SmartGen
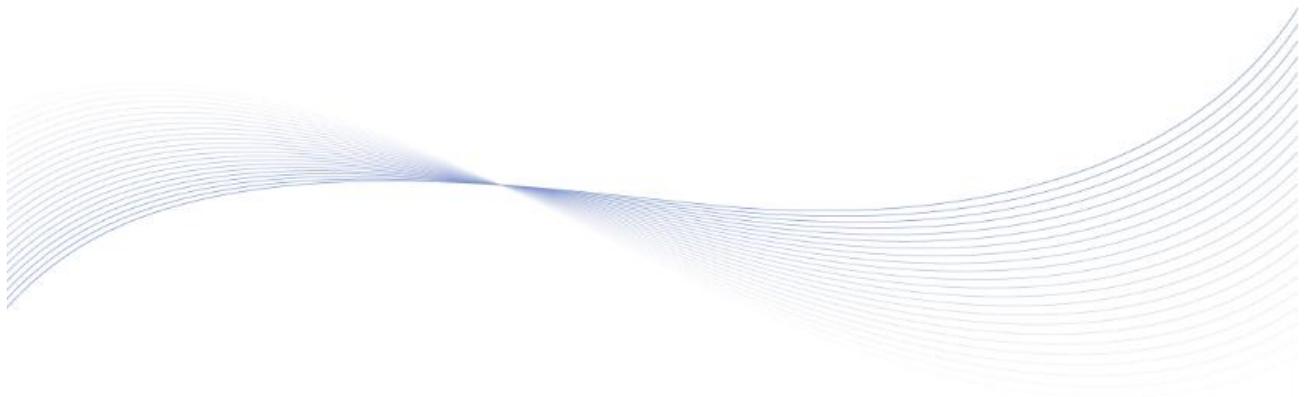
MAKING CONTROL SMARTER

ACC7100

DIESEL AIR COMPRESSOR 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

SmartGen reserves the right to change the contents of this document without prior notice.

Table 1 - Software Version

Date	Version	Note
2019-10-18	1.0	Original release.
2022-11-21	1.1	1. Update company logo; 2. Add some communication data.

CONTENT

1. INTRODUCTION

This protocol describes read and write command format of PC serial port and the definition of internal information data for the third-party to develop and use.

MODBUS communication protocol allows the module to transfer information and data effectively with PLC, RTU, SCADA system of international brands (such as, Schneider, Siemens, and Modicon etc.), and DCS or third-party monitoring system which is compatible with MODBUS. The monitoring system can be set up if a central PC (or IPC)-based communication master software is added (such as Kingview, Intouch, FIX, synall etc.).

2. MODBUS BASIC RULES

— All communication loops should follow the master-slave mode. In this way, data can be transferred between a master (e.g. PC) and 32 slaves.
— No communication can start from slaves.
— In communication loop, all communication should be transmitted in "information frame".
— If master or slave receives information frame with unknown command, no response will be given.

3. DATA FRAME FORMAT

Communication is asynchronously transferred by the unit of byte (data frame). Each data frame is a serial data stream of 10 bits (stop bit: 1) or 11 bits (stop bit: 2) between master and slave.

Table 2 - Data Frame Format

Item	Description
Start bit	1-bit
Data bit	8-bit
Parity bit	No parity
Stop bit	1-bit, 2-bit can be set.
Baud rate	9600bps

4. COMMUNICATION PROTOCOL

4.1 ILLUSTRATION

When communication command is sent to the instrument, device who accords with the address code receives the communication command, and removes the address code to read information. If nothing goes wrong, it shall conduct the task, and then send implementation result to the sender. The returned information includes address code, function code of implemented action, data after implemented action, and CRC. If an error occurs, then nothing shall be sent.

4.2 INFORMATION FRAME FORMAT

Table 3 - Information Frame Format

Initiating structure	Address code	Function code	Data field	CRC	End structure
Delay (equivalent to 4 bytes)	1 byte 8-bit	1 byte 8-bit	N bytes N*8-bit	2 bytes 16-bit	Delay (equivalent to 4 bytes)

4.3 ADDRESS CODE

Address code is the first data frame (8-bit) in each transmitted information frame (0-255). Single device address range is 1-255, which means that slave device whose address code is defined by users will receive the information sent by the master. Each slave has a unique address code, and each response begins with its address code. The address code issued by the master means the slave address to be sent to, while address code issued by slave means the responded slave address.

4.4 FUNCTION CODE

4.4.1 ILLUSTRATION

Function code is the second data of each communication transmission. ModBus communication protocol defines function code as 1-255 (01H-0FFH). ACC7100 controller uses a part of it. By master request master can tell slave to conduct certain action. By slave response slave can show that it has responded to the master and conducted the action as the function code issued by the slave is the same as the one issued by the master. If the function code MSB is 1 (function code>127), it means slave does not respond, or response has an error.

The following table shows the specific signification and operation of function code.

Table 4 - ModBus Partial Function Codes

Function code	Definition	Operation
03H	Read Registers	Reads single or multiple register data.
05H	Force Single Coil	Forces a single coil.
06H	Write Single Register	Write a 16-bit binary number to register.

