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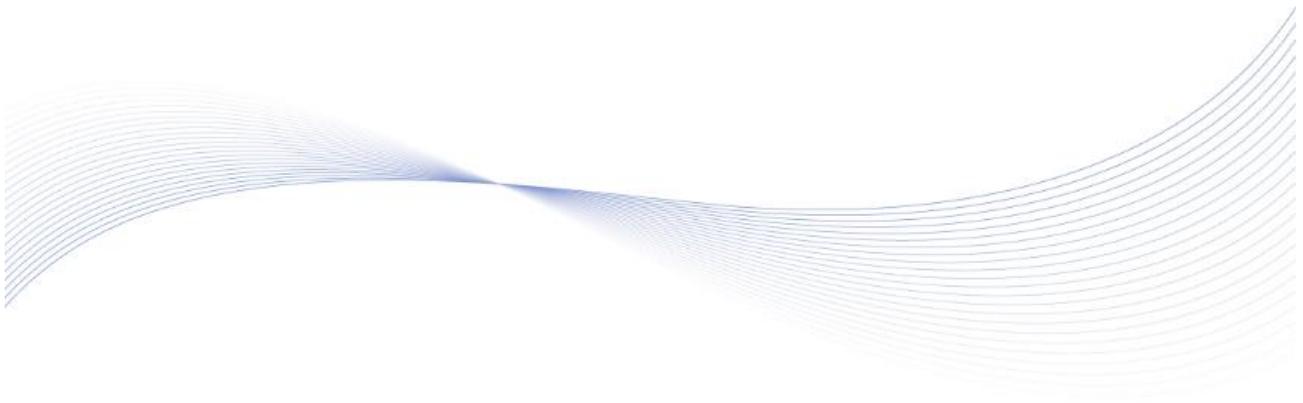
**SmartGen**

MAKING CONTROL SMARTER

**HGM7220N\_HGM7220S**

**GENSET CONTROLLER**

**COMMUNICATION PROTOCOL**



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**Table 1 Software Version**

Date	Version	Content
2022-11-28	V1.0	Original release.
2023-09-19	V1.1	1. Update contents of 03 function code; 2. Modify the protocol according to the latest format.
2025-05-19	V1.2	1. Update contents of 03 and 06 function code.

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## 1. DESCRIPTION

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

This controller has one RS485 port, which can be used as the slave, using Modbus-RTU protocol, and does not support other protocols such as Modbus-ASCII.

Communication address: 1~254 (default: 1)

Baud rate: 9600bps

Start bit: 1-bit

Data bit: 8-bit

Parity bit: None

Stop bit: 1-bit or 2-bit (default: 2-bit)

Supported function code: 03H, 05H, 06H. Function code 03H is used for reading controller alarm, status information and various electricity data; 05H is used for sending remote command; 06H is used for writing single point register.

Data calibration method: CRC16.

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

Communication timeout period: over 200ms.

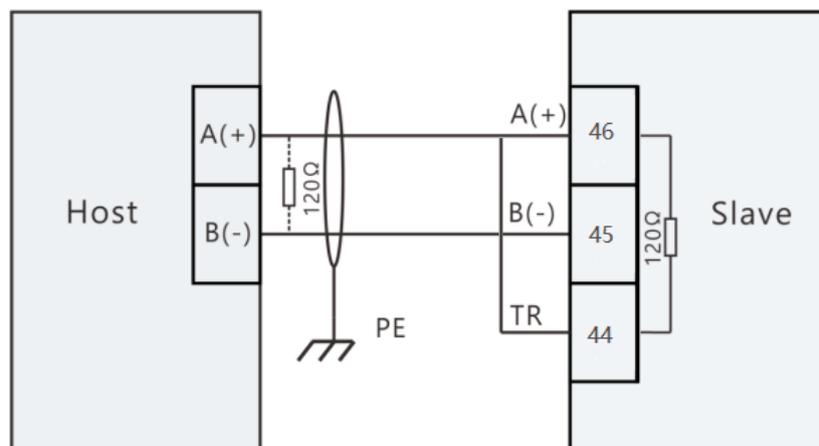
Communication distance: 9600 baud rate, the longest distance can reach 1,000m when using 120Ω shielding twisted pair line.

Once maximum 120 data of byte register can be read.

Up to 32 controllers can be deployed for network communication.

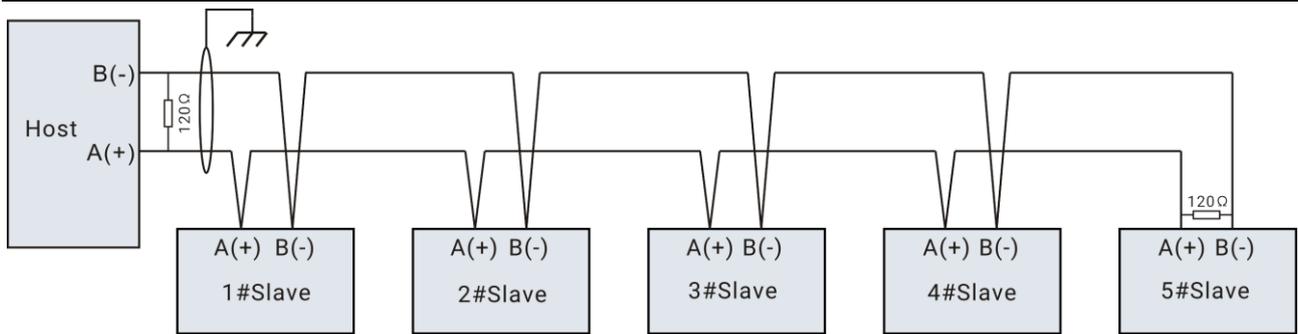
When RS485 is connected, 120Ω twisted pair line with shielding layer shall be used, and the shielding layer shall be grounded at one end.

## 2. WIRING DIAGRAM



**Fig.1 Single Unit Communication Wiring Diagram**

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



**Fig.2 Multi-unit Communication Wiring Diagram**

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

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

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3. CONTROLLER INTERNAL REGISTER ADDRESS AND DATA

3.1 FUNCTION CODE 03H, 06H MAPPING COIL FIELD AND DATA FIELD

06H function code only can be written for address 0199-0210 and 0225-0231, other addresses are unavailable.

