

Communication Protocol of Residential Hybrid Inverter

V1.1.2

Version No.	Date of preparation	Revised contents and reasons for revision
1.0.12	2016/02/22	Initial released version.
1.0.13	2016/10/13	Modify content for register: 5003-5005,13036-13038,13055.
1.0.14	2017/12/05	Add register: 2582-2626 (Firmware Version).
1.0.15	2018/03/12	1.Modify register 13008-13009 data type from U32 to S32. 2.Add Appendix 1.3 fault code instructions.
1.0.16	2018/06/13	1.Add description for valid device types. 2. Add device code definition to register 5000. 3.Modify register 13061 data range from 30.0-48.0V to 32.0-48.0V.
1.0.17	2018/07/17	Delete content for register 13076-13079 and 13081-13082.
1.0.18	2019/01/05	1.Add register 13086 (Meter Comm. Detection). 2. Delete content for register 2582-2626.
1.0.19	2019/05/28	Add new valid device types: SH5K-30/SH3K6-30/SH4K6-30, SH3.6RS/SH5.0RS/SH6.0RS, SH5.0RT/SH6.0RT/SH8.0RT/SH10RT.
1.0.20	2020/04/07	1.Add register 4954 (ARM software version) and register 4969 (DSP software version). 2.Modify register 13087 (Export Power Limitation) to include: SH5.0RT/SH6.0RT/SH8.0RT/SH10RT. 3.Add Running in External EMS mode 0x4000 in Appendix 1.1 system state for SH5.0RT/SH6.0RT/SH8.0RT/SH10RT.
1.0.21	2020/05/08	1.Modify register 13055 to include Li-ion TAWAKI. 2.Modify register 13062 data range from 20.0-60.0°C to 20.0-70.0°C. 3.Modify register 13068 data range from 40.00-60.00V to 40.00-63.00V. 4.Modify register 13069 data range from 30.000-50.000V to 30.000-53.000V. 5.Modify register 13080 data range from 0-20s to 1-1000s.
1.0.22	2020/11/13	Add register 5622 (Export limit min), register 5623 (Export limit max), register 5628 (BDC rated power), register 5635 (Max. Charging Current (BMS)), register 5636 (Max. Discharging Current (BMS)). Modify register 13052 Charge/discharge power data range to 0-100 times of BDC rated Power (RO register 5628) for SH5.0RT/SH6.0RT/SH8.0RT/SH10RT. Modify register 13074 Export power limitation to 10 times of Export limit min (RO register 5622) -10 times of Export limit max (RO register 5623).
1.0.23	2021/12/22	1.Modify notes about SH3.0RS/SH3.6RS/SH4.0RS/SH5.0RS/ SH6.0RS for register 5000,5622,5623,5628,5635,5636,13087. 2.Add new valid device types:

		SH3.0RS/SH4.0RS
1.0.24	2022/11/29	Add new valid device types: SH5.0RT-20/SH6.0RT-20/SH8.0RT-20/SH10RT-20.
1.0.25	2023/01/12	Add new valid device types: SH5.0RT-V112/SH6.0RT-V112/SH8.0RT-V112/SH10RT-V112. Add new valid device types: SH5.0RT-V122/SH6.0RT-V122/SH8.0RT-V122/SH10RT-V122.
1.0.13	2016/10/13	Modify content for register: 5003-5005,13036-13038,13055.
1.1.0	2023/03/02	<p>1) Update the fault table in Appendix 4.3 to bit-based analysis</p> <p>2) Add remarks that measuring points forwarded by WINET-S through TCP/IP are not supported</p> <p>3) Delete the read-only measuring points of carbon dioxide emission reduction (13015 ~ 13016), and delete the registers that only support old models (SH3K6, SH4K6, SH5K-20, SH5K-V13, SH3K6-30, SH4K6-30, and SH5K-30)</p> <p>4) Add remarks that address segments 6100-6826 only support shipped items, while SH5-25T, SH3.0-6.0 RS and SH8-10KHV under research and subsequent models are no longer supported</p> <p>5) Modify the SOC upper limit (13058) to 50.0-100.0</p> <p>6) Add Read-only registers: 5015, 5016, 5214, 5242, 5603, 5605, 5607, 5631, 5639, 5720, 5721, 5722, 5723, 5724, 5725, 5726, 5731, 5732, 5733, 5734, 13050~13079</p> <p>7) Add Holding registers: 13001, 31222, 33042, 33047, 33048, 33148, 33208, 33209, 33210, 33211, 33212, 33213, 33214, 33215, 33216, 33217, 33218, 33219, 33274</p> <p>8) Add state enumeration values to system states (13000) in Appendix 4.1: off-grid charge (0x0041), stop (0x0001), update failed (0x0200), open loop (0x2000), running in external EMS mode (0x4000)</p> <p>9) Merge equipment types, add equipment name of SH8-10KHV, and delete SH3K6, SH4K6, SH5K-20, SH5K-V13, SH3K6-30, SH4K6-30, SH5K-30. Refer to Appendix 4.6 for data of device type codes (5000)</p> <p>10) Change the version number (4954) of read-only register ARM software to the certification version number of ARM software, change type to UTF-8, and change the version number of DSP software to the certification version number of DSP software. Change type to UTF-8</p> <p>11) Change system state (13000) to running state, and change running state (13001) to power flow status</p> <p>12) Add remarks and explanations of read-only registers 13002 ~ 13019, and 13045 ~ 13047</p> <p>13) Add appendix 4.4, 4.5, 4.6</p>
1.1.1	2023/10/07	Add new valid device types : SH8.0RS, SH10RS
1.1.2	2023/10/18	1) Modified Appendix 4.1, Add a lot of work status

