SmartGen

MAKING CONTROL SMARTER

HGM9580

BUS TIE BUS PARALLEL UNIT

COMMUNICATION PROTOCOL

郑州众智科技股份有限公司
SMARTGEN(ZHENGZHOU)TECHNOLOGY CO.,LTD.

SmartGen Registered trademark
No. 28 Xuemei Street, Zhengzhou, Henan, China
Tel: +86-371-67988888/67981888/67992951
+86-371-67981000(overseas)
Fax: +86-371-67992952
Web: www.smartgen.com.cn/
www.smartgen.cn/
Email: sales@smartgen.cn

Table 1 Software Version

Date	Version	Content
2024-08-09	1.0	Original release.

CONTENT

1. DESCRIPTION

This protocol describes read and write command format of RS485 half-duplex serial port communication and definition of internal information data in detail for the third-party to develop and use.

This controller has 1 RS485 port.

The controller is used as the slave, using Modbus-RTU protocol, and does not support other protocols such as Modbus-ASCII.

Communication address: 1~254 (default: 1)
Baud rate: 9600bps
Data bit: 8-bit
Parity bit: None
Stop bit: 1-bit or 2-bit

Supported function code: 03H, 05H, 06H. Function code 03H is used for reading controller alarm, status information and various electricity data; 05H is used for sending remote command, 06H is used for saving single data to the memory inside the device.

Data calibration method: CRC16.

Internal registers of controller are in the unit of “byte (double bytes)”.

Communication timeout period: over 200ms.

Communication distance: 9600 baud rate, the longest distance can reach 1,000m when using 120Ω shielding twisted pair line.

Once maximum 120 data of byte register can be read.

Up to 32 controllers can be deployed for network communication.

When RS485 is connected, 120Ω twisted pair line with shielding layer shall be used, and the shielding layer shall be grounded at one end.

2. WIRING DIAGRAM

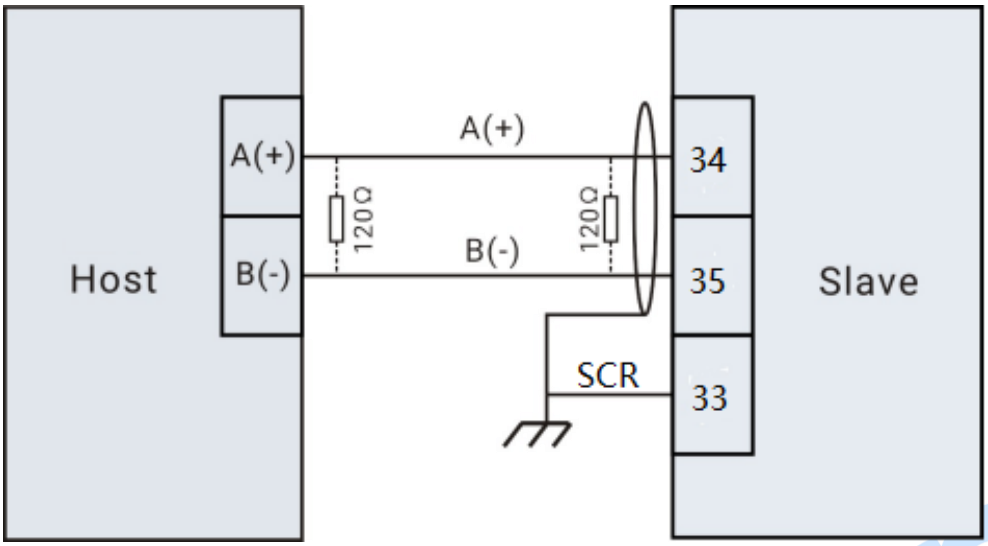

Fig.1 Single Unit Communication Wiring Diagram

NOTE1: 2 120Ω impedance resistors can be connected automatically according to site situation, details refer to the following description.

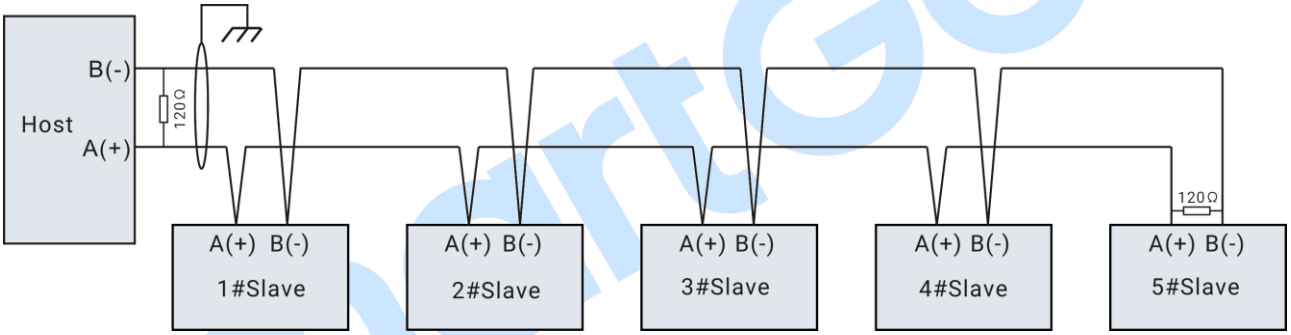

Fig.2 Multi-unit Communication Wiring Diagram

NOTE1: Please set each controller's communication module address before networking. Same module address is inhibited in the same network.

