

Runhood Residential ESS & Portable Power Station Product User Manual F2400-US V1.3

version management

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1 Product Definition

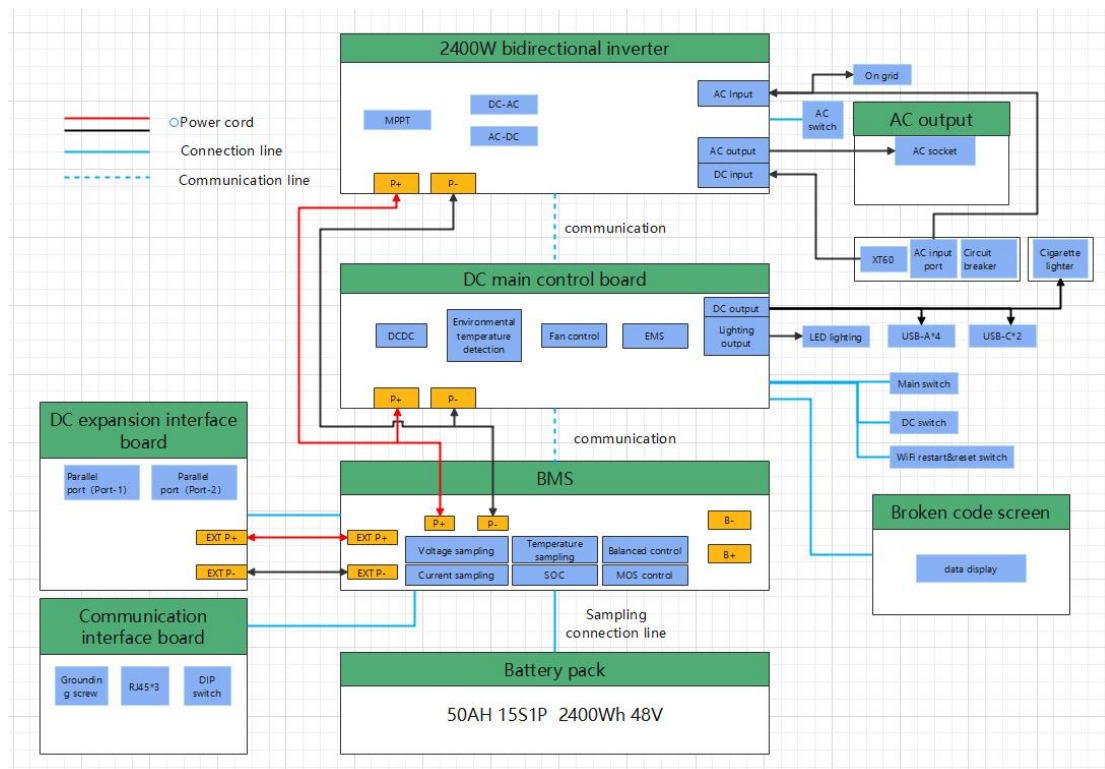
1.1 Application scenarios

Application Scenario one: Used as an outdoor mobile energy storage power source. Supports input methods such as AC charging, photovoltaic charging, and vehicle charging. Supports DC output such as USB, DC12V10A, and AC output. Can be moved and stacked for use.

Application scenario two: Used as a balcony photovoltaic, supporting grid connection function.

Application scenario three: As a home energy storage battery pack, it can be matched with hybrid inverters for use.

