SmartGen

MAKING CONTROL SMARTER

HGM9420N_HGM9420LT

GENSET CONTROLLER

COMMUNICATION PROTOCOL

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Table 1 Software Version

Date	Version	Content
2019-11-07	V1.0	Original release.
2025-05-16	V1.1	Update the template and the protocol.

CONTENTS

1 DESCRIPTION

This protocol describes the command format for reading and writing via the controller's RS485 half-duplex serial ports, as well as the definition of internal messages and data to facilitate third-party development and use.

The HGM9420N_HGM9420LT controller has two RS485 ports, and both follow the same protocol.

The controller works as a slave module. It supports the Modbus-RTU protocol but does not support other protocols, such as Modbus-ASCII.

Communication address: 1~254 (Default: 1)
Baud rate: 2400/4800/9600/19200bps (Default: 9600bps)
Start bit: 1-bit
Data bit: 8-bit
Parity bit: no parity, odd parity and even parity (Default: no parity)
Stop bit: 1-bit or 2-bit (Default: 2-bit)

Function code supported: 03H, 05H, and 06H. 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 commands; Function code 06H is used for setting controller time, total running time, total energy, user total running time and total energy.

Data checking method: CRC16.

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

Communication timeout period: over 200ms.

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

A maximum of 120 registers can be read per request.

It can support the communication of 32 networked controllers.

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

2 WIRING DIAGRAM

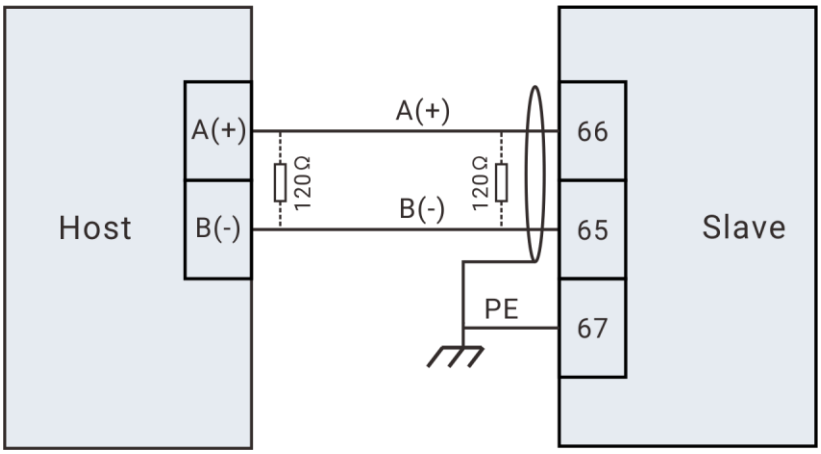

Fig.1 Single Device Communication Wiring Diagram

NOTE 1: Two 120-ohm resistors can be connected on both ends of the cable according to the site's requirement. See details in the instruction below.

NOTE 2: The diagram shown is for the RS485-1, and the diagram of RS485-2 is the same as above.

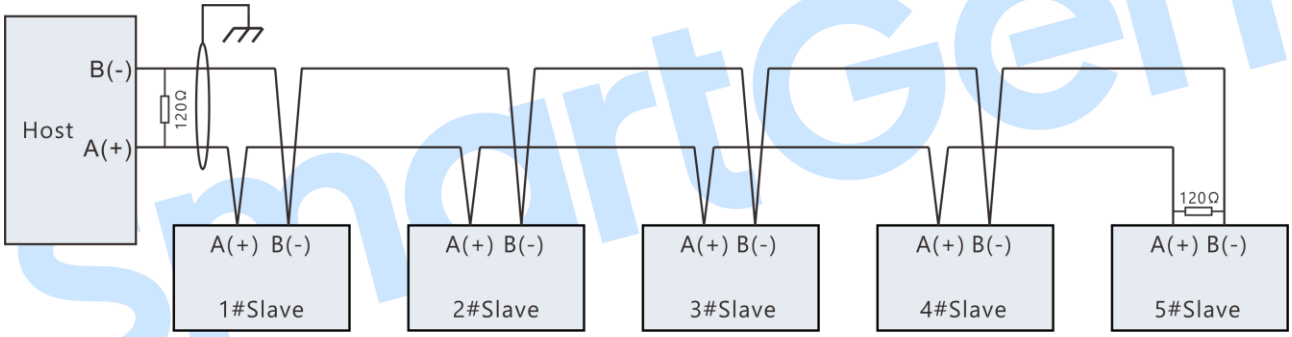

Fig.2 Multiple Devices Communication Wiring Diagram

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

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

3 ADDRESS AND DATA OF CONTROLLER INTERNAL REGISTERS

The slash mark ("/") in the following tables means the address is reserved.

3.1 FUNCTION CODE 03H MAPPING ALARM AND STATUS COIL OF DATA FIELD

Table 2 Alarm and Coil Status of Data Field

Modbus Address	Item	Description	Bytes
0.0	Common Alarm	"0" means no common alarm occurs "1" means a common alarm occurs (0.0 means the Boolean value at Bit0 of address 0) The content listed below follows the same rule	1bit
0.1	Common Shutdown Alarm	1 for active	1bit
0.2	Common Warning Alarm	1 for active	1bit
0.3	Common Trip and Stop Alarm	1 for active	1bit
0.4	Common Trip Alarm	1 for active	1bit
0.5	/		
0.6	/		
0.7	Common Block Alarm	1 for active	1bit
0.8	System in Test Mode	1 for active	1bit
0.9	System in Auto Mode	1 for active	1bit
0.10	System in Manual Mode	1 for active	1bit
0.11	System in Stop Mode	1 for active	1bit
0.12	/		
0.13	/		
0.14	/		
0.15	/		
1-20	Shutdown Alarm Field	ALARMS DATA **TABLE**	
21-40	Trip and Stop Alarm Field		
41-60	Trip Alarm Field		
61-80	Reserved		
81-100	Reserved		
101-120	Block Alarm Field		
121-140	Warning Alarm Field		
141.0	Emergency Input Status	1 for active	1bit
141.1	Digital Input 1 Status	1 for active	1bit
141.2	Digital Input 2 Status	1 for active	1bit
141.3	Digital Input 3 Status	1 for active	1bit
141.4	Digital Input 4 Status	1 for active	1bit
141.5	Digital Input 5 Status	1 for active	1bit
141.6	Digital Input 6 Status	1 for active	1bit
141.7	Digital Input 7 Status	1 for active	1bit

Modbus Address	Item	Description	Bytes
141.8	Digital Input 8 Status	1 for active	1bit
141.9	Digital Input 9 Status	1 for active	1bit
141.10	Digital Input 10 Status	1 for active	1bit
141.11	/		
141.12	/		
141.13	/		
141.14	/		
141.15	/		
142.0	DIN16 Input 1 Status	1 for active	1bit
142.1	DIN16 Input 2 Status	1 for active	1bit
142.2	DIN16 Input 3 Status	1 for active	1bit
142.3	DIN16 Input 4 Status	1 for active	1bit
142.4	DIN16 Input 5 Status	1 for active	1bit
142.5	DIN16 Input 6 Status	1 for active	1bit
142.6	DIN16 Input 7 Status	1 for active	1bit
142.7	DIN16 Input 8 Status	1 for active	1bit
142.8	DIN16 Input 9 Status	1 for active	1bit
142.9	DIN16 Input 10 Status	1 for active	1bit
142.10	DIN16 Input 11 Status	1 for active	1bit
142.11	DIN16 Input 12 Status	1 for active	1bit
142.12	DIN16 Input 13 Status	1 for active	1bit
142.13	DIN16 Input 14 Status	1 for active	1bit
142.14	DIN16 Input 15 Status	1 for active	1bit
142.15	DIN16 Input 16 Status	1 for active	1bit
143.0	Fuel Output Status	1 for active	1bit
143.1	Crank Output Status	1 for active	1bit
143.2	Digital Output 1 Status	1 for active	1bit
143.3	Digital Output 2 Status	1 for active	1bit
143.4	Digital Output 3 Status	1 for active	1bit
143.5	Digital Output 4 Status	1 for active	1bit
143.6	Digital Output 5 Status	1 for active	1bit
143.7	Digital Output 6 Status	1 for active	1bit
143.8	Digital Output 7 Status	1 for active	1bit
143.9	Digital Output 8 Status	1 for active	1bit
143.10	Digital Output 9 Status	1 for active	1bit
143.11	Digital Output 10 Status	1 for active	1bit
143.12	Remote Control Mode Input	1 for active	1bit
143.13	/		
143.14	/		
143.15	/		
144.0	DOUT16 Output 1 Status	1 for active	1bit
144.1	DOUT16 Output 2 Status	1 for active	1bit
144.2	DOUT16 Output 3 Status	1 for active	1bit

