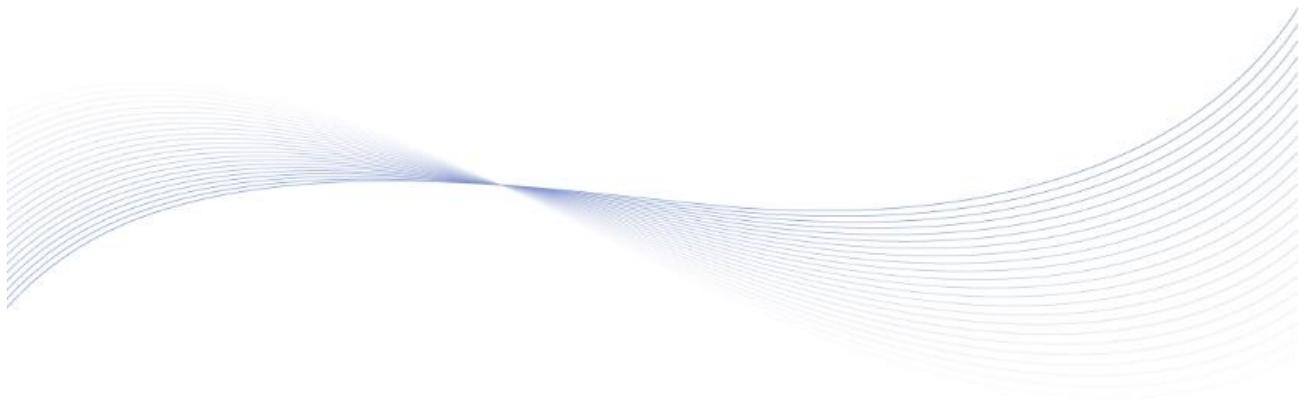

SmartGen

MAKING CONTROL SMARTER

HED400
ENGINE MONITORING MODULE
COMMUNICATION PROTOCOL



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SMARTGEN(ZHENGZHOU)TECHNOLOGY CO.,LTD.

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SmartGen

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Table 1 Software Version

Date	Version	Content
2025-07-11	V1.0	Original release.

1 DESCRIPTION

This protocol describes the module RS485 half-duplex serial port's reading and writing command format, and the definition of internal information & data for the third-party to develop and use.

The module works as a slave module, and uses Modbus-RTU protocol, but it doesn't support other protocols, such as Modbus-ASCII, etc.

Communication address: 1~254 (Default: 1)

Baud rate: 9600/19200/38400bps (Default: 9600bps)

Start bit: 1 bit

Data bit: 8 bits

Parity bit: None

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

Function code supported: 03H. Function code 03H is used for reading the alarms, status and various kinds of electric parameters.

Data checking method: CRC16.

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

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 modules.

