Communication Protocol of PV Grid-Connected String Inverters

Version Record

Version	Description	Time
V1.0	• V1.0 released	2022-12-07

1. Introduction

This communication adopts Modbus-RTU protocol, and applies to the communication between EVVO PV grid-connected string inverters and the upper computer (PC) monitoring software. This protocol can read the real-time operating data and fault states of inverters.

2. Communication Interface — RS485

Port	Default Value
Communication format	Modbus-RTU (RS485)
Commincation rate	9600bps (support: 9600, 38400, 57600, 115200)
Device address	1 (range: 1 ~ 247)
Start bit	1
Data bit	8
Check bit	None
Stop bit	1

3. Data Frame

Frame Format	In Line with Modbus Protocol
Device address	1
Function code	0x03: Read 1-N registers 0x06: Write a single register 0x10: Write multiple registers
Max. number of registers that can be read at a time	100

4. Definition of Address

4.1 Data Type

U16	• Unsigned 16-Bit integer data. • The output transmission: High byte before, low byte after.
I16	• Signed 16-Bit integer data. • The output transmission: High byte first, low byte after.
U32	• Unsigned 32-Bit integer data. • The output transmission: Low word first, high word last; High byte before, low byte after.
I32	• Signed 32-Bit integer data. • The output transmission: Low word first, high word last; High byte before, low byte after.

4.2 Value Description

Some parameters in the protocol are explained as follows:

Gain: Actual value of related parameters = return value/gain;

Ex.: The MPPT1 input voltage.

When the register address is 40500, the return value 5642 and the gain 10, the calculated MPPT1 input voltage is 564.2V.

4.3 Error Code

0x01: Illegal function code

0x02: Illegal data address

0x03: Illegal data value

0x04: Slave node device failure

0x05: The service invocation the master node receives

0x06: Slave device busy

0x07: Data frame length error

0x08: Data frame verification error

0x09: Data frame error

Example:

Error Code Frame Reply From the Slave Device

The first byte is the device address; The second byte is [function code + 0x80]; The third byte is the error code, and the last two bytes are the CRC check code.

0x01：01 83 01 80 F0　　0x02：01 86 02 C3 A1　　0x03：01 90 03 0C 01

5. Frame Example

Delivery of query command frames	01 03 00 00 00 32 C4 1F 01: Slave ID 03: Function code for reading register value command 00 00: Query the first address of the register. 0x0000 with high byte first and low byte last 00 32: Query the number of registers. 0x0032 with high byte first and low byte last C4 1F: Check code
Response to query command frames	01 03 64 00 00 00 02 00 00 01 F4 01 0E 13 88 04 2C 00 00 00 00 00 00 27 10 00 00 02 26 03 9B FF 38 00 84 D6 EF FA 8D 0C 9F 0E CF 0E 47 07 E9 07 E8 07 E5 00 00 00 00 00 00 00 00 00 05 00 00 00 00 00 00 00 00 00 02 30 50 00 00 00 00 73 A0 02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 98 A0 01: Slave ID 03: Function code for reading register value command 64: Response data length. The number of bytes is twice that of registers 00 00: The first register value, 0x0000 with high byte first and low byte last 00 02: The second register value, 0x0002 with high byte first and low byte last 98 A0: Check code
Delivery of setting command frames	01 06 00 0C 00 03 09 C8 01: Slave ID 06: Function code for single register setting command 00 0C: Register address, 0x000C with high byte first and low byte last 00 03: Set value, 0x0003 with high byte first and low byte last 09 C8: Check code
Response to setting command frames	01 06 00 0C 00 03 09 C8 Setting command response frame detail: Consistent wth the setting command frame

6. Modbus Protocol

6.1 Telemetry (Read Only)

No.	Name	Data Type	Unit	Gain	Address	Number	Note
1	MPPT1 input voltage	I16	V	10	40500	1	
2	MPPT2 input voltage	I16	V	10	40501	1	
3	MPPT3 input voltage	I16	V	10	40502	1	
4	MPPT4 input voltage	I16	V	10	40503	1	
5	MPPT5 input voltage	I16	V	10	40504	1	
6	MPPT6 input voltage	I16	V	10	40505	1	
7	MPPT7 input voltage	I16	V	10	40506	1	
8	MPPT8 input voltage	I16	V	10	40507	1	
9	String 01 input current	I16	A	100	40508	1	
10	String 02 input current	I16	A	100	40509	1	
11	String 03 input current	I16	A	100	40510	1	
12	String 04 input current	I16	A	100	40511	1	
13	String 05 input current	I16	A	100	40512	1	
14	String 06 input current	I16	A	100	40513	1	
15	String 07 input current	I16	A	100	40514	1	
16	String 08 input current	I16	A	100	40515	1	
17	String 09 input current	I16	A	100	40516	1	
18	String 10 input current	I16	A	100	40517	1	

No.	Name	Data Type	Unit	Gain	Address	Number	Note
19	String 11 input current	I16	A	100	40518	1	
20	String 12 input current	I16	A	100	40519	1	
21	String 13 input current	I16	A	100	40520	1	
22	String 14 input current	I16	A	100	40521	1	
23	String 15 input current	I16	A	100	40522	1	
24	String 16 input current	I16	A	100	40523	1	
25	MPPT1 input power	U16	kW	100	40524	1	
26	MPPT2 input power	U16	kW	100	40525	1	
27	MPPT3 input power	U16	kW	100	40526	1	
28	MPPT4 input power	U16	kW	100	40527	1	
29	MPPT5 input power	U16	kW	100	40528	1	
30	MPPT6 input power	U16	kW	100	40529	1	
31	MPPT7 input power	U16	kW	100	40530	1	
32	MPPT8 input power	U16	kW	100	40531	1	
33	Power grid line AB voltage	I16	V	10	40532	1	Single-phase inverter: Power grid voltage
34	Power grid line BC voltage	I16	V	10	40533	1	
35	Power grid line AC voltage	I16	V	10	40534	1	
36	Grid A-phase current (Ia)	I16	A	10	40535	1	Single-phase inverter: Grid side current
37	Grid B-phase current (Ib)	I16	A	10	40536	1	
38	Grid C-phase current (Ic)	I16	A	10	40537	1	