4.4.2 03H READ REGISTERS

With communication command of function code 03H, master can read the numerical registers (all kinds of collected analogue data and pre-set parameter values are stored in the register) inside the instrument. Input register value of 03H mapping data field is 16-bit (2 bytes). So register values read from the instrument are all 2 bytes. For each time maximum readable register values are 125.

Command format of slave response is address code, function code, data field, and CRC code. Data in data field are dual bytes in a group of 2 bytes and high byte is in the front.

4.4.3 05H FORCE SINGLE COIL

With this command master can store single coil data to bit registers (e.g. ATS transfer control). Slave also can respond information to the master with this command.

4.4.4 06H WRITE SINGLE REGISTER

With this command master can store single data to bit registers in the instrument. Register in ModBus communication protocol refers to 16-bit (2 bytes) and high byte is in the front. In this way all

points in the device are 2 bytes. Command format is slave address, function code, data field and CRC code.

4.5 DATA FIELD

4.5.1 ILLUSTRATION

Data field varies with different function codes.

4.5.2 FUNCTION 03H DATA FIELD FORMAT

Table 5 - Master Request

Data Sequence	Data Signification	Byte Count
1	Starting address	2
2	Read register numbers	2

Table 6 - Slave Response

Data Sequence	Data Signification	Byte Count
1	Loopback byte count	1
2	N register data	N

4.5.3 FUNCTION 05H DATA FIELD FORMAT

Table 7 - Master Request

Data Sequence	Data Signification	Byte Count
1	Coil address	2
2	Force single coil value	2

Table 8 - Slave Response

Data Sequence	Data Signification	Byte Count
1	Coil address	2
2	Single coil value	2

4.5.4 FUNCTION 06H DATA FIELD FORMAT

Table 9 - Master Request

Data Sequence	Data Signification	Byte Count
1	Register address	2
2	Register value (2 bytes)	2

Table 10 - Slave Response

Data Sequence	Data Signification	Byte Count
1	Register address	2
2	Register value (2 bytes)	2

![SmartGen logo - MAKING CONTROL SMARTER]

4.6 ERROR CHECK CODE (CRC)

Master or slave can detect whether the received information is wrong or not with CRC. Sometimes due to electric noise or other interference, information will have small change in the transmission process. CRC ensures master or slave does not respond to the wrong information in the transmission process. In this way system safety and efficiency are guaranteed. CRC applies CRC-16 calibration method.

For 2 bytes CRC, low byte is in the front and high byte is in the back.

⚠**NOTE:** All information frame formats are same: address code, function code, data area and CRC code.

CRC includes 2 bytes, which is 16-bit binary number. CRC is counted by the sender and placed at the end of the transmitted information. Responded device will count the received information is the same as the information again. If they are different, then it means there is an error.

CRC counting method: first place 16-bit register as 1. Then gradually tackle with 8-bit data information. Only 8-bit of data is used in the process of CRC counting. Start bit and stop bit are not included.

In the process of CRC counting, 8-bit data is Exclusive OR with the register data. The obtained result moves 1 bit to the low byte direction and fill MSB with 0. Check LSB again and if LSB is 1, then make register contents Exclusive OR with the preset values. If LSB is 0, then do not do Exclusive OR counting.

This process is repeated for many times. After the eighth bit move, the next 8-bit shall Exclusive OR with the current register contents. This also repeated for 8 times as the last one. Until all data information is handled, the last register contents are CRC value.

CRC-16 Calculation Procedure:
1) Place a 16-bit register as FFFF hex;
2) Make the first 8-bit data Exclusive OR with the low 8-bit of the CRC register, and put the result in the CRC register;
3) Shift the CRC register one bit to the right, and fill MSB with 0. Examine the moved-out bit;
4) If LSB was 0: repeat Step 3 (another shift);
   If LSB was 1: Exclusive OR the CRC register with A001 hex;
5) Repeat Step 3 and 4 until 8 shifts have been performed. When this is done, a complete 8–bit data are processed;
6) Repeat Step 2 to 5 for the next 8-bit data of the message;
7) The final CRC register value is the CRC code. Least Significant Byte is transmitted first and Most Significant Byte is at the last.

⚠**NOTE:** The calculation of CRC code starts from <slave address> for all bytes, excluding <CRC code>.

4.7 EXAMPLES OF INFORMATION FRAME FORMAT

4.7.1 FUNCTION CODE 03H

Slave address is 00 and start address is 0026H of 3 data (each data is 2 bytes).

Table 11 - Data Address Example

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

Table 12 - Function Code 03H Master Request Example

Request	Bytes	Example (Hex)	
Slave address	1	01	Send to slave 01
Function code	1	03	Read holding registers
Starting address	2	00 26	Starting address is 0026H
Count number	2	00 03	Read 3 data (total 6 bytes)
CRC code	2	E4 00	CRC code which calculated by PC

Table 13 - Function Code 03H Slave Response Example

Response	Bytes	Example (Hex)	
Slave address	1	01	Respond slave address 01
Function code	1	03	Read register
Read count	1	06	3 data (total 6 bytes)
Data 1	2	00 14	The content of address 0026H
Data 2	2	00 14	The content of address 0027H
Data 3	2	00 05	The content of address 0028H
CRC code	2	91 71	CRC code which calculated by slave

4.7.2 FUNCTION CODE 05H

Slave address is 01 and starting address is 0002H of 1 coil. Place 0002H unit as 1.