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

2 WIRING DIAGRAM

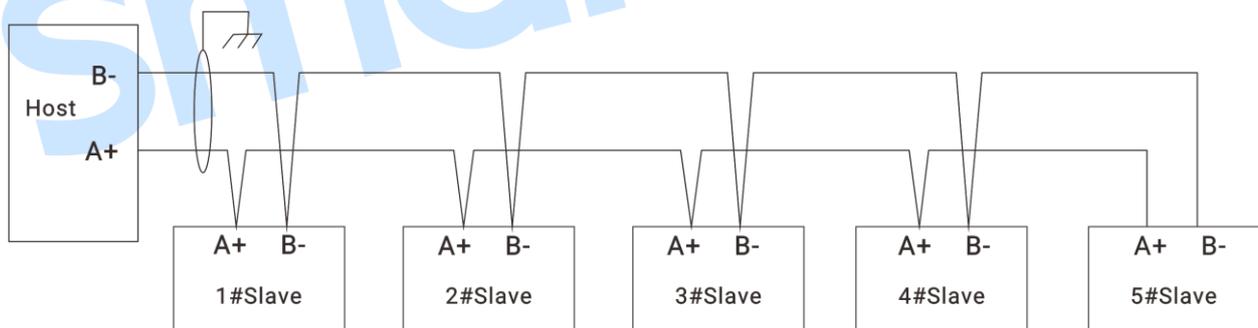


Fig. 1 Multiple Devices Communication Wiring Diagram

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

3 MODULE INTERNAL REGISTER ADDRESS AND DATA

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

Table 2 Alarm and Coil Status of Data Field

Modbus Address	Item	Description
000.0	Common Alarm	"0" means no common alarm occurs "1" means a common alarm occurs (000.0 means the Boolean value at bit0 of address 000) The content listed below follows the same rule
000.1	Reserved	
000.2	Common Warning Alarm	
000.3	Reserved	
000.4	Reserved	
000.5	Reserved	
000.6	Reserved	
000.7	Normal Running	
000.8	Reserved	
000.9	Reserved	
000.10	Reserved	
000.11	Reserved	
000.12	Reserved	
000.13	Reserved	
000.14	Reserved	
000.15	Reserved	
0001	Reserved	
0002	Reserved	
0003	Reserved	
0004	Reserved	
0005	Reserved	
0006	Reserved	
0007	Reserved	
0008	Reserved	
0009	Reserved	
0010	Reserved	
0011	Reserved	
0012	Reserved	
0013	Reserved	
0014	Reserved	
0015	Reserved	
0016	Reserved	
0017	Reserved	

Modbus Address	Item	Description
0018	Reserved	
0019	Reserved	
0020.0	Engine Over Speed Warning	
0020.1	Reserved	
0020.2	Reserved	
0020.3	Manual DPF Regeneration	
0020.4	NCD Error	
0020.5	Reserved	
0020.6	Reserved	
0020.7	Reserved	
0020.8	Reserved	
0020.9	Charging Failure	
0020.10	Battery Overvoltage Warning	
0020.11	Battery Undervoltage Warning	
0020.12	Reserved	
0020.13	Reserved	
0020.14	Reserved	
0020.15	ECU Warning	
0021.0	Coolant Temp. (ECU) High	
0021.1	Coolant Temp. (ECU) Low	
0021.2	Oil Pressure (ECU) High	
0021.3	Oil Pressure (ECU) Low	
0021.4	Reserved	
0021.5	Reserved	
0021.6	Reserved	
0021.7	Reserved	
0021.8	Flex. Sensor 1 Open Warning	
0021.9	Flex. Sensor 1 High Warning	
0021.10	Flex. Sensor 1 Low Warning	
0021.11	Reserved	
0021.12	Flex. Sensor 2 Open Warning	
0021.13	Flex. Sensor 2 High Warning	
0021.14	Flex. Sensor 2 Low Warning	
0021.15	Reserved	
0022.0	Flex. Sensor 3 Open Warning	
0022.1	Flex. Sensor 3 High Warning	
0022.2	Flex. Sensor 3 Low Warning	
0022.3	Flex. Sensor 3 Error	
0022.4	Flex. Sensor 4 Open Warning	
0022.5	Flex. Sensor 4 High Warning	
0022.6	Flex. Sensor 4 Low Warning	
0022.7	Flex. Sensor 4 Error	
0022.8	Flex. Sensor 5 Open Warning	
0022.9	Flex. Sensor 5 High Warning	

Modbus Address	Item	Description
0022.10	Flex. Sensor 5 Low Warning	
0022.11	Flex. Sensor 5 Error	
0022.12	Flex. Sensor 6 Open Warning	
0022.13	Flex. Sensor 6 High Warning	
0022.14	Flex. Sensor 6 Low Warning	
0022.15	Flex. Sensor 6 Error	
0023	Reserved	
0024.0	Input 1 Warning	
0024.1	Input 2 Warning	
0024.2	Input 3 Warning	
0024.3	Reserved	
0024.4	Reserved	
0024.5	Reserved	
0024.6	Reserved	
0024.7	Reserved	
0024.8	Reserved	
0024.9	Reserved	
0024.10	Reserved	
0024.11	Reserved	
0024.12	Reserved	
0024.13	Reserved	
0024.14	Reserved	
0024.15	Reserved	
0025.0	Maintenance 1 Time Due	
0025.1	Maintenance 2 Time Due	
0025.2	Maintenance 3 Time Due	
0025.3	Maintenance 4 Time Due	
0025.4	Maintenance 5 Time Due	
0025.5	Maintenance 6 Time Due	
0025.6	Maintenance 7 Time Due	
0025.7	Maintenance 8 Time Due	
0025.8	Maintenance 9 Time Due	
0025.9	Maintenance 10 Time Due	
0025.10	Reserved	
0025.11	Reserved	
0025.12	Reserved	
0025.13	Reserved	
0025.14	Reserved	
0025.15	Reserved	
0026	Reserved	
0027	Reserved	
0028	Reserved	
0029	Reserved	
0030	Reserved	

