HMP300-2
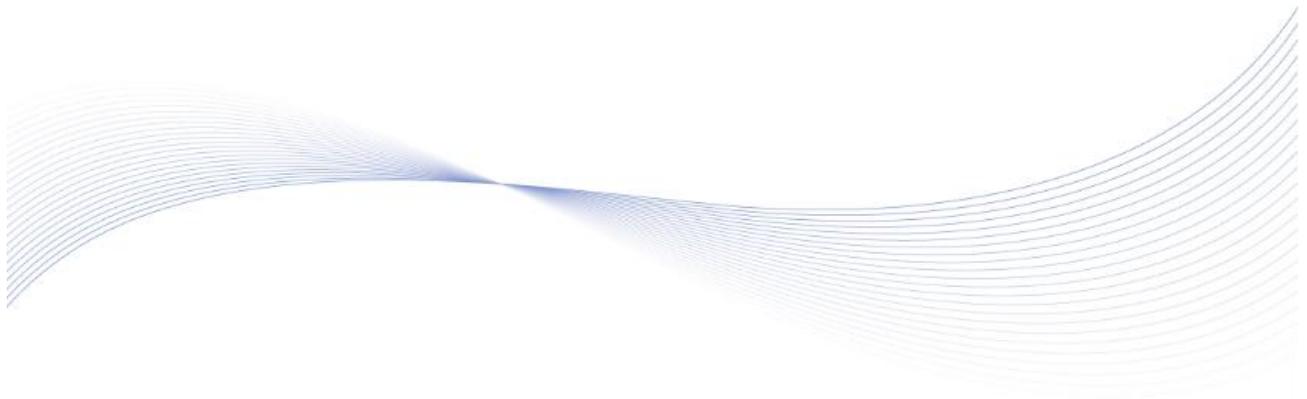
POWER INTEGRATED PROTECTION MODULE

COMMUNICATION PROTOCOL

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SmartGen

SmartGen Registered trademark

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Table 1 - Software Version

Date	Version	Note
2019-06-01	V1.0	Original release.
2020-08-10	V1.1	Add function code 05 control.
2021-07-15	V1.2	Add current actual collection data sending.
2023-03-15	V1.3	Add description of current decimal place.
2024-09-12	V1.4	Add function code 06.

CONTENTS

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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 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	2-bit
Baud rate	9600bps

4 COMMUNICATION PROTOCOL

4.1 ILLUSTRATION

When communication command is sent to the instrument, device which 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 (from 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). This module uses a part of it. By master request master can tell slave to conduct certain action with function code. 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 one issued by the master. If the function code MSB issued by the slave 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 Holding Registers	Reads single or multiple register data;
05H	Force Single Coil	Forces a single coil;
06H	Write Single Register	Write data into single 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. 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 device.

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*2

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

Table 10 Slave Response

Data Sequence	Data Signification	Byte Count
1	Register address	2
2	Register value	2

4.6 ERROR CHECK CODE (CRC)

Master or slave can detect whether the received information is wrong 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 format are the 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 whether 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 pre-set 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 Exclusives OR with the register data. The obtained result moves 1 bit to the low byte direction and fills 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) Pre-set 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>.

5 EXAMPLES OF INFORMATION FRAME FORMAT

5.1 FUNCTION CODE 03H

Slave address is 01 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 (6 bytes in total)
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 holding 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.

5.2 FUNCTION CODE 05H

Slave address is 01 and starting address is 0002H. Set 0002 coil as 1.

Table 14 Data Address Example

Address	Data (Hex)
0000	0
0001	1
0002	0

⚠ **NOTE:** FF00 hex coil value is forced to 1 and 000H 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 02	Starting address is 0002
Data	2	00 FF	Set coil as 1
CRC code	2	2C 4A	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 single coil
Starting address	2	00 02	Starting address is 0002
Data	2	00 FF	Set coil as 1
CRC code	2	2C 4A	CRC code which calculated by slave.

5.3 FUNCTION CODE 06H

Slave address is 01 and register address is 1001H. Write data of 0190H into the register (400 in decimal).

Table 17 Data Address Example

Address	Data (Hex)
1001	012C
1100	01F4
1201	01F4

Table 18 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	03 E9	Starting address is 1001
Data	2	01 90	Write data of 400 into the register
CRC code	2	59 68	CRC code which calculated by PC.

