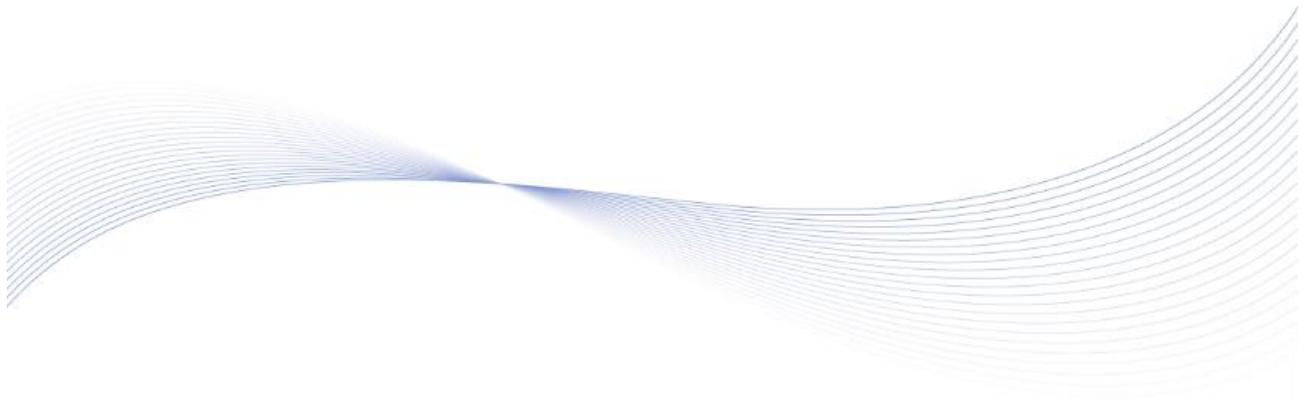




APC1700
ENGINE PUMP CONTROLLER
COMMUNICATION PROTOCOL



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

SmartGen Registered trademark

No. 28 Xuemei Street, Zhengzhou, Henan, China

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

+86-371-67981000(overseas)

Fax: +86-371-67992952

Web: www.smartgen.com.cn/

www.smartgen.cn/

Email: sales@smartgen.cn

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Table 1 Software Version

Date	Version	Content
2025-04-27	V1.0	Original release.

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SmartGen

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.

There is one RS485 port on the APC1700 controller.

The RS485 port is used as 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: 9600/19200/38400bps (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: 1-bit)

Function code supported: 03H, and 05H. Function code 03H is used for reading controller's alarms, status and related parameters; Function code 05H is used for sending remote command.

Data checking method: CRC16.