NOTE2: The shielding layer of communication line is single-end grounded on the host side.

3. CONTROLLER INTERNAL REGISTER ADDRESS AND DATA

3.1 FUNCTION CODE 03H MAPPING ALARM, STATUS COIL FIELD

Table 2 Alarm, Status Coil Data Field

Modbus Address	PLC Address	Item	Description
0000.0	40001.0	Common Alarm	0 means no common alarm occurs; 1 means there is common alarm. (0000.0 is the boolean value of bit 0 of address 000) The following contents in turn. 0 means no common alarm occurs; 1 means there is common alarm.
0000.1	40001.1	Reserved	
0000.2	40001.2	Common Warning Alarm	1 for active
0000.3	40001.3	Reserved	
0000.4	40001.4	Common Trip Alarm	1 for active
0000.5	40001.5	Reserved	
0000.6	40001.6	Reserved	
0000.7	40001.7	Reserved	
0000.8	40001.8	Reserved	
0000.9	40001.9	System in Auto Mode	1 for active
0000.10	40001.10	System in Manual Mode	1 for active
0000.11	40001.11	Reserved	
0000.12	40001.12	Reserved	
0000.13	40001.13	Reserved	
0000.14	40001.14	Reserved	
0000.15	40001.15	Reserved	
0001-0015	40002-40016	Reserved	
0016.0	40017.0	Reserved	
0016.1	40017.1	Reserved	
0016.2	40017.2	Reserved	
0016.3	40017.3	Reserved	
0016.4	40017.4	Input 1 Trip But Not Stop	1 for active
0016.5	40017.5	Input 2 Trip But Not Stop	1 for active
0016.6	40017.6	Input 3 Trip But Not Stop	1 for active
0016.7	40017.7	Input 4 Trip But Not Stop	1 for active
0016.8	40017.8	Input 5 Trip But Not Stop	1 for active
0016.9	40017.9	Input 6 Trip But Not Stop	1 for active

Modbus Address	PLC Address	Item	Description
0016.10	40017.10	Input 7 Trip But Not Stop	1 for active
0016.11	40017.11	Reserved	
0016.12	40017.12	Reserved	
0016.13	40017.13	Reserved	
0016.14	40017.14	Reserved	
0016.15	40017.15	Reserved	
0017-0018	40018-40019	Reserved	
0019.0	40020.0	Reserved	
0019.1	40020.1	Reserved	
0019.2	40020.2	Reserved	
0019.3	40020.3	MSC ID Error Trip	1 for active
0019.4	40020.4	Volt. Bus Error Trip	1 for active
0019.5	40020.5	Busbar 1 Phase Sequence Error Trip	1 for active
0019.6	40020.6	Busbar 2 Phase Sequence Error Trip	1 for active
0019.7	40020.7	Reserved	
0019.8	40020.8	Reserved	
0019.9	40020.9	Reserved	
0019.10	40020.10	Busbar Switch Failure Trip	1 for active
0019.11	40020.11	Few MSC Module Trip	1 for active
0019.12	40020.12	Reserved	
0019.13	40020.13	Reserved	
0019.14	40020.14	Reserved	
0019.15	40020.15	Sync. Failure Trip	1 for active
0020.0	40021.0	Reserved	
0020.1	40021.1	Reserved	
0020.2	40021.2	Reserved	
0020.3	40021.3	Reserved	
0020.4	40021.4	Reserved	
0020.5	40021.5	Reserved	
0020.6	40021.6	Reserved	
0020.7	40021.7	Reserved	
0020.8	40021.8	Reserved	
0020.9	40021.9	Reserved	
0020.10	40021.10	Battery Over Volt. Warn	1 for active
0020.11	40021.11	Battery Under Volt. Warn	1 for active
0020.12	40021.12	Reserved	
0020.13	40021.13	Reserved	
0020.14	40021.14	Reserved	
0020.15	40021.15	Reserved	
0021.0	40022.0	Busbar 1 Loss of Phase Warn	1 for active
0021.1	40022.1	Busbar 1 Reverse Phase	1 for active