		2) Modified the range of Optimized power of load 1 (13016) (0~5000 to 0~60000) ; applicable types add SH5-25T 3) Charge/Discharge Power(13052) add applicable types SH5-25T 4) Export power limitation(13074) add applicable types SH5-25T 5) Delete SH5-25T_V12 Series,Delete SH22T_V11
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Valid device types: Refer to appendix 4.6

I. Introduction

This communication protocol, complies ModBus, applies to the communication between Sungrow grid-connected hybrid inverters (SH-inverter) and monitoring system. Refer to remarks of measuring points (if any). If there is no remark of a measuring point, all models listed in Appendix 4.6 are supported.

II. Communication Interface

1、RS485

Item	Default setting
Address	Inverter: 1 – 247 settable PC: 1 – 247 settable
Broadcast	Yes
Baud rate	9600 bit/s
Check bit	Null or settable
Data bit	8
Stop bit	1
Mode	RTU

Appliance interface	RS485-2W cable connection
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2、Ethernet (optional, Modbus TCP, Default: DHCP:ON, Port: 502)

III. Address Definition

- Read-only register type supports the command code of 0x04.
- Holding register type supports the command codes of 0x03, 0x10 and 0x06.

3.1 Running information variable address definition(read-only register)

No	Name	Address	Data type	Data range	Unit	Note
1	Protocol No	4950~4951	U32			
2	Protocol ver	4952~4953	U32			
3	Certification version number of ARM software	4954 - 4968	UTF-8			
4	Certification version number of DSP software	4969 - 4983	UTF-8			
5	Reserved	4984-4989				
6	SN	4990~4999	UTF-8			
7	Device type code	5000	U16			Refer to appendix 4.6
8	Nominal output power	5001	U16		0.1kW	
9	Output type	5002	U16	0—Single; 1—3P4L; 2—3P3L		
10	Daily Output Energy	5003	U16		0.1kWh	Power generation of active output (including PV power generation and battery discharge)
11	Total Output Energy	5004 ~ 5005	U32		0.1kWh	
12	Reserved	5006 ~ 5007				
13	Inside Temperature	5008	S16		0.1°C	
14	Reserved	5009~5010				

15	MPPT 1 Voltage	5011	U16		0.1V	
16	MPPT 1 Current	5012	U16		0.1A	
17	MPPT 2 Voltage	5013	U16		0.1V	
18	MPPT 2 Current	5014	U16		0.1A	
19	MPPT 3 Voltage	5015	U16		0.1V	
20	MPPT 3 Current	5016	U16		0.1A	
21	Total DC power	5017 ~ 5018	U32		W	PV Power
22	A-B line voltage/phase A voltage	5019	U16		0.1V	Refer to Output type (address: 5002) 0: phase voltage; 1: phase voltage; 2: line voltage
23	B-C line voltage/phase B voltage	5020	U16		0.1V	
24	C-A line voltage/phase voltage	5021	U16		0.1V	
25	Reserved	5022~5030				
26	Reactive power	5033~5034	S32		var	
27	Power factor	5035	S16		0.001	
28	Grid frequency	5036	U16		0.1Hz	
29	Battery power - Wide range	5214-5215	S32		1W	
30	Grid Frequency - High precision	5242	U16		0.01Hz	
31	Meter Phase A Active Power	5603	S32		1W	
32	Meter Phase B Active Power	5605	S32		1W	
33	Meter Phase C Active Power	5607	S32		1W	
34	Export limit min	5622	U16		10W	
35	Export limit max	5623	U16		10W	
36	BDC rated power	5628	U16		100W	
37	Battery Current	5631	S16		0.1A	
38	Max. Charging Current (BMS)	5635	U16		1A	
39	Max. Discharging Current (BMS)	5636	U16		1A	
40	Battery Capacity- High precision	5639	U16		0.01KWh	

