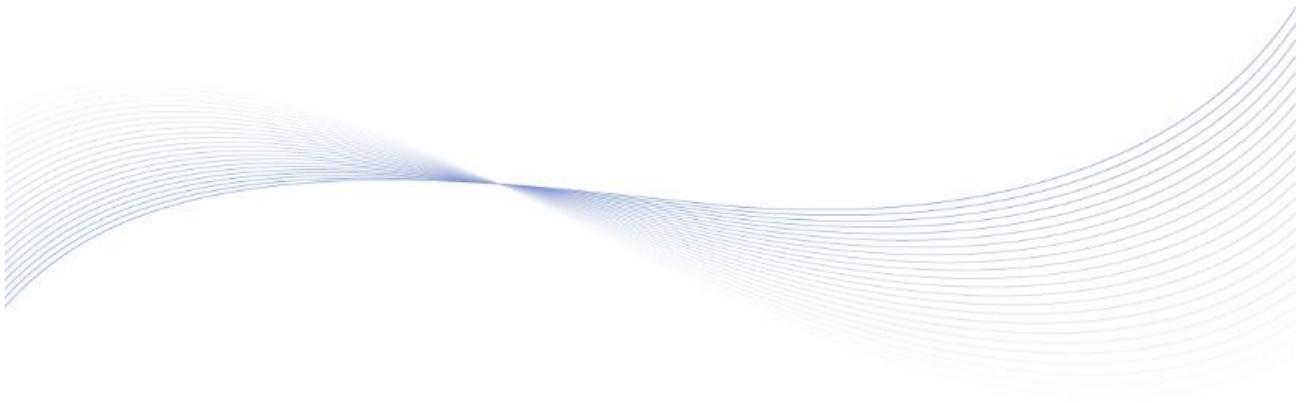

SmartGen

MAKING CONTROL SMARTER

HGM8100N SERIES

GENSET CONTROLLER

COMMUNICATION PROTOCOL



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Table 1 Software Version

Date	Version	Note
2016-05-24	1.0	Original release.
2019-06-26	2.0	Added HGM8152 communication data; Used new text template.
2022-01-17	2.1	Modified remote output address error. Added HGM8151 remote gen close/open address.
2022-02-20	2.2	Modified address error of remote close/open.
2023-03-11	2.3	1. Update the protocol; 2. Delete the protocol of HGM8151, HGM98152.
2025-05-24	2.4	1. Add subtitles for different parts of alarm field to avoid ambiguity; 2. Change the company logo in the page header; 3. Add the description of byte order in the information frame for Function Code 05 request; 4. Update the data field mapped by Function Code 05H.

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1. INTRODUCTION

This protocol describes read and write command format of serial port communication 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 compatible with MODBUS. The monitoring system can be set up only if it is added a central communication master software (such as Kingview, Intouch, FIX, Synall) based on PC (or IPC).

2. MODBUS BASIC RULES

- 1) 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.
- 2) No communication can start from slaves.
- 3) In communication loop, all communication should be transmitted in "information frame".
- 4) If master or slave receives information frame containing unknown command, none response will be given.

3. DATA FRAME FORMAT

Communication is asynchronously transferred, by the unit of byte (data frame). Between master and slave, every transmitted data frame is 11-bit (stop bit: 2) serial data stream.

Table 2 Data Frame Format

Item	Description
Start bit	1-bit
Data bit	8-bit
Parity bit	None
Stop bit	2-bit
Baud rate	9600bps

4. COMMUNICATION PROTOCOL

4.1 ILLUSTRATION

When communication command is issued, the device which has the corresponding address code receives it, afterwards removes address code to read the information. If nothing goes wrong, it will execute the command, and then send the result back to the master. Response information includes address code, function code of executing command, data after action and error check code (CRC). If an error occurs, it will not send any information.

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 from 0 to 255. Device address range is 1-255. This byte shows that the slave whose address is defined by users will receive the information sent by the master. Each slave has a unique address code, and responses by beginning with the address code. An address code sent by master means the slave address which the master is going to send to, while the address code send by slave means the slave address which the slave responses.

4.4 FUNCTION CODE

4.4.1 ILLUSTRATION

Function code is the second byte of each communication transmission. ModBus communication protocol defines function code is 1-255 (01H-0FFH). This controller uses a part of them. As a master request, function code tells slave to execute a kind of action. As slave response, function code is the same as function code master issues, which means slave has responded to the master and executed certain action. If the function code MSB that slave sends is 1 (function code>127), it means slave doesn't respond or response has an error.

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

Table 4 ModBus Partial Function Code

Function code	Definition	Operation
01H	Read Coils	Read single or multiple coils.
03H	Read Registers	Reads one or multiple registers data.
05H	Place Single Coil	Place single coil.
06H	Write Single Register	Write a 16-bit binary into the register.

4.4.2 01H READ COILS

With communication command of function code 01, master can read all kinds of coils in the controller (e.g. switch close/open, fault, auto/manual status etc.).

4.4.3 03H READ REGISTERS

With function code 03H command, master can read the numerical registers inside the device (numerical registers contain setting values of various analog and parameters). Input register values of function code 03H mapping data field are 16 bits (2 bytes). Therefore, register values read from the device are 2 bytes. Maximum number of readable registers is 125 for each time.

Command format of slave response is slave address, function code, data field and CRC code. The data of data field is double bytes in a group of two bytes, and high byte is in the front.

4.4.4 05H PLACE SINGLE COIL

Master uses this command to save a single coil data into bit registers in the device (such as ATS transfer coil). The slave also uses this function code to feedback information to the master.

4.4.5 06H WRITE SINGLE REGISTER

Master uses this command to save a single register data into registers in the device. Register refers to 16-bit (2-byte) in Modbus communication protocol and high byte is in the front. In this way point in the device is 2-byte. 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 DATA FIELD FORMAT CORRESPONDING TO FUNCTION CODE 01H

Table 5 Master Request

Data sequence	Data signification	Byte count
1	Starting address	2
2	Read coils	2

Table 6 Slave Response

Data sequence	Data signification	Byte count
1	Loopback byte count	1
2	N coils data	$(N+7)/8$ (use integer)

4.5.3 DATA FIELD FORMAT CORRESPONDING TO FUNCTION CODE 03H

Table 7 Master Request

Data sequence	Data signification	Byte count
1	Starting address	2
2	Read registers	2

Table 8 Slave Response

Data sequence	Data signification	Byte count
1	Loopback byte count	1
2	N - register data	$N*2$

4.5.4 DATA FIELD FORMAT CORRESPONDING TO FUNCTION CODE 05H

Table 9 Master Request

Data sequence	Data signification	Byte count
1	Coil address	2
2	Forced single coil	2

Table 10 Slave Response

Data sequence	Data signification	Byte count
1	Coil address	2
2	Single coil value	2

4.5.5 DATA FIELD FORMAT CORRESPONDING TO FUNCTION CODE 06H

Table 11 Master Request

Data sequence	Data signification	Byte count
1	Register address	2
2	Register value (2-byte)	2

Table 12 Slave Response

Data sequence	Data signification	Byte count
1	Register address	2
2	Register value (2-byte)	2

4.6 ERROR CHECK CODE (CRC)

Error Check Code allows master or slave to detect whether a received packet goes wrong or not. Sometimes, because of electronic noise, or other disturbance, information will get changed in certain way in the transmission process. CRC code ensures master or slave will not respond to the wrong information in the process, which promotes system safety and efficiency. CRC applies CRC-16 calibration method.

For 2-byte CRC, low-order byte is appended first, and high-order byte is appended at last.

NOTE: All information packet formats are the same: address code, function code, data field and CRC code.

CRC contains 2 bytes, 16-bit binary value. CRC is calculated by issuing terminal and placed at the end of transmitted information. The receiving device again calculates whether it is the same as the received information. If they are different, then something goes wrong.