Modbus Address	PLC Address	Item	Description
		Sequence Warn	
0021.2	40022.2	Sync. Failure Warn	1 for active
0021.3	40022.3	Reserved	
0021.4	40022.4	Reserved	
0021.5	40022.5	Reserved	
0021.6	40022.6	Reserved	
0021.7	40022.7	Busbar Switch Failure Warn	1 for active
0021.8	40022.8	Reserved	
0021.9	40022.9	Reserved	
0021.10	40022.10	Reserved	
0021.11	40022.11	Reserved	
0021.12	40022.12	Reserved	
0021.13	40022.13	Reserved	
0021.14	40022.14	Reserved	
0021.15	40022.15	Reserved	
0022-0027	40023-40028	Reserved	
0028.0	40029.0	Reserved	
0028.1	40029.1	Reserved	
0028.2	40029.2	Reserved	
0028.3	40029.3	Reserved	
0028.4	40029.4	Reserved	
0028.5	40029.5	Reserved	
0028.6	40029.6	Reserved	
0028.7	40029.7	Reserved	
0028.8	40029.8	Reserved	
0028.9	40029.9	Reserved	
0028.10	40029.10	Few MSC Module Warn	1 for active
0028.11	40029.11	Reserved	
0028.12	40029.12	Reserved	
0028.13	40029.13	Reserved	
0028.14	40029.14	Reserved	
0028.15	40029.15	Reserved	
0029.0	40030.0	Input 1 Warn	1 for active
0029.1	40030.1	Input 2 Warn	1 for active
0029.2	40030.2	Input 3 Warn	1 for active
0029.3	40030.3	Input 4 Warn	1 for active
0029.4	40030.4	Input 5 Warn	1 for active
0029.5	40030.5	Input 6 Warn	1 for active
0029.6	40030.6	Input 7 Warn	1 for active
0029.7	40030.7	Reserved	
0029.8	40030.8	Reserved	
0029.9	40030.9	Reserved	
0029.10	40030.10	Reserved	

Modbus Address	PLC Address	Item	Description
0029.11	40030.11	Reserved	
0029.12	40030.12	Reserved	
0029.13	40030.13	Reserved	
0029.14	40030.14	Reserved	
0029.15	40030.15	Reserved	
0030-0031	40031-40032	Reserved	
0032.0	40033.0	Reserved	
0032.1	40033.1	Reserved	
0032.2	40033.2	Reserved	
0032.3	40033.3	Reserved	
0032.4	40033.4	Reserved	
0032.5	40033.5	Reserved	
0032.6	40033.6	Auto Mode Input	1 for active
0032.7	40033.7	Auto Mode Inactive	1 for active
0032.8	40033.8	Reserved	
0032.9	40033.9	Reserved	
0032.10	40033.10	Reserved	
0032.11	40033.11	Reserved	
0032.12	40033.12	Reserved	
0032.13	40033.13	Reserved	
0032.14	40033.14	Reserved	
0032.15	40033.15	Reserved	
0033.0	40034.0	Input 1 Indication	1 for active
0033.1	40034.1	Input 2 Indication	1 for active
0033.2	40034.2	Input 3 Indication	1 for active
0033.3	40034.3	Input 4 Indication	1 for active
0033.4	40034.4	Input 5 Indication	1 for active
0033.5	40034.5	Input 6 Indication	1 for active
0033.6	40034.6	Input 7 Indication	1 for active
0033.7	40034.7	Reserved	
0033.8	40034.8	Reserved	
0033.9	40034.9	Reserved	
0033.10	40034.10	Reserved	
0033.11	40034.11	Reserved	
0033.12	40034.12	Reserved	
0033.13	40034.13	Reserved	
0033.14	40034.14	Reserved	
0033.15	40034.15	Reserved	
0034	40035	Reserved	
0035.0	40036.0	Reserved	
0035.1	40036.1	Input 1 Status	1 for active
0035.2	40036.2	Input 2 Status	1 for active
0035.3	40036.3	Input 3 Status	1 for active

