm	

Type	Dimensions	Description
	(adjustable); depth: 1000 mm, 1100 mm, or 1200 mm (adjustable)	

Fixed Bases

Fixed bases for the smart module include cabinet bases (600 mm wide), air conditioner bases (300 mm wide), PDC bases (600 mm wide), and cabinet bases (800 mm wide).

Table 4-6 lists base specifications.

Table 4-6 Base specifications

Type	Base dimensions (H x W x D)	Description
Cabinet base (600 mm wide)	250 mm x 600 mm x 1200 mm	Used to support an IT cabinet, battery cabinet, and network cabinet. (All the cabinets are 600 mm wide.)
Air conditioner base (300 mm wide)	250 mm x 300 mm x 1200 mm	Used to support a 300 mm wide air conditioner and air conditioner adaptive frame.
PDC base (600 mm)	250 mm x 600 mm x 1200 mm	Used to support a PDC.
Cabinet base (800 mm wide)	250 mm x 800 mm x 1200 mm	Used to support an 800 mm wide IT cabinet and 800 mm wide network cabinet.

4.2 Power Supply and Distribution System

Features

- The smart module has an integrated and intelligent power supply and distribution system, and supports N+1 or 2N power distribution systems.
- The power distribution branch of the integrated power supply and distribution system can detect currents, voltages, active power, electricity, and temperatures.
- Battery management supports CIM (model: CIM01C2) and BIM (model: BIM01C3).
- The power supply and distribution system allows lead-acid batteries to power off automatically in the case of fire.

4.2.1 Power Supply and Distribution System of Smart Module A

N+1 System Power Distribution Diagram

Figure 4-14 shows the power distribution diagram for the N+1 system.

Figure 4-14 N+1 system power distribution diagram

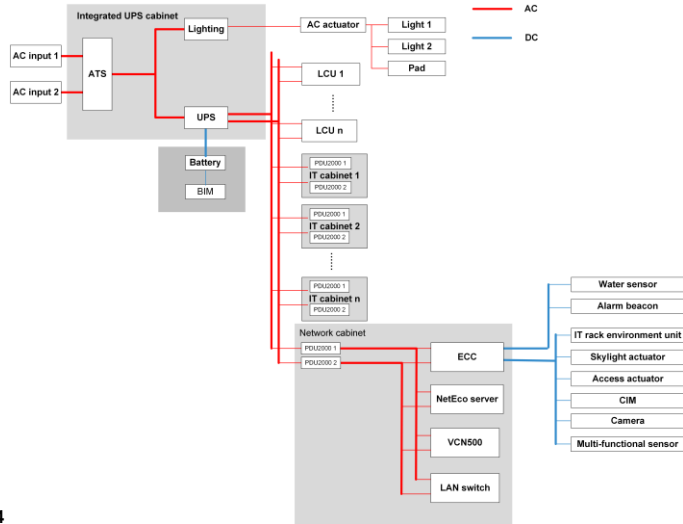


Figure 14

2N System Power Distribution Diagram

Figure 4-15 shows the power distribution diagram for the 2N system.

Figure 4-15 2N system power distribution diagram

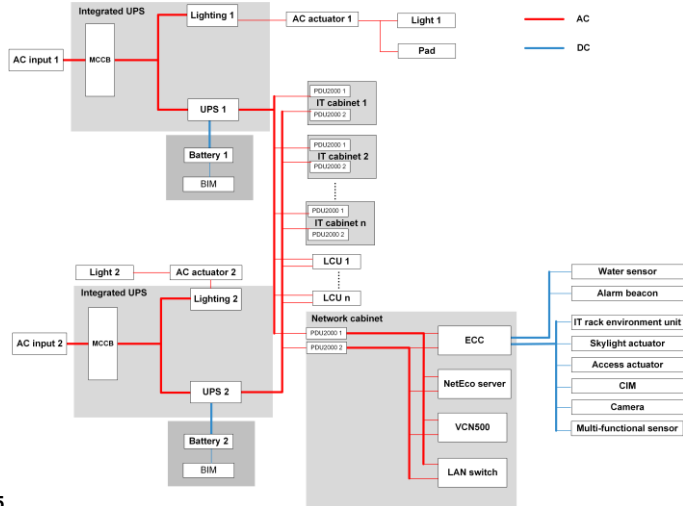


Figure 15

4.2.2 Power Supply and Distribution System of Smart Module B

N+1 System Power Distribution Diagram

Figure 4-16 N+1 system power distribution diagram (precision PDC)

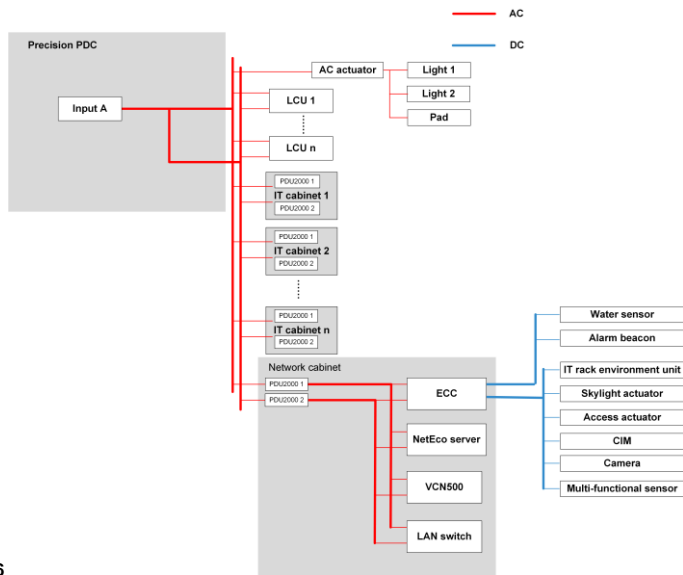


Figure 16

Figure 4-17 N+1 system power distribution diagram (new main way)



Figure 17

2N System Power Distribution Diagram

Figure 4-18 2N system power distribution diagram (precision PDC)

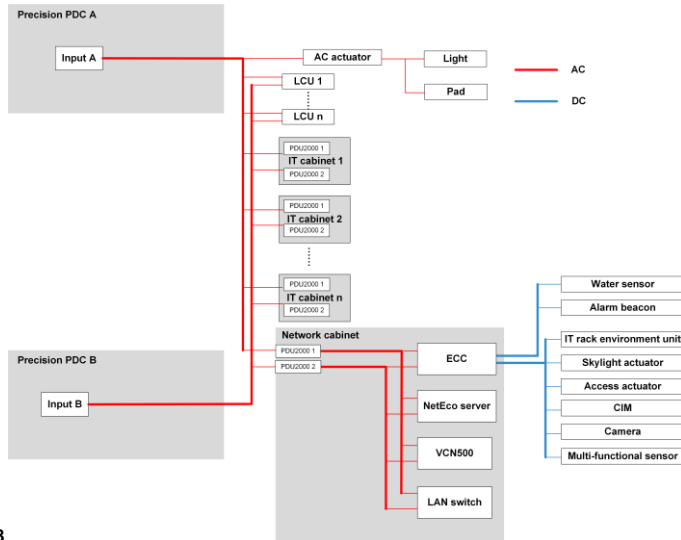


Figure 18

Figure 4-19 2N system power distribution diagram (new main way)

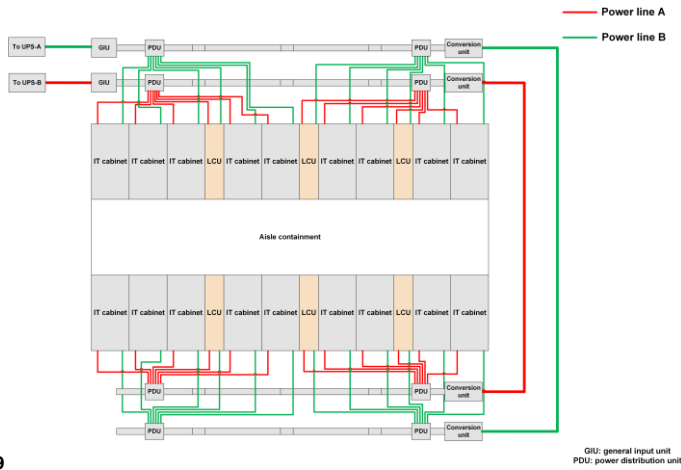


Figure 19

4.2.3 Integrated UPS Cabinet

The integrated UPS cabinet has the following features.

- Uses a unified architecture, and provides reliable quality, comprehensive functions, and consistent appearance.
- Integrates an ATS or MCCB and components for distributing power to IT equipment, air conditioners, lights, and UPSs.

Error! Reference source not found. shows an integrated UPS cabinet.

Figure 4-20 Integrated UPS cabinet



Figure 20 DP05000042

Error! Reference source not found. lists the configurations of an integrated UPS cabinet.

Table 4-7 Structural specifications of an integrated UPS cabinet

Configuration	N+1 Scenario	2N Scenario
Input mode	Dual-route ATS 250 A	Single-route MCCB 250 A
Power distribution circuit breakers for air conditioners	40 A/1P x 18 (applicable to the air conditioners with only cooling function) 63 A/1P x 6 (applicable to the air conditioners with heating and humidification functions)	
Power distribution circuit breakers for lights	10 A/1P x 3	
Power distribution circuit breakers for IT equipment	40 A/1P x 18 x 2; 63 A/1P x 6 x 2	
Dimensions (H x W x D)	2000 mm x 600 mm x 1100 mm 2000 mm x 600 mm x 1200 mm (with a tail frame) 2200 mm x 600 mm x 1200 mm (with a top frame and tail frame)	

An integrated UPS cabinet works in 380 V, 400 V, or 415 V power mode, and features redundancy, high reliability, high efficiency, energy saving, environmental protection, and intelligent and easy operation. **Error! Reference source not found.** lists the technical specifications for the integrated UPS.

Table 4-8 Technical specifications for the integrated UPS

Category	Item	Specifications
Input	Power system	Three phases
	Rated input voltage	380 V, 400 V, or 415 V AC, three-phase, four-wire, and PE
	Input voltage range	80–280 V AC (phase voltage) (When the input voltage ranges from 80 V AC to 176 V AC, loads are linearly derated.)
	Input frequency range	40–70 Hz
	Input power factor	> 0.99 (full load); > 0.98 (50% load)
	Rated input current	250A
Output	Rated voltage	380 V, 400 V, or 415 V AC, three-phase, four-wire, and PE
	Total harmonic distortion (THD) (linear load)	THD ≤ 1%
	Total harmonic distortion (THD) (non-linear load)	THD ≤ 4%
	Power factor	1
	Maximum peak factor for loads	3:1 (in compliance with IEC 62040-3 standard)
	Overload capability	60 min (105%–110% load) 10 min (111%–125% load) 1 min (125%–150% load)
Battery	Number of batteries	30 to 40 12 V batteries (32 batteries by default) Derated by 6% when 30 batteries are used
	Battery string sharing	Battery strings are shared in the cabinet by default. There are no combined cabinets in the Smart Module.
	Charge voltage	Equalized charging voltage: 2.35 V/cell; float charging voltage: 2.25 V/cell The maximum battery capacity is 3,000 Ah. The charging current is limited based on the battery capacity.
System	Display	LCD+LED
	System efficiency	≥ 96%
	Current equalization	< 5% (in parallel mode)
	Number of combined cabinets	In a Smart Module, cabinets do not need to be combined.
	Cable connection	Routed in and out from the top
	Rated power	The integrated UPS supports the 3+1 working mode (three power modules and one redundant module) and supports up to 112 kW IT cabinet power. IT cabinet power can be 32 kW (1+1), 72 kW (2+1), or 112 kW (3+1).

