SmartGen
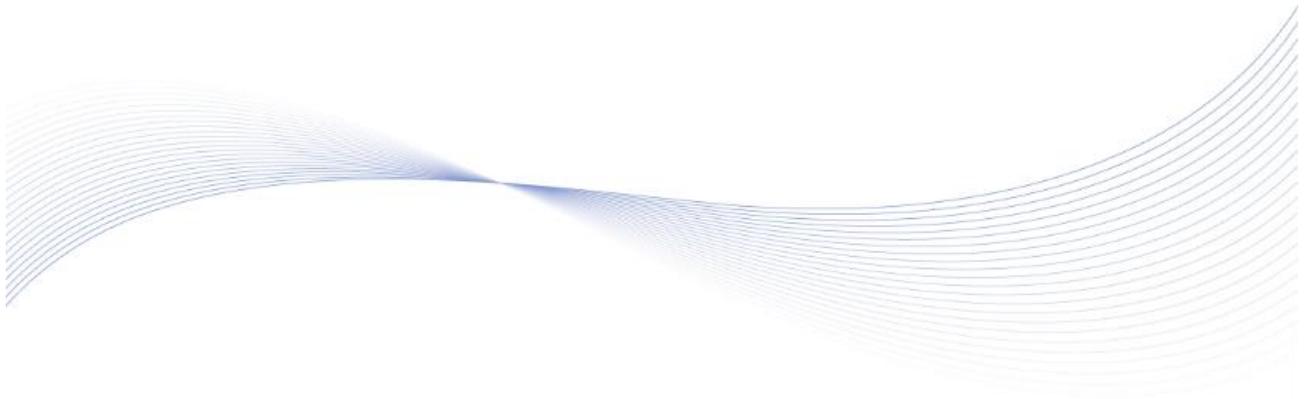MAKING CONTROL SMARTER

EP4300
ENGINE CONTROLLER
COMMUNICATION PROTOCOL

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Table 1 – Version History

Date	Version	Content
2021-09-07	V1.0	Original release.
2024-12-11	V1.1	Add function code 05H, and modify part of contents in function code 01H and 03H.

CONTENTS

1   DESCRIPTION

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

EP4300 engine controller has 1 RS485 interface, 1 USB interface 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: 9600bps

Start bit: 1-bit

Data bit: 8-bit

Parity bit: No parity, odd parity, even parity (Default: no parity)

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

Supported function code: 01H, 03H. Function code 01H is used for reading controller alarm information; function code 03H is used for reading controller status information and all real-time data.

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 communication distance can reach 1,000m when using 120Ω shielding twisted pair line.

Once maximum 120 data of word register can be read.

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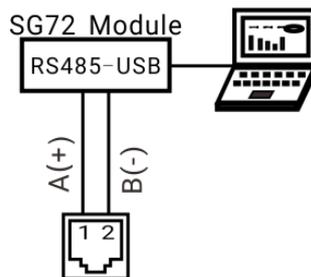
2   WIRING DIAGRAM
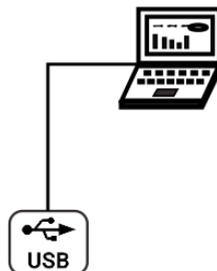

