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AHF-PRO
SVG-PRO

Activer Harmonics Filter
Static Var Generator

MODBUS 2 Communication Protocol V102

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1. Outline

1.1 Protocol Overview

MODBUS is an application layer protocol and widely used in industrial control. It is the de facto industry standard. This protocol describes the MODBUS communication protocol. Communication uses response mode, the host sends request, then the slave to execute request and response.

About the MODBUS communication protocol standards are not described in this article, please refer to MODBUS communication protocol standards for details.

1.2 ApplicationScope

This protocol applies to AHF/SVG series product, for DSP (digital signal processor) module data exchange with monitor and for monitor data exchange with background software.

1.3 ReferenceStandard

MODBUS RTU communication protocol standards

1.4 Based level communication protocol

Asynchronous serial protocol UART

1.5 Physical interface

· Two-wire RS485 interface
· Ethernet Port

1.6 Data transfer rate

Optional between 9600/ 19200/ 38400 bps, default is 19200 bps.

1.7 Character format

The transfer mode is asynchronous mode; half duplex mode; start bit contains 1 bit; data bit contains 8 bits; stop bit contains 1 bit; no check.

2. Datatype

2.1 Integer

Integer storage format is 2 bytes. When transmitting, high bytes D15~D8 go first, and then low bytes D7~D0.

2.2 Float

Floating-point storage format is four bytes, using IEEE32 bit standard Floating-point format (Standard C language format). First transmit high bytes D31~D24, second D23~D16, third D15~D8, last transmit low bytes D7~D0.

3. Communication

Communication applies Master-Slave mode, monitor as the host and DSP module as the slave; or backstage software as the host, monitor as the slave.

After the host sends the request, it will wait for the slave to reply within 100ms. If there is no reply after the timeout or an error response is received, the communication process will be considered as failure.

4. Application layer packet/Frame format definition

4.1 Data Verification

The cyclic redundancy check (CRC) is a procedure for determining a check value for data in order to be able to detect errors during transmission or storage. Ideally, the procedure can even independently correct the received data to avoid retransmission. The CRC uses 16 bits (2 bytes) here. The CRC content is appended to the end of the message, first in low bytes and then in high bytes. For the specific CRC check, please refer to the „7. Appendix II: CRC calculation function“ on page 24.

4.2 Function Code Supported by device

Function Code	Function Description
02	Read status information and alarming information of the device
03, 04	Read analog data, waveform, histogram, and information of manufacturer
16	Set parameter into device

4.2.1 Function Code 02

Request Frame:

Format	Address	Function Code	Status Bit Start Address		Status Quantity		Check
			High	Low	High	Low	
Byte	1	1	1	1	1	1	2

The address range of the device is 0 ~ 247, and the default address is 1. 0xFF is the broadcast address.

Response Frame:

Format	Address	Function Code	Byte Quantity	Data	Check
Byte	1	1	1	……	2

For example, to get all 61 status and alarm analog data:
TX: 01 02 00 00 00 3D B9 DB
RX:01 02 08 00 00 00 00 00 00 00 C4 12

4.2.2 Function Code 03, 04

Request Frame:

Format	Address	Function Code	Register Start Address		Register Quantity		Check
			High	Low	High	Low	
Byte	1	1	1	1	1	1	2

Response Frame:

Format	Address	Function Code	Byte Quantity	Data	Check
Byte	1	1	1	……	2

Byte Quantity = Register Quantity * 2

For example, to get the first frame data (50 analog data):
Tx: 01 04 00 00 00 64 F1 E1
Rx: 01 04 C8 xx xxxx… CRCL CRCH

xx means the feedback data. CRCL: check code (low bytes). CRCH: check code (high bytes)

4.2.3 Function Code 16

Request Frame:

Format	Address	Function Code	Register Start Address		Register Quantity		Data Bytes	Data	Check
			High	Low	High	Low			
Byte	1	1	1	1	1	1	1	……	2

Response Frame:

Format	Address	Function Code	Register Start Address		Register Quantity		Check
			High	Low	High	Low	
Byte	1	1	1	1	1	1	2

For example:

1. To set the operation mode as “Constant Q”
   Tx:01 10 20 1c00 02 04 41 40 00 00 7E DF
   Rx:01 10 20 1c 00 02 8BCE
2. Set the Constant reactive as 300 (300 kvar inductive power output)
   Tx:01 10 20 54 00 02 04 43 96 00 00 9B 09
   Rx:01 10 20 54 00 02 0B D8

