USER MANUAL

KWHIQ IQCT04000br2

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Xemex
info@xemex.eu
+32 (0)3 201 95 95
www.xemex.eu

NL Burgemeester Burgerslaan 40
5245 NH 's-Hertogenbosch
BE Metropoolstraat 11a
B2900 Schoten

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1.Safety Instructions

⚠ WARNING

Read all safety information and operating instructions before using the meter to avoid personal injury.

Transport and Storage

Refer to clause 16 “Transport and storage”.

Installation

Power must be cut off before installation or removal of the meter. Refer to clause 16 “Meter Installation” for more details.

Operation

Do not break the seal and remove terminal cover without authorization.
Do not break the seal and remove communicate module without authorization.
Never remove the meter cover while the meter is in operation. The exposed circuits and components may lead to injuries or damage to the meter.
Meter working voltage should be less than 120% nominal voltage (120%Un), load current should be less than 120% maximum current (120% Imax). Long time over voltage and over load may lead to damage the meter.
Do not operate the meter with wet hands.

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2. Overview

This document is the guideline for users to install, operate and maintain the IQCT04000BR2 three phase smart meter connect through current transformer.

IQCT04000BR2 three phase meter is designed for measuring and monitoring energy parameters, such as total active/reactive energy in both directions, instantaneous voltage and current, Power Factor, Vrms, Irms, active and reactive power in three-phase four-wire network. It arms with a wireless M-Bus interface to multi-utility meters, i.e. gas meter, water meter and heat meter and P1 to support end customer display device. It provides P0 port for Local configuration and maintenance through infrared communication. The remote communication module is modular designed with its own box and embedded into the meter box. This makes it flexible to support different type of communication modules. There is segment LCD display and push-button for user to read metering information on site. It provides auxiliary relay used to tariff control public equipment.

2.1. Abbreviation

A	Active energy
+A	Active energy import
-A	Active energy export
+R	Reactive energy import
-R	Reactive energy export
R1	Reactive energy QI
R2	Reactive energy QII
R3	Reactive energy QIII
R4	Reactive energy QIV
	Active power
+P	Active power import
-P	Active power export
	Reactive power
+Q	Reactive power import
-Q	Reactive power export
MD	Maximum Demand
PF	Power Factor
TOU	Time Of Use
RTC	Real Time Clock
HES	Head End System
IHD	In Home Display
HHU	Hand Held Unit
AA	Application Association
AARE	Application Association Response
AARQ	Application Association Request
ACSE	Association Control Service Element
APDU	Application Protocol Data Unit
ASE	Application Service Element
HDLC	High-level Data Link Control
HLS	COSEM High Level Security
IC	COSEM Interface Class
KEK	Key Encrypting Key
LAN	Local Area Network
MAC	Medium Access Control
PLC	Power line carrier
PKI	Public Key Infrastructure
WZ	Service Interface
H1	Consumer Interface
M2	Multi Utility Interface

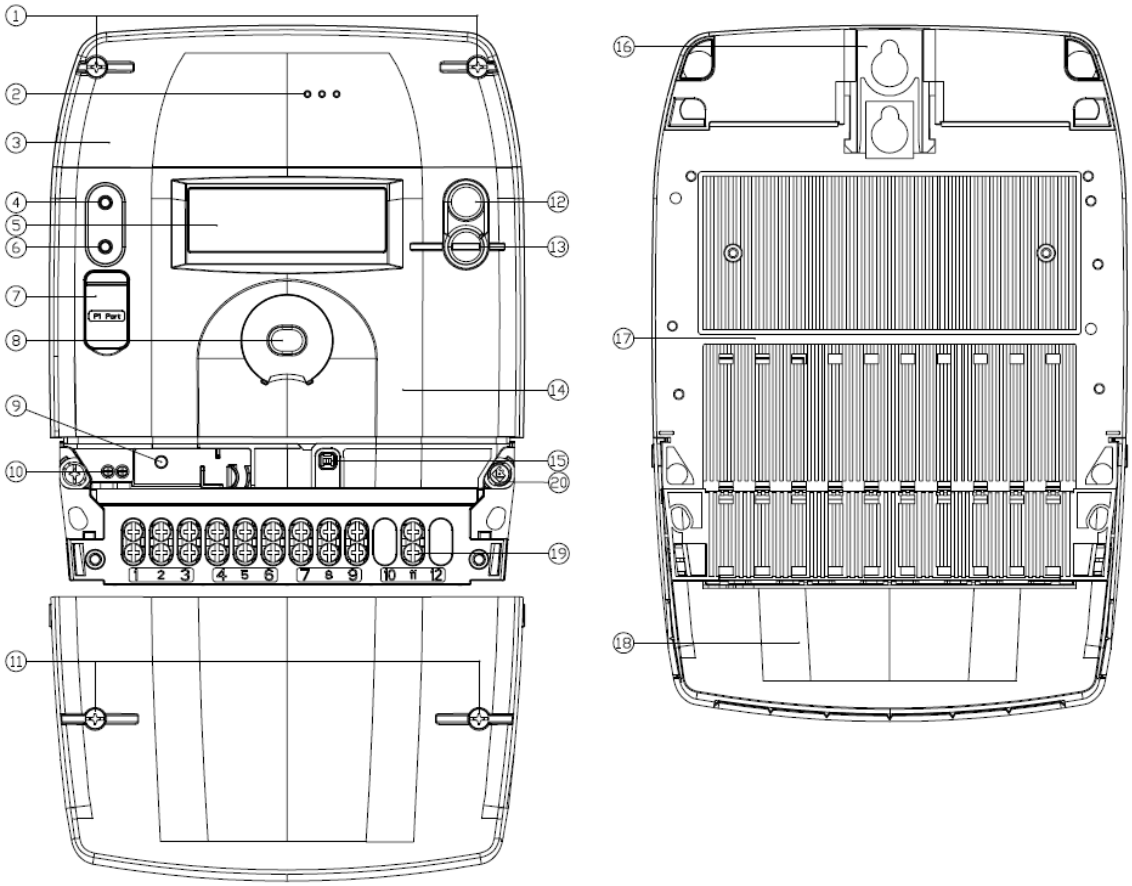
2.2. Reference

The meter complies with the following standards.

No.	Standard No.	Title
1	EN 50470-1, 2006	General requirements, tests and test conditions –Metering equipment.
2	EN 50470-3, 2006	Particular requirements-Static meters for active energy.
3	IEC 62052-11, 2003	General requirements, tests and test conditions for metering equipment
4	IEC 62052-21, 2002	General requirements, tests and test conditions for tariff equipment
5	IEC 62053-21, 2003	Electricity metering equipment for active energy class indexes 1 and 2
6	IEC 62053-22, 2003	Electricity metering equipment for active energy class 0.2S and 0.5S
7	IEC 62053-23, 2003	Electricity metering equipment for reactive energy class indexes 2 and 3
8	IEC 62053-61, 1998	Electricity Metering Equipment (a.c.) - Particular Requirements - Part 61: Power Consumption And Voltage Requirements
9	IEC 62054-21, 2004	Electricity metering (a.c.) Tariff and load control Part 21
10	DIN 43857, 1978	Part 2: Watt-hour meters in molded insulation case without instrument transformers up to 60A rated maximum current; Part 4: Principal dimensions for three-phase meters.
11	EN 13757	Communication system for meters and remote reading of meters: Part 3: Dedicated application layer; Part 4: Wireless meter readout (Radio meter reading for operation in the 868 MHz to 870 MHz SRD band);
12	IEC 60529, 2001	Degrees of protection provided by enclosures
13	IEC 62055-31, 2005	Sections 7.9.3 Performance requirements for load switching
14	IEC 62053-31, 1999	Pulse output devices for electromechanical and electronic meters
15	IEC 62056-21, 2002	Electricity metering – data exchange for meter reading, tariff and load control – Part 21 Direct local data exchange
16	IEC 62056-46, 2002	Electricity metering – Data exchange for meter reading, tariff and load control - Part 46: Data link layer using HDLC protocol
17	IEC 62056-53, 2001	Electricity metering - Data exchange for meter reading, tariff and load control - Part 53 Part: COSEM Application layer
18	IEC 62056-61, 2001	Electricity metering - Data exchange for meter reading, tariff and load control - Part 61 Part: Object identification system (OBIS)
19	IEC 62056-62, 2001	Electricity metering - Data exchange for meter reading, tariff and load control - Part 62: Interface classes

3. General Description

3.1. Front View and Rear View



(1) Module seals
(2) Status indicate LED
(3) Module cover
(4) Active pulse LED
(5) LCD
(6) Reactive pulse LED
(7) P1 Port interface
(8) Infrared port
(9) MCX antenna port (Optional)
(10) Auxiliary relay terminal (Optional)
(11) Terminal cover seals
(12) Push Button
(13) Seal button
(14) Meter cover
(15) Terminal cover detection switch
(16) Installation hook
(17) Meter base
(18) Terminal cover
(19) Terminals
(20) Meter cover seal

3.2. Features List

Measurement accuracy	Active: Class C Reactive: Class 2
Connection type	Three phase four wire, connected through current transformer
Nominal voltage(Un)	3*230V / 400 V
Voltage range	0.8Un~1.2Un
Current range	0.01~1(6)A
Starting current	0.4%Ib
Frequency	50 Hz (± 5%)
Meter constant	10000 imp./kWh(kvarh)
Power consumption	Voltage circuit: < 2W / 10 VA per phase Current circuit: < 1 VA per phase
LCD	Segment type LCD
Backlight	None
Energy LED	One LED for active energy and one LED for reactive energy, Three states for LED: 1) On: indicates first time use, becoming active after first load (starting current) or meter detected no load, the LED will be turn off. 2) Blink: indicates energy import or export for relative energy type. 3) Off: between the two pulses, the LED is off
Buttons	A button for display control, A button for wireless M-bus install
Communication interfaces	Optical port, DLMS/COSEM, HDLC on IEC 62056-21. DLMS/COSEM direct HDLC profile. Wireless M-Bus(optional) P1 Port GPRS CAT M + NB RF MESH
Auxiliary terminals	One auxiliary load relay (230VAC, 10A)
RTC	Compliant with IEC 62054-21
Data retention	Over 15 years
Backup power supply	Super capacitor (support 5 days without the main supply)
Mechanical	Weight: 1.4 kg Ingress protection rating: IP54 without suction Dimension: 249mm×170mm×89.9mm
Environmental	Limit temperature range: -40°C ~ +70°C Temperature range of storage and transport: -40°C ~ +80°C. Relative humidity: Up to 95% non-condensing

3.3. Function Characteristics

Energy parameters	+A, -A +R, -R Import/Export energy TOU energy
Instantaneous parameters	U, I, P, Q, S, PF, Frequency
Tariff	• 2 tariffs switching scripts • 4 weeks profiles • 4 seasons profiles • 4 days profiles • 20 special days Refer to Annexure II for default configuration.
Load profile	Load profiles: • 15 minutes cumulative energy load profile • Daily load profile • Power quality profile • Data of billing period 1 • M-Bus master load profile
Tamper detection	Terminal cover removal detection (even when power off) Meter cover removal detection (even when power off) Inverse current detection Magnetic field detection
Event log	Refer to clause of event logs
Self-diagnosis	The meter diagnoses the hardware at power on, or new firmware is deployed, periodically. Refer to Annexure III for meter status.
Measure period	The measuring period output (15min) over the optical interface
general block transfer	In the same time, only one client communication via GBT is supported. The maximum GBT length can support to get full entries load profile 1.
Certification mode	Status of the Certification mode must be accessible on the meter via the maintenance interface WZ. 1. Activating and deactivating the certification mode 2. Define the Energy register resolution on the display 3. Define the Demand register resolution on the display 4. Reconfiguration of the certification LED source (A, R, S)
Auxiliary Supply out control management	Command control Control by a schedule

4. Meter Construction

4.1. Enclosure

Features of meter enclosure:

The case is double insulated to protective class II.

The case provides an ingress protection rating of IP54 without suction.

The terminal block is molded in glass-filled polycarbonate.

The main terminals are cage type.

The main cover is fixed to the base during manufacturing and sealed with seal caps. It is impossible to open the main cover without breaking the seal cap.

The terminal cover can be sealed for limit access to the main meter connections.

The meter has face cover and terminal cover removal detection.

The metal ring of the optical port is fixed under the face cover.

One button is provided for display scrolling.

