SOFARSOLAR

Sofarsolar ModBus-RTU Communication Protocol

1. General Information

1.1 Physical Layer

Transmission Mode: RS485
Communication Address: 1 ~ 31
Baud rate: 9600bps
Communication Length: Maximum 1,000m
Communication Medium: Shield twisted cable
Communication Mode: MODBUS-RTU

1.2 Data Link Layer

Transmission Mode: Master-Slave Half Duplex
Data Format:
Start bit: 1,
Data bit: 8,
Stop bit: 1,
Parity Check: No parity checks.
Data transmission format:

Device Address	Function Code	Data	CRC
1-Byte	1-Byte	N-Byte	2byte

1.3 Device Address:

Modbus Address Range: 1-31(one byte)

1.4 Function Code

Function Code	Register Address Range	Remark
0x03	Read inverter input register information: 0x0000-0x00FF	Get one or multiple register value
	Read inverter internal combiners box input register information: 0x0100-0x01FF	Get one or multiple register value
0x04	Read inverter holding register information 0x1000-0x10FF	Get one or multiple register value
	Read inverter internal combiners box information: 0x1100-0x11FF	Get one or multiple register value
0x13	Write or set inverter parameters 0x1000-0x10FF	Write one or multiple value to inverter register
	Write internal combiner info 0x1100-0x11FF	Write one or multiple value to inverter register combiner box
0x02	Automatic time correction	
0x01	Remote on/off , power/power factor control	
0x50	Read EEPROM data	
0x60	Read SD card data	
0x10	Read current time	
0x30	Factory reset	
0x31	Clear today energy	
0x32	Reset protection value of current country code	
0x33	Clear total generation	
0x34	Clear historical event record	
0x06	Real time power control(write)	
0x39	Set inverter modbus address	
0x40	Set country code	
0x41	Set Input Mode(parallel or independent)	

2. Broad Casting (address 0x88)

No data response message for broad casting

2.1.1Automatic time correction

Device Address	0x88
Function Code	0x02
Register AddressHi	0x50
Register Address Lo	0x00
Register No.(Hi Byte)	0x00
Register No.(Lo Byte)	0x03
Data(Second)	
Data(Minutes)	
Data(Hour)	
Data(Day)	
Data(Month)	
Data(Year)	
CRC Lo	
CRC Hi	

Automatic time correction register

Address	Definition	Variable Type	Length	Range	Default	Remark
0x5000	Automatic time correction	BCD				

2.1.2 Remote On/Off

1. Remote On/off

Device Address	0x88
Function Code	0x01
Register Address Hi	0x01
Register Address Lo	0x42
Register Value Hi	0x00
Register Value Lo	0x55/0x66
CRC Lo	0x82
CRC Hi	0xBB

Turn ON (Register ValueLo=0x55)

Turn OFF (Register Value Lo=0X66)

2.1.3 Active Power Control

1. Active power control

Device Address	0x88
Function Code	0x01
Register AddressHi	0x01
Register AddressLo	0x41
Register Value Hi	
Register Value Hi	
CRC Lo	
CRC Hi	

2.1.4 Power factor setting

1. Power factor setting

Device Address	0x88
Function Code	0x01
Register Address Hi	0x01
Register Address Lo	0x61
Register Value Hi	
Register Value Hi	
CRC Lo	
CRC Hi	

2.1.5 Reactive power setting

1. Reactive power setting

Device Address	0x88
Function Code	0x01
Register Address Hi	0x01
Register Address Lo	0x62
Register Value Hi	
Register Value Hi	
CRC Lo	
CRC Hi	

3. Instruction

3.1 Read the real time data (Function Code 0x03)

3.1.1 Data frame format

Request:

Slave Address	Function Code	Starting Address	Number of Registers	CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes
0xxx	0x03	Hi Byte Lo Byte	Hi Byte Lo Byte	Lo Byte Hi Byte

Reply

Address	Function Code	Byte No.	Register-1stvalue	....	Register- Nthvalue	CRC16
1 byte	1 byte	1 byte	2 bytes	N-2	2 bytes	2 bytes
Byte	Byte	Byte	Hi Byte Lo Byte	......	Hi Byte Lo Byte	Lo Byte Hi Byte

Example (query the status of the Inverter):

Query:

Slave Address	0x01
Function Code	0x03
Starting Address Hi	0x00
Starting Address Lo	0x00
Number of Registers Hi	0x00
Number of Registers Lo	0x01
CRC16 Lo	0x84
CRC16 Hi	0x0A

Response:

Slave Address	0x01
Function Code	0x03
Byte Count	0x02
Register-1 value Hi	0x00
Register-1 value Lo	0x00
CRC16 Lo	0xB8
CRC16 Hi	0x44