Modbus Address	PLC Address	Item	Description
0035.4	40036.4	Input 4 Status	1 for active
0035.5	40036.5	Input 5 Status	1 for active
0035.6	40036.6	Input 6 Status	1 for active
0035.7	40036.7	Input 7 Status	1 for active
0035.8	40036.8	Reserved	
0035.9	40036.9	Reserved	
0035.10	40036.10	Reserved	
0035.11	40036.11	Reserved	
0035.12	40036.12	Reserved	
0035.13	40036.13	Reserved	
0035.14	40036.14	Reserved	
0035.15	40036.15	Reserved	
0036	40037	Reserved	
0037.0	40038.0	Reserved	
0037.1	40038.1	Reserved	
0037.2	40038.2	Aux. Output 1 Status	1 for active
0037.3	40038.3	Aux. Output 2 Status	1 for active
0037.4	40038.4	Aux. Output 3 Status	1 for active
0037.5	40038.5	Aux. Output 4 Status	1 for active
0037.6	40038.6	Aux. Output 5 Status	1 for active
0037.7	40038.7	Aux. Output 6 Status	1 for active
0037.8	40038.8	Aux. Output 7 Status	1 for active
0037.9	40038.9	Aux. Output 8 Status	1 for active
0037.10	40038.10	Reserved	
0037.11	40038.11	Reserved	
0037.12	40038.12	Reserved	
0037.13	40038.13	Reserved	
0037.14	40038.14	Reserved	
0037.15	40038.15	Reserved	
0038-0042	40039-40043	Reserved	
0043.0	40044.0	Busbar 2 Normal	1 for active
0043.1	40044.1	Busbar 2 Close	1 for active
0043.2	40044.2	Busbar 1 Normal	1 for active
0043.3	40044.3	Busbar 1 Close	1 for active
0043.4	40044.4	Running Indicator Status	1 for active
0043.5	40044.5	Alarm Mute Indicator Status	1 for active
0043.6	40044.6	Reserved	
0043.7	40044.7	Reserved	
0043.8	40044.8	Reserved	
0043.9	40044.9	Reserved	
0043.10	40044.10	Reserved	
0043.11	40044.11	Reserved	
0043.12	40044.12	Reserved	

Modbus Address	PLC Address	Item	Description
0043.13	40044.13	Reserved	
0043.14	40044.14	Reserved	
0043.15	40044.15	Reserved	
0044	40045	Reserved	
0045.0	40046.0	Input 1 Active	1 for active
0045.1	40046.1	Input 2 Active	1 for active
0045.2	40046.2	Input 3 Active	1 for active
0045.3	40046.3	Input 4 Active	1 for active
0045.4	40046.4	Input 5 Active	1 for active
0045.5	40046.5	Input 6 Active	1 for active
0045.6	40046.6	Input 7 Active	1 for active
0045.7	40046.7	Reserved	
0045.8	40046.8	Reserved	
0045.9	40046.9	Reserved	
0045.10	40046.10	Reserved	
0045.11	40046.11	Reserved	
0045.12	40046.12	Reserved	
0045.13	40046.13	Reserved	
0045.14	40046.14	Reserved	
0045.15	40046.15	Reserved	
0046	40047	Reserved	
0047	40048	Reserved	
0048	40049	Reserved	
0049	40050	Reserved	
0050	40051	Reserved	
0051	40052	Reserved	
0052	40053	Reserved	
0053	40054	Reserved	
0054	40055	Reserved	

Example:

Read “Battery Over Voltage Warn” status and “Busbar Switch Failure Warn”, firstly get their addresses are 0020.10 and 0021.7 by checking the table, then it is known that you need to read 2 addresses’ data.

Assume the slave address is 01, the master (may be computer) request command is as following:

Table 3 Master Request Command

Slave Address	Function Code	Starting Address (0020)		Request Data Qty. (2)		CRC 16 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
01	**03**	**00**	**14**	**00**	**02**	**84**	**0F**

The slave response command is as following:

Table 4 Slave Response Command

Slave Address	Function Code	Data Qty. (Bytes)	Data				CRC 16 Calibration	
			Data MSB of Address 0020	Data LSB of Address 0020	Data MSB of Address 0021	Data LSB of Address 0021	LSB	MSB
01	**03**	**04**	**04**	**00**	**00**	**80**	**FA**	**A3**

Table 5 Data Analysis

Address	Received Data (Hex)	Convert to Binary	Data Signification
0020	0400H	0000 0100 0000 0000 (correspond to 0003.15, 0003.14…….0003.1, 0003.0)	Data of bit 10 is 1 indicates that battery overvoltage warn is active.
0021	0080H	0000 0000 1000 0000 (correspond to 0004.15 , 0004.14…….0004.1 , 0004.0)	Data of bit 7 is 1 indicates that busbar switch failure warn is active.

3.2 VALUE DATA FIELD CORRESPONDING TO FUNCTION CODE 03H, 06H

06H function code is only available for 0025-0231, other addresses are unavailable.