Table 14 - Coil Data Address Example

Address	Data (Hex)
0000	0
0001	1
0002	0

⚠**NOTE:** FF00 hex coil value is forced to 1 and 0000H is forced to 0. Other values are illegal and will not affect the coil.

Table 15 - Function Code 05H Master Request Example

Request	Bytes	Example (Hex)	
Slave address	1	01	Send slave address 01
Function code	1	05	Force coil
Starting address	2	00 00	Starting address is 0000H
Data	2	FF 00	Set coil as 1
CRC code	2	CD FB	CRC code which calculated by PC

Table 16 - Function Code 05H Slave Response Example

Slave Response	Bytes	Example (Hex)	
Slave address	1	01	Respond slave address 01
Function code	1	05	Force coil
Starting address	2	00 00	Starting address is 0000H
Data	2	FF 00	Set coil as 1
CRC code	2	CD FB	CRC code which calculated by slave

4.7.3 FUNCTION CODE 06H

Slave address is 01 and place starting address of 00E3H of 1 point as 0002H.

Table 17 - Function Code 06H Master Request Example

Request	Bytes	Example (Hex)	
Slave address	1	01	Send slave address 01
Function code	1	06	Write single register
Starting address	2	00 E3	Starting address is 00E3H
Data	2	00 02	Place 1 point data (total 2 bytes)
CRC code	2	F9 FD	CRC code which calculated by PC

Table 18 - Function Code 06H Slave Response Example

Slave Response	Bytes	Example (Hex)	
Slave address	1	01	Respond slave address 01
Function code	1	06	Write single register
Starting address	2	00 E3	Starting address is 00E3H
Data	2	00 02	Place 1 point data (total 2 bytes)
CRC code	2	F9 FD	CRC code which calculated by slave

4.8 ERROR HANDLING

When device detects other errors except the CRC code, the slave must send information to the master. The function code MSB is 1, which means the response function code by slave should add 128 based on the function code sent by the master. The following codes show that unexpected errors have occurred.

If CRC error occurs for the information received by the slave, then the device will ignore.

Table 19 - Error Code Format of Slave Response (CRC excluded)

Type	Byte
Address code	1 byte
Function code	1 byte (MSB is 1)
Error code	1 byte
CRC code	2 bytes

Error code:

01 illegal function code

The function code received in the query is not an allowable action for the slave.

02 illegal data address

The data address received in the query is not an allowable address for the slave.

03 illegal data value

A value contained in the query data field is not an allowable value for the slave.
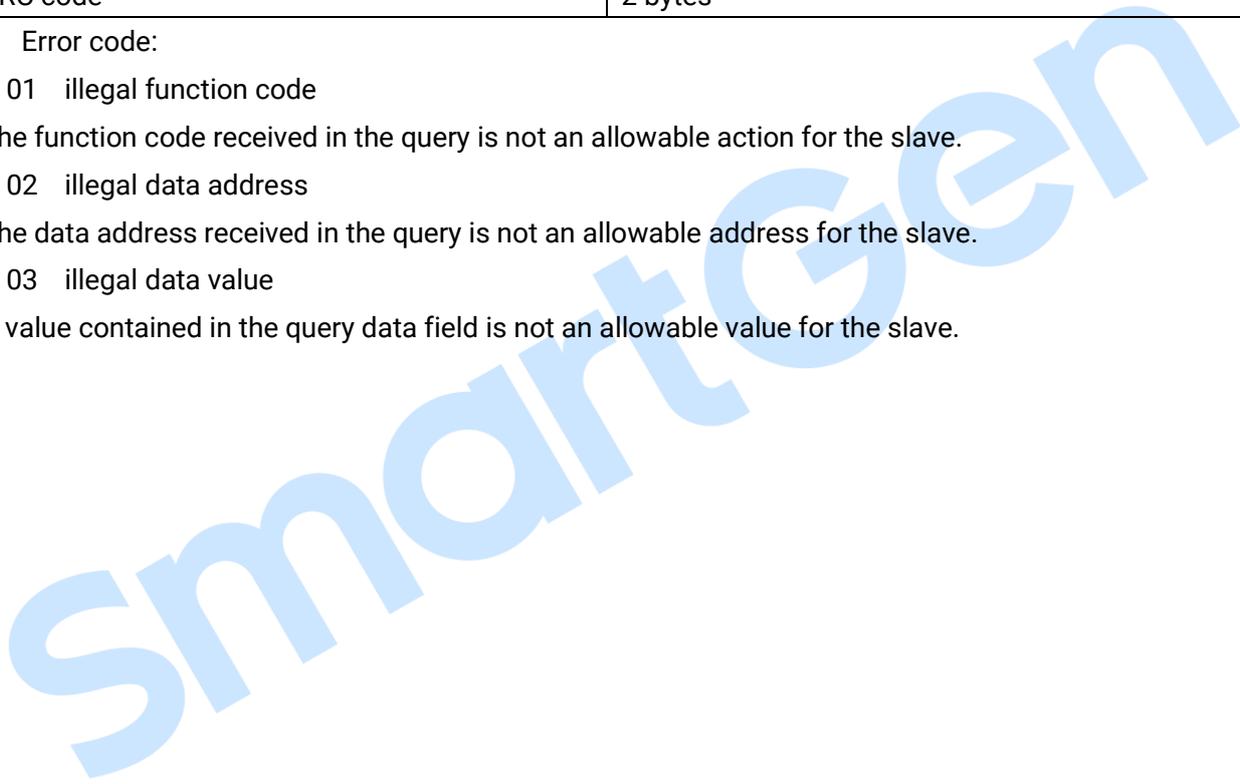
5. ATTACHMENT: ADDRESS AND DATA