Category	Item	Specifications
	Noise	At atmospheric pressure (25°C) <ul style="list-style-type: none"> • 25% load: 54 dB • 50% load: 58 dB • 75% load: 61 dB • 100% load: 65 dB
Others	Maintenance mode	Maintained from the front or rear
	Surge protection	Level C SPD

ATS (Optional)

Error! Reference source not found. lists the specifications of an ATS.

Table 4-9 ATS specifications

Item	Specifications
Input voltage range	187–264 V AC (phase voltage)
Input frequency range	40–70 Hz

4.2.4 Precision PDC

The precision PDC provides the following features:

- Modular design, facilitating capacity expansion and backup
- Compatible with cabinets of low to high power density

Figure 4-21 and Figure 4-21 show the precision PDC with a single input.

Figure 4-21 Precision PDC with a single input

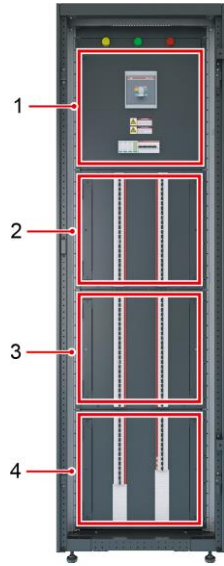


Figure 21

DP02W00003

(1) Input module

(2) Output module 1

(3) Output module 2

(4) Output module 3

Figure 4-22 Precision PDC with a single input

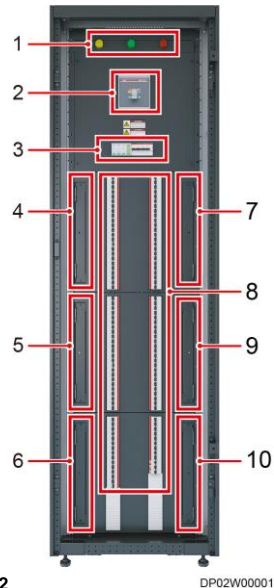


Figure 22

DP02W00001

- | | |
|---------------------------------|--------------------------------|
| (1) Indicators | (2) MCCB input circuit breaker |
| (3) SPD and SPD circuit breaker | (4) Monitoring board 1 |
| (5) Monitoring board 2 | (6) Monitoring board 3 |
| (7) Monitoring board 4 | (8) MCB output circuit breaker |
| (9) Monitoring board 5 | (10) Monitoring board 6 |

Figure 4-23 and Figure 4-23 show the precision PDC with two inputs.

Figure 4-23 Precision PDC with two inputs

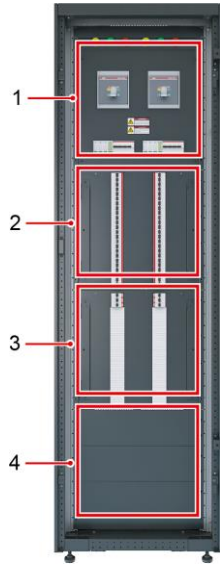


Figure 23

DP02W00006

(1) Input module

(2) Output module 1

(3) Output module 2

(4) Output module 3

Figure 4-24 Precision PDC with two inputs

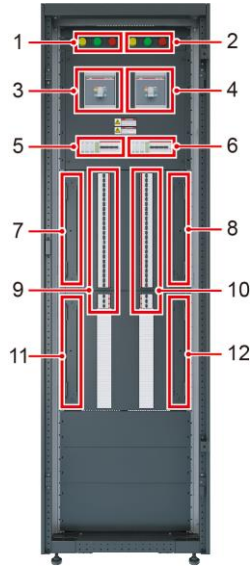


Figure 24

DP02W00004

- | | |
|--|---|
| (1) Indicator of route I | (2) Indicator of route II |
| (3) Input circuit breaker of route I | (4) Input circuit breaker of route II |
| (5) SPD and SPD circuit breaker of route I | (6) SPD and SPD circuit breaker of route II |
| (7) Monitoring board 1 | (8) Monitoring board 3 |
| (9) Output circuit breaker of route I | (10) Output circuit breaker of route II |
| (11) Monitoring board 2 | (12) Monitoring board 4 |

Table 4-10 lists the precision PDC specifications.

Table 4-10 Technical specifications

Item	Technical Specifications
Dimensions (H x W x D)	<ul style="list-style-type: none"> 2000 mm x 600 mm x 1100 mm 2000 mm x 600 mm x 1200 mm (with a tail frame) 2200 mm x 600 mm x 1200 mm (with a top frame and a tail frame)
Weight (kg)	< 350
Rated operating voltage (V)	208/220/380/400/415
Rated insulation voltage (V)	690
Rated frequency (Hz)	50/60
Rated operating current (A)	400/250/160
Enclosure protection level	IP20
Output switch	Single-phase 40 A; maximum: 144 single-phase

Item	Technical Specifications
	routes
Surge protection level	Level C
Cable routing	Routed from the top
Certification	CCC (GB 7251) and CE (IEC 60950)
Environmental friendliness	RoHS and REACH

4.2.5 New Main Way

Appearance



DC05W00002

Features

Feature	Description
High efficiency, economical, and rapid delivery	Space saving: saves the IT cabinet space.
	Easy maintenance: requires short maintenance duration, less than 10 minutes for replacing a single power distribution unit
	High scalability: Busbar trunking units can be added. Each busbar trunking unit connects to one power distribution unit.
	Long lifespan: over 35 years
	Power saving: saves about 1600 kWh power each year in a typical scenario with 80 kW 50% loads.
Safe, reliable, and flexible O&M	Reliability: uses a foolproof structure with installation position marks and spacing measures.
	Easy O&M: can be easily maintained as the new main way is highly reliable and allows users to replace power distribution units.
	Easy installation: requires less than 10 man-hours to install the new main way (smart module R16 N+1 80 kW).
Intelligent monitoring and flexible management	Easy to network through an FE port to implement teleindication, telemetering,

Feature	Description
	and teleadjusting.
	Flexible to manage and monitor the power usage effectiveness (PUE) and maintenance.
	Intelligently measures and monitors parameters such as electricity, currents, voltages, power factor, total active power, total apparent power, total reactive power, and neutral wire currents.

Technical Specifications

Item	Technical Specifications
System type	TN-S supports three-phase five-wire input.
Rated operating voltage (Un)	380 V AC/400 V AC/415 V AC
Overvoltage type	III
Rated operating current (In) at 40°C	160 A/250 A
Input switch	<ul style="list-style-type: none"> • One 160 A/3P MCCB • One 250 A/3P MCCB
Output switch	Six 40 A/1P MCBs
Rated transient withstand current (Icw)	6 kA, 1s
Rated power frequency withstand voltage	2000 V AC, 1 min
Rated frequency	50 Hz/60 Hz
Protection level	IP30
Electric shock protection type	Type I
Electromagnetic compatibility (EMC) environment	Class B
Cabling mode	Routed in from the end
Cable connection capacity	<ul style="list-style-type: none"> • 160 A rated current: 4 x 70 mm² + 1 x 35 mm² • 250 A rated current: 4 x 95 mm² + 1 x 50 mm²

4.2.6 Battery Cabinet

The battery cabinet provides batteries, space for installing CIM, and space for routing cables for a data center. Figure 4-25 shows a battery cabinet.

Figure 4-25 Battery cabinet



Figure 25

DP1500040

The components of the battery cabinet are shown in Figure 4-26.

Figure 4-26 Battery cabinet components

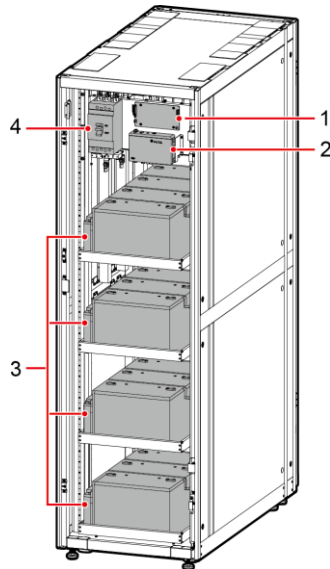


Figure 26

DP1500041

(1) BIB

(2) CIM

(3) Batteries

(4) Circuit breaker

Table 4-11 lists the technical specifications of a battery cabinet.

Table 4-11 Battery cabinet technical specifications

Parameter	Specifications
Dimensions (H x W x D)	<ul style="list-style-type: none"> Basic dimensions: 2000 mm x 600 mm x 1100 mm Basic dimensions: 2000 mm x 600 mm x 1200 mm Dimensions after expansion: 2200 mm x 600 mm x 1200 mm (with the top frame)
Color	Black
Materials	The materials are high-intensity class A carbon cold rolled steel sheet and zinc-coated steel sheet.
Ventilation channel	Front and rear ventilation channels
Installation space	Provides 42 U space
Installation mode	ESD floor or concrete floor
Door opening mode	The front door is a single door, and the rear door is a double one.
Weight	128 kg (excluding batteries)
Protection level	IP20

Table 4-12 lists the number of batteries with different capacity a single battery cabinet can house.



NOTE

Shoto and Enersys batteries are supported.

Table 4-12 Maximum number of batteries in a single battery cabinet

Battery Capacity	Maximum Number of Batteries in a Single Battery Cabinet
26 Ah	40
40 Ah	
65 Ah	20
100 Ah	

Table 4-13 Configuration scenario (The main battery cabinet and auxiliary battery cabinet are not differentiated.)

Battery Capacity	Cabinet Layer (from Top to Bottom)	Number of Batteries				
-	-	40	38	36	34	32
26 Ah/40 Ah	The first layer	10	9	8	7	6
	The second layer	10	10	10	10	10
	The third layer	10	10	10	10	10
	The fourth layer	10	9	8	7	6

Table 4-14 Configuration scenario (The main battery cabinet and auxiliary battery cabinet are differentiated.)

Battery Capacity	Cabinet Layer (from Top to Bottom)	Main Battery Cabinet					Auxiliary Battery Cabinet				
		20	19	18	17	16	20	19	18	17	16
-	-	20	19	18	17	16	20	19	18	17	16
65 Ah/100 Ah	The first layer	5	4	3	2	1	5	4	3	2	1
	The second layer	5	5	5	5	5	5	5	5	5	5
	The third layer	5	5	5	5	5	5	5	5	5	5
	The fourth layer	5	5	5	5	5	5	5	5	5	5

4.2.7 PDU2000

Figure 4-27 and Figure 4-28 show PDU2000s.

NOTE

Figures provided in this document are for reference only.

Figure 4-27 Full-height PDU2000



Figure 27

DP13000030

Table 4-15 describes the PDU2000 specifications.

Figure 4-28 Half-height PDU2000



Figure 28

Table 4-15 PDU2000 specifications

PDU2000 Type	PDU2000 Model	PDU2000 Output Port
Basic type	PDU2000-32-1PH-9/3-B1 (half height)	9 x C13 + 3 x C19
	PDU2000-32-1PH-20/2-B1 (full height)	20 x C13 + 2 x C19
	PDU2000-32-3PH-12/9-B2 (full height)	12 x C13 + 9 x C19

4.2.8 Intelligent Battery Monitoring System

The intelligent battery monitoring system consists of the CIM (CIM01C2) and BIM (BIM01C3). The communication interface module (CIM) is an intelligent battery management module that collects wireless communication data from the downstream battery interface module (BIM) groups, collects and analyzes the operating data of battery strings, calculates state of charge (SOC) and state of health (SOH) of batteries and battery strings and estimates the battery health status accordingly, supports battery tripping management, and uploads data to the management unit through COM or PoE ports. The BIM is a battery monitoring module that monitors the voltages, internal resistances, and pole temperatures of batteries.

NOTE

- One CIM can support a maximum of 300 BIMs, and manage BIMs of a maximum of four battery strings.
- The BIM01C3 supports Shoto and EnerSys batteries.

In the scenario with battery cabinets, the CIM is installed inside a smart module battery cabinet and the CIM communications cable connects to a smart ETH gateway. Figure 4-29 shows the CIM and BIM networking in the scenario with battery cabinets.