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

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

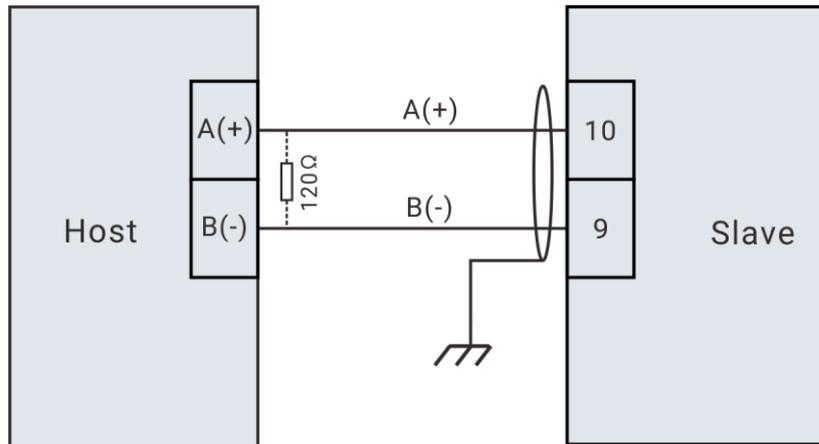


Fig.1 Single Device Communication Wiring Diagram

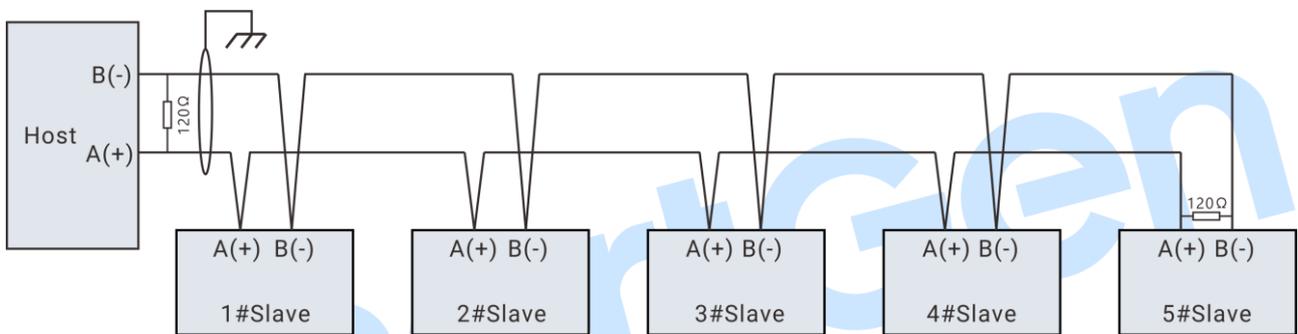


Fig.2 Multiple Devices Communication Wiring Diagram

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

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

Table 2 Alarm and Coil Status of Data Field

Modbus Address	PLC Address	Item	Description
0000.0	40001.0	Common Alarm	"0" means no common alarm occurs "1" means there are common alarms (0000.0 means the Boolean value of bit 0 at address 0) The content listed below follows the same rule
0000.1	40001.1	Common Shutdown	
0000.2	40001.2	Common Warning	
0000.3	40001.3	Reserved	
0000.4	40001.4	Reserved	
0000.5	40001.5	Reserved	
0000.6	40001.6	Reserved	
0000.7	40001.7	Reserved	
0000.8	40001.8	Reserved	
0000.9	40001.9	System in Auto Mode	
0000.10	40001.10	System in Manual Mode	
0000.11	40001.11	System in Stop Mode	
0000.12	40001.12	Reserved	
0000.13	40001.13	Reserved	
0000.14	40001.14	Manual Heating Status	
0000.15	40001.15	Lock Mode	
0001.0	40002.0	Emergency Stop	
0001.1	40002.1	Overspeed Shutdown	
0001.2	40002.2	Underspeed Shutdown	
0001.3	40002.3	Loss of Speed Signal Alarm	
0001.4	40002.4	Reserved	
0001.5	40002.5	Reserved	
0001.6	40002.6	Reserved	
0001.7	40002.7	Reserved	
0001.8	40002.8	Failed to Start Alarm	
0001.9	40002.9	Reserved	
0001.10	40002.10	Reserved	
0001.11	40002.11	Reserved	
0001.12	40002.12	Low Water Level Input Shutdown	
0001.13	40002.13	Low Coolant Level Input Shutdown	

Modbus Address	PLC Address	Item	Description
0001.14	40002.14	High Temp. Input Shutdown	
0001.15	40002.15	Low Oil Pressure Input Shutdown	
0002.0	40003.0	Reserved	
0002.1	40003.1	Reserved	
0002.2	40003.2	Reserved	
0002.3	40003.3	Reserved	
0002.4	40003.4	Reserved	
0002.5	40003.5	Reserved	
0002.6	40003.6	Reserved	
0002.7	40003.7	Reserved	
0002.8	40003.8	Aux. Sensor 1 Open Shutdown	
0002.9	40003.9	Aux. Sensor 1 High Shutdown	
0002.10	40003.10	Aux. Sensor 1 Low Shutdown	
0002.11	40003.11	Reserved	
0002.12	40003.12	Aux. Sensor 2 Open Shutdown	
0002.13	40003.13	Aux. Sensor 2 High Shutdown	
0002.14	40003.14	Aux. Sensor 2 Low Shutdown	
0002.15	40003.15	Reserved	
0003.0	40004.0	Aux. Sensor 3 Open Shutdown	
0003.1	40004.1	Aux. Sensor 3 High Shutdown	
0003.2	40004.2	Aux. Sensor 3 Low Shutdown	
0003.3	40004.3	Reserved	
0003.4	40004.4	Aux. Sensor 4 Open Shutdown	
0003.5	40004.5	Aux. Sensor 4 High Shutdown	
0003.6	40004.6	Aux. Sensor 4 Low Shutdown	
0003.7	40004.7	Reserved	
0003.8	40004.8	Aux. Sensor 5 Open Shutdown	
0003.9	40004.9	Aux. Sensor 5 High Shutdown	
0003.10	40004.10	Aux. Sensor 5 Low Shutdown	
0003.11	40004.11	Reserved	
0003.12	40004.12	Reserved	
0003.13	40004.13	Reserved	
0003.14	40004.14	Reserved	
0003.15	40004.15	Reserved	
0004.0	40005.0	Reserved	
0004.1	40005.1	Reserved	
0004.2	40005.2	Reserved	
0004.3	40005.3	Reserved	
0004.4	40005.4	Reserved	
0004.5	40005.5	Reserved	
0004.6	40005.6	Reserved	
0004.7	40005.7	Reserved	