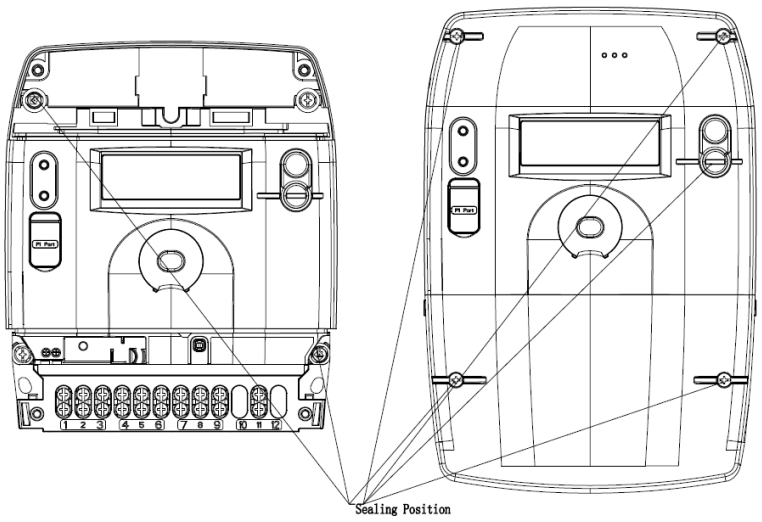
The name plate is laser printed on the face cover and terminal cover.

The wiring diagram is laser printed on face cover

4.2. Sealing of Meter

The meter has two seals for the communication module.

The meter has three seals for the meter face cover to seal the metrology part of the meter. It is impossible to touch the meter metrology part unless break the seals, the seals and the meter face cover or base are physically and clearly destroyed. Below picture –figure 3.3 shows the sealing position of the meter.



4.3. Push Button

The meter provides buttons.

The display button is used to alternate the display parameters manually.

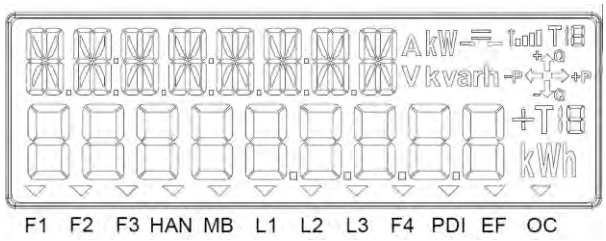
5. Display Control

5.1. Display Introduction

The meter provides a display and push buttons as the local user interface.

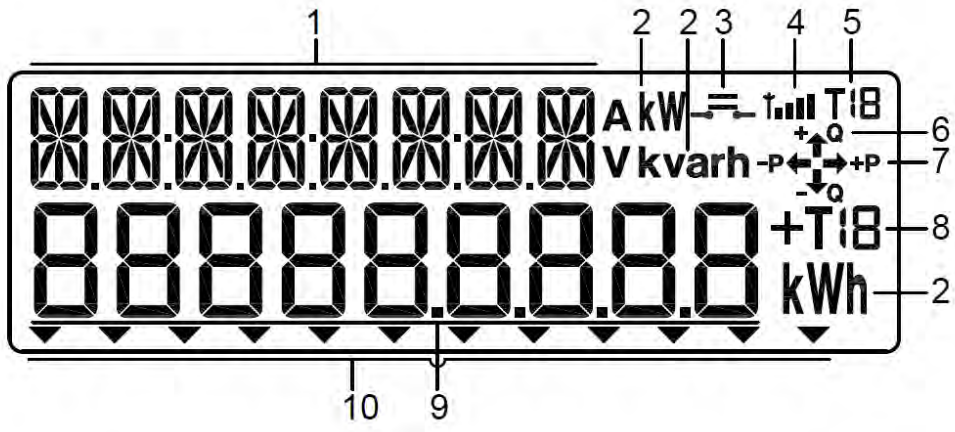
Using the push button, the user can step through a menu structure on the display to check the consumption data and further information.

As shown in the below figure, the LCD is portioned into different segments, each fulfilling distinct needs.



5.2. Basic Layout

The basic layout shows all indication possibilities of the LCD.



1	Alphanumeric row
2	Unit indications
3	Main breaker state indication
4	signal strength
5	Rate indication
6	Reactive energy direction indication(+Q:import,-Q:export)
7	Active energy direction indication(+P:import,-P:export)
8	Rate indication(not used)
9	Numeric row
10	Icons(more details: Special characters on display)

5.3. Display operating modes

The meter has 3 operating modes for the display. In each mode, the display list is configurable. For the complete configurable display items, please refer to the object model.

1. Auto Scroll Mode (default mode)
   In this mode the information on the display is refreshed every 5 seconds.
   The display list of auto scroll mode:

1-0:1.8.0.255	Active energy import (+A)

2. Button Scroll Mode
   This mode can be activated manually by pressing the button. The display will turn back to the “Auto Scroll Mode” 30 seconds after releasing.
   The display list of manual scroll mode:

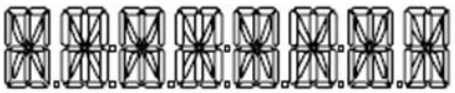
1-0:1.8.0.255	Active energy import (+A)
1-0:3.8.0.255	Reactive energy import (+R)
1-0:1.7.0.255	Active power import
	CT ratio (numerator)
	CT ratio (denominator)

3. Test Mode
   This mode is only available when the terminal cover is removed. The display will return to the “Auto Scroll Mode” after the terminal cover is reinstalled. Pressing the button will activate the display.
   The display list of test mode:

0-0:1.0.0.255	Date&Time
1-0:1.8.0.255	Active energy import (+A)
1-0:2.8.0.255	Active energy export (−A)
1-0:3.8.0.255	Reactive energy import (+R)
1-0:4.8.0.255	Reactive energy import (-R)
1-0:1.7.0.255	Active power import
1-0:2.7.0.255	Active power export
1-0:32.7.0.255	Voltage of phase L1
1-0:52.7.0.255	Voltage of phase L2
1-0:72.7.0.255	Voltage of phase L3
1-0:31.7.0.255	Current of phase L1

1-0:51.7.0.255	Current of phase L2
1-0:71.7.0.255	Current of phase L3
1-0:128.7.0.255	Phase L1 Active power ((+P)+(-P))
1-0:129.7.0.255	Phase L2 Active power ((+P)+(-P))
1-0:130.7.0.255	Phase L3 Active power ((+P)+(-P))
1-0:14.7.0.255	Frequency
,1-0:0.2.0.255	Active FW Version Core
1-0:0.2.8.255	Active FW Core Signature
1-1:0.2.0.255	Active FW Version App
1-1:0.2.8.288	Active FW App Signature
1-3:0.2.8.255	Version information
	CT ratio (numerator)
	CT ratio (denominator)
1.6.6.6.6.255	Display test - All segments on

Alphanumeric row



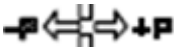
- If the meter is in “manual scroll mode” the 8-digit row shows either active power, or device type as text (e.g. “Gas”, “Water”,….).
- If the meter is in “test mode”, the 8 digits row shows either the active power, or the device type as text (e.g. “Gas”, “Water”,….), or the Firmware version, or the active power per phase (L1,L2,L3), or the active threshold

Numeric row



- During normal operation, where the display is in “auto scroll mode”, the lower 9 numeric digit row on the display shows the total active energy and total reactive energy for each direction on a 5 second cycle.
- If the meter is in “manual scroll mode” the 9 digit row shows either active energy, or serial numbers of connected M-bus devices
- If the meter is in “test mode”, the 9 digits row shows almost the following options:
  1. Total consumption of energy. In the manual scroll mode and auto scroll mode, 7 digit integer will be displayed. In the test mode, 6 digit integer and 3 digit decimal will be displayed.
  2. Current date.
  3. Equipment identifier of M-bus device.
  4. Firmware core version and firmware core version.
  5. Checksum for program memory

Special characters on display

Symbol	Description	Purpose
	Unit identifier	Indicates the unit of measurement for the quantity shown on the display
	signal strength	The signal strength is categorized as following: No reception: RSSI < -111 dBm low reception: -111 <= RSSI < -105 dBm second reception: -105 <= RSSI < -97 dBm third reception: -97 <= RSSI < -89 dBm high reception: RSSI >= -89 dBm
	Flow direction	Shows the actual direction of the energy flow
	Unit identifier	Indicates the unit of the energy measurement
	Reactive energy	Displays the actual flow direction of reactive energy, reserve for future use.
	Icon	There are 12 triangles in the display activated by different states and events in the meter. On the meter cover just below the display is it corresponding triangle marking codes which explains the meaning of the triangles in the display Triangle marking consist of the following codes: F1: Not used F2: Not used F3: Not used HAN: HAN Communication. It blinks when sending HAN messages. MB: Always on when Mbus devices installed. It blinks when sending messages to Mbus devices. L1: Phase 1 has voltages L2: Phase 2 has voltages L3: Phase 3 has voltages F4: Not used PDI: Phase disorder indication EF: Earth fault indication OC: Covers (including meter covers and terminal covers) open

5.4. Display Mode and Menu

The following display modes are available using 1 push buttons:

- Auto-Scroll Display mode
- Button Display mode
- Test Dsiplay mode

The push buttons provide the following functionality:

[A]–Button: for stepping through the menu structure and display items

[A] Button behavior:

Switch to the next menu or display list item

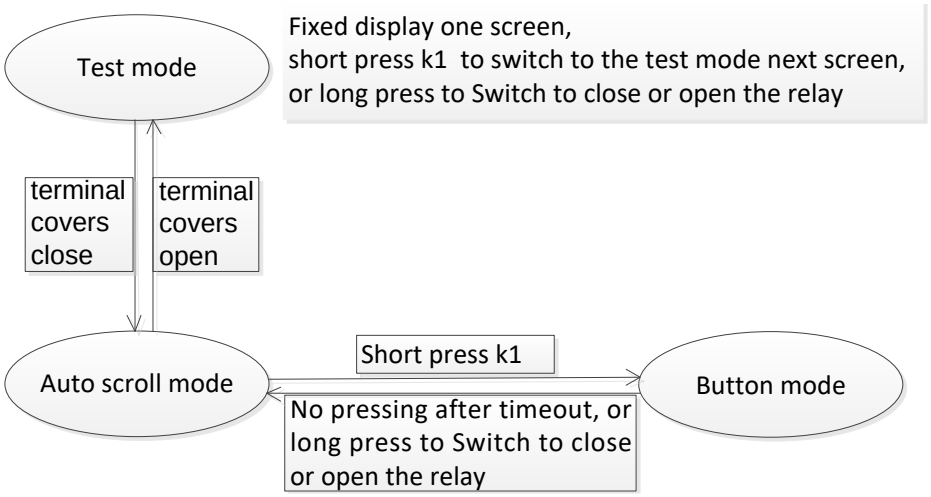
-Short press (t < 5s)

Switch to close or open the relay

-Long press (t > 10s)

Independent of the currently active display mode, 20min after the last button press the display returns to the Default mode, please refer to 4.2.1 Default mode display.

Shown below is a flow chart of the menu structure with some examples of how the data could look on a display.



6. Alarm and Event Handling

A lot of events are generated by the meter itself or by its environment. All these events are logged in several event logs. Additionally, they are also used to set and clear errors as well as to trigger.

6.1. Alarm and Error

Some of the events can trigger alarms or error. If one of these events occurs, the corresponding flag in the alarm or error registers is set and an alarm and error is then raised via communication channel. All alarm or error flags in the alarm registers remain active until the alarm registers are cleared.

Each bit in the alarm registers represents a different alarm. If the bit is set (logical 1) the alarm (corresponding to position of the set bit) was recorded. The value in the Alarm Registers is a summary of all active and inactive alarms at that time.

Depending on the capabilities of the HES and the policy of the utility, not all possible alarms are wanted. Therefore, the Alarm Filters can be programmed to mask out unwanted alarms. The structure of the filter is the same as the structure of the Alarm Registers. To mask out unwanted alarms, the corresponding bits in Alarm Filters should be set to logical 0.

