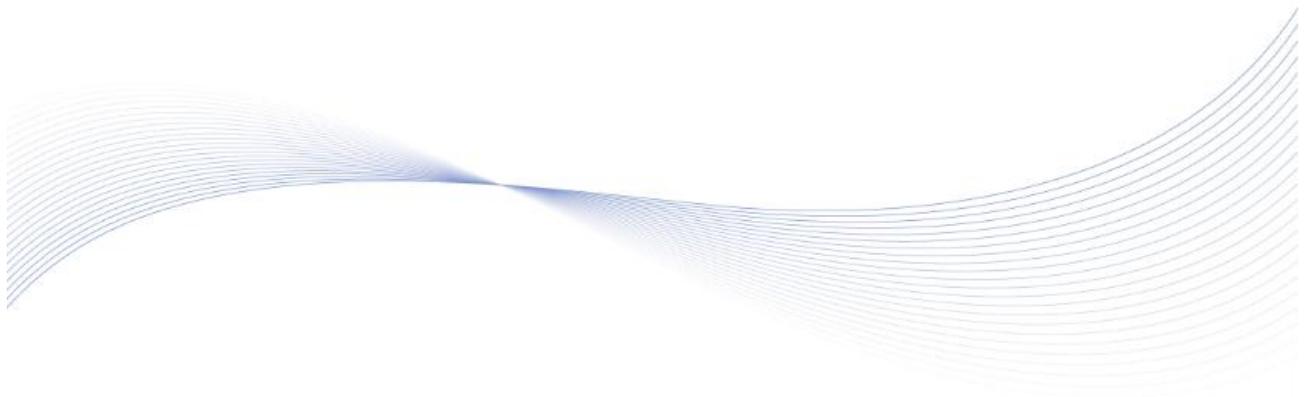


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**SmartGen**

MAKING CONTROL SMARTER

**HMAT821**  
**MEDIUM VOLTAGE BUS TIE CONTROLLER**  
**COMMUNICATION PROTOCOL**



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

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**SmartGen 众智** Chinese trademark

**SmartGen** English trademark

**SmartGen** – make your generator *smart*

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**Table 1 – Software Version**

Date	Version	Content
2022-05-24	V1.0	Original release.

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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 for the third-party to develop and use.

HMAT821 controller has 2 RS485 interfaces with same communication protocol.

The controller is used as a slave, using Modbus-RTU protocol, and 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/Odd/Even Parity (default: no parity)

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

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

Data check mode: CRC16.

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

Communication timeout period: over 200ms.

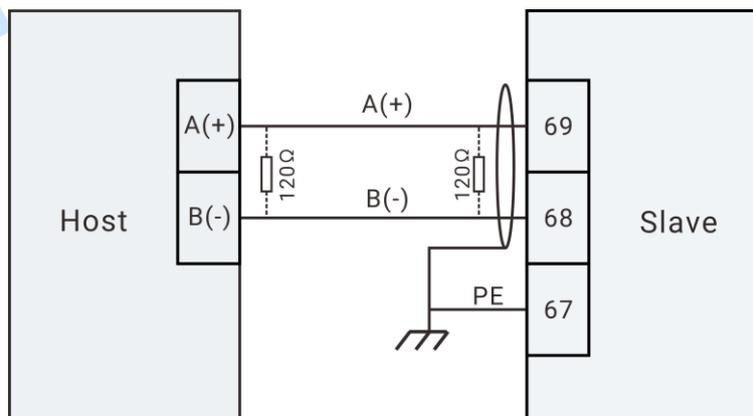
Communication distance: 9600 baud rate, the longest distance can reach 1,000m when using 120Ω shielding twisted pair.

Once maximum 120 data of word register can be read.

Up to 32 controllers can be connected together for network communication.

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

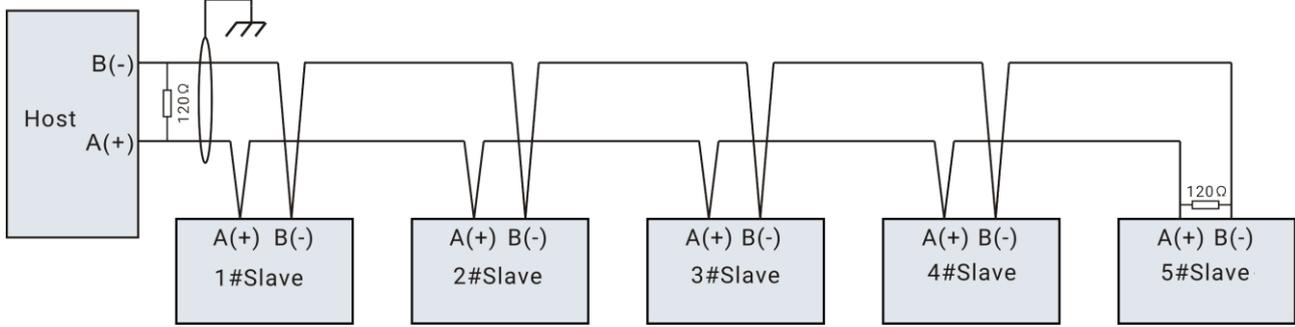
## 2. WIRING DIAGRAM



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

**NOTE1:** 2 120Ω impedance resistors can be connected automatically according to site situation, details refer to the following description.

**NOTE2:** This figure is RS485-1 wiring diagram, RS485-2 wiring diagram is as above.



**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.

**3. CONTROLLER INTERNAL REGISTER ADDRESS AND DATA**

**3.1 ILLUSTRATION**

In the following table, S1 refers to 1# power, S2 refers to 2# power, “/” means this item is reserved.