5.1 FUNCTION CODE 03H MAPPING DATA FIELD

Table 20 - Function Code 03H Mapping Data Field

Address	Item	Description	Byte
0000	Common Alarm	1 for active (LSB)	1bit
	Common Shutdown Alarm	1 for active	1bit
	Common Warning Alarm	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Auto Mode	1 for active	1bit
	Manual Mode	1 for active	1bit
	Stop Mode	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for manual	1bit
	Reserved	1 for active	1bit
	Lock Mode	1 for active (MSB)	1bit
0001	Emergency Stop Alarm	1 for active	1bit
	Engine Overspeed Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
	Loss of Speed Signal Alarm	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Failed to Start Alarm	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	ECU Alarm Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
	Urea Level Low Shutdown	1 for active	1bit
	High Temp. Shutdown	1 for active	1bit
	Low Oil Press Shutdown	1 for active	1bit
0002	ECU Comm. Fail Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit

Address	Item	Description	Byte
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Temp. Sensor Open Shutdown	1 for active	1bit
	High Temp. Shutdown	1 for active	1bit
	Low Temp. Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
	Oil Pressure Sensor Open Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
	Low Oil Pressure Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
0003	Fuel Level Open Shutdown	1 for active	1bit
	Fuel Level High Shutdown	1 for active	1bit
	Fuel Level Low Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
	Discharge Pressure Open Shutdown	1 for active	1bit
	Discharge Pressure High Shutdown	1 for active	1bit
	Discharge Pressure Low Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
	Discharge Temp. Open Shutdown	1 for active	1bit
	Discharge Temp. High Shutdown	1 for active	1bit
	Discharge Temp. Low Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
	Flexible Sensor 1 Open Shutdown	1 for active	1bit
	Flexible Sensor 1 High Shutdown	1 for active	1bit
	Flexible Sensor 1 Low Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
0004	Flexible Sensor 2 Open Shutdown	1 for active	1bit
	Flexible Sensor 2 High Shutdown	1 for active	1bit
	Flexible Sensor 2 Low Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
	Flexible Sensor 3 Open Shutdown	1 for active	1bit
	Flexible Sensor 3 High Shutdown	1 for active	1bit
	Flexible Sensor 3 Low Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
	Flexible Sensor 4 Open Shutdown	1 for active	1bit
	Flexible Sensor 4 High Shutdown	1 for active	1bit
	Flexible Sensor 4 Low Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
	Flexible Sensor 5 Open Shutdown	1 for active	1bit
	Flexible Sensor 5 High Shutdown	1 for active	1bit
	Flexible Sensor 5 Low Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
0005	Input 1 Shutdown	1 for active	1bit
	Input 2 Shutdown	1 for active	1bit

Address	Item	Description	Byte
	Input 3 Shutdown	1 for active	1bit
	Input 4 Shutdown	1 for active	1bit
	Input 5 Shutdown	1 for active	1bit
	Input 6 Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Authorization Time Due Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
0006	Fuel Filter Maintenance Time Due	1 for active	1bit
	Oil Separator Maintenance Time Due	1 for active	1bit
	Air Filter Maintenance Time Due	1 for active	1bit
	Lubrication Maintenance Time Due	1 for active	1bit
	Engine Oil Filter Maintenance Time Due	1 for active	1bit
	Engine Fuel Filter Maintenance Time Due	1 for active	1bit
	Engine Lubrication Maintenance Time Due	1 for active	1bit
	Maintenance 8 Time Due	1 for active	1bit
	Maintenance 9 Time Due	1 for active	1bit
	Maintenance 10 Time Due	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
0007	Reserved	2Bytes	2Bytes
0008	Reserved	2Bytes	2Bytes
0009	Reserved	2Bytes	2Bytes
0010	Reserved	2Bytes	2Bytes
0011	Reserved	2Bytes	2Bytes
0012	Reserved	2Bytes	2Bytes
0013	Reserved	2Bytes	2Bytes
0014	Reserved	2Bytes	2Bytes
0015	Reserved	2Bytes	2Bytes
0016	Reserved	2Bytes	2Bytes
0017	Reserved	2Bytes	2Bytes
0018	Reserved	2Bytes	2Bytes
0019	Reserved	2Bytes	2Bytes
0020	Engine Over Speed Warning	1 for active	1bit

