



EMS-1-P Datasheet

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Zhuhai Virtual Power Plant Technology Co., Ltd

Declaration

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1 Introduction

1.1 System Architecture

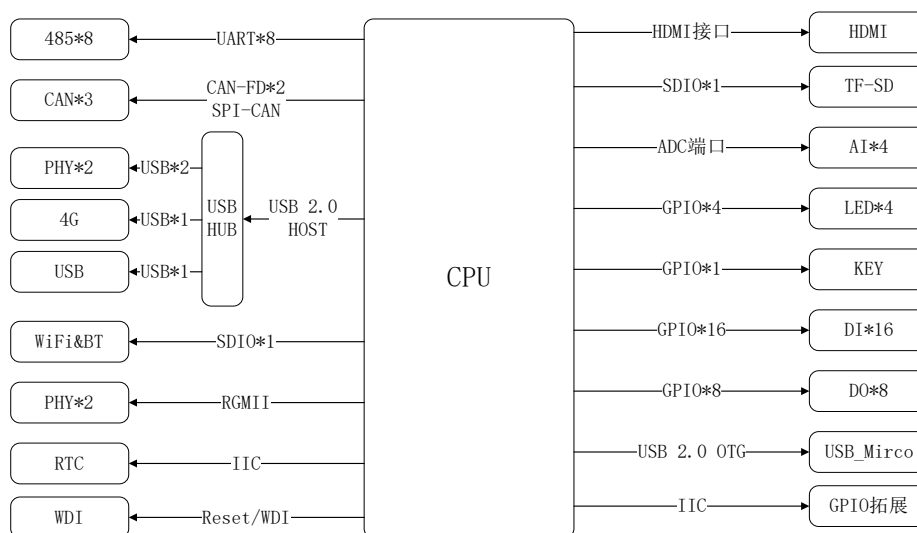
The EMS-1-P Commercial & Industrial Energy Management Center Series is designed to meet the energy demands of commercial and industrial scenarios, including solar power, energy storage, vehicle charging, and consumption. It supports fundamental functions such as the integration of various equipment units within energy storage cabinets, data collection, protocol conversion, data storage, centralized monitoring, and maintenance. Additionally, it enables multiple application strategies, including peak shaving and valley filling, demand control, backup power management, anti-reverse power flow, and new energy consumption.

Building on the centralized management of cabinet units, this product achieves unified dispatch and energy allocation for photovoltaic systems, energy storage, charging piles, and loads in commercial and industrial settings. It also supports parallel cabinet management for multiple energy storage units. Users can configure strategies for solar-storage-charging systems through this product to maximize the utilization of photovoltaic power generation.

This Commercial & Industrial Energy Management Center supports advanced strategies such as load forecasting and energy prediction. It is compatible with various industry-standard protocols, including MODBUS and MQTT, and enables seamless integration with third-party systems.

2 Basic Parameters

2.1 System Block Diagram



2.2 Technical Parameters

Category	Configuration	Specifications
Hardware Parameters	CPU	RK3576J, octa-core 64-bit ARM V8 processor, 4×A72@2.2GHz+4×A53@1.8GHz+arm Cortex-M0 MCU supports NEON instruction set
	NPU	Supports INT4/INT8/INT16/FP16/BF16/TF32 mixed operations, computing power up to 6 TOPS
	GPU	G52 MC3 GPU @ 900MHz, supports Open GL ES 3.2, and supports 2D RGA acceleration module
	VPN	8K@30fps H.264/H.2652 Decoder 4K@60fps H.264/H.265 Encoder
	IPS	16M ISP with HDR (up to 120dB)
	OS	Linux 6.1

