

July

| 14

Modbus Communication Protocol

Date	11.06.2014
Last changes	03.07.2014



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1 Detailed data definition

1.1 Data classification

Data type	abbreviation	Data	Attribute (Read or write)
Holding registers	HR	Meter parameter; Tariff rate parameters; Demand parameters; Load profile parameters; Display parameters; Event log.	Read Write
File record	FR	Load profile	Read

1.2 Energy and Demand

1.2.1 Code (binary)

AA XX XXXX XXXX XXXX	AA = Data type
00	00 = parameter or event log (Detailed definition reference 1.3)
01	01 = energy
10	10 = max demand
11	11 = The occurred Time of max demand
AA BB BBB X XXXX XXXX	BB BBB = History data
00 000	00 000 = Current data
00 001	00 001 = Prev1 data
00 010	00 010 = Prev2 data

10 100	10 100 = Prev20 data
AABB BBB C XXXX XXXX	C = Direction
0	0 = forward
1	1 = reverse
AABB BBB C D XXX XXXX	D = active or reactive
0	0 = active
1	1 = reactive(this meter do not have)
AABB BBB C DEE X XXXX	EE = Relevant Phase
00	00 = Total
01	01 = Phase L1
10	10 = Phase L2
11	11 = Phase L3
AABB BBB C DEE F FFF X	F FFF = Tariff rate (split-phase do not have tariff rate X)
0 000	0 000 = tariff rate all
0 001	0 001 = tariff rate 1
0 010	0 010 = tariff rate 2

1 000	1 000 = tariff rate 8



AABB BBBC DEEF FFF**G**

G = MODBUS specified in each register is 2 bytes, this section defines the data is 4 bytes, so G always equal to zero

0 = high word
1 = low word

1.2.2 E.g. for Energy data

Name	Binary Address	Hexadecimal Address	Data Format (4 bytes, 3 decimal places, the unit : kWh)		
The current total tariff rate import active energy	0100 0000 0000 0000	0x4000	0x0011	0x00112233 =1122867	1122.867kWh
	0100 0000 0000 0001	0x4001	0x2233		

1.2.3 E.g. for Demand data

Name	Binary Address	Hexadecimal Address	Data Format (4 bytes, 4 decimal places, the unit : kWh)		
The current tariff rate 1 export active demand	1000 0001 0000 0010	0x8102	0x0011	0x00112233 =1122867	112.2867kW
	1000 0001 0000 0011	0x8103	0x2233		

1.2.4 E.g. for Demand data occurred time

Name	Binary Address	Hexadecimal Address	Data Format (4 bytes of second index)		
Prev1 tariff rate 5 import active demand occurred time	1100 0010 0000 1010	0xC20A	0x0011	0x00112233 =1122867	1122867sec
	1100 0010 0000 1011	0xC20B	0x2233		

1.2.5 Log of demand stored and demand reset

Code (binary)

0010 000X XXXX XXXX demand stored and reset

When the demand of archived and reset, Meter will record the relevant time, record 20 times

- record archived and reset time second index

Name	Hexadecimal	Data Format(4 bytes)
------	-------------	----------------------



	Address			
Prev1 data	0x2000	0x0011	0x00112233	1122867sec
	0x2001	0x2233	= 1122867	
Prev2 data	0x2002			
	0x2003			
.....				
.....				
Prev20 data	0x2026			
	0x2027			

1.3 Parameter data

Code(binary)

000**H HH**XX XXXX XXXX
 0000 00XX XXXX XXXX
 0000 01XX XXXX XXXX
 0000 10XX XXXX XXXX
 0000 11XX XXXX XXXX
 0001 00XX XXXX XXXX

H HH = Parameter type
0 00 = Instantaneous data
0 01 = basic parameter
0 10 = Tariff rate and demand calculation parameters
0 11 = Load Profile parameters
1 00 = Display parameters