**3.2 ALARM, STATUS COIL DATA FIELD CORRESPONDING TO FUNCTION CODE 03H**

**Table 2 – Alarm, Status Coil Data Field**

Modbus Address	PLC Address	Name	Description
500.0	40501.0	Common Alarm	0 means no common alarm occurs; 1 means there is common alarm. (500.0 is the boolean value of bit 0 of address 500) The following contents in turn.
500.1	40501.1	Common Warn Alarm	
500.2	40501.2	Common Fault Alarm	
500.3	40501.3	/	
500.4	40501.4	/	
500.5	40501.5	/	
500.6	40501.6	Audible Alarm	
500.7	40501.7	/	
500.8	40501.8	Auto Mode	0: Manual Mode 1: Auto Mode
500.9	40501.9	/	
500.10	40501.10	S1 Master	S1 refers to 1# power. 1 means 1# power as common power; 0 means 1# power as backup power.
500.11	40501.11	S2 Master	S2 refers to 2# power. 1 means 2# power as common power; 0 means 2# power as backup power.
500.12	40501.12	/	

Modbus Address	PLC Address	Name	Description
500.13	40501.13	/	
500.14	40501.14	/	
500.15	40501.15	Genset Start Output	0 means genset start signal not output; 1 means genset start signal outputs.
501.0	40502.0	S1 Voltage Normal	
501.1	40502.1	S1 Voltage Abnormal	
501.2	40502.2	S1 Volt Instant. Abnormal	
501.3	40502.3	/	
501.4	40502.4	/	
501.5	40502.5	/	
501.6	40502.6	/	
501.7	40502.7	/	
501.8	40502.8	S1 Blackout	
501.9	40502.9	S1 Over Voltage	
501.10	40502.10	S1 Under Voltage	
501.11	40502.11	S1 Over Frequency	
501.12	40502.12	S1 Under Frequency	
501.13	40502.13	S1 Loss of Phase	
501.14	40502.14	S1 Reverse Phase Seq.	
501.15	40502.15	/	
502.0	40503.0	S2 Voltage Normal	
502.1	40503.1	S2 Voltage Abnormal	
502.2	40503.2	S2 Volt Instant. Abnormal	
502.3	40503.3	/	
502.4	40503.4	/	
502.5	40503.5	/	
502.6	40503.6	/	
502.7	40503.7	/	
502.8	40503.8	S2 Blackout	
502.9	40503.9	S2 Over Voltage	
502.10	40503.1	S2 Under Voltage	
502.11	40503.11	S2 Over Frequency	
502.12	40503.12	S2 Under Frequency	
502.13	40503.13	S2 Loss of Phase	
502.14	40503.14	S2 Reverse Phase Seq.	
502.15	40503.15	/	
503.0	40504.0	ATS Transfer Failure	
503.1	40504.1	S1 Close Failure	
503.2	40504.2	S1 Open Failure	
503.3	40504.3	Earth Fault	
503.4	40504.4	S2 Close Failure	
503.5	40504.5	S2 Open Failure	
503.6	40504.6	QS1 Earth & Overcurrent	

Modbus Address	PLC Address	Name	Description
		Fault	
503.7	40504.7	QS2 Earth & Overcurrent Fault	
503.8	40504.8	S1 Load Overcurrent Trip	
503.9	40504.9	S2 Load Overcurrent Trip	
503.10	40504.10	Forced Open Fault Alarm	
503.11	40504.11	S1 Genset Fault	
503.12	40504.12	S2 Genset Fault	
503.13	40504.13	Breaker Trip Fault Alarm	
503.14	40504.14	Sync. Failure Fault	
503.15	40504.15	QTIE Trip Alarm	
504.0	40505.0	S1 Load Overcurrent Warn	
504.1	40505.1	S2 Load Overcurrent Warn	
504.2	40505.2	Forced Open Warn	
504.3	40505.3	Overload Warn	
504.4	40505.4	S1 PT Break	
504.5	40505.5	Sync. Failure Warn	
504.6	40505.6	S2 PT Break	
504.7	40505.7	Earth Fault Warn	
504.8	40505.8	/	
504.9	40505.9	Genset Fault	
504.10	40505.10	/	
504.11	40505.11	Switch Parallel Alarm	
504.12	40505.12	QTIE Close Failure	
504.13	40505.13	QTIE Open Failure	
504.14	40505.14	QS1 Trip Fault	
504.15	40505.15	QS2 Trip Fault	
505.0	40506.0	Aux. Input 1 Status	0 means there is no input; 1 means there is input.
505.1	40506.1	Aux. Input 2 Status	Refer to "Aux. Input 1 Status" description.
505.2	40506.2	Aux. Input 3 Status	
505.3	40506.3	Aux. Input 4 Status	
505.4	40506.4	Aux. Input 5 Status	
505.5	40506.5	Aux. Input 6 Status	
505.6	40506.6	Aux. Input 7 Status	
505.7	40506.7	Aux. Input 8 Status	
505.8	40506.8	Aux. Input 9 Status	
505.9	40506.9	Aux. Input 10 Status	
505.10	40506.10	Aux. Input 11 Status	
505.11	40506.11	Aux. Input 12 Status	
505.12	40506.12	/	
505.13	40506.13	/	
505.14	40506.14	/	

