HGM9530N

GENSET CONTROLLER

COMMUNICATION PROTOCOL

SMARTGEN (ZHENGZHOU) TECHNOLOGY CO., LTD.

Chinese trademark

English trademark

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Table 1 - Software Version

Date	Version	Note
2018-12-21	1.0	Original release.

This protocol is only suit for HGM9530N genset controller.
Description of symbols used in this file is as below,

Table 2 – Symbols Description

Symbol	Instruction
NOTE	Highlights an essential element of a procedure to ensure correctness.
CAUTION	Indicates a procedure or practice, which, if not strictly observed, could result in damage or destruction of equipment.
WARNING	Indicates a procedure or practice, which could result in injury to personnel or loss of life if not followed correctly.

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), and DCS or third-party monitoring system compatible with MODBUS. The monitoring system can be set up if only adding central communication master software (such as Kingview，Intouch、FIX、Synal) basing on PC (or IPC).

2. MODBUS BASIC RULES

— All communication loops should follow the master-slave mode. If so, 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 received information frame contains unknown command, no response will be given.

3. DATA FRAME FORMAT

Communication is asynchronously transferred, using byte (data frame) as unit. Between master and slave, every transmitted data frame is 10-bit (1-bit stop bit) or 11-bit (2-bit stop bit) serial data stream.

Table 3 - Data frame format

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

4. COMMUNICATION PROTOCOL

4.1 ILLUSTRATION

When communication command is sent to the slave, corresponding slave receives the communication command, then removes address code, and read the information. If no mistakes, it will execute commands, and sends the result back to the master. Response information includes address code, function code, data and error check code (CRC). If an error occurred in receipt of the command, it will send no information.

4.2 INFORMATION FRAME FORMAT

Table 4 – 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. Single device address range is 1–255; this byte shows that the slave defined by users will receive the information sent by the master. Each slave has a unique address code, and responses begin with the address code. A master addresses a slave by placing the slave address in the address field of the message. When the slave sends its response, it places its own address in this address field of the response to let the master know which slave is responding.

4.4 FUNCTION CODE

4.4.1 ILLUSTRATION

This is the second byte of each transmission. ModBus communication protocol defined function code as 1-255 (01H-0FFH). HGM9530N controller uses part of it. Master sends the request and the slave executes actions according to the function code. If the function code sent by slave is same as that sent by master, it means the response is active. But if the function code MSB is 1 (function code range>127), it means there is no response or response has error.

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

Table 5 - ModBus Partial Function Codes

Function code	Definition	Operation
03H	Read Holding Registers	Reads the contents of holding registers
05H	Force Single Coil	Force a single coil to either ON or OFF.
06H	Write Single Register	Write a 16-bit binary value into a holding register.

4.4.2 03H READ HOLDING REGISTERS

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

The slave received command format is slave address, function code, data field and the CRC code. The data of data field is in double bytes with every two bytes for a group, and high byte is in advance.

4.4.3 05H FORCE SINGLE COIL

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

4.4.4 06H PRESET SINGLE REGISTER

Master uses this command to save a single register data into registers in the device. The register in ModBus communication protocol is 16-bit (2 bytes) and the high order bit is in advance. All the register data are two bytes. The slave received command format is slave address, function code, data field and the CRC code.

4.5 DATA FIELD

4.5.1 ILLUSTRATION

Data field varies with different function codes.

4.5.2 FUNCTION 03H –READ HOLDING REGISTERS

Request:

Data Sequence	Data Signification	Byte Count
1	Starting address	2
2	Read registers	2

Response:

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

4.5.3 FUNCTION 05H –FORCE SINGLE COIL

Request:

Data Sequence	Data Signification	Byte Count
1	Coil address	2
2	Force Single Coil	2

Response:

Data Sequence	Data Signification	Byte Count
1	Coil address	1
2	Single Coil Value	N

4.5.4 FUNCTION 06H –WRITE SINGLE REGISTER

Request:

Data Sequence	Data Signification	Byte Count
1	Register address	2
2	Register Value (2 Bytes)	2

Response:

Data Sequence	Data Signification	Byte Count
1	Register address	2
2	Register Value (2 Bytes)	2

4.6 ERROR CHECK CODE (CRC)

The Error Check Code allows the receiving device to detect a packet that has been corrupted with transmission errors. Sometimes, the transmission information occur imperceptible changes due to electronic noise and other interference and the CRC code ensure the error information does not work to increase the system's safety and efficiency. CRC adapts CRC-16 method of calibration.

When the CRC is appended to the message, the low-order byte is appended first, followed by the high-order byte.