4.2.4 Error Code

Request Frame:

Format	Address	Function Code	Fault Code	Check
Byte	1	1	1	2

Error Code= Function Code + 0x80
Fault Code

- 01 Function Code Error
- 02 Address Error
- 03 Data Error
- 04 Device Failure
- 05 Confirm
- 06 Busy

5. Request/Response Information Details

5.1 Acquire status information and alarming information of the device

Function Code = 02
Status Start Address = 0x0000

Status Address	Byte	Description	Remark	Data Attribute
0x0000	1	Initialize flag	0: no Initialization, 1: Initialization	
0x0001	1	Running status	0: Standby 1: Run	
0x0002	1	Reserved		
0x0003	1	Reserved		
0x0004	1	Reserved		
0x0005	1	Reserved		
0x0006	1	Reserved		
0x0007	1	Reserved		
0x0008	1	Reserved		
0x0009	1	Reserved		
0x000A	1	Reserved		
0x000B	1	Reserved		
0x000C	1	Reserved		
0x000D	1	Reserved		
0x000E	1	Reserved		
0x000F	1	Reserved		
0x0010	1	Dry contact output 1	0: Lowlevel 1: Highlevel	
0x0011	1	Dry contact output 2	0: Lowlevel 1: Highlevel	
0x0012	1	Dry contact output 3	0: Lowlevel 1: Highlevel	
0x0013	1	Dry contact output 4	0: Lowlevel 1: Highlevel	
0x0014	1	Dry contact output 5	0: Lowlevel 1: Highlevel	
0x0015	1	Dry contact output 6	0: Lowlevel 1: Highlevel	
0x0016	1	Dry contact output 7	0: Lowlevel 1: Highlevel	
0x0017	1	Dry contact output 8	0: Lowlevel 1: Highlevel	
0x0018	1	Lightning arrester failure	0: Normal 1: Abnormal	
0x0019	1	Reserved		
0x001A	1	Reserved		

Status Address	Byte	Description	Remark	Data Attribute
0x001B	1	Reserved		
0x001C	1	Reserved		
0x001D	1	Reserved		
0x001E	1	Reserved		
0x001F	1	Reserved		
0x0020	1	Reserved		
0x0021	1	Reserved		
0x0022	1	Reserved		
0x0023	1	Reserved		
0x0024	1	Reserved		
0x0025	1	Reserved		
0x0026	1	Reserved		
0x0027	1	Reserved		
0x0028	1	Inverter short-circuit failure	0: Normal 1: Abnormal	
0x0029	1	Output current abnormal	0: Normal 1: Abnormal	
0x002A	1	Auxiliary power failure	0: Normal 1: Abnormal	
0x002B	1	Fuse failure	0: Normal 1: Abnormal	
0x002C	1	Fan failure	0: Normal 1: Abnormal	
0x002D	1	Inverter over-temperature	0: Normal 1: Abnormal	
0x002E	1	CT ratio setting failure	0: Normal 1: Abnormal	
0x002F	1	Inverter overload failure	0: Normal 1: Abnormal	
0x0030	1	System failure	0: Normal 1: Abnormal	
0x0031	1	Input frequency abnormal	0: Normal 1: Abnormal	
0x0032	1	Input voltage abnormal	0: Normal 1: Abnormal	
0x0033	1	Input phase reverse	0: Normal 1: Abnormal	
0x0034	1	Control software compatibility failure	0: Normal 1: Abnormal	
0x0035	1	Controller parameter setting failure	0: Normal 1: Abnormal	
0x0036	1	Monitoring parameter setting failure	0: Normal 1: Abnormal	
0x0037	1	Capacity reading failure	0: Normal 1: Abnormal	

