HEXING

HXE110

User Manual

Single Phase Smart Meter

Focus on creating value for clients

Revision history

Index	Date	Name	Remarks
V1.0	2012-6-19	DingZuoming /13968013900	First edition
V1.1	8.10.2013	DingZuoming /13968013900	Adjust the document content and format

Introduction

Range of validity

The present user manual applies to the meter specified on the title page.

Purpose

The user manual contains all the information required for application of the meters for the intended purpose. This includes:

- Provision of knowledge concerning characteristics, construction and function of the meter
- Information about possible dangers, their consequences and measures to prevent any danger
- Details concerning the performance of all work throughout the service life of the meter

Target group

The contents of this user manual are intended for technically qualified personnel of energy supply companies responsible for the meter planning, installation, operation and maintenance of the meter.

Hexing Electrical reserves the right of final interpretation

Content

1 Overview

1.1 General view

Fig. 1.1 View of HXE110 Smart Meter

1.2 Front View

The meter information is printed on front cover and front door. The information could be printed according to requirements of Power Supply Company. There is a button for data query and manual disconnector control, an optical communication interface complying with IEC1107 interface standard for PDA and local maintenance. The optical port with a lock can ensure the contact reliability.

1.3 Field of application

This type of smart meter is designed for single phase users. Max. current is 100A.

The meter data can be shown via LCD or acquired through optical communication interface or remote communication module. The remote communication modules such as

PLC module, GPRS module, zigbee module or RS232 can be chosen according to different application filed. An independent RS-485/MBUS communication ports can be developed for locak network or expanding outside module for remote communication. Or the RS-485 is customized according to to user's different needs, for example, this interface is used for data interaction (like gas meter or water meter) with other metering equipment. HXE110 can help the utility build smart home and AMI system. The meter inside is with internal relay for users to manane the power.
Any application beyong the above definition belong to illegal application.

1.4 Characteristics

- Plug-in remote communication module
- Open communication protocol: DLMS/COSEM.
- Sofware upgrade locally or remotely
- Communication data encryption can assure highly reliable communication
- Internal large capacity magnetic latching relay supports for load control through parameter configuration or communication command.
- Four-quadrant active and reactive energy measurement, support 4 tariff
- Active energery accuracy: Class B(MID), Class 1(IEC62053-21).
- Reactive energy accuracy: Class 2(IEC62053-23).
- Wide range of current measurement from starting current to maximum current with correct accuracy.
- LCD display
- IP54
- Various events detection and record including operational type, grid net type and tampering type events
- Maximum 8 channels and 3400K byte for load record
- Support independent RS-485/MBUS interface
- Changeable battery supports for display without power
- Real-time clock

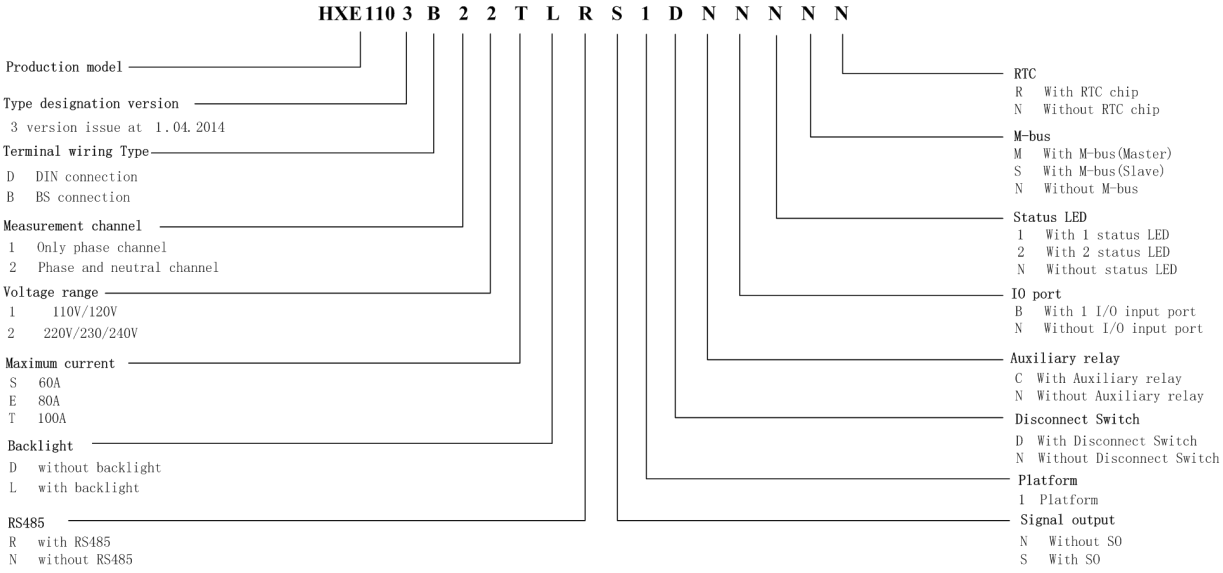
1.5 Compliant standard

- **IEC62052-11** "Electricity metering equipment (a.c.) – General requirements, testsand test conditions – Part 11: Metering equipment "
- **IEC62053-21** "Electricity metering equipment (a.c.) –Particular requirements –Part 21:Static meters for active energy(classes 1 and 2) "
- **IEC62053-23** "Electricity metering equipment (a.c.) – Particular requirements –Part 23: Static meters for reactive energy (classes 2 and 3) "
- **IEC62056-21** "Electricity metering – Data exchange for meter reading, tariff and load control – Part 21:Direct local data exchange"
- **IEC62056-42** " Electricity metering – Data exchange for meter reading, tariff and load control – Part 42:Physical layer services and procedures for connection-oriented asynchronous data exchange"
- **IEC62056-46** "Electricity metering – Data exchange for meter reading, tariff

and load control – Part 46: Data link layer using HDLC protocol"

- **IEC62056-47** "Electricity metering – Data exchange for meter reading, tariff and load control – Part 47:COSEM transport layer for IP networks"
- **IEC62056-53** "Electricity metering – Data exchange for meter reading, tariff and load control – Part 53:COSEM Application layer"
- **IEC62056-61** "Electricity metering – Data exchange for meter reading, tariff and load control – Part 61:OBIS Object identification system"
- **IEC62056-62** "Electricity metering – Data exchange for meter reading, tariff and load control – Part 62:Interface classes"
- **IEC13757-2** "Communication system for meters and remote reading of meters – part 2:physical and link layer"
- **IEC13757-3** "Communication system for meters and remote reading of meters – part 2:Dedicated application layer"

1.6 Model definition



1.7 Electricity Meter Technical Parameter

1.7.1 Voltage Values

- Rated voltage Un----------220V/230V/240V
- Voltage range ----------0.8 to 1.15Un
- Starting work voltage ----------161V
- Limit voltage ----------276V

1.7.2 Current Values

- Rated current----------10 A
- Maximum current ----------100 A
- Starting current----------15mA

1.7.3 Frequency Values

- Rated frequency fn----------50Hz / 60Hz
- Frequency range ----------45 to 65 Hz

1.7.4 Power Consumption

For voltage:

- Active power consumption < 2W
- Apparent power consumption < 10VA

For current :

- Active power consumption < 1VA

1.7.5 Measuring Accuracy

Accuracy for active energy---------- Class 1(IEC62053-21), Class B(MID)

Accuracy for reactive energy-------- Class 2(IEC62053-23)

1.7.6 Calendar Clock Accuracy

- Movement accuracy ----------< 0.5S/Day
- The power reserve of the battery for the clock ----------15 year（Pls refer to chapter 4.5real time clock for details)）

1.7.7 Display

- Display Type ----------LCD (liquid crystal display)
- Number of digits value field----------up to 8
- Digit size----------10.0 x 5.0mm
- Pls refer to chapter 4.7 LCD for details

1.7.8 Meter Constant

- Active energy Constant----------1000 imp/kWh
- Reactive energy Constant----------1000 imp/kvarh

1.7.9 Test Output Active and Reactive Power

- Type ----------LED
- Pulse width----------35ms

1.7.10 Communication

Optical interface

- Communication standards----------IEC62056-21 E mode
- Baud rate----------300bps for standby，9600 bps for communication（configurable）

Plug-in interface

- For different communication medium
- Include GPRS/PLC

RS-485 interface

- Communication standards----------DLMS HDLC
- Baud rate----------1200~9600 bps（configurable）

Optional:M-bus interface

- Communication standards----------EN-13757
- Baud rate----------2400 bps

1.7.11 Temperature range

- Operation for display -30℃ to +70℃
- Operation for meter –30℃ to +70℃
- Storage and transportation -40℃ to +85℃

1.7.12 Insulatin tensity

AC voltage test

- Insulation class ----------4KV 1min

Impulse voltage strength

- Impulse voltage 1.2/50μs mains connections---------6KV

1.7.13 Magnetic compability

Electrostatic discharges

- Contact discharge ----------8KV

Electromagnetic RF fields (80MHz to 2000MHz)

- 10V/m (have current)
- 30 V/m (without current)

Fast transient burst test

- 4KV

Surge

- 4KV

1.8 Weight and Dimensions

Weight ----------around 0.7 kg (without communication module)
Around .0.8 kg (with PLC communication module)
Around.0.83 kg (with GPRS communication module)

(Take type 3B22TLRS1DNNNNN for example. Different type the weight is different.)

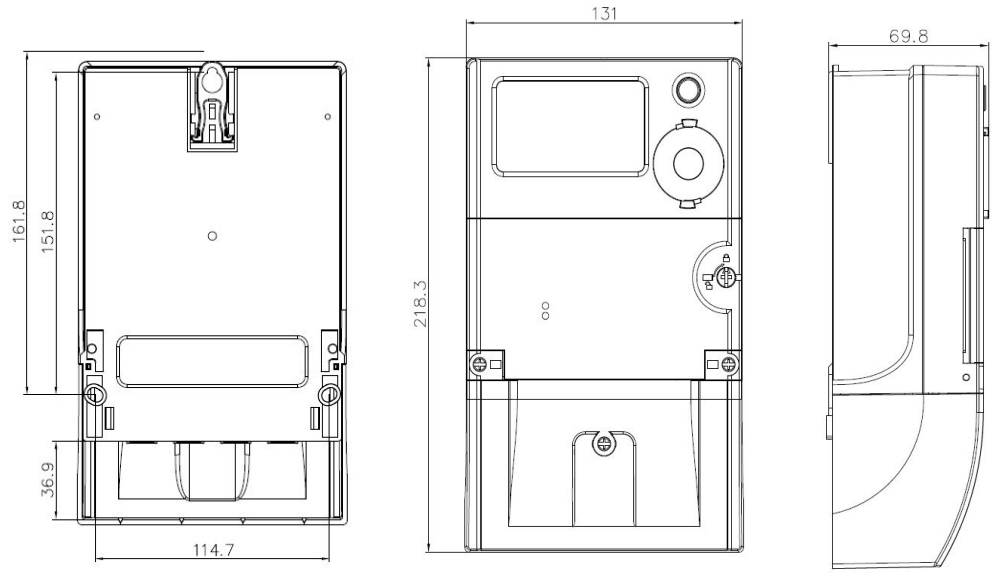


Fig. 1.8.1 Dimension of smart meter

- Width----------131 mm
- Height ----------218.25 mm
- Depth ----------69.8 mm
- Terminal cover----------36.9 mm for connection

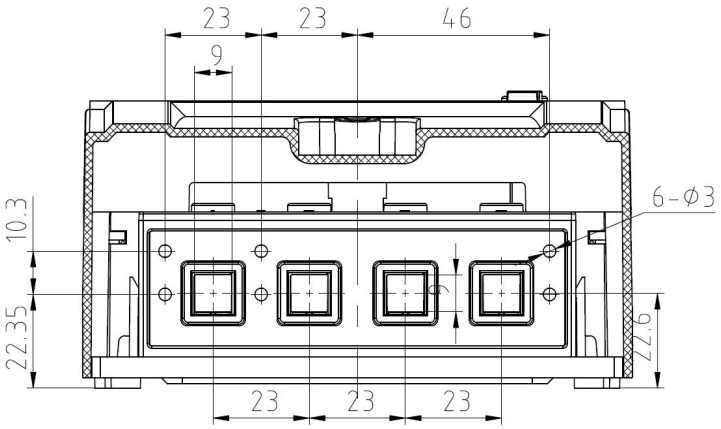


Fig.1.8.2 Terminal drawing of smart meter

1.9 Terminal Layout

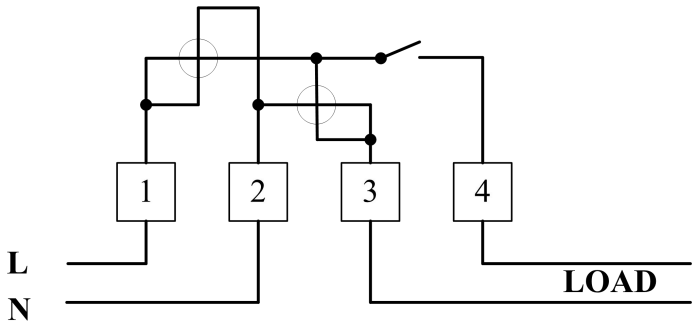


Fig. 1.9.1 Diagram of BS connection

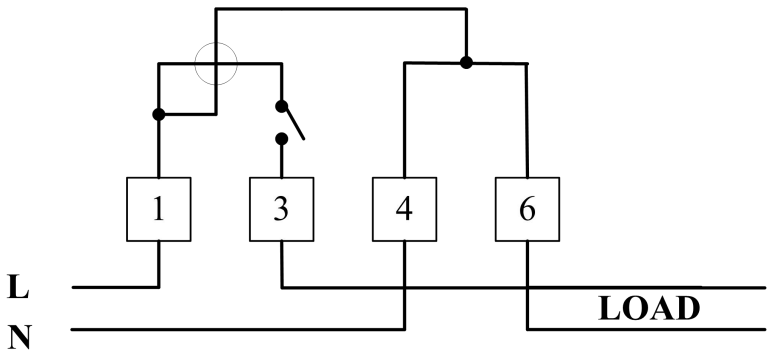


Fig. 1.9.2 Diagram of DIN connection

1.10 Auxiliary terminal wiring diagram

The auxiliary terminal of this product has two options:

- RS-485/M-bus communication interface, if chosen, it will take 2 terminals
- Energy pulse signal output will take 2 terminals. Through software, it can choose active energy pulse or reactive energy pulse
- IO input, it will take two terminals

Referring to chapter 1.6 for more details

NOTE	1. This HXE110 have 4 terminals in total (refer to Figure 1.10.1 “Auxiliary terminal physical diagram”) 2. The terminal location is not fixed; different terminal is designed for different model. The specific situation can refer to corresponding auxiliary terminal wiring diagram.

Figure 1.10.1 Auxiliary terminal physical diagram

This section takes example of the auxiliary terminal connection of the typical common model

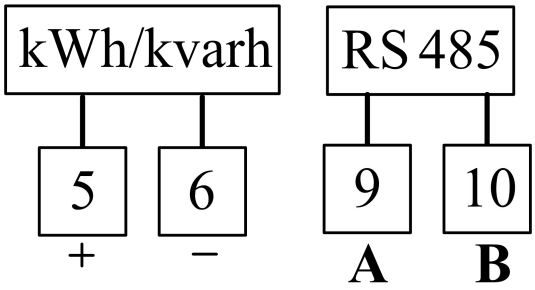
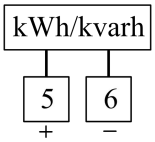
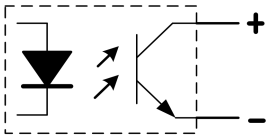
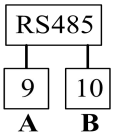
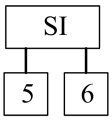


Figure 1.10.2 Auxiliary terminal wiring diagram

1.11 Auxiliary terminal description and electrical characteristics

	Energy pulse output(without power supply)  Maximum withstand voltage：27VDC Conductive interval time：35ms~50ms Zi < 300Ω
	RS-485 communication interface。 A refers to RS-485 A。 B refers to RS-485 B。
	Input signal of detecting meter box open input signal without voltage , only on-off state On, indicating closing the meter box Off , indicating opening the meter box

2 Safety

2.1 Safety information

In the following charter, below warning signs are used to indicate the danger class and faulty probability

 **WARNING**	it may lead to serious personal injury or death
 **CAUTION**	it may lead to personal injury or physical damage
 **NOTE**	the product will perhaps be damaged in the working environment or this description and other useful information are to remind the work.

Besides the dange class, the safety information also describes the dange type, source, possible results and measurements etc.

2.2 Responsibility

The owner of the meters is usually utility who responsisble is for all the relative operator of the meter to assure that they all have done following points:

- have read and understand the relative charters in this user manual
- Have the qualification to operate
- Strictly comply with the safety regulation (section 2.3) and the relevant operational information mentioned in subsequent chapters

The owner of the meter takes following responsibility:

- Protect the working personnel
- Prevent the equipment from damage
- Train the relative personnel

We Hangzhou Hexing Electrical Co., Ltd can provide the relative training course; if interested, welcome contact us.

2.3 Safety Regulation

Following safety regulations have to be abided at tany time.

- The meter operation of the installation, replacement and removal has to be cut off the power supply. Any touch with the bare metal parts will threaten the safety. The protective device on the front of the meter (such as fuse) should be installed in the safe place or be kept by special personnel till all the operation are finished in order to any unexpected power on during the process.
- The local safety regulations must be complied. The installation must be trained by qualified personnel.
- The meter have to be protected during the meter installation.If the meter falls, it maybe results in danger

- The fallen meters are not allowed to install, even there is no damage from the experience, those meter have to be returned for test or maintain as internal damage can result in functional disorders or short-circuits.

The Meters are not allowed to clean by running water or high pressure equipment, water infiltration may cause short circuit.

3 Mechanical Structure

3.1 Case

The internal construction of the meter is not described here, as meter protected by manufacturer seal. The meter couldn't be opened after delivery.

The following drawing shows the meter components visible from outside.

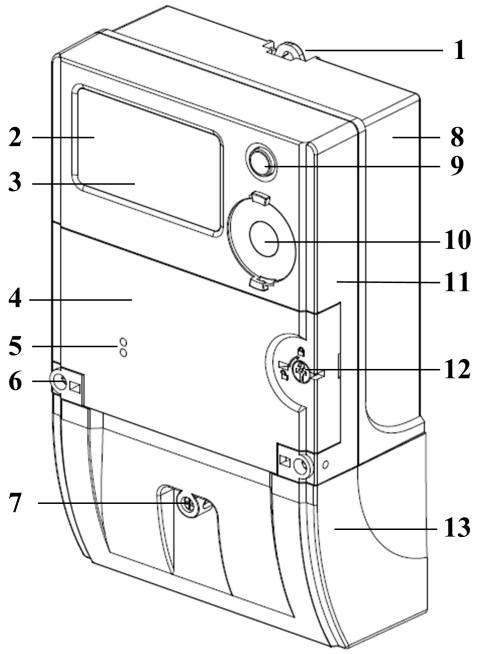


Fig 3.1.1 Front view

1 Suspension hanger
2 Liquid crystal display (LCD)
3 Impulse indicator
4 Front cover
5 Plug In Module indicator
6 Screw with manufacture seal
7 Terminal cover screw with company seal
8 Lower part of case
9 Display button
10 Optical interface
11 Upper part of case
12 Company seal for front cover
13 Terminal cover

NOTE

The front door must be opened to access to the battery compartment and communication module

The battery and communication module can be replaced only opening the

front cover instead of terminal cover

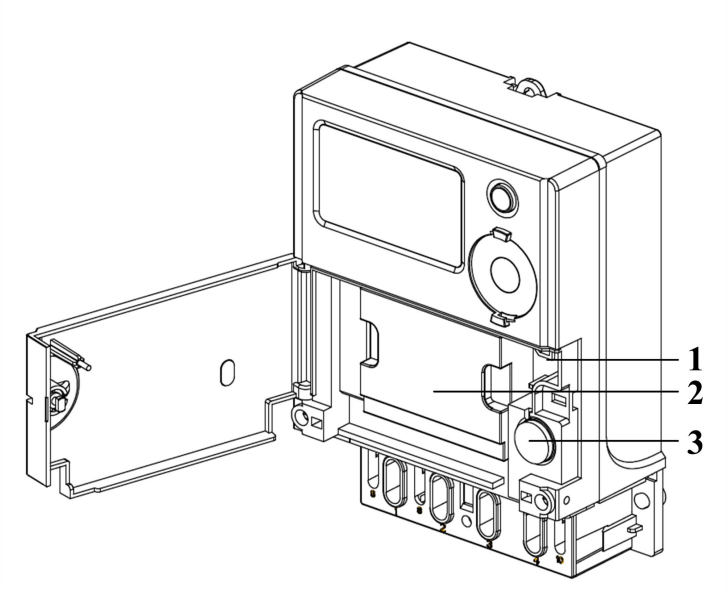


Fig 3.1.2 Meter with communication cover open

1 Button detecting front cover open
2 Plug In Module
3 Battery compartment

3.2 Seal

Figure .3.2.1 Terminal cover seal

Figure.3.2.2 meter cover seal

Figure .3.2.3 Front cover seal

3.3 Connections

The terminal block with the meter connections is situated under the terminal cover. One company seal in the fixing screw of the terminal cover prevent unauthorized access to the phase connections and therefore to unrecorded current consumption.

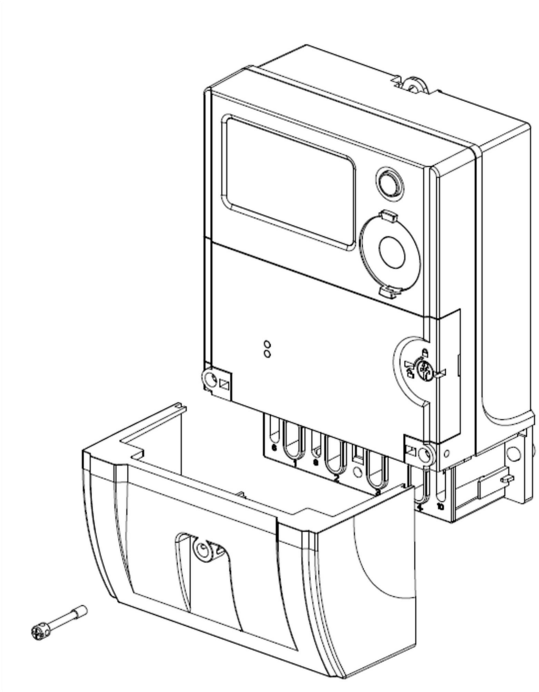


Fig.3.3.1 Meter with terminal cover removed

4 Function

4.1 Block Schematic Diagram

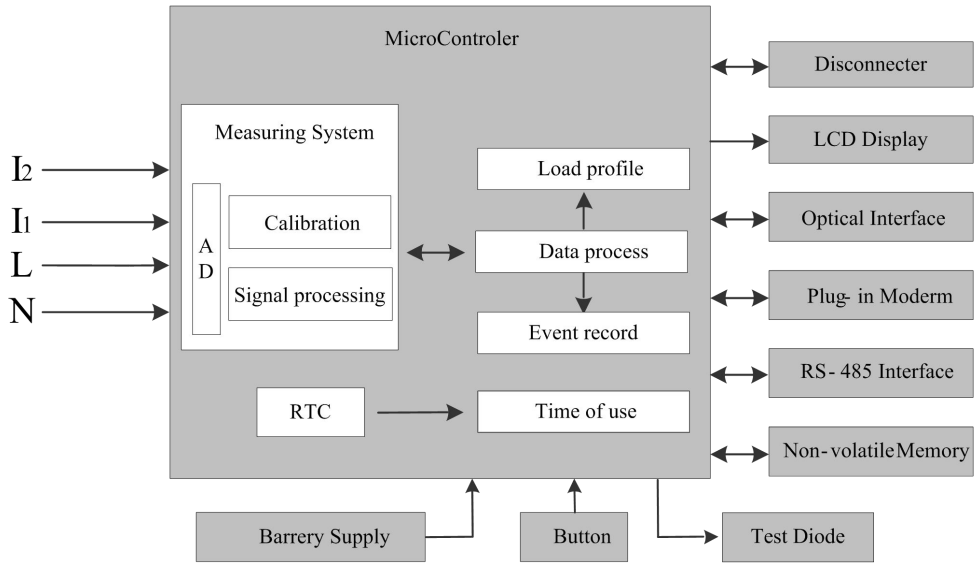


Fig.4.1.1 meter block schematic diagram

Input:

The main inputs to the meter are:

- Phase line L, neutral line N, current I1(main loop),neutral line I2(secondary loop)
  - For the power supply to the meter

- For sampling signal of measure

- Push buttons
  - For scrolling display
  - For relay connecting and disconnecting manually
- External data signal inputs through communication interface
- Battery is used to maintain the meter normally work when power is off.

