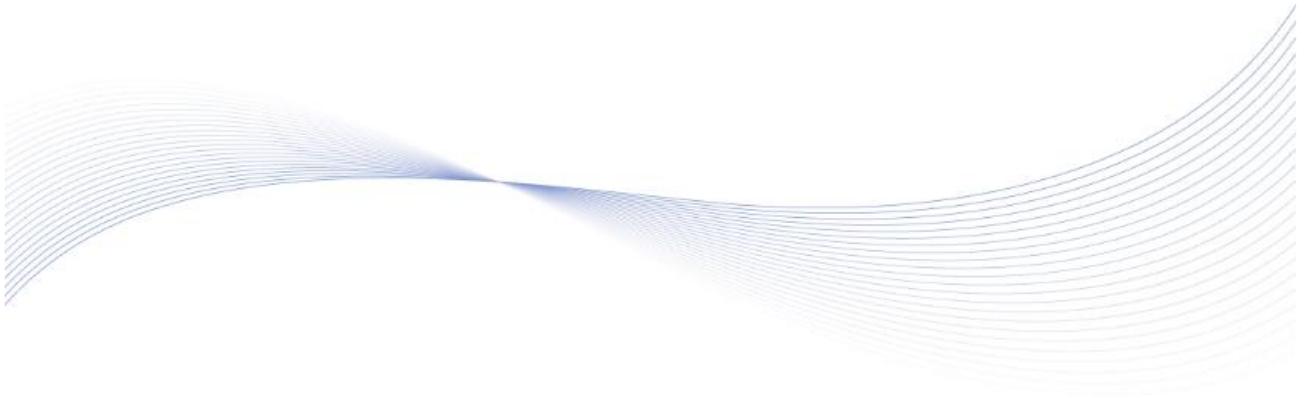

SmartGen

MAKING CONTROL SMARTER

**HGM9510N/HGM9520N/HGM9530N
GENSET CONTROLLER
COMMUNICATION PROTOCOL**



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Table 1 Software Version

Date	Version	Content
2018-12-21	1.0	Original release.
2023-05-05	1.1	1. Modify it with the latest protocol format; 2. Add network communication and modify the parameter range of 03H function code corresponding data field.
2023-06-12	1.2	1. Update the contents of 03 & 05 function code; 2. Add the title of "Remote Start/Stop Steps"; 3. Update the solutions of "Communication Failure".
2023-09-27	1.3	Update some measurement range contents of 03 function code.
2024-05-16	1.4	Update some contents of 03 function code.
2024-07-22	1.5	1. Update new contents of 03 function code (0353-0629); 2. Modify some contents of 05 function code.

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1. DESCRIPTION

This protocol describes read and write command format of RS485 and RJ45 communication and definition of internal information data for the third-party to develop and use.

1.1 PHYSICAL LAYER

This controller has two RS485 ports with same communication protocol, 1 RJ45 port. RS485 follows Modbus-RTU communication format, RJ45 follows Modbus-TCP/UDP communication format.

1.1.1 RS485 PORT

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

Data format:

Communication address: 1~245 (default: 1)

Baud rate: 9600bps

Start bit: 1-bit

Data bit: 8-bit

Parity bit: None, odd parity, even parity (default: none)

Stop bit: 1-bit, 2-bit can be set

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.

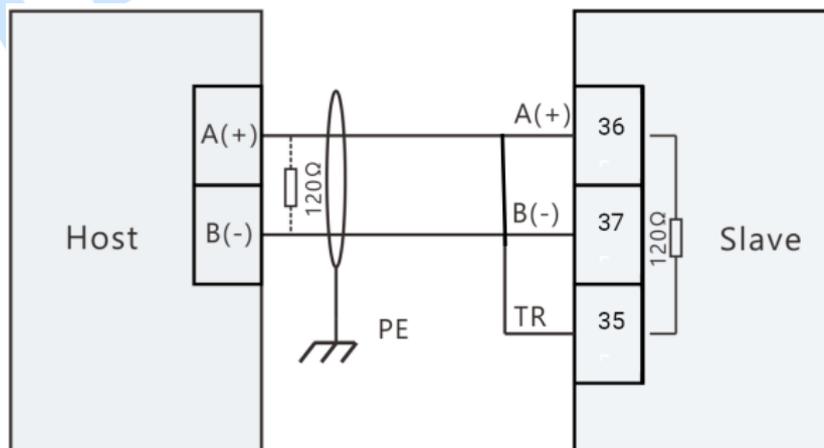


Fig.1 Single Unit Communication Wiring Diagram

NOTE1: 120Ω resistor can be connected automatically according to site situation. TR terminal on the controller side is integrated with the 120Ω resistor. It represents that 120Ω resistor has been connected when short-connecting terminal 36 and 35.

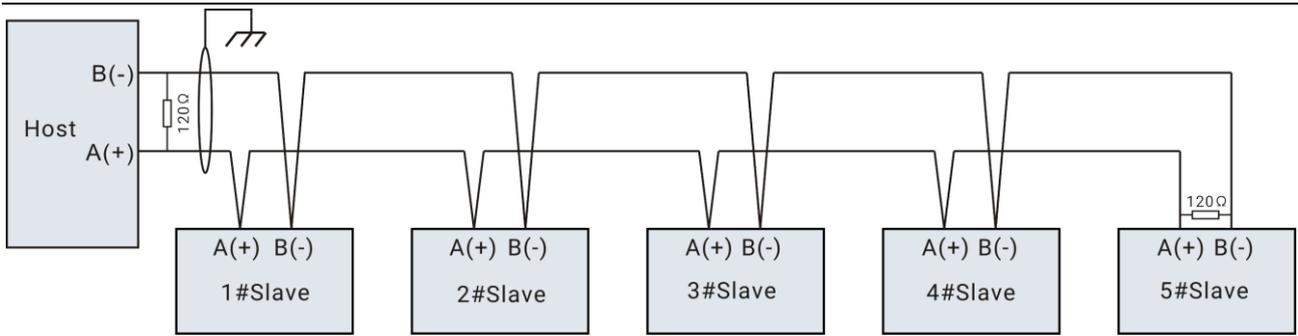


Fig.2 Multi-unit Communication Wiring Diagram

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.

1.1.2 ETHERNET PORT

As the network server, the controller adopts ModBus_TCP/UDP network communication protocol, integrates the switch function internally and supports redundancy of device-level ring network.

Communication speed: 10M/100M self-adaption

Port: 502

Communication distance: point-point ETHERNET cable must not exceed 100m.

Communication cable specification: The cable must meet or be higher than SF/UTP CAT5e, RJ45 cross and straight through cables (T568A, T568B) are available.

Wiring method is shown as the following:

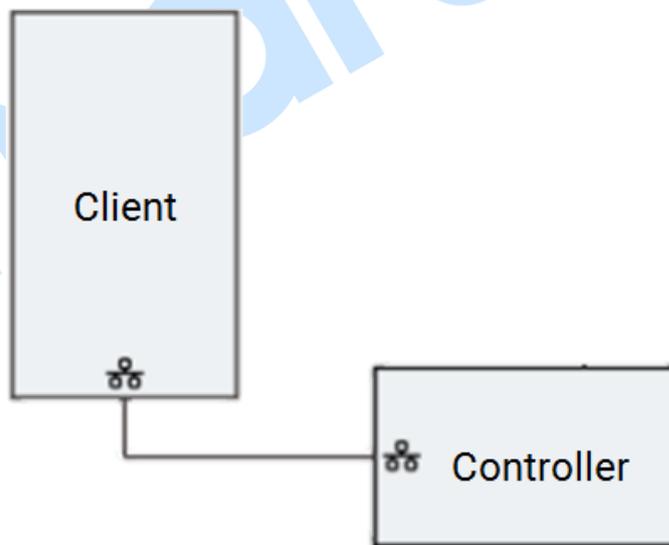


Fig.3 Single Unit Network Communication Wiring Diagram

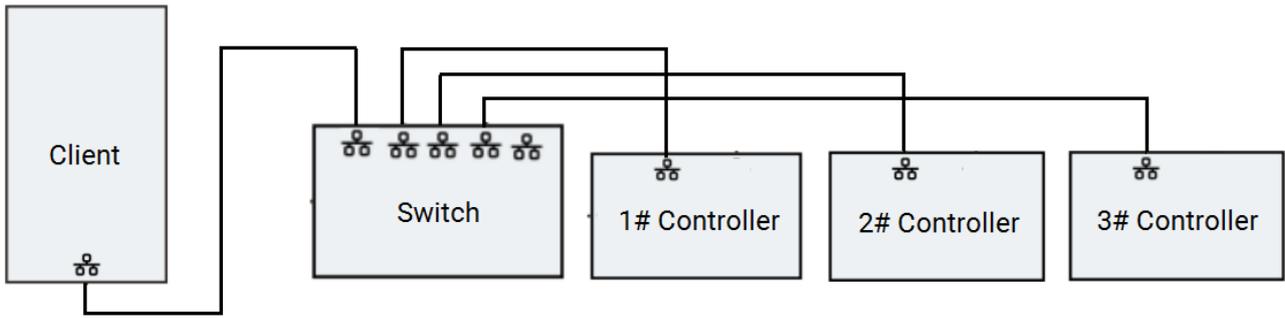


Fig.4 Multi-unit Network Communication Wiring Diagram

1.2 DATA LINK LAYER

Modbus general protocol frame format is as follows:

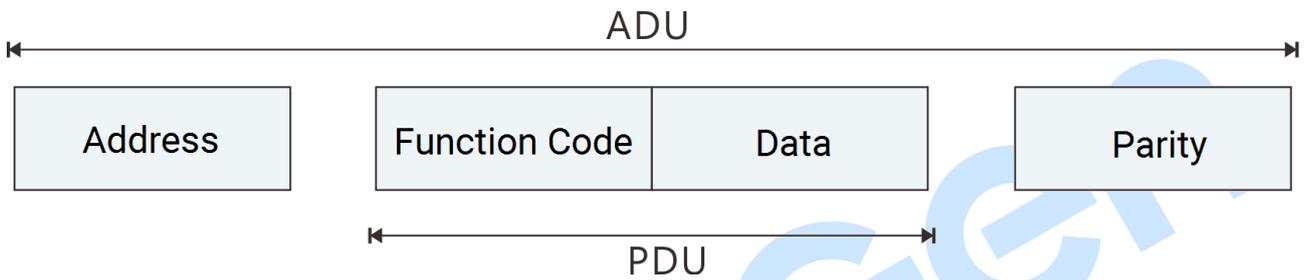


Fig.5 Modbus General Protocol Frame Format

1.2.1 MODBUS-RTU

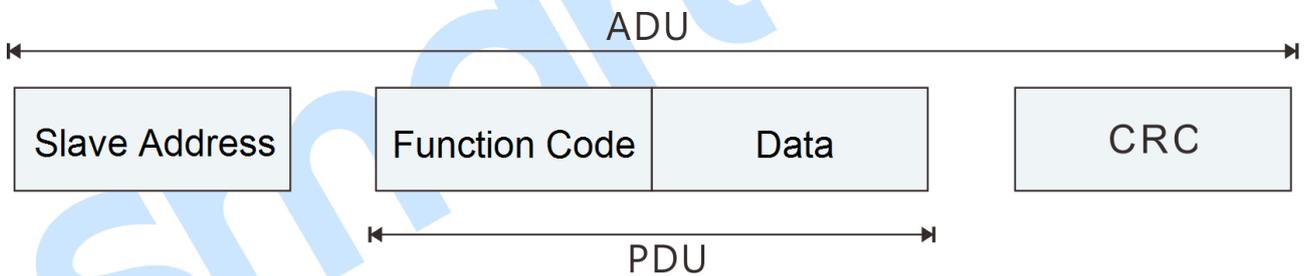


Fig.6 Modbus-RTU General Protocol Frame Format

ADU length, based on serial bus ADU, which is designed according to 256 bytes, wherein:

Slave address: 1 byte

PDU: 253 bytes

CRC: 2 bytes

Modbus-RTU communication is commonly used in serial communication, slave address is assigned as follows:

Table 2 Communication Address Assignment

Broadcast Address	Slave Node Address	Reserved
0	1~254	255

Reserved address for standby.