Status Address	Byte	Description	Remark	Data Attribute
0x0038	1	Emergency stop	0: Normal 1: Abnormal	
0x0039	1	Busbar differential abnormal	0: Normal 1: Abnormal	
0x003A	1	CT current zero point calibration failure	0: Normal 1: Abnormal	
0x003B	1	Module communication failure	0: Normal 1: Abnormal	
0x003C	1	Module software compatibility failure	0: Normal 1: Abnormal	
0x003D	1	Capacitor over-current	0: Normal 1: Abnormal	
0x003E	1	Soft-starter failure	0: normal,1: abnormal	
0x003F	1	Sync signal failure	0: Normal 1: Abnormal	
0x0040	1	Grid voltage sampling failure	0: Normal 1: Abnormal	
0x0041	1	Hall censor failure	0: Normal 1: Abnormal	
0x0042	1	Busbar sampling failure	0: normal,1: abnormal	
0x0043	1	Air switch abnormal disconnect	0: Normal 1: Abnormal	
0x0044	1	Electric operating mechanism failed to connect	0: Normal 1: Abnormal	
0x0045	1	Electric operating mechanism failed to disconnect	0: Normal 1: Abnormal	
0x0046	1	Output current unbalance	0: Normal 1: Abnormal	
0x0047	1	Harmonics exceed limits	0: Normal 1: Abnormal	
0x0048	1	Over-temperature under low load rate	0: Normal 1: Abnormal	

5.2 Acquire analog data

Function Code = 03, 04
Register Start Address= 0x0000

Register Address	Byte	Description	Unit	Data Attribute
0x0000	4	L1 Load Current	A	
0x0002	4	L2 Load Current	A	
0x0004	4	L3 Load Current	A	
0x0006	4	L1 Load THDI	%	
0x0008	4	L2 Load THDI	%	
0x000A	4	L3 Load THDI	%	
0x000C	4	L1 Load Power Factor		
0x000E	4	L2 Load Power Factor		
0x0010	4	L3 Load Power Factor		
0x0012	4	L1 Inductor Current	A	
0x0014	4	L2 Inductor Current	A	
0x0016	4	L3 Inductor Current	A	
0x0018	4	L1 Grid Apparent Power	kVA	
0x001A	4	L2 Grid Apparent Power	kVA	
0x001C	4	L3 Grid Apparent Power	kVA	
0x001E	4	L1 Active Power	kW	
0x0020	4	L2 Active Power	kW	
0x0022	4	L3 Active Power	kW	
0x0024	4	N Line Grid Current	A	
0x0026	4	N Line Load Current	A	
0x0028	4	L1 Grid Current	A	
0x002A	4	L2 Grid Current	A	
0x002C	4	L3 Grid Current	A	
0x002E	4	L1 Grid THDI	%	
0x0030	4	L2 Grid THDI	%	
0x0032	4	L3 Grid THDI	%	
0x0034	4	L1 Grid Power Factor		
0x0036	4	L2 Grid Power Factor		
0x0038	4	L3 Grid Power Factor		
0x003A	4	Temperature 1	°C	
0x003C	4	Temperature 2	°C	
0x003E	4	Temperature 3	°C	

Register Address	Byte	Description	Unit	Data Attribute
0x0040	4	L1 Grid Reactive Power	kVar	
0x0042	4	L2 Grid Reactive Power	kVar	
0x0044	4	L3 Grid Reactive Power	kVar	
0x0046	4	L1 Grid COSPHI		
0x0048	4	L2 Grid COSPHI		
0x004A	4	L3 Grid COSPHI		
0x004C	4	L1 Load Reactive Power	kVar	
0x004E	4	L2 Load Reactive Power	kVar	
0x0050	4	L3 Load Reactive Power	kVar	
0x0052	4	L1 Comp Current	A	
0x0054	4	L2 Comp Current	A	
0x0056	4	L3 Comp Current	A	
0x0058	4	L1 Comp Current Load Rate	%	
0x005A	4	L2 Comp Current Load Rate	%	
0x005C	4	L3 Comp Current Load Rate	%	
0x005E	4	Temperature 4	°C	
0x0060	4	Temperature 5	°C	
0x0062	4	Temperature 6	°C	
0x0064	4	L1 Load Apparent Power	kVA	
0x0066	4	L2 Load Apparent Power	kVA	
0x0068	4	L3 Load Apparent Power	kVA	
0x006A	4	L1 Load Active Power	kW	
0x006C	4	L2 Load Active Power	kW	
0x006E	4	L3 Load Active Power	kW	
0x0070	4	L1 Load COSPHI		
0x0072	4	L2 Load COSPHI		
0x0074	4	L3 Load COSPHI		
0x0076	4	L1 Grid Voltage	V	
0x0078	4	L2 Grid Voltage	V	
0x007A	4	L3 Grid Voltage	V	
0x007C	4	L1 Grid Frequency	Hz	
0x007E	4	L2 Grid Frequency	Hz	
0x0080	4	L3 Grid Frequency	Hz	
0x0082	4	L1 Grid THDU	%	