Outputs:

The main outputs to the meter are:

- LCD liquid crystal display with display buttons
- Electronic test impulse
- Signal outputs through communication interface

Measuring system:

Sample and calculate the input power grid signal to get related power grid information, including following parameters:

- Active power
- Reactive power
- Voltage
- Current
- Frequency
- Power factor

Electric test pulse:

Active or Reactive power pulse is generated for testing the error of the meter.

Power supply:

The supply voltage for the meter is obtained from the power grid, ensuring the normal operation of internal parts of the meter.

Battery:

The battery supply connected in parallel with the normal supply ensures the operation of the meter free from interruption. When the normal supply is switched off, the backup battery has the capability to support the RTC in meter and detect cover opening tampering events.

RTC:

Real Time Clock is served as a time-base for calendar clock in the meter. It's mainly supported by the power supply when the grid power is on, but once interruption occurs, battery will ensure the normal operation of meter instead.

Memory:

There are two kinds of memory shown as below:

- FRAM is for recording data which is used frequently
- NorFlash memory, this meter has one piece of this memory for storing the events, load data, billing data and software upgrade package of the energy meter.

Relay:

The connection and disconnection of user network can be controlled with relay, including load control and human control.

Communication interface:

There are three types of interfaces as below:

- Optical interface: Through this interface, PDA or HHU can communicate with meter with near-infrared communication.
- Plug-in module: This part is situated in the meter, protected by the communication cover and terminal cover. It can be replaced by different communication module if there is necessary for upgrading to build an AMI system.
- RS485/M-bus communication interface: it's used for local maintenance.

4.2 Measuring unit

4.2.1 Overview

Data flow:

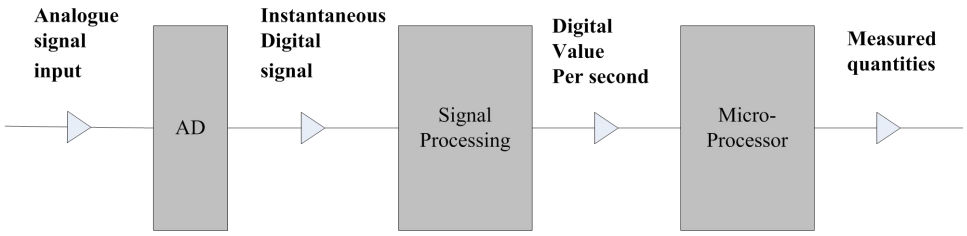


Fig. 4.2.1 data flow of the measuring unit

Analogue input signals:

Analogue signals include analogue voltage and current

Signal conversion:

The AD converter in meter measuring system generates calibrated instantaneous digital values of voltage and current from the analogue input signals.

Data preparation:

Signal processor determines the following digital mean values (averaged for one second in each case) from the instantaneous values and current generated by AD converter. Following are all mean values in every second.

- Active power for main loop (with sign for direction of power)
- Reactive power for main loop (with sign for direction of power)
- Apparent power for main loop
- Current for main loop
- Power factor for main loop
- Active power for secondary loop (with sign for direction of power)
- Reactive power for secondary loop (with sign for direction of power)
- Apparent power for secondary loop
- Current for secondary loop
- Power factor for secondary loop
- Voltage
- Power grid frequency

Data processing:

The microprocessor calculates the following measured quantities from the mean values provided by the signal processor.

- The current energy measuring channel (main/secondary loop)

- Voltage
- Power grid frequency
- Forward mean active power in 1 second for main loop
- Reverse mean active power in 1 second for main loop
- Forward mean reactive power in 1 second for main loop
- Reverse mean reactive power in 1 second for main loop
- Apparent power for main loop
- Current for main loop
- Power factor for main loop
- Forward mean active power in 1 second for secondary loop
- Reverse mean active power in 1 second for secondary loop
- Forward mean reactive power in 1 second for secondary loop
- Reverse mean reactive power in 1 second for secondary loop
- Apparent power for secondary loop
- Current for secondary loop
- Power factor for secondary loop

4.2.2 Signal Conversion and Processing

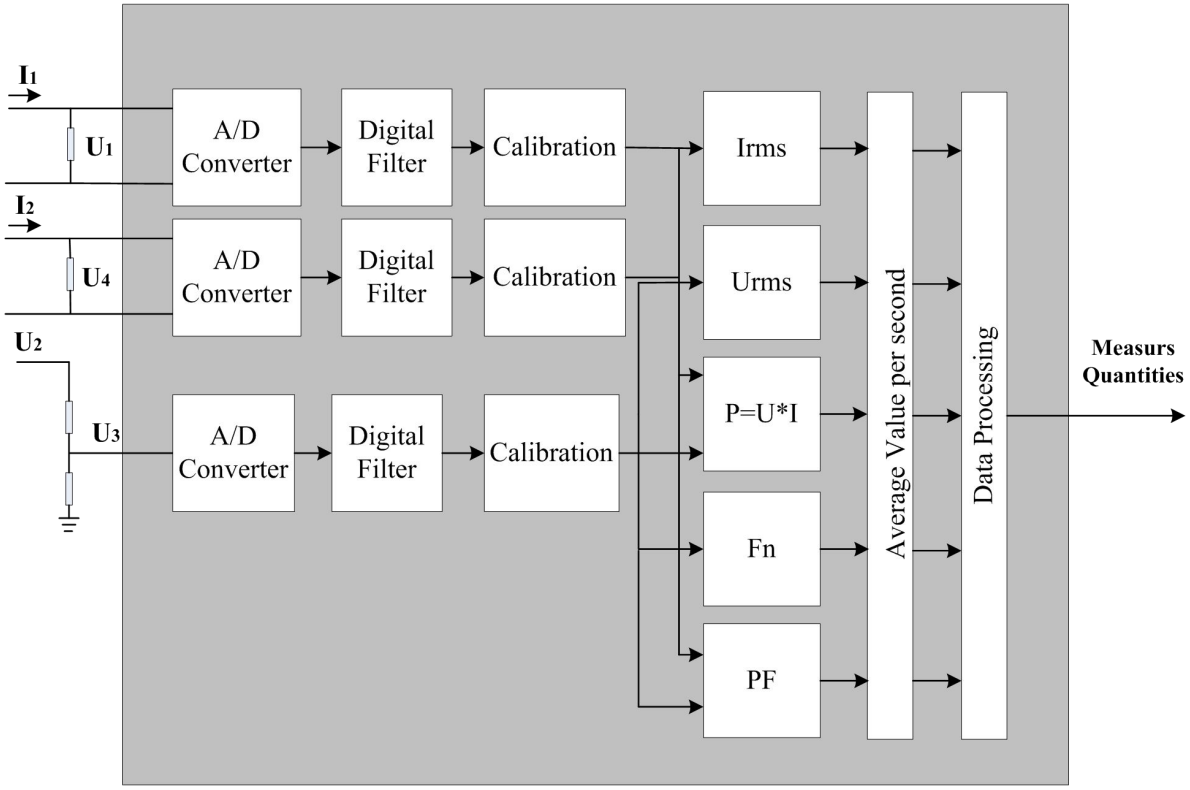


Fig 4.2.2.1 Diagram of signal conversion and processing

Signal input circuits:

- Input voltage signal is divided into low sampling voltages by high resistance voltage dividers of which resistance is 1050KΩ and 1KΩ respectively. The proportional amount is 1050:1. For example, if the input signal U2 is 230V, the sampling voltage U3 will be 219mV and the passing current will be 218μA.

- The sampling current of life line loop is obtained by using a shunt placed in the meter; the sampling current of neutral line loop is obtained by using a CT. The resistance of shunt is 180μΩ. The CT is 5 (120)A/5mA, the sampling resistance is 3Ω.When the current of the life line loop is 100A, the sampling voltage U1 is 18mV,.When the current of the neutral line loop is 100A, the sampling voltage U2 is 300mV.

Digitizing:

The inputting analogue signals is converted by AD converter in measuring system and then filtered. After that, the signals are calibrated and finally form the required digital instantaneous values.

Mean value formation:

From digital instantaneous values, measuring system calculates the mean values per second by integral calculus. Then the microprocessor scans these values at intervals of one second for further processing.

4.2.3 Data processing

By scanning the mean values per second (active power, voltage, current, frequency, power factor), microprocessor forms related measured quantities. Meanwhile the active power per second is regarded as the active energy per second to be added into the total energy consumption, the reactive power per second is regarded as the reactive energy per second to be added into the total reactive energy consumption, the apparent power per second is regarded as the apparent energy per second to be added into the total apparent energy consumption.

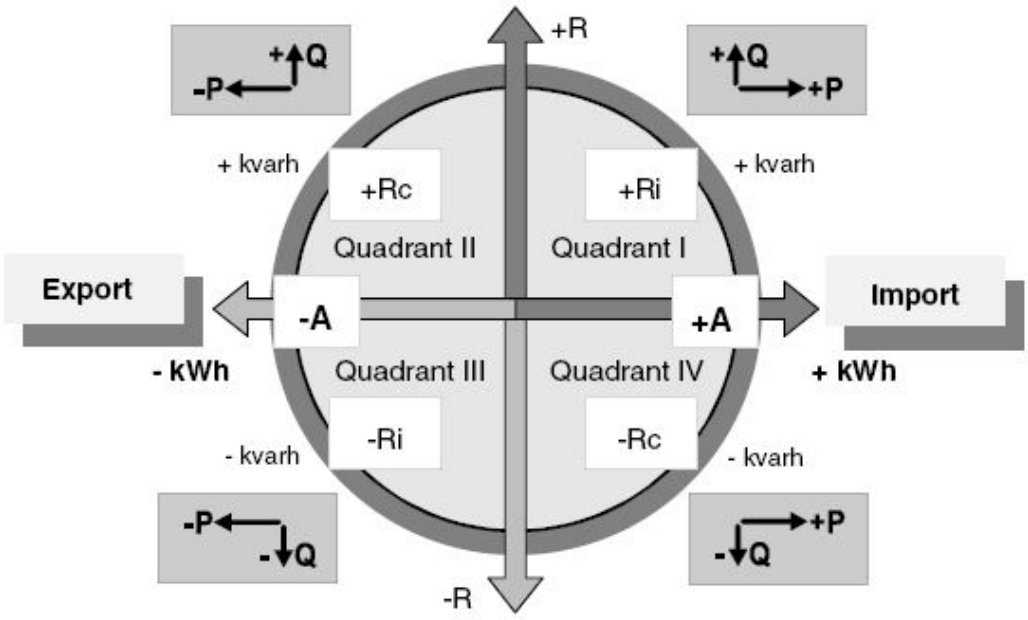


Fig 4.2.3.1 Diagram of Four-Quadrant power

4.2.4 Display and readout of the measured quantities

The data mentioned above can be displayed and read with communication manners, and the format of display and communication is shown as table 4.2.4.1.

Table 4.2.4.1 Formats of display and communication readout of measured quantities

Type	OBIS	Display Format	ID / OBIS	Communication Format/Unit
Active power import in 1s	21.7.0	xxxxxx.xx kW	3 / 1-0:21.7.0.255	U16 / 10W
Active power export in 1s	22.7.0	xxxxxx.xx kW	3 / 1-0:22.7.0.255	U16 / 10W
Reactive power import in 1s	23.7.0	xxxxxx.xx kvar	3 / 1-0:23.7.0.255	U16 / 10var
Reactive power export in 1s	24.7.0	xxxxxx.xx kvar	3 / 1-0:24.7.0.255	U16 / 10var
Apparent power	29.7.0	xxxxxx.xx kVA	3/ 1-0:29.7.0.255	U16 / 10VA
Power factor	33.7.0	x.xxx	3 / 1-0:33.7.0.255	U16 / 0.001
Current	31.7.0	xxxxxx.xx A	3 / 1-0:31.7.0.255	U16 / 1A
Voltage	32.7.0	xxxxxx.xx V	3 / 1-0:32.7.0.255	U16 / 1V
Frequency	14.7.0	xx.xx Hz	3 / 1-0:14.7.0.255	U16 / 0.01Hz

NOTE

- U16 means unsigned 16 bits integer data.
- The calculation method of active power import, active power export, reactive power import and reactive power export is the same of the method to calculate active energy import, active energy export, reactive energy import and reactive energy export.

4.3 Energy recording

4.3.1 Overview

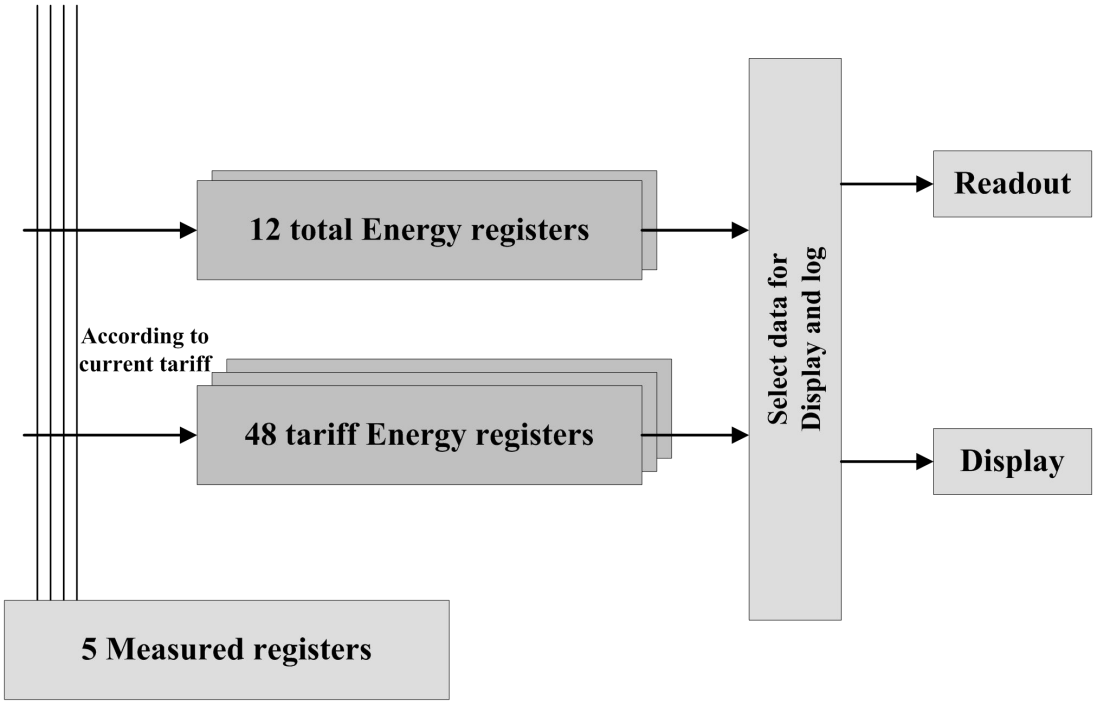


Fig.4.3.1.1 Block schematic diagram of energy recording

Microprocessor obtains the measuring data per second, after calculating, five data are obtained: forward active power in 1s (namely forward active accumulation energy within 1s), reverse active power in 1s (namely reverse active accumulation energy within 1s), forward reactive power in 1s (namely forward reactive accumulation energy within 1s), reverse reactive power in 1s (namely reverse reactive accumulation energy within 1s), apparent power in 1s (namely apparent accumulation energy within 1s), above five values are as input value of energy accumulation and are respectively accumulated into forward active total energy register, reverse active total energy register, forward reactive total energy register, reverse reactive total energy register, forward apparent total energy register, reverse apparent total energy register, quadrant I reactive total energy register, quadrant II reactive energy register, quadrant III reactive energy register, quadrant IV reactive energy register as well as corresponding tariff energy register according to current tariff.

Microprocessor then selects the information from the energy registers for display, load profile and remote readout.

Registers are included as follows:

- Total active energy register (+TA)
- Total active energy tariff 1 register (+TA_1)
- Total active energy tariff 2 register (+TA_2)
- Total active energy tariff 3 register (+TA_3)
- Total active energy tariff 4 register (+TA_4)
- Forward active energy tariff 1 register (+A_1)
- Forward active energy tariff 2 register (+A_2)
- Forward active energy tariff 3 register (+A_3)

- Forward active energy tariff 4 register (+A_4)
- Reverse active energy register (-A)
- Reverse active energy tariff 1 register (-A_1)
- Reverse active energy tariff 2 register (-A_2)
- Reverse active energy tariff 3 register (-A_3)
- Reverse active energy tariff 4 register (-A_4)
- Forward reactive energy register (+R)
- Forward reactive energy tariff 1 register (+R_1)
- Forward reactive energy tariff 2 register (+R_2)
- Forward reactive energy tariff 3 register (+R_3)
- Forward reactive energy tariff 4 register (+R_4)
- Reverse reactive energy register (-R)
- Reverse reactive energy tariff 1 register (-R_1)
- Reverse reactive energy tariff 2 register (-R_2)
- Reverse reactive energy tariff 3 register (-R_3)
- Reverse reactive energy tariff 4 register (-R_4)
- Forward apparent energy register (+Q)
- Forward apparent energy tariff 1 register (+Q_1)
- Forward apparent energy tariff 2 register (+Q_2)
- Forward apparent energy tariff 3 register (+Q_3)
- Forward apparent energy tariff 4 register (+Q_4)
- Reverse apparent energy register (-Q)
- Reverse apparent energy tariff 1 register (-Q_1)
- Reverse apparent energy tariff 2 register (-Q_2)
- Reverse apparent energy tariff 3 register (-Q_3)
- Forward apparent energy tariff 4 register (-Q_4)
- Quadrant I reactive energy register (R1)
- Quadrant I reactive energy tariff 1 register ($R1_1$)
- Quadrant I reactive energy tariff 2 register ($R1_2$)
- Quadrant I reactive energy y tariff 3 register ($R1_3$)
- Quadrant I reactive energy tariff 4 register ($R1_4$)
- Quadrant II reactive energy register (R2)
- Quadrant II reactive energy tariff 1 register ($R2_1$)
- Quadrant II reactive energy tariff 2 register ($R2_2$)
- Quadrant II reactive energy y tariff 3 register ($R2_3$)
- Quadrant II reactive energy tariff 4 register ($R2_4$)
- Quadrant III reactive energy register (R3)
- Quadrant III reactive energy tariff 1 register ($R3_1$)
- Quadrant III reactive energy tariff 2 register ($R3_2$)
- Quadrant III reactive energy y tariff 3 register ($R3_3$)
- Quadrant III reactive energy tariff 4 register ($R3_4$)
- Quadrant IV reactive energy register (R4)
- Quadrant IV reactive energy tariff 1 register ($R4_1$)
- Quadrant IV reactive energy tariff 2 register ($R4_2$)

- Quadrant IV reactive energy y tariff 3 register ($R4_3$)
- Quadrant IV reactive energy tariff 4 register ($R4_4$)

4.3.2 Energy Accumulation Method

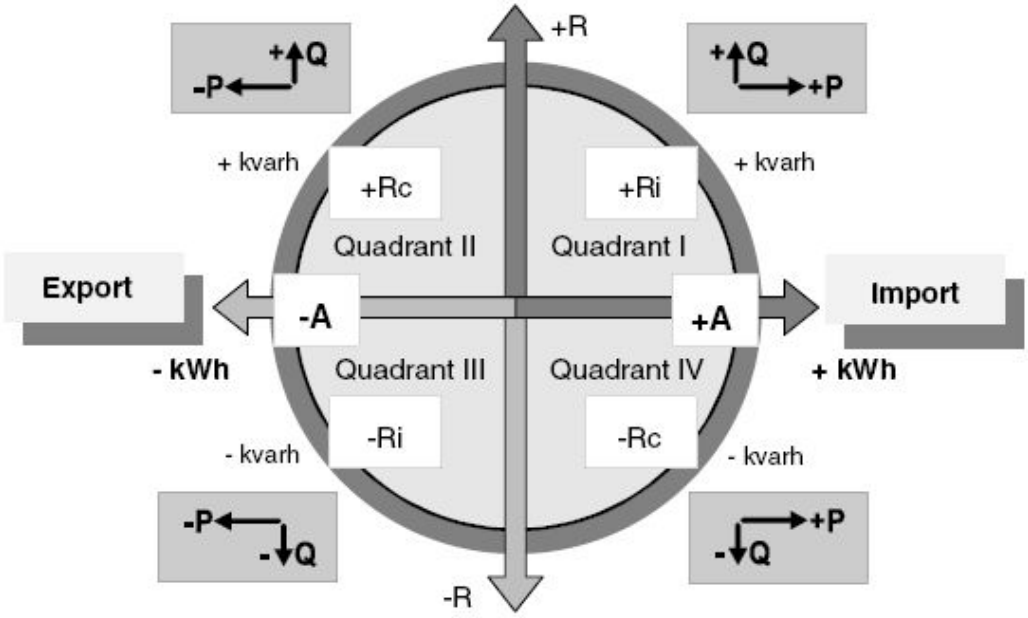


Figure 4.3.2.1 four quadrant power factor

Active, apparent energy accumulation:

- TAR = |+A| + |-A|
- +AR = |+A| or +AR = |+A| + |-A|
- -A R= |-A|
- +QR=|+Q| or +QR=|+Q| + |-Q|
- -QR=|-Q|

Notes:

|+A|: absolute import active energy

|-A|: absolute export active energy

|+Q|: absolute import apparent energy

|-Q|: absolute export apparent energy

Reactive energy accumulation:

There are four methods for energy accumulation:

- +RR= |+Ri|+|+Rc|+|-Ri|+|-Rc| -RR = 0
- +RR = |+Ri|+|+Rc| -RR = |-Ri|+|-Rc|
- +RR = |+Ri|+ |-Rc| -RR = |+Rc|+|-Ri|
- +RR = |+Ri|+|+Rc|+|-Ri|+|-Rc| -RR = |+Rc|+|-Ri|

Notes:

- |+Ri|：Quadrant I reactive energy
- |+Rc|：Quadrant II reactive energy
- |-Ri|：Quadrant III reactive energy
- |-Rc|：Quadrant IV reactive energy

4.3.3 Display and readout of Energy consumption

The value of energy consumption has the resolution 0.0001kWh. The format of the data shown as below 4.3.3.1