⚠Note: All information frame format are same: address code, function code, data area and CRC code.

The CRC field is two bytes, containing a 16-bit binary value. The CRC value is calculated by the transmitting device, which appends the CRC to the message. The receiving device recalculates a CRC during receipt of the message, and compares the calculated value to the actual value that received in the CRC field. If the two values are not equal, an error will result.

The CRC is started by first preloading a 16–bit register to all 1's. Then a process begins of applying successive 8–bit bytes of the message to the current contents of the register. Only the eight bits of data in each character are used for generating the CRC. Start and stop bits do not apply to the CRC.

During generation of the CRC, each 8–bit character is exclusive OR with the register contents. Then the result is shifted in the direction of the least significant bit (LSB), with a zero filled into the most significant bit (MSB) position. The LSB is extracted and examined. If the LSB was a 1, the register is then exclusive OR with a preset, fixed value. If the LSB was a 0, no exclusive OR takes place.

This process is repeated until eight shifts have been performed. After the last (eighth) shift, the next 8–bit byte is exclusive OR with the register's current value, and the process repeats for eight more shifts as described above. The final contents of the register, after all the bytes of the message have been applied, is the CRC value.

CRC-16 CALCULATIONPROCEDURE

1) Load a 16–bit register with FFFF hex (all 1's). Call this the CRC register.
2) Exclusive OR the first 8–bit byte of the message with the low–order byte of the CRC register, putting the result in the CRC register.
3) Shift the CRC register one bit to the right (toward the LSB), zero–filling the MSB. Extract and examine the LSB.
4) (If the LSB was 0): Repeat Step 3 (another shift).
   (If the LSB was 1): Exclusive OR the CRC register with the polynomial value A001 hex (1010 0000 0000 0001).
5) Repeat Steps 3 and 4 until 8 shifts have been performed. When this is done, a complete 8–bit byte will have been processed.
6) Repeat Steps 2 through 5 for the next 8–bit byte of the message. Continue doing this until all bytes have been processed.
7) The final contents of the CRC register are the CRC value. Least Significant Byte first. When the 16–bit CRC (two 8–bit bytes) is transmitted in the message, the low-order byte will be transmitted first, followed by the high-order byte.

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

4.7 EXAMPLES OF INFORMATION FRAME FORMAT

4.7.1 FUNCTION CODE 03H

Slave address is 01 and starting address is 3 data of 0026H (each data contains 2 bytes).

Data addresses of this example are:

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

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 0026 26
No. of Points	2	00 Read 3 registers (total 6 bytes) 03
CRC code	2	E4 CRC code calculated by host computer 00

Response	Bytes	Example (Hex)
Slave address	1	01 Send to the slave 01
Function code	1	03 Read Holding Registers
Read number of bytes	1	06 3 data（6 bytes in total）
Data No.1	2	00 The content of address 0026H 14
Data No.2	2	00 The content of address 0027H 14
Data No.3	2	00 The content of address 0028H 05
CRC code	2	91 CRC code calculated by slave 71

4.7.2 FUNCTION CODE 05H

Slave address is 01 and starting address is 1 coil of 0000H, set 0000H unit as 1.

Data addresses of this example are:

Address	Data（Hex）
0000	0
0001	1
0002	0

Note: A value of 00FF hex requests the coil to be ON. A value of 0000H requests it to be OFF. All other values are illegal and will not affect the coil.

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

Response	Bytes	Example (Hex)
Slave address	1	01 Send to the slave 01
Function code	1	05 Force single coil
Starting address	2	00 Starting address is 0000H 00
Data	2	FF Set coil as 1 00
CRC code	2	CD CRC code calculated by host computer FB

4.7.3 FUNCTION CODE 06H

Slave address is 01 and starting address is 1 register of 00E3H (content is 0002H).

Data addresses of this example are:

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 Set one register (2 bytes in total) 02
CRC code	2	F9 CRC code calculated by host computer FD

Response	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

Response	Bytes	Example (Hex)
Data	2	00 Set one register (2 bytes in total) 02
CRC code	2	F9 CRC code calculated by host computer FD

4.8 ERROR HANDLING

When device detected 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. The following codes show that unexpected errors have occurred.

CRC error received from the master will be ignored by the device.

The frame format of error code that responds by slave is as follows (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. APPENDIX: ADDRESS AND DATA

5.1 FUNCTION CODE 03H, 06H MAP DATA FIELD

The 06H function code can only be written to the address 0296-0302, and other addresses cannot be written.