Modbus Address	PLC Address	Item	Description
0004.8	40005.8	Reserved	
0004.9	40005.9	Reserved	
0004.10	40005.10	Reserved	
0004.11	40005.11	Reserved	
0004.12	40005.12	Reserved	
0004.13	40005.13	Reserved	
0004.14	40005.14	Reserved	
0004.15	40005.15	Reserved	
0005.0	40006.0	Input 1 Shutdown	
0005.1	40006.1	Input 2 Shutdown	
0005.2	40006.2	Input 3 Shutdown	
0005.3	40006.3	Input 4 Shutdown	
0005.4	40006.4	Input 5 Shutdown	
0005.5	40006.5	Reserved	
0005.6	40006.6	Reserved	
0005.7	40006.7	Reserved	
0005.8	40006.8	Reserved	
0005.9	40006.9	Reserved	
0005.10	40006.10	Reserved	
0005.11	40006.11	Reserved	
0005.12	40006.12	Reserved	
0005.13	40006.13	Over Flow Shutdown	
0005.14	40006.14	Reserved	
0005.15	40006.15	Reserved	
0006.0	40007.0	Engine Oil Filter Time Over	
0006.1	40007.1	Engine Fuel Filter Time Over	
0006.2	40007.2	Engine Lubricant Time Over	
0006.3	40007.3	Engine Air Filter Time Over	
0006.4	40007.4	Maintenance 5 Time Over	
0006.5	40007.5	Maintenance 6 Time Over	
0006.6	40007.6	Maintenance 7 Time Over	
0006.7	40007.7	Maintenance 8 Time Over	
0006.8	40007.8	Maintenance 9 Time Due	
0006.9	40007.9	Maintenance 10 Time Over	
0006.10	40007.10	Reserved	
0006.11	40007.11	Reserved	
0006.12	40007.12	Reserved	
0006.13	40007.13	Reserved	
0006.14	40007.14	Reserved	
0006.15	40007.15	Reserved	
0007 ~00019	40008 ~40020	Reserved	
0020.0	40021.0	Overspeed Warning	

Modbus Address	PLC Address	Item	Description
0020.1	40021.1	Underspeed Warning	
0020.2	40021.2	Loss of Speed Signal Warning	
0020.3	40021.3	Reserved	
0020.4	40021.4	Reserved	
0020.5	40021.5	Reserved	
0020.6	40021.6	Reserved	
0020.7	40021.7	Reserved	
0020.8	40021.8	Failed to Stop Warning	
0020.9	40021.9	Reserved	
0020.10	40021.10	Battery Overvoltage Warning	
0020.11	40021.11	Battery Undervoltage Warning	
0020.12	40021.12	Reserved	
0020.13	40021.13	Reserved	
0020.14	40021.14	Reserved	
0020.15	40021.15	Reserved	
0021.0	40022.0	Reserved	
0021.1	40022.1	Reserved	
0021.2	40022.2	Reserved	
0021.3	40022.3	Reserved	
0021.4	40022.4	Reserved	
0021.5	40022.5	Reserved	
0021.6	40022.6	Reserved	
0021.7	40022.7	Reserved	
0021.8	40022.8	Aux. Sensor 1 Open Warning	
0021.9	40022.9	Aux. Sensor 1 High Warning	
0021.10	40022.10	Aux. Sensor 1 Low Warning	
0021.11	40022.11	Reserved	
0021.12	40022.12	Aux. Sensor 2 Open Warning	
0021.13	40022.13	Aux. Sensor 2 High Warning	
0021.14	40022.14	Aux. Sensor 2 Low Warning	
0021.15	40022.15	Reserved	
0022.0	40023.0	Aux. Sensor 3 Open Warning	
0022.1	40023.1	Aux. Sensor 3 High Warning	
0022.2	40023.2	Aux. Sensor 3 Low Warning	
0022.3	40023.3	Reserved	
0022.4	40023.4	Aux. Sensor 4 Open Warning	
0022.5	40023.5	Aux. Sensor 4 High Warning	
0022.6	40023.6	Aux. Sensor 4 Low Warning	
0022.7	40023.7	Aux. Sensor 4 Error	
0022.8	40023.8	Aux. Sensor 5 Open Warning	
0022.9	40023.9	Aux. Sensor 5 High Warning	
0022.10	40023.10	Aux. Sensor 5 Low Warning	
0022.11	40023.11	Reserved	