CRC calibration is as follows:

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).
- 5) If the LSB was 1: CRC register exclusive ORed with the A001 hexadecimal;
- 6) Repeat Step 3 and 4 until 8 shifts have been performed. In this way eight shifts have been performed;
- 7) Repeat Step 2 to 5 and perform the next data handling process;
- 8) 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>

1.2.2 MODBUS-TCP/UDP

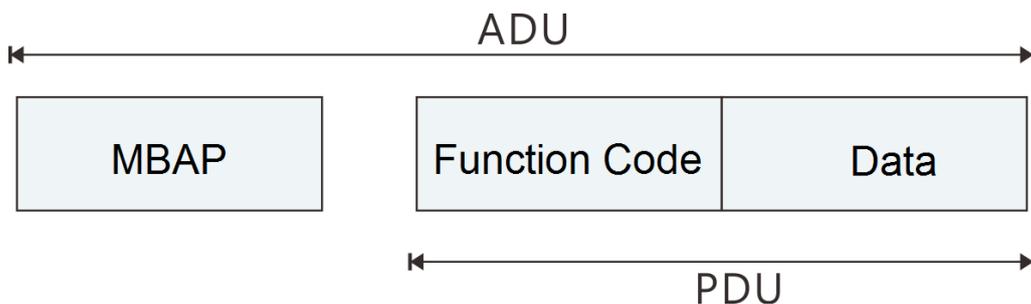


Fig.7 Modbus-TCP/UDP General Protocol Frame Format

The recommended frame length based on the standard is 260 bytes. When some extended functions are applied, data served can extend ADUs to an appropriate length according to its own resources to improve the efficiency of network transmission. The actual ADU length is reflected in the MBAP length field.

When Modbus is applied for TCP/IP, a special MBAP (Modbus application protocol MBAP) will be used to identify Modbus application data unit (ADU). MBAP consists of 4 fields and a total of 7 bytes, as defined below:

Table 3 MBAP Definition

Data Field	Length (Byte)	Description	Client	Server
Transmission Identifier	2	Match identification of request frame and response frame	Client allocation, it is recommended that data request transmission identifier of each frame is different	This identifier in the response frame on the server side must be consistent with the request frame
Protocol Type	2	0 = MODBUS protocol	Client allocation, defaulted as 0	This identifier in the response frame on the server side must be consistent with the request frame
Data Length	2	Subsequent data length	The client allocates it according to the actual frame	The server allocates it according to the length of actual frame
Logical Device ID	1	0	The client allocates it according to the request of actual frame	This identifier in the response frame on the server side must be consistent with the request frame

1.3 APPLICATION LAYER

1.3.1 FUNCTION CODE

Supported function code: 03H, 05H, 06H. Function code 03H is used for reading value register inside the device, 05H is used for saving single coil data to bit memory inside the device and sending remote command, while 06H is used for saving single data to memory inside the device.

Data calibration method: CRC16.

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

When communication command is sent to the instrument, the instrument with corresponding address code shall receive it, and then remove the address code, read the information. If nothing goes wrong, it shall execute the command, and send the result back to the sender. The backward information includes address code, function code for action execution, data after the action execution and error check code (CRC). If an error occurs, no information is sent.

1.3.2 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 4 Error Code Format Responded by Slave (CRC excluded)

Item	Description
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.

2. CONTROLLER INTERNAL REGISTER ADDRESS AND DATA

2.1 FUNCTION CODE 03H MAPPLING COIL FIELD

Table 5 Alarm, Status Coil Data Field

Modbus Address	PLC Address	Item	Description	Byte
0000.0	40001.0	Common Alarm	0 represents there is no common alarm; 1 represents there is common alarm (0000.0 represents the Boolean value of bit 0 at address 0000); and so on .	1bit (LSB 0)
0000.1	40001.1	Common Shutdown Alarm	1 for active	1bit
0000.2	40001.2	Common Warning Alarm	1 for active	1bit
0000.3	40001.3	Common Trip and Stop Alarm	1 for active	1bit
0000.4	40001.4	Common Trip Alarm	1 for active	1bit
0000.5	40001.5	Common Safety Trip and Stop Alarm	1 for active	1bit
0000.6	40001.6	Common Safety Trip Alarm	1 for active	1bit
0000.7	40001.7	Common Block Alarm	1 for active	1bit
0000.8	40001.8	In Test Mode	1 for active	1bit
0000.9	40001.9	In Auto Mode	1 for active	1bit
0000.10	40001.10	In Manual Mode	1 for active	1bit
0000.11	40001.11	In Stop Mode	1 for active	1bit
0000.12	40001.12	Remote Lock	1 for active	1bit
0000.13	40001.13	Reserved		1bit
0000.14	40001.14	Reserved		1bit
0000.15	40001.15	Reserved		1bit
0001-0015	40002-40016	Shutdown Alarm Field	Alarm Data Table	30Bytes
0016-0030	40017-40031	Trip and Stop Alarm Field		30Bytes
0031-0045	40032-40046	Trip Alarm Field		30Bytes
0046-0060	40047-40061	Safety Trip AND Stop Alarm Field		30Bytes
0061-0075	40062-40076	Safety Trip Alarm Field		30Bytes
0076-0090	40077-40091	Block Field		30Bytes
0091-0105	40092-40106	Warning Field		30Bytes
0106.0	40107.0	Emergency Input Port Status	1 for active	1bit
0106.1	40107.1	Aux. Input 1 Status	1 for active	1bit
0106.2	40107.2	Aux. Input 2 Status	1 for active	1bit
0106.3	40107.3	Aux. Input 3 Status	1 for active	1bit

Modbus Address	PLC Address	Item	Description	Byte
0106.4	40107.4	Aux. Input 4 Status	1 for active	1bit
0106.5	40107.5	Aux. Input 5 Status	1 for active	1bit
0106.6	40107.6	Aux. Input 6 Status	1 for active	1bit
0106.7	40107.7	Aux. Input 7 Status	1 for active	1bit
0106.8	40107.8	Aux. Input 8 Status	1 for active	1bit
0106.9	40107.9	Aux. Input 9 Status	1 for active	1bit
0106.10	40107.10	Aux. Input 10 Status	1 for active	1bit
0106.11	40107.11	Aux. Input 11 Status	1 for active	1bit
0106.12	40107.12	Aux. Input 12 Status	1 for active	1bit
0106.13	40107.13	Aux. Input 13 Status	1 for active	1bit
0106.14	40107.14	Aux. Input 14 Status	1 for active	1bit
0106.15	40107.15	Aux. Input 15 Status	1 for active	1bit
0107.0	40108.0	Exp. Input 1 Status	1 for active	1bit
0107.1	40108.1	Exp. Input 2 Status	1 for active	1bit
0107.2	40108.2	Exp. Input 3 Status	1 for active	1bit
0107.3	40108.3	Exp. Input 4 Status	1 for active	1bit
0107.4	40108.4	Exp. Input 5 Status	1 for active	1bit
0107.5	40108.5	Exp. Input 6 Status	1 for active	1bit
0107.6	40108.6	Exp. Input 7 Status	1 for active	1bit
0107.7	40108.7	Exp. Input 8 Status	1 for active	1bit
0107.8	40108.8	Exp. Input 9 Status	1 for active	1bit
0107.9	40108.9	Exp. Input 10 Status	1 for active	1bit
0107.10	40108.10	Exp. Input 11 Status	1 for active	1bit
0107.11	40108.11	Exp. Input 12 Status	1 for active	1bit
0107.12	40108.12	Exp. Input 13 Status	1 for active	1bit
0107.13	40108.13	Exp. Input 14 Status	1 for active	1bit
0107.14	40108.14	Exp. Input 15 Status	1 for active	1bit
0107.15	40108.15	Exp. Input 16 Status	1 for active	1bit
0108.0	40109.0	Fuel Output Port Status	1 for active	1bit
0108.1	40109.1	Crank Output Port Status	1 for active	1bit
0108.2	40109.2	Aux. Output 1 Status	1 for active	1bit
0108.3	40109.3	Aux. Output 2 Status	1 for active	1bit
0108.4	40109.4	Aux. Output 3 Status	1 for active	1bit
0108.5	40109.5	Aux. Output 4 Status	1 for active	1bit
0108.6	40109.6	Aux. Output 5 Status	1 for active	1bit
0108.7	40109.7	Aux. Output 6 Status	1 for active	1bit
0108.8	40109.8	Aux. Output 7 Status	1 for active	1bit
0108.9	40109.9	Aux. Output 8 Status		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

Modbus Address	PLC Address	Item	Description	Byte
0108.15	40109.15	Reserved		1bit
0109.0	40110.0	Exp. Output 1 Status	1 for active	1bit
0109.1	40110.1	Exp. Output 2 Status	1 for active	1bit
0109.2	40110.2	Exp. Output 3 Status	1 for active	1bit
0109.3	40110.3	Exp. Output 4 Status	1 for active	1bit
0109.4	40110.4	Exp. Output 5 Status	1 for active	1bit
0109.5	40110.5	Exp. Output 6 Status	1 for active	1bit
0109.6	40110.6	Exp. Output 7 Status	1 for active	1bit
0109.7	40110.7	Exp. Output 8 Status	1 for active	1bit
0109.8	40110.8	Exp. Output 9 Status	1 for active	1bit
0109.9	40110.9	Exp. Output 10 Status	1 for active	1bit
0109.10	40110.10	Exp. Output 11 Status	1 for active	1bit
0109.11	40110.11	Exp. Output 12 Status	1 for active	1bit
0109.12	40110.12	Exp. Output 13 Status	1 for active	1bit
0109.13	40110.13	Exp. Output 14 Status	1 for active	1bit
0109.14	40110.14	Exp. Output 15 Status	1 for active	1bit
0109.15	40110.15	Exp. Output 16 Status	1 for active	1bit
0110	40111	Reserved		2Bytes
0111	40112	Reserved		2Bytes
0112	40113	Reserved		2Bytes
0113	40114	Reserved		2Bytes
0114.0	40115.0	Mains Normal	1 for active	1bit
0114.1	40115.1	Mains On Load	1 for active	1bit
0114.2	40115.2	Gen Normal	1 for active	1bit
0114.3	40115.3	Gen Close	1 for 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
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 need to read "In Manual Mode", firstly get its address is 0000.10 bit by checking the table, then it is known that 1-byte data needs to be read.

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

Table 6 Master (Computer) Request Command

Slave Address	Function Code	Starting Address (0000)		Request Data Qty. (1)		CRC 16 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
01	03	00	00	00	01	84	0A

Table 7 Master (Computer) Ethernet Request Command

MBAP						Function Code	Data					
Protocol Identifier		Protocol Type		Data Length			Logical Device ID		Starting Address (0000)		Request Data Qty. (1)	
									MSB	LSB	MSB	LSB
00	01	00	00	00	06	01	03	00	00	00	01	

The slave response command is as following:

Table 8 Slave (Controller) Response Command

Slave Address	Function Code	Data Qty. (Bytes)	Data		CRC 16 Calibration	
			Data MSB of Address 0000	Data LSB of Address 0000	LSB	MSB
01	03	02	84	07	AA	3F

Table 9 Slave (Controller) Ethernet Response Command

MBAP						Function Code	Data				
Protocol Identifier		Protocol Type		Data Length			Logical Device ID		Data Qty. (Bytes)	Return Data	
										Data MSB of Address 142	Data LSB of Address 142
00	01	00	00	00	05	01	03	02	84	07	

Table 10 Data Analysis

Address	Received Data (Hex)	Binary	Data Signification
0000	8407H	1000 0100 0000 0111 (corresponds to 0000.15, 0000.14.....0000.1, 0000.0	Data of bit 10 is 1, which means system manual mode is active

2.2 FUNCTION CODE 03H, 06H MAPPING VALUE DATA FIELD

06H function code only can be written by address 0296-0302, other addresses are unavailable.

