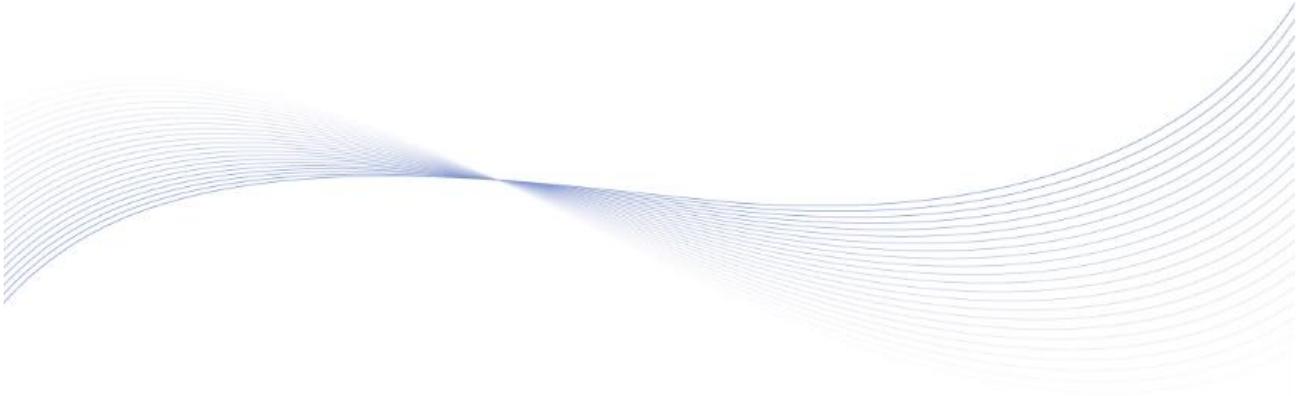




HGM8510
GENSET PARALLEL CONTROLLER
COMMUNICATION PROTOCOL



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

CONTENT

1 DESCRIPTION.....	4
1.1 PHYSICAL LAYER.....	4
1.1.1 RS485 PORT	4
1.1.2 ETHERNET PORT	5
1.2 DATA LINK LAYER	6
1.2.1 MODBUS-RTU	6
1.2.2 MODBUS-TCP/UDP	7
1.3 APPLICATION LAYER	9
1.3.1 FUNCTION CODES	9
1.3.2 ERROR HANDLING	9
2 CONTROLLER INTERNAL REGISTER ADDRESS AND DATA	10
2.1 FUNCTION CODE 03H MAPPING ALARM AND COIL STATUS OF DATA FIELD	10
2.2 FUNCTION CODE 03H MAPPING PARAMETERS OF DATA FIELD	15
2.3 FUNCTION CODE 05H MAPPING REMOTE COIL FIELD	28
2.4 ALARMS DATA LIST	30
2.5 GENSET RUNNING STATUS.....	39
2.6 REMOTE START STATUS	39
2.7 SWITCH STATUS	39
2.8 MAINS STATUS.....	40
3 REMOTE START/STOP PROCEDURE	41
4 VIEW AND CONFIGURATION OF COMMUNICATION PARAMETERS	42
5 FAQ	43
5.1 GROUNDING OF THE CABLE SHIELD	43
5.2 TERMINATION RESISTOR	43
5.3 RS485 TO USB CONVERTER	43
5.4 NETWORK PORT COMMUNICATION.....	43
5.5 EXTEND TRANSMISSION DISTANCE	44
5.6 SOLUTIONS FOR COMMUNICATION FAILURE	44

No. 28 Xuemei Street, Zhengzhou, Henan, China

Tel: +86-371-67988888/67981888/67992951

+86-371-67981000(overseas)

Fax: +86-371-67992952

Web: www.smartgen.com.cn/

www.smartgen.cn/

Email: sales@smartgen.cn

All rights reserved. No part of this publication maybe reproduced in any material form (including photocopying or storing in any medium by electronic means or other) without the written permission of the copyright holder.

SmartGen reserves the right to change the contents of this document without prior notice.

Table 1 Software Version

Date	Version	Content
2023-03-20	V1.0	Original release.

1 DESCRIPTION

This protocol describes the controller communication's read and write command format, and the definition of internal information & data for the third-party to develop and use.

1.1 PHYSICAL LAYER

HGM8510 genset parallel controller can realize external communication via RS485 port and RJ45 ports. 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 PORT

The controller works as a RS485 slave module, and uses Modbus-RTU protocol, but it doesn't support other protocols, such as Modbus-ASCII, etc.

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 (Default: 2 bits)

Communication timeout period: over 100ms.

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.

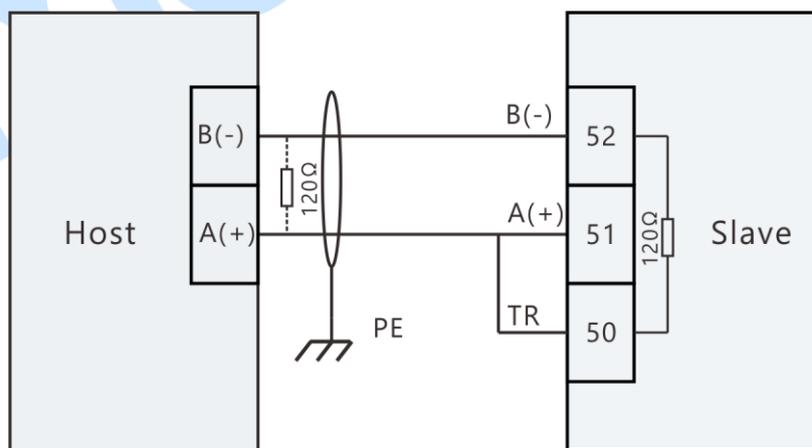


Fig.1 Single Device RS485 Communication Wiring Diagram

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 120-ohm resistors inside. Short the Terminal 50 and Terminal 51 to connect with the 120-ohm resistors. See details in the instruction below.

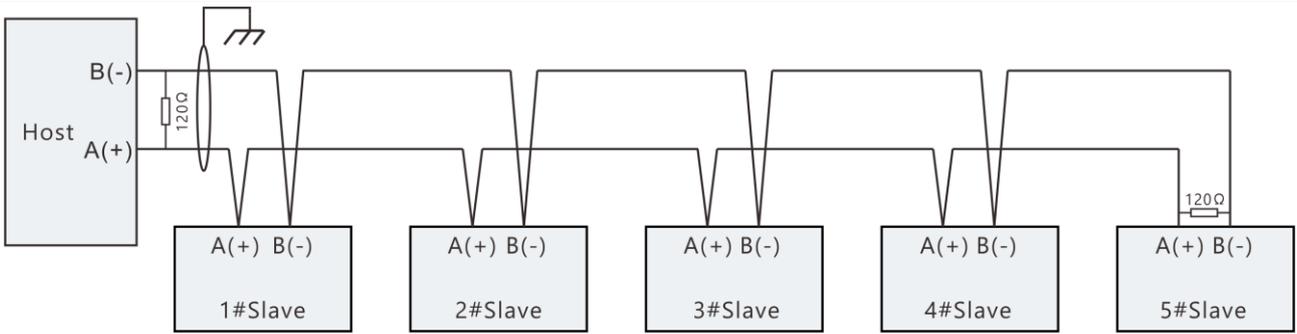


Fig.2 Multiple Devices RS485 Communication Wiring Diagram

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.

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:

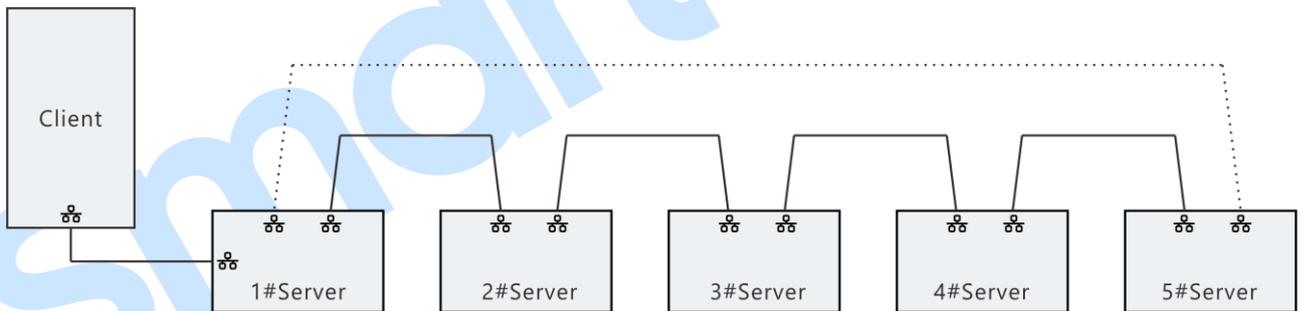


Fig.3 Multiple Devices Communication Wiring Diagram 1

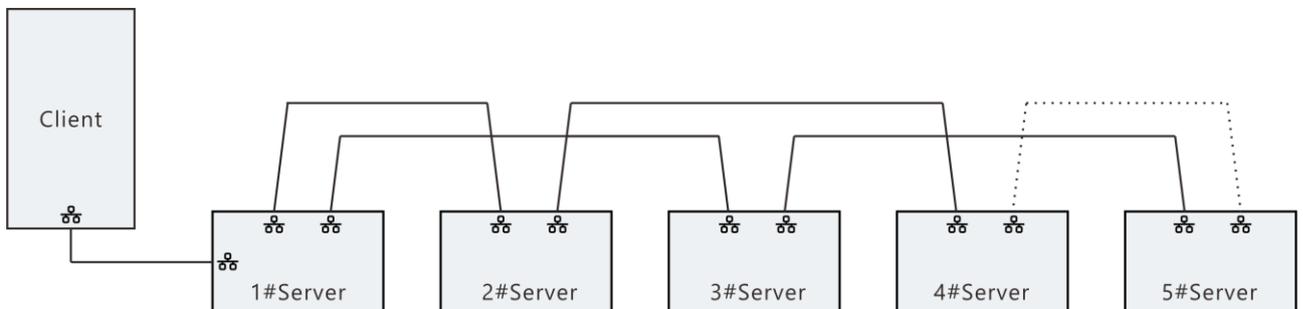


Fig.4 Multiple Devices Communication Wiring Diagram 2

1.2 DATA LINK LAYER

The Modbus common frame format is as follows:

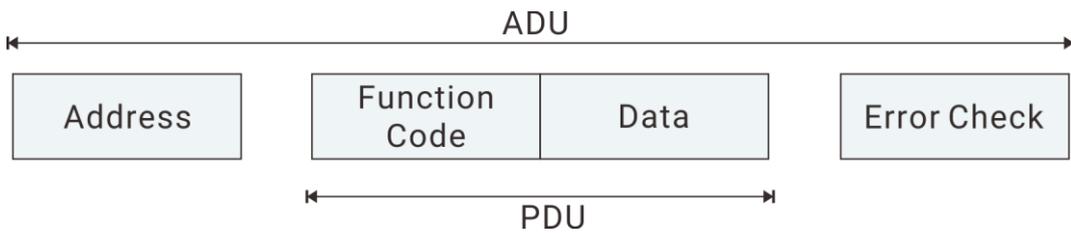


Fig.5 Modbus Common Frame Format

1.2.1 MODBUS-RTU

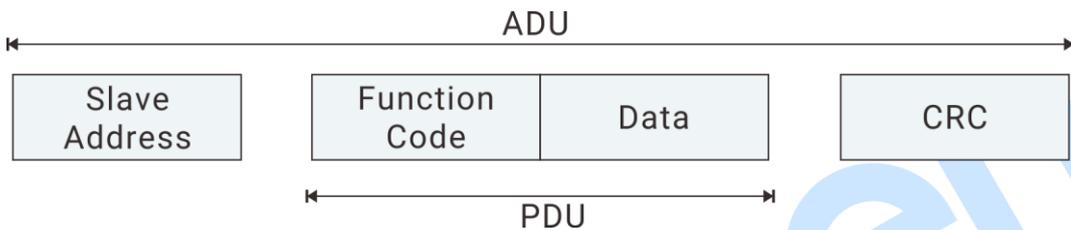


Fig.6 Modbus-RTU Common Frame Format

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 information occurs 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 a process begins of applying successive 8-bit bytes of the message to the current contents of the

register. 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

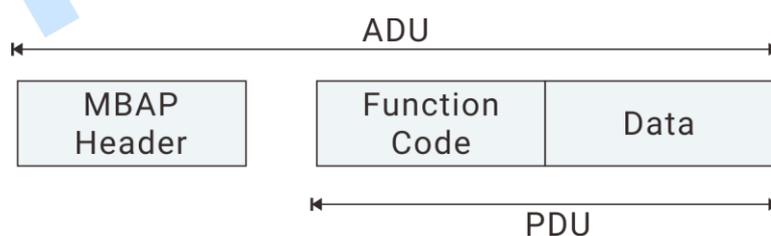


Fig.7 Modbus-TCP/UDP Common Frame Format

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

Table 4 Function Codes List

Function Codes	Function	Description
03H	Read registers	Read the data of single register or multiple registers
05H	Write single coil	Write single coil

Function code supported: 03H, 05H. Function code 03H is used for reading controller’s alarms, status and various kinds of electric parameters; Function code 05H is used for sending remote command.

Data checking method: CRC16.

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

1.3.2 ERROR HANDLING

When the device detects an error (exclude CRC error), it must return information to the master, 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 slave response data indicates that an exception error has occurred.

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

Table 5 Slave Response Error Code (Exclude CRC)

Item	Description
Address	1 byte
Function Code	1 byte (the MSB is 1)
Error Code	1 byte
CRC Code	2 bytes

Exception Function Code

- 1 Illegal Function
The function code received is not supported
- 2 Illegal Data Address
The specified address exceeds the range of the slave address
- 3 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 ALARM AND COIL STATUS OF DATA FIELD

Table 6 Alarm and Coil Status of Data Field

Modbus Address	PLC Address	Bit Address	Function	Description
000.0	40001.0	bit0	Common Alarm	“0” means there is no common alarm “1” means there are common alarms (000.0 means the Boolean value at bit 0 of address 000) 1 as active (low order)
000.1	40001.1	bit1	Common Shutdown	1 as active
000.2	40001.2	bit2	Common Warning	1 as active
000.3	40001.3	bit3	Common Trip and Stop	1 as active
000.4	40001.4	bit4	Common Trip	1 as active
000.5	40001.5	bit5	Common Safety Trip and Stop	1 as active
000.6	40001.6	bit6	Common Safety Trip	1 as active
000.7	40001.7	bit7	Common Block	1 as active
000.8	40001.8	bit8	In Test Mode	1 as active
000.9	40001.9	bit9	In Auto Mode	1 as active
000.10	40001.10	bit10	In Manual Mode	1 as active
000.11	40001.11	bit11	In Stop Mode	1 as active
000.12	40001.12	bit12	Reserved	1 as active
000.13	40001.13	bit13	Reserved	1 as active
000.14	40001.14	bit14	Reserved	1 as active
000.15	40001.15	bit15	Reserved	1 as active
001-020	40002-40021		Shutdown	See details in Alarms Data List
021-040	40022-40041		Trip and Stop Alarm	
041-060	40042-40061		Trip Alarm	
061-080	40062-40081		Safety Trip and Stop Alarm	
081-100	40082-40101		Safety Trip Alarm	
101-120	40102-40121		Block Alarm	
121-140	40122-40141		Warning Alarm	
141.0	40142.0	bit0	Emergency Input Status	1 as active
141.1	40142.1	bit1	Input 1 Status	1 as active
141.2	40142.2	bit2	Input 2 Status	1 as active
141.3	40142.3	bit3	Input 3 Status	1 as active
141.4	40142.4	bit4	Input 4 Status	1 as active
141.5	40142.5	bit5	Input 5 Status	1 as active
141.6	40142.6	bit6	Input 6 Status	1 as active

Modbus Address	PLC Address	Bit Address	Function	Description
141.7	40142.7	bit7	Input 7 Status	1 as active
141.8	40142.8	bit8	Input 8 Status	1 as active
141.9	40142.9	bit9	Input 9 Status	1 as active
141.10	40142.10	bit10	Input 10 Status	1 as active
141.11	40142.11	bit11	Input 11 Status	1 as active
141.12	40142.12	bit12	Input 12 Status	1 as active
141.13	40142.13	bit13	Input 13 Status	1 as active
141.14	40142.14	bit14	Input 14 Status	1 as active
141.15	40142.15	bit15	Input 15 Status	1 as active
142.0	40143.0	bit0	DIN16 Input 1 Status	1 as active
142.1	40143.1	bit1	DIN16 Input 2 Status	1 as active
142.2	40143.2	bit2	DIN16 Input 3 Status	1 as active
142.3	40143.3	bit3	DIN16 Input 4 Status	1 as active
142.4	40143.4	bit4	DIN16 Input 5 Status	1 as active
142.5	40143.5	bit5	DIN16 Input 6 Status	1 as active
142.6	40143.6	bit6	DIN16 Input 7 Status	1 as active
142.7	40143.7	bit7	DIN16 Input 8 Status	1 as active
142.8	40143.8	bit8	DIN16 Input 9 Status	1 as active
142.9	40143.9	bit9	DIN16 Input 10 Status	1 as active
142.10	40143.10	bit10	DIN16 Input 11 Status	1 as active
142.11	40143.11	bit11	DIN16 Input 12 Status	1 as active
142.12	40143.12	bit12	DIN16 Input 13 Status	1 as active
142.13	40143.13	bit13	DIN16 Input 14 Status	1 as active
142.14	40143.14	bit14	DIN16 Input 15 Status	1 as active
142.15	40143.15	bit15	DIN16 Input 16 Status	1 as active
143.0	40144.0	bit0	Flex. Output 1 Status	1 as active
143.1	40144.1	bit1	Flex. Output 2 Status	1 as active
143.2	40144.2	bit2	Flex. Output 3 Status	1 as active
143.3	40144.3	bit3	Flex. Output 4 Status	1 as active
143.4	40144.4	bit4	Flex. Output 5 Status	1 as active
143.5	40144.5	bit5	Flex. Output 6 Status	1 as active
143.6	40144.6	bit6	Flex. Output 7 Status	1 as active
143.7	40144.7	bit7	Flex. Output 8 Status	1 as active
143.8	40144.8	bit8	Flex. Output 9 Status	1 as active
143.9	40144.9	bit9	Flex. Output 10 Status	1 as active
143.10	40144.10	bit10	Flex. Output 11 Status	1 as active
143.11	40144.11	bit11	Flex. Output 12 Status	1 as active
143.12	40144.12	bit12	Flex. Output 13 Status	1 as active
143.13	40144.13	bit13	Flex. Output 14 Status	1 as active
143.14	40144.14	bit14	Flex. Output 15 Status	1 as active
143.15	40144.15	bit15	Flex. Output 16 Status	1 as active
144.0	40145.0	bit0	DOUT16 Output 1 Status	1 as active
144.1	40145.1	bit1	DOUT16 Output 2 Status	1 as active

Modbus Address	PLC Address	Bit Address	Function	Description
144.2	40145.2	bit2	DOUT16 Output 3 Status	1 as active
144.3	40145.3	bit3	DOUT16 Output 4 Status	1 as active
144.4	40145.4	bit4	DOUT16 Output 5 Status	1 as active
144.5	40145.5	bit5	DOUT16 Output 6 Status	1 as active
144.6	40145.6	bit6	DOUT16 Output 7 Status	1 as active
144.7	40145.7	bit7	DOUT16 Output 8 Status	1 as active
144.8	40145.8	bit8	DOUT16 Output 9 Status	1 as active
144.9	40145.9	bit9	DOUT16 Output 10 Status	1 as active
144.10	40145.10	bit10	DOUT16 Output 11 Status	1 as active
144.11	40145.11	bit11	DOUT16 Output 12 Status	1 as active
144.12	40145.12	bit12	DOUT16 Output 13 Status	1 as active
144.13	40145.13	bit13	DOUT16 Output 14 Status	1 as active
144.14	40145.14	bit14	DOUT16 Output 15 Status	1 as active
144.15	40145.15	bit15	DOUT16 Output 16 Status	1 as active
145.0	40146.0	bit0	Input 16 Status	1 as active
145.1	40146.1	bit1	Input 17 Status	1 as active
145.2	40146.2	bit2	Input 18 Status	1 as active
145.3	40146.3	bit3	Input 19 Status	1 as active
145.4	40146.4	bit4	Input 20 Status	1 as active
145.5	40146.5	bit5	Input 21 Status	1 as active
145.6	40146.6	bit6	Input 22 Status	1 as active
145.7	40146.7	bit7	Input 23 Status	1 as active
145.8	40146.8	bit8	Flex. Output 17 Status	1 as active
145.9	40146.9	bit9	Flex. Output 18 Status	1 as active
145.10	40146.10	bit10	Flex. Output 19 Status	1 as active
145.11	40146.11	bit11	Flex. Output 20 Status	1 as active
145.12	40146.12	bit12	Display Output Status	1 as active
145.13	40146.13	bit13	Input 24 Status	1 as active
145.14	40146.14	bit14	Input 25 Status	1 as active
145.15	40146.15	bit15	Input 26 Status	1 as active
146.0	40147.0	bit0	MSC Normal	1 as active
146.1	40147.1	bit1	Ring Network Status	1 as active
146.2	40147.2	bit2	Frequency Sync.	1 as active
146.3	40147.3	bit3	Voltage Sync.	1 as active
146.4	40147.4	bit4	Phase Sync.	1 as active
147	40148		Reserved	
148	40149		Reserved	
149.0	40150.0	bit0	Mains Normal	1 as active
149.1	40150.1	bit1	Mains Closed	1 as active
149.2	40150.2	bit2	Gen. Normal	1 as active
149.3	40150.3	bit3	Gen. Closed	1 as active
149.4	40150.4	bit4	Running Indicator-Green	1 as active
149.5	40150.5	bit5	Mute Indicator (Alarm (1 =	1 as active