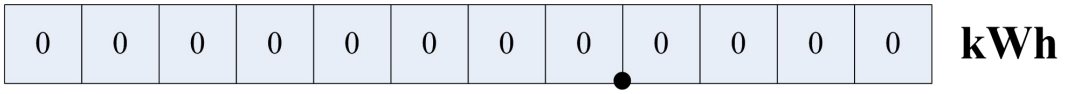


Fig 4.3.3.1The format of energy data storage

All the energy data can be displayed and read with communication manners, and the format of display and communication readout is noticed as table 4.3.3.1.(Notes: display of decimal digits can be set, meter default display 2 decimal digits)

Table 4.3.3.1Formats of display and communication readout of energy consumption

Type	OBIS	Display format	Communication ID / OBIS	Communication format /unit
TA	15.8.0	xxxxxx.xx kWh	3 / 1-0:15.8.0.255	U32 / 1wh
TA_1	15.8.1	xxxxxx.xx kWh	3 / 1-0:15.8.1.255	U32 / 1wh
TA_2	15.8.2	xxxxxx.xx kWh	3 / 1-0:15.8.2.255	U32 / 1wh
TA_3	15.8.3	xxxxxx.xx kWh	3 / 1-0:15.8.3.255	U32 / 1wh
TA_4	15.8.4	xxxxxx.xx kWh	3 / 1-0:15.8.4.255	U32 / 1wh
+A	1.8.0	xxxxxx.xx kWh	3 / 1-0:1.8.0.255	U32 / 1wh
$+A_1$	1.8.1	xxxxxx.xx kWh	3 / 1-0:1.8.1.255	U32 / 1wh
$+A_2$	1.8.2	xxxxxx.xx kWh	3 / 1-0:1.8.2.255	U32 / 1wh
$+A_3$	1.8.3	xxxxxx.xx kWh	3 / 1-0:1.8.3.255	U32 / 1wh
$+A_4$	1.8.4	xxxxxx.xx kWh	3 / 1-0:1.8.4.255	U32 / 1wh
-A	2.8.0	xxxxxx.xx kWh	3 / 1-0:2.8.0.255	U32 / 1wh
$-A_1$	2.8.1	xxxxxx.xx kWh	3 / 1-0:2.8.1.255	U32 / 1wh
$-A_2$	2.8.2	xxxxxx.xx kWh	3 / 1-0:2.8.2.255	U32 / 1wh
$-A_3$	2.8.3	xxxxxx.xx kWh	3 / 1-0:2.8.3.255	U32 / 1wh
$-A_4$	2.8.4	xxxxxx.xx kWh	3 / 1-0:2.8.4.255	U32 / 1wh
+R	3.8.0	xxxxxx.xx kvarh	3 / 1-0:3.8.0.255	U32 / 1varh
$+R_1$	3.8.1	xxxxxx.xx kvarh	3 / 1-0:3.8.1.255	U32 / 1varh
$+R_2$	3.8.2	xxxxxx.xx kvarh	3 / 1-0:3.8.2.255	U32 / 1varh
$+R_3$	3.8.3	xxxxxx.xx kvarh	3 / 1-0:3.8.3.255	U32 / 1varh
$+R_4$	3.8.4	xxxxxx.xx kvarh	3 / 1-0:3.8.4.255	U32 / 1varh
-R	4.8.0	xxxxxx.xx kvarh	3 / 1-0:4.8.0.255	U32 / 1varh
$-R_1$	4.8.1	xxxxxx.xx kvarh	3 / 1-0:4.8.1.255	U32 / 1varh
$-R_2$	4.8.2	xxxxxx.xx kvarh	3 / 1-0:4.8.2.255	U32 / 1varh
$-R_3$	4.8.3	xxxxxx.xx kvarh	3 / 1-0:4.8.3.255	U32 / 1varh
$-R_4$	4.8.4	xxxxxx.xx kvarh	3 / 1-0:4.8.4.255	U32 / 1varh
+Q	9.8.0	xxxxxx.xx kVAh	3 / 1-0:9.8.0.255	U32 / 1vah
$+Q_1$	9.8.1	xxxxxx.xx kVAh	3 / 1-0:9.8.1.255	U32 / 1vah
$+Q_2$	9.8.2	xxxxxx.xx kVAh	3 / 1-0:9.8.2.255	U32 / 1vah

$+Q_3$	9.8.3	xxxxxx.xx kVAh	3 / 1-0:9.8.3.255	U32	/ 1vah
$+Q_4$	9.8.4	xxxxxx.xx kVAh	3 / 1-0:9.8.4.255	U32	/ 1vah
-Q	10.8.0	xxxxxx.xx kVAh	3/ 1-0: 10.8.0.255	U32	/ 1vah
$-Q_1$	10.8.1	xxxxxx.xx kVAh	3/ 1-0: 10.8.1.255	U32	/ 1vah
$-Q_2$	10.8.2	xxxxxx.xx kVAh	3/ 1-0: 10.8.2.255	U32	/ 1vah
$-Q_3$	10.8.3	xxxxxx.xx kVAh	3/ 1-0: 10.8.3.255	U32	/ 1vah
$-Q_4$	10.8.4	xxxxxx.xx kVAh	3/ 1-0: 10.8.4.255	U32	/ 1vah
+R1	5.8.0	xxxxxx.xx kvarh	3 / 1-0:5.8.0.255	U32	/ 1varh
$+R1_1$	5.8.1	xxxxxx.xx kvarh	3 / 1-0:5.8.1.255	U32	/ 1varh
$+R1_2$	5.8.2	xxxxxx.xx kvarh	3 / 1-0:5.8.2.255	U32	/ 1varh
$+R1_3$	5.8.3	xxxxxx.xx kvarh	3 / 1-0:5.8.3.255	U32	/ 1varh
$+R1_4$	5.8.4	xxxxxx.xx kvarh	3 / 1-0:5.8.4.255	U32	/ 1varh
+R2	6.8.0	xxxxxx.xx kvarh	3 / 1-0:6.8.0.255	U32	/ 1varh
$+R2_1$	6.8.1	xxxxxx.xx kvarh	3 / 1-0:6.8.1.255	U32	/ 1varh
$+R2_2$	6.8.2	xxxxxx.xx kvarh	3 / 1-0:6.8.2.255	U32	/ 1varh
$+R2_3$	6.8.3	xxxxxx.xx kvarh	3 / 1-0:6.8.3.255	U32	/ 1varh
$+R2_4$	6.8.4	xxxxxx.xx kvarh	3 / 1-0:6.8.4.255	U32	/ 1varh
+R3	7.8.0	xxxxxx.xx kvarh	3 / 1-0:7.8.0.255	U32	/ 1varh
$+R3_1$	7.8.1	xxxxxx.xx kvarh	3 / 1-0:7.8.1.255	U32	/ 1varh
$+R3_2$	7.8.2	xxxxxx.xx kvarh	3 / 1-0:7.8.2.255	U32	/ 1varh
$+R3_3$	7.8.3	xxxxxx.xx kvarh	3 / 1-0:7.8.3.255	U32	/ 1varh
$+R3_4$	7.8.4	xxxxxx.xx kvarh	3 / 1-0:7.8.4.255	U32	/ 1varh
+R4	8.8.0	xxxxxx.xx kvarh	3 / 1-0:8.8.0.255	U32	/ 1varh
$+R4_1$	8.8.1	xxxxxx.xx kvarh	3 / 1-0:8.8.1.255	U32	/ 1varh
$+R4_2$	8.8.2	xxxxxx.xx kvarh	3 / 1-0:8.8.2.255	U32	/ 1varh
$+R4_3$	8.8.3	xxxxxx.xx kvarh	3 / 1-0:8.8.3.255	U32	/ 1varh
$+R4_4$	8.8.4	xxxxxx.xx kvarh	3 / 1-0:8.8.4.255	U32	/ 1varh

NOTE

●U32 represents unsigned 32-bits integer

●The maximum value of U32 is 4294967295, so the meter can transmit the maximum energy value of 4294967.295KWh. When the readout value exceeds this maximum, it will start from 0. If display is configured as one decimal, for example, when 4294967.3kWh is shown on the LCD, the value unit is 0.1kWh.

●In order to keep the consistency of the value between measuring unit with the communication readout, please make sure that the accumulative energy consumption remains within the threshold of 4294967kWh. It assures the 20 years of normal usage for meter under the circumstances of 230V and 100A.

4.4 MD

4.4.1 Overview

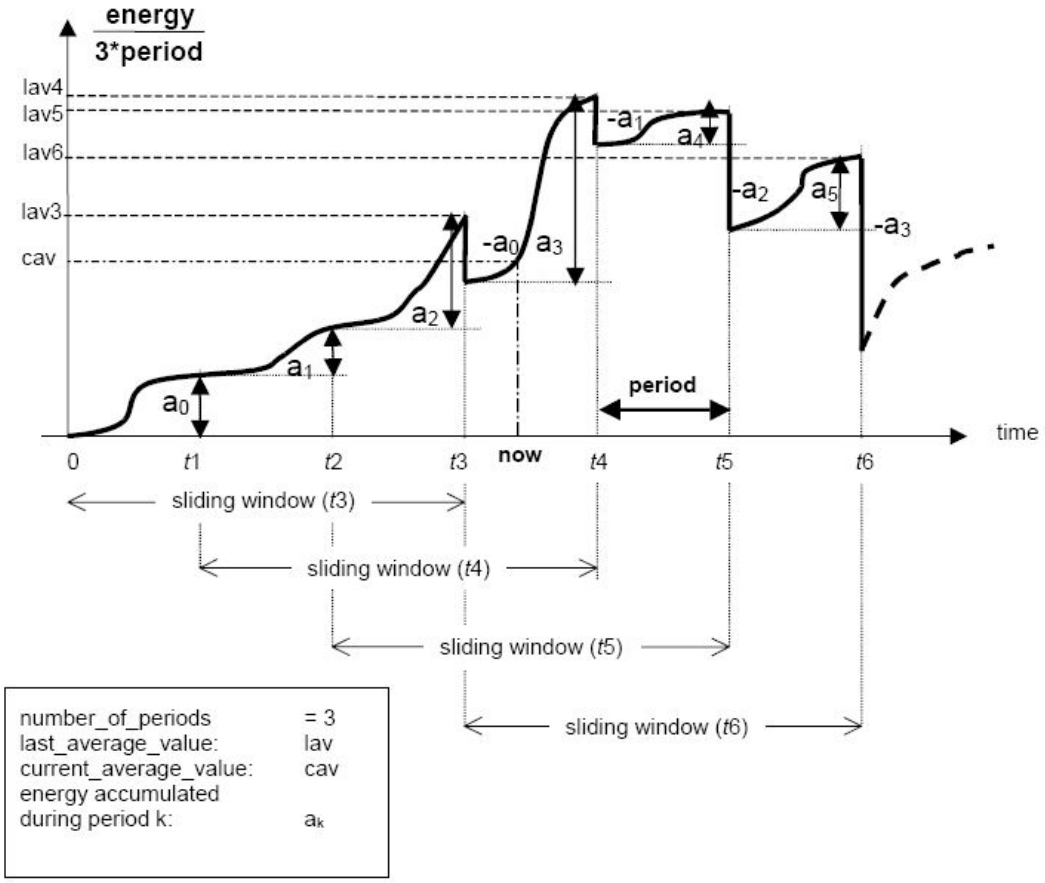


Fig 4.4.1.1 MD measuring schematic diagram

- Final demand average value: which is obtained from formula (accumulating energy within current window/ numbers of period*period) when each integrating period is on.
- MD in current month: Max. value of final demand average value in current month.
- Accumulating MD: MD accumulating value of each month.
- MD period
- Numbers of MD period
- Integrating period: MD period* Numbers of MD period
- Every time when meter powers on, meter starts to accumulate and calculate energy after integral minute is on.

Obtained below demand register：

- Forward active MD register（+MA）
- Forward active tariff1 MD register（+MA_1）
- Forward active tariff2 MD register（+MA_2）
- Forward active tariff3 MD register（+MA_3）
- Forward active tariff4 MD register（+MA_4）
- Reverse active MD register（-MA）

- Reverse active tariff1 MD register（-MA_1）
- Reverse active tariff2 MD register（-MA_2）
- Reverse active tariff3 MD register（-MA_3）
- Reverse active tariff4 MD register（-MA_4）
- Forward reactive tariff MD register（+MR）
- Forward reactive tariff1 MD register（+MR_1）
- Forward reactive tariff2 MD register（+MR_2）
- Forward reactive tariff3MD register（+MR_3）
- Forward reactive tariff4 MD register（+MR_4）
- Reverse reactive tariff MD register（-MR）
- Reverse reactive tariff1 MD register（-MR_1）
- Reverse reactive tariff2 MD register（-MR_2）
- Reverse reactive tariff3MD register（-MR_3）
- Reverse reactive tariff4 MD register（-MR_4）
- Forward apparent MD register（+MQ）
- Forward apparent tariff1 MD register（+MQ_1）
- Forward apparent tariff2 MD register（+MQ_2）
- Forward apparent tariff3 MD register（+MQ_3）
- Forward apparent tariff4 MD register（+MQ_4）
- Reverse apparent MD register（-MQ）
- Reverse apparent tariff1 MD register（-MQ_1）
- Reverse apparent tariff2 MD register（-MQ_2）
- Reverse apparent tariff3 MD register（-MQ_3）
- Reverse apparent tariff4 MD register（-MQ_4）

4.4.2 Display and Readout of Demand

Table 4.4.2.1 Formats of demand display and communication readout

Data item	OBIS	Display format	Communication ID / OBIS	Communication format/unit
+MA	1.6.0	xxxxx.xxx kW	4 / 1-0:1.6.0.255	BCD3 / 1w
+MA_1	1.6.1	xxxxx.xxx kW	4 / 1-0:1.6.1.255	BCD3 / 1w
+MA_2	1.6.2	xxxxx.xxx kW	4 / 1-0:1.6.2.255	BCD3 / 1w
+MA_3	1.6.3	xxxxx.xxx kW	4 / 1-0:1.6.3.255	BCD3 / 1w
+MA_4	1.6.4	xxxxx.xxx kW	4 / 1-0:1.6.4.255	BCD3 / 1w
-MA	2.6.0	xxxxx.xxx kW	4 / 1-0:2.6.0.255	BCD3 / 1w
-MA_1	2.6.1	xxxxx.xxx kW	4 / 1-0:2.6.1.255	BCD3 / 1w
-MA_2	2.6.2	xxxxx.xxx kW	4 / 1-0:2.6.2.255	BCD3 / 1w
-MA_3	2.6.3	xxxxx.xxx kW	4 / 1-0:2.6.3.255	BCD3 / 1w
-MA_4	2.6.4	xxxxx.xxx kW	4 / 1-0:2.6.4.255	BCD3 / 1w
+MR	3.6.0	xxxxx.xxx kvar	4 / 1-0:3.6.0.255	BCD3 / 1var
+MR_1	3.6.1	xxxxx.xxx kvar	4 / 1-0:3.6.1.255	BCD3 / 1 var
+MR_2	3.6.2	xxxxx.xxx kvar	4 / 1-0:3.6.2.255	BCD3 / 1 var
+MR_3	3.6.3	xxxxx.xxx kvar	4 / 1-0:3.6.3.255	BCD3 / 1 var

$+MR_4$	3.6.4	xxxxx.xxx kvar	4 / 1-0:3.6.4.255	BCD3	/ 1 var
-MR	4.6.0	xxxxx.xxx kvar	4 / 1-0:4.6.0.255	BCD3	/ 1 var
$-MR_1$	4.6.1	xxxxx.xxx kvar	4 / 1-0:4.6.1.255	BCD3	/ 1 var
$-MR_2$	4.6.2	xxxxx.xxx kvar	4 / 1-0:4.6.2.255	BCD3	/ 1 var
$-MR_3$	4.6.3	xxxxx.xxx kvar	4 / 1-0:4.6.3.255	BCD3	/ 1 var
$-MR_4$	4.6.4	xxxxx.xxx kvar	4 / 1-0:4.6.4.255	BCD3	/ 1 var
+MQ	9.6.0	xxxxx.xxx kVA	4 / 1-0:9.6.0.255	BCD3	/ 1VA
$+MQ_1$	9.6.1	xxxxx.xxx kVA	4 / 1-0:9.6.1.255	BCD3	/ 1 VA
$+MQ_2$	9.6.2	xxxxx.xxx kVA	4 / 1-0:9.6.2.255	BCD3	/ 1 VA
$+MQ_3$	9.6.3	xxxxx.xxx kVA	4 / 1-0:9.6.3.255	BCD3	/ 1 VA
$+MQ_4$	9.6.4	xxxxx.xxx kVA	4 / 1-0:9.6.4.255	BCD3	/ 1 VA
-MQ	10.6.0	xxxxx.xxx kVA	4 / 1-0:10.6.0.255	BCD3	/ 1 VA
$-MQ_1$	10.6.1	xxxxx.xxx kVA	4/ 1-0: 10.6.1.255	BCD3	/ 1 VA
$-MQ_2$	10.6.2	xxxxx.xxx kVA	4/ 1-0: 10.6.2.255	BCD3	/ 1 VA
$-MQ_3$	10.6.3	xxxxx.xxx kVA	4/ 1-0: 10.6.3.255	BCD3	/ 1 VA
$-MQ_4$	10.6.4	xxxxx.xxx kVA	4/ 1-0: 10.6.4.255	BCD3	/ 1 VA

4.5 Real-time Clock

Clock work mode of the meter, namely internal clock of microprocessor

4.5.1 Internal microcontroller clock

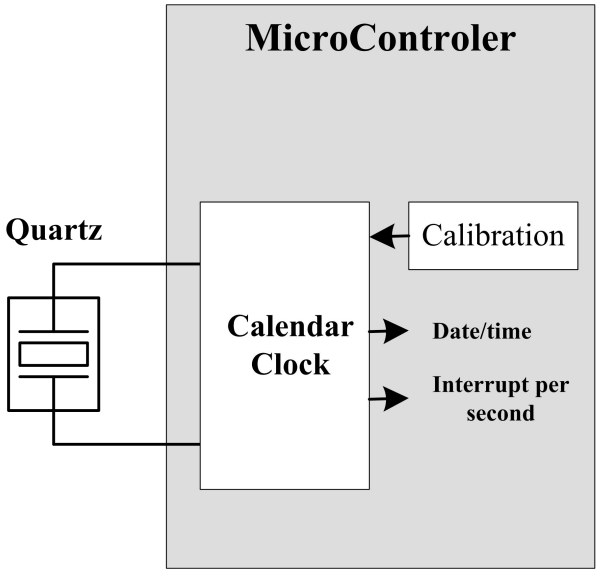


Fig 4.5.1.1 working diagram of Internal microcontroller clock

The external crystal oscillator (32.768kHz) is necessary for clock module (RTCC) to work. The RTCC could calibrate the initial deviation and sends an interrupt signal to micro controller every second. The micro controller reads and configures current clock via internal register.

The parameters of the internal clock are as follows:

- Under normal temperature 23℃, deviation <=0.5s per day.

4.5.2 Details

- The Gregorian calendar clock

- Automatic leap year switch
- Support DST(daylight saving time), the fixed DST or configurable DST can be chosen, Under the fixed DST mode, two o'clock in the last Sunday of the March every year will be changed to three o'clock and three o'clock in the last Sunday of October every year will be changed to two o'clock. Under the configurable DST mode: the starting and ending time of the DST can be configurable for the near next 20 years.
- The DST shift events will be added into the events log, the recorded time of events is in accordance with the shifted time. The sign of S9 will appear on the LCD when entering the daylight saving time.

NOTE When configure the DST parameter in communication, firstly fill the number of DST then other parameter, it is not allowed to configure from the middle parameter, otherwise, the DST will not workable.

- If DST mode be chosen, but the starting and ending time of DST(daylight saving time) is not configured, anytime is regarded as winter time.
- DST can be enabled or disabled, if meter is in the summer time, at the same time, DST function is disabled, meter will automatically decrease one hour and switches into winter time. If meter is in the period of summer time and DST function is enabled, meters will automatically increase one hour and switches into summer time.
- The time function provides the following time elements
  - ✧ Year （2000 ~ 2099）
  - ✧ Month （01 ~ 12）
  - ✧ Day （01 ~ 31）
  - ✧ Weekdays （01 ~ 07）(1…7, where 1=Monday, 2=Tuesday, etc.)
  - ✧ Hour （00 ~ 23）
  - ✧ Minute （00 ~ 59）
  - ✧ Second （00 ~ 59）

4.5.3 Display and readout of real-time clock

Display and readout of real-time clock as the table 4.5.3.1 as below.

Table 4.5.3.1 Display format of real time clock

Data Item	OBIS	Display format
Date	0.9.2	MM:DD:YY
Clock	0.9.1	HH:MM :SS

NOTE The time of clock can be read and configured via communication ports and it should be configured with DST status flag, otherwise the meter might switch to DST automatically and a DST switch event would be added into the event log.

For example: if meter is in DST mode, and the current time is:

Standard time: 13:00pm, July 24th, 2010

DST: 14:00pm, July 24th, 2010

The following situations that may occur when the clock is overwritten:

1, Written with: 14:00pm, 24th of July, 2010, with DST status flag.
The adjusted time will be: 14:00pm, 24th of July, 2010, DST. No event is recorded

2. Written with: 14:00pm, 24th of July, 2010, without DST status flag.
The adjusted time will be: 15:00pm, 24th of July, 2010, DST. DST switch event is recorded.

3. Written with: 13:00pm, 24th of July, 2010, without DST status flag.
The adjusted time will be: 14:00pm, 24th of July, 2010, DST. DST switch event is recorded.

4, Written with: 13:00pm, 24th of July, 2010, with DST status flag.
The adjusted time will be: 13:00pm, 24th of July, 2010, DST. No event is recorded.

NOTE It's required to write the clock according the (1)、(4) method, because others may lead to mistakes.

4.5.4 Limitation of clock reset

The meter has limitation for clock reset. The limitation time could be configured and the default time is 60s. When the difference between the reset time (standard time) and current time(standard time) exceeds the limitation, meter clock will be considered as fault. The invalid rest signal and exceeds limitation signal will be displayed.

NOTE In the DST mode, wirting time must be with the DST status flag in order to guarantee the correctness。
When the DST is prohibited, wirting time with the DST status flag is invalid, the default inside the meter is .winter time.