Table 11 Data Field

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0115	40116	Reserved					2Bytes
0116	40117	Reserved					2Bytes
0117	40118	Reserved					2Bytes
0118	40119	Reserved					2Bytes
0119	40120	Reserved					2Bytes
0120	40121	Busbar/Mains UAB	0~4294967295	0.1	V	LSB	2Bytes
0121	40122					MSB	2Bytes
0122	40123	Busbar/Mains UBC	0~4294967295	0.1	V	LSB	2Bytes
0123	40124					MSB	2Bytes
0124	40125	Busbar/Mains UCA	0~4294967295	0.1	V	LSB	2Bytes
0125	40126					MSB	2Bytes
0126	40127	Busbar/Mains UA	0~4294967295	0.1	V	LSB	2Bytes
0127	40128					MSB	2Bytes
0128	40129	Busbar/Mains UB	0~4294967295	0.1	V	LSB	2Bytes
0129	40130					MSB	2Bytes
0130	40131	Busbar/Mains UC	0~4294967295	0.1	V	LSB	2Bytes
0131	40132					MSB	2Bytes
0132	40133	Busbar/Mains UA Phase Angle	0~360.0	0.1	°		2Bytes
0133	40134	Busbar/Mains UB Phase Angle	0~360.0	0.1	°		2Bytes
0134	40135	Busbar/Mains UC Phase Angle	0~360.0	0.1	°		2Bytes
0135	40136	Busbar/Mains Freq.	0~100.00	0.01	Hz		2Bytes
0136	40137	ROCOF					2Bytes
0137	40138	Reserved					2Bytes
0138	40139	Reserved					2Bytes
0139	40140	Reserved					2Bytes
0140	40141	Gen UAB	0~4294967295	0.1	V	LSB	2Bytes
0141	40142					MSB	2Bytes
0142	40143	Gen UBC	0~4294967295	0.1	V	LSB	2Bytes
0143	40144					MSB	2Bytes
0144	40145	Gen UCA	0~4294967295	0.1	V	LSB	2Bytes
0145	40146					MSB	2Bytes
0146	40147	Gen UA	0~4294967295	0.1	V	LSB	2Bytes
0147	40148					MSB	2Bytes
0148	40149	Gen UB	0~4294967295	0.1	V	LSB	2Bytes
0149	40150					MSB	2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0150	40151	Gen UC	0~4294967295	0.1	V	LSB	2Bytes
0151	40152					MSB	2Bytes
0152	40153	Gen UA Phase Angle	0~360.0	0.1	°		2Bytes
0153	40154	Gen UB Phase Angle	0~360.0	0.1	°		2Bytes
0154	40155	Gen UC Phase Angle	0~360.0	0.1	°		2Bytes
0155	40156	Gen Freq.	0~100.00	0.01	Hz		2Bytes
0156	40157	Voltage Difference	-32768~32767	0.1	V	Signed	2Bytes
0157	40158	Freq. Difference	-32768~32767	0.01	Hz	Signed	2Bytes
0158	40159	Phase Difference	-32768~32767	0.1	°	Signed	2Bytes
0159	40160	Current Gen Active Percentage	-32768~32767	0.1	%	Signed	2Bytes
0160	40161	Target Gen Active Percentage	-32768~32767	0.1	%	Signed	2Bytes
0161	40162	Current Gen Reactive Percentage	-32768~32767	0.1	%	Signed	2Bytes
0162	40163	Target Gen Reactive Percentage	-32768~32767	0.1	%	Signed	2Bytes
0163	40164	GOV Output PCT	-100.0~100.0	0.1	%	Signed	2Bytes
0164	40165	AVR Output PCT	-100.0~100.0	0.1	%	Signed	2Bytes
0165	40166	Reserved					2Bytes
0166	40167	A Phase Current	0~65535	0.1	A		2Bytes
0167	40168	B Phase Current	0~65535	0.1	A		2Bytes
0168	40169	C Phase Current	0~65535	0.1	A		2Bytes
0169	40170	Earth Current	0~65535	0.1	A		2Bytes
0170	40171	A-phase Current Phase Angle	0~360.0	0.1	°		2Bytes
0171	40172	B-phase Current Phase Angle	0~360.0	0.1	°		2Bytes
0172	40173	C-phase Current Phase Angle	0~360.0	0.1	°		2Bytes
0173	40174	Earth Current Phase Angle	0~360.0	0.1	°		2Bytes
0174	40175	A Phase Active Power	-2,147,483,648 ~2,147,483,647	0.1	kW	Signed LSB	2Bytes
0175	40176					Signed MSB	2Bytes
0176	40177	B Phase Active Power	-2,147,483,648 ~2,147,483,647	0.1	kW	Signed LSB	2Bytes
0177	40178					Signed MSB	2Bytes
0178	40179	C Phase Active Power	-2,147,483,648 ~2,147,483,647	0.1	kW	Signed LSB	2Bytes
0179	40180					Signed MSB	2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0180	40181	Total Active Power	-2,147,483,648	0.1	kW	Signed LSB	2Bytes
0181	40182		~2,147,483,647			Signed MSB	2Bytes
0182	40183	A Phase Reactive Power	-2,147,483,648	0.1	kvar	Signed LSB	2Bytes
0183	40184		~2,147,483,647			Signed MSB	2Bytes
0184	40185	B Phase Reactive Power	-2,147,483,648	0.1	kvar	Signed LSB	2Bytes
0185	40186		~2,147,483,647			Signed MSB	2Bytes
0186	40187	C Phase Reactive Power	-2,147,483,648	0.1	kvar	Signed LSB	2Bytes
0187	40188		~2,147,483,647			Signed MSB	2Bytes
0188	40189	Total Reactive Power	-2,147,483,648	0.1	kvar	Signed LSB	2Bytes
0189	40190		~2,147,483,647			Signed MSB	2Bytes
0190	40191	A Phase Apparent Power	-2,147,483,648	0.1	kVA	Signed LSB	2Bytes
0191	40192		~2,147,483,647			Signed MSB	2Bytes
0192	40193	B Phase Apparent Power	-2,147,483,648	0.1	kVA	Signed LSB	2Bytes
0193	40194		~2,147,483,647			Signed MSB	2Bytes
0194	40195	C Phase Apparent Power	-2,147,483,648	0.1	kVA	Signed LSB	2Bytes
0195	40196		~2,147,483,647			Signed MSB	2Bytes
0196	40197	Total Apparent Power	-2,147,483,648	0.1	kVA	Signed LSB	2Bytes
0197	40198		~2,147,483,647			Signed MSB	2Bytes
0198	40199	A Phase Power Factor	-100.000~100.000	0.001	CosΦ	Signed	2Bytes
0199	40200	B Phase Power Factor	-100.000~100.000	0.001	CosΦ	Signed	2Bytes
0200	40201	C Phase 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	Negative Phase Angle					2Bytes
0203	40204	Zero Phase Angle					2Bytes
0204	40205	Unbalanced Current	0~65535	0.1	A	Signed	2Bytes
0205	40206	Reserved					2Bytes
0206	40207	Reserved					2Bytes
0207	40208	Reserved					2Bytes
0208	40209	Reserved					2Bytes
0209	40210	Reserved					2Bytes
0210	40211	Reserved					2Bytes
0211	40212	Reserved					2Bytes
0212	40213	Engine Speed	0~65535	1	r/min		2Bytes
0213	40214	Battery Voltage	0~65535	0.1	V		2Bytes
0214	40215	Charger Voltage	0~65535	0.1	V		2Bytes
0215	40216	Reserved					2Bytes
0216	40217	Reserved					2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0217	40218	Reserved					2Bytes
0218	40219	Reserved					2Bytes
0219	40220	Reserved					2Bytes
0220	40221	Temp. Sensor Value	-50~10000	1	°C		2Bytes
0221	40222	Reserved					2Bytes
0222	40223	Pressure Sensor Value	0~10000	1	kPa		2Bytes
0223	40224	Reserved					2Bytes
0224	40225	Level Sensor Value	0~200	1	%		2Bytes
0225	40226	Reserved					2Bytes
0226	40227	Aux. Sensor 1 Value					2Bytes
0227	40228	Reserved					2Bytes
0228	40229	Aux. Sensor 2 Value					2Bytes
0229	40230	Reserved					2Bytes
0230	40231	Reserved					2Bytes
0231	40232	Reserved					2Bytes
0232	40233	Load Percentage	-100~100	1	%		2Bytes
0233	40234	Coolant Level	0~200	1	%	Signed, it is reserved when engine is not ECU. 16-bit Signed	2Bytes
0234	40235	Oil Temp.	-32768~32767	1	°C		2Bytes
0235	40236	Coolant Pressure	0~32767	1	kPa		2Bytes
0236	40237	Fuel Pressure	0~32767	1	kPa		2Bytes
0237	40238	Fuel Temp.	-32768~32767	1	°C		2Bytes
0238	40239	Inlet Temp.	-32768~32767	1	°C		2Bytes
0239	40240	Exhaust Temp.	-32768~32767	1	°C		2Bytes
0240	40241	Turbo Pressure	0~32767	1	kPa		2Bytes
0241	40242	Fuel Consumption	0~32767	0.1	L/h		2Bytes
0242	40243	Accumulated Fuel Consumption	0~99999999	1	L		32-bit Unsigned
0243	40244						
0244	40245	Reserved					2Bytes
0245	40246	Reserved					2Bytes
0246	40247	Reserved					2Bytes
0247	40248	Reserved					2Bytes
0248	40249	Reserved					2Bytes
0249	40250	Reserved					2Bytes
0250	40251	Reserved					2Bytes
0251	40252	Current Mains Active Percentage	-32768~32767	0.1	%	Signed	2Bytes
0252	40253	Current Mains Reactive Percentage	-32768~32767	0.1	%	Signed	2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0253	40254	Mains Active	-2,147,483,648	0.1	kW	32-bit Signed	4Bytes
0254	40255	Power	~2,147,483,647				
0255	40256	Mains Reactive	-2,147,483,648	0.1	kvar	32-bit Signed	4Bytes
0256	40257	Power	~2,147,483,647				
0257	40258	Mains Apparent	-2,147,483,648	0.1	kVA	32-bit Signed	4Bytes
0258	40259	Power	~2,147,483,647				
0259	40260	Mains Power Factor	-100.000~100.000	0.001	CosΦ	16-bit Signed	2Bytes
0260	40261	Generator Status				Generator Status Table	2Bytes
0261	40262	Delay Value					2Bytes
0262	40263	Remote Start Status				Remote Start Status Table	2Bytes
0263	40264	Delay Value					2Bytes
0264	40265	Gen. ATS Status				ATS Status Table	2Bytes
0265	40266	Delay Value					2Bytes
0266	40267	Mains Status				Mains Status Table	2Bytes
0267	40268	Delay Value					2Bytes
0268	40269	Mains ATS Status				ATS Status Table	2Bytes
0269	40270	Delay Value					2Bytes
0270	40271	Accumulated Running Hours	0~65534	1	h		2Bytes
0271	40272	Accumulated Running Minutes	0~59	1	min		2Bytes
0272	40273	Accumulated Running Seconds	0~59	1	s		2Bytes
0273	40274	Accumulated Start Times	0~65534		time		2Bytes
0274	40275	Accumulated Energy kWh	0~99999999	0.1	kWh		4Bytes
0275	40276	Energy kWh	0~99999999				
0276	40277	Accumulated Energy kvarh	0~99999999	0.1	kvarh		4Bytes
0277	40278	Energy kvarh	0~99999999				
0278	40279	Accumulated Energy kVAh	0~99999999	0.1	KVAh		4Bytes
0279	40280	Energy kVAh	0~99999999				
0280	40281	Reserved					4Bytes
0281	40282						
0282	40283	Maint. Left Hours	0~30000	1	h		2Bytes
0283	40284	Maint. Left Minutes	0~59	1	min		2Bytes
0284	40285	Maint. Left	0~59	1	s		2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
		Seconds					
0285	40286	Multi-unit Total	-2,147,483,648	0.1	kvarh	Signed	2Bytes
0286	40287	Reactive Power	~2,147,483,647				2Bytes
0287	40288	Reserved					2Bytes
0288	40289	Controller Model					2Bytes
0289	40290	Software Version		0.1			2Bytes
0290	40291	Hardware Version		0.1			2Bytes
0291	40292	Release Year	0~99	1	year	Only save last two digits of year	2Bytes
0292	40293	Release Month	1~12	1	month		2Bytes
0293	40294	Release Day	1~31	1	day		2Bytes
0294	40295	Reserved					2Bytes
0295	40296	Reserved					2Bytes
0296	40297	Controller Year Time:	0~99	1	year	Only save last two digits of year	2Bytes
0297	40298	Controller Month Time:	1~12	1	month		2Bytes
0298	40299	Controller Day Time:	1~31	1	day		2Bytes
0299	40300	Controller Week Time:	0~6	1	week		2Bytes
0300	40301	Controller Hour Time:	0~23	1	h		2Bytes
0301	40302	Controller Min Time:	0~59	1	min		2Bytes
0302	40303	Controller Time: S	0~59	1	s		2Bytes
0303	40304	Module MSC ID	0~31				2Bytes
0304	40305	Module Priority				Signed	2Bytes
0305	40306	Total Module	0~254				2Bytes
0306	40307	Multi-unit Total	-2,147,483,648	0.1	kW	Signed	2Bytes
0307	40308	Active Power	~2,147,483,647				2Bytes
0308	40309	Reserved					2Bytes
0309	40310	AIN24-1 Sensor 15 Value				Signed	2Bytes
0310	40311	AIN24-1 Sensor 16 Value				Signed	2Bytes
0311	40312	AIN24-1 Sensor 17 Value				Signed	2Bytes
0312	40313	AIN24-1 Sensor 18 Value				Signed	2Bytes
0313	40314	AIN24-1 Sensor 19				Signed	2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
		Value					
0314	40315	AIN24-1 Sensor 20 Value				Signed	2Bytes
0315	40316	AIN24-1 Sensor 21 Value				Signed	2Bytes
0316	40317	AIN24-1 Sensor 22 Value				Signed	2Bytes
0317	40318	AIN24-1 Sensor 23 Value				Signed	2Bytes
0318	40319	AIN24-1 Sensor 24 Value				Signed	2Bytes
0319	40320	AIN24-2 Sensor 15 Value				Signed	2Bytes
0320	40321	AIN24-2 Sensor 6 Value				Signed	2Bytes
0321	40322	AIN24-2 Sensor 17 Value				Signed	2Bytes
0322	40323	AIN24-2 Sensor 18 Value				Signed	2Bytes
0323	40324	AIN24-2 Sensor 19 Value				Signed	2Bytes
0324	40325	AIN24-2 Sensor 20 Value				Signed	2Bytes
0325	40326	AIN24-2 Sensor 21 Value				Signed	2Bytes
0326	40327	AIN24-2 Sensor 22 Value				Signed	2Bytes
0327	40328	AIN24-2 Sensor 23 Value				Signed	2Bytes
0328	40329	AIN24-2 Sensor 24 Value				Signed	2Bytes
0329	40330	Reserved					2Bytes
0330	40331	Reserved					2Bytes
0331	40332	Reserved					2Bytes
0332	40333	Reserved					2Bytes
0333	40334	Reserved					2Bytes
0334	40335	Reserved					2Bytes