Modbus Address	PLC Address	Bit Address	Function	Description
			Light up, 0 = Fast flash))	
149.6	40150.6	bit6	Alarm Indicator-Yellow	1 as active
149.7	40150.7	bit7	Alarm Indicator-Red	1 as active
149.8	40150.8	bit8	Reserved	1 as active
149.9	40150.9	bit9	Reserved	1 as active
149.10	40150.10	bit10	Running Indicator-Green (1 = Light up, 0 = Slow flash)	1 as active
149.11	40150.11	bit11	Running Indicator-Red	1 as active
149.12	40150.12	bit12	Alarm Indicator-Green	1 as active
149.13	40150.13	bit13	Reserved	1 as active
149.14	40150.14	bit14	485 Normal	1 as active
149.15	40150.15	bit15	CAN Normal	1 as active
150.0	40151.0	bit0	Mains Abnormal	1 as active
150.1	40151.1	bit1	Mains Overvoltage	1 as active
150.2	40151.2	bit2	Mains Undervoltage	1 as active
150.3	40151.3	bit3	Mains Overfrequency	1 as active
150.4	40151.4	bit4	Mains Underfrequency	1 as active
150.5	40151.5	bit5	Mains Loss of Phase	1 as active
150.6	40151.6	bit6	Mains Reverse Phase Sequence	1 as active
150.7	40151.7	bit7	Mains Blackout	1 as active
150.8	40151.8	bit8	Mains Overcurrent	1 as active
150.9	40151.9	bit9	Mains Over Power	1 as active
150.10	40151.10	bit10	Mains Reverse Power	1 as active
150.11	40151.11	bit11	Mains Phase Jump	1 as active
150.12	40151.12	bit12	Mains Overfrequency Jump	1 as active
150.13	40151.13	bit13	Reserved	1 as active
150.14	40151.14	bit14	Reserved	1 as active
150.15	40151.15	bit15	Reserved	1 as active
151	40152		Reserved	
152	40153		Reserved	
153	40154		Reserved	
154	40155		Reserved	

If “DIN16 Input 1 Status” and “Flex. Output 4 Status” need to be read, check the table above and find their Modbus addresses are 142.0 and 143.3, so it needs to read two data addresses.

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

Table 7 Master (PC) Request Frame

Slave Address	Function Code	Start Address (142)		Request Data Length (2)		CRC 16	
		MSB	LSB	MSB	LSB	LSB	MSB
01	03	00	8E	00	02	A4	20

Table 8 Client (PC) Request Frame via Ethernet

MBAP Header							Function Code	Data			
Transaction ID	Protocol ID	Data Length		Unit ID	Start Address (142)			Request Data Length (2)			
		MSB	LSB		MSB	LSB					
00	01	00	00	00	06	01	03	00	8E	00	02

The slave response is as following:

Table 9 Slave (Controller) Response Frame

Slave Address	Function Code	Data Length (Bytes)	Data				CRC 16	
			Data of Address 142 MSB	Data of Address 142 LSB	Data of Address 143 MSB	Data of Address 143 LSB	LSB	MSB
01	03	04	00	01	00	08	AA	35

Table 10 Server (Controller) Response Frame via Ethernet

MBAP Header							Function Code	Data Length (Bytes)	Data			
									Data Returned			
Transaction ID	Protocol ID	Data Length		Unit ID	Data of Address 142 MSB	Data of Address 142 LSB			Data of Address 143 MSB	Data of Address 143 LSB		
		00	01		00	00	00	07	01	03	04	00

Table 11 Data Analysis

Address	Data Received (Hexadecimal)	Convert to Binary	Meaning
142	0001H	0000 0000 0000 0001 (Mapping to 142.15, 142.14,, 142.1, 142.0 respectively)	Data of Bit 0 is 1, which means there is signal output in the DIN16 Input 1 Status.
143	0008H	0000 0000 0000 1000 (Mapping to 143.15, 143.14,, 143.1, 143.0 respectively)	Data of Bit 143.3 is 1, which means there is signal output in the Flex. Output 4.

2.2 FUNCTION CODE 03H MAPPING PARAMETERS OF DATA FIELD

Table 12 Parameters of Data Field

Modbus Address	PLC Address	Function	Range (Decimal)	Ratio	Unit	Description	Remarks
155	40156	Mains/Busbar UAB (Line A-B Voltage)	0~4294967295	0.1	V	32-bit Unsigned	NOTE 2
156	40157						
157	40158	Mains/Busbar UBC (Line B-C Voltage)	0~4294967295	0.1	V	32-bit Unsigned	
158	40159						
159	40160	Mains/Busbar UCA (Line C-A Voltage)	0~4294967295	0.1	V	32-bit Unsigned	
160	40161						
161	40162	Mains/Busbar UA (Phase A Voltage)	0~4294967295	0.1	V	32-bit Unsigned	
162	40163						
163	40164	Mains/Busbar UB (Phase B Voltage)	0~4294967295	0.1	V	32-bit Unsigned	
164	40165						
165	40166	Mains/Busbar UC (Phase C Voltage)	0~4294967295	0.1	V	32-bit Unsigned	
166	40167						
167	40168	Mains/Busbar UA Phase (Phase A Angle)	0~65535	0.1	°	16-bit Unsigned	NOTE 3
168	40169	Mains/Busbar UB Phase (Phase B Angle)	0~65535	0.1	°	16-bit Unsigned	
169	40170	Mains/Busbar UC Phase (Phase C Angle)	0~65535	0.1	°	16-bit Unsigned	
170	40171	Mains/Busbar Frequency	0~10000	0.01	Hz	16-bit Unsigned	
171	40172	Reserved					
172	40173	Reserved					
173	40174	Reserved					
174	40175	Reserved					
175	40176	Gen. UAB	0~4294967295	0.1	V	32-bit Unsigned	NOTE 2
176	40177						
177	40178	Gen. UBC	0~4294967295	0.1	V	32-bit Unsigned	
178	40179						
179	40180	Gen. UCA	0~4294967295	0.1	V	32-bit Unsigned	
180	40181						
181	40182	Gen. UA	0~4294967295	0.1	V	32-bit Unsigned	
182	40183						
183	40184	Gen. UB	0~4294967295	0.1	V	32-bit Unsigned	
184	40185						
185	40186	Gen. UC	0~4294967295	0.1	V	32-bit Unsigned	
186	40187						
187	40188	Gen. UA Phase	0~65535	0.1	°	16-bit	

Modbus Address	PLC Address	Function	Range (Decimal)	Ratio	Unit	Description	Remarks
						Unsigned	
188	40189	Gen. UB Phase	0~65535	0.1	°	16-bit Unsigned	
189	40190	Gen. UC Phase	0~65535	0.1	°	16-bit Unsigned	
190	40191	Gen. Frequency	0~10000	0.01	Hz	16-bit Unsigned	
191	40192	Voltage Difference	-32766~32767	1	V	16-bit Signed	
192	40193	Frequency Difference	-5000~5000	0.01	Hz	16-bit Signed	
193	40194	Phase Difference	-1800~1800	0.1	°	16-bit Signed	
194	40195	Current Gen. Active Power Percentage	-1000~1000	0.1	%	16-bit Signed	
195	40196	Target Gen. Active Power Percentage	0~1000	0.1	%	16-bit Signed	
196	40197	Current Gen. Reactive Power Percentage	-1000~1000	0.1	%	16-bit Signed	
197	40198	Target Gen. Reactive Power Percentage	0~1000	0.1	%	16-bit Signed	
198	40199	GOV Output Percentage	-1000~1000	0.1	%	16-bit Signed	
199	40200	AVR Output Percentage	-1000~1000	0.1	%	16-bit Signed	
200	40201	Reserved					
201	40202	Phase A Current	0~65535	0.1	A	16-bit Unsigned	
202	40203	Phase B Current	0~65535	0.1	A	16-bit Unsigned	
203	40204	Phase C Current	0~65535	0.1	A	16-bit Unsigned	
204	40205	Neutral Wire Current (Zero sequence current, Ground wire current)	0~65535	0.1	A	16-bit Signed	
205	40206	Phase A Current Angle	0~65535	0.1	°	16-bit Signed	
206	40207	Phase B Current Angle	0~65535	0.1	°	16-bit Signed	
207	40208	Phase C Current	0~65535	0.1	°	16-bit	

Modbus Address	PLC Address	Function	Range (Decimal)	Ratio	Unit	Description	Remarks
		Angle				Signed	
208	40209	Neutral Wire Current Phase	0~65535	0.1	°	16-bit Signed	
209	40210	Phase A Active Power	-2,147,483,647	0.1	kW	32-bit Signed	NOTE 2
210	40211		~2,147,483,647				
211	40212	Phase B Active Power	-2,147,483,647	0.1	kW	32-bit Signed	
212	40213		~2,147,483,647				
213	40214	Phase C Active Power	-2,147,483,647	0.1	kW	32-bit Signed	
214	40215		~2,147,483,647				
215	40216	Total Active Power	-2,147,483,647	0.1	kW	32-bit Signed	
216	40217		~2,147,483,647				
217	40218	Phase A Reactive Power	-2,147,483,647	0.1	kvar	32-bit Signed	
218	40219		~2,147,483,647				
219	40220	Phase B Reactive Power	-2,147,483,647	0.1	kvar	32-bit Signed	
220	40221		~2,147,483,647				
221	40222	Phase C Reactive Power	-2,147,483,647	0.1	kvar	32-bit Signed	
222	40223		~2,147,483,647				
223	40224	Total Reactive Power	-2,147,483,647	0.1	kvar	32-bit Signed	
224	40225		~2,147,483,647				
225	40226	Phase A Apparent Power	0~4294967295	0.1	kVA	32-bit Signed	
226	40227						
227	40228	Phase B Apparent Power	0~4294967295	0.1	kVA	32-bit Signed	
228	40229						
229	40230	Phase C Apparent Power	0~4294967295	0.1	kVA	32-bit Signed	
230	40231						
231	40232	Total Apparent Power	0~4294967295	0.1	kVA	32-bit Signed	
232	40233						
233	40234	Phase A Power Factor	-1000~1000	0.00 1		16-bit Unsigned	2Bytes
234	40235	Phase B Power Factor	-1000~1000	0.00 1		16-bit Unsigned	2Bytes
235	40236	Phase C Power Factor	-1000~1000	0.00 1		16-bit Unsigned	2Bytes
236	40237	Average Power Factor	-1000~1000	0.00 1		16-bit Unsigned	2Bytes
237	40238	Negative Sequence Current Percentage	0~1000	0.1	%	16-bit Unsigned	2Bytes
238	40239	Zero Sequence Current Percentage	0~1000	0.1	%	16-bit Unsigned	2Bytes
239	40240	Negative Sequence Current	0~65535	0.1	A	16-bit Unsigned	2Bytes
240	40241	Mains/Busbar Current	0~65535	0.1	A	16-bit Unsigned	2Bytes