1.2 System Block Diagram



1.3 F2400

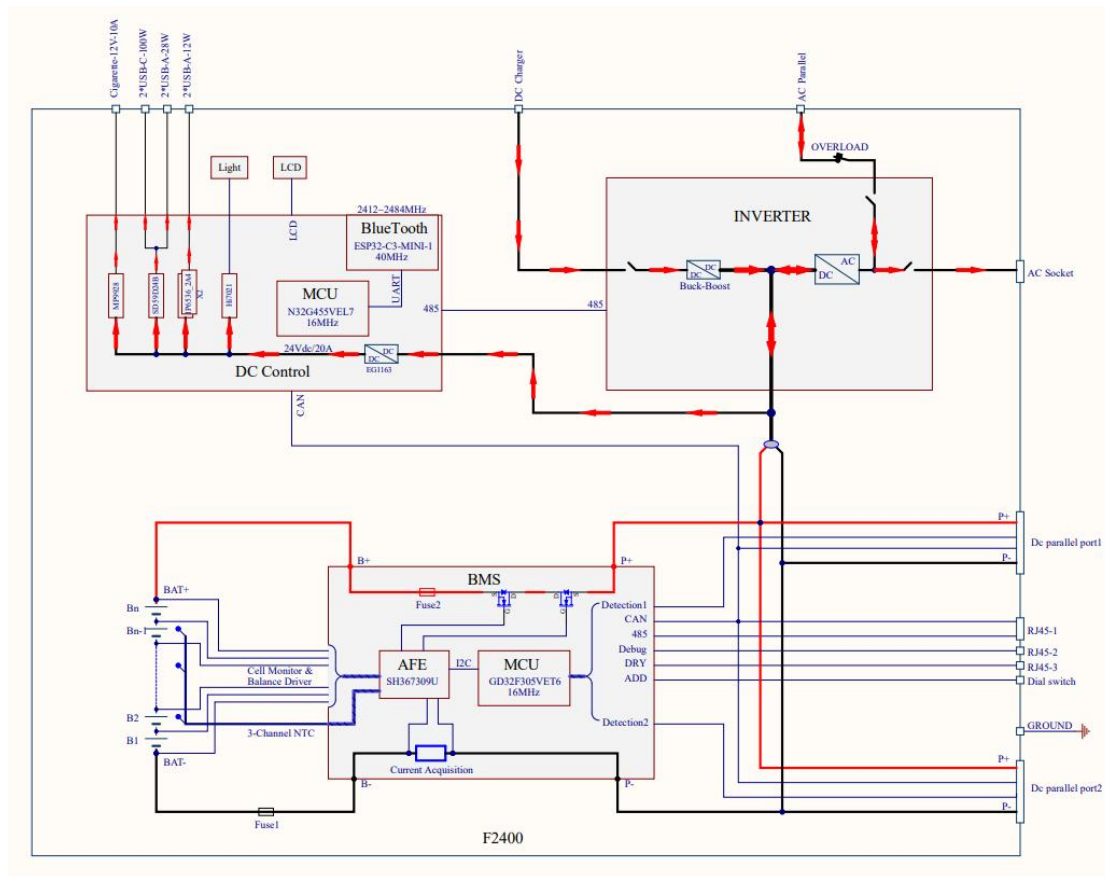
Composed of battery pack, inverter, DC interface, parallel interface, etc.

1.3.1 Product appearance



F2400 product appearance diagram

1.3.2 Principle Block Diagram



F2400 Principle Block Diagram

1.3.3 Specification parameters

F2400		
Battery	Cell specifications	LiFePO4 (LFP64151, 50Ah)
	Cell model	LFP64151/50Ah
	Grouping method	15S1P
	Electricity level	2400Wh
	Rated current	charging: 40A; discharge: 50A

	Maximum current	charging: 40A; discharge: 80A
	Voltage range	40.5-54Vdc
	temperature range	charging: -15°C~55°C; discharge: -25°C~55°C
	Number of cycles	8000 cycles to 70%+ capacity@25°C
LCD Screen	LCD	Support (Broken code screen)
Lamp	LED	Support (Flip)
Key	Key1	Main Power switch on/off
	Key2	AC on/off
	Key3	DC on/off
	Key4	Wifi Reset
PV	Input	PV Max Input Voltage 60Vdc
		PV MPPT Voltage Range 12~58Vdc
		PV Max input Current 25A
		Maximum PV input Power 1200W Max
DC	Input	Rated 12~60Vdc, Supports the Maximum voltage of 150V, DC 25A, 1200W Max
	Output	USB-A(*2) 5V/2.4A 12W Max
		USB-A(*2) QC3.0 5V/3A, 9V/3A, 12V/2.4A, 28W Max
		USB-C(*2) PD3.0 5V/3A, 9V/3A, 15V/3A, 20V/5A, 100W Max
AC	Input	American regulations 120Vac, 60Hz, 15A, 1800W Max
		Japanese regulations 100Vac, 50/60Hz, 15A, 1500W Max
		European regulations 230Vac, 50Hz, 10A, 1800W Max
		English regulations 230Vac, 50Hz, 10A, 1800W Max