Table 2 Function Code 03H, 06H Mapping Coil Field and Data Field

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0000	40001	Common Alarm				1 for active (LSB)	1bit
		Common Shutdown Alarm				1 for active	1bit
		Common Warning Alarm				1 for active	1bit
		Common Trip and Stop Alarm				1 for active	1bit
		Common Trip				1 for active	1bit
		Common Trip and Stop & Common Shutdown Alarm				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Auto Mode				1 for active	1bit
		Manual Mode				1 for active	1bit
		Stop Mode				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved				(MSB)	1bit
0001	40002	Emergency Stop Alarm				1 for active	1bit
		Overspeed Shutdown				1 for active	1bit
		Underspeed Shutdown				1 for active	1bit
		Speed Signal Loss Alarm				1 for active	1bit
		Gen Over Freq. Shutdown				1 for active	1bit
		Gen Under Freq. Shutdown				1 for active	1bit
		Gen Over Volt Shutdown				1 for active	1bit
		Gen Under Volt Shutdown				1 for active	1bit
		Crank Failure Alarm				1 for active	1bit

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
		Gen Overcurrent Shutdown				1 for active	1bit
		Maintenance Time Due Shutdown				1 for active	1bit
		ECU Shutdown				1 for active	1bit
		Reverse Power Shutdown				1 for active	1bit
		Over Power Shutdown				1 for active	1bit
		High Temp. IN Shutdown				1 for active	1bit
		Low OP IN Shutdown				1 for active	1bit
0002	40003	ECU Comm. Failure Shutdown				1 for active	1bit
		Low Level IN Shutdown				1 for active	1bit
		Sync. Failure Shutdown				1 for active	1bit
		Gen Phase Sequence Wrong Shutdown				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Temp. Sensor Open Shutdown				1 for active	1bit
		High Temp. Shutdown				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		OP Sensor Open Shutdown				1 for active	1bit
		Reserved					1bit
		Low OP Shutdown				1 for active	1bit
		Reserved					1bit
0003	40004	Level Sensor Open Shutdown				1 for active	1bit
		Reserved					1bit
		Low Level Shutdown				1 for active	1bit
		Reserved					1bit
		Aux. Sensor 1 Open Shutdown				1 for active	1bit
		Aux.1 High Shutdown				1 for active	1bit
		Aux.1 Low Shutdown				1 for active	1bit
		Reserved					1bit
		Aux. Sensor 2 Open Shutdown				1 for active	1bit

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
		Aux.2 High Shutdown				1 for active	1bit
		Aux.2 Low Shutdown				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
0004	40005	Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
0005	40006	Reserved					2Bytes
0006	40007	Reserved					2Bytes
0007	40008	Reserved					2Bytes
0008	40009	Input 1 Shutdown				1 for active	1bit
		Input 2 Shutdown				1 for active	1bit
		Input 3 Shutdown				1 for active	1bit
		Input 4 Shutdown				1 for active	1bit
		Input 5 Shutdown				1 for active	1bit
		Input 6 Shutdown				1 for active	1bit
		Input 7 Shutdown				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
0009	40010	Reserved					2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0010	40011	Reserved					2Bytes
0011	40012	Reserved					2Bytes
0012	40013	Overcurrent Trip and Stop				1 for active	1bit
		Maintenance Time Due Trip and Stop				1 for active	1bit
		Reverse Power Trip and Stop				1 for active	1bit
		Over Power Trip and Stop				1 for active	1bit
		Input 1 Trip and Stop				1 for active	1bit
		Input 2 Trip and Stop				1 for active	1bit
		Input 3 Trip and Stop				1 for active	1bit
		Input 4 Trip and Stop				1 for active	1bit
		Input 5 Trip and Stop				1 for active	1bit
		Input 6 Trip and Stop				1 for active	1bit
		Input 7 Trip and Stop				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
0013	40014	Reserved					2Bytes
0014	40015	Reserved					2Bytes
0015	40016	Reserved					2Bytes
0016	40017	Overcurrent Trip				1 for active	1bit
		Maintenance Time Due Trip				1 for active	1bit
		Reverse Power Trip				1 for active	1bit
		Over Power Trip				1 for active	1bit
		Input 1 Trip				1 for active	1bit
		Input 2 Trip				1 for active	1bit
		Input 3 Trip				1 for active	1bit
		Input 4 Trip				1 for active	1bit
		Input 5 Trip				1 for active	1bit
		Input 6 Trip				1 for active	1bit
		Input 7 Trip				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
0017	40018	Reserved					2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0018	40019	Reserved					2Bytes
0019	40020	Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Mains Breaker C/O Failure Trip				1 for active	1bit
		Gen Breaker C/O Failure Trip				1 for active	1bit
		Sync. Failure Trip				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
0020	40021	Overspeed Warning				1 for active	1bit
		Underspeed Warning				1 for active	1bit
		Speed Signal Loss Warning				1 for active	1bit
		Gen Over Freq. Warning				1 for active	1bit
		Gen Under Freq. Warning				1 for active	1bit
		Gen Over Volt Warning				1 for active	1bit
		Gen Under Volt Warning				1 for active	1bit
		Gen Overcurrent Warning				1 for active	1bit
		Stop Failure Warning				1 for active	1bit
		Charge Failure Warning				1 for active	1bit
		Battery Over Volt Warning				1 for active	1bit
		Battery Under Volt Warning				1 for active	1bit
		Maintenance Time Due Warning				1 for active	1bit
		Reverse Power Warning				1 for active	1bit
		Over Power Warning				1 for active	1bit

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
		ECU Warning				1 for active	1bit
0021	40022	Gen Loss of Phase Warning				1 for active	1bit
		Gen Reverse Phase Sequence Warning				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Sync. Failure Warning				1 for active	1bit
		Gen Beaker C/O Failure Warning				1 for active	1bit
		Mains Beaker C/O Failure Warning				1 for active	1bit
		Switch Failure Warning				1 for active	1bit
		Temp. Sensor Open Warning				1 for active	1bit
		High Temp. Warning				1 for active	1bit
		Low Temp. Warning				1 for active	1bit
		Reserved					1bit
		OP Sensor Open Warning				1 for active	1bit
		Reserved					1bit
		Low OP Warning				1 for active	1bit
		Reserved					1bit
0022	40023	Level Sensor Open Warning				1 for active	1bit
		Reserved					1bit
		Low Level Warning				1 for active	1bit
		Reserved					1bit
		Aux. Sensor 1 Open Warning				1 for active	1bit
		Aux. Sensor 1 High Warning				1 for active	1bit
		Aux. Sensor 1 Low Warning				1 for active	1bit
		Reserved				1 for active	1bit
		Aux. Sensor 2 Open Warning				1 for active	1bit
		Aux. Sensor 2 High Warning				1 for active	1bit
		Aux. Sensor 2 Low Warning				1 for active	1bit
		Reserved					1bit
		Reserved					1bit



Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
		Input 3 Warning				1 for active	1bit
		Input 4 Warning				1 for active	1bit
		Input 5 Warning				1 for active	1bit
		Input 6 Warning				1 for active	1bit
		Input 7 Warning				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		High Box Temp. IN Warning				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
0030	40031	Regeneration is required				1 for active	1bit
		Regeneration at the service station is required				1 for active	1bit
		DPF Regeneration				1 for active	1bit
		DPF Regeneration Inhibit				1 for active	1bit
		PCD and NCD System Fault				1 for active	1bit
		High Exhaust Temp. Alarm				1 for active	1bit
		Driver Warning				1 for active	1bit
		Red Shutdown				1 for active	1bit
		Engine Yellow Alarm				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
0031	40032	Inhibit Shutdown Indication				1 for active	1bit
		Maintenance Time Due Indication				1 for active	1bit
		In Scheduled Not Run Indication				1 for active	1bit
		Reserved					1bit

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
0032	40033	Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Auto Mode Input				1 for active	1bit
		Auto Mode Invalid				1 for active	1bit
		Remote Control				1 for active	1bit
		Reserved					1bit
		Alt. Configuration 1 Indication				1 for active	1bit
		Alt. Configuration 2 Indication				1 for active	1bit
		Alt. Configuration 3 Indication				1 for active	1bit
		Overcurrent Indication				1 for active	1bit
		Reverse Power Indication				1 for active	1bit
		Over Power Indication				1 for active	1bit
0033	40034	Input 1 Indication				1 for active	1bit
		Input 2 Indication				1 for active	1bit
		Input 3 Indication				1 for active	1bit
		Input 4 Indication				1 for active	1bit
		Input 5 Indication				1 for active	1bit
		Input 6 Indication				1 for active	1bit
		Input 7 Indication				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
0034	40035	Mains Available Indication				1 for active	1bit
		Mains Unavailable Indication				1 for active	1bit
		Gen Normal Running Indication				1 for active	1bit
		Gen Stop Indication				1 for active	1bit
		Mains On-load Indication				1 for active	1bit
		Gen On-load Indication				1 for active	1bit
		Auto Mode Indication				1 for active	1bit
		Non-auto Mode Indication				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
0035	40036	Emergency Input Status				1 for active	1bit
		Input 1 Status				1 for active	1bit
		Input 2 Status				1 for active	1bit
		Input 3 Status				1 for active	1bit
		Input 4 Status				1 for active	1bit
		Input 5 Status				1 for active	1bit
		Input 6 Status				1 for active	1bit
		Input 7 Status				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0036	40037	Reserved					2Bytes
0037	40038	Fuel Relay Output Status				1 for active	1bit
		Crank Relay Output Status				1 for active	1bit
		Aux. Output 1 Status				1 for active	1bit
		Aux. Output 2 Status				1 for active	1bit
		Aux. Output 1 Status				1 for active	1bit
		Aux. Output 1 Status				1 for active	1bit
		Aux. Output 1 Status				1 for active	1bit
		Aux. Output 1 Status				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
0038	40039	Reserved					2Bytes
0039	40040	Reserved					2Bytes
0040	40041	Reserved					2Bytes
0041	40042	Reserved					2Bytes
0042	40043	Reserved					2Bytes
0043	40044	Mains Available				1 for active	1bit
		Mains Close				1 for active	1bit
		Gen Available				1 for active	1bit
		Gen Close				1 for active	1bit
		Alarm Light Indicator				1 for active	1bit
		Running Light Indicator				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
0044		Mains Unavailable				1 for active	1bit
		Mains Over Volt				1 for active	1bit
		Mains Under Volt				1 for active	1bit

