

iHM Communication Protocol

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Changes

Version	Date	Change Description
V1.0.0	2025-03-31	Initial version
V1.0.1	2025-07-11	The following changes have been made based on V1.0.0: 1. Added channel 2 data of the meter(8565~8574); 2. Added Application Software Version(8318~8332); 3. Added active power limit(8051~8052);
V1.0.2	2026-01-21	The following changes have been made based on V1.0.1: 1. Added Feed-in limitation (8028); 2. Changed the data type of Feed-in limitation ratio(8031) from S32 to S16.

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1 Introduction

The Modbus RTU/TCP protocol is a widely used communication protocol in the industrial field, through which the iHM can communicate with other devices via the communication link (such as RS485/Ethernet). This protocol applies to the communication between iHM and third-party upper computer monitoring software. The iHM Communication Address is 247.

Note: iHM only supports system energy dispatch-related data forwarding and does not support data forwarding for connected devices (including inverters, WiNet-S/S2, etc.)

1.1 Abbreviations

Table 1 Abbreviations

Name	Definition
Host station	In question-and-answer communication, the party that initiates the communication becomes the host station, such as a third-party upper computer monitoring system.
Slave station	In question-and-answer communication, the party that responds passively to the command becomes the slave station, such as an iHM.
Broadcast address	The value is fixed to 0. Through the broadcast address, you can set all slave stations on the communication link execute a command.
Register address	A register address corresponds to 2 bytes of data.
UTF8	String data, the high-byte data is in the front and the low-byte data is at back. Example: Transmission order of UTF-8 data ABCD is A, B, C, D.
U16	16-bit unsigned integer, big-endian. Example: Transmission order of U16 data 0x0102 is 01, 02.
S16	16-bit signed integer, big-endian.
U32	32-bit unsigned integer; little-endian for double-word data. Big-endian for byte data. Example: Transmission order of U32 data 0x01020304 is 03, 04, 01, 02
S32	32-bit signed integer, little-endian for double-word data. Big-endian for byte data.
U64	64-bit unsigned integer, big-endian format Example: Transmission order of U64 data 0x0102030405060708 is 01、02、03、04、05、06、07、08
S64	64-bit signed integer, big-endian format

1.2 System Requirements

Table 2 Communication Interface Definition

1.Communication Interface RS485

Parameter	Default Setting (Note: Changes are not supported)
Communication address	247
Broadcast	Yes
Baud rate	9600 bit/s
Check	None
Data bit	8
Stop bit	1
Mode	RTU

2. Communication Interface Ethernet

Parameter	Default Setting
IP	12.12.12.12
Port	502/503/504(Note: Each port supports only 1 TCP connection)

3.Data Requirements:

- 1) Visit all registers by subtracting 1 from the register address.

Example: if the register is 8000 –8001, visit it using address 7999 –8000.

Entering “F7 04 1F 3F 00 02 + CRC” to check the data of address 8000 –8001.

- 2) Verify type: CRC16 generates polynomial 0xA001, little-endian.

- 3) The decimal parameters are transmitted as integer after expansion.

Example: 10.333 kW is transmitted as 10333, 800.5 V is transmitted as 8005.

- 4) Negative numbers are transmitted as complement.

Example: 0xFFFF signifying -1.

- 5) Unavailable register cannot be viewed or set. The return of unsigned number is F,

Example: “0xFFFF” is the return for U16, “0xFFFFFFFF” is the return for U32;

The return of signed number is the max. positive number,

Example: “0x7FFF” for S16, “0x7FFFFFFF” for S32; 0x00 for UTF-8.

UTF-8 occupies 1 byte, the length of odd number is complemented by 0x00.

- 6) Minimum Request period (RS485 Time out): 1000 ms

After sending an unicast request, before receiving a respond from the , the host station should wait for up to 1000ms to send a new unicast request to iHM. If no respond is received from the iHM after waiting for 1000 ms, the host station should regard this request as a timeout.

2 Register Definition

2.1 Running Information Variable

Table 3 Running Information Variable (RO (read-only) register, Support Modbus Command 0x04)