Modbus Address	PLC Address	Function	Range (Decimal)	Ratio	Unit	Description	Remarks
241	40242	Reserved					2Bytes
242	40243	Reserved					2Bytes
243	40244	Reserved					2Bytes
244	40245	Reserved					2Bytes
245	40246	Reserved					2Bytes
246	40247	Reserved					2Bytes
247	40248	Engine Speed	0~9999	1	r/min	16-bit Unsigned	2Bytes
248	40249	Battery Voltage	0~600	0.1	V	16-bit Unsigned	2Bytes
249	40250	Charger Voltage	0~600	0.1	V	16-bit Unsigned	2Bytes
250	40251	PLC Status	0~2	1	No.	0: Normal 1: PLC Fault 2: No PLC	2Bytes
251	40252	USB Flash Drive Status	0~2	1	No.	0: Normal; 1: Not connected; 2: Error	2Bytes
252	40253	USB Flash Drive Capacity	0~65535	1	GB	1*GB	2Bytes
253	40254	USB Flash Drive Remaining Capacity	0~65535	1	GB	1*GB	2Bytes
254	40255	Reserved					2Bytes
255	40256	Sensor 1 Value				16-bit Signed	2Bytes
256	40257	Reserved					2Bytes
257	40258	Sensor 2 Value				16-bit Signed	2Bytes
258	40259						2Bytes
259	40260	Sensor 3 Value				16-bit Signed	2Bytes
260	40261						2Bytes
261	40262	Sensor 4 Value				16-bit Signed	2Bytes
262	40263	Reserved					2Bytes
263	40264	Sensor 5 Value				16-bit Signed	2Bytes
264	40265	Reserved					2Bytes
265	40266	Sensor 6 Value				16-bit Signed	2Bytes
266	40267	Reserved					2Bytes
267	40268	Engine Load		0.1	%	16-bit	2Bytes

Modbus Address	PLC Address	Function	Range (Decimal)	Ratio	Unit	Description	Remarks
		Percentage				Signed	
268	40269	Coolant Level		1	%	16-bit Signed	2Bytes
269	40270	Oil Temp.		1	°C	16-bit Signed	2Bytes
270	40271	Coolant Pressure		1	kPa	16-bit Signed	2Bytes
271	40272	Fuel Pressure		1	kPa	16-bit Signed	2Bytes
272	40273	Fuel Temp.		1	°C	16-bit Signed	2Bytes
273	40274	Air Inlet Temp.		1	°C	16-bit Signed	2Bytes
274	40275	Exhaust Outlet Temp.		1	°C	16-bit Signed	2Bytes
275	40276	Turbo Pressure		1	kPa	16-bit Signed	2Bytes
276	40277	Fuel Consumption		0.1	L	16-bit Signed	2Bytes
277	40278	Total Fuel Consumption	0~4294967295	1	L	32-bit Unsigned	4Bytes
278	40279						
279	40280	Engine Temp.		1	°C	16-bit Signed	2Bytes
280	40281	Engine Oil Pressure		1	kPa	16-bit Signed	2Bytes
281	40282	Reserved					2Bytes
282	40283	Reserved					2Bytes
283	40284	Reserved					2Bytes
284	40285	Reserved					2Bytes
285	40286	Reserved					2Bytes
286	40287	Current Mains Active Power Percentage	-1000~1000	0.1	%	16-bit Signed	2Bytes
287	40288	Current Mains Reactive Power Percentage	-1000~1000	0.1	%	16-bit Signed	2Bytes
288	40289	Mains/Busbar Active Power	-2,147,483,647 ~2,147,483,647	0.1	kW	32-bit Signed	2Bytes
289	40290						2Bytes
290	40291	Mains/Busbar Reactive Power	-2,147,483,647 ~2,147,483,647	0.1	kvar	32-bit Signed	2Bytes
291	40292						2Bytes
292	40293	Mains/Busbar Apparent Power	0~4294967295	0.1	kVA	32-bit Unsigned	2Bytes
293	40294						2Bytes
294	40295	Mains/Busbar	-1000~1000	0.00		16-bit	2Bytes

Modbus Address	PLC Address	Function	Range (Decimal)	Ratio	Unit	Description	Remarks
		Power Factor		1		Signed	
295	40296	Genset Running Status	0~15	1		Genset Running Status	2Bytes
296	40297	Gen. Delay	0~3600	1	s	16-bit Signed	2Bytes
297	40298	Remote Start Status	0~2	1		Remote Start Status	2Bytes
298	40299	Remote Start Delay	0~3600	1	s	16-bit Signed	2Bytes
299	40300	Gen. Switch Status		1		Switch Status	2Bytes
300	40301	Gen. Switch Transfer Delay	0~3600	1	s	16-bit Signed	2Bytes
301	40302	Mains Status	0~3	1		Mains Status	2Bytes
302	40303	Mains Delay	0~3600	1	s	16-bit Signed	2Bytes
303	40304	Mains Switch Status		1		Switch Status	2Bytes
304	40305	Mains Switch Transfer Delay	0~3600	1	s	16-bit Signed	2Bytes
305	40306	Accumulated Running Hours	0~65535	1	h	16-bit Unsigned	2Bytes
306	40307	Accumulated Running Minutes	0~65535	1	min	16-bit Unsigned	2Bytes
307	40308	Accumulated Running Seconds	0~65535	1	s	16-bit Unsigned	2Bytes
308	40309	Accumulated Start Times	0~65535	1		16-bit Unsigned	2Bytes
309	40310	Accumulated Electric Energy kWh	0~4294967295	0.1	kWh	32-bit Unsigned	4Bytes
310	40311						
311	40312	Accumulated Electric Energy kvarh	0~4294967295	0.1	kvarh	32-bit Unsigned	4Bytes
312	40313						
313	40314	Accumulated Electric Energy kVAh	0~4294967295	0.1	kVAh	32-bit Unsigned	4Bytes
314	40315						
315	40316	Accumulated Electric Energy NkWh	0~4294967295	0.1	NkWh	32-bit Unsigned	4Bytes
316	40317						
317	40318	Reserved					2Bytes

Modbus Address	PLC Address	Function	Range (Decimal)	Ratio	Unit	Description	Remarks
318	40319	Reserved					2Bytes
319	40320	Reserved					2Bytes
320	40321	Multi-genset Total	-2,147,483,647	0.1	kvar	32-bit Signed	2Bytes
321	40322	Reactive Power	~2,147,483,647				2Bytes
322	40323	Reserved					2Bytes
323	40324	Controller Model					2Bytes
324	40325	Controller Software Version					2Bytes
325	40326	Controller Hardware Version					2Bytes
326	40327	Release Year	0~99	1	Year	Save the last two digits of the Year only.	2Bytes
327	40328	Release Month	1~12	1	Month	Signed	2Bytes
328	40329	Released Day	1~31	1	Day	Signed	2Bytes
329	40330	Reserved					2Bytes
330	40331	Reserved					2Bytes
331	40332	Controller Date: Year	0~99	1	Year	Save the last two digits of the Year only.	2Bytes
332	40333	Controller Date: Month	1~12	1	Month	Signed	2Bytes
333	40334	Controller Date: Day	1~31	1	Day	Signed	2Bytes
334	40335	Controller Date: Week	0~6	1	Week	Signed	2Bytes
335	40336	Controller Time: Hour	0~23	1	Hour	Signed	2Bytes
336	40337	Controller Time: Minute	0~59	1	Minute	Signed	2Bytes
337	40338	Controller Time: Second	0~59	1	Second	Signed	2Bytes
338	40339	Module MSC ID	0~15	1			2Bytes
339	40340	Module Priority	0~15	1			2Bytes
340	40341	Number of Modules	0~32	1			2Bytes
341	40342	Multi-genset Total	-2,147,483,647	0.1	kW	32-bit Signed	2Bytes
342	40343	Active Power	~2,147,483,647				2Bytes
343	40344	MCU Temp.	-400~1250	0.1	°C	16-bit Signed	2Bytes
344	40345	AIN24-1 Sensor 15				16-bit	2Bytes

Modbus Address	PLC Address	Function	Range (Decimal)	Ratio	Unit	Description	Remarks
		Value				Signed	
345	40346	AIN24-1 Sensor 16 Value				16-bit Signed	2Bytes
346	40347	AIN24-1 Sensor 17 Value				16-bit Signed	2Bytes
347	40348	AIN24-1 Sensor 18 Value				16-bit Signed	2Bytes
348	40349	AIN24-1 Sensor 19 Value				16-bit Signed	2Bytes
349	40350	AIN24-1 Sensor 20 Value				16-bit Signed	2Bytes
350	40351	AIN24-1 Sensor 21 Value				16-bit Signed	2Bytes
351	40352	AIN24-1 Sensor 22 Value				16-bit Signed	2Bytes
352	40353	AIN24-1 Sensor 23 Value				16-bit Signed	2Bytes
353	40354	AIN24-1 Sensor 24 Value				16-bit Signed	2Bytes
354	40355	AIN24-2 Sensor 15 Value				16-bit Signed	2Bytes
355	40356	AIN24-2 Sensor 16 Value				16-bit Signed	2Bytes
356	40357	AIN24-2 Sensor 17 Value				16-bit Signed	2Bytes
357	40358	AIN24-2 Sensor 18 Value				16-bit Signed	2Bytes
358	40359	AIN24-2 Sensor 19 Value				16-bit Signed	2Bytes
359	40360	AIN24-2 Sensor 20 Value				16-bit Signed	2Bytes
360	40361	AIN24-2 Sensor 21 Value				16-bit Signed	2Bytes
361	40362	AIN24-2 Sensor 22 Value				16-bit Signed	2Bytes
362	40363	AIN24-2 Sensor 23 Value				16-bit Signed	2Bytes
363	40364	AIN24-2 Sensor 24 Value				16-bit Signed	2Bytes
364	40365					16-bit Signed	2Bytes
365	40366					16-bit Signed	2Bytes