Address	Item	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 Alarm	1 for active	1bit
	Common Safe Trip and Stop Alarm	1 for active	1bit
	Common Safe Trip Alarm	1 for active	1bit
	Common Lock Alarm	1 for active	1bit
	Reserved	1 for active	1bit
	System In Auto Mode	1 for active	1bit
	System In Manual Mode	1 for active	1bit
	System 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
0001-0015	Shutdown Alarm Area	*ALARM DATA FORM*	30Bytes
0016-0030	Trip and Stop Alarm Area		30Bytes
0031-0045	Trip Alarm Area		30Bytes
0046-0060	Safe Trip and Stop Alarm Area		30Bytes
0061-0075	Safe Trip Alarm Area		30Bytes
0076-0090	Lock Area		30Bytes
0091-0105	Warning Area		30Bytes
0106	Reserved		2Bytes
0107	Reserved		2Bytes
0108	Fuel Output Status	1 for active	1bit
	Start Output Status	1 for active	1bit
	Programmable Output 1 Status	1 for active	1bit
	Programmable Output 2 Status	1 for active	1bit
	Programmable Output 3 Status	1 for active	1bit
	Programmable Output 4 Status	1 for active	1bit

Address	Item	Description	Bytes
	Programmable Output 5 Status	1 for active	1bit
	Programmable Output 6 Status	1 for active	1bit
	Programmable Output 7 Status	1 for active	1bit
	Programmable 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
0109	Reserved		2Bytes
0110	Reserved		2Bytes
0111	Reserved		2Bytes
0112	Reserved		2Bytes
0113	Reserved		2Bytes
0114	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Gen Normal	1 for active	1bit
	Close Gen	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
0115	Reserved		2Bytes
0116	Reserved		2Bytes
0117	Reserved		2Bytes
0118	Reserved		2Bytes
0119	Reserved		2Bytes
0120	Bus/Mains UAB	LSB (*10)	2Bytes
0121		MSB (*10)	2Bytes
0122	Bus/Mains UBC	LSB (*10)	2Bytes
0123		MSB (*10)	2Bytes
0124	Bus/Mains UCA	LSB (*10)	2Bytes
0125		MSB (*10)	2Bytes
0126	Bus/Mains UA	LSB (*10)	2Bytes

Address	Item	Description	Bytes
0127		MSB (*10)	2Bytes
0128	Bus/Mains UB	LSB (*10)	2Bytes
0129		MSB (*10)	2Bytes
0130	Bus/Mains UC	LSB (*10)	2Bytes
0131		MSB (*10)	2Bytes
0132	Reserved		2Bytes
0133	Reserved		2Bytes
0134	Reserved		2Bytes
0135	Bus/Mains Frequency	(*100)	2Bytes
0136	Reserved		2Bytes
0137	Reserved		2Bytes
0138	Reserved		2Bytes
0139	Reserved		2Bytes
0140	Gen UAB	LSB (*10)	2Bytes
0141		MSB (*10)	2Bytes
0142	Gen UBC	LSB (*10)	2Bytes
0143		MSB (*10)	2Bytes
0144	Gen UCA	LSB (*10)	2Bytes
0145		MSB (*10)	2Bytes
0146	Gen UA	LSB (*10)	2Bytes
0147		MSB (*10)	2Bytes
0148	Gen UB	LSB (*10)	2Bytes
0149		MSB (*10)	2Bytes
0150	Gen UC	LSB (*10)	2Bytes
0151		MSB (*10)	2Bytes
0152	Reserved		2Bytes
0153	Reserved		2Bytes
0154	Reserved		2Bytes
0155	Gen Frequency	(*100)	2Bytes
0156	Voltage Difference	Signed	2Bytes
0157	Frequency Difference	Signed(*100)	2Bytes
0158	Phase Difference	Signed (*10)	2Bytes
0159	Gen Active Power Percentage (Present)	Signed (*10)	2Bytes
0160	Gen Active Power Percentage (Target)	Signed (*10)	2Bytes
0161	Gen Reactive Power Percentage (Present)	Signed (*10)	2Bytes
0162	Gen Reactive Power Percentage (Target)	Signed (*10)	2Bytes
0163	GOV Output Percentage	Signed (*10)	2Bytes
0164	AVR Output Percentage	Signed (*10)	2Bytes
0165	Reserved		2Bytes
0166	A-Phase Current	(*10)	2Bytes
0167	B-Phase Current	(*10)	2Bytes
0168	C-Phase Current	(*10)	2Bytes
0169	Earth Current	(*10)	2Bytes