1.3.1 Instantaneous data

Name	Hexadecimal Address	Data Format(4 bytes)		
The total Import active power	0x0000	0x0011	0x00112233	1 decimal places, the unit W
	0x0001	0x2233	= 1122867	
The total export active power	0x0002	0x0011	0x00112233	1 decimal places, the unit W
	0x0003	0x2233	= 1122867	
L1 Voltage effective value	0x0004	0x0011	0x00112233	2 decimal places, the unit V
	0x0005	0x2233	= 1122867	
L2 Voltage effective value	0x0006	0x0011	0x00112233	2 decimal places, the unit V
	0x0007	0x2233	= 1122867	
L3 Voltage effective value	0x0008	0x0011	0x00112233	2 decimal places, the unit V
	0x0009	0x2233	=1122867	
L1 Current effective value	0x000A	0x0011	0x00112233	3 decimal places, the unit A
	0x000B	0x2233	= 1122867	
L2 current effective value	0x000C	0x0011	0x00112233	3 decimal places, the unit A
	0x000D	0x2233	= 1122867	
L3 current effective value	0x000E	0x0011	0x00112233	3 decimal places, the unit A
	0x000F	0x2233	= 1122867	



Power factor	0x0010 0x0011	0x0011 0x2233	0x00112233 = 1122867	3 decimal places, unitless.
Frequency	0x0012 0x0013	0x0011 0x2233	0x00112233 = 1122867	3 decimal places, the unit Hz
The total Import demand	0x0014 0x0015	0x0011 0x2233	0x00112233 = 1122867	4 decimal places, the unit kW
The total export demand	0x0016 0x0017	0x0011 0x2233	0x00112233 = 1122867	4 decimal places, the unit kW
L1 voltage threshold	0x0018 0x0019	0x0011 0x2233	0x00112233 = 1122867	3 decimal places, the unit %
L2 voltage threshold	0x001A 0x001B	0x0011 0x2233	0x00112233 = 1122867	3 decimal places, the unit %
L3 voltage threshold	0x001C 0x001D	0x0011 0x2233	0x00112233 = 1122867	3 decimal places, the unit %

1.3.2 basic parameter

Name	Hexadecimal Address	Data Format (default 2 bytes)	Attribute (Read or write)
Second index	0x0400 0x0401	4 bytes, the unit: s (Only in the Factory Mode meter is allowed to be set 0 value)	RW
Meter number	0x0402 0x0403 0x0404	6 bytes, Low in the first, Compression BCD (Only in the Factory Mode meter is writable)	RW
Soft clock date	0x0405 0x0406	2 bytes definition refer to Date format which below this form	RW
Soft clock time	0x0407 0x0408	2 bytes definition refer to Time format which below this form	RW
Asynchronous clock cycle	0x0409 0x040A	4 bytes, the unit:s	RW
Communication baud rate	0x040B	5 – 9600bps 6 – 19200bps Other – Retain	RW
Rated Voltage	0x040C	230.00V, 2 decimal places	R



Rated Current	0x040D	5.000A,3 decimal places	R
Rated Frequency	0x040E	50.000Hz,3 decimal places	R
Maximum Current	0x040F	65.000A,3 decimal places	R
Active pulse constant	0x0410	1000imp/kWh	R
Active remote control pulse constant	0x0411	Configurable : 1000 imp/kWh 500 imp/kWh 250 imp/kWh 100 imp/kWh	RW
Times of Demand archived	0x0412		R
Status word	0x0413	definition refer to Status format which below this form Status format	R
.....			
Factory production commands	0x04FF	0 – Initialization 1 –Clear the energy demand 2 – Clear the event logs 3 –Clear Load Profile 4 –Enter the calibration status 5 – Upgrade the Firmware	W

Date and time format	Octet	8
Date format	Octet	4
Year	U08	1
Month (1..12)	U08	1
Day (1..31)	U08	1
Day of week (1:Monday, 0:Sunday)	U08	1
Time format	Octet	4
Hour (0..23)	U08	1
Minute (0..59)	U08	1
Second (0..59)	U08	1
Hundredths (0..99)	U08	1

Status formats
bit 0 - RTC error
bit 1 - EEPROM error
bit 2 - Dataflash error
bit 3 - Reserved
bit 4 - Reserved
bit 5 - Reserved



bit 6 - Reserved
bit 7 - Reserved
bit 8 - Phase failure–phase 1
bit 9 - Phase failure–phase 2
bit10 - Phase failure–phase 3
bit11 - Anti Phase Sequence
bit12 - Reserved
bit13 - Reserved
bit14 - Reserved
bit15 - Reserved