Table 19 Function Code 06H Slave Response Example

Slave Response	Bytes	For Example (Hex)	
Slave address	1	01	Respond slave address 01
Function code	1	06	Write single register
Starting address	2	03 E9	Starting address is 1001
Data	2	01 90	Write data of 400 into the register
CRC code	2	59 68	CRC code which calculated by slave.

5.4 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 20 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.

6 MODBUS DATA FIELD

6.1 FUNCTION CODE 03H MAPPING DATA FIELD

Table 21 Function Code 03H Mapping Data Field

Address		Item	Description	Byte
0000	Bit0	Common Alarm	1 for active (LSB)	1bit
	Bit1	Common Shutdown Alarm	1 for active	1bit
	Bit2	Common Warning Alarm	1 for active	1bit
	Bit3	Reserved	1 for active	1bit
	Bit4	Reserved	1 for active	1bit
	Bit5	Reserved	1 for active	1bit
	Bit6	Reserved	1 for active	1bit
	Bit7	Reserved	1 for active	1bit
	Bit8	Reserved	1 for active	1bit
	Bit9	Reserved	1 for active	1bit
	Bit10	Reserved	1 for active	1bit
	Bit11	Reserved	1 for active	1bit
	Bit12	Reserved	1 for active	1bit
	Bit13	Reserved	1 for manual	1bit
	Bit14	Reserved	1 for active	1bit
	Bit15	Reserved	1 for active (MSB)	1bit
0001	Bit0	Gen Over Voltage Trip Alarm	1 for active (LSB)	1bit
	Bit1	Gen Under Voltage Trip Alarm	1 for active	1bit
	Bit2	Gen Loss of Phase Trip Alarm	1 for active	1bit
	Bit3	Gen Phase Sequence Wrong Trip Alarm	1 for active	1bit
	Bit4	Gen Over Frequency Trip Alarm	1 for active	1bit
	Bit5	Gen Under Frequency Trip Alarm	1 for active	1bit
	Bit6	Gen Over Current Trip Alarm	1 for active	1bit
	Bit7	NEL 1 Trip	1 for active	1bit
	Bit8	Gen Over Power Trip Alarm	1 for active	1bit
	Bit9	Reserved	1 for active	1bit
	Bit10	Gen Reverse Power Trip Alarm	1 for active	1bit
	Bit11	Over Current Long Trip	1 for active	1bit
	Bit12	NEL 2 Trip	1 for active	1bit
	Bit13	NEL 3 Trip	1 for active	1bit
	Bit14	Input 1 Trip	1 for active	1bit
	Bit15	Input 2 Trip	1 for active (MSB)	1bit
0002	Bit0	Gen Over Voltage Warning	1 for active (LSB)	1bit
	Bit1	Gen Under Voltage Warning Alarm	1 for active	1bit
	Bit2	Reserved	1 for active	1bit
	Bit3	Reserved	1 for active	1bit
	Bit4	Gen Over Frequency Warning Alarm	1 for active	1bit
	Bit5	Gen Under Frequency Warning Alarm	1 for active	1bit

Address		Item	Description	Byte
	Bit6	Reserved	1 for active	1bit
	Bit7	Gen Over Current Warning	1 for active	1bit
	Bit8	Reserved	1 for active	1bit
	Bit9	Gen Over Power Warning	1 for active	1bit
	Bit10	Reserved	1 for active	1bit
	Bit11	Gen Reverse Power Warning	1 for active	1bit
	Bit12	Gen Over Current Early Warning	1 for active	1bit
	Bit13	Reserved	1 for active	1bit
	Bit14	Input 1 Warning	1 for active	1bit
	Bit15	Input 2 Warning	1 for active (MSB)	1bit
0003	Bit0	Voltage L1 Harmonic Distortion Threshold-crossing	1 for active (LSB)	1bit
	Bit1	Voltage L2 Harmonic Distortion Threshold-crossing	1 for active	1bit
	Bit2	Voltage L3 Harmonic Distortion Threshold-crossing	1 for active	1bit
	Bit3	Current L1 Harmonic Distortion Threshold-crossing	1 for active	1bit
	Bit4	Current L2 Harmonic Distortion Threshold-crossing	1 for active	1bit
	Bit5	Current L3 Harmonic Distortion Threshold-crossing	1 for active	1bit
	Bit6	Voltage L1 Harmonic Gradation Threshold-crossing	1 for active	1bit
	Bit7	Voltage L2 Harmonic Gradation Threshold-crossing	1 for active	1bit
	Bit8	Voltage L3 Harmonic Gradation Threshold-crossing	1 for active	1bit
	Bit9	Current L1 Harmonic Gradation Threshold-crossing	1 for active	1bit
	Bit10	Current L2 Harmonic Gradation Threshold-crossing	1 for active	1bit
	Bit11	Current L3 Harmonic Gradation Threshold-crossing	1 for active	1bit
	Bit12	Reserved	1 for active	1bit
	Bit13	Reserved	1 for active	1bit
	Bit14	Reserved	1 for active	1bit
	Bit15	Reserved	1 for active (MSB)	1bit
0004		Reserved		2 Bytes
0005	Bit0	Input 1 Status	1 for active (LSB)	1bit
	Bit1	Input 2 Status	1 for active	1bit
	Bit2	Reserved	1 for active	1bit
	Bit3	Reserved	1 for active	1bit
	Bit4	Reserved	1 for active	1bit