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
		Mains Over Freq.				1 for active	1bit
		Mains Under Freq.				1 for active	1bit
		Mains Loss of Phase				1 for active	1bit
		Mains Reverse Phase Sequence				1 for active	1bit
		Mains Blackout				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
0045	40046	Input 1 Active				1 for active	1bit
		Input 2 Active				1 for active	1bit
		Input 3 Active				1 for active	1bit
		Input 4 Active				1 for active	1bit
		Input 5 Active				1 for active	1bit
		Input 6 Active				1 for active	1bit
		Input 7 Active				1 for active	1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
		Reserved					1bit
0046	40047	Reserved					2Bytes
0047	40048	Reserved					2Bytes
0048	40049	Reserved					2Bytes
0049	40050	Reserved					2Bytes
0050	40051	Reserved					2Bytes
0051	40052	Reserved					2Bytes
0052	40053	Reserved					2Bytes
0053	40054	Reserved					2Bytes
0054	40055	Reserved					2Bytes
0055	40056	Mains UAB	0~65535	1	V	16-bit Signed	2Bytes
0056	40057	Mains UBC	0~65535	1	V	16-bit Signed	2Bytes
0057	40058	Mains UCA	0~65535	1	V	16-bit Signed	2Bytes
0058	40059	Mains UA	0~65535	1	V	16-bit Signed	2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0059	40060	Mains UB	0~65535	1	V	16-bit Signed	2Bytes
0060	40062	Mains UC	0~65535	1	V	16-bit Signed	2Bytes
0061	40062	Mains UA Phase	0~360.0	0.1	°	16-bit Signed	2Bytes
0062	40063	Mains UB Phase	0~360.0	0.1	°	16-bit Signed	2Bytes
0063	40064	Mains UC Phase	0~360.0	0.1	°	16-bit Signed	2Bytes
0064	40065	Mains Frequency	0~100.00	0.01	Hz	16-bit Unsigned	2Bytes
0065	40066	Volt Difference	0~65535	1	V	16-bit Signed	2Bytes
0066	40067	Freq. Difference	0~100.00	0.01	Hz	16-bit Unsigned	2Bytes
0067	40068	Phase Difference	0~360.0	0.1	°	16-bit Signed	2Bytes
0068	40069	PC Software Version MSB	0~65535	1		16-bit Unsigned	2Bytes
0069	40070	PC Software Version LSB	0~65535	1		16-bit Unsigned	2Bytes
0070	40071	Reserved					2Bytes
0071	40072	Reserved					2Bytes
0072	40073	Reserved					2Bytes
0073	40074	Reserved					2Bytes
0074	40075	Reserved					2Bytes
0075	40076	Gen UAB	0~65535	1	V	16-bit Signed	2Bytes
0076	40077	Gen UBC	0~65535	1	V	16-bit Signed	2Bytes
0077	40078	Gen UCA	0~65535	1	V	16-bit Signed	2Bytes
0078	40079	Gen UA	0~65535	1	V	16-bit Signed	2Bytes
0079	40080	Gen UB	0~65535	1	V	16-bit Signed	2Bytes
0080	40081	Gen UC	0~65535	1	V	16-bit Signed	2Bytes
0081	40082	Gen UA Phase	0~360.0	0.1	°	16-bit Signed	2Bytes
0082	40083	Gen UB Phase	0~360.0	0.1	°	16-bit Signed	2Bytes
0083	40084	Gen UC Phase	0~360.0	0.1	°	16-bit Signed	2Bytes
0084	40085	Gen Frequency	0~100.00	0.01	Hz	16-bit Unsigned	2Bytes
0085	40086	Reserved					2Bytes
0086	40087	Reserved					2Bytes
0087	40088	Reserved					2Bytes
0088	40089	Reserved					2Bytes
0089	40090	Reserved					2Bytes
0090	40091	Reserved					2Bytes
0091	40092	Reserved					2Bytes
0092	40093	Reserved					2Bytes
0093	40094	Reserved					2Bytes
0094	40095	Reserved					2Bytes
0095	40096	A Phase Current	0~65535	0.1	A	16-bit Unsigned	2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0096	40097	B Phase Current	0~65535	0.1	A	16-bit Unsigned	2Bytes
0097	40098	C Phase Current	0~65535	0.1	A	16-bit Unsigned	2Bytes
0098	40099	Reserved					2Bytes
0099	40100	Reserved					2Bytes
0100	40101	Reserved					2Bytes
0101	40102	Reserved					2Bytes
0102	40103	Reserved					2Bytes
0103	40104	A Phase Active Power	-2,147,483,648 ~2,147,483,647	0.1	kW	32-bit Signed	4Bytes
0104	40105						
0105	40106	B Phase Active Power	-2,147,483,648 ~2,147,483,647	0.1	kW	32-bit Signed	4Bytes
0106	40107						
0107	40108	C Phase Active Power	-2,147,483,648 ~2,147,483,647	0.1	kW	32-bit Signed	4Bytes
0108	40109						
0109 0110	40110 40111	Total Active Power	-2,147,483,648 ~2,147,483,647	0.1	kW	32-bit Signed	4Bytes
0111	40112	A Phase Reactive Power	-2,147,483,648 ~2,147,483,647	0.1	kvar	32-bit Signed	4Bytes
0112	40113						
0113	40114	B Phase Reactive Power	-2,147,483,648 ~2,147,483,647	0.1	kvar	32-bit Signed	4Bytes
0114	40115						
0115	40116	C Phase Reactive Power	-2,147,483,648 ~2,147,483,647	0.1	kvar	32-bit Signed	4Bytes
0116	40117						
0117	40118	Total Reactive Power	-2,147,483,648 ~2,147,483,647	0.1	kvar	32-bit Signed	4Bytes
0118	40119						
0119	40120	A Phase Apparent Power	-2,147,483,648 ~2,147,483,647	0.1	kVA	32-bit Signed	4Bytes
0120	40121						
0121	40122	B Phase Apparent Power	-2,147,483,648 ~2,147,483,647	0.1	kVA	32-bit Signed	4Bytes
0122	40123						
0123	40124	C Phase Apparent Power	-2,147,483,648 ~2,147,483,647	0.1	kVA	32-bit Signed	4Bytes
0124	40125						
0125	40126	Total Apparent Power	-2,147,483,648 ~2,147,483,647	0.1	kVA	32-bit Signed	4Bytes
0126	40127						