Modbus Address	PLC Address	Item	Description
0022.12	40023.12	Reserved	
0022.13	40023.13	Reserved	
0022.14	40023.14	Reserved	
0022.15	40023.15	Reserved	
0023.0	40024.0	Reserved	
0023.1	40024.1	Reserved	
0023.2	40024.2	Reserved	
0023.3	40024.3	Reserved	
0023.4	40024.4	Reserved	
0023.5	40024.5	Reserved	
0023.6	40024.6	Reserved	
0023.7	40024.7	Reserved	
0023.8	40024.8	Reserved	
0023.9	40024.9	High Outlet Pressure to Idle Warning	
0023.10	40024.10	Reserved	
0023.11	40024.11	Reserved	
0023.12	40024.12	Over Flow Warning	
0023.13	40024.13	Reserved	
0023.14	40024.14	Reserved	
0023.15	40024.15	Reserved	
0024.0	40025.0	Input 1 Warning	
0024.1	40025.1	Input 2 Warning	
0024.2	40025.2	Input 3 Warning	
0024.3	40025.3	Input 4 Warning	
0024.4	40025.4	Input 5 Warning	
0024.5	40025.5	Reserved	
0024.6	40025.6	Reserved	
0024.7	40025.7	Reserved	
0024.8	40025.8	Reserved	
0024.9	40025.9	Reserved	
0024.10	40025.10	Reserved	
0024.11	40025.11	Reserved	
0024.12	40025.12	Reserved	
0024.13	40025.13	Reserved	
0024.14	40025.14	Reserved	
0024.15	40025.15	Reserved	
0025.0	40026.0	Engine Oil Filter Time Over	
0025.1	40026.1	Engine Fuel Filter Time Over	
0025.2	40026.2	Engine Lubricant Time Over	
0025.3	40026.3	Engine Air Filter Time Over	
0025.4	40026.4	Maintenance 5 Time Over	
0025.5	40026.5	Maintenance 6 Time Over	

Modbus Address	PLC Address	Item	Description
0025.6	40026.6	Maintenance 7 Time Over	
0025.7	40026.7	Maintenance 8 Time Over	
0025.8	40026.8	Maintenance 9 Time Due	
0025.9	40026.9	Maintenance 10 Time Over	
0025.10	40026.10	Reserved	
0025.11	40026.11	Reserved	
0025.12	40026.12	Reserved	
0025.13	40026.13	Reserved	
0025.14	40026.14	Reserved	
0025.15	40026.15	Reserved	
0026 ~0032	40027 ~40033	Reserved	
0033.0	40034.0	Reserved	
0033.1	40034.1	Reserved	
0033.2	40034.2	Reserved	
0033.3	40034.3	Reserved	
0033.4	40034.4	Reserved	
0033.5	40034.5	Reserved	
0033.6	40034.6	Reserved	
0033.7	40034.7	Reserved	
0033.8	40034.8	Reserved	
0033.9	40034.9	Reserved	
0033.10	40034.10	Reserved	
0033.11	40034.11	Reserved	
0033.12	40034.12	Reserved	
0033.13	40034.13	Reserved	
0033.14	40034.14	Reserved	
0033.15	40034.15	Reserved	
0034.0	40035.0	Reserved	
0034.1	40035.1	Reserved	
0034.2	40035.2	Reserved	
0034.3	40035.3	Reserved	
0034.4	40035.4	Reserved	
0034.5	40035.5	Reserved	
0034.6	40035.6	Reserved	
0034.7	40035.7	Reserved	
0034.8	40035.8	Reserved	
0034.9	40035.9	Reserved	
0034.10	40035.10	Reserved	
0034.11	40035.11	Reserved	
0034.12	40035.12	Reserved	
0034.13	40035.13	Reserved	
0034.14	40035.14	Reserved	