Modbus Address	PLC Address	Name	Description
505.15	40506.15	/	
506.0	40507.0	Aux. Output 1 Status	1 means there is output; 0 means there is no output.
506.1	40507.1	Aux. Output 2 Status	Refer to " Aux. Output 1 Status" Description.
506.2	40507.2	Aux. Output 3 Status	
506.3	40507.3	Aux. Output 4 Status	
506.4	40507.4	Aux. Output 5 Status	
506.5	40507.5	Aux. Output 6 Status	
506.6	40507.6	Aux. Output 7 Status	
506.7	40507.7	Aux. Output 8 Status	
506.8	40507.8	Aux. Output 9 Status	
506.9	40507.9	Aux. Output 10 Status	
506.10	40507.10	Aux. Output 11 Status	
506.11	40507.11	Aux. Output 12 Status	
506.12	40507.12	L Supply Output Status	
506.13	40507.13	N Supply Output Status	
506.14	40507.14	Aux. Output 13 Status	Refer to " Aux. Output 1 Status" Description.
506.15	40507.15	/	
507.0	40508.0	S1 Close Output	
507.1	40508.1	S1 Open Output	
507.2	40508.2	S2 Close Output	
507.3	40508.3	S2 Open Output	
507.4	40508.4	S1 Closed Status	
507.5	40508.5	S2 Closed Status	
507.6	40508.6	/	
507.7	40508.7	/	
507.8	40508.8	/	
507.9	40508.9	/	
507.10	40508.10	/	
507.11	40508.11	/	
507.12	40508.12	Remote Start On-load	
507.13	40508.13	Remote Start Off-load	
507.14	40508.14	Gen Start Mains NG	
507.15	40508.15	Scheduled Run	
508.0	40509.0	/	
508.1	40509.1	/	
508.2	40509.2	/	
508.3	40509.3	/	
508.4	40509.4	Scheduled Not Run	
508.5	40509.5	/	
508.6	40509.6	/	
508.7	40509.7	/	

Modbus Address	PLC Address	Name	Description
508.8	40509.8	/	
508.9	40509.9	/	
508.10	40509.10	Start Inhibit	
508.11	40509.11	/	
508.12	40509.12	S1 Close Inhibit	
508.13	40509.13	S2 Close Inhibit	
508.14	40509.14	Wait S1 Close PF Input	
508.15	40509.15	Wait S2 Close PF Input	
509.0	40510.0	NEL1 Trip	
509.1	40510.1	NEL2 Trip	
509.2	40510.2	NEL3 Trip	
509.3	40510.3	/	
509.4	40510.4	/	
509.5	40510.5	Elevator Control	
509.6	40510.6	/	
509.7	40510.7	/	
509.8	40510.8	QTIE Close Inhibit	
509.9	40510.9	/	
509.10	40510.10	Wait QTIE Close PF Input	
509.11	40510.11	Auto Trans./Restore	
509.12	40510.12	Remote Control Inhibit	
509.13	40510.13	S1 Supply QTIE Close Inhibit	
509.14	40510.14	S2 Supply QTIE Close Inhibit	
509.15	40510.15	/	
510.0	40511.0	/	
510.1	40511.1	/	
510.2	40511.2	QTIE Close Output	
510.3	40511.3	QTIE Open Output	
510.4	40511.4	/	
510.5	40511.5	/	
510.6	40511.6	/	
510.7	40511.7	QTIE Closed Status	
510.8	40511.8	/	
510.9	40511.9	/	
510.10	40511.10	QS1 QTIE Close Inhibit	
510.11	40511.11	QS2 QTIE Close Inhibit	
510.12	40511.12	/	
510.13	40511.13	/	
510.14	40511.14	/	
510.15	40511.15	/	

**Example:**

If need to read “Aux. Output 1 Status” and “S1 Closed Status”, firstly get their corresponding

address is 506.0 and 507.4 by checking the table, it is known that you need to read 2 addresses' data.

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

**Table 3 – Master (Computer) Request Command**

Slave Address	Function Code	Starting Address (506)		Data Qty. (2)		CRC 16 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
01	03	01	FA	00	02	E5	C6

Slave response command is as following:

**Table 4 – Slave (Controller) Response Command**

Slave Address	Function Code	Data Qty. (Bytes)	Data				CRC 16 Calibration	
			Data MSB of Address 506	Data LSB of Address 506	Data MSB of Address 507	Data LSB of Address 507	LSB	MSB
01	03	04	00	01	00	10	AA	3F

**Table 5 – Data Analysis**

Address	Received Data (Hex)	Convert to Binary	Data Signification
506	0001H	0000 0000 0000 0001 (correspond to 506.15, 506.14.....506.1, 506.0)	Data of bit 0 is 1 indicates that aux. output 1 is active.
507	0010H	0000 0000 0001 0000 (correspond to 507.15, 507.14.....507.1, 507.0)	Data of bit 507.4 is 1 indicates S1 is closed.

### 3.3 VALUE DATA FIELD CORRESPONDING TO FUNCTION CODE 03H

**Table 6 – Value Data Field**

Modbus Address	PLC Address	Name	Range (Decimal)	Ratio	Unit	Description	Remark
1000	41001	UAB1 (1# AB Line Voltage)	0~65000	1	V	16-bit Unsigned	
1001	41002	UBC1 (1# BC Line Voltage)	0~65000	1	V	16-bit Unsigned	
1002	41003	UCA1 (1# CA Line Voltage)	0~65000	1	V	16-bit Unsigned	
1003	41004	UA1 (1# A Phase Voltage)	0~65000	1	V	16-bit Unsigned	
1004	41005	UB1 (1# B Phase Voltage)	0~65000	1	V	16-bit Unsigned	
1005	41006	UC1 (1# C Phase Voltage)	0~65000	1	V	16-bit Unsigned	