3.1.2 Data Address Table

Operating State (0x0000)

00: wait

01: Check

02: Normal

03: Fault

04: Permanent

Inverter fault Message (0x0001~0x0005 mapping with Byte0 to Byte9):

Byte0

bit	Error Message	ID code(detailed)
Bit0	GridOVP	ID01 Grid Over Voltage Protection
Bit1	GridUVP	ID02 Grid Under Voltage Protection
Bit2	GridOFP	ID03 Grid Over Frequency Protection
Bit3	GridUFP	ID04 Grid Under Frequency Protection
Bit4	PVUVP	ID05 PV Under Voltage Protection
Bit5	GridLVRT	ID06 Grid Low Voltage Ride through
Bit6	reserve	ID07
Bit7	reserve	ID08

Byte1

bit位	Error Message	ID code(detailed)
Bit0	PVOVP	ID09 PV Over Voltage Protection
Bit1	IpvUnbalance	ID10 PV Input Current Unbalance
Bit2	PvConfigSetWrong	ID11 PV Input Mode Configure wrong
Bit3	GFCIFault	ID12 Ground-Fault circuit interrupters Fault
Bit4	PhaseSequenceFault	ID13 Phase sequence Fault
Bit5	HwBoostOCP	ID14 hardware boost over current protection
Bit6	HwAcOCP	ID15 Hardware AC over current protection
Bit7	AcRmsOCP	ID16 The Grid current is too high

Byte2

bit	Error Message	ID code(detailed)
Bit0	HwADFaultIGrid	ID17 The Grid current sampling is error
Bit1	HwADFaultDCI	ID18 The DCI sampling is error
Bit2	HwADFaultVGrid	ID19 The Grid voltage sampling is error
Bit3	GFCIDeviceFault	ID20 GFCI device sampling is error
Bit4	MChip_Fault	ID21 Main chip fault
Bit5	HwAuxPowerFault	ID22 Hardware auxiliary power fault
Bit6	BusVoltZeroFault	ID23 Bus voltage zero fault
Bit7	IacRmsUnbalance	ID24 The output current is not balanced

Byte3

bit	Error Message	ID code(detailed)
Bit0	BusUVP	ID25 Bus under voltage protection
Bit1	BusOVP	ID26 Bus over voltage protection
Bit2	VbusUnbalance	ID27 Bus voltage unbalance
Bit3	DciOCP	ID28 The DCI is too high
Bit4	SwOCPInstant	ID29 The Grid current is too high
Bit5	SwBOCPInstant	ID30 The input current is too high
Bit6	reserved	ID31
Bit7	reserved	ID32

Byte4,byte5

bit	Error Message	ID code(detailed)
Bit0	reserved	33/41
Bit1	reserved	34 /42
Bit2	reserved	35/43
Bit3	reserved	36/44
Bit4	reserved	37/45
Bit5	reserved	38/46
Bit6	reserved	39/47
Bit7	reserved	40/48

Byte6

bit	Error Message	ID code(detailed)
Bit0	ConsistentFault_VGrid	ID49 The grid voltage sampling value between the master and slave DSP is Vary widely
Bit1	ConsistentFault_FGrid	ID50 The grid frequency sampling value between the master and slave DSP is Vary widely
Bit2	ConsistentFault_DCI	ID51 The DCI sampling value between the master and slave DSP is Vary widely
Bit3	ConsistentFault_GFCI	ID52 The GFCI sampling value between the master and slave DSP is Vary widely
Bit4	SpiCommLose	ID53 The communication between the master and slave DSP is fail
Bit5	SciCommLose	ID53 The communication between the slave and communication board is fail
Bit6	RelayTestFail	ID55 The relay is fault
Bit7	PvIsoFault	ID56 The insulation resistance between the PV array and the earth is too low

Byte7

bit	Error Message	ID code(detailed)
Bit0	OverTempFault_Inv	ID57 The inverter temp is too high
Bit1	OverTempFault_Boost	ID58 The boost temp is too high
Bit2	OverTempFault_Env	ID59 The environment temp is too high
Bit3	PEConnectFault	ID60 The inverter is not connect the PE wire
Bit4	reserved	ID61
Bit5	reserved	ID 62
Bit6	reserved	ID 63
Bit7	reserved	ID 64

