Network Energy
Huawei Smart Data Center Solution

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Leading Energy Digitalization for a Smart and Sustainable World
Huawei Network Energy Product Line

“DCIM+” Management System

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<th>Outdoor</th>
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<td>Micro &amp; Small DC FusionModule500/800</td>
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<td>Medium &amp; Large DC FusionModule2000/5000</td>
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<td>Small DC FusionModule1000-A</td>
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<td>Medium &amp; Large DC FusionModule1000-B</td>
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<table>
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<th>Subsystem</th>
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<tr>
<td>UPS2000-A/G 1-20kVA</td>
<td>UPS5000-E 25-800kVA</td>
</tr>
<tr>
<td>UPS5000-S 50-800kVA</td>
<td>UPS5000-S-FP 990-1600kVA</td>
</tr>
<tr>
<td>Li-ion Battery</td>
<td>NetCol5000-5000-A 12-46kW</td>
</tr>
<tr>
<td>NetCol5000-C 30-80kW</td>
<td>NetCol8000-A 13-120kW</td>
</tr>
<tr>
<td>NetCol8000-C 62-253kW</td>
<td>NetCol8000-E 220-440kW</td>
</tr>
<tr>
<td>NetEco6000</td>
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</tr>
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</table>

Indoor & Outdoor Solutions
Huawei Data Center Market Share is Leading Industry

Prefabricated DC Facility
World’s NO.1

Source: IHS Markit, 2018

Modular UPS
World’s NO.1

Source: Frost & Sullivan. 2017

Modular DC
China’s NO.1

Source : ICT Research 2018

In-Row
China’s NO.1

Source : ICT Research 2018
Micro & Small Data Centers: Simple and Efficient Integrated Solution

FusionModule500
- Load ≤ 3 kW
- 1–2 ICT Racks
- 42U/24U space

FusionModule800
- Load ≤ 25 kW
- Space for 1–12 Racks
- 42U

Simple construction
- Integrated design, factory-installed
- On-site 4-hour deployment, 2-day service rollout

Efficient operation
- DC variable-frequency Smart Cooling Products, on-demand cooling
- Cold/hot-aisle containment, PUE reduced to 1.37

Simple maintenance
- Centralized multi-DC management, timely alarm reporting, and efficient troubleshooting
- Mobile O&M using a tablet computer or mobile phone, easy and convenient
- Cloud services, cloud maintenance
Huawei Mini DC Solution
FusionModule500: Integrated Solution for DC of 1–2 ICT Racks

1~2 ICT racks

Natural heat dissipation (no A/C)

Total IT load recommend less than 3 kW

Power backup time: 15min~240min

Rack dimension (W x D x H):
- 600X850X1200 (24U)
- 600X1100X2000 (42U)
4 Typical Configurations, Rapid to Output Final Solutions

- **3kVA/24U**
  - IT Space 12U
  - 2 battery optional 12U

- **6kVA/42U**
  - IT Space 24U
  - 4 battery optional 12U

- **10kVA/42U**
  - IT Space 24U
  - 4 battery optional 12U

- **3kVA/42U**
  - IT Space 24U

- **6kVA/42U**
  - IT Space 24U

- **10kVA/42U**
  - IT Space 24U
Huawei Small DC Solution
FusionModule800: Integrated Solution for DC of 1–10 ICT Racks

- **Total IT racks**: 1-10 (Total cabinets 1-12)
- **Cooling**: Rack Smart Cooling (12.5kW/pcs)
- Single row, **Cold & Hot sealed** (250mm cold aisle + 1100mm cabinet hot aisle, the cabinet without side panel, module total depth 1350mm)
- **Total IT load** ≤ 25kW
- **Rack power density** ≤ 7kW
- Components of UPS, indoor units, PDU, etc. will be shipped after installation in integrated cabinet

Notes:
- **T1**: normal temperature (-20°C ~ 45°C)
- **LT**: low temperature (-40°C ~ 45°C)
- **T3**: high temperature (-10°C ~ 55°C)
FusionModule800: Requirements for the Installation Space

Dimensions of the room layout
(Left or right sides can be installed against the wall.)