Modbus Address	PLC Address	Name	Range (Decimal)	Ratio	Unit	Description	Remark
		Voltage)					
1006	41007	UA1 Phase (1# A Phase)	0~360.0	0.1	°	16-bit Unsigned	<a href="#">NOTE3</a>
1007	41008	UB1 Phase (1# B Phase)	0~360.0	0.1	°	16-bit Unsigned	
1008	41009	UC1 Phase (1# C Phase)	0~360.0	0.1	°	16-bit Unsigned	
1009	41010	Frequency 1 (1# Power Frequency)	0~100.00	0.01	Hz	16-bit Unsigned	
1010	41011	/					
1011	41012	/					
1012	41013	/					
1013	41014	/					
1014	41015	/					
1015	41016	/					
1016	41017	/					
1017	41018	/					
1018	41019	/					
1019	41020	/					
1020	41021	UAB2 (2# AB Line Voltage)	0~65000	1	V	16-bit Unsigned	
1021	41022	UBC2 (2# BC Line Voltage)	0~65000	1	V	16-bit Unsigned	
1022	41023	UCA2 (2# CA Line Voltage)	0~65000	1	V	16-bit Unsigned	
1023	41024	UA2 (2# A Phase Voltage)	0~65000	1	V	16-bit Unsigned	
1024	41025	UB2 (2# B Phase Voltage)	0~65000	1	V	16-bit Unsigned	
1025	41026	UC2 (2# C Phase Voltage)	0~65000	1	V	16-bit Unsigned	
1026	41027	UA2 Phase (2# A Phase)	0~360.0	0.1	°	16-bit Unsigned	
1027	41028	UB2 Phase (2# B Phase)	0~360.0	0.1	°	16-bit Unsigned	
1028	41029	UC2 Phase	0~360.0	0.1	°	16-bit	

Modbus Address	PLC Address	Name	Range (Decimal)	Ratio	Unit	Description	Remark
		(2# C Phase)				Unsigned	
1029	41030	Frequency 2 (2# Power Frequency)	0~100.00	0.01	Hz	16-bit Unsigned	
1030	41031	S1S2 Volt Diff. (1#/2# Power Volt Diff.)	-32768~ +32767	1	V	16-bit Signed	<a href="#">NOTE4</a>
1031	41032	S1S2 Freq. Diff. (1#/2# Power Freq. Diff.)	-100.00~ +100.00	0.01	Hz	16-bit Signed	
1032	41033	S1S2 Phase Diff. (1#/2# Power Phase Diff.)	-180.0~ +180.0	0.1	°	16-bit Signed	
1033	41034	S1 Voltage Unbalance	0~100	1	%	16-bit Unsigned	
1034	41035	S2 Voltage Unbalance	0~100	1	%	16-bit Unsigned	
1035	41036	/					
1036	41037	/					
1037	41038	/					
1038	41039	/					
1039	41040	/					
1040	41041	S1 A Phase Current	0~65000	0.1	A	16-bit Unsigned	
1041	41042	S1 B Phase Current	0~65000	0.1	A	16-bit Unsigned	
1042	41043	S1 C Phase Current	0~65000	0.1	A	16-bit Unsigned	
1043	41044	S1 N Phase Current (Zero-sequence Current)	0~65000	0.1	A	16-bit Unsigned	
1044	41045	S1 A Phase Current Phase	0~360.0	0.1	°	16-bit Unsigned	
1045	41046	S1 B Phase Current Phase	0~360.0	0.1	°	16-bit Unsigned	
1046	41047	S1 C Phase Current Phase	0~360.0	0.1	°	16-bit Unsigned	
1047	41048	S1 N Phase Current Phase	0~360.0	0.1	°	16-bit Unsigned	
1048	41049	S1 A Phase Active Power (LSB)	-2147483648~ 2147483647	0.1	kW	32-bit Signed	<a href="#">NOTE2</a>

Modbus Address	PLC Address	Name	Range (Decimal)	Ratio	Unit	Description	Remark
1049	41050	S1 A Phase Active Power (MSB)					
1050	41051	S1 B Phase Active Power (LSB)	-2147483648~ 2147483647	0.1	kW	32-bit Signed	
1051	41052	S1 B Phase Active Power (MSB)					
1052	41053	S1 C Phase Active Power (LSB)	-2147483648~ 2147483647	0.1	kW	32-bit Signed	
1053	41054	S1 C Phase Active Power (MSB)					
1054	41055	S1 Total Active Power (LSB)	-2147483648~ 2147483647	0.1	kW	32-bit Signed	
1055	41056	S1 Total Active Power (MSB)					
1056	41057	S1 A Phase Reactive Power (LSB)	-2147483648~ 2147483647	0.1	kW	32-bit Signed	
1057	41058	S1 A Phase Reactive Power (MSB)					
1058	41059	S1 B Phase Reactive Power (LSB)	-2147483648~ 2147483647	0.1	kW	32-bit Signed	
1059	41060	S1 B Phase Reactive Power (MSB)					
1060	41061	S1 C Phase Reactive Power (LSB)	-2147483648~ 2147483647	0.1	kW	32-bit Signed	
1061	41062	S1 C Phase Reactive Power (MSB)					
1062	41063	S1 Total Reactive Power (LSB)	-2147483648~ 2147483647	0.1	kW	32-bit Signed	
1063	41064	S1 Total Reactive Power (MSB)					
1064	41065	S1 A Phase Apparent Power	-2147483648~ 2147483647	0.1	kW	32-bit Signed	