Modbus Address	PLC Address	Item	Description
0034.15	40035.15	Reserved	
0035.0	40036.0	Emergency Stop Input Status	"0" means there is no signal input. "1" means there is signal input.
0035.1	40036.1	Input 1 Status	
0035.2	40036.2	Input 2 Status	
0035.3	40036.3	Input 3 Status	
0035.4	40036.4	Input 4 Status	
0035.5	40036.5	Input 5 Status	
0035.6	40036.6	Reserved	
0035.7	40036.7	Reserved	
0035.8	40036.8	Reserved	
0035.9	40036.9	Reserved	
0035.10	40036.10	Reserved	
0035.11	40036.11	Reserved	
0035.12	40036.12	Reserved	
0035.13	40036.13	Reserved	
0035.14	40036.14	Reserved	
0035.15	40036.15	Reserved	
0036	40037	Reserved	
0037.0	40038.0	Fuel Relay Output Status	"1" means there is signal output. "0" means there is no signal output.
0037.1	40038.1	Crank Relay Output Status	
0037.2	40038.2	Aux. Output 1 Status	
0037.3	40038.3	Aux. Output 2 Status	
0037.4	40038.4	Aux. Output 3 Status	
0037.5	40038.5	Aux. Output 4 Status	
0037.6	40038.6	Reserved	
0037.7	40038.7	Reserved	
0037.8	40038.8	Reserved	
0037.9	40038.9	Reserved	
0037.10	40038.10	Reserved	
0037.11	40038.11	Reserved	
0037.12	40038.12	Reserved	
0037.13	40038.13	Reserved	
0037.14	40038.14	Reserved	
0037.15	40038.15	Reserved	
0038 ~0042	40039 ~40043	Reserved	
0043.0	40044.0	Reserved	
0043.1	40044.1	Reserved	
0043.2	40044.2	Reserved	
0043.3	40044.3	Reserved	
0043.4	40044.4	Running Status Indicator	"1" means the status indicator is on

Modbus Address	PLC Address	Item	Description
			"0" means the status indicator is off
0043.5	40044.5	Reserved	
0043.6	40044.6	Reserved	
0043.7	40044.7	Reserved	
0043.8	40044.8	Idle Running Status	
0043.9	40044.9	Reserved	
0043.10	40044.10	Reserved	
0043.11	40044.11	Reserved	
0043.12	40044.12	Reserved	
0043.13	40044.13	Reserved	
0043.14	40044.14	Reserved	
0043.15	40044.15	Reserved	
0044.0	40045.0	Reserved	
0044.1	40045.1	Reserved	
0044.2	40045.2	Reserved	
0044.3	40045.3	Reserved	
0044.4	40045.4	Reserved	
0044.5	40045.5	Reserved	
0044.6	40045.6	Reserved	
0044.7	40045.7	Reserved	
0044.8	40045.8	Reserved	
0044.9	40045.9	Reserved	
0044.10	40045.10	Reserved	
0044.11	40045.11	Reserved	
0044.12	40045.12	Reserved	
0044.13	40045.13	Reserved	
0044.14	40045.14	Reserved	
0044.15	40045.15	Reserved	
0045.0	40046.0	Input 1 Active	"0" means the input is inactive. "1" means the input is active.
0045.1	40046.1	Input 2 Active	
0045.2	40046.2	Input 3 Active	
0045.3	40046.3	Input 4 Active	
0045.4	40046.4	Input 5 Active	
0045.5	40046.5	Reserved	
0045.6	40046.6	Reserved	
0045.7	40046.7	Reserved	
0045.8	40046.8	Reserved	
0045.9	40046.9	Reserved	
0045.10	40046.10	Reserved	
0045.11	40046.11	Reserved	
0045.12	40046.12	Reserved	
0045.13	40046.13	Reserved	

Modbus Address	PLC Address	Item	Description
0045.14	40046.14	Reserved	
0045.15	40046.15	Reserved	
0046	0047	Reserved	

EXAMPLE:

If “Overspeed Shutdown” and “High Engine Temp. Shutdown” need to be read, check the table above and find their coil addresses are 0001.1 and 0002.1, so it needs to read two data addresses.

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 (0001)		Request Data Length (2)		CRC 16	
		MSB	LSB	MSB	LSB	LSB	MSB
01	03	00	01	00	02	95	CB

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 0001 MSB	Data of Address 0001 LSB	Data of Address 0002 MSB	Data of Address 0002 LSB	LSB	MSB
01	03	04	00	02	00	02	DA	32

Table 5 Data Analysis

Address	Data Received (Hex)	Convert to Binary	Meaning
0001	0002H	0000 0000 0000 0010 (Mapping to 0001.15, 0001.14,....., 0001.1, 0001.0 respectively)	Data of 0001.1 is 1, which means “Overspeed Shutdown” is active
0002	0002H	0000 0000 0000 0010 (Mapping to 0002.15, 0002.14,, 0002.1, 0002.0 respectively)	Data of 0002.1 is 1, which means “High Engine Temp. Shutdown” is active.