Address		Item	Description	Byte
	Bit5	Reserved	1 for active	1bit
	Bit6	Reserved	1 for active	1bit
	Bit7	Reserved	1 for active	1bit
	Bit8	Reserved	1 for active	1bit
	Bit9	Reserved	1 for active	1bit
	Bit10	Reserved	1 for active	1bit
	Bit11	Reserved	1 for active	1bit
	Bit12	Reserved	1 for active	1bit
	Bit13	Reserved	1 for active	1bit
	Bit14	Reserved	1 for active	1bit
	Bit15	Reserved	1 for active (MSB)	1bit
0006		Reserved		2 Bytes
0007	Bit0	Output 1 Status	1 for active (LSB)	1bit
	Bit1	Output 2 Status	1 for active	1bit
	Bit2	Output 3 Status	1 for active	1bit
	Bit3	Output 4 Status	1 for active	1bit
	Bit4	Reserved	1 for active	1bit
	Bit5	Reserved	1 for active	1bit
	Bit6	Reserved	1 for active	1bit
	Bit7	Reserved	1 for active	1bit
	Bit8	Reserved	1 for active	1bit
	Bit9	Reserved	1 for active	1bit
	Bit10	Reserved	1 for active	1bit
	Bit11	Reserved	1 for active	1bit
	Bit12	Reserved	1 for active	1bit
	Bit13	Reserved	1 for active	1bit
	Bit14	Reserved	1 for active	1bit
	Bit15	Reserved	1 for active (MSB)	1bit
0008		Reserved		2Bytes
0009		Gen UAB	Signed	2Bytes
0010		Gen UBC	Signed	2Bytes
0011		Gen UCA	Signed	2Bytes
0012		Gen UA	Signed	2Bytes
0013		Gen UB	Signed	2Bytes
0014		Gen UC	Signed	2Bytes
0015		Gen UA Phase	Signed	2Bytes
0016		Gen UB Phase	Signed	2Bytes
0017		Gen UC Phase	Signed	2Bytes
0018		Gen Frequency	Signed (*100)	2Bytes
0019		Reserved		2Bytes
0020		Reserved		2Bytes
0021		Reserved		2Bytes
0022		A Phase Current	Signed (*10) If the rated current is	2Bytes

Address	Item	Description	Byte
		more than 2000A, there is no decimal place.	
0023	B Phase Current	Signed (*10) If the rated current is more than 2000A, there is no decimal place.	2Bytes
0024	C Phase Current	Signed (*10) If the rated current is more than 2000A, there is no decimal place.	2Bytes
0025	Active Power Percentage (%)	Signed	2Bytes
0026	Reactive Power Percentage (%)	Signed	2Bytes
0027	CT Primary Ratio	Signed	2Bytes
0028	CT Secondary Ratio	Signed	2Bytes
0029	Reserved	Signed	2Bytes
0030	AC Input Method	0-3 3 Phase 4 Wire 3 Phase 3 Wire 2 Phase 3 Wire Single Phase 2 Wire	2Bytes
0031	Reserved	Unsigned	2Bytes
0032	A Phase Secondary Current (mA)	Unsigned	2Bytes
0033	B Phase Secondary Current (mA)	Unsigned	2Bytes
0034	C Phase Secondary Current (mA)	Unsigned	2Bytes
0035 0036	A Phase Active Power	Signed (*10)	4Bytes
0037 0038	B Phase Active Power	Signed (*10)	4Bytes
0039 0040	C Phase Active Power	Signed (*10)	4Bytes
0041 0042	Total Active Power	Signed (*10)	4Bytes
0043 0044	A Phase Reactive Power	Signed (*10)	4Bytes
0045 0046	B Phase Reactive Power	Signed (*10)	4Bytes
0047 0048	C Phase Reactive Power	Signed (*10)	4Bytes
0049 0050	Total Reactive Power	Signed (*10)	4Bytes
0051 0052	A Phase Apparent Power	Signed (*10)	4Bytes
0053 0054	B Phase Apparent Power	Signed (*10)	4Bytes