Modbus Address	PLC Address	Name	Range (Decimal)	Ratio	Unit	Description	Remark
		(LSB)					
1065	41066	S1 A Phase Apparent Power (MSB)					
1066	41067	S1 B Phase Apparent Power (LSB)	-2147483648~2147483647	0.1	kW	32-bit Signed	
1067	41068	S1 B Phase Apparent Power (MSB)					
1068	41069	S1 C Phase Apparent Power (LSB)	-2147483648~2147483647	0.1	kW	32-bit Signed	
1069	41070	S1 C Phase Apparent Power (MSB)					
1070	41071	S1 Total Apparent Power (LSB)	-2147483648~2147483647	0.1	kW	32-bit Signed	
1071	41072	S1 Total Apparent Power (MSB)					
1072	41073	A Phase Power Factor	-100~100	0.01		16-bit Signed	
1073	41074	B Phase Power Factor	-100~100	0.01		16-bit Signed	
1074	41075	C Phase Power Factor	-100~100	0.01		16-bit Signed	
1075	41076	Average Power Factor	-100~100	0.01		16-bit Signed	
1076	41077	/					
1077	41078	/					
1078	41079	/					
1079	41080	S1 Zero-sequence Current	0~65000	0.1	A	16-bit Signed	
1080	41081	S1 Zero-sequence Current PCT Rating	0~1000	0.1	%	16-bit Unsigned	
1081	41082	/					
1082	41083	/					
1083	41084	Sync. Failure	0~65535	1	s	16-bit	

Modbus Address	PLC Address	Name	Range (Decimal)	Ratio	Unit	Description	Remark
		Delay				Unsigned	
1084	41085	Breaker Transfer Alarm Delay	0~65535	1	s	16-bit Unsigned	
1085	41086	/					
1086	41087	/					
1087	41088	/					
1088	41089	S1 Volt Status	0~65535	No		16-bit Unsigned	See <a href="#">S1 Power Status</a>
1089	41090	S1 Volt Delay	0~65535	1	s	16-bit Unsigned	
1090	41091	S2 Volt Status	0~65535	No		16-bit Unsigned	See <a href="#">S2 Power Status</a>
1091	41092	S2 Volt Delay	0~65535	1	s	16-bit Unsigned	
1092	41093	Genset Status	0~65535	No		16-bit Unsigned	See <a href="#">Genset Status</a>
1093	41094	Genset Delay	0~65535	1	s	16-bit Unsigned	
1094	41095	ATS Status	0~65535	No		16-bit Unsigned	See <a href="#">ATS Status</a>
1095	41096	ATS Delay	0~65535	1	s	16-bit Unsigned	
1096	41097	/					
1097	41098	/					
1098	41099	/					
1099	41100	/					
1100	41101	Controller Time: Year	0~100	1	year	16-bit Unsigned	
1101	41102	Controller Time: Month	1~12	1	month	16-bit Unsigned	
1102	41103	Controller Time: Day	1~31	1	day	16-bit Unsigned	
1103	41104	Controller Time: Week	0~6	/		16-bit Unsigned	0: Sunday 1~6: Monday~Saturday
1104	41105	Controller Time: Hour	0~23	1	h	16-bit Unsigned	
1105	41106	Controller Time: Minute	0~59	1	min	16-bit Unsigned	
1106	41107	Controller Time: Second	0~59	1	s	16-bit Unsigned	
1107	41108	/					

Modbus Address	PLC Address	Name	Range (Decimal)	Ratio	Unit	Description	Remark
1108	41109	Continuous Power Time: h (LOAD2)	0~65535	1	h	16-bit Unsigned	
1109	41110	Continuous Power Time: min (LOAD2)	0~59	1	min	16-bit Unsigned	
1110	41111	Continuous Power Time: s (LOAD2)	0~59	1	s	16-bit Unsigned	
1111	41112	Continuous Supply Time: h (LOAD1)	0~65535	1	h	16-bit Unsigned	
1112	41113	Continuous Supply Time: min (LOAD1)	0~59	1	min	16-bit Unsigned	
1113	41114	Continuous Supply Time: s (LOAD1)	0~59	1	s	16-bit Unsigned	
1114	41115	Last Continuous Supply Time (LOAD1): h	0~65535	1	h	16-bit Unsigned	
1115	41116	Last Continuous Supply Time (LOAD1): min	0~59	1	min	16-bit Unsigned	
1116	41117	Last Continuous Supply Time (LOAD1): s	0~59	1	s	16-bit Unsigned	
1117	41118	S1 Accum. Supply Time (h) LSB	0~4294967296	1	h	32-bit Unsigned	<a href="#">NOTE2</a>
1118	41119	S1 Accum. Supply Time (h) MSB					
1119	41120	S1 Accum. Supply Time (min)	0~59	1	min	16-bit Unsigned	
1120	41121	S1 Accum. Supply Time (s)	0~59	1	s	16-bit Unsigned	
1121	41122	S2 Accum. Supply Time (h) LSB	0~4294967296	1	h	32-bit Unsigned	<a href="#">NOTE2</a>
1122	41123	S2 Accum. Supply Time (h) MSB					

Modbus Address	PLC Address	Name	Range (Decimal)	Ratio	Unit	Description	Remark	
1123	41124	S2 Accum. Supply Time (min)	0~59	1	min	16-bit Unsigned		
1124	41125	S2 Accum. Supply Time (s)	0~59	1	s	16-bit Unsigned		
1125	41126	S1 Accum. Active Energy (LSB)	0~99999999	0.1	kWh	32-bit Signed		
1126	41127	S1 Accum. Active Energy (MSB)						
1127	41128	S1 Accum. Reactive Energy (LSB)	0~99999999	0.1	kWh	32-bit Signed		
1128	41129	S1 Accum. Reactive Energy (MSB)						
1129	41130	S1 Accum. Active Energy (LSB)	0~99999999	0.1	kWh	32-bit Signed		
1130	41131	S1 Accum. Active Energy (MSB)						
1131	41132	S2 Accum. Active Energy (LSB)	0~99999999	0.1	kWh	32-bit Signed		<a href="#">NOTE2</a>
1132	41133	S2 Accum. Active Energy (MSB)						
1133	41134	S1 Accum. Close Times (LSB)	0~4294967296	1	times	32-bit Unsigned		
1134	41135	S1 Close Times (MSB)						
1135	41136	S2 Accum. Close Times (LSB)	0~4294967296	1	times	32-bit Unsigned		
1136	41137	S2 Accum. Close Times (MSB)						
1137	41138	QTIE Accum. Close Times (LSB)	0~4294967296	1	times	32-bit Unsigned		
1138	41139	QTIE Accum. Close Times (MSB)						