6.2. Alarm and Error Registers

Assignment of Error Register/Alarm Register 1 bits

Bit	Alarm	Triggering event ID(please check the object model if needed)
0	Clock invalid	7
1	phase_disorder_indication	-
2	power_up	2
3	L1_interrption	241
4	L2_interrption	242
5	L3_interrption	243
6	power_failure_any_phase	240
7	power_back_any_phase	244~251
8	Program memory error	10
9	ram_error	11
10	nv_mem_err	12
11	mic_sys_err	13
12	wtdog_error	14
13	frd_attempt	20,22,23,24
14	meter_reconfig	4
15	earth_fault	20
16	Mbus_comm_error	-
17	New_mbus_discovery	-
18	open_breaker_pressing_button	35
19	close_breaker_pressing_button	32

20	reserve3	-
21	L1_interrption_ends	244,245
22	L2_interrption_ends	246,247
23	L3_interrption_ends	248,249
24	reserve	-
25	Power_quality_alert	40~73 and not equal to 66 or 67
26	Change_clock_out_allow_limit	3
27	Frequency_offset_start	66
28	Frequency_offset_end	67
29	L1_cur_Reverse	-
30	L2_cur_Reverse	-
31	L3_cur_Reverse	-

Assignment of Alarm Register 2 bits

Bit	Alarm	Triggering event ID(please check the object model if needed)
0	THD_start_L1	68
1	THD_start_L2	69
2	THD_start_L3	70
3	THD_end_L1	71
4	THD_end_L2	72
5	THD_end_L3	73
6	L1_long_term_under_voltage_start	40
7	L2_long_term_under_voltage_start	41
8	L3_long_term_under_voltage_start	42
9	L1_long_term_under_voltage_ends	43
10	L2_long_term_under_voltage_ends	44
11	L3_long_term_under_voltage_ends	45
12	L1_short_term_under_voltage_start	52
13	L2_short_term_under_voltage_start	53
14	L3_short_term_under_voltage_start	54
15	L1_short_term_under_voltage_ends	55
16	L2_short_term_under_voltage_ends	56
17	L3_short_term_under_voltage_ends	57
18	voltage_unbalance_start	64
19	voltage_unbalance_ends	65
20	L1_long_term_over_voltage_start	46
21	L2_long_term_over_voltage_start	47
22	L3_long_term_over_voltage_start	48
23	L1_long_term_over_voltage_ends	49
24	L2_long_term_over_voltage_ends	50
25	L3_long_term_over_voltage_ends	51
26	L1_short_term_over_voltage_start	58

27	L2_short_term_over_voltage_start	59
28	L3_short_term_over_voltage_start	60
29	L1_short_term_over_voltage_ends	61
30	L2_short_term_over_voltage_ends	62
31	L3_short_term_over_voltage_ends	63

6.3. Event log profile

Log profile	capacity	objects	sorted method:
Standard Event Log	100	clock_time; standard event code	unsorted (FIFO)
Fraud detection Event Log	30	clock_time; fraud detection event code	unsorted (FIFO)
Switch Control log	30	clock_time; disconnect event code; active threshold	unsorted (FIFO)
Power Quality log	100	clock_time; Power Quality event code	unsorted (FIFO)
Firmware Event Log	10	clock_time; Firmware event code	unsorted (FIFO)
Power Fail Event Log	100	clock_time; event code;duration time;Instant active power and vrms	unsorted (FIFO)
Communication Event Log	200	clock_time; Communication event code	unsorted (FIFO)

6.4. Standard Event Log

Event name	Event code	Trigger corresponding event	Trigger corresponding alarm
Power off	1	Power Down	None
Power on	2	Power Up	Power Up
Change of clock outside allowed limit	3	Change of clock outside allowed limit	Change of clock outside allowed limit
Parameter change	4	Meter reconfigured	Meter reconfigured
Self diagnostic error	5	Eeprom error	None
TOU Activated relay	6	Tariff2 shift time activated	None
Clock invalid	7	Clock invalid	Clock invalid
Replace battery	8	Replace battery	None
Passive TOU programmed relay	9	Set tariff2 activation time	None
Program memory error	10	Program memory error	Program memory error
Ram error	11	RAM Error	RAM Error
NV memory error	12	NV memory Error	NV memory Error
Measurement error	13	Measurement System Error	Measurement System Error
Watchdog error	14	Watchdog error	Watchdog error
TOU activated energy	15	Tariff1 shift time activated	None
Passive TOU programmed energy	16	Set tariff1 parameter	None
Open auxiliary relay by scheduler	36	Open auxiliary relay by scheduler	None
Close auxiliary relay by scheduler	37	Close auxiliary relay by scheduler	None
Open auxiliary relay by command	38	Open auxiliary relay	None
Open auxiliary relay by command	39	Close auxiliary relay	None
Event log cleared	255	Event log cleared	None

6.5. Fraud detection Event Log

Event name	Event code	Trigger corresponding event	Trigger corresponding alarm
Neutral Fault start	20	Two phase voltage >= 253V && other phase <= 190V,start time threshold:60s	Neutral Fault
Neutral Fault end	21	Two phase voltage >= 253V && other phase <= 190V),end time threshold:3s	None
Strong DC field detection	22	Strong DC field detection ,start time threshold:0s	Fraud attempt
Meter cover open	23	Meter cover open ,start time threshold:0s	Fraud attempt
Terminal cover open	24	Terminal cover open ,start time threshold:0s	Fraud attempt
Fail login attempt	25	key error	Fraud attempt
Meter cover closed	26	Meter cover closed ,end time threshold:0s	None
Terminal cover closed	27	Terminal cover closed ,end time threshold:0s	None
Event log cleared	255	Event log cleared	None

6.6. Power Quality log

Event name	Event code	Trigger corresponding event	Trigger corresponding alarm
Long term under voltage start L1	40	Va > 56V && Va < 207V,start time threshold:600s	L1 Long term under voltage start
Long term under voltage start L2	41	Vb > 56V && Vb < 207V,start time threshold:600s	L2 Long term under voltage start
lock	42	Vc > 56V && Vc < 207V,start time threshold:600s	L3 Long term under voltage start
Long term under voltage end L1	43	Va <= 56V || Va >= 207V,end time threshold:3s	L1 Long term under voltage ends
Long term under voltage end L2	44	Vb <= 56V || Vb >= 207V,end time threshold:3s	L2 Long term under voltage ends

Long term under voltage end L3	45	Vc <= 56V || Vc >= 207V,end time threshold:3s	L3 Long term under voltage ends
Long term over voltage start L1	46	Va > 253V,start time threshold:600s	L1 Long term over voltage start
Long term over voltage start L2	47	Vb > 253V,start time threshold:600s	L2 Long term over voltage start
Long term over voltage start L3	48	Vc > 253V,start time threshold:600s	L3 Long term over voltage start
Long term over voltage end L1	49	Va <= 253V,end time threshold:3s	L1 Long term over voltage ends
Long term over voltage end L2	50	Vb <= 253V,end time threshold:3s	L2 Long term over voltage ends
Long term over voltage end L3	51	Vc <= 253V,end time threshold:3s	L3 Long term over voltage ends
Short term under voltage start L1	52	Va > 56 && Va < 161,start time threshold:5s	L1 Short term under voltage start
Short term under voltage start L2	53	Vb > 56 && Vb < 161,start time threshold:5s	L2 Short term under voltage start
Short term under voltage start L3	54	Vc > 56 && Vc < 161,start time threshold:5s	L3 Short term under voltage start
Short term under voltage end L1	55	Va <= 56 || Va >= 161,end time threshold:3s	L1 Short term under voltage ends
Short term under voltage end L2	56	Vb <= 56 || Vb >= 161,end time threshold:3s	L2 Short term under voltage ends
Short term under voltage end L3	57	Vc <= 56 || Vc >= 161,end time threshold:3s	L3 Short term under voltage ends
Short term over voltage start L1	58	Va > 265V,start time threshold:5s	L1 Short term over voltage start
Short term over voltage start L2	59	Vb > 265V,start time threshold:5s	L2 Short term over voltage start
Short term over voltage start L3	60	Vc > 265V,start time threshold:5s	L3 Short term over voltage start
Short term over voltage end L1	61	Va <= 265V,end time threshold:3s	L1 Short term over voltage ends
Short term over voltage end L2	62	Vb <= 265V,end time threshold:3s	L2 Short term over voltage ends

Short term over voltage end L3	63	Vc <= 265V,end time threshold:3s	L3 Short term over voltage ends
Voltage unbalance start	64	(Vmax - Vmin) / Vmax > 2%,start time threshold:600s	Voltage unbalance start
Voltage unbalance end	65	(Vmax - Vmin) / Vmax <= 2%,end time threshold:3s	Voltage unbalance ends
Frequency offset start	66	Freq <= 44 || Freq >= 54,start time threshold:10s	Frequency offset start
Frequency offset end	67	Freq > 44 && Freq < 54,end time threshold:3s	Frequency offset end
THD start L1	68	Vathd > 8%,start time threshold:600s	THD start L1
THD start L2	69	Vbthd > 8%,start time threshold:600s	THD start L2
THD start L3	70	Vcthd > 8%,start time threshold:600s	THD start L3
THD end L1	71	Vathd <= 8%,end time threshold:3s	THD end L1
THD end L2	72	Vbthd <= 8%,end time threshold:3s	THD end L2
THD end L3	73	Vcthd <= 8%,end time threshold:3s	THD end L3
Second Hormonic Distortion L1 start	74	Vathd > 2.0%,start time threshold:600s	None
Second Hormonic Distortion L2 start	75	Vbthd > 2.0%,start time threshold:600s	None
Second Hormonic Distortion L3 start	76	Vcthd > 2.0%,start time threshold:600s	None
Second Hormonic Distortion L1 end	77	Vathd <= 2.0%,end time threshold:3s	None
Second Hormonic Distortion L2 end	78	Vbthd <= 2.0%,end time threshold:3s	None
Second Hormonic Distortion L3 end	79	Vcthd <= 2.0%,end time threshold:3s	None
Third Hormonic Distortion L1 start	80	Vathd > 5.0%,start time threshold:600s	None

Third Hormonic Distortion L2 start	81	Vbthd > 5.0%,start time threshold:600s	None
Third Hormonic Distortion L3 start	82	Vcthd > 5.0%,start time threshold:600s	None
Third Hormonic Distortion L1 end	83	Vathd <= 5.0%,end time threshold:3s	None
Third Hormonic Distortion L2 end	84	Vbthd <= 5.0%,end time threshold:3s	None
Third Hormonic Distortion L3 end	85	Vcthd <= 5.0%,end time threshold:3s	None
Fourth Hormonic Distortion L1 start	86	Vathd > 1.0%,start time threshold:600s	None
Fourth Hormonic Distortion L2 start	87	Vbthd > 1.0%,start time threshold:600s	None
Fourth Hormonic Distortion L3 start	88	Vcthd > 1.0%,start time threshold:600s	None
Fourth Hormonic Distortion L1 end	89	Vathd <= 1.0%,end time threshold:3s	None
Fourth Hormonic Distortion L2 end	90	Vbthd <= 1.0%,end time threshold:3s	None
Fourth Hormonic Distortion L3 end	91	Vcthd <= 1.0%,end time threshold:3s	None
Fifth Hormonic Distortion L1 start	92	Vathd > 6.0%,start time threshold:600s	None
Fifth Hormonic Distortion L2 start	93	Vbthd > 6.0%,start time threshold:600s	None
Fifth Hormonic Distortion L3 start	94	Vcthd > 6.0%,start time threshold:600s	None
Fifth Hormonic Distortion L1 end	95	Vathd <= 6.0%,end time threshold:3s	None
Fifth Hormonic Distortion L2 end	96	Vbthd <= 6.0%,end time threshold:3s	None
Fifth Hormonic Distortion L3 end	97	Vcthd <= 6.0%,end time threshold:3s	None
Sixth Hormonic Distortion L1 start	98	Vathd > 0.5%,start time threshold:600s	None

Sixth Hormonic Distortion L2 start	99	Vbthd > 0.5%,start time threshold:600s	None
Sixth Hormonic Distortion L3 start	100	Vcthd > 0.5%,start time threshold:600s	None
Sixth Hormonic Distortion L1 end	101	Vathd <= 0.5%,end time threshold:3s	None
Sixth Hormonic Distortion L2 end	102	Vbthd <= 0.5%,end time threshold:3s	None
Sixth Hormonic Distortion L3 end	103	Vcthd <= 0.5%,end time threshold:3s	None
Seventh Hormonic Distortion L1 start	104	Vathd > 5.0%,start time threshold:600s	None
Seventh Hormonic Distortion L2 start	105	Vbthd > 5.0%,start time threshold:600s	None
Seventh Hormonic Distortion L3 start	106	Vcthd > 5.0%,start time threshold:600s	None
Seventh Hormonic Distortion L1 end	107	Vathd <= 5.0%,end time threshold:3s	None
Seventh Hormonic Distortion L2 end	108	Vbthd <= 5.0%,end time threshold:3s	None
Seventh Hormonic Distortion L3 end	109	Vcthd <= 5.0%,end time threshold:3s	None
Eighth Hormonic Distortion L1 start	110	Vathd > 0.5%,start time threshold:600s	None
Eighth Hormonic Distortion L2 start	111	Vbthd > 0.5%,start time threshold:600s	None
Eighth Hormonic Distortion L3 start	112	Vcthd > 0.5%,start time threshold:600s	None
Eighth Hormonic Distortion L1 end	113	Vathd <= 0.5%,end time threshold:3s	None
Eighth Hormonic Distortion L2 end	114	Vbthd <= 0.5%,end time threshold:3s	None
Eighth Hormonic Distortion L3 end	115	Vcthd <= 0.5%,end time threshold:3s	None
Nineth Hormonic Distortion L1 start	116	Vathd > 1.5%,start time threshold:600s	None