CRC calculation method: first pre-set 16-register to 1. Then gradually deal with 8-bit data information. Only 8-bit data is used in CRC calculation and starting bit and stop bit are not calculated.

In the process of CRC calculation, 8-bit data Exclusive OR with register data, and make the result move 1 bit in the direction of LSB with 0 filled into MSB. Then check LSB, if it is 1, then make register contents Exclusive OR with pre-set value; if LSB is 0, do not Exclusive OR.

Repeat the process for many times. After 8 times move, next 8-bit Exclusive OR with current register contents; Like this repeat for 8 times as last time. After all data information is done, the last register content is CRC value.

CRC-16 code calculation steps:

- 1) Set a 16-bit CRC register to FFFF hex;
- 2) Exclusive OR 8-bit data with the low-order 8-bit of the CRC register, and put the result in the CRC register.
- 3) Move CRC content to right 1 bit with 0 filled into MSB, and check the moved out bit.
- 4) If LSB was 0: Repeat Step 3 (another shift).
If LSB was 1: Exclusive OR CRC register with the polynomial value A001 hex.
- 5) Repeat Step 3 and Step 4 and move right for 8 times; In this way all 8-bit data are processed.
- 6) Repeat Step 2 to Step 5 and process next data.
- 7) The final result is CRC register value. In process transmission lower-order 8 bits is transmitted first and high-order 8 bits at last.

NOTE: The calculating of CRC code starts from <slave address> except for all bytes of <CRC code>.

4.7 EXAMPLES OF INFORMATION FRAME FORMAT

4.7.1 FUNCTION CODE 01H

Slave address is 00, and read 1CH (decimal) coil value with starting address 0000H.

Table 13 Function Code 01H Master Request Example

Request	Bytes	Example (Hex)
Slave address	1	01 Transmitted to slave 01
Function code	1	01 Read coil value
Starting address	2	00 Starting address is 0000. 00
Read numbers	2	00 Read 28 coils 1C
CRC code	2	3D CRC code which is calculated by master. C3

Table 14 Function Code 01H Slave Response Example

Response	Bytes	Example (Hex)
Slave address	1	01 Return slave address 01
Function code	1	01 Read coil
Byte count	1	04 Return coils: 28 coils (total 4 bytes)
Data 1	1	30 Content of address 07-00
Data 2	1	00 Content of address 0F-08
Data 3	1	93 Content of address 17-10
Data 4	1	0A Content of address 1C-18
CRC code	2	18 CRC code which is calculated by slave. 26

NOTE: Coil 07-00 value is 30H in hex, is 00110000 in binary; coil 07 is high-order of the byte, and 00 is the low-order. Coil 07-00 status is: OFF-OFF-ON-ON-OFF-OFF-OFF-OFF.

4.7.2 FUNCTION CODE 03H

Slave address is 01, and starting address is 3 points of 0026H.

Table 15 Data Address Example

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

Table 16 Function Code 03H Master Request Example

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

Table 17 Function Code 03H Slave Response Example

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

4.7.3 FUNCTION CODE 05H

Slave address is 01, starting address is 1 coil of 0002H. Set 0002 unit to 1.

Table 18 Coil Data Address Example

Address	Data (Hex)
0000	0
0001	1
0002	0

NOTE: Forced coil of hex FF00 is 1, 0000H is 0. All other values are illegal and will not affect the coil status.

Table 19 Function Code 05H Master Request Example

Request	Bytes	Example (Hex)
Slave address	1	01 Send to the slave 01
Function code	1	05 Forced coil
Starting address	2	00 Starting address is 0002. 00
Data	2	Set coil to 1 FF (MSB) 00 (LSB)
CRC code	2	2D CRC code which is calculated by master. FA

Table 20 Function Code 05H Slave Response Example

Response	Bytes	Example (Hex)
Slave address	1	01 Return slave address 01
Function code	1	05 Forced coil
Starting address	2	00 Starting address is 0002. 00
Data	2	Set coil to 1 FF (MSB) 00 (LSB)
CRC code	2	2D CRC code which is calculated by master. FA

4.7.4 FUNCTION CODE 06H

Slave address is 01, and set the 1 point content of starting address 00E3H to 0002H.

Table 21 Function Code 06H Master Request Example

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

Table 22 Function Code 06H Slave Response Example

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

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 on the basis of the function code. The following codes show unexpected errors have occurred.

Device will ignore CRC error received by master.

Table 23 CRC Error Format of Slave Response (CRC excluded)

Address code	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, 06H MAPPING DATA FIELD

06H function code can only be written for address 0199-0210 and 0225-0231, other addresses are unavailable.

Table 24 Function Code 03H, 06H Mapping Data Field

Address	Items	Description	Bytes
0000	Common Alarm	1 for active (LSB)	1bit
	Common Shutdown Alarm	1 for active	1bit
	Common Warning Alarm	1 for active	1bit
	Common Trip and Stop Alarm	1 for active	1bit
	Common Trip	1 for active	1bit
	Common Trip and Stop Alarm & Common Shutdown Alarm	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	In Test Mode	1 for active	1bit
	In Auto Mode	1 for active	1bit
	In Manual Mode	1 for active	1bit
	In Stop Mode	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active (MSB)	1bit
Shutdown Alarm			
0001	Emergency Stop Alarm	1 for active	1bit
	Over Speed Shutdown	1 for active	1bit
	Under Speed Shutdown	1 for active	1bit
	Loss of Speed Signal Alarm	1 for active	1bit
	Gen Over Frequency Shutdown	1 for active	1bit
	Gen Under Frequency Shutdown	1 for active	1bit
	Gen Over Voltage Shutdown	1 for active	1bit
	Gen Under Voltage Shutdown	1 for active	1bit
	Fail to Start Alarm	1 for active	1bit
	Gen Overcurrent Shutdown	1 for active	1bit
	Maintenance Due Shutdown	1 for active	1bit
	ECU Shutdown	1 for active	1bit
	Reverse Power Shutdown	1 for active	1bit
	Over Power Shutdown	1 for active	1bit
	High Temp Shutdown	1 for active	1bit
	Low Oil Pressure Shutdown	1 for active	1bit
0002	ECU Comm. Failure Shutdown	1 for active	1bit
	Reserved	1 for active	1bit

Address	Items	Description	Bytes
	Reserved	1 for active	1bit
	Gen Phase Sequence Wrong Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
	Unbalanced Current Shutdown	1 for active	1bit
	Earth Fault Shutdown	1 for active	1bit
	Loss of Excitation Fault Shutdown	1 for active	1bit
	Temp Sensor Open	1 for active	1bit
	High Temp Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Oil Pressure Sensor Open	1 for active	1bit
	Reserved	1 for active	1bit
	Low Oil Pressure Shutdown	1 for active	1bit
	Reserved	1 for active	1bit
0003	Level Sensor Open	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Flexible Sensor 1 Open	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
	Flexible Sensor 2 Open	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
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
0004	Input Module1 Comm. Failure	1 for active	1bit
	Input Module1 Exhaust Temp High	1 for active	1bit
	Input Module1 Sensor15 Open	1 for active	1bit
	Input Module1 Sensor15 High	1 for active	1bit
	Input Module1 Sensor15 Low	1 for active	1bit
	Input Module1 Sensor16 Open	1 for active	1bit
	Input Module1 Sensor16 High	1 for active	1bit
	Input Module1 Sensor16 Low	1 for active	1bit
	Input Module1 Sensor17 Open	1 for active	1bit
	Input Module1 Sensor17 High	1 for active	1bit
	Input Module1 Sensor17 Low	1 for active	1bit
	Input Module1 Sensor18 Open	1 for active	1bit
	Input Module1 Sensor18 High	1 for active	1bit
	Input Module1 Sensor18 Low	1 for active	1bit