Modbus Address	Item	Description
0031	Reserved	
0032	Reserved	
0033	Reserved	
0034	Reserved	
0035	Reserved	
0036	Reserved	
0037	Reserved	
0038	Reserved	
0039	Reserved	
0040	Reserved	
0041	Reserved	
0042	Reserved	
0043	Reserved	
0044	Reserved	
0045	Reserved	
0046	Reserved	
0047	Reserved	
0048	Reserved	
0049	Reserved	

3.2 FUNCTION CODE 03H MAPPING PARAMETERS OF DATA FIELD

Table 3 Parameters of Data Field

Modbus Address	Item	Ratio	Unit	Description	Remarks
0050	Engine Speed	1	rpm	16-bit Unsigned	
0051	Coolant Temp.	1	°C	16-bit Signed	
0052	Engine Oil Pressure	1	kPa	16-bit Unsigned	
0053	Battery Voltage	0.1	V	16-bit Unsigned	
0054	Charger D+ Voltage	0.1	V	16-bit Unsigned	
0055	/				
0056	/				
0057	/				
0058	/				
0059	/				
0060	/				
0061	/				
0062	/				
0063	/				
0064	/				
0065	Module Model	1		16-bit Unsigned	
0066	/				
0067	Flex. Sensor 1 Resistance	0.1	Ω	16-bit Unsigned	
0068	Flex. Sensor 1 Value	1		16-bit Signed	

Modbus Address	Item	Ratio	Unit	Description	Remarks
0069	Flex. Sensor 2 Resistance	0.1	Ω	16-bit Unsigned	
0070	Flex. Sensor 2 Value	1		16-bit Signed	
0071	Flex. Sensor 3 Resistance/Current/Voltage Value	0.1/ 0.01	Ω/mA/V	16-bit Unsigned	
0072	Flex. Sensor 3 Value	1		16-bit Signed	
0073	Flex. Sensor 4 Resistance/Current/Voltage Value	0.1/ 0.01	Ω/mA/V	16-bit Unsigned	
0074	Flex. Sensor 4 Value	1		16-bit Signed	
0075	Flex. Sensor 5 Resistance/Current/Voltage Value	0.1/ 0.01	Ω/mA/V	16-bit Unsigned	
0076	Flexible Sensor 5 Value	1		16-bit Signed	
0077	Flex. Sensor 6 Resistance/Current/Voltage Value	0.1/ 0.01	Ω/mA/V	16-bit Unsigned	
0078	Flex. Sensor 6 Value	1		16-bit Signed	
0079	Coolant Pressure	1	kPa	16-bit Unsigned	
0080	Coolant Level	1	%	16-bit Unsigned	
0081	Fuel Pressure	1	kPa	16-bit Unsigned	
0082	Fuel Temp.	1	°C	16-bit Signed	
0083	Oil Temp.	1	°C	16-bit Signed	
0084	Air Inlet Temp.	1	°C	16-bit Signed	
0085	Turbo Pressure	1	kPa	16-bit Unsigned	
0086	Intake Pressure	1	kPa	16-bit Unsigned	
0087	Exhaust Outlet Temp.	1	°C	16-bit Signed	
0088	Fuel Consumption	0.1	L/h	16-bit Unsigned	
0089	Accumulated Fuel Consumption	1	L	32-bit Unsigned	
0090					
0091	Fuel Level	1	%	16-bit Unsigned	
0092	/				
0093	Engine Load Ratio	1	%	16-bit Unsigned	
0094	Torque Percentage	1	%	16-bit Signed	
0095	Water in Fuel			16-bit Unsigned	
0096	DPF Carbon Load	1	%	16-bit Unsigned	
0097	Urea Level	1	%	16-bit Unsigned	
0098	Urea Temp.	1	°C	16-bit Signed	
0099	DPF Soot Load Ratio	1	%	16-bit Unsigned	
00100	SCR Inlet Temp.	1	°C	16-bit Signed	
00101	SCR Outlet Temp.	1	°C	16-bit Signed	
00102	ECU Engine Running Status	0.1	h	32-bit Unsigned	
00103					
00104	DPF Outlet Temp.	1	°C	16-bit Signed	
00105	DOC Inlet Temp.	1	°C	16-bit Signed	
00106	Barometric Pressure	1	kPa	16-bit Unsigned	
00107	Ambient Temp.	1	°C	16-bit Signed	