Address	Item	Description	Bytes
0170	Reserved		2Bytes
0171	Reserved		2Bytes
0172	Reserved		2Bytes
0173	Reserved		2Bytes
0174	A Phase Active Power	Signed LSB (*10)	2Bytes
0175		Signed MSB (*10)	2Bytes
0176	B Phase Active Power	Signed LSB (*10)	2Bytes
0177		Signed MSB (*10)	2Bytes
0178	C Phase Active Power	Signed LSB (*10)	2Bytes
0179		Signed MSB (*10)	2Bytes
0180	Total Active Power	Signed LSB (*10)	2Bytes
0181		Signed MSB (*10)	2Bytes
0182	A Phase Reactive Power	Signed LSB (*10)	2Bytes
0183		Signed MSB (*10)	2Bytes
0184	B Phase Reactive Power	Signed LSB (*10)	2Bytes
0185		Signed MSB (*10)	2Bytes
0186	C Phase Reactive Power	Signed LSB (*10)	2Bytes
0187		Signed MSB (*10)	2Bytes
0188	Total Reactive Power	Signed LSB (*10)	2Bytes
0189		Signed MSB (*10)	2Bytes
0190	A Phase Apparent Power	Signed LSB (*10)	2Bytes
0191		Signed MSB (*10)	2Bytes
0192	B Phase Apparent Power	Signed LSB (*10)	2Bytes
0193		Signed MSB (*10)	2Bytes
0194	C Phase Apparent Power	Signed LSB (*10)	2Bytes
0195		Signed MSB (*10)	2Bytes
0196	Total Apparent Power	Signed LSB (*10)	2Bytes
0197		Signed MSB (*10)	2Bytes
0198	A Phase Power Factor	Signed (*1000)	2Bytes
0199	B Phase Power Factor	Signed (*1000)	2Bytes
0200	C Phase Power Factor	Signed (*1000)	2Bytes
0201	Average Power Factor	Signed (*1000)	2Bytes
0202	Reserved		2Bytes
0203	Reserved		2Bytes
0204	Unbalanced Current	Signed (*10)	2Bytes
0205	Reserved		2Bytes
0206	Reserved		2Bytes
0207	Reserved		2Bytes
0208	Reserved		2Bytes

Address	Item	Description	Bytes
0209	Reserved		2Bytes
0210	Reserved		2Bytes
0211	Reserved		2Bytes
0212	Engine Speed		2Bytes
0213	Battery Voltage	(*10)	2Bytes
0214	Charger Voltage	(*10)	2Bytes
0215	Reserved		2Bytes
0216	Reserved		2Bytes
0217	Reserved		2Bytes
0218	Reserved		2Bytes
0219	Reserved		2Bytes
0220	Temperature Sensor Value		2Bytes
0221	Reserved		2Bytes
0222	Pressure Sensor Value		2Bytes
0223	Reserved		2Bytes
0224	Fuel Level Sensor Value		2Bytes
0225	Reserved		2Bytes
0226	Flexible Sensor 1 Value		2Bytes
0227	Reserved		2Bytes
0228	Flexible Sensor 2 Value		2Bytes
0229	Reserved		2Bytes
0230	Reserved		2Bytes
0231	Reserved		2Bytes
0232	Reserved		2Bytes
0233	Coolant Level	Signed, it is reserved if engine is not J-1939 engine.	2Bytes
0234	Engine Oil Temperature		2Bytes
0235	Coolant Pressure		2Bytes
0236	Fuel Pressure		2Bytes
0237	Fuel Temperature		2Bytes
0238	Inlet Temperature		2Bytes
0239	Exhaust Temperature		2Bytes
0240	Turbine Pressure		2Bytes
0241	Fuel Consumption		2Bytes
0242 0243	Total Fuel Consumption		4Bytes
0244	Reserved		2Bytes
0245	Reserved		2Bytes
0246	Reserved		2Bytes
0247	Reserved		2Bytes
0248	Reserved		2Bytes
0249	Reserved		2Bytes
0250	Reserved		2Bytes
0251	Reserved		2Bytes