Address	Item	Description	Byte
	Reserved	1 for active	1bit
	Loss of Speed Signal Warning	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Failed to Stop Warning	1 for active	1bit
	Charge Alt Fail Warning	1 for active	1bit
	Battery Overvoltage Warning	1 for active	1bit
	Battery Undervoltage Warning	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Urea Level Low Warning	1 for active	1bit
	ECU Warning	1 for active	1bit
0021	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Engine Temp. Sensor Open Warning	1 for active	1bit
	Engine High Temp. Warning	1 for active	1bit
	Engine Low Temp. Warning	1 for active	1bit
	Reserved	1 for active	1bit
	Engine Oil Pressure Sensor Open Warning	1 for active	1bit
	Reserved	1 for active	1bit
	Low Engine Oil Pressure Warning	1 for active	1bit
	Reserved	1 for active	1bit
0022	Fuel Level Open Warning	1 for active	1bit
	Fuel Level High Warning	1 for active	1bit
	Fuel Level Low Warning	1 for active	1bit
	Reserved	1 for active	1bit
	Discharge Pressure Open Warning	1 for active	1bit
	Discharge Pressure High Warning	1 for active	1bit
	Discharge Pressure Low Warning	1 for active	1bit
	Reserved	1 for active	1bit
	Discharge Temp. Open Warning	1 for active	1bit
	Discharge Temp. High Warning	1 for active	1bit
	Discharge Temp. Low Warning	1 for active	1bit
	Reserved	1 for active	1bit
	Flexible Sensor 1 Open Warning	1 for active	1bit

Address	Item	Description	Byte
	Flexible Sensor 1 High Warning	1 for active	1bit
	Flexible Sensor 1 Low Warning	1 for active	1bit
	Reserved	1 for active	1bit
0023	Flexible Sensor 2 Open Warning	1 for active	1bit
	Flexible Sensor 2 High Warning	1 for active	1bit
	Flexible Sensor 2 Low Warning	1 for active	1bit
	Reserved	1 for active	1bit
	Flexible Sensor 3 Open Warning	1 for active	1bit
	Flexible Sensor 3 High Warning	1 for active	1bit
	Flexible Sensor 3 Low Warning	1 for active	1bit
	Reserved	1 for active	1bit
	Flexible Sensor 4 Open Warning	1 for active	1bit
	Flexible Sensor 4 High Warning	1 for active	1bit
	Flexible Sensor 4 Low Warning	1 for active	1bit
	Reserved	1 for active	1bit
	Flexible Sensor 5 Open Warning	1 for active	1bit
	Flexible Sensor 5 High Warning	1 for active	1bit
	Flexible Sensor 5 Low Warning	1 for active	1bit
	Reserved	1 for active	1bit
0024	Input 1 Warning	1 for active	1bit
	Input 2 Warning	1 for active	1bit
	Input 3 Warning	1 for active	1bit
	Input 4 Warning	1 for active	1bit
	Input 5 Warning	1 for active	1bit
	Input 6 Warning	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Authorization Time Due Warning	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
0025	Fuel Filter Maintenance Time Due Warn	1 for active	1bit
	Oil Separator Maintenance Time Due Warn	1 for active	1bit
	Air Filter Maintenance Time Due Warn	1 for active	1bit
	Lubrication Maintenance Time Due Warn	1 for active	1bit
	Engine Oil Filter Maintenance Time Due Warn	1 for active	1bit
	Engine Fuel Filter Maintenance Time Due Warn	1 for active	1bit
	Engine Lubrication Maintenance Time Due	1 for active	1bit

Address	Item	Description	Byte
	Warn		
	Maintenance 8 Time Due Warn	1 for active	1bit
	Maintenance 9 Time Due Warn	1 for active	1bit
	Maintenance 10 Time Due Warn	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
0026	Reserved	2Bytes	2Bytes
0027	Reserved	2Bytes	2Bytes
0028	Reserved	2Bytes	2Bytes
0029	Reserved	2Bytes	2Bytes
0030	Reserved	2Bytes	2Bytes
0031	Reserved	2Bytes	2Bytes
0032	Reserved	2Bytes	2Bytes
0033	Input 1 Indication	1 for active	1bit
	Input 2 Indication	1 for active	1bit
	Input 3 Indication	1 for active	1bit
	Input 4 Indication	1 for active	1bit
	Input 5 Indication	1 for active	1bit
	Input 6 Indication	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
0034	Fuel Filter Maintenance Time Due Indication	1 for active	1bit
	Oil Separator Maintenance Time Due Indication	1 for active	1bit
	Air Filter Maintenance Time Due Indication	1 for active	1bit
	Lubrication Maintenance Time Due Indication	1 for active	1bit
	Engine Oil Filter Maintenance Time Due Indication	1 for active	1bit
	Engine Fuel Filter Maintenance Time Due Indication	1 for active	1bit