Register Address	Byte	Description	Unit	Data Attribute
0x0084	4	L2 Grid THDU	%	
0x0086	4	L3 Grid THDU	%	
0x0088	4	Config Variable 1		
0x008A	4	Config Variable 2		
0x008C	4	Config Variable 3		
0x008E	4	Config Variable 4		
0x0090	4	Config Variable 5		
0x0092	4	Config Variable 6		
0x0094	4	Operation Time	Sec	
0x0096	4	Over 50% Load Operation Time	Sec	
0x0098	4	Below 50% Load Operation Time	Sec	
0x009A	4	Positive DC Bus Voltage	V	
0x009C	4	Negative DC Bus Voltage	V	
0x009E	4	Inductor Temperature	°C	
0x00A0	4	Capacitance Current	0.01A	

5.3 Acquire Waveform

Function Code = 03, 04
Register Start Address = 0x0500

A complete waveform consists of 128 points. A byte represents the value of a point. 128 points are needed to draw a complete waveform. Data is transferred from low to high, where the first byte represents the first point, and so on.

Register Address	Byte	Description	Remark	Data Attribute
0x0500	128	L1 Voltage Waveform		
0x0540	128	L2 Voltage Waveform		
0x0580	128	L3 Voltage Waveform		
0x05C0	128	L1 Load Current Waveform		
0x0600	128	L2 Load Current Waveform		
0x0640	128	L3 Load Current Waveform		
0x0680	128	L1 Comp Current Waveform		
0x06C0	128	L2 Comp Current Waveform		
0x0700	128	L3 Comp Current Waveform		
0x0740	128	L1 Grid Current Waveform		
0x0780	128	L2 Grid Current Waveform		
0x07C0	128	L3 Grid Current Waveform		

5.4 Acquire Histogram

Function Code = 03, 04
Register Start Address = 0x0B00

A complete histogram consists of 50 points, one byte representing the value of one point, and only needs to be transmitted once. Data is transferred from low to high, where the first byte represents the first point, and so on.

Register Address	Byte	Description	Remark	Data Attribute
0x0B00	80	L1 THDU Histogram		
0x0B28	80	L2 THDU Histogram		
0x0B50	80	L3 THDU Histogram		
0x0B78	80	L1 Load THDI Histogram		
0x0BA0	80	L2 Load THDI Histogram		
0x0BC8	80	L3 Load THDI Histogram		
0x0BF0	80	L1 Grid THDI Histogram		
0x0C18	80	L2 Grid THDI Histogram		
0x0C40	80	L3 Grid THDI Histogram		

5.5 Acquire Information of Manufacturer

Function Code = 03, 04
Register Start Address = 0x1000

Register Address	Byte	Description	Remark
0x1000	2	Protocol Version	In decimal form E.g. 100 means V100 protocol.
0x1001	2	Software Version	In decimal form upper 12 bits represent main version lower 4 bits represent branch version. E.g. 0x0641means that main version is 100 and branch version is 01
0x1002	2	Device Address	1 ~ 247
0x1003	2	Reserved	

5.6 Read Information of Monitor Manufacturer

Function Code 03, 04
Register Start Address = 0x1200

Register Address	Byte	Name	Remark
0x1200	2	Protocol Version	In decimal form E.g. 100 means V100 protocol.
0x1201	2	Software Version	In decimal form upper 12bits represent main version lower 4 bits represent branch version. E.g. 0x0641means that main version is 100 and branch version is 01
0x1202	2	Device Address	1 ~ 247
0x1203	2	Reserved	In decimal form 0: APF; 1: SVG; 2: ASVG; 3: SVG600
0x1204	2	Dry contact input	From low to high, every bit respectively represents dry contact input 1, dry contact input 2 and so on. 1: High level 0: Low level
0x1205	2	Dry contact output	From low to high, every bit respectively represents dry contact output 1, dry contact output 2 and so on. 1: High level 0: Low level

