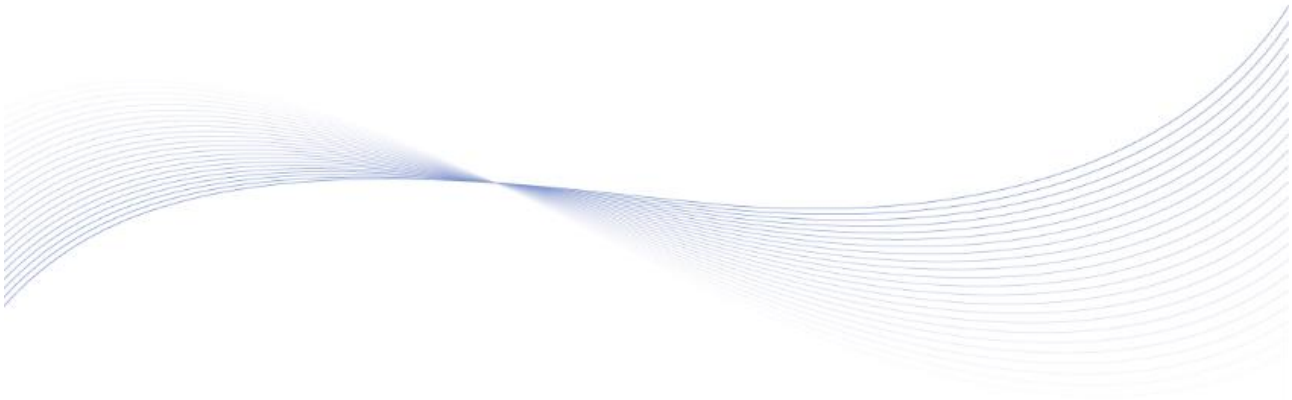
SmartGen

MAKING CONTROL SMARTER

PCC95

POWER CONVERSION SYSTEM (PCS) CONTROLLER

COMMUNICATION PROTOCOL



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CONTENT

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Table 1 Software Version

Date	Version	Content
2024-05-09	V1.0	Original release.

1 DESCRIPTION

This protocol describes the controller RS485 and RJ45 ports' read and write command format, and the definition of internal message & data for the third-party to develop and use.

1.1 PHYSICAL LAYER

The PCC95 PCS controller has two RS485 ports and one RJ45 port, and the RS485 ports follow the same protocol. The RS485 port follows the Modbus-RTU communication format, and the RJ45 network port follows the Modbus-TCP/UDP communication format.

1.1.1 RS485 PORTS

The controller works as a slave module, and uses Modbus-RTU protocol, but it doesn't support other protocols, such as Modbus-ASCII, etc.

Frame format:

Communication address: 1~254 (Default: 1)

Baud rate: 9600bps

Start bit: 1 bit

Data bit: 8 bits

Parity bit: no parity, odd parity and even parity (Default: no parity)

Stop bit: 1 bit or 2 bits

The register data inside the controller are packed as two bytes per register.

Communication timeout period: over 200ms.

Transmission distance: At a baud rate of 9600bps, the maximum transmission distance can reach up to 1,000 meters with 120-ohm shielded twisted pair cable.

A maximum of 120 registers can be read per request.

It can support the communication of 32 networked controllers.

RS485 cabling must use 120-ohm shielded twisted pair cable, and one end of the shield should be grounded.

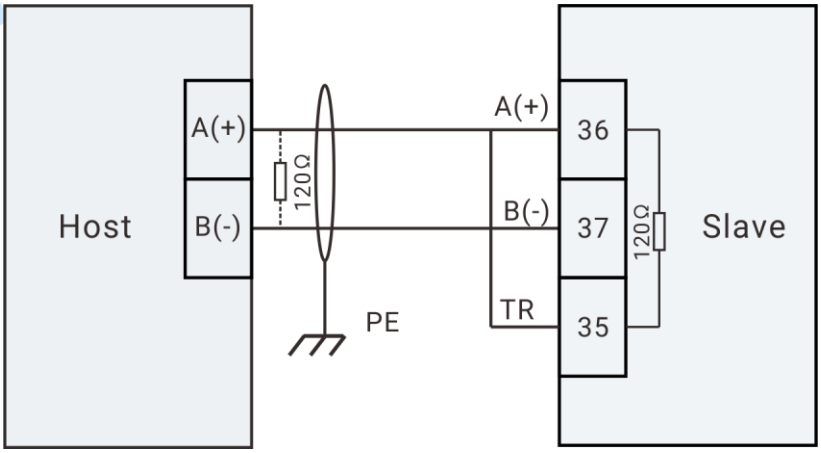

Fig.1 Single Device Communication Wiring Diagram

NOTE 1: The 120-ohm termination resistor can be connected according to the site's requirement. There is a TR terminal on the controller, which integrates a 120-ohm resistor inside. Short the Terminal 36 and Terminal 35 to connect with the 120-ohm resistor.

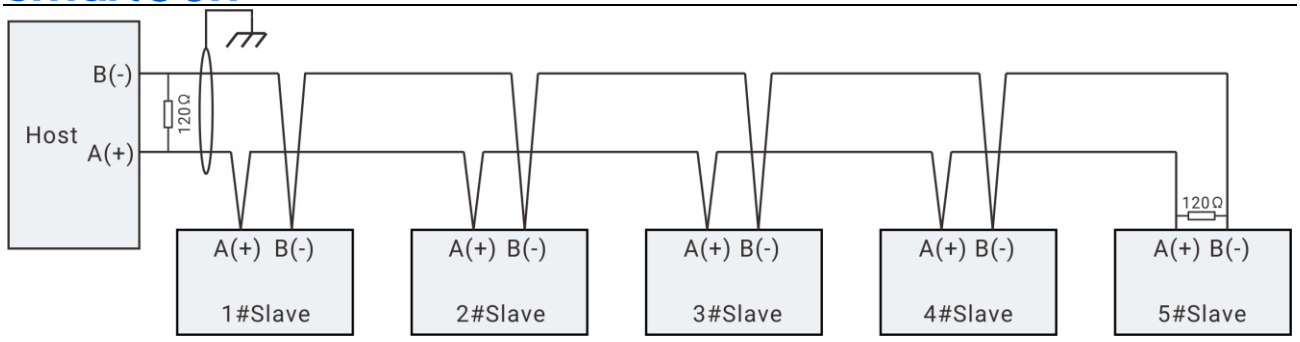

Fig.2 Multiple Devices Communication Wiring Diagram

NOTE 1: Please configure each controller's communication module address before networking. Same module address is not allowed in one network.

NOTE 2: One end of the communication cable shield should be grounded at the host side.

NOTE 3: If the RS485 port is used for PCS or BMS communication, the RS485 port of controller works as the host, and it doesn't support remote monitoring function.

1.1.2 ETHERNET PORT

As the network server, the controller adopts ModBus-TCP/UDP communication protocol, integrates switch functions internally, and supports device-level ring network redundancy.

Communication rate: 10M/100M (Adaptive)

Port: 502

Transmission distance: Point-to-point Ethernet cable shall not exceed 100 meters

Communication cable specifications: It must meet or exceed the SF/UTP CAT5e standard, and crossover or straight through RJ45 cable (T568A, T568B) can be used.