Fig.1 RS485 Communication Wiring Diagram

Fig.2 USB Communication Wiring Diagram

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3   CONTROLLER INTERNAL REGISTER ADDRESS AND DATA

3.1   FUNCTION CODE 01H MAPPING COIL FIELD

Table 2 − Alarm, Status Coil Data Field

Address	Item	Description	Bytes
0000H	Common Alarm	1 for active (LSB)	1bit
0001H	Common Warning Alarm	1 for active	1bit
0002H	Common Shutdown Alarm	1 for active	1bit
0003H	Reserved	1 for active	1bit
0004H	Stop Mode	1 for active	1bit
0005H	Reserved	1 for active	1bit
0006H	Reserved	1 for active	1bit
0007H	Reserved	1 for active	1bit
0008H	Reserved	1 for active	1bit
0009H	Overspeed Alarm Shutdown	1 for active	1bit
000AH	Underspeed Alarm Shutdown	1 for active	1bit
000BH	Loss of Speed Signal Alarm Shutdown	1 for active	1bit
000CH	Reserved	1 for active	1bit
000DH	Reserved	1 for active	1bit
000EH	Reserved	1 for active	1bit
000FH	Reserved	1 for active	1bit
0010H	Reserved	1 for active	1bit
0011H	Crank Failure Alarm Shutdown	1 for active	1bit
0012H	High Temperature Alarm Shutdown	1 for active	1bit
0013H	Low Oil Pressure Alarm Shutdown	1 for active	1bit
0014H	Reserved	1 for active	1bit
0015H	Input Port Alarm Shutdown	1 for active	1bit
0016H	Low Fuel Level Alarm Shutdown	1 for active	1bit
0017H	Low Coolant Level Alarm Shutdown	1 for active	1bit
0018H	High Temperature Warning	1 for active	1bit
0019H	Low Oil Pressure Warning	1 for active	1bit
001AH	Reserved	1 for active	1bit
001BH	Stop Failure Warning	1 for active	1bit
001CH	Low Fuel Level Warning	1 for active	1bit
001DH	Charging Failure Warning	1 for active	1bit
001EH	Battery Undervoltage Warning	1 for active	1bit
001FH	Battery Overvoltage Warning	1 for active	1bit
0020H	Input Port Warning	1 for active	1bit
0021H	Loss of Speed Signal Warning	1 for active	1bit
0022H	Low Coolant Level Warning	1 for active	1bit
0023H	Sensor 1 Open Warning	1 for active	1bit
0024H	Sensor 2 Open Warning	1 for active	1bit
0025H	Sensor 3 Open Warning	1 for active	1bit
0026H	Charger Failed to Charge Warning	1 for active	1bit
0027H	Reserved	1 for active	1bit

Address	Item	Description	Bytes
0028H	Reserved	1 for active	1bit
0029H	Reserved	1 for active	1bit
002AH	Reserved	1 for active	1bit
002BH	Reserved	1 for active	1bit
002CH	Aux. Sensor 1 Open Shutdown	1 for active	1bit
002DH	Aux. Sensor 2 Open Shutdown	1 for active	1bit
002EH	Aux. Sensor 3 Open Shutdown	1 for active	1bit
002FH	Reserved	1 for active	1bit
0030H	Input Port 1 Status	1 for active	1bit
0031H	Input Port 2 Status	1 for active	1bit
0032H	Input Port 3 Status	1 for active	1bit
0033H	Reserved	1 for active	1bit
0034H	Reserved	1 for active	1bit
0035H	Reserved	1 for active	1bit
0036H	Reserved	1 for active	1bit
0037H	Reserved	1 for active	1bit
0038H	Crank Relay Output	1 for active	1bit
0039H	Fuel Relay Output	1 for active	1bit
003AH	Aux. Output Port 1 Status	1 for active	1bit
003BH	Aux. Output Port 2 Status	1 for active	1bit
003CH	Aux. Output Port 3 Status	1 for active	1bit
003DH	CAN_TMR Status	1 for active	1bit
003EH	Reserved	1 for active	1bit
003FH	Reserved	1 for active	1bit
0040H	Reserved	1 for active	1bit
0041H	Reserved	1 for active	1bit
0042H	Reserved	1 for active	1bit
0043H	Reserved	1 for active	1bit
0044H	Reserved	1 for active	1bit
0045H	Reserved	1 for active	1bit
0046H	Reserved	1 for active	1bit
0047H	Reserved	1 for active	1bit
0048H	Reserved	1 for active	1bit
0049H	Reserved	1 for active	1bit
004AH	Reserved	1 for active	1bit
004BH	Reserved	1 for active	1bit
004CH	Reserved	1 for active	1bit
004DH	Reserved	1 for active	1bit
004EH	Reserved	1 for active	1bit
004FH	ECU Warning	1 for active	1bit
0050H	ECU Alarm Shutdown	1 for active	1bit
0051H	ECU Comm. Failure Alarm Shutdown	1 for active	1bit
0052H	Reserved	1 for active	1bit
0053H	Reserved	1 for active	1bit