No.	Name	Register	Data type	Ratio	Unit	Remarks
1.	Device type code	8000	U16			0x072A
2.	Protocol No.	8001 - 8002	UTF8			“AW0”
3.	Protocol version	8003 - 8004	U32			Example: V1.0.2, Transmission “0x02000100”
4.	Total number of connected devices	8005	U16	1	Set	Communication devices connected only via RS485/WIFI/ETH, excluding devices connected through DO;
5.	Total number of connected devices in fault	8006	U16	1	Set	
6.	Total rated active power	8145 - 8146	U32	0.1	kW	
7.	Total rated battery capacity	8147 - 8148	U32	0.1	kWh	
8.	Battery charging/discharging upper limit range	8149 - 8150	U32	0.1	kW	
9.	Maximum allowable battery charging power	8151	U16	0.1	kW	
10.	Minimum allowable battery charge power	8152	U16	0.1	kW	
11.	Maximum allowable battery discharge power	8153	U16	0.1	kW	
12.	Minimum allowable battery discharge power	8154	U16	0.1	kW	
13.	Total active power of inverter	8155 - 8156	S32	0.01	kW	Total active power accumulated from connected inverters
14.	Total active power of grid connection point	8157 - 8158	S32	0.01	kW	See note 1
15.	Total load active power	8159 - 8160	S32	0.01	kW	
16.	Battery power	8161 - 8162	S32	0.01	kW	
17.	Battery level (SOC)	8163	U16	0.1	%	
18.	Import energy at the grid connection point	8176 - 8177	U32	0.1	kWh	See note 1
19.	Export energy at the grid connection point	8178 - 8179	U32	0.1	kWh	See note 1
20.	Application software version	8318 - 8332	UTF8			

21.	Charging status of charger	8552	U16	0.1	V	1: Idle (unplugged) 2: Standby (plugged) 3: Charging 6: Charging completed
22.	Output type	8554	U16	0.1	V	0: Single-phase 1: Three-phase four-wire 2: Three-phase three-wire
23.	A-B line voltage/A-phase voltage	8555	U16	0.1	V	Output type (address 8554) is 0: upload A-phase voltage; is 1: upload phase voltage; is 2: upload line voltage;
24.	B-C line voltage/B-phase voltage	8556	U16	0.1	V	
25.	C-A line voltage/C-phase voltage	8557	U16	0.1	V	
26.	Grid Frequency	8558	U16	0.1	Hz	
27.	Phase A active power	8559 - 8560	S32	1	W	See note 1
28.	Phase B active power	8561 - 8562	S32	1	W	See note 1
29.	Phase C active power	8563 - 8564	S32	1	W	See note 1
30.	Channel 2 Grid Frequency	8568	U16	0.1	Hz	See note 2
31.	Channel 2 Phase A active power	8569 - 8570	S32	1	W	See note 2
32.	Channel 2 Phase B active power	8571 - 8572	S32	1	W	See note 2
33.	Channel 2 Phase C active power	8573 - 8574	S32	1	W	See note 2

Note 1: This data is obtained through the GRID.CT sampling port of iHM;

Note 2: This data is obtained through the PROD.CT sampling port of iHM;

2.2 Parameter Setting Definition

Table 4 Parameter Setting Definition (RW (Read-Write) Register, Support Modbus Command 0x03/0x06/0x10)

No.	Name	Register	Data type	Data range	Unit/Ratio	Remarks
1.	Energy management mode	8024	U16	1: Self-consumption mode (by default) 4: VPP 5: Compulsory mode		
2.	Charging/discharging command	8025	U16	0xAA: Charge; 0xBB: Discharge 0xCC: Stop		
3.	Charging/discharging power	8026	U32	0 - Battery charging/discharging upper limit range	0.1kW	
4.	Feed-in limitation	8028	U16	1: On 0: Off		
5.	Feed-in limitation ratio	8031	S16	0-1000	0.1%	

6.	External VPP heartbeat	8033	U16	0-1000	1s	
7.	Start/Stop	8047	U16	0xCF: Boot 0xCE: Shutdown		
8.	Charger charging modes	8048	U16	0xA0: Fast charging 0xA1: Eco charging		
9.	Charger enable/disable	8049	U16	0xAA: Enable 0x55: Disable		
10.	Grid power draw permission	8050	U16	0xAA: Enable 0x55: Disable		Setting is allowed when the charging mode is Eco charging mode.
11.	Active Power Limitation	8051	U16	0xAA: On 0x55: Off		
12.	Active Power Limit Ratio	8052	U16	0-1000	0.1%	

3 Function Settings

3.1 Export Power Limitation

Table 5 Export Power Limitation Parameters

No.	Name	Register	Data type	Data range	Unit/Ratio	Remarks
1.	Total rated active power	8145 - 8146	U32	0.1	kW	Read-only
2.	Feed-in limitation ratio	8031	S16	0-1000	0.1%	Read-Write
3.	Active Power Limitation	8051	U16	0xAA: On 0x55: Off		Read-Write
4.	Active Power Limit Ratio	8052	U16	0-1000	0.1%	Read-Write

Note1: The Feed-in Limitation Function (related registers: Feed-in limitation ratio [8031]) differs from the Power Limiting Function (related register: Active Power Limit Ratio [8052]) in their control points for restricting inverter grid-connected power. As shown in Figure 1, Point A represents the control point of the Feed-in Limitation Function [grid connection point], while Point B represents the control point of the Power Limiting Function [inverter's AC output port].