Figure 4-29 CIM and BIM networking (in the scenario with battery cabinets)

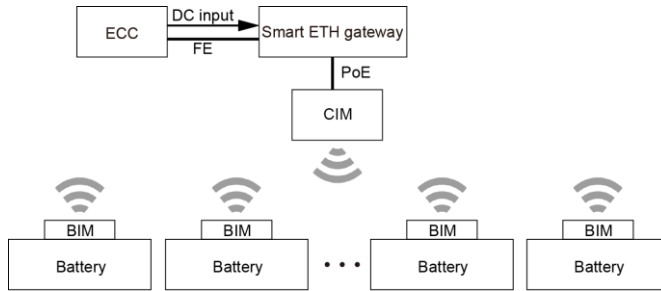


Figure 29

UB07000022

If a battery system needs to be managed by multiple CIMs, CIMs can connect to northbound devices over straight-through cables (the ECC supports four parallel CIMs) without being cascaded, as shown in Figure 4-30.

Figure 4-30 CIM communications cable connecting to a smart ETH gateway

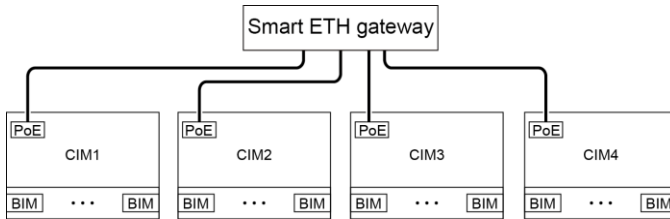


Figure 30

UB07N10002

4.2.8.1 CIM

CIM is a battery information collection module. It collects battery status data from the downstream BIM groups through wireless communication, and sends the data to the ECC, UPS, and the third-party network management system (NMS) through COM or PoE ports.

Features

- Collects battery data detected by the BIM through wireless communication.
- Each CIM can manage a maximum of four battery strings or 300 batteries.
- An external Hall effect sensor is connected to monitor the current of each battery string.
- Calculates the SOC and SOH of batteries and battery strings.
- Accurately identifies weak batteries in a battery string.
- Identifies loose battery terminals and battery terminal overtemperature, and controls battery switch tripping.
- Supports WebUI display, northbound communication over FE and RS485, and a third-party NMS.
- Supports CIM and BIM online upgrade on the monitoring system.

NOTE

If the upgrade package is transmitted to the CIM within 30 minutes, the upgrade is complete. The BIM upgrade is finished through the CIM backend. The CIM ensures the successful upgrade of the BIM through retransmitting and flow control.

Appearance

Figure 4-31 and Figure 4-32 show the appearance of a CIM.

Figure 4-31 CIM front view

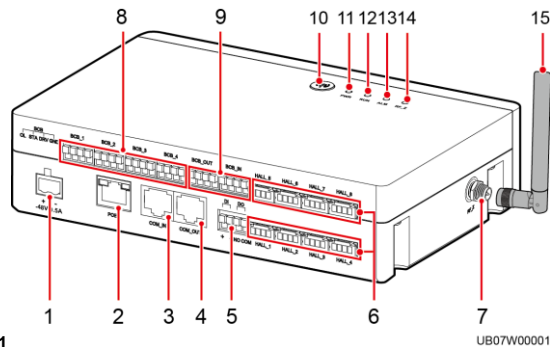


Figure 31

- | | | |
|---|-----------------------|---|
| (1) -48 V 0.5 A port (power input) | (2) PoE port | (3) COM_IN port (RS485 communication input) |
| (4) COM_OUT port (RS485 communication output) | (5) DI and DO ports | (6) HALL_1–HALL_8 current monitoring ports |
| (7) RF_Z antenna port | (8) BCB_1–BCB_4 ports | (9) BCB_OUT and BCB_IN ports |
| (10) Networking switch | (11) PWR indicator | (12) RUN indicator |
| (13) ALM indicator | (14) RF_Z indicator | (15) Delivered antenna indicator |

 **NOTE**

Ports are protected by a security mechanism.

Figure 4-32 CIM bottom view

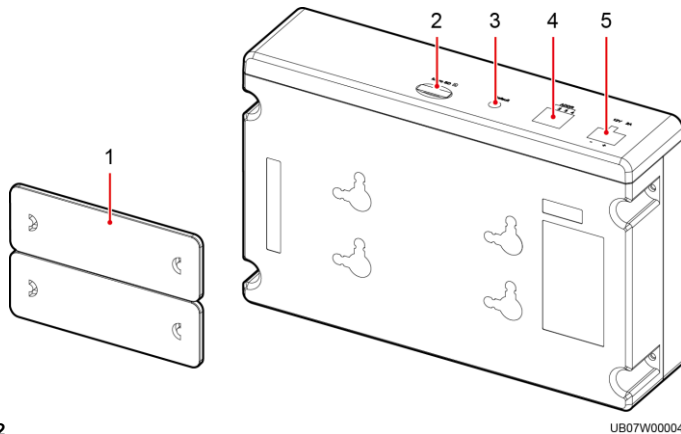


Figure 32

- (1) Fastener
- (2) Micro SD card slot
- (3) Default button (IP reset)
- (4) ADDR dual in-line package (DIP) switch (RS485 communications address)
- (5) 12V 2A port (power input)

UB07W00004

4.2.8.2 BIM

The BIM is a battery monitoring module that monitors the voltages, internal resistances, and pole temperatures of batteries and supports 12 V power.

Features

- Monitors the voltages, internal resistances, and pole temperatures of 12 V batteries.
- Supports the hibernation function. (When it detects that the battery voltage is low, it will enter the low-power mode.)
- Communicates with the CIM wirelessly.

BIM Appearance

Figure 4-33 shows a BIM.

Figure 4-33 BIM



Figure 33

DD00000088

4.3 Cooling System

Features

- Supports L1/L2 linkage and teamwork control for the indoor units.
- Operates under T1 and T3 environment and extremely low temperature environment.

4.3.1 System Description

The cooling system uses chilled water in-row precision air conditioners and an aisle containment for cooling. The in-row precision air conditioners and equipment cabinets form an aisle containment as shown in Figure 4-34 to separate hot air from cold air.

With the rapid development of data centers, power consumption of core equipment in a traditional equipment room has risen from 3-5 kW per cabinet to 10 kW per cabinet. This brings challenges of heat dissipation, energy saving, and environment protection to the traditional air cooling system.

The traditional air cooling system cannot meet the requirements of new-generation data centers. The new in-row air conditioners can solve heat dissipation problems caused by high-density deployment to lower the data center cooling power consumption and the PUE value. They can be installed beside cabinets thanks to good compatibility with standard cabinets.

The in-row air conditioners provide a high-heat-flux cooling solution that applies to high-density data centers or overheated areas in common data centers. High-heat-flux cooling solutions are classified into water-based or non-water-based solutions depending on the cooling medium. The NetCol5000-C in-row air conditioner is a water-based solution.

In-row air conditioners are close to heat sources, which shortens the air supply distance, reduces airflow pressure loss and cold air loss, and maximizes the use of cooling capacity.

Figure 4-34 Aisle containment scenario

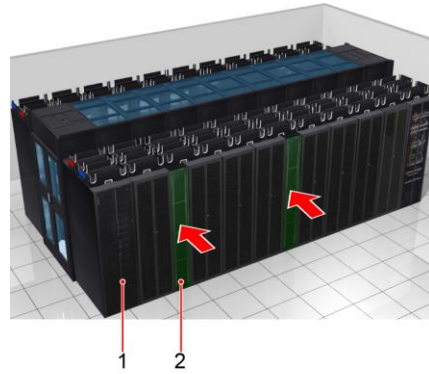


Figure 34

DS00000118

- (1) Devices in the equipment room (2) Air conditioners

NetCol5000-C 30 kW chilled water in-row precision air conditioners are used in this system.

4.3.2 NetCol5000-C 30 kW

This section describes the components, operating environment, and technical specifications of the NetCol5000-C 30 kW chilled water in-row precision air conditioner (NetCol5000-C in-row precision air conditioner for short).

Figure 4-35 Appearance



Figure 35

NH04W00028

4.3.2.1 Components

The NetCol5000-C consists of cooling components, the controller, and monitoring system.

Cooling Components

The NetCol5000-C consists of the chilled water valve, electronic commutation (EC) fan, heat exchanger, air filter, condensate pump (optional), deflector (optional), electric heater (optional), and electrode humidifier (optional).

- Chilled water valve
- The brand name flow regulating valve is used, which features good environment adaptability, precise adjustment and temperature control, energy efficient, high reliability, long service life, and easy installation.
- EC fan
- The brand name fan features high reliability and long service life, and saves more energy than common fans by 30%.
- Heat exchanger
- The finned-tube heat exchanger with a zinc-plated layer adopts the computational fluid dynamics (CFD) to optimize the process design, which greatly improves the heat exchange efficiency.
- Air filter
- The air filter meets requirements for equipment room cleanness.
- Condensate pump (optional)
- The drainage system uses dual floats and double water pumps, achieving higher reliability.
- Deflector (optional)
- It controls the horizontal supply air flow direction.
- Electric heater (optional)
- The positive temperature coefficient (PTC) heater automatically adjusts heating capacity and provides multiple protection mechanisms to ensure operating security and reliability. The electric heater features quick start, large heating capacity, and even heating.
- Electrode humidifier (optional)
- The electrode humidifier provides stepless adjustment of humidification capacity and precise control of humidity in equipment room.

Controller

The controller of the NetCol5000-C consists of a liquid crystal display (LCD), main control board, and temperature and humidity collection board.

LCD

The 7-inch true color-sensitive LCD offers a user-friendly interface for you to perform query, settings, monitoring, and maintenance. Figure 4-36 shows an LCD.

Figure 4-36 LCD

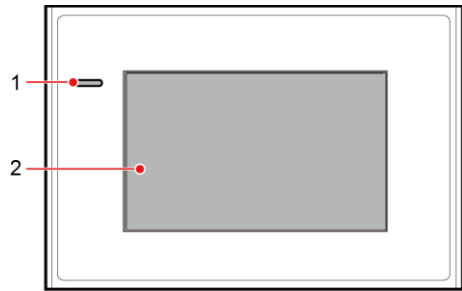


Figure 36

DT4500003

(1) Indicator

(2) Screen

Functions

- When only one NetCol5000-C is running, the controller provides logic control of components in the NetCol5000-C to meet temperature and humidity requirements.
- The 7-inch true color-sensitive LCD allows you to set parameters for the NetCol5000-C and query its status.
- When multiple NetCol5000-Cs work cooperatively, the controller optimally distributes the heat load to reduce power consumption and provides backup to improve reliability.

Features

- Provides a touchscreen with a compact interface.
- Controls the NetCol5000-C precisely and responds quickly.
- Uses a multi-level password protection mechanism to prevent misoperation.
- Protects the NetCol5000-C from power failures and water leaks, ensuring system reliability.
- Displays the operating status and time of the components in the NetCol5000-C in real time.
- Uses a fault diagnosis system to automatically display fault information, which facilitates maintenance.
- Provides abundant external ports such as FE ports, RS485 ports, and USB ports that are protected by a security mechanism.
- Stores a maximum of 500 historical alarms.

Monitoring System

The monitoring system provides logic control, data collection, control demand delivering, alarm reporting, data storage, user right management, and teamwork control. You can connect your monitoring system to the monitoring system of the NetCol5000-C over a northbound port (RS485 or FE) to perform remote management.

The NetCol5000-C can be networked over a controller area network (CAN) bus to perform the teamwork, which efficiently saves energy and prolongs the service life.

Figure 4-37 shows the network diagram of the monitoring system.