Address	Items	Description	Bytes
	Input Module1 Sensor19 Open	1 for active	1bit
	Input Module1 Sensor19 High	1 for active	1bit
0005	Input Module1 Sensor19 Low	1 for active	1bit
	Input Module1 Sensor20 Open	1 for active	1bit
	Input Module1 Sensor20 High	1 for active	1bit
	Input Module1 Sensor20 Low	1 for active	1bit
	Input Module1 Sensor21 Open	1 for active	1bit
	Input Module1 Sensor21 High	1 for active	1bit
	Input Module1 Sensor21 Low	1 for active	1bit
	Input Module1 Sensor22 Open	1 for active	1bit
	Input Module1 Sensor22 High	1 for active	1bit
	Input Module1 Sensor22 Low	1 for active	1bit
	Input Module1 Sensor23 Open	1 for active	1bit
	Input Module1 Sensor23 High	1 for active	1bit
	Input Module1 Sensor23 Low	1 for active	1bit
	Input Module1 Sensor24 Open	1 for active	1bit
	Input Module1 Sensor24 High	1 for active	1bit
	Input Module1 Sensor24 Low	1 for active	1bit
0006	Input Module2 Comm. Failure	1 for active	1bit
	Input Module2 Exhaust Temp High	1 for active	1bit
	Input Module2 Sensor15 Open	1 for active	1bit
	Input Module2 Sensor15 High	1 for active	1bit
	Input Module2 Sensor15 Low	1 for active	1bit
	Input Module2 Sensor16 Open	1 for active	1bit
	Input Module2 Sensor16 High	1 for active	1bit
	Input Module2 Sensor16 Low	1 for active	1bit
	Input Module2 Sensor17 Open	1 for active	1bit
	Input Module2 Sensor17 High	1 for active	1bit
	Input Module2 Sensor17 Low	1 for active	1bit
	Input Module2 Sensor18 Open	1 for active	1bit
	Input Module2 Sensor18 High	1 for active	1bit
	Input Module2 Sensor18 Low	1 for active	1bit
	Input Module2 Sensor19 Open	1 for active	1bit
	Input Module2 Sensor19 High	1 for active	1bit
0007	Input Module2 Sensor19 Low	1 for active	1bit
	Input Module2 Sensor20 Open	1 for active	1bit
	Input Module2 Sensor20 High	1 for active	1bit
	Input Module2 Sensor20 Low	1 for active	1bit
	Input Module2 Sensor21 Open	1 for active	1bit
	Input Module2 Sensor21 High	1 for active	1bit
	Input Module2 Sensor21 Low	1 for active	1bit
	Input Module2 Sensor22 Open	1 for active	1bit
	Input Module2 Sensor22 High	1 for active	1bit
	Input Module2 Sensor22 Low	1 for active	1bit

Address	Items	Description	Bytes
	Input Module2 Sensor23 Open	1 for active	1bit
	Input Module2 Sensor23 High	1 for active	1bit
	Input Module2 Sensor23 Low	1 for active	1bit
	Input Module2 Sensor24 Open	1 for active	1bit
	Input Module2 Sensor24 High	1 for active	1bit
	Input Module2 Sensor24 Low	1 for active	1bit
0008	Input 1 Shutdown	1 for active	1bit
	Input 2 Shutdown	1 for active	1bit
	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
	Input 7 Shutdown	1 for active	1bit
	Input 8 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
	PLC Function 1	1 for active	1bit
	PLC Function 2	1 for active	1bit
	PLC Function 3	1 for active	1bit
	PLC Function 4	1 for active	1bit
0009	PLC Function 5	1 for active	1bit
	PLC Function 6	1 for active	1bit
	PLC Function 7	1 for active	1bit
	PLC Function 8	1 for active	1bit
	PLC Function 9	1 for active	1bit
	PLC Function 10	1 for active	1bit
	PLC Function 11	1 for active	1bit
	PLC Function 12	1 for active	1bit
	PLC Function 13	1 for active	1bit
	PLC Function 14	1 for active	1bit
	PLC Function 15	1 for active	1bit
	PLC Function 16	1 for active	1bit
	PLC Function 17	1 for active	1bit
	PLC Function 18	1 for active	1bit
	PLC Function 19	1 for active	1bit
	PLC Function 20	1 for active	1bit
0010	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Expand Switch Input Comm. Failure	1 for active	1bit
	Expand Switch Output Comm. Failure	1 for active	1bit
	Expand Switch Input1	1 for active	1bit
	Expand Switch Input2	1 for active	1bit

Address	Items	Description	Bytes
	Expand Switch Input3	1 for active	1bit
	Expand Switch Input4	1 for active	1bit
	Expand Switch Input5	1 for active	1bit
	Expand Switch Input6	1 for active	1bit
	Expand Switch Input7	1 for active	1bit
	Expand Switch Input8	1 for active	1bit
	Expand Switch Input9	1 for active	1bit
	Expand Switch Input10	1 for active	1bit
	Expand Switch Input11	1 for active	1bit
	Expand Switch Input12	1 for active	1bit
0011	Expand Switch Input13	1 for active	1bit
	Expand Switch Input14	1 for active	1bit
	Expand Switch Input15	1 for active	1bit
	Expand Switch Input16	1 for active	1bit
	Input Module1 Cylinder Temp Difference Large	1 for active	1bit
	Input Module1 Cylinder Temp High	1 for active	1bit
	Input Module2 Cylinder Temp Difference Large	1 for active	1bit
	Input Module2 Cylinder Temp High	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
Trip and Stop Alarm			
0012	Overcurrent Trip and Stop	1 for active	1bit
	Maintenance Due Trip and Stop	1 for active	1bit
	Reverse Power Trip and Stop	1 for active	1bit
	Over Power Trip and Stop	1 for active	1bit
	Input 1 Trip and Stop	1 for active	1bit
	Input 2 Trip and Stop	1 for active	1bit
	Input 3 Trip and Stop	1 for active	1bit
	Input 4 Trip and Stop	1 for active	1bit
	Input 5 Trip and Stop	1 for active	1bit
	Input 6 Trip and Stop	1 for active	1bit
	Input 7 Trip and Stop	1 for active	1bit
	Input 8 Trip and Stop	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Expand Switch Input Comm. Fail	1 for active	1bit

Address	Items	Description	Bytes
	Expand Switch Output Comm. Fail	1 for active	1bit
0013	PLC Function 1	1 for active	1bit
	PLC Function 2	1 for active	1bit
	PLC Function 3	1 for active	1bit
	PLC Function 4	1 for active	1bit
	PLC Function 5	1 for active	1bit
	PLC Function 6	1 for active	1bit
	PLC Function 7	1 for active	1bit
	PLC Function 8	1 for active	1bit
	PLC Function 9	1 for active	1bit
	PLC Function 10	1 for active	1bit
	PLC Function 11	1 for active	1bit
	PLC Function 12	1 for active	1bit
	PLC Function 13	1 for active	1bit
	PLC Function 14	1 for active	1bit
	PLC Function 15	1 for active	1bit
	PLC Function 16	1 for active	1bit
0014	PLC Function 17	1 for active	1bit
	PLC Function 18	1 for active	1bit
	PLC Function 19	1 for active	1bit
	PLC Function 20	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Expand Switch Input1	1 for active	1bit
	Expand Switch Input2	1 for active	1bit
	Expand Switch Input3	1 for active	1bit
	Expand Switch Input4	1 for active	1bit
	Expand Switch Input5	1 for active	1bit
	Expand Switch Input6	1 for active	1bit
	Expand Switch Input7	1 for active	1bit
	Expand Switch Input8	1 for active	1bit
	Expand Switch Input9	1 for active	1bit
	Expand Switch Input10	1 for active	1bit
0015	Expand Switch Input11	1 for active	1bit
	Expand Switch Input12	1 for active	1bit
	Expand Switch Input13	1 for active	1bit
	Expand Switch Input14	1 for active	1bit
	Expand Switch Input15	1 for active	1bit
	Expand Switch Input16	1 for active	1bit
	Mains Over Frequency Trip and Stop	1 for active	1bit
	Main Under Frequency Trip and Stop	1 for active	1bit
	Mains Over Volt Trip and Stop	1 for active	1bit
	Mains Under Volt Trip and Stop	1 for active	1bit
	Mains Frequency Change Trip and Stop	1 for active	1bit