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0127	40128	A Phase Power Factor	-100~100	0.01	CosΦ	16-bit Signed	2Bytes
0128	40129	B Phase Power Factor	-100~100	0.01	CosΦ	16-bit Signed	2Bytes
0129	40130	C Phase Power Factor	-100~100	0.01	CosΦ	16-bit Signed	2Bytes
0130	40131	Average Power Factor	-100~100	0.01	CosΦ	16-bit Signed	2Bytes
0131	40132	Current Run Time (h)	0~23	1	h	16-bit Unsigned	2Bytes
0132	40133	Current Run Time (min)	0~59	1	min	16-bit Unsigned	2Bytes
0133	40134	Current Run Time (s)	0~59	1	s	16-bit Unsigned	2Bytes
0134	40135	Current Electric Energy	0~99999999	0.1	kWh	32-bit Signed	4Bytes
0135	40136						
0136	40137	Average Power	0~99999999	0.1	kvarh	32-bit Signed	4Bytes
0137	40138						
0138	40139	History Power	0~99999999	0.1	kVAh	32-bit Signed	4Bytes
0139	40140						
0140	40141	Load Percentage	0~100	1	%	16-bit Unsigned	2Bytes
0141	40142	Engine Speed	0~65535	1	r/min	16-bit Unsigned	2Bytes
0142	40143	Battery Voltage	0~65535	0.1	V	16-bit Unsigned	2Bytes
0143	40144	Charger Voltage	0~65535	0.1	V	16-bit Unsigned	2Bytes
0144	40145	GSM Energy	0~99	1		16-bit Signed	2Bytes
0145	40146	Reserved					2Bytes
0146	40147	Reserved					2Bytes
0147	40148	Reserved					2Bytes
0148	40149	Temp. Sensor Resistance Value	0~65535	0.1		16-bit Unsigned	2Bytes
0149	40150	Temp. Sensor Value	-50~10000	1	°C	16-bit Signed	2Bytes
0150	40151	Pressure Sensor Resistance Value	0~65535	0.1		16-bit Unsigned	2Bytes
0151	40152	Pressure Sensor Value	0~10000	1	kPa	16-bit Signed	2Bytes
0152	40153	Level Sensor Resistance Value	0~65535	0.1		16-bit Unsigned	2Bytes
0153	40154	Level Sensor Value	0~200	1	%	16-bit Signed	2Bytes
0154	40155	Aux. Sensor 1 Resistance Value	0~65535	0.1		16-bit Unsigned	2Bytes
0155	40156	Aux. Sensor 1 Value				16-bit Signed	2Bytes
0156	40157	Aux. Sensor 2 Resistance Value	0~65535	0.1		16-bit Unsigned	2Bytes
0157	40158	Aux. Sensor 2 Value				16-bit Signed	2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0158	40159	Reserved					2Bytes
0159	40160	Reserved					2Bytes
0160	40161	Reserved					2Bytes
0161	40162	Reserved					2Bytes
0162	40163	Coolant Level	0~200	1	%	16-bit Unsigned	2Bytes
0163	40164	Oil Temperature	-32768~32767	1	°C	16-bit Signed	2Bytes
0164	40165	Coolant Pressure	0~32767	1	kPa	16-bit Signed	2Bytes
0165	40166	Fuel Pressure	0~32767	1	kPa	16-bit Signed	2Bytes
0166	40167	Fuel Temperature	-32768~32767	1	°C	16-bit Signed	2Bytes
0167	40168	Inlet Temperature	-32768~32767	1	°C	16-bit Signed	2Bytes
0168	40169	Exhaust Temperature	-32768~32767	1	°C	16-bit Signed	2Bytes
0169	40170	Turbo Pressure	0~32767	1	kPa	16-bit Signed	2Bytes
0170	40171	Fuel Consumption	0~32767	0.1	L/h	16-bit Signed	2Bytes
0171	40172	Accumulated Fuel Consumption	0~999999999	1	L	32-bit Unsigned	4Bytes
0172	40173						
0173	40174	ECU Running Time		1	h	32-bit Signed	4Bytes
0174	40175						
0175	40176	MTU FC		1	RPM	16-bit Unsigned	2Bytes
0176	40177	MTU Droop		0.1	%	16-bit Unsigned	2Bytes
0177	40178	MTU Speed Demand				16-bit Unsigned	2Bytes
0178	40179	MTU SSD				16-bit Unsigned	2Bytes
0179	40180	ECU Temp.			°C	16-bit Signed	2Bytes
0180	40181	Ambient Pressure		1	kPa	16-bit Signed	2Bytes
0181	40182	Throttle Position		1	%	16-bit Signed	2Bytes
0182	40183	Air Inlet Pressure		1	kPa	16-bit Signed	2Bytes
0183	40184	Gas Pressure		1	kPa	16-bit Unsigned	2Bytes
0184	40185	Exhaust Oxygen Content		1	%	16-bit Unsigned	2Bytes
0185	40186	Turbo Inlet Temp.		1	°C	16-bit Signed	2Bytes
0186	40187	Fuel Valve Position		1	%	16-bit Unsigned	2Bytes
0187	40188	Fuel Rail Pressure		1	kPa	16-bit Unsigned	2Bytes
0188	40189	Reserved					2Bytes
0189	40190	Gen Status				<a href="#">Gen Status</a>	2Bytes
0190	40191	Gen Delay	0~65535	1	s	16-bit Unsigned	2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0191	40192	Remote Start Status				<a href="#">Remote Start Status</a>	2Bytes
0192	40193	Remote Start Delay	0~65535	1	s	16-bit Unsigned	2Bytes
0193	40194	ATS Status				<a href="#">ATS Status</a>	2Bytes
0194	40195	ATS Transfer Delay	0~65535	1	s	16-bit Unsigned	2Bytes
0195	40196	Mains Status				<a href="#">Mains Status</a>	2Bytes
0196	40197	Mains Delay	0~65535	1	s	16-bit Unsigned	2Bytes
0197	40198	Reserved					2Bytes
0198	40199	Reserved					2Bytes
0199	40200	Accum. Run Hours	0~65535	1	h	16-bit Unsigned	2Bytes
0200	40201	Accum. Run Minutes	0~59	1	min	16-bit Unsigned	2Bytes
0201	40202	Accum. Run Seconds	0~59	1	s	16-bit Unsigned	2Bytes
0202	40203	Accum. Start Times	0~65535	1	times	16-bit Unsigned	2Bytes
0203	40204	Accum. Electric Energy kWh	0~99999999	0.1	kWh	32-bit Signed	4Bytes
0204	40205						
0205	40206	Accum. Electric Energy kVarh	0~99999999	0.1	kvarh	32-bit Signed	4Bytes
0206	40207						
0207	40208	Accum. Electric Energy kVAh	0~99999999	0.1	KVAh	32-bit Signed	4Bytes
0208	40209						
0209	40210	Reserved					2Bytes
0210	40211	Reserved					2Bytes
0211	40212	Maint. Left Hours	0~23	1	h	16-bit Unsigned	2Bytes
0212	40213	Maint. Left Minutes	0~59	1	min	16-bit Unsigned	2Bytes
0213	40214	Maint. Left Seconds	0~59	1	s	16-bit Unsigned	2Bytes
0214	40215	Reserved					2Bytes
0215	40216	Reserved					2Bytes
0216	40217	Reserved					2Bytes
0217	40218	Controller Model	0~65535	1		16-bit Unsigned	2Bytes
0218	40219	Software Version	0~65535	0.1		16-bit Unsigned	2Bytes
0219	40220	Hardware Version	0~65535	0.1		16-bit Unsigned	2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0220	40221	Release Year	0~99	1	year	Only save last two digits of year	2Bytes