1.3.3 Tariff Rate and Demand calculation parameters

Name	Hexadecimal Address	Data Format (2 bytes)	Attribute (Read or write)
Demand calculation cycle	0x0800	60,120,300, 600,900,1200, The unit :s	RW
Demand archived	0x0801	1 – Archived others – Don't archived	W
The current Tariff rate	0x0802	[1,8]	When the tariff rate is controlled by external terminal, This parameter is read-only; When the tariff rate is controlled by command, This parameter can be read and written
Tariff Rate control word	0x0803	0 – controlled by external terminal 1 – controlled by command –Retain	RW

1.3.4 Load Profile parameters

Name	Hexadecimal	Data Format	Attribute
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	Address	(2 bytes)	(Read or write)
Record interval	0x0C00	1,2,5,30, 60,120, 300,600,900,1800,3600,the unit:s When the parameter is set less than or equal to 60, load profile winding is prohibited	RW
Record points amount	0x0C01	Maximum 43200	R
Configure the channel 1	0x0C02	Second Index	R
Configure the channel 2	0x0C03		RW
Configure the channel 3	0x0C04	Voltage, current, power, Power factor, demand, energy or status word	RW
Configure the channel 4	0x0C05		RW
Configure the channel 5	0x0C06		RW
Configure the channel 6	0x0C07		RW
Configure the channel 7	0x0C08		RW
Configure the channel 8	0x0C09		RW

1.3.5 Display parameters

Name	Hexadecimal Address	Data Format (2 bytes)	Attribute (Read or write)
Auto mode display interval time	0x1000	4~20, the unit:s , Default 10s	RW
Manual mode Display exiting interval time	0x1001	4~20,the unit; s, Default 10s	RW
Whether enable the Test mode	0x1002	0 – yes 1 – no	RW
Auto mode display amount	0x1010	0~32	RW
Manual mode display amount	0x1011	0~32	RW

Test mode display amount	0x1012	0~32	RW
configurable display items under the auto mode	0x1100~ 0x111F	Voltage, current, Power, Frequency Demand, Energy or Second Index, (OBIS code display reference standard)	RW
configurable display items under the manual mode	0x1120~ 0x113F		RW
configurable display items under the test mode	0x1140~ 0x115F		RW

1.3.6 Configurable display items

Name	Hexadecimal Address	OBIS code	Notes	
Tariff rate X Import active energy	reference 1.2	1.8.x	X=0 means total	
Tariff rate X Export active energy		2.8.x	The history data of 20 archived cycle can also be displayed.	
Tariff rate X Import active demand		1.6.x	when display historical data, OBIS area	
Tariff rate X export active demand		2.6.x	Of the display will be display the OBIS codes and Prxx alternating.	
Phase L1 total import Active energy		21.8.0		
Phase L1 total export Active energy		22.8.0		
Phase L2 total import Active energy		41.8.0		
Phase L2 total export Active energy		42.8.0		
Phase L3 total import Active energy		61.8.0		
Phase L3 total export Active energy		62.8.0		
total import Active Power		reference 1.3.1	1.7.0	
total export Active Power			2.7.0	
L1 Voltage effective value			32.7.0	
L2 Voltage	52.7.0			



effective value			
L3 Voltage effective value		72.7.0	
L1 Current effective value		31.7.0	
L2 Current effective value		51.7.0	
L3 Current effective value		71.7.0	
Power factor		13.7.0	
Frequency		14.7.0	
Soft clock date	reference 1.3.2	0.9.2	
Soft clock time		0.9.1	

1.4 Event log

Code(binary)

001 I III X XXXX XXXX
 0010 001 X XXXX XXXX
 0010 010 X XXXX XXXX
 0010 011 X XXXX XXXX
 0010 100 X XXXX XXXX

I III = Data type
 0 001 = Second index reset event
 0 010 = Power on and Power off event
 0 011 = Second index synchronization event
 0 100 = The clock asynchronous event

1.4.1 Power on and Power off event

Record at least the last 20 times, the data will be reset automatically when the second index reset, Record format is as follows:

- 1.Second index at the last time power off;
- 2.Second index at this time power on;

Name	Hexadecimal Address	Data Format (4 bytes)		
Prev1 record	0x2400 0x2401	0x0011 0x2230	0x00112230 = 1122864	Second index of the last time power off, 1122864sec
	0x2402 0x2403	0x0011 0x2233	0x00112233 = 1122867	Second index of this time power on ,1122867sec
Prev2 record	0x2404			
	0x2405			
	0x2406			
	0x2407			
.....				
.....				