Modbus Address	PLC Address	Function	Range (Decimal)	Ratio	Unit	Description	Remarks
366	40367					16-bit Signed	2Bytes
367	40368	Maintenance Countdown Hour	0~65535	1	h	16-bit Unsigned	2Bytes
368	40369	Maintenance Countdown Minute	0~59	1	min	16-bit Unsigned	2Bytes
369	40370	Maintenance Countdown Second	0~59	1	s	16-bit Unsigned	2Bytes
370	40371	Maintenance Countdown Hour	0~65535	1	h	16-bit Unsigned	2Bytes
371	40372	Maintenance Countdown Minute	0~59	1	min	16-bit Unsigned	2Bytes
372	40373	Maintenance Countdown Second	0~59	1	s	16-bit Unsigned	2Bytes
373	40374	Maintenance Countdown Hour	0~65535	1	h	16-bit Unsigned	2Bytes
374	40375	Maintenance Countdown Minute	0~59	1	min	16-bit Unsigned	2Bytes
375	40376	Maintenance Countdown Second	0~59	1	s	16-bit Unsigned	2Bytes
376	40377	User Accumulated Running Hours A	0~65535	1	h		2Bytes
377	40378	User Accumulated Running Minutes A	0~59	1	min		2Bytes
378	40379	User Accumulated Running Seconds A	0~59	1	s		2Bytes
379	40380	User Accumulated Start Times A	0~65535	1			2Bytes
380	40381	User Accumulated Electric Energy A (kWh)	0~4294967295	1	kWh		2Bytes
381	40382						2Bytes
382	40383	User Accumulated Running Hours B	0~65535	1	h		2Bytes
383	40384	User Accumulated Running Minutes B	0~59	1	min		2Bytes
384	40385	User Accumulated Running Seconds B	0~59	1	s		2Bytes
385	40386	User Accumulated Start Times B	0~65535	1			2Bytes
386	40387	User Accumulated Electric Energy B (kWh)	0~4294967295	0.1	kWh		2Bytes
387	40388						2Bytes
388	40389	Reserved					2Bytes

Modbus Address	PLC Address	Function	Range (Decimal)	Ratio	Unit	Description	Remarks
389	40390	Reserved					2Bytes
390	40391	Reserved					2Bytes
391	40392	AIN24-1 Sensor 1 Value				16-bit Signed	2Bytes
392	40393	AIN24-1 Sensor 2 Value				16-bit Signed	2Bytes
393	40394	AIN24-1 Sensor 3 Value				16-bit Signed	2Bytes
394	40395	AIN24-1 Sensor 4 Value				16-bit Signed	2Bytes
395	40396	AIN24-1 Sensor 5 Value				16-bit Signed	2Bytes
396	40397	AIN24-1 Sensor 6 Value				16-bit Signed	2Bytes
397	40398	AIN24-1 Sensor 7 Value				16-bit Signed	2Bytes
398	40399	AIN24-1 Sensor 8 Value				16-bit Signed	2Bytes
399	40400	AIN24-1 Sensor 9 Value				16-bit Signed	2Bytes
400	40401	AIN24-1 Sensor 10 Value				16-bit Signed	2Bytes
401	40402	AIN24-1 Sensor 11 Value				16-bit Signed	2Bytes
402	40403	AIN24-1 Sensor 12 Value				16-bit Signed	2Bytes
403	40404	AIN24-1 Sensor 13 Value				16-bit Signed	2Bytes
404	40405	AIN24-1 Sensor 14 Value				16-bit Signed	2Bytes
405	40406	AIN24-2 Sensor 1 Value				16-bit Signed	2Bytes
406	40407	AIN24-2 Sensor 2 Value				16-bit Signed	2Bytes
407	40408	AIN24-2 Sensor 3 Value				16-bit Signed	2Bytes
408	40409	AIN24-2 Sensor 4 Value				16-bit Signed	2Bytes
409	40410	AIN24-2 Sensor 5 Value				16-bit Signed	2Bytes
410	40411	AIN24-2 Sensor 6 Value				16-bit Signed	2Bytes
411	40412	AIN24-2 Sensor 7 Value				16-bit	2Bytes

Modbus Address	PLC Address	Function	Range (Decimal)	Ratio	Unit	Description	Remarks
		Value				Signed	
412	40413	AIN24-2 Sensor 8 Value				16-bit Signed	2Bytes
413	40414	AIN24-2 Sensor 9 Value				16-bit Signed	2Bytes
414	40415	AIN24-2 Sensor 10 Value				16-bit Signed	2Bytes
415	40416	AIN24-2 Sensor 11 Value				16-bit Signed	2Bytes
416	40417	AIN24-2 Sensor 12 Value				16-bit Signed	2Bytes
417	40418	AIN24-2 Sensor 13 Value				16-bit Signed	2Bytes
418	40419	AIN24-2 Sensor 14 Value				16-bit Signed	2Bytes
419	40420					16-bit Signed	2Bytes
530	40531	AIN8 Sensor 1 Value				16-bit Signed	2Bytes
531	40532	AIN8 Sensor 2 Value				16-bit Signed	2Bytes
532	40533	AIN8 Sensor 3 Value				16-bit Signed	2Bytes
533	40534	AIN8 Sensor 4 Value				16-bit Signed	2Bytes
534	40535	AIN8 Sensor 5 Value				16-bit Signed	2Bytes
535	40536	AIN8 Sensor 6 Value				16-bit Signed	2Bytes
536	40537	AIN8 Sensor 7 Value				16-bit Signed	2Bytes
537	40538	AIN8 Sensor 8 Value				16-bit Signed	2Bytes
546	40547	Reserved					2Bytes
547	40548	Reserved					2Bytes
548	40549	Reserved					2Bytes
549	40550	Reserved					2Bytes
550	40551	Reserved					2Bytes
551	40552	Reserved					2Bytes
552	40553	Reserved					2Bytes
553	40554	Reserved					2Bytes
554	40555	Reserved					2Bytes
555	40556	Reserved					2Bytes

Modbus Address	PLC Address	Function	Range (Decimal)	Ratio	Unit	Description	Remarks
556	40557	Reserved					2Bytes
557	40558						2Bytes
558	40559	Reserved					2Bytes
559	40560						2Bytes
560	40561	Auto Mode				Unsigned	0: Auto Priority 1: Auto Normal Mode 2: Auto Battle Mode 3: Auto Balanced Running 4: Auto Fuel Economy 5: Auto Battle Mode 2
561	40562	MSC Net Comm. Quality %				Unsigned	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 low order bits come first and the high order bits follows. 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 "Accumulated Electric Energy kWh" (current value is 12345.6 kWh) needs to be read, check the table above and find its coil address is 309 and 310, so it needs to read two bytes of data.

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

Table 13 Master Request Command

Slave Address	Function Code	Start Address (309)		Request Data Length (2)		CRC 16	
		MSB	LSB	MSB	LSB	LSB	MSB
01	03	01	35	00	02	D5	F9

Table 14 Client Request Frame via Ethernet

MBAP Header							Function Code	Data				
Transaction ID		Protocol ID		Data Length		Unit ID		Remote Address (404)		Remote Data		
						MSB		LSB	MSB	LSB		
00	01	00	00	00	06	01	03	01	35	00	02	

The slave response command is as following:

Table 15 Slave Response Command

Slave Address	Function Code	Data Length (Bytes)	Data				CRC 16	
			Data of Address 309 MSB	Data of Address 309 LSB	Data of Address 310 MSB	Data of Address 310 LSB	LSB	MSB
01	03	04	E2	40	00	01	0C	5F

Table 16 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 309 MSB	Data of Address 309 LSB	Data of Address 310 MSB	Data of Address 310 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 17 Data Analysis

Address	Data Received (Hex)	Data Combined (Hex)	Accumulated Electric Energy (Decimal)
309	E240H	0001E240H	12345.6
310	0001H		

2.3 FUNCTION CODE 05H MAPPING REMOTE COIL FIELD

Table 18 Remote Coil Field

Modbus Address	PLC Address	Function	Description
0	1	Remote Start Key	Active only when sending FF00H
1	2	Remote Stop Key	Active only when sending FF00H
2	3	Remote Test Key	Active only when sending FF00H
3	4	Remote Auto Key	Active only when sending FF00H
4	5	Remote Manual Key	Active only when sending FF00H
5	6	Remote Mains Close/Open Key (Gen. Closed)	Active only when sending FF00H
6	7	Remote Gen. Close/Open Key (Gen. Open)	Active only when sending FF00H
7	8	Remote Up Key	Active only when sending FF00H
8	9	Remote Down Key	Active only when sending FF00H
9	10	Remote Left Key	Active only when sending FF00H
10	11	Remote Right Key	Active only when sending FF00H
11	12	Remote Confirm Key	Active only when sending FF00H
12	13	Remote Mute Key	Active only when sending FF00H
13	14	Remote ESC Return Key	Active only when sending FF00H
14	15	Remote Alarm Reset Key	Active only when sending FF00H
15	16	Remote Genset Quick Stop	Active only when sending FF00H
16	17	Remote Genset Emergency Stop	Active only when sending FF00H
17	18	Remote FN Key	Active only when sending FF00H
18	19	Remote Lamp Test Key	Active only when sending FF00H
19	20	Reserved	Active only when sending FF00H
20	21	Remote Output 1	Active only when sending FF00H or 0000H Sending FF00H as output Sending 0000H as not output
21	22	Remote Output 2	
22	23	Remote Output 3	
23	24	Remote Output 4	
24	25	Remote Output 5	
25	26	Remote Output 6	
26	27	Remote Output 7	
27	28	Remote Output 8	
28	29	Remote Output 9	
29	30	Remote Output 10	
30	31	Remote Output 11	
31	32	Remote Output 12	
32	33	Remote Output 13	
33	34	Remote Output 14	
34	35	Remote Output 15	
35	36	Remote Output 16	
36	37	Remote Output 17	

Modbus Address	PLC Address	Function	Description
37	38	Remote Output 18	
38	39	Remote Output 19	
39	40	Remote Output 20	
40	41	Remote Display Module Output	
41	42	Remote Auto Normal Mode	Active only when sending FF00H
42	43	Remote Auto Battle Mode	Active only when sending FF00H
43	44	Remote Auto Normal Mode 2	Active only when sending FF00H
44	45	Remote Auto Battle Mode 2	Active only when sending FF00H
45	46		
46	47		
47	48		
48	49		
49	50		
50	51	Active Power Output + (Fn+Up)	Active only when sending FF00H
51	52	Active Power Output - (Fn+Down)	Active only when sending FF00H
52	53	Reactive Power Output + (Fn+Left)	Active only when sending FF00H
53	54	Reactive Power Output - (Fn+Right)	Active only when sending FF00H
54	55	Aftertreatment Inhibit Regeneration On (Fn+Up)	Active only when sending FF00H
55	56	Aftertreatment Inhibit Regeneration Off (Fn+Down)	Active only when sending FF00H
56	57	Aftertreatment Manual Regeneration On (Fn+Left)	Active only when sending FF00H
57	58	Aftertreatment Manual Regeneration Off (Fn+Right)	Active only when sending FF00H
58	59		

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

Example:

If the remote controller is in auto mode, check the table first and find its remote address is 3.