The wiring method is as follows:

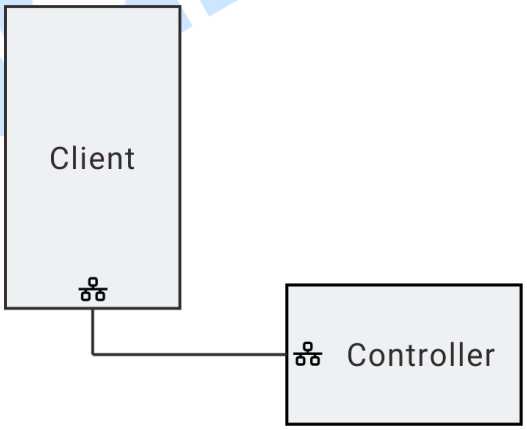

Fig.3 Single Device Communication Wiring Diagram

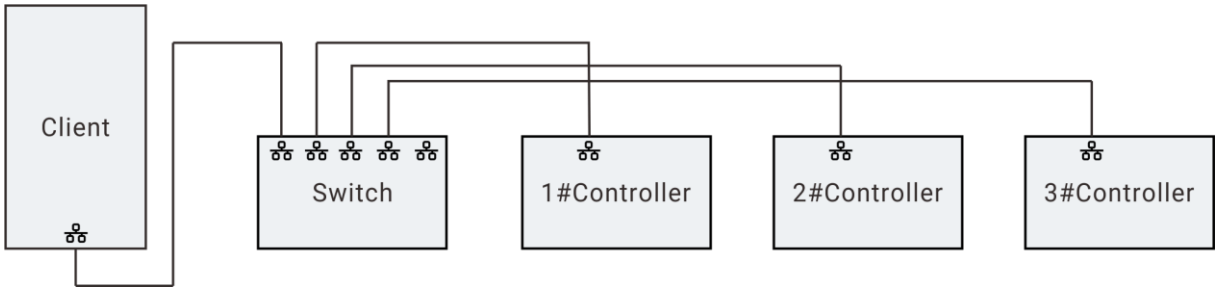

Fig.4 Multiple Devices Communication Wiring Diagram

1.2 DATA LINK LAYER

The Modbus common frame format is as follows:

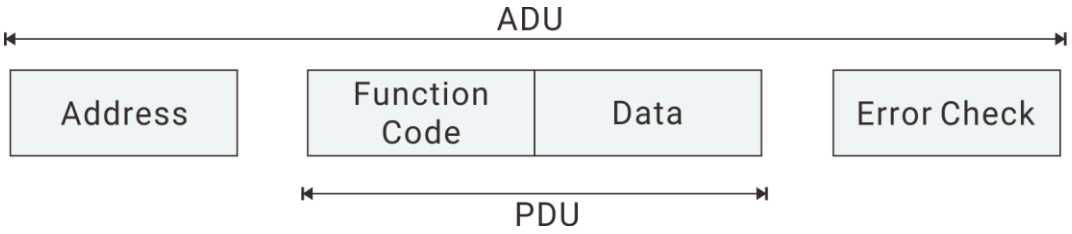

Fig.5 Modbus Common Frame Format

1.2.1 MODBUS-RTU

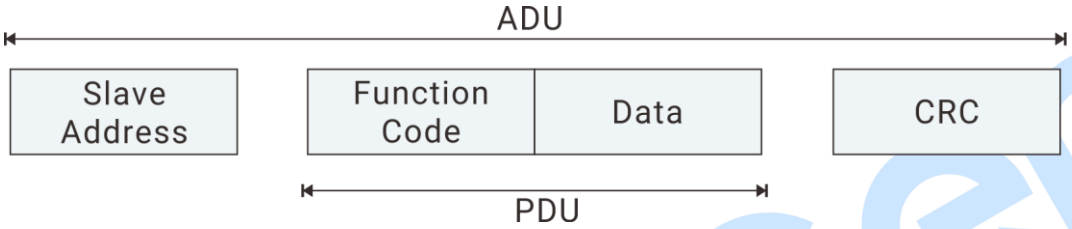

Fig.6 Modbus-RTU Common Frame Format

The ADU length spans 256 bytes based on the serial bus, which consists of:

Slave address: 1 byte

PDU: 253 bytes

CRC: 2 bytes

As shown in serial communication, Modbus-RTU mode is commonly used, and the slave address range is assigned as follows:

Table 2 Communication Address Assignment

Broadcast Address	Slave Node Address	Reserved
0	1~254	255

The reserved address is a backup.

The CRC error check code is calculated as follows:

The CRC code allows the master or slave to check if the frame or packet has errors. Sometimes, the message occur imperceptible changes due to electronic noise and other interference when transmitted, and the error check code ensures the error information does not work during the transmission process, which increases the system's reliability and efficiency. Error check code adopts CRC-16 method.

The CRC code contains two bytes, and the low-order byte is appended first, followed by the high-order byte.

NOTE: All message frame format is same: address code, function code, data field and CRC code.

The CRC code contains two bytes, which is a 16-bit binary value. The CRC code is calculated by the transmitting device, and follows the entire data/message. The receiving device recalculates the CRC code of the message received, and compares the recalculated value to the actual value it received. If the two values are not equal, an error occurs.

The calculation method of CRC code is started by first preloading a 16-bit register to all 1's. Then it begins to process successive 8–bit bytes of the message. Only the eight bits of data in each character are used for generating the CRC code. Start and stop bits do not apply to the CRC code.

During generation of the CRC code, each 8-bit character is exclusive OR with the register contents. Then the result is shifted in the direction of the least significant bit (LSB), with a zero filled into the most significant bit (MSB) position. The LSB is extracted and examined. If the LSB was 1, the register 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 more shifts as described above. The final contents of the register, after all the bytes of the message have been applied, is the value of CRC code.

CRC-16 CALCULATION PROCEDURE:

——Load a 16-bit register with FFFF hex (all 1's). Call this the CRC register;

——Exclusive OR the first 8-bit byte of the message with the LSB of the CRC register, putting the result in the CRC register;

——Shift the CRC register one bit to the right (toward the LSB), zero–filling the MSB. Extract and examine the LSB;

——If the LSB was 0: Repeat Step 3 (another shift);

——If the LSB was 1: Exclusive OR the CRC register with the A001 hex;

——Repeat Step 3 and Step 4 until 8 shifts have been performed. When this is done, a complete 8–bit byte has been processed;

——Repeat Step 2 to Step 5 for the next 8–bit byte of the message. Continue repeating this procedure until all bytes have been processed;

——The final contents of the CRC register are the CRC value. 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 calculating of CRC code starts from ＜slave address＞ and except for all bytes of <CRC code>.

1.2.2 MODBUS-TCP/UDP

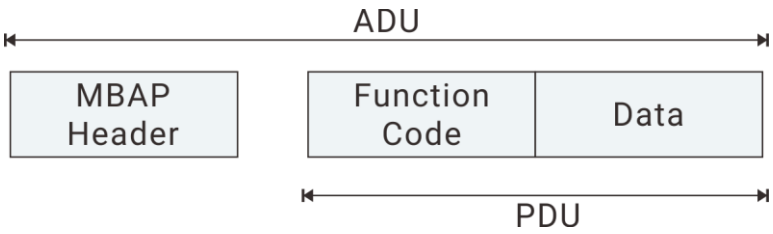

Fig.7 Modbus-TCP/UDP Common Frame Format

The recommended standard frame length is 260 bytes. When some extended functions are applied, the data service provider can expand the ADU to an appropriate length according to its own resources to improve the network transmission efficiency. The actual ADU length is included in the length field of MBAP header.

Modbus over TCP/IP will adopt a dedicated MBAP header (Modbus Application Protocol Header) to identify the Modbus Application Data Unit (ADU). The MBAP header is divided into 4 fields, with a total of 7 bytes, and defined as follows:

Table 3 Definition of MBAP Header

Fields	Length (Byte)	DESCRIPTION	Client	Server
Transaction Identifier	2	Identification of a Request/Response transaction	Initialized by the client, and it is recommended that the transaction identifier for each data request frame be different	The identifier of the server response frame must be consistent with the request frame
Protocol Identifier	2	0 = MODBUS protocol	Initialized by the client, default is 0	The identifier of the server response frame must be consistent with the request frame
Data Length	2	Length of following data	Initialized by the client according to the actual frame	Initialized by the server according to the actual frame length
Unit ID	1	0	Initialized by the client according to the actual request	The identifier of the server response frame must be consistent with the request frame

1.3 APPLICATION LAYER

1.3.1 FUNCTION CODES

Function codes supported: 03H, 05H, 06H. Function code 03H is used for reading the numeric registers inside the controller; Function code 05H is used for saving the single digital data into the bit memory inside the controller and sending the remote command. Function code 06H is used for saving a single value data into the memory inside the controller.

Error checking method: CRC16.

The register data inside the controller are packed as two bytes per register.

When the communication command is sent to the device, the device that matches the corresponding address code will receive the communication command. It removes the address code, reads the message, performs the corresponding task if there is no error, and then returns the execution result to the sender. The message returned includes the address code, the function code of the action, the data after the action, and the error check code (CRC). If an error occurs, no message will be sent.

1.3.2 ERROR HANDLING

When the device detects an error (exclude CRC error), it must return message to the master/host, and the MSB of the function code is 1, that is, the function code returned by the slave device is the function code sent by the master plus 128 (0x80). The following codes indicate that an exception error has occurred.