3.2 FUNCTION CODE 03H MAPPING PARAMETERS OF DATA FIELD

Table 6 Parameters of Data Field

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remarks
47 ~49	40048 ~40050	Reserved					
50	40051	Engine Speed	(0~6000)	1	r/min	16-bit Unsigned	
51	40052	Battery Voltage	(0~600)	0.1	V	16-bit Unsigned	
52	40053	Reserved					
53	40054	Reserved					
54	40055	Reserved					
55	40056	Reserved					
56	40057	Reserved					
57	40058	Sensor 1 Resistance	(0~65535)	0.1		16-bit Unsigned	
58	40059	Sensor 1 Value (Aux. 1)	(-50~+32767)	1	°C	16-bit Signed	
59	40060	Sensor 2 Resistance	(0~65535)	0.1		16-bit Unsigned	
60	40061	Sensor 2 Value (Aux. 2)	(0~32767)	1	kPa	16-bit Signed	
61	40062	Sensor 3 Resistance	(0~65535)	0.1		16-bit Unsigned	
62	40063	Sensor 3 Value (Aux. 3)	(0~32767)	1	%	16-bit Signed	
63	40064	Sensor 4 Resistance/Current/Voltage Value	(0~65535)	Ω/mA: 0.1; V: 0.01		16-bit Unsigned	
64	40065	Sensor 4 Value (Aux. 4)	(-50~+32767)			16-bit Signed	
65	40066	Sensor 5 Current	(0~65535)	0.1		16-bit Unsigned	
66	40067	Sensor 5 Value (Aux. 5)	(-50~+32767)			16-bit Signed	
67 ~93	40068 ~40094	Reserved					
94	40095	Engine Running Status	(0-15)	No.		16-bit Unsigned	Table 13
95	40096	Engine Delay	(0-3600)	1	s	16-bit Unsigned	
96	40097	Engine Remote Status	(0-2)	No.		16-bit Unsigned 1: Remote Start 2: Remote Stop	
97	40098	Reserved					
98	40099	Remote Start Type	(0-3)	No.		16-bit Unsigned 1: Remote Start 2: High Water Level Start 3: Low Pipe Pressure Start	
99 ~100	40100 ~40101	Reserved					
101	40102	Total Running Hours	(0-65535)	1	h	16-bit Unsigned	
102	40103	Total Running Minutes	(0~59)	1	min	16-bit Unsigned	

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remarks
103	40104	Total Running Seconds	(0~59)	1	s	16-bit Unsigned	
104	40105	Total Start Times	(0-65535)	1		16-bit Unsigned	
105 ~112	40106 ~40113	Reserved					
113	40114	Reserved					
114	40115	Controller Software Version		0.1			
115	40116	Controller Hardware Version		0.1			
116	40117	Release Year	(0-99)	1		Save the last two digits of the Year only.	
117	40118	Release Month	(1-12)	1		16-bit Unsigned	
118	40119	Released Day	(1-31)	1		16-bit Unsigned	
119	40120	PC Software Version	(0-65535)	1		16-bit Unsigned	
120	40121	Number of Event Logs	(0-99)	1		16-bit Unsigned	
121	40122	Reserved					
122	40123	Reserved					
123	40124	Reserved					
124	40125	Reserved					
125	40126	Reserved					
126	40127	Reserved					
127	40128	Reserved					
128	40129	Current Running Hours	(0-65535)	1	h	16-bit Unsigned	
129	40130	Current Running Minutes	(0~59)	1	min	16-bit Unsigned	
130	40131	Current Running Seconds	(0~59)	1	s	16-bit Unsigned	
131 132	40132 40133	Current Flow Rate	(0-99999999)	1	m ³	32-bit Unsigned	
133 134	40134 40135	Total Flow Rate	(0-99999999)	1	m ³	32-bit Unsigned	
135 ~159	40136 ~40160	Reserved					
160	40161	Maintenance 1 Countdown Hour	(0-65535)	1	h	16-bit Unsigned	
161	40162	Maintenance 1 Countdown Minute	(0~59)	1	min	16-bit Unsigned	
162	40163	Maintenance 1 Countdown Second	(0~59)	1	s	16-bit Unsigned	
163	40164	Maintenance 2 Countdown Hour	(0-65535)	1	h	16-bit Unsigned	
164	40165	Maintenance 2 Countdown Minute	(0~59)	1	min	16-bit Unsigned	