Address	Item	Description	Bytes
0252	Reserved		2Bytes
0253	Reserved		2Bytes
0254	Reserved		2Bytes
0255	Reserved		2Bytes
0256	Reserved		2Bytes
0257	Reserved		2Bytes
0258	Reserved		2Bytes
0259	Reserved		2Bytes
0260	Gen Status	*GENERATOR STATUS FORM*	2Bytes
0261	Gen Delay Value		2Bytes
0262	Remote Start Status	*REMOTE START STATUS FORM*	2Bytes
0263	Remote Start Delay Value		2Bytes
0264	Gen Breaker Status	*BREAKER STATUS FORM*	2Bytes
0265	Gen Breaker Delay		2Bytes
0266	Reserved		2Bytes
0267	Reserved		2Bytes
0268	Reserved		2Bytes
0269	Reserved		2Bytes
0270	Total Running Time (Hour)		2Bytes
0271	Total Running Time (Minute)		2Bytes
0272	Total Running Time (Second)		2Bytes
0273	Total Start Times		2Bytes
0274 0275	Total Energy kWh		4Bytes
0276 0277	Total Energy kVarh		4Bytes
0278 0279	Total Energy kVAh		4Bytes
0280 0281	Reserved		4Bytes
0282	Maintenance Time Left (Hour)		2Bytes
0283	Maintenance Time Left (Minute)		2Bytes
0284	Maintenance Time Left (Second)		2Bytes
0285	Multi-sets Total Reactive Power	Signed (*10)	2Bytes
0286			2Bytes
0287	Reserved		2Bytes
0288	Controller Model		2Bytes
0289	Controller Software Version	(*10)	2Bytes
0290	Controller Hardware Version	(*10)	2Bytes
0291	Controller Release Time (Year)	Only reserve last two	2Bytes

Address	Item	Description	Bytes
		numbers of the year.	
0292	Controller Release Time (Month)		2Bytes
0293	Controller Release Time (Day)		2Bytes
0294	Reserved		2Bytes
0295	Reserved		2Bytes
0296	Controller Time: Year	Only reserve last two numbers of the year.	2Bytes
0297	Controller Time: Month		2Bytes
0298	Controller Time: Day		2Bytes
0299	Controller Time: Week		2Bytes
0300	Controller Time: Hour		2Bytes
0301	Controller Time: Minute		2Bytes
0302	Controller Time: Second		2Bytes
0303	Module MSC ID		2Bytes
0304	Module Priority	Signed	2Bytes
0305	Number of Module		2Bytes
0306	Multi-sets Total Active Power	Signed (*10)	2Bytes
0307			2Bytes
0308	Reserved		2Bytes
0309	AIN24-1 Sensor 15 Value	Signed	2Bytes
0310	AIN24-1 Sensor 16 Value	Signed	2Bytes
0311	AIN24-1 Sensor 17 Value	Signed	2Bytes
0312	AIN24-1 Sensor 18 Value	Signed	2Bytes
0313	AIN24-1 Sensor 19 Value	Signed	2Bytes
0314	AIN24-1 Sensor 20 Value	Signed	2Bytes
0315	AIN24-1 Sensor 21 Value	Signed	2Bytes
0316	AIN24-1 Sensor 22 Value	Signed	2Bytes
0317	AIN24-1 Sensor 23 Value	Signed	2Bytes
0318	AIN24-1 Sensor 24 Value	Signed	2Bytes
0319	AIN24-2 Sensor 15 Value	Signed	2Bytes
0320	AIN24-2 Sensor 16 Value	Signed	2Bytes
0321	AIN24-2 Sensor 17 Value	Signed	2Bytes
0322	AIN24-2 Sensor 18 Value	Signed	2Bytes
0323	AIN24-2 Sensor 19 Value	Signed	2Bytes
0324	AIN24-2 Sensor 20 Value	Signed	2Bytes
0325	AIN24-2 Sensor 21 Value	Signed	2Bytes
0326	AIN24-2 Sensor 22 Value	Signed	2Bytes
0327	AIN24-2 Sensor 23 Value	Signed	2Bytes
0328	AIN24-2 Sensor 24 Value	Signed	2Bytes
0329	Reserved		
0330	Reserved		