The message received from the master/host will be ignored by the device if there is a CRC error.

Table 4 Slave Response Error Code (exclude CRC)

Item	DESCRIPTION
Address	1 byte
FUNCTION CODES	1 byte (the MSB is 1)
Error Code	1 byte
CRC Code	2 bytes

Exception Function Code

01 Illegal Function Code

The function code received is not supported

02 Illegal Data Address

The specified address exceeds the range of the slave address

03 Illegal Data Value

The data value received from the master is outside the data range of the corresponding address.

2 CONTROLLER INTERNAL REGISTER ADDRESS AND DATA

2.1 FUNCTION CODE 03H MAPPING COIL FIELD

Table 5 Alarm and Status Coil of Data Field

Modbus Address	PLC Address	Item	Description	Bytes
0000.0	40001.0	Common Alarm	"0" means there is no common alarm "1" means there are common alarms (0000.0 means the Boolean value of bit 0 at address 0000) The content listed below follows the same rule	1bit (LSB 0)
0000.1	40001.1	Common Shutdown	1 as active	1bit
0000.2	40001.2	Common Warning	1 as active	1bit
0000.3	40001.3	Common Trip and Stop	1 as active	1bit
0000.4	40001.4	Common Trip	1 as active	1bit
0000.5	40001.5	Reserved		1bit
0000.6	40001.6	Reserved		1bit
0000.7	40001.7	Common Block	1 as active	1bit
0000.8	40001.8	In Test Mode	1 as active	1bit
0000.9	40001.9	In Auto Mode	1 as active	1bit
0000.10	40001.10	In Manual Mode	1 as active	1bit
0000.11	40001.11	In Stop Mode	1 as active	1bit
0000.12	40001.12	Reserved		1bit
0000.13	40001.13	Reserved		1bit
0000.14	40001.14	Reserved		1bit
0000.15	40001.15	Reserved		1bit
0001-0015	40002-40016	Shutdown Alarms	See details in Alarms Data List	30Bytes
0016-0030	40017-40031	Trip and Stop Alarms		30Bytes
0031-0045	40032-40046	Trip Alarms		30Bytes
0046-0060	40047-40061	Reserved		30Bytes
0061-0075	40062-40076	Reserved		30Bytes
0076-0090	40077-40091	Block Alarms		30Bytes
0091-0105	40092-40106	Warning Alarms		30Bytes
0106.0	40107.0	Emergency Input Status	1 as active	1bit
0106.1	40107.1	Aux. Input 1 Status	1 as active	1bit
0106.2	40107.2	Aux. Input 2 Status	1 as active	1bit
0106.3	40107.3	Aux. Input 3 Status	1 as active	1bit
0106.4	40107.4	Aux. Input 4 Status	1 as active	1bit
0106.5	40107.5	Aux. Input 5 Status	1 as active	1bit
0106.6	40107.6	Aux. Input 6 Status	1 as active	1bit

Modbus Address	PLC Address	Item	Description	Bytes
0106.7	40107.7	Aux. Input 7 Status	1 as active	1bit
0106.8	40107.8	Aux. Input 8 Status	1 as active	1bit
0106.9	40107.9	Aux. Input 9 Status	1 as active	1bit
0106.10	40107.10	Aux. Input 10 Status	1 as active	1bit
0106.11	40107.11	Reserved		1bit
0106.12	40107.12	Reserved		1bit
0106.13	40107.13	Reserved		1bit
0106.14	40107.14	Reserved		1bit
0106.15	40107.15	Reserved		1bit
0107	40108	Reserved		2Bytes
0108.0	40109.0	Aux. Output 1 Status	1 as active	1bit
0108.1	40109.1	Aux. Output 2 Status	1 as active	1bit
0108.2	40109.2	Aux. Output 3 Status	1 as active	1bit
0108.3	40109.3	Aux. Output 4 Status	1 as active	1bit
0108.4	40109.4	Aux. Output 5 Status	1 as active	1bit
0108.5	40109.5	Aux. Output 6 Status	1 as active	1bit
0108.6	40109.6	Aux. Output 7 Status	1 as active	1bit
0108.7	40109.7	Aux. Output 8 Status	1 as active	1bit
0108.8	40109.8	Aux. Output 9 Status	1 as active	1bit
0108.9	40109.9	Aux. Output 10 Status	1 as active	1bit
0108.10	40109.10	Reserved		1bit
0108.11	40109.11	Reserved		1bit
0108.12	40109.12	Reserved		1bit
0108.13	40109.13	Reserved		1bit
0108.14	40109.14	Reserved		1bit
0108.15	40109.15	Reserved		1bit
0109	40110	Reserved		2Bytes
0110	40111	Reserved		2Bytes
0111	40112	Reserved		2Bytes
0112	40113	Reserved		2Bytes
0113	40114	Reserved		2Bytes
0114.0	40115.0	Reserved		1bit
0114.1	40115.1	Reserved		1bit
0114.2	40115.2	PCS Normal	1 as active	1bit
0114.3	40115.3	PCS Close	1 as active	1bit
0114.4	40115.4	Reserved		1bit
0114.5	40115.5	Reserved		1bit
0114.6	40115.6	Reserved		1bit
0114.7	40115.7	Reserved		1bit
0114.8	40115.8	Reserved		1bit
0114.9	40115.9	Reserved		1bit
0114.10	40115.10	Reserved		1bit
0114.11	40115.11	Reserved		1bit

Modbus Address	PLC Address	Item	Description	Bytes
0114.12	40115.12	Reserved		1bit
0114.13	40115.13	Reserved		1bit
0114.14	40115.14	Reserved		1bit
0114.15	40115.15	Reserved		1bit

EXAMPLE:

If the status of “In Manual Mode” needs to be read, check the table above and find its coil address is 0000.10, so it needs to read one data address.

Assuming the slave (controller) address is 01, the master/host (could be PC) request command is as following:

Table 6 Master (PC) Request Frame

Slave Address	Function Code	Start Address (0000)		Request Data Length (1)		CRC 16	
		MSB	LSB	MSB	LSB	LSB	MSB
01	**03**	**00**	**00**	**00**	**01**	**84**	**0A**

Table 7 Master (PC) Request Frame via Ethernet

MBAP Header							Function Code	Data			
Transaction ID		Protocol ID		Data Length		Unit ID		Start Address (0000)		Request Data Length (1)	
								MSB	LSB	MSB	LSB
00	**01**	**00**	**00**	**00**	**06**	**01**	**03**	**00**	**00**	**00**	**01**

The slave response is as following:

Table 8 Slave (Controller) Response Frame

Slave Address	Function Code	Data Length (Bytes)	Data		CRC 16	
			Data of Address 0000 MSB	Data of Address 0000 LSB	LSB	MSB
01	**03**	**02**	**84**	**07**	**9A**	**86**

Table 9 Server (Controller) Response Frame via Ethernet

MBAP Header							Function Code	Data		
								Data Length (Bytes)	Data Returned	
Transaction ID		Protocol ID		Data Length		Unit ID			Data of Address 142 MSB	Data of Address 142 LSB
00	**01**	**00**	**00**	**00**	**05**	**01**	**03**	**02**	**84**	**07**

Table 10 Data Analysis

Address	Data Received (Hex)	Convert to Binary	Meaning
0000	8407H	1000 0100 0000 0111 (Mapping to 0000.15, 0000.14, ..., 0000.1, 0000.0 respectively)	Data of Bit 10 is 1, which means status of "In Manual Mode" is active.

2.2 FUNCTION CODE 03H & 06H MAPPING PARAMETERS OF DATA FIELD

Function code 06H can only be written to address 0296-0302, other addresses cannot be written.