0221	40222	Release Month	1~12	1	month	16-bit Unsigned	2Bytes
0222	40223	Release Day	1~31	1	day	16-bit Unsigned	2Bytes
0223	40224	Reserved					2Bytes
0224	40225	Reserved					2Bytes
0225	40226	Controller Time: Year	0~99	1	year	Only save last two digits of year	2Bytes
0226	40227	Controller Time: Month	1~12	1	month	16-bit Unsigned	2Bytes
0227	40228	Controller Time: Day	1~31	1	day	16-bit Unsigned	2Bytes
0228	40229	Controller Time: Week	0~6	1	week	16-bit Unsigned	2Bytes
0229	40230	Controller Time: Hour	0~23	1	h	16-bit Unsigned	2Bytes
0230	40231	Controller Time: Minute	0~59	1	min	16-bit Unsigned	2Bytes
0231	40232	Controller Time: Second	0~59	1	s	16-bit Unsigned	2Bytes
0232	40233	Reserved					2Bytes
0233	40234	Reserved					2Bytes
0234	40235	Reserved					2Bytes
0235	40236	Reserved					2Bytes
0236	40237	Reserved					2Bytes
0237	40238	Reserved					2Bytes
0238	40239	Reserved					2Bytes
0239	40240	Reserved					2Bytes
0240	40241	Reserved					2Bytes
0241	40242	Reserved					2Bytes
0242	40243	Reserved					2Bytes
0243	40244	Reserved					2Bytes
0244	40245	Reserved					2Bytes
0245	40246	Reserved					2Bytes
0246	40247	Reserved					2Bytes
0247	40248	Reserved					2Bytes
0248	40249	Reserved					2Bytes
0249	40250	Reserved					2Bytes
0250	40251	Reserved					2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0251	40252	Reserved					2Bytes
0252	40253	Reserved					2Bytes
0253	40254	Reserved					2Bytes
0254	40255	Reserved					2Bytes
0255	40256	Reserved					2Bytes
0256	40257	Reserved					2Bytes
0257	40258	Reserved					2Bytes
0258	40259	Reserved					2Bytes
0259	40260	Reserved					2Bytes
0260	40261	Reserved					2Bytes
0261	40262	Reserved					2Bytes
0262	40263	Reserved					2Bytes
0263	40264	Reserved					2Bytes
0264	40265	Reserved					2Bytes
0265	40266	Reserved					2Bytes
0266	40267	Reserved					2Bytes
0267	40268	Reserved					2Bytes
0268	40269	Reserved					2Bytes
0269	40270	Reserved					2Bytes
0270	40271	MCUID_H1				32-bit Unsigned	4Bytes
0271	40272						
0272	40273	MCUID_H2				32-bit Unsigned	4Bytes
0273	40274						
0274	40275	MCUID_L				32-bit Unsigned	4Bytes
0275	40276						
0276	40277	GPS Longitude		0.0000001	°	32-bit Signed	4Bytes
0277	40278						
0278	40279	GPS Latitude		0.0000001	°	32-bit Signed	4Bytes
0279	40280						
0280	40281	GPS Altitude		0.1	m	32-bit Signed	4Bytes
0281	40282						
0282	40283	GPS Energy		1		16-bit Unsigned	2Bytes
0283	40284	High Exhaust Temp. Alarm Indicator		1		16-bit Unsigned	2Bytes 0: Off 1: On
0284	40285	Driver Warning Indicator		1		16-bit Unsigned	2Bytes 0: Off 1: On 4: Flash
0285	40286	DM1 Alarm SPN1	SPN				4Bytes
0286	40287						
0287	40288		FMI				LSB 1Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
			OC			MSB	1Bytes
0288	40289	DM1 Alarm SPN2	SPN				4Bytes
0289	40290						
0290	40291		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0291	40292	DM1 Alarm SPN3	SPN				4Bytes
0292	40293						
0293	40294		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0294	40295	DM1 Alarm SPN4	SPN				4Bytes
0295	40296						
0296	40297		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0297	40298	DM1 Alarm SPN5	SPN				4Bytes
0298	40299						
0299	40300		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0300	40301	DM1 Alarm SPN6	SPN				4Bytes
0301	40302						
0302	40303		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0303	40304	DM1 Alarm SPN7	SPN				4Bytes
0304	40305						
0305	40306		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0306	40307	DM1 Alarm SPN8	SPN				4Bytes
0307	40308						
0308	40309		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0309	40310	DM1 Alarm SPN9	SPN				4Bytes
0310	40311						
0311	40312		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0312	40313	DM1 Alarm SPN10	SPN				4Bytes
0313	40314						
0314	40315		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0315	40316	DM2 Alarm SPN1	SPN				4Bytes
0316	40317						
0317	40318		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0318	40319	DM2 Alarm SPN2	SPN				4Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
0319	40320						
0320	40321		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0321	40322	DM2 Alarm SPN3	SPN				4Bytes
0322	40323						
0323	40324		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0324	40325	DM2 Alarm SPN4	SPN				4Bytes
0325	40326						
0326	40327		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0327	40328	DM2 Alarm SPN5	SPN				4Bytes
0328	40329						
0329	40330		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0330	40331	DM2 Alarm SPN6	SPN				4Bytes
0331	40332						
0332	40333		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0333	40334	DM2 Alarm SPN7	SPN				4Bytes
0334	40335						
0335	40336		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0336	40337	DM2 Alarm SPN8	SPN				4Bytes
0337	40338						
0338	40339		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0339	40340	DM2 Alarm SPN9	SPN				4Bytes
0340	40341						
0341	40342		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0342	40343	DM2 Alarm SPN10	SPN				4Bytes
0343	40344						
0344	40345		FMI			LSB	1Bytes
			OC			MSB	1Bytes
0345	40346	ECU Shutdown Quantity				16-bit Unsigned	2Bytes
0346	40347	ECU Warning Quantity				16-bit Unsigned	2Bytes
0347	40348	SIM Card Status				16-bit Unsigned	2Bytes
0348	40349	GSM Connection Status				16-bit	2Bytes