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

Table 19 Master Request Command

Slave Address	Function Code	Remote Address (3)		Remote Data		CRC 16	
		MSB	LSB	MSB	LSB	LSB	MSB
01	05	00	03	FF	00	7C	3A

Table 20 Client Request Frame via Ethernet

MBAP Header							Function Code	Data			
Transaction ID	Protocol ID	Data Length	Unit ID	Remote Address (404)		Remote Data					
				MSB	LSB	MSB		LSB			
00	01	00	00	00	06	01	05	00	03	FF	00

The slave response command is as following:

Table 21 Slave Response Command

Slave Address	Function Code	Remote Address (3)		Remote Data		CRC 16	
		MSB	LSB	MSB	LSB	LSB	MSB
01	05	00	03	FF	00	7C	3A

Table 22 Controller Response Frame via Ethernet

MBAP Header							Function Code	Data			
Transaction ID		Protocol ID		Data Length		Unit ID		Remote Address (404)		Remote Data	
						MSB		LSB	MSB	LSB	
00	01	00	00	00	06	01	05	00	03	FF	00

Whether the remote command is active can be checked by sending function code 03H to read auto mode status of address 0.9.

2.4 ALARMS DATA LIST

Table 23 Alarms Data List

Offset Address	Item	Description	Bytes
0000	Emergency Stop	1 as active (bit0)	1bit
	Overspeed	1 as active (bit1)	1bit
	Underspeed	1 as active (bit2)	1bit
	Loss of Speed Signal	1 as active (bit3)	1bit
	Gen. Overfrequency	1 as active (bit4)	1bit
	Gen. Underfrequency	1 as active (bit5)	1bit
	Gen. Overvoltage	1 as active (bit6)	1bit
	Gen. Undervoltage	1 as active (bit7)	1bit
	Start Failure	1 as active (bit8)	1bit
	Gen. Overcurrent	1 as active (bit9)	1bit
	Current Imbalance	1 as active (bit10)	1bit
	Ground Fault	1 as active (bit11)	1bit
	Reverse Power	1 as active (bit12)	1bit
	Over Power	1 as active (bit13)	1bit
	Loss of Excitation Fault	1 as active (bit14)	1bit
	ECU Comm. Failure	1 as active (bit15)	1bit
0001	ECU Alarm	1 as active (bit0)	1bit
	Aux. High Temp. Alarm	1 as active (bit1)	1bit
	Aux. Low Oil Pressure Alarm	1 as active (bit2)	1bit
	MSC ID Error	1 as active (bit3)	1bit
	Voltage Bus Error	1 as active (bit4)	1bit
	Gen. Phase Sequence Error	1 as active (bit5)	1bit

Offset Address	Item	Description	Bytes
	Voltage Bus Phase Sequence Error	1 as active (bit6)	1bit
	Flex. Sensor 1 Open	1 as active (bit7)	1bit
	Flex. Sensor 1 High	1 as active (bit8)	1bit
	Flex. Sensor 1 Low	1 as active (bit9)	1bit
	Flex. Sensor 1 Error	1 as active (bit10)	1bit
	Flex. Sensor 2 Open	1 as active (bit11)	1bit
	Flex. Sensor 2 High	1 as active (bit12)	1bit
	Flex. Sensor 2 Low	1 as active (bit13)	1bit
	Flex. Sensor 2 Error	1 as active (bit14)	1bit
	Flex. Sensor 3 Open	1 as active (bit15)	1bit
0002	Flex. Sensor 3 High	1 as active (bit0)	1bit
	Flex. Sensor 3 Low	1 as active (bit1)	1bit
	Flex. Sensor 3 Error	1 as active (bit2)	1bit
	Flex. Sensor 4 Open	1 as active (bit3)	1bit
	Flex. Sensor 4 High	1 as active (bit4)	1bit
	Flex. Sensor 4 Low	1 as active (bit5)	1bit
	Flex. Sensor 4 Error	1 as active (bit6)	1bit
	Flex. Sensor 5 Open	1 as active (bit7)	1bit
	Flex. Sensor 5 High	1 as active (bit8)	1bit
	Flex. Sensor 5 Low	1 as active (bit9)	1bit
	Flex. Sensor 5 Error	1 as active (bit10)	1bit
	Stop Failure	1 as active (bit11)	1bit
	Charging Failure	1 as active (bit12)	1bit
	Battery Overvoltage	1 as active (bit13)	1bit
	Battery Undervoltage	1 as active (bit14)	1bit
	Sync. Failure	1 as active (bit15)	1bit
0003	GOV Reach Limit	1 as active (bit0)	1bit
	AVR Reach Limit	1 as active (bit1)	1bit
	Insufficient Gen. Capacity	1 as active (bit2)	1bit
	Voltage Asynchrony	1 as active (bit3)	1bit
	Frequency Asynchrony	1 as active (bit4)	1bit
	Phase Asynchrony	1 as active (bit5)	1bit
	Mains Switch Alarm	1 as active (bit6)	1bit
	Gen. Switch Alarm	1 as active (bit7)	1bit
	Mains Closed Failure	1 as active (bit8)	1bit
	Gen. Closed Failure	1 as active (bit9)	1bit
	Mains Open Failure	1 as active (bit10)	1bit
	Gen. Open Failure	1 as active (bit11)	1bit
	Mains Overfrequency	1 as active (bit12)	1bit
	Mains Underfrequency	1 as active (bit13)	1bit
	Mains Overvoltage	1 as active (bit14)	1bit
	Mains Undervoltage	1 as active (bit15)	1bit
0004	Mains ROCOF	1 as active (bit0)	1bit

Offset Address	Item	Description	Bytes
	Mains Vector Shift	1 as active (bit1)	1bit
	Freq. Error Too High	1 as active (bit2)	1bit
	Few MSC Modules	1 as active (bit3)	1bit
	Maintenance 1 Time Due	1 as active (bit4)	1bit
	Maintenance 2 Time Due	1 as active (bit5)	1bit
	Maintenance 3 Time Due	1 as active (bit6)	1bit
	Low Coolant Level Alarm	1 as active (bit7)	1bit
	Detonation Alarm	1 as active (bit8)	1bit
	Gas Leakage Alarm	1 as active (bit9)	1bit
	Gen. Reverse Phase Sequence	1 as active (bit10)	1bit
	Gen. Loss of Phase	1 as active (bit11)	1bit
	MSC Comm. Failure	1 as active (bit12)	1bit
	Reserved	1 as active (bit13)	1bit
	Reserved	1 as active (bit14)	1bit
	Reserved	1 as active (bit15)	1bit
0005	Digital Input 1	1 as active (bit0)	1bit
	Digital Input 2	1 as active (bit1)	1bit
	Digital Input 3	1 as active (bit2)	1bit
	Digital Input 4	1 as active (bit3)	1bit
	Digital Input 5	1 as active (bit4)	1bit
	Digital Input 6	1 as active (bit5)	1bit
	Digital Input 7	1 as active (bit6)	1bit
	Digital Input 8	1 as active (bit7)	1bit
	Digital Input 9	1 as active (bit8)	1bit
	Digital Input 10	1 as active (bit9)	1bit
	Digital Input 11	1 as active (bit10)	1bit
	Digital Input 12	1 as active (bit11)	1bit
	PLC Function 1	1 as active (bit12)	1bit
	PLC Function 2	1 as active (bit13)	1bit
	PLC Function 3	1 as active (bit14)	1bit
	PLC Function 4	1 as active (bit15)	1bit
0006	PLC Function 5	1 as active (bit0)	1bit
	PLC Function 6	1 as active (bit1)	1bit
	PLC Function 7	1 as active (bit2)	1bit
	PLC Function 8	1 as active (bit3)	1bit
	PLC Function 9	1 as active (bit4)	1bit
	PLC Function 10	1 as active (bit5)	1bit
	PLC Function 11	1 as active (bit6)	1bit
	PLC Function 12	1 as active (bit7)	1bit
	PLC Function 13	1 as active (bit8)	1bit
	PLC Function 14	1 as active (bit9)	1bit
	PLC Function 15	1 as active (bit10)	1bit
	PLC Function 16	1 as active (bit11)	1bit

Offset Address	Item	Description	Bytes
	PLC Function 17	1 as active (bit12)	1bit
	PLC Function 18	1 as active (bit13)	1bit
	PLC Function 19	1 as active (bit14)	1bit
	PLC Function 20	1 as active (bit15)	1bit
0007	DIN16 Comm. Failure	1 as active (bit0)	1bit
	DIN16 Input 1	1 as active (bit1)	1bit
	DIN16 Input 2	1 as active (bit2)	1bit
	DIN16 Input 3	1 as active (bit3)	1bit
	DIN16 Input 4	1 as active (bit4)	1bit
	DIN16 Input 5	1 as active (bit5)	1bit
	DIN16 Input 6	1 as active (bit6)	1bit
	DIN16 Input 7	1 as active (bit7)	1bit
	DIN16 Input 8	1 as active (bit8)	1bit
	DIN16 Input 9	1 as active (bit9)	1bit
	DIN16 Input 10	1 as active (bit10)	1bit
	DIN16 Input 11	1 as active (bit11)	1bit
	DIN16 Input 12	1 as active (bit12)	1bit
	DIN16 Input 13	1 as active (bit13)	1bit
	DIN16 Input 14	1 as active (bit14)	1bit
	DIN16 Input 15	1 as active (bit15)	1bit
0008	DIN16 Input 16	1 as active (bit0)	1bit
	DOU16 Comm. Failure	1 as active (bit1)	1bit
	AIN24-1 Comm. Failure	1 as active (bit2)	1bit
	AIN24-1 Cylinder Temp. High	1 as active (bit3)	1bit
	AIN24-1 Exhaust Temp. High	1 as active (bit4)	1bit
	AIN24-1 Cylinder Temp. Difference High	1 as active (bit5)	1bit
	AIN24-1 Sensor 15 Open	1 as active (bit6)	1bit
	AIN24-1 Sensor 15 High	1 as active (bit7)	1bit
	AIN24-1 Sensor 15 Low	1 as active (bit8)	1bit
	AIN24-1 Sensor 16 Open	1 as active (bit9)	1bit
	AIN24-1 Sensor 16 High	1 as active (bit10)	1bit
	AIN24-1 Sensor 16 Low	1 as active (bit11)	1bit
	AIN24-1 Sensor 17 Open	1 as active (bit12)	1bit
	AIN24-1 Sensor 17 High	1 as active (bit13)	1bit
	AIN24-1 Sensor 17 Low	1 as active (bit14)	1bit
	AIN24-1 Sensor 18 Open	1 as active (bit15)	1bit
0009	AIN24-1 Sensor 18 High	1 as active (bit0)	1bit
	AIN24-1 Sensor 18 Low	1 as active (bit1)	1bit
	AIN24-1 Sensor 19 Open	1 as active (bit2)	1bit
	AIN24-1 Sensor 19 High	1 as active (bit3)	1bit
	AIN24-1 Sensor 19 Low	1 as active (bit4)	1bit
	AIN24-1 Sensor 20 Open	1 as active (bit5)	1bit