Modbus Address	Item	Ratio	Unit	Description	Remarks
00108	EGR Valve	1	%	16-bit Unsigned	
00109	Throttle Pedal	1	%	16-bit Unsigned	
00110	Crankcase Pressure	1	kPa	16-bit Unsigned	
00111	Left Exhaust Temp.	1	°C	16-bit Signed	
00112	Right Exhaust Temp.	1	°C	16-bit Signed	
00113	Gearbox Lubricating Oil Temp.	1	°C	16-bit Signed	
00114	Gearbox Lubricating Oil Pressure	1	kPa	16-bit Unsigned	
00115	Exhaust Outlet 1 Temp.	1	°C	16-bit Signed	
00116	Exhaust Outlet 2 Temp.	1	°C	16-bit Signed	
00117	Exhaust Outlet 3 Temp.	1	°C	16-bit Signed	
00118	Exhaust Outlet 4 Temp.	1	°C	16-bit Signed	
00119	Exhaust Outlet 5 Temp.	1	°C	16-bit Signed	
00120	Exhaust Outlet 6 Temp.	1	°C	16-bit Signed	
00121	Exhaust Outlet 7 Temp.	1	°C	16-bit Signed	
00122	Running Hours	1	h	16-bit Unsigned	
00123	Running Minutes	1	min	16-bit Unsigned	
00124	Running Seconds	1	s	16-bit Unsigned	
00125	Exhaust Outlet 8 Temp. (°C)	1	°C	16-bit Signed	
00126	Exhaust Outlet 9 Temp. (°C)	1	°C	16-bit Signed	
00127	Exhaust Outlet 10 Temp. (°C)	1	°C	16-bit Signed	
00128	Exhaust Outlet 11 Temp. (°C)	1	°C	16-bit Signed	
00129	Exhaust Outlet 12 Temp. (°C)	1	°C	16-bit Signed	
00130	Exhaust Outlet 13 Temp. (°C)	1	°C	16-bit Signed	
00131	Exhaust Outlet 14 Temp. (°C)	1	°C	16-bit Signed	
00132	Exhaust Outlet 15 Temp. (°C)	1	°C	16-bit Signed	
00133	Software Version	0.1		16-bit Unsigned	
00134	Hardware Version	0.1		16-bit Unsigned	
00135	Release Year	1		16-bit Unsigned	Save the last two digits of the Year only.
00136	Release Month	1		16-bit Unsigned	
00137	Released Day	1		16-bit Unsigned	
00138	Reserved				
00139	Event Log Quantity			16-bit Unsigned	
00140	Reserved				
00141	Reserved				
00142	Reserved				
00143	Reserved				
00144	Reserved				
00145	Reserved				
00146	Reserved				