Byte8

bit	Error Message	ID code(detailed)
Bit0	unrecoverHwAcOCP	ID65 The grid current is too high,and has cause unrecoverable fault
Bit1	unrecoverBusOVP	ID66 The bus voltage is too high,and has cause unrecoverable fault
Bit2	unrecoverIacRmsUnbalance	ID67 The grid current is unbalance,and has cause unrecoverable fault
Bit3	unrecoverIpvUnbalance	ID68 The input current is unbalance,and has cause unrecoverable fault
Bit4	unrecoverVbusUnbalance	ID69 The bus voltage is unbalance,and has cause unrecoverable fault
Bit5	unrecoverOCPInstant	ID70 The grid current is too high,and has cause unrecoverable fault
Bit6	unrecoverPvConfigSetWrong	ID65 PV Input Mode Configure wrong,and has cause unrecoverable fault
Bit7	reserved	72

Byte9

bit位	Error Message	ID code(detailed)
Bit0	reserved	73
Bit1	unrecoverIPVInstant	ID74 The input current is too high.and has cause unrecoverable fault
Bit2	unrecoverWRITEEEPROM	ID75 Reading EEPROM fault
Bit3	unrecoverREADEEPROM	ID76 Writing EEPROM is fault

Bit4	unrecoverRelayFail	ID77 The relay is fault, and has cause unrecoverable fault
Bit5	reserved	ID 78
Bit6	reserved	ID 79
Bit7	reserved	ID 80

Inverter alert message (0x0025): byte0

bit位	Error Message	ID code(detailed)
Bit0	OverTempDerating	ID81 The inverter is de-rating because of the temperature is too high
Bit1	OverFreqDerating	ID82 The inverter is de-rating because of the grid frequency is too high
Bit2	RemoteDerating	ID83 inverter is de-rating by remote control
Bit3	RemoteOff	ID84 inverter turned off by remote control
Bit4	UnderFreqDerate	ID85ID82 The inverter is de-rating because of the grid frequency is too low
Bit5	reserved	ID86
Bit6	reserved	ID87
Bit7	reserved	ID88

Inverter alert message (0x0025):byte1

bit	Error Message	ID code(detailed)
Bit0	reserved	reserved
Bit1	reserved	reserved
Bit2	reserved	reserved
Bit3	reserved	reserved
Bit4	reserved	reserved
Bit5	reserved	reserved
Bit6	reserved	reserved
Bit7	reserved	reserved

Communication board inner message (0x0027): byte0

bit	Error Message	ID code(detailed)
Bit0	Fan1 alarm	ID91 Fan1 alarm
Bit1	Fan2 alarm	ID92 Fan2 alarm
Bit2	Lightning protection alarm	ID93 Lightning protection alarm
Bit3	Software version is not consistent	ID94 Software version is not consistent
Bit4	Communication board EEPROM fault	ID95 The communication board EEPROM is fault
Bit5	RTCFatult	ID96 RTC clock chip is fault

Bit6	InValidCountry	ID97 The country is invalid
Bit7	SDfault	ID98 The SD card is fault

Communication board inner message (0x0027): byte1

bit	Error Message	ID code(detailed)
Bit0	Fan3 alarm	ID90 Fan3 alarm
Bit1	WIFI Fault	WIFI Fault
Bit2	Fan 4 alarm	ID86 Fan3 alarm
Bit3	Fan 5 alarm	ID87 Fan3 alarm
Bit4	reserved	reserved
Bit5	reserved	reserved
Bit6	reserved	reserved
Bit7	reserved	reserved

Inverter Data Address table

Address	Define	Variable type	length	range	Default value	Remarks
0x0000	Operating state	Uint	16			Low byte only
0x0001	Fault1	Uint	16			High-Byte:byte1 Low-Byte:byte0
0x0002	Fault2	Uint	16			High-Byte:byte3 Low-Byte:byte2
0x0003	Fault3	Uint	16			High-Byte:byte5 Low-Byte:byte4
0x0004	Fault4	Uint	16			High-Byte:byte7 Low-Byte:byte6
0x0005	Fault5	Uint	16			High-Byte:byte9 Low-Byte:byte8

PV Input Message

Address	Define	Variable type	Len	range	Default value	Remarks
0x0006	PV1 voltage	Uint	16	0-1000V		Unit:0.1V
0x0007	PV1 current	int	16	0-100A		Unit:0.01A
0x0008	PV2 voltage	Uint	16	0-1000V		Unit:0.1V
0x0009	PV2 current	int	16	0-100A		Unit:0.01A
0x000A	PV3 voltage	Uint	16	0-1000V		Unit:0.1V
0x000B	PV3 current	Uint	16	0-100A		Unit:0.01A
0x000C	PV1 Power	Uint	16	0-100kw		Unit:0.01kw
0x000D	PV2 Power	Uint	16	0-100kw		Unit:0.01kw