Offset Address	Item	Description	Bytes
	AIN24-1 Sensor 20 High	1 as active (bit6)	1bit
	AIN24-1 Sensor 20 Low	1 as active (bit7)	1bit
	AIN24-1 Sensor 21 Open	1 as active (bit8)	1bit
	AIN24-1 Sensor 21 High	1 as active (bit9)	1bit
	AIN24-1 Sensor 21 Low	1 as active (bit10)	1bit
	AIN24-1 Sensor 22 Open	1 as active (bit11)	1bit
	AIN24-1 Sensor 22 High	1 as active (bit12)	1bit
	AIN24-1 Sensor 22 Low	1 as active (bit13)	1bit
	AIN24-1 Sensor 23 Open	1 as active (bit14)	1bit
	AIN24-1 Sensor 23 High	1 as active (bit15)	1bit
0010	AIN24-1 Sensor 23 Low	1 as active (bit0)	1bit
	AIN24-1 Sensor 24 Open	1 as active (bit1)	1bit
	AIN24-1 Sensor 24 High	1 as active (bit2)	1bit
	AIN24-1 Sensor 24 Low	1 as active (bit3)	1bit
	AIN24-2 Comm. Failure	1 as active (bit4)	1bit
	AIN24-2 Cylinder Temp. High	1 as active (bit5)	1bit
	AIN24-2 Exhaust Temp. High	1 as active (bit6)	1bit
	AIN24-2 Cylinder Temp. Difference High	1 as active (bit7)	1bit
	AIN24-2 Sensor 15 Open	1 as active (bit8)	1bit
	AIN24-2 Sensor 15 High	1 as active (bit9)	1bit
	AIN24-2 Sensor 15 Low	1 as active (bit10)	1bit
	AIN24-2 Sensor 16 Open	1 as active (bit11)	1bit
	AIN24-2 Sensor 16 High	1 as active (bit12)	1bit
	AIN24-2 Sensor 16 Low	1 as active (bit13)	1bit
	AIN24-2 Sensor 17 Open	1 as active (bit14)	1bit
	AIN24-2 Sensor 17 High	1 as active (bit15)	1bit
0011	AIN24-2 Sensor 17 Low	1 as active (bit0)	1bit
	AIN24-2 Sensor 18 Open	1 as active (bit1)	1bit
	AIN24-2 Sensor 18 High	1 as active (bit2)	1bit
	AIN24-2 Sensor 18 Low	1 as active (bit3)	1bit
	AIN24-2 Sensor 19 Open	1 as active (bit4)	1bit
	AIN24-2 Sensor 19 High	1 as active (bit5)	1bit
	AIN24-2 Sensor 19 Low	1 as active (bit6)	1bit
	AIN24-2 Sensor 20 Open	1 as active (bit7)	1bit
	AIN24-2 Sensor 20 High	1 as active (bit8)	1bit
	AIN24-2 Sensor 20 Low	1 as active (bit9)	1bit
	AIN24-2 Sensor 21 Open	1 as active (bit10)	1bit
	AIN24-2 Sensor 21 High	1 as active (bit11)	1bit
	AIN24-2 Sensor 21 Low	1 as active (bit12)	1bit
	AIN24-2 Sensor 22 Open	1 as active (bit13)	1bit
	AIN24-2 Sensor 22 High	1 as active (bit14)	1bit
	AIN24-2 Sensor 22 Low	1 as active (bit15)	1bit

Offset Address	Item	Description	Bytes
0012	AIN24-2 Sensor 23 Open	1 as active (bit0)	1bit
	AIN24-2 Sensor 23 High	1 as active (bit1)	1bit
	AIN24-2 Sensor 23 Low	1 as active (bit2)	1bit
	AIN24-2 Sensor 24 Open	1 as active (bit3)	1bit
	AIN24-2 Sensor 24 High	1 as active (bit4)	1bit
	AIN24-2 Sensor 24 Low	1 as active (bit5)	1bit
	Power Factor Low	1 as active (bit6)	1bit
	THD High	1 as active (bit7)	1bit
	Gen. Voltage Imbalance	1 as active (bit8)	1bit
	MSC Mains Decoupling	1 as active (bit9)	1bit
	Ground Relay Close Failure	1 as active (bit10)	1bit
	Ground Relay Open Failure	1 as active (bit11)	1bit
	Static Parallel Failure	1 as active (bit12)	1bit
	Master Controller Failure	1 as active (bit13)	1bit
	Reserved	1 as active (bit14)	1bit
	Reserved	1 as active (bit15)	1bit
0013	AIN8 Comm. Failure	1 as active (bit0)	1bit
	AIN8 Sensor 1 Open	1 as active (bit1)	1bit
	AIN8 Sensor 1 High	1 as active (bit2)	1bit
	AIN8 Sensor 1 Low	1 as active (bit3)	1bit
	AIN8 Sensor 2 Open	1 as active (bit4)	1bit
	AIN8 Sensor 2 High	1 as active (bit5)	1bit
	AIN8 Sensor 2 Low	1 as active (bit6)	1bit
	AIN8 Sensor 3 Open	1 as active (bit7)	1bit
	AIN8 Sensor 3 High	1 as active (bit8)	1bit
	AIN8 Sensor 3 Low	1 as active (bit9)	1bit
	AIN8 Sensor 4 Open	1 as active (bit10)	1bit
	AIN8 Sensor 4 High	1 as active (bit11)	1bit
	AIN8 Sensor 4 Low	1 as active (bit12)	1bit
	AIN8 Sensor 5 Open	1 as active (bit13)	1bit
	AIN8 Sensor 5 High	1 as active (bit14)	1bit
	AIN8 Sensor 5 Low	1 as active (bit15)	1bit
0014	AIN8 Sensor 6 Open	1 as active (bit0)	1bit
	AIN8 Sensor 6 High	1 as active (bit1)	1bit
	AIN8 Sensor 6 Low	1 as active (bit2)	1bit
	AIN8 Sensor 7 Open	1 as active (bit3)	1bit
	AIN8 Sensor 7 High	1 as active (bit4)	1bit
	AIN8 Sensor 7 Low	1 as active (bit5)	1bit
	AIN8 Sensor 8 Open	1 as active (bit6)	1bit
	AIN8 Sensor 8 High	1 as active (bit7)	1bit
	AIN8 Sensor 8 Low	1 as active (bit8)	1bit
	Flex. Sensor 6 Open	1 as active (bit9)	1bit
	Flex. Sensor 6 High	1 as active (bit10)	1bit

Offset Address	Item	Description	Bytes
	Flex. Sensor 6 Low	1 as active (bit11)	1bit
	Flex. Sensor 6 Error	1 as active (bit12)	1bit
	Temp. Sensor Open	1 as active (bit13)	1bit
	High Engine Temp.	1 as active (bit14)	1bit
	Low Engine Temp.	1 as active (bit15)	1bit
0015	Oil Pressure Sensor Open	1 as active (bit0)	1bit
	High Oil Pressure	1 as active (bit1)	1bit
	Low Oil Pressure	1 as active (bit2)	1bit
	Digital Input 13	1 as active (bit3)	1bit
	Digital Input 14	1 as active (bit4)	1bit
	Digital Input 15	1 as active (bit5)	1bit
	Digital Input 16	1 as active (bit6)	1bit
	Digital Input 17	1 as active (bit7)	1bit
	Digital Input 18	1 as active (bit8)	1bit
	Digital Input 19	1 as active (bit9)	1bit
	Digital Input 20	1 as active (bit10)	1bit
	Digital Input 21	1 as active (bit11)	1bit
	Digital Input 22	1 as active (bit12)	1bit
	Digital Input 23	1 as active (bit13)	1bit
	Digital Input 24	1 as active (bit14)	1bit
	Digital Input 25	1 as active (bit15)	1bit
0016	Digital Input 26	1 as active (bit0)	1bit
	ID Error	1 as active (bit1)	1bit
	Switch Fault	1 as active (bit2)	1bit
	IP Error	1 as active (bit3)	1bit
	Ring Network Disconnect	1 as active (bit4)	1bit
	Reserved	1 as active (bit5)	1bit
	Reserved	1 as active (bit6)	1bit
	Reserved	1 as active (bit7)	1bit
	Reserved	1 as active (bit8)	1bit
	Reserved	1 as active (bit9)	1bit
	Reserved	1 as active (bit10)	1bit
	Reserved	1 as active (bit11)	1bit
	Reserved	1 as active (bit12)	1bit
	Reserved	1 as active (bit13)	1bit
	Reserved	1 as active (bit14)	1bit
	Reserved	1 as active (bit15)	1bit
0017	Reserved	1 as active (bit0)	1bit
	Reserved	1 as active (bit1)	1bit
	Reserved	1 as active (bit2)	1bit
	Reserved	1 as active (bit3)	1bit
	Reserved	1 as active (bit4)	1bit
	Reserved	1 as active (bit5)	1bit

Offset Address	Item	Description	Bytes
	Reserved	1 as active (bit6)	1bit
	Reserved	1 as active (bit7)	1bit
	Reserved	1 as active (bit8)	1bit
	Reserved	1 as active (bit9)	1bit
	Reserved	1 as active (bit10)	1bit
	Reserved	1 as active (bit11)	1bit
	Reserved	1 as active (bit12)	1bit
	Reserved	1 as active (bit13)	1bit
	Reserved	1 as active (bit14)	1bit
	Reserved	1 as active (bit15)	1bit
0018	Reserved	1 as active (bit0)	1bit
	Reserved	1 as active (bit1)	1bit
	Reserved	1 as active (bit2)	1bit
	Reserved	1 as active (bit3)	1bit
	Reserved	1 as active (bit4)	1bit
	Reserved	1 as active (bit5)	1bit
	Reserved	1 as active (bit6)	1bit
	Reserved	1 as active (bit7)	1bit
	Reserved	1 as active (bit8)	1bit
	Reserved	1 as active (bit9)	1bit
	Reserved	1 as active (bit10)	1bit
	Reserved	1 as active (bit11)	1bit
	Reserved	1 as active (bit12)	1bit
	Reserved	1 as active (bit13)	1bit
	Reserved	1 as active (bit14)	1bit
	Reserved	1 as active (bit15)	1bit
0019	Reserved	1 as active (bit0)	1bit
	Reserved	1 as active (bit1)	1bit
	Reserved	1 as active (bit2)	1bit
	Reserved	1 as active (bit3)	1bit
	Reserved	1 as active (bit4)	1bit
	Reserved	1 as active (bit5)	1bit
	Reserved	1 as active (bit6)	1bit
	Reserved	1 as active (bit7)	1bit
	Reserved	1 as active (bit8)	1bit
	Reserved	1 as active (bit9)	1bit
	Reserved	1 as active (bit10)	1bit
	Reserved	1 as active (bit11)	1bit
	Reserved	1 as active (bit12)	1bit
	Reserved	1 as active (bit13)	1bit
	Reserved	1 as active (bit14)	1bit
	Reserved	1 as active (bit15)	1bit

For example:

Example of shutdown alarms:

When the "Bit1" of register address 0000 is written as 1, check Table 6 (Alarm and Coil Status of Data Field) to see that there is a shutdown alarm in the system, indicating that there is a digital value that is written as 1 in the shutdown addresses range of 0001~0020.