4.6 Tariff

4.6.1 Tariff judgment

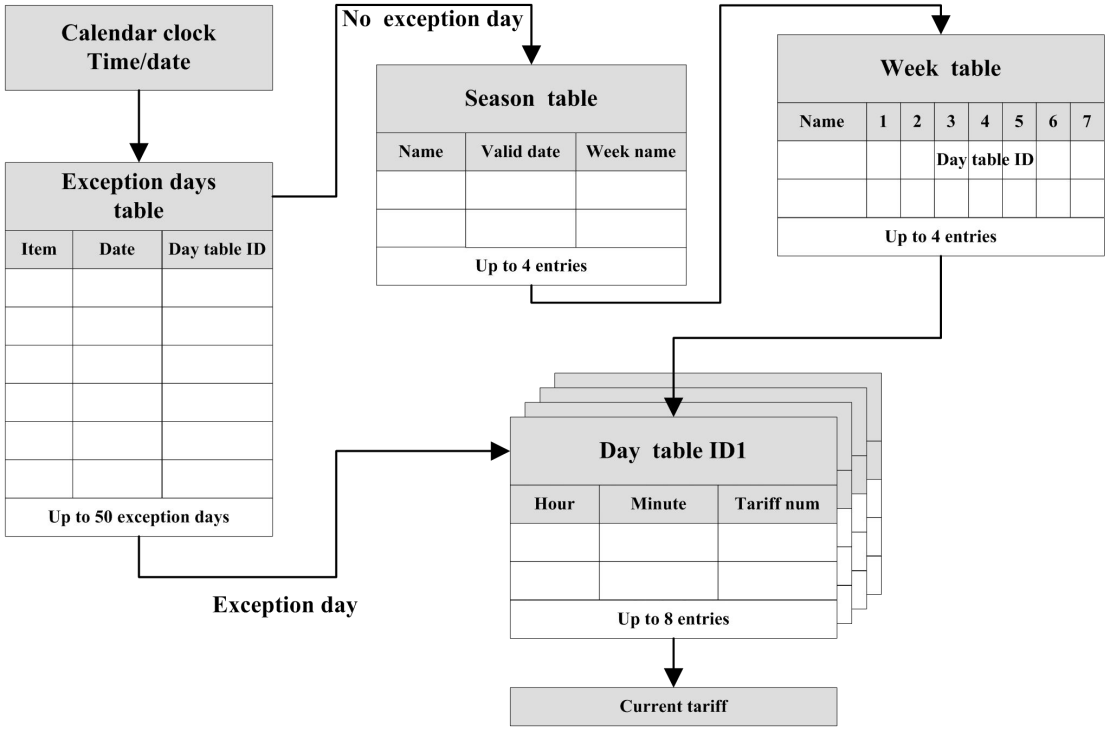


Fig 4.6.1.1 Sequence to determine day table effective

Inputs Current date and time.

Outputs Corresponding tariff number (1-4)

Exception day table

Exception days table is formed by item, date, and corresponding day table ID. The meter compares the date with the entries in the exception days table. If the date is included in the table, it is an exception day. The season table and week table will be skipped, the day table ID will be directly used.

Exception days are divided to two classes: appointed exception days and public exception days.

Appointed exception days are valid in appointed years and public exceptions are valid in every year.

The exception day table can contain up to 50 entries.

Season table

The season table contains season name, valid beginning date and week name. Meter determines whether the current date is belong to the season table. If it is, the corresponding week table name will be obtained.

Just valid beginning time is available in the season table. If the current date is between two valid beginning dates, it will be judged as

belong to the former season.

For example:

Spring 1st, March

Summer 1st, June

Autumn 1st, September

Winter 1st, December

If the current date is 1st, May, it will be judged belonging to Spring.

Up to 4 season tables could be set.

Week table

The week table defines the type of day valid in each case in lines for each day from Monday to Sunday. The week table name and day table ID form the week table. The meter compares the current date with the corresponding week table and then gets the day table ID.

Up to 4 week tables could be set.

Day table

The day table contains time (hour and minute) and tariff No. The meter compares the current time with the day table ID to get current tariff No.

Up to 8 day table could be set.

The day table could contain up to 8 entries.

4.6.2 Renewal of Passive Tariff

A passive calendar could be set with valid time. When the valid time comes, the passive calendar will be activated and replace the former main tariff.

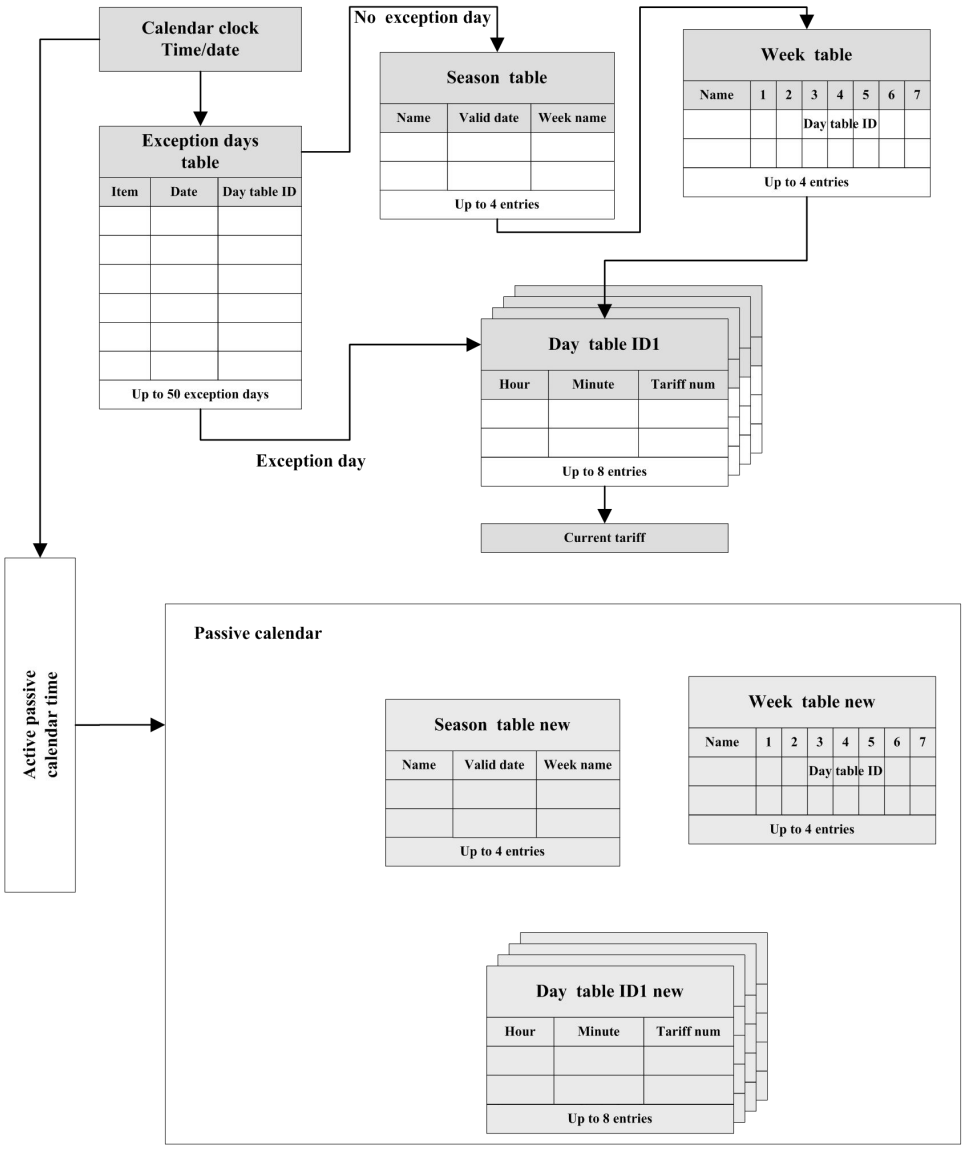


Fig 4.6.2.1 Block schematic before the passive tariff table is activated

If the valid time of the passive calendar is before current time, the passive calendar will be activated immediately after being set.

If the power grid is powered off leading the current time skips the valid time of passive calendar, the passive calendar will be activated immediately when power is on.

After the passive calendar is activated, the former passive calendar and activation time will be stored. But the mark of “To be activated” in meter will be cleared and the passive calendar will not be activated again.

An event of activation will be added to the event log after the activation of passive tariff table.

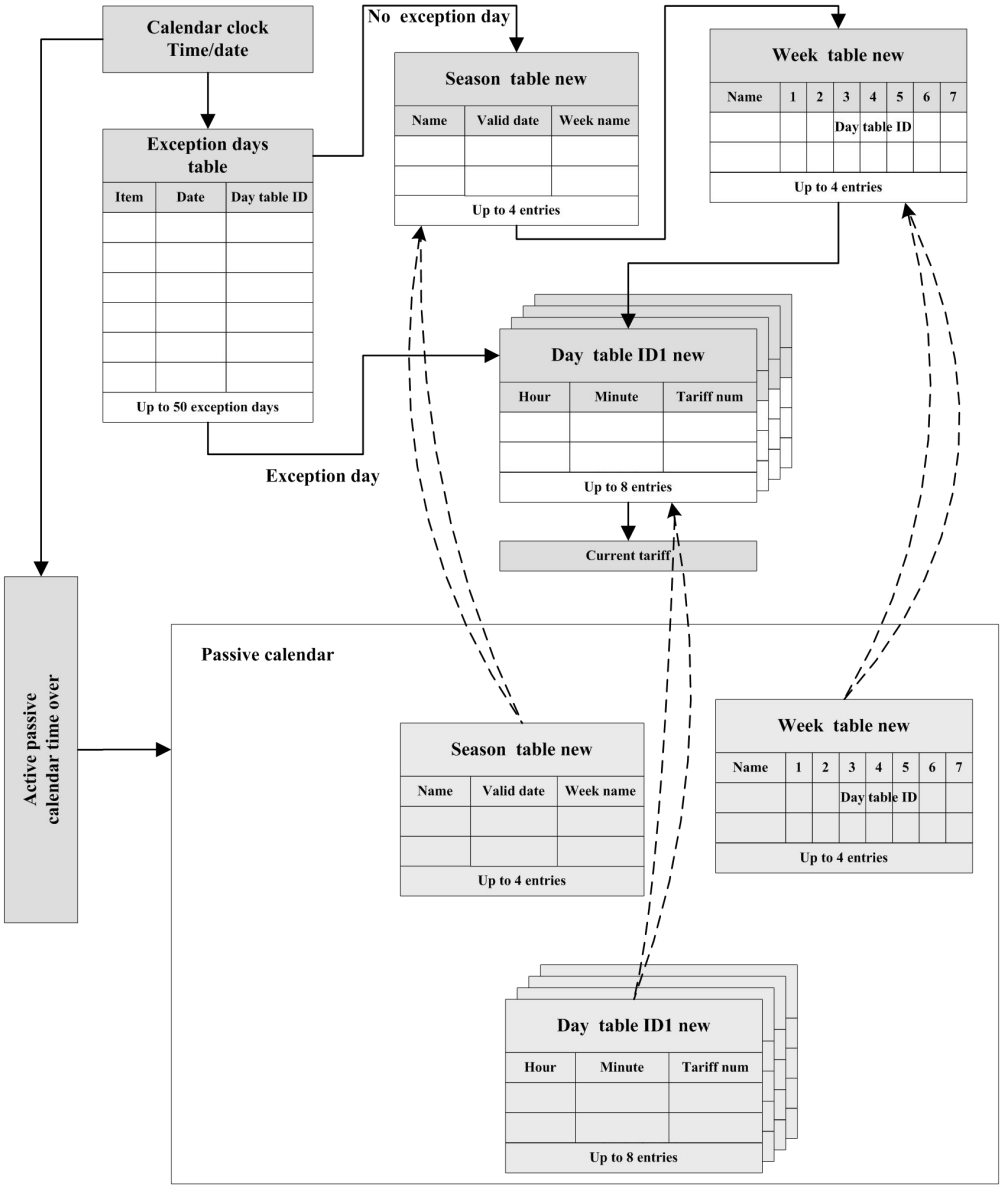


Fig 4.6.2.2 Block schematic after the passive tariff table is activated

4.6.3 Notes for Passive Tariff Configuration

NOTE

The following principles have to be comply with when configuring the passive tariff in remote communication

When configuring the main tariff, start from the name then configure other parameters.

When configuring the passive tariff, start from the name then configure other parameters.

When configuring the exception day table, start from the number if exception day, then configure other parameters

If the exception day table, main tariff or passive tariff are needed to modied, all the parameters have to be modified completely, it is not allowed to start from the middle parameter or mofidy partial parameters.

	Only the parameters of the passive tariff are completed, then the activation time can be set.

4.7 LCD display

4.7.1 Overview

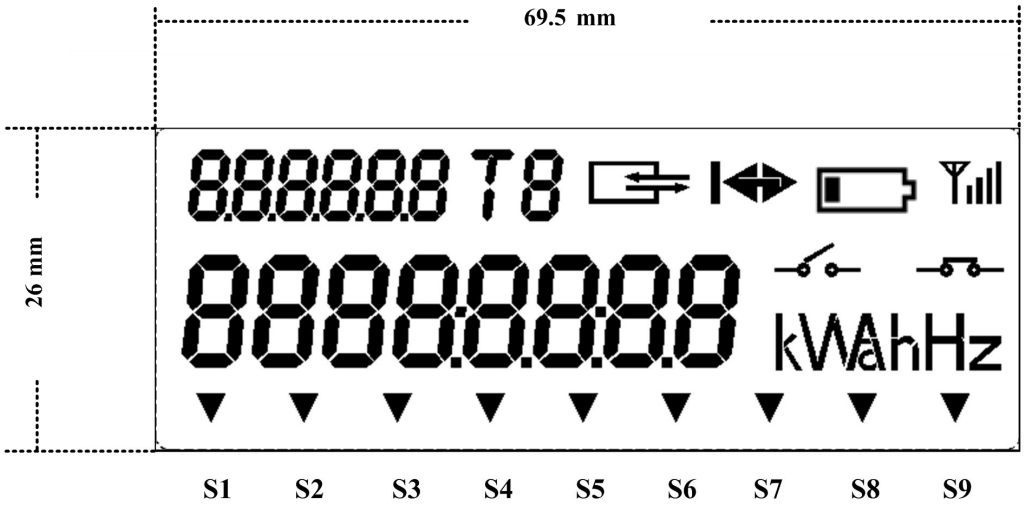


Fig 4.7.1.1 Basic layout of the liquid crystal display (LCD)

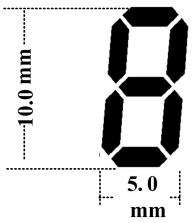


Fig 4.7.1.2 Dimension of displayed digit

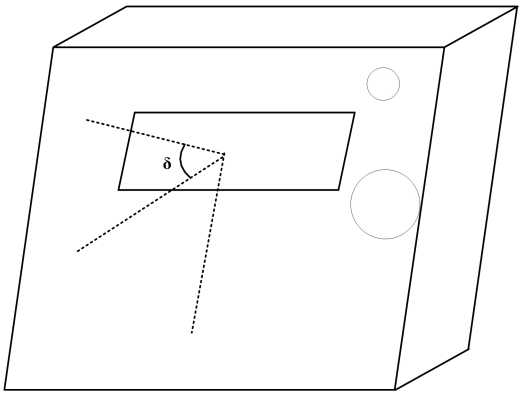


Fig 4.7.1.3 View angle

- Meter has a clear visibility with a range of view angle of 45°right down the LCD within one meter.
- The display is provided with background lighting for easy reading.

OBIS

 When the meter displays import active energy, the current display will be 1.8.0 . Letters are right aligned.

Current tariff No.

 If Tariff 1 is the current tariff, the display will be T1.

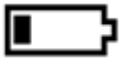
Communication indicator

 If the meter is using optical communication or RS-485 communication, the communication indicator will flash with a frequency of 1Hz.

Power direction indicator

 The arrow is right when the meter imports energy from power network. The arrow is left when the meter exports energy to power network. If there is no current, the indicator will not be showed.

Battery condition

 The indicator will flash with 1Hz frequency when the voltage of battery is low or battery life is almost over. The flash will disappear after the battery is replaced. The battery replacement process could be seen in 4.15.4.

GPRS signal indicator

 The indicator shows the GPRS signal degree. (The current meter doesn't use this indicator)

Value field

Up to 8-digit indices are displayed.

Disconnector status

 The indicator shows the current physical status of disconnector.

Unit field

 Different units can be shown: kWh, Hz, etc.

Other indicators

S1 S2 S3 S4 S5 S6 S7 S8 S9

- S1: It flashes after meter cover has been open.
- S2: The meter is in button display mode
- S3: Meter is in test display mode
- S4: PLC module is registed
- S5: The meter is in reactive mode.
- S6: The disconnector could be connected by pressing button manually.
- S7: Meter cover is open now or there is magnetic field which is over 0.5mT.
- S8: Grid have power.
- S9: The meter is in DST

4.7.2 Display mode

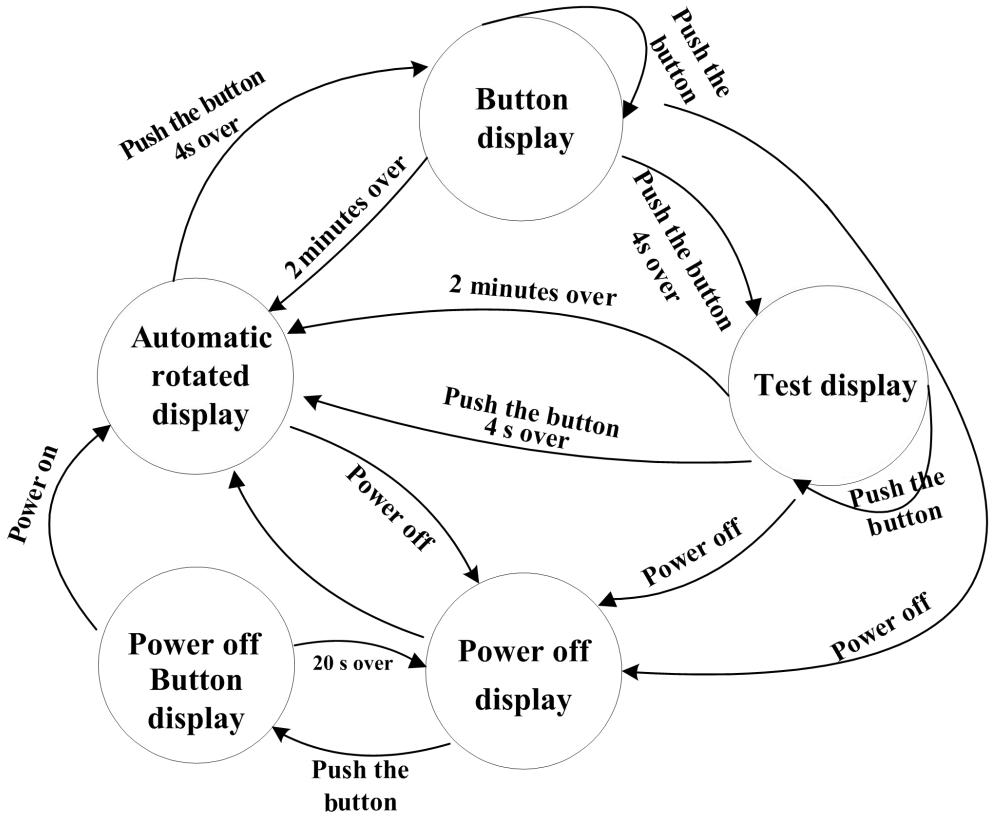


Fig 4.7.2.1 Diagram of switching display mode

- Five display modes are supported: automatic scrolling display, button display mode, test display mode, power off display mode and power off button display mode.
- Automatic scrolling display time, automatic scrolling display item, button display items, testing display item could be configured.
- Up to 60 display items could be set in automatic scrolling display table, button display table and testing display table
- Automatic scrolling display is the default display mode and it could be switched to button display mode through long push button over 4s. Meter can switch to test display mode from button display mode through long push button over 4s.The button display mode and test display mode will be switched to automatic scrolling display mode automatically if the button is not operated over 2 minutes,and the meter will display from the first automatic scrolling display item.
- The meter will be in automatic scrolling display mode if the button is not pressed . The default scrolling display interval is 10 seconds.
- The power off display mode could be switched to power off button display mode by pushing button when power down. Power off display mode use button display table.It will be returned to power off display mode if the button is not operated over 20 seconds.
- If the LCD is with backlit, button display mode and test display mode will light the

backlit

Figure 4.7.2.2 View of LCD with backlit on

4.7.3 Display item and display format

Automatic scrolling display item, button display item and testing display item could be configured. The display items and display formats are listed in the bellowing Fig.4.7.3.1

Fig 4.7.3.1 Display item and display format

Display OBIS	Display Item	Display Format	Example
15.8.0	Total active energy	xxxxxx.xx kWh	000000.00 kWh
15.8.1	Total active energy of tariff 1	xxxxxx.xx kWh	000000.00 kWh
15.8.2	Total active energy of tariff 2	xxxxxx.xx kWh	000000.00 kWh
15.8.3	Total active energy of tariff 3	xxxxxx.xx kWh	000000.00 kWh
15.8.4	Total active energy of tariff 4	xxxxxx.xx kWh	000000.00 kWh
1.8.0	Total forward active energy	xxxxxx.xx kWh	000000.00 kWh
1.8.1	Forward active energy of tariff 1	xxxxxx.xx kWh	000000.00 kWh
1.8.2	Forward active energy of tariff 2	xxxxxx.xx kWh	000000.00 kWh
1.8.3	Forward active energy of tariff 3	xxxxxx.xx kWh	000000.00 kWh
1.8.4	Forward active energy of tariff 4	xxxxxx.xx	000000.00 kWh

		kWh	
2.8.0	Total reverse active energy	xxxxxx.xx kWh	000000.00 kWh
2.8.1	Reverse active energy of tariff 1	xxxxxx.xx kWh	000000.00 kWh
2.8.2	Reverse active energy of tariff 2	xxxxxx.xx kWh	000000.00 kWh
2.8.3	Reverse active energy of tariff 3	xxxxxx.xx kWh	000000.00 kWh
2.8.4	Reverse active energy of tariff 4	xxxxxx.xx kWh	000000.00 kWh
3.8.0	Total forward reactive energy	xxxxxx.xx kvarh	000000.00 kvarh
3.8.1	Forward reactive energy of tariff 1	xxxxxx.xx kvarh	000000.00 kvarh
3.8.2	Forward reactive energy of tariff 2	xxxxxx.xx kvarh	000000.00 kvarh
3.8.3	Forward reactive energy of tariff 3	xxxxxx.xx kvarh	000000.00 kvarh
3.8.4	Forward reactive energy of tariff 4	xxxxxx.xx kvarh	000000.00 kvarh
4.8.0	Total reverse reactive energy	xxxxxx.xx kvarh	000000.00 kvarh
4.8.1	Reverse reactive energy of tariff 1	xxxxxx.xx kvarh	000000.00 kvarh
4.8.2	Reverse reactive energy of tariff 2	xxxxxx.xx kvarh	000000.00 kvarh
4.8.3	Reverse reactive energy of tariff 3	xxxxxx.xx kvarh	000000.00 kvarh
4.8.4	Reverse reactive energy of tariff 4	xxxxxx.xx kvarh	000000.00 kvarh
9.8.0	Total forward apparent energy	xxxxxx.xx kVAh	000000.00 kVAh
9.8.1	Forward apparent energy of tariff 1	xxxxxx.xx kVAh	000000.00 kVAh
9.8.2	Forward apparent energy of tariff 2	xxxxxx.xx kVAh	000000.00 kVAh
9.8.3	Forward apparent energy of tariff 3	xxxxxx.xx kVAh	000000.00 kVAh
9.8.4	Forward apparent energy of tariff 4	xxxxxx.xx kVAh	000000.00 kVAh
10.8.0	Total reverse apparent energy	xxxxxx.xx kVAh	000000.00 kVAh