Modbus Address	PLC Address	Name	Range (Decimal)	Ratio	Unit	Description	Remark
1139 ~1154	41140 ~41155	/					
1155	41156	Last Continuous Power Time: h (LOAD2)	0~65535	1	h	16-bit Unsigned	
1156	41157	Last Continuous Power Time: min (LOAD2)	0~59	1	min	16-bit Unsigned	
1157	41158	Last Continuous Power Time: s (LOAD2)	0~59	1	s	16-bit Unsigned	
1158	41159	LOAD1 Accum. Power Time: h (LSB)	0~4294967296	1	h	32-bit Unsigned	<a href="#">NOTE2</a>
1159	41160	LOAD1 Accum. Power Time: h (MSB)					
1160	41161	LOAD1 Accum. Power Time: min	0~59	1	min	16-bit Unsigned	
1161	41162	LOAD1 Accum. Power Time: s	0~59	1	s	16-bit Unsigned	
1162	41163	LOAD2 Accum. Power Time: h (LSB)	0~4294967296	1	h	32-bit Unsigned	<a href="#">NOTE2</a>
1163	41164	LOAD2 Accum. Power Time: h (MSB)					
1164	41165	LOAD2 Accum. Power Time: min	0~59	1	min	16-bit Unsigned	
1165	41166	LOAD2 Accum. Power Time: s	0~59	1	s	16-bit Unsigned	
1166	41167	S2 A Phase Current	0~65000	0.1	A	16-bit Unsigned	
1167	41168	S2 B Phase Current	0~65000	0.1	A	16-bit Unsigned	
1168	41169	S2 C Phase Current	0~65000	0.1	A	16-bit Unsigned	
1169	41170	S2 N Phase Current (Zero-sequence Current/Ground Current)	0~65000	0.1	A	16-bit Unsigned	
1170	41171	S2 A Phase	0~360.0	0.1	°	16-bit	

Modbus Address	PLC Address	Name	Range (Decimal)	Ratio	Unit	Description	Remark
		Current Phase				Unsigned	
1171	41172	S2 B Phase Current Phase	0~360.0	0.1	°	16-bit Unsigned	
1172	41173	S2 C Phase Current Phase	0~360.0	0.1	°	16-bit Unsigned	
1173	41174	S2 N Phase Current Phase	0~360.0	0.1	°	16-bit Unsigned	
1174	41175	S2 A Phase Active Power (LSB)	-2147483648 ~2147483647	0.1	kW	32-bit Signed	<a href="#">NOTE2</a>
1175	41176	S2 A Phase Active Power (MSB)					
1176	41177	S2 B Phase Active Power (LSB)	-2147483648 ~2147483647	0.1	kW	32-bit Signed	
1177	41178	S2 B Phase Active Power (MSB)					
1178	41179	S2 B Phase Active Power (LSB)	-2147483648 ~2147483647	0.1	kW	32-bit Signed	
1179	41180	S2 B Phase Active Power (MSB)					
1180	41181	S2 Total Active Power (LSB)	-2147483648 ~2147483647	0.1	kW	32-bit Signed	
1181	41182	S2 Total Active Power (MSB)					
1182	41183	S2 A Phase Reactive Power (LSB)	-2147483648 ~2147483647	0.1	kW	32-bit Signed	
1183	41184	S2 A Phase Reactive Power (MSB)					
1184	41185	S2 B Phase Reactive Power (LSB)	-2147483648 ~2147483647	0.1	kW	32-bit Signed	
1185	41186	S2 B Phase Reactive Power (MSB)					
1186	41187	S2 C Phase Reactive Power	-2147483648 ~2147483647	0.1	kW	32-bit Signed	

Modbus Address	PLC Address	Name	Range (Decimal)	Ratio	Unit	Description	Remark
		(LSB)					
1187	41188	S2 C Phase Reactive Power (MSB)					
1188	41189	S2 Total Reactive Power (LSB)	-2147483648 ~2147483647	0.1	kW	32-bit Signed	
1189	41190	S2 Total Reactive Power (MSB)					
1190	41191	S2 A Phase Apparent Power (LSB)	-2147483648 ~2147483647	0.1	kW	32-bit Signed	
1191	41192	S2 A Phase Apparent Power (MSB)					
1192	41193	S2 B Phase Apparent Power (LSB)	-2147483648 ~2147483647	0.1	kW	32-bit Signed	
1193	41194	S2 B Phase Apparent Power (MSB)					
1194	41195	S2 C Phase Apparent Power (LSB)	-2147483648 ~2147483647	0.1	kW	32-bit Signed	
1195	41196	S2 C Phase Apparent Power (MSB)					
1196	41197	S2 Total Apparent Power (LSB)	-2147483648 ~2147483647	0.1	kW	32-bit Signed	
1197	41198	S2 Total Apparent Power (MSB)					
1198	41199	S2 A Phase Power Factor	-100~100	0.01		16-bit Signed	
1199	41200	S2 B Phase Power Factor	-100~100	0.01		16-bit Signed	
1200	41201	S2 C Phase Power Factor	-100~100	0.01		16-bit Signed	
1201	41202	S2 Average Power Factor	-100~100	0.01		16-bit Signed	
1202	41203	S2 Zero-sequence Current	0~65000	0.1	A	16-bit Signed	

Modbus Address	PLC Address	Name	Range (Decimal)	Ratio	Unit	Description	Remark
1203	41204	S2 Zero-sequence Current PCT Rating	0~1000	0.1	%	16-bit Unsigned	