Nineth Hormonic Distortion L2 start	117	Vbthd > 1.5%,start time threshold:600s	None
Nineth Hormonic Distortion L3 start	118	Vcthd > 1.5%,start time threshold:600s	None
Nineth Hormonic Distortion L1 end	119	Vathd <= 1.5%,end time threshold:3s	None
Nineth Hormonic Distortion L2 end	120	Vbthd <= 1.5%,end time threshold:3s	None
Nineth Hormonic Distortion L3 end	121	Vcthd <= 1.5%,end time threshold:3s	None
Tenth Hormonic Distortion L1 start	122	Vathd > 0.5%,start time threshold:600s	None
Tenth Hormonic Distortion L2 start	123	Vbthd > 0.5%,start time threshold:600s	None
Tenth Hormonic Distortion L3 start	124	Vcthd > 0.5%,start time threshold:600s	None
Tenth Hormonic Distortion L1 end	125	Vathd <= 0.5%,end time threshold:3s	None
Tenth Hormonic Distortion L2 end	126	Vbthd <= 0.5%,end time threshold:3s	None
Tenth Hormonic Distortion L3 end	127	Vcthd <= 0.5%,end time threshold:3s	None
Eleventh Hormonic Distortion L1 start	128	Vathd > 3.5%,start time threshold:600s	None
Eleventh Hormonic Distortion L2 start	129	Vbthd > 3.5%,start time threshold:600s	None
Eleventh Hormonic Distortion L3 start	130	Vcthd > 3.5%,start time threshold:600s	None
Eleventh Hormonic Distortion L1 end	131	Vathd <= 3.5%,end time threshold:3s	None
Eleventh Hormonic Distortion L2 end	132	Vbthd <= 3.5%,end time threshold:3s	None
Eleventh Hormonic Distortion L3 end	133	Vcthd <= 3.5%,end time threshold:3s	None
Twelveth Hormonic Distortion L1 start	134	Vathd > 0.5%,start time threshold:600s	None

Twelveth Hormonic Distortion L2 start	135	Vbthd > 0.5%,start time threshold:600s	None
Twelveth Hormonic Distortion L3 start	136	Vcthd > 0.5%,start time threshold:600s	None
Twelveth Hormonic Distortion L1 end	137	Vathd <= 0.5%,end time threshold:3s	None
Twelveth Hormonic Distortion L2 end	138	Vbthd <= 0.5%,end time threshold:3s	None
Twelveth Hormonic Distortion L3 end	139	Vcthd <= 0.5%,end time threshold:3s	None
Thirteenth Hormonic Distortion L1 start	140	Vathd > 3.0%,start time threshold:600s	None
Thirteenth Hormonic Distortion L2 start	141	Vbthd > 3.0%,start time threshold:600s	None
Thirteenth Hormonic Distortion L3 start	142	Vcthd > 3.0%,start time threshold:600s	None
Thirteenth Hormonic Distortion L1 end	143	Vathd <= 3.0%,end time threshold:3s	None
Thirteenth Hormonic Distortion L2 end	144	Vbthd <= 3.0%,end time threshold:3s	None
Thirteenth Hormonic Distortion L3 end	145	Vcthd <= 3.0%,end time threshold:3s	None
Fourteenth Hormonic Distortion L1 start	146	Vathd > 0.5%,start time threshold:600s	None
Fourteenth Hormonic Distortion L2 start	147	Vbthd > 0.5%,start time threshold:600s	None
Fourteenth Hormonic Distortion L3 start	148	Vcthd > 0.5%,start time threshold:600s	None
Fourteenth Hormonic Distortion L1 end	149	Vathd <= 0.5%,end time threshold:3s	None
Fourteenth Hormonic Distortion L2 end	150	Vbthd <= 0.5%,end time threshold:3s	None
Fourteenth Hormonic Distortion L3 end	151	Vcthd <= 0.5%,end time threshold:3s	None
Fifteenth Hormonic Distortion L1 start	152	Vathd > 0.5%,start time threshold:600s	None

Fifteenth Hormonic Distortion L2 start	153	Vbthd > 0.5%,start time threshold:600s	None
Fifteenth Hormonic Distortion L3 start	154	Vcthd > 0.5%,start time threshold:600s	None
Fifteenth Hormonic Distortion L1 end	155	Vathd <= 0.5%,end time threshold:3s	None
Fifteenth Hormonic Distortion L2 end	156	Vbthd <= 0.5%,end time threshold:3s	None
Fifteenth Hormonic Distortion L3 end	157	Vcthd <= 0.5%,end time threshold:3s	None
Sixteenth Hormonic Distortion L1 start	158	Vathd > 0.5%,start time threshold:600s	None
Sixteenth Hormonic Distortion L2 start	159	Vbthd > 0.5%,start time threshold:600s	None
Sixteenth Hormonic Distortion L3 start	160	Vcthd > 0.5%,start time threshold:600s	None
Sixteenth Hormonic Distortion L1 end	161	Vathd <= 0.5%,end time threshold:3s	None
Sixteenth Hormonic Distortion L2 end	162	Vbthd <= 0.5%,end time threshold:3s	None
Sixteenth Hormonic Distortion L3 end	163	Vcthd <= 0.5%,end time threshold:3s	None
Seventeenth Hormonic Distortion L1 start	164	Vathd > 2.0%,start time threshold:600s	None
Seventeenth Hormonic Distortion L2 start	165	Vbthd > 2.0%,start time threshold:600s	None
Seventeenth Hormonic Distortion L3 start	166	Vcthd > 2.0%,start time threshold:600s	None
Seventeenth Hormonic Distortion L1 end	167	Vathd <= 2.0%,end time threshold:3s	None
Seventeenth Hormonic Distortion L2 end	168	Vbthd <= 2.0%,end time threshold:3s	None
Seventeenth Hormonic Distortion L3 end	169	Vcthd <= 2.0%,end time threshold:3s	None
Eighteenth Hormonic Distortion L1 start	170	Vathd > 0.5%,start time threshold:600s	None

Eighteenth Hormonic Distortion L2 start	171	Vbthd > 0.5%,start time threshold:600s	None
Eighteenth Hormonic Distortion L3 start	172	Vcthd > 0.5%,start time threshold:600s	None
Eighteenth Hormonic Distortion L1 end	173	Vathd <= 0.5%,end time threshold:3s	None
Eighteenth Hormonic Distortion L2 end	174	Vbthd <= 0.5%,end time threshold:3s	None
Eighteenth Hormonic Distortion L3 end	175	Vcthd <= 0.5%,end time threshold:3s	None
Nineteenth Hormonic Distortion L1 start	176	Vathd > 1.5%,start time threshold:600s	None
Nineteenth Hormonic Distortion L2 start	177	Vbthd > 1.5%,start time threshold:600s	None
Nineteenth Hormonic Distortion L3 start	178	Vcthd > 1.5%,start time threshold:600s	None
Nineteenth Hormonic Distortion L1 end	179	Vathd <= 1.5%,end time threshold:3s	None
Nineteenth Hormonic Distortion L2 end	180	Vbthd <= 1.5%,end time threshold:3s	None
Nineteenth Hormonic Distortion L3 end	181	Vcthd <= 1.5%,end time threshold:3s	None
Twentieth Hormonic Distortion L1 start	182	Vathd > 0.5%,start time threshold:600s	None
Twentieth Hormonic Distortion L2 start	183	Vbthd > 0.5%,start time threshold:600s	None
Twentieth Hormonic Distortion L3 start	184	Vcthd > 0.5%,start time threshold:600s	None
Twentieth Hormonic Distortion L1 end	185	Vathd <= 0.5%,end time threshold:3s	None
Twentieth Hormonic Distortion L2 end	186	Vbthd <= 0.5%,end time threshold:3s	None
Twentieth Hormonic Distortion L3 end	187	Vcthd <= 0.5%,end time threshold:3s	None
Twenty- first Hormonic Distortion L1 start	188	Vathd > 0.5%,start time threshold:600s	None

Twenty- first Hormonic Distortion L2 start	189	Vbthd > 0.5%,start time threshold:600s	None
Twenty- first Hormonic Distortion L3 start	190	Vcthd > 0.5%,start time threshold:600s	None
Twenty- first Hormonic Distortion L1 end	191	Vathd <= 0.5%,end time threshold:3s	None
Twenty- first Hormonic Distortion L2 end	192	Vbthd <= 0.5%,end time threshold:3s	None
Twenty- first Hormonic Distortion L3 end	193	Vcthd <= 0.5%,end time threshold:3s	None
Twenty- second Hormonic Distortion L1 start	194	Vathd > 0.5%,start time threshold:600s	None
Twenty- second Hormonic Distortion L2 start	195	Vbthd > 0.5%,start time threshold:600s	None
Twenty- second Hormonic Distortion L3 start	196	Vcthd > 0.5%,start time threshold:600s	None
Twenty- second Hormonic Distortion L1 end	197	Vathd <= 0.5%,end time threshold:3s	None
Twenty- second Hormonic Distortion L2 end	198	Vbthd <= 0.5%,end time threshold:3s	None
Twenty- second Hormonic Distortion L3 end	199	Vcthd <= 0.5%,end time threshold:3s	None
Twenty- third Hormonic Distortion L1 start	200	Vathd > 1.5%,start time threshold:600s	None
Twenty- third Hormonic Distortion L2 start	201	Vbthd > 1.5%,start time threshold:600s	None
Twenty- third Hormonic Distortion L3 start	202	Vcthd > 1.5%,start time threshold:600s	None

Twenty- third Hormonic Distortion L1 end	203	Vathd <= 1.5%,end time threshold:3s	None
Twenty- third Hormonic Distortion L2 end	204	Vbthd <= 1.5%,end time threshold:3s	None
Twenty- third Hormonic Distortion L3 end	205	Vcthd <= 1.5%,end time threshold:3s	None
Twenty- fourth Hormonic Distortion L1 start	206	Vathd > 0.5%,start time threshold:600s	None
Twenty- fourth Hormonic Distortion L2 start	207	Vbthd > 0.5%,start time threshold:600s	None
Twenty- fourth Hormonic Distortion L3 start	208	Vcthd > 0.5%,start time threshold:600s	None
Twenty- fourth Hormonic Distortion L1 end	209	Vathd <= 0.5%,end time threshold:3s	None
Twenty- fourth Hormonic Distortion L2 end	210	Vbthd <= 0.5%,end time threshold:3s	None
Twenty- fourth Hormonic Distortion L3 end	211	Vcthd <= 0.5%,end time threshold:3s	None
Twenty- fifth Hormonic Distortion L1 start	212	Vathd > 1.5%,start time threshold:600s	None
Twenty- fifth Hormonic Distortion L2 start	213	Vbthd > 1.5%,start time threshold:600s	None
Twenty- fifth Hormonic Distortion L3 start	214	Vcthd > 1.5%,start time threshold:600s	None
Twenty- fifth Hormonic Distortion L1 end	215	Vathd <= 1.5%,end time threshold:3s	None
Twenty- fifth Hormonic Distortion L2 end	216	Vbthd <= 1.5%,end time threshold:3s	None

Twenty- fifth Hormonic Distortion L3 end	217	Vcthd <= 1.5%,end time threshold:3s	None
Event log cleared	255	Event log cleared	None

6.7. Firmware upgrade Log

Event name	Event code	Trigger corresponding event	Trigger corresponding alarm
Firmware transfer ok	230	Firmware transfer ok	None
Firmware verification fail	231	Firmware verification fail	None
Firmware verification ok	232	Firmware verification ok	None
Firmware activation fail	233	Firmware activation fail	None
Firmware activation ok	234	Firmware activation ok	None
Firmware roll back	235	None	None
Event log cleared	255	Event log cleared	None