Installation Environment Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground smoothness</td>
<td>Allowed deviation 3mm/2000mm</td>
</tr>
<tr>
<td>Height of the equipment room</td>
<td>≥2.6m</td>
</tr>
<tr>
<td>Equipment room area</td>
<td>8m² - 40m²</td>
</tr>
<tr>
<td>Equipment room door</td>
<td>Height: &gt;2.2m; Width: &gt;0.9m</td>
</tr>
<tr>
<td>Installation Mode</td>
<td>The cabinet can be installed on a</td>
</tr>
<tr>
<td></td>
<td>concrete floor, raised floor, or ESD floor.</td>
</tr>
<tr>
<td>Height of the raised floor in the lower pipe</td>
<td>≥250mm</td>
</tr>
</tbody>
</table>
FusionModule800: Requirements for the smart cooling installation

Principles:
- Upper pipe system installation layout.
- Down pipe system installation layout.

The maximum pipe length of the indoor and outdoor units is 80m.

<table>
<thead>
<tr>
<th>Pipe length</th>
<th>Refrigerant</th>
<th>Refrigerant Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤30m</td>
<td>delivered with outdoor unit</td>
<td>pre-filled</td>
</tr>
<tr>
<td>30m &lt; L ≤ 80m</td>
<td>needs to be purchased.</td>
<td>pre-filled</td>
</tr>
<tr>
<td>&gt; 80m</td>
<td>Please contact Huawei engineer</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
There is a risk of frostbite in the refrigerant leakage. Please take protective measures (wearing antifreeze gloves, etc.) during the process of handling the refrigerant.
7 Typical Solutions, easy copy

- **IT load**
  - ≤8.5kW (T1&LT)
  - ≤7kW (T3)
- **8.5kW~17kW (T1&LT)**
  - 7kW~14kW (T3)
- **17kW~25kW (T1&LT)**
  - 14kW~21kW (T3)

**Intelligent power distribution**

- ≤8.5kW (T1&LT)
  - ≤7kW (T3)
- 8.5kW~17kW (T1&LT)
  - 7kW~14kW (T3)
Easy On-site Combination and Quick Installation in 4 Hours

Traditional construction mode

<table>
<thead>
<tr>
<th>Design</th>
<th>Site integration equipment</th>
<th>Equipment installation</th>
<th>Commissioning acceptance</th>
<th>Run</th>
</tr>
</thead>
</table>

### FusionModule800

<table>
<thead>
<tr>
<th>Typical configuration</th>
<th>Integration transport</th>
<th>Rack combination</th>
<th>Simple Commissioning</th>
<th>Run</th>
</tr>
</thead>
</table>

1. **The product is pre-fabricated in the factory and packed for transportation.**
2. **Cabinets are simply connected on site.**
3. **The infrastructure is established in 4 hours.**
4. **Services go online in two days.**

10 days business on the line

Saving 80% of the installation time

2 days business on the line
Multi-DC Remote Monitoring, L1-L2 Integration Management

L1 NetEco6000

APP O&M

Northbound integration

Intranet/Internet

L2 esight

Third-party system

Modular DC

Small DC

Site 1

Micro DC

Site 2

Micro DC

Site n

IP/IT device
Modularization Keeps DC Room Clean and Tidy

FusionModule800

FusionModule500

VS

Traditional DC
Medium & Large DC: Simple, Efficient, Reliable, All Modular Design

**FusionModule2000**  
Medium Data Center  
2~48 IT Racks  
IT Load of Module≤235kW

**FusionModule5000**  
Large Data Center  
6~48 IT Racks  
IT Load of Module≤310kW

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**Simple maintenance**
- Digital quantization, visual view display
- Data center quantitative visualization, PAD mobile management, remote centralized monitoring
- Effectively improve operation and maintenance efficiency by **30%**