5.2 FUNCTION CODE 05H MAP DATA FIELD

Address	Items	Description
0000	Remote Start Key	1 for active
0001	Remote Stop Key	1 for active
0002	Reserved	1 for active
0003	Remote Auto Key	1 for active
0004	Remote Manual Key	1 for active
0005	Remote Close Gen Key	1 for active
0006	Remote Open Gen Key	1 for active
0007	Reserved	1 for active
0008	Reserved	1 for active
0009	Reserved	1 for active
0010	Reserved	1 for active
0011	Reserved	1 for active
0012	Reserved	1 for active
0013	Reserved	1 for active
0014	Reserved	1 for active
0015	Reserved	1 for active
0016	Reserved	1 for active
0017	Reserved	1 for active
0018	Reserved	1 for active
0020	Remote Output Port 1 Output	1 for active, o for inactive
0021	Remote Output Port 2 Output	1 for active, o for inactive
0022	Remote Output Port 3 Output	1 for active, o for inactive
0023	Remote Output Port 4 Output	1 for active, o for inactive
0024	Remote Output Port 5 Output	1 for active, o for inactive
0025	Remote Output Port 6 Output	1 for active, o for inactive
0026	Remote Output Port 7 Output	1 for active, o for inactive
0027	Remote Output Port 8 Output	1 for active, o for inactive
0028	Remote Output Port 9 Output	1 for active, o for inactive
0029	Remote Output Port 10 Output	1 for active, o for inactive
0030	Remote Output Port 11 Output	1 for active, o for inactive
0031	Remote Output Port 12 Output	1 for active, o for inactive
0032	Remote Output Port 13 Output	1 for active, o for inactive
0033	Remote Output Port 14 Output	1 for active, o for inactive
0034	Remote Output Port 15 Output	1 for active, o for inactive
0035	Remote Output Port 16 Output	1 for active, o for inactive
0036	Remote Output Port 17 Output	1 for active, o for inactive
0037	Remote Output Port 18 Output	1 for active, o for inactive

5.3 FUNCTION CODE 06H MAP DATA FIELD

Address	Item	Description
4368	Load paralleling output active power percentage	Active when in gen control mode (fixed power) Data range: 0-1000 Corresponding percentage: 0.0%-100.0%
4370	Load paralleling output reactive power percentage	

5.4 ALARM DATA FORM

Offset Address	Items	Description	Bytes
0000	Emergency Stop Alarm	1 for active	1bit
	Overspeed Alarm	1 for active	1bit
	Underspeed Alarm	1 for active	1bit
	Loss of Speed Signal	1 for active	1bit
	Gen Overfrequency	1 for active	1bit
	Gen Underfrequency	1 for active	1bit
	Gen Overvoltage	1 for active	1bit
	Gen Undervoltage	1 for active	1bit
	Fail to Start Alarm	1 for active	1bit
	Gen Overcurrent	1 for active	1bit
	Current Unbalance	1 for active	1bit
	Earth Fault	1 for active	1bit
	Reverse Power Alarm	1 for active	1bit
	Over Power Alarm	1 for active	1bit
	Loss of Excitation	1 for active	1bit
	ECU Communication Fail	1 for active	1bit
0001	ECU Alarm	1 for active	1bit
	Temperature High Input Alarm	1 for active	1bit
	Temperature Low Input Alarm	1 for active	1bit
	MSC ID Error	1 for active	1bit
	Voltage Bus Error	1 for active	1bit
	Gen Phase Sequence Wrong Error	1 for active	1bit
	Voltage Bus Phase Seq. Wrong Error	1 for active	1bit
	Temperature Sensor Open Circuit	1 for active	1bit
	Engine Temperature High	1 for active	1bit
	Engine Temperature Low	1 for active	1bit
	Temperature Sensor Error	1 for active	1bit
	Oil Pressure Sensor Open Circuit	1 for active	1bit
	Oil Pressure High	1 for active	1bit
	Oil Pressure Low	1 for active	1bit
	Oil Pressure Sensor Error	1 for active	1bit
	Fuel Level Sensor Open Circuit	1 for active	1bit
0002	Fuel Level High	1 for active	1bit
	Fuel Level Low	1 for active	1bit
	Fuel Level Sensor Error	1 for active	1bit

Offset Address	Items	Description	Bytes
	Flexible Sensor 1 Open Circuit	1 for active	1bit
	Flexible Sensor 1 High	1 for active	1bit
	Flexible Sensor 1 Low	1 for active	1bit
	Flexible Sensor 1 Error	1 for active	1bit
	Flexible Sensor 2 Open Circuit	1 for active	1bit
	Flexible Sensor 2 High	1 for active	1bit
	Flexible Sensor 2 Low	1 for active	1bit
	Flexible Sensor 2 Error	1 for active	1bit
	Fail to Stop	1 for active	1bit
	Fail to Charge	1 for active	1bit
	Battery Overvoltage	1 for active	1bit
	Battery Undervoltage	1 for active	1bit
	Fail to Sync.	1 for active	1bit
0003	GOV Reaches The Limit	1 for active	1bit
	AVR Reaches The Limit	1 for active	1bit
	Gen Undercapacity	1 for active	1bit
	Voltage Out of Sync.	1 for active	1bit
	Frequency Out of Sync.	1 for active	1bit
	Phase Out of Sync.	1 for active	1bit
	MCB Alarm	1 for active	1bit
	GCB Alarm	1 for active	1bit
	Fail to Close Mains	1 for active	1bit
	Fail to Close Gen	1 for active	1bit
	Fail to Open Mains	1 for active	1bit
	Fail to Open Gen	1 for active	1bit
	Mains Overfrequency	1 for active	1bit
	Mains Underfrequency	1 for active	1bit
	Mains Overvoltage	1 for active	1bit
	Mains Undervoltage	1 for active	1bit
0004	Mains ROCOF	1 for active	1bit
	Mains Vector Shift	1 for active	1bit
	Frequency Error Big Warning	1 for active	1bit
	MSC too Few Sets	1 for active	1bit
	Maintenance 1 Due	1 for active	1bit
	Maintenance 2 Due	1 for active	1bit
	Maintenance 3 Due	1 for active	1bit
	Water Level Low Alarm	1 for active	1bit
	Detonation Alarm	1 for active	1bit
	Gas Leak Alarm	1 for active	1bit
	Gen Phase Sequence Wrong	1 for active	1bit
	Gen Loss of Phase	1 for active	1bit
	MSC1 Fail to Communicate	1 for active	1bit
	MSC2 Fail to Communicate	1 for active	1bit