Table 11 Parameters Data Field

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remarks
0115	40116	Reserved					2Bytes
0116	40117	Reserved					2Bytes
0117	40118	Reserved					2Bytes
0118	40119	Reserved					2Bytes
0119	40120	Reserved					2Bytes
0120	40121	Busbar UAB	0~4294967295	0.1	V	LSB	2Bytes
0121	40122					MSB	2Bytes
0122	40123	Busbar UBC	0~4294967295	0.1	V	LSB	2Bytes
0123	40124					MSB	2Bytes
0124	40125	Busbar UCA	0~4294967295	0.1	V	LSB	2Bytes
0125	40126					MSB	2Bytes
0126	40127	Busbar UA	0~4294967295	0.1	V	LSB	2Bytes
0127	40128					MSB	2Bytes
0128	40129	Busbar UB	0~4294967295	0.1	V	LSB	2Bytes
0129	40130					MSB	2Bytes
0130	40131	Busbar UC	0~4294967295	0.1	V	LSB	2Bytes
0131	40132					MSB	2Bytes
0132	40133	Busbar UA Phase Angle	0~360.0	0.1	°		2Bytes
0133	40134	Busbar UB Phase Angle	0~360.0	0.1	°		2Bytes
0134	40135	Busbar UC Phase Angle	0~360.0	0.1	°		2Bytes
0135	40136	Busbar Frequency	0~100.00	0.01	Hz		2Bytes
0136	40137	Reserved					2Bytes
0137	40138	Reserved					2Bytes
0138	40139	Reserved					2Bytes
0139	40140	Reserved					2Bytes
0140	40141	PCS UAB	0~4294967295	0.1	V	LSB	2Bytes
0141	40142					MSB	2Bytes
0142	40143	PCS UBC	0~4294967295	0.1	V	LSB	2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remarks
0143	40144					MSB	2Bytes
0144	40145	PCS UCA	0~4294967295	0.1	V	LSB	2Bytes
0145	40146					MSB	2Bytes
0146	40147	PCS UA	0~4294967295	0.1	V	LSB	2Bytes
0147	40148					MSB	2Bytes
0148	40149	PCS UB	0~4294967295	0.1	V	LSB	2Bytes
0149	40150					MSB	2Bytes
0150	40151	PCS UC	0~4294967295	0.1	V	LSB	2Bytes
0151	40152					MSB	2Bytes
0152	40153	PCS UA Phase Angle	0~360.0	0.1	°		2Bytes
0153	40154	PCS UB Phase Angle	0~360.0	0.1	°		2Bytes
0154	40155	PCS UC Phase Angle	0~360.0	0.1	°		2Bytes
0155	40156	PCS Frequency	0~100.00	0.01	Hz		2Bytes
0156	40157	Voltage Difference	-32768~32767	0.1	V	Signed	2Bytes
0157	40158	Frequency Difference	-32768~32767	0.01	Hz	Signed	2Bytes
0158	40159	Phase Difference	-32768~32767	0.1	°	Signed	2Bytes
0159	40160	Current PCS Active Power Percentage	-32768~32767	0.1	%	Signed	2Bytes
0160	40161	Target PCS Active Power Percentage	-32768~32767	0.1	%	Signed	2Bytes
0161	40162	Current PCS Reactive Power Percentage	-32768~32767	0.1	%	Signed	2Bytes
0162	40163	Target PCS Reactive Power Percentage	-32768~32767	0.1	%	Signed	2Bytes
0163	40164	Reserved					2Bytes
0164	40165	Reserved					2Bytes
0165	40166	Reserved					2Bytes
0166	40167	Phase A Current	0~65535	0.1	A		2Bytes
0167	40168	Phase B Current	0~65535	0.1	A		2Bytes
0168	40169	Phase C Current	0~65535	0.1	A		2Bytes
0169	40170	Ground Current	0~65535	0.1	A		2Bytes
0170	40171	Phase A Current Angle	0~360.0	0.1	°		2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remarks
0171	40172	Phase B Current Angle	0~360.0	0.1	°		2Bytes
0172	40173	Phase C Current Angle	0~360.0	0.1	°		2Bytes
0173	40174	Reserved	0~360.0	0.1	°		2Bytes
0174	40175	Phase A Active Power	-2,147,483,648 ~2,147,483,647	0.1	kW	Signed LSB	2Bytes
0175	40176					Signed MSB	2Bytes
0176	40177	Phase B Active Power	-2,147,483,648 ~2,147,483,647	0.1	kW	Signed LSB	2Bytes
0177	40178					Signed MSB	2Bytes
0178	40179	Phase C Active Power	-2,147,483,648 ~2,147,483,647	0.1	kW	Signed LSB	2Bytes
0179	40180					Signed MSB	2Bytes
0180	40181	Total Active Power	-2,147,483,648 ~2,147,483,647	0.1	kW	Signed LSB	2Bytes
0181	40182					Signed MSB	2Bytes
0182	40183	Phase A Reactive Power	-2,147,483,648 ~2,147,483,647	0.1	kvar	Signed LSB	2Bytes
0183	40184					Signed MSB	2Bytes
0184	40185	Phase B Reactive Power	-2,147,483,648 ~2,147,483,647	0.1	kvar	Signed LSB	2Bytes
0185	40186					Signed MSB	2Bytes
0186	40187	Phase C Reactive Power	-2,147,483,648 ~2,147,483,647	0.1	kvar	Signed LSB	2Bytes
0187	40188					Signed MSB	2Bytes
0188	40189	Total Reactive Power	-2,147,483,648 ~2,147,483,647	0.1	kvar	Signed LSB	2Bytes
0189	40190					Signed MSB	2Bytes
0190	40191	Phase A Apparent Power	-2,147,483,648 ~2,147,483,647	0.1	kVA	Signed LSB	2Bytes
0191	40192					Signed MSB	2Bytes
0192	40193	Phase B Apparent Power	-2,147,483,648 ~2,147,483,647	0.1	kVA	Signed LSB	2Bytes
0193	40194					Signed MSB	2Bytes
0194	40195	Phase C Apparent Power	-2,147,483,648 ~2,147,483,647	0.1	kVA	Signed LSB	2Bytes
0195	40196					Signed MSB	2Bytes
0196	40197	Total Apparent Power	-2,147,483,648 ~2,147,483,647	0.1	kVA	Signed LSB	2Bytes
0197	40198					Signed MSB	2Bytes
0198	40199	Phase A Power Factor	-100.000~100.000	0.001	CosΦ	Signed	2Bytes
0199	40200	Phase B Power Factor	-100.000~100.000	0.001	CosΦ	Signed	2Bytes
0200	40201	Phase C Power Factor	-100.000~100.000	0.001	CosΦ	Signed	2Bytes
0201	40202	Average Power Factor	-100.000~100.000	0.001	CosΦ	Signed	2Bytes
0202	40203	Reserved					2Bytes
0203	40204	Reserved					2Bytes
0204	40205	Unbalanced Current	0~65535	0.1	A	Signed	2Bytes
0205	40206	Reserved					2Bytes
0206	40207	Reserved					2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remarks
0207	40208	Reserved					2Bytes
0208	40209	Reserved					2Bytes
0209	40210	Reserved					2Bytes
0210	40211	Reserved					2Bytes
0211	40212	Reserved					2Bytes
0212	40213	Reserved					2Bytes
0213	40214	Supply Voltage	0~65535	0.1	V		2Bytes
0214	40215	Reserved					2Bytes
0215	40216	Reserved					2Bytes
0216	40217	Reserved					2Bytes
0217	40218	Reserved					2Bytes
0218	40219	Reserved					2Bytes
0219	40220	Reserved					2Bytes
0220	40221	Flexible Sensor 1 Value					2Bytes
0221	40222	Reserved					2Bytes
0222	40223	Flexible Sensor 2 Value					2Bytes
0223	40224	Reserved					2Bytes
0224	40225	Flexible Sensor 3 Value					2Bytes
0225	40226	Reserved					2Bytes
0226	40227	Flexible Sensor 4 Value					2Bytes
0227	40228	Reserved					2Bytes
0228	40229	Flexible Sensor 5 Value					2Bytes
0229	40230	Reserved					2Bytes
0230	40231	Battery Voltage	0~65535	0.1	V		2Bytes
0231	40232	Battery Current	-32768~32767	0.1	A	Signed	2Bytes
0232	40233	Battery Power	-32768~32767	0.1	kW	Signed	2Bytes
0233	40234	Reserved					2Bytes
0234	40235	Battery SOC%	0-100.0	0.1	%		2Bytes
0235	40236	Battery SOH%	0-100.0	0.1	%		2Bytes
0236	40237	Max. Discharge Current	0~65535	0.1	A		2Bytes
0237	40238	Max. Charge Current	0~65535	0.1	A		2Bytes
0238	40239	Reserved					2Bytes
0239	40240	Reserved					2Bytes
0240	40241	Reserved					2Bytes
0241	40242	Reserved					2Bytes
0242	40243	Total Charge	0~65535	0.1	kWh	Unsigned	2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remarks
		Energy (kWh)				LSB	
0243	40244					Unsigned MSB	2Bytes
0244	40245	Total Discharge Energy (kWh)	0~65535	0.1	kWh	Unsigned LSB	2Bytes
0245	40246					Unsigned MSB	2Bytes
0246	40247	PCS Working Mode	0-2	00 PQ Mode 01 VF Mode 02 VSG Mode			2Bytes
0247	40248	PCS Running Status	0-2	00 Standby 01 Starting 02 Normal Running 03 Stopping 04 Fault Shutdown			2Bytes
0248	40249	PCS Active Power Set Value	-100.0-100.0	0.1	%	Signed	2Bytes
0249	40250	PCS Reactive Power Set Value	-100.0-100.0	0.1	%	Signed	2Bytes
0250	40251	PCS Current Active Power Output	-32768~32767	0.1	kW	Signed	2Bytes 2Bytes
0251	40252	PCS Current Reactive Power Output	-32768~32767	0.1	kvar	Signed	2Bytes 2Bytes
0252	40253	Gen. Current Active Power	-2,147,483,648 ~2,147,483,647	0.1	kW	Signed LSB	2Bytes
0253	40254					Signed MSB	2Bytes
0254	40255	Gen. Current Reactive Power	-2,147,483,648 ~2,147,483,647	0.1	kvar	Signed LSB	2Bytes
0255	40256					Signed MSB	2Bytes
0256	40257	Load Total Active Power	-2,147,483,648 ~2,147,483,647	0.1	kW	Signed LSB	2Bytes
0257	40258					Signed MSB	2Bytes
0258	40259	Load Total Reactive Power	-2,147,483,648 ~2,147,483,647	0.1	kvar	Signed LSB	2Bytes
0259	40260					Signed MSB	2Bytes
0260	40261	Gen. Total Rated Active Power	-2,147,483,648 ~2,147,483,647	0.1	kW	Signed LSB	2Bytes
0261	40262					Signed MSB	2Bytes
0262	40263	Gen. Total Rated Reactive Power	-2,147,483,648 ~2,147,483,647	0.1	kvar	Signed LSB	2Bytes
0263	40264					Signed MSB	2Bytes
0264	40265	System Total Rated Active	-2,147,483,648 ~2,147,483,647	0.1	kW	Signed LSB	2Bytes
0265	40266					Signed MSB	2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remarks
		Power					
0266	40267	System Total Rated Reactive Power	-2,147,483,648 ~2,147,483,647	0.1	kvar	Signed LSB	2Bytes
0267	40268					Signed MSB	2Bytes
0268	40269	PCS Allowable Charge Power	-2,147,483,648 ~2,147,483,647	0.1	kW	Signed LSB	2Bytes
0269	40270					Signed MSB	2Bytes
0270	40271	PCS Transient Frequency	0~100.00	0.01	Hz		2Bytes
0271 1 0295	40272 40296	Reserved					
0296	40297	Remote Start Status				Remote Start Status	2Bytes
0297	40298	Remote Start Delay					2Bytes
0298	40299	ATS Status				ATS Status	2Bytes
0299	40300	ATS Delay					2Bytes
0300	40301	Reserved					2Bytes
0301	40302	Reserved					2Bytes
0302	40303	Gensets Quantity	0-31				2Bytes
0303	40304	Reserved					2Bytes
0304	40305	Reserved					2Bytes
0305	40306	Reserved					2Bytes
0306	40307	Reserved					2Bytes
0307	40308	Reserved					2Bytes
0308	40309	Reserved					2Bytes
0309	40310	Reserved					2Bytes
0310	40311	Reserved					2Bytes
0311	40312	Controller Software Version		0.1			2Bytes
0312	40313	Controller Hardware Version		0.1			2Bytes
0313	40314	Controller Release Year	0~99	1	Year	Save the last two digits of the Year only.	2Bytes
0314	40315	Controller Release Month	1~12	1	Month		2Bytes
0315	40316	Controller Release Day	1~31	1	Day		2Bytes
0316	40317	Reserved					2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remarks
0317	40318	Reserved					2Bytes
0318	40319	Controller Date: Year	0~99	1	Year	Save the last two digits of the Year only.	2Bytes
0319	40320	Controller Date: Month	1~12	1	Month		2Bytes
0320	40321	Controller Date: Day	1~31	1	Day		2Bytes
0321	40322	Controller Date: Week	0~6	1	Week		2Bytes
0322	40323	Controller Time: Hour	0~23	1	Hour		2Bytes
0323	40324	Controller Time: Minute	0~59	1	Min.		2Bytes
0324	40325	Controller Time: Second	0~59	1	Sec.		2Bytes
0325	40326	Module MSC ID	0~31				2Bytes
0326	40327	Module Priority	0~31				2Bytes
0327	40328	Modules Quantity	0~254				2Bytes