Modbus Address	Item	Description	Bytes
144.3	DOUT16 Output 4 Status	1 for active	1bit
144.4	DOUT16 Output 5 Status	1 for active	1bit
144.5	DOUT16 Output 6 Status	1 for active	1bit
144.6	DOUT16 Output 7 Status	1 for active	1bit
144.7	DOUT16 Output 8 Status	1 for active	1bit
144.8	DOUT16 Output 9 Status	1 for active	1bit
144.9	DOUT16 Output 10 Status	1 for active	1bit
144.10	DOUT16 Output 11 Status	1 for active	1bit
144.11	DOUT16 Output 12 Status	1 for active	1bit
144.12	DOUT16 Output 13 Status	1 for active	1bit
144.13	DOUT16 Output 14 Status	1 for active	1bit
144.14	DOUT16 Output 15 Status	1 for active	1bit
144.15	DOUT16 Output 16 Status	1 for active	1bit
145-147	/		
148.0	DIN16 Fail to Communicate	1 for active	1bit
148.1	DOUT16 Fail to Communicate	1 for active	1bit
148.2	AIN24-1 Fail to Communicate	1 for active	1bit
148.3	AIN24-2 Fail to Communicate	1 for active	1bit
148.4	AIN16-M02-1 Fail to Communicate	1 for active	1bit
148.5	AIN16-M02-2 Fail to Communicate	1 for active	1bit
148.6	BAC150CAN Fail to Communicate	1 for active	1bit
148.7	AIN8 Fail to Communicate	1 for active	1bit
148.8	/		
148.9	/		
148.10	/		
148.11	/		
148.12	/		
148.13	/		
148.14	/		
148.15	/		
149.0	Mains Normal	1 for active	1bit
149.1	Mains Close	1 for active	1bit
149.2	Gen. Normal	1 for active	1bit
149.3	Gen. Close	1 for active	1bit
149.4	Running Status Indicator	1 for active	1bit
149.5	Mute Indicator	1 for active	1bit
149.6	Fn Indicator	1 for active	1bit
149.7	/		
149.8	/		
149.9	/		
149.10	/		
149.11	/		
149.12	/		

Modbus Address	Item	Description	Bytes
149.13	/		
149.14	/		
149.15	/		
150.0	Mains Abnormal	1 for active	1bit
150.1	Mains Over Voltage	1 for active	1bit
150.2	Mains Under Voltage	1 for active	1bit
150.3	Mains Over Frequency	1 for active	1bit
150.4	Mains Under Frequency	1 for active	1bit
150.5	Mains Loss of Phase	1 for active	1bit
150.6	Mains Reverse Phase Sequence	1 for active	1bit
150.7	Mains None	1 for active	1bit
150.8	/		
150.9	/		
150.10	/		
150.11	/		
150.12	/		
150.13	/		
150.14	/		
150.15	/		
151.0	Digital Input 1 Active	1 for active	1bit
151.1	Digital Input 2 Active	1 for active	1bit
151.2	Digital Input 3 Active	1 for active	1bit
151.3	Digital Input 4 Active	1 for active	1bit
151.4	Digital Input 5 Active	1 for active	1bit
151.5	Digital Input 6 Active	1 for active	1bit
151.6	Digital Input 7 Active	1 for active	1bit
151.7	Digital Input 8 Active	1 for active	1bit
151.8	Digital Input 9 Active	1 for active	1bit
151.9	Digital Input 10 Active	1 for active	1bit
151.10	Auto Mode Inhibit	1 for active	1bit
151.11	Auto Mode Input	1 for active	1bit
151.12	Scheduled Not Run	1 for active	1bit
151.13	Alternative Config 1 Active	1 for active	1bit
151.14	Alternative Config 2 Active	1 for active	1bit
151.15	Alternative Config 3 Active	1 for active	1bit
152.0	DIN16 Input 1 Active	1 for active	1bit
152.1	DIN16 Input 2 Active	1 for active	1bit
152.2	DIN16 Input 3 Active	1 for active	1bit
152.3	DIN16 Input 4 Active	1 for active	1bit
152.4	DIN16 Input 5 Active	1 for active	1bit
152.5	DIN16 Input 6 Active	1 for active	1bit
152.6	DIN16 Input 7 Active	1 for active	1bit
152.7	DIN16 Input 8 Active	1 for active	1bit

Modbus Address	Item	Description	Bytes
152.8	DIN16 Input 9 Active	1 for active	1bit
152.9	DIN16 Input 10 Active	1 for active	1bit
152.10	DIN16 Input 11 Active	1 for active	1bit
152.11	DIN16 Input 12 Active	1 for active	1bit
152.12	DIN16 Input 13 Active	1 for active	1bit
152.13	DIN16 Input 14 Active	1 for active	1bit
152.14	DIN16 Input 15 Active	1 for active	1bit
152.15	DIN16 Input 16 Active	1 for active	1bit
153	/		

EXAMPLE:

If "Emergency Stop Input Status" and "Digital Input 10 Status" need to be read, check the table above and find their Modbus addresses are 141.0 and 141.10, so it needs to read one data address.

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

Table 3 Master (PC) Request Frame

Slave Address	Function Code	Start Address (141)		Request Data Length (1)		CRC 16	
		MSB	LSB	MSB	LSB	LSB	MSB
01	**03**	**00**	**8D**	**00**	**01**	**14**	**21**

The slave response is as following:

Table 4 Slave (Controller) Response Frame

Slave Address	Function Code	Data Length (Bytes)	Data		CRC 16	
			Data of Address 141 MSB	Data of Address 141 LSB	LSB	MSB
01	**03**	**02**	**04**	**01**	**7B**	**44**

Table 5 Data Analysis

Address	Data Received (Hex)	Convert to Binary	Meaning
141	0401H	0000 0100 0000 0001 (Mapping to 141.15, 141.14, ..., 141.1, 141.0 respectively)	Data of Bit 0 is 1, which means the status of Emergency Stop Input is active. Data of Bit 10 is 1, which means the status of Digital Input 10 is active.

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

Function code 06H can only be written to address 331-337, 305-316, 376-387 and 660-662, and other addresses cannot be written.

Table 6 Parameters of Data Field

Modbus Address	Items	Range (Decimal)	Ratio	Unit	Description	Remarks
154	/					
155	Mains UAB	(0-30000)	0.1	V	32-bit Signed	
156						
157	Mains UBC	(0-30000)	0.1	V	32-bit Signed	
158						
159	Mains UCA	(0-30000)	0.1	V	32-bit Signed	
160						
161	Mains UA	(0-30000)	0.1	V	32-bit Signed	
162						
163	Mains UB	(0-30000)	0.1	V	32-bit Signed	
164						
165	Mains UC	(0-30000)	0.1	V	32-bit Signed	
166						
167	Mains UA Phase	(0-360.0)	0.1	°	16-bit Signed	
168	Mains UB Phase	(0-360.0)	0.1	°	16-bit Signed	
169	Mains UC Phase	(0-360.0)	0.1	°	16-bit Signed	
170	Mains Frequency	(0-99.99)	0.01	Hz	16-bit Signed	
171-174	/					
175	Gen. UAB	(0-30000)	0.1	V	32-bit Signed	
176						
177	Gen. UBC	(0-30000)	0.1	V	32-bit Signed	
178						
179	Gen. UCA	(0-30000)	0.1	V	32-bit Signed	
180						
181	Gen. UA	(0-30000)	0.1	V	32-bit Signed	
182						
183	Gen. UB	(0-30000)	0.1	V	32-bit Signed	
184						
185	Gen. UC	(0-30000)	0.1	V	32-bit Signed	
186						
187	Gen. UA Phase	(0-360.0)	0.1	°	16-bit Signed	
188	Gen. UB Phase	(0-360.0)	0.1	°	16-bit Signed	
189	Gen. UC Phase	(0-360.0)	0.1	°	16-bit Signed	
190	Gen. Frequency	(0-99.99)	0.01	Hz	16-bit Signed	
191	Voltage Difference	(0-30000)	1	V	16-bit Signed	
192	Frequency Difference	(0-99.99)	0.01	Hz	16-bit Signed	
193	Phase Difference	(0-360.0)	0.1	°	16-bit Signed	
194-200	/					