No.	Name	Data Type	Unit	Gain	Address	Number	Note
39	Grid power	I16	Hz	100	40538	1	
40	AC active power	I16	kW	100	40539	1	
41	AC reactive power	I16	kVar	100	40540	1	
42	DC input power	I16	kW	100	40541	1	
43	Inverter efficiency	U16	%	100	40542	1	9800 means efficiency of 98.00%
44	Power factor	I16	N/A	1000	40543	1	
45	Internal machine temperature	I16	℃	10	40544	1	
46	Insulation resistance	U16	kΩ	10	40545	1	
47	Inverter switch status	U16	N/A	1	40546	1	0: Shutdown state 1: Grid-connected state
48	Inverter status	U16	N/A	1	40547	1	• Bit0: Standby state • Bit1: Standby self-test state • Bit2: Grid-connected start-up state • Bit3: Grid-connected operation • Bit4: Alarm operation • Bit5: Power-limitted operation • Bit6: Dispatching operation • Bit7: Failure shutdown • Bit8: Stop instruction
49	Energy genereated for the day	U32	kWh	100	40548	2	
50	Total generated energy	U32	kWh	100	40550	2	
51	CO2 emission reduction amount	U32	kg	100	40552	2	
52	Daily running time	U16	Hour	100	40554	1	Integer value calculated according to the gain
53	Total running time	U32	Hour	100	40555	2	Integer value calculated according to the gain

No.	Name	Data Type	Unit	Gain	Address	Number	Note
54	Inverter startup time	U32	N/A	1	40557	2	Convert the time_t format to a time. Note: The benchmark time of the inverter is 1970.1.1 ~ 00:00:00, and the time zone of the current region must be considered when setting the time for the server
55	Inverter shutdown time	U32	N/A	1	40559	2	Convert the time_t format to a time. Note: The benchmark time of the inverter is 1970.1.1 ~ 00:00:00, and the time zone of the current region must be considered when setting the time for the server
56	Inverter fault word 1	U16	N/A	1	40561	1	• Bit1: EEPROM parameters back to the default value • Bit5: Internal communication failure • Bit6: System failure • Bit7: Abnormal inverter circuit • Bit8: Abnormal DC circuit
57	Inverter fault word 2	U16	N/A	1	40562	1	Three-phase inverter: • Bit0: Phase A hardware overcurrent • Bit1: Phase B hardware overcurrent • Bit2: Phase C hardware overcurrent • Bit3: A-phase current reaches the wave-by-wave current limit time • Bit4: B-phase current reaches the wave-by-wave current limit time • Bit5: C-phase current reaches the wave-by-wave current limit time

No.	Name	Data Type	Unit	Gain	Address	Number	Note
57	Inverter fault word 2	U16	N/A	1	40562	1	• Bit6：Busbar hardware overvoltage • Bit7：Semi-bus hardware overvoltage Single-phase inverter: • Bit0: Grid-side hardware overcurrent • Bit3: Grid-side current reaches the wave-by-wave current limit time • Bit6：Busbar hardware overvoltage
58	Inverter fault word 3	U16	N/A	1	40563	1	• Bit0: Power grid overvoltage • Bit3: Power grid undervoltage • Bit8: Grid overfrequency • Bit9: Grid underfrequency • Bit11: Anti-islanding protection • Bit12: The output voltage to ground is abnormal • Bit14: Low voltage ride through protection (single-phase inverter: Bit14: Reserved)

59	Inverter fault word 4	U16	N/A	1	40564	1	• Bit0:
							  • Three-phase inverter: Module A phase software overcurrent
							  • Single-phase inverter: Grid-side sofetware overcurrent
							• Bit1: Module B phase software overcurrent
							• Bit2: Module C phase software overcurrent

No.	Name	Data Type	Unit	Gain	Address	Number	Note
59	Inverter fault word 4	U16	N/A	1	40564	1	• Bit3: Module current imbalance (Single-phase inverter: Bit1 ~ Bit3: Reserved) • Bit4: Filter capacitor undervoltage • Bit5: Module temperature is too high • Bit6: The temperature inside the machine is too high • Bit7: DC component exceeds the limit • Bit8: AD sampling zero drift is too large • Bit9: Residual current continues to exceed the limit • Bit10: Residual current self-test error • Bit13: Low conversion efficiency of the inverter • Bit14: The sudden change of residual current exceeds the limit
60	Inverter fault word 5	U16	N/A	1	40565	1	• Bit0: Inverter synchronization timeout • Bit1: Bus operation short circuit • Bit5: Bus running overvoltage • Bit6: Bus running undervoltage • Bit7: Bus voltage imbalance • Single-phase inverter: Reserved

No.	Name	Data Type	Unit	Gain	Address	Number	Note
61	Inverter fault word 6	U16	N/A	1	40566	1	• Bit0: Grid-connected relay open circuit • Bit1: Grid-connected relay short circuit
62	Inverter fault word 7	U16	N/A	1	40567	1	• Bit0: Auxiliary power supply overvoltage fault • Bit2: Busbar hardware overvoltage • Bit3: Hardware overcurrent • Bit4: Unit 1 hardware overcurrent • Bit5: Unit 2 hardware overcurrent • Bit6: Unit 3 hardware overcurrent • Bit7: Unit 4 hardware overcurrent • Single-phase inverter: Bit6 ~ Bit7: Reserve
63	Inverter fault word 8	U16	N/A	1	40568	1	• Bit0: AD zero drift is too large • Bit1: RAM self test failed • Bit2: EEPROM parameters back to default values • Bit3: EEPROM read and write failed • Bit7: Busbar software overvoltage • Bit8: Unit 1 software overcurrent • Bit9: Unit 2 software overcurrent • Bit10: Unit 3 software overcurrent • Bit11: Unit 4 software overcurrent