41	Phase A Backup Current	5720	S16		0.1A	
42	Phase B Backup Current	5721	S16		0.1A	
43	Phase C Backup Current	5722	S16		0.1A	
44	Phase A Backup Power	5723	S16		W	
45	Phase B Backup Power	5724	S16		W	
46	Phase C Backup Power	5725	S16		W	
47	Total Backup Power	5726-5727	U32		W	
48	Phase A Backup Voltage	5731	U16		0.1V	
49	Phase B Backup Voltage	5732	U16		0.1V	
50	Phase C Backup Voltage	5733	U16		0.1V	
51	Backup Frequency	5734	U16		0.01Hz	
52	PV Power of today	6100~6195	U16		1W	WINET-S forwarding via Ethernet TCP/IP is not supported Applicable types: SH5.0-10.0RT
53	Daily PV energy yields	6196~6226	U16		0.1KWh	
54	Monthly PV energy yields	6227~6238	U16		0.1KWh	
55	Reserved	6239~6243				
56	Yearly PV energy yields	6250~6289	U32*20	Valid for 15 years	0.1kWh	
57	Direct power consumption of today from PV	6290~6385	U16*96		1W	
58	Daily direct energy consumption from PV	6386~6416	U16*31		0.1kWh	
59	Monthly direct energy consumption from PV	6417~6428	U16*12		0.1kWh	
60	Yearly direct energy consumption from PV	6429~6468	U32*20	Valid for 15 years	0.1kWh	
61	Export power from PV of today	6469~6564	U16*96		1W	
62	Daily export energy from PV	6565~6595	U16*31		0.1kWh	

63	Monthly export energy from PV	6596~6607	U16*12		0.1kWh	
64	Yearly export energy from PV	6608~6647	U32*20	Valid for 15 years	0.1kWh	
65	Battery charge power of today	6648~6743	U16*96		1W	
66	Daily battery charge energy from PV	6744~6774	U16*31		0.1kWh	
67	Monthly battery charge energy from PV	6775~6786	U16*12		0.1kWh	
68	Yearly battery charge energy from PV	6787~6826	U32*20	Valid for 15 years	0.1kWh	
69	Reserved	6827-6849				
70	Reserved	6862-12999				
71	Running state	13000	U16			Refer to Appendix 4.1
72	Power Flow Status	13001	U16			Refer to Appendix 4.2
73	Daily PV Generation	13002	U16		0.1kWh	Electricity generated by the inverter through the PV module on the day
74	Total PV Generation	13003~13004	U32		0.1kWh	Total electricity generated by the inverter through the PV module
75	Daily export power from PV	13005	U16		0.1kWh	Electricity delivered by the inverter to power grid through the PV module on the day
76	Total export energy from PV	13006~13007	U32		0.1kWh	Total electricity delivered by the inverter to power grid through the PV module
77	Load power	13008~13009	S32		1W	Power consumed by loads
78	Export power	13010~13011	S32		1W	Power delivered by the inverter to power grid
79	Daily battery charge energy from PV	13012	U16		0.1kWh	Electricity that the inverter charges the batteries through the PV module on the day
80	Total battery charge energy from PV	13013~13014	U32		0.1kWh	Total electricity that the inverter charges the

						batteries through the PV module
81	Daily direct energy consumption	13017	U16		0.1kWh	Electricity taken from PV module by loads on the day
82	Total direct energy consumption	13018~13019	U32		0.1kWh	Accumulated electricity taken by the inverter from the PV module
83	Battery voltage	13020	U16		0.1V	
84	Battery current	13021	U16		0.1A	
85	Battery power	13022	U16		1W	
86	Battery level	13023	U16		0.1%	
87	Battery state of healthy	13024	U16		0.1%	
88	Battery temperature	13025	S16		0.1°C	
89	Daily battery discharge energy	13026	U16		0.1kWh	
90	Total battery discharge energy	13027~13028	U32		0.1kWh	
91	Self-consumption of today	13029	U16		0.1%	
92	Reserved	13030	U16		-	
93	Phase A current	13031	S16		0.1A	Output type (address 5002) is 0: only phase A current is uploaded; 1 or 2: current of corresponding phases is uploaded
94	Phase B current	13032	S16		0.1A	
95	Phase C current	13033	S16		0.1A	
96	Total active power	13034~13035	S32		W	
97	Daily Import Energy	13036	U16		0.1kWh	
98	Total Import Energy	13037~13038	U32		0.1kWh	
99	Battery Capacity	13039	U16		0.1kwh or 1Ah	Li-ion: 0.1kWh; Lead-acid: 1Ah Applicable types: SH5.0-10.0RT SH8.0-10RS
100	Daily Charge Energy	13040	U16		0.1kWh	Total charge of batteries on the day
101	Total Charge Energy	13041~13042	U32		0.1kWh	Accumulated charge of batteries
102	DRM State	13043	U16	1~9: DRM0~DRM8 Other Value: Invalid		