Figure 4-37 Teamwork control network diagram

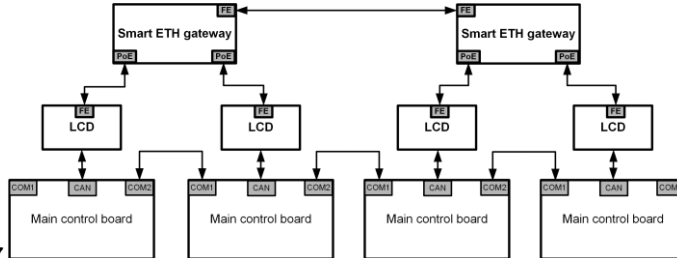


Figure 37

4.3.2.2 Working Conditions

Environment requirements

Table 4-16 Environment requirements

Item	Environment Requirements
Environment	Class A environment in data centers
Operating temperature ^a	4°C to 55°C
Operating humidity	≤ 95% RH
Altitude	0 m to 1000 m. The cooling capacity is derated when the altitude is above 1000 m. For details, see Error! Reference source not found..
Storage temperature	-40°C to +70°C
Storage humidity	≤ 95% RH

a: When the ambient temperature is below 0°C, the NetCol5000-C needs to increase certain concentration of ethylene glycol solution. For details, see [Cooling Capacity Curve in Proportion to the Glycol Solution Density](#).

4.4 Management System

Table 4-17 Management system configurations

Function	ECC800 WEB	ECC800 App	NetEco
Work order management	No	No	Yes
Energy efficiency management	No	No	Yes
PUE statistics	Yes	Yes	Yes
Capacity management	No	No	Yes
Generating alarms for SNMP northbound equipment	Yes	No	Yes
Monitoring data for	Yes	No	Yes

Function	ECC800 WEB	ECC800 App	NetEco
SNMP northbound equipment			
Mobile app O&M	Yes	Yes	Yes
Monitoring data/alarms for power supply and distribution equipment	Yes	Yes	Yes
Monitoring data/alarms for cooling equipment	Yes	Yes	Yes
Monitoring data/alarms for environment equipment	Yes	Yes	Yes
Monitoring data/alarms for fire extinguishing equipment	No	No	Yes
Access control management	Yes	Yes	Yes
Intelligent lighting	Yes	Yes	Yes
View presetting	Yes	Yes	No (manually drag)
Alarm notification by SMS or email	Yes	No	No
Battery monitoring	Optional	Optional	Optional
Log recording	Yes	Yes	Yes
Management range	A single smart module	A single smart module	Multiple smart modules
Configuration principle	Mandatory	Optional	Optional

4.4.2 System Description

The management system consists of the management software and other components. It implements data collection and management for various processes and infrastructure of the smart module.

The ECC800 provides the real-time status, alarms, and configuration information about the equipment inside the smart module for management. It also provides a graphical user interface (GUI) for ease of operating and maintaining equipment inside the smart module.

With a flexible structure and modular design, the NetEco can manage infrastructure of a single smart module or multiple smart modules in different areas in a centralized manner.

Figure 4-38 Management system inside the smart module (power supply and distribution cabinet)

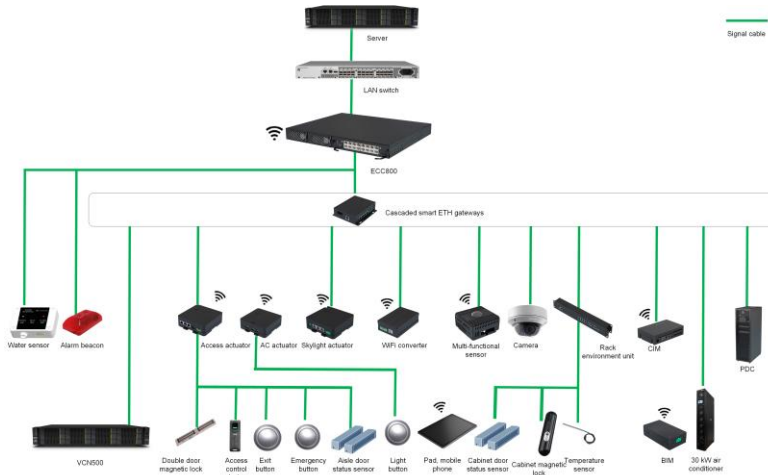


Figure 38

Figure 4-39 Management system inside the smart module (new main way)

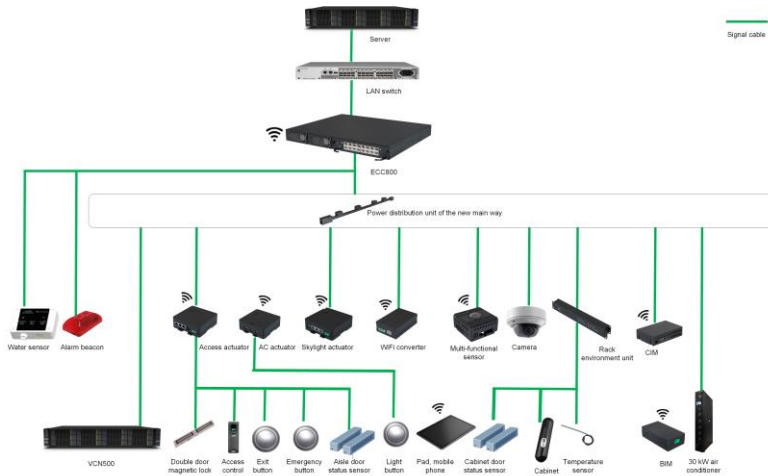


Figure 39

The smart module provides the WiFi and RF_Z wireless networking functions. The mobile app can be connected by wireless networking. Certain southbound components (such as the skylight actuator, AC actuator, multi-functional sensor, and access actuator) can be connected by RF_Z wireless networking. The management system provides a GUI to implement comprehensive management functions based on requirements. The system can monitor the following equipment:

- Power equipment, including precision air conditioners, UPSs, and ATSS

- Environment monitoring equipment, including multi-functional sensors (smoke, temperature, and humidity sensors) and water sensors
- Video equipment, including cameras and network video recorders VCN500.
- Access control equipment: A standard access management system is integrated to manage and monitor key information such as door status, card swiping, and permission setting.
- Standard network management interface: The NetEco provides SNMP interfaces to communicate with third-party NMSs. The system can be customized to support other protocols for the access from different devices.

4.4.3 Server

Tecal RH2288V2 Server

The Tecal RH2288V2 rack server (RH2288V2 for short) of Huawei features large capacity and high performance and can meet customers' medium and long term requirements. It serves as the monitoring host of the NetEco and is responsible for data processing and analysis. The RH2288V2 is 2 U high, and can be installed in a standard rack. Figure 4-40 shows an RH2288V2. Table 4-18 lists the specifications.

Figure 4-40 RH2288V2 server



Figure 40 DS11000013

The RH2288V2 has the following features:

- It has powerful computing and storage capacity and scalability.
- It can be flexibly configured with value-added components and has multiple functions.

Table 4-18 RH2288V2 specifications

Item	Specifications	
Structural design	2 U, H x W x D: 87.5 mm x 447 mm x 740 mm Can be installed in a standard 19-inch cabinet with the depth equal to or greater than 1000 mm	
Main board	CPU	One or two
	CPU model	Supports Intel®Xeon® E5-2600 (Romely-EP) series 4C/6C/8C processors with a maximum power of 135 W. The maximum main frequency is 3.3 GHz, and a single CPU provides the L3 cache of 20 MB.
	Memory	Provides 24 DIMM slots, supports RDIMM/LRDIMM memory of DDR3 with a maximum capacity of 768 GB.
	Hard drive	Supports eight hot-swappable 6 Gbit/s SAS/SATA/SSD hard drives of 2.5 inches, or twelve hot-swappable 6 Gbit/s SAS/SATA hard drives of 3.5 inches and two hot-swappable 6 Gbit/s SAS/SATA/SSD hard drives of 2.5 inches.
Expansion	Provides six expansion slots for PCIe 3.0 cards: one for PCIe3.0X16, four for PCIe3.0X8, and one for RAID.	

4.4.4 ECC800

The ECC800 controller is mainly used for device and environment monitoring in a modular data center. It consists of two power supply units (PSUs) and one ECC800 monitoring module. Figure 4-41 and Figure 4-42 show an ECC800 controller.

Figure 4-41 ECC800 controller (front view)

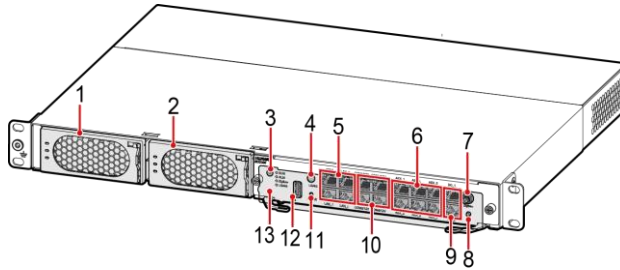


Figure 41

DS34000020

- | | | | |
|--|---------------------------------|-----------------------|------------------------|
| (1) PSU | (2) PSU | (3) Status indicator | (4) 3G/4G antenna port |
| (5) FE ports (WAN_1–WAN_2 and LAN_1–LAN_2) | (6) AI/DI_1–6 sensor input port | (7) RF_Z antenna port | (8) SW button |
| (9) DO_1–2 dry contact output | (10) RS485 port (COM1–4/12V) | (11) Default button | (12) USB port |
| (13) ECC800 monitoring module | | | |

Figure 4-42 ECC800 controller (rear view)

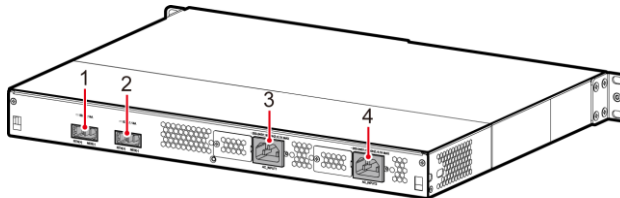


Figure 42

DS34000021

- | | | |
|------------------|------------------|---------------|
| (1) 53.5VDC_OUT1 | (2) 53.5VDC_OUT2 | (3) AC_INPUT1 |
| (4) AC_INPUT2 | | |

Specifications

Table 4-19 lists the ECC800 technical specifications.

Table 4-19 ECC800 technical specifications

Item	Specifications
------	----------------

Item	Specifications
Power input	<ul style="list-style-type: none"> Supports two AC inputs Rated voltage; 200–240 V AC/100–120 V AC rated frequency; 50 Hz/60 Hz Input current; 6.7 A
Power output	<ul style="list-style-type: none"> rated voltage: 53.5 V DC Output power of two power supplies: 2000 W (176–300 V AC); 940 W (linear derating at 85–175 V AC) Output power of a single power supply: 1000 W (176–300 V AC); 470 W (linear derating at 85–175 V AC) Output current: 14 A
System memory	512 MB
Solid state disk	2 GB and 128 MB of storage space
FE port expansion	Supports two WAN ports, two LAN ports, and 10/100M communications rate
RS485 serial port expansion	<ul style="list-style-type: none"> Four RS485 ports with the default communications rate of 9600 bit/s Each port provides 12 V DC power with the rated current of 450 mA.
AI/DI expansion (RJ45)	<ul style="list-style-type: none"> Supports six AI/DI ports to connect to smoke sensors, water sensors, and temperature sensors. Each port provides 12 V DC power with the rated current of 85 mA.
DO expansion (RJ45)	<ul style="list-style-type: none"> Supports two expansion dry contacts with contact point capacity of 20 W, maximum withstand voltage of 60 V DC, and rated current of 0.5 A. Supports the active DO port with an output voltage of 12 V DC and output current of 450 mA.
Wireless communication	Supports wireless communication that complies with IEEE802.15.4.
3G	<p>Supports 3G (WCDMA) communication and is compatible with 2G (GSM) communication. A standard SIM card slot is provided.</p> <p>NOTE The prerequisite for using a SIM card is that the site has signal coverage.</p>
USB	Provides a general USB port.
Button	<ul style="list-style-type: none"> SW: wireless network pairing button Default: restores the default IP address

4.4.5 LAN Switch

Figure 4-43 shows an S5320 LAN switch.