Modbus Address	Items	Range (Decimal)	Ratio	Unit	Description	Remarks
201	Phase A Current	(0-6000.0)	0.1	A	16-bit Unsigned	
202	Phase B Current	(0-6000.0)	0.1	A	16-bit Unsigned	
203	Phase C Current	(0-6000.0)	0.1	A	16-bit Unsigned	
204	Earth Current	(0-6000.0)	0.1	A	16-bit Unsigned	
205-208	/					
209	Phase A Active Power	(-6000-6000)	0.1	kW	32-bit Signed	
210						
211	Phase B Active Power	(-6000-6000)	0.1	kW	32-bit Signed	
212						
213	Phase C Active Power	(-6000-6000)	0.1	kW	32-bit Signed	
214						
215	Total Active Power	(-6000-6000)	0.1	kW	32-bit Signed	
216						
217	Phase A Reactive Power	(-6000-6000)	0.1	kvar	32-bit Signed	
218						
219	Phase B Reactive Power	(-6000-6000)	0.1	kvar	32-bit Signed	
220			0.1			
221	Phase C Reactive Power	(-6000-6000)	0.1	kvar	32-bit Signed	
222			0.1			
223	Total Reactive Power	(-6000-6000)	0.1	kVA	32-bit Signed	
224						
225	Phase A Apparent Power	(-6000-6000)	0.1	kVA	32-bit Signed	
226						
227	Phase B Apparent Power	(-6000-6000)	0.1	kVA	32-bit Signed	
228						
229	Phase C Apparent Power	(-6000-6000)	0.1	kVA	32-bit Signed	
230						
231	Total Apparent Power	(-6000-6000)	0.1	kVA	32-bit Signed	
232						
233	Phase A Power Factor	(-1.000-1.000)	0.001		16-bit Signed	
234	Phase B Power Factor	(-1.000-1.000)	0.001		16-bit Signed	
235	Phase C Power Factor	(-1.000-1.000)	0.001		16-bit Signed	
236	Average Power Factor	(-1.000-1.000)	0.001		16-bit Signed	
237	Negative Pole Phase Angle			°	16-bit Unsigned	
238	Zero Order Phase Angle			°	16-bit Unsigned	
239	Unbalanced Current	(0-6000.0)	0.1	A	16-bit Unsigned	
240-245	/					
246	DC Voltage	(0.0-75.0)	0.1	V	16-bit Signed	
247	Engine Speed	(0-6000)	1	r/min	16-bit Signed	
248	Battery Voltage	(0-60)	0.1	V	16-bit Signed	
249	Charger D+ Voltage	(0-60)	0.1	V	16-bit Signed	
250	GSM Signal Strength				16-bit Signed	
251	USB Flash Drive Status				16-bit Unsigned	

Modbus Address	Items	Range (Decimal)	Ratio	Unit	Description	Remarks
252	USB Flash Drive Remaining Capacity		0.1	GB	16-bit Unsigned	
253	USB Flash Drive Total Capacity		0.1	GB	16-bit Unsigned	
254	/					
255	Temperature Sensor Value	(-50-300)	1	°C	16-bit Signed	
256	/					
257	Pressure Sensor Value	(0-1000)	1	kPa	16-bit Signed	
258	/					
259	Level Sensor Value	(0-100)	1	%	16-bit Signed	
260	/					
261	Flexible Sensor 1 Value	(0-1000)	1		16-bit Signed	
262	/					
263	Flexible Sensor 2 Value	(0-1000)	1		16-bit Signed	
264	/					
265	Flexible Sensor 3 Value	(0-1000)	1		16-bit Signed	
266	Barometric Pressure	(0-1000)	1	kPa		
267	Load Percentage	(0-100)	1	%		
268	Coolant Level	(0-100)	1	%		
269	Engine Oil Temperature	(-40-300)	1	°C		
270	Coolant Pressure	(0-1000)	1	kPa		
271	Fuel Pressure	(0-1000)	1	kPa		
272	Fuel Temperature	(-40-300)	1	°C	Signed. It is reserved if the engine is non-ECU type.	
273	Intake Temperature	(-40-300)	1	°C		
274	Exhaust Temperature	(-40-300)	1	°C		
275	Turbo Pressure	(0-1000)	1	kPa		
276	Fuel Consumption	(0-1000)	0.1	L/h		
277	Total Fuel Consumption	(0-99999999)	1	L		
278						
279	Throttle Valve 1 Position	(0-100)	1	%		
280-284	/					
285	Air Inlet Temperature	(-40-300)	1	°C	16-bit Signed	
286-294	/					
295	Genset Status	(0-15)	1		GENSET **STATUS**	
296	Gen. Delay	(0-6000)	1	s	16-bit Unsigned	
297	Remote Start Status	(0-2)	1		REMOTE START **STATUS**	
298	Remote Start Delay	(0-6000)	1	s	16-bit Unsigned	
299	ATS Status	(0-10)	1		ATS STATUS	
300	ATS Delay	(0-6000)	1	s	16-bit Unsigned	

Modbus Address	Items	Range (Decimal)	Ratio	Unit	Description	Remarks
301	Mains Status	(0-3)	1		MAINS **STATUS**	
302	Mains Status Delay	(0-6000)	1	s	16-bit Unsigned	
303	/					
304	/					
305	Total Running Hours	(0-65535)	1	h	16-bit Unsigned	
306	Total Running Minutes	(0-65535)	1	min	16-bit Unsigned	
307	Total Running Seconds	(0-65535)	1	s	16-bit Unsigned	
308	Total Start Times	(0-65535)	1		16-bit Unsigned	
309	Total Energy kWh	(0-2147483647)	0.1	kWh	32-bit Signed	
310						
311	Total Energy kvarh	(0-2147483647)	0.1	kvarh	32-bit Signed	
312						
313	Total Energy kVAh	(0-2147483647)	0.1	kVAh	32-bit Signed	
314						
315-321	/					
322	ATS Status Select	(0-1)	1		16-bit Unsigned	
323	Controller Model	(0-65535)	1		16-bit Unsigned	
324	Controller Software Version	(0-65535)	0.1		16-bit Unsigned	
325	Controller Hardware Version	(0-65535)	0.1		16-bit Unsigned	
326	Controller Release Year	(0-99)	1		Save the last two digits of the Year only.	
327	Controller Release Month	(1-12)	1		16-bit Unsigned	
328	Controller Release Day	(1-31)	1		16-bit Unsigned	
329	Gas Rail Pressure	(0-1000)	1	kPa		
330	/					
331	Controller Date: Year	(0-99)			Save the last two digits of the Year only.	
332	Controller Date: Month	(1-12)	1		16-bit Unsigned	
333	Controller Date: Day	(1-31)	1		16-bit Unsigned	
334	Controller Date: Week	(0-6)	1		16-bit Unsigned	
335	Controller Time: Hour	(0-23)	1		16-bit Unsigned	
336	Controller Time: Minute	(0-59)	1		16-bit Unsigned	
337	Controller Time: Second	(0-59)	1		16-bit Unsigned	
338-343	/					
344	AIN24-1 Sensor 15 Value	(0-1000)	1		16-bit Signed	
345	AIN24-1 Sensor 16 Value	(0-1000)	1		16-bit Signed	
346	AIN24-1 Sensor 17 Value	(0-1000)	1		16-bit Signed	
347	AIN24-1 Sensor 18 Value	(0-1000)	1		16-bit Signed	
348	AIN24-1 Sensor 19 Value	(0-1000)	1		16-bit Signed	