103	Reserved	13044				
104	Daily export energy	13045	U16		0.1kWh	Electricity delivered by the inverter to power grid through the PV module or batteries on the day
105	Total export energy	13046~13047	U32		0.1kWh	Accumulated electricity delivered by the inverter to power grid through the PV module or batteries
106	Reserved	13048~13049				
107	Inverter alarm	13050~13051	U32			Refer to Appendix 4.3
108	Grid-side fault	13052~13053	U32			
109	System fault 1	13054~13055	U32			
110	System fault 2	13056~13057	U32			
111	DC-side fault	13058~13059	U32			
112	Permanent fault	13060~13061	U32			
113	BDC-side fault	13062~13063	U32			
114	BDC-side permanent fault	13064~13065	U32			
115	Battery fault	13066~13067	U32			
116	Battery alarm	13068~13069	U32			
117	BMS alarm	13070~13071	U32			Refer to Appendix 4.4 This part of data is the fault alarm information of the batteries used for the inverter. The communication address is the communication address of the batteries. For example, if 5 batteries are connected, the communication address of the batteries is 200-204
118	BMS protection	13072~13073	U32			
119	BMS fault 1	13074~13075	U32			
120	BMS fault 2	13076~13077	U32			
121	BMS alarm 2	13078~13079	U32			

Note: please refer to the troubleshooting chapter in SH-inverter manuals for fault code

3.2 Parameter setting address definition(holding register)

No	Name	Address	Data type	Data range	Unit	Note
1	System clock: Year	5000	U16	2000~2099		
2	System clock: Month	5001	U16	1~12		
3	System clock: Day	5002	U16	1~31		
4	System clock: Hour	5003	U16	0~23		
5	System clock: Minute	5004	U16	0~59		
6	System clock: Second	5005	U16	0~59		
7	Reserved	5006-12999				
8	Start/Stop	13000	U16	0xCF(Start) 0xCE(Stop)		
9	DO Configuration	13001	U16	0:Off 1: Load Control Mode 2: Grounding Fault Indication 3: MicroGrid System Mode		
10	Load Control Mode	13002	U16	0: Timing mode; 1: ON/OFF mode; 2: Power optimized mode 3: Disable		Refer to Appendix 4.4
11	Load 1 timing period 1: Start hour	13003	U16	0~23	1h	
12	Load 1 timing period 1: Start minute	13004	U16	0~59	1min	
13	Load 1 timing period 1: End hour	13005	U16	0~23	1h	
14	Load 1 timing period 1: End minute	13006	U16	0~59	1min	
15	Load 1 timing period 2: Start hour	13007	U16	0~23	1h	
16	Load 1 timing period 2: Start minute	13008	U16	0~59	1min	
17	Load 1 timing period 2: End hour	13009	U16	0~23	1h	

18	Load 1 timing period 2: End minute	13010	U16	0~59	1min	
19	Load 1 ON/OFF mode	13011	U16	0xAA (ON) 0x55 (OFF)		
20	Load 1 power optimized mode: Start hour	13012	U16	0~23	1h	
21	Load 1 power optimized mode: Start minute	13013	U16	0~59	1min	
22	Load 1 power optimized mode: End hour	13014	U16	0~23	1h	
23	Load 1 power optimized mode: End minute	13015	U16	0~59	1min	
24	Optimized power of load 1	13016	U16	0~60000	1W	
25	Reserved	13017~13049				
26	EMS mode selection	13050	U16	0: Self-consumption mode (Default); 2: Forced mode 3: External EMS mode 4:VPP		Refer to Appendix 4.5
27	Charge/discharge command	13051	U16	0xAA:Charge; 0xBB:Discharge 0xCC:Stop		
28	Charge/discharge power	13052	U16	(1)0-5000W Default:1000W (SH3.0-6.0RS) (2) 0-100% of BDC rated power(RO register 5628). Pay attention to Unit Coeff difference.(SH5.0- 10.0RT)	1W	
29	Reserved	13053~13054				
30	Max. SOC	13058	U16	50.0~100.0	0.1%	
31	Min. SOC	13059	U16	0.0~50.0	0.1%	
32	Reserved	13064				
33	Export power limitation	13074	U16		1W	

34	Off-grid option	13075	U16	0x55:Disable 0xAA:Enable		
35	Reserved	13076~13079	-			
36	External EMS heartbeat	13080	U16	0~1000 Default:20S	1s	
37	Reserved	13081~13082				
38	Meter Comm. Detection	13086	U16	0xAA:Enable 0x55:Disable		
39	Export Power Limitation	13087	U16	0xAA:Enable 0x55:Disable		
40	Reserved	13085~13099				
41	Reserved SOC for backup	13100	U16	0~100	%	
42	Charge Cutoff Voltage –Wide range	33042	U16		0.1V	
43	Max. Charging Power	33047	U16	1~1060	0.01kW	
44	Max. Discharging Power	33048	U16	1~1060	0.01kW	
45	Charging/Discharging Power –Wide range	33148	U16		0.01kW	
46	Feed-in Limitation – Wide range	31222	U16		0.01kW	
47	Forced Charging	33208	U16	0x55:Disable 0xAA:Enable		
48	Forced Charging Valid Time	33209	U16	0: Weekday 1: Every Day		
49	Forced Charging Start Time 1 (h)	33210	U16	0~23	h	
50	Forced Charging Start Time 1 (min)	33211	U16	0~59	min	
51	Forced Charging End Time 1 (h)	33212	U16	0~23	h	
52	Forced Charging End Time 1 (min)	33213	U16	0~59	min	
53	Forced Charging Target SOC1	33214	U16	0~100	%	
54	Forced Charging Start Time 2 (h)	33215	U16	0~23	h	
55	Forced Charging Start Time 2 (min)	33216	U16	0~59	min	
56	Forced Charging End Time 2 (h)	33217	U16	0~23	h	
57	Forced Charging End Time 2 (min)	33218	U16	0~59	min	