5.7 Acquire Parameters of Device (General Settings)

Function Code = 03, 04
Register Start Address = 0x2000

Register Address	Byte	Description	Remark
Initialization			
0x2000	4	Number of Slave	[1-10] Default: 1
0x2002	4	CT ratio	[0, 30000] Default: 300 (Module rebooting after setting)
0x2004	4	External transformer ratio	[0, 1.75] Default: 1.0 (Module rebooting after setting)
0x2006	4	Parallel Machine Capacity	[10, 30000] Default: 25 (Module rebooting after setting)
0x2008	4	Reserved	
0x200A	4	Reserved	
0x200C	4	Harmonic Compensation Rate	[0.01, 1] Default: 1
0x200E	4	Target Power Factor	[-1, 1] Default: 1
0x2010	4	Reserved	
0x2012	4	Reserved	
0x2014	4	Reserved	
0x2016	4	Reserved	
0x2018	4	Reserved	
0x201A	4	Reserved	

Register Address	Byte	Description	Remark
Initialization			
0x201C	4	Working Mode	Default: 0 (Harmonic Compensation) For details, please refer to Appendix II.
0x201E	4	Power On Mode	0: Auto 1:Manual Default:1
0x2020	4	Compensation Mode	0:Intelligent 1:Sequential 2: All Default: 1 (Module rebooting after setting)
0x2022	4	CT location	0: Grid 1: Load Default: 1 (Module rebooting after setting)
0x2024	4	Network Wiring Configu-ration	0:3P4W 1:3P3W Default: 0 (Module rebooting after setting)
0x2026	4	Reserved	
0x2028	4	CT Secondary Wiring	0: Series 1:Parallel Default:0 (Module rebooting after setting)
0x202A	4	Reserved	
0x202C	4	Inductance Current Calibration Process	0: Capacitive Current Calibration 1: Inductive Current Calibration Default: 0 (Module rebooting after setting)
0x202E	4	Input Frequency Level	0:50Hz 1:60Hz Default: 50Hz
0x2030	4	PPL Enable	1: Disable 0:Enable Default:1
0x2032	4	Input Current Abnormal Enable	1: Disable 0:Enable Default:1
0x2034	4	Reserved	
0x2036	4	Temperature Derating Enable	1: Disable 0:Enable Default:1
0x2038	4	Capacitive Reactive Power Compensation Enable	1: Disable 0:Enable Default:1
0x203A	4	Reserved	
0x203C	4	Reserved	
0x203E	4	Grid Voltage Adjustment Enable	1: Disable 0:Enable Default:1
0x2040	4	Reserved	
0x2042	4	Reserved	
0x2044	4	Reserved	
0x2046	4	Target voltage	[100, 700] Default: 230
0x2048	4	Reserved	
0x204A	4	Reserved	

Register Address	Byte	Description	Remark
Initialization			
0x204C	4	Reserved	
0x204E	4	Reserved	
0x2050	4	Reserved	
0x2052	4	Reserved	
0x2054	4	Constant reactive	[-3000.0, 3000.0] Default: 1 Accuracy: 0.1
0x2056	4	Voltage Upper Limit (%)	[0, 20%] Default: 7%
0x2058	4	Voltage Lower Limit (%)	[-20%,0] Default: 10%
0x205A	4	Reserved	
0x205C	4	THDu Limit (%)	[0, 50] Default: 0
0x205E	4	Unbalance Limit	[0, 1] Default: 0
0x2060	4	Reactive Power Tracking Control Value	[-3000.0, 3000.0] Default: 0 Keep one decimal place
0x2062	4	Reserved	
0x2064	4	Reserved	
0x2066	4	Reserved	
0x2068	4	Reserved	
0x206A	4	Low Load Energy-saving Shutdown Mode	[0.0, 100.0] (0 means disable) Default: 0 Keep one decimal place.
0x206C	4	Reserved	
0x206E	4	Reserved	

5.8 Acquire Parameters of Device (Parameter of Phase Angle Offset)

Function Code = 03, 04
Register start address = 0x2500

Register Address	Byte	Name	Remark
Initialization			
0x2500	4	Fundamental phase angle offset	[-40, 40] Accuracy: 0.1 Default: 0
0x2502	4	3rd Harmonic phase angle offset	[-180, 180] Accuracy: 0.1 Default: 0
0x2504	4	5th Harmonic phase angle offset	[-180, 180] Accuracy: 0.1 Default: 0
0x2506	4	7th Harmonic phase angle offset	[-180, 180] Accuracy: 0.1 Default: 0
0x2508	4	9th Harmonic phase angle offset	[-180, 180] Accuracy: 0.1 Default: 0
0x250A	4	11th Harmonic phase angle offset	[-180, 180] Accuracy: 0.1 Default: 0
0x250C	4	13th Harmonic phase angle offset	[-180, 180] Accuracy: 0.1 Default: 0