Modbus Address	Items	Range (Decimal)	Ratio	Unit	Description	Remarks
349	AIN24-1 Sensor 20 Value	(0-1000)	1		16-bit Signed	
350	AIN24-1 Sensor 21 Value	(0-1000)	1		16-bit Signed	
351	AIN24-1 Sensor 22 Value	(0-1000)	1		16-bit Signed	
352	AIN24-1 Sensor 23 Value	(0-1000)	1		16-bit Signed	
353	AIN24-1 Sensor 24 Value	(0-1000)	1		16-bit Signed	
354	AIN24-2 Sensor 15 Value	(0-1000)	1		16-bit Signed	
355	AIN24-2 Sensor 16 Value	(0-1000)	1		16-bit Signed	
356	AIN24-2 Sensor 17 Value	(0-1000)	1		16-bit Signed	
357	AIN24-2 Sensor 18 Value	(0-1000)	1		16-bit Signed	
358	AIN24-2 Sensor 19 Value	(0-1000)	1		16-bit Signed	
359	AIN24-2 Sensor 20 Value	(0-1000)	1		16-bit Signed	
360	AIN24-2 Sensor 21 Value	(0-1000)	1		16-bit Signed	
361	AIN24-2 Sensor 22 Value	(0-1000)	1		16-bit Signed	
362	AIN24-2 Sensor 23 Value	(0-1000)	1		16-bit Signed	
363	AIN24-2 Sensor 24 Value	(0-1000)	1		16-bit Signed	
364	/					
365	/					
366	/					
367	Maintenance 1 Countdown Hour	(0-65535)	1	h	16-bit Unsigned	
368	Maintenance 1 Countdown Minute	(0-65535)	1	min	16-bit Unsigned	
369	Maintenance 1 Countdown Second	(0-65535)	1	s	16-bit Unsigned	
370	Maintenance 2 Countdown Hour	(0-65535)	1	h	16-bit Unsigned	
371	Maintenance 2 Countdown Minute	(0-65535)	1	min	16-bit Unsigned	
372	Maintenance 2 Countdown Second	(0-65535)	1	s	16-bit Unsigned	
373	Maintenance 3 Countdown Hour	(0-65535)	1	h	16-bit Unsigned	
374	Maintenance 3 Countdown Minute	(0-65535)	1	min	16-bit Unsigned	
375	Maintenance 3 Countdown Second	(0-65535)	1	s	16-bit Unsigned	
376	User Total Running Hours A	(0-65535)	1	h	16-bit Unsigned	
377	User Total Running Minutes A	(0-65535)	1	min	16-bit Unsigned	
378	User Total Running Seconds A	(0-65535)	1	s	16-bit Unsigned	
379	User Total Start Times A	(0-65535)	1		16-bit Unsigned	
380	User Total Energy A	(0-	0.1	kWh	32-bit Signed	

Modbus Address	Items	Range (Decimal)	Ratio	Unit	Description	Remarks
381		2147483647)				
382	User Total Running Hours B	(0-65535)	1	h	16-bit Unsigned	
383	User Total Running Minutes B	(0-65535)	1	min	16-bit Unsigned	
384	User Total Running Seconds B	(0-65535)	1	s	16-bit Unsigned	
385	User Total Start Times B	(0-65535)	1		16-bit Unsigned	
386	User Total Energy B	(0-2147483647)	0.1	kWh	32-bit Signed	
387						
388	/					
389	/					
390	/					
391	AIN24-1 Sensor 1 Value	(0-1000)	1	°C	16-bit Signed	
392	AIN24-1 Sensor 2 Value	(0-1000)	1	°C	16-bit Signed	
393	AIN24-1 Sensor 3 Value	(0-1000)	1	°C	16-bit Signed	
394	AIN24-1 Sensor 4 Value	(0-1000)	1	°C	16-bit Signed	
395	AIN24-1 Sensor 5 Value	(0-1000)	1	°C	16-bit Signed	
396	AIN24-1 Sensor 6 Value	(0-1000)	1	°C	16-bit Signed	
397	AIN24-1 Sensor 7 Value	(0-1000)	1	°C	16-bit Signed	
398	AIN24-1 Sensor 8 Value	(0-1000)	1	°C	16-bit Signed	
399	AIN24-1 Sensor 9 Value	(0-1000)	1	°C	16-bit Signed	
400	AIN24-1 Sensor 10 Value	(0-1000)	1	°C	16-bit Signed	
401	AIN24-1 Sensor 11 Value	(0-1000)	1	°C	16-bit Signed	
402	AIN24-1 Sensor 12 Value	(0-1000)	1	°C	16-bit Signed	
403	AIN24-1 Sensor 13 Value	(0-1000)	1	°C	16-bit Signed	
404	AIN24-1 Sensor 14 Value	(0-1000)	1	°C	16-bit Signed	
405	AIN24-2 Sensor 1 Value	(0-1000)	1	°C	16-bit Signed	
406	AIN24-2 Sensor 2 Value	(0-1000)	1	°C	16-bit Signed	
407	AIN24-2 Sensor 3 Value	(0-1000)	1	°C	16-bit Signed	
408	AIN24-2 Sensor 4 Value	(0-1000)	1	°C	16-bit Signed	
409	AIN24-2 Sensor 5 Value	(0-1000)	1	°C	16-bit Signed	
410	AIN24-2 Sensor 6 Value	(0-1000)	1	°C	16-bit Signed	
411	AIN24-2 Sensor 7 Value	(0-1000)	1	°C	16-bit Signed	
412	AIN24-2 Sensor 8 Value	(0-1000)	1	°C	16-bit Signed	
413	AIN24-2 Sensor 9 Value	(0-1000)	1	°C	16-bit Signed	
414	AIN24-2 Sensor 10 Value	(0-1000)	1	°C	16-bit Signed	
415	AIN24-2 Sensor 11 Value	(0-1000)	1	°C	16-bit Signed	
416	AIN24-2 Sensor 12 Value	(0-1000)	1	°C	16-bit Signed	
417	AIN24-2 Sensor 13 Value	(0-1000)	1	°C	16-bit Signed	
418	AIN24-2 Sensor 14 Value	(0-1000)	1	°C	16-bit Signed	
419-439	/					
440	Throttle Valve 2 Position	(0-100)	1	%	16-bit Signed	
441	/					

Modbus Address	Items		Range (Decimal)	Ratio	Unit	Description	Remarks
442	Current Running Hours		(0-65535)	1	h	16-bit Unsigned	
443	Current Running Minutes		(0-65535)	1	min	16-bit Unsigned	
444	Current Running Seconds		(0-65535)	1	s	16-bit Unsigned	
445	Current Running Total Energy		(0-2147483647)	0.1	kWh	32-bit Signed	
446							
447	THD1		(0-200)	0.1	%	16-bit Signed	
448	THD2		(0-200)	0.1	%	16-bit Signed	
449	THD3		(0-200)	0.1	%	16-bit Signed	
450	Gen. Voltage Imbalance		(0-200)	0.1	%	16-bit Signed	
451	DM1 Alarm Type					16-bit Unsigned	
452	DM1 Alarm Quantity					16-bit Unsigned	
453	DM1 Alarm 1	SPN	(0-524287)	1		32-bit Unsigned	
454							
455		FMI OC	(0-65535)	1		FMI OC	
456	DM1 Alarm 2	SPN	(0-524287)	1		32-bit Unsigned	
457							
458		FMI OC	(0-65535)	1		FMI OC	
459	DM1 Alarm 3	SPN	(0-524287)	1		32-bit Unsigned	
460							
461		FMI OC	(0-65535)	1		FMI OC	
462	DM1 Alarm 4	SPN	(0-524287)	1		32-bit Unsigned	
463							
464		FMI OC	(0-65535)	1		FMI OC	
465	DM1 Alarm 5	SPN	(0-524287)	1		32-bit Unsigned	
466							
467		FMI OC	(0-65535)	1		FMI OC	
468	DM1 Alarm 6	SPN	(0-524287)	1		32-bit Unsigned	
469							
470		FMI OC	(0-65535)	1		FMI OC	
471	DM1 Alarm 7	SPN	(0-524287)	1		32-bit Unsigned	
472							
473		FMI OC	(0-65535)	1		FMI OC	
474	DM1 Alarm 8	SPN	(0-524287)	1		32-bit Unsigned	
475							
476		FMI OC	(0-65535)	1		FMI OC	