Offset Address	Items	Description	Bytes
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
0005	Digital Input 1	1 for active	1bit
	Digital Input 2	1 for active	1bit
	Digital Input 3	1 for active	1bit
	Digital Input 4	1 for active	1bit
	Digital Input 5	1 for active	1bit
	Digital Input 6	1 for active	1bit
	Digital Input 7	1 for active	1bit
	Digital Input 8	1 for active	1bit
	Digital Input 9	1 for active	1bit
	Digital Input 10	1 for active	1bit
	Digital Input 11	1 for active	1bit
	Digital Input 12	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
0006	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
0007	DIN16 Fail to Communicate	1 for active	1bit
	DIN16 Input 1	1 for active	1bit
	DIN16 Input 2	1 for active	1bit
	DIN16 Input 3	1 for active	1bit
	DIN16 Input 4	1 for active	1bit
	DIN16 Input 5	1 for active	1bit
	DIN16 Input 6	1 for active	1bit
	DIN16 Input 7	1 for active	1bit
	DIN16 Input 8	1 for active	1bit

Offset Address	Items	Description	Bytes
	DIN16 Input 9	1 for active	1bit
	DIN16 Input 10	1 for active	1bit
	DIN16 Input 11	1 for active	1bit
	DIN16 Input 12	1 for active	1bit
	DIN16 Input 13	1 for active	1bit
	DIN16 Input 14	1 for active	1bit
	DIN16 Input 15	1 for active	1bit
0008	DIN16 Input 16	1 for active	1bit
	DOUT16 Fail to Communicate	1 for active	1bit
	AIN24 1 Fail to Communicate	1 for active	1bit
	AIN24 1 Cylinder Temperature High	1 for active	1bit
	AIN24 1 Exhaust Temperature High	1 for active	1bit
	AIN24 1 Large Temp. Difference	1 for active	1bit
	AIN24 1 Sensor 15 Open Circuit	1 for active	1bit
	AIN24 1 Sensor 15 High	1 for active	1bit
	AIN24 1 Sensor 15 Low	1 for active	1bit
	AIN24 1 Sensor 16 Open Circuit	1 for active	1bit
	AIN24 1 Sensor 16 High	1 for active	1bit
	AIN24 1 Sensor 16 Low	1 for active	1bit
	AIN24 1 Sensor 17 Open Circuit	1 for active	1bit
	AIN24 1 Sensor 17 High	1 for active	1bit
	AIN24 1 Sensor 17 Low	1 for active	1bit
	AIN24 1 Sensor 18 Open Circuit	1 for active	1bit
0009	AIN24 1 Sensor 18 High	1 for active	1bit
	AIN24 1 Sensor 18 Low	1 for active	1bit
	AIN24 1 Sensor 19 Open Circuit	1 for active	1bit
	AIN24 1 Sensor 19 High	1 for active	1bit
	AIN24 1 Sensor 19 Low	1 for active	1bit
	AIN24 1 Sensor 20 Open Circuit	1 for active	1bit
	AIN24 1 Sensor 20 High	1 for active	1bit
	AIN24 1 Sensor 20 Low	1 for active	1bit
	AIN24 1 Sensor 21 Open Circuit	1 for active	1bit
	AIN24 1 Sensor 21 High	1 for active	1bit
	AIN24 1 Sensor 21 Low	1 for active	1bit
	AIN24 1 Sensor 22 Open Circuit	1 for active	1bit
	AIN24 1 Sensor 22 High	1 for active	1bit
	AIN24 1 Sensor 22 Low	1 for active	1bit
	AIN24 1 Sensor 23 Open Circuit	1 for active	1bit
	AIN24 1 Sensor 23 High	1 for active	1bit
0010	AIN24 1 Sensor 23 Low	1 for active	1bit
	AIN24 1 Sensor 24 Open Circuit	1 for active	1bit
	AIN24 1 Sensor 24 High	1 for active	1bit
	AIN24 1 Sensor 24 Low	1 for active	1bit