NOTE 1: Actual value = data received * ratio. Take the Frequency as the example: if the data received is 5000 (1388H), ratio is 0.01Hz, then the actual frequency value is 50.00Hz (5000*0.01Hz).

NOTE 2: If there are 4 bytes in the data, the actual value = high order bits of data received * 65536 + low order bits of data received.

NOTE 3: If data received is 32766, it means there is no normal data, and "###" will be shown.

NOTE 4: Definition of signed number: Take the data received "8000H" as the example, convert it to binary number "1000 0000 0000 0000b". The MSB is 1, which means it is negative. The number minus 1 will get its 1's complement, then inverting it will get the absolute value of the negative number. Finally convert the absolute value to decimal number -32768.

EXAMPLE:

If "Phase A Active Power" (current value is 123456 times) needs to be read, check the table above and find its Modbus address is 0174 and 0175, so it needs to read two bytes data.

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

Table 12 Master Request Command

Slave Address	Function Code	Start Address (0174)		Request Data Length (2)		CRC 16	
		MSB	LSB	MSB	LSB	LSB	MSB
01	**03**	**00**	**AE**	**00**	**02**	**A5**	**EA**

Table 13 Client Request Frame via Ethernet

MBAP Header							Function Code	Data			
Transaction ID		Protocol ID		Data Length		Unit ID		Remote Address (0174)		Request Data Length (2)	
								MSB	LSB	MSB	LSB
00	**01**	**00**	**00**	**00**	**06**	**01**	**03**	**00**	**AE**	**00**	**02**

The slave response command is as following:

Table 14 Slave Response Command

Slave Address	Function Code	Data Length (Bytes)	Data				CRC 16	
			Data of Address 0174 MSB	Data of Address 0174 LSB	Data of Address 0175 MSB	Data of Address 0175 LSB	LSB	MSB
01	**03**	**04**	**E2**	**40**	**00**	**01**	**0C**	**5F**

Table 15 Controller Response Frame via Ethernet

MBAP Header							Function Code	Data				
									Data Returned			
Transaction ID		Protocol ID		Data Length		Unit ID		Data Length (Bytes)	Data of Address 0174 MSB	Data of Address 0174 LSB	Data of Address 0175 MSB	Data of Address 0175 LSB
00	**01**	**00**	**00**	**00**	**07**	**01**	**03**	**04**	**E2**	**40**	**00**	**01**

Fill the data received into the address respectively, as shown in the table below.