	RAM	4GB LPDDR4X
	EMMC	32GB EMMC
	HDMI	1× HDMI 2.1, supports up to 7680x4320@60Hz output
	ETHERNET	2× 10/100/1000M, 2x 10/100M
	USB-C	1× TYPE-C port, compatible with USB 3.0 and lower protocols
	USB-A	1× TYPE-A port, compatible with USB 2.0 and lower protocols
	SD	1× Micro SD slot, supports up to 256GB
	RS485	8 channels
	CAN	3 channels
	DI	16 channels (Digital Input)
	PWM	1× PWM input detection, 1x PWM output
	AI	3× current detection, 1x voltage detection (Analog Input)
	DO	8 channels (Digital Output)
	4G	FDD-LTE、TDD-LTE
	GPS	GNSS/GPS
	WiFi	IEEE 802.11b/g/n/ax(@2.4GHz), Wi-Fi compliant
	BT	BLE5.2
Software Parameters	Southbound Data Acquisition	Supports data access and protocol adaptation for various devices such as BMS, PCS, EMS, PV, and I/O systems
	Northbound Data Upload	Supports multi-channel encrypted transmission to platforms like SOLMAN, and standard protocol platforms such as IEC104 and Modbus TCP
	Multi-Cabinet Management	≤ 16
	Energy Strategies	Peak Shaving and Valley Filling
		Demand Management
		Load Tracking + Reverse Power Flow Prevention
		Power Control

		New Energy Consumption
		Other Custom Advanced Strategies
	User Configuration	Local Web Configuration
		Remote Server Configuration
	Firmware Upgrade	Remote Upgrade
		Local Web Upgrade
	Security Mechanism	Software Watchdog
		Hardware Watchdog
	Strategy Configuration	Local/Remote Strategy Configuration
	Others	Real-time Control, Remote OTA, Breakpoint Resumption

2.3 Electrical Characteristics

2.3.1 Electrical Characteristics (Ta=25°C)

Parameters		Min	Typ	Max	Unit	Comment
Power	Operating Voltage	12	24	36	V	
	Operating Current		200		mA	Under transient conditions
	Power Detection	12	-	36	V	Self-detection of power supply
Voltage Sampling	Voltage Range	0	-	36	V	
	Accuracy		±5		%	
Current Sampling	Current Range	0	-	20	mA	
	Accuracy		±5		%	
DI Signal Type	Voltage Type	0	-	5	V	Max. 6V supported
	Dry Contact Type	Supports relay type and switch type				
DO Output	DO Output Voltage		24		V	DO output voltage equals power supply voltage
	DO Output Current	0	-	1	A	Powered by J6 connector
RS485	Withstand		-	5	V	

	Voltage					
	Load Resistance		120		Ω	
CAN	Withstand Voltage		-	5	V	
	Load Resistance		120		Ω	

2.3.2 Maximum Absolute Ratings

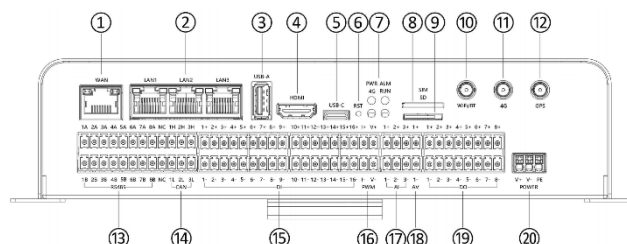
Characteristics		Min	Max	Unit	Comment
Input Voltage		-0.3	100	V	
Operating Environment	Temperature	-30	85	°C	
	Humidity	5	95	%	Non-condensing
	Altitude		5000	m	
Storage Temperature			25	°C	
ESD Protection	Air Discharge	-	15	kV	
	Contact Discharge		8		

2.3.3 RF Characteristics

Category	Parameter	Value	
4G	Operating Frequency	LTE-FDD	CN: B1/ 3/ 5/ 8 EU: B1/ 3/ 5/ 7/ 8/ 20/ 28 LA: B1/ 2/ 3/ 5/ 7/ 8/ 28/ 66
		LTE-TDD	CN: B34/ 39/ 40/ 41 EU: B38/ 40/ 41 LA: B38/ 40/ 41
		GSM/GPRS	CN: 900/ 1800 MHZ EU: 900/ 1800 MHZ LA: 850/ 900/ 1800/ 1900 MHZ
	Transmit Power	GSM850: +33dBm (Power Class4) EGSM900: +33dBm (Power Class4) DCS1800: +30dBm (Power Class1) PCS1900: +30dBm (Power Class1) LTE: +23dbm (Power Class3)	