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remarks
		Countdown Minute					
165	40166	Maintenance 2 Countdown Second	(0~59)	1	s	16-bit Unsigned	
166	40167	Maintenance 3 Countdown Hour	(0-65535)	1	h	16-bit Unsigned	
167	40168	Maintenance 3 Countdown Minute	(0~59)	1	min	16-bit Unsigned	
168	40169	Maintenance 3 Countdown Second	(0~59)	1	s	16-bit Unsigned	
169	40170	Maintenance 4 Countdown Hour	(0-65535)	1	h	16-bit Unsigned	
170	40171	Maintenance 4 Countdown Minute	(0~59)	1	min	16-bit Unsigned	
171	40172	Maintenance 4 Countdown Second	(0~59)	1	s	16-bit Unsigned	
172	40173	Maintenance 5 Countdown Hour	(0-65535)	1	h	16-bit Unsigned	
173	40174	Maintenance 5 Countdown Minute	(0~59)	1	min	16-bit Unsigned	
174	40175	Maintenance 5 Countdown Second	(0~59)	1	s	16-bit Unsigned	
175	40176	Maintenance 6 Countdown Hour	(0-65535)	1	h	16-bit Unsigned	
176	40177	Maintenance 6 Countdown Minute	(0~59)	1	min	16-bit Unsigned	
177	40178	Maintenance 6 Countdown Second	(0~59)	1	s	16-bit Unsigned	
178	40179	Maintenance 7 Countdown Hour	(0-65535)	1	h	16-bit Unsigned	
179	40180	Maintenance 7 Countdown Minute	(0~59)	1	min	16-bit Unsigned	
180	40181	Maintenance 7 Countdown Second	(0~59)	1	s	16-bit Unsigned	
181	40182	Maintenance 8 Countdown Hour	(0-65535)	1	h	16-bit Unsigned	
182	40183	Maintenance 8 Countdown Minute	(0~59)	1	min	16-bit Unsigned	
183	40184	Maintenance 8 Countdown Second	(0~59)	1	s	16-bit Unsigned	
184	40185	Maintenance 9 Countdown Hour	(0-65535)	1	h	16-bit Unsigned	
185	40186	Maintenance 9 Countdown Minute	(0~59)	1	min	16-bit Unsigned	

Modbus Address	PLC Address	Item	Range (Decimal)	Ratio	Unit	Description	Remarks
186	40187	Maintenance 9 Countdown Second	(0~59)	1	s	16-bit Unsigned	
187	40188	Maintenance 10 Countdown Hour	(0~65535)	1	h	16-bit Unsigned	
188	40189	Maintenance 10 Countdown Minute	(0~59)	1	min	16-bit Unsigned	
189	40190	Maintenance 10 Countdown Second	(0~59)	1	s	16-bit Unsigned	
190	40191	Engine Temperature	(-50~+32767)	1	°C	16-bit Signed	
191	40192	Engine Oil Pressure	(0~32767)	1	kPa	16-bit Signed	
192	40193	Engine Fuel Level	(0~32767)	1	%	16-bit Signed	
193	40194	Outlet Pressure	(0~32767)	1	kPa	16-bit Signed	
194	40195	Flow Rate	(0~65535)	1	m ³ /h	16-bit Unsigned	
195	40196	Head	(0~65535)	1	m	16-bit Unsigned	
196	40197	Pipe Pressure	(0~32767)	1	kPa	16-bit Signed	
197 ~216	40198 ~40217	Reserved					
217	40218	Controller Model					

NOTE 1: Actual value = data received * ratio. Take the Voltage as the example: if the data received is 276 (114H), ratio is 0.1V, then the actual Frequency value is 27.6V (276*0.1V).

NOTE 2: The 4-byte data uses CDAB byte order, so 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: If data received is 32767, it means there is no normal data, and “+++” will be shown.

NOTE 5: 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 “Total Flow Rate” (current value is 123456 m³/h) needs to be read, check the table above and find its coil address is 0133 and 0134, so it needs to read two bytes of addresses.