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remark
						Unsigned	
0349	40350	GSM Registration Status				16-bit Unsigned	2Bytes
0350	40351	IMEI				64-bit Unsigned	8Bytes
0351	40352						
0352	40353						
0353	40354						
0354	40355	Regeneration Reminder Indicator				16-bit Unsigned	2Bytes 0: Off 1: On 4: Flash
0355	40356	Regeneration Inhibit Indicator				16-bit Unsigned	2Bytes 0: Off 1: On
0356	40357	DPF Regeneration Status Indicator				16-bit Unsigned	2Bytes 0: Off 1: On
0357	40358	PCD and NCD Status Indicator				16-bit Unsigned	2Bytes 0: Off 1: On
0358	40359	Urea Temp.		1	°C	16-bit Signed	2Bytes
0359	40360	Urea Level		0.1	%	16-bit Unsigned	2Bytes

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

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

**NOTE3:** When received data is 32766, it represents that there is no normal data, “###” will be displayed.

**NOTE4:** Definition of signed number. Take received data 8000H as the example, transfer it to binary 1000 0000 0000 0000b, the MSB is 1, which is a negative number. One’s complement is obtained by subtracting 1 from it, which is inverted to obtain the absolute value of the negative number. Then transfer it to -32768 in decimal.

**Example:**

Read “Accum. Fuel Consumption (current is 123456L)”, firstly get its address is 0171 and 0172 by checking the table, then it is known that you need to read 2 bytes’ data.

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

**Table 3 Master Request Command**

Slave Address	Function Code	Starting Address (0171)		Request Data Qty. (2)		CRC 16 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
01	03	00	AB	00	02	B5	EB

The slave response command is as following:

**Table 4 Slave Response Command**

Slave	Function	Data Qty.	Data	CRC 16 Calibration
-------	----------	-----------	------	--------------------

Address	Code	(Bytes)	Data MSB of Address 0171	Data LSB of Address 0171	Data MSB of Address 0172	Data LSB of Address 0172	LSB	MSB
<b>01</b>	<b>03</b>	<b>04</b>	<b>E2</b>	<b>40</b>	<b>00</b>	<b>01</b>	<b>0C</b>	<b>5F</b>

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

**Table 5 Data Analysis**

Address	Received Data (Hex)	After Combination (Hex)	Accum. Fuel Consumption (Decimal)
0171	E240H	0001E240H	123456
0172	0001H		

SmartGen

3.2 FUNCTION CODE 05H MAPPING REMOTE COIL FIELD

Table 6 Remote Coil Field

Modbus Address	PLC Address	Item	Description
0000	0001	Remote Start Key	Only send FF00H for active
0001	0002	Remote Stop Key	Only send FF00H for active
0002	0003	Reserved	Only send FF00H for active
0003	0004	Remote Auto Key	Only send FF00H for active
0004	0005	Remote Manual Key	Only send FF00H for active
0005	0006	Remote Mains C/O Key	Only send FF00H for active
0006	0007	Remote Gen C/O Key	Only send FF00H for active
0007	0008	Remote Up Key	Only send FF00H for active
0008	0009	Remote Down Key	Only send FF00H for active
0009	0010	Remote Left Key	Only send FF00H for active
0010	0011	Remote Right Key	Only send FF00H for active
0011	0012	Remote Confirm Key	Only send FF00H for active
0012	0013	Remote Mute Key	Only send FF00H for active
0013	0014	Remote Standby Engine Start Key	Only send FF00H for active
0014	0015	Remote Standby Engine Stop Key	Only send FF00H for active
0015	0016	Remote Oil Engine Fast Start	Only send FF00H for active
0016	0017	Reserved	Only send FF00H for active
0017	0018	Reserved	Only send FF00H for active
0018	0019	Reserved	Only send FF00H for active
0019	0020	Remote Output 1 Active	Send FF00H for active, send 0000H for inactive
0020	0021	Remote Output 2 Active	Send FF00H for active, send 0000H for inactive
0021	0022	Remote Output 3 Active	Send FF00H for active, send 0000H for inactive
0022	0023	Remote Output 4 Active	Send FF00H for active, send 0000H for inactive
0023	0024	Remote Output 5 Active	Send FF00H for active, send 0000H for inactive
0024	0025	Remote Output 6 Active	Send FF00H for active, send 0000H for inactive
0025	0026	Reserved	
0026	0027	Reserved	
0027	0028	Reserved	
0028	0029	Reserved	
0029	0030	Reserved	
0030	0031	Remote Lock/Unlock	Send FF00H for active, send 0000H for inactive

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

**Example:**

Remote control controller to work in auto mode, firstly get its remote address is 0003.

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

**Table 7 Master Request Command**

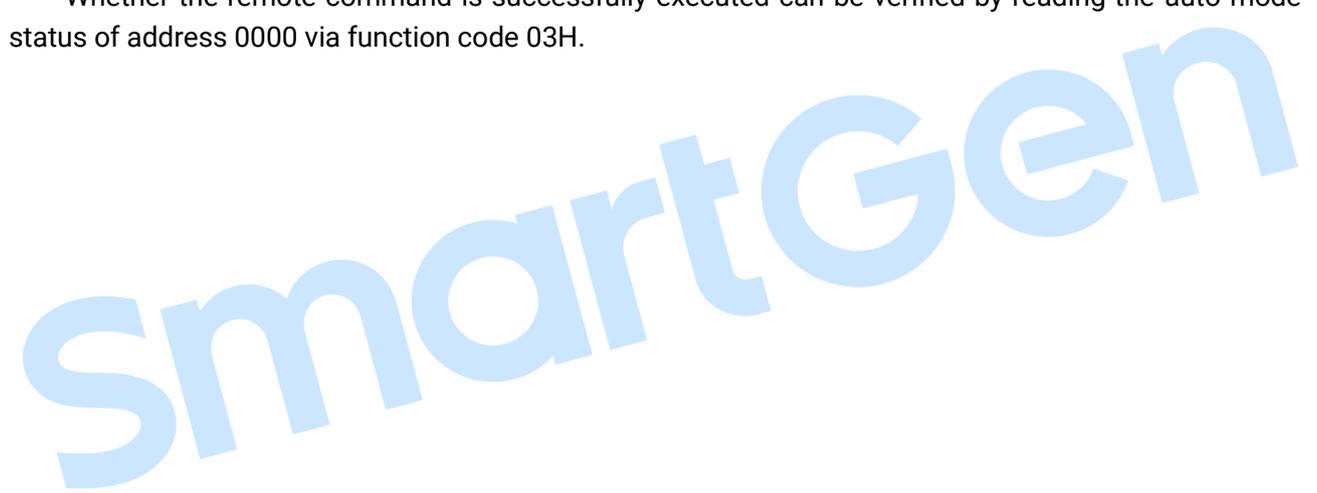
Slave Address	Function Code	Remote Address (0003)		Remote Data		CRC 16 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
<b>01</b>	<b>05</b>	<b>00</b>	<b>03</b>	<b>FF</b>	<b>00</b>	<b>7C</b>	<b>3A</b>

The slave response command is as following:

**Table 8 Slave Response Command**

Slave Address	Function Code	Remote Address (0003)		Remote Data		CRC 16 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
<b>01</b>	<b>05</b>	<b>00</b>	<b>03</b>	<b>FF</b>	<b>00</b>	<b>7C</b>	<b>3A</b>

Whether the remote command is successfully executed can be verified by reading the auto mode status of address 0000 via function code 03H.