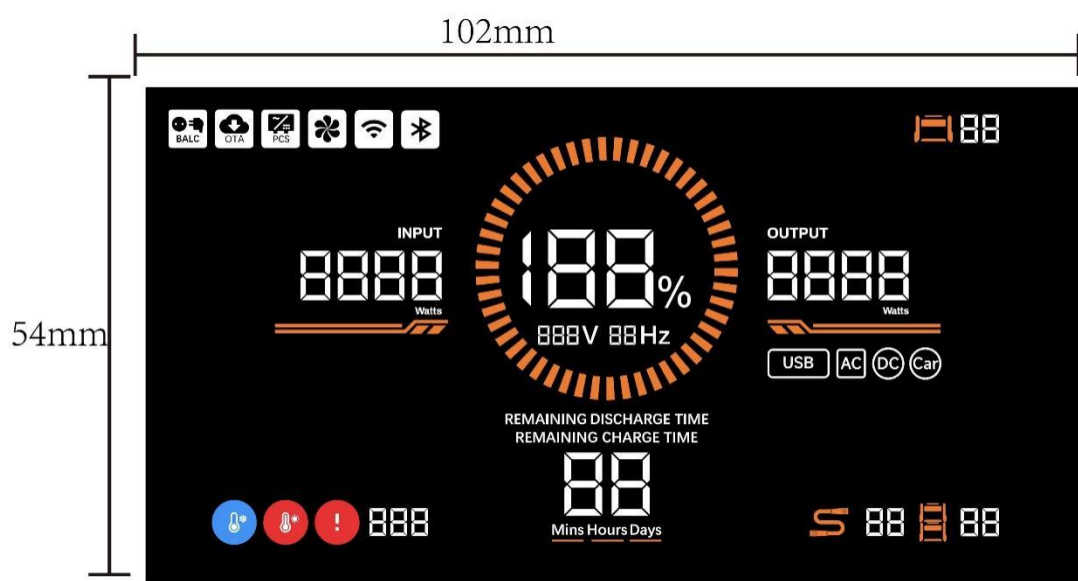
		Australian regulations 230Vac, 50Hz, 10A, 1800W Max
		China regulations 220Vac, 50Hz, 10A, 1800W Max
	Output	American regulations 120Vac, 60Hz, total 2400W Max (Socket*5 & Back-Up*1)
		Japanese regulations 100Vac, 50/60Hz, total 2400W Max (Socket*4 & Back-Up*1)
		European regulations 230Vac, 50Hz, total 2400W Max (Socket*4 & Back-Up*1)
		English regulations 230Vac, 50Hz, total 2400W Max (Socket*4 & Back-Up*1)
		Australian regulations 230Vac, 50Hz, total 2400W Max (Socket*4 & Back-Up*1)
		China regulations 220Vac, 50Hz, total 2400W Max (Socket*4 & Back-Up*1)
AC	On-Grid	European regulations 230Vac, 50Hz, 2400W Max
Wifi/Bluetooth		Support
Extra Battery Port (*2)		Power and Communications
Extra Battery packs Quantity		8 Max
External communication		RJ45 *3(Com1:PCS/EMS/ Bidirectional electricity meter /CT Com2: Debugging/Inverter Com3: Dry junction)
Grounding point		Grounding identification
DIP switch		Terminal resistance
On and off grid		ON: on-grid 、 OFF: off-grid

switch		
Weight		29kg
Dimensions		503mm*323mm*344mm

1.3.4 basic function

1. LCD display screen

Display the battery level and usage status information of the product.



icon	information	Prompt explanation
	Current address	The current ID of the F2400 product.
	Number of battery packs connected to the system	This icon indicates the number of battery packs that the system is connected to for expansion.
	Number of battery packs for normal system	This icon indicates the current number of parallel battery packs that are working properly.

	operation	
	Grid connected power generation prompt	When the grid connection switch is turned on, this icon is displayed.
	OTA indication	During OTA, this icon is displayed.
	External hybrid inverter indication	The system supports the use of external grid connected hybrid inverters. At this time, the product can be used as a home storage battery pack. This icon prompts when the system is connected to an external hybrid inverter.
	WIFI/BLE indicate	When connecting to WIFI/Bluetooth, this icon is displayed.
	USB 、 AC 、 DC 、 Car indicate	Turn on the DC button to display the USB, DC, and Car icons; Turn on the AC button and display the AC icon.
	High temperature alarm	The high temperature icon indicates that the battery temperature is too high. When the high temperature icon is lit, the system does not allow charging or discharging. Please place the product in a ventilated area, wait for the equipment to cool down and automatically reset. If the device does not reset, please contact our product expertservice.@runhoodpower.com。
	Low temperature alarm	The low temperature icon indicates that the battery temperature is too low. When the low temperature icon is displayed, the system will

		not allow charging or discharging. The product will automatically reset after reaching the working temperature. If the device does not reset, please contact our product expertservice@runhoodpower.com。
	Important faults	When this icon prompts, it indicates a serious malfunction. Check for strong static or magnetic interference, and then restart the device. If the device fails to work again, please contact our product expertsservice@runhoodpower.com。
	Fan status	When the host temperature overheats, the system will turn on the fan and light up the fan icon. If a fan icon appears but the fan is not working, please check if the fan is blocked. Before reusing, please turn off the device and carefully clean and vacuum all ventilation openings around it. If the device cannot operate, please contact our product expertsservice@runhoodpower.com。

2. AC output switch (hold down to turn on or off) AC output indicator light

The AC power button controls the AC power output of F2400. To enable AC power, click the AC power button. When the AC power supply of F2400 is enabled, the AC indicator light will light up. When Overload occurs or the battery level is 0%, the AC output and AC indicator lights will turn off. When the battery level returns to above 2%, the AC output can return to normal.