No.	Name	Data Type	Unit	Gain	Address	Number	Note
63	Inverter fault word 8	U16	N/A	1	40568	1	• Single-phase inverter: Bit10 ~ Bit11: Reserved • Bit12: Input polarity reverse • Bit13: Insulation failure of positive polarity to ground • Bit14: Insulation failure of negative polarity to ground • Bit15: Booster side short circuit
64	Inverter alarm word 1	U16	N/A	1	40569	1	
65	Inverter alarm word 2	U16	N/A	1	40570	1	
66	Inverter alarm word 3	U16	N/A	1	40571	1	• Bit6: Grid abnormality • Bit7: Grid voltage imbalance exceeds the limit • Bit10: The phase sequence of the grid is reversed • Single-phase inverter: Bit7 ~ Bit10: Reserved • Bit13: Grid voltage anomaly
67	Inverter alarm word 4	U16	N/A	1	40572	1	• Bit12: High conversion efficiency of the inverter
68	Inverter alarm word 5	U16	N/A	1	40573	1	• Bit2: Abnormal DC voltage detected • Bit8: The input voltage of the PV module is high
69	Inverter alarm word 6	U16	N/A	1	40574	1	• Bit4: AC side SPD abnormality • Bit5: Internal fan failure • Bit6: External fan failure

No.	Name	Data Type	Unit	Gain	Address	Number	Note
70	Inverter alarm word 7	U16	N/A	1	40575	1	• Bit0: DC side SPD abnormality • Bit6: Booster side open circuit • Bit8: String abnormal warning
71	Inverter alarm word 8	U16	N/A	1	40576	1	
72	PID status	U16	N/A	1	40577	1	0: Not running 1: Run
73	Running status of the inverter	U16	N/A	1	40578	1	0: Standby 1: Power generation 2: Self-derating power generation 3: Power generation with power limit and derating 4: Planned shutdown 5: Power limit-caused shutdown 6: Fault shutdown Note: Currently used in Xinjiang Power Grid (power station type)
74	Running status of the inverter	U16	N/A	1	40579	1	0: Stop/standby 1: Running 2: Maintenance Note: Currently applied to Heilongjiang Power Grid (power station type)
75	Running status of the inverter	U16	N/A	1	40580	1	1: Running 2: Shutdown 3: Maintenance 4: Standby Note: Currently applied to Ningxia Power Grid (power station type)
76	Running status of the inverter	U16	N/A	1	40581	1	0: Fault 1: Normal 2: Standby 3: Controlled

No.	Name	Data Type	Unit	Gain	Address	Number	Note
							Note: Currently applied to Sichuan Power Grid (power station type)
77	Running status of the inverter	U16	N/A	1	40582	1	1: Run 2: Standby 3: Shutdown (failure, maintenance, limited) Note: Currently applied to Northwest Power Grid (power station type)
78	Running status of the inverter	U16	N/A	1	40583	1	0: Grid-connected operation 1: Standby 2: Power limit 3: Shutdown Note: Currently applied to Tianjin Power Grid (power station type)
79	Running status of the inverter	U16	N/A	1	40584	1	• Bit0: Standby • Bit1： Power generation • Bit2: Self-derating power generation • Bit3: Power generation with power limit and derating • Bit4: Planned shutdown • Bit5: Power limit-caused shutdown • Bit6: Fault shutdown Note: Currently used in Xinjiang Power Grid (power station type)
80	Running status of the inverter	U16	N/A	1	40585	1	• Bit0: Standby • Bit1: Power generation • Bit2: Self-derating power generation • Bit3: Power generation with power limit and derating

No.	Name	Data Type	Unit	Gain	Address	Number	Note
80	Running status of the inverter	U16	N/A	1	40585	1	• Bit4: Planned shutdown at the station • Bit5: Planned shutdown off the station • Bit6: Power limit-caused shutdown • Bit7: Fault shutdown Note: Currently applied to Hebei Power Grid (power station type)
81	Busbar voltage	I16	V	10	40586	1	
82	Positive bus voltage	I16	V	10	40587	1	
83	String 17 input current	I16	A	100	40588	1	
84	String 18 input current	I16	A	100	40589	1	
85	String 19 input current	I16	A	100	40590	1	
86	String 20 input current	I16	A	100	40591	1	
87	Fault code	U16	N/A	1	40592	1	For detailed definition, see protocols of fault and alarm codes
88	Alarm code	U16	N/A	1	40593	1	
89	AC apparent power	I16	kVA	100	40594	1	
90	Data	U16	N/A	1	40595	1	
91	Data	U16	N/A	1	40596	1	
92	Data	U16	N/A	1	40597	1	
93	Data	U16	N/A	1	40598	1	
94	Data	U16	N/A	1	40599	1	
95	Countercurrent active power	I32	kW	1000	42000	2	For anti-backflow protection for single machine: Keep three decimal places
96	Power taking active power of the grid	I32	kW	1000	42002	2	
97	Loads consumed active power	I32	kW	1000	42004	2	

No.	Name	Data Type	Unit	Gain	Address	Number	Note
98	Total backflow electricity	I32	kWh	100	42006	2	For anti-backflow protection for single machine: Keep two decimal places
99	Total electricity taken from the grid	I32	kWh	100	42008	2	
100	Total electricity consumed by the load	I32	kWh	100	42010	2	