5.9 Acquire Parameters of Device (Harmonic Compensation Parameters)

Function Code = 03, 04
Register start address = 0x2A00

Register Address	Byte	Name	Remark
Initialization			
0x2A00	4	2nd Harmonic compensation degree	[0, 110] Default: 0
0x2A02	4	3rd Harmonic compensation degree	[0, 110] Default: 0
0x2A04	4	4th Harmonic compensation degree	[0, 110] Default: 0
0x2A06	4	5th Harmonic compensation degree	[0, 110] Default: 0
0x2A08	4	6th Harmonic compensation degree	[0, 110] Default: 0
0x2A0A	4	7th Harmonic compensation degree	[0, 110] Default: 0
0x2A0C	4	8th Harmonic compensation degree	[0, 110] Default: 0
0x2A0E	4	9th Harmonic compensation degree	[0, 110] Default: 0
0x2A10	4	10th Harmonic compensation degree	[0, 110] Default: 0
0x2A12	4	11th Harmonic compensation degree	[0, 110] Default: 0
0x2A14	4	12th Harmonic compensation degree	[0, 110] Default: 0

Register Address	Byte	Name	Remark
Initialization			
0x2A16	4	13th Harmonic compensation degree	[0, 110] Default: 0
0x2A18	4	14th Harmonic compensation degree	[0, 110] Default: 0
0x2A1A	4	15th Harmonic compensation degree	[0, 110] Default: 0
0x2A1C	4	16th Harmonic compensation degree	[0, 110] Default: 0
0x2A1E	4	17tth Harmonic compensation degree	[0, 110] Default: 0
0x2A20	4	18th Harmonic compensation degree	[0, 110] Default: 0
0x2A22	4	19th Harmonic compensation degree	[0, 110] Default: 0
0x2A24	4	20th Harmonic compensation degree	[0, 110] Default: 0
0x2A26	4	21st Harmonic compensation degree	[0, 110] Default: 0
0x2A28	4	22nd Harmonic compensation degree	[0, 110] Default: 0
0x2A2A	4	23rd Harmonic compensation degree	[0, 110] Default: 0
0x2A2C	4	24th Harmonic compensation degree	[0, 110] Default: 0
0x2A2E	4	25th Harmonic compensation degree	[0, 110] Default: 0
0x2A30	4	26th Harmonic compensation degree	[0, 110] Default: 0
0x2A32	4	27th Harmonic compensation degree	[0, 110] Default: 0
0x2A34	4	28th Harmonic compensation degree	[0, 110] Default: 0
0x2A36	4	29th Harmonic compensation degree	[0, 110] Default: 0
0x2A38	4	30th Harmonic compensation degree	[0, 110] Default: 0
0x2A3A	4	31st Harmonic compensation degree	[0, 110] Default: 0
0x2A3C	4	32nd Harmonic compensation degree	[0, 110] Default: 0
0x2A3E	4	33rd Harmonic compensation degree	[0, 110] Default: 0
0x2A40	4	34th Harmonic compensation degree	[0, 110] Default: 0
0x2A42	4	35th Harmonic compensation degree	[0, 110] Default: 0
0x2A44	4	36th Harmonic compensation de-gree	[0, 110] Default: 0
0x2A46	4	37th Harmonic compensation degree	[0, 110] Default: 0

Register Address	Byte	Name	Remark
Initialization			
0x2A48	4	38th Harmonic compensation degree	[0, 110] Default: 0
0x2A4A	4	39th Harmonic compensation degree	[0, 110] Default: 0
0x2A4C	4	40th Harmonic compensation degree	[0, 110] Default: 0
0x2A4E	4	41st Harmonic compensation degree	[0, 110] Default: 0
0x2A50	4	42nd Harmonic compensation degree	[0, 110] Default: 0
0x2A52	4	43rd Harmonic compensation degree	[0, 110] Default: 0
0x2A54	4	44th Harmonic compensation degree	[0, 110] Default: 0
0x2A56	4	45th Harmonic compensation degree	[0, 110] Default: 0
0x2A58	4	46th Harmonic compensation degree	[0, 110] Default: 0
0x2A5A	4	47th Harmonic compensation degree	[0, 110] Default: 0
0x2A5C	4	48th Harmonic compensation degree	[0, 110] Default: 0
0x2A5E	4	49th Harmonic compensation degree	[0, 110] Default: 0
0x2A60	4	50th Harmonic compensation degree	[0, 110] Default: 0
0x2A62	4	Reserved	
0x2A64	4	Reserved	
0x2A66	4	Reserved	
0x2A68	4	Reserved	
0x2A6A	4	Reserved	
0x2A6C	4	Reserved	
0x2A6E	4	Reserved	
0x2A70	4	Reserved	
0x2A72	4	Reserved	
0x2A74	4	Reserved	
0x2A76	4	Reserved	