6.8. Power failure log

Event name	Event code	Trigger corresponding event	Trigger corresponding alarm
Voltage interruption any phase start	240	Voltage interruption any phase start,start time threshold:100ms	Power failure in any phase
Voltage interruption L1 start	241	Voltage interruption L1 start,start time threshold:100ms	L1 Power interruption start
Voltage interruption L2 start	242	Voltage interruption L2 start,start time threshold:100ms	L2 Power interruption start
Voltage interruption L3 start	243	Voltage interruption L3 start,start time threshold:100ms	L3 Power interruption start
Long power failure L1 end	244	Long power failure L1 end time > 180s	Power back in any phase
Short power failure L1 end	245	Short power failure L1 end time <= 180s	Power back in any phase
Long power failure L2 end	246	Long power failure L2 end time > 180s	Power back in any phase
Short power failure L2 end	247	Short power failure L2 end time <= 180s	Power back in any phase
Long power failure L3 end	248	Long power failure L3 end time > 180s	Power back in any phase

Short power failure L3 end	249	Short power failure L3 end time <= 180s	Power back in any phase
Long power failure all phase end	250	Long power failure all phase end time > 180s	Power back in any phase
Short power failure all phase end	251	Short power failure all phase end time <= 180s	Power back in all phase
Event log cleared	255	Event log cleared	None

6.9. Communication Event log

Event name	Event code	Trigger corresponding event	Trigger corresponding alarm
Modem recognition failed	256	Meter can't recognize the modem type.	None
Modem SIM card ok	257	Modem detected SIM card after power on	None
Modem reboot by initial failed	258	Modem startup failed	None
Modem register success	259	Modem attach to the network success	None
Modem register failed	260	Modem attach to the network failed	None
Modem PDP context establish success	261	Modem established the PDP context	None
Modem PDP context destroyed	262	Modem destroyed the PDP context	None
Modem TCP/UDP connection failed	263	Modem can't establish the connection for TCP/UDP after push triggered.	None
Modem TCP listen destroyed	264	Modem destroyed the TCP server.	None
Modem TCP connection no transfer timeout	265	The TCP connection closed by modem when the configurable timer no date interaction expired (default 5 minutes).	None
Modem removed	267	The modem pull out.	None

Modem reboot by PDP roll check	268	Modem reboot by itself when PDP context destroyed up to three times.	None
Modem SIM card failed	269	Modem can't detect the SIM card after power on.	None
Modem reboot by reset timer expired	270	Modem reboot by itself when the configurable timer no date interaction expired (default 24 hours).	None
Modem reboot by physical roll check	271	Modem reboot by itself when network deactivated up to five times.	None
Modem reboot by TCP listen roll check	272	Modem reboot by itself when TCP server destroyed up to five times.	None
Event log cleared	255	Event log cleared	None

7. Real Time Clock

The RTC complies with IEC 62054-21. At reference voltage and reference temperature (23°C), clock accuracy is better than ±0,5 s/day. The variation of the clock accuracy with the temperature shall be less than (±0,15 s/°C/24 h).

The RTC supports leap year, day light saving time. In case of power cut, the RTC of the meter can continue to run for about 5 days when the meter, with the support of super capacitor. If the RTC loses current time due to a long power down of more than 5 days, when the meter is powered on, RTC will continue to run with the time of last power down. However, the chronology of the measurement values will be sustained. In the case that tariff registers are used, a default tariff (tariff 1) will be used until the meter's clock is synchronized to a correct clock.

Meter time and date synchronization is possible through central system as well as via the optical interface. If the difference between the setting time and meter time is bigger than 7 seconds. The time will be set to the RTC. Time synchronization event will be logged in the log file.

8. Disconnector and Load Management

The Disconnector of the meter can be controlled by the command or based on a schedule.

8.1. Auxiliary relay control activity calendar

- Using a dedicated activity calendar for the load management allows the configuration of the load switches independent of the tariff rate switching.
- The load management activity calendar supports the following:4 seasons profiles
  - 4 weeks profiles
  - 4 day profiles
  - 20 special days

8.2. Auxiliary relay control special days table

The table allows the defining of special days for the load management activity calendar.

Special day's table support a maximum of 20 entries in order to cover all fixed and flexible holidays

The relevant entries take precedence over the "Load Management activity calendar" object driven selection of a day profile. The day profile referenced in the "Load Management special day's table" activates the day_schedule of the day_profile_table in the "Load Management activity calendar" object by referencing through the day_id.

If there is no valid day_id available in the day_profile_table, the special day request will be simply ignored.

On special day table updates, the current "Load Management activity calendar" actions and schedules are updated immediately.

8.3. Auxiliary relay control scheduler

Tariff				
		Monday to Sunday（week ID1）		
		start	end	Tariff
Jan-01	Day ID1	6:00	22:00	T2
		22:00	6:00	T2
		Monday to Sunday（week ID2）		
Apr-01	Day ID1	6:00	22:00	T2
		22:00	6:00	T2
		Monday to Sunday（week ID3）		
July-01	Day ID1	6:00	22:00	T2
		22:00	6:00	T2
		Monday to Sunday（week ID4）		
Oct-01	Day ID1	6:00	22:00	T2
		22:00	6:00	T2

8.4. Disconnect Control log

All events concerning the auxiliary will be recorded into the standard event log, please see standard event log.

9. Tariff Management

The meter calendar and tariff handling follows the same rules as defined in the IDIS package 2 specification [D]:

Tariffication activity calendar

The activity calendar supports the following:

- 4 seasons profiles
- 4 weeks profiles, exactly one per season
- 4 days profiles
- 2 switching times per day

Within the “Tariffication activity calendar”, the integrity must be verified from season to days in the following way:

=> Each season profile references a valid week profile which again references valid day profiles

- keeping week profiles that are not referenced by a season profile is allowed
- keeping day profiles that are not referenced by a week profile is allowed

For setting the activate_passive_calendar_time attribute, the following conditions apply:

- Current date and time as local time (hundredths of seconds must be ignored)
- Day of Week must be handled correctly
- Deviation must be set to 0x8000
- Status must be set to 0xFF

Tariffication special days table

Special days table must support a 20 entries.

The relevant entries take precedence over the “Tariffication activity calendar” object driven selection of a day profile. The day profile referenced in the “Tariffication special days table” activates the day_schedule of the day_profile_table in the “Tariffication activity calendar” object by referencing through the day_id.

If there is no valid day_id available in the day_profile_table, the special day request is simply ignored.

On special day table updates, the current “Tariffication activity calendar” actions and schedules are updated immediately.

Default tariffication script

Holds the script selector number as defined in the Tariffication Script Table which must be activated in the case of invalid tariff information or invalid clock.

Currently active energy tariff

Holds the name of the currently active mask as defined in the Register activation, the currently active energy tariff always display on LCD.

During the tariff activation and configuration, the meter records some tariff-related event log. Please see table 5.1 Standard Event Log.

10. Load Profiles

10.1. Load Profile Characteristics

Each load profile has the following characteristics:

A circular buffer is used for each load profile.

Each entry of load profile has a time stamp and load profile status word.

The capture interval of each load profile is programmable, configurable within below values: 300 seconds, 600 seconds, 900 seconds, 1800 seconds, 3600 seconds, 7200 seconds, 14400 seconds, 21600 seconds, 43200 seconds and 86400 seconds, and the default value is 900 seconds (15 minutes).

If power off cross capture points, the meter will supplement the missing points after power on.

The load profile supports read by range and by entry, also supports selectable capture objects.

10.2. Load Profile Status Word

Each load profile entry includes a load profile status word with eight bits:

Bit #	Description
7	Power down(PDN): This bit is set to indicate that a total power outage has been detected during the affected capture period.
6	Reserved: The reserved bit is always set to 0.
5	Clock adjusted(CAD): The bit is set when the clock has been adjusted by more than the synchronization limit.
4	Reserved: The reserved bit is always set to 0.
3	Daylight saving(DST): Indicates whether or not the daylight saving time is currently active. The bit is set if the daylight saving time is active (summer) and cleared during normal time (winter).
2	Data not valid(DNV): Indicates that the current entry may not be used for billing purposes without further validation because a special event has occurred.
1	Clock invalid(CIV): The power reserve of the calendar clock has been exhausted. The time is declared as invalid. At the same time the DNV bit is set.
0	Critical error(ERR): A serious error such as a hardware failure or a checksum error has occurred. If the ERR bit is set then also the DNV bit is set.

10.3. Load Profile List

The meter supports following load profiles:

Load Profile	Interval	Capacity	Capture Objects Display Enable symbol
Cumulative energy load profile (1-0:99.1.0.255)	15 Minutes	4320	{8,0-0:1.0.0.255,2,0} (Date Time) Time in load profile include the time zone {1,0-0:96.10.2.255} (AMR Profile Status Code Emeter) {3,1-0:1.8.0.255,2,0} (Active energy Import) {3,1-0:2.8.0.255,2,0} (Active energy Export) {3,1-0:3.8.0.255,2,0} (Reactive energy Import) {3,1-0:4.8.0.255,2,0} (Reactive energy Export)
Daily energy load profile (1-0:99.3.0.255)	12 hours (at 0 and 12 o'clock of each day)	45	{8,0-0:1.0.0.255,2,0} (Date Time) {0-0:96.10.2.255}(AMR Profile Status Code E meter) {3,1-0:21.26.0.255,2,0} (Max Active power Import L1 Phase) {1,1-0:21.26.128.255,2,0} (Timestamp Max Active power Import L1 Phase) {3,1-0:41.26.0.255,2,0} (Max Active power Import L2 Phase) {1,1-0:41.26.128.255,2,0} (TimestampMax Active power Import L2 Phase) {3,1-0:61.26.0.255,2,0} (Max Active power Import L3 Phase) {1,1-0:61.26.128.255,2,0} (Timestamp Max Active power Import L3 Phase) {3,1-0:22.26.0.255,2,0} (Max Active power Export L1 Phase) {1,1-0:22.26.128.255,2,0} (Timestamp Max Active power Export L1 Phase) {3,1-0:42.26.0.255,2,0} (Max Active power Export L2 Phase) {1,1-0:42.26.128.255,2,0} (Timestamp Max Active power Export L2 Phase) {3,1-0:62.26.0.255,2,0} (Max Active power Export L3 Phase) {1,1-0:62.26.128.255,2,0} (Timestamp Max Active power Export L3 Phase)

			{3,1-0:23.26.0.255,2,0} (Max Reactive power Import L1 Phase) {1,1-0:23.26.128.255,2,0} (Timestamp Max Reactive power Import L1 Phase) {3,1-0:43.26.0.255,2,0} (Max Reactive power Import L2 Phase) {1,1-0:43.26.128.255,2,0} (Timestamp Max Reactive power Import L2 Phase) {3,1-0:63.26.0.255,2,0} (Max Reactive power Import L3 Phase) {1,1-0:63.26.128.255,2,0} (Timestamp Max Reactive power Import L3 Phase) {3,1-0:24.26.0.255,2,0} (Max Reactive power Export L1 Phase) {1,1-0:24.26.128.255,2,0} (Timestamp Max Reactive power Export L1 Phase) {3,1-0:44.26.0.255,2,0} (Max Reactive power Export L2 Phase) {1,1-0:44.26.128.255,2,0} (Timestamp Max Reactive power Export L2 Phase) {3,1-0:64.26.0.255,2,0} (Max Reactive power Export L3 Phase) {1,1-0:64.26.128.255,2,0} (Timestamp Max Reactive power Export L3 Phase) {3,1-0:32.26.1.255,2,0}(Max voltage L1) {1,1-0:32.26.128.255,2,0}(Timestamp Max voltage L1) {3,1-0:52.26.1.255,2,0}(Max voltage L2) {1,1-0:52.26.128.255,2,0}(Time stamp Max voltage L2) {3,1-0:72.26.1.255,2,0}(Max voltage L3) {1,1-0:72.26.128.255,2,0}(Timestamp Max voltage L3) {3,1-0:32.23.0.255,2,0}(Min voltage L1) {1,1-0:32.23.128.255,2,0}(Timestamp Min voltage L1) {3,1-0:52.23.0.255,2,0}(Min voltage L2) {1,1-0:52.23.128.255,2,0}(Timestamp Min voltage L2) {3,1-0:72.23.0.255,2,0}(Min voltage L3) {1,1-0:72.23.128.255,2,0}(Timestamp Min voltage L3) {3,1-0:31.26.1.255,2,0}(Max current L1)

			{1,1-0:31.26.128.255,2,0}(Timestamp Max current L1) {3,1-0:51.26.1.255,2,0}(Max current L2) {1,1-0:51.26.128.255,2,0}(Timestamp Max current L2) {3,1-0:71.26.1.255,2,0}(Max current L3) {1,1-0:71.26.128.255,2,0}(Timestamp Max current L3) {3,1-0:32.7.0.255,2,0 x=32,52,72} (Inst voltage) {3,1-0:x.7.0.255,2,0 x=21,41,61} (Inst P+) {3,x-0:2.7.0.255,2,0 x=22,42,62} (Inst P-) {3,x-0:3.7.0.255,2,0 x= 23,42,63} (Inst R+) {3,x-0:4.7.0.255,2,0 x=24,44,64} (Inst R-)
Billing Profile (1-0:98.1.0.255)	externally triggered via "End of monthly billing period	13	{8,0-0:1.0.0.255,2,0} (Date Time) {1,0-0:96.10.2.255} (AMR Profile Status Code Emeter) {3,1-0:1.8.0.255,2,0} (Active energy Import) {3,1-0:2.8.0.255,2,0} (Active energy Export) {3,1-0:3.8.0.255,2,0} (Reactive energy Import) {3,1-0:4.8.0.255,2,0} (Reactive energy Export)

10.4. Load Profile Event Handling

IDIS describes the behaviour of the profile and the setting of the status bits considering different events.