Figure 4-43 S5320 LAN switch



Figure 43

DM12W00001

Table 4-20 describes parameters of the S5320 LAN switch.

Table 4-20 Parameters of the S5320 LAN switch

Item	Parameter
Dimensions (H x W x D)	44.4 mm x 442 mm x 420 mm
Maximum power consumption (fully configured)	913 W (Power consumption: 173 W; PoE: 740 W)
Weight	≤ 8 kg
DC input voltage	Rated voltage: -48 V DC to -60 V DC Voltage range: -36 V DC to -72 V DC
AC input voltage	Rated voltage: 100-240 V AC Voltage range: 90-264 V AC
Temperature	<ul style="list-style-type: none"> Operating temperature: 0°C to +50°C <p>NOTICE When the altitude ranges from 1800 m to 5000 m, the highest temperature decreases by 1°C for each additional 220 m.</p> <ul style="list-style-type: none"> Storage temperature: -40°C to +70°C
Relative humidity	5%-95% RH, non-condensing
Altitude	<ul style="list-style-type: none"> Non-PoE device: <ul style="list-style-type: none"> ◆ With DC power: 0–2000 m ◆ With AC power: 0–5000 m PoE device: 0–5000 m

4.4.6 Video System

The video system consists of the camera and VCN500, implementing real-time monitoring, video recording, and playback.

4.4.6.1 IP Camera

The existing network is equipped with the ECC800 that supports the Dynamic Host Configuration Protocol (DHCP). After the ECC800 and IPC6325 camera are powered on, the IPC6325 camera automatically obtains an IP address that is in the same network segment as the ECC800 IP address. Therefore, the IPC6325 camera IP address should be reset before camera commissioning begins.

The IPC6325-WD-VR network camera (IPC6325 camera for short) is a two-megapixel wide dynamic infrared zoom dome camera that can be wall-mounted or ceiling-mounted.

Figure 4-44 IPC6325 camera



Figure 44

DM08W00002

Table 4-21 IPC6325 camera technical specifications

Item	Specifications
Image sensor	1/2.7" two-megapixel progressive scan CMOS
Lowest illuminance	<ul style="list-style-type: none"> Color: 0.01 lux (F1.4, AGC ON) Black and white: 0.004 lux (F1.4, AGC ON) 0 lux (infrared enabled)
Wide dynamic range	120 dB
Focal length	2.8–12 mm manual zoom, 4.3x optical zoom
Video coding format	H.265/H.264/MJPEG
Maximum resolution	1920x1080
Intelligent video analysis	Supports tripwire detection, loitering detection, intrusion detection, abandoned object detection, removed object detection, target color recognition, classifications of people and vehicles, and metadata backhaul.
Power supply	PoE (802.3at/af), 24 V AC±25%, 24 V DC±25%, 12 V DC±25% (polarity-insensitive DC power supply), applicable to DC/AC adapter and PoE hot backup
Protection level	IP66; complying with IEC 60529
Explosion protection level	IK10; complying with IEC 62262

4.4.6.2 VCN500

Figure 4-45 shows a VCN500.

Figure 4-45 VCN500



Figure 45

DS16000020

Table 4-22 lists the performance indicators of a VCN500.

Table 4-22 Performance indicators of a VCN500

Item	Description
Video input	A single VCN500 connects to a maximum of 32 cameras and a maximum inbound bandwidth of 160 Mbit/s.
Video forwarding	A single VCN500 supports 32 cameras or the media forwarding capacity of 160 Mbit/s.
Storage performance	A single VCN500 stores a maximum of 32 cameras and a maximum inbound bandwidth of 160 Mbit/s.
Video playback and download	A single VCN500 supports 32 cameras or the media playback and download capacity of 160 Mbit/s.

Table 4-23 lists the hardware specifications of a VCN500.

Table 4-23 Hardware specifications of a VCN500

Item	Description
Hard drive slot	12 slots for 3.5-inch hard drives
Type and number of supported hard drives	Twelve 4 TB SATA hard drives NOTE The VCN500 supports hard drives at enterprise and monitoring levels.
RAID controller card	The VCN500 does not have a RAID controller card on its mainboard.
Type and number of supported CPUs	One 1 GHz CPU, max. 10 MB cache
Memory capacity	2 GB
I/O ports	Two service network ports, with RJ45 connectors and LNK/ACT indicators
Power parameters	Single power supply only
	Maximum PSU power: 250 W
	AC power input voltage range: 100–240 V
	AC power frequency range: 50–60 Hz
Full configuration weight	≤ 20 kg
Typical power consumption (excluding hard drives)	40 W
Maximum power consumption (excluding hard drives)	70 W
Typical power consumption (including monitoring hard drives)	170 W
Maximum power consumption (including monitoring hard drives)	215 W
Typical power consumption (including enterprise hard drives)	200 W
Maximum power	250 W

Item	Description
consumption (including enterprise hard drives)	
Dimensions (H x W x D)	86.1 mm x 447.0 mm x 470.0 mm

4.4.7 Skylight Control System

4.4.7.1 Skylight Actuator

The skylight actuator controls the rotating skylight on the aisle containment of the Smart Module through the alarm linkage information from the fire extinguishing system or the control information from the upper computer. The skylight actuator supports E-labels and wireless networking (802.15.4). Figure 4-46 shows a skylight actuator.

Figure 4-46 Skylight actuator

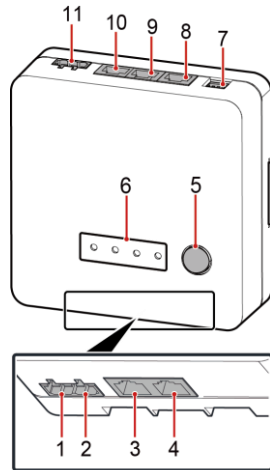


Figure 46

DS07000023

- | | | | |
|---|---|-------------------------------|-------------------------------|
| (1) LOCK/GND magnetic lock DO output port | (2) BUTTON/GND window open button DI input port | (3) AI/DI_1 sensor input port | (4) AI/DI_2 sensor input port |
| (5) BLINK button | (6) Status indicator | (7) Address DIP switch | (8) COM1 RS485 port |
| (9) COM2 RS485 port | (10) PoE port | (11) 48 V power port | |

Specifications

Table 4-24 lists the skylight actuator environmental specifications.

Table 4-24 Skylight actuator technical specifications

Item	Specifications
Power input	36–60 V DC input voltage, phoenix terminal

Item	Specifications
PoE port	<ul style="list-style-type: none"> FE communication with the rate of 10/100M 36–60 V DC power input
Wireless communication	One wireless port that complies with IEEE802.15.4, mutual backup with FE communication
AI/DI port	Two AI/DI ports for detecting fire extinguishing linkage signals; smoke detection signals also supported
DO output	One 12 V DC power output for controlling the skylight magnetic lock; driving six skylight magnetic locks simultaneously
DI input	One DI input port for connecting to the window open button
BLINK button	<ul style="list-style-type: none"> Hold down the button for less than 1 second to start blinking. Hold down the button for 1–5 seconds to search for a network and start networking. Hold down the button for more than 6 seconds to clear network parameters.
Address DIP switch	4-pin address DIP switch
E-label	Supported

4.4.8 Access Control System

4.4.8.1 Access Actuator

The access actuator is the control component for the aisle door in a Smart Module. It connects to the ECC800 controller system over FE port, wireless networking (802.15.4), or RS485 port. It opens the magnetic lock by detecting the card swiping information of the card reader, door open button information, and fire linkage information. It has access right management, access event record, and alarm record functions. Figure 4-47 shows an access actuator.

Figure 4-47 Access actuator

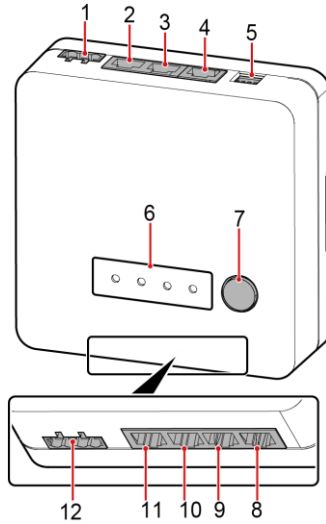


Figure 47

DS07000020

- | | | | |
|----------------------------|--------------------------|--------------------------|---|
| (1) 48 V power port | (2) PoE port | (3) RS485 port COM2 | (4) RS485 port COM1 |
| (5) Address DIP switch | (6) Status indicator | (7) BLINK button | (8) WG_2 Wiegand interface |
| (9) WG_1 Wiegand interface | (10) AI/DI_2 dry contact | (11) AI/DI_1 dry contact | (12) LOCK/GND/GATE/GND/door status and magnetic lock port |

Specifications

Table 4-25 lists the access actuator environmental specifications.

Table 4-25 Access actuator technical specifications

Item	Specifications
Power input	36–60 V DC input voltage, phoenix terminal
PoE port	FE communication, 10/100M communications rate, 36–60 V DC power input
Wireless communication	One wireless communication port that complies with IEEE802.15.4, mutual backup with FE communication
AI/DI port	Two AI/DI ports, can connect to the fire alarm and exit button
DO output	One 12 V DC power output that controls magnetic locks, phoenix terminal
DI input	One DI input port for connecting to the door status switch
RS485 serial port expansion	Two RS485 ports (one route) with the default communications rate of 9600 bit/s, physical port cascading supported (reserved function)
Wiegand	Two Wiegand interfaces, 12 V DC card reader operating power

Item	Specifications
interface	output; two routes of card readers can operate at the same time.
BLINK button	<ul style="list-style-type: none"> Press the button for less than 1 second to start blinking. Hold down the button for 1–5 seconds to search for a network and start networking. Hold down the button for more than 6 seconds to clear network parameters.
Address DIP switch	4-pin address DIP switch
E-label	Supported

4.4.8.2 Aisle Access Control

The aisle access control system applies to the aisle containment. It provides monitoring and data for devices and personnel moving into or out of the aisle containment. It can support the fingerprint and card reader with a password keyboard, fingerprint and card reader, and card reader with a password keyboard.

Fingerprint and Card Reader with a Password Keyboard

Figure 4-48 shows a fingerprint and card reader with a password keyboard.

Figure 4-48 Fingerprint and card reader with a password keyboard



Figure 48 DS33000032

Table 4-26 lists the specifications of a fingerprint and card reader with a password keyboard.

Table 4-26 Specifications of a fingerprint and card reader with a password keyboard

Item	Specifications
Dimensions (L x W x H)	156 mm x 53 mm x 38 mm
Operating voltage	Range: 10.8–13.2 V DC, rated voltage: 12 V DC
Operating current	Static standby current < 200 mA, dynamic card swiping operating current < 300 mA, minimum input

Item	Specifications
	current 500 mA at 12 V DC
Supported card	Mifare-1 S50 IC card
Authorized storage	A maximum of 3000 authorized users, a maximum of 6000 fingerprints
Communication mode	RS485 port, Wiegand port
Operating status	<ul style="list-style-type: none"> Standby: The blue indicator is on, and the green indicator on the fingerprint acquisition position is steady on Acquiring fingerprints: The red indicator on the fingerprint acquisition position is on Collecting fingerprints illegally: The buzzer beeps twice, and the red and blue indicators blink twice Collecting fingerprints legally: The buzzer beeps once, and the red and blue indicators blink once Swiping a card: The buzzer beeps once, and the red and blue indicators blink once

Fingerprint and Card Reader

Figure 4-49 shows a fingerprint and card reader.