6.2 Remote Control (Writable, Readable)

No.	Name	Data Type	Unit	Gain	Address	Number	Note
1	Startup command	U16	N/A	1	40200	1	0: Invalid 1: Power on
2	Shutdown command	U16	N/A	1	40201	1	0: Invalid 1: Power off
3	Reset command	U16	N/A	1	40202	1	0: Invalid 1: Reset
4	SVG startup	U16	N/A	1	40203	1	0: Invalid 1: Valid

6.3 Remote Regulating (Writable, Readable)

No.	Name	Data Type	Unit	Gain	Address	Number	Note
1	Date and time setting	U32	N/A	1	40000	2	0 ~ 3155759999 Note see below
	Note: The benchmark time of the inverter is 1970.1.1 ~ 00:00:00, and the time zone of the current region must be considered when setting the time for the server. Example: 1. Write register address 40000 Write value: 1546516800 = 1546488000 (time_t format seconds) + 28800 (seconds of a time zone). When converted into Beijing time (time zone: 1970.1.1 ~ 08:00:00), the date and time are 2019/1/3 12:00:00. 2. Read register address 40000 Read value: 1546516800, but the really needed value is 1546488000 (time_t format of seconds) = 1546516800 (read value) - 28800 (seconds of a time zone). When converted into Beijing time (time zone: 1970.1.1 ~ 08:00:00), the date and time are 2019/1/3 12:00:00.						

No.	Name	Data Type	Unit	Gain	Address	Number	Note
2	Reactive power regulation mode	U16	N/A	1	40002	1	0 ~ 5 0: Reactive power output disabled 1: Power factor regulation 2: Reactive power kVar regulation 3: Reactive power ratio regulation
3	Power factor regulation	I16	N/A	10000	40003	1	-0.8 ~ +0.8
4	Reactive power kVar regulation	I16	kVar	10	40004	1	-0.6 * Pn * 100 ~ 0.6 * Pn * 100 Pn Indicates the rated power (unit: kW). Eg.: If the rated power is 10kW, the Pn is 10
5	Reactive power ratio regulation	I16	%	100	40005	1	-60% ~ +60% if the register value is 5000, the ratio is 50.00%
6	Active power regulation mode	U16	N/A	1	40011	1	0: Active power regulation disabled 1: Active power actual regulation 2: Active power ratio regulation
7	Active power actual regulation	I16	kW	100	40012	1	0 ~ 1.1 * Pn * 100 Pn Indicates the rated power (unit: kW). Eg.: If the rated power is 10kW, the Pn is 10
8	Active power ratio regulation	I16	%	100	40013	1	0 ~ 110%

6.4 Device Feature Information (Read Only)

No.	Name	Data Type	Unit	Gain	Address	Number	Note
1	Data	U16	N/A	1	40600	1	
2	Electronic serial number of the device	U16	N/A	1	40601	30	
3	Software version _DC_AC	U32	N/A	1	40631	2	
4	Software version _DC_DC	U32	N/A	1	40633	2	
5	Software version _FPGA	U32	N/A	1	40635	2	
6	Parameter version _DC_AC	U32	N/A	1	40637	2	
7	Software version_ bootloader	U32	N/A	1	40639	2	
8	Communication protocol version	U32	N/A	1	40641	2	V000.000.000: Version 1 of the protocol V001.000.000: Version 2 of the protocol V002.000.000: Version 3 of the protocol V003.000.000: Version 4 of the protocol V004.000.000: Version 5 of the protocol V005.000.000: Version 6 of the protocol V006.000.000: Version 7 of the protocol V007.000.000: Version 8 of the protocol V008.000.000: Version 9 of the protocol V009.000.000: Version 10 of the protocol
9	Parameter version _DC_DC	U32	N/A	1	40643	2	
10	Data	U16	N/A	1	40645	1	
11	Rated power	U16	kW	1	40646	1	
12	Rated voltage	U16	V	1	40647	1	

No.	Name	Data Type	Unit	Gain	Address	Number	Note
13	Data	U16	N/A	1	40648	1	
14	Data	U16	N/A	1	40649	1	
15	Data	U16	N/A	1	40650	1	

7. APP Protocol

App Maintenance Settings (Writable and Readable)

No.	Name	Data Type	Unit	Gain	Address	Number	Note
1	Upgrade command	U32	N/A	1	1080	2	0 ~ 3155759999
2	M4 restart command	U16	N/A	1	1082	1	0 ~ 1
3	Save command for fixed parameters	U16	N/A	1	30000	1	0 ~ 2 0: Do not save 1: Fix current parameters 2: Restore default parameters
4	M4 maintenance command	U16	N/A	1	30001	1	0 ~ 65535 0: Do not restore 1: Restore the M4 upgrade configuration file 2: Format the M4 SPI flash 3: Delete the fault log 4: Restart the inverter side (28062)
5	Current date and time	U32	N/A	1	30002	2	0 ~ 3155759999 Display only and cannot be set Note: The benchmark time of the inverter is 1970.1.1 ~ 00:00:00, and the time zone of the current region must be considered when setting the time for the server
6 ~ 22	Data				30004 ~ 30020		