Address	Items	Description	Bytes
	Mains Vector Shift Trip and Stop	1 for active	1bit
	Reserved	1 for active	1bit
	Loss of Excitation Fault Trip and Stop	1 for active	1bit
	Earth Fault Trip and Stop	1 for active	1bit
	Unbalanced Current Trip and Stop	1 for active	1bit
0016	Overcurrent Trip	1 for active	1bit
	Reserved	1 for active	1bit
	Reverse Power Trip	1 for active	1bit
	Over Power Trip	1 for active	1bit
	Input 1 Trip	1 for active	1bit
	Input 2 Trip	1 for active	1bit
	Input 3 Trip	1 for active	1bit
	Input 4 Trip	1 for active	1bit
	Input 5 Trip	1 for active	1bit
	Input 6 Trip	1 for active	1bit
	Input 7 Trip	1 for active	1bit
	Input 8 Trip	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Expand Switch Input Comm. Failure	1 for active	1bit
	Expand Switch Output Comm. Failure	1 for active	1bit
Trip Alarm			
0017	PLC Function 1	1 for active	1bit
	PLC Function 2	1 for active	1bit
	PLC Function 3	1 for active	1bit
	PLC Function 4	1 for active	1bit
	PLC Function 5	1 for active	1bit
	PLC Function 6	1 for active	1bit
	PLC Function 7	1 for active	1bit
	PLC Function 8	1 for active	1bit
	PLC Function 9	1 for active	1bit
	PLC Function 10	1 for active	1bit
	PLC Function 11	1 for active	1bit
	PLC Function 12	1 for active	1bit
	PLC Function 13	1 for active	1bit
	PLC Function 14	1 for active	1bit
	PLC Function 15	1 for active	1bit
	PLC Function 16	1 for active	1bit
0018	PLC Function 17	1 for active	1bit
	PLC Function 18	1 for active	1bit
	PLC Function 19	1 for active	1bit
	PLC Function 20	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit

Address	Items	Description	Bytes
	Expand Switch Input1	1 for active	1bit
	Expand Switch Input2	1 for active	1bit
	Expand Switch Input3	1 for active	1bit
	Expand Switch Input4	1 for active	1bit
	Expand Switch Input5	1 for active	1bit
	Expand Switch Input6	1 for active	1bit
	Expand Switch Input7	1 for active	1bit
	Expand Switch Input8	1 for active	1bit
	Expand Switch Input9	1 for active	1bit
	Expand Switch Input10	1 for active	1bit
0019	Expand Switch Input11	1 for active	1bit
	Expand Switch Input12	1 for active	1bit
	Expand Switch Input13	1 for active	1bit
	Expand Switch Input14	1 for active	1bit
	Expand Switch Input15	1 for active	1bit
	Expand Switch Input16	1 for active	1bit
	Gen Over Voltage Trip	1 for active	1bit
	Gen Over Frequency Trip	1 for active	1bit
	Gen Under Voltage Trip	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Gen Under Frequency Trip	1 for active	1bit
	Loss of Excitation Fault Trip	1 for active	1bit
	Earth Fault Trip	1 for active	1bit
	Unbalanced Current Trip	1 for active	1bit
	Reserved	1 for active	1bit
Warning			
0020	Over Speed Warn	1 for active	1bit
	Under Speed Warn	1 for active	1bit
	Loss of Speed Signal Warn	1 for active	1bit
	Gen Over Frequency Warn	1 for active	1bit
	Gen Under Frequency Warn	1 for active	1bit
	Gen Over Voltage Warn	1 for active	1bit
	Gen Under Voltage Warn	1 for active	1bit
	Gen Overcurrent Warn	1 for active	1bit
	Fail to Stop Warn	1 for active	1bit
	Charge Alt Fail Warn	1 for active	1bit
	Battery High Voltage Warn	1 for active	1bit
	Battery Low Voltage Warn	1 for active	1bit
	Maintenance Due Warn	1 for active	1bit
	Reverse Power Warn	1 for active	1bit
	Over Power Warn	1 for active	1bit
	ECU Warn	1 for active	1bit
0021	Gen Loss of Phase Warn	1 for active	1bit

Address	Items	Description	Bytes
	Gen Reverse Phase Sequence Warn	1 for active	1bit
	Reserved	1 for active	1bit
	Unbalanced Current Warn	1 for active	1bit
	Earth Fault Warn	1 for active	1bit
	Loss of Excitation Fault Warn	1 for active	1bit
	Mains Breaker Failure Warn	1 for active	1bit
	Gen Breaker Failure Warn	1 for active	1bit
	Temp Sensor Open Warn	1 for active	1bit
	High Temp Warn	1 for active	1bit
	Low Temp Warn	1 for active	1bit
	GOV Reach the Limit	1 for active	1bit
	Oil Pressure Sensor Open	1 for active	1bit
	Reserved	1 for active	1bit
	Low Oil Pressure Warn	1 for active	1bit
	AVR Reach the Limit	1 for active	1bit
0022	Level Sensor Open	1 for active	1bit
	Reserved	1 for active	1bit
	Low Level Warn	1 for active	1bit
	Gen Under Capacity	1 for active	1bit
	Flexible Sensor 1 Open	1 for active	1bit
	Flexible Sensor 1 High	1 for active	1bit
	Flexible Sensor 1 Low	1 for active	1bit
	Reserved	1 for active	1bit
	Flexible Sensor 2 Open	1 for active	1bit
	Flexible Sensor 2 High	1 for active	1bit
	Flexible Sensor 2 Low	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Input Module2 Cylinder Temp High	1 for active	1bit
0023	Input Module1 Comm. Failure	1 for active	1bit
	Input Module1 Exhaust Temp High	1 for active	1bit
	Input Module1 Sensor15 Open	1 for active	1bit
	Input Module1 Sensor15 High	1 for active	1bit
	Input Module1 Sensor15 Low	1 for active	1bit
	Input Module1 Sensor16 Open	1 for active	1bit
	Input Module1 Sensor16 High	1 for active	1bit
	Input Module1 Sensor16 Low	1 for active	1bit
	Input Module1 Sensor17 Open	1 for active	1bit
	Input Module1 Sensor17 High	1 for active	1bit
	Input Module1 Sensor17 Low	1 for active	1bit
	Input Module1 Sensor18 Open	1 for active	1bit
	Input Module1 Sensor18 High	1 for active	1bit