10.8.1	Reverse apparent energy of tariff 1	xxxxxx.xx kVAh	000000.00 kVAh
10.8.2	Reverse apparent energy of tariff 2	xxxxxx.xx kVAh	000000.00 kVAh
10.8.3	Reverse apparent energy of tariff 3	xxxxxx.xx kVAh	000000.00 kVAh
10.8.4	Reverse apparent energy of tariff 4	xxxxxx.xx kVAh	000000.00 kVAh
1.6.0	Forward active M.D.	xxxxx.xxx kW	0.000 kW
1.6.0	Forward active M.D.occurrence time	Mmdd.hh:mm	0304.08:30
1.6.1	Forward active M.D.of tariff 1	xxxxx.xxx kW	0.000 kW
1.6.1	Forward active M.D.occurrence time of tariff 1	Mmdd.hh:mm	0304.08:30
1.6.2	Forward active M.D.of tariff 2	xxxxx.xxx kW	0.000 kW
1.6.2	Forward active M.D.occurrence time of tariff 2	Mmdd.hh:mm	0304.08:30
1.6.3	Forward active M.D.of tariff 3	xxxxx.xxx kW	0.000 kW
1.6.3	Forward active M.D.occurrence time of tariff 3	Mmdd.hh:mm	0304.08:30
1.6.4	Forward active M.D.of tariff 4	xxxxx.xxx kW	0.000 kW
1.6.4	Forward active M.D.occurrence time of tariff 4	Mmdd.hh:mm	0304.08:30
2.6.0	Reverse active M.D.	xxxxx.xxx kW	0.000 kW
2.6.0	Reverse active M.D.occurrence time	Mmdd.hh:mm	0304.08:30
2.6.1	Reverse active M.D.of tariff 1	xxxxx.xxx kW	0.000 kW
2.6.1	Reverse active M.D.occurrence time of tariff 1	Mmdd.hh:mm	0304.08:30
2.6.2	Reverse active M.D.of tariff 2	xxxxx.xxx kW	0.000 kW
2.6.2	Reverse active M.D.occurrence time of tariff 2	Mmdd.hh:mm	0304.08:30
2.6.3	Reverse active M.D.of tariff 3	xxxxx.xxx kW	0.000 kW
2.6.3	Reverse active M.D.occurrence time of tariff 3	Mmdd.hh:mm	0304.08:30
2.6.4	Reverse active M.D.of tariff 4	xxxxx.xxx kW	0.000 kW
2.6.4	Reverse active M.D.occurrence time of tariff 4	Mmdd.hh:mm	0304.08:30
3.6.0	Forward reactive M.D.	xxxxx.xxx kvar	0.000 kvar
3.6.0	Forward reactive M.D.occurrence time	Mmdd.hh:mm	0304.08:30
3.6.1	Forward reactive M.D.of tariff 1	xxxxx.xxx	0.000 kvar

		kvar	
3.6.1	Forward reactive M.D.occurrence time of tariff 1	Mmdd.hh:mm	0304.08:30
3.6.2	Forward reactive M.D.of tariff 2	xxxxx.xxx kvar	0.000 kvar
3.6.2	Forward reactive M.D.occurrence time of tariff 2	Mmdd.hh:mm	0304.08:30
3.6.3	Forward reactive M.D.of tariff 3	xxxxx.xxx kvar	0.000 kvar
3.6.3	Forward reactive M.D.occurrence time of tariff 3	Mmdd.hh:mm	0304.08:30
3.6.4	Forward reactive M.D.of tariff 4	xxxxx.xxx kvar	0.000 kvar
3.6.4	Forward reactive M.D.occurrence time of tariff 4	Mmdd.hh:mm	0304.08:30
4.6.0	Reverse reactive M.D.	xxxxx.xxx kvar	0.000 kvar
4.6.0	Reverse reactive M.D. occurrence time	Mmdd.hh:mm	0304.08:30
4.6.1	Reverse reactive M.D.of tariff 1	xxxxx.xxx kvar	0.000 kvar
4.6.1	Reverse reactive M.D. occurrence time of tariff 1	Mmdd.hh:mm	0304.08:30
4.6.2	Reverse reactive M.D.of tariff 2	xxxxx.xxx kvar	0.000 kvar
4.6.2	Reverse reactive M.D. occurrence time of tariff 2	Mmdd.hh:mm	0304.08:30
4.6.3	Reverse reactive M.D.of tariff 3	xxxxx.xxx kvar	0.000 kvar
4.6.3	Reverse reactive M.D. occurrence time of tariff 3	Mmdd.hh:mm	0304.08:30
4.6.4	Reverse reactive M.D.of tariff 4	xxxxx.xxx kvar	0.000 kvar
4.6.4	Reverse reactive M.D. occurrence time of tariff 4	Mmdd.hh:mm	0304.08:30
9.6.0	Forward apparent M.D.	xxxxx.xxx kVA	0.000 kVA
9.6.0	Forward apparent M.D. occurrence date	Mmdd.hh:mm	0304.08:30
9.6.1	Forward apparent M.D.of tariff 1	xxxxx.xxx kVA	0.000 kVA
9.6.1	Forward apparent M.D. occurrence date of tariff 1	Mmdd.hh:mm	0304.08:30

9.6.2	Forward apparent M.D.of tariff 2	xxxxx.xxx kVA	0.000 kVA
9.6.2	Forward apparent M.D. occurrence time of tariff 2	Mmdd.hh:mm	0304.08:30
9.6.3	Forward apparent M.D.of tariff 3	xxxxx.xxx kVA	0.000 kVA
9.6.3	Forward apparent M.D. occurrence date of tariff 3	Mmdd.hh:mm	0304.08:30
9.6.4	Forward apparent M.D.of tariff 4	xxxxx.xxx kVA	0.000 kVA
9.6.4	Forward apparent M.D. occurrence date of tariff 4	Mmdd.hh:mm	0304.08:30
10.6.0	Reverse apparent M.D.	xxxxx.xxx kVA	0.000 kVA
10.6.0	Reverse apparent M.D. occurrence time	Mmdd.hh:mm	0304.08:30
10.6.1	Reverse apparent M.D. of tariff 1	xxxxx.xxx kVA	0.000 kVA
10.6.1	Reverse apparent M.D. occurrence time of tariff 1	Mmdd.hh:mm	0304.08:30
10.6.2	Reverse apparent M.D. of tariff 2	xxxxx.xxx kVA	0.000 kVA
10.6.2	Reverse apparent M.D. occurrence time of tariff 2	Mmdd.hh:mm	0304.08:30
10.6.3	Reverse apparent M.D. of tariff 3	xxxxx.xxx kVA	0.000 kVA
10.6.3	Reverse apparent M.D. occurrence time of tariff 3	Mmdd.hh:mm	0304.08:30
10.6.4	Reverse apparent M.D. of tariff 4	xxxxx.xxx kVA	0.000 kVA
10.6.4	Reverse apparent M.D. occurrence time of tariff 4	Mmdd.hh:mm	0304.08:30
32.7.0	Voltage	xxx.xx V	230.00 V
31.7.0	Current	xxxxxx.xx A	10.00 A
21.7.0	Forward active power	xxxx.xxxx kW	2.3000 kW
22.7.0	Reverse active power	xxxx.xxxx kW	2.3000 kW
23.7.0	Forward reactive power	xxxx.xxxx kvar	2.3000 kvar
24.7.0	Reverse reactive power	xxxx.xxxx kvar	2.3000 kvar
29.7.0	Apparent power	xxxx.xxxx kVA	2.3000 kVA
33.7.0	Power factor	x.xxx	1.000

14.7.0	Frequency	xx.xx Hz	50.00Hz
0.9.1	Time	hh:mm:ss	14 : 23: 10
0.9.2	date	mm-dd-yy	08-08-12
C.6.1	Current battery remained engergy	x.xx	0.99
C.6.3	Current battery voltage	x.x V	3.5 V
97.97.0	Failed rigister	xxxxxxxx	00000000
C.1.0	E-meter serial number	xxxxxxxx	10023416
17.0.0	Threshold of current flow	xx.xx A/kW	80.00
96.3.10	Reason of relay disconnection	xx	6
	Full interface		

4.8 Power Quality Monitoring

Meter can monitor real-time power quality.

4.8.1 Grid power off monitoring

Event name	power off for a short time	power off for a long time
Event definition	When the working voltage Ux is lower than the grid power off threshold Udd, the duration time is more than or equal the delaying time Tdd, it is regarded as power off for a long time, otherwise it is power off for a short time	
Detection premise	Grid is normal (when the working voltage is higher than the grid power off threshold)	
Starting condition	the grid is power off (when the working voltage is lower than the grid power off threshold, Ux<Udd)	
Ending condition	Grid is normal (when the working voltage is higher than the grid power off threshold)	
Event parameter	power off threshold Udd Delaying time Tdd, default is 180 seconds, the configurable range is 3-65535)	
Record content	The number times of the power off for a short time The number times of the power off for a long time The power off occurring time and at that time the forward active energy register(refer to Chapter 4.10.11 Power Grid Power-off Special Events The power off ending time (refer to 4.10.4 Power Grid Events) The last 20 times of the ending time and duration period of the grid is power off for a long time	

4.8.2 Over –voltage and under-voltage Monitoring

Event name	Over-voltage
Event definition	The working voltage is higher than the overvotltage threshold Ugg and the duration time reaches the event duration time Td
Detection premise	The grid is normal

Starting condition	Ux>Ugg， The duration time reach Td
Ending condition	1．Ux≤Ugg, The duration time reaches Td
Event parameter	The overvoltage threshod is Ugg, default is 110%Un, and configurable range is 105%-200%. Due to working range is relatively wide for this meter, the overvoltage threshold value is configured as the voltage value instead of the proportional relationship, the range is 60V-480V The default duration time is 10 seconds; the configurable range is 3-65535.
Record content	-The overvoltage occurring time (refer to Chapter 4.10.4 Power Grid Events) -The overvoltage ending time (refer to Chapter 4.10.4 Power Grid Events)

Event name	Undervoltage
Event definition	The working voltage is lower than the overvotltage threshold Ugg and the duration time reaches the event duration time Td
Detection premise	The grid is normal
Starting condition	Ux<Ugd，The duration time reach Td
Ending condition	1．Ux≥Ugd，The duration time reach Td
Event parameter	Undervoltage threshold Ugd, the default is 91%Un and configurable range is 60%-95%。 Due to working range is relatively wide for this meter, the undervoltage threshold value is configured as the voltage value instead of the proportional relationship, the range is46V-480V. The default duration time is 10 seconds; the configurable range is 3-65535.
Record content	-The undervoltage occurring time (refer to Chapter 4.10.4 Power Grid Events) -The ending time (refer to Chapter 4.10.4 Power Grid Events)

4.9 Relay Control

4.9.1 Physical Features

- Connection and disconnection points
- Maximum contacting resistance: 100mΩ
- Maximum voltage: 250VAC
- Imax = 120A
- Maximum power:250VA
- Mechanical life span: 10000 times
- Electrical lifespan: 100000 times
- Maximum short-circuit current: 3000A/10ms
- The withstand voltage between relay connection terminal and other parts of the meter: 4000VAC 50/60Hz(1Min)

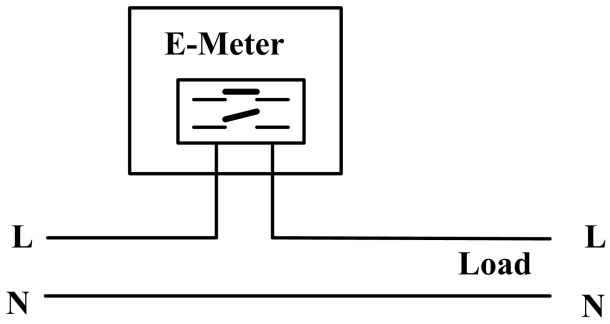


Figure.4.9.1.1 The internal relay load control connection diagram

4.9.2 Control Logic

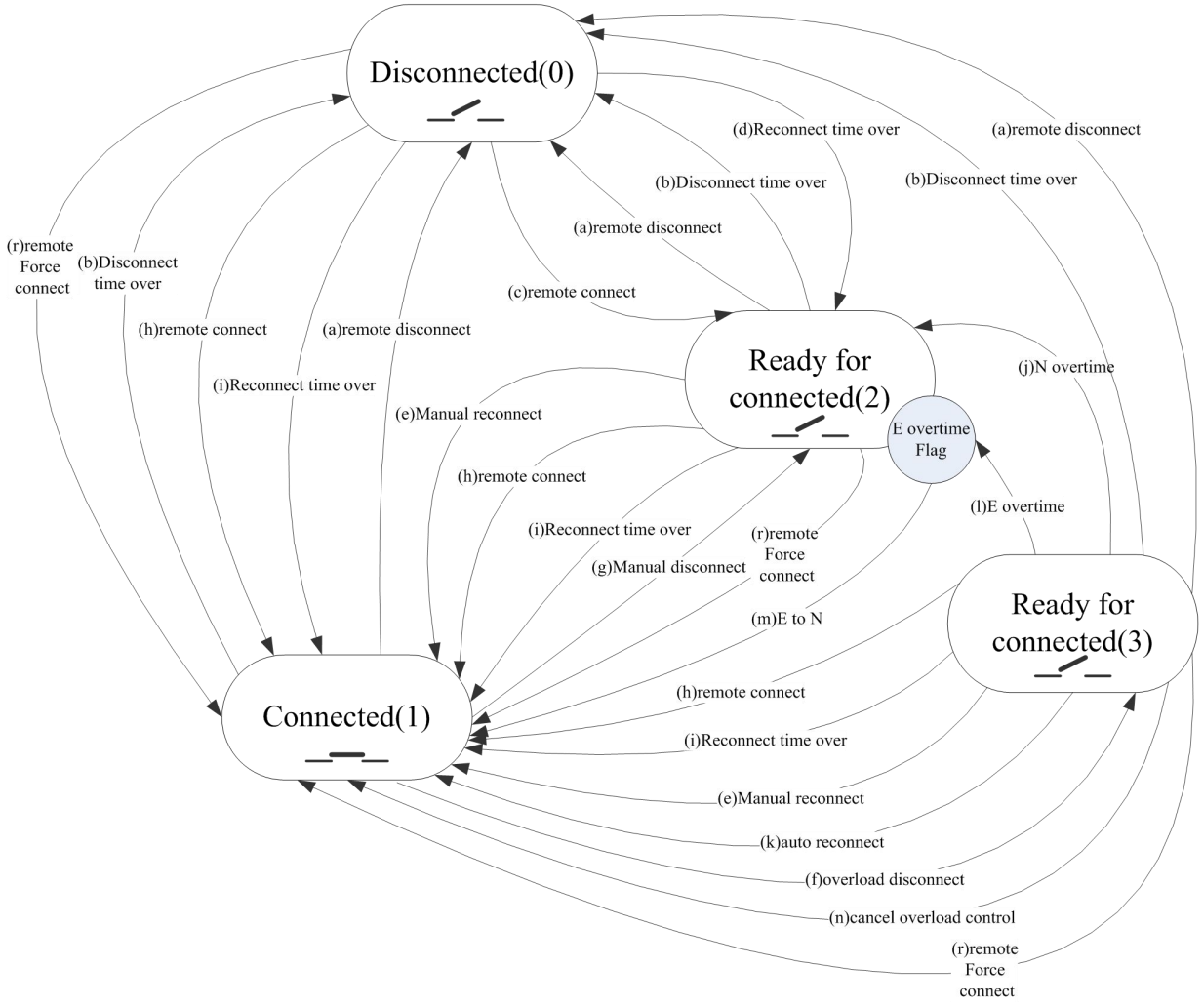


Fig 4.9.2.1 Diagram of relay control logic

Control status:

There are four statuses: disconnected (0), connected (1), ready for connected with lock (2), ready for connected (3).

- Disconnected (0): relay is under disconnected status. Relay is not permitted to execute any operation before receiving connection order from Master Station/PC software or it is designated time for connection.

- Connected (1): relay is under connected status.
- Ready for connected with lock (2): relay is under disconnected status. Relay won't connect automatically.
- Ready for connected (3): relay is under disconnected status. Disconnected by overcurrent, relay will connect automatically after a specific period.

- If Master Station sends command (a) remote disconnect, status will switch to disconnected (0), no matter which status is relay currently under. The physical status of relay is disconnected.
- If it is time for disconnection, which is configurable on meter, (b) disconnect time over will be executed. Status will switch to disconnected (0), no matter which status is relay currently under. The physical status of relay is disconnected.
- If Master Station sends order (c) remote connect, (c) or (h) will be executed based on current control mode.
- If it is time for connection, which is configurable on meter, (d) or (i) will be executed based on current control mode.
- If status is connected (1) and load is over threshold, (f) overload disconnect will be executed automatically and status will switch to ready for connected (3).
- If status is ready for connected with lock (2) or ready for connected (3), (e) manual reconnect can be executed through long press on key for 3 seconds, and status will switch to connect (1).
- If status is ready for connected (3), it can switch to connected (1) through the execution of (k) auto reconnect.
- Generally, (j) N overtime will be executed after specific times of overflow disconnection, then, status switches to ready for connect (2).
- In emergency, (1) E overtime will be executed after specific times of overflow disconnection, then, status switches to ready for connect (2), at the same time, E overtime flag will be set.
- If status is ready for connect (2) and there is E overtime flag, (m) E to N will be executed, when emergency switches to normal situation, then, status switches to connected (1).
- If the working mode permits, (g) manual disconnect can be executed through long press on key for 3 seconds, then, status switches to ready for connected with lock (2).
- If Master Station sends order（r）remote force connect, no matter which mode of relay,it will all to swift to the command Connect(1).

Control mode:

There are 4 modes: mode 1, mode2, mode 3, mode 4.

Mode 0: no operation can be executed, meter is under protection mode.

Mode 1: executable operations: a / b / c / d / e / f / g / j/ k / l / m / n/ r

Mode 2: executable operations: a / b / e / f / g / h / i / j/ k / l / m / n/ r

Mode 3: executable operations: a / b / c / d / e / f / j/ k / l / m / n/ r

Mode 4: executable operations: a / b / e / f / h / i / j/ k / l / m / n/ r

Power utilities can choose one of the four modes or switch from one mode to another

while in operation.

Overload judgement:

If current apparent power exceeds the valid overload threshold of (threshold active), the value of Roverload (a register used to store delay of overload) will increase itself by 1 per second; if current apparent power less than Threshold active, Roverload will decrease itself by 1 per second until 0. If the value of Rover exceeds period of delay which is configurable 1s~65535s, an overload event will be recorded, triggering disconnection of relay.

After executing of relay disconnection (relay control status is Disconnected), the process of overload judgment won't be executed

After executing of relay connection, Roverload will be reset and the process of overcurrent judgment will start over.

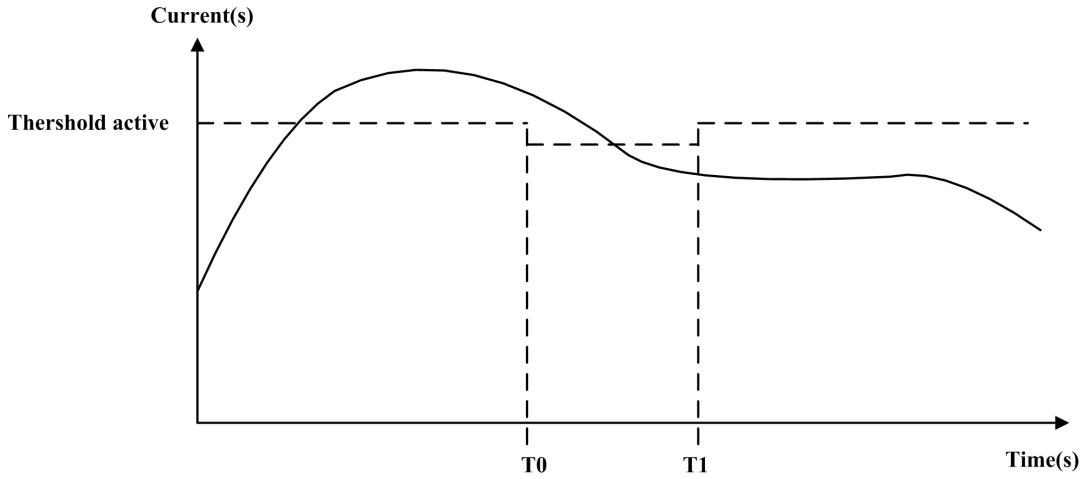


Fig 4.9.2.2 Overcurrent judgment

Meter can be configured with an emergency timetable. If current time is defined in the emergency timetable, threshold will switch automatically to the threshold in emergency. E.g., in Fig 4.9.2.2, at the time point T0, threshold switches to the threshold in emergency, at T1, it switches back.

Disposing power on after power off：

Relay disconnects automatically (non-power protection) after powering off, when meter powers on again, relay will reconnect randomly within 15s,this can be configurable from 10s to 60s (if relay is in the status of reconnection.)

4.9.3 Disconnector status judgment

The physical status is judged by whether there is power voltage in the rear-end of disconnector. If yes, the disconnector is considered as connecting. Otherwise it is considered as disconnecting.

NOTE The relay do not support physical status detection,the display status is according to the relay control status.

4.9.4 Malfunction judgment and handling

The meter checks the consistency of physical status of disconnector with the control status every 10 seconds. If the physical status of disconnector is checked out for 3 times that is not match with the control status, the malfunction sign and warning are to be set as well as the malfunction event is to be recorded.(Once the operation is successful, the malfunction sign will be cleaned, but the warning will be kept.).

If the two statuses are not match with each other every time, the meter will continue to execute disconnector operation until the physical status and the control status are matched with each other.

If the consistency between two statuses is happened after the malfunction occurred, the event of disconnector restoration will be recorded and malfunction sign will be cleaned, while the warning will be kept.

Example

- If the physical status of disconnector remains disconnected while it is supposed to be connected, the meter will check this situation every 10 seconds and repeat previous action. If inconsistency is checked out for 3 times, the malfunction sign and warning will be set as well as the event signal. But if the disconnector is disconnected before malfunction is detected, the control status will be switched to Disconnected (0), the meter will be not able to detect the malfunction of disconnector due to the consistency between physical status and control status.
- The overload check time should not be set less than 3 seconds avoiding judging abnormal current generated by connecting disconnector

4.9.5 Reasons of disconnecting disconnector

The meter provides a register to indicate the reason of disconnecting the disconnector.

Reason

00 The disconnetor is disconnected because the power is off
01 The meter receives the command to disconnect the disconnector.
02 The set time for disconnecting the disconnector is over.
03 The meter is overload
06 The disconnector is disconnected manually.
07 The reason is unknown.

Priority level

Reason 01 and 02 have the priority.
Reason 03 and 06 have the lower priority

Priority principle

In the same priority level, reasons will be indicated in time sequence.
If the reason with high priority level happens after the reason with lower priority level, the former will be indicated first.
If the disconnector recover from disconnect with high priority reasons

(such as the meter receives the command to connect the disconnector, the connecting time is over or the credit is recharged), but the disconnector stays in Ready for connected, then the reason 07 will be indicated. The disconnector could be connected manually.

4.10 Event log

The meter is able to record a large quantity of events, which comprise 13 different types of events. The event type, corresponding record format, event code, judge method and record capacity could be seen in the later description.

4.10.1 Standard events recording

No special characteristics are declared in this kind of events.

Record format: even code and occurring time.