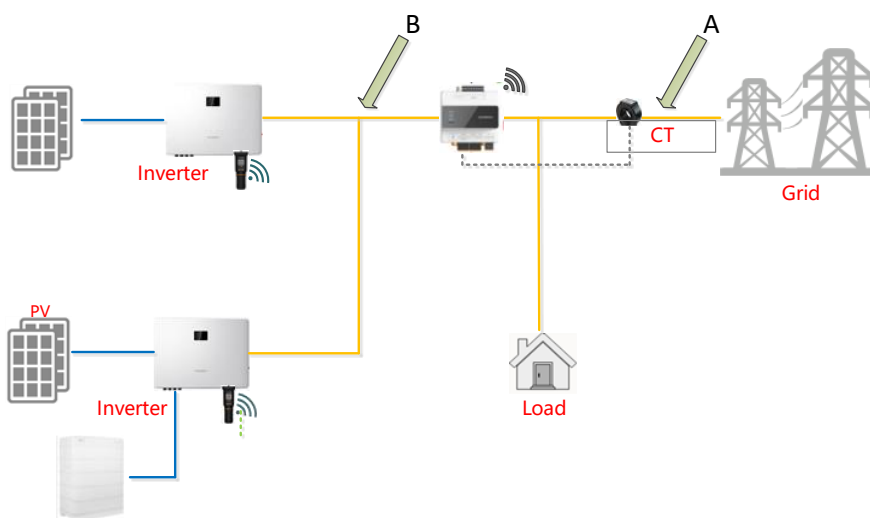


Figure 1 Schematic diagram of active power control point

3.1.1 Disabling Export Limitation

The system will not receive any derating command.

Method:

1. Set the " **Feed-in limitation** " (register 8028) to 0 (disabled).
2. If the value of the " **Feed-in limitation** " (Register 8028) is set to 1, then the value of the Set the "**Feed-in limitation ratio**" (register 8031) needs to be set to 1000.
3. Set the " **Active Power Limitation** " (register 8051) to 0x55 (disabled).
4. If the value of the " **Active Power Limitation** " (Register 8051) is set to 0xAA, then the value of the " **Active**

Power Limit Ratio " (Register 8052) needs to be set to 1000.

3.1.2 Setting Export Power Limitation

1. **The Feed-in Limitation Function:** The host station directly issues the target value of Feed-in limitation ratio. The command is an absolute power value. The settable range is from "0-1000".

Method:

1. Set the **"Feed-in Limitation "** (register 8028) to 1.
2. Set **"Feed-in Limitation Ratio"** (register 8031) to the target value. The unit is % and the adjustment accuracy is 0.1.

2. **The Power Limiting Function:** The host station directly issues the target value of Active Power Limitation. The command is in percentage form of rated power. The range is 0-100.0%.

Method:

1. Set the **"Active Power Limitation"** (register 8051) to 0xAA.
2. Set **"Active Power Limit Ratio"** (register 8052) to the target value. The unit is % and the adjustment accuracy is 0.1.

Note2: If both the "Feed-in Limitation Function" and "Power Limitation Function" have their set values activated simultaneously, the system will execute according to the most stringent output power requirement.

For example:

When the "Feed-in Limitation Ratio" is set to 0%,

"Active Power Limit Ratio" is set to 50%,

With a "Total rated active power" of 10 kW

Scenario: When the load is 8 kW.

1. To meet the 0% Feed-in Limitation requirement, the system's output power will be limited to 8 kW (matching the load power).
2. To meet the 50% Active Power Limit requirement, the system's output power will be limited to 5 kW (50% of 10 kW rated power).

Result: The system will ultimately implement the stricter 5 kW output power limitation.

3.2 Charge and Discharge Control

Table 6 Charge and Discharge Control Parameters

No.	Name	Register	Data type	Data range	Unit/Ratio	Remarks
1.	Battery charging/discharging upper limit range	8149 - 8150	U32	0.1	kW	Read-only
2.	Maximum allowable battery charging power	8151	U16	0.1	kW	Read-only
3.	Minimum allowable battery charge power	8152	U16	0.1	kW	Read-only
4.	Maximum allowable battery	8153	U16	0.1	kW	Read-only

	discharge power					
5.	Minimum allowable battery discharge power	8154	U16	0.1	kW	Read-only
6.	Energy management mode	8024	U16	1: Self-consumption mode 4: VPP 5: Compulsory mode		Read-Write
7.	Charging/discharging command	8025	U16	0xAA: Charge; 0xBB: Discharge 0xCC: Stop		Read-Write
8.	Charging/discharging power	8026	U32	0 - Battery charging/discharging upper limit range	0.1kW	Read-Write

3.2.1 Stop charging and discharging

The battery is not supplying power and is in standby mode.