58	Forced Charging Target SOC 2	33219	U16	0~100	%	
59	Load Rated Power	33274	U16	0~60000	0.01kW	

Note:

Communication address = protocol address – 1. If data of address 5000 is to be inquired, the corresponding sending address data is 4999 (0x1387);

U16: 16-bit unsigned integer, big-endian;

U32: 32-bit unsigned integer; little-endian for double-word data. Big-endian for byte data;

S16: 16-bit signed integer, big-endian;

S32: 32-bit signed integer; little-endian for double-word data. Big-endian for byte data

Power factor: + means leading; - means lagging, 1000 means power factor 1.000, 950 means power factor 0.95.

IV. Appendix

4.1 Running state

Running	0x0000/0x0040
Off-grid Charge	0x0041
Update Failed	0x0200
Running in maintain mode	0x0400
Running in forced mode	0x0800
Running in off-grid mode	0x1000
Uninitialized	0x1111

Initial standby	0x12000/x0010
Shutdown	0x1300/0x0002
Standby	0x1400/0x0008
Emergency Stop	0x1500/0x0004
Startup	0x1600/0x0020
AFCI self-test shutdown	0x1700
Intelligent Station Building Status	0x1800
Safe Mode	0x1900
Open loop	0x2000
Restarting	0x2501
Running in External EMS mode	0x4000
Emergency Charging Operation	0x4001
Fault	0x55000/x0100
Stop	0x8000/0x0001
Derating Running	0x8100
Dispatch Running	0x8200
Warn Run	0x9100

4.2 Power Flow Status

Power Flow Status			
Bit0	PV power	Bit0 == 0	No power generated from PV
		Bit0 == 1	Power generated from PV
Bit1	Battery charging	Bit1 == 0	Not charging
		Bit1 == 1	Charging
Bit2	Battery discharging	Bit2 == 0	Not discharging
		Bit2 == 1	Discharging
Bit3	Positive load power	Bit3 == 0	Load is reactive
		Bit3 == 1	Load is active
Bit4	Feed-in power	Bit4 == 0	No power feed-in the grid
		Bit4 == 1	Power feed-in the grid
Bit5	Import Power from grid	Bit5 == 0	No power imported from the grid
		Bit5 == 1	Importing power from grid
Bit6	Reserved	Bit6	
Bit7 (Refitting System)	Negative load power	Bit7 == 0	No power generated from "Load"
		Bit7 == 1	Power generated from "Load"

4.3 Fault code instructions

Bit-based fault analysis of inverter:

Inverter alarm	Bit0	Fan Alarm
	Bit1	Lightning Protection Alarm on AC Side

	Bit2	Lightning Protection Alarm on DC Side
	Bit3	Bypass Switch Abnormal
	Bit4	Communication Alarm
	Bit5	Parallel Communication Alarm
	Bit6	Device Abnormality
	Bit7	Junction Box leakage Protector Alarm
	Bit8	PV1 Abnormal Warn
	Bit9	PV2 Abnormal Warn
	Bit10	PV3 Abnormal Warn
	Bit11	PV4 Abnormal Warn
	Bit12	Fan 2 Rotate Low Speed Alarm
	Bit13	Fan 2 Stall Alarm
	Bit14	The energy meter input and output ports are reversed, or the meter is connected to other wrong terminals
	Bit15	Software Version Mismatch
	Bit16	SPD or Fuse Alarm
	Bit17	FRAM Read Alarm
	Bit18	SPI Com Alarm
	Bit19	Ambient Temperature Sensor Open Circuit Alarm
	Bit20	Ambient Temperature Sensor Short Circuit Alarm
	Bit21	Inversion T Sensor Open Circuit Alarm
	Bit22	Inversion T Sensor Short Circuit Alarm
	Bit23	Boost T Sensor Open Circuit Alarm
	Bit24	Boost T Sensor Short Circuit Alarm
	Bit25	Input Cfg Alarm In DC Source Mode Or Clock Reset Abnormal Alarm
	Bit26	PV HV Flt
	Bit27	Ambient Low Temperature Sensor Open Circuit Alarm
	Bit28	Fan 1 Low Rotation Speed Alarm
	Bit29	Fan 1 Stall Alarm
	Bit30	Meter Communication Alarm
	Bit31	BOOST Short Circuit Alarm
Grid-side fault	Bit0	Grid Overvoltage
	Bit1	Grid Transient V-over
	Bit2	Grid Undervoltage
	Bit3	Grid V-low
	Bit4	Reserved
	Bit5	AC C-over
	Bit6	Grid Overfrequency
	Bit7	Grid Underfrequency
	Bit8	Grid Power Outage
	Bit9	Device Abnormality