No.	Name	Data Type	Unit	Gain	Address	Number	Note
23	Communication mode selection	U16	N/A	1	30021	1	0: RS485 1: PLC
24	Communication station address	U16	N/A	1	30022	1	1 ~ 247 The default Modbus communication site address (all inverters): 1
25	Baud rate of communication	U16	bps	0.01	30023	1	Supported baud rate include 9600bps, 19200bps, 38400bps, 57600bps and 115200bps
26	Data				30024 ~ 30025		
27	System configuration parameter setting word	U16	N/A	1	30026	1	0 ~ 65535 • Bit13: Low voltage ride through support enabling • Bit14: High voltage ride through support enabling • Bit15: Islanding test enabling
28	String automatic test enabling	U16	N/A	1	30027	1	0: Disable 1: Open
29	Battery string installation and configuration (setting)	U16	N/A	1	30028	1	0 ~ 65535 • Bit0 ~ Bit15: Battery string 1 ~ 16 connection enabling
30	Residual current test enabling	U16	N/A	1	30029	1	0: Disable 1: Open
31	PID enabling	U16	N/A	1	30030	1	
32	PID running time threshold	U16	Min	1	30031	1	0 ~ 720
33	PID power supply fault test delay	U16	Sec	100	30032	1	0.00 ~ 100.00 Keep 2 decimal places
34	PID power supply secondary failure test delay	U16	Min	1	30033	1	0 ~ 720

No.	Name	Data Type	Unit	Gain	Address	Number	Note
35	Lower limit of normal shutdown time of inverter	U16	Hr	1	30034	1	00 ~ 23 0:00 ~ 23:00, no minutes
36	Upper limit of normal shutdown time of inverter	U16	Hr	1	30035	1	
37	Normal shutdown time threshold of the inverter	U16	Min	1	30036	1	0 ~ 720
38 ~ 56	Data				30037 ~ 30055		
57	Battery string installation and configuration high Bit (set)	U16	N/A	1	30056	1	0 ~ 65535 • Bit0 ~ Bit3: Battery string 17 ~ 20 connection enabling
58	Actual battery string configuration high Bit (read only)	U16	N/A	1	30057	1	
59	Booster side fault mask word 1 (setting)	U16	N/A	1	30058	1	0 ~ 65535 • Bit0: Auxiliary power supply fault • Bit2: Busbar hardware overvoltage • Bit3: Hardware overcurrent • Bit4 ~ Bit7: Unit 1 ~ 4 hardware overcurrent
60	Booster side fault mask word 2 (setting)	U16	N/A	1	30059	1	0 ~ 65535 • Bit0: AD zero drift is too large • Bit1: RAM self test failed • Bit2: EEPROM parameters back to default values • Bit3: EEPROM read and write failed

No.	Name	Data Type	Unit	Gain	Address	Number	Note
60	Booster side fault mask word 2 (setting)	U16	N/A	1	30059	1	• Bit7: Busbar software overvoltage • Bit8 ~ Bit11: Unit 1 ~ 4 software overcurrent • Bit12: Input polarity reverse • Bit13: Positive busbar grounding fault • Bit14: Negative busbar grounding fault • Bit15: Booster side short circuit
61	Booster side warning mask word 1 (setting)	U16	N/A	1	30060	1	0 ~ 65535 • Bit0: DC lightning arrester fault • Bit6: Booster side open circuit • Bit8: String abnormal warning • Bit9: Insulation failure of positive polarity to ground • Bit10: Insulation failure of negative polarity to ground
62	Inverter fault mask word 1	U16	N/A	1	30061	1	0 ~ 65535 Three-phase inverter: • Bit0: Phase A hardware overcurrent • Bit1: Phase B hardware overcurrent • Bit2: Phase C hardware overcurrent • Bit3: A-phase current reaches the wave-by-wave current limit time • Bit4: B-phase current reaches the wave-by-wave current limit time • Bit5: C-phase current reaches the wave-by-wave current limit time

No.	Name	Data Type	Unit	Gain	Address	Number	Note
62	Inverter fault mask word 1	U16	N/A	1	30061	1	• Bit6: Busbar hardware overvoltage • Bit7: Semi-bus hardware overvoltage Single-phase inverter: • Bit0: Grid-side hardware overcurrent • Bit3: Grid-side current reaches the wave-by-wave current limit time • Bit6: Busbar hardware overvoltage
63	Inverter fault mask word 2	U16	N/A	1	30062	1	0 ~ 65535 • Bit0: Power grid overvoltage • Bit3: Power grid under-voltage • Bit8: Power grid overfrequency • Bit9: Power grid underfrequency • Bit11: Anti-islanding protection • Bit12: The output voltage to ground is abnormal • Bit14: Low voltage ride through protection

64	Inverter fault mask word 3	U16	N/A	1	30063	1	0 ~ 65535
							• Bit0:
							  • Three-phase inverter: Module A phase software overcurrent
							  • Single-phase inverter: Grid-side software overcurrent
							• Bit1: Module B phase software overcurrent
							• Bit2: Module C phase software overcurrent

No.	Name	Data Type	Unit	Gain	Address	Number	Note
64	Inverter fault mask word 3	U16	N/A	1	30063	1	• Bit3: Module current imbalance (Single-phase inverter: Bit1 ~Bit3: Reserved) • Bit4: Filter capacitor undervoltage • Bit5: Module temperature is too high • Bit6: The temperature inside the machine is too high • Bit7: DC component exceeds the limit • Bit8: AD sampling zero drift is too large • Bit9: Residual current continues to exceed the limit • Bit10: Residual current self test error • Bit13: Low conversion efficiency of the inverter • Bit14: The sudden change of residual current exceeds the limit
65	Inverter fault mask word 4	U16	N/A	1	30064	1	0 ~ 65535 • Bit0: Inverter synchronization timeout • Bit1: Bus operation short circuit • Bit5: Bus running overvoltage • Bit6: Bus running undervoltage • Bit7: Bus voltage imbalance • Single-phase inverter: Bit7: Reserved