3. AC output socket

Power devices such as laptops, televisions, mini refrigerators, vacuum cleaners, etc. through communication sockets. Support the use of 2400W appliances for power reduction (not all excess appliances are supported, need to be tested to confirm their functionality to avoid affecting your work and life).

4. LED lights

The use of LED lights adopts a flip type. Flip up and turn on the light. The light intensity can be adjusted through the app.

5. Main power button

After pressing the main power button for 1.5 seconds and hearing a beep, turn on the Anku F2400 home mobile energy storage power supply. Long press for 3 seconds and hear a beep, then release the switch and execute the shutdown. If unable to shut down normally, press and hold the power switch for 10 seconds and hear three beeps. The system will attempt to forcibly shut down. When the Anku F2400 home mobile energy storage power is turned on, the LCD display screen will light up. If the power supply is idle for 2 minutes (the time can be set through the APP), the LCD display screen will decrease in brightness. If the home mobile energy storage power supply is idle (all output switches are turned off and the product is not charged) for more than 5 minutes (the time can be set through the APP), the Anku F2400 home mobile energy storage power supply will automatically shut down.

When connected to B2400, B2400 will remain in the same open or closed state as F2400.

6. PV or DC charging input port

Specification XT60EW-M. We can charge the power supply through the dedicated connection cable of RUNHOOD's built-in car charging port, and can charge the power supply through a photovoltaic panel.

Supports solar panel series parallel input, rated voltage range: 12-60Vdc, maximum supported voltage: 150V, current: 25A Max, power: 1200W Max.

7. DC output switch (vehicle charging output port, USB output) and DC output port indicator light

Press and hold the DC switch to turn on or off the F2400 DC power output, while lighting up the indicator light for the DC output. This button controls the DC output, USB-A, and USB-C outputs of the F2400 car charging port.

When there is an overload alarm prompt on the DC side output, pressing this button can clear the alarm prompt.

8. WIFI, BLE restart, reset switch

When the system is working, WIFI and BLE are in the working state by default. Short pressing this switch for 1 second can turn on and off the WIFI and BLE modules. Long press this switch for 3 seconds to reset the WIFI and BLE modules.

9. Car charging output port

The car charging port supports a maximum current output of 10A and can be used for general on-board appliances.

10. USB-A output port

Charge various devices, such as iPhone, tablet, GoPro, speakers, or any other device that charges through the USB-A port.

Fast charging outputs 28W * 2 power, while slow charging outputs 12W * 2 power.

11. Fast charging 100W USB-C output port

Output: USB-C can charge devices including MacBook Pro, Android phones, and any other USB-C port.

Fast charging outputs 100W * 2 power.

12. Ventilation and heat dissipation holes

The heat dissipation hole can prevent F2400 from overheating.

13. Buzzer output

The system is equipped with a buzzer reminder, which includes:

- 1) Intermittent long beep: lasts for 0.5 seconds, pauses for 2 seconds. Low battery warning;
When the battery level is below 5%, the buzzer outputs a long beep interval and can be turned off by pressing the main power button;
- 2) When prompted for low battery, insert the charger and the prompt sound will turn off;

- 3) Turn on the main power button, and the buzzer will sound once to prompt the system to turn on. Press and hold the main power button for 3 seconds, the buzzer will sound once, indicating that the system is shut down normally. Press and hold the main power button for 10 seconds, the buzzer will sound three times, indicating that the system is forced to shut down.

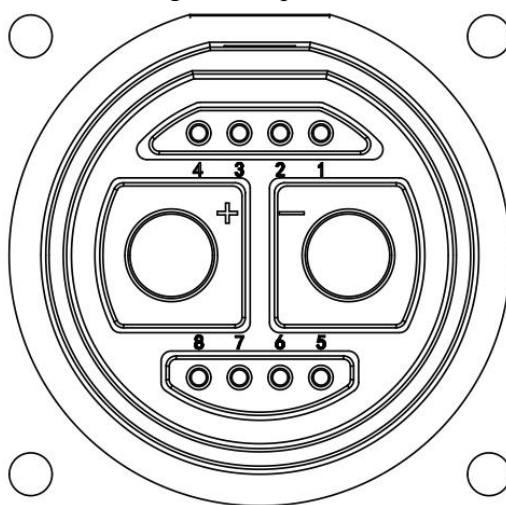
14. Parallel interface

The parallel port is used to connect to the dedicated parallel connection line of Ankou during the DC parallel connection of the product, to expand the capacity of the battery pack.

PORT-1 is connected to the front product, and PORT-2 is connected to the rear product.