Address	Item	Description	Byte
0055 0056	C Phase Apparent Power	Signed (*10)	4Bytes
0057 0058	Total Apparent Power	Signed (*10)	4Bytes
0059	A Phase Power Factor	Signed (*100)	2Bytes
0060	B Phase Power Factor	Signed (*100)	2Bytes
0061	C Phase Power Factor	Signed (*100)	2Bytes
0062	Average Power Factor	Signed (*100)	2Bytes
0063	A Phase Voltage Harmonic Distortion Rate	Unit/%, 1 decimal place	2Bytes
0064	B Phase Voltage Harmonic Distortion Rate	Unit/%, 1 decimal place	2Bytes
0065	C Phase Voltage Harmonic Distortion Rate	Unit/%, 1 decimal place	2Bytes
0066	A Phase Current Harmonic Distortion Rate	Unit/%, 1 decimal place	2Bytes
0067	B Phase Current Harmonic Distortion Rate	Unit/%, 1 decimal place	2Bytes
0068	C Phase Current Harmonic Distortion Rate	Unit/%, 1 decimal place	2Bytes
0069	Total Active Power	Signed (*10)	2Bytes
0070			2Bytes
0071	Total Reactive Power	Signed (*10)	2Bytes
0072			2Bytes
0073	Controller Model	Signed	2Bytes
0074	Controller Software Version	Signed (*10)	2Bytes
0075	Controller Hardware Version	Signed (*10)	2Bytes
0076	Release Time (Year)	Only reserve last two digits	2Bytes
0077	Release Time (Month)	Signed	2Bytes
0078	Release Time (Day)	Signed	2Bytes
0079	Reserved		2Bytes
0080	Reserved		2Bytes
0081	Reserved		2Bytes
0082	Reserved		2Bytes
0083	Reserved		2Bytes
0084	Reserved		2Bytes
0085	Reserved		2Bytes
0086	Reserved		2Bytes
0087	Reserved		2Bytes
0088	Reserved		2Bytes
0089	Reserved		2Bytes
0090	Voltage A/AB Harmonic 3 times	Unit/%, 1 decimal place	2Bytes
0091	Voltage A/AB Harmonic 5 times	Unit/%, 1 decimal place	2Bytes
0092	Voltage A/AB Harmonic 7 times	Unit/%, 1 decimal place	2Bytes
0093	Voltage A/AB Harmonic 9 times	Unit/%, 1 decimal place	2Bytes
0094	Voltage A/AB Harmonic 11 times	Unit/%, 1 decimal place	2Bytes
0095	Voltage A/AB Harmonic 13 times	Unit/%, 1 decimal place	2Bytes
0096	Voltage A/AB Harmonic 15 times	Unit/%, 1 decimal place	2Bytes
0097	Voltage A/AB Harmonic 17 times	Unit/%, 1 decimal place	2Bytes