Table 16 Data Analysis

Address	Data Received (Hex)	Data Combined (Hex)	Phase A Active Power (Decimal)
0174	E240H	0001E240H	123456
0175	0001H		

2.3 FUNCTION CODE 05H MAPPING REMOTE COIL FIELD

Table 17 Remote Coil Field

Modbus Address	PLC Address	Item	Description
0000	0001	Remote Start Key	Active only when sending FF00H
0001	0002	Remote Stop Key	Active only when sending FF00H
0002	0003	Reserved	
0003	0004	Remote Auto Key	Active only when sending FF00H
0004	0005	Remote Manual Key	Active only when sending FF00H
0005	0006	Remote Close Key	Active only when sending FF00H

Modbus Address	PLC Address	Item	Description
0006	0007	Remote Open Key	Active only when sending FF00H
0007	0008	Remote Up Key	Active only when sending FF00H
0008	0009	Remote Down Key	Active only when sending FF00H
0009	0010	Reserved	
0010	0011	Reserved	
0011	0012	Remote Confirm Key	Active only when sending FF00H
0012	0013	Remote Mute Key	Active only when sending FF00H
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	Active when sending FF00H, inactive when sending 0000H
0021	0022	Remote Output 2	Active when sending FF00H, inactive when sending 0000H
0022	0023	Remote Output 3	Active when sending FF00H, inactive when sending 0000H
0023	0024	Remote Output 4	Active when sending FF00H, inactive when sending 0000H
0024	0025	Remote Output 5	Active when sending FF00H, inactive when sending 0000H
0025	0026	Remote Output 6	Active when sending FF00H, inactive when sending 0000H
0026	0027	Remote Output 7	Active when sending FF00H, inactive when sending 0000H
0027	0028	Remote Output 8	Active when sending FF00H, inactive when sending 0000H
0028	0029	Remote Output 9	Active when sending FF00H, inactive when sending 0000H
0029	0030	Remote Output 10	Active when sending FF00H, inactive when sending 0000H
0030	0031	Reserved	
0031	0032	Reserved	
0032	0033	Reserved	
0033	0034	Reserved	
0034	0035	Reserved	
0035	0036	Reserved	
0036	0037	Reserved	
0037	0038	Reserved	

NOTE 1: The remote command in the table above only needs to be sent once.

NOTE 2: If function code 05 adopts Modbus address to communicate: it needs to send FF00H to load corresponding bit as 1, and send 0000H to load corresponding bit as 0; If function code 05 adopts PLC address to communicate: it needs to send 1 to load corresponding bit as 1, and send 0 to load corresponding bit as 0.

EXAMPLE:

If the remote controller is in manual mode, check the table first and find its remote address is 0004.

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

Table 18 Master Request Command

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

Table 19 Client Request Frame via Ethernet

MBAP Header							Function Code	Data			
Transaction ID		Protocol ID		Data Length		Unit ID		Remote Address (0004)		Remote Data	
								MSB	LSB	MSB	LSB
00	**01**	**00**	**00**	**00**	**06**	**01**	**05**	**00**	**04**	**FF**	**00**

The slave response command is as following:

Table 20 Slave Response Command

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

Table 21 Controller Response Frame via Ethernet

MBAP Header							Function Code	Data			
Transaction ID		Protocol ID		Data Length		Unit ID		Remote Address (0004)		Remote Data	
								MSB	LSB	MSB	LSB
00	**01**	**00**	**00**	**00**	**06**	**01**	**05**	**00**	**04**	**FF**	**00**

Whether the remote command is active and executed can be checked by sending function code 01H to read manual mode status of address 0000.10.

2.4 FUNCTION CODE 06H MAPPING PARAMETERS OF DATA FIELD

Table 22 Parameters of Data Field

Modbus Address	PLC Address	Item	Description
4332	44333	Control Method Select	Data range: 0-2 0: Constant power 1: Demand power 2: Genset power
4333	44334	Constant Power Active Power Percentage	Data range: -1000-1000 Corresponding percentage: -100.0%-100.0% Positive value means discharge, negative value means charge
4334	44335	Constant Power Reactive Power & Power Factor Control Setting	Data range: 0-1 0: Reactive power 1: Power factor NOTE: For power factor control, it needs to calculate the reactive power percentage setting (address 4335) based on the active power percentage.
4335	44336	Constant Power Reactive Power Percentage	Data range: 0-1000 Corresponding percentage: 0.0%-100.0%
4336	44337	Demand Power Coefficient k	Data range: 0-100 Corresponding coefficient: 0.0-10.0
4337	44338	Demand Power Adjusted Power b	Data range: -6000-6000 Corresponding coefficient: -6000kW-6000kW
4338	44339	Demand Power Adjusted Power b Selection	Data range: 0-1 0: Fixed power 1: SOC-b
4355	44356	Genset Power Genset Constant Power	Data range: 0-1000 Corresponding percentage: 0.0%-100.0%
1317	41318	PCS Rated Active Power	Data range: (0-6000)kW
1318	41319	PCS Rated Reactive Power	Data range: (0-6000)kvar

EXAMPLE:

If “PCS Constant Power Active Power Percentage” will be sent, check the table above and find its Modbus address is 4333.

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

Table 23 Master Request Command

Slave Address	Function Code	PCS Constant Power Active Power Percentage (4333)		Value		CRC 16	
		MSB	LSB	MSB	LSB	LSB	MSB
01	**06**	**10**	**ED**	**00**	**32**	**9C**	**EA**

Table 24 Master Request Frame via Ethernet

MBAP Header							Function Code	Data			
Transaction ID		Protocol ID		Data Length		Unit ID		Start Address (4333)		Value	
								MSB	LSB	MSB	LSB
00	01	00	00	00	06	01	06	10	ED	00	32

Table 25 Slave Response Frame

Slave Address	Function Code	PCS Constant Power Active Power Percentage (4333)		Value		CRC 16	
		MSB	LSB	MSB	LSB	LSB	MSB
01	06	10	ED	00	32	9C	EA

Table 26 Controller Response Frame via Ethernet

MBAP Header							Function Code	Data			
Transaction ID		Protocol ID		Data Length		Unit ID		Remote Address (4333)		Value	
								MSB	LSB	MSB	LSB
00	01	00	00	00	06	01	06	10	ED	00	32

2.5 ALARMS DATA LIST

Table 27 Alarms Data List

Offset Address	Item	Description	Bytes
0000.0	Emergency Stop	1 as active (bit0)	1bit
0000.1	Reserved	1 as active (bit1)	1bit
0000.2	BMS Comm. Failure	1 as active (bit2)	1bit
0000.3	PCS Comm. Failure	1 as active (bit3)	1bit
0000.4	PCS Over Frequency	1 as active (bit4)	1bit
0000.5	PCS Under Frequency	1 as active (bit5)	1bit
0000.6	PCS Overvoltage	1 as active (bit6)	1bit
0000.7	PCS Undervoltage	1 as active (bit7)	1bit
0000.8	Start Failure	1 as active (bit8)	1bit
0000.9	PCS Overcurrent	1 as active (bit9)	1bit
0000.10	Current Imbalance	1 as active (bit10)	1bit
0000.11	Ground Fault	1 as active (bit11)	1bit
0000.12	PCS Charge Over Power	1 as active (bit12)	1bit
0000.13	PCS Discharge Over Power	1 as active (bit13)	1bit
0000.14	Common Fault	1 as active (bit14)	1bit
0000.15	Reserved	1 as active (bit15)	1bit
0001.0	Reserved	1 as active	1bit
0001.1	Reserved	1 as active	1bit
0001.2	Reserved	1 as active	1bit
0001.3	MSC ID Error	1 as active	1bit

Offset Address	Item	Description	Bytes
0001.4	Voltage Bus Error	1 as active	1bit
0001.5	PCS Phase Sequence Error	1 as active	1bit
0001.6	Voltage Bus Phase Sequence Error	1 as active	1bit
0001.7	Flexible Sensor 1 Open	1 as active	1bit
0001.8	Flexible Sensor 1 High	1 as active	1bit
0001.9	Flexible Sensor 1 Low	1 as active	1bit
0001.10	Flexible Sensor 1 Error	1 as active	1bit
0001.11	Flexible Sensor 2 Open	1 as active	1bit
0001.12	Flexible Sensor 2 High	1 as active	1bit
0001.13	Flexible Sensor 2 Low	1 as active	1bit
0001.14	Flexible Sensor 2 Error	1 as active	1bit
0001.15	Flexible Sensor 3 Open	1 as active	1bit
0002.0	Flexible Sensor 3 High	1 as active	1bit
0002.1	Flexible Sensor 3 Low	1 as active	1bit
0002.2	Flexible Sensor 3 Error	1 as active	1bit
0002.3	Flexible Sensor 4 Open	1 as active	1bit
0002.4	Flexible Sensor 4 High	1 as active	1bit
0002.5	Flexible Sensor 4 Low	1 as active	1bit
0002.6	Flexible Sensor 4 Error	1 as active	1bit
0002.7	Flexible Sensor 5 Open	1 as active	1bit
0002.8	Flexible Sensor 5 High	1 as active	1bit
0002.9	Flexible Sensor 5 Low	1 as active	1bit
0002.10	Flexible Sensor 5 Error	1 as active	1bit
0002.11	Reserved	1 as active	1bit
0002.12	Reserved	1 as active	1bit
0002.13	Supply Overvoltage	1 as active	1bit
0002.14	Supply Undervoltage	1 as active	1bit
0002.15	Sync. Failure	1 as active	1bit
0003.0	Reserved	1 as active	1bit
0003.1	Reserved	1 as active	1bit
0003.2	Reserved	1 as active	1bit
0003.3	Voltage Asynchrony	1 as active	1bit
0003.4	Frequency Asynchrony	1 as active	1bit
0003.5	Phase Asynchrony	1 as active	1bit
0003.6	Reserved	1 as active	1bit
0003.7	ATS Alarm	1 as active	1bit
0003.8	Reserved	1 as active	1bit
0003.9	ATS Close Failure	1 as active	1bit
0003.10	Reserved	1 as active	1bit
0003.11	ATS Open Failure	1 as active	1bit
0003.12	Reserved	1 as active	1bit
0003.13	Reserved	1 as active	1bit
0003.14	Reserved	1 as active	1bit
0003.15	Reserved	1 as active	1bit