DC parallel connection port (PORT-1), port (orange) containing wires and communication lines, has different functions in different scenarios:

- 1) When F2400 is used for home energy storage applications, this port is connected to the battery port of the PCS.
- 2) During DC parallel operation, this port is connected to the lower connection port of the front F2400. The schematic diagram and pin definitions are as follows:



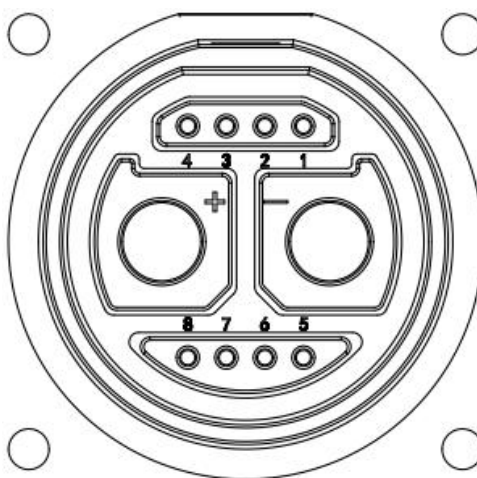
Schematic diagram of DC parallel connection port (PORT-1)

Description of the pins for the DC parallel connection port (PORT-1)

Number	identification	description
+	P+	Connect the positive pole of the battery module in series

-	P-	Connect the negative electrode of the battery module in series
1	CAN0H	Signal line of CAN bus
2	CAN0L	Signal line of CAN bus
3	M_TX	Signal transmission through uplink communication
4	M_RX	Signal transmission through uplink communication
5	GND	Ground
6	SYN_ON	System start signal
7	M_DET	Signal detection for uplink access
8	GND	Ground

DC parallel connection port (PORT-2), port (black) containing wires and communication lines, connects to the upper connection port of F2400 or B2400. The schematic diagram and pin definitions are as follows:



Schematic diagram of DC parallel connection port (PORT-2)

Description of the pins for the DC parallel connection port (PORT-2)

Number	identification	description
+	P+	Connect the positive pole of the battery module in series

-	P-	Connect the negative electrode of the battery module in series
1	CANH	Parallel communication CAN-H
2	CANL	Parallel communication CAN-L
3	S_RX	Lower link communication receiving
4	S_TX	Send signal through lower link
5	S_DET	Downlink access signal detection
6	SYN_ON	System start signal
7	GND	Ground
8	GND	Ground

15. Communication Interface

The RJ45 interface includes three interfaces: expansion communication port COM-1, debugging communication port COM-2, and dry junction communication port COM-3.

When this product is used in home energy storage application scenarios, the extended communication port COM-1 port is used to connect home storage hybrid inverter devices for communication. The communication method is CAN or RS485, and it supports external EMS (RS485), bidirectional electricity meter or CT (RS485).

Debug the communication port COM-2 for professional technical maintenance personnel to use, supporting CAN or RS485 (inverter data can be accessed through this interface).

The communication port COM-3 for the dry and wet contact signals reserved for the product.

The specific information is shown in the table below.

RJ45-1 (COM1) Expansion communication port pin description

Number	identification	description
1	RS485_B_CT	CT module RS485-B
2	RS485_A_CT	CT module RS485-A
3	RS485_B_EMS	EMS module RS485-B
4	CAN1H	PCS Module CAN-H
5	CAN1L	PCS Module CAN-L

6	RS485_A_EMS	EMS module RS485-A
7	RS485_A	PCS module RS485 A
8	RS485_B	PCS module RS485 B

RJ45-2 (COM2) Debug Port Pin Description

Number	identification	description
1	CAN0H	Debugging communication CAN_H
2	CAN0L	Debugging communication CAN_L
3	GND	Ground
4	RS485_B1	Internal inverter module RS485-B
5	RS485_A1	Internal inverter module RS485-A
6	ACT	Start signal
7	GND	Ground
8	RESET	Reset

RJ45-3 (COM3) Dry Node Port Pin Description

Number	identification	description
1	NO1	Output dry contact signal 1 (In)
2	COM1	Output dry contact signal 1 (Out)
3	NO2	Output dry contact signal 2 (In)
4	COM2	Output dry contact signal 2 (Out)
5	DIN+	Input dry contact signal 1+
6	DIN1	Input dry contact signal 1
7	DIN+	Input dry contact signal 2+
8	DIN2	Input dry contact signal 2

16. DIP switch

The dial switch has a total of 6 digits. The following are the instructions and usage of the dial

switch.

- 1) 6-digit dial switch, 1-5 is the reserved switch, and 6 is the communication internal resistance 120 Ω access switch.
- 2) When there are multiple F2400 connected to the grid, it is necessary to select one F2400 as the main device. Set the main device dial 1 to ON and 2-5 to OFF; The remaining F2400 dials 1-5 to OFF. After starting F2400, the main device will be automatically selected based on the dialing status.
- 3) When the product is locked due to a malfunction (fault code 68), dial 1-5 to ON and then all to OFF to clear the fault.