Please refer to the following section of the IDIS package2 specifications [D]:

- Events

11. Power Quality

The smart meter refreshes the instantaneous value in real time, monitoring sag, swell and power fail of the voltage. And calculate the average value, maximum value and minimum value of the current and voltage in each measurement period 2.

11.1. Instantaneous Power values

For the monitoring of the instantaneous power values, the following functionality must be available:

- Instantaneous Voltage per phase.
- Instantaneous Current total and per phase.
- Instantaneous Frequency.
- Instantaneous power +P/-P/+Q/-Q total and per phase.
- Instantaneous power factor total and per phase.
- Instantaneous phase angle (U-I) L1/L2/L3.
- Average voltage, Maximum voltage, Minimum voltage per phase.

Instantaneous measurements are supported by the following objects (captured object configurable):

Object / Attribute Name	Class	Ver.	OBIS code
Instantaneous voltage L1,L2,L3	3	0	1-0:x.7.0.255 x=32,52,72
Instantaneous current L1,L2,L3	3	0	1-0:x.7.0.255 x=31,51,71
Instantaneous net frequency	3	0	1-0:14.7.0.255
Instantaneous power +P;-P;+Q;-Q ;	3	0	1-0:x.7.0.255 x=1,2,3,4,21, 22, 23, 24,41, 42, 43, 44,61, 62, 63, 64
Instantaneous power factor import (+P/+S) total,L1,L2,L3	3	0	1-0:x.7.0.255 x=13,33,53,73
Average voltage L1,L2,L3	3	0	1-0:x.24.0.255 x=32,52,72
Maximum voltage L1,L2,L3	3	0	1-0:x.26.0.255 x=32,52,72
Minimum voltage L1,L2,L3	3	0	1-0:x.23.0.255 x=32,52,72
Maximum Current L1,L2,L3	3	0	1-0:x.26.0.255 x=31,51,71

11.2. Sag and Swell detection

For the monitoring of sags and swells, the following functionality must be available:

- Number of sags and swells L1/L2/L3

Furthermore, the following configuration items are supported:

- Threshold for voltage sag (default 161V range:120~228)
- Time threshold for voltage sag (default 5s range:1~300)
- Threshold for voltage swell (default 265V range 232~300)
- Time threshold for voltage swell (default 5s range 1~300)
- Threshold for long under sag (default 207V range:120~228)

- Time threshold for long under voltage (default 600s range 10~2520)
- Threshold for long over voltage (default 253V range:232~300)
- Time threshold for long over voltage (default 600s range:10~2520)

The events will be recoded in a specific Power Quality event log.

The event time stamps in the power quality event log represent the start time of the Sag-, Swell- or Normal condition. It is not the timestamp of logging the event into the power quality log.

Voltage sag and swell (long under and over voltage) detection is supported by the following objects:

Object / Attribute Name	Class	Ver.	OBIS code
Threshold for voltage sag (long under voltage)	3	0	1-0:12.31.0.255
Time threshold for voltage sag (long under voltage)	3	0	1-0:12.43.0.255
Number of Voltage Sags L1/L2/L3	1	0	1-0:x.32.0.255 x=32,52,72
Threshold for voltage swell (long over-voltage)	3	0	1-0:12.35.0.255
Time threshold for long-term voltage swell (long over-voltage)	3	0	1-0:12.44.0.255
Number of Voltage Swells L1/L2/L3	1	0	1-0:x.36.0.255 x=32,52,72

short under and over voltage detection is supported by the following objects:

Object / Attribute Name	Class	Ver.	OBIS code
Threshold for short under voltage	3	0	1-0:12.31.128.255
Time threshold for short under voltage	3	0	1-0:12.43.128.255
Threshold for short over-voltage	3	0	1-0:12.35.128.255
Time threshold for short over-voltage	3	0	1-0:12.44.128.255

11.3. Voltage unbalance and Frequency

- Threshold for voltage unbalance (default 2% range:2%~100%)
- Time threshold for voltage unbalance (default 600s range:60~600)
- Grid Frequency offset (the thresholds are not configurable. The default offset up threshold is 54Hz, and the default down threshold is 44Hz. The time threshold is 10s)

The events will be recoded in a specific Power Quality event log.

Voltage unbalance is supported by following objects

Object / Attribute Name	Class	Ver.	OBIS code
Threshold for Voltage Unbalance	3	0	1-0:12.35.129.255
Time threshold for Voltage Unbalance	3	0	1-0:12.44.129.255

11.4. Power fail detection

For the monitoring of power fails, the following functionality is available:

- Number of power fails
- Number of long power fails

Smart meter will be record event log if the meter detected power up and power down. If the power failure time exceeds 180s, it's considered to be long power failures, otherwise it is short power failures.

Power fail is supported by following objects

Object / Attribute Name	Class	Ver.	OBIS code
Number of power failures in any phase	1	0	0-0:96.7.21.255
Number of long power failures in any phase	1	0	0-0:96.7.9.255
Power Failure Log event code	1	0	0-0;96.11.3.255
Duration of power failures	3	0	0-0:96.7.19.255
The instantaneous power of the moment when the power failure happens	3	0	0-0:96.8.19.255
The instantaneous voltage of the moment when the power failure happens	3	0	0-0:96.9.19.255
Power Failure Event Log	7	1	1-0:99.97.0.255

11.5. Harmonic detection

For the monitoring of harmonic, the following functionality must be available:

- Instantaneous first …twenty-fifth Harmonic Voltage L1/L2/L3

Further, the following configuration items must be supported:

- Threshold for harmonic distortion (default 8%)
- Time threshold for harmonic distortion (default 60s)

Object / Attribute Name	Class	Ver.	OBIS code
Instantaneous first …twenty-fifth Harmonic Voltage L1/L2/L3	3	0	1-2:x.11.y.255 x=32,52,72 y=1 … 25
Threshold for harmonic distortion	3	0	1-0:12.35.124.255
Time threshold for harmonic distortion	3	0	1-0:12.44.124.255

11.6. Neutral fault voltage detection

For the monitoring of neutral fault voltage, the following configuration items must be supported:

- Threshold for Neutral Fault Voltage High
- Threshold for Neutral Fault Voltage
- Time Threshold for Neutral Fault Detection

Object / Attribute Name	Class	Ver.	OBIS code
Threshold for Neutral Fault Voltage High	3	0	1-0:12.35.130.255
Threshold for Neutral Fault Voltage	3	0	1-0:12.31.130.255
Time Threshold for Neutral Fault Detection	3	0	1-0:12.44.130.255
Power Quality Log	7	1	0-0:99.98.3.255

11.7. Power Quality profile

The Power Quality Profile periodically records objects based on the options below:

- the average Voltage per phase
- the min Voltage per phase
- the max Voltage per phase

The period length for the averaging of voltage and current as well as the monitoring interval for the min / max detection is based on the configuration of the object “Measurement Period 2 for Instantaneous values” described below,

Power Quality

Capacity: 6480 entries (per 10 minutes in 45 days)

Structure: clock_time, profile_status, values

capture period: 1,5,10,15,30,60 min, the value is equal to the measurement period of all the captured objects. Further, the measurement period of the captured objects and the capture_period must be synchronised. The default setting is 10 minutes.

Captured objects: clock.time, Vav_a, Vav_b, Vav_c, Vmin_a, Vmin_b, Vmin_c, Vmax_a, Vmax_b, Vmax_c

the default value is

{8,0-0:1.0.0.255,2,0} (Date Time)

{3,1-0:32.26.0.255,2,0} (Maximum voltage L1)

{3,1-0:32.23.0.255,2,0} (Minimum voltage L1)

{3,1-0:32.24.0.255,2,0} (Average voltage L1)

{3,1-0:52.26.0.255,2,0} (Maximum voltage L2)

{3,1-0:52.23.0.255,2,0} (Minimum voltage L2)

{3,1-0:52.24.0.255,2,0} (Average voltage L2)

{3,1-0:72.26.0.255,2,0} (Maximum voltage L3)

{3,1-0:72.23.0.255,2,0} (Minimum voltage L3)

{3,1-0:72.24.0.255,2,0} (Average voltage L3)

Buffer encoding: normal: clock with every entry

Selective access: by range and by entry

Sorted method: unsorted (FIFO)

Average voltage and current

The algorithm of the averaging calculation is based on the number of captured instantaneous voltage and current samples within the interval period. This allows to generate meaningful data in the event of a disrupted interval due to power failure or a time change event. For example:

⇨ Voltage of 220V and Current of 10A with an averaging period of 10min
When there is power off for 5min within this period, the results for the average voltage and current would be still 220V and 10A based on the collected samples while the device was powered.

Min and Max Voltage

The algorithm of the voltage min/max calculation is based on comparing the captured instantaneous voltage samples to the last recorded values:

- For the Voltage minimum: update if the voltage sample value is smaller.
- For the Voltage maximum: update if the voltage sample value is higher.

At the start of a new integration period, the min/max registers are initialized with the first captured instantaneous voltage sample.

12. Firmware Update

The meter firmware is designed according to WELMEC software guide 7.2. The metrological part of the firmware is separated from all other firmware elements.

The meter supports remote and local firmware update for metrological part, non-metrological part. The update of the firmware only starts after the new firmware is completely downloaded to the meter by checking the signature of the firmware.

Firmware update list:

Firmware	description
Legal	Legal upgrade image, include measurement /load profile/demand/low derive related.
Non Legal	Application upgrade image,

Both remote and local meter firmware update is protected with security level 6 and 7 of HLS. The meter records the event log for the firmware update.

The remote FW update follows the definition of the IDIS package 2 specification [D].

Please refer to the following section of the IDIS package2 specifications [D]:

- Firmware Update

The meter supports only a single instance of the Image Transfer.

In case the meter supports the download of multiple parts of the firmware, it is the manufacturer's responsibility to ensure the proper identification and activation of these images.

Every image for download to the E-meter requires a digital signature.

The meter specifies the usage of the following algorithm

=> ECDSA P-256.

The activation of a new FW image requires the successful validation of the digital signature. The activation must be rejected in case the verification fails.

As part of the image verification, the E-meter checks the integrity of the received image and verifies the correctness of the image_identifier and image_size information (manufacturer specific data provided during the image transfer initialisation)

- Supported block size: 64 to 1024.
- The image file is encrypted using AES-128.
- Image transfer activation for scheduler.
- Only image files higher than current version are allowed to be upgrading.
- The FW Update client can be used for the image distribution via broadcast.

13. Communication Interfaces and Communication

The meter provides up to 4 communication interfaces:

Interface	Purpose	Baud Rate	Protocol
Optical port	Local communication	9600 bps	DLMS/COSEM HDLC profile basing on

The optical port and M_bus on the base meter. NBIoT or GPRS or RF or Cat-M are on communication module. The modular designed communication module supports plug and play. The communication module can be replaced without de-energizing the meter. All communication parameters and data are stored in the base meters.