**NOTE1:** Actual value=Received Data\*Ratio. Take frequency as the example, received data is 5000 (1388H), ratio is 0.01Hz, so the actual frequency value is 50.00Hz (5000\*0.01Hz);

**NOTE2:** For 4-byte data, the actual value=Received Data MSB\*65536 + Received Data LSB;

**NOTE3:** When the received data is 32766, it means no normal data, “###” can 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 “S1 Accum. Close Times (current is 123456 times)”, firstly get their corresponding address is 1129 and 1130 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 7 – Master Request Command**

Slave Address	Function Code	Starting Address (1129)		Data Qty. (2)		CRC 16 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
01	03	04	69	00	02	15	27

Slave response command is as following:

**Table 8 – Slave Response Command**

Slave Address	Function Code	Data Qty. (Bytes)	Data				CRC 16 Calibration	
			Data MSB of Address 1129	Data LSB of Address 1129	Data MSB of Address 1130	Data LSB of Address 1130	LSB	MSB
01	03	04	E2	40	00	01	0C	5F

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

**Table 9 – Data Analysis**

Address	Received Data (Hex)	Combination (Hex)	S1 Accum. Close Times (Decimal)
1129	E240H	0001E240H	123456
1130	0001H		

**3.4 REMOTE COIL FIELD CORRESPONDING TO FUNCTION CODE 05H**

**Table 10 – Remote Coil Field**

Modbus Address	PLC Address	Name	Description
400	401	Remote S1 Close	Only send FF00H active
401	402	Remote Open	Only send FF00H active
402	403	Remote S2 Close	Only send FF00H active
403	404	Remote Open (same as Modbus address 401)	Only send FF00H active
404	405	Auto/Manual	Manual Mode: Only send 0000H active Auto Mode: Only send FF00H active
405	406	S1 Master Status Set	Only send FF00H active
406	407	S2 Master Status Set	Only send FF00H active
407	408	Alarm Reset	Only send FF00H active
408	409	Remote Genset Start	Only send FF00H active
409	410	Remote Genset Stop	Only send FF00H active
410	411	/	Only send FF00H active
411	412	/	Only send FF00H active
412	413	Remote Output 1 Output	Only send FF00H active
413	414	Remote Output 2 Output	Only send FF00H active
414	415	Remote Output 3 Output	Only send FF00H active
415	416	Remote Output 4 Output	Only send FF00H active
416	417	Remote Output 5 Output	Only send FF00H active
417	418	Remote Output 6 Output	Only send FF00H active
418	419	Remote Output 7 Output	Only send FF00H active
419	420	Remote Output 8 Output	Only send FF00H active
420	421	Remote Output 9 Output	Only send FF00H active
421	422	Remote Output 10 Output	Only send FF00H active
422	423	Remote Output 11 Output	Only send FF00H active
423	424	Remote Output 12 Output	Only send FF00H active
424	425	Remote Output 13 Output	Only send FF00H active
425	426	/	
426	427	/	
427	428	/	
428	429	/	
429	430	/	
430	431	Remote ATS Transfer 000 (All Open)	Only send FF00H active
431	432	Remote ATS Transfer 101	Only send FF00H active
432	433	Remote ATS Transfer 110	Only send FF00H active
433	434	Remote ATS Transfer 011	Only send FF00H active
434	435	Remote ATS Transfer 100	Only send FF00H active
435	436	Remote ATS Transfer 001	Only send FF00H active

**NOTE:** Remote command in the above table can be sent once only.

**Example:**

Remotely control controller to work in auto mode, firstly get its remote address is 404 by checking the table.

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

**Table 11 – Master Request Command**

Slave Address	Function Code	Remote Address (404)		Data		CRC 16 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
<b>01</b>	<b>05</b>	<b>01</b>	<b>94</b>	<b>FF</b>	<b>00</b>	<b>CC</b>	<b>2A</b>

Slave response command is as following:

**Table 12 – Slave Response Command**

Slave Address	Function Code	Remote Address (404)		Data		CRC 16 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
<b>01</b>	<b>05</b>	<b>01</b>	<b>94</b>	<b>FF</b>	<b>00</b>	<b>CC</b>	<b>2A</b>

Then whether the remote command is executed successfully can be confirmed by reading the auto mode status of address 500.8 via function code 03H.

**3.5 S1 POWER STATUS DESCRIPTION**

**Table 13 – S1 Power Status Description**

Value (No.)	Status	Delay
0	S1 Available	Delay (Unit: s)
1	S1 Unavailable	Delay (Unit: s)
2	S1 Voltage Normal	No Delay
3	S1 Blackout	No Delay
4	S1 Over Voltage	No Delay
5	S1 Under Voltage	No Delay
6	S1 Over Frequency	No Delay
7	S1 Under Frequency	No Delay
8	S1 Loss of Phase	No Delay
9	S1 Reverse Phase Sequence	No Delay

**Example:**

If the content of address 1088 is 1, 1089 is 5, it indicates that currently 1# power is in voltage abnormal delay, countdown 5s.

If the content of address 1088 is 4, it indicates that currently 1# power has over voltage.