Up to 200 standard events can be recorded

Table **4.10.1.1 Standard events recording**

Code	Corresponding event	Judgment
3	The time in meter is switched to DST	The meter switches to DST automatically and the time before switch is recorded. See detail in 4.5.2
4	The clock is modified-according to the time before modification	Clock is modified through remote communication
5	The clock is modified-according to the time after modification	Clock is modified through remote communication
6	Malfunction happens in clock	The RTC exists hardware fault or exception happens in the current clock
7	The battery needs to be replaced	The battery voltage is lower than 3V or the remaining power is less than 20%
9	Passive tariff activated	Passive calendar time over
11	Warning register cleared	Clearing the fault register
14	Fault register cleared	The non-volatile register is checked every hour or the grid is power on
15	Exception reset	The meter doesn’t deal with power off correctly
16	Measuring unit fault	Measured quantities are not reported more than 5s or incorrect values being recorded in 3 seconds running.
17	Upgrading program ready	Confirmation of firmware upgrade, see details in chapter 4.16
18	Firmware upgrade finished	Firmware upgrade being finished, see details in chapter 4.16
20	Disconnector malfunction	Disconnector malfunction, see details in chapter 4.9

21	Disconnector restoration	Disconnector restoration, see details in chapter 4.9
22	DST is enabled	DST is switched from forbidden status to enabled status.
23	DST is forbidden	DST is switched from enabled status to forbidden status

4.10.2 Tampering

These are electricity tampering related events, the record format of which is event code plus occurrence time. Up to 200 pieces of events can be recorded.

Table 4.10.2.1 Tampering events

Code	Event type	Judgment standard
40	Terminal cover open	Status of terminal cover from close to open
41	Terminal cover close	Status of terminal cover from open to close
42	Start of strong magnetic field	Strong magnetic field appears
43	End of strong magnetic field	Strong magnetic field disappears
44	Meter cover open	Status of meter cover from close to open
45	Meter cover close	Status of meter cover from open to close
46	Multiple errors of communication key	If access with wrong key is detected for consecutive 3 times, communication will be forbidden lasting 3 minutes, communication will re-open after 3minutes.
47	Module cover open	Status of communication module cover from close to open
48	Module cover close	Status of communication module cover from open to close.
49	Grounding error start	Grounding error appears.If the transparent power of life line or neutral line loop is more than 10% nominal power, meanwhile difference of power between two loop is more than 10%, it is judged as grounding error. The detecting time of grounding error is same as current reverse.
50	Grounding error end	From grounding error starting to end

4.10.3 Relay Control Events

These are relay control related events, the record format of which is event code plus occurrence time plus overcurrent threshold. Up to 200 pieces of events can be recorded.

Table 4.10.3.1 Relay control events

Code	Event type	Judgment standard
60	Manual disconnection	Execution of (g) manual disconnect
61	Manual connection	Execution of (e) manual reconnect
62	Remote disconnection	Execution of (a) remote disconnect or (b) disconnect time over
63	Remote connection	Execution of (c) or (h) remote connect or (d) (i) Reconnect time over
64	Overpower disconnection	Execution of (f) overload disconnect
65	automatical connection after overpower disconnection	Execution of (k)auto reconnect
66	Remotely force to connect relay	Execution (n)remote force connect

NOTE Note: Only those operations which are actually executed by meter will be recorded. If master station sends a remote disconnect order again when meter relay is under the status of Disconnected (0), meter will receive the order, but it will not execute "(a)remote disconnect" again, namely the event will not be recorded. For details of relay's control logic please refer to chapter 4.9.2

4.10.4 Power Grid Events

These are power grid related events, the record format of which is event code plus occurrence time. Up to 200 pieces of events can be recorded.

Table 4.10.4.1 Power grid events

Code	Event type	Judgment standard
75	Power-off of power grid	Power-off of power grid
76	Power-on of power grid	Power-on of power grid
78	Start of current reversal	Current from forward to reverse, detection time is configurable
79	End of current reversal	Current from reverse to forward, detection time is configurable
86	Start of under-voltage	Voltage from normal to under-voltage, for details please refer to chapter 4.8
87	End of under-voltage	Voltage from under-voltage to normal, for details please refer to chapter 4.8
94	Start of overvoltage	Voltage from normal to overvoltage, for details please refer to chapter 4.8
95	End of overvoltage	Voltage from overvoltage to normal, for details please refer to chapter 4.8

4.10.5 Power Grid Long Time Power-off Events

Long time power-off events are recorded separately, the record format of which is end time of long power off plus duration of power-off. Up to 20 pieces of events can be recorded.

Table 4.10.5.1 power grid events

Code	Event name	Judgment standard
	Long power-off	Duration of power-off is longer than period of judgment, for details please refer to chapter 4.8.1

4.10.6 Strong Magnetic Field Events

These events record occurrence of strong magnetic field, the record format of which is occurrence time plus total forward active energy. Up to 20 pieces of events can be recorded.

Table 4.10.6.1 strong magnetic field events

Code	Event name	Judgment standard
	Strong magnetic field	Strong magnetic field is detected, threshold: 0.5mT.

4.10.7 Meter Cover Opening Events

These events record meter cover opening, the record format of which is occurrence time plus total forward active energy. Up to 20 pieces of events can be recorded

Table 4.10.7.1 meter cover opening events

Code	Event name	Judgment standard
	Meter cover opening	Meter is detected from meter cover opening to meter cover closing

4.10.8 Terminal Cover Opening Events

These events record terminal cover open, the record format of which is occurrence time plus total forward active energy. Up to 20 pieces of events can be recorded.

Table 4.10.8.1 terminal cover opening events

Code	Event name	Judgment standard
	Terminal cover opening	Meter is detected from terminal cover opening to terminal cover closing

4.10.9 Current Reversal Events

These events record current reversal, the record format of which is occurrence time plus total forward active energy. Up to 20 pieces of events can be recorded.

Table 4.10.9.1 current reversal events

Code	Event name	Judgment standard
	Current reversal	Meter is detected from normal to current

		reversal (neither life line loop nor neutral line loop current reversal is regarded as current reversal)

4.10.10 Meter Reprogramming Special Events

These events record meter reprogramming, the record format of which is occurrence time plus total forward active energy. Up to 20 pieces of events can be recorded.

Table 4.10.10.1 meter reprogramming events

Code	Event name	Judgment standard
	Meter reprogramming	Meter is reprogrammed; programming within 6 seconds is recorded as one programming event; clearance of warning register and events is not recorded as programming events; if last programming of consecutive programming is clearance of warning register, they will not be recorded as programming events.

4.10.11 Power Grid Power-off Special Events

These events record power-off of power grid, the record format of which is occurrence time plus total forward active energy. Up to 20 pieces of events can be recorded.

Table 4.10.11.1 power grid power-off events

Code	Event name	Judgment standard
	Power-off of power grid	Power-off of power grid

4.10.12 Bypass Special Event

This event records the bypass.

The recording format are event occurring time and at that time the forward active energy consumption.

At most record 20 piecs.

Figure 4.10.12.1 Bypass special event table

Code	Event name	criterion
	Bypass	Current measured in live line exceeds the current measured in neutral line exceeds 10% and the configured detection interval(the time can be configured), it is regarded as the bypass special event

4.10.13 Optical visit event

Optical visit event will be recorded.

Record format: occurring time, whether communication is successful.

Up to 200 such events could be recorded.

Table 4.10.13.1 Optical visit event

Code	Corresponding event	Judgment standard
	Optical communication	An optical communication event will be recorded, if the meter optical port receives a handshake frame. If it doesn't pass the authentication, it is recorded as unsuccessful visit. If it pass the authentication (HLS), it is considered as successful visit. The time of disconnecting visit will be recorded as time of event.

4.10.14 Failure event analysis

- If two events of same type occur within 1 second, the two events will be considered as occurring in the same time. The table will record from small to large. This situation will lead deviation in record and should be paid attention to.
  For example, the terminal cover is opened immediately after it is closed. In the tampering events log, the terminal close event will be recorded before the terminal open is recorded, but the recorded order is reverse as the two events occur at the same time.
- An event will be recorded 1 second later after it is judged. If power grid is power off during this period, the event will be judged but not be recorded.
  For example, if under voltage event is detected before power off, there will be an under voltage ending event not under voltage beginning event in the events log after the grid is power on

4.11 Load record

4.11.1 Load record description

Up to 8 load record channels could be set in this meter, and the total storage capacity is 1638400 bytes. Storage capacity of every load record channel could be configured according to customers' demand. Power supply company could configure the start address, bytes, capture cycle (1 minute~1440 minutes are optional) and capture objects. See table 4.13.1.

Table 4.11.1 capture objects and the bytes

capture objects	bytes
time	7
AMR status word of current meter	1
Total active energy	6
Total tariff 1 active energy	6
Total tariff 2 active energy	6

Total tariff 3 active energy	6
Total tariff 4 active energy	6
Forward active energy	6
Forward tariff 1 active energy	6
Forward tariff 2 active energy	6
Forward tariff 3 active energy	6
Forward tariff 4 active energy	6
Reverse active energy	6
Reverse tariff 1 active energy	6
Reverse tariff 2 active energy	6
Reverse tariff 3 active energy	6
Reverse tariff 4 active energy	6
Forward reactive energy	6
Forward tariff 1 reactive energy	6
Forward tariff 2 reactive energy	6
Forward tariff 3 reactive energy	6
Forward tariff 4 reactive energy	6
Reverse reactive energy	6
Reverse tariff 1 reactive energy	6
Reverse tariff 2 reactive energy	6
Reverse tariff 3 reactive energy	6
Reverse tariff 4 reactive energy	6
Total apparent energy	6
Total tariff 1 apparent energy	6
Total tariff 2 apparent energy	6
Total tariff 3 apparent energy	6
Total tariff 4 apparent energy	6
Quadrant I reactive engergy	6
Quadrant I reactive energy of tariff 1	6
Quadrant I reactive energy of tariff 2	6
Quadrant I reactive energy of tariff 3	6
Quadrant I reactive energy of tariff 4	6
Quadrant II reactive engergy	6
Quadrant II reactive energy of tariff 1	6
Quadrant II reactive energy of tariff 2	6
Quadrant II reactive energy of tariff 3	6
Quadrant II reactive energy of tariff 4	6
Quadrant III reactive engergy	6
Quadrant III reactive energy of tariff 1	6
Quadrant III reactive energy of tariff 2	6
Quadrant III reactive energy of tariff 3	6
Quadrant III reactive energy of tariff 4	6
Quadrant IV reactive engergy	6

Quadrant IV reactive energy of tariff 1	6
Quadrant IV reactive energy of tariff 2	6
Quadrant IV reactive energy of tariff 3	6
Quadrant IV reactive energy of tariff 4	6
Mean value of voltage	2
Minimum value of voltage	2
Maximum value of voltage	2
Mean value of current	2
Minimum value of current	2
Maximum value of current	2
Mean value of forward active power	2
Minimum value of forward active power	2
Maximum value of forward active power	2
Mean value of reverse active power	2
Minimum value of reverse active power	2
Maximum value of reverse active power	2
Mean value of forward reactive power	2
Minimum value of forward reactive power	2
Maximum value of forward reactive power	2
Mean value of reverse reactive power	2
Minimum value of reverse reactive power	2
Maximum value of reverse reactive power	2
Mean value of power frequency	2
Minimum value of power frequency	2
Maximum value of power frequency	2
Mean value of power factor	2
Minimum value of power factor	2
Maximum value of power factor	2
Mean value of reactive power in quadrant I	2
Mean value of reactive power in quadrant II	2
Mean value of reactive power in quadrant III	2
Mean value of reactive power in quadrant IV	2

User can use supporting PC software to read maximum number of recordings of each channel after the configuration of capture objects.

Example:

If storage capacity of channel 1 is configured with 21840 bytes and capture objects are time and forward active energy, each recording needs 13 bytes, thus, up to 1680 recordings can be kept.

NOTE If power is off during recording period, above value will lose, after powering on, they will be re-calculated. If capture interval time is 10min, from first to fifth min power off, power on at sixth minutes, then the data

	which is captured at tenth minute is from sixth to tenth minute. The first capture objects of the fixed configuration is the time for communication retrieve

4.11.2 Analysis of Failure

- Recording of load is executed only at the exact setting time point, it will not record if meter passes the recording time. E.g., if capture period of channel 1 is 1440 min (1 day), recording is executed at 00:00:00 each day. If it is power-off at that point, recording will not be executed after power-on, thus, recording of that day is lost in the load profile.

4.12 Billing

4.12.1 Billing Logic

Meter can store the latest 13 history billing data.

Billing date and time is configurable for power utilities which are selectable from the 1st 00:00:00 to 28th 23:00:00 of each month.

Billing is performed as below situations:

- Current time is the exactly billing time;
- Current time is bigger than billing time, while date is one month bigger than last billing time or jumping the billing time;
- Current time is smaller than billing time, while date is one month bigger than last billing time

To ensure that history bills are always process in time, billing will be judged in following situations.

- Power-on;
- Integral hour of clock;
- Modification of meter clock;
- Modification of billing date and time.

4.12.2 Billing Objects

Billing objects are fixed and cannot be modified by software. For details of billing objects please refer to table 4.12.2.1.

Table 4.12.2.1 settlement object

Capture object	Data type
Time	time_date
AMI status	Unsigned
Total active energy import	double-long-unsigned
Active energy import T1	double-long-unsigned
Active energy import T2	double-long-unsigned
Active energy import T3	double-long-unsigned
Active energy import T4	double-long-unsigned
Total reactive energy import	double-long-unsigned
Reactive energy import T1	double-long-unsigned
Reactive energy import T2	double-long-unsigned

Reactive energy import T3	double-long-unsigned
Reactive energy import T4	double-long-unsigned
Total active energy export	double-long-unsigned
Active energy export T1	double-long-unsigned
Active energy export T2	double-long-unsigned
Active energy export T3	double-long-unsigned
Active energy export T4	double-long-unsigned
Total reactive energy export	double-long-unsigned
Reactive energy export T1	double-long-unsigned
Reactive energy export T2	double-long-unsigned
Reactive energy export T3	double-long-unsigned
Reactive energy export T4	double-long-unsigned
Total apparent energy import	double-long-unsigned
Apparent energy import T1	double-long-unsigned
Apparent energy import T2	double-long-unsigned
Apparent energy import T3	double-long-unsigned
Apparent energy import T4	double-long-unsigned
Total apparent energy export	double-long-unsigned
Apparent energy export T1	double-long-unsigned
Apparent energy export T2	double-long-unsigned
Apparent energy export T3	double-long-unsigned
Apparent energy export T4	double-long-unsigned
Total reactive energy 1st quadrant	double-long-unsigned
Reactive energy T1 1st quadrant	double-long-unsigned
Reactive energy T2 1st quadrant	double-long-unsigned
Reactive energy T3 1st quadrant	double-long-unsigned
Reactive energy T4 1st quadrant	double-long-unsigned
Total reactive energy 2nd quadrant	double-long-unsigned
Reactive energy T1 2nd quadrant	double-long-unsigned
Reactive energy T2 2nd quadrant	double-long-unsigned
Reactive energy T3 2nd quadrant	double-long-unsigned
Reactive energy T4 2nd quadrant	double-long-unsigned
Total reactive energy 3rd quadrant	double-long-unsigned
Reactive energy T1 3rd quadrant	double-long-unsigned
Reactive energy T2 3rd quadrant	double-long-unsigned
Reactive energy T3 3rd quadrant	double-long-unsigned
Reactive energy T4 3rd quadrant	double-long-unsigned
Total reactive energy 4th quadrant	double-long-unsigned
Reactive energy T1 4th quadrant	double-long-unsigned
Reactive energy T2 4th quadrant	double-long-unsigned
Reactive energy T3 4th quadrant	double-long-unsigned
Reactive energy T4 4th quadrant	double-long-unsigned
Total active energy	double-long-unsigned

Total active energy of tariff 1	double-long-unsigned
Total active energy of tariff 2	double-long-unsigned
Total active energy of tariff 3	double-long-unsigned
Total active energy of tariff4	double-long-unsigned
Forward active M.D.	BCD8
Forward active M.D. of tariff 1	BCD8
Forward active M.D. of tariff 2	BCD8
Forward active M.D. of tariff 3	BCD8
Forward active M.D. of tariff 4	BCD8
Forward reactive M.D.	BCD8
Forward reactive M.D. of tariff 1	BCD8
Forward reactive M.D. of tariff 2	BCD8
Forward reactive M.D. of tariff 3	BCD8
Forward reactive M.D. of tariff 4	BCD8
Reverse active M.D.	BCD8
Reverse active M.D. of tariff 1	BCD8
Reverse active M.D. of tariff 2	BCD8
Reverse active M.D. of tariff 3	BCD8
Reverse active M.D. of tariff 4	BCD8
Reverse reactive M.D.	BCD8
Reverse reactive M.D. of tariff 1	BCD8
Reverse reactive M.D. of tariff 2	BCD8
Reverse reactive M.D. of tariff 3	BCD8
Reverse reactive M.D. of tariff 4	BCD8
Forward apparent M.D.	BCD8
Forward apparent M.D. of tariff 1	BCD8
Forward apparent M.D. of tariff 2	BCD8
Forward apparent M.D. of tariff 3	BCD8
Forward apparent M.D. of tariff 4	BCD8
Reverse apparent M.D.	BCD8
Reverse apparent M.D. of tariff 1	BCD8
Reverse apparent M.D. of tariff 2	BCD8
Reverse apparent M.D. of tariff 3	BCD8
Reverse apparent M.D. of tariff 4	BCD8
Monthly mean power factor	long-unsigned
Monthly mean power factor of tariff 1	long-unsigned
Monthly mean power factor of tariff 2	long-unsigned
Monthly mean power factor of tariff 3	long-unsigned
Monthly mean power factor of tariff 4	long-unsigned

NOTE

time_date is time and date data tye.
Double-long-unsigned is unsigned 32-digit integer data type.
BCD8 is 8-digit BCD code, format: 0D 08 xx xx xx yy yy yy yy yy, of which xx xx xx is demand value, yy yy yy yy yy is demand occurrence time.

4.13 Optical Communication

4.13.1 Physical Features

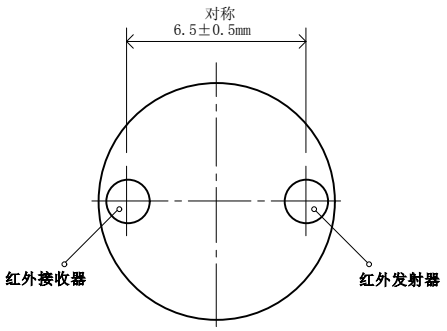


Fig 4.13.1.1 Front view of optical port

- In compliance with IEC62056-21 optical communication physical interface standard.
- Wave length of signal: 900nm~1000nm (infrared)
- Optical transmitting valve:
  - Luminescent (logic level is 0): 500μW/cm2≤Ee/T≤5000μW/cm2
  - Non-luminous (logic level is 1): Ee/T≤10μW/cm2
- Optical receiving tube:
  - Optical signal received (logic level is 0): $E_{e/R}$≥200μW/cm2
  - Optical signal not received (logic level is 1): $E_{e/R}$≤20μW/cm2

    Note:$E_{e/R}$ is signal radiation intensity of 1cm under reference plane.
- For installation location of this interface please refer to chapter 3.

A screw hole is on the meter for fixing the optical port and improving the communication stability, the screw hole is as Figure 4.13.1.2 and Figure 4.13.1.3

Figure 4.13.1.2 IEC1107 Optical interface

Figure 4.13.1.3 IEC1107 Optica interface with opticl communication port

4.13.2 Communication Protocol

IEC62056-21 E mode communication protocol has been applied. It has following characteristics.

- Standby: 300bps, communication after handshake: 9600bps;
- Advanced ID authentication: HLS;
- Authentication encryption method5(GMAC)
- Data communication with encryption and authentication
- Support for low-level authentication(LLS), only read, without encryption and authentication, password length is 8 bytes
- Data length of each frame doesn't exceed 255 bytes;
- Logic long name: LN;
- Supporting for reading through communication;
- Supporting for setting through communication;
- Supporting for method operation;
- Supporting for reading and writing of data block;
- Supporting for reading by time interval.
- Supporting for DLMS protocol V06

In compliance with following communication protocols:

- IEC62056-21
- IEC62056-46
- IEC62056-62
- IEC62056-61

For detailed communication data items and format please consulate engineer of Hexing Co. or refer to “Communication ID for HXE110.xls”

4.13.3 Parameter configuration

There are following two working parameter can be configured for the optical communication interface

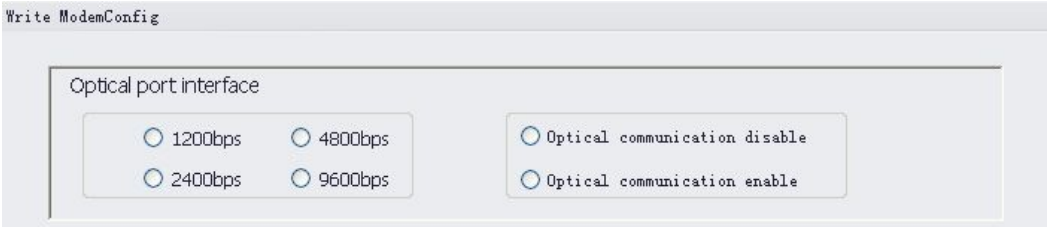


Figure 4.13.3.1 The PC software interface of the optica port working parameter

（1）The communication baud rate can be configured as 1200bps or 2400bps or 4800bps or 9600bps

（2）Optical interface can be configured to enable or prohibit. In some applications, by prohibit optical communication interface can realize maximum security

CAUTION Please carefully choose to prohibit the optical interface. Once the parameter configuration takes effect, electric meter can only enable it to work through the following three ways:

1. Through the RS - 485 communication interface;
2. Through the remote communication;
3. The meter is returned back to the factory for maintenance;

The special requirements, Hexing don't open the authoration to configure the function without expecial requirement.

4.14 RS-485 Communication

4.14.1 Physical Characteristics

（1）Comply with EIA - 485 standard of twisted-pair cable specifications.

（2）The maximum baud rate can reach 9600bps

（3）With polarity, it must connect the A and B correctly for communication, the specific terminal can refer to user manual for installation and maintence.

（4）The maximum number of meter that the RS485 bus can be connected is 32 piecies, if need more large capacity, it can be achieved via RS485 repeater

4.14.2 Communication protocol

- DLMS communication protocol has been applied. It has following characteristics.