0335	40336	Reserved					2Bytes
0336	40337	Reserved					2Bytes
0337	40338	Reserved					2Bytes
0338	40339	Reserved					2Bytes
0339	40340	Reserved					2Bytes
0340	40341	Reserved					2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0341	40342	A Accum. Running Time: Hour	0~65534	1	h	Unsigned	2Bytes
0342	40343	A Accum. Running Time: Min	0~59	1	min	Unsigned	2Bytes
0343	40344	A Accum. Running Time: S	0~59	1	s	Unsigned	2Bytes
0344	40345	A Accum. Start Times	0~65534	1		Unsigned	2Bytes
0345	40346	A Accum. Energy	0~99999999	0.1	kWh	Signed	4Bytes
0346	40347						
0347	40348	B Accum. Running Time: Hour	0~65534	1	h	Unsigned	2Bytes
0348	40349	B Accum. Running Time: Min	0~59	1	min	Unsigned	2Bytes
0349	40350	B Accum. Running Time: S	0~59	1	s	Unsigned	2Bytes
0350	40351	B Accum. Start Times	0~65534	1		Unsigned	2Bytes
0351	40352	B Accum. Energy	0~99999999	0.1	kWh	Signed	4Bytes
0352	40353						
0353	40354	Reserved					2Bytes
0354	40355	Reserved					2Bytes
0355	40356	Reserved					2Bytes
0356	40357	AIN24-1 KIN1 Temp. Value				Unsigned	2Bytes
0357	40358	AIN24-1 KIN2 Temp. Value				Unsigned	2Bytes
0358	40359	AIN24-1 KIN3 Temp. Value				Unsigned	2Bytes
0359	40360	AIN24-1 KIN4 Temp. Value				Unsigned	2Bytes
0360	40361	AIN24-1 KIN5 Temp. Value				Unsigned	2Bytes
0361	40362	AIN24-1 KIN6 Temp. Value				Unsigned	2Bytes
0362	40363	AIN24-1 KIN7 Temp. Value				Unsigned	2Bytes
0363	40364	AIN24-1 KIN8 Temp. Value				Unsigned	2Bytes
0364	40365	AIN24-1 KIN9 Temp. Value				Unsigned	2Bytes
0365	40366	AIN24-1 KIN10 Temp. Value				Unsigned	2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0366	40367	AIN24-1 KIN11 Temp. Value				Unsigned	2Bytes
0367	40368	AIN24-1 KIN12 Temp. Value				Unsigned	2Bytes
0368	40369	AIN24-1 KIN13 Temp. Value				Unsigned	2Bytes
0369	40370	AIN24-1 KIN14 Temp. Value				Unsigned	2Bytes
0370	40371	AIN24-2 KIN1 Temp. Value				Unsigned	2Bytes
0371	40372	AIN24-2 KIN2 Temp. Value				Unsigned	2Bytes
0372	40373	AIN24-2 KIN3 Temp. Value				Unsigned	2Bytes
0373	40374	AIN24-2 KIN4 Temp. Value				Unsigned	2Bytes
0374	40375	AIN24-2 KIN5 Temp. Value				Unsigned	2Bytes
0375	40376	AIN24-2 KIN6 Temp. Value				Unsigned	2Bytes
0376	40377	AIN24-2 KIN7 Temp. Value				Unsigned	2Bytes
0377	40378	AIN24-2 KIN8 Temp. Value				Unsigned	2Bytes
0378	40379	AIN24-2 KIN9 Temp. Value				Unsigned	2Bytes
0379	40380	AIN24-2 KIN10 Temp. Value				Unsigned	2Bytes
0380	40381	AIN24-2 KIN11 Temp. Value				Unsigned	2Bytes
0381	40382	AIN24-2 KIN12 Temp. Value				Unsigned	2Bytes
0382	40383	AIN24-2 KIN13 Temp. Value				Unsigned	2Bytes
0383	40384	AIN24-2 KIN14 Temp. Value				Unsigned	2Bytes
0384	40385	Reserved					2Bytes
0385	40386	Reserved					2Bytes
0386	40387	Reserved					2Bytes
0387	40388	Reserved					2Bytes
0388	40389	Reserved					2Bytes
0389	40390	Reserved					2Bytes
0390	40391	Reserved					2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0391	40392	Reserved					2Bytes
0392	40393	Reserved					2Bytes
0393	40394	Reserved					2Bytes
0394	40395	Reserved					2Bytes
0395	40396	Reserved					2Bytes
0396	40397	Reserved					2Bytes
0397	40398	Reserved					2Bytes
0398	40399	Reserved					2Bytes
0399	40400	Reserved					2Bytes
0400	40401	Reserved					2Bytes
0401	40402	Reserved					2Bytes
0402	40403	Reserved					2Bytes
0403	40404	Reserved					2Bytes
0404	40405	Reserved					2Bytes
0405	40406	Reserved					2Bytes
0406	40407	ECU Temperature		1	°C	Signed	2Bytes
0407	40408	Current Running Time: Hour				Unsigned	2Bytes
0408	40409	Current Running Time: Minute				Unsigned	2Bytes
0409	40410	Current Running Time: Second				Unsigned	2Bytes
0410	40411	Current Accum. Energy		0.1	kWh	Signed	4Bytes
0411	40412						
0412	40413	THD1		0.1	%	Signed	2Bytes
0413	40414	THD2		0.1	%	Signed	2Bytes
0414	40415	THD3		0.1	%	Signed	2Bytes
0415	40416	Unbalanced Gen. Voltage		0.1	%	Signed	2Bytes
0416	40417	DM1 Alarm Type				Alarm Type Table	2Bytes
0417	40418	DM1 Alarm Quantity				Unsigned	2Bytes
0418	40419	DM1 Alarm 1				SPN LSB	2Bytes
0419	40420		SPN MSB				2Bytes
0420	40421		High 8-bit: OC Low 8-bit: FMI				2Bytes
0421	40422	DM1 Alarm 2				SPN LSB	2Bytes
0422	40423		SPN MSB				2Bytes
0423	40424		High 8-bit: OC Low 8-bit: FMI				2Bytes
0424	40425	DM1 Alarm 3				SPN LSB	2Bytes
0425	40426		SPN MSB				2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0426	40427					High 8-bit: OC Low 8-bit: FMI	2Bytes
0427	40428	DM1 Alarm 4				SPN LSB	2Bytes
0428	40429					SPN MSB	2Bytes
0429	40430					High 8-bit: OC Low 8-bit: FMI	2Bytes
0430	40431	DM1 Alarm 5				SPN LSB	2Bytes
0431	40432					SPN MSB	2Bytes
0432	40433					High 8-bit: OC Low 8-bit: FMI	2Bytes
0433	40434	DM1 Alarm 6				SPN LSB	2Bytes
0434	40435					SPN MSB	2Bytes
0435	40436					High 8-bit: OC Low 8-bit: FMI	2Bytes
0436	40437	DM1 Alarm 7				SPN LSB	2Bytes
0437	40438					SPN MSB	2Bytes
0438	40439					High 8-bit: OC Low 8-bit: FMI	2Bytes
0439	40440	DM1 Alarm 8				SPN LSB	2Bytes
0440	40441					SPN MSB	2Bytes
0441	40442					High 8-bit: OC Low 8-bit: FMI	2Bytes
0442	40443	DM1 Alarm 9				SPN LSB	2Bytes
0443	40444					SPN MSB	2Bytes
0444	40445					High 8-bit: OC Low 8-bit: FMI	2Bytes
0445	40446	DM1 Alarm 10				SPN LSB	2Bytes
0446	40447					SPN MSB	2Bytes
0447	40448					High 8-bit: OC Low 8-bit: FMI	2Bytes
0448	40449	DM2 Alarm Type				Alarm Type Table	2Bytes
0449	40450	DM2 Alarm Quantity				Unsigned	2Bytes
0450	40451	DM2 Alarm 1				SPN LSB	2Bytes
0451	40452					SPN MSB	2Bytes
0452	40453					High 8-bit: OC Low 8-bit: FMI	2Bytes
0453	40454	DM2 Alarm 2				SPN LSB	2Bytes
0454	40455					SPN MSB	2Bytes
0455	40456					High 8-bit: OC Low 8-bit: FMI	2Bytes
0456	40457	DM2 Alarm 3				SPN LSB	2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0457	40458					SPN MSB	2Bytes
0458	40459					High 8-bit: OC Low 8-bit: FMI	2Bytes
0459	40460	DM2 Alarm 4				SPN LSB	2Bytes
0460	40461					SPN MSB	2Bytes
0461	40462					High 8-bit: OC Low 8-bit: FMI	2Bytes
0462	40463	DM2 Alarm 5				SPN LSB	2Bytes
0463	40464					SPN MSB	2Bytes
0464	40465					High 8-bit: OC Low 8-bit: FMI	2Bytes
0465	40466	DM2 Alarm 6				SPN LSB	2Bytes
0466	40467					SPN MSB	2Bytes
0467	40468					High 8-bit: OC Low 8-bit: FMI	2Bytes
0468	40469	DM2 Alarm 7				SPN LSB	2Bytes
0469	40470					SPN MSB	2Bytes
0470	40471					High 8-bit: OC Low 8-bit: FMI	2Bytes
0471	40472	DM2 Alarm 8				SPN LSB	2Bytes
0472	40473					SPN MSB	2Bytes
0473	40474					High 8-bit: OC Low 8-bit: FMI	2Bytes
0474	40475	DM2 Alarm 9				SPN LSB	2Bytes
0475	40476					SPN MSB	2Bytes
0476	40477					High 8-bit: OC Low 8-bit: FMI	2Bytes
0477	40478	DM2 Alarm 10				SPN LSB	2Bytes
0478	40479					SPN MSB	2Bytes
0479	40480					High 8-bit: OC Low 8-bit: FMI	2Bytes
0480	40481	Reserved					2Bytes
0481	40482	Reserved					2Bytes
0482	40483	Reserved					2Bytes
0483	40484	Reserved					2Bytes
0484	40485	Reserved					2Bytes
0485	40486	Reserved					2Bytes
0486	40487	Reserved					2Bytes
0487	40488	Reserved					2Bytes
0488	40489	Reserved					2Bytes
0489	40490	Reserved					2Bytes
0490	40491	Reserved					2Bytes
0491	40492	Reserved					2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0492	40493	Reserved					2Bytes
0493	40494	Reserved					2Bytes
0494	40495	Reserved					2Bytes
0495	40496	AIN8 Flexible Sensor 1 Value				Unsigned; Sensor type is set as flow sensor; Default ratio is 0.1, otherwise it is 1.	2Bytes
0496	40497	AIN8 Flexible Sensor 2 Value					2Bytes
0497	40498	AIN8 Flexible Sensor 3 Value					2Bytes
0498	40499	AIN8 Flexible Sensor 4 Value					2Bytes
0499	40500	AIN8 Flexible Sensor 5 Value					2Bytes
0500	40501	AIN8 Flexible Sensor 6 Value					2Bytes
0501	40502	AIN8 Flexible Sensor 7 Value					2Bytes
0502	40503	AIN8 Flexible Sensor 8 Value					2Bytes
0503	40504	Reserved					2Bytes
0504	40505	Reserved					2Bytes
0505	40506	Reserved					2Bytes
0506	40507	Reserved					2Bytes
0507	40508	Reserved					2Bytes
0508	40509	Reserved					2Bytes
0509	40510	Reserved					2Bytes
0510	40511	Reserved					2Bytes
0511	40512	Alarm Quantity				Unsigned	2Bytes
0512	40513	Reserved					2Bytes
0513	40514	Reserved					2Bytes
0514	40515	Reserved					2Bytes
0515	40516	Reserved					2Bytes
0516	40517	Reserved					2Bytes
0517	40518	Reserved					2Bytes
0518	40519	Reserved					2Bytes
0519	40520	Reserved					2Bytes
0520	40521	Reserved					2Bytes
0521	40522	Reserved					2Bytes
0522	40523	Reserved					2Bytes
0523	40524	Reserved					2Bytes
0524	40525	Reserved					2Bytes
0525	40526	Reserved					2Bytes
0526	40527	Reserved					2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0527	40528	Reserved					2Bytes
0528	40529	Reserved					2Bytes
0529	40530	Reserved					2Bytes
0530	40531	Reserved					2Bytes
0531	40532	Reserved					2Bytes
0532	40533	Reserved					2Bytes
0533	40534	Reserved					2Bytes
0534	40535	Reserved					2Bytes
0535	40536	Reserved					2Bytes
0536	40537	Reserved					2Bytes
0537	40538	Reserved					2Bytes
0538	40539	Reserved					2Bytes
0539	40540	Reserved					2Bytes
0540	40541	Reserved					2Bytes
0541	40542	Reserved					2Bytes
0542	40543	ECU Cylinder Temp. 1				Signed; If engine type is non-ECU, the items will be reserved; 16-bit signed.	2Bytes
0543	40544	ECU Cylinder Temp. 2					2Bytes
0544	40545	ECU Cylinder Temp. 3					2Bytes
0545	40546	ECU Cylinder Temp. 4					2Bytes
0546	40547	ECU Cylinder Temp. 5					2Bytes
0547	40548	ECU Cylinder Temp. 6					2Bytes
0548	40549	ECU Cylinder Temp. 7					2Bytes
0549	40550	ECU Cylinder Temp. 8					2Bytes
0550	40551	ECU Cylinder Temp. 9					2Bytes
0551	40552	ECU Cylinder Temp. 10					2Bytes
0552	40553	ECU Cylinder Temp. 11					2Bytes
0553	40554	ECU Cylinder Temp. 12					2Bytes
0554	40555	ECU Cylinder Temp. 13					2Bytes
0555	40556	ECU Cylinder Temp. 14					2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0556	40557	ECU Cylinder Temp. 15					2Bytes
0557	40558	ECU Cylinder Temp. 16					2Bytes
0558	40559	ECU Cylinder Temp. 17					2Bytes
0559	40560	ECU Cylinder Temp. 18					2Bytes
0560	40561	ECU Cylinder Temp. 19					2Bytes
0561	40562	ECU Cylinder Temp. 20					2Bytes
0562	40563	Throttle Valve 1 Position		0.1	%	Signed; It is suitable for non-KINGBAND genset	2Bytes
0563	40564	Throttle Valve 2 Position		0.1	%		2Bytes
0564	40565	Reserved					2Bytes
0565	40566	Turbo Bypass Position		0.1	%	Signed; If engine type is non-ECU, the items will be reserved; 16-bit signed.	2Bytes
0566	40567	Reserved					2Bytes
0567	40568	Reserved					2Bytes
0568	40569	Reserved					2Bytes
0569	40570	Reserved					2Bytes
0570	40571	Fuel Valve 1 Position		0.1	%		2Bytes
0571	40572	Fuel Valve 2 Position		0.1	%		2Bytes
0572	40573	Fuel Inlet Pressure		0.1	kPa		2Bytes
0573	40574	Fuel Pressure Difference		0.1	kPa		2Bytes
0574	40575	Reserved					2Bytes
0575	40576	Turbo 1 Pressure		1	kPa		2Bytes
0576	40577	Turbo 2 Pressure		1	kPa		2Bytes
0577	40578	Exhaust Oxygen Content		0.1	%		2Bytes
0578	40579	Reserved					2Bytes
0579	40580	Turbo Oil Temp.		1	°C		2Bytes
0580	40581	Intercooler Temp.		1	°C		2Bytes
0581	40582	Reserved				2Bytes	
0582	40583	Engine Oil Level		0.1	%	2Bytes	
0583	40584	Atmospheric		1	kPa	2Bytes	