13.1. Optical Port Communication

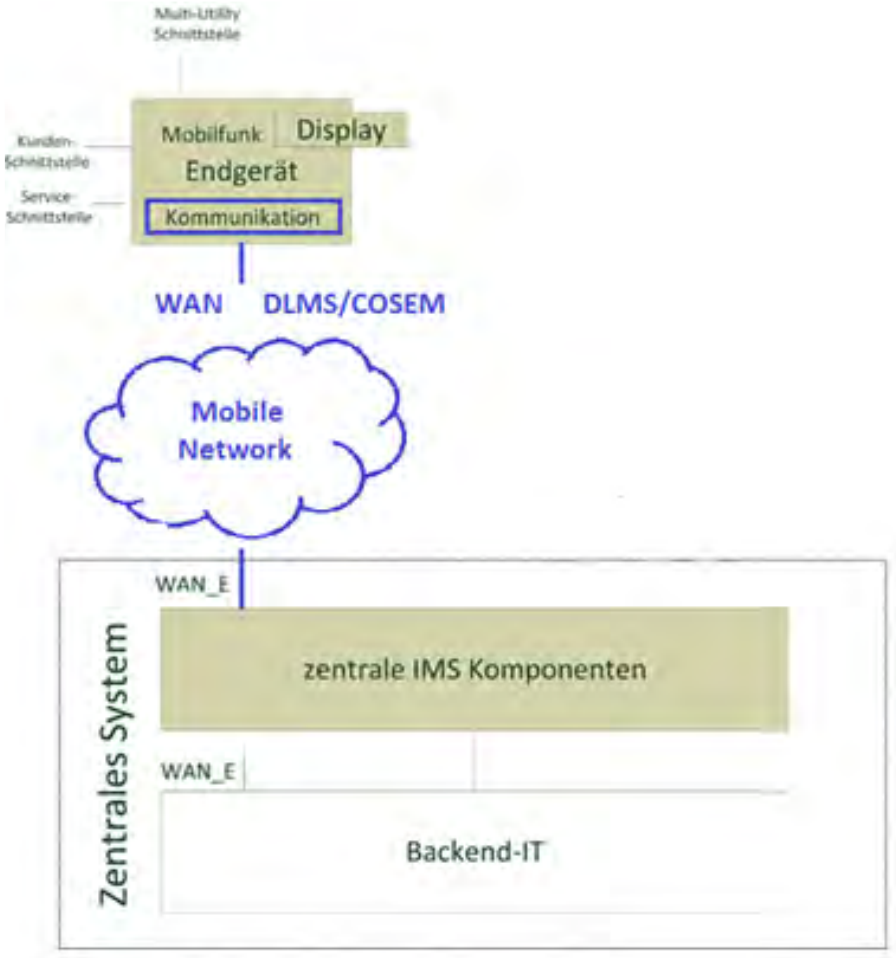
This optical port is used to read meter, to configure the meter parameter or to control the meter locally. In general, HHU or PC software is used to communicate with meter via this optical port.

Access to meter via this port is protected in a secure way as described in the security section.

The meter can be configured through the optical port only when local programmable mode is activated.

13.2. GPRS Profile

The DLMS/COSEM communication via the WAN interface is based on TCP over the IPv4 or IPv6 stack in combination with the GPRS cellular radio transport layer. A detailed description of the DLMS/COSEM related ommunication profiles and service is available in the P2P WAN Implementation Guide [3].



The P2P communication modem will act as a bridge between meters and Central Systems by enabling IP based transfers of meter data through mobile networks. On the network side, the modem shall be responsible for establishing and maintaining reliable IP connections to the customer's network. Contrarily on the meter side, the modem will act as a server towards the meter, enabling the meter to have full control over the data that is sent or retrieved from the modem (through a set of AT-commands defined by the modem supplier).

13.3. P2P Functionality Description

The P2P communication interface is designed to directly access the meter by using mobile technology, such as LTE CAT1 and NBIOT. The interface conforms to the latest 3GPP standard release v14. The main features of the communication interface include:

Communication bands: FDD-LTE B3/B8/B20;

LTE CAT1 - Uplink up to 5Mbps Downlink up to 10Mbps;

LTE CAT-M1(eMTC) - Uplink up to 375kbps, Downlink up to 300kbps;

NB-IOT - Uplink up to 66kbps, Downlink up to 34kbps;

Data network access authentication with APN, Username, and Password;

Support of push-Events, notification, and pull data;

IP message & domain name resolution;

PHY randomization procedure (preventing meters to send network registration request simultaneously)

Support self-diagnostics (auto reset in case of network anomalies)

Periodic ping to designated destinations;

Register communication data volume including uplink and downlink

13.4. Wireless M-Bus Communication to Multi-utility Meters

Up to 4 M-Bus multi-utility devices is available to connect to the electricity meter. The communication protocol complies with EN13757-3/4.

The electricity meter collects the reading data of M-Bus device every hour. The most recent multi-utility meter reading is available in the electricity meter (if it is not older than 24 hours) using m3 as the unit of measurement. The valve status of multi-utility meter is sent immediately after the next communication with the specific device (taking into account the delay of the medium).

Low power management is integrated for driving the M-Bus module in low power mode. A low power mode is entered when no M-Bus device is connected. During installation mode or when a device is installed the M-Bus module operates in normal power mode.

The meter supports the management of M-Bus devices through control commands, including valve control, clock synchronization and clear alarm.

13.5. Communication to IHD

The communication interface between E-meter and IHD is P1 interface, and it complies with SSMR5_Annex 02-5 Dutch Smart Meter Requirements v5.0.2 Final P1. After the IHD has paired with the E-meter, the E-meter and IHD is in a one-way communication. The E-meter transmits the data to the IHD periodically.

- The message transmitted by the meter includes:
- Equipment identifier
- Actual meter energy reading of electricity meter
- Actual electrical power

14. Security

14.1. Physical Security

The meter comply with double insulation of protective Class II followed EN62052-11. It could withstand 4KV AC voltage and 6KV impulse voltage test.

The meter has three seals for the meter face cover to seal the metrology part of the meter. It is impossible to access the metrological part of the meter unless the seals, the seals and the meter face cover or base are physically and clearly destroyed. The meter records the meter cover removal event and terminal cover removal event in both power on condition and power off condition with super cap charged.

The meter immunes magnetic field disturbance and records the magnetic field disturbance event.

The meter supports following anti-tamper features:

Event Code	Name	Description
40	Terminal cover removed	Indicates that the terminal cover has been removed.
41	Terminal cover closed	Indicates that the terminal cover has been closed.
42	Strong DC field detected	Indicates that a strong magnetic DC field has been detected.
43	No strong DC field anymore	Indicates that the strong magnetic DC field has disappeared.
44	Meter cover removed	Indicates that the meter cover has been removed.
45	Meter cover closed	Indicates that the meter cover has been closed.

14.2. Communication Security

The meter use security suite 1 initially (which adds support for digital signatures key agreement, and an authentication mechanism based on ECDSA using ECC P-256 asymmetric cryptography, all the while also supporting the suite 0 mechanisms for authenticated encryption and key wrapping).

14.3. Certificate handling

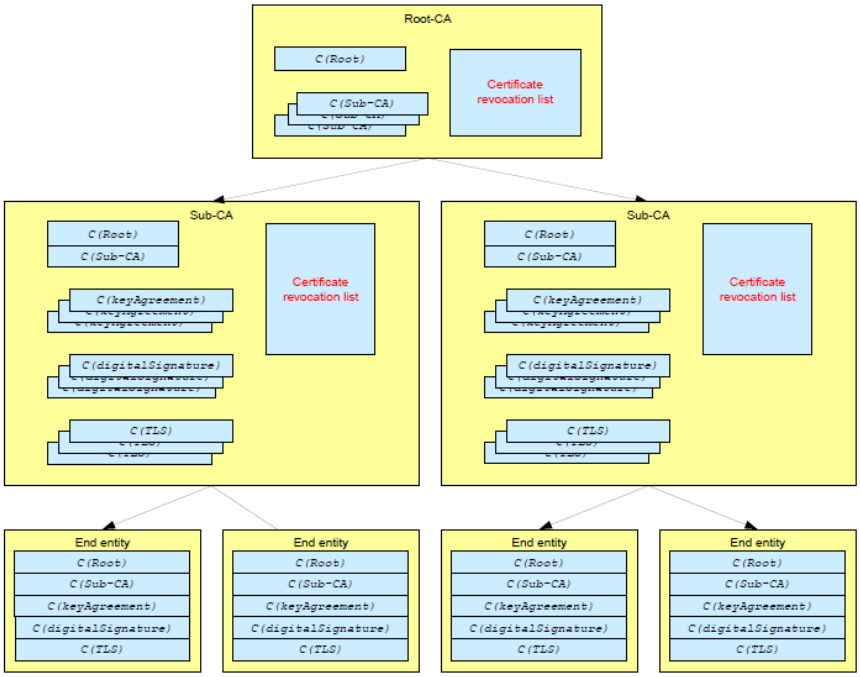
For DLMS/COSEM based meter data exchange systems using public key cryptography various public-private key pairs and public key certificates should be in place. A public key certificate binds a public key to an identity: the subject. A certificate is digitally signed by a Certification Authority. To provide and manage the certificates, some form of Public Key Infrastructure is required. A PKI consists of Certification Authorities issuing certificates and end entities using these certificates. For a PKI example, see green book 9.0 9.2.6.3.3.

In its simplest form, a certification hierarchy consists of a single CA. However, the hierarchy usually contains multiple CAs that have clearly defined parent-child relationships. It is also possible to deploy multiple hierarchies.

The PKI needs a trust anchor that is used to validate the first certificate in a sequence of certificates. The trust anchor may be a Root-CA certificate, a Sub-CA certificate or a directly trusted key.

Using the features of the DLMS security suites 1 like the generation of digital signatures and key agreement requires the support of Public Key certificates.

In general, the following PKI infrastructure is considered in order to create and manage public key certificates for facilitating the use of public key cryptography.



The following trusted certificates need supporting by the meter at a minimum:

- ⇨ Trust Anchor:
  - o Root CA Certificate
- ⇨ For the Sub-CA:
  - o Sub CA Certificate 1 (for DLMS Server certificates)
  - o Sub CA Certificate 2 (for DLMS Client certificates – Management and Readout clients)
  - o Sub CA Certificate 3 (for DLMS Client certificates – PLC Management client)
- ⇨ For the DLMS server:
  - o Meter certificate (for meter digital signature key pair)
- ⇨ For each DLMS client that uses Public key based features of Security Suite 1 and 2:
  - o Up to 2 HES certificates (Management Client security setup)
  - o Up to 2 HES certificates (Readout Client security setup)
  - o Up to 2 HES certificates (PLC Management Client security setup)

14.4. Updating Certificates

When updating any certificates within this structure, the chain of trust must be respected and validated.

To limit the impact on the embedded devices, the validation of the trust chain is only required at the time of importing a new certificate.

Further to this, the validation of the chain is always running from newly imported certificate down to the root certificate.

- Importing a new Root certificate
  - o Root certificate is validated by its own Root Public Key
- Importing a new Sub-CA certificate
  - o New Sub-CA certificate is validated by the Root Public Key
  - o Root certificate is validated by its own Root Public Key
- Importing a new Digital Signature certificate
  - o New Digital Signature certificate is validated by the Sub-CA Public Key
  - o Sub-CA certificate is validated by the Root Public Key
  - o Root certificate is validated by its own Root Public Key

The Server Digital Signature certificate cannot be removed from the server. When an update of this certificate is needed, a new key pair is generated, a new certificate request is generated and a new certificate is imported. The current key pair remains valid and active until the new certificate is successfully imported. The successful import of the new certificate automatically activates the new key pair in the server.

14.5. Keys

The meter has the following keys which are stored in the base meter in an encrypted way.

No	Type Name	Description
1	Authentication key	Ensure data integrity and authenticity
2	Encryption key	Ensure data confidentiality
3	Master key	Use to change other keys
4	HLS secret	Access security key
5	Certificate	Digital signatures and key agreement requires the support of Public Key certificates.

Each meter has its own individual keys once out of factory.

14.6. Clients

The logical device can have several associations. The following section defines the usage and capabilities of these clients. There is a one to one assignment between the clients and the physical interface. The only exception here is the Public Client, which is accessible on the local WZ interface as well as the LAN/WAN interface.

The access rights of these clients are indicated in Table 13.6.1: Client list.

There will be no direct access possible between the interfaces, for example from the WZ interface to the LAN/WAN interface.

Access to the H1 interface is provided through the objects offered by the logical device.