No.	Name	Data Type	Unit	Gain	Address	Number	Note
66	Inverter fault mask word 5	U16	N/A	1	30065	1	0 ~ 65535 • Bit0: Grid-connected relay open circuit • Bit1: Grid-connected relay short circuit
67	Inverter warning enabling word 1	U16	N/A	1	30066	1	0 ~ 65535
68	Inverter warning enabling word 2	U16	N/A	1	30067	1	0 ~ 65535 • Bit6: Power grid abnormality • Bit7: Grid voltage imbalance exceeds limit • Single-phase inverter: Bit7: Reserved • Bit10: The phase sequence of the grid is reversed • Bit13: Grid voltage anomaly
69	Inverter warning enabling word 3	U16	N/A	1	30068	1	0 ~ 65535 • Bit11: The unit temperature is too high • Bit12: High conversion efficiency of the inverter
70	Inverter warning enabling word 4	U16	N/A	1	30069	1	0 ~ 65535 • Bit2: Abnormal DC voltage detected • Bit8: The input voltage of the PV module is high
71	Inverter warning enabling word 5	U16	N/A	1	30070	1	0 ~ 65535 • Bit4: DC side SPD abnormality • Bit5: Internal fan failure • Bit6: External fan failure
72	Bus voltage setting	U16	V	10	30071	1	540 ~ 880

No.	Name	Data Type	Unit	Gain	Address	Number	Note
73	Grid failure delay time	U16		1	30072	1	0: Disable 1: Open
74	Grid failure delay time	U16	s	1	30073	1	0 ~ 3600
75 ~ 81	Data				30074 ~ 30080		
82	Level 1 overvoltage protection point of power grid	U16	%	10	30081	1	100 ~ 150
83	Power grid level 1 overvoltage protection time	U16	ms	1	30082	1	0 ~ 65535
84	Level 2 overvoltage protection point of power grid	U16	%	10	30083	1	100 ~ 150
85	Power grid level 2 overvoltage protection time	U16	ms	1	30084	1	0 ~ 65535
86	Level 3 overvoltage protection point of power grid	U16	%	10	30085	1	100 ~ 150
87	Power grid level 3 overvoltage protection time	U16	ms	1	30086	1	0 ~ 65535
88	Level 1 undervoltage protection point of power grid	U16	%	10	30087	1	5 ~ 100
89	Power grid level 2 undervoltage protection time	U16	ms	1	30088	1	0 ~ 65535
90	Level 2 undervoltage protection point of power grid	U16	%	10	30089	1	5 ~ 100
91	Power grid level 2 undervoltage protection time	U16	ms	1	30090	1	0 ~ 65535

No.	Name	Data Type	Unit	Gain	Address	Number	Note
92	Level 3 undervoltage protection point of power grid	U16	%	10	30091	1	5 ~ 100
93	Power grid level 3 undervoltage protection time	U16	ms	1	30092	1	0 ~ 65535
94	Level 1 overfrequency protection point of power grid	U16	Hz	100	30093	1	50 ~ 70
95	Power grid level 1 overfrequency protection time	U16	s	1	30094	1	0 ~ 65535
96	Level 2 overfrequency protection point of power grid	U16	Hz	100	30095	1	50 ~ 70
97	Power grid level 2 overfrequency protection time	U16	s	1	30096	1	0 ~ 65535
98	Level 3 overfrequency protection point of power grid	U16	Hz	100	30097	1	50 ~ 70
99	Power grid level 3 overfrequency protection time	U16	ms	1	30098	1	0 ~ 65535
100	Level 1 underfrequency protection point of power grid	U16	Hz	100	30099	1	40 ~ 60
101	Power grid level 1 underfrequency protection time	U16	s	1	30100	1	0 ~ 65535
102	Level 2 underfrequency protection point of power grid	U16	Hz	100	30101	1	40 ~ 60
103	Power grid level 2 underfrequency protection time	U16	s	1	30102	1	0 ~ 65535

No.	Name	Data Type	Unit	Gain	Address	Number	Note
104	Level 3 underfrequency protection point of power grid	U16	Hz	100	30103	1	40 ~ 60
105	Power grid level 3 underfrequency protection time	U16	ms	1	30104	1	0 ~ 65535
106	Insulation impedance fault threshold	U16	kΩ	10	30105	1	0 ~ 500
107	Insulation impedance fault voltage percentage threshold	U16	%	1	30106	1	0 ~ 30
108	Continuous ultra-limit coefficient of residual current	U16	N/A	1	30107	1	0 ~ 100
109	Continuous residual current overlimit confirmation time	U16	ms	1	30108	1	0 ~ 65535
110	Level 1 abrupt change threshold of residual current	U16	mA	1	30109	1	0 ~ 1000
111	Level 1 abrupt change confirmation time of residual current	U16	ms	1	30110	1	0 ~ 65535
112	Level 2 abrupt change threshold of residual current	U16	mA	1	30111	1	0 ~ 1000
113	Level 2 abrupt change confirmation time of residual current	U16	ms	1	30112	1	0 ~ 65535

No.	Name	Data Type	Unit	Gain	Address	Number	Note
114	Level 3 abrupt change threshold of residual current	U16	mA	1	30113	1	0 ~ 1000
115	Level 3 abrupt change confirmation time of residual current	U16	ms	1	30114	1	0 ~ 65535
116	Grid-side automatic reset enabling word	U16	N/A	1	30115	1	0 ~ 65535 • Bit0: Bus operation short circuit • Bit1: Low conversion efficiency of the inverter • Bit2: Grid-connected relay short circuit
117	Data				30116		
118	Internal debugging parameter 1	U32	N/A	100	30117	2	0 ~ 3155759999
119	Internal debugging parameter 2	U32	N/A	100	30119	2	0 ~ 3155759999
120	Internal debugging parameter 3	U16	N/A	100	30121	1	0 ~ 65535
121	Internal debugging parameter 4	U32	N/A	100	30122	2	0 ~ 3155759999
122 ~ 124	Data				30124 ~ 30126		
125	Actual battery string configuration (read only)	U16	N/A	1	30127	1	0 ~ 65535 • Bit0 ~ Bit15: Battery string 1 ~ 16 connection enabling
126	Booster side fault mask word 1 (read only)	U16	N/A	1	30128	1	0 ~ 65535 • Bit0: Auxiliary power supply fault • Bit2: Busbar hardware overvoltage