Table 6 Value Data Field

Modbus Address	PLC Address	Name	Range (Decimal)）	Ratio	Unit	Description	Remark
0055	40056	Busbar 2UAB	0~32767	1	V	16-bit Signed	
0056	40057	Busbar 2UBC	0~32767	1	V	16-bit Signed	
0057	40058	Busbar 2UCA	0~32767	1	V	16-bit Signed	
0058	40059	Busbar 2UA	0~32767	1	V	16-bit Signed	
0059	40060	Busbar 2UB	0~32767	1	V	16-bit Signed	
0060	40061	Busbar 2UC	0~32767	1	V	16-bit Signed	
0061	40062	Busbar 2UA Phase	0~360.0	0.1	°	16-bit Signed	
0062	40063	Busbar 2UB Phase	0~360.0	0.1	°	16-bit Signed	
0063	40064	Busbar 2UC Phase	0~360.0	0.1	°	16-bit Signed	
0064	40065	Busbar 2 Frequency	0~100.00	0.01	Hz	16-bit Signed	
0065	40066	Reserved					
0066	40067	Reserved					
0067	40068	Target Frequency	0~100.00	0.01	Hz	16-bit Signed	
0068	40069	Reserved					
0069	40070	Target Voltage	0~32767	1	V	16-bit Signed	
0070	40071	Reserved					
0071	40072	MSC2 kWh	-2,147,483,648~2,147,483,647	0.1	kW	32-bit Signed	
0072	40073						
0073	40074	MSC2 kVarh	-2,147,483,648~2,147,483,647	0.1	kvar	32-bit Signed	
0074	40075						
0075	40076	Busbar 1UAB	0~32767	1	V	16-bit Signed	
0076	40077	Busbar 1UBC	0~32767	1	V	16-bit Signed	
0077	40078	Busbar 1UCA	0~32767	1	V	16-bit Signed	
0078	40079	Busbar 1UA	0~32767	1	V	16-bit Signed	
0079	40080	Busbar 1UB	0~32767	1	V	16-bit Signed	
0080	40081	Busbar 1UC	0~32767	1	V	16-bit Signed	
0081	40082	Busbar 1UA Phase	0~360.0	0.1	°	16-bit Signed	
0082	40083	Busbar 1UB Phase	0~360.0	0.1	°	16-bit Signed	
0083	40084	Busbar 1UC Phase	0~360.0	0.1	°	16-bit Signed	

Modbus Address	PLC Address	Name	Range (Decimal)）	Ratio	Unit	Description	Remark
0084	40085	Busbar 1 Frequency	0~100.00	0.01	Hz	16-bit Signed	
0085	40086	Voltage Difference	-32768~32767	1	V	16-bit Signed	
0086	40087	Frequency Difference	0~100.00	0.01	Hz	16-bit Signed	
0087	40088	Phase Difference	0~360.0	0.1	°	16-bit Signed	
0088	40089	Current kWh Percentage MSC1	-3276.8~3276.7	0.1	kW	16-bit Signed	
0089	40090	Target kWh Percentage MSC1	0~3276.7	0.1	%	16-bit Signed	
0090	40091	Current kVarh Percentage MSC1	-3276.8~3276.7	0.1	kvar	16-bit Signed	
0091	40092	Target kVarh Percentage MSC1	0~3276.7	0.1	%	16-bit Signed	
0092-0136	40093-40137	Reserved					
0137	40138	Current kWh Percentage MSC2	-3276.8~3276.7	0.1	kW	16-bit Signed	
0138	40139	Target kWh Percentage MSC2	0~3276.7	0.1	%	16-bit Signed	
0139	40140	Current kVarh Percentage MSC2	-3276.8~3276.7	0.1	kvar	16-bit Signed	
0140	40141	Target kVarh Percentage MSC2	0~3276.7	0.1	%	16-bit Signed	
0141	40142	Reserved					
0142	40143	Battery Voltage	0~65535	0.1	V	16-bit Signed	
0143-0188	40144-40189	Reserved					
0189	40190	Busbar Status		No.		Bus Status Table	
0190	40191	Busbar Delay Value		1	s	16-bit Unsigned	
0191	40192	Reserved					

Modbus Address	PLC Address	Name	Range (Decimal)）	Ratio	Unit	Description	Remark
0192	40193	Reserved					
0193	40194	Busbar Switch Status		No.		Switch Status Table	
0194	40195	Busbar Switch Delay Value		1	s	16-bit Unsigned	
0195	40196	Reserved					
0196	40197	Reserved					
0197	40198	Reserved					
0198	40199	Reserved					
0199	40200	Reserved					
0200	40201	Reserved					
0201	40202	Reserved					
0202	40203	Reserved					
0203	40204	Reserved					
0204	40205	Reserved					
0205	40206	Reserved					
0206	40207	Reserved					
0207	40208	Reserved					
0208	40209	Reserved					
0209	40210	Reserved					
0210	40211	Reserved					
0211	40212	Reserved					
0212	40213	Reserved					
0213	40214	Reserved					
0214	40215	MSC1 kVarh	-2,147,483,648~2,147,483,647	0.1	kvar	32-bit Signed	
0215	40216						
0216	40217	Reserved					
0217	40218	Controller Model				16-bit Unsigned	
0218	40219	Controller Software Version		0.1		16-bit Unsigned	
0219	40220	Controller Hardware Version		0.1		16-bit Unsigned	
0220	40221	Release Year	0~99	1	Year	16-bit Unsigned	
0221	40222	Release Month	1~12	1	Month	16-bit Unsigned	
0222	40223	Release Day	1~31	1	Day	16-bit Unsigned	
0223	40224	Reserved					
0224	40225	Reserved					
0225	40226	Controller Time: Year	0~99	1	Year	16-bit Unsigned	