1.3.5 Grid connection function

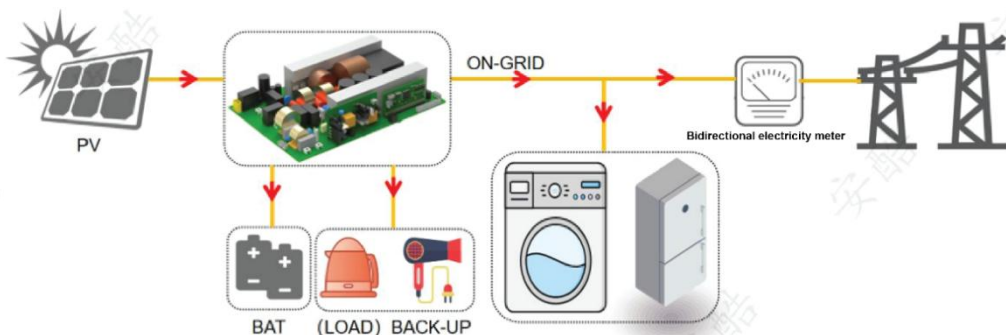
1. EMS Energy Management

It is mainly divided into spontaneous self use mode, timed mode, and disaster recovery mode. When the SOC is less than 10% (configurable through the APP) and there is no charging protection, the battery will no longer discharge and can only be charged.

(1) Spontaneous self use mode (default mode)

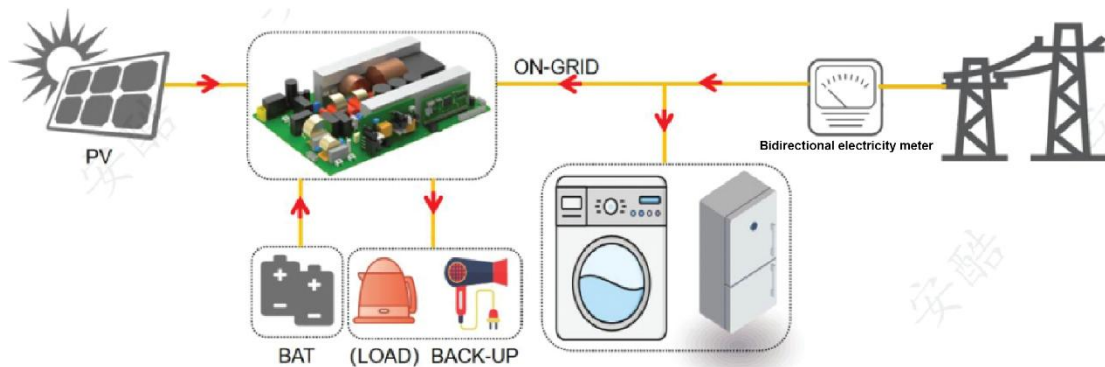
This mode is suitable for grid areas with low-priced power generation and high electricity consumption, prioritizing the use of photovoltaic and battery energy, and minimizing the use of grid energy as much as possible. Specific working methods:

- 1) When the power grid is connected and the PV is sufficient, the PV prioritizes supplying power to the AC load and general load, then charges the battery, and any remaining energy can be connected to the grid.



- 2) When the power grid is connected and the PV is insufficient, the battery prioritizes

supplying power to the load, and the insufficient power is then supplied to the load by the power grid.



(2) Timer mode

Set the charging and discharging time period through the manual APP, such as during the low electricity price period at night, which can be set as the charging time period. The system charges the energy storage at maximum charging power during this period, and during the high electricity price period, it is set as the discharging time period. The battery can only be discharged during the discharging time period, saving household electricity costs.

(3) Disaster recovery mode

When the power grid is normal and the battery SOC is not 90% (SOC can be set), start charging (photovoltaic priority), and discharge when the power grid is abnormal.

2. F2400 communicates with smart sockets

To complete normal communication between F2400 and the smart socket, the following steps are required:

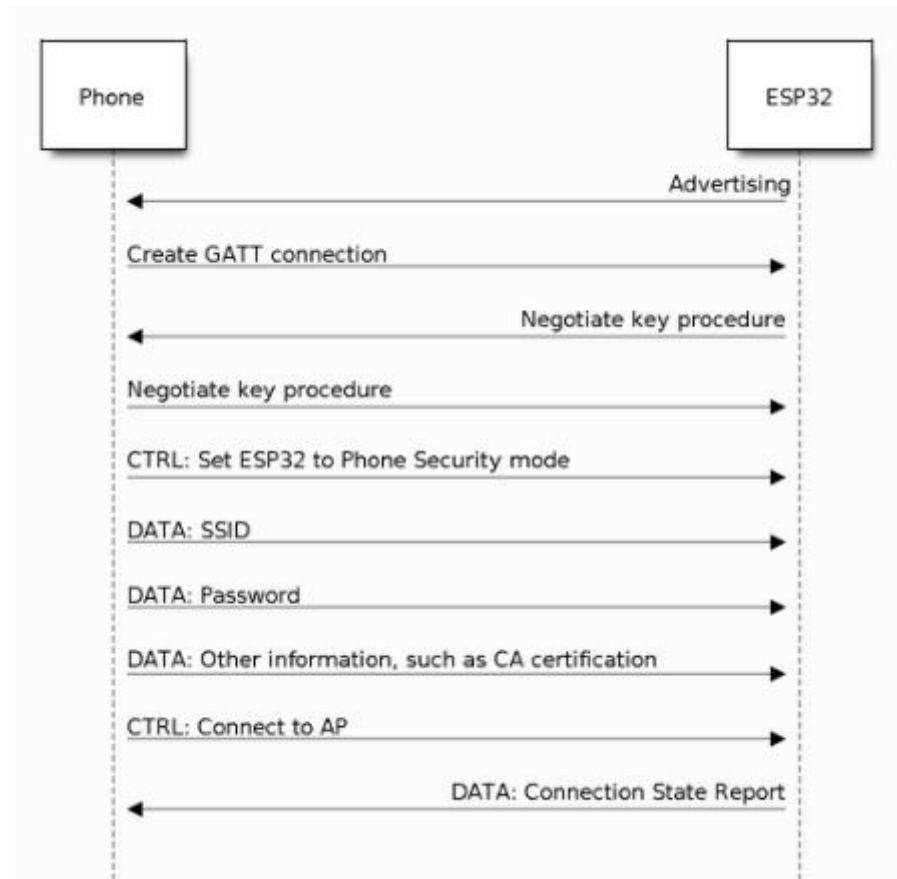
- 1) Bluetooth network configuration;
- 2) LAN device discovery;
- 3) LAN TCP communication.

Attention: Wired RS485 communication is required with bidirectional meters or CT modules

(1) Bluetooth network configuration

The APP sends WIFI information to F2400 and smart sockets through Bluetooth, completing the Bluetooth network configuration of F2400 and smart sockets respectively. The distribution

network process uses the BluFi provided by ESP32, which is a WIFI network configuration function based on Bluetooth channel. The process diagram and the specific distribution network process of F2400 are as follows:



F2400/Intelligent socket Bluetooth network distribution process diagram

- 1) ESP32 enables GATT Server mode to send broadcasts with specific advertising data. This broadcast does not belong to the BluFi Profile and can be customized as needed. (The device name is configured as "RHG", the broadcast content is 21 bytes, the first byte represents the device type, and the remaining 20 bytes represent the device SN number).
- 2) After searching for the broadcast using a mobile application, the phone will connect to ESP32 as a GATT client. There are no specific requirements for which mobile application to use in this step.
- 3) After successfully establishing a GATT connection, the phone will send data frames to

ESP32 for key negotiation.

- 4) After receiving the data frame for key negotiation, ESP32 will parse it according to a custom negotiation method.
- 5) Key negotiation between mobile phone and ESP32. The negotiation process can use encryption algorithms such as DH/RSA/ECC.
- 6) After the negotiation is completed, the mobile end sends a control frame to ESP32 to set the security mode.
- 7) After receiving the control frame, ESP32 encrypts and decrypts communication data using a shared key and security configuration.
- 8) The mobile phone sends data frames defined in the BluFi frame format to ESP32, including Wi Fi configuration information such as SSID and password.
- 9) The control frame for the mobile phone to send a Wi Fi connection request to ESP32. After receiving the control frame, ESP32 assumes that the phone has completed the necessary information transmission and is ready to connect to Wi Fi.
- 10) After connecting to Wi Fi, ESP32 sends the control frame of the Wi Fi connection status report to the phone. At this point, the distribution network is over.

Attention: The intelligent socket distribution network process refers to the F2400 distribution network process and will not be explained in detail.

(2) LAN device discovery

Using UDP multicast, the smart socket (abbreviated as Wi Fi device) sends an address to the multicast address after powering on. F2400 can receive messages as long as it listens to the address and replies to the message in UDP unicast mode. Wi Fi devices can also obtain the IP address of F2400 devices upon receiving the message. The UDP multicast address and port number are 232.10.11.12:3339. The process diagram is shown in the following figure.