Modbus Address	Item	Ratio	Unit	Description	Remarks
00147	Exhaust Outlet 16 Temp.	1	°C	16-bit Signed	
00148	Exhaust Outlet 17 Temp.	1	°C	16-bit Signed	
00149	Exhaust Outlet 18 Temp.	1	°C	16-bit Signed	
00150	Exhaust Outlet 19 Temp.	1	°C	16-bit Signed	
00151	Exhaust Outlet 20 Temp.	1	°C	16-bit Signed	
00152	Absolute Intake Pressure	1	kPa	16-bit Unsigned	
00153	Air Filter Differential Pressure Right	1	kPa	16-bit Unsigned	
00154	Maintenance 1 Countdown Hours	1	h	16-bit Unsigned	
00155	Maintenance 1 Countdown Minutes	1	min	16-bit Unsigned	
00156	Maintenance 1 Countdown Seconds	1	s	16-bit Unsigned	
00157	Maintenance 2 Countdown Hours	1	h	16-bit Unsigned	
00158	Maintenance 2 Countdown Minutes	1	min	16-bit Unsigned	
00159	Maintenance 2 Countdown Seconds	1	s	16-bit Unsigned	
00160	Maintenance 3 Countdown Hours	1	h	16-bit Unsigned	
00161	Maintenance 3 Countdown Minutes	1	min	16-bit Unsigned	
00162	Maintenance 3 Countdown Seconds	1	s	16-bit Unsigned	
00163	Maintenance 4 Countdown Hours	1	h	16-bit Unsigned	
00164	Maintenance 4 Countdown Minutes	1	min	16-bit Unsigned	
00165	Maintenance 4 Countdown Seconds	1	s	16-bit Unsigned	
00166	Maintenance 5 Countdown Hours	1	h	16-bit Unsigned	
00167	Maintenance 5 Countdown Minutes	1	min	16-bit Unsigned	
00168	Maintenance 5 Countdown Seconds	1	s	16-bit Unsigned	
00169	Maintenance 6 Countdown Hours	1	h	16-bit Unsigned	
00170	Maintenance 6 Countdown Minutes	1	min	16-bit Unsigned	
00171	Maintenance 6 Countdown Seconds	1	s	16-bit Unsigned	
00172	Maintenance 7 Countdown Hours	1	h	16-bit Unsigned	
00173	Maintenance 7 Countdown Minutes	1	min	16-bit Unsigned	
00174	Maintenance 7 Countdown Seconds	1	s	16-bit Unsigned	
00175	Maintenance 8 Countdown Hours	1	h	16-bit Unsigned	
00176	Maintenance 8 Countdown Minutes	1	min	16-bit Unsigned	
00177	Maintenance 8 Countdown Seconds	1	s	16-bit Unsigned	
00178	Maintenance 9 Countdown Hours	1	h	16-bit Unsigned	
00179	Maintenance 9 Countdown Minutes	1	min	16-bit Unsigned	
00180	Maintenance 9 Countdown Seconds	1	s	16-bit Unsigned	
00181	Maintenance 10 Countdown Hours	1	h	16-bit Unsigned	
00182	Maintenance 10 Countdown Minutes	1	min	16-bit Unsigned	
00183	Maintenance 10 Countdown Seconds	1	s	16-bit Unsigned	
00184	Turbo Inlet Temp.	1	°C	16-bit Signed	
00185	Fuel Filter Differential Pressure	1	kPa	16-bit Unsigned	
00186	Lubricating Oil Filter Differential Pressure	1	kPa	16-bit Unsigned	
00187	Air Filter Differential Pressure Left	1	kPa	16-bit Unsigned	
00188	Intercooler Temp.	1	°C	16-bit Signed	

Modbus Address	Item	Ratio	Unit	Description	Remarks
00189	Throttle Percentage	1	%	16-bit Unsigned	
00190	Vehicle Speed	1	km/h	16-bit Unsigned	
00191	Friction Torque	1	%	16-bit Signed	
00192	Flow	0.1/ 0.01	L/min or m ³ /h	16-bit Unsigned	
00193	Roller Speed	1	rpm	16-bit Unsigned	
00194	Alarm 1 SPN				
00195					
00196	Alarm 1 FMI				
00197	Alarm 2 SPN				
00198					
00199	Alarm 2 FMI				
00200	Alarm 3 SPN				
00201					
00202	Alarm 3 FMI				
00203	Alarm 4 SPN				
00204					
00205	Alarm 4 FMI				
00206	Alarm 5 SPN				
00207					
00208	Alarm 5 FMI				
00209	Alarm 6 SPN				
00210					
00211	Alarm 6 FMI				
00212	Alarm 7 SPN				
00213					
00214	Alarm 7 FMI				
00215	Alarm 8 SPN				
00216					
00217	Alarm 8 FMI				
00218	Alarm 9 SPN				
00219					
00220	Alarm 9 FMI				
00221	Alarm 10 SPN				
00222					
00223	Alarm 10 FMI				

4 EXAMPLES OF MESSAGE FRAME FORMAT

4.1 FUNCTION CODE 03H

With the slave address 01 and the start address 0026H, three pieces of data are as follows (each data length is 2 bytes).

Table 4 Examples of Data Address

Address	Data (Hex)
0026H	0014
0027H	0014
0028H	0005

Table 5 Examples of 03H Master/Host Request

Master/Host Request	Bytes	Examples (Hex)
Slave Address	1	01 Send to the slave address 01
Function Code	1	03 Read single point register
Start Address	2	00 26 Start address is 0026H
Quantity of Registers	2	00 03 Read 3 registers (6 bytes in total)
CRC Code	2	E4 00 CRC code calculated by the master/host

Table 6 Examples of 03H Slave Response

Slave Response	Bytes	Examples (Hex)
Slave Address	1	01 Return the slave address 01
Function Code	1	03 Read single point register
Quantity of Bytes	1	06 Read 3 registers (6 bytes in total)
Point 1 Data	2	00 14 Content of Address 0026H
Point 2 Data	2	00 14 Content of Address 0027H
Point 3 Data	2	00 05 Content of Address 0028H
CRC Code	2	91 71 CRC code calculated by the slave