Modbus Address	PLC Address	Name	Range (Decimal)）	Ratio	Unit	Description	Remark
0226	40227	Controller Time: Month	1~12	1	Month	16-bit Unsigned	
0227	40228	Controller Time: Day	1~31	1	Day	16-bit Unsigned	
0228	40229	Controller Time: Week	0~6	1	Week	16-bit Unsigned	0: Sun 1~6: Mon.~Sat.
0229	40230	Controller Time: Hour	0~23	1	h	16-bit Unsigned	
0230	40231	Controller Time: Min	0~59	1	min	16-bit Unsigned	
0231	40232	Controller Time: S	0~59	1	s	16-bit Unsigned	
0232	40233	Module MSC ID	0~31			16-bit Unsigned	
0233	40234	Module Priority	0~31			16-bit Unsigned	
0234	40235	Total Modules MSC1	1~245			16-bit Unsigned	
0235	40236	MSC1 kWh	-2,147,483,648~2,147,483,647	0.1	kW	32-bit Signed	
0236	40237						
0237	40238	Total Modules MSC2	1~245			16-bit Unsigned	
0238-0281	40239-40282	Reserved					
0282	40283	9560 Total Modules MSC1				16-bit Unsigned	
0283	40284	9560 Total Modules MSC2				16-bit Unsigned	
0284	40285	Reserved					
0285	40286	MSC1 Rated kWh				16-bit Signed	
0286	40287	MSC1 Rated kVarh				16-bit Signed	
0287	40288	MSC2 Rated kWh				16-bit Signed	
0288	40289	MSC2 Rated kVarh				16-bit Signed	
0289	40290	Reserved					

NOTE1: Actual value=received data*ratio. Take the frequency as the example, if received data is 5000(1388H), ratio is 0.01Hz, then actual frequency value is 50.00Hz(5000*0.01Hz).

NOTE2: For 4-byte data, actual value=received data*65536+receied data LSB.

NOTE3: When received data is 32766, it means no normal data, "###" will be displayed.

NOTE4: Definition of signed number. Take received data 8000H as the example, transfer it to binary 1000 0000 0000

0000b, the MSB is 1, which is a negative number. One's complement is obtained by subtracting 1 from it, which is inverted to obtain the absolute value of the negative number. Then transfer it to -32768 in decimal.

Example:

Read "MSC1 kWh (Current is 123456)", firstly get its addresses are 0235 and 0236 by checking the table, then it is known that 2-byte data needs to be read.

Assume the slave address is 01, the master request command is as following:

Table 7 Master Request Command

Slave Address	Function Code	Starting Address (0235)		Request Data Qty. (2)		CRC 16 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
01	**03**	**00**	**EB**	**00**	**02**	**B4**	**3F**

The slave response command is as following:

Table 8 Slave Response Command

Slave Address	Function Code	Data Qty. (Bytes)	Data				CRC 16 Calibration	
			Data MSB of Address 0235	Data LSB of Address 0235	Data MSB of Address 0236	Data LSB of Address 0236	LSB	MSB
01	**03**	**04**	**E2**	**40**	**00**	**01**	**0C**	**5F**

Fill the received data into the corresponding address, as shown in the table below:

Table 9 Data Analysis

Address	Received Data (Hex)	After Combination (Hex)	MSC1 kWh (Decimal)
0235	E240H	0001E240H	123456
0236	0001H		

3.3 FUNCTION CODE 05H MAPPING REMOTE COIL FIELD

Table 10 Remote Coil Field

Modbus Address	PLC Address	Item	Description
0000	0001	Reserved	
0001	0002	Remote Alarm Reset Key	Only send FF00H for active
0002	0003	Remote Test	Only send FF00H for active
0003	0004	Remote Auto Key	Only send FF00H for active
0004	0005	Remote Manual Key	Only send FF00H for active
0005	0006	Remote Busbar Open Key	Only send FF00H for active
0006	0007	Remote Busbar Close Key	Only send FF00H for active
0007	0008	Remote Up Key	Only send FF00H for active
0008	0009	Remote Down Key	Only send FF00H for active
0009	0010	Remote Left Key	Only send FF00H for active
0010	0011	Remote Right Key	Only send FF00H for active
0011	0012	Remote Confirm Key	Only send FF00H for active
0012	0013	Remote Mute Key	Only send FF00H for active