	Antenna Selection	4G: Passive antenna, gain +2.5~5dB GPS: Passive antenna, gain +18~36dB
WiFi	Operating Frequency	2400~2483.5MHZ (2.4GHz ISM Band)
	WiFi Type	WiFi 6
	WiFi Standard	IEEE 802.11 b/g/n/ax
	Output Power	802.11b/1Mbps 20dBm, Typical @ EVM≤-10.5dB 802.11b/11Mbps 20dBm, Typical @ EVM≤-15.5dB 802.11g/6Mbps 19dBm, Typical @ EVM≤-5dB 802.11g/54Mbps 16dBm, Typical @ EVM≤-25dB 802.11n/MCS0(20/40M) 19dBm, Typical @ EVM≤-5dB 802.11n/MCS7(20/40M) 15dBm, Typical @ EVM≤-27dB 802.11ax/MCS0(20M) 19dBm, Typical @ EVM≤-5dB 802.11ax/MCS9(20M) 14dBm, Typical @ EVM≤-32dB
	Receiver Sensitivity	1Mbps -98dBm, typical 11Mbps -89dBm, typical
	Antenna Selection	External 2.4G antenna, 2400~2500MHz
BLE	Operating Frequency	2400~2483.5MHz (2.4GHz ISM Band)
	Bluetooth Standard	BLE5.2
	Transmit Power	20dBm, Typical
	Receiver Sensitivity	Sensitivity @ PER=30.8% for LE(1Mbps) -98dBm, Typical Sensitivity @ PER=30.8% for LE(2Mbps) -95dBm, Typical Sensitivity @ PER=30.8% for LE(S2) -101dBm, Typical Sensitivity @ PER=30.8% for LE(S5) -104dBm, Typical
	Antenna Selection	External 2.4G antenna, 2400~2500MHz

3 Interface Definition



No.	Port Number	Functional Interface	Function/Comment
①	J7	RJ45 × 1	WAN
②	J8	RJ45 × 3	LAN × 3
③	J9	USB 2.0 Type-A	Program upgrade, data storage
④	J10	HDMI 2.1 Type-A	External display
⑤	J11	TYPE-C 3.0	Firmware burning
⑥	S1	RST	Reset
⑦	J12, J13	LED	Displays controller status (top-left, bottom-left, top-right, bottom-right): Power, 4G, Alarm, Operation Status Indicators
⑧	J15	Micro SIM	SIM card slot
⑨	J14	Micro SD	SD card slot
⑩	J16	SMA Female Jack	WiFi & BT antenna
⑪	J17	SMA Female Jack	4G antenna
⑫	J18	SMA Female Jack	GPS passive antenna
⑬	J1	RS485 × 8	Terminal interface definition, see section 3.1
⑭	J1	CAN × 3	Terminal interface definition, see section 3.1
⑮	J2, J3	DI Ports	Terminal interface definition, see sections 3.2 & 3.3
⑯	J3	PWM Port	Terminal interface definition, see section 3.3
⑰	J4	AI Port	Terminal interface definition, see section 3.4
⑱	J4	AV Port	Terminal interface definition, see section 3.4
⑲	J5	DO Port	Terminal interface definition, see section 3.5
⑳	J6	Power Input Port	Terminal interface definition, see section 3.6

The J1 port integrates 8 channels of RS485 and 3 channels of CAN. The specific pin definitions are as follows:

Connector	Name	Description
J1	RS485_1A ^[1]	Channel 1 RS485A
	RS485_1B ^[1]	Channel 1 RS485B