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
		Pressure					
0584	40585	Ambient Temp.		1	°C		2Bytes
0585	40586	Air Intake Temp.		1	°C		2Bytes
0586	40587	Intake Manifold Pressure		1	kPa		2Bytes
0587	40588	Intake Manifold Temp.		1	°C		2Bytes
0588	40589	Air Intake Pressure		1	kPa		2Bytes
0589	40590	Air Filter Pressure Difference		0.1	kPa		2Bytes
0590	40591	ECU Battery Voltage		0.1	V		2Bytes
0591	40592	ECU Switch Voltage		0.1	V		2Bytes
0592	40593	Throttle Position		0.1	%		2Bytes
0593	40594	Reserved					2Bytes
0594	40595	Engine Wait To Start Indicator					2Bytes
0595	40596	Engine Stopped By Engine Protection System				Indicator Status Table	2Bytes
0596	40597	Water In Fuel Indicator 1					2Bytes
0597	40598	Water In Fuel Indicator 2					2Bytes
0598	40599	DPF PM Level		0.1	%	Signed; If engine type is non-ECU, the item will be reserved; 16-bit signed.	2Bytes
0599	40600	DPF Ash Level		0.1	%		2Bytes
0600	40601	DPF Indicator Command				Indicator Status Table	2Bytes
0601	40602	DPF Active Regen. Status					2Bytes
0602	40603	DPF Status					2Bytes
0603	40604	DPF Regen. Inhibit Status					2Bytes
0604	40605	Exhaust System High Temp. Indicator Command					2Bytes
0605	40606	DEF Tank Level		0.1	%	Signed;	2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0606	40607	DEF Tank Temp.		1	°C	If engine type is non-ECU, the item will be reserved; 16-bit signed.	2Bytes
0607	40608	DEF Tank Low Level Indicator				Indicator Status Table	2Bytes
0608	40609	SCR System Clean Indicator Command			2Bytes		
0609	40610	SCR System Clean Inhibit Status			2Bytes		
0610	40611	DEF Supply Rate		1	g/h	Signed;	2Bytes
0611	40612	DEF Supply Pressure		1	kPa	If engine type is non-ECU, the item will be reserved; 16-bit signed.	2Bytes
0612	40613	SCR Intensity				Indicator Status Table	2Bytes
0613	40614	CM1 Inhibit					2Bytes
0614	40615	CM1 Forced					2Bytes
0615	40616	DWS Indicator				Indicator Status Table	2Bytes
0616	40617	Ignition Timing		0.1	CA	Signed; It is suitable for ECU engine Exon-Gas	2Bytes
0617	40618	Engine Target Speed				Signed	2Bytes
0618	40619	Air-Gas Ratio		0.01		Signed; It is suitable for ECU engine Exon-Gas	2Bytes
0619	40620	Gas Pressure		0.01	kPa	Signed	2Bytes
0620	40621	Gas Temp.		1	°C	Signed	2Bytes
0621	40622	Exhaust Back Pressure		0.01	kPa	Signed	2Bytes
0622	40623	Throttle Valve Position		0.0001	%	Signed;	4Bytes
0623	40624	Command				If engine type is non-ECU, the item will be reserved;	
0624	40625	Engine Running Time		0.1	h	16-bit signed.	4Bytes
0625	40626						

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0626	40627	Cloud Platform Connection Status Icon				Unsigned	2Bytes
0627	40628	Ignition Timing		0.01	deg	Signed; It is suitable for ECU engine KINGBAND	2Bytes
0628	40629	Air-Fuel Ratio		0.01			2Bytes
0629	40630	Throttle Valve 2 Position		0.1	%		2Bytes

NOTE1: 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).

NOTE2: If there are 4 bytes in the data, the actual value = high order bits of data received * 65536 + low order bits of data received.