	Bit10	Excessive Leakage Current	
	Bit11	Grid Abnormal	
	Bit12	10 Minutes Grid Overvoltage	
	Bit13	High Grid Voltage	
	Bit14	Output Overload	
	Bit15	Grid Voltage Imbalance	
	Bit16	Inversion C-over Hardware Flt	
	Bit17	High Grid Frequency	
	Bit18	Grid F-low	
	Bit19	V-Grid Uniform Fault	
	Bit20	Grid Frequency Uniform Fault	
	Bit21	Network Side Protection Self-test Failed	
	Bit22	Grounding Cable Fault	
	Bit23	Inversion V DC Ject V-over Flt	
	Bit24	AC Side Undervoltage	
	Bit25	AC Side Overvoltage	
	Bit26	AC Side Underfrequency	
	Bit27	AC Side Overfrequency	
	Bit28	Vac Unbal	
	Bit29	Bypass Instantaneous Overcurrent	
	Bit30	Bypass Switch Over Current	
	Bit31	Reserved	
	System fault 1	Bit0	Inversion Switch Tube Over-temperature
		Bit1	BOOST Switch Tube T-over
		Bit2	PV IR Flt
		Bit3	Bypass Switch Fault
		Bit4	EPS Relay Failure
		Bit5	Junction Box Relay Fault
		Bit6	Input and Output Mismatch Fault
		Bit7	PV HV P-over Alarm or Prot
		Bit8	Redundancy Fault
		Bit9	R-phase inverter voltage sampling channel abnormal
Bit10		S-phase inverter voltage sampling channel abnormal	
Bit11		T-phase inverter voltage sampling channel abnormal	
Bit12		R-phase DC component sampling channel abnormal	
Bit13		S-phase DC component sampling channel abnormal	
Bit14		T-phase DC component sampling channel abnormal	
Bit15		PV 1 current sampling channel abnormal	
Bit16		PV 2 current sampling channel abnormal	

	Bit17	PV 1 MPPT current sampling channel abnormal
	Bit18	PV 2 MPPT current sampling channel abnormal
	Bit19	Control Board Power Supply Undervoltage Fault
	Bit20	Leak Current CT Self-detection Fault
	Bit21	SPI Com Flt
	Bit22	LCD and Main DSP Communication Fault
	Bit23	Reserved
	Bit24	PV3 current sampling channel failure
	Bit25	N-wire current sampling channel abnormal
	Bit26	Balance bridge current sampling channel abnormal
	Bit27- Bit31	Reserved
System fault 2	Bit0	Module Overtemperature
	Bit1	Excessively High Ambient Temperature
	Bit2	Device Abnormality
	Bit3	Low System Insulation Resistance
	Bit4 - Bit6	Device Abnormality
	Bit7	Low Ambient Temperature
	Bit8 - Bit10	Device Abnormality
	Bit11	Input Configuration Abnormality
	Bit12 - Bit14	Device Abnormality
	Bit15	Backup Load Overpower Fault
Bit16 - Bit31	Reserved	
DC-side fault	Bit0 - Bit3	Device Abnormality
	Bit4	PV Access Failure
	Bit5 – Bit6	Device Abnormality
	Bit7 - Bit8	Reserved
	Bit9	PV1 Reverse Connection Fault
	Bit10	PV2 Reverse Connection Fault
	Bit11 – Bit15	Device Abnormality
	Bit16	Bus Overvoltage Hardware Fault
	Bit17	Busbar Average Undervoltage
	Bit18	PV Hardware Overcurrent Fault
	Bit19	PV Voltage Exceeds Bus Voltage
	Bit20	BOOST1 Short Circuit Fault
	Bit21	BOOST2 Short Circuit Fault
	Bit22	DC C-over
	Bit23	PV3 Overcurrent
	Bit24	PV3 Reverse Connection Fault
Bit25	BOOST3 short circuit fault	
Bit26	Half-bus overvoltage hardware fault	
Bit27	Balance bridge overcurrent hardware fault	
Bit28	PV4 Reverse Connection Fault	