Address	Item	Description	Byte
	Engine Lubrication Maintenance Time Due Indication	1 for active	1bit
	Maintenance 8 Time Due Indication	1 for active	1bit
	Maintenance 9 Time Due Indication	1 for active	1bit
	Maintenance 10 Time Due Indication	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
0035	Emergency Input Status	1 for active	1bit
	Input 1 Status	1 for active	1bit
	Input 2 Status	1 for active	1bit
	Input 3 Status	1 for active	1bit
	Input 4 Status	1 for active	1bit
	Input 5 Status	1 for active	1bit
	Input 6 Status	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
0036	Reserved	2Bytes	2Bytes
0037	Reserved	1 for active	1bit
	Start Relay Output Status	1 for active	1bit
	Aux. Output 1 Status	1 for active	1bit
	Aux. Output 2 Status	1 for active	1bit
	Aux. Output 3 Status	1 for active	1bit
	Aux. Output 4 Status	1 for active	1bit
	Aux. Output 5 Status	1 for active	1bit
	Aux. Output 6 Status	1 for active	1bit
	Aux. Output 7 Status	1 for active	1bit
	Aux. Output 8 Status	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit

Address	Item	Description	Byte
0038	Reserved	2Bytes	2Bytes
0039	Reserved	2Bytes	2Bytes
0040	Reserved	2Bytes	2Bytes
0041	Load Valve Auto Control Output	1 for active	1bit
	Load Status Output	1 for active	1bit
	Load Rate High Protection Status	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Auto Drain Output	1 for active	1bit
	Idle Running Status	1 for active	1bit
	Shutdown Alarm Inhibit	1 for active	1bit
	Instrument Mode Status	1 for active	1bit
	Reserved	1 for active	1bit
	Remote Start Status	1 for active	1bit
	Auto Start Inhibit	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
0042	Alternate Config. 1 Active	1 for active	1bit
	Alternate Config. 2 Active	1 for active	1bit
	Alternate Config. 3 Active	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
0043	Maintenance Pre-alarm Lamp	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Running Status Lamp	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit

Address	Item	Description	Byte
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
0044	DPF Fault	1 for active	1bit
	DPF Request	1 for active	1bit
	DPF Inhibit Lamp	1 for active	1bit
	DPF Exhaust Lamp	1 for active	1bit
	DPF Response Lamp	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
0045	Input 1 Active	1 for active	1bit
	Input 2 Active	1 for active	1bit
	Input 3 Active	1 for active	1bit
	Input 4 Active	1 for active	1bit
	Input 5 Active	1 for active	1bit
	Input 6 Active	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
0046	Reserved	2Bytes	2Bytes
0047	Reserved	2Bytes	2Bytes
0048	Reserved	2Bytes	2Bytes
0049	Reserved	2Bytes	2Bytes
0050	Engine Speed	Unsigned	2Bytes

Address	Item	Description	Byte
0051	Battery Voltage	Signed (*10)	2Bytes
0052	Charger Voltage	Signed (*10)	2Bytes
0053	Sensor 1 Resistance	Unsigned (*10)	2Bytes
0054	Sensor 1 Value (Water Temp.)	Signed	2Bytes
0055	Sensor 2 Resistance	Unsigned (*10)	2Bytes
0056	Sensor 2 Value (Oil Press.)	Signed	2Bytes
0057	Sensor 3 Resistance/Current/Voltage	Unsigned (*10)	2Bytes
0058	Sensor 3 Value (Fuel Level)	Signed	2Bytes
0059	Sensor 4 Resistance/Current/Voltage	Unsigned (*10)	2Bytes
0060	Sensor 4 Value (Discharge Pressure)	Signed	2Bytes
0061	Sensor 5 Resistance	Unsigned (*10)	2Bytes
0062	Sensor 5 Value (Discharge Temp.)	Signed	2Bytes
0063	Sensor 6 Current	Unsigned (*10)	2Bytes
0064	Sensor 6 Value (Flexible 1)	Signed	2Bytes
0065	Sensor 7 Current	Unsigned (*10)	2Bytes
0066	Sensor 7 Value (Flexible 2)	Signed	2Bytes
0067	Sensor 8 Resistance/Current/Voltage	Unsigned (*10)	2Bytes
0068	Sensor 8 Value (Flexible 3)	Signed	2Bytes
0069	Sensor 9 Resistance/Current/Voltage	Unsigned (*10)	2Bytes
0070	Sensor 9 Value (Flexible 4)	Signed	2Bytes
0071	Sensor 10 Resistance	Unsigned (*10)	2Bytes
0072	Sensor 10 Value (Flexible 5)	Signed	2Bytes
0073	Reserved	Unsigned (*10)	2Bytes
0074	Reserved	Signed	2Bytes
0075	SCR Inlet Temperature	Unsigned (*10)	2Bytes
0076	SCR Outlet Temperature	Signed	2Bytes
0077	Coolant Pressure	Signed	2Bytes
0078	Coolant Level	Signed	2Bytes
0079	Fuel Pressure	Signed	2Bytes
0080	Fuel Temperature	Signed	2Bytes
0081	Engine Oil Temperature	Signed	2Bytes
0082	Inlet Temperature	Signed	2Bytes
0083	Turbo Pressure	Signed	2Bytes
0084	Exhaust Temperature	Signed	2Bytes
0085	Fuel Consumption	Signed	2Bytes
0086	Total Fuel Used (LSB)	Signed	4Bytes
0087	Total Fuel Used (MSB)		
0088	Reserved	Signed	2Bytes
0089	DPF Smoke Load Rate	Signed	2Bytes
0090	Engine load Rate	Signed	2Bytes
0091	Torque Percentage	Signed	2Bytes
0092	Water in Fuel Status	Signed	2Bytes
0093	Urea Level	Signed	2Bytes
0094	Engine Status	Running Status Table	2Bytes