No.	Name	Data Type	Unit	Gain	Address	Number	Note
126	Booster side fault mask word 1 (read only)	U16	N/A	1	30128	1	• Bit3: Hardware overcurrent • Bit4 ~ Bit7: Unit 1 ~ 4 hardware overcurrent
127	Booster side fault mask word 2 (read only)	U16	N/A	1	30129	1	0 ~ 65535 • Bit0: AD zero drift is too large • Bit1: RAM self test failed • Bit2: EEPROM parameters back to default values • Bit3: EEPROM read and write failed • Bit7: Busbar software overvoltage • Bit8 ~ Bit11: Unit 1 ~ 4 software overcurrent (Single-phase inverter: Bit10 ~ Bit11: Reserved) • Bit12: Input polarity reverse • Bit13: Insulation failure of positive polarity to ground • Bit14: Insulation failure of negative polarity to ground • Bit15: Booster side short circuit
128	Booster side warning mask word 1 (read only)	U16	N/A	1	30130	1	0 ~ 65535 • Bit0: DC side SPD abnormality • Bit6: Booster side open circuit • Bit8: String abnormal warning • Bit9: Insulation failure of positive polarity to ground • Bit10: Insulation failure of negative polarity to ground

No.	Name	Data Type	Unit	Gain	Address	Number	Note
129	Background protocol	U32	N/A	1	31112	2	0 ~ 3155759999
	It can be read only. The address is the same as the automatic aging protocol parameter address.						
130	Product Attribute	U32	N/A	1	31114	2	0 ~ 3155759999
	It can be read only. The address is the same as the automatic aging protocol parameter address.						
131	Data						
132	Single machine anti-backflow enablinng	U16	N/A	1	32000	1	0: Unenabled 1: Enabled
133	Anti-backflow power	I16	W	1	32001	1	-32768 ~ +32767
134	Trsnaformation ratio of the anti-backflow CT	U16	N/A	1	32002	1	0 ~ 65535
135	Anti-backflow invalidation enablinng	U16	N/A	1	32003	1	0: Unenabled 1: Enabled
136	Percentage of anti-backflow invalidation power	U16	%	100	32004	1	
137	Anti-backflow meter type	U16	N/A	1	32005	1	• Meter made by Anruike Electric Co.Ltd • Meter made by Donghong Techology Co. Ltd

Note:

No. 133 ~ 137: Used for single machine against backflow.

8. Examples

8.1 Read Single Register

Start address of the register: 40500 and 40001.

Address	Request to Send by the Host	Reply Frame from the Slave
40500	01 03 9E 34 00 01 EA 2C • 01: Slave ID • 03: Function code 0x03 for reading single register value command • 9E 34: Read the first address of the register. 0x9E34 with high byte first and low byte last • 00 01: Read the number of registers, the number of 0x0001 with high byte first and low byte last • EA 2C: CRC check code	Under normal conditions: 01 03 02 00 00 B8 44 • 01: Slave ID • 03: Function code 0x03 for reading single register value command • 02: Read the number of registers with a total number of 0x0002 • 00 00: Read the register contents of 0x0000 with high byte first and low byte last • B8 44: CRC check code Note: Read one value of the register whose address is 40500.
40001	01 03 9C 41 00 01 FA 4E • 01: Slave ID • 03: Function code 0x03 for reading single register value command • 9C 41: Read the first address of the register. 0x9C41 with high byte first and low byte last • 00 01: Read the number of registers, a total number of 0x0001 with high byte first and low byte last • FA 4E: CRC check code	Under abnormal conditions: 01 83 02 C0 F1 • 01: Slave ID • 83: Function code 0x03 + 0x80 for reading reply function code for register value abnormality • 02: Error code indicating illegal data address (refer to the Error Code table in the Basic Definition sheet) • C0 F1: CRC check code Note: Test non-existent register address.

8.2 Read Multiple Registers

Start address of the register: 40500 and 40001.

Address	Request to Send by the Host	Reply Frame from the Slave
40000	01 03 9C 40 00 03 2A 4F • 01: Slave ID • 03: Function code 0x03 for reading multiple register value commands • 9C 40: Read the first address of the register. 0x9C40 with high byte first and low byte last • 00 03: Read the number of registers, a total number of 0x0003 with high byte first and low byte last • 2A 4F: CRC check code	Under normal conditions: 01 03 06 00 00 00 00 00 00 21 75 • 01: Slave ID • 03: Function code 0x03 for reading single register value command • 06: Read the total number of bytes of the register contents of 0x06 • 00 00 00 00 00 00: Read the register contents with high byte first and low byte last • 21 75: CRC check code Read the values of 2 registers with register addresses 40000 ~ 40003 (continuous addresses). Note: The address 40000 contains 2 register units, and the address 40002 contains 1 register unit, so an actual length of 3 register units is read.
40500	01 03 9E 34 00 45 EA 1F • 01: Slave ID • 03: Function code 0x03 for reading multiple register value commands • 9E 34: Read the first address of the register. 0x9E34 with high byte first and low byte last • 00 45: Read the number of registers, a total number of 0x0045 with high byte first and low byte last • EA 1F: CRC check code	Under normal conditions: 01 03 8A 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 2C EC • 01: Slave ID • 03: Function code 0x03 for reading single register value command

Address	Request to Send by the Host	Reply Frame from the Slave
		• 8A: Read the total number bytes of the register contents of 0x008A • All 00: Read all register contents as 0 with high byte first and low byte last • 2C EC: CRC check code Read the values of 69 registers with register addresses of 40500 ~ 40564 (continuous addresses)
40000	01 03 9C 40 00 0F 2A 4A • 01: Slave ID • 03: Function code 0x03 for reading multiple register value commands • 9C 40: Read the first address of the register. 0x9C40 with high byte first and low byte last • 00 0F: Read the number of registers, a total number of 0x000F with high byte first and low byte last • 2A 4A: CRC check code	Under abnormal conditions: 01 83 09 81 36 • 01: Slave ID • 83: Function code 0x03 + 0x80 for reading reply function code for register value abnormality • 09: Error code indicating data frame error (refer to the Error Code table in the Basic Definition sheet) • 81 36: CRC check code Test to read the error length of multiple registers.