Offset Address	Item	Description	Bytes
0004.0	Reserved	1 as active	1bit
0004.1	Reserved	1 as active	1bit
0004.2	Large Frequency Error Warning	1 as active	1bit
0004.3	Few MSC Modules	1 as active	1bit
0004.4	Reserved	1 as active	1bit
0004.5	Reserved	1 as active	1bit
0004.6	Reserved	1 as active	1bit
0004.7	Reserved	1 as active	1bit
0004.8	Reserved	1 as active	1bit
0004.9	Reserved	1 as active	1bit
0004.10	PCS Reverse Phase Sequence	1 as active	1bit
0004.11	PCS Loss of Phase	1 as active	1bit
0004.12	MSC1 Comm. Failure	1 as active	1bit
0004.13	Reserved	1 as active	1bit
0004.14	Reserved		1bit
0004.15	Reserved		1bit
0005.0	Digital Input 1	1 as active	1bit
0005.1	Digital Input 2	1 as active	1bit
0005.2	Digital Input 3	1 as active	1bit
0005.3	Digital Input 4	1 as active	1bit
0005.4	Digital Input 5	1 as active	1bit
0005.5	Digital Input 6	1 as active	1bit
0005.6	Digital Input 7	1 as active	1bit
0005.7	Digital Input 8	1 as active	1bit
0005.8	Digital Input 9	1 as active	1bit
0005.9	Digital Input 10	1 as active	1bit
0005.10	Digital Input 11	1 as active	1bit
0005.11	Digital Input 12	1 as active	1bit
0005.12	PLC Function 1	1 as active	1bit
0005.13	PLC Function 2	1 as active	1bit
0005.14	PLC Function 3	1 as active	1bit
0005.15	PLC Function 4	1 as active	1bit
0006.0	PLC Function 5	1 as active	1bit
0006.1	PLC Function 6	1 as active	1bit
0006.2	PLC Function 7	1 as active	1bit
0006.3	PLC Function 8	1 as active	1bit
0006.4	PLC Function 9	1 as active	1bit
0006.5	PLC Function 10	1 as active	1bit
0006.6	PLC Function 11	1 as active	1bit
0006.7	PLC Function 12	1 as active	1bit
0006.8	PLC Function 13	1 as active	1bit
0006.9	PLC Function 14	1 as active	1bit
0006.10	PLC Function 15	1 as active	1bit
0006.11	PLC Function 16	1 as active	1bit

Offset Address	Item	Description	Bytes
0006.12	PLC Function 17	1 as active	1bit
0006.13	PLC Function 18	1 as active	1bit
0006.14	PLC Function 19	1 as active	1bit
0006.15	PLC Function 20	1 as active	1bit
0007.0	Reserved	1 as active	1bit
0007.1	Reserved	1 as active	1bit
0007.2	Reserved	1 as active	1bit
0007.3	Reserved	1 as active	1bit
0007.4	Reserved	1 as active	1bit
0007.5	Reserved	1 as active	1bit
0007.6	Reserved	1 as active	1bit
0007.7	Reserved	1 as active	1bit
0007.8	Reserved	1 as active	1bit
0007.9	Reserved	1 as active	1bit
0007.10	Reserved	1 as active	1bit
0007.11	Reserved	1 as active	1bit
0007.12	Reserved	1 as active	1bit
0007.13	Reserved	1 as active	1bit
0007.14	Reserved	1 as active	1bit
0007.15	Reserved	1 as active	1bit
0008.0	Reserved	1 as active	1bit
0008.1	Reserved	1 as active	1bit
0008.2	Reserved	1 as active	1bit
0008.3	Reserved	1 as active	1bit
0008.4	Reserved	1 as active	1bit
0008.5	Reserved	1 as active	1bit
0008.6	Reserved	1 as active	1bit
0008.7	Reserved	1 as active	1bit
0008.8	Reserved	1 as active	1bit
0008.9	Reserved	1 as active	1bit
0008.10	Reserved	1 as active	1bit
0008.11	Reserved	1 as active	1bit
0008.12	Reserved	1 as active	1bit
0008.13	Reserved	1 as active	1bit
0008.14	Reserved	1 as active	1bit
0008.15	Reserved	1 as active	1bit
0009.0	Reserved	1 as active	1bit
0009.1	Reserved	1 as active	1bit
0009.2	Reserved	1 as active	1bit
0009.3	Reserved	1 as active	1bit
0009.4	Reserved	1 as active	1bit
0009.5	Reserved	1 as active	1bit
0009.6	Reserved	1 as active	1bit
0009.7	Reserved	1 as active	1bit

Offset Address	Item	Description	Bytes
0009.8	Reserved	1 as active	1bit
0009.9	Reserved	1 as active	1bit
0009.10	Reserved	1 as active	1bit
0009.11	Reserved	1 as active	1bit
0009.12	Reserved	1 as active	1bit
0009.13	Reserved	1 as active	1bit
0009.14	Reserved	1 as active	1bit
0009.15	Reserved	1 as active	1bit
0010.0	Reserved	1 as active	1bit
0010.1	Reserved	1 as active	1bit
0010.2	Reserved	1 as active	1bit
0010.3	Reserved	1 as active	1bit
0010.4	Reserved	1 as active	1bit
0010.5	Reserved	1 as active	1bit
0010.6	Reserved	1 as active	1bit
0010.7	Reserved	1 as active	1bit
0010.8	Reserved	1 as active	1bit
0010.9	Reserved	1 as active	1bit
0010.10	Reserved	1 as active	1bit
0010.11	Reserved	1 as active	1bit
0010.12	Reserved	1 as active	1bit
0010.13	Reserved	1 as active	1bit
0010.14	Reserved	1 as active	1bit
0010.15	Reserved	1 as active	1bit
0011.0	Reserved	1 as active	1bit
0011.1	Reserved	1 as active	1bit
0011.2	Reserved	1 as active	1bit
0011.3	Reserved	1 as active	1bit
0011.4	Reserved	1 as active	1bit
0011.5	Reserved	1 as active	1bit
0011.6	Reserved	1 as active	1bit
0011.7	Reserved	1 as active	1bit
0011.8	Reserved	1 as active	1bit
0011.9	Reserved	1 as active	1bit
0011.10	Reserved	1 as active	1bit
0011.11	Reserved	1 as active	1bit
0011.12	Reserved	1 as active	1bit
0011.13	Reserved	1 as active	1bit
0011.14	Reserved	1 as active	1bit
0011.15	Reserved	1 as active	1bit
0012.0	Reserved	1 as active	1bit
0012.1	Reserved	1 as active	1bit
0012.2	Reserved	1 as active	1bit
0012.3	Reserved	1 as active	1bit