**3.6 S2 POWER STATUS DESCRIPTION**

**Table 14 – S2 Power Status Description**

Value (No.)	Status	Delay
0	S2 Available	Delay (Unit: s)
1	S2 Unavailable	Delay (Unit: s)
2	S2 Voltage Normal	No Delay
3	S2 Blackout	No Delay
4	S2 Over Voltage	No Delay
5	S2 Under Voltage	No Delay
6	S2 Over Frequency	No Delay
7	S2 Under Frequency	No Delay
8	S2 Loss of Phase	No Delay
9	S2 Reverse Phase Sequence	No Delay

**3.7 GENSET STATUS DESCRIPTION**

**Table 15 – Genset Status Description**

Value (No.)	Status	Delay
0	Start Delay	Delay (Unit: s)
1	Stop Delay	Delay (Unit: s)
2	Scheduled Not Run	Delay (Unit: s)
3	Scheduled Run	Delay (Unit: s)
4	/	
5	/	
6	/	
7	/	
8	Genset Start	No Delay
9	Genset Standby	No Delay

**Example:**

If the content of address 1092 is 1, 1093 is 50, it indicates that genset is preparing to start, countdown 50s.

If the content of address 1092 is 8, it indicates that 1# power corresponding genset has been started.

**3.8 ATS STATUS DESCRIPTION**

**Table 16 – ATS Status Description**

Value (No.)	Status	Delay
0	Ready to Transfer	No Delay
1	S1 Closing	Delay (Unit: s)
2	S1 Opening	Delay (Unit: s)
3	S2 Closing	Delay (Unit: s)
4	S2 Opening	Delay (Unit: s)
5	Transfer Rest	Delay (Unit: s)
6	/	Delay (Unit: s)
7	/	Delay (Unit: s)
8	/	Delay (Unit: s)
9	QTIE Sync. Close	Delay (Unit: s)
10	Wait for Sync	Delay (Unit: s)
11	S1 Sync. Close	Delay (Unit: s)
12	S2 Sync. Close	Delay (Unit: s)
13	Wait S1 PF Input	Delay (Unit: s)
14	Wait S2 PF Input	Delay (Unit: s)
15	Elevator Control Delay	Delay (Unit: s)
16	S1 On-load	No Delay
17	S2 On-load	No Delay
18	Off-load	No Delay
19	Wait QTIE PF Input	Delay (Unit: s)
20	QTIE Closing	Delay (Unit: s)
21	QTIE Opening	Delay (Unit: s)
22	QS1 Close QTIE Close	No Delay
23	QS2 Close QTIE Close	No Delay
24	QS1 Close QS2 Close	No Delay
25	QTIE Close	No Delay

4. COMMUNICATION PARAMETER VIEW AND CONFIGURATION

4.1 VIEW CURRENT COMMUNICATION PARAMETERS

In controller main interface, press  key, the following interface is displayed.

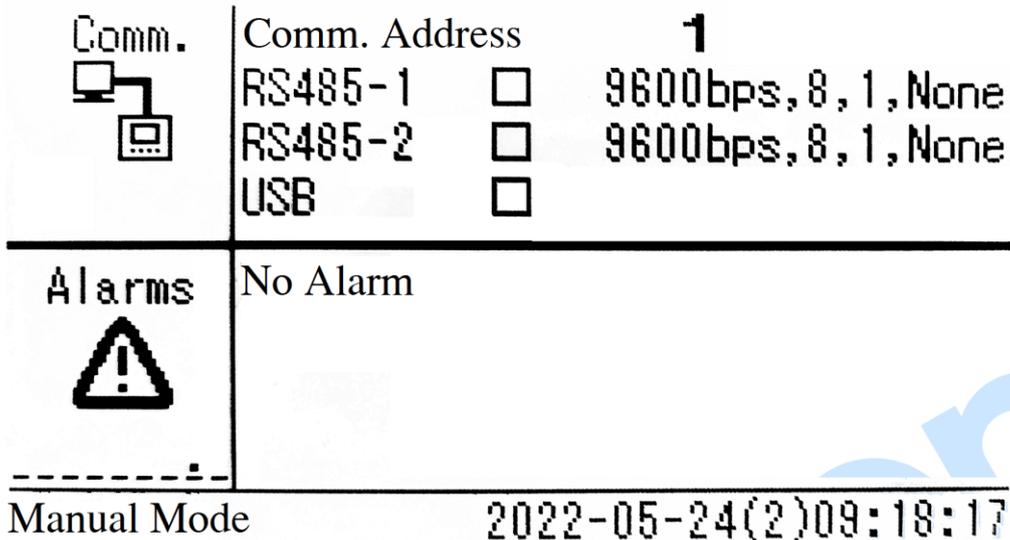


Fig.3 Comm. Parameters Interface

This interface displays **RS485-1 9600bps, 8, 1, None**, which indicates that the current communication rate of RS485-1 is 9600bps, data bit is 8-bit, stop bit is 1-bit, no parity (None: No parity/ Even: Even parity/Odd: Odd parity).

4.2 COMMUNICATION PARAMETERS CONFIGURATION

- 1) In the home page 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 01234), press  key to enter the main interface of parameter;
- 4) Select "Module Setting" via  key, press  key to enter submenu;
- 5) Select "Module 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, press  key to complete editing, then the selected status disappear;
- 7) Long press  key to return the main interface.

**NOTE:** The configuration will be active after parameter setting is completed.

## 5. FAQ

### 5.1 COMMUNICATION LINE SHIELDING LAYER GROUNDED

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

### 5.2 TERMINAL RESISTOR

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

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

### 5.3 RS485 TO USB COMMUNICATION ADAPTOR

PC can communicate with SG72A module produced by our company.

### 5.4 EXTENDED COMMUNICATION DISTANCE

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



**Fig.4 SGCAN300 Application Diagram**

### 5.5 COMMON SOLUTIONS OF COMMUNICATION FAILURE

- 1) Check whether the positive and negative of RS485 is correctly connected;
- 2) Check whether the communication parameter setting in parameter setting is correct;
- 3) Check whether the RS485 converter (if configured) is normal;
- 4) Check whether the terminal resistor is correctly connected;
- 5) 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;
- 6) It is recommended to download third-party communication software such as modscan32, modbus poll to check whether communication is normal.