5.10 Acquire Parameters of Device (No Initialization)

Function Code = 03, 04
Register start address = 0x2C00
End address = 0x30ff

Register Address	Byte	Name	Remark
No Initialization			
0x2C00	4	L1 Input Voltage Calibration	Greater than 0
0x2C02	4	L2 Input Voltage Calibration	Greater than 0
0x2C04	4	L3 Input Voltage Calibration	Greater than 0
0x2C06	4	Reserved	Greater than 0
0x2C08	4	L1 Inductance Current Calibra-tion	Greater than 0
0x2C0A	4	L2 Inductance Current Calibra-tion	Greater than 0
0x2C0C	4	L3 Inductance Current Calibra-tion	Greater than 0
0x2C0E	4	L1 CT Current Calibration	Greater than 0
0x2C10	4	L2 CT Current Calibration	Greater than 0
0x2C12	4	L3 CT Current Calibration	Greater than 0
0x2C14	4	L1 Inverter Current Calibration	Greater than 0
0x2C16	4	L2 Inverter Current Calibration	Greater than 0
0x2C18	4	L3 Inverter Current Calibration	Greater than 0
0x2C1A	4	Clear Fault	Pass 1
0x2C1C	4	CT Zero Point Calibration Enable	Pass 1 (Module rebooting after setting)
0x2C1E	4	Power On	Pass 1
0x2C20	4	Power Off	Pass 1
0x2c22	4	Reserved	
0x2c24	4	Reserved	
0x2c26	4	Reserved	

5.11 Setting Parameters of Device

The parameter setting value is a floating point number. It is represented by 4 bytes. Therefore, the function code 16 is used to set a single parameter and a plurality of parameters, including general parameters, phase angle offset parameters, harmonic compensation parameters, and no initialization parameters.

5.12 Acquire Fault Record

Function Code: 03, 04
Register start address = 0xf000

6. Appendix I: Working Mode

Difference devices have different working modes.
H: Harmonic compensation; Q: Reactive power compensation; B: Load balancing

Device	Working Mode
AHF	0: H; 1: H+Q; 2: H+Q+B; 3: Auto-aging; 4: H+B+Q; 5: H+B; 6: Q+H;7: Q+H+B; 8: Q+B+H; 9: B+H; 10: B+H+Q; 11: B+Q+H
SVG	1: Q; 2: Q+B; 3: Auto- Aging; 4: B+Q; 5: B; 12: Constant Q

7. Appendix II: CRC calculation function

Pass parameter:
buffer: Array pointer
Length: Data length

Return Value:

16 bit CRC

```
unsigned short calculateCRC16(const unsigned char * buffer, int length)
{
        unsigned short   InitCrc = 0xffff;
        unsigned short Crc = 0;
        inti = 0;
        int j = 0;
      if ((buffer == 0) || (length <= 0))
        {
                return 0;
        }

      for(i=0; i<length; i++)
      {
      InitCrc ^=  buffer[i];
                for(j=0; j<8; j++)
                {
      Crc = InitCrc;
      InitCrc>>= 1;
                if(Crc&0x0001)
      InitCrc ^= 0xa001;
                }
        }

   return InitCrc;
}
```

8. Appendix III: DSP module communication and explanation

- For analog data, no more than 50 data per frame when transmitting. If there are less than 50 data in the last frame, it can be taken according to the actual remaining quantity.
- Parameter setting supports single parameter setting and multiple parameters settings. For multiple parameters settings, starting address must be fixed, up to 60 data per frame, according to classification general parameters, phase angle offset parameters, harmonic compensation parameters, no initialization parameters. If there are less than 60 data in the last frame, it can be set according to the actual remaining amount.
- Histogram data of all three phases are read at once.
- The baud rate of module communication is fixed at 19200 bps.