Modbus Address	Items		Range (Decimal)	Ratio	Unit	Description	Remarks
477	DM1 Alarm 9	SPN	(0-524287)	1		32-bit Unsigned	
478							
479		FMI OC	(0-65535)	1		FMI OC	
480	DM1 Alarm 10	SPN	(0-524287)	1		32-bit Unsigned	
481							
482		FMI OC	(0-65535)	1		FMI OC	
483-519	/						
520	LCD Temperature		(-40-80)	0.1	°C	16-bit Signed	
521	MCU Temperature		(-40-80)	0.1	°C	16-bit Signed	
522	MCUID_H1					32-bit Unsigned	
523							
524	MCUID_H2					32-bit Unsigned	
525							
526	MCUID_L					32-bit Unsigned	
527							
528	Longitude		(-180-180)	0.000 001	°	32-bit Signed	
529							
530	Latitude		(-90-90)	0.000 001	°	32-bit Signed	
531							
532	Altitude		(-999.9-999.9)	0.1	m	32-bit Signed	
533							
534	GPS Satellite Quantity		(0-100)	1		16-bit Unsigned	
535-554	/						
555	AIN16-M02-1 Sensor 1		(0-1000)	1	°C	16-bit Signed	
556	AIN16-M02-1 Sensor 2		(0-1000)	1	°C	16-bit Signed	
557	AIN16-M02-1 Sensor 3		(0-1000)	1	°C	16-bit Signed	
558	AIN16-M02-1 Sensor 4		(0-1000)	1	°C	16-bit Signed	
559	AIN16-M02-1 Sensor 5		(0-1000)	1	°C	16-bit Signed	
560	AIN16-M02-1 Sensor 6		(0-1000)	1	°C	16-bit Signed	
561	AIN16-M02-1 Sensor 7		(0-1000)	1	°C	16-bit Signed	
562	AIN16-M02-1 Sensor 8		(0-1000)	1	°C	16-bit Signed	
563	AIN16-M02-1 Sensor 9		(0-1000)	1		16-bit Signed	
564	AIN16-M02-1 Sensor 10		(0-1000)	1		16-bit Signed	
565	AIN16-M02-1K Sensor 1		(0-1000)	1	°C	16-bit Signed	
566	AIN16-M02-1K Sensor 2		(0-1000)	1	°C	16-bit Signed	
567	AIN16-M02-2 Sensor 1		(0-1000)	1	°C	16-bit Signed	
568	AIN16-M02-2 Sensor 2		(0-1000)	1	°C	16-bit Signed	
569	AIN16-M02-2 Sensor 3		(0-1000)	1	°C	16-bit Signed	
570	AIN16-M02-2 Sensor 4		(0-1000)	1	°C	16-bit Signed	
571	AIN16-M02-2 Sensor 5		(0-1000)	1	°C	16-bit Signed	
572	AIN16-M02-2 Sensor 6		(0-1000)	1	°C	16-bit Signed	

Modbus Address	Items	Range (Decimal)	Ratio	Unit	Description	Remarks
573	AIN16-M02-2 Sensor 7	(0-1000)	1	°C	16-bit Signed	
574	AIN16-M02-2 Sensor 8	(0-1000)	1	°C	16-bit Signed	
575	AIN16-M02-2 Sensor 9	(0-1000)	1		16-bit Signed	
576	AIN16-M02-2 Sensor 10	(0-1000)	1		16-bit Signed	
577	AIN16-M02-2K Sensor 1	(0-1000)	1	°C	16-bit Signed	
578	AIN16-M02-2K Sensor 2	(0-1000)	1	°C	16-bit Signed	
579	AIN16-M02-1 4-20mA Output 1	(4.00-20.00)	0.2	mA	16-bit Unsigned	
580	AIN16-M02-1 4-20mA Output 2	(4.00-20.00)	0.2	mA	16-bit Unsigned	
581	AIN16-M02-1 4-20mA Output 3	(4.00-20.00)	0.2	mA	16-bit Unsigned	
582	AIN16-M02-2 4-20mA Output 1	(4.00-20.00)	0.2	mA	16-bit Unsigned	
583	AIN16-M02-2 4-20mA Output 2	(4.00-20.00)	0.2	mA	16-bit Unsigned	
584	AIN16-M02-2 4-20mA Output 3	(4.00-20.00)	0.2	mA	16-bit Unsigned	
585	BAC150CAN Status	(0-65535)	1		BAC150CAN CHARGING STATUS	
586	/					
587	BAC150CAN Absorption Charge Remaining Time	(0-65535)	1	s	16-bit Unsigned	
588	BAC150CAN Charging Voltage	(0-48.00)	2	V	16-bit Unsigned	
589	BAC150CAN Charging Current	(0-30.00)	2	A	16-bit Unsigned	
590	BAC150CAN Battery Temperature	(0-1000)	1	k	16-bit Unsigned	
591	Average Load	(-6000-6000)	0.1	kW	32-bit Signed	
592						
593	Historical Average Load	(-6000-6000)	0.1	kW	32-bit Signed	
594						
595	Historical Max. Load	(-6000-6000)	0.1	kW	32-bit Signed	
596						
597	Fuel Consumption	(0-1000)	0.1	L/h	16-bit Unsigned	
598	Remaining Fuel	(0-10000)	1	L	16-bit Unsigned	
599	Running Time by Remaining Fuel	(0-10000)	0.1	h	16-bit Unsigned	
600	AIN8 Sensor 1	(0-1000)	1	°C	16-bit Signed	
601	AIN8 Sensor 2	(0-1000)	1	°C	16-bit Signed	
602	AIN8 Sensor 3	(0-1000)	1	°C	16-bit Signed	

Modbus Address	Items	Range (Decimal)	Ratio	Unit	Description	Remarks
603	AIN8 Sensor 4	(0-1000)	1	°C	16-bit Signed	
604	AIN8 Sensor 5	(0-1000)	1	°C	16-bit Signed	
605	AIN8 Sensor 6	(0-1000)	1	°C	16-bit Signed	
606	AIN8 Sensor 7	(0-1000)	1	°C	16-bit Signed	
607	AIN8 Sensor 8	(0-1000)	1	°C	16-bit Signed	
608-615	/					
616	SIM Card IMEI				64-bit Unsigned	
617						
618						
619						
620	DPF Regeneration Reminder Indicator				16-bit Signed. It is reserved if the engine is non-ECU type.	
621	DPF Regeneration Status Indicator					
622	DPF Status Indicator					
623	DPF Regeneration Inhibit Status					
624	High Exhaust Temperature Alarm Indicator					
625	AdBlue Level	(0-1000)	0.1	%		
626	AdBlue Temperature	(-40-300)	1	°C		
627	Low Level Indication					
628	/					
629	/					
630	/					
631	/					
632	Aftertreatment Fault				It is reserved if the engine is non-ECU type.	
633	DPF Regeneration Inhibit Switch					
634	SCR Inlet Temperature	(-40-300)	1	°C		
635	Driver Alarm Indicator					
636	Fuel Valve 1 Position	(0-100)	1	%		
637	Fuel Valve 2 Position	(0-100)	1	%		
638	Gas Pressure	(0-1000)	1	kPa		
639	Exhaust Temperature 1	(-40-300)	1	°C		
640	Exhaust Temperature 2	(-40-300)	1	°C		
641	Exhaust Temperature 3	(-40-300)	1	°C		
642	Exhaust Temperature 4	(-40-300)	1	°C		
643	Exhaust Temperature 5	(-40-300)	1	°C		
644	Exhaust Temperature 6	(-40-300)	1	°C		
645	Exhaust Temperature 7	(-40-300)	1	°C		
646	Exhaust Temperature 8	(-40-300)	1	°C		
647	Exhaust Temperature 9	(-40-300)	1	°C		

Modbus Address	Items	Range (Decimal)	Ratio	Unit	Description	Remarks
648	Exhaust Temperature 10	(-40-300)	1	°C		
649	Exhaust Temperature 11	(-40-300)	1	°C		
650	Exhaust Temperature 12	(-40-300)	1	°C		
651	Exhaust Temperature 13	(-40-300)	1	°C		
652	Exhaust Temperature 14	(-40-300)	1	°C		
653	Exhaust Temperature 15	(-40-300)	1	°C		
654	Exhaust Temperature 16	(-40-300)	1	°C		
655	Ambient Pressure	(0-1000)	1	kPa		
656	Gas Temperature	(-40-300)	1	°C		
657	Crankcase Pressure	(0-1000)	1	kPa		
658	Intercooler Temperature	(-40-300)	1	°C		
659	Hardware Fault Interrupt Record Code					
660	User Self-Defined 1				16-bit Unsigned User can read and write	
661	User Self-Defined 2					
662	User Self-Defined 3					
663-669	/					

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 the data has 4 bytes, the actual value = high-order bits of data received * 65536 + low-order bits of data received.

NOTE 3: If the 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 "LCD Temperature" and "MCU Temperature" needs to be read, check the table above and find its coil address is 520 and 521, so it needs to read two bytes of data.