	RS485_2A ^[1]	Channel 2 RS485A
	RS485_2B ^[1]	Channel 2 RS485B
	RS485_3A ^[1]	Channel 3 RS485A
	RS485_3B ^[1]	Channel 3 RS485B
	RS485_4A ^[1]	Channel 4 RS485A
	RS485_4B ^[1]	Channel 4 RS485B
	RS485_5A ^[1]	Channel 5 RS485A
	RS485_5B ^[1]	Channel 5 RS485B
	RS485_6A ^[1]	Channel 6 RS485A
	RS485_6B ^[1]	Channel 6 RS485B
	RS485_7A ^[1]	Channel 7 RS485A
	RS485_7B ^[1]	Channel 7 RS485B
	RS485_8A ^[1]	Channel 8 RS485A
	RS485_8B ^[1]	Channel 8 RS485B
	NC	NC
	NC	NC
	CAN_1H ^[2]	Channel 1 CAN_H
	CAN_1L ^[2]	Channel 1 CAN_L
	CAN_2H ^[2]	Channel 2 CAN_H
	CAN_2L ^[2]	Channel 2 CAN_L
	CAN_3H ^[2]	Channel 3 CAN_H
	CAN_3L ^[2]	Channel 3 CAN_L

Note:[1] The RS485 circuit board is equipped with a 120Ω load resistor.

[2] The CAN circuit board is equipped with a 120Ω load resistor.

The J2 port integrates 9 channels of DI. The specific pin definitions are as follows:

Connector	Name	Description
J2	DI_1+	Channel 1 DI+
	DI_1-	Channel 1 DI-
	DI_2+	Channel 2 DI+
	DI_2-	Channel 2 DI-
	DI_3+	Channel 3 DI+
	DI_3-	Channel 3 DI-
	DI_4+	Channel 4 DI+
	DI_4-	Channel 4 DI-
	DI_5+	Channel 5 DI+
	DI_5-	Channel 5 DI-
	DI_6+	Channel 6 DI+
	DI_6-	Channel 6 DI-

	DI_7+	Channel 7 DI+
	DI_7-	Channel 7 DI-
	DI_8+	Channel 8 DI+
	DI_8-	Channel 8 DI-
	DI_9+	Channel 9 DI+
	DI_9-	Channel 9 DI-

The J3 port integrates 7 channels of DI and 2 channels of PWM. The specific pin definitions are as follows:

Connector	Name	Description
J3	DI_10+	Channel 10 DI+
	DI_10-	Channel 10 DI-
	DI_11+	Channel 11 DI+
	DI_11-	Channel 11 DI-
	DI_12+	Channel 12 DI+
	DI_12-	Channel 12 DI-
	DI_13+	Channel 13 DI+
	DI_13-	Channel 13 DI-
	DI_14+	Channel 14 DI+
	DI_14-	Channel 14 DI-
	DI_15+	Channel 15 DI+
	DI_15-	Channel 15 DI-
	DI_16+	Channel 16 DI+
	DI_16-	Channel 16 DI-
	PWM_IN+	PWM Input+
	PWM_IN-	PWM Input-
	PWM_VOUT+	PWM Output+
	PWM_VOUT-	PWM Output-

The J4 port integrates 3 channels of AI and 1 channel of AV. The specific pin definitions are as follows:

Connector	Name	Description
J4	AI_1+	Channel 1 current sampling+
	AI_1-	Channel 1 current sampling-
	AI_2+	Channel 2 current sampling+
	AI_2-	Channel 2 current sampling-
	AI_3+	Channel 3 current sampling+
	AI_3-	Channel 3 current sampling-

	AV_1+	Channel 1 voltage sampling+
	AV_1-	Channel 1 voltage sampling-

The J5 port integrates 8 channels of DO. The specific pin definitions are as follows:

Connector	Name	Description
J5	DO_1+	Channel 1 high-side relay drive output +
	DO_1-	Channel 1 high-side relay drive output -
	DO_2+	Channel 2 high-side relay drive output +
	DO_2-	Channel 2 high-side relay drive output -
	DO_3+	Channel 3 high-side relay drive output +
	DO_3-	Channel 3 high-side relay drive output -
	DO_4+	Channel 4 high-side relay drive output +
	DO_4-	Channel 4 high-side relay drive output -
	DO_5+	Channel 5 high-side relay drive output +
	DO_5-	Channel 5 high-side relay drive output -
	DO_6+	Channel 6 high-side relay drive output +
	DO_6-	Channel 6 high-side relay drive output -
	DO_7+	Channel 7 high-side relay drive output +
	DO_7-	Channel 7 high-side relay drive output -
	DO_8+	Channel 8 high-side relay drive output +
	DO_8-	Channel 8 high-side relay drive output -





The J6 port is the power input interface. The specific pin definitions are as follows:

Connector	Name	Description
J6	V+	24V Power Input Positive
	V-	24V Power Input Negative

	PE ^[1]	Chassis Earth (Ground)
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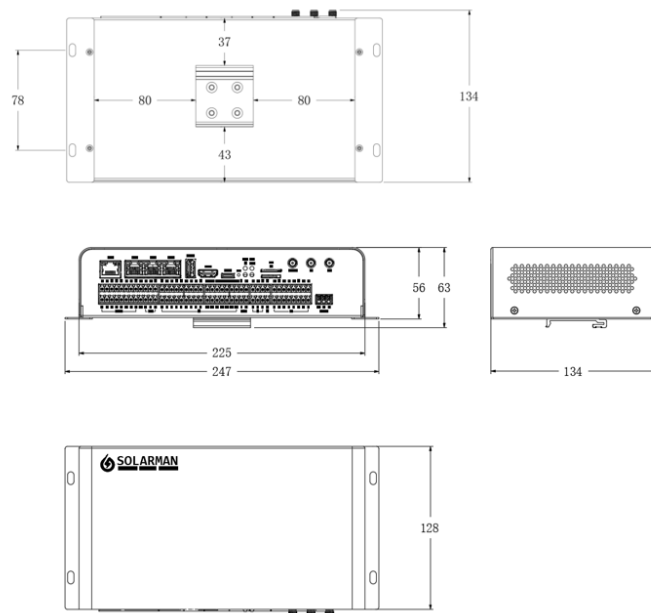
Note:[1] Ensure the PE (Protective Earth) is properly grounded.

4 Actual Photos

Name	Illustration
Top View	
Bottom View	
Front View	
Left View	



5 Mechanical Dimensions



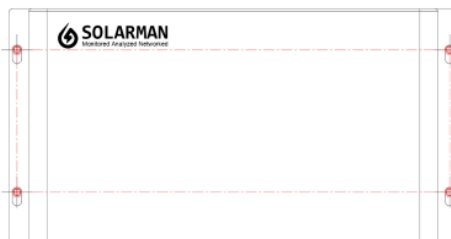
Dimensions (Unit: mm, Tolerance: $\pm 5\%$)

6 Accessories

6.1 Structural Assembly Accessories:

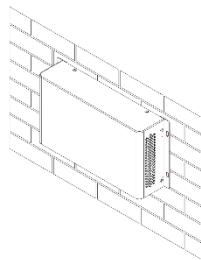
1. Direct-Mount Fixing Accessories:

The product can be fixed using either mounting ears or clips. Mounting ears are installed by default upon shipment, and include 4× PM4×18mm screws and 4× M4 nuts for assembly. For detailed installation instructions, please refer to the installation manual.



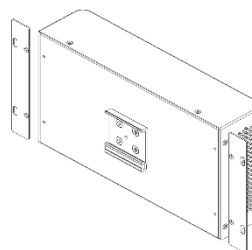
2. Wall-Mount Fixing Accessories:

The product includes 4× M4 self-tapping screws and 4× plastic expansion tubes for wall-mounted installation. For detailed installation instructions, please refer to the installation manual.



3. Clip-On Fixing Accessories:

The product includes 4× KM4×5mm screws and 1× DIN rail clip for clip-on installation. For detailed installation instructions, please refer to the installation manual.