3.3 GEN STATUS

Table 9 Gen Status

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

3.4 REMOTE START STATUS

Table 10 Remote Start Status

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

3.5 ATS STATUS

Table 11 HGM7220N ATS Status

No.	Item	Description
0	Load Disconnect	No delay value for this status
1	Mains On-Load	No delay value for this status
2	Gen On-Load	No delay value for this status
3	Open Output	
4	Transfer Rest	
5	Mains Close Delay	
6	Gen Close Delay	
7	Wait Opened	No delay value for this status
8	Wait Gen Closed	No delay value for this status
9	Wait Mains Closed	No delay value for this status
10	Normal	No delay value for this status

**Table 12 HGM7220S ATS Status**

No.	Item	Description
0	Load Disconnect	No delay value for this status
1	Gen Synchronizing	No delay value for this status
2	Gen Close Delay	
3	Wait Gen Closed	No delay value for this status
4	Gen On-load	No delay value for this status
5	Gen Open Delay	
6	Wait Gen Opened	
7	Parallel Delay	
8	Mains Synchronizing	No delay value for this status
9	Mains Close Delay	
10	Wait Mains Closed	No delay value for this status
11	Mains On-Load	No delay value for this status
12	Mains Close Delay	
13	Wait Mains Opened	No delay value for this status
14	Transfer Delay	No delay value for this status
15	Gen Open	No delay value for this status
16	Gen Close	No delay value for this status

**3.6 MAINS STATUS**

**Table 13 Mains Status**

No.	Item	Description
0	Mains Available	No delay value for this status
1	Mains Available Delay	
2	Mains Unavailable	No delay value for this status
3	Mains Unavailable Delay	

## 4. REMOTE START & STOP PROCEDURES

Start procedures:

- 1) Make controller switch to Manual Mode through sending "Remote Manual Key" command of 05 function code;
- 2) Read 0000 address's data through 03 function code, then controller current mode can be obtained, next confirm whether controller is in manual mode; if not, repeat step 1 and 2;
- 3) When controller is in Manual Mode, send "Remote Start Key" command of 05 function code;
- 4) Controller enters start procedure after receiving the command, then generator start procedure can be obtained by reading the generator status data corresponding to "Generator Status Table" via 03 function code;
- 5) If generator status is between 1 (Preheat) to 8 (Wait for Load) of "Generator Status Table", generator will start, otherwise, it can't start, then repeat step 3 and 4;
- 6) If generator is normally running, send "Remote Gen Close/Open Key" command of 05 function code;
- 7) Controller will close the generator breaker after receiving the command, then it can obtain gen close procedures by reading "ATS Status" address data corresponding to "ATS Status Table" via 03 function code;
- 8) If ATS is in 8 (Wait Gen Closed) of "ATS Status Table", it enters close procedure, otherwise, it can't close, then repeat step 6 and 7;
- 9) When generator is normally running and gen breaker is closed, generator takes the load and runs.

Stop method 1:

- 1) Make controller switch to Manual Mode through sending "Remote Manual Key" command of 05 function code;
- 2) Read 0000 address's data through 03 function code, then controller current mode can be obtained, next confirm whether controller is in manual mode; if not, repeat step 1 and 2;
- 3) When controller is in Manual Mode, send "Remote Gen Close/Open Key" command of 05 function code;
- 4) Controller opens the generator after receiving the command, then it can obtain gen open procedures by reading "ATS Status" address data corresponding to "ATS Status Table" via 03 function code;
- 5) If ATS is in 7 (Wait Opened) of "ATS Status Table", it enters open procedure, otherwise, it can't open, then repeat step 3 and 4;
- 6) When ATS is in "Load Disconnect", then gen will be opened, send "Remote Stop Key" command of 05 function code;
- 7) Controller enters stop procedure after receiving the command, generator stop procedure can be obtained by reading generator status data corresponding to "Generator Status Table" via 03 function code;
- 8) If generator status is between 10 (High Speed Cooling) to 13 (Wait for Stop) of "Generator Status Table", it enters stop procedure, otherwise, it can't stop, then repeat step 6 and 7;
- 9) When generator is in standby status and load is disconnected, generator completes stopping.

Stop method 2 (active for auto or manual mode):

- 1) Make controller switch to Stop Mode through sending "Remote Stop Key" command of 05 function code;

- 2) Read 0000 address's data through 03 function code, then controller current mode can be obtained, next confirm whether controller is in stop mode; if not, repeat step 1 and 2;
- 3) When controller is in Stop Mode, generator enters stop procedure;
- 4) Gen open procedures can be obtained by reading "ATS Status" address data corresponding to "ATS Status Table" via 03 function code; gen stop procedure can be obtained by reading generator status corresponding to "Generator Status Table" via 03 function code;
- 5) When generator is in standby status and load is disconnected, generator completes stopping.

**NOTE1:** Only once for each time to send remote key command of 05 function code.

**NOTE2:** When generator is starting, if controller receives "Remote Start Key" command or press start key, it will jump to next status and enter gen on-load running status quickly.

**NOTE3:** When generator is stopping, if controller receives "Remote Stop Key" command or press stop key, it will jump to next status and enter stop status quickly.

## 5. COMMUNICATION PARAMETER VIEWING AND CONFIGURATION

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

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

## 6. FAQ

### 6.1 COMMUNICATION LINE SHIELDING LAYER GROUNDED

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

### 6.2 TERMINAL RESISTOR

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

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

### 6.3 RS485 TO USB COMMUNICATION ADAPTOR

PC can communicate with SG72A module produced by our company.

### 6.4 EXTENDED COMMUNICATION DISTANCE

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



Fig.3 SGCAN300 Application Diagram

### 6.5 COMMON SOLUTIONS OF COMMUNICATION FAILURE

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

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

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