NOTE3: If data received is 32766, it means there is no normal data, and “###” will be shown.

NOTE4: 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:

Read “A Phase Active Power (Current is 123456)”, firstly get its addresses are 0174 and 0175 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 12 Master Request Command

Slave Address	Function Code	Starting Address (0174)		Request Data Qty. (2)		CRC 16 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
01	03	00	AE	00	02	A5	EA

Table 13 Client Ethernet Request Command

MBAP						Function Code	Data					
Protocol Identifier		Protocol Type		Data Length			Logical Device ID		Starting Address (0174)		Request Data Qty. (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 Qty. (Bytes)	Data				CRC 16 Calibration	
			Data MSB of Address 0174	Data LSB of Address 0174	Data MSB of Address 0175	Data LSB of Address 0175	LSB	MSB
01	03	04	E2	40	00	01	0C	5F

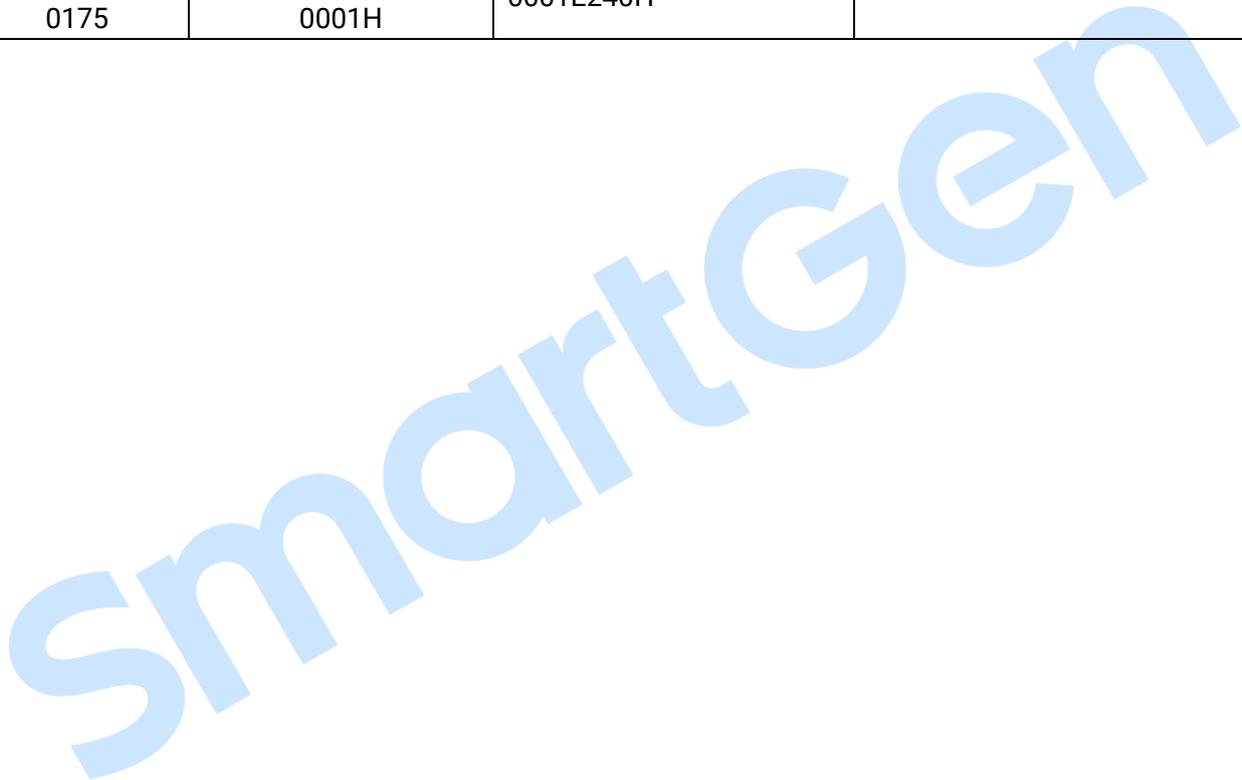
Table 15 Controller Ethernet Response Command

MBAP							Function Code	Data				
								Data Qty. (Bytes)	Return Data			
Protocol Identifier		Protocol Type		Data Length		Logical Device ID			Data MSB of Address 0174	Data LSB of Address 0174	Data MSB of Address 0175	Data LSB of Address 0175
00	01	00	00	00	07	01	03	04	E2	40	00	01

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

Table 16 Data Analysis

Address	Received Data (Hex)	After Combination (Hex)	A Phase 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	Only send FF00H for active
0001	0002	Remote Stop Key	Only send FF00H for active
0002	0003	Reserved	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	HGM9510N, HGM9530N Remote Gen Close Key	Only send FF00H for active
		HGM9520N Remote Mains Close/Open Key	
0006	0007	HGM9510N, HGM9530N Remote Gen Open Key	Only send FF00H for active
		HGM9520N Remote Gen Close/Open Key	
0007	0008	Remote Up Key	Only send FF00H for active
0008	0009	Remote Down Key	Only send FF00H for active
0009	0010	Reserved	
0010	0011	Reserved	
0011	0012	Remote Confirm Key	Only send FF00H for active
0012	0013	Remote Mute Key	Only send FF00H for active
0013	0014	Reserved	
0014	0015	Reserved	
0015	0016	Remote Diesel Engine Fast Stop	Only send FF00H for active
0016	0017	Reserved	
0017	0018	Remote Alarm Reset	Only send FF00H for active
0018	0019	Reserved	
0019	0020	Reserved	
0020	0021	Remote Output 1 Active	Send FF00H for active, 0000H for Inactive
0021	0022	Remote Output 2 Active	Send FF00H for active, 0000H for Inactive
0022	0023	Remote Output 3 Active	Send FF00H for active, 0000H for Inactive
0023	0024	Remote Output 4 Active	Send FF00H for active, 0000H for Inactive
0024	0025	Remote Output 5 Active	Send FF00H for active, 0000H for Inactive
0025	0026	Remote Output 6 Active	Send FF00H for active, 0000H for Inactive
0026	0027	Remote Output 7 Active	Send FF00H for active, 0000H for Inactive
0027	0028	Remote Output 8 Active	Send FF00H for active, 0000H for Inactive
0028	0029	Reserved	Send FF00H for active, 0000H for Inactive
0029	0030	Reserved	Send FF00H for active, 0000H for Inactive
0030	0031	Reserved	Send FF00H for active, 0000H for Inactive
0031	0032	Remote Lock	Send FF00H for active, 0000H for Inactive

NOTE 1: The above remote command only can be sent once only.

NOTE 2: Communication over Modbus address: sending FF00H to place the corresponding address to 1, sending 0000H to place the corresponding address to 0; communication over PLC address: sending 1 to place the corresponding address to 1, sending 0 to place the corresponding address to 0.

Example:

Remote control controller to work in manual mode, firstly get its remote address is 0004.

Assume 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 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
01	05	00	04	FF	00	CD	FB

Table 19 Client Ethernet Request Command

MBAP							Function Code	Data			
Protocol Identifier		Protocol Type		Data Length		Logical Device 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 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
01	05	00	04	FF	00	CD	FB

Table 21 Controller Ethernet Response Command

MBAP							Function Code	Data			
Protocol Identifier		Protocol Type		Data Length		Logical Device 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 successfully executed can be verified by reading the manual mode status of address 0000.10 via function code 01H.

2.4 FUNCTION CODE 06H MAPPING COIL FIELD

Table 22 Coil Field

Modbus Address	PLC Address	Item	Description
4368	44369	Load Parallel Output Active Power Percentage	Active in gen control mode (constant power) Data range: 0-1000 Corresponding percentage: 0.0%-100.0%
4370	44371	Load Parallel Output Reactive Power Percentage	

Example:

Send "Load Parallel Output Active Power Percentage", firstly get its remote address is 4368.

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

Table 23 Master Request Command

Slave Address	Function Code	Load Parallel Output Active Power Percentage (4368)		Value		CRC 16 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
01	06	11	10	00	32	0C	E6

Table 24 Master Ethernet Request Command

MBAP							Function Code	Data			
Protocol Identifier		Protocol Type		Data Length		Logical Device ID		Starting Address (4368)		Value	
MSB	LSB	MSB	LSB	MSB	LSB	MSB		LSB	MSB	LSB	
00	01	00	00	00	06	01	06	11	10	00	32

The slave response command is as following:

Table 25 Slave Response Command

Slave Address	Function Code	Load Parallel Output Active Power Percentage (4368)		Value		CRC 16 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
01	06	11	10	00	32	0C	E6

Table 26 Controller Ethernet Response Command

MBAP							Function Code	Data			
Protocol Identifier		Protocol Type		Data Length		Logical Device ID		Remote Address (4368)		Value	
MSB	LSB	MSB	LSB	MSB	LSB	MSB		LSB	MSB	LSB	
00	01	00	00	00	06	01	06	11	10	00	32

Table 27 Alarm Data

Offset Address	Item	Description	Bit
0000.0	Emergency Stop Alarm	1 for active (bit0)	1bit
0000.1	Overspeed Alarm	1 for active (bit1)	1bit
0000.2	Underspeed Alarm	1 for active (bit2)	1bit
0000.3	Speed Signal Loss	1 for active (bit3)	1bit
0000.4	Gen Overfrequency	1 for active (bit4)	1bit
0000.5	Gen Underfrequency	1 for active (bit5)	1bit
0000.6	Gen Overvoltage	1 for active (bit6)	1bit
0000.7	Gen Undervoltage	1 for active (bit7)	1bit
0000.8	Crank Failure Alarm	1 for active (bit8)	1bit
0000.9	Gen Overcurrent	1 for active (bit9)	1bit
0000.10	Current Imbalance	1 for active (bit10)	1bit
0000.11	Earth Fault	1 for active (bit11)	1bit
0000.12	Reverse Power Alarm	1 for active (bit12)	1bit
0000.13	Over Power Alarm	1 for active (bit13)	1bit
0000.14	Loss of Excitation Fault	1 for active (bit14)	1bit
0000.15	ECU Communication Failure	1 for active (bit15)	1bit
0001.0	ECU Alarm	1 for active	1bit
0001.1	High Temp. Input Alarm	1 for active	1bit
0001.2	Low Oil Pressure Input Alarm	1 for active	1bit
0001.3	MSC ID Error	1 for active	1bit
0001.4	Voltage Bus Error	1 for active	1bit
0001.5	Gen Phase Sequence Error	1 for active	1bit
0001.6	Voltage Bus Phase Sequence Error	1 for active	1bit
0001.7	Temp. Sensor Open	1 for active	1bit
0001.8	High Engine Temp.	1 for active	1bit
0001.9	Low Engine Temp.	1 for active	1bit
0001.10	Temp. Sensor Error	1 for active	1bit
0001.11	Oil Pressure Sensor Open	1 for active	1bit
0001.12	High Oil Pressure	1 for active	1bit
0001.13	Low Oil Pressure	1 for active	1bit
0001.14	Oil Pressure Sensor Error	1 for active	1bit
0001.15	Fuel Level Sensor Open	1 for active	1bit
0002.0	High Fuel Level	1 for active	1bit
0002.1	Low Fuel Level	1 for active	1bit
0002.2	Fuel Level Sensor Error	1 for active	1bit
0002.3	Aux. Sensor 1 Open	1 for active	1bit
0002.4	Aux. Sensor 1 High	1 for active	1bit
0002.5	Aux. Sensor 1 Low	1 for active	1bit
0002.6	Aux. Sensor 1 Error	1 for active	1bit
0002.7	Aux. Sensor 2 Open	1 for active	1bit