Address	Item	Description	Bytes
0054H	Reserved	1 for active	1bit
0055H	Reserved	1 for active	1bit
0056H	Reserved	1 for active	1bit
0057H	Reserved	1 for active	1bit
0058H	Sensor 1 High Warning	1 for active	1bit
0059H	Sensor 1 Low Warning	1 for active	1bit
005AH	Sensor 2 High Warning	1 for active	1bit
005BH	Sensor 2 Low Warning	1 for active	1bit
005CH	Sensor 3 High Warning	1 for active	1bit
005DH	Sensor 3 Low Warning	1 for active	1bit
005EH	Reserved	1 for active	1bit
005FH	Reserved	1 for active	1bit
0060H	Sensor 1 High Alarm Shutdown	1 for active	1bit
0061H	Sensor 1 Low Alarm Shutdown	1 for active	1bit
0062H	Sensor 2 High Alarm Shutdown	1 for active	1bit
0063H	Sensor 2 Low Alarm Shutdown	1 for active	1bit
0064H	Sensor 3 High Alarm Shutdown	1 for active	1bit
0065H	Sensor 3 Low Alarm Shutdown	1 for active	1bit
0066H	Reserved	1 for active	1bit
0067H	Reserved	1 for active	1bit
0068H	Reserved	1 for active	1bit
0069H	Reserved	1 for active	1bit
006AH	Reserved	1 for active	1bit
006BH	Reserved	1 for active	1bit
006CH	Reserved	1 for active	1bit
006DH	Reserved	1 for active	1bit
006EH	Reserved	1 for active	1bit
006FH	Reserved	1 for active	1bit
0070H	Reserved	1 for active	1bit
0071H	Reserved	1 for active	1bit
0072H	Reserved	1 for active	1bit
0073H	Reserved	1 for active	1bit
0074H	Reserved	1 for active	1bit
0075H	Reserved	1 for active	1bit
0076H	Reserved	1 for active	1bit
0077H	Reserved	1 for active	1bit

Example:

Sub-address is 00, read 20H (decimal 32) coil of starting address 0000H.

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 (0000H)		Data Qty. (2)		CRC 16 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
01	**01**	**00**	**00**	**00**	**1C**	**3D**	**C3**

Table 4 – Slave (Controller) Response Command

Slave Address	Function Code	Data Qty. (Bytes)	Data				CRC 16 Calibration	
			Data1	Data2	Data3	Data4	LSB	MSB
01	01	04	Contents of address 07－00	Contents of address 0F－08	Contents of address 17－10	Contents of address 1C－18	18	26

Data analysis:

The value of coil 07－00 is shown as 30H with hex, 00110000 with binary. Coil 07 is the high byte, 00 is the low byte. The status of 07－00 is OFF－OFF－ON－ON－OFF－OFF－OFF－OFF.

3.2　FUNCTION CODE 03H MAPPING VALUE DATA FIELD

Table 5 – Value Data Field

Address	Item	Description	Bytes
00	CAN0 Value	Signed (LSB)	2Bytes
01		Signed (MSB)	2Bytes
02	CAN1 Value	Signed (LSB)	2Bytes
03		Signed (MSB)	2Bytes
04	CAN2 Value	Signed (LSB)	2Bytes
05		Signed (MSB)	2Bytes
06	CAN3 Value	Signed (LSB)	2Bytes
07		Signed (MSB)	2Bytes
08	CAN4 Value	Signed (LSB)	2Bytes
09		Signed (MSB)	2Bytes
010	CAN5 Value	Signed (LSB)	2Bytes
011		Signed (MSB)	2Bytes
012	CAN6 Value	Signed (LSB)	2Bytes
013		Signed (MSB)	2Bytes
014	CAN7 Value	Signed (LSB)	2Bytes
015		Signed (MSB)	2Bytes
016	CAN8 Value	Signed (LSB)	2Bytes
017		Signed (MSB)	2Bytes
018	CAN9 Value	Signed (LSB)	2Bytes
019		Signed (MSB)	2Bytes
020	CAN10 Value	Signed (LSB)	2Bytes
021		Signed (MSB)	2Bytes
022	CAN11 Value	Signed (LSB)	2Bytes
023		Signed (MSB)	2Bytes
024	CAN12 Value	Signed (LSB)	2Bytes
025		Signed (MSB)	2Bytes
026	CAN13 Value	Signed (LSB)	2Bytes
027		Signed (MSB)	2Bytes
028	CAN14 Value	Signed (LSB)	2Bytes
029		Signed (MSB)	2Bytes
030	CAN15 Value	Signed (LSB)	2Bytes