Offset Address	Item	Description	Bytes
0012.4	Reserved	1 as active	1bit
0012.5	Reserved	1 as active	1bit
0012.6	Reserved	1 as active	1bit
0012.7	THD High	1 as active	1bit
0012.8	PCS Voltage Imbalance	1 as active	1bit
0012.9	Reserved	1 as active	1bit
0012.10	Reserved	1 as active	1bit
0012.11	Reserved	1 as active	1bit
0012.12	Reserved	1 as active	1bit
0012.13	Reserved	1 as active	1bit
0012.14	Reserved		1bit
0012.15	Reserved		1bit
0013.0	Reserved	1 as active	1bit
0013.1	Reserved	1 as active	1bit
0013.2	Reserved	1 as active	1bit
0013.3	Reserved	1 as active	1bit
0013.4	Reserved	1 as active	1bit
0013.5	Reserved	1 as active	1bit
0013.6	Reserved	1 as active	1bit
0013.7	Reserved	1 as active	1bit
0013.8	Reserved	1 as active	1bit
0013.9	Reserved	1 as active	1bit
0013.10	Reserved	1 as active	1bit
0013.11	Reserved	1 as active	1bit
0013.12	Reserved	1 as active	1bit
0013.13	Reserved	1 as active	1bit
0013.14	Reserved	1 as active	1bit
0013.15	Reserved	1 as active	1bit
0014.0	Reserved	1 as active	1bit
0014.1	Reserved	1 as active	1bit
0014.2	Reserved	1 as active	1bit
0014.3	Reserved	1 as active	1bit
0014.4	Reserved	1 as active	1bit
0014.5	Reserved	1 as active	1bit
0014.6	Reserved	1 as active	1bit
0014.7	Reserved	1 as active	1bit
0014.8	Reserved	1 as active	1bit
0014.9	Reserved		1bit
0014.10	Reserved		1bit
0014.11	Reserved		1bit
0014.12	Reserved		1bit
0014.13	Reserved		1bit
0014.14	Reserved		1bit
0014.15	Reserved		1bit

2.6 REMOTE START STATUS

Table 28 Remote Start Status

No.	Content	DESCRIPTION
0	No Delay	No delay value in the status
1	Start Delay	
2	Stop Delay	

2.7 ATS STATUS

Table 29 ATS Status

No.	Content	DESCRIPTION
0	In Sync.	No delay value is shown in the status
1	Close Delay	
2	Waiting for Closing Input	No delay value is shown in the status
3	Closed	No delay value is shown in the status
4	Waiting for Opening	No delay value is shown in the status
5	Open Delay	
6	Waiting for Opening Input	No delay value is shown in the status
7	Opened	No delay value is shown in the status

3 REMOTE START/STOP PROCEDURE

Start Procedure:

1) Send 05 function code "Remote Manual Key to set the controller in manual mode;
2) Read the data of Address 0000 through the 03 function code to obtain the current mode of the controller, then confirm whether the controller is in manual mode, and if the controller is not in manual mode, repeat step 1 and step 2;
3) Read the “PCS Working Mode” through the 03 function code, if the PCS is in PQ mode, after the busbar voltage is normal, sent 05 function code “Remote Close Key”, then wait the PCS to close; If PCS is in VF mode or VSG mode, it will enter the step 4 and send the start command;
4) When the controller is in manual mode, send 05 function code “Remote Start Key”;
5) The controller receives the command and enters the start process, the PCS start process can be obtained by reading the data of “PCS Running Status" based on the address table via the 03 function code;
6) If the value of "PCS Running Status" is 1 (Starting) to 2 (Normal Running), the PCS enters the start process, otherwise it does not. If it does not enter the start process, check the PCS working mode and repeat step 3 and step 4;

Stop Procedure: (This method can be used when the controller is in automatic or manual mode):

1) Send 05 function code "Remote Stop Key” to set the controller in stop mode;
2) Read the data of Address 0000 through the 03 function code to obtain the current mode of the controller, then confirm whether the controller is in stop mode, and if the controller is not in stop mode, repeat step 1 and step 2;
3) When the controller is in the stop mode, the PCS enters the stop process;
4) The PCS stop process can be obtained by reading the data of “PCS Running Status" based on the address table via the 03 function code;
5) When“PCS Running Status” is in “Standby” and the “ATS Status" is in “Opened”, then the PCS completes the stop process.

NOTE: When sending 05 function code remote control key command, it only needs to be sent once at a time.

4 VIEW AND CONFIGURATION OF COMMUNICATION PARAMETERS

1) In the homepage of main screen, press the  key to enter the menu page;

2) Press the Down key to select the “Parameter Setting”, then press the  key to enter the parameters password page;

3) Enter the correct password (default: 0318), press the  key to get into the parameter setting menu;

4) Press the  key,  key to select “Controller Address”, then press the  key to edit the parameter, the corresponding parameters will be selected;

5) Set the current selected parameter via  key and  key, then press the  key to confirm and end the setting editing, then the selected status will disappear;

6) Press and hold the  key to return the home page.

NOTE: The configuration takes effect once the parameter setting is completed.

5 FAQ

5.1 GROUNDING OF THE CABLE SHIELD

To prevent the coupling of interference on the cable, one end of the cable shield should be grounded.

5.2 TERMINATION RESISTOR

At both ends of the linear network (between the two communication ports furthest apart), two 120-ohm termination resistors need to be installed in parallel. According to the signal transmission theory, the termination resistor can avoid the signal reflections and improve the signal integrity effectively. The value of two termination resistor in parallel is basically equal to the characteristic impedance of the transmission cable.

A standard RS-485 network will usually use the termination resistor. The resistor can be avoided while the cable is too short, or it is a temporary or lab test.

5.3 RS485 TO USB CONVERTER

It can communicate with PC via the SmartGen SG72A converter.

5.4 EXTEND TRANSMISSION DISTANCE

Adding two SmartGen SGCAN300 Repeaters can extend the communication distance to at most 10 kilometers.

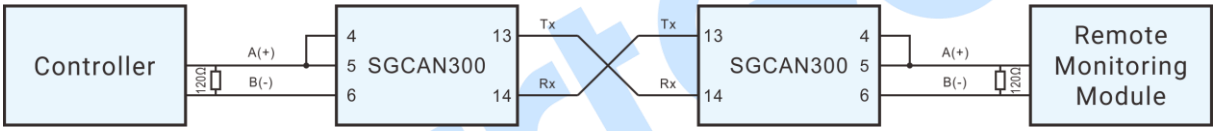

Fig.8 SGCAN300 Application Diagram

5.5 SOLUTIONS FOR COMMUNICATION FAILURE

1) Check the positive and negative of RS485, or network cable is connected correctly. Check the RS485 converter (if any) is normal;
2) Check the termination resistors are connected correctly or not;
3) Check the communication parameters setting is correct or not. Baud rate, data bit, parity bit and stop bit meet the requirement of controller;
4) Check the Terminal COM is connected correctly with the USB port of PC via RS485 converter;
5) Check the communication address of controller is correct, and the default address is 01;
6) When using function code 03, the maximum data length to be read is 120 addresses, and the ending address can't exceed the greatest one of Modbus communication address. Please note that for the 06 function code mapping parameters data field, only one address can be written at a time;
7) If there is offset address in the Modbus communication address, the actual Modbus communication address equals to the base address plus offset address;
8) If function code 05 adopts Modbus address to communicate: Although 1 means active, and 0 means inactive, it needs to send FF00H to load corresponding bit as 1, and send 0000H to load corresponding bit as 0. If function code 05 adopts PLC address to communicate: it needs to send 1 to load corresponding bit as 1, and send 0 to load corresponding bit as 0.
9) As for CRC-16, the low-order byte is checked first, the high-order byte is checked later.
10) The frequency of multiple read operations for controller data should not too high, and the recommended interval between two read operations is no less than 500ms;

11) When using the network port to read data, please pay attention to whether the IP address and subnet mask settings of the controller are correct (after changing the network setting parameters of the controller, such as IP address, subnet mask, etc., the controller needs to be powered off and powered on again to make the new setting parameters take effect), please do not change the MAC address unless special needs are required;
12) Please configure each controller's communication module address before networking. Same module address is not allowed in one network.
13) Modbus serial protocol does not support multiple masters, so multiple software cannot communicate with the controller at the same time;
14) Disconnect the RS485 cables to the controller, test the voltage difference of RS485 Terminal A and B on the controller, if the result is between -200mV and +200mV, it means the communication port is abnormal;
15) If the cable length is too long, it will result in signal attenuation. So it is recommended to use high-quality cable or add repeaters in the cable.
16) It is recommended to download third-party communication test software to verify whether the serial communication is normal, such as modscan32, modbus poll, etc.
17) It is recommended to download third-party communication test software to verify whether the network communication is normal, such as NetAssist, PortHelper;