Address	Items	Description	Bytes
	Input Module1 Sensor18 Low	1 for active	1bit
	Input Module1 Sensor19 Open	1 for active	1bit
	Input Module1 Sensor19 High	1 for active	1bit
0024	Input Module1 Sensor19 Low	1 for active	1bit
	Input Module1 Sensor20 Open	1 for active	1bit
	Input Module1 Sensor20 High	1 for active	1bit
	Input Module1 Sensor20 Low	1 for active	1bit
	Input Module1 Sensor21 Open	1 for active	1bit
	Input Module1 Sensor21 High	1 for active	1bit
	Input Module1 Sensor21 Low	1 for active	1bit
	Input Module1 Sensor22 Open	1 for active	1bit
	Input Module1 Sensor22 High	1 for active	1bit
	Input Module1 Sensor22 Low	1 for active	1bit
	Input Module1 Sensor23 Open	1 for active	1bit
	Input Module1 Sensor23 High	1 for active	1bit
	Input Module1 Sensor23 Low	1 for active	1bit
	Input Module1 Sensor24 Open	1 for active	1bit
	Input Module1 Sensor24 High	1 for active	1bit
	Input Module1 Sensor24 Low	1 for active	1bit
0025	Input Module2 Comm. Failure	1 for active	1bit
	Input Module2 Exhaust Temp High	1 for active	1bit
	Input Module2 Sensor15 Open	1 for active	1bit
	Input Module2 Sensor15 High	1 for active	1bit
	Input Module2 Sensor15 Low	1 for active	1bit
	Input Module2 Sensor16 Open	1 for active	1bit
	Input Module2 Sensor16 High	1 for active	1bit
	Input Module2 Sensor16 Low	1 for active	1bit
	Input Module2 Sensor17 Open	1 for active	1bit
	Input Module2 Sensor17 High	1 for active	1bit
	Input Module2 Sensor17 Low	1 for active	1bit
	Input Module2 Sensor18 Open	1 for active	1bit
	Input Module2 Sensor18 High	1 for active	1bit
	Input Module2 Sensor18 Low	1 for active	1bit
	Input Module2 Sensor19 Open	1 for active	1bit
	Input Module2 Sensor19 High	1 for active	1bit
0026	Input Module2 Sensor19 Low	1 for active	1bit
	Input Module2 Sensor20 Open	1 for active	1bit
	Input Module2 Sensor20 High	1 for active	1bit
	Input Module2 Sensor20 Low	1 for active	1bit
	Input Module2 Sensor21 Open	1 for active	1bit
	Input Module2 Sensor21 High	1 for active	1bit
	Input Module2 Sensor21 Low	1 for active	1bit
	Input Module2 Sensor22 Open	1 for active	1bit
	Input Module2 Sensor22 High	1 for active	1bit

Address	Items	Description	Bytes
	Input Module2 Sensor22 Low	1 for active	1bit
	Input Module2 Sensor23 Open	1 for active	1bit
	Input Module2 Sensor23 High	1 for active	1bit
	Input Module2 Sensor23 Low	1 for active	1bit
	Input Module2 Sensor24 Open	1 for active	1bit
	Input Module2 Sensor24 High	1 for active	1bit
0027	Reserved	1 for active	1bit
	Expand Switch Input Comm. Failure	1 for active	1bit
	Expand Switch Output Comm. Failure	1 for active	1bit
	Expand Switch Input1	1 for active	1bit
	Expand Switch Input2	1 for active	1bit
	Expand Switch Input3	1 for active	1bit
	Expand Switch Input4	1 for active	1bit
	Expand Switch Input5	1 for active	1bit
	Expand Switch Input6	1 for active	1bit
	Expand Switch Input7	1 for active	1bit
	Expand Switch Input8	1 for active	1bit
	Expand Switch Input9	1 for active	1bit
	Expand Switch Input10	1 for active	1bit
	Expand Switch Input11	1 for active	1bit
	Expand Switch Input12	1 for active	1bit
	Expand Switch Input13	1 for active	1bit
0028	Expand Switch Input14	1 for active	1bit
	Expand Switch Input15	1 for active	1bit
	Expand Switch Input16	1 for active	1bit
	Mains Over Frequency Warn	1 for active	1bit
	Mains Under Frequency Warn	1 for active	1bit
	Mains Over Voltage Warn	1 for active	1bit
	Mains Under Voltage Warn	1 for active	1bit
	Mains Frequency Change Warn	1 for active	1bit
	Mains Vector Shift Warn	1 for active	1bit
	Frequency Error Large Warn	1 for active	1bit
	Few MSC Modules Warn	1 for active	1bit
	Input Module1 Cylinder Temp Difference Large	1 for active	1bit
	Input Module1 Cylinder Temp High	1 for active	1bit
	Input Module2 Cylinder Temp Difference Large	1 for active	1bit
	Input Module2 Cylinder Temp High	1 for active	1bit
	AIN8 Communication Failure	1 for active	1bit
0029	Aux Input 1 Warn	1 for active	1bit
	Aux Input 2 Warn	1 for active	1bit
	Aux Input 3 Warn	1 for active	1bit
	Aux Input 4 Warn	1 for active	1bit

Address	Items	Description	Bytes
	Aux Input 5 Warn	1 for active	1bit
	Aux Input 6 Warn	1 for active	1bit
	Aux Input 7 Warn	1 for active	1bit
	Aux Input 8 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
	PLC Function 1	1 for active	1bit
	PLC Function 2	1 for active	1bit
	PLC Function 3	1 for active	1bit
	PLC Function 4	1 for active	1bit
0030	PLC Function 5	1 for active	1bit
	PLC Function 6	1 for active	1bit
	PLC Function 7	1 for active	1bit
	PLC Function 8	1 for active	1bit
	PLC Function 9	1 for active	1bit
	PLC Function 10	1 for active	1bit
	PLC Function 11	1 for active	1bit
	PLC Function 12	1 for active	1bit
	PLC Function 13	1 for active	1bit
	PLC Function 14	1 for active	1bit
	PLC Function 15	1 for active	1bit
	PLC Function 16	1 for active	1bit
	PLC Function 17	1 for active	1bit
	PLC Function 18	1 for active	1bit
	PLC Function 19	1 for active	1bit
	PLC Function 20	1 for active	1bit
Indication			
0031	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	In Not Run Time Indication	1 for active	1bit
	PLC Function 19	1 for active	1bit
	PLC Function 1	1 for active	1bit
	PLC Function 2	1 for active	1bit
	PLC Function 3	1 for active	1bit
	PLC Function 4	1 for active	1bit
	PLC Function 5	1 for active	1bit
	PLC Function 6	1 for active	1bit
	PLC Function 7	1 for active	1bit
	PLC Function 8	1 for active	1bit
	PLC Function 9	1 for active	1bit
	PLC Function 10	1 for active	1bit
	PLC Function 11	1 for active	1bit

Address	Items	Description	Bytes
	PLC Function 12	1 for active	1bit
0032	PLC Function 13	1 for active	1bit
	PLC Function 14	1 for active	1bit
	PLC Function 15	1 for active	1bit
	PLC Function 16	1 for active	1bit
	PLC Function 17	1 for active	1bit
	PLC Function 18	1 for active	1bit
	Auto Mode Input	1 for active	1bit
	Auto Mode Inactive	1 for active	1bit
	Reserved	1 for active	1bit
	PLC Function 20	1 for active	1bit
	Alternative Config.1 Indication	1 for active	1bit
	Alternative Config.2 Indication	1 for active	1bit
	Alternative Config.3 Indication	1 for active	1bit
	Overcurrent Indication	1 for active	1bit
	Reverse Power Indication	1 for active	1bit
	Over Power Indication	1 for active	1bit
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
	Input 7 Indication	1 for active	1bit
	Input 8 Indication	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Exp. Switch Input Comm. Failure	1 for active	1bit
	Exp. Switch Output Comm. Failure	1 for active	1bit
	Reserved	1 for active	1bit
	Loss of Excitation Fault	1 for active	1bit
	Earth Fault	1 for active	1bit
	Current Imbalance	1 for active	1bit
0034	Mains Normal Indication	1 for active	1bit
	Mains Abnormal Indication	1 for active	1bit
	Gen Normal Indication	1 for active	1bit
	Gen Shutdown Indication	1 for active	1bit
	Mains On-load Indication	1 for active	1bit
	Gen On-load Indication	1 for active	1bit
	Auto Mode Indication	1 for active	1bit
	Non-auto Mode Indication	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit

Address	Items	Description	Bytes
	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 Port Status	1 for active	1bit
	Input Port 1 Status	1 for active	1bit
	Input Port 2 Status	1 for active	1bit
	Input Port 3 Status	1 for active	1bit
	Input Port 4 Status	1 for active	1bit
	Input Port 5 Status	1 for active	1bit
	Input Port 6 Status	1 for active	1bit
	Input Port 7 Status	1 for active	1bit
	Input Port 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
	Reserved	1 for active	1bit
0036	Expand Switch Input 1	1 for active	1bit
	Expand Switch Input 2	1 for active	1bit
	Expand Switch Input 3	1 for active	1bit
	Expand Switch Input 4	1 for active	1bit
	Expand Switch Input 5	1 for active	1bit
	Expand Switch Input 6	1 for active	1bit
	Expand Switch Input 7	1 for active	1bit
	Expand Switch Input 8	1 for active	1bit
	Expand Switch Input 9	1 for active	1bit
	Expand Switch Input 10	1 for active	1bit
	Expand Switch Input 11	1 for active	1bit
	Expand Switch Input 12	1 for active	1bit
	Expand Switch Input 13	1 for active	1bit
	Expand Switch Input 14	1 for active	1bit
	Expand Switch Input 15	1 for active	1bit
	Expand Switch Input 16	1 for active	1bit
Status			
0037	Fuel Relay Output Status	1 for active	1bit
	Start Relay Output Status	1 for active	1bit
	Relay Output 1 Status	1 for active	1bit
	Relay Output 2 Status	1 for active	1bit
	Relay Output 3 Status	1 for active	1bit
	Relay Output 4 Status	1 for active	1bit

Address	Items	Description	Bytes
	Relay Output 5 Status	1 for active	1bit
	Relay Output 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
Output Ports Status			
0038	Expand Switch Output 1	1 for active	1bit
	Expand Switch Output 2	1 for active	1bit
	Expand Switch Output 3	1 for active	1bit
	Expand Switch Output 4	1 for active	1bit
	Expand Switch Output 5	1 for active	1bit
	Expand Switch Output 6	1 for active	1bit
	Expand Switch Output 7	1 for active	1bit
	Expand Switch Output 8	1 for active	1bit
	Expand Switch Output 9	1 for active	1bit
	Expand Switch Output 10	1 for active	1bit
	Expand Switch Output 11	1 for active	1bit
	Expand Switch Output 12	1 for active	1bit
	Expand Switch Output 13	1 for active	1bit
	Expand Switch Output 14	1 for active	1bit
	Expand Switch Output 15	1 for active	1bit
	Expand Switch Output 16	1 for active	1bit
0039	Reserved		2Bytes
0040	Reserved		2Bytes
0041	Reserved		2Bytes
0042	Expand Switch Input Comm. Failure	1 for active	1bit
	Expand Switch Output Comm. Failure	1 for active	1bit
	Input Module 1 Comm. Failure	1 for active	1bit
	Input Module 2 Comm. Failure	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

Address	Items	Description	Bytes
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
0043	Mains OK	1 for active	1bit
	Close Mains	1 for active	1bit
	Gen OK	1 for active	1bit
	Close Gen	1 for active	1bit
	Running Indicator Status	1 for active	1bit
	Mute Indicator 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
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
0044	Mains Abnormal	1 for active	1bit
	Mains Over Voltage	1 for active	1bit
	Mains Under Voltage	1 for active	1bit
	Mains Over Frequency	1 for active	1bit
	Mains Under Frequency	1 for active	1bit
	Mains Loss of Phase	1 for active	1bit
	Mains Reverse Phase Sequence	1 for active	1bit
	Mains Blackout	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
	Input 7 Active	1 for active	1bit
	Input 8 Active	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit

Address	Items	Description	Bytes
	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	Expand Switch Input1 Active	1 for active	1bit
	Expand Switch Input2 Active	1 for active	1bit
	Expand Switch Input3 Active	1 for active	1bit
	Expand Switch Input4 Active	1 for active	1bit
	Expand Switch Input5 Active	1 for active	1bit
	Expand Switch Input6 Active	1 for active	1bit
	Expand Switch Input7 Active	1 for active	1bit
	Expand Switch Input8 Active	1 for active	1bit
	Expand Switch Input9 Active	1 for active	1bit
	Expand Switch Input10 Active	1 for active	1bit
	Expand Switch Input11 Active	1 for active	1bit
	Expand Switch Input12 Active	1 for active	1bit
	Expand Switch Input13 Active	1 for active	1bit
	Expand Switch Input14 Active	1 for active	1bit
	Expand Switch Input15 Active	1 for active	1bit
	Expand Switch Input16 Active	1 for active	1bit
0047	AIN8 Sensor1 Open Warn	1 for active	1bit
	AIN8 Sensor1 High Warn	1 for active	1bit
	AIN8 Sensor1 Low Warn	1 for active	1bit
	Reserved	1 for active	1bit
	AIN8 Sensor2 Open Warn	1 for active	1bit
	AIN8 Sensor2 High Warn	1 for active	1bit
	AIN8 Sensor2 Low Warn	1 for active	1bit
	Reserved	1 for active	1bit
	AIN8 Sensor3 Open Warn	1 for active	1bit
	AIN8 Sensor3 High Warn	1 for active	1bit
	AIN8 Sensor3 Low Warn	1 for active	1bit
	Reserved	1 for active	1bit
	AIN8 Sensor4 Open Warn	1 for active	1bit
	AIN8 Sensor4 High Warn	1 for active	1bit
	AIN8 Sensor4 Low Warn	1 for active	1bit
	Reserved	1 for active	1bit
0048	AIN8 Sensor5 Open Warn	1 for active	1bit
	AIN8 Sensor5 High Warn	1 for active	1bit
	AIN8 Sensor5 Low Warn	1 for active	1bit
	Reserved	1 for active	1bit
	AIN8 Sensor6 Open Warn	1 for active	1bit
	AIN8 Sensor6 High Warn	1 for active	1bit

Address	Items	Description	Bytes
	AIN8 Sensor6 Low Warn	1 for active	1bit
	Reserved	1 for active	1bit
	AIN8 Sensor7 Open Warn	1 for active	1bit
	AIN8 Sensor7 High Warn	1 for active	1bit
	AIN8 Sensor7 Low Warn	1 for active	1bit
	Reserved	1 for active	1bit
	AIN8 Sensor8 Open Warn	1 for active	1bit
	AIN8 Sensor8 High Warn	1 for active	1bit
	AIN8 Sensor8 Low Warn	1 for active	1bit
	Reserved	1 for active	1bit
0049	AIN8 Sensor1 High Shutdown	1 for active	1bit
	AIN8 Sensor1 Low Shutdown	1 for active	1bit
	AIN8 Sensor2 High Shutdown	1 for active	1bit
	AIN8 Sensor2 Low Shutdown	1 for active	1bit
	AIN8 Sensor3 High Shutdown	1 for active	1bit
	AIN8 Sensor3 Low Shutdown	1 for active	1bit
	AIN8 Sensor4 High Shutdown	1 for active	1bit
	AIN8 Sensor4 Low Shutdown	1 for active	1bit
	AIN8 Sensor5 High Shutdown	1 for active	1bit
	AIN8 Sensor5 Low Shutdown	1 for active	1bit
	AIN8 Sensor6 High Shutdown	1 for active	1bit
	AIN8 Sensor6 Low Shutdown	1 for active	1bit
	AIN8 Sensor7 High Shutdown	1 for active	1bit
	AIN8 Sensor7 Low Shutdown	1 for active	1bit
	AIN8 Sensor8 High Shutdown	1 for active	1bit
	AIN8 Sensor8 Low Shutdown	1 for active	1bit
0050	Reserved		2Bytes
0051	Reserved		2Bytes
0052	Reserved		2Bytes
0053	Reserved		2Bytes
0054	Reserved		2Bytes
0055	Mains UAB		2Bytes
0056	Mains UBC		2Bytes
0057	Mains UCA		2Bytes
0058	Mains UA		2Bytes
0059	Mains UB		2Bytes
0060	Mains UC		2Bytes
0061	Mains UA Phase	Signed (*10)	2Bytes
0062	Mains UB Phase	Signed (*10)	2Bytes
0063	Mains UC Phase	Signed (*10)	2Bytes
0064	Mains Frequency	(*100)	2Bytes
0065	Reserved		2Bytes
0066	Reserved		2Bytes
0067	Reserved		2Bytes