Address	Item	Description	Byte
0095	Engine Delay Value	Unsigned	2Bytes
0096	Reserved	Unsigned	2Bytes
0097	Reserved	Unsigned	2Bytes
0098	Reserved	Unsigned	2Bytes
0099	Reserved	Unsigned	2Bytes
0100	Reserved	Unsigned	2Bytes
0101	Total Running Hours	Unsigned	2Bytes
0102	Total Running Minutes	Unsigned	2Bytes
0103	Total Running Seconds	Unsigned	2Bytes
0104	Total Start Times	Unsigned	2Bytes
0105	Current Running Hours	Unsigned	2Bytes
0106	Current Running Minutes	Unsigned	2Bytes
0107	Current Running Seconds	Unsigned	2Bytes
0108	Reserved	Unsigned	2Bytes
0109	Reserved	Unsigned	2Bytes
0110	Reserved	Unsigned	2Bytes
0111	Reserved	Unsigned	2Bytes
0112	Reserved	Unsigned	2Bytes
0113	Controller Model	Unsigned	2Bytes
0114	Controller Software Version	Unsigned (*10)	2Bytes
0115	Controller Hardware Version	Unsigned (*10)	2Bytes
0116	Release Time (Year)	Only reserve last two numbers	2Bytes
0117	Release Time (Month)	Unsigned	2Bytes
0118	Release Time (Day)	Unsigned	2Bytes
0119	Reserved	Unsigned	2Bytes
0120	Event Logs	Unsigned	2Bytes
0121	Controller Time: Year	Only reserve last two numbers	2Bytes
0122	Controller Time: Month	Unsigned	2Bytes
0123	Controller Time: Day	Unsigned	2Bytes
0124	Controller Time: Week	Unsigned	2Bytes
0125	Controller Time: Hour	Unsigned	2Bytes
0126	Controller Time: Minute	Unsigned	2Bytes
0127	Controller Time: Second	Unsigned	2Bytes
0128	Reserved	Unsigned	2Bytes
0129	Reserved	Unsigned	2Bytes
0130	Reserved	Unsigned	2Bytes
0131	Reserved	Unsigned	2Bytes
0132	Reserved	Unsigned	2Bytes
0133	Reserved	Unsigned	2Bytes
0134	Reserved	Unsigned	2Bytes
0135	Maintenance 1 Due Countdown (Hours)	Unsigned	2Bytes
0136	Maintenance 1 Due Countdown (Minutes)	Unsigned	2Bytes

Address	Item	Description	Byte
0137	Maintenance 1 Due Countdown (Seconds)	Unsigned	2Bytes
0138	Maintenance 2 Due Countdown (Hours)	Unsigned	2Bytes
0139	Maintenance 2 Due Countdown (Minutes)	Unsigned	2Bytes
0140	Maintenance 2 Due Countdown (Seconds)	Unsigned	2Bytes
0141	Maintenance 3 Due Countdown (Hours)	Unsigned	2Bytes
0142	Maintenance 3 Due Countdown (Minutes)	Unsigned	2Bytes
0143	Maintenance 3 Due Countdown (Seconds)	Unsigned	2Bytes
0144	Maintenance 4 Due Countdown (Hours)	Unsigned	2Bytes
0145	Maintenance 4 Due Countdown (Minutes)	Unsigned	2Bytes
0146	Maintenance 4 Due Countdown (Seconds)	Unsigned	2Bytes
0147	Maintenance 5 Due Countdown (Hours)	Unsigned	2Bytes
0148	Maintenance 5 Due Countdown (Minutes)	Unsigned	2Bytes
0149	Maintenance 5 Due Countdown (Seconds)	Unsigned	2Bytes
0150	Maintenance 6 Due Countdown (Hours)	Unsigned	2Bytes
0151	Maintenance 6 Due Countdown (Minutes)	Unsigned	2Bytes
0152	Maintenance 6 Due Countdown (Seconds)	Unsigned	2Bytes
0153	Maintenance 7 Due Countdown (Hours)	Unsigned	2Bytes
0154	Maintenance 7 Due Countdown (Minutes)	Unsigned	2Bytes
0155	Maintenance 7 Due Countdown (Seconds)	Unsigned	2Bytes
0156	Maintenance 8 Due Countdown (Hours)	Unsigned	2Bytes
0157	Maintenance 8 Due Countdown (Minutes)	Unsigned	2Bytes
0158	Maintenance 8 Due Countdown (Seconds)	Unsigned	2Bytes
0159	Maintenance 9 Due Countdown (Hours)	Unsigned	2Bytes
0160	Maintenance 9 Due Countdown (Minutes)	Unsigned	2Bytes
0161	Maintenance 9 Due Countdown (Seconds)	Unsigned	2Bytes
0162	Maintenance 10 Due Countdown (Hours)	Unsigned	2Bytes
0163	Maintenance 10 Due Countdown (Minutes)	Unsigned	2Bytes
0164	Maintenance 10 Due Countdown (Seconds)	Unsigned	2Bytes
0165	MCUID MSB 1	Unsigned	4Bytes
0166			
0167	MCUID MSB 2	Unsigned	4Bytes
0168			
0169	MCUID LSB	Unsigned	4Bytes
0170			
0171	Reserved	Unsigned	2Bytes
0172	Reserved	Unsigned	2Bytes
0173	SCM Temp.	Unsigned	2Bytes
0174	LCD Temp.	Unsigned	2Bytes
0175-0206	Reserved	Unsigned	2Bytes
0207	AIN8 Sensor 1 Resistance/Current/Voltage Value	Unsigned	2Bytes
0208	AIN8 Sensor 2 Resistance/Current/Voltage Value	Unsigned	2Bytes