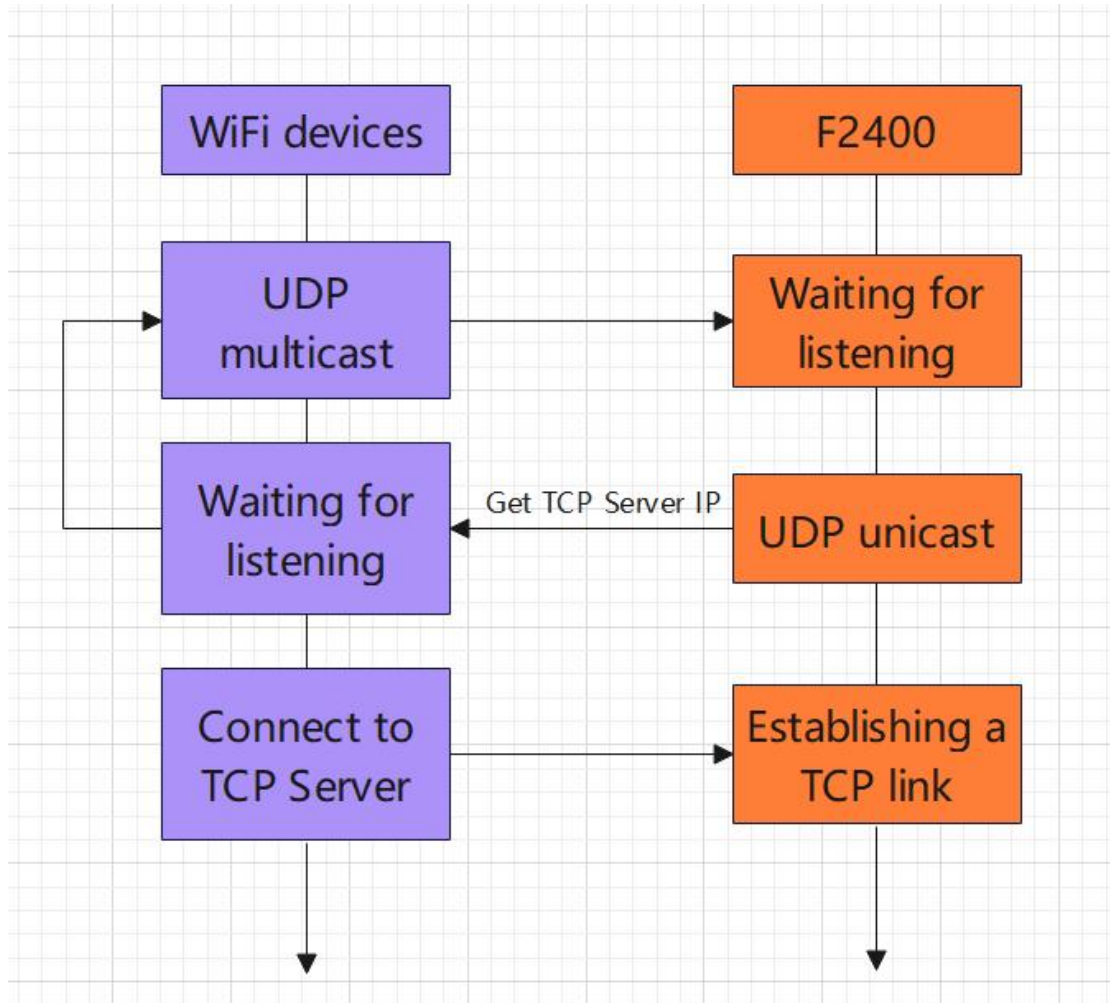


Diagram of LAN Device Discovery

The process of WiFi device discovery in local area network is as follows:

- 1) Triggered by power on, if no correct response is received, continue to send with a 1-second interval between sending;
- 2) After confirming disconnection from TCP Server, continue to send multicast messages;
- 3) After receiving the correct reply and obtaining the TCP Server IP address, end multicast message sending.

After receiving a multicast message from a WiFi device, F2400 will reply to the message in UDP unicast mode.

(3) LAN TCP communication

Within the local area network, WiFi devices act as TCP clients and F2400 acts as TCP servers for data transmission; WiFi devices report data every 1 second, and the server responds with the corresponding message after receiving the data; The fixed port number is 3333.

During TCP communication, there is a live function, as follows:

- 1) The server enables the liveliness function to determine whether the client is disconnected, and after the client is disconnected, relevant tasks are deleted;
- 2) If the client does not receive a reply message from the server within 5 seconds, it is considered that the server is offline and enters UDP multicast mode.

2 Appendix

2.1 Disclaimer

The length of all external cables shall not exceed 3m.

2.2 FCC Caution

a、 § 15.19 Labeling requirements.

This device complies with part 15 of the FCC Rules. Operation is subject to the following

two conditions: (1) This device may not cause harmful interference, and (2) this device

must accept any interference received, including interference that may cause undesired

operation.

b、 § 15.21 Changes or modification warning.

Any Changes or modifications not expressly approved by the party responsible for

compliance could void the user's authority to operate the equipment.

c、 § 15.105 Information to the user.

Note: This equipment has been tested and found to comply with the limits for a

Class B digital device, pursuant to part 15 of the FCC Rules. These limits are

designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

*RF warning for Mobile device:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

FCC ID:2BB59-F2400-US