Prev20 record	0x244C			
	0x244D			
	0x244E			
	0x244F			

1.4.2 Second index synchronization event log

Record at least the last 20 times

Record format is as follows:

1. Second index at the Synchronous moment;
2. Second stamp before the Synchronous moment;
3. Second stamp after the Synchronous moment.

Notes : Second stamp is reference time defined by UNIX system,
Starting at 1970.1.1 00:00:00.

Name	Hexadecimal Address	Data Format (4 bytes)		
Prev1 record	0x2600 0x2601	0x0011 0x2230	0x00112230 = 1122864	Second index at the Synchronous moment, 1122864sec
	0x2602 0x2603	0x0011 0x2233	0x00112233 = 1122867	Second stamp before the Synchronous moment; 1122867sec
	0x2604 0x2605	0x0011 0x2236	0x00112236 = 1122870	Second stamp after the Synchronous moment. 1122870sec
Prev2 record	0x2606			
	0x2607			
	0x2608			
	0x2609			
	0x260A			
	0x260B			
.....				
.....				
Prev20 record	0x2672			
	0x2673			
	0x2674			
	0x2675			
	0x2676			
	0x2677			

1.4.3 The clock asynchronous event log

Soft clock needs periodic calibration (period is configurable), if was not calibrated during the calibration period, record the clock asynchronous event log.

Recorded 20 times,

Record the Second index when the asynchronous occurred;



Name	Hexadecimal Address	Data Format (4 bytes)		
Prev1 record	0x2800	0x0011	0x00112233	1122867sec
	0x2801	0x2233	= 1122867	
Prev2 record	0x2802			
	0x2803			
.....				
.....				
Prev20 record	0x2826			
	0x2827			

1.5 Load profile record

Load profile will be read in the form of file, record maximum 43200 points, each point save to a file, containing eight channels of data, the number of bytes in each channel fixed on 4, The bytes which did not used will be filled with 0 x00
 The record of Load profile will be reset automatically when the second index reset.

Name	File number	Record number	Data Format (4 bytes)			
Prev1 record	0x0001	0x0000	0x0011	0x00112233	Channel1 data : Fixed for Second index 1122867sec	
		0x0001	0x2233	= 1122867		
		0x0002				Channel 2 data
		0x0003				
		0x0004				Channel 3 data
		0x0005				
		0x0006				Channel 4 data
		0x0007				
		0x0008				Channel 5 data
		0x0009				
		0x000A				Channel 6 data
		0x000B				
		0x000C				Channel 7 data
		0x000D				
		0x000E				Channel 8 data
		0x000F				
Prev2 record	0x0002	0x0000~0x000F				
.....						
.....						
Prev43200 record	0xA8C0	0x0000~0x000F				



1.6 Definition of other useful data in the meter

1.6.1 RTU Communicate Address

The two digits lowest value of Meter ID plus 1.

e.g. meter ID : 0000000011 , the communicate address: 11+1 =12.

1.6.2 Device Identification

Object ID	Describe	Data Type	Data Length	Notes
0x00	Manufacturers	ASCII String	3	REC
0x01	Product code	ASCII String	8	
0x02	Version	ASCII String	5	V2.01

1.7 MMS Communication data format e.g.

1.7.1 Read data

Send to meter: **12 03 04 0D 00 01 16 5A**

12 –communication address

03 –means read

04 0D—register address ,means **Rated Current**

00 01 ---length of register data

16 5A-- verify

Receive : **12 03 02 13 88 30 D1**

12 –communication address

03 –means read

02—length of data field

13 88 ---data field

30 D1—CRC

1.7.2 Write data

1. ACK

Send to meter : **12 06 04 0B 00 06 7B 99**

12 –communication address

06 –means write

04 0B—register address ,means **Communication baud rate**

00 06 --- data

7B 99-- CRC

Receive : **12 06 04 0B 00 06 7B 99**

Receive data consistent with the send data means write successful.



2. NACK

Some commands is writable only in the Factory Mode meter.If not in the factory mode, meter will return the NACK when commands be written.

Send to meter : **12 06 04 FF 00 02 3B A8**

12 –communication address

06 –means write

04 FF—register address ,means **Factory production commands**

00 02 --- data, means **Clear the event logs**

3B A8—CRC

Receive : **12 86 04 B2 66**

12 –communication address

86 –means **NACK**

04—abnormal sign of write register

B2 66 --- CRC