0x000E	PV3 Power	Uint	16	0-100kw		Unit:0.01kw

Output Grid Message

Address	Define	Variable Type	len	range	Default Value	Remarks
0x000F	Output active power	Uint	16			Unit:0.01kW
0x0010	Output reactive power	int	16			Unit:0.01kVar
0x0011	Grid frequency	Uint	16			Unit:0.01Hz
0x0012	A-phase voltage	Uint	16			Unit:0.1V
0x0013	A-phase current	Uint	16			Unit:0.01A
0x0014	B-phase voltage	Uint	16			Unit:0.1V
0x0015	B-phase current	Uint	16			Unit:0.01A
0x0016	C-phase voltage	Uint	16			Unit:0.1V
0x0017	C-phase current	Uint	16			Unit:0.01A

Inverter Generation message

Address	Define	Variable type	Len	range	Default value	Remarks
0x0018	Total production high-byte	Uint	16	0-65536		Unit:1kWh
0x0019	Total production low-byte	Uint	16	0-65536		
0x001A	Total generation time high-byte	Uint	16	0-65536		Unit:1 hour
0x001B	Total generation time low-byte	Uint	16	0-65536		
0x001C	Today production	Uint	16	0-1000		Unit:0.01kWh
0x001D	Today generation time	Uint	16	0-65536		Unit:1 Minute

Inverter inner message

Address	Define	Variable type	Len	Range	Default value	Remarks
0x001E	Inverter heat sink temperature	int	16			
0x001F	Inverter inner temperature	int	16			
0x0020	Inverter Bus voltage	Uint	16	0-1000V		Unit:0.1V
0x0021	PV1 voltage sampled by slave CPU	Uint	16	0-1000V		Unit:0.1V
0x0022	PV2 voltage sampled by slave CPU	Uint	16	0-1000V		Unit:0.1V
0x0023	PV3 voltage sampled by slave CPU	Uint	16	0-1000V		Unit:0.1V
0x0024	Count down time	Uint	16			Unit: 1s
0x0025	Inverter Alarm Info	Uint	16			See above table
0x0026	Input Mode	Uint	16			0x00: P, 0x01: Inde
0x0027	Inverter inner info					See above table
0x0028	Insulation of PV2 to					Unit: k Ohms

	ground					
0x0029	Reserved					
0x002A	Reserved					
0x002B	Country Code	int	16	0-100		
0x002C	Temperature of R phase inverter module	int	16	-50-150		Unit: 1 C
0x002D	Temperature of S phase inverter module	Uint 16	16	-50-150		Unit: 1 C
0x002E	Temperature of T phase inverter module	int	16	-50-150		Unit: 1 C
PV string input information						
Address	Define	Variable Type	Len	Range	Default	Remark
0x0105	PV1 voltage	Uint	16	0-1000V		Unit 0.1V
0x0106	PV1 current	Uint	16	-20-20A		Unit 0.01A
0x0107	PV2 voltage	Uint	16	0-1000V		Unit 0.1V
0x0108	PV2 current	Uint	16	-20-20A		Unit 0.01A
0x0109	PV3 voltage	Uint	16	0-1000V		Unit 0.1V
0x010A	PV3 current	Uint	16	-20-20A		Unit 0.01A
0x010B	PV4 voltage	Uint	16	0-1000V		Unit 0.1V
0x010C	PV4 current	Uint	16	-20-20A		Unit 0.01A
0x010D	PV5 voltage	Uint	16	0-1000V		Unit 0.1V
0x010E	PV5 current	Uint	16	-20-20A		Unit 0.01A
0x010F	PV6 voltage	Uint	16	0-1000V		Unit 0.1V
0x0110	PV6 current	Uint	16	-20-20A		Unit 0.01A
0x0111	PV7 voltage	Uint	16	0-1000V		Unit 0.1V
0x0112	PV7 current	Uint	16	-20-20A		Unit 0.01A
0x0113	PV8 voltage	Uint	16	0-1000V		Unit 0.1V
0x0114	PV8 current	Uint	16	-20-20A		Unit 0.01A
0x0115	PV9 voltage	Uint	16	0-1000V		Unit 0.1V
0x0116	PV9 current	Uint	16	-20-20A		Unit 0.01A
0x0117	PV10 voltage	Uint	16	0-1000V		Unit 0.1V
0x0118	PV10 current	Uint	16	-20-20A		Unit 0.01A
0x0119	PV11 voltage	Uint	16	0-1000V		Unit 0.1V
0x011A	PV11 current	Uint	16	-20-20A		Unit 0.01A
0x011B	PV12 voltage	Uint	16	0-1000V		Unit 0.1V
0x011C	PV12 current	Uint	16	-20-20A		Unit 0.01A
0x011C-0x011F	Reserved					