Address	Item	Description	Bytes
031		Signed (MSB)	2Bytes
032	CAN16 Value	Signed (LSB)	2Bytes
033		Signed (MSB)	2Bytes
034	Aux. Sensor 1 Value	Unsigned	2Bytes
035	Aux. Sensor 1 Sampling Value	Unsigned	2Bytes
036	Aux. Sensor 2 Value	Unsigned	2Bytes
037	Aux. Sensor 2 Sampling Value	Unsigned	2Bytes
038	Aux. Sensor 3 Value	Unsigned	2Bytes
039	Aux. Sensor 3 Sampling Value	Unsigned	2Bytes
040	Speed	Unsigned	2Bytes
041	Battery Voltage	Unsigned (*0.1)	2Bytes
042	D+ Voltage	Signed (*0.1)	2Bytes
043	CAN17 Value	Signed (LSB)	2Bytes
044		Signed (MSB)	2Bytes
045	CAN18 Value	Signed (LSB)	2Bytes
046		Signed (MSB)	2Bytes
047	CAN19 Value	Signed (LSB)	2Bytes
048		Signed (MSB)	2Bytes
049	CAN20 Value	Signed (LSB)	2Bytes
050		Signed (MSB)	2Bytes
051	CAN21 Value	Signed (LSB)	2Bytes
052		Signed (MSB)	2Bytes
053	CAN22 Value	Signed (LSB)	2Bytes
054		Signed (MSB)	2Bytes
055	CAN23 Value	Signed (LSB)	2Bytes
056		Signed (MSB)	2Bytes
057	CAN24 Value	Signed (LSB)	2Bytes
058		Signed (MSB)	2Bytes
059	Controller Running Status	Unsigned	2Bytes
060	Delay	Unsigned	2Bytes
061	Engine Oil Pressure	Unsigned	2Bytes
062	Engine Load Rate	Unsigned	2Bytes
063	ATS Running Status	Unsigned	2Bytes
064	ATS Delay	Unsigned	2Bytes
065	CAN25 Value	Signed (LSB)	2Bytes
066		Signed (MSB)	2Bytes
067	CAN26 Value	Signed (LSB)	2Bytes
068		Signed (MSB)	2Bytes
069	CAN27 Value	Signed (LSB)	2Bytes
070		Signed (MSB)	2Bytes
071	CAN28 Value	Signed (LSB)	2Bytes
072		Signed (MSB)	2Bytes
073	CAN29 Value	Signed (LSB)	2Bytes
074		Signed (MSB)	2Bytes

Address	Item	Description	Bytes
075	CAN30 Value	Signed (LSB)	2Bytes
076		Signed (MSB)	2Bytes
077	Accumulated Start Times	Unsigned (MSB)	2Bytes
078	Accumulated Start Times	Unsigned (LSB)	2Bytes
079	CAN31 Value	Signed (LSB)	2Bytes
080		Signed (MSB)	2Bytes
081	CAN32 Value	Signed (LSB)	2Bytes
082		Signed (MSB)	2Bytes
083	Controller Software Version	Unsigned (*0.1)	2Bytes
084	Controller Hardware Version	Unsigned (*0.1)	2Bytes
085	CAN33 Value	Signed (LSB)	2Bytes
086		Signed (MSB)	2Bytes
087	CAN34 Value	Signed (LSB)	2Bytes
088		Signed (MSB)	2Bytes
089	CAN35 Value	Signed (LSB)	2Bytes
090		Signed (MSB)	2Bytes
091	Reserved	Signed	2Bytes
092	Actual Air Fuel Ratio	Signed	2Bytes
093	Throttle Valve Position	Signed	2Bytes
094	Coolant Level	Signed	2Bytes
095	Oil Temperature	Signed	2Bytes
096	Coolant Pressure	Signed	2Bytes
097	Fuel Pressure	Signed	2Bytes
098	Fuel Temperature	Signed	2Bytes
099	Inlet Temperature	Signed	2Bytes
0100	Exhaust Temperature	Signed	2Bytes
0101	Turbo Pressure	Signed	2Bytes
0102	Fuel Consumption	Signed	2Bytes
0103	Reserved	Signed	2Bytes
0104	Accumulated Fuel Consumption	Unsigned (LSB)	2Bytes
0105		Unsigned (MSB)	2Bytes
0106	Coolant Temperature	Unsigned	2Bytes
0107	CAN36 Value	Signed (LSB)	2Bytes
0108		Signed (MSB)	2Bytes
0109	Reserved	Unsigned	2Bytes
0110	CAN37 Value	Signed (LSB)	2Bytes
0111		Signed (MSB)	2Bytes
0112	CAN38 Value	Signed (LSB)	2Bytes
0113		Signed (MSB)	2Bytes
0114	CAN39 Value	Signed (LSB)	2Bytes
0115		Signed (MSB)	2Bytes
0116	CAN40 Value	Signed (LSB)	2Bytes
0117		Signed (MSB)	2Bytes