Figure 4-49 Fingerprint and card reader



Figure 49 DS33000025

Table 4-27 lists the specifications of a fingerprint and card reader.

Table 4-27 Specifications of a fingerprint and card reader

Item	Specifications
Dimensions (L x W x H)	156 mm x 53 mm x 38mm
Operating voltage	Rated 12 V DC ±5%

Item	Specifications
Operating current	Rated 300 mA±5%
Supported card	IC card
Authorized storage	A maximum of 3000 authorized users, a maximum of 6000 fingerprints
Communication mode	RS485 port, Wiegand port
Operating status	<ul style="list-style-type: none"> Standby: The blue indicator is on, and the green indicator on the fingerprint acquisition position is steady on Acquiring fingerprints: The red indicator on the fingerprint acquisition position is on Collecting fingerprints illegally: The buzzer beeps twice, and the red and blue indicators blink twice Collecting fingerprints legally: The buzzer beeps once, and the red and blue indicators blink once Swiping a card: The buzzer beeps once, and the red and blue indicators blink once

Card Reader with a Password Keyboard

Figure 4-50 shows a card reader with a password keyboard.

Figure 4-50 Card reader with a password keyboard



Figure 50

DS33000031

Table 4-28 lists the specifications of a card reader with a password keyboard.

Table 4-28 Specifications of a card reader with a password keyboard

Item	Specifications
Dimensions (L x W x H)	114mmx63mmx25mm
Operating voltage	Range: 10.8–13.2 V DC, rated voltage: 12 V DC
Operating current	Static standby current 80 mA, operating current during card swiping and button pressing 150 mA,

Item	Specifications
	minimum input current 300 mA at 12 V DC
Communication mode	RS485 port

Magnetic Double-door Lock

Figure 4-51 shows a magnetic double-door lock.

Figure 4-51 Revolving door magnetic lock



Figure 51

DM4300011

Figure 4-52 Sliding door magnetic lock

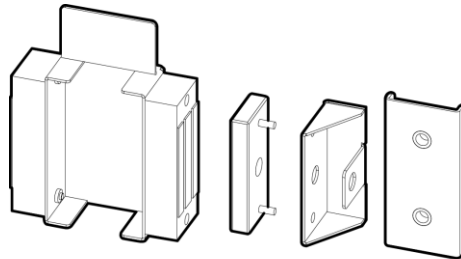


Figure 52

DM04W0002

- The access control system applies to the equipment room, aisle containment, and cabinet doors.
- The access control system consists of the access controller (for double doors), fingerprint reader with a password keyboard, magnetic lock, and exit button.
- The emergency door release button can disconnect the power supply to the electronic lock to open the door in case of emergency.

4.4.8.3 (Optional) Cabinet Access Control System

The cabinet access control system applies to cabinets in the aisle containment to ensure data and device security.

Electronic Cabinet Lock

Figure 4-53 Electronic Cabinet Lock



Figure 53 DM88000003

Table 4-29 Electronic cabinet lock specifications

Item	Specifications
Rated input voltage	12–24 V DC
Rated current	200–300 mA
Unlock mode	Power on to unlock
Applicable card	IC card
Mechanically unlocking	Supported

Features:

- The IC card for the cabinet access control system can be used after being authorized with software.
- An IC card can be authorized for one electronic lock or all electronic locks.
- Door opening information can be recorded through a network.
- The system displays the status of cabinet doors and locks in real time, and generates alarms for unauthorized door opening.
- The system supports door opening using a remote NMS.

Mechanical Lock

Figure 4-54 shows a mechanical lock.

Figure 4-54 Mechanical lock



Figure 54 DM88000023

Functions and features:

- The cabinet door can be opened with only the key and without the password.
- The cabinet door can be opened with only the password and without the key.
- The user can set a password.
- A password should contain at least three digits.
- If a user forgot the password, he can reset it.

4.4.9 (Optional) Water Sensor

The water sensor monitors leak water on the floor in real time. When water intrusion is found, the water sensor generates an audible alarm and outputs dry contact signals to report the alarm. Figure 4-55 shows the water sensor and water detection cable. Table 4-30 lists the technical specifications.

Figure 4-55 Water sensor and water detection cable



Figure 55 DS05000013

Table 4-30 Technical specifications of a water sensor

Item	Specifications
Operating voltage	12 V DC (9–16 V DC)
Output when no liquid exists	CLOSED
Output when liquid exists	OPEN
Insulation resistance	> 500 megohms
Operating temperature	–20°C to +70°C, 10%–80%RH (non-condensing)
Storage temperature	–40°C to +80°C, 10%–80%RH (non-condensing)
Default length of the water detection cable	5 m
Extensibility	The water detection cable can connect to the quick-connect terminal and can be extended flexibly to 50 m at most.
Reliability of the water detection cable	The water detection cable cannot be installed on the surface of metal.
Reliability	Failure rate: 800 fits
Power consumption	< 1 W

4.4.10 (Optional) Smoke Detector

Smoke detectors are used to detect smoke in the aisle containment. Figure 4-56 shows a smoke detector. Table 4-31 lists its technical specifications.

Figure 4-56 Smoke detector



Figure 56

DF02000013

Table 4-31 Technical specifications of a smoke detector

Item	Specifications
Operating voltage	9–16 V DC
Quiescent current	< 8 mA
Alarm current	< 35 mA
Output mode	Relay output
Output contact capacity	3 A/120 V AC or 3 A/24 V DC
Operating temperature	–10°C to +50°C
Ambient humidity	≤ 95% RH
Dimensions	Diameter: 112 mm, height: 41 mm

4.4.11 (Optional) Temperature Sensor

Figure 4-57 shows a temperature sensor.

Figure 4-57 Temperature sensor



Figure 57

DF03000016

Table 4-32 lists the temperature sensor specifications.

Table 4-32 Temperature sensor specifications

Item	Specifications
Measurement range	-20°C to +70°C
Measurement precision	±1°C
Operating temperature	-10°C to +55°C
Operating voltage	10-16 V DC
Storage temperature	-40°C to +70°C

4.4.12 Multi-Functional Sensor

A multi-functional sensor integrates the smoke sensor and temperature and humidity (T/H) sensor and can connect to the ECC800 controller system over PoE or wireless communication.

Figure 4-58 shows a multi-functional sensor.

Figure 4-58 Multi-functional sensor

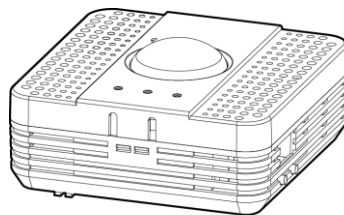


Figure 58

DS28000002

Specifications

Table 4-33 lists the multi-functional sensor technical specifications.

Table 4-33 Multi-functional sensor technical specifications

Item	Specifications
Temperature monitoring	-40°C to +80°C, precision $\leq \pm 0.5^\circ\text{C}$ (0-50°C)
Humidity monitoring	0-100% RH, precision $\leq \pm 5\%$ RH (25°C, 20%-80% RH)
Smoke monitoring	Complies with UI217. The smoke sensor generates an alarm when testing 3.2% weak dust for each foot.
PoE port	One PoE port that complies with IEEE802.3AT
RS485 port	Reserved
DI input	One DI input port, 12 V DC power input
BLINK button	Wireless communication: <ul style="list-style-type: none"> • Press the button for less than 1s to start blinking. • Hold down the button for 1-5 seconds to search for a network and start networking. • Hold down the button for more than 6 seconds to clear network parameters.
Smoke sensor test button	Supported
E-label	Supported

4.4.13 Rack Environment Unit

The rack environment unit collects and controls the environmental data of IT cabinets in the modular data center. Figure 4-59 shows a rack environment unit.

Figure 4-59 Rack environment unit

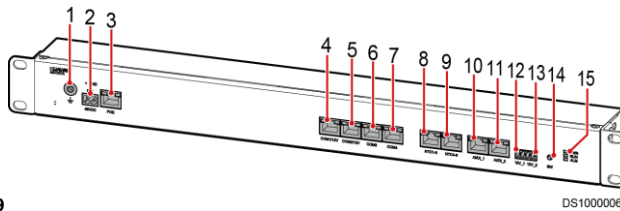


Figure 59

- | | | | |
|-------------------|------------------------------|-----------------------|-------------------|
| (1) Ground port | (2) 48 V DC power input port | (3) PoE port | (4) COM1/12V port |
| (5) COM2/12V port | (6) COM3 port | (7) COM4 port | (8) NTC1-3 |
| (9) NTC4-6 | (10) AI/DI_1 port | (11) AI/DI_2 port | (12) 12V_1 port |
| (13) 12V_2 port | (14) SW button | (15) Status indicator | |

Specifications

Table 4-34 lists the environment specifications for the rack environment unit.

Table 4-34 Technical specifications for the rack environment unit

Item	Specifications
Power input	Phoenix terminal, with input voltage of 36–60 V DC
12 V power output	Two 12 V DC power outputs with the rated output current of 250 mA
PoE port	<ul style="list-style-type: none"> FE communication with the rate of 10/100M 36–60 V DC power input
RS485 serial port expansion	<ul style="list-style-type: none"> Four RS485 ports with the default communications rate of 9600 bit/s Among the four RS485 ports, two support 12 V DC, 400 mA power output. The other two are isolated, with the default communications rate of 9600 bit/s, and do not support power output.
AI/DI input	Two active 12 V DC, 200 mA AI/DI input ports
Temperature sensor port	Provides two RJ45 ports to connect to six temperature sensors, each RJ45 port connecting to three temperature sensors.
BLINK button	Provides a BLINK button.

4.4.14 Smart ETH Gateway

A smart ETH gateway allows the extension of the 53.5 V DC power supply and FE communication for the ECC800 and can be flexibly deployed in a modular data center. Figure 4-60 shows a smart ETH gateway.

Figure 4-60 Smart ETH gateway

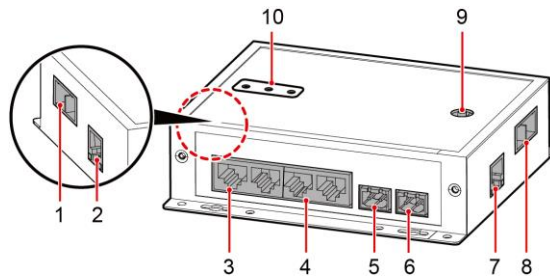


Figure 60

- | | | | |
|---------------------------------|--------------------------------|--------------------------------|----------------------------------|
| (1) PWR_IN cascading power port | (2) FE_1 cascading signal port | (3) PoE_1–2 ports | (4) PoE_3–4 ports |
| (5) 48V_OUT1 power output port | (6) 48V_OUT2 power output port | (7) FE_2 cascading signal port | (8) PWR_OUT cascading power port |
| (9) BLINK button | (10) Status indicator | | |

DD00000084

Specifications

Table 4-35 lists the environmental specifications for a smart ETH gateway.

Table 4-35 Technical specifications for a smart ETH gateway

Item	Specifications
Power input	PWR_IN D-type power input terminal, for power cascading, input voltage range: 45–55 V DC
Power output	<ul style="list-style-type: none"> PWR_OUT D-type power output terminal, for power cascading, output voltage range: 45–55 V DC 48V_OUT1 and 48V_OUT2, phoenix terminal, output voltage range: 45–55 V DC
FE port	Two FE ports, RJ45 terminal with an indicator, 10/100M communication rate, for the cascading between smart ETH gateways and the communication with the upper computer
PoE port	Four PoE ports, RJ45 terminal with an indicator, 10/100M communications rate, 45–55 V DC of power output, complying with IEEE802.3at
BLINK button	If you press the BLINK button once, the RUN indicator blinks intermittently at super short intervals (blinking at super short intervals for 0.5s and then off for 0.5s) for 10 seconds. This indicates that the smart ETH gateway reports the Media Access Control (MAC) address and equipment serial number (ESN) to the ECC800.