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**Energy Saving**
- Intelligent AI enabled, on-demand cooling
- E2E collaborates on refined energy efficiency management to cope with complex conditions, reducing PUE by **8%**

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**Reliable Running**
- Real-time protection of over-temperature, over-voltage and over-current of each branch node
- Real-time monitoring of power supply and distribution connections
- Passive warning to active prevention
The Overview of Huawei FusionModule2000

- NetEco Management System
- Cabling System
- Cooling System
- Contained Aisle
- Cabinet System
- Monitoring System
- Mobile APP for remote inspection

**Integrated UPS/PDC**
- UPS: 1~125KW, PDC: 145KW/235KW

**Cabling System**
- Single Row: 2~24 IT Cabinets
- Dual Row: 6~48 IT Cabinets

**Cooling System**
- Inverter PAC 25/42kW

**Contained Aisle**
- Rotating/Sliding door

**Cabinet System**
- 42U/47U
- 600/800mm

**IT load per Module ≤235kW**
FusionModule2000: Multiple Application Scenarios

- **UPS Outside**
- ** UPS In-row**
- **Above-rack Pipeline**
- **Beneath-rack Pipeline**
Efficient Cooling: PUE Down 0.05 with Interaction of Power & Cooling

- Data collection
- Data handling

Core controller (ECC800)

Temperature

Power

Module layout information

PUE = 1.5

Data analysis

Instruction queue

Command execution

Logical operation

Power & cooling interaction

PUE = 1.45
Prefabricated Modular DC Solutions Adapt to Diverse Scenarios

**Prefabricated Integrated IT Solution**
- 40-feet integrated data center solution
- 6–8 cabinets, N+X or 2N configuration to meet Tier III

**Prefabricated Modular IT Solution**
- Large scale prefabricated data center solution

**Prefabricated Integrated IT Solution**
- 20-feet integrated equipment room solution
- 20 kW, 2m x 4m white space

**Prefabricated Modular ICT Solution**
- Air-cooled ICT equipment room solution

**Prefabricated Modular ICT Solution**
- Air-cooled CT equipment room solution

Various Construction Needs
FusionModule1000-A: 100% Prefabrication, Plug& Play Smart Data Center

Integrate all subsystems of data center facility into a ISO standard 40ft prefabricated module

**Enclosure**
ISO standard 40ft

**Rack**
7-8x42U IT racks
Support 200mm sliding

**Cooling**
Air-cooled in-row
Hot aisle containment

**Power**
Integrated modular UPS
2N&N+X available

**Fire protection**
HFC-227ea (standard)
Novec1230 (optional)

**Management System**
ECC800&NetEco DCIM+

**Management Hardware**
Lan switch
Server

Huawei Confidential
FusionModule1000-A: Layout of 380V-2N Scenario-Advanced Configuration

**specification**
- Enclosure: ISO standard 40ft
- IT Rack space: 7*42U IT rack (1.2m & 1.1m deep)
- Power: integrated UPS*2 + battery cabinet*1
- Battery backup: 10min (full-load)
- Power density: 6~9kW/rack
- Total IT load: 54kW
- Cooling: air-cooled in-row, 3+1 redundancy
- Sensible cooling capacity: 25kW/unit
- Hot aisle containment

**layout**
- IT rack 4*42U: 600mm*1200mm*2000mm
- IT rack 3*42U: 600mm*1100mm*2000mm
- Integrated UPS*2
- Cooling outdoor unit: 4*25kW air-cooled in-row
- Cooling indoor unit
- Battery cabinet*1

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**Enclosure**: ISO standard 40ft
**IT Rack space**: 7*42U IT rack (1.2m & 1.1m deep)
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**Power density**: 6~9kW/rack
**Total IT load**: 54kW
**Cooling**: air-cooled in-row, 3+1 redundancy
**Sensible cooling capacity**: 25kW/unit
**Hot aisle containment**
FusionModule1000-A: Sliding Cabinet Design Provide Better Maintenance Space