Address	Item	Description	Byte
0098	Voltage A/AB Harmonic 19 times	Unit/%, 1 decimal place	2Bytes
0099	Voltage A/AB Harmonic 21 times	Unit/%, 1 decimal place	2Bytes
0100	Voltage A/AB Harmonic 23 times	Unit/%, 1 decimal place	2Bytes
0101	Voltage A/AB Harmonic 25 times	Unit/%, 1 decimal place	2Bytes
00102	Voltage A/AB Harmonic 27 times	Unit/%, 1 decimal place	2Bytes
00103	Voltage A/AB Harmonic 29 times	Unit/%, 1 decimal place	2Bytes
00104	Voltage A/AB Harmonic 31 times	Unit/%, 1 decimal place	2Bytes
00105	Voltage B/BC Harmonic 3 times	Unit/%, 1 decimal place	2Bytes
00106	Voltage B/BC Harmonic 5 times	Unit/%, 1 decimal place	2Bytes
00107	Voltage B/BC Harmonic 7 times	Unit/%, 1 decimal place	2Bytes
00108	Voltage B/BC Harmonic 9 times	Unit/%, 1 decimal place	2Bytes
00109	Voltage B/BC Harmonic 11 times	Unit/%, 1 decimal place	2Bytes
00110	Voltage B/BC Harmonic 13 times	Unit/%, 1 decimal place	2Bytes
00111	Voltage B/BC Harmonic 15 times	Unit/%, 1 decimal place	2Bytes
00112	Voltage B/BC Harmonic 17 times	Unit/%, 1 decimal place	2Bytes
00113	Voltage B/BC Harmonic 19 times	Unit/%, 1 decimal place	2Bytes
00114	Voltage B/BC Harmonic 21 times	Unit/%, 1 decimal place	2Bytes
00115	Voltage B/BC Harmonic 23 times	Unit/%, 1 decimal place	2Bytes
00116	Voltage B/BC Harmonic 25 times	Unit/%, 1 decimal place	2Bytes
00117	Voltage B/BC Harmonic 27 times	Unit/%, 1 decimal place	2Bytes
00118	Voltage B/BC Harmonic 29 times	Unit/%, 1 decimal place	2Bytes
00119	Voltage B/BC Harmonic 31 times	Unit/%, 1 decimal place	2Bytes
00120	Voltage C/CA Harmonic 3 times	Unit/%, 1 decimal place	2Bytes
00121	Voltage C/CA Harmonic 5 times	Unit/%, 1 decimal place	2Bytes
00122	Voltage C/CA Harmonic 7 times	Unit/%, 1 decimal place	2Bytes
00123	Voltage C/CA Harmonic 9 times	Unit/%, 1 decimal place	2Bytes
00124	Voltage C/CA Harmonic 11 times	Unit/%, 1 decimal place	2Bytes
00125	Voltage C/CA Harmonic 13 times	Unit/%, 1 decimal place	2Bytes
00126	Voltage C/CA Harmonic 15 times	Unit/%, 1 decimal place	2Bytes
00127	Voltage C/CA Harmonic 17 times	Unit/%, 1 decimal place	2Bytes
00128	Voltage C/CA Harmonic 19 times	Unit/%, 1 decimal place	2Bytes
00129	Voltage C/CA Harmonic 21 times	Unit/%, 1 decimal place	2Bytes
00130	Voltage C/CA Harmonic 23 times	Unit/%, 1 decimal place	2Bytes
00131	Voltage C/CA Harmonic 25 times	Unit/%, 1 decimal place	2Bytes
00132	Voltage C/CA Harmonic 27 times	Unit/%, 1 decimal place	2Bytes
00133	Voltage C/CA Harmonic 29 times	Unit/%, 1 decimal place	2Bytes
00134	Voltage C/CA Harmonic 31 times	Unit/%, 1 decimal place	2Bytes
00135	Current A/AB Harmonic 3 times	Unit/%, 1 decimal place	2Bytes
00136	Current A/AB Harmonic 5 times	Unit/%, 1 decimal place	2Bytes
00137	Current A/AB Harmonic 7 times	Unit/%, 1 decimal place	2Bytes
00138	Current A/AB Harmonic 9 times	Unit/%, 1 decimal place	2Bytes
00139	Current A/AB Harmonic 11 times	Unit/%, 1 decimal place	2Bytes
00140	Current A/AB Harmonic 13 times	Unit/%, 1 decimal place	2Bytes