4.4.15 WiFi Converter

The WiFi converter is used in a modular data center to convert PoE signals into WiFi signals for communicating with devices such as the pad and mobile phone.

Figure 4-61 shows the WiFi converter.

Figure 4-61 WiFi converter

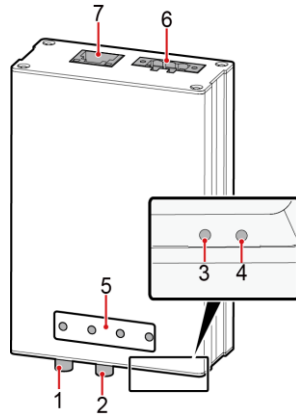


Figure 61

DD00000085

- (1) RF_1 antenna port (2) RF_2 antenna port (3) Reset button (4) WPS button
 (5) Status indicator (6) 48 V power port (7) PoE port

Specifications

Table 4-36 lists the WiFi converter technical specifications.

Table 4-36 WiFi converter technical specifications

Item	Specifications
Power input	One power input port with the 3-pin Phoenix terminal; input voltage range: 36–60 V DC
WiFi function	<ul style="list-style-type: none"> 2.4 GHz frequency, two antennas, supporting eight STA connections, 50 m WiFi coverage (no blockage) Support the WPS button
PoE port	One PoE port, complying with IEEE802.3AT, 25.5 W
Reset button	Press and hold down the button for more than 5s to restore the factory settings of the WiFi converter.
WPS button	Support fast WiFi access by WPS

NOTE

WPS function: If you choose **Advanced settings > WPS connection** on the WLAN of the intelligent device and press the WPS button on the WiFi converter at the same time, the intelligent device will quickly connect to the WiFi hotspot of the micro-module.

4.4.16 Alarm Beacon

The alarm beacon is installed at the periphery of the aisle containment. When a fire occurs or smokes are generated in the micro-modular equipment room, the alarm beacon generates an audible signal and flashes to inform operators of fire and security risks. Figure 4-62 shows an alarm beacon.

Figure 4-62 Alarm beacon



Figure 62

DF05000028

Table 4-37 lists the structural specifications of an alarm beacon.

Table 4-37 Structural specifications of an alarm beacon

Item	Specifications
Dimensions (L x W x H)	130 mm x 75 mm x 55 mm
Installation requirements	Installed on a wall

Item	Specifications
Protection level	IP50
Environmental requirements	RoHS, Reach
MTBF	≥ 100,000 hours

Table 4-38 lists the technical specifications of an alarm beacon.

Table 4-38 Technical specifications of an alarm beacon

Item	Specifications
Power input	RJ45 port, input voltage 9–16 V DC, operating current ≤ 400 mA
Sound pressure	≥ 100 ± 3 dB/30 cm
Continuous operating time	≥ 45 min

4.4.17 PAD

The PAD allows the wireless access from the data center management system. You can monitor the equipment in the data center and environmental parameters in real time over the APP. Figure 4-63 shows a PAD.

Figure 4-63 PAD

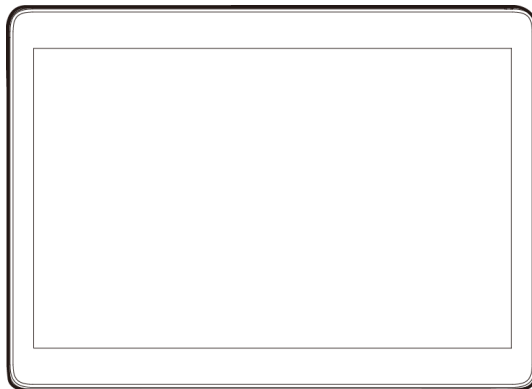


Figure 63

DM26000026

The PAD used in the micro-module is a capacitive touchscreen that supports multi-touch technology. Table 4-39 lists the PAD structural specifications.

Table 4-39 PAD structural specifications

Item	Specifications
Dimensions (L x W x H)	248.5 mm x 150 mm x 8.3 mm
Weight	About 433 g

Table 4-40 lists PAD technical specifications.

Table 4-40 PAD technical specifications

Item	Specifications
Touchscreen	9.6-inch, 1280x800 IPS full view, IPS screen, and capacitive five-point touch
Chip processor	MSM8916, quad-core A53, 1.2 GHz integrated chip
WLAN	802.11a/b/g/n@2.4GHz&5GHz
Store	<ul style="list-style-type: none"> Machine: 16 GB Memory: 2 GB LPDDR3 Extension card: microSD, a maximum of 64 GB supported
Button/Port	<ul style="list-style-type: none"> Power switch and volume button 3.5 mm stereo headphones port Micro SD card port Micro-USB port that supports charging and synchronization with PC data
Battery	<ul style="list-style-type: none"> Materials: Li-polymer Capacity: 4800 mAh WiFi connection/Web page browse time: about 6.5 hours Power adapter charge time: about 6 hours
Operating system	Android 4.4 (KitKat)+EMUI 3.0

4.4.18 Cable Management

Cables inside cabinets are sorted by cable managers, cable rings, and cable trays. Cable managers route cables horizontally, cable rings on the cabinet side route cables vertically, and cable trays route cables from the cabinet front to cabinet rear.

Cable Manager

A cable manager is used for horizontal cabling inside the cabinet.

Figure 4-64 Cable manager



Figure 64

DC06W00015

Table 4-41 Cable manager specifications

Dimensions (H x W x D)	Weight	Space Occupied
43.6 mm x 482.6 mm x 91 mm	0.56 kg	1 U

Cable Ring

A cable ring is installed on a side post in the cabinet to secure vertically routed cables.

Figure 4-65 Cable ring



Figure 65

DC02W00080

Table 4-42 Cable ring specifications

Name	Dimensions (H x W x D)	Weight
Standard cable ring	55 mm x 48 mm x 188.6 mm	0.163 kg
Small cable ring	55 mm x 48 mm x 44 mm	0.096 kg

Cable Tray

A cable tray is used for forward and backward cabling. It uses mounting ears to facilitate device installation.

Figure 4-66 Cable tray



Figure 66

DC06W00014

Table 4-43 Cable tray specifications

Dimensions (H x W x D)	Weight	Space Occupied
43.6 mm x 482.6 mm x 250 mm	1.89 kg	1 U

4.5 Lighting System

The lighting system consists of an AC actuator and aisle lights which can be configured based on the actual situation.

4.5.1 AC Actuator

The AC actuator is used in a smart module to control lights by receiving commands from a lighting button or access control device. The AC actuator can connect to the ECC800 controller by wireless networking (802.15.4).

Figure 4-67 shows an AC actuator.

Figure 4-67 AC actuator

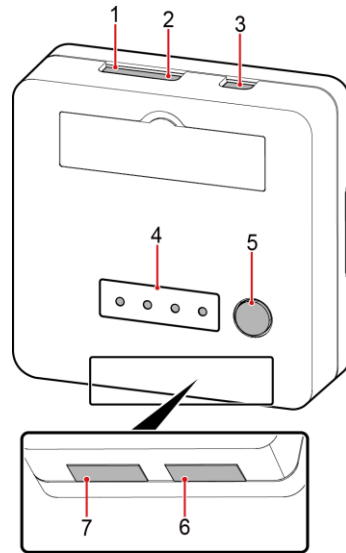


Figure 67

DS34000024

- (1) AC OUT2 port (2) AC OUT1 port (3) AC IN port (4) Status indicator
 (5) BLINK button (6) AI/DI dry contact (7) COM1–2 RS485 port

Specifications

Table 4-44 lists the AC actuator technical specifications.

Table 4-44 AC actuator technical specifications

Item	Specifications
Power input	One AC input, 90–240 V AC
Power output	Two AC outputs, 90–240 V AC, maximum current 5 A
Wireless communication	One wireless communication port, complying with IEEE802.15.4
RS485 port	One route of dual RS485 ports, not isolated (reserved)
AI/DI detection	One AI/DI dry contact connects to the lighting switch, and the other is reserved.
BLINK button	<ul style="list-style-type: none"> Press the button for less than 1 second to start blinking. Hold down the button for 1–5 seconds to search for a network and start networking. Hold down the button for more than 6 seconds to clear network parameters.

4.5.2 Aisle Lights

Light emitting diode (LED) lights are used in aisles. LED lights are installed on the top at both ends of the aisles.

Figure 4-68 shows an LED light. Table 4-45 lists the technical specifications of an LED light.

Figure 4-68 LED light



Figure 68

DJ02000043

Table 4-45 Technical specifications of an LED light

Item	Specifications
Installation mode	Ceiling-mounted
Light holder requirement	The light holder and light are integrated
Protection level	IP20
Electric insulation class	Class I
Standards compliance	IEC 598
Rated operating voltage	220–240 V AC (working normally in the range of 176 V AC to 288 V AC)
Light color	Daylight color
Luminous flux	≥ 500 lx
Service life	≥ 30,000 hours
Power	12–16 W

4.6 Surge Protection and Grounding System

The surge protection and grounding system of the Smart Module consists of the surge protection solution and grounding solution.

4.6.1 Surge Protection Solution

Surge protection modules are installed in the integrated UPS cabinet and precision PDC.

4.6.2 Grounding Solution

Solution 1: M-shaped (Grid) Grounding (Recommended)

Figure 4-69 M-shaped (grid) grounding solution for a single-row aisle containment

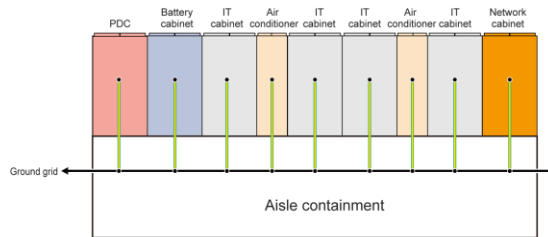


Figure 69

DC00550004

Figure 4-70 M-shaped (grid) grounding solution for a dual-row aisle containment

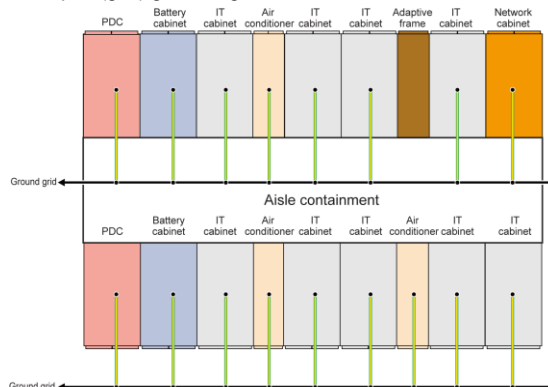


Figure 70

DC00550005

NOTE

The new main way is grounded over the ground point on the general input unit.

As shown in Figure 4-69 and Figure 4-70:

1. Each cabinet in the smart module connects to the nearest ground grid using ground cables with the minimum cross-sectional area of 16 mm².
2. Use 100 x 0.3 copper foils or copper braids with a cross-sectional area of 25 mm² for the equipotential connection grid. Use 30 x 3 copper strips for the equipotential bonding bar based on the customer's configurations.

Solution 2: S-shaped (Star) Grounding (Not Recommended)

NOTE

The S-shaped (star) grounding solution is not supported in the scenario where the new main way is deployed.