Address	Items	Description	Bytes
0068	Reserved		2Bytes
0069	Reserved		2Bytes
0070	Reserved		2Bytes
0071	Reserved		2Bytes
0072	Reserved		2Bytes
0073	Reserved		2Bytes
0074	Reserved		2Bytes
0075	Gen UAB		2Bytes
0076	Gen UBC		2Bytes
0077	Gen UCA		2Bytes
0078	Gen UA		2Bytes
0079	Gen UB		2Bytes
0080	Gen UC		2Bytes
0081	Gen UA Phase	Signed (*10)	2Bytes
0082	Gen UB Phase	Signed (*10)	2Bytes
0083	Gen UC Phase	Signed (*10)	2Bytes
0084	Gen Frequency	(*100)	2Bytes
0085	Reserved		2Bytes
0086	Reserved		2Bytes
0087	Reserved		2Bytes
0088	Reserved		2Bytes
0089	Reserved		2Bytes
0090	Reserved		2Bytes
0091	Reserved		2Bytes
0092	Reserved		2Bytes
0093	Reserved		2Bytes
0094	Reserved		2Bytes
0095	A-phase Current	(*10)	2Bytes
0096	B-phase Current	(*10)	2Bytes
0097	C-phase Current	(*10)	2Bytes
0098	Earth Current	(*10)	2Bytes
0099	Reserved		2Bytes
0100	Reserved		2Bytes
0101	Reserved		2Bytes
0102	Reserved		2Bytes
0103 0104	A-phase Active Power	Signed (*10)	4Bytes
0105 0106	B-phase Active Power	Signed (*10)	4Bytes
0107 0108	C-phase Active Power	Signed (*10)	4Bytes
0109 0110	Total Active Power	Signed (*10)	4Bytes
0111	A-phase Reactive Power	Signed (*10)	4Bytes

Address	Items	Description	Bytes
0112			
0113 0114	B-phase Reactive Power	Signed (*10)	4Bytes
0115 0116	C-phase Reactive Power	Signed (*10)	4Bytes
0117 0118	Total Reactive Power	Signed (*10)	4Bytes
0119 0120	A-phase Apparent Power	Signed (*10)	4Bytes
0121 0122	B-phase Apparent Power	Signed (*10)	4Bytes
0123 0124	C-phase Apparent Power	Signed (*10)	4Bytes
0125 0126	Total Apparent Power	Signed (*10)	4Bytes
0127	A-phase Power Factor	Signed (*100)	2Bytes
0128	B-phase Power Factor	Signed (*100)	2Bytes
0129	C-phase Power Factor	Signed (*100)	2Bytes
0130	Average Power Factor	Signed (*100)	2Bytes
0131	Reserved		2Bytes
0132	Earth Current Percentage	(*10)	2Bytes
0133	Reserved		2Bytes
0134	Reserved		2Bytes
0135	Reserved		2Bytes
0136	Reserved		2Bytes
0137	Reserved		2Bytes
0138	Reserved		2Bytes
0139	Reserved		2Bytes
0140	Reserved		2Bytes
0141	Engine Speed		2Bytes
0142	Battery Voltage	(*10)	2Bytes
0143	Charger Voltage	(*10)	2Bytes
0144	GSM Signal Strength		2Bytes
0145	Reserved		2Bytes
0146	Reserved		2Bytes
0147	Reserved		2Bytes
0148	Temp Sensor Resistance Value	Unsigned (*10)	2Bytes
0149	Temp Sensor Value	Signed	2Bytes
0150	Pressure Sensor Resistance Value	Unsigned (*10)	2Bytes
0151	Pressure Sensor Value	Signed	2Bytes
0152	Level Sensor Resistance Value	Unsigned (*10)	2Bytes
0153	Level Sensor Value	Signed	2Bytes
0154	Flexible Sensor 1 Resistance Value	Unsigned (*10)	2Bytes
0155	Flexible Sensor 1 Value	Signed	2Bytes

Address	Items	Description	Bytes	
0156	Flexible Sensor 2 Resistance Value	Unsigned (*10)	2Bytes	
0157	Flexible Sensor 2 Value	Signed	2Bytes	
0159	Reserved		2Bytes	
0159	Reserved		2Bytes	
0160	Reserved		2Bytes	
0161	Engine Load Percentage	Signed; These items are "Reserved" if ECU is NOT used.	2Bytes	
0162	Coolant Level		2Bytes	
0163	Oil Temperature		2Bytes	
0164	Coolant Pressure		2Bytes	
0165	Fuel Pressure		2Bytes	
0166	Fuel Temperature		2Bytes	
0167	Inlet Temperature		2Bytes	
0168	Exhaust Temperature		2Bytes	
0169	Turbo Pressure		2Bytes	
0170	Fuel Consumption		2Bytes	
0171	Total Fuel Consumption			4Bytes
0172				
0173	Atmospheric Pressure		2Bytes	
0174	Inlet Temperature		2Bytes	
0175	ECU Temperature		2Bytes	
0176	Preheat Indication		2Bytes	
0177	Reserved			2Bytes
0178	Reserved			2Bytes
0179	Reserved			2Bytes
0180	Reserved			2Bytes
0181	Reserved		2Bytes	
0182	Reserved		2Bytes	
0183			2Bytes	
0184	Reserved		2Bytes	
0185			2Bytes	
0186	Reserved		2Bytes	
0187			2Bytes	
0188	Reserved		2Bytes	
0189	Gen Status	Gen Status	2Bytes	
0190	Gen Delay Value		2Bytes	
0191	Remote Start Status	Remote Start Status	2Bytes	
0192	Remote Start Delay Value		2Bytes	
0193	ATS Status	ATS Status	2Bytes	
0194	ATS Transfer Delay Value		2Bytes	
0195	Mains Status	Mains Status	2Bytes	
0196	Mains Delay Value		2Bytes	
0197	Reserved		2Bytes	
0198	Reserved		2Bytes	
0199	Accumulated Run Time (HH)		2Bytes	

Address	Items	Description	Bytes
0200	Accumulated Run Time (MM)		2Bytes
0201	Accumulated Run Time (SS)		2Bytes
0202	Accumulated Start Times		2Bytes
0203 0204	Accumulated Energy kWh	Signed (*10)	4Bytes
0205 0206	Accumulated Energy kvarh	Signed (*10)	4Bytes
0207 0208	Accumulated Energy kVAh	Signed (*10)	4Bytes
0209 0210	Reserved		4Bytes
0211	Maintenance Remain Time (HH)		2Bytes
0212	Maintenance Remain Time (MM)		2Bytes
0213	Maintenance Remain Time (SS)		2Bytes
0214 0215	Reserved		2Bytes 2Bytes
0216	COM (Earth)		2Bytes
0217	Controller Model		2Bytes
0218	Software Version	(*10)	2Bytes
0219	Hardware Version	(*10)	2Bytes
0220	Issue Date (YY)	Save the last two digits only.	2Bytes
0221	Issue Date (MM)		2Bytes
0222	Issue Date (DD)		2Bytes
0223	Reserved		2Bytes
0224	Reserved		2Bytes
0225	Controller Time (YY)	Save the last two digits only.	2Bytes
0226	Controller Time (MM)		2Bytes
0227	Controller Time (DD)		2Bytes
0228	Controller Time (Week)		2Bytes
0229	Controller Time (HH)		2Bytes
0230	Controller Time (MM)		2Bytes
0231	Controller Time (SS)		2Bytes
0232	Reserved		2Bytes
0233	Reserved		2Bytes
0234	Reserved		2Bytes
0235 0236	Reserved		2Bytes 2Bytes
0237	Reserved		2Bytes
0238	Expand AIN24-1, Sensor 15	Signed	2Bytes
0239	Expand AIN24-1, Sensor 16	Signed	2Bytes
0240	Expand AIN24-1, Sensor 17	Signed	2Bytes
0241	Expand AIN24-1, Sensor 18	Signed	2Bytes
0242	Expand AIN24-1, Sensor 19	Signed	2Bytes
0243	Expand AIN24-1, Sensor 20	Signed	2Bytes