Method:

Set "Charge/discharge command" (register 8025) to 0xCC. It is the default setting.

3.2.2 Enabling Charging/Discharging

Set battery charging or discharging, where the charging and discharging power range is from 0 to " Battery charging/discharging upper limit range " (register 8149 - 8150).

Method:

1. Set "**Charge/discharge command**" (register 8025) to 0xAA for charging or to 0xBB for discharging.
2. Set "**Charge/discharge power**" (register 8026) to a target value. The unit is kW and the adjustment accuracy is 0.1kW.

Note 1: The actual charge and discharge power of the battery is limited by factors such as the battery's SOC and ambient temperature. The actual achievable charge and discharge power values are determined by the "**Maximum allowable battery charging power, Minimum allowable battery charge power, Maximum allowable battery discharge power, and Minimum allowable battery discharge power.**"

Note 2: The actual battery charging and discharging control can only be executed when the "**Energy management mode**" (register 8024) is set to " VPP or Compulsory mode "; if it is set to "Self-Consumption", the iHM will automatically implement optimal control based on external conditions such as load and battery SOC.

3.3 Energy Management

Table 7 Energy Management Parameter

No.	Name	Register	Data type	Data range	Unit/Ratio	Remarks
1.	Energy management mode	8024	U16	1: Self-consumption mode 4: VPP 5: Compulsory mode		Read-Write
2.	External VPP heartbeat	8033	U16	0-1000	1s	Read-Write
3.	Charging/discharging command	8025	U16	0xAA: Charge; 0xBB: Discharge 0xCC: Stop		Read-Write
4.	Charging/discharging power	8026	U32	0 - Battery charging/discharging upper limit range	0.1kW	Read-Write
5.	Feed-in limitation ratio	8031	S32	0-1000	0.1%	Read-Write
6.	Active Power Limitation	8051	U16	0xAA: On 0x55: Off		Read-Write
7.	Active Power Limit Ratio	8052	U16	0-1000	0.1%	Read-Write

3.3.1 Set energy management mode

Three Energy Management Modes are available.

Self-consumption mode: The iHM dispatches itself, if the PV is sufficient, the load will take priority, if the PV is insufficient, the battery will discharge for supplement, to maximize the green electricity utilization rate.

Compulsory mode: The iHM controls battery charge and discharge as much as possible based on the set mandatory charge and discharge power. This mode is used for general maintenance.

VPP: The external energy management system controls the iHM via Modbus RTU or TCP.

Method:

1. Set " **Energy management mode** " (register 8024) as required, 1 for Self-consumption mode for example.
2. If the " **Energy management mode** " (register 8024) is set to 5 (Compulsory mode), you can continue to set the battery "Charging/discharging command" (register 8025) and the charging/discharging power" (register 8026).
3. If the " **Energy management mode** " (register 8024) is set to 4 (VPP), the iHM is fully scheduled by the external VPP system. The scheduling command is delivered via Modbus protocol. Deliver the heartbeat value within the timeout period of "External EMS Heartbeat" (register 8033). If the heartbeat value is not delivered within the timeout period, the iHM returns to self-consumption mode. For example, if External EMS Heartbeat is set to 20s, you are advised to set the value to 20 every 10 seconds on average.
4. If it is necessary to limit the system's output power at the grid connection point, it can be achieved through the "

Feed-in limitation ratio " (Register 8031). If it is necessary to limit the system's output power at the inverter AC port, it can be achieved through the "**Active Power Limitation "** (Register 8051) and the "**Active Power Limit Ratio "** (Register 8052).

4 Examples

1. When the backend communicates with iHM (address: 247) via network and binds to port 502, to query iHM battery power:

Background sends: 09 79 00 00 00 06 F7 04 1F E0 00 02

iHM response data: 09 79 00 00 00 07 F7 04 04 00 00 00

In the data replied, "09 79 00 00 00 06" and "09 79 00 00 00 07" are headers of the Modbus TCP message, 0xF7 is the address of the iHM, 0x04 is the function code, and 0x1FE0 = 8160 is to query the data of Register 8161. According to this protocol, Register 8161-8162 indicates the "Battery Power", the data in the iHM response data is 0, indicating that the current battery power is 0.

2. Setting EMS local commands (multiple parameters supported)

Send command: 00 00 00 00 00 0D F7 10 1F 57 00 03 06 00 04 00 AA 00 64

Reply data: 00 00 00 00 00 06 F7 10 1F 57 00 04

In the command sent, "00 00 00 00 00 0b" is the Modbus TCP message header, F7 is the iHM address, 10 is the function code, 0x1F57 = 8023 is to write three consecutive register data to the starting address of Register 8024, and the value to write is 0x0004, 0x00AA, 0x0064. The value represents setting energy management mode to VPP, charge/discharge command to 0xAA (charge), and charge power to 10 kW.