Address	Item	Description	Byte
00141	Current A/AB Harmonic 15 times	Unit/%, 1 decimal place	2Bytes
00142	Current A/AB Harmonic 17 times	Unit/%, 1 decimal place	2Bytes
00143	Current A/AB Harmonic 19 times	Unit/%, 1 decimal place	2Bytes
00144	Current A/AB Harmonic 21 times	Unit/%, 1 decimal place	2Bytes
00145	Current A/AB Harmonic 23 times	Unit/%, 1 decimal place	2Bytes
00146	Current A/AB Harmonic 25 times	Unit/%, 1 decimal place	2Bytes
00147	Current A/AB Harmonic 27 times	Unit/%, 1 decimal place	2Bytes
00148	Current A/AB Harmonic 29 times	Unit/%, 1 decimal place	2Bytes
00149	Current A/AB Harmonic 31 times	Unit/%, 1 decimal place	2Bytes
00150	Current B/BC Harmonic 3 times	Unit/%, 1 decimal place	2Bytes
00151	Current B/BC Harmonic 5 times	Unit/%, 1 decimal place	2Bytes
00152	Current B/BC Harmonic 7 times	Unit/%, 1 decimal place	2Bytes
00153	Current e B/BC Harmonic 9 times	Unit/%, 1 decimal place	2Bytes
00154	Current B/BC Harmonic 11 times	Unit/%, 1 decimal place	2Bytes
00155	Current B/BC Harmonic 13 times	Unit/%, 1 decimal place	2Bytes
00156	Current B/BC Harmonic 15 times	Unit/%, 1 decimal place	2Bytes
00157	Current B/BC Harmonic 17 times	Unit/%, 1 decimal place	2Bytes
00158	Current B/BC Harmonic 19 times	Unit/%, 1 decimal place	2Bytes
00159	Current B/BC Harmonic 21 times	Unit/%, 1 decimal place	2Bytes
00160	Current B/BC Harmonic 23 times	Unit/%, 1 decimal place	2Bytes
00161	Current B/BC Harmonic 25 times	Unit/%, 1 decimal place	2Bytes
00162	Current B/BC Harmonic 27 times	Unit/%, 1 decimal place	2Bytes
00163	Current B/BC Harmonic 29 times	Unit/%, 1 decimal place	2Bytes
00164	Current B/BC Harmonic 31 times	Unit/%, 1 decimal place	2Bytes
00165	Current C/CA Harmonic 3 times	Unit/%, 1 decimal place	2Bytes
00166	Current C/CA Harmonic 5 times	Unit/%, 1 decimal place	2Bytes
00167	Current C/CA Harmonic 7 times	Unit/%, 1 decimal place	2Bytes
00168	Current C/CA Harmonic 9 times	Unit/%, 1 decimal place	2Bytes
00169	Current C/CA Harmonic 11 times	Unit/%, 1 decimal place	2Bytes
00170	Current C/CA Harmonic 13 times	Unit/%, 1 decimal place	2Bytes
00171	Current C/CA Harmonic 15 times	Unit/%, 1 decimal place	2Bytes
00172	Current C/CA Harmonic 17 times	Unit/%, 1 decimal place	2Bytes
00173	Current C/CA Harmonic 19 times	Unit/%, 1 decimal place	2Bytes
00174	Current C/CA Harmonic 21 times	Unit/%, 1 decimal place	2Bytes
00175	Current e C/CA Harmonic 23 times	Unit/%, 1 decimal place	2Bytes
00176	Current C/CA Harmonic 25 times	Unit/%, 1 decimal place	2Bytes
00177	Current C/CA Harmonic 27 times	Unit/%, 1 decimal place	2Bytes
00178	Current C/CA Harmonic 29 times	Unit/%, 1 decimal place	2Bytes
00179	Current C/CA Harmonic 31 times	Unit/%, 1 decimal place	2Bytes
01001	Rated Voltage	Unsigned, Unit/V, no decimal place	2Bytes
01100	Rated Frequency	Unsigned, Unit/Hz, one decimal place	2Bytes

Address	Item	Description	Byte
01201	Rated Current	Unsigned, Unit/A, no decimal place	2Bytes
01202	Rated Active Power	Unsigned, Unit/kW, no decimal place	2Bytes
01203	Rated Reactive Power	Unsigned, Unit/kVar, no decimal place	2Bytes

6.2 FUNCTION CODE 05H MAPPING DATA FIELD

Table 22 Function Code 05H Mapping Data Field

Address	Item	Description
0000	Alarm Reset	1 for active
0001	Total Data Reset	1 for active
0002	Reserved	1 for active
0003	Reserved	1 for active
0004	Reserved	1 for active
0005	Reserved	1 for active

6.3 FUNCTION CODE 06H MAPPING DATA FIELD

Table 23 Function Code 06H Mapping Data Field

Address	Item	Description	Bytes
01001	Rated Voltage	Unsigned, Unit/V, no decimal place	2Bytes
01100	Rated Frequency	Unsigned, Unit/Hz, one decimal place	2Bytes
01201	Rated Current	Unsigned, Unit/A, no decimal place	2Bytes
01202	Rated Active Power	Unsigned, Unit/kW, no decimal place	2Bytes
01203	Rated Reactive Power	Unsigned, Unit/kVar, no decimal place	2Bytes

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