3.2 Read product information (Function Code 0x04)

3.2.1 Read data format

By function code 0x04, query data message of every allowable register, command format as below:

Master request:

Slave address	Function code	Starting Address	Number of Registers	CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes
0xxx	0x04	Hi Byte Lo Byte	Hi Byte Lo Byte	Lo Byte Hi Byte

Slave reply:

Slave Addres	Function code	Byte Count	Register-1 value	......	Register-N value	CRC16
1byte	1byte	1byte	1byte	N-2	1byte	1byte
Byte	Byte	Byte	Hi Byte Lo Byte	......	Hi Byte Lo Byte	Lo Byte Hi Byte

3.2.2 Address table of read inverter's manufacturer message

Inverter's Manufacturer message						
Address	define	Variable type	length	range	Default value	Remarks
0x2000	Product code					0: 5KW 1: 6KW 2: 8KW 3: 10KW 4: 12KW 5: 15KW 6: 17KW 7: 20KW 8: 25KW 9: 30KW
0x2001 to 0x2007	Manufacturer serial number					
0x2008 to 0x2009	Software version code					
0x200A to 0x200B	Hardware version code					
0x200C to 0x200F	reserved					

Serial number definition table:

ID	Value	Remarks

1	'S'	S means Sofar
2-3	"A1"or "B1"or "C1"or "D1"	A1(1-3K),B1(3-5K),C1(10-20K), D1(30-43K),F4(3.3-12K),H1(3-7.5K) L1(20-33K),J2(50-70K)
4	E/C	E(English),C(Chinese)
5-6	S0~S5	Single phase WIFI or DC

7-8	10/30/50/06/08/10/12/15/17/20/25/30	//If bit2、bit3 is A1 (1-3K),10 represent 1000W
		//If bit2、bit3 is B1(3-5K)30 represent 3000W
		//If bit2、bit3 is C1(10-20K) represent 20000W
		//If bit2、bit3 is D1(30-40K) represent 30000W

9	Year	2000~2010(0,1,2,3,4,5,6,7,8,9,A) 2011~2017(B,C,D,E,F,G,H) 2018(J) 2019~2028(K,L,M,N,O,P,Q,R,S)
10	month	Jan~Dec(1,2,3,4,5,6,7,8,9,A,B,C)
11	day	1~10(1,2,3,4,5,6,7,8,9,A) 11~20(B,C,D,E,F,G,H,I,J,K) 21~31(L,M,N,O,P,Q,R,S,T,U,V)
12-14	xxx	001(sequence number of that day)

3.2.2 Read/Write Parameters (Function Code 0x04/0x13)

Read Data format (see details in function code 04)

Write Data format
Master request message:

Device Address	Function Code	Register start address	Register No.	register value 1	......	register value (N)	CRC
1 byte	1 byte	1 word	1 word	1 word	N-2	1 word	1 word
Byte	Byte	Hi ByteLo Byte	Hi ByteLo Byte	Hi Byte Lo Byte	......	HiByte Lo Byte	HiByte Lo Byte

Slave response message

Device Address	Function Code	Register start address	Register No.	register value 1	......	register value (N)	CRC
1 byte	1 byte	1 word	1 word	1 word	N-2	1 word	1 word
Byte	Byte	HiByte LoByte	HiByte LoByte	Hi Byte LoByte	......	HiByte LoByte	HiByte Lo Byte

Enable Registers:
Enable grid voltage protection register: 0x1010

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Reserved	Reserved	Reserved	Reserved	Enable grid under-volt level2 protection	Enable grid under-volt level1 protection	Enable grid over-volt level2 protection	Enable grid over-volt level1 protection
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

Enable grid frequency protection register: 0x1020

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Reserved	Reserved	Reserved	Reserved	Enable grid under-freq level2 protection	Enable grid under-freq level1 protection	Enable grid over-freq level2 protection	Enable grid over-freq level1 protection
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

Remote active power de-rating and on/off control: 0x1040

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Reserved	Reserved	Reserved	Reserved	Reserved	Enable over voltage power de-rating	Enable remote on/off control	Enable remote active power control
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

Enable PE detection and PV Insulation detection:0x10A2

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Enable PE defection 0: Disable 1: Enable	Enable PV Insulation 0: Disable 1: Enable
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