- Standby: 300bps, communication after handshake: 9600bps;
- Advanced ID authentication: HLS;
- Authentication encryption method5(GMAC)
- Data communication with encryption and authentication
- Support for low-level authentication(LLS), only read, without encryption and authentication, password length is 8 bytes
- Data length of each frame doesn't exceed 255 bytes;
- Logic long name: LN;
- Supporting for reading through communication;
- Supporting for setting through communication;
- Supporting for method operation;
- Supporting for reading and writing of data block;
- Supporting for reading by time interval.
- Supporting for DLMS protocol V06
- In compliance with following communication protocols:
- IEC62056-21
- IEC62056-46
- IEC62056-62
- IEC62056-61

For detailed communication data items and format please consulate engineer of Hexing Co.Ltd

NOTE The RS485 communication interface can be customized for clients. According to customer's actual application, it can realize various functions, such as the extension of reading gas meter, water meter, etc It also can be used for extension external remote communication module

4.14.3 Parameter configuration

RS485 has following working configuration

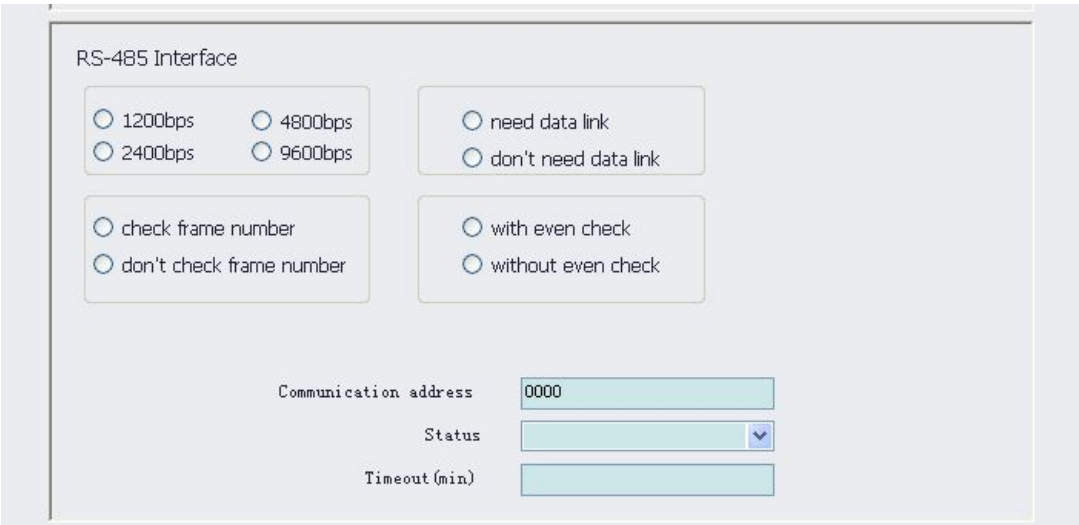


Figure.4.14.3.1 The PC software interface of the RS485 working configuration

（1）The communication baud rate can be configured as 1200bps、2400bps、4800bps or 9600bps

（2）The link layer linking can be enabled. It must be linked or do not need to link. When do not need to link, it can simplify the process of communication

（3）In HDLC frame number efficacy can enable. It must frame efficacy or don't need to frame efficacy.

NOTE	When the RS - 485 interface is used to expand external remote communication module, it do not need to link layer linking and do not need to frame a charm. Because of external communication module usually don't use the DLMS in HDLC protocol, and the link layer linking and frame number efficay have DLMS in HDLC protocol.

（4）Byte even efficacy can enable. It can enable or prohibit the even efficacy for supportting the different external communication requirements.

（5）Communication address is the communication of theDLMS and HDLC protocol. The range is 0001~3FFD。

（6）Regestration status. The meter has two statuses, one is the new meter the other is regerstrated.

（7）Not visit timeout after registration. If the time is out, the meter will automatically return to new meter status. If the tiem is configured as zero, the timeout function is null.

NOTE	The registration mechanism of the RS-485 communication can consult with DLMS Association or the supportive staff of Hexing

4.15 Plug in Communication Module

Meter supports for one plug-in communication module. For installation location of this module please refers to Chapter 3 “Mechanism Structure”. Hexing will develop many modules to satify the power utilities’ requirements including GSM/GPRS module, PLC module etc.

The interface protocol between the meter and module is DLMS HDLC, also complys with following enterprise standard:

“The hardware interface standard of Hexing communication module and energy meter”

“The interface protocol standard between Hexing communication module and energy meter:

If the customers want to customize the communication module, they can consult with Hexing Technical engineer to acquire very detailed designing information so that the module can match with the meter perfectly.

4.15.1 GPRS Communciation module

4.15.1.1 Overview

Model：MGB1-HX3806

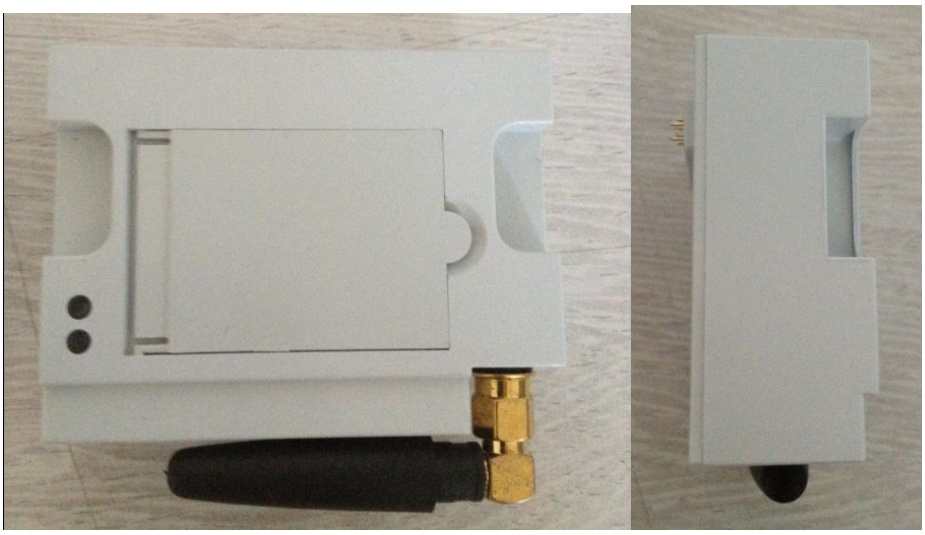


Figure 4.15.1.1.1 Front view and side view of the GPRS/Wireless module

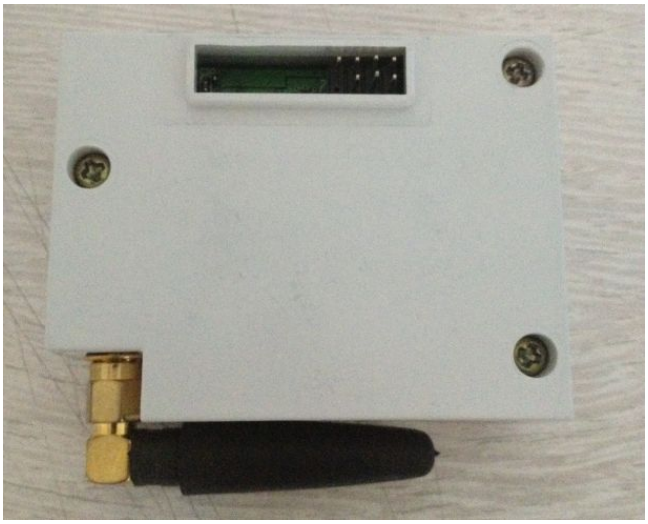


Figure 4.15.1.1.2 GBackview view of the GPRS/Wireless module

4.15.1.2 Techncial characteristics

- Working temperature -40°C to +85°C
- Storage temperature -40°C to +85°C
- Working humility <=95%RH
- Frequency band（optional）：Dual-band ：EGSM 900/1800MHZ
- Quad-band EGSM 850/900/1800/1900MHZ
- Sending power: Class 4 (2W) @ 900 MHz
- Class 1 (1W) @ 1800 MHz
- Receive sensitivity ： 850/900MHz: -107dBm
- 1800/1900MHz: -106 dBm
- Dimension：92.6mm×95.6mm×30.0mm
- Weight：118.8g
- SIM Card: External SIM connectivity
- Multi-slot class 10 (4 Rx / 2 Tx / 5 Sum)
- Class B

- GSM 07.10 multiplexing protocol
- Support GSM/GPRS communication and SMS communication, it can configure SMS mode or GPRS MODE per request, under GPRS communication mode , the SMS can process at the same time
- Support there mode as permenant on-line, periodly on-line and passive activiation
- Support client and Server；
- Upward communication protocol is DLMS IP mode；
- under GPRS mode, it support to report the warning information initatively
- Support report the power off alarm in real-time (optional)
- It can be configured to prevent the illegal mobile phone call
- Support plug-in

LED indicator

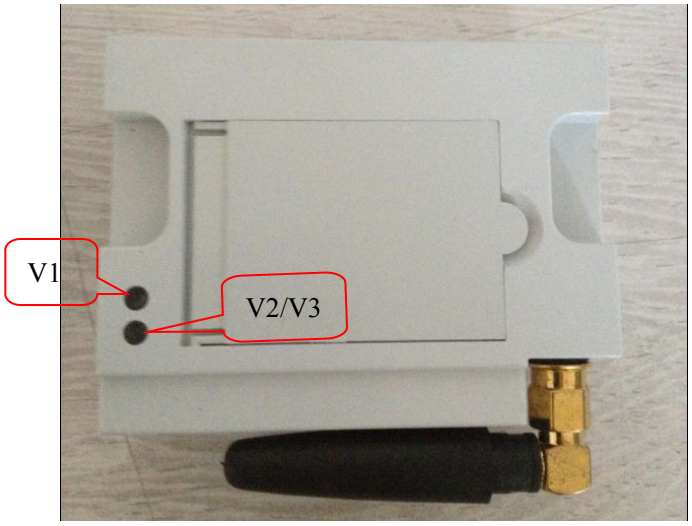


Figure .4.15.1.2.1 MGB1-HX3806 Module indicator location

- V1 indicator is the green local communication LED, when the LED is always light up, which means that the module and meter is on work normally. If The V1 LED goes out, which means the module and meter do not work normally.
- V2/V3 indicator is on the right of the V1 and the green indicator V2 is the network communication LED, the red indictor V3 is the data communication LED
- V2 is the network communication LED, when it goes out, it measn there is no network/no SIM card/no signal/faulty module.
- 1HZ flash, the registration of GSM network succeeds.
- Always light. The GRPS login succeeds.
- Data communication LED. When the module is interacting with external data, the LED flash with 10HZ.

4.15.1.3Parameterconfiguration

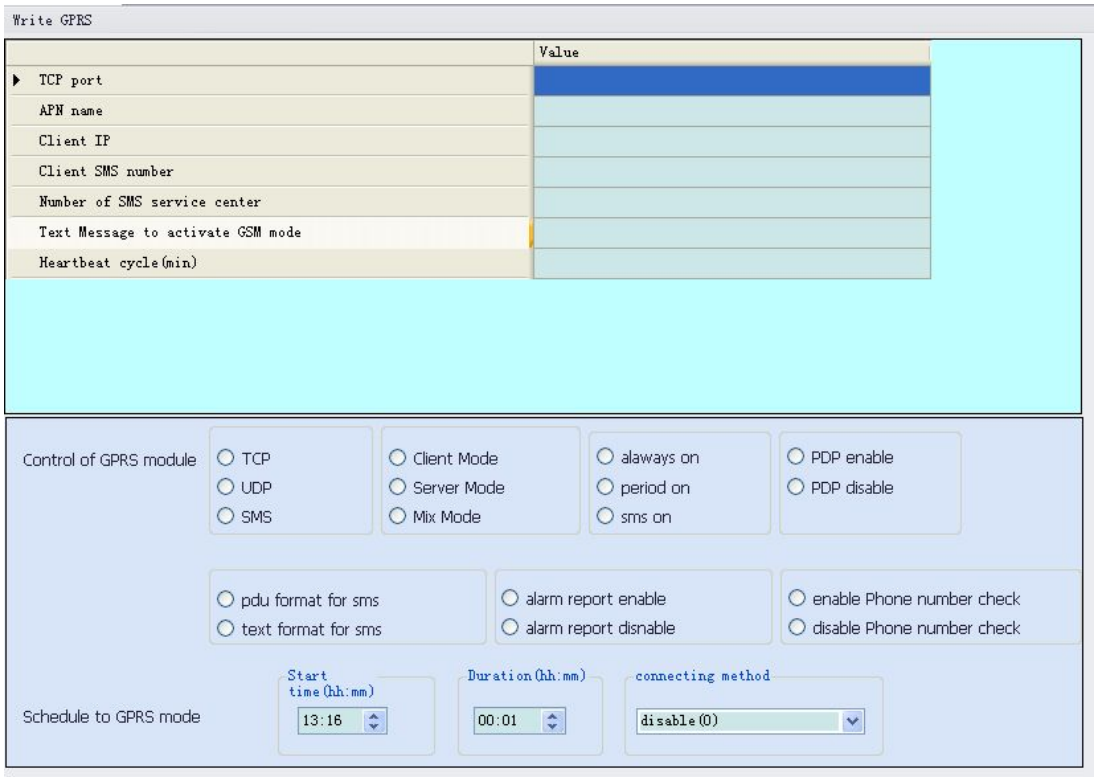


Figure 4.15.1.3.1 The PC software interface of the GSM/GPRS working parameter configuration

The following working parameter can be set for the GSM/GPRS communication module:

（1）TCP port

（2）APN name.

（3）Client IP. The remote master staion IP address

（4）Client SMS number. The mobilephone number activated by remote SMS

（5）Number of SMS service center. The mobilephone number of the SMS center

（6）Test message to activate GSM mode. Only the message is correct, the GSM can be activated

（7）HeartBeat cycle(min)。It is the interval time that the module configuration sends the Heartbeat

（8）PDP user name, PDP password。Authentication username and password.

（9）Control of GPRS module:

- Protocol, the optional are TCP, UDP, MS, GSM. The TCP mode can support GPRS, SMS, CSD. SMS mode can only support SMS and GSM can only support CSD function.
- GPRS connection mode, the optional are client mode, server mode, mix mode. Under the client mode, the module will connect with the master station automatically; under the server mode, the module is waiting for the connection from master station, while under the mix mode, the module usually on the server mode, when it need to report the alarm, it will temporarily switch to client

mode.

- GPRS on-line mode, the optional are always on, period on, SMS on, mix on. Under always on mode, the module will be always on line. Under period on mode, the module will be on line in the configured time. Under SMS on mode, the moule will be on line only when receiving the activation message. Under mix on mode, the module will be on line in the configured time and also when receiving the activation message.
- PDP Feasibility. the optional are PDP enable, PDP disable. Under PDP enable mode, the module will use the configured PDP usename and PDP password to log in; under PDP disable mode, the moduel does not need the username and password.
- The optional ar pdu or text
- The alarm report enables, it can choose to prevent or enable the alarm report.
- The mobilephone confirmation. It can choose prohibition or enabiliy. Under prohibition mode, the module do not need to check the mobilephone number, any mobilephone number can activation the module for on-line. Under enabiliy mode, the moduel need to check the mobilephone number, only the mobilephone number is the same number configured in the module, it can activate the module for on line.

（10）Schedule to GPRS mode.It is the online time period of the GPRS module, the starting time, online cycle, and online frequency can be configured, the online frequency can choose every online, single-numbered day online or even-numbered day online, or online from every 2 day to every seven day.

4.15.1.4 SIM card installation and replacement process.

（1）Grid power off

WARNING Before SIM card is replaced, disconnect the line fuse. The connection wire must be off power before replacement, otherwise which will threaten the life. Make sure the line fuse is disconnected and put in the safe place to assure nobody can power on during the replacement.

（2）Open the front cover

（3）Open the SIM cover of the GSM/GPRS module.

Figure 4.15.1.4.1 MGB1-HX3807 View of SIM card cover after MGB1-HX3807 module

（4）Open the SIM base

（5） Insert SIM

NOTE Before inserti SIM card, make sure it have the relative function(for example GPRS) and the credit is enough

（6）Close the SIM card base

（7）Close the SIM card cover

（8）Power on

（9）Wait for 2 mintues and oberserve if the GPRS signal tensitivity indication on the meter is normal (at leat one indicator refer to Chapter 4.7.1 LCD Overview), if there is signal, which means the installation of GPRS is workable, if not, check procedure 1, do it again till the GPRS signal indication display, otherwise, the installation fails, which need to check the reason further, normally there are following reasons:

- SIM card credit is not engouh
- GSM/GPRS working parameters like APN are not correct.(refer to Chapter 4.15.1.3 “ parameter configuration)
- GSM/GPRS module is not installed correctly. Which can defined throught the LED indicator of the GSM/GPRS module(refer to Chapter4.15.1.2 technical characteristics) and the communication module indication on the meter LCD(refer to chapter 4.7.1 Technical characteristics)

（10）Close the front cover

（11）Seal the front cover

4.15.2 PLC Communicaiton Module

4.15.2.1 Overview

Model：MPB11-HX4007

Figure 4.15.2.1.1 Front and side view of the PLC communication module

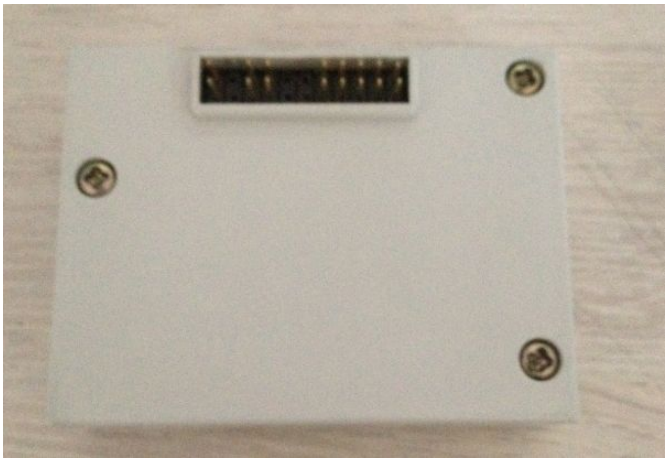


Figure 4.15.2.1.2 Back view of the PLC module

- 4.15.2.2 Techncial Characteristics
- Working temperature -40°C to +85°C
- Storage temperature -40°C to +85°C
- Working humility： <=95%RH
- Demension：92.6mm×95.6mm×30.0mm
- Weight：112.g
- Physical layer：comlys with IEC 61334-5-1 , EN 50065-1
- Modulation mode：S-FSK
- The optimal communication carrier frequency：Fm：63.3kHz；Fs：74kHz
- The carrier frequency range: 50kHz ~ 90kHz
- Communicatin rate：1200bps or 2400 bps
- Support 50HZ or 60HZ
- Data linking layer DLL(including MAC and LLC sub-layer)： complys with IEC 61334-5-1，IEC 61334-4-32
- Physical layer：comly with IEC 61334-5-511
- Support alarm report
- support plug in
- Compliant to CENELEC EN50065 series of standards
- Compliant to IEC 61000 series of standards

LED indicator

Figure.4.15.2.2.1 MPB11-HX4008 Module indicator location

- V1 indicator is the local communication LED, if V1 indicator flash suddenly, which means it receives the correct carrier data telex.
- V2 indicator is the local communiation LED, the V2 indicator flash suddenly, which means the module is sending the carrier telex.

NOTE

1. The S4 indicator on the LCD of the meter can define if the LCD module is registrated into the concentrator or not. It can refer to Chapter 4.7.1 LCD overview.
2. The MAC address both of the meter and concentrator can be defined on the LCD displaying item. It can refer to Chapter 4.7.3 displaying item and format".

4.16 Software Upgrading

Software of meter can be upgraded locally through optical interface or remotely by master station, in order to prevent potential bug or upgrade new function.

4.16.1 Upgrading Process

(1) PC software or master station initializes upgrading process.
(2) PC software or master station sends data packets for upgrading.
(3) PC software or master station checks if all packets have been correctly sent, if not, goes back to step (2), Software or master station resends packets that have not been correctly received.
(4) PC software or master station reads version number of software to be upgrading and MD5 check code of packet. If they do not match, this upgrading fails, goes back to step (1), upgrading process starts over.
(5) After confirmation of upgrading packet, PC software or master station sets activation time of upgrading packet. If the activation time is before current time, meter starts to active at once.

(6) Meter starts to upgrade and active new version of software at the activation time.
(7) After upgrading, meter works with the new version of software.
For more details of updating information please consult in technicians of Hexing Co.

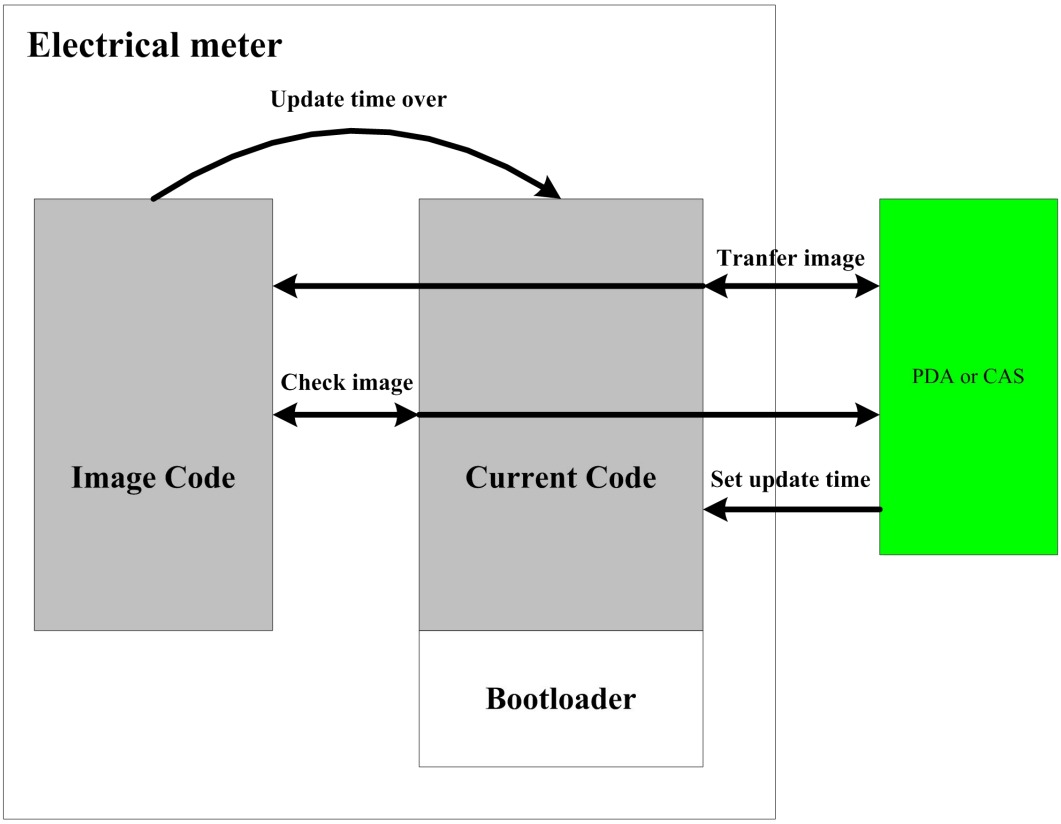


Fig4.16.1.1 Diagram of updating process

4.16.2 Safety Protection of Updating

Following measures are adopted by meter to ensure security of upgrading.

- When the PDA or CAS start the upgrade initialization, the meter will verify if it can support the upgrade software version, if not, it will reject upgrade in case that the PDA or CAS mis-uses the wrong upgrade package.
- Every data frame comes with the CRC verification of the DLMS protocol.
- Every mirror data block comes with the CRC verification in view of the data block.
- The PDA or CAS verifies whether all of the data blocks are received successfully.
- Before upgrade the PDA or CAS compares the software version inside of the meter which is waiting for upgrade and the MD5 verification code to define whether all of the mirror upgrade packages are received successfully.
- Before upgrade, the meter will proceeds MD verification for the mirror upgrade package and compare with the former MD5 verification code.
- The reading and writing of the Image Code memory are compared many times to assure every reading and writing is correct.
- After re-programing the software, the meter will read out again to verify in case of any error.

4.16.3 Failure Analysis

Following situations may result in upgrading failure.

- Hardware malfunction of Image Code memory during upgrading: in this case, part of the codes has been covered by mirror upgrading packet, while others not, which causes meter unable to work properly. Only when Image Code memory restores from malfunction can meter goes back to normal. This situation usually causes meter deadly consequences.
- Hardware malfunction of Image Code memory before upgrading: in this case, as hardware malfunction has been detected, meter will not perform upgrading and still works with original version of software.

4.16.4 Upgrading Characteristics and Attentions

Upgarde characteristics and Notes

It will take less than 15 minutes for the PDA to transfer all of the mirror upgrade package to the meter

During the process of the transfer, the other function of the meter will not be affected.