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

Table 7 Master Request Command

Slave Address	Function Code	Start Address (0133)		Request Data Length (2)		CRC 16	
		MSB	LSB	MSB	LSB	LSB	MSB
01	03	00	85	00	02	D5	E2

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 0133 MSB	Data of Address 0133 LSB	Data of Address 0134 MSB	Data of Address 0134 LSB	LSB	MSB
01	03	04	E2	40	00	01	0C	5F

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

Table 9 Data Analysis

Address	Data Received (Hex)	Data Combined (Hex)	Total Flow Rate (Decimal)
0133	E240H	0001E240H	123456
0134	0001H		



3.3 FUNCTION CODE 05H MAPPING REMOTE COIL FIELD

Table 10 Remote Coil Field

Modbus Address	PLC Address	Item	Description
0	1	Remote Start Key	Active only when sending FF00H
1	2	Remote Stop Key	Active only when sending FF00H
2	3	Reserved	
3	4	Remote Auto Mode	Active only when sending FF00H
4	5	Reserved	
5	6	Reserved	
6	7	Reserved	
7	8	Reserved	
8	9	Remote Down Key	Active only when sending FF00H
9	10	Reserved	
10	11	Reserved	
11	12	Remote Confirm Key	Active only when sending FF00H
12	13	Remote Return Key	Active only when sending FF00H
13	14	Reserved	
14	15	Reserved	
15	16	Reserved	
16	17	Reserved	
17	18	Reserved	
18	19	Remote Unlock	Active only when sending FF00H
19	20	Remote Lock	Active only when sending FF00H
20	21	Remote Output 1	Active only when sending FF00H
21	22	Remote Output 2	Active only when sending FF00H
22	23	Remote Output 3	Active only when sending FF00H
23	24	Remote Output 4	Active only when sending FF00H
24	25	Reserved	
25	26	Reserved	
26	27	Reserved	
27	28	Reserved	
28	29	Reserved	
29	30	Reserved	

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

EXAMPLE:

If the controller is controlled remotely to stop, and the remote address is 1.

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

Table 11 Master Request Command

Slave Address	Function Code	Remote Address (1)		Remote Data		CRC 16	
		MSB	LSB	MSB	LSB	LSB	MSB
01	05	00	01	FF	00	DD	FA

The slave response command is as following:

Table 12 Slave Response Command

Slave Address	Function Code	Remote Address (1)		Remote Data		CRC 16	
		MSB	LSB	MSB	LSB	LSB	MSB
01	05	00	01	FF	00	DD	FA

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4 ENGINE RUNNING STATUS

4.1 ENGINE RUNNING STATUS

Table 13 Engine Running Status

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

5 CONFIGURATION OF COMMUNICATION PARAMETERS

- 1) In the homepage of main screen, press and hold the  key to enter the menu page;
- 2) Press the Down key to select the "Parameter Set", then press the  key to enter the parameters password page;
- 3) Enter the correct password (**Default: 01234**), press the  key to get into the parameter main page;
- 4) Press the  key to select "Module Set", and press the  key to enter the submenu;
- 5) Press the  and  key to select "Comm. Address", then press the  key to edit the parameter, the corresponding parameters will be selected;
- 6) Press the  Up key and  Down key to edit the parameter value, then press the  Confirm key to move the cursor. After the last bit is modified, press the  Confirm key to save the parameter;
- 7) The setting of "RS485 Comm. Setting" is same as the method above, and parameters of "Baud Rate", "Stop Bit" and "Parity Bit" are available to set in the "RS485 Comm. Setting";

NOTE: The configuration takes effect after the controller is restarted once the RS485 communication setting is completed.

6 FAQ

6.1 GROUNDING OF THE CABLE SHIELD

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

6.2 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.

6.3 RS485 TO USB CONVERTER

It can communicate with PC via the SmartGen SG72A converter.

6.4 EXTEND TRANSMISSION DISTANCE

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

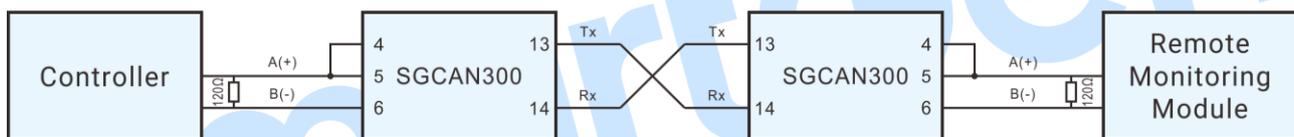


Fig.3 SGCAN300 Application Diagram

6.5 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;
- 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 too high, and the recommended interval between two read operations is no less than 500ms;
- 11) Please configure each controller's communication module address before networking. Same module address is not allowed in one network;
- 12) Modbus serial protocol does not support multiple masters, so multiple software can not communicate with the controller at the same time;
- 13) 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;
- 14) 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;
- 15) It is recommended to download third-party communication test software to verify whether the serial communication is normal, such as modscan32, modbus poll, etc.

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