Notes: Only for 1200mm-deep rack of advanced configuration
FusionModule1000-A: Module Extreme Test & All-round Simulation Ensure System Reliability

Unique module-level test @ -40-55°C ensure smooth running at extreme conditions

All-round CFD simulation ensure optimal airflow and cooling reliability
FusionModule1000-A: Ultra Reliability with World’s 1st TIER-Ready III Certification

Manufacturer: HUAWEI Technologies Co., Ltd
Model: Fusion Module 1000A-2N50
Issued September 2018

- **Save Time**: Reduces end-user’s Tier Certification time by 65% due to the design being pre-validated by the manufacturer.

- **Reduce Risk**: Lowers project risk by pre-validating designs for TIER compliance at the manufacturer level.

- **Lower Cost**: Decreases end-user’s Tier Certification costs considerably due to decrease in scope of certification engagement.
FusionModule1000-A: Unattended O&M with Smart Management System & APP

One PAD
Display all systems information

One APP
O&M anytime anywhere

One DCIM+
Centralized management
# FusionModule1000-A: 50%+Quicker DC Construction by Facility Prefabrication

## Traditional data center solution

<table>
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<tr>
<th>Site Survey</th>
<th>Planning &amp; Design</th>
<th>Civil Work</th>
<th>Subsystem Installed one-by-one</th>
<th>Commissioning</th>
<th>Pilot Run</th>
<th>Acceptance Test</th>
</tr>
</thead>
</table>

## Prefabricate AIO DC solution

<table>
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<th>Site Survey</th>
<th>Planning &amp; Design</th>
<th>Civil Work</th>
<th>Installation</th>
<th>Commissioning &amp; Acceptance test</th>
</tr>
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<tbody>
<tr>
<td>Factory preparation</td>
<td>Pre-Test</td>
<td>Deliver</td>
<td></td>
<td></td>
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### 50%+ Quicker

- **Factory prefabrication**: 4 weeks
- **Pretest before delivery**: 1 day
- **Delivery**: 1 day
- **Simple installation**
Huawei Intelligent Power Supply and Distribution Solution for All Scenarios

- **Headquarters-level data center**
  - Modular FusionPower5000-S (1,000–1,600 kVA)
  - Modular UPS5000-S (50–800 kVA)
  - Modular UPS5000-E (25–800 kVA)

- **Region-level data center**
  - High-frequency UPS5000-A (30–800 kVA)
  - SmartLi Lithium battery cabinet
  - Intelligent power distribution cabinet
  - iBattery intelligent monitoring

- **Branch office equipment room**
  - UPS2000-G series (1–20 kVA)
  - UPS2000-A series (1–10 kVA)

- **Branch**

Huawei UPS Li-ion Battery Cabinet Overview

- Battery cell: LFP (LiFePO$_4$)
- Nominal voltage: 512Vdc
- Discharge rate: 6C
- Nominal capacity: 80Ah/40.96kWh
- Operation voltage range: 408 - 544Vdc
- Charging current: 0.1 - 1C
- Backup time: 10min/15min
- Maximum discharge current: 480A continuous
- Cycle life: 5000 cycles @ 50% DOD, 25ºC
- Cable Entry: top entry
- Maximum number of cabinets: 8

1. Monitoring module
2. Battery breaker
3. Fuse
4. Intelligent battery management module
5. Monitor Unit
6. Battery Module
Long Floating Charging Lifespan, NO Need replacement in the Life Cycle

**Li-ion battery**
Floating Charging @ 25°C

**Lead-acid battery**
Floating Charging @ 25°C
Li-ion cycle life is longer than VRLA

**Li-ion battery**

**Lead-acid battery**
Li-ion discharge capacity is bigger than VRLA at large rate
High Power Density, High Utilization of Space