Modbus Address	PLC Address	Item	Description
0013	0014	Reserved	
0014	0015	Reserved	
0015	0016	Reserved	
0016	0017	Reserved	
0017	0018	Reserved	
0018	0019	Reserved	
0019	0020	Reserved	
0020	0021	Remote Output 1 Output	Send FF00H for active, while send 0000H for inactive.
0021	0022	Remote Output 2 Output	Send FF00H for active, while send 0000H for inactive.
0022	0023	Remote Output 3 Output	Send FF00H for active, while send 0000H for inactive.
0023	0024	Remote Output 4 Output	Send FF00H for active, while send 0000H for inactive.
0024	0025	Remote Output 5 Output	Send FF00H for active, while send 0000H for inactive.
0025	0026	Remote Output 6 Output	Send FF00H for active, while send 0000H for inactive.
0026	0027	Remote Output 7 Output	Send FF00H for active, while send 0000H for inactive.
0027	0028	Remote Output 8 Output	Send FF00H for active, while send 0000H for inactive.
0028	0029	Reserved	

NOTE1: The above remote command only can be sent once only.

NOTE1: 05 function code uses Modbus address for communication: sending FF00H to make corresponding bit be 1; uses PLC address for communication: sending 1 to make corresponding bit be 1, while sending 0 to make corresponding bit be 0.

Example:

Remote control the manual key, its remote address 0004 can be obtained by checking the table. Assume the slave address is 01, the master request command is as following:

Table 11 Master Request Command

Slave Address	Function Code	Remote Address (0004)		Remote Data		CRC 16 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
01	**05**	**00**	**04**	**FF**	**00**	**CD**	**FB**

The slave response command is as following:

Table 12 Slave Response Command

Slave Address	Function Code	Remote Address (0004)		Remote Data		CRC 16 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
01	**05**	**00**	**04**	**FF**	**00**	**CD**	**FB**

3.4 ERROR HANDLING

When the device detects other errors except the CRC code, the slave must send information to the master. The function code MSB is 1, which means the response function code by slave should add 128 based on the function code. The following codes show that unexpected errors have occurred.

CRC error received from the master will be ignored by the device.

Table 13 Error Code Format Responded by Slave (CRC excluded)

Type	Byte
Address code	1 byte
Function code	1 byte (MSB is 1)
Error code	1 byte
CRC code	2 bytes

Error code:

01 illegal function code

The function code received in the query is not an allowable action for the slave.

02 illegal data address

The data address received in the query is not an allowable address for the slave.

03 illegal data value

A value contained in the query data field is not an allowable value for the slave.

3.5 ERROR CHECK CODE (CRC)

By Error Check Code the master or slave can detect whether the receiving information is right or not. Sometimes, due to electronic noise or other interference, the information may change in the transmission process and CRC code ensures the error information does not work in the transmission process. It increases the system's safety and efficiency. CRC code adopts CRC-16 calibration method.

CRC code of 2 bytes is front low byte and behind high byte.

NOTE: All information frame formats are the same: address code, function code, data field and CRC.

Cyclic Redundancy Check (CRC) contains two bytes. That is a 16-bit binary value. The CRC code is calculated by the transmitting device, and placed at the end of the transmitted information. The receiving device recalculates the CRC code of the receiving information. If the two values are different, then something goes wrong.

CRC code computing method is: first put the 16-bit register all to “1”; and then handle the 8-bit data information each gradually. In the process of computing the CRC code only 8 data bit is used and he start bit and stop bit are not included in it.

In the process of computing the CRC code, each 8–bit data is exclusive OR with the register data; and the result obtained moves 1 bit to the least significant bit (LSB), then use 0 to make up for the most significant bit (MSB). Then the LSB is examined. If the LSB was 1, the register content is then exclusive OR with a preset fixed value. If the LSB was 0, no exclusive OR takes place.

This process is repeated until eight shifts have been performed. After the last (eighth) shift, the next 8-bit byte is exclusive OR with the register’s current value, and the process repeats for eight times as described above. The final contents of the register, after all the bytes of the message have been applied, is the CRC value.

CRC-16 Code Calculation Procedure:

1) Make 16-bit CRC register as hexadecimal FFFF;
2) Make the first 8-bit byte exclusive ORed with the low–order byte of the CRC register, and put the result in the CRC register;
3) Shift the CRC register one bit to the right, with a zero filled into the MSB. The LSB is extracted and examined.
4) If the LSB was 0: Repeat Step 3 (another shift).
   If the LSB was 1: CRC register exclusive ORed with the A001 hexadecimal;
5) Repeat Step 3 and 4 until 8 shifts have been performed. In this way eight shifts have been performed;
6) Repeat Step 2 to 5 and perform the next data handling process;
7) The final contents of the CRC register are the CRC value. When the CRC is appended to the message, the low-order Least Significant Byte first. When the 16-bit CRC (two 8-bit bytes) is transmitted in the message, the low-order byte will be transmitted first, followed by the high-order byte.