Offset Address	Item	Description	Bit
0002.8	Aux. Sensor 2 High	1 for active	1bit
0002.9	Aux. Sensor 2 Low	1 for active	1bit
0002.10	Aux. Sensor 2 Error	1 for active	1bit
0002.11	Stop Failure	1 for active	1bit
0002.12	Charging Failure	1 for active	1bit
0002.13	Battery Overvoltage	1 for active	1bit
0002.14	Battery Undervoltage	1 for active	1bit
0002.15	Synchronization Failure	1 for active	1bit
0003.0	GOV Reach Limit	1 for active	1bit
0003.1	AVR Reach Limit	1 for active	1bit
0003.2	Gen Insufficient Capacity	1 for active	1bit
0003.3	Voltage Out of Synchronization	1 for active	1bit
0003.4	Frequency Out of Synchronization	1 for active	1bit
0003.5	Phase Out of Synchronization	1 for active	1bit
0003.6	Mains Breaker Alarm	1 for active	1bit
0003.7	Gen Breaker Alarm	1 for active	1bit
0003.8	Mains Close Failure	1 for active	1bit
0003.9	Gen Close Failure	1 for active	1bit
0003.10	Mains Open Failure	1 for active	1bit
0003.11	Gen Open Failure	1 for active	1bit
0003.12	Mains Overfrequency	1 for active	1bit
0003.13	Mains Underfrequency	1 for active	1bit
0003.14	Mains Overvoltage	1 for active	1bit
0003.15	Mains Undervoltage	1 for active	1bit
0004.0	Mains Frequency Change	1 for active	1bit
0004.1	Mains Vector Drift	1 for active	1bit
0004.2	Large Frequency Difference Warning	1 for active	1bit
0004.3	Few MSC	1 for active	1bit
0004.4	Maintenance 1 Time Due	1 for active	1bit
0004.5	Maintenance 2 Time Due	1 for active	1bit
0004.6	Maintenance 3 Time Due	1 for active	1bit
0004.7	Low Water Level Alarm	1 for active	1bit
0004.8	Detonation Alarm	1 for active	1bit
0004.9	Gas Leak Alarm	1 for active	1bit
0004.10	Gen Reverse Phase Sequence	1 for active	1bit
0004.11	Gen Loss of Phase	1 for active	1bit
0004.12	MSC1 Communication Failure	1 for active	1bit
0004.13	MSC2 Communication Failure	1 for active	1bit
0004.14	Reserved	1 for active	1bit
0004.15	Reserved	1 for active	1bit
0005.0	Digital Input 1	1 for active	1bit
0005.1	Digital Input 2	1 for active	1bit
0005.2	Digital Input 3	1 for active	1bit
0005.3	Digital Input 4	1 for active	1bit

Offset Address	Item	Description	Bit
0005.4	Digital Input 5	1 for active	1bit
0005.5	Digital Input 6	1 for active	1bit
0005.6	Digital Input 7	1 for active	1bit
0005.7	Digital Input 8	1 for active	1bit
0005.8	Digital Input 9	1 for active	1bit
0005.9	Digital Input 10	1 for active	1bit
0005.10	Digital Input 11	1 for active	1bit
0005.11	Digital Input 12	1 for active	1bit
0005.12	PLC Function 1	1 for active	1bit
0005.13	PLC Function 2	1 for active	1bit
0005.14	PLC Function 3	1 for active	1bit
0005.15	PLC Function 4	1 for active	1bit
0006.0	PLC Function 5	1 for active	1bit
0006.1	PLC Function 6	1 for active	1bit
0006.2	PLC Function 7	1 for active	1bit
0006.3	PLC Function 8	1 for active	1bit
0006.4	PLC Function 9	1 for active	1bit
0006.5	PLC Function 10	1 for active	1bit
0006.6	PLC Function 11	1 for active	1bit
0006.7	PLC Function 12	1 for active	1bit
0006.8	PLC Function 13	1 for active	1bit
0006.9	PLC Function 14	1 for active	1bit
0006.10	PLC Function 15	1 for active	1bit
0006.11	PLC Function 16	1 for active	1bit
0006.12	PLC Function 17	1 for active	1bit
0006.13	PLC Function 18	1 for active	1bit
0006.14	PLC Function 19	1 for active	1bit
0006.15	PLC Function 20	1 for active	1bit
0007.0	DIN16 Communication Failure	1 for active	1bit
0007.1	DIN16 Input 1	1 for active	1bit
0007.2	DIN16 Input 2	1 for active	1bit
0007.3	DIN16 Input 3	1 for active	1bit
0007.4	DIN16 Input 4	1 for active	1bit
0007.5	DIN16 Input 5	1 for active	1bit
0007.6	DIN16 Input 6	1 for active	1bit
0007.7	DIN16 Input 7	1 for active	1bit
0007.8	DIN16 Input 8	1 for active	1bit
0007.9	DIN16 Input 9	1 for active	1bit
0007.10	DIN16 Input 10	1 for active	1bit
0007.11	DIN16 Input 11	1 for active	1bit
0007.12	DIN16 Input 12	1 for active	1bit
0007.13	DIN16 Input 13	1 for active	1bit
0007.14	DIN16 Input 14	1 for active	1bit
0007.15	DIN16 Input 15	1 for active	1bit

Offset Address	Item	Description	Bit
0008.0	DIN16 Input 16	1 for active	1bit
0008.1	DOUT16 Communication Failure	1 for active	1bit
0008.2	AIN24 1 Communication Failure	1 for active	1bit
0008.3	AIN24 1 Cylinder Temp. High	1 for active	1bit
0008.4	AIN24 1 Exhaust Temp. High	1 for active	1bit
0008.5	AIN24 1 Large Cylinder Temp. Difference	1 for active	1bit
0008.6	AIN24 1 Sensor 15 Open	1 for active	1bit
0008.7	AIN24 1 Sensor 15 High	1 for active	1bit
0008.8	AIN24 1 Sensor 15 Low	1 for active	1bit
0008.9	AIN24 1 Sensor 16 Open	1 for active	1bit
0008.10	AIN24 1 Sensor 16 High	1 for active	1bit
0008.11	AIN24 1 Sensor 16 Low	1 for active	1bit
0008.12	AIN24 1 Sensor 17 Open	1 for active	1bit
0008.13	AIN24 1 Sensor 17 High	1 for active	1bit
0008.14	AIN24 1 Sensor 17 Low	1 for active	1bit
0008.15	AIN24 1 Sensor 18 Open	1 for active	1bit
0009.0	AIN24 1 Sensor 18 High	1 for active	1bit
0009.1	AIN24 1 Sensor 18 Low	1 for active	1bit
0009.2	AIN24 1 Sensor 19 Open	1 for active	1bit
0009.3	AIN24 1 Sensor 19 High	1 for active	1bit
0009.4	AIN24 1 Sensor 19 Low	1 for active	1bit
0009.5	AIN24 1 Sensor 20 Open	1 for active	1bit
0009.6	AIN24 1 Sensor 20 High	1 for active	1bit
0009.7	AIN24 1 Sensor 20 Low	1 for active	1bit
0009.8	AIN24 1 Sensor 21 Open	1 for active	1bit
0009.9	AIN24 1 Sensor 21 High	1 for active	1bit
0009.10	AIN24 1 Sensor 21 Low	1 for active	1bit
0009.11	AIN24 1 Sensor 22 Open	1 for active	1bit
0009.12	AIN24 1 Sensor 22 High	1 for active	1bit
0009.13	AIN24 1 Sensor 22 Low	1 for active	1bit
0009.14	AIN24 1 Sensor 23 Open	1 for active	1bit
0009.15	AIN24 1 Sensor 23 High	1 for active	1bit
0010.0	AIN24 1 Sensor 23 Low	1 for active	1bit
0010.1	AIN24 1 Sensor 24 Open	1 for active	1bit
0010.2	AIN24 1 Sensor 24 High	1 for active	1bit
0010.3	AIN24 1 Sensor 24 Low	1 for active	1bit
0010.4	AIN24 2 Communication Failure	1 for active	1bit
0010.5	AIN24 2 Cylinder Temp. High	1 for active	1bit
0010.6	AIN24 2 Exhaust Temp. High	1 for active	1bit
0010.7	AIN24 2 Large Cylinder Temp. Difference	1 for active	1bit
0010.8	AIN24 2 Sensor 15 Open	1 for active	1bit
0010.9	AIN24 2 Sensor 15 High	1 for active	1bit
0010.10	AIN24 2 Sensor 15 Low	1 for active	1bit
0010.11	AIN24 2 Sensor 16 Open	1 for active	1bit

Offset Address	Item	Description	Bit
0010.12	AIN24 2 Sensor 16 High	1 for active	1bit
0010.13	AIN24 2 Sensor 16 Low	1 for active	1bit
0010.14	AIN24 2 Sensor 17 Open	1 for active	1bit
0010.15	AIN24 2 Sensor 17 High	1 for active	1bit
0011.0	AIN24 2 Sensor 17 Low	1 for active	1bit
0011.1	AIN24 2 Sensor 18 Open	1 for active	1bit
0011.2	AIN24 2 Sensor 18 High	1 for active	1bit
0011.3	AIN24 2 Sensor 18 Low	1 for active	1bit
0011.4	AIN24 2 Sensor 19 Open	1 for active	1bit
0011.5	AIN24 2 Sensor 19 High	1 for active	1bit
0011.6	AIN24 2 Sensor 19 Low	1 for active	1bit
0011.7	AIN24 2 Sensor 20 Open	1 for active	1bit
0011.8	AIN24 2 Sensor 20 High	1 for active	1bit
0011.9	AIN24 2 Sensor 20 Low	1 for active	1bit
0011.10	AIN24 2 Sensor 21 Open	1 for active	1bit
0011.11	AIN24 2 Sensor 21 High	1 for active	1bit
0011.12	AIN24 2 Sensor 21 Low	1 for active	1bit
0011.13	AIN24 2 Sensor 22 Open	1 for active	1bit
0011.14	AIN24 2 Sensor 22 High	1 for active	1bit
0011.15	AIN24 2 Sensor 22 Low	1 for active	1bit
0012.0	AIN24 2 Sensor 23 Open	1 for active	1bit
0012.1	AIN24 2 Sensor 23 High	1 for active	1bit
0012.2	AIN24 2 Sensor 23 Low	1 for active	1bit
0012.3	AIN24 2 Sensor 24 Open	1 for active	1bit
0012.4	AIN24 2 Sensor 24 High	1 for active	1bit
0012.5	AIN24 2 Sensor 24 Low	1 for active	1bit
0012.6	Low Power Factor	1 for active	1bit
0012.7	High THD	1 for active	1bit
0012.8	Gen Voltage Imbalance	1 for active	1bit
0012.9	MSC Mains Split	1 for active	1bit
0012.10	Earth Breaker Close Failure	1 for active	1bit
0012.11	Earth Breaker Open Failure	1 for active	1bit
0012.12	Static Parallel Failure	1 for active	1bit
0012.13	Master Controller Failure	1 for active	1bit
0012.14	Reserved	1 for active	1bit
0012.15	Reserved	1 for active	1bit
0013.0	AIN8 Communication Failure	1 for active	1bit
0013.1	AIN8 Sensor 1 Open	1 for active	1bit
0013.2	AIN8 Sensor 1 High	1 for active	1bit
0013.3	AIN8 Sensor 1 Low	1 for active	1bit
0013.4	AIN8 Sensor 2 Open	1 for active	1bit
0013.5	AIN8 Sensor 2 High	1 for active	1bit
0013.6	AIN8 Sensor 2 Low	1 for active	1bit
0013.7	AIN8 Sensor 3 Open	1 for active	1bit