Address	Item	Description	Bytes
0118	CAN41 Value	Signed (LSB)	2Bytes
0119		Signed (MSB)	2Bytes
0120	CAN42 Value	Signed (LSB)	2Bytes
0121		Signed (MSB)	2Bytes
0122	CAN43 Value	Signed (LSB)	2Bytes
0123		Signed (MSB)	2Bytes
0124	Controller Issue Year	Signed	2Bytes
0125	Controller Issue Month	Signed	2Bytes
0126	Controller Issue Day	Signed	2Bytes
0127	CAN44 Value	Signed (LSB)	2Bytes
0128		Signed (MSB)	2Bytes
0129	CAN45 Value	Signed (LSB)	2Bytes
0130		Signed (MSB)	2Bytes
0131	CAN46 Value	Signed (LSB)	2Bytes
0132		Signed (MSB)	2Bytes
0133	CAN47 Value	Signed (LSB)	2Bytes
0134		Signed (MSB)	2Bytes
0135	CAN48 Value	Signed (LSB)	2Bytes
0136		Signed (MSB)	2Bytes
0137	CAN49 Value	Signed (LSB)	2Bytes
0138		Signed (MSB)	2Bytes
0139	ECU Running Time	Unsigned (LSB)	2Bytes
0140		Unsigned (MSB)	2Bytes
0141	Reserved	Unsigned	2Bytes
0142	Reserved	Unsigned	2Bytes
0143	Reserved	Unsigned	2Bytes
0144	Reserved	Unsigned	2Bytes
0145	Accumulated Running Hours	Signed (MSB)	2Bytes
0146	Accumulated Running Hours	Signed (LSB)	2Bytes
0147	Accumulated Running Minutes	Signed	2Bytes
0148	Accumulated Running Seconds	Signed	2Bytes
0149	Reserved	Unsigned	2Bytes
0150	Reserved	Unsigned	2Bytes
0151	Reserved	Signed	2Bytes
0152	Reserved	Signed	2Bytes
0153	DEF Tank Level	Signed	2Bytes
0154	DEF Tank Temperature	Signed	2Bytes
0155	DEF Supply Quantity	Signed	2Bytes
0156	DEF Supply Pressure	Signed	2Bytes
0157	DPF Soot Content	Signed	2Bytes
0158	DPF Ash Content	Signed	2Bytes
0159	SCR Inlet Temperature	Signed	2Bytes
0160	SCR Outlet Temperature	Signed	2Bytes

NOTE1: Actual value = received data * ratio. Take battery voltage as the example: received data is 278, ratio is 0.1, then

the actual voltage is 27.8V;

NOTE2: For 4-byte data, the actual value = received data MSB*65535 + 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, 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 "ECU Running Time (current is 123456h)", firstly get the corresponding address is 0138 and 0139 by checking the table, then it is known that you need to read 2 words' data.

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

Table 6 − Master Request Command

Slave Address	Function Code	Starting Address (0138)		Data Qty. (2)		CRC 16 Calibration	
		MSB	LSB	MSB	LSB	LSB	MSB
01	03	00	8A	00	02	9C	21

Slave response command is as following:

Table 7 − Slave Response Command

Slave Address	Function Code	Data Qty. (Bytes)	Data				CRC 16 Calibration	
			Data MSB of address 0138	Data LSB of address 0138	Data MSB of address 0139	Data LSB of address 0139	LSB	MSB
01	03	04	E2	40	00	01	0D	BD

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

Table 8 − Slave Response Command

Address	Received Data (Hex)	Combination (Hex)	S1 Accum. Close Times (Decimal)
0138	E240H	0001E240H	123456
0139	0001H		

3.3 GENSET STATUS DESCRIPTION

Table 9 − Genset Status Description

No.	Content	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 Delay	
6	Start Idle	
7	High Speed Warming Up	

No.	Content	Description
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	After Stop	
15	Stop Failure	No delay value for this status.

Example:

If the content of address 059 is 1, the content of 060 is 0, it means engine is in standby, no delay.

3.4 FUNCTION CODE 05H MAPPING COILS ADDRESS

Table 10 – Coils Address

Address	Item	Description
0000	Remote Start Key	1 for active
0001	Remote Stop Key	1 for active
0002	Reserved	1 for active
0003	Reserved	1 for active
0004	Reserved	1 for active
0005	Reserved	1 for active
0006	Reserved	1 for active
0007	Reserved	1 for active
0008	Reserved	1 for active
0009	Reserved	1 for active
0010	Reserved	1 for active
0011	Reserved	1 for active
0012	Reserved	1 for active
0013	Reserved	1 for active
0014	Reserved	1 for active
0015	Reserved	1 for active
0016	Reserved	1 for active
0017	Reserved	1 for active
0018	Reserved	1 for active
0019	Reserved	1 for active
0020	Reserved	1 for active
0021	Reserved	1 for active
0022	Reserved	1 for active
0023	Reserved	1 for active

4 FAQ

4.1 COMMUNICATION LINE SHIELDING LAYER GROUNDED

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

4.2 RS485 TO USB COMMUNICATION ADAPTOR

PC can communicate with SG72A module produced by our company.

4.3 COMMON SOLUTIONS OF COMMUNICATION FAILURE

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

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