	Bit29 - Bit31	Reserved
Permanent fault	Bit0	PV Overcurrent Permanent Fault
	Bit1	Inversion Overcurrent Permanent Fault
	Bit2	High DC Injection Permanent Fault
	Bit3	Bus V-over Perm. Flt
	Bit4	Relay Perm Fault
	Bit5	PV1 Self-check Permanent Fault
	Bit6	PV2 Self-check Permanent Fault
	Bit7	Inversion Open-loop Self-detection Perm. Flt
	Bit8	Entire Temperature Sensor Failure
	Bit9	BOOST3 open-loop self-check permanent fault
	Bit10	Balance bridge overcurrent permanent fault
	Bit11	Half-bus overvoltage permanent fault
	Bit12 - Bit31	Reserved
	BDC-side fault	Bit0
Bit1		BDC Discharge Transient I-over
Bit2		Clamping Capacitance V-low Fault
Bit3		Clamping Capacitance Transient V-over
Bit4		Reserved
Bit5		Battery Pre-charge Relay Failure
Bit6 - Bit7		Reserved
Bit8		BDC Self-detect Flt
Bit9 - Bit11		Reserved
Bit12		BDC T-over Flt
Bit13 - Bit15		Reserved
Bit16		BDC Hardware I-over
Bit17 - Bit19		Reserved
Bit20		BDC Current Sampling Channel Abnormality
Bit21		Reserved
Bit22		Leakage Current Sampling Channel Abnormality
Bit23		Secondary DSP Communication Fault
Bit24		BDC Soft Start Flt
Bit25 - Bit31	Reserved	
BDC-side permanent fault	Bit0	BDC I-over Perm. Flt
	Bit1	Reserved
	Bit2	Battery Overvoltage Permanent Fault
	Bit3	Reserved
	Bit4	BDC Self-detect Permanent Flt
	Bit5 - Bit6	Reserved
	Bit7	BDC Soft Start Perm. Flt
	Bit8 - Bit31	Reserved
Battery fault	Bit0 - Bit2	Reserved
	Bit3	Battery Average Undervoltage Fault

	Bit4 - Bit6	Reserved
	Bit7	Battery Overtemperature Fault
	Bit8	Battery Low Temperature Fault
	Bit9 - Bit10	Reserved
	Bit11	Battery Transient Overvoltage
	Bit12	Battery Average Overvoltage Fault
	Bit13	Reserved
	Bit14	BMS Communication Fault
	Bit15	Battery Hardware Overvoltage
	Bit16	Abnormal Battery Connection(Reversed Polarity)
	Bit17	BMS and Battery Fault
	Bit18 - Bit31	Reserved
	Battery alarm	Bit0
Bit1		BDC T Sensor Short Circuit Alarm
Bit2 - Bit31		Reserved

Bit-based fault analysis of individual battery:

BMS alarm	Bit0	Overvoltage Alarm
	Bit1	Overtemperature Alarm
	Bit2	Low Temperature Alarm
	Bit3	Charge/Discharge Overcurrent Alarm
	Bit4	Reserved
	Bit5	Battery Voltage Unbalance
	Bit6	Reserved
	Bit7	Undervoltage Alarm
	Bit8	Abnormal SD Card
	Bit9	Cell Voltage Imbalance Alarm
	Bit10	Cell Temperature Difference Alarm
	Bit11	Battery Module Inconsistency Alarm
	Bit12	Mixed Cell Alarm
	Bit13 - Bit31	Reserved
BMS protection	Bit0	Overvoltage Protection
	Bit1	Overtemperature Protection
	Bit2	Low Temperature Protection
	Bit3	Charge/Discharge Overcurrent Protection
	Bit4	Over Charge Power Limit Fault
	Bit5	Over Discharge Power Limit Fault
	Bit6	Reserved
	Bit7	Low Voltage Protection
	Bit8	Slave Battery Fault
	Bit9	Pre-Charge Failed
	Bit10	Abnormal External Power Line Status
	Bit11	Current Sampling Fault

	Bit12	Temperature Sampling Fault
	Bit13	Voltage Sampling Fault
	Bit14	Battery Internal Communication Failure
	Bit15	DC Contactor Failure
	Bit16 - Bit31	Reserved
BMS fault 1	Bit0	FET Failure/Battery Switch Failure
	Bit1	Failure in Battery Internal Hardware
	Bit2	Overcurrent Fault
	Bit3	Battery Short Circuit Fault
	Bit4	Internal Communication Fault
	Bit5	Input Overvoltage
	Bit6	Reserved
	Bit7	Software Version Mismatch Fault
	Bit8	Heating Alarm
	Bit9	Heating Circuit Abnormal
	Bit10 - Bit11	Reserved
	Bit12	Battery Self-test Fault
	Bit13 - Bit31	Reserved
	BMS fault 2	Bit0 – Bit31
BMS alarm 2	Bit0	BMS Internal Alarm
	Bit1 - Bit31	Reserved

4.4 Load Control Mode

Load Control Mode	Note
0: Timing mode	Start the load within the set time frame
1: Switch mode	Control the load according to the set switch state
2: Intelligent Mode	<p>In the self-consumption mode, the feed power is > the rated power of the load. The DO relay automatically pulls in within the set time frame, thus the surplus PV power can be fully utilized to increase the self-consumption rate;</p> <p>Tips:</p> <p>(1) It is forbidden to enable this function in off-grid mode or inverter fault state;</p> <p>(2) When the intelligent mode is enabled, run for at least 20min after DO relay pulls in;</p> <p>(3) When the communication of the electric meter is abnormal, maintain the original DO state before the abnormality until the intelligent mode time is over, and then cut off DO;</p>