**Power density (Wh/kg):**
- LFP: 100~150  
- Lead-acid battery: 30~50

**Power density (Wh/L):**
- LFP: 200~300  
- Lead-acid battery: 60~90

- **Weight comparison**
- **Volume comparison**

Power density: LFP : lead-acid battery = 3 : 1

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**70% space saved, 14 more IT racks**

Lead-acid battery

**Footprint: 11.2 m²**

Li-ion battery

**Footprint: 3.06 m²**

Condition: 800kW load, 15min backup time.
Active Voltage Balance Control, One Module Failure, System Can Work Normally

One battery module failure, the system can work normally
Huawei SmartLi has intelligent battery management module (built-in DC/DC conversion), which can boost the voltage of battery string and ensure voltage balance.
Remarks: Other vendors have no intelligent battery management module (built-in DC/DC conversion)
Supporting New and Old Battery Cabinets Mixed Use, Flexible to Expand; Bias current <2%

**Can not make full use of the existing battery for expansion**

- Current imbalance ratio is under 2%
- Support new and old battery cabinets mixed use, phase by phase scale-up
- Don’t need to consider the voltage difference for cabinet parallel system

**Active current balance control, flexible to expand**

- Current imbalance cannot be controlled
- New and old battery cabinets cannot be mixed use
- In order to connect the cabinet parallel system, the voltage difference should be under 5V

- The voltage difference between new and old battery cabinets will cause cross current
- The internal resistance difference between new and old battery cabinets will cause bias current, which reduces battery lifespan
Three-level BMS System Ensures Reliability

**Third-level SBCU system:**
- Management of BCU system and BMU, communication with UPS or network management, providing interface ports
- Alarm management & report analysis
- SOC and SOH management

**Second-level BCU system:**
- BMU management
- Charge and discharge current detection
- Alarm & protection of abnormal work
- Current balance control between cabinets

**First-level BMU:**
- Voltage and temperature detection
- Battery current balance management
LFP Cell Ensures Safety and Reliability

LFP material is with higher stability

Huawei LFP Cell

LFP material is with higher stability

Olive-like 3D
More stable

Cubic crystal 3D
Stable

Layered 2D
Fragile

Layered 2D
Fragile

LFP decomposition does not generate $O_2$, which dramatically reduce the explosion risk

LFP

$LiFePO_4$ Charging $FePO_4$

LMO

$LiMn_2O_4$ Charging $Li_xMn_2O_4$

LCO

$LiCoO_2$ Charging $Li_{0.5}CoO_2$

NCM

$LiCo_{2/3}Ni_{1/3}Mn_{1/3}O_2$ Charging $CoO_2 + NiO_2$

Normal charging

$FePO_4$

$Mn_2O_3 + O_2$

$LiCoO_2 + Co_3O_4 + O_2$

$NiO_x + Mn_3O_4 + O_2$

Over-charged / temperature

Thermal Run Away

$FePO_4$

$Mn_2O_3 + O_2$

$LiCoO_2 + Co_3O_4 + O_2$

$NiO_x + Mn_3O_4 + O_2$

$FePO_4$

$Mn_2O_3 + O_2$

$LiCoO_2 + Co_3O_4 + O_2$

$NiO_x + Mn_3O_4 + O_2$
SmartLi is ON

More Value

Same Investment

< 10 years warranty >
DC Ready - SmartLi is ON SPIF Policy introduction

- **Applicable Products**: UPS5000-SmartLi-Lithium-Battery cabinet

- **Target**: All CFT partners of Russia EBG dept.

- **Policy Duration**: 1\textsuperscript{st} Oct. 2019 – 31\textsuperscript{st} Dec. 2020

- **Partner Incentive**: During the valid period of this incentive policy, each of two sets of lithium battery cabinet sold by each partner, Huawei will give the partner sales staff a P30 Pro, and Huawei will issue it to CFT partners through third-party companies.

- **Distribution time**: Within one quarter after Huawei confirm the revenue in system.
Thank you.

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