8.3 Write Single Register

Start address of the register: 40002 and 60000.

Address	Request to Send by the Host	Reply Frame from the Slave
40002	01 06 9C 42 00 03 47 8F • 01: Slave ID • 06: Function code 0x06 for setting single register value command • 9C 42: Set the first address of the register. 0x9C42 with high byte first and low byte last • 00 03: Set the register contents, the value of 0x0003 with high byte first and low byte last • 47 8F: CRC check code	Under normal conditions: 01 06 9C 42 00 03 47 8F • 01: Slave ID • 06: Function code 0x06 for setting single register value command • 9C 42: Set the first address of the register. 0x9C42 with high byte first and low byte last • 00 03: Set the register contents, the value of 0x0003 with high byte first and low byte last • 47 8F: CRC check code Write the value of 1 register to register address 40002.

Address	Request to Send by the Host	Reply Frame from the Slave
60000	01 06 EA 60 00 01 7C 0C • 01: Slave ID • 06: Function code 0x06 for setting single register value command • EA 60: Set the first address of the register. 0xEA60 with high byte first and low byte last • 00 01: Set the register contents, the value of 0x0001 with high byte first and low byte last • 7C 0C: CRC check code	Under normal conditions: 01 06 EA 60 00 01 7C 0C • 01: Slave ID • 06: Function code 0x06 for setting single register value command • EA 60: Set the first address of the register. 0xEA60 with high byte first and low byte last • 00 01: Set the register contents, the value of 0x0001 with high byte first and low byte last • 7C 0C: CRC check code Under abnormal conditions: 01 86 02 C3 A1 • 01: Slave ID • 86: Function code 0x06 + 0x80 for setting reply function code for single register value abnormality • 02: Error code indicating illegal data address (refer to the Error Code table in the Basic Definition sheet) • C3 A1: CRC check code Note: Write the value of 1 register to register address 60000 (illegal register address).

8.4 Write Multiple Registers

Start address of the register: 40000 and 40200.

Address	Request to Send by the Host	Reply Frame from the Slave
40000	01 10 9C 40 00 03 06 33 44 55 66 00 04 23 DA • 01: Slave ID • 10: Function code 0x10 for setting multiple register value commands • 9C 40: Set the first address of the register. 0x9C40 with high byte first and low byte last • 00 03: Set the number of registers, a total number of 0x0003 with high byte first and low byte last • 06: Set the total number of bytes of the register contents • 33 44 55 66 00 04: Set the value of the register • 23 DA: CRC check code	Under normal conditions: 01 10 9C 40 00 03 AF 8C • 01: Slave ID • 10: Function code 0x10 for setting multiple register value commands • 9C 40: Set the first address of the register. 0x9C40 with high byte first and low byte last • 00 03: Set the number of registers, a total number of 0x0003 with high byte first and low byte last • AF 8C: CRC check code Write the value of 2 registers to register address 40000 ~ 40002 (continuous addresses). Note: The address 40000 contains 2 register units and the address 40002 contains 1 register unit, so an actual length of 3 register units is written.
40200	01 10 9D 08 00 03 06 00 01 00 01 00 01 0C 04 • 01: Slave ID • 10: Function code 0x10 for setting multiple register value commands • 9D 08: Set the first address of the register. 0x9D08 with high byte first and low byte last • 00 03: Set the number of registers, a total number of 0x0003 with high byte first and low byte last • 06: Set the total number of bytes of the register contents of 0x06 • 00 01 00 01 00 01: Set the value of the register • 0C 04: CRC check code	Under normal conditions: • 01: Slave ID • 10: Function code 0x10 for setting multiple register value commands • 9D 08: Set the first address of the register. 0x9D08 with high byte first and low byte last • 00 03: Set the number of registers, a total number of 0x0003 with high byte first and low byte last • 2E 66: CRC check code Write the value of 3 registers to register address 40200 ~ 40202 (continuous addresses).

Address	Request to Send by the Host	Reply Frame from the Slave
40000	• 01 10 9C 40 00 0F 1E 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 7F 03 • 01: Slave ID • 10: Function code 0x10 for setting multiple register value commands • 9C 40: Set the first address of the register. 0x9C40 with high byte first and low byte last • 00 0F: Set the number of registers, a total number of 0x000F with high byte first and low byte last • 1E: Set the total number of bytes of the register contents of 0x1E; A total of 30 bytes • 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00: Set the value of the register with a total number of 30 bytes • 7F 03: CRC check code	Under abnormal conditions: 01 90 09 8C 06 • 01: Slave ID • 90: Function code 0x10+0x80 for setting reply function code for multiple register value abnormality • 09: Error code indicating data frame error (refer to the Error Code table in the Basic Definition sheet) • 8C 06: CRC check code Test to write the error length of multiple regusterss. The address of the current setting frame is discontinuous.

Note:

1. Please refer to the related description in the Basic Definition sheet.

2. Please calculate the real frame data length based on the fact that 1 register unit contains 2 bytes, 32 Bit integer contains 2 register units, and 16 Bit integer contains 1 register unit.