Offset Address	Items	Description	Bytes
	AIN24 2 Fail to Communicate	1 for active	1bit
	AIN24 2 Cylinder Temperature High	1 for active	1bit
	AIN24 2 Exhaust Temperature High	1 for active	1bit
	AIN24 2 Large Temp. Difference	1 for active	1bit
	AIN24 2 Sensor 15 Open Circuit	1 for active	1bit
	AIN24 2 Sensor 15 High	1 for active	1bit
	AIN24 2 Sensor 15 Low	1 for active	1bit
	AIN24 2 Sensor 16 Open Circuit	1 for active	1bit
	AIN24 2 Sensor 16 High	1 for active	1bit
	AIN24 2 Sensor 16 Low	1 for active	1bit
	AIN24 2 Sensor 17 Open Circuit	1 for active	1bit
	AIN24 2 Sensor 17 High	1 for active	1bit
0011	AIN24 2 Sensor 17 Low	1 for active	1bit
	AIN24 2 Sensor 18 Open Circuit	1 for active	1bit
	AIN24 2 Sensor 18 High	1 for active	1bit
	AIN24 2 Sensor 18 Low	1 for active	1bit
	AIN24 2 Sensor 19 Open Circuit	1 for active	1bit
	AIN24 2 Sensor 19 High	1 for active	1bit
	AIN24 2 Sensor 19 Low	1 for active	1bit
	AIN24 2 Sensor 20 Open Circuit	1 for active	1bit
	AIN24 2 Sensor 20 High	1 for active	1bit
	AIN24 2 Sensor 20 Low	1 for active	1bit
	AIN24 2 Sensor 21 Open Circuit	1 for active	1bit
	AIN24 2 Sensor 21 High	1 for active	1bit
	AIN24 2 Sensor 21 Low	1 for active	1bit
	AIN24 2 Sensor 22 Open Circuit	1 for active	1bit
	AIN24 2 Sensor 22 High	1 for active	1bit
	AIN24 2 Sensor 22 Low	1 for active	1bit
0012	AIN24 2 Sensor 23 Open Circuit	1 for active	1bit
	AIN24 2 Sensor 23 High	1 for active	1bit
	AIN24 2 Sensor 23 Low	1 for active	1bit
	AIN24 2 Sensor 24 Open Circuit	1 for active	1bit
	AIN24 2 Sensor 24 High	1 for active	1bit
	AIN24 2 Sensor 24 Low	1 for active	1bit
	Power Factor Low	1 for active	1bit
	High Waveform Distortion	1 for active	1bit
	Gen Voltage Unbalanced	1 for active	1bit
	MSC Mains Disconnected	1 for active	1bit
	Earth Breaker Fail to Close	1 for active	1bit
	Earth Breaker Fail to Open	1 for active	1bit
	Static Paralleling Fail	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit

Offset Address	Items	Description	Bytes
	Reserved	1 for active	1bit
0013	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
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
0014	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
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit
	Reserved	1 for active	1bit

5.5 GENERATOR STATUS FORM

No.	Content	Description
0	Standby	There is no delay value in this status.
1	Preheat	
2	Fuel Output	There is no delay value in this status.
3	Crank	
4	Crank Rest	
5	Safe Delay	
6	Start Idle	
7	Hi-speed Warming Up	
8	Waiting for Load	There is no delay value in this status.
9	Normal Running	There is no delay value in this status.
10	Hi-speed Cooling	
11	Stop Idle	
12	Energize to Stop	
13	Wait for Stop	
14	After Stop	
15	Fail to Stop	There is no delay value in this status.

5.6 REMOTE START STATUS FORM

No.	Content	Description
0	No Delay	There is no delay value in this status.
1	Start Delay	
2	Stop Delay	

5.7 BREAKER STATUS FORM

No.	Content	Description
0	Synchronizing	There is no delay value in this status.
1	Close Delay	
2	Waiting for Close Input	There is no delay value in this status.
3	Closed	There is no delay value in this status.
4	Unloading	There is no delay value in this status.
5	Open Delay	
6	Waiting for Open Input	There is no delay value in this status.
7	Opened	There is no delay value in this status.