NOTE: The calculation of CRC code starts from <slave address>, exclusive of all bytes of <CRC code>.

3.6 BUSBAR STATUS

Table 14 Busbar Status

No.	Item	Description
0	At rest	No delay value for this status
1	Reserved	
2	Running	No delay value for this status

3.7 SWITCH STATUS

Table 15 Switch Status

No.	Item	Description
0	Synchronizing	No delay value for this status
1	Close Delay	
2	Wait for Closing	No delay value for this status
3	Closed	No delay value for this status
4	Unloading	No delay value for this status
5	Open Delay	
6	Wait for Opening	No delay value for this status
7	Opened	No delay value for this status

4. COMMUNICATION PARAMETER VIEWING AND CONFIGURATION

1) In the homepage of main interface, press Enter key to enter menu interface;
2) Press Down key to select “Parameter Setting”, then press Enter key to enter parameter password interface;
3) Input correct password (default 0318), press Enter key to enter the main interface of parameter;
4) Select “Controller Address” via , key, Press Enter key to enter parameter edit function, corresponding parameters will be in the selected status;
5) Set the current selected content via , key, then press Enter key to confirm, after editing, then the selected status will disappear;
6) Long press Esc key to return the main interface.

NOTE: After parameter setting is completed, the configuration takes effect.

5. FAQ

5.1 COMMUNICATION LINE SHIELDING LAYER GROUNDED

In order to prevent coupled interference signal on communication line, its single end needs to be grounded.

5.2 TERMINAL RESISTOR

At both ends of the linear network (on the two communication ports furthest apart), it is necessary to connect 120Ω terminal resistor in parallel on a pair of communication lines. According to the transmission line theory, the terminal resistor can absorb reflected waves on the network, effectively enhancing the signal strength. The value of two terminal resistors in parallel should be approximately equal to the characteristic impedance of the transmission line at the communication frequency.

A regular RS485 network usually uses terminal resistor. It can also be not used in the case of network connection line is very short, temporary or laboratory test.

5.3 RS485 TO USB COMMUNICATION ADAPTOR

PC can communicate with SG72A module produced by our company.

5.4 EXTENDED COMMUNICATION DISTANCE

Long distance (up to 10km) communication can be realized by a pair of SGCAN300 fiber optical relay modules.

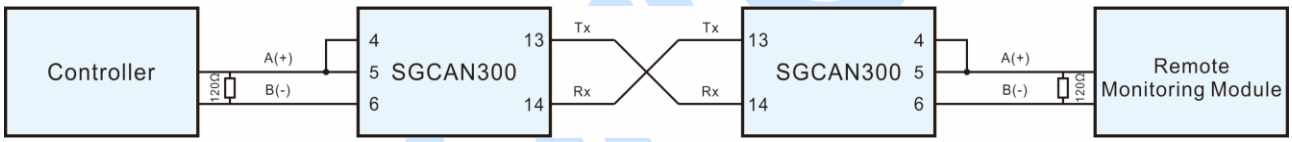

Fig.3 SGCAN300 Application Diagram

5.5 COMMON SOLUTIONS OF COMMUNICATION FAILURE

1) Check whether the positive and negative of RS485 or network cable is correctly connected; check whether the RS485 converter (if configured) is normal;
2) Check whether the terminal resistor is correctly connected;
3) Check whether the communication parameter in parameter setting is correct, for example, baud rate, data bit, parity bit and stop bit must meet the controller requirements;
4) Check whether the COM port corresponds to USB port where the RS485 converter is connected to the computer;
5) Check whether the controller communication address is correct, which is defaulted as 01;
6) When using 03 function code, note that the maximum length of data read each time is 120 addresses, and the last address read cannot exceed the maximum Modbus communication address; note that only one address data can be written for 06 function code mapping value data;
7) If there is offset address in Modbus communication address, the original base address plus the offset address is required to be the correct Modbus communication address for the item;
8) Modbus communication for 05 function code: although 1 for active and 0 for inactive, FF00H must be sent to make the corresponding bit be 1 and 0000H to make the corresponding bit be 0. PLC communication: Send 1 to position 1, send 0 to position 0;

9) Check whether CRC-16 low-order byte is in front, and high-order byte is in the back;
10) Do not read controller data too quickly for multiple times. It is recommended that the interval be more than 500ms;
11) Please set each controller's communication module address before networking. Same module address is inhibited in the same network;
12) Because Modbus serial port does not support multiple masters, multiple software cannot communicate with controller at the same time;
13) Disconnect the connection line of controller's RS485, measure the voltage difference of RS485's A and B terminal. If the difference is between ±200mV, it means communication port has abnormal situation;
14) If signal is weak caused by too long communication distance, you can replace the cable with a better quality or add a relay in the middle of communication cable;
15) It is recommended to download third-party communication software such as modscan32, modbus poll to check whether communication is normal.