- A main ground bar is installed inside the PDC. A branch ground bar is installed inside the first battery cabinet or IT cabinet adjacent to the PDC. Ground terminals of cabinets inside the module are connected to the branch ground bar by ground cables with a minimum cross-sectional area of 16 mm². The main ground bar connects to a floor earthing bar (FEB) or collective ground bar (copper bar with an area of 25 mm x 3 mm routed along a cable tray or wall in an equipment room).
- Metal components and parts of cabinets are properly connected. A structural connection area is protected and applied with antioxidants. A protected area should ensure that two metal components can be properly connected. The DC resistance is within 0.1 ohm between any two connected metal components. Use ground cables to connect two metal components that cannot be directly connected, such as cabinets and cabinet doors. A cable for connecting these two metal components has a minimum cross-sectional area of 6 mm².
- A ground bar or general ground point is provided in each cabinet for equipment grounding. These ground bars are not insulated.
- A ground terminal is greater than or equal to M8 in dimensions. A yellow ground label



is attached close to the general ground terminal for cabinets.

Connect equipotential cables to metal components without carrying currents in the module, such as metal doors and windows, cable trays, and ESD floor supports. Each equipotential cable has a minimum cross-sectional area of 6 mm².

Figure 4-71 shows the equipotential bonding for cabinets in the single-row aisle containment.

Figure 4-71 Equipotential cable connections for single-row cabinets

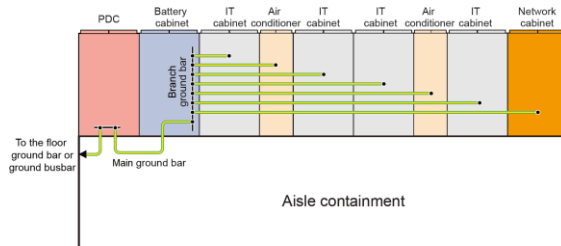


Figure 71

DC00550008

In a dual-row aisle containment, two branch ground copper bars are used. The general ground copper bar is in the PDC, and a branch ground copper bar is in the first IT cabinet near the PDC. See Figure 4-72.

Figure 4-72 Equipotential cable connections for dual-row cabinets (two branch ground copper bars)

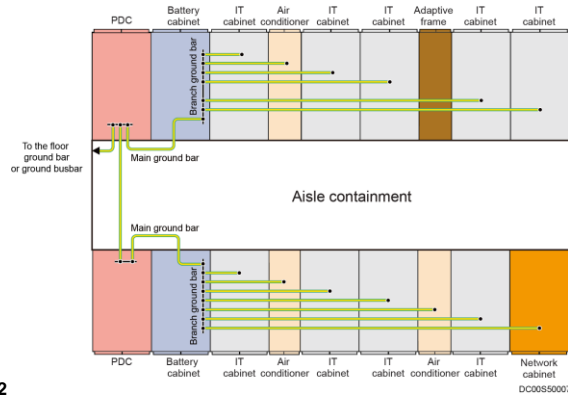


Figure 72

4.7 Integrated Cabling System

The integrated cabling system of the Smart Module includes cable routing devices and cables.

4.7.1 Cable Trough

Cable troughs are installed on the top of cabinets for routing cables. Cable troughs include signal cable troughs and power cable troughs. They are used for routing signal cables and power cables respectively. When a dual-row aisle containment is configured with one PDC and one network cabinet, the power cables are routed through the control skylight located on the top of the PDC to the other end of the module, and the signal cables are routed through the control skylight located on the top of the network cabinet to the other end of the module.

Error! Reference source not found.shows how to route cables.

Figure 4-73 Diagram for routing cables

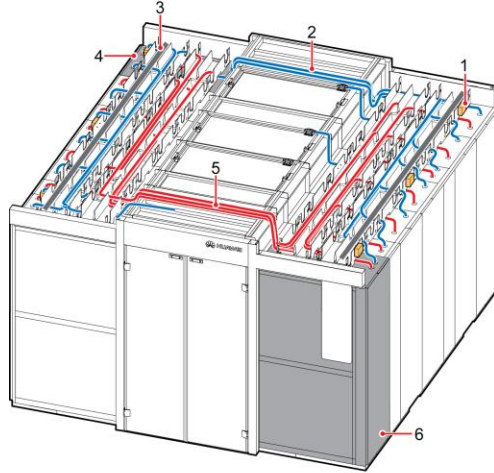


Figure 73

DC0800094

- (1) Smart ETH gateway
- (2) Signal cable
- (3) Optical fiber
- (4) Network cabinet
- (5) Power cable
- (6) PDC

When the distance between two modules is 1200 mm, the power cables are routed through the cable tray located on the top of the PDC to the other module, and the signal cable is routed through the cable tray located on the top of the network cabinet to the other module. Figure 4-74 shows how to route cables between modules.

Figure 4-74 Diagram for routing cables between modules

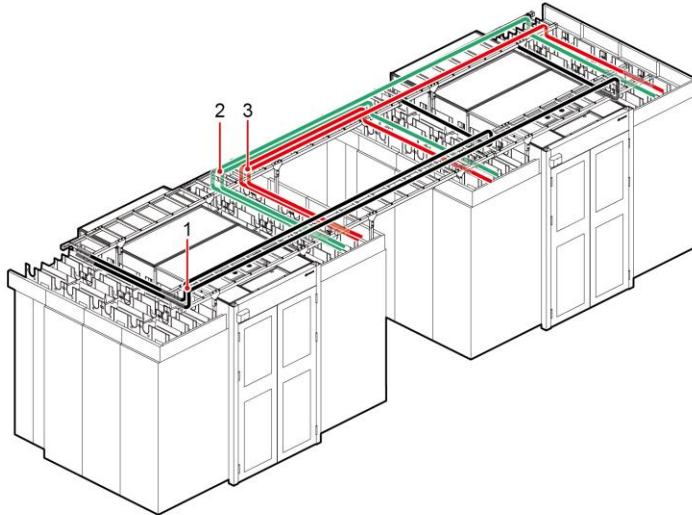


Figure 74

DC0800018

- (1) Power cable (2) Signal cable (3) Optical fiber

4.7.2 Cable Routes for the Dual-Row Aisle Containment Scenario (New Main Way)

Figure 4-75 shows how cables are routed in the dual-row aisle containment scenario when you are configuring the new main ways.



NOTICE

- Ensure that strong-current cables and weak-current cables are at least 100 mm away from each other.
- Connect the power cables from the general input unit side to the smart module.

Figure 4-75 Routing power cables and network cables

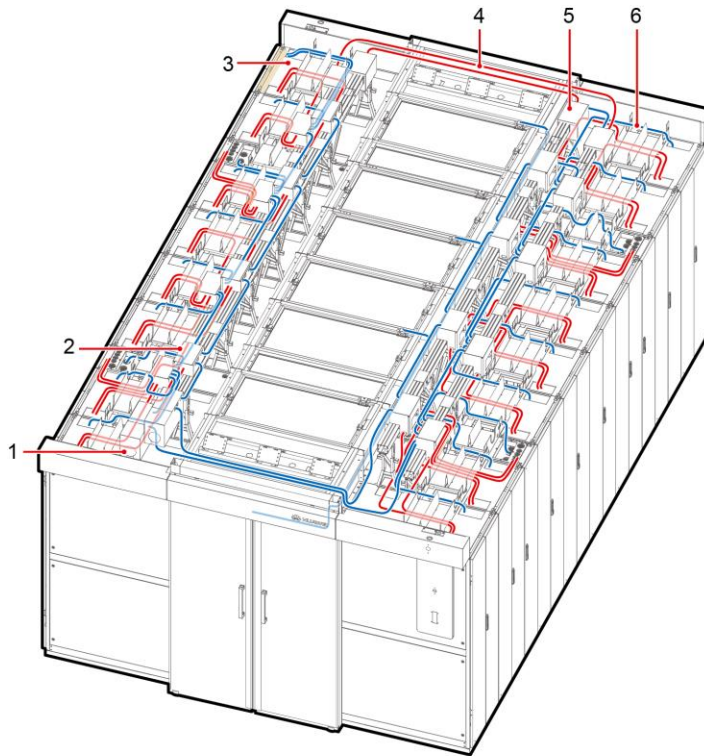


Figure 75

- (1) General input unit (2) Power distribution unit (3) Network cabinet
(4) Power cable (5) Conversion unit (6) Signal cables

DC02110033

4.7.3 Cables

Power Cable

The power cables include power cables to UPSs, battery cabinets, air conditioners, and PDU2000s.

Ground Cable

The ground cables include ground cables to PDU8000s, battery cabinets, and IT cabinets.

Monitoring Cable

The monitoring cables include monitoring cables to air conditioners and UPSs, video cables, door status alarm cables, cables inside the network cabinet, and all sensor cables.

Fire Control Cable

The fire control cables include alarm beacon cables and skylight actuator cables.

5 Other service

Huawei can supply end to end service in civil work part in data center area, demolish and modify existing decoration to match the requirements of data center, the work scope includes:

- (1) Partition modification of computer room and power room
- (2) Sealing the openings of computer room and power room
- (3) Re-painting of computer room and power room
- (4) Fire proof doors of computer room and power room
- (5) Lightings and power sockets of computer room and power room
- (6) Wall display in NOC room

Remark:

Data center area includes computer room, power room, NOC.

Fire Proof Materials

The material should be free of asbestos, lead-containing paint, PCB's, and other environmental hazards.

Fire-resistant material should be used in Data Center. Consider of building fire-resistance, the building structural system should be concrete. Fire resistive requirement is over 90min.

Floors, walls, and ceiling shall be painted heat preservation latex paint, in order to reduce cooling power consumption.

Anti-static PVC tile

Anti-static PVC tiles without pedestal will be supplied for equipment room and cable vault room for anti-static electric.

Fire Proof & Air Lock Door

Fire Proof and air lock door will be supplied for equipment room, door shall be 2.1 m wide and 2.13 m high, without doorsill, hinged to open outward (code permitting) or

slide side-to-side, or be removable. Doors shall be fitted with a lock and have either no center post or a removable center post to facilitate access for large equipment.

Fire proof& Air lock door



Lighting and Emergency Lighting

Lighting shall be a minimum of 500 lux (50 foot-candles) in the horizontal plane and 200 lux (20 foot-candles) in the vertical plane, measured 1 m above the finished floor in middle of all aisles between cabinets. Exit signs shall be properly placed.

A Equipment Derating Coefficients

UPS

Table A-1 lists the derating coefficients of the UPS5000.

 **NOTE**

The coefficients listed in the [Table A-1](#) are based on the dry air density being 1.225 kg/m³ (sea level + 15°C).

Table A-1 Derating coefficients of the UPS5000

Altitude (unit: m)	Derating Coefficients
1000	1.0
1500	0.95
2000	0.91
2500	0.86
3000	0.82
3500	0.78
4000	0.74
4500	0.7
5000	0.67

B Acronyms and Abbreviations

A	
AC	alternate current
ATS	Auto Transformer Switch
B	
BCB	Battery Circuit Breaker
BIB	Battery control I/O board
BIM	Battery Interface Module
BSPP	British Standard Pipe Parallel Thread
C	
CAN	Controller Area Network
CE	Conformité Européenne
CFD	Computational Fluid Dynamics
CIM	Communication Interface Module
D	
DC	direct current
E	
EC	Electronic Commutation
ECC	Energy Control Center
ETH	Ethernet
F	
FE	Fast Ethernet
I	
iBAT	ibattery
IC	Integrated Circuit
IDC	Internet Data Center
FusionModule	integrated data-center solution
IT	Internet Technology
L	
LCD	Liquid Crystal Display

LED	Light Emitting Diode
M	
MTBF	mean time between failures
MTTR	mean time to repair
N	
NTC	negative temperature coefficient
P	
PDU	Power Distribution Unit
PE	Protective Earthing
PoE	Power over Ethernet
PUE	power usage effectiveness
R	
RCCB	Residual Current Circuit Breaker
S	
SD	Secure Digital Memory
SIM	Subscriber Identity Module
SNMP	Simple Network Management Protocol
SPD	surge protective device
U	
USB	Universal Series Bus
UPS	uninterruptible power system
V	
VCN	Video Cloud Node
W	
WiFi	Wireless Fidelity