Address	Item	Description	Byte
0209	AIN8 Sensor 3 Resistance/Current/Voltage Value	Unsigned	2Bytes
0210	AIN8 Sensor 4 Resistance/Current/Voltage Value	Unsigned	2Bytes
0211	AIN8 Sensor 5 Resistance/Current/Voltage Value	Unsigned	2Bytes
0212	AIN8 Sensor 6 Resistance/Current/Voltage Value	Unsigned	2Bytes
0213	AIN8 Sensor 7 Resistance/Current/Voltage Value	Unsigned	2Bytes
0214	AIN8 Sensor 8 Resistance/Current/Voltage Value	Unsigned	2Bytes
0215	AIN8 Sensor 1 Value	Signed	2Bytes
0216	AIN8 Sensor 2 Value	Signed	2Bytes
0217	AIN8 Sensor 3 Value	Signed	2Bytes
0218	AIN8 Sensor 4 Value	Signed	2Bytes
0219	AIN8 Sensor 5 Value	Signed	2Bytes
0220	AIN8 Sensor 6 Value	Signed	2Bytes
0221	AIN8 Sensor 7 Value	Signed	2Bytes
0222	AIN8 Sensor 8 Value	Signed	2Bytes

5.2 FUNCTION CODE 05H MAPPING COIL FIELD

Table 21 - Function Code 05H Mapping Data Field

Coil Data		
Address	Item	Description
0000	Remote Start Key	1 for active
0001	Remote Stop Key	1 for active
0002	Remote Unload Key	1 for active
0003	Remote Onload Key	1 for active
0004	Remote Alarm Reset Key	1 for active
0005	Remote Maintenance Key	1 for active
0006	Reserved	1 for active
0007	Remote Up Key	1 for active
0008	Remote Down Key	1 for active
0009	Remote Confirm Key	1 for active
0010	Remote Return Key	1 for active
0011	Reserved	1 for active
0012	Reserved	1 for active
0013	Reserved	1 for active
0014	Reserved	1 for active
0015	Remote Rapid Stop	1 for active
0016	Reserved	1 for active
0017	Reserved	1 for active

Coil Data		
Address	Item	Description
0018	Remote Unlock	1 for active
0019	Remote Lock	1 for active
0020	Remote Output Port 1 Output	1 for active; 0 for inactive
0021	Remote Output Port 2 Output	1 for active; 0 for inactive
0022	Remote Output Port 3 Output	1 for active; 0 for inactive
0023	Remote Output Port 4 Output	1 for active; 0 for inactive
0024	Remote Output Port 5 Output	1 for active; 0 for inactive
0025	Remote Output Port 6 Output	1 for active; 0 for inactive
0026	Remote Output Port 7 Output	1 for active; 0 for inactive
0027	Remote Output Port 8 Output	1 for active; 0 for inactive
0028	Reserved	1 for active; 0 for inactive
0029	Reserved	1 for active; 0 for inactive
0030	Reset Maintenance 1 Time	1 for active
0031	Reset Maintenance 2 Time	1 for active
0032	Reset Maintenance 3 Time	1 for active
0033	Reset Maintenance 4 Time	1 for active
0034	Reset Maintenance 5 Time	1 for active
0035	Reset Maintenance 6 Time	1 for active
0036	Reset Maintenance 7 Time	1 for active
0037	Reset Maintenance 8 Time	1 for active
0038	Reset Maintenance 9 Time	1 for active
0039	Reset Maintenance 10 Time	1 for active

5.3 ENGINE RUNNING STATUS

Table 22 - Engine Running Status

No.	Item	Range	Description
0	Standby		No delay will be displayed in this status
1	Pre-heat		
2	Fuel Output		
3	Crank Delay		
4	Crank Rest		
5	Safety On		
6	Start Idle		
7	Warming Up		
8	Waiting for Load		No delay will be displayed in this status
9	Normal Running		No delay will be displayed in this status
10	Cooling		
11	Stop Idle		
12	Energize to Stop		
13	Wait Stop Time		
14	Failed to Stop		No delay will be displayed in this status
15	After Stop Time		

_____