Read/Write parameters in inverter

Inverter Start Parameters Setting(SafetyStart)						
address	Definition	Variable Type	Len	Range	Default	Remark
0x1000	Wait time			0-1000		Unit: second
0x1001	Raise speed	Uint	16			Power Percentage per minute
0x1002	Reconnect time after	Uint	16	0-1000		Unit: second

address	Definition	Variable Type	Len	Range	Default	Remark
	fault					
0x1003	Raise speed after fault	Uint	16			Power Percentage per minute
0x1004	Over voltage protection before start	Uint	16			Unit: 0.1V
0x1005	Under voltage protection before start	Uint	16			Unit: 0.1V
0x1006	Over frequency protection before start	Uint	16			Unit: 0.01Hz
0x1007	Under frequency protection before start	Uint	16			Unit: 0.01Hz
0x1008 to 0x100F	Reserved					
Grid voltage protection setting(SafetyVolt)						
address	Definition	Variable Type	Len	Range	Default	Remark
0x1010	Enable grid voltage protection	Uint	16			
0x1011	Grid over voltage protection level1	Uint	16	10-300		Unit: 0.1V
0x1012	Delay time of Grid over-volt protection level1	Uint	16	0-65536		Unit: 10ms
0x1013	Grid over voltage protection level2	Uint	16	10-300		Unit: 0.01A
0x1014	Delay time of Grid over-volt protection level2	Uint	16	0-65536		Unit: 10ms
0x1015	Grid under voltage protection level1	Uint	16	10-300		Unit: 0.01A
0x1016	Delay time of Grid under-volt protection level1	Uint	16	0-65536		Unit: 10ms
0x1017	Grid under voltage protection level2	Uint	16	10-300		Unit: 0.01A
0x1019	Delay time of Grid under-volt protection level2	Uint	16	0-65536		Unit: 10ms
0x1019	Grid over voltage protection in 10mins	Uint	16	10-300		Unit: 0.01A
0x101A	Reserved					

to 0x101F						
Grid frequency protection setting(SafetyFreq)						
Address	Definition	Variable Type	Len	Range	Default	Remark
0x1020	Enable grid frequency protection	Uint	16			
0x1021	Grid over frequency protection level1	Uint	16	50-55		Unit: 0.01Hz
0x1022	Delay time of Grid over-freq protection level1	Uint	16	0-65536		Unit: 10ms
0x1023	Grid over frequency protection level2	Uint	16	50-55		Unit: 0.01Hz
0x1024	Delay time of Grid over-freq protection level2	Uint	16	0-65536		Unit: 10ms
0x1025	Grid under frequency protection level1	Uint	16	45-55		Unit: 0.01Hz
0x1026	Delay time of Grid under-freq protection level1	Uint	16	0-65536		Unit: 10ms
0x1027	Grid under frequency protection level2	Uint	16	45-55		Unit: 0.01Hz
0x1028	Delay time of Grid under-freq protection level2	Uint	16	0-65536		Unit: 10ms
0x1029 To 0x102F	Reserved					
Active Power control and Remote on/off control						
0x1040	Enable address of power control and remote on/off					Check details in Enable register
0x1041	Active power percentage			0-1000		0.1%
0x1042	Remote On/off					Turn ON (0x55) Turn OFF (0X66)
0x1043	Start point of grid voltage de-rating					Unit 0.1V
0x1044	End point of grid voltage de-rating					Unit 0.1V
0x1045 to	Reserved					

0x104F						
Other Protection parameters						
0x10A0	Is-landing enable register					
0x10A1	GFCI enable register					
0x10A2	PV insulation enable register					
0x10A3	PV insulation value					

3.4 Read Time (Function Code 0x10)

3.4.1 Read Data Format

Master Request Message:

Device Address	Function Code	Register Start Address	Register No.	CRC
1 Byte	1 Byte	1 Word	1 Word	1 Word
Byte	Byte	Hi Byte Lo Byte	0x00 0x00	Lo Byte Hi Byte

Slave Reply Message:

Device Address	Function Code	Byte No.	Data	CRC
1 Byte	1 Byte	1 Byte	N Byte	1 Word
Byte	Byte	Byte	N Bytes	Lo Byte Hi Byte

3.4.2 Time register (read) address list

Address	Definition	Variable Type	Len(bytes)	Range	Default	Remark
0x8000	System Time	BCD	7			
0x8001	Power On time	BCD	7			

3.5 Factory Reset (Function Code 0x30)

Master Request Message:

Device Address	Function Code	Register Start Address	Register No.	CRC

1 Byte	1 Byte	1 Word	1 Word	1 Word
Byte	Byte	Hi ByteLo Byte	Hi Byte Lo Byte	Lo Byte Hi Byte

Slave Reply Message:

Device Address	Function Code	Register Start Address	Register No.	CRC
1 Byte	1 Byte	1 Word	1 Word	1 Word
Byte	Byte	Hi ByteLo Byte	Hi Byte Lo Byte	Lo Byte Hi Byte

3.6 Clear Today Generation (Function Code 0x31)

Master Request Message:

Device Address	Function Code	Register Start Address	Register No.	CRC
1 Byte	1 Byte	1 Word	1 Word	1 Word
Byte	Byte	Hi ByteLo Byte	Hi Byte Lo Byte	Lo Byte Hi Byte

Slave Reply Message:

Device Address	Function Code	Register Start Address	Register No.	CRC
1 Byte	1 Byte	1 Word	1 Word	1 Word
Byte	Byte	Hi ByteLo Byte	Hi Byte Lo Byte	Lo Byte Hi Byte

3.7 Reset protection value of current country code (Function Code 0x32)

Master Request Message:

Device Address	Function Code	Register Start Address	Register No.	CRC
1 Byte	1 Byte	1 Word	1 Word	1 Word
Byte	Byte	Hi ByteLo Byte	Hi Byte Lo Byte	Lo Byte Hi Byte

Slave Reply Message:

Device Address	Function Code	Register Start Address	Register No.	CRC
1 Byte	1 Byte	1 Word	1 Word	1 Word
Byte	Byte	Hi ByteLo Byte	Hi Byte Lo Byte	Lo Byte Hi Byte

3.8 Clear Generation (Function Code0x33)

Master Request Message:

Device Address	Function Code	Register Start Address	Register No.	CRC
1 Byte	1 Byte	1 Word	1 Word	1 Word
Byte	Byte	Hi Byte Lo Byte	Hi Byte Lo Byte	Lo Byte Hi Byte

Slave Reply Message:

Device Address	Function Code	Register Start Address	Register No.	CRC
1 Byte	1 Byte	1 Word	1 Word	1 Word
Byte	Byte	Hi Byte Lo Byte	Hi Byte Lo Byte	Lo Byte Hi Byte

3.9 Clear history event record (Function Code 0x34)

Master Request Message:

Device Address	Function Code	Register Start Address	Register No.	CRC
1 Byte	1 Byte	1 Word	1 Word	1 Word
Byte	Byte	Hi Byte Lo Byte	Hi Byte Lo Byte	Lo Byte Hi Byte

Slave Reply Message:

Device Address	Function Code	Register Start Address	Register No.	CRC
1 Byte	1 Byte	1 Word	1 Word	1 Word
Byte	Byte	Hi Byte Lo Byte	Hi Byte Lo Byte	Lo Byte Hi Byte

3.10 Read history generation and event from EPPROM (Function Code 0x50)

3.10.1Read Data Format

Master request message

Device Address	Function Code	Register Start Address	Register No.	CRC
1 Byte	1 Byte	1 Word	1 Word	1 Word
Byte	Byte	Hi ByteLo Byte	Hi Byte Lo Byte	Lo Byte Hi Byte

Slave response message

Device Address	Function Code	Data No.	Data	CRC
1 Byte	1 Byte	1 Byte	N Byte	1 Word
Byte	Byte	Byte	N Bytes	Lo Byte Hi Byte

3.11 Register List of history generation and event

Address	Define	Variable Type	Len (byte)	Range	Default	Remark
0x6000	Today Generation	Hex	2*24			
0x6001	Monthly Generation	Hex	2*31			
0x6002	Yearly Generation	Hex	4*12			
0x6003	Total Generation	Hex	4			
0x6004	The Nth yearly generation	Hex	4 or 4*20			The value in register is N, for example N=2 , it means it will show last two years generation, if N=0xFF, it reads last 20 years generation
0x6005	The Nth history event	Hex	8			The value in register is N, for example N=2, it means it will show last two event records, it can record maximum 100 history event.

0x6006	The Nth time correction record	Hex	12			The value in register is N, for example N=2, it means it will show last two time correction record, it records maximum 10 time correction records.
0x6007	The Nth generation clear record	HEX	6			The value in register is N, for example N=2, it means it will show last two time generation clear record, it records maximum 10 generation clear record.
0x6008	The Nth event clear record	HEX	6			The value in register is N, for example N=2, it means it will show last two time event clear record, it records maximum 10 event clear record.