4.5 Energy Management Mode

Energy Management Mode	Note
0: Self-Consumption(Default)	Inverter self-scheduling
2: Compulsory Mode	The inverter is devised to satisfy the current set mandatory charge and discharge power as far as practicable
3: External EMS Mode	The external energy management system controls the inverter through Modbus RTU or TCP
4: VPP	The inverter receives charge and discharge commands from an external VPP system

4.6 Device Type Code

Series name	Specific model	Device type code
SH3.0-6.0RS	SH3.0RS	0xD17
	SH3.6RS	0xD0D
	SH4.0RS	0xD18
	SH5.0RS	0xD0F
	SH6.0RS	0xD10
SH8.0-10RS	SH8.0RS	0xD1A
	SH10RS	0xD1B
SH5.0-10RT	SH5.0RT	0xE00
	SH6.0RT	0xE01
	SH8.0RT	0xE02
	SH10RT	0xE03
	SH5.0RT-20	0xE10
	SH6.0RT-20	0xE11
	SH8.0RT-20	0xE12
	SH10RT-20	0xE13
	SH5.0RT-V112	0xE0C
	SH6.0RT-V112	0xE0D

	SH8.0RT-V112	0xE0E
	SH10RT-V112	0xE0F
	SH5.0RT-V122	0xE08
	SH6.0RT-V122	0xE09
	SH8.0RT-V122	0xE0A
	SH10RT-V122	0xE0B
SH5-25T	SH5T-V11	0xE20
	SH6T-V11	0xE21
	SH8T-V11	0xE22
	SH10T-V11	0xE23
	SH12T-V11	0xE24
	SH15T-V11	0xE25
	SH20T-V11	0xE26
	SH25T-V11	0xE28

4.7 Example

Take ComTest for example.

1. Acquire one piece of running information

Supposed that the inverter address is 1, it needs to acquire data from address 5000 of 3x address type.

The PC sends (HEX):

01 04 13 87 00 01 85 67

The inverter replies (HEX):

01 04 02 00 22 39 29

Note: The type code of inverter SG4KTL is 0x0022.

2.Acquire multiple running information

Supposed that the inverter address is 1, it needs to acquire 10 data from address starting from 5000 of 3x address type

The PC sends (HEX):

01 04 13 87 00 0A C4 A0

The inverter replies (HEX):

01 04 14 00 22 00 28 00 00 00 00 00 05 00 00 00 26 00 00 00 00 00 00 AF F8

Note: The type code of inverter SG4KTL is 0x0022. The nominal output power is 4.0 kW, two-phase. Daily power generation is 0. The total power generation is 5 kWh. The total running time is 38 h. The internal temperature is 0°C. The internal transformer temperature is 0°C.

3.Acquire SN

Supposed that the inverter address is 1, it needs to acquire 10 data from address starting from 4990 of 3x address type

The PC sends (HEX):

01 04 13 7D 00 0A E4 91

The inverter replies (HEX):

01 04 14 31 32 31 32 31 32 30 30 31 00 00 00 00 00 00 00 00 00 9B 56

Note:

1. SN data type is UTF-8;

2. Serial number is: 121212001

4. Read one setting datum

Supposed that the inverter address is 1, it needs to read data from address 5000 of 4x address type.

The PC sends (HEX):

01 03 13 87 00 01 30 A7

The inverter replies (HEX):

01 03 02 07 D8 BA 2E

Note: the data read out is year 2008.

5. Read multiple setting data

Supposed that the inverter address is 1, it needs to read 10 data from address starting from 5000 of 4x address type.

The PC sends (HEX):

01 03 13 87 00 0A 71 60

The inverter replies (HEX):

01 03 14 07 DA 00 0A 00 1E 00 09 00 28 00 25 00 CE 00 AA 01 F4 00 00 80 53

Note: The data are October 30th, 2010, 09:40:37; Stop; power limitation enabled, power limitation value is 50%.

6. Set one datum

Supposed that the inverter address is 1, it needs to set data from address 5000 of 4x address type.

The PC sends (HEX):

01 10 13 87 00 01 02 07 DA 19 4D

The inverter replies (HEX):

01 10 13 87 00 01 B5 64

Or

The PC sends (HEX):

01 06 13 87 07 DA BE CC

The inverter replies (HEX):

01 06 13 87 07 DA BE CC

Note: The setting data is year 2010

7. Set multiple data

Supposed that the inverter address is 1, it needs to set 10 data to address starting from 5000 of 4x address type.

The PC sends (HEX):

01 10 13 87 00 0A 14 07 D9 00 0A 00 1E 00 09 00 10 00 00 00 CE 00 AA 01 F4 00 00 3E 65

The inverter replies (HEX):

01 10 13 87 00 0A F4 A3

Note: The data are October 30th, 2009, 09:16:00, stop, power limitation enabled, power limitation value is 50%.