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

Table 7 Master Request Command

Slave Address	Function Code	Start Address (520)		Request Data Length (2)		CRC 16	
		MSB	LSB	MSB	LSB	LSB	MSB
01	**03**	**02**	**08**	**00**	**02**	**44**	**71**

The slave response command is as following:

Table 8 Slave Response Command

Slave Address	Function Code	Data Length (Bytes)	Data				CRC 16	
			Data of Address	Data of Address	Data of Address	Data of Address	LSB	MSB

			520 MSB	520 LSB	521 MSB	521 LSB		
01	**03**	**04**	**00**	**F1**	**01**	**46**	**2B**	**A2**

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

Table 9 Data Analysis

Address	Data Received (Hex)	Convert to Decimal	LCD Temperature (ratio = 0.1)	MCU Temperature (ratio = 0.1)
520	00F1H	241	24.1	
521	0146H	326		32.6

3.3 FUNCTION CODE 05H MAPPING REMOTE COIL FIELD

Table 10 Remote Coil Field

Address	Item	Description
0	Remote Start Key	Active only when sending FF00H
1	Remote Stop Key	Active only when sending FF00H
2	Remote Test Key	Active only when sending FF00H
3	Remote Auto Key	Active only when sending FF00H
4	Remote Manual Key	Active only when sending FF00H
5	Remote Mains Close/Open Key	Active only when sending FF00H
6	Remote Gen. Close/Open Key	Active only when sending FF00H
7	Remote Up Key	Active only when sending FF00H
8	Remote Down Key	Active only when sending FF00H
9	/	
10	/	
11	Remote Confirm Key	Active only when sending FF00H
12	Remote Mute Key	Active only when sending FF00H
13	/	
14	/	
15	Remote Engine Quick Stop	Active only when sending FF00H
16	Remote Reset	Active only when sending FF00H
17	Fn Key	Active only when sending FF00H
18	/	
19	/	
20	Remote Output 1	Sending FF00H for active Sending 0000H for inactive
21	Remote Output 2	Sending FF00H for active Sending 0000H for inactive
22	Remote Output 3	Sending FF00H for active Sending 0000H for inactive
23	Remote Output 4	Sending FF00H for active Sending 0000H for inactive
24	Remote Output 5	Sending FF00H for active Sending 0000H for inactive
25	Remote Output 6	Sending FF00H for active Sending 0000H for inactive
26	Remote Output 7	Sending FF00H for active Sending 0000H for inactive
27	Remote Output 8	Sending FF00H for active Sending 0000H for inactive
28	Remote Output 9	Sending FF00H for active Sending 0000H for inactive
29	Remote Output 10	Sending FF00H for active Sending 0000H for inactive

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

EXAMPLE:

If taking Remote Up Key as example, check the table first and find its remote address is 7.

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

Table 11 Master Request Command

Slave Address	Function Code	Remote Address (7)		Remote Data		CRC 16	
		MSB	LSB	MSB	LSB	LSB	MSB
01	**05**	**00**	**07**	**FF**	**00**	**3D**	**FB**

The slave response command is as following:

Table 12 Slave Response Command

Slave Address	Function Code	Remote Address (7)		Remote Data		CRC 16	
		MSB	LSB	MSB	LSB	LSB	MSB
01	**05**	**00**	**07**	**FF**	**00**	**3D**	**FB**

3.4 ALARMS DATA TABLE

Table 13 Alarms Data Table

Offset Address	Items	Description	Bytes
0000	Emergency Stop Alarm	1 for active	1bit
	Overspeed Alarm	1 for active	1bit
	Underspeed Alarm	1 for active	1bit
	Loss of Speed Signal	1 for active	1bit
	Gen. Over Frequency	1 for active	1bit
	Gen. Under Frequency	1 for active	1bit
	Gen. Over Voltage	1 for active	1bit
	Gen. Under Voltage	1 for active	1bit
	Fail to Start Alarm	1 for active	1bit
	Gen. Overcurrent	1 for active	1bit
	Current Imbalance	1 for active	1bit
	Earth Fault	1 for active	1bit
	Reverse Power Alarm	1 for active	1bit
	Over Power Alarm	1 for active	1bit
	Loss of Excitation Fault	1 for active	1bit
	ECU Fail to Communicate	1 for active	1bit
0001	ECU Alarm	1 for active	1bit
	High Temperature Input Alarm	1 for active	1bit
	Low Oil Pressure Input Alarm	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Temperature Sensor Open	1 for active	1bit
	High Engine Temperature	1 for active	1bit
	Low Engine Temperature	1 for active	1bit
	Temperature Sensor Error	1 for active	1bit
	Oil Pressure Sensor Open	1 for active	1bit
	High Oil Pressure	1 for active	1bit
	Low Oil Pressure	1 for active	1bit
	Oil Pressure Sensor Error	1 for active	1bit
	Fuel Level Sensor Open	1 for active	1bit
0002	High Fuel Level	1 for active	1bit
	Low Fuel Level	1 for active	1bit
	Fuel Level Sensor Error	1 for active	1bit
	Flexible Sensor 1 Open	1 for active	1bit
	Flexible Sensor 1 High	1 for active	1bit
	Flexible Sensor 1 Low	1 for active	1bit
	Flexible Sensor 1 Error	1 for active	1bit
	Flexible Sensor 2 Open	1 for active	1bit

Offset Address	Items	Description	Bytes
	Flexible Sensor 2 High	1 for active	1bit
	Flexible Sensor 2 Low	1 for active	1bit
	Flexible Sensor 2 Error	1 for active	1bit
	Fail to Stop	1 for active	1bit
	Fail to Charge	1 for active	1bit
	Battery Over Voltage	1 for active	1bit
	Battery Under Voltage	1 for active	1bit
	Fail to Sync.	1 for active	1bit
0003	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Voltage Out of Sync.	1 for active	1bit
	Frequency Out of Sync.	1 for active	1bit
	Phase Out of Sync.	1 for active	1bit
	Mains ATS Alarm	1 for active	1bit
	Gen. ATS Alarm	1 for active	1bit
	Mains Fail to Close	1 for active	1bit
	Gen. Fail to Close	1 for active	1bit
	Mains Fail to Open	1 for active	1bit
	Gen. Fail to Open	1 for active	1bit
	Mains Over Frequency	1 for active	1bit
	Mains Under Frequency	1 for active	1bit
	Mains Over Voltage	1 for active	1bit
	Mains Under Voltage	1 for active	1bit
0004	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Maintenance 1 Time Due	1 for active	1bit
	Maintenance 2 Time Due	1 for active	1bit
	Maintenance 3 Time Due	1 for active	1bit
	Low Water Level Alarm	1 for active	1bit
	Detonation Alarm	1 for active	1bit
	Gas Leakage Alarm	1 for active	1bit
	Gen. Reverse Phase Sequence	1 for active	1bit
	Gen. Loss of Phase	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	ATS Fail to Transfer	1 for active	1bit
0005	Digital Input 1	1 for active	1bit
	Digital Input 2	1 for active	1bit
	Digital Input 3	1 for active	1bit
	Digital Input 4	1 for active	1bit

Offset Address	Items	Description	Bytes
	Digital Input 5	1 for active	1bit
	Digital Input 6	1 for active	1bit
	Digital Input 7	1 for active	1bit
	Digital Input 8	1 for active	1bit
	Digital Input 9	1 for active	1bit
	Digital Input 10	1 for active	1bit
	Digital Input 11	1 for active	1bit
	Digital Input 12	1 for active	1bit
	PLC Function 1	1 for active	1bit
	PLC Function 2	1 for active	1bit
	PLC Function 3	1 for active	1bit
	PLC Function 4	1 for active	1bit
0006	PLC Function 5	1 for active	1bit
	PLC Function 6	1 for active	1bit
	PLC Function 7	1 for active	1bit
	PLC Function 8	1 for active	1bit
	PLC Function 9	1 for active	1bit
	PLC Function 10	1 for active	1bit
	PLC Function 11	1 for active	1bit
	PLC Function 12	1 for active	1bit
	PLC Function 13	1 for active	1bit
	PLC Function 14	1 for active	1bit
	PLC Function 15	1 for active	1bit
	PLC Function 16	1 for active	1bit
	PLC Function 17	1 for active	1bit
	PLC Function 18	1 for active	1bit
	PLC Function 19	1 for active	1bit
	PLC Function 20	1 for active	1bit
0007	DIN16 Fail to Communicate	1 for active	1bit
	DIN16 Input 1	1 for active	1bit
	DIN16 Input 2	1 for active	1bit
	DIN16 Input 3	1 for active	1bit
	DIN16 Input 4	1 for active	1bit
	DIN16 Input 5	1 for active	1bit
	DIN16 Input 6	1 for active	1bit
	DIN16 Input 7	1 for active	1bit
	DIN16 Input 8	1 for active	1bit
	DIN16 Input 9	1 for active	1bit
	DIN16 Input 10	1 for active	1bit
	DIN16 Input 11	1 for active	1bit
	DIN16 Input 12	1 for active	1bit
	DIN16 Input 13	1 for active	1bit
	DIN16 Input 14	1 for active	1bit
	DIN16 Input 15	1 for active	1bit