6.2 Connector Female Sockets

The product includes 6 corresponding connector female sockets, as shown in the figure below:



6.3 Power Adapter (Optional)

An optional power adapter is available for the product, as shown in the figure below:



Note: The color and dimensions of the power adapter housing may change. Customers will be notified in advance of any changes.

Electrical Performance Specifications:

Input Characteristics	Min	Nominal	Max
Input Voltage/	90Vac	100Vac~240Vac	264Vac
Input Frequency	47Hz	60Hz/50Hz	63Hz
Output Characteristics	Rated Load	Output Range	R+N
Rate Min. Load	Max. Load	+5V	
0.0 A	7.0A	22.8V~25.2V	200mVp-p

6.4 Antennas

The product includes standard 4G and WiFi antennas, with an optional GPS antenna, as shown in the figure below:



Antenna Parameters:

4G	Impedance	50Ω
	Frequency Band	824~960MHz, 1710~2170MHz, 2300~2690MHz
	VSWR	<3.0
	Gain	+2.5~5dBi
	Radiation Pattern	Omnidirectional
	Polarization	Vertical

WiFi&BT	Impedance	50Ω
	Frequency Band	2.4GHz~2.5GHz, 5.15GHz~5.95GHz
	VSWR	<2.0
	Gain	+2.5~3dBi
	Radiation Pattern	Omnidirectional
	Polarization	Vertical
GPS	Impedance	50Ω
	Frequency Band	1574.397MHz~1576.443MHz
	VSWR	≤1.5

6.5 Ethernet Cable

The product includes 1× 1-meter Cat5e Ethernet cable, as shown in the figure below:



7 Indicator Light Description

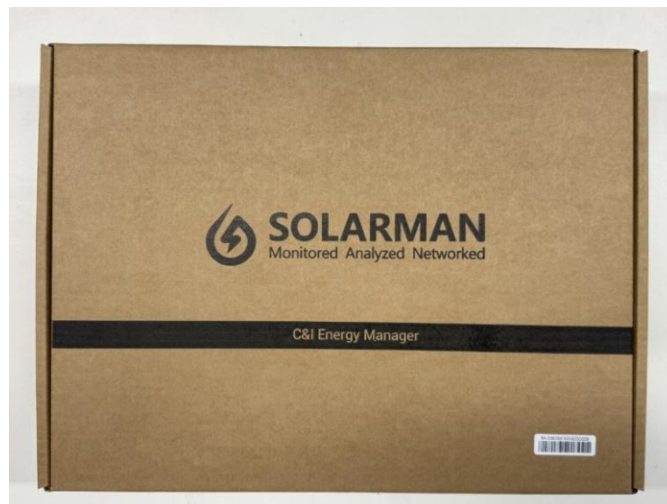
Indicator	State	Meaning
PWR	Red Off	No power / Power failure / System exception
	Red Solid	Red Solid
4G	Green Off	4G disabled or no SIM card detected
	Green Slow Blink	(1s on, 1s off) Data transmitting
	Green Fast Blink	(100ms on, 100ms off) 4G disconnected or communication interrupted
	Green Solid	4G dial-up successful
ALM	Red Off	No alarm
	Red Slow Blink	(1s on, 1s off) System minor alarm
	Red Fast Blink	(100ms on, 100ms off) System critical alarm
	Green Off	Server connection abnormality

RUN	Green Slow Blink	(1s on, 1s off) Server connecting
	Green Solid	Server connection normal

8 Packaging and Packing List

8.1 Product Package Dimensions

450×330×100mm (Tolerance: ±3mm).



8.2 Packing List

No.	Item	Quantity
1	DIN Rail Clip	1
2	KM4×5mm Screws	4
3	PM4×18mm Screws	4
4	M4 Nuts	4
5	M4 Self-Tapping Screws	4
6	Plastic Expansion Tubes	4
7	Connector Female Sockets	6

8	4G Antenna	1
9	WiFi Antenna	1
10	1m Ethernet Cable	1
11	Certificate of Compliance	1
12	Installation Guide	1
13	GPS Antenna (Optional)	1
14	Power Adapter (Optional)	1