Reply message of history event (0x6005):

Event ID No. and time							
Event ID No.	Year YY	Month MM	Day DD	Week Dayth	Hour HH	Minute MM	Second SS

Reply message of time correction (0x6006)

Time of before correction						Time of after correction					
Second ss	Minute mm	Hour hh	Day DD	Month MM	Year YY	Second ss	Minute mm	Hour hh	Day DD	Month MM	Year YY

Reply message of generation clear record (0x6007)

Time when generation clear					
Second ss	Minute mm	Hour hh	Day DD	Month MM	Year YY

Reply message of history event clear record (0x6008)

Time when history event clear					
Second ss	Minute mm	Hour hh	Day DD	Month MM	Year YY

3.12 Read history generation from SD card (Function Code0x60)

3.12.1 Read Data Format

Master request message

Device Address	Function Code	Register start Address	Register Info	CRC
1 Byte	1 Byte	1 Word	3 bytes	1 Word
Byte	Byte	Hi Byte Lo Byte	3 Byte	Lo Byte Hi Byte

Slave response message

Device Address	Function Code	Byte No.	Data	CRC
1 Byte	1 Byte	1 Byte	N Byte	1 Word
Byte	Byte	Byte	N Bytes	Lo ByteHi Byte

3.12.2 Register address of history generation

Address	Define	Variable Type	Len(byte)	Range	Default	Remark
0x7000	Daily Generation	Hex	2*24			
0x7001	Monthly Generation	Hex	2*31			
0x7002	Yearly generation	Hex	4*12			

Register info (3 bytes) of daily generation

Year	Month	Day
YY	MM	DD
BCD CODE	BCD CODE	BCD CODE

Register info (3 bytes) of monthly generation

Year YY	Month MM	Reserved
BCD CODE	BCD CODE	00

Register info (3 bytes) of yearly generation

Year YY	Reserved	Reserved
BCD CODE	00	00

3.13 Real time power control (function code 0x06)

3.13.1 Data Format

Request

Device Address	Function Code	Register start address	Power percentage	CRC
1 byte	1 byte	1 word	1 word	1 word
Byte	0x06	0x90 0x00		Lo Byte Hi Byte

Reply

Device Address	Function Code	Register start address	Power percentage	CRC
1 byte	1 byte	1 word	1 word	1 word
Byte	0x06	0x90 0x00		Lo Byte Hi Byte

Power percentage unit is 1%, for example if set it as 0x00 0x64 , it means 100%

3.14 Set inverter Modbus Address (function code 0x39)

3.14.1data format

Master request message

Device Address	function code	Register start address	Inverter Modbus Address	CRC
1 byte	1 byte	1 word	1 word	1 word
Byte	Byte	Hi Byte Lo Byte	Hi Byte Lo Byte	Hi Byte Lo Byte

Slave reply message

Device Address	function code	Register start address	Inverter Modbus Address	CRC
1 byte	1 byte	1 word	1 word	1 word
Byte	Byte	Hi Byte Lo Byte	Hi Byte Lo Byte	Hi Byte Lo Byte

Inverter Modbus Address range：0 - 31

3.15 Set inverter country code (function code 0x40)

3.15.1data format

Master request message

Device Address	function code	Register start address	Country Code	CRC
1 byte	1 byte	1 word	1 word	1 word
Byte	Byte	Hi Byte Lo Byte	Hi Byte Lo Byte	HiByte Lo Byte

Slave reply message

Device Address	function code	Register start address	Country Code	CRC
1 byte	1 byte	1 word	1 word	1 word
Byte	Byte	Hi Byte Lo Byte	Hi Byte Lo Byte	Hi Byte Lo Byte

3.16 Set Input mode (function code 0x41)

3.16.1data format

Master request message

Device Address	function code	Register start address	Input Mode value	CRC
1 byte	1 byte	1 word	1 word	1 word
Byte	Byte	Hi Byte Lo Byte	Hi Byte Lo Byte	Hi Byte Lo Byte

Slave reply message

Device Address	function code	Register start address	Input Mode value	CRC
1 byte	1 byte	1 word	1 word	1 word
Byte	Byte	Hi Byte Lo Byte	Hi Byte Lo Byte	Hi Byte Lo Byte

Input Mode value : 0x00 means Parallel; 0x01 means Independent

4.0 Instruction Example

1. **Get the real-time data(function code 0x03)**
   AP Request:
   01 03 00 00 00 24 45 D1

Inverter response:

01 03 48 00 02 00 00 00 00 00 00 00 00 00 00 08 D5 01 A0 00 41 00 00 00 5E 00 00 00 59 00 00 13 87 09 05 01 85 00 00 00 00 00 00 00 00 00 00 00 8A 00 00 00 22 00 04 00 02 00 1C 00 26 0E 52 08 D5 00 41 00 1E 00 00 00 01 00 00 4E F2

The Operating state is: 0x02(Normal)

2. **Get the product information(function code 0x04)**

AP Request:

01 04 20 00 00 10 FA 06

Inverter response:

01 04 20 00 02 53 42 31 45 53 30 34 30 45 38 47 30 31 34 56 31 37 30 56 31 30 30 00 00 00 00 00 00 00 00 5A BB

SN: SB1ES040E8G014
Software Version: V1.70
Hardware Version: V1.00