Address	Items	Description	Bytes
0244	Expand AIN24-1, Sensor 21	Signed	2Bytes
0245	Expand AIN24-1, Sensor 22	Signed	2Bytes
0246	Expand AIN24-1, Sensor 23	Signed	2Bytes
0247	Expand AIN24-1, Sensor 24	Signed	2Bytes
0248	Expand AIN24-2, Sensor 15	Signed	2Bytes
0249	Expand AIN24-2, Sensor 16	Signed	2Bytes
0250	Expand AIN24-2, Sensor 17	Signed	2Bytes
2051	Expand AIN24-2, Sensor 18	Signed	2Bytes
0252	Expand AIN24-2, Sensor 19	Signed	2Bytes
0253	Expand AIN24-2, Sensor 20	Signed	2Bytes
0254	Expand AIN24-2, Sensor 21	Signed	2Bytes
0255	Expand AIN24-2, Sensor 22	Signed	2Bytes
0256	Expand AIN24-2, Sensor 23	Signed	2Bytes
0257	Expand AIN24-2, Sensor 24	Signed	2Bytes
0258	Reserved		
0259	Reserved		
0260	Reserved		
0261	Reserved		
0262	Reserved		
0263	Reserved		
0264	Reserved		
0265	Reserved		
0266	Reserved		
0267	Reserved		
0268	Reserved		
0269	Reserved		
0270	Accumulated Running Hours (A)		2Bytes
0271	Accumulated Running Minutes (A)		2Bytes
0272	Accumulated Running Seconds (A)		2Bytes
0273	Accumulated Start Times (A)		2Bytes
0274	Accumulated Energy kWh (A)	Signed (*10)	4Bytes
0275			
0276	Accumulated Running Hours (B)		2Bytes
0277	Accumulated Running Minutes (B)		2Bytes
0278	Accumulated Running Seconds (B)		2Bytes
0279	Accumulated Start Times (B)		2Bytes
0280	Accumulated Energy kWh (B)	Signed (*10)	4Bytes
0281			
0282	Reserved		2Bytes
0283	Reserved		2Bytes
0284	Reserved		2Bytes
0285	Expand AIN24-1, Sensor 1	Signed (*10)	2Bytes
0286	Expand AIN24-1, Sensor 2	Signed (*10)	2Bytes
0287	Expand AIN24-1, Sensor 3	Signed (*10)	2Bytes

Address	Items	Description	Bytes
0288	Expand AIN24-1, Sensor 4	Signed (*10)	2Bytes
0289	Expand AIN24-1, Sensor 5	Signed (*10)	2Bytes
0290	Expand AIN24-1, Sensor 6	Signed (*10)	2Bytes
0291	Expand AIN24-1, Sensor 7	Signed (*10)	2Bytes
0292	Expand AIN24-1, Sensor 8	Signed (*10)	2Bytes
0293	Expand AIN24-1, Sensor 9	Signed (*10)	2Bytes
0294	Expand AIN24-1, Sensor 10	Signed (*10)	2Bytes
0295	Expand AIN24-1, Sensor 11	Signed (*10)	2Bytes
0296	Expand AIN24-1, Sensor 12	Signed (*10)	2Bytes
0297	Expand AIN24-1, Sensor 13	Signed (*10)	2Bytes
0298	Expand AIN24-1, Sensor 14	Signed (*10)	2Bytes
0299	Expand AIN24-2, Sensor 1	Signed (*10)	2Bytes
0300	Expand AIN24-2, Sensor 2	Signed (*10)	2Bytes
0301	Expand AIN24-2, Sensor 3	Signed (*10)	2Bytes
0302	Expand AIN24-2, Sensor 4	Signed (*10)	2Bytes
0303	Expand AIN24-2, Sensor 5	Signed (*10)	2Bytes
0304	Expand AIN24-2, Sensor 6	Signed (*10)	2Bytes
0305	Expand AIN24-2, Sensor 7	Signed (*10)	2Bytes
0306	Expand AIN24-2, Sensor 8	Signed (*10)	2Bytes
0307	Expand AIN24-2, Sensor 9	Signed (*10)	2Bytes
0308	Expand AIN24-2, Sensor 10	Signed (*10)	2Bytes
0309	Expand AIN24-2, Sensor 11	Signed (*10)	2Bytes
0310	Expand AIN24-2, Sensor 12	Signed (*10)	2Bytes
0311	Expand AIN24-2, Sensor 13	Signed (*10)	2Bytes
0312	Expand AIN24-2, Sensor 14	Signed (*10)	2Bytes

5.2 FUNCTION CODE 05H MAPPING DATA FIELD

Table 25 Function Code 05H Mapping Data Field

Address	Item	Description
0000	Remote Start Key	Only send FF00H for active
0001	Remote Stop Key	Only send FF00H for active
0002	Reserved	
0003	Remote Auto Key	Only send FF00H for active
0004	Remote Manual Key	Only send FF00H for active
0005	Remote Mains Close/Open Key	Only send FF00H for active
0006	Remote Gen Close/Open Key	Only send FF00H for active
0005	Remote Gen Open Key	Only send FF00H for active
0006	Remote Gen Close Key	Only send FF00H for active
0007	Remote Up Key	Only send FF00H for active
0008	Remote Down Key	Only send FF00H for active
0009	Reserved	
0010	Reserved	
0011	Remote Confirm Key	Only send FF00H for active
0012	Remote Mute Key	Only send FF00H for active
0013	Reserved	
0014	Reserved	
0015	Remote Oil Engine Fast Stop Key	Only send FF00H for active
0016	Reserved	
0017	Reserved	
0018	Reserved	
0019	Reserved	
0020	Remote Output 1	Send FF00H for active; 0000H for inactive
0021	Remote Output 2	Send FF00H for active; 0000H for inactive
0022	Remote Output 3	Send FF00H for active; 0000H for inactive
0023	Remote Output 4	Send FF00H for active; 0000H for inactive
0024	Remote Output 5	Send FF00H for active; 0000H for inactive
0025	Remote Output 6	Send FF00H for active; 0000H for inactive
0026	Reserved	
0027	Reserved	
0028	Reserved	

5.3 GEN STATUS

Table 26 Gen Status

No.	Items	Description
0	At Rest	No delay value for this status
1	Pre-heating	
2	Fuel Output	No delay value for this status
3	Cranking	
4	Crank Rest	
5	Safety On	
6	Start Idle	
7	Warming Up	
8	Waiting for Load	No delay value for this status
9	Normal Running	No delay value for this status
10	Cooling Down	
11	Stop Idle	
12	ETS Hold	
13	Wait for Stop	
14	Stop Failure	No delay value for this status
15	After Stop	

5.4 REMOTE START STATUS

Table 27 Remote Start Status

No.	Items	Description
0	No Delay	No delay value for this status
1	Start Delay	
2	Stop Delay	

5.5 ATS STATUS

Table 28 ATS Status

No.	Items	Description
0	Reserved	
1	Reserved	
2	Reserved	
3	Open Delay	
4	ATS Transfer Delay	
5	Mains Close Delay	
6	Gen Close Delay	
7	Wait for Opening	
8	Wait for Gen Closed	
9	Wait for Mains Closed	
10	Normal	

5.6 MAINS STATUS

Table 29 Mains Status

No.	Items	Description
0	Mains Normal	No delay value for this status
1	Mains Normal Delay	
2	Mains Abnormal	No delay value for this status
3	Mains Abnormal Delay	

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