It will take less than one minute for the meter to verify the mirror data block.

It will take less than one minute for the meter to complete the upgrade

During the process fo the mirror data block verification, the meter will only verify the data instead of other functional tasks.

From starting upgrade to comleption, the meter will only process the upgrade instead of other functional tasks.

CAUTION During the process of the upgrade, do not put the meter nearby the strong magnetic field to prevent its effects lead to the prgraming data error and increase the risks of the failure.

4.17 Battery

Meter is equipped with a lithium cell of 1000/1200mAh, which supplies power to meter for its display of calendar clock, cover opening record and other key-press awakened display while power-off.

Battery can be replaced easily. Detailed installation location please refers to Chapeter 3 Mechanical Structure.

4.17.1 Battery Voltage Detection

The current battery voltage can be calculated through every second sampling when power on：

- Calculation accuracy of voltage: ±0.1V.
- Calculated voltage range of battery under normal operation: 3.4~3.8V.
- Battery voltage display value is invalid while power-off.

4.17.2 Monitoring Battery Balance Energy

Meter provides function of battery balance energy monitoring. Balance energy of battery can be calculated through following method:

Balance energy =(Balance energy before power-off – energy consumption while power-off);

Energy consumption while power-off = duration of power-off * mean working current of power off;

Mean working current is theoretic maximum mean working current while power-off, which is 40μA.

(Note: Balance energy of battery is only for reference. It is not standard of balance energy calculation.)

4.17.3 Power Shortage of Battery

If it is detected that voltage is less than 3V or balance energy is less than 20% for consecutive 10 seconds, meter gives a alarm that battery needs replacement, at the same time, an power shortage alarm displays on LCD(for details please refer to chapter 4.7.1) and an event of battery needs replacement is recorded.

If power is completely supplied by battery, meter can work 20000 hours before balance energy of battery is less than 20%.

4.17.4 Battery Replacement

Following process should be executed during battery replacement.

（1）Grid power off

WARNING	Disconnect the line fuse before Battery replacement. Before battery is replaced, disconnect the line fuse. The connection wire must be off power before replacement, otherwise which will threaten the life. Make sure the line fuse is disconnected and put in the safe place to assure nobody can power on during the replacement.

（2）Open the front cover

Figure 4.17.4.1 open the front cover view

（3）Take out the battery

Figure 4.17.4.2 battery taking out view

（4）Push the button over and over again till the meter will not display.

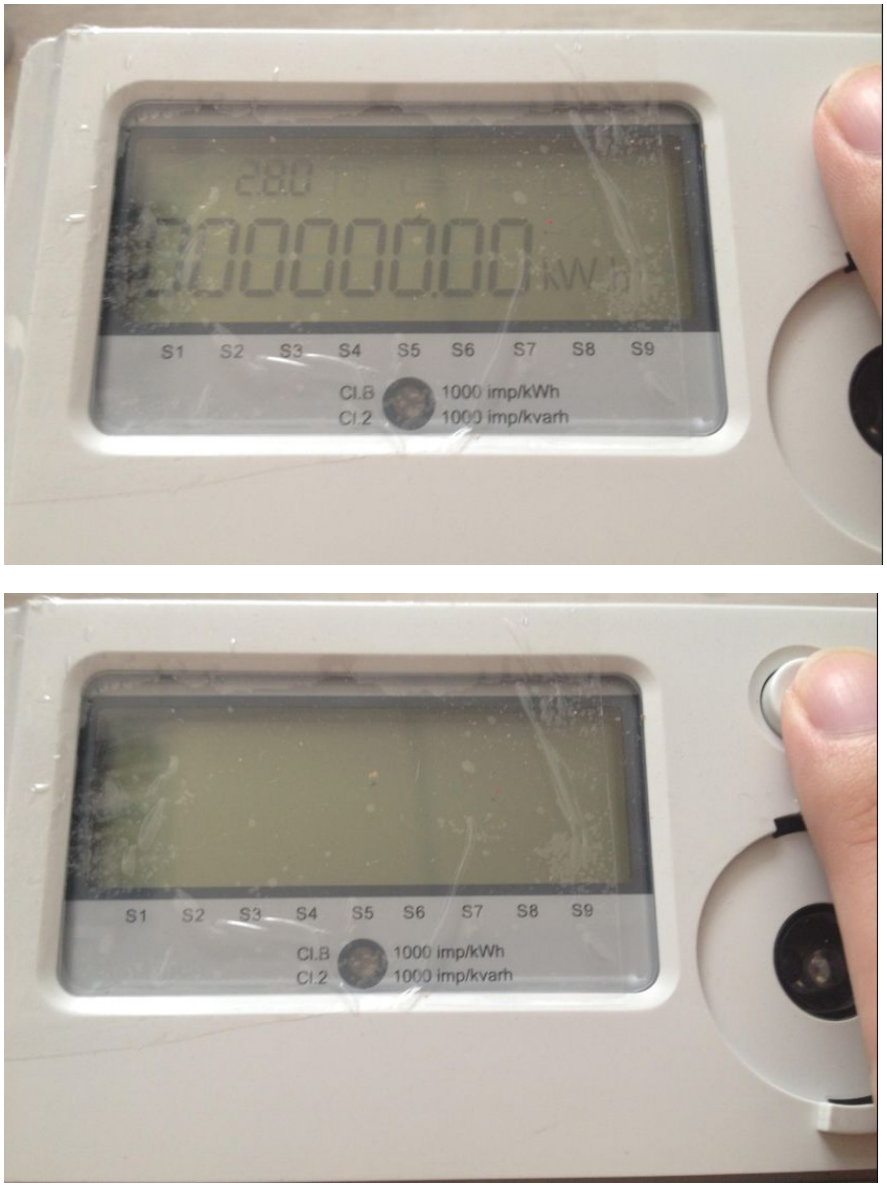


Figure 4.17.4.3 Manual button press view

（5）Replace the new battery

Figure 4.17.4.4 Battery installation view

（6）Push the manual button, if the meter have display, which means the battery has been replaced correctly.

（7）Close the front cover

（8）Grid power on

（9）Execute the battery replacement via PC or HHU, the practical operation includes: recovery the battery, compare the time clock, clear the alarm register, read out the battery voltage via communication to verify if the replacement of the battery is correct.

（10）Seal the front cover

4.17.5 Service Life of Battery

Mean working current:

- Power-on 0.1μA < I < 1μA
- Power-off（no key-press display） 15μA < I < 25μA
- Power-off（key-press display） 30μA < I < 60μA

Service life:

Battery can work for 15 years, if total power-off time is no more than 20000 hours.

4.18 Self-checking

Meter check saving data and hardware everyday and power on,meanwhile, during working process, monitoring meter working status in real time and display the working status on LCD, master can get the meter alarm status word, AMI status word through

communication to check if meter is under normal situation.

4.18.1 Error register

Register includes four bytes and describes as below:

Byte0		Set status
Clock invalid	Bit0	clock error
Replace battery	Bit1	shortage of battery
Reserve	Bit2	
Disconnector error	Bit3	relay physical status is different from control status
Reserve	Bit4	
Reserve	Bit5	
Reserve	Bit6	
Reserve	Bit7	

Byte1		Set status
data error	Bit0	
data error	Bit1	
NV memory error	Bit2	non-volatile memory error
Measurement system error	Bit3	measuring chip error
watchdog error	Bit4	Abnormality reset
Reserve	Bit5	
data error	Bit6	memory data abnormal
Reserve	Bit7	

Byte2		Set status
Reserve	Bit0	
Reserve	Bit1	
Reserve	Bit2	
Reserve	Bit3	
Reserve	Bit4	
Reserve	Bit5	
Reserve	Bit6	
Reserve	Bit7	

Byte3		Set status
Strong magnimat	Bit0	detecting magnetic is bigger than 0.5mT
Fram memory error	Bit1	Detecting Fram error
Reserve	Bit2	
Dataflash error	Bit3	Detecting Dataflash error
Reserve	Bit4	

Reserve	Bit5
Reserve	Bit6
Reserve	Bit7

In which, the bit1 of the Byte1 and Byte0 only can an cleared by communication. The other will be cleared automatic when error disappear.

NOTE When occurring NV memory error, The meter will display the faulty memory interface (detailed please refer to Chapter 4.7.3 " Display item and format) to hint that the meter have fatal error.

4.18.2 Alarm register

The alarm register is used for hint the historical warnings of the meter, only via communication they can be cleared otherwise, he warning sign will be kept once it occurs Register includes four bytes and describes as below:

Byte0		Set status
Clock invalid	Bit0	Clock error
Replace battery	Bit1	Shortage of battery
Reserve	Bit2	
Disconnector error	Bit3	relay physical status is different from control status
Reserve	Bit4	
Reserve	Bit5	
Reserve	Bit6	
Reserve	Bit7	

Byte1		Set status
data error	Bit0	
data error	Bit1	
NV memory error	Bit2	non-volatile memory error
Measurement system error	Bit3	measuring chip error
watchdog error	Bit4	abnormal reset
fraud attempt	Bit5	cover opening event
data error	Bit6	memory data abnormal
Reserve	Bit7	

Byte2		Set status
Reserve	Bit0	
Reserve	Bit1	
Reserve	Bit2	
Reserve	Bit3	
Reserve	Bit4	
Reserve	Bit5	
Reserve	Bit6	

Reserve	Bit7

Byte3		Set status
Reserve	Bit0	
Reserve	Bit1	
Reserve	Bit2	
Reserve	Bit3	
Reserve	Bit4	
Reserve	Bit5	
Reserve	Bit6	
Reserve	Bit7	

4.18.3 AMI status word

Register includes one byte and describes as below:

Byte0		Set status
Critical error（CIV）	Bit0	register error memory data check error
Clock invalid	Bit1	Clock error
Data not valid（DNV）	Bit2	clock modification exceed limited threshold clock error register clock memory data check error
Daylight saving	Bit3	currently under DST status
Reserve	Bit4	
Clock adjusted	Bit5	clock modification exceed limited threshold
Reserve	Bit6	
Power down	Bit7	Power grid power off

Once the AMI status word is captured by load record, it will clear automatically and re-start to detect the load period status signal. The remote center can read out the AMI status word in the load record to defind the working status in load period.

4.18.4 Event status word

For indicating the current working status of the meteter

Byte0		Set status
Standard event records	Bit0	every occurrence of standard errors will be recorded with this mark
Fraud event records	Bit1	every occurrence of fraud events will be recorded with this mark
relay control event records	Bit2	every occurrence of relay control event will be recorded with this mark
grid event records	Bit3	every occurrence of grid events will be recorded with

		this mark
long time power off event records	Bit4	every occurrence of long time power off events will be recorded with this mark
MBUS event records	Bit5	every occurrence of MBUS events will be recorded with this mark
reserve	Bit6	
reserve	Bit7	

Byte1		Set status
reserve	Bit0	
reserve	Bit1	
strong magnetic field event record	Bit2	occurrence of this event will be recorded with this mark
meter cover open event record	Bit3	occurrence of this event will be recorded with this mark
terminal cover open event record	Bit4	occurrence of this event will be recorded with this mark
current reverse event record	Bit5	occurrence of this event will be recorded with this mark
reprograming event record	Bit6	occurrence of this event will be recorded with this mark
grid power off event record	Bit7	occurrence of this event will be recorded with this mark

Byte2		Set status
Under-voltage	Bit0	Occurrence of under-voltageevent
reserve	Bit1	
reserve	Bit2	
Over-voltage	Bit3	ocurrence of over-voltage event
reserve	Bit4	
reserve	Bit5	
Over-current	Bit6	ocurrence of over-current event
reserve	Bit7	

Byte3		Set status
reserve	Bit0	
reserve	Bit1	
reserve	Bit2	
reserve	Bit3	
reserve	Bit4	
reserve	Bit5	
reserve	Bit6	
reserve	Bit7	

5 Installation

Check whether the meter has obvious damage during the transportion (such as the

broken meter cover, suspension hanger, seal and LCD etc) If any damage, replace the meter.

5.1 Assemble

Assemble the meter on the panel or similar object according to the meter weight and dimension (refer to Chapter 1.7 Weight and Dimension), the procedures are as follows:

1. Confirm the correcton installation location of the meter; make sure there is no cable on the mounting hole of the meter to avoid damaging the cable threatening the personnel lives.

2. Use the neutral and live line testing device (such as the electroprobe) to test the voltage of the line to assure the line is power off.

3. Choose the location of the suspension hanger (high or low position)

4.Remark the meter fixed location on the installation panel (the fixed three location refers to following figure 5.1.1)

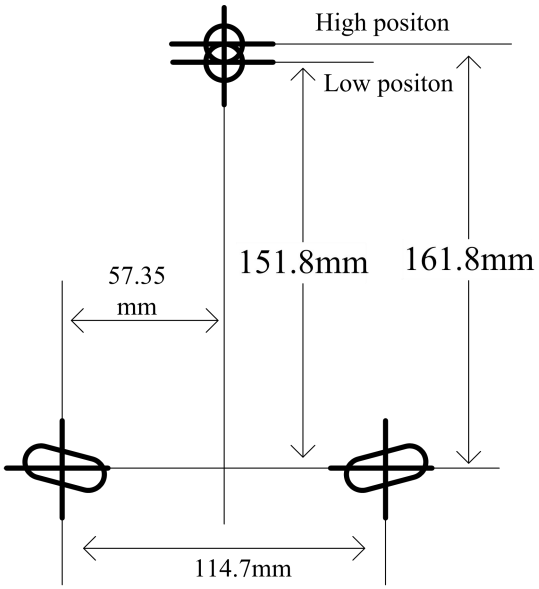


Figure 5.1.1Drilling hole location

5. Drill three holes on the assembly panel.

NOTE If the panel has adjustable hole, the procedure 4 and 5 can be removed

6. Open the meter terminal cover

7. Adjust the suspension hanger according to the location (refer to Figure 5.1.2 and Figure 5.1.3)

NOTE The defult is low location when the meters are exported from the factory to match with the inner box and prvent the damage during transportion.

Figure 5.1.2 Low position suspension hanger

High position suspension hanger

8. Fix the meter with three screws

NOTE	The appearance diameter of the base fixed screw has to exceed 7mm. while the upper fixed screw has to exceed 11mm to assure solid installation.

5.2 Connection

WARNING	Disconnect the line fuse before connection. Before installating the connection wire, disconnect the line fuse. The connection wire must be off power before connection, otherwise which will threaten the life. Make sure the line fuse is disconnected and put in the safe place to assure nobody can power on during the connection.

WARNING	Offering over current protection Inside of the meter has no over current protection device, so after installatation the over current device have to installed

Conenction with cable

1. Cut the cable to the required length and strip by wire stripping plier. The recommended length of the bare metal part after stripping is 22mm

WARNING It is strongly recommend that the bared mental part length can be meet to assure the enough length can be fixed by two connection screws, also assure the length will not exceed the terminal block, the insulation and safety can be guaranteed.

2. Insert the connection wire to the corresponding terminal connection hole (refer to Chapter 1.8 Connection) and tighten the connector screws (the maximum torque is 3Nm）

When the smaller sectional area of the cable is used (such as 4mm2), the connection wire must be put in the middle position so that the connector screw will not tilt to either side when fixing the screw and lead to the unstable connection.

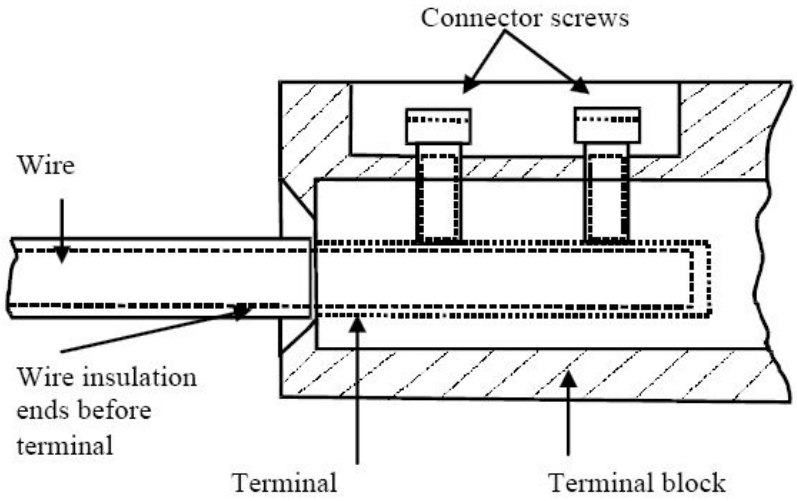


Figure 5.2.1 Wire connection diagram

NOTE It is recommend to use the qualified testing tool (such as the multimeter) to test the input and ouput wire to assure correct connection.

NOTE Fix the connector screw.

If the connector screw does not fix tightly, it will increase the resistance of the connection, which will result into the energy loss and terminal heat to increase the danger. 1 mΩcontacting resistance will lead to 6.4W power loss in 80A

WARNING Do not plug the connection wire when the termincal cover is closed.

Once the terminal cover is closed, do not plug the connection wire, which will result into the protential damage and danger.

5.3 Connection Check

Before check the functional installation of the meter, following items have to be checked to assure correct connection:

1. Wether the correct serial number of the meter is installed.
2. Whether all the parts except the terminal cover are sealed.
3. Whether the connector screw is fixed tightly.
4. Whether the input and output connect correctly

After checking the connection, assemble the terminal cover, fix the screw and seal.

5.4 Function Check

Before using the installed meter, following procedures have to be done to check the function

1. Insert the fuse and power on the meter
2. Check If the meter display correctly without the fautly code indication, opening cover and strong magenetic field indication (LCD has no S7 indicaton; please refer to Chapter 4.7.1 LCD Introduction). When the user has no load, the meter will have no current indication
3. Press the button and display the voltage, confirm the displaying voltage is correct
4. Link load and confirm the LCD has current indication.
5. Check whether the external control relay of the meter (if the meter has the external control relay) is in the correct applicable status.

5.5 Removal

Following procedures are apllied to removal of meter:

1. The meter is power off

WARNING	Berfore remova, disconnect the line fuse.Before removing the meter, disconnect the line fuse. The connection wire must be off power before removal, otherwise which will threaten the life. Make sure the line fuse is disconnected and put in the safe place to assure nobody can power on during the removal.

NOTE	Whether the meter is power off can not determine by whether the LCD is closed or not. According to different user's application requirement, the meter will not close the dislay when the power is off.

2. Open the terminal cover seal
3. Open and remove the terminal cover
4. Use the voltage testing device (such as multimeter) to test the meter connection and assure there is no voltage on the meter connection. If there is voltage, check if the fuse disconnect correctly in the line. Till there is no voltage, the next procedures can contitue.
5. Open the meter's auxiliary terminal connector wire by appropriate screw driver, and then remove the connection
6. Open the voltage and current connector screw by appropriate screw driver, and then

remove

7. Open the meter by proper screw driver and assemble the screw.

8. Take out the meter

CAUTION When doing the procedures 7 and 8, open the meter and take out the assembling screws, the upper assembling screws are lastly taken out, if they are needed to take out, it should be follow the procedures to prevent the meter falling down during the operation and cause personnel injure or meter damage.

9. If needed, the new meter are replaced and installed. (Refer to the relative chapter in former)

WARNING If new meter are not replaced for the momement, the voltage and current connection wire are wraped by insulated material to assure there is no bare metal part otherwise it will threathen the lives. The meter has to be installed as soon as possible.

6 Service

6.1 Faulty operation

If LCD can not display correctly, or the data communication can not work normally, the following points can be checked one by one:

1. If the meter is power on (whether the fuse is connected or not)

2. If the environmental temperature exceeds the working terperature limitation of the meter?

3. If the optical communication interface or the LCD display are clean (no scratch, no paint, or other ways of pollution)?

If the faulties are not the above-mentioned reasons, the meter has to be removed and send back to Hexing (refer to Chapter 6.3 Meter maintainence)

6.2 Faulty code

Detailed error code description please refer to Chapter 4.18.1 Error register

No continuous or fatal faulty will automatically cleared after the faulties disappeare. The comtinuous or fatal faulty will be not automatically reset. If the meter continuously displays one faulty code, the mter will be regarded as unsecure and can not be used any more. The next procedure can be conducted please refer to Chapter 6.3 Meter Maintenance

6.3 Meter Maintenance

The meter maintenance is necessary, and can be conducted as following procedures:

1. If the meter is already installed, then remove the meter (refer to Chapter 5.5 removal) and replace with new meter.

2. Describe the faulty as more and accurately as possible (if possible, please offer the error code), write down the name, phone number who is responsible for this meter for further query more questions in future maintenance. At the same time remake the meter number and full model.

3. Meter packing should asuure there is no damage during the transportation. Try best to use the original package, the lost part of the meter should not be contained in the package.

4. Return the meter back to Hexing for maintenance.

7 Maintenance

In the lifecycle of the meter, there is no need to test the accuracy of the meter. The meter maintenance can be conducted for a period time according to the local regulations; it is recommened every five to ten year to conduct once maintenance.

7.1 Clean

Use the dry dishcloth to clean the meter appreanance to wipt out the dirty mark and get rid of the possible mosquito

WARNING The meter is not allowed to clean by flow water or high pressure device. The water maybe penetrates into the meter resulting into short circuit.

7.2 Error Test and function check

The error test can be conducted according to following procedure

Put the meter on the pole of error test testbech (the meter wiring hole code can refer to Chapter 1.8 Conenction), fix tightly the connector screw of the meter (the maximum torque 3Nm)

2. The pulse test part of the error testbech faces to the LED of the meter or connect with the SO output of the terminal block

Figure 7.2.2 View of the HXE100-KP error testbech with meter

3. Sart the error testbench, add the rated voltage without the current, confirm there is

no current indication on the meter LCD, check if the meter is correct or not (no error code indication)

4. Start the testbench to sart the error test.

5. When the meter is only connected with the voltage wire and not connected with current wire, through the PC execute the relay control operation (If the meter is with relay) and check if the relay work normally.

6. The test finishes, remove the meter from the tesbench.

7.3 reinstallation

It is recommended to installed the meter re-installed at the former location avoid any modification about the asset management.

The detailed information about the installation process can refer to Chapter 5 Installation and Removal

8 Disposal

This chapater describes how to dispose with the meter correctly.

Complying with the ISO14001 environmental certification standard, the electronical part inside of the meter can be separated at most, so after they are dismantled, the relative parts can be supplied to wast and recycling station.

NOTE The disposal methods can refer to local wast and environmental regulations.

The meter can dismantled into different parts, the recommended disposal methods are as follows:

Parts	Recommended disposal methods
PCB board	Electronic waste: according to the local regulations
Metal part, including the optical communication iron ring, the terminal connection Aluminum pole, the inside current connection wire etc.	Supply to the metal material recycling station
Plastic part	Supply to the plastic material recycling station, if they are not recyclable, burn them

9 Appedix: Product Conformity Statement

Here we, Hangzhou Hexing Electronical Co., Ltd certify that
HXE100-KP series of enegery watter comlys with following instruction and standard

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Complying with DLMS/COSEM protocol standard

Certification No. 1301

Complying with IEC/EN standard

IEC62053-11
IEC62053-22
IEC62053-23
EN50470-1/EN50470-3 MID Notified Body No.1383
Number: TCM 221/13-5105

NOTE Due to the model of this series of the energy meter covers a wide range, the above certification is conducted with typical mode, most of the product model varies a little, Hexing commit its conformity.