Offset Address	Items	Description	Bytes
0008	DIN16 Input 16	1 for active	1bit
	DOUT16 Fail to Communicate	1 for active	1bit
	AIN24 1 Fail to Communicate	1 for active	1bit
	AIN24 1 Cylinder Temperature High	1 for active	1bit
	AIN24 1 Exhaust Temperature High	1 for active	1bit
	AIN24 1 Large Cylinder Temperature Difference	1 for active	1bit
	AIN24 1 Sensor 15 Open	1 for active	1bit
	AIN24 1 Sensor 15 High	1 for active	1bit
	AIN24 1 Sensor 15 Low	1 for active	1bit
	AIN24 1 Sensor 16 Open	1 for active	1bit
	AIN24 1 Sensor 16 High	1 for active	1bit
	AIN24 1 Sensor 16 Low	1 for active	1bit
	AIN24 1 Sensor 17 Open	1 for active	1bit
	AIN24 1 Sensor 17 High	1 for active	1bit
	AIN24 1 Sensor 17 Low	1 for active	1bit
	AIN24 1 Sensor 18 Open	1 for active	1bit
0009	AIN24 1 Sensor 18 High	1 for active	1bit
	AIN24 1 Sensor 18 Low	1 for active	1bit
	AIN24 1 Sensor 19 Open	1 for active	1bit
	AIN24 1 Sensor 19 High	1 for active	1bit
	AIN24 1 Sensor 19 Low	1 for active	1bit
	AIN24 1 Sensor 20 Open	1 for active	1bit
	AIN24 1 Sensor 20 High	1 for active	1bit
	AIN24 1 Sensor 20 Low	1 for active	1bit
	AIN24 1 Sensor 21 Open	1 for active	1bit
	AIN24 1 Sensor 21 High	1 for active	1bit
	AIN24 1 Sensor 21 Low	1 for active	1bit
	AIN24 1 Sensor 22 Open	1 for active	1bit
	AIN24 1 Sensor 22 High	1 for active	1bit
	AIN24 1 Sensor 22 Low	1 for active	1bit
	AIN24 1 Sensor 23 Open	1 for active	1bit
	AIN24 1 Sensor 23 High	1 for active	1bit
0010	AIN24 1 Sensor 23 Low	1 for active	1bit
	AIN24 1 Sensor 24 Open	1 for active	1bit
	AIN24 1 Sensor 24 High	1 for active	1bit
	AIN24 1 Sensor 24 Low	1 for active	1bit
	AIN24 2 Fail to Communicate	1 for active	1bit
	AIN24 2 Cylinder Temperature High	1 for active	1bit
	AIN24 2 Exhaust Temperature High	1 for active	1bit
	AIN24 2 Large Cylinder Temperature Difference	1 for active	1bit
	AIN24 2 Sensor 15 Open	1 for active	1bit
	AIN24 2 Sensor 15 High	1 for active	1bit
	AIN24 2 Sensor 15 Low	1 for active	1bit
	AIN24 2 Sensor 16 Open	1 for active	1bit

Offset Address	Items	Description	Bytes
	AIN24 2 Sensor 16 High	1 for active	1bit
	AIN24 2 Sensor 16 Low	1 for active	1bit
	AIN24 2 Sensor 17 Open	1 for active	1bit
	AIN24 2 Sensor 17 High	1 for active	1bit
0011	AIN24 2 Sensor 17 Low	1 for active	1bit
	AIN24 2 Sensor 18 Open	1 for active	1bit
	AIN24 2 Sensor 18 High	1 for active	1bit
	AIN24 2 Sensor 18 Low	1 for active	1bit
	AIN24 2 Sensor 19 Open	1 for active	1bit
	AIN24 2 Sensor 19 High	1 for active	1bit
	AIN24 2 Sensor 19 Low	1 for active	1bit
	AIN24 2 Sensor 20 Open	1 for active	1bit
	AIN24 2 Sensor 20 High	1 for active	1bit
	AIN24 2 Sensor 20 Low	1 for active	1bit
	AIN24 2 Sensor 21 Open	1 for active	1bit
	AIN24 2 Sensor 21 High	1 for active	1bit
	AIN24 2 Sensor 21 Low	1 for active	1bit
	AIN24 2 Sensor 22 Open	1 for active	1bit
	AIN24 2 Sensor 22 High	1 for active	1bit
	AIN24 2 Sensor 22 Low	1 for active	1bit
0012	AIN24 2 Sensor 23 Open	1 for active	1bit
	AIN24 2 Sensor 23 High	1 for active	1bit
	AIN24 2 Sensor 23 Low	1 for active	1bit
	AIN24 2 Sensor 24 Open	1 for active	1bit
	AIN24 2 Sensor 24 High	1 for active	1bit
	AIN24 2 Sensor 24 Low	1 for active	1bit
	Low Power Factor	1 for active	1bit
	THD High	1 for active	1bit
	Gen. Voltage Imbalance	1 for active	1bit
	AIN8 Fail to Communicate	1 for active	1bit
	AIN8 Sensor 1 Open	1 for active	1bit
	AIN8 Sensor 1 High	1 for active	1bit
	AIN8 Sensor 1 Low	1 for active	1bit
	AIN8 Sensor 2 Open	1 for active	1bit
	AIN8 Sensor 2 High	1 for active	1bit
	AIN8 Sensor 2 Low	1 for active	1bit
0013	AIN8 Sensor 3 Open	1 for active	1bit
	AIN8 Sensor 3 High	1 for active	1bit
	AIN8 Sensor 3 Low	1 for active	1bit
	AIN8 Sensor 4 Open	1 for active	1bit
	AIN8 Sensor 4 High	1 for active	1bit
	AIN8 Sensor 4 Low	1 for active	1bit
	AIN8 Sensor 5 Open	1 for active	1bit
	AIN8 Sensor 5 High	1 for active	1bit

Offset Address	Items	Description	Bytes
	AIN8 Sensor 5 Low	1 for active	1bit
	AIN8 Sensor 6 Open	1 for active	1bit
	AIN8 Sensor 6 High	1 for active	1bit
	AIN8 Sensor 6 Low	1 for active	1bit
	AIN8 Sensor 7 Open	1 for active	1bit
	AIN8 Sensor 7 High	1 for active	1bit
	AIN8 Sensor 7 Low	1 for active	1bit
	AIN8 Sensor 8 Open	1 for active	1bit
0014	AIN8 Sensor 8 High	1 for active	1bit
	AIN8 Sensor 8 Low	1 for active	1bit
	Flexible Sensor 3 Open	1 for active	1bit
	Flexible Sensor 3 High	1 for active	1bit
	Flexible Sensor 3 Low	1 for active	1bit
	Flexible Sensor 3 Error	1 for active	1bit
	Reserved	1 for active	1bit
	Cycle Start Fail to Communicate	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	SGE02-4G Fail to Communicate	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
0015	AIN16M02 1 Fail to Communicate	1 for active	1bit
	AIN16M02 1 Sensor 1 Open	1 for active	1bit
	AIN16M02 1 Sensor 1 High	1 for active	1bit
	AIN16M02 1 Sensor 1 Low	1 for active	1bit
	AIN16M02 1 Sensor 2 Open	1 for active	1bit
	AIN16M02 1 Sensor 2 High	1 for active	1bit
	AIN16M02 1 Sensor 2 Low	1 for active	1bit
	AIN16M02 1 Sensor 3 Open	1 for active	1bit
	AIN16M02 1 Sensor 3 High	1 for active	1bit
	AIN16M02 1 Sensor 3 Low	1 for active	1bit
	AIN16M02 1 Sensor 4 Open	1 for active	1bit
	AIN16M02 1 Sensor 4 High	1 for active	1bit
	AIN16M02 1 Sensor 4 Low	1 for active	1bit
	AIN16M02 1 Sensor 5 Open	1 for active	1bit
	AIN16M02 1 Sensor 5 High	1 for active	1bit
	AIN16M02 1 Sensor 5 Low	1 for active	1bit
0016	AIN16M02 1 Sensor 6 Open	1 for active	1bit
	AIN16M02 1 Sensor 6 High	1 for active	1bit
	AIN16M02 1 Sensor 6 Low	1 for active	1bit
	AIN16M02 1 Sensor 7 Open	1 for active	1bit