Assuming that "ECU Shutdown Alarm" exists in the system now, check Table 23 (Alarm Data List) to see that the offset address of "ECU Alarm" is 0001.0.

The register address = start address of shutdown alarm + offset address = 0001 + 0001 = 0002, and the corresponding PLC address is 40003.

The data of register 0002 is converted from 1 (decimal) to 0000 0000 0000 0001 (binary), and the bit0 of register 0002 is 1, that is, there is an "ECU Shutdown" now.

Example of warning alarms:

When the "Bit2" of register address 0000 is written as 1, check Table 6 (Alarm and Coil Status of Data Field) to see that there is a warning alarm in the system, indicating that there is a digital value that is written as 1 in the warning addresses range of 0121~0140.

Assuming that "Few MSC Modules" and "Low Coolant Level Alarm" exist in the system now, check Table 23 (Alarm Data List) to see that the offset address of "Few MSC Modules" and "Low Coolant Level Alarm" is "0004.3" and "0004.7".

The register address = start address of warning alarm + offset address = 0121 + 0004 = 0125, and the corresponding PLC address is 40126.

The data of register 0005 is converted from 136 (decimal) to 0000 0000 1000 1000 (binary), and the bit3 and bit7 of register 0005 are 1, that is, there are "Few MSC Modules" and "Low Coolant Level Alarm" in the system.

NOTE 1: The bit digit starts from 0, that is, bit0.

NOTE 2: The calculation method of other alarms is consistent with the calculation methods of "shutdown alarms" and "warning alarms" in the example above.

2.5 GENSET RUNNING STATUS

Table 24 Genset Running Status

No.	Content	Default (Range)	Description
0	Standby		No delay value is shown in the status
1	Preheat		
2	Fuel Output		No delay value is shown in the status
3	Crank		
4	Crank Rest		
5	Safety on Delay		
6	Start Idle		
7	High Speed Warming up		
8	Wait for On-load		No delay value is shown in the status
9	Normal Running		No delay value is shown in the status
10	Cooling		
11	Stop Idle		
12	ETS		
13	Wait for Stop		
14	Stop Failure		No delay value is shown in the status
15	After Stop		

2.6 REMOTE START STATUS

Table 25 Remote Start Status

No.	Content	Default (Range)	Description
0	No Delay		No delay value is shown in the status
1	Start Delay		
2	Stop Delay		

2.7 SWITCH STATUS

Table 26 Switch Status

No.	Content	Default (Range)	Description
0	Waiting for Closing		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

Table 27 Mains Status

No.	Content	Default (Range)	Description
0	Mains Normal		No delay value is shown in the status
1	Mains Normal Delay		
2	Mains Abnormal		No delay value is shown in the status
3	Mains Abnormal Delay		

SmartGen

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) When the controller is in manual mode, send 05 function code "Remote Start Key";
- 4) The controller receives the command and enters the start process, the genset start process can be obtained by reading the 03 function code "Genset Running Status" address in "Genset Running Status" table;
- 5) If "Genset Running Status" is from 1 (Preheat) to 8 (Wait for On-load), the genset enters the start process, otherwise it does not. If it does not enter the start process, repeat step 3 and step 4;
- 6) If "Genset Running Status" is "Normal Running", send 05 Function Code "Remote Gen. Close/Open Key" (Gen. Closed);
- 7) The controller receives the command and close the genset switch, the genset closing process can be obtained by reading the 03 function code "Gen. Switch Status" address in "Switch Status" table;
- 8) If "Gen. Switch Status" is from 0 (Syncing) to 2 (Wait for Closing Input), the genset enters the closing process, otherwise it does not. If it does not enter the closing process, repeat step 6 and step 7;
- 9) When "Genset Running Status" is in "Normal Running" and "The "Gen. Switch Status" is in "Closed", The genset completes on-load running.

Stop Method 1:

- 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) When the controller is in manual mode, send 05 function code "Remote Gen. Close/Open Key" (Gen. Open);
- 4) The controller receives the command and open the genset switch, the genset opening process can be obtained by reading the 03 function code "Gen. Switch Status" address in "Switch Status" table;
- 5) If "Gen. Switch Status" is from 4 (Unloading) to 6 (Wait for Opening Input), the genset enters the opening process, otherwise it does not. If it does not enter the opening process, repeat step 3 and step 4;
- 6) When the "Gen. Switch Status" is "Opened", the genset switch is opened successfully, then send 05 function code "Remote Stop Key";
- 7) The controller receives the command and enters the stop process, the genset stop process can be obtained by reading the 03 function code "Genset Running Status" address in "Genset Running Status" table;
- 8) If "Genset Running Status" is from 10 (Cooling) to 13 (Wait for Stop), the genset enters the stop process, otherwise it does not. If it does not enter the stop process, repeat step 6 and step 7;

- 9) When "Genset Running Status" is in "Standby" and the "Gen. Switch Status" is in "Opened", then the genset completes the stop process.

Stop Method 2 (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 genset enters the stop process;
- 4) The genset opening process can be obtained by reading the 03 function code "Gen. Switch Status" address in "Switch Status" table. The genset stop process can be obtained by reading "Genset Running Status" address in "Genset Running Status" table;
- 5) When "Genset Running Status" is in "Standby" and the "Gen. Switch Status" is in "Opened", then the genset completes the stop process.

NOTE 1: When sending 05 function code remote control key command, it only need to send it once at a time.

NOTE 2: When the "Genset Running Status" is in the start process, the controller receives the "Remote Start Key" command or the start key is pressed, the "Genset Running Status" will jump to the next one, and can quickly enter the genset on-load running status.

NOTE 3: When the "Genset Running Status" is in the stop process, the controller receives the "Remote Stop Key" command or the stop key is pressed, the "Genset Running Status" will jump to the next one and it can quickly enter the stop status.

4 VIEW AND CONFIGURATION OF COMMUNICATION PARAMETERS

- 1) In the homepage of main screen, press and hold 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 setting page;
- 3) Enter the correct password (default: 00318), then press the  key to get into the parameter setting menu;
- 4) Press the  key to select "Module Setting", and press the  key to submenu;
- 5) Press the  key,  key to select "Module Address", "RS485 Comm. Setting" and "Network Setting", then press the  key to enter the parameter edit function, the corresponding parameters will be selected;
- 6) 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;
- 7) Press and hold the  key to return the home page.

NOTE: The parameter setting takes effect after the controller is restarted.

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 NETWORK PORT COMMUNICATION

SF/UTP CAT5e or above crossover or straight through RJ45 cable is required.

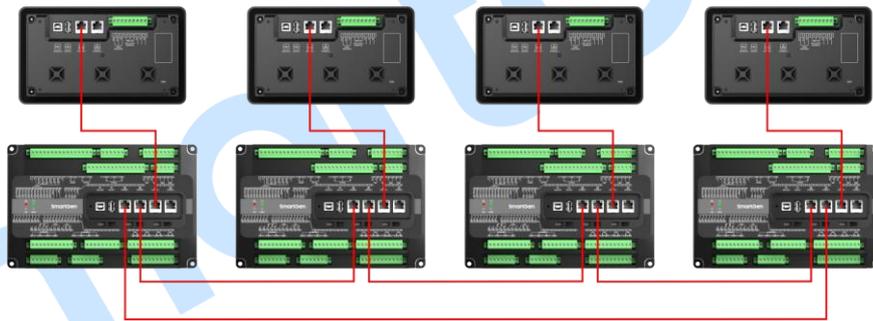


Fig.8 HGM8510 Communication Wiring Diagram 1

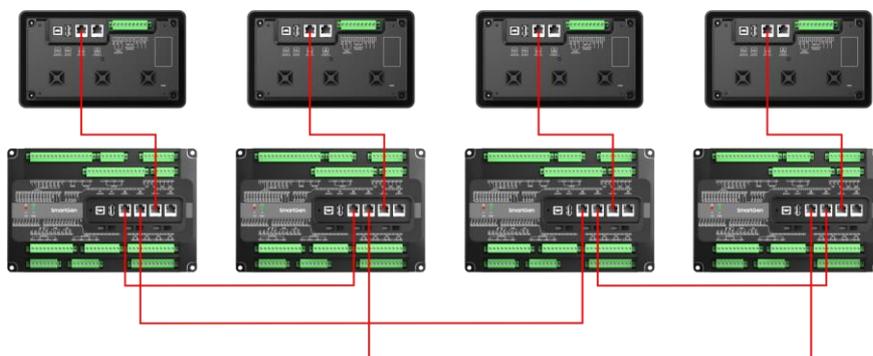


Fig.9 HGM8510 Communication Wiring Diagram 2

Note that the controller integrates the switch function, which is a ring network redundant connection method. If another switch is connected externally, do not connect with the controller's

internal ring network or take it carefully (to avoid external ring formation). If ring network redundancy is not needed, there is no limit on the connection.

5.5 EXTEND TRANSMISSION DISTANCE

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

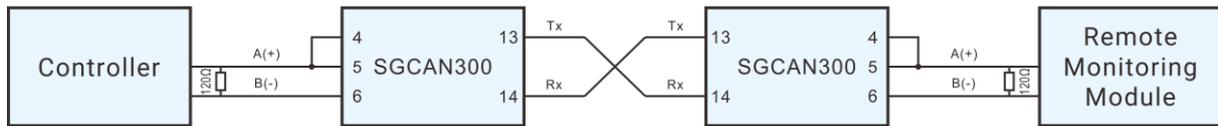


Fig.10 SGCAN300 Application Diagram

5.6 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;
- 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) 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; Adopts PLC address to communicate: send 1 as position 1, send 0 as position 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 can not 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 modbus poll, modscan32;
 - 17) It is recommended to download third-party communication test software to verify whether the network communication is normal, such as NetAssist, PortHelper;
 - 18) It is recommended to download SmartGen upper PC software for HGM8510 to verify whether the communication is normal.
-

SmartGen