SmartGen

Offset Address	Item	Description	Bit
0013.8	AIN8 Sensor 3 High	1 for active	1bit
0013.9	AIN8 Sensor 3 Low	1 for active	1bit
0013.10	AIN8 Sensor 4 Open	1 for active	1bit
0013.11	AIN8 Sensor 4 High	1 for active	1bit
0013.12	AIN8 Sensor 4 Low	1 for active	1bit
0013.13	AIN8 Sensor 5 Open	1 for active	1bit
0013.14	AIN8 Sensor 5 High	1 for active	1bit
0013.15	AIN8 Sensor 5 Low	1 for active	1bit
0014.0	AIN8 Sensor 6 Open	1 for active	1bit
0014.1	AIN8 Sensor 6 High	1 for active	1bit
0014.2	AIN8 Sensor 6 Low	1 for active	1bit
0014.3	AIN8 Sensor 7 Open	1 for active	1bit
0014.4	AIN8 Sensor 7 High	1 for active	1bit
0014.5	AIN8 Sensor 7 Low	1 for active	1bit
0014.6	AIN8 Sensor 8 Open	1 for active	1bit
0014.7	AIN8 Sensor 8 High	1 for active	1bit
0014.8	AIN8 Sensor 8 Low	1 for active	1bit
0014.9	Reserved	1 for active	1bit
0014.10	Reserved	1 for active	1bit
0014.11	Reserved	1 for active	1bit
0014.12	Reserved	1 for active	1bit
0014.13	Reserved	1 for active	1bit
0014.14	Reserved	1 for active	1bit
0014.15	Reserved	1 for active	1bit

2.6 GENERATOR STATUS

Table 28 Generator Status

No.	Item	Description
0	Standby	No delay value for this status
1	Preheat	
2	Fuel Output	No delay value for this status
3	Crank	
4	Crank Rest	
5	Safety Run	
6	Start Idle	
7	High Speed Warming Up	
8	Wait for Load	No delay value for this status
9	Normal Running	No delay value for this status
10	High Speed Cooling	
11	Stop Idle	
12	ETS	
13	Wait for Stop	
14	After Stop	
15	Stop Failure	No delay value for this status

2.7 REMOTE START STATUS

Table 29 Remote Start Status

No.	Item	Description
0	No Delay	No delay value for this status
1	Start Delay	
2	Stop Delay	

2.8 ATS STATUS

Table 30 ATS 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

2.9 MAINS STATUS

Table 31 Mains Status

No.	Item	Description
0	Normal	No delay value for this status
1	Normal Delay	
2	Abnormal	No delay value for this status
3	Abnormal Delay	

2.10 ALARM TYPE

Table 32 Alarm Type

No.	Item	Description
0	No Alarm	
1	Warning	
2	Block	
3	Safety Trip	
4	Safety Trip and Stop	
5	Trip	
6	Trip and Stop	
7	Shutdown	

2.11 INDICATOR STATUS

Table 33 Indicator Status

No.	Item	Description
0	Engine Wait To Start Indicator	0: No icon displayed, 1: Icon remains on
1	Engine Stopped By Engine Protection System	0: No icon displayed, 1: Icon remains on
2	Water In Fuel Indicator 1	1: Icon remains on 3: No icon displayed (Timeout, and no data received)
3	Water In Fuel Indicator 2	1: Icon remains on 3: No icon displayed (Timeout, and no data received)
4	DWS Indicator	1, 2, 3, 5, 6: Icon remains on 4: Icon flashes 7: No icon displayed (Timeout, and no data received)

5	DPF Indicator Command	1: Icon remains on 4: Icon flashes 5: Icon flashes in reverse display 7: No icon displayed (Timeout, and no data received)
6	DPF Active Regen. Status	1: Icon remains on 2: Icon flashes 3: No icon displayed (Timeout, and no data received)
7	DPF Status	1: Icon remains on 2: Icon flashes 3: Icon flashes in reverse display 7: No icon displayed (Timeout, and no data received)
8	DPF Regen. Inhibit Status	1: Icon remains on 3: No icon displayed (Timeout, and no data received)
9	Exhaust System High Temp. Indicator Command	1: Icon remains on 7: No icon displayed (Timeout, and no data received)
10	DEF Tank Low Level Indicator	1, 2, 3, 5, 6: Icon remains on 4: Icon flashes 7: No icon displayed (Timeout, and no data received)
11	SCR Intensity	1, 2: Icon remains on 3, 4: Icon flashes 5, 6: Icon flashes in reverse display 7: No icon displayed (Timeout, and no data received)
12	SCR System Clean Indicator Command	1: Icon remains on 4: Icon flashes 7: No icon displayed (Timeout, and no data received)
13	SCR System Clean Inhibit Status	1: Icon remains on 3: No icon displayed (Timeout, and no data received)

3. REMOTE START/STOP STEPS

Start Steps:

- 1) Sending 05 function code the order of pressing "Remote Manual Key" to make controller in manual mode;
- 2) Reading the data of 0000 address via 03 function code to obtain the current mode of the controller and ensure that the controller is in manual mode or not. If it is not in manual mode, please repeat step 1 and step 2;
- 3) When controller is in manual mode, send 05 function code the order of pressing "Remote Start Key";
- 4) Controller will enter the start process when receiving the order, reading the data of "Generator Status" address corresponding to "Generator Status Table" via 03 function code, which can obtain the start process of generator;
- 5) If "Generator Status" corresponding to "Generator Status Table" is between 1 (Preheat) and 8 (Wait for Loading), generator will enter the start process, otherwise, the controller is failed to entering the start process, then repeat step 3 and step 4;
- 6) If "Generator Status" is in "Normal Running", sending 05 function code the order of pressing "Remote Gen Close/Open" (Remote Gen Close);
- 7) When controller receives the order and performs the gen closing, reading the data of "Gen Switch Status" address corresponding to "Switch Status Table" via 03 function code, which can obtain the closing process of generating;
- 8) If "Gen Switch Status" corresponding to "Switch Status Table" is between 0 (synchronizing) and 2 (Wait for Closing Input), then it enters the closing process. If it not enters the closing process, please repeat Step 6 and Step 7;
- 9) When "Generator Status" is in "Normal Running" and "Gen Switch Status" is "Closed", the generator finishes the on-load running.

STOP MODE 1:

- 1) Sending 05 function code the order of pressing "Remote Manual" key to make controller in manual mode;
- 2) Reading the data of 0000 address via 03 function code to obtain the current mode of the controller and ensure that the controller is in manual mode or not. If it is not in manual mode, please repeat step 1 and step 2;
- 3) When controller is in manual mode, send 05 function code the order of pressing "Remote Control Gen Close/Open" (Remote Gen Open);
- 4) Controller will enter the Gen open process when receiving the order, reading the data of "Gen Switch Status" address corresponding to "Switch Status Table" via 03 function code, which can obtain the Gen open process;
- 5) If "Gen Switch Status" corresponding to "Switch Status Table" is between 4 (Off Loading) and 6 (Wait for Opening Input), generator will enter the opening process, otherwise, the controller is failed to entering the opening process, then please repeat step 3 and step 4;
- 6) If "Gen Switch Status" is open, it means gen open successfully, sending 05 function code the order of pressing "Remote Control Stop";
- 7) When controller receives the order and enters the stop progress, reading the data of "Generator Status" address corresponding to "Switch Status Table" via 03 function code, which can obtain the stop process of generator;

8) If "Generator Status" corresponding to "Generator Status Table" is between 10 (high-speed Cooling) and 13 (Wait for Stop), then it enters the stop process. If it not enters the stop process, please repeat Step 6 and Step 7;

9) When "Generator Status" is in "At Rest" and "Gen Switch Status" is "Open", the generator finishes shutdown.

STOP MODE 2 (It is available for both AUTO mode and MANUAL mode):

1) Sending 05 function code the order of pressing "Remote Stop" key to make controller in stop mode;
2) Reading the data of 0000 address via 03 function code to obtain the current mode of the controller and ensure that the controller is in stop mode or not. If it is not in stop mode, please repeat step 1 and step 2;

3) When controller is in stop mode, the generator will enter the stop process;

4) Reading the data of "Gen Switch Status" address corresponding to "Switch Status Table" via 03 function code to obtain the Gen open process, reading the data of "Generator Status" address corresponding to "Generator Status Table" to obtain the stop process of generator;

5) When "Generator Status" is in "At Rest" and "Gen Switch Status" is "Open", the generator finishes shutdown

NOTE 1: Only once for each time of sending 05 function code the order of remote control.

NOTE 2: When "Generator Status" is in start process, the controller receives the order of "Remote Start" or pressing the start key, the "Generator Status" will go to next status, which can rapidly enter the Gen on-load running status.

NOTE 3: When "Generator Status" is in stop process, the controller receives the order of "Remote Stop" or pressing the stop key, "Generator Status" will go to next status, which can rapidly enter the stop status.

4. COMMUNICATION PARAMETER VIEWING AND CONFIGURATION

- 1) press  key, input correct password (default 0318) can enter the parameter setting menu;
- 2) Select "Controller Parameter Setting" via Down key, press  key to enter parameter password interface;
- 3) Input correct password (default: 0318), press  key to enter parameter main interface;
- 4) Select "Controller Address" via ,  key, parameter editing function is available after pressing  key, corresponding parameters will be in the selected status;
- 5) Set the current selected content via ,  key, then press  key to confirm, after editing, then the selected status will disappear;
- 6) Press  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.

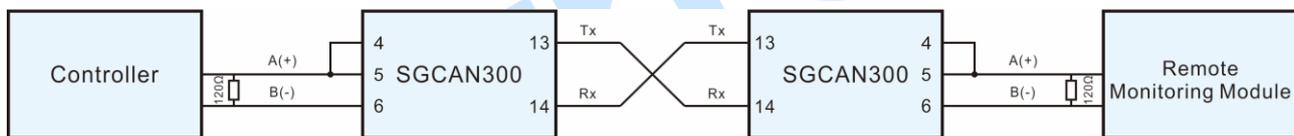


Fig.8 SGCAN300 Application Diagram

5.5 COMMON SOLUTIONS OF COMMUNICATION FAILURE

- 1) Check whether the positive and negative of RS485 or network cable are 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 is correct; the baud rate, data bit and parity bit and stop bit should be the same as the requirement of the controller;
- 4) Whether the selected COM port corresponds to the USB port where RS485 converter is connected;
- 5) Whether the communication address is correct, factory default is 01;
- 6) When using 03 function code, up to 120 addresses can be read of data length for each time, and the last address can't exceed the max. Modbus communication address. The write function of 06 function code map data area can only write one address at a time;
- 7) If there is an offset address in Modbus communication address, you need to add the original base address to the offset address to obtain the correct Modbus communication address;
- 8) 05 function code using Modbus address for communication: despite 1 for active, 0 for inactive, only sending FF00H can make corresponding bit as 1, sending 0000H can make corresponding bit as 0; while using PLC address for communication: sending 1 to position 1, sending 0 to position 0;
- 9) Whether CRC-16 LSB first and MSB last are correct;

- 10) It is better not read controller data too fast for multiple times, the interval for 500ms is recommended.
- 11) When reading data through a network port, ensure that the IP address and subnet mask of the controller are correct. (After modifying the network parameter, such as IP address, subnet mask, the new parameter will take effect when power it on again). Don't change MAC address unless you have special needs;
- 12) Please configure the communication module address of the controller before networking. Don not have the same the module address in the same network;
- 13) Since the Modbus serial protocol does not support the multiple masters, multiple software can't communicate with the controller at the same time;
- 14) Disconnect the RS485 wiring and measure the voltage difference between terminal A and B of RS485. If the voltage difference is between +-200mV, the communication port is abnormal.
- 15) If the long communication distance results in the signal attenuation, it is better to replace the cable with high quality, or add a repeater in the middle of the communication cable;
- 16) The third-party software of serial port communication, such as modscan32 and modbus poll are recommended, which can verify the communication is normal or not;
- 17) The third-party software of network port communication, such as NetAssist and PortHelper are recommended, which can verify the communication is normal or not.