Offset Address	Items	Description	Bytes
	AIN16M02 1 Sensor 7 High	1 for active	1bit
	AIN16M02 1 Sensor 7 Low	1 for active	1bit
	AIN16M02 1 Sensor 8 Open	1 for active	1bit
	AIN16M02 1 Sensor 8 High	1 for active	1bit
	AIN16M02 1 Sensor 8 Low	1 for active	1bit
	AIN16M02 1 Sensor 9 Open	1 for active	1bit
	AIN16M02 1 Sensor 9 High	1 for active	1bit
	AIN16M02 1 Sensor 9 Low	1 for active	1bit
	AIN16M02 1 Sensor 10 Open	1 for active	1bit
	AIN16M02 1 Sensor 10 High	1 for active	1bit
	AIN16M02 1 Sensor 10 Low	1 for active	1bit
	AIN16M02 1 Sensor 11 Open	1 for active	1bit
0017	AIN16M02 1 Sensor 11 High	1 for active	1bit
	AIN16M02 1 Sensor 11 Low	1 for active	1bit
	AIN16M02 1 Sensor 12 Open	1 for active	1bit
	AIN16M02 1 Sensor 12 High	1 for active	1bit
	AIN16M02 1 Sensor 12 Low	1 for active	1bit
	AIN16M02 2 Fail to Communicate	1 for active	1bit
	AIN16M02 2 Sensor 1 Open	1 for active	1bit
	AIN16M02 2 Sensor 1 High	1 for active	1bit
	AIN16M02 2 Sensor 1 Low	1 for active	1bit
	AIN16M02 2 Sensor 2 Open	1 for active	1bit
	AIN16M02 2 Sensor 2 High	1 for active	1bit
	AIN16M02 2 Sensor 2 Low	1 for active	1bit
	AIN16M02 2 Sensor 3 Open	1 for active	1bit
	AIN16M02 2 Sensor 3 High	1 for active	1bit
	AIN16M02 2 Sensor 3 Low	1 for active	1bit
	AIN16M02 2 Sensor 4 Open	1 for active	1bit
0018	AIN16M02 2 Sensor 4 High	1 for active	1bit
	AIN16M02 2 Sensor 4 Low	1 for active	1bit
	AIN16M02 2 Sensor 5 Open	1 for active	1bit
	AIN16M02 2 Sensor 5 High	1 for active	1bit
	AIN16M02 2 Sensor 5 Low	1 for active	1bit
	AIN16M02 2 Sensor 6 Open	1 for active	1bit
	AIN16M02 2 Sensor 6 High	1 for active	1bit
	AIN16M02 2 Sensor 6 Low	1 for active	1bit
	AIN16M02 2 Sensor 7 Open	1 for active	1bit
	AIN16M02 2 Sensor 7 High	1 for active	1bit
	AIN16M02 2 Sensor 7 Low	1 for active	1bit
	AIN16M02 2 Sensor 8 Open	1 for active	1bit
	AIN16M02 2 Sensor 8 High	1 for active	1bit
	AIN16M02 2 Sensor 8 Low	1 for active	1bit
	AIN16M02 2 Sensor 9 Open	1 for active	1bit
	AIN16M02 2 Sensor 9 High	1 for active	1bit

Offset Address	Items	Description	Bytes
0019	AIN16M02 2 Sensor 9 Low	1 for active	1bit
	AIN16M02 2 Sensor 10 Open	1 for active	1bit
	AIN16M02 2 Sensor 10 High	1 for active	1bit
	AIN16M02 2 Sensor 10 Low	1 for active	1bit
	AIN16M02 2 Sensor 11 Open	1 for active	1bit
	AIN16M02 2 Sensor 11 High	1 for active	1bit
	AIN16M02 2 Sensor 11 Low	1 for active	1bit
	AIN16M02 2 Sensor 12 Open	1 for active	1bit
	AIN16M02 2 Sensor 12 High	1 for active	1bit
	AIN16M02 2 Sensor 12 Low	1 for active	1bit
	BAC150CAN Fail to Communicate	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit

3.5 GENSET STATUS

Table 14 Genset Status

No.	Content	DESCRIPTION
0	Standby	No delay value for the status
1	Preheat	
2	Fuel Output	No delay value for 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 for the status
9	Normal Running	No delay value for the status
10	High Speed Cooling	
11	Stop Idle	
12	Energize to Stop	
13	Wait for Stop	
14	After Stop	
15	Fail to Stop	No delay value for the status

3.6 REMOTE START STATUS

Table 15 Remote Start Status

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

3.7 ATS STATUS

NOTE: The ATS Status list is determined based on the value of ATS Status (0322). 0: Asynchronous Transfer, 1: Synchronous Transfer.

Table 16 Asynchronous Transfer ATS Status

No.	Content	Description
0	Off-load	No delay value is shown in the status
1	Mains Close	No delay value is shown in the status
2	Gen. Close	No delay value is shown in the status
3	Open Delay	
4	ATS Transfer Delay	
5	Mains Close Delay	
6	Gen. Close Delay	
7	Wait for Open	No delay value is shown in the status
8	Wait for Gen. Close	No delay value is shown in the status
9	Wait for Mains Close	No delay value is shown in the status
10	Normal	No delay value is shown in the status

Table 17 Synchronous Transfer ATS Status

No.	Content	Description
0	Off-load	No delay value is shown in the status
1	Gen. in Sync.	
2	Gen. Close Delay	
3	Wait for Gen. Close	No delay value is shown in the status
4	Gen. On-load	No delay value is shown in the status
5	Gen. Open Delay	
6	Wait for Gen. Open	No delay value is shown in the status
7	Parallel Delay	
8	Mains in Sync.	
9	Mains Close Delay	
10	Wait for Mains Close	No delay value is shown in the status
11	Mains On-load	No delay value is shown in the status
12	Mains Open Delay	
13	Wait for Mains Open	No delay value is shown in the status
14	ATS Transfer Delay	

3.8 MAINS STATUS

Table 18 Mains Status

No.	Content	Description
0	Mains Normal	No delay value for the status
1	Mains Normal Delay	
2	Mains Abnormal	No delay value for the status
3	Mains Abnormal Delay	

3.9 BAC150CAN CHARGING STATUS

Table 19 BAC150CAN Charging Status

No.	Content	Description
8	Power off	No delay value for the status
E	Reverse Connection Error	
9	Fail to Charge	No delay value for the status
3	Over Charge	
0	Standby	
1	Quick Charging	
2	Absorption Charging	
5	Float Charging	

4 FAQ

4.1 GROUNDING OF THE CABLE SHIELD

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

4.2 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.

4.3 RS485 TO USB CONVERTER

It can communicate with PC via the SmartGen SG72A converter.

4.4 EXTEND TRANSMISSION DISTANCE

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

Fig.3 SGCAN300 Application Diagram

4.5 SOLUTIONS FOR COMMUNICATION FAILURE

1) Check the positive and negative of RS485, or network cable is connected correctly. Check the RS485 converter (if any) is normal;
2) Check the termination resistors are connected correctly or not;
3) Check the communication parameters setting is correct or not. Baud rate, data bit, parity bit and stop bit meet the requirement of controller;
4) Check the Terminal COM is connected correctly with the USB port of PC via RS485 converter;
5) Check the communication address of controller is correct, and the default address is 01;
6) When using function code 03, the maximum data length to be read is 120 addresses, and the ending address can't exceed the greatest Modbus communication address. Please note that for the function code 06 mapping parameters data field, only one address can be written at a time;
7) If there is offset address in the Modbus communication address, the actual Modbus communication address equals to the base address plus offset address;
8) 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; Function code 05 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 be 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 modscan32, modbus poll, etc.
17) It is recommended to download third-party communication test software to verify whether the network communication is normal, such as NetAssist, PortHelper.