Below type of clients need to be supported

- Public client (LAN/WAN)
- Management client (LAN/WAN)
- Data Readout client (LAN/WAN)
- Maintenance client (WZ)

Client	SPA ID	Access port	Mandatory Services	Establishment	Security setting
Public	16	LAN/WAN	• Block-transfer-with-get • Get • General-block-transfer • Action • Access	LOWEST SECURITY	LOWEST SECURITY
Management	1	LAN/WAN	• Block-transfer-with-get • Block-transfer-with-set • Get • Set • Multiple-references • Selective Access • Action • General-block-transfer • General-protection • Access	HLS7, HLS6 and HLS5	• Security suite 1 • Security policy = all messages are authenticated and encrypted • Applicable keys: Global Unicast Encryption key Global Authentication key • Applicable certificates: Sub CA Certificate 1 Sub CA Certificate 2 HES certificate 1 Meter Digital signature certificate 1
Data Readout	32	LAN/WAN	• Block-transfer-with-get • Block-transfer-with-set • Get • Set • Multiple-references • Selective Access • Data-Notification • Action • General-block-transfer • General-protection • Access	LLS	LLS Key

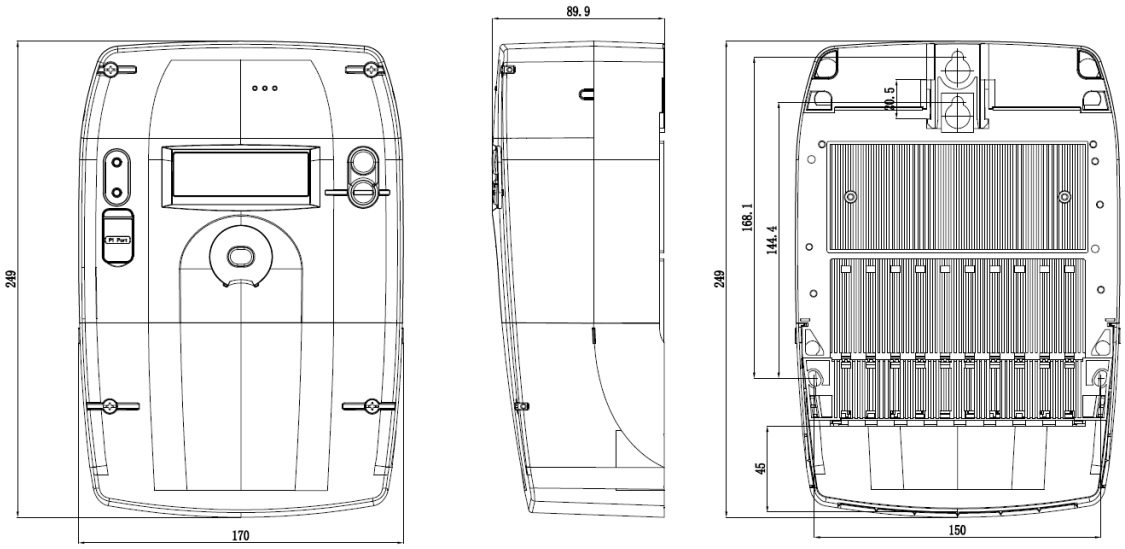
Maintenance	6	LAN	• Block-transfer-with-get • Block-transfer-with-set • Get • Set • Multiple-references • Selective Access • Action • General-block-transfer • General-protection • Access	HLS5 and HLS 6	• Security suite 1 • Security policy = all messages are authenticated and encrypted • Applicable keys: Global Unicast Encryption key Global Authentication key • Applicable certificates: Sub CA Certificate 1 Sub CA Certificate 2 HES certificate 1 Meter Digital signature certificate 1

15. Meter Installation

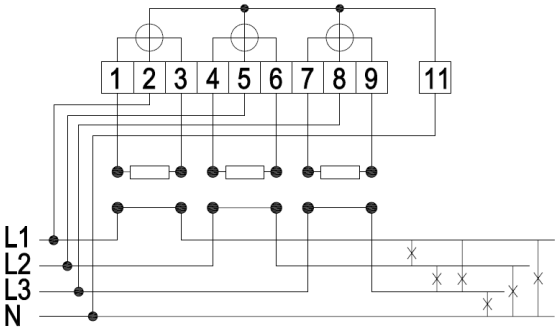
The meter should be installed at a dry and well-ventilated place. The installation board should be fixed on a solid, fire-resistant and sturdy wall.

15.1. Meter Dimension

The dimension of is 249mm×170mm×89.9mm.



15.2. Wiring Diagram

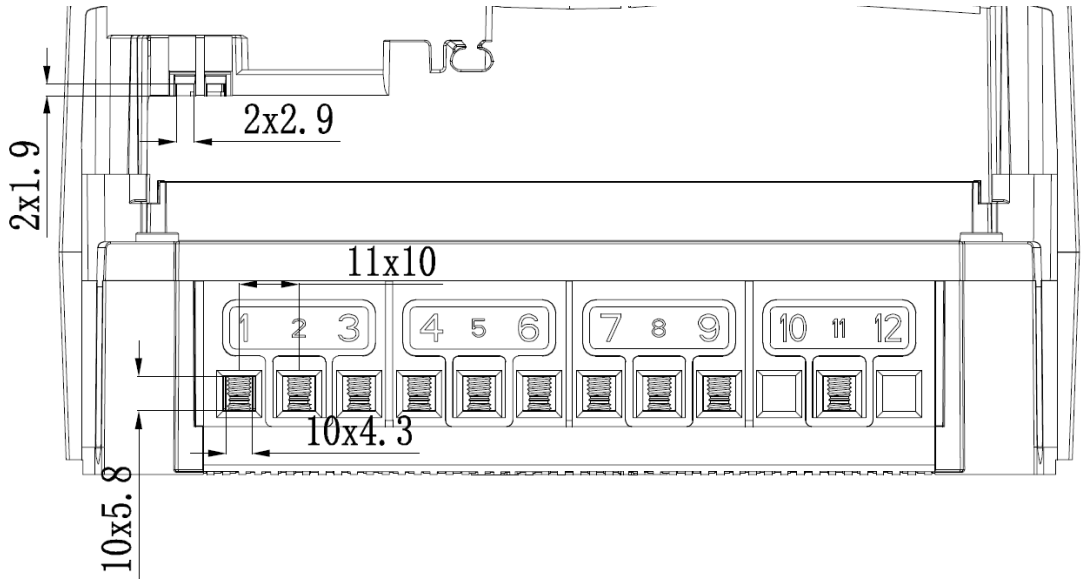


15.3. Requirements on Wires

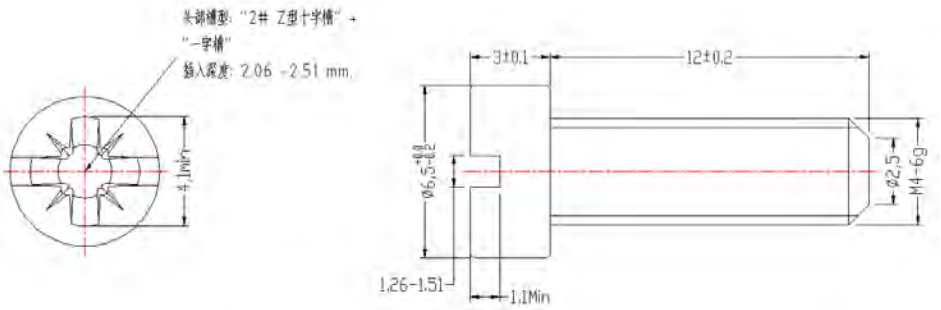
1.The terminal block allows inserting wires with varying cross-sectional area ranging from 4 to 10 mm^2.

The cable diameters shown are calculated for a conducting area of 10 mm^2, according to IEC60228-2004

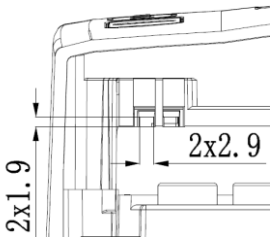
Solid cable = 3.7 mm	1.9mm smaller than the mounting holes of the connectors
Stranded cable= 4.2 mm	0.1 mm smaller than the mounting holes of the connectors



All terminal connectors are pre-assembled with combination-head screws (M4*12) that accept either a slotted or Pozidrive screwdriver. The recommended torque for tightening the screws is 1.2Nm with PZ 2 screw driver.



2. The auxiliary terminal allows inserting wires with varying cross-sectional area ranging from 0.5 to 1.5 mm^2.The commended torque for tightening the screws is at least 0.5Nm with PH 1 or 3.0x0.5mm tip head screwdriver.



15.4. Tools for Installation

The following tools are needed for the meter installation:

1) Screw driver: PZ 2 screw driver for main terminal screw and sealing screw.
2) PH 1 screw driver screw driver or 3.0x0.5mm tip head screw driver for auxiliary terminal screw.
   Fixing screw and Hook screw: M5 slotted countersunk (flat) head tapping screw.
3) Electric drill with M5 broach and plastic plug for concrete wall installation.

15.5. Installation Steps

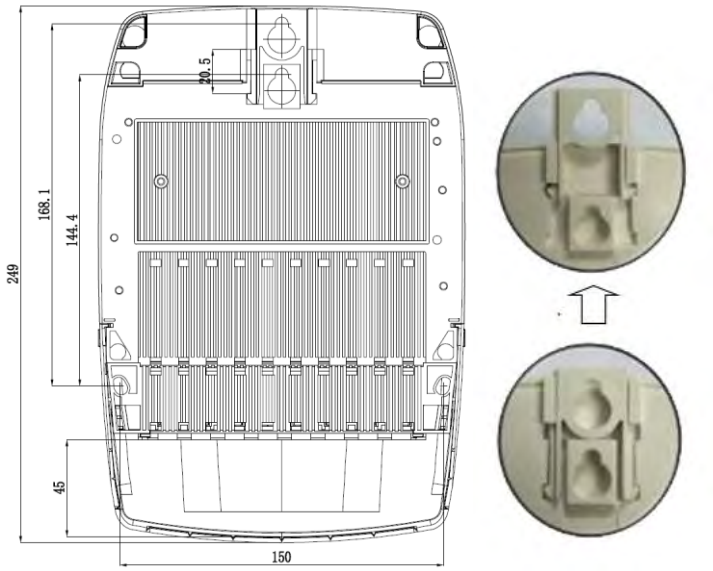
Step 1: Inspect meter before installation.

Before installation, please make sure there is no damage, broken or other defect on the meter. If defect is found, please don't install the meter.

Step 2: Fixing

The meter is a 3 points mounted meter, fixed by 1 hook and 2 fixing screws.

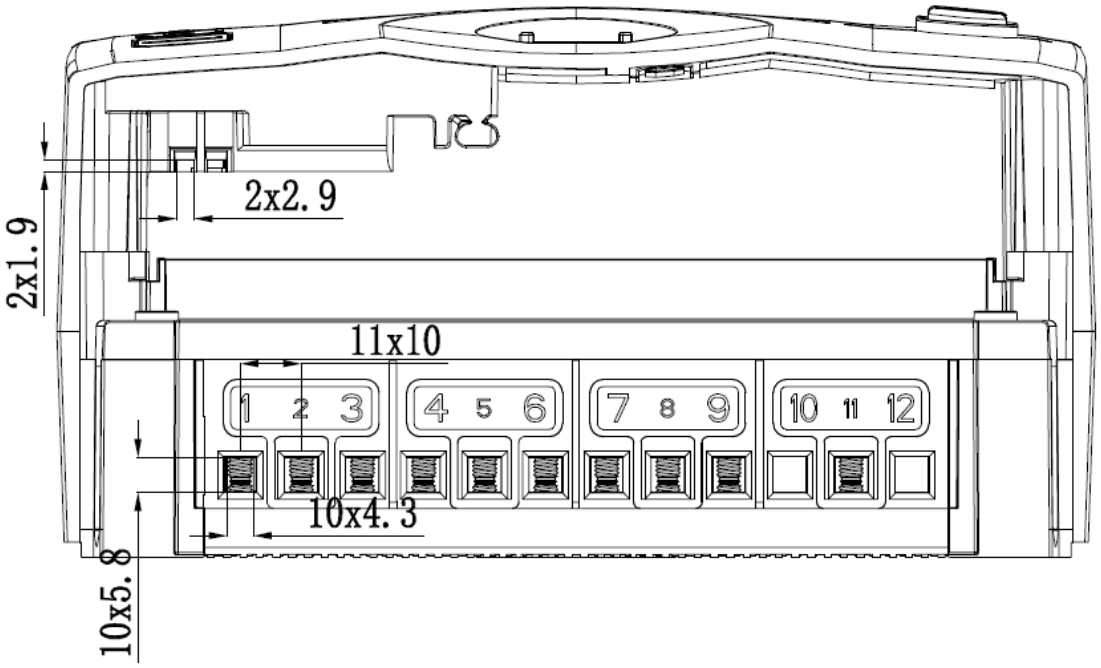
There are three hook points choice, supporting 3 different installation dimensions as below picture. The distance between hook and fixing hole is adjustable as following figure.



To fix meter, hang the meter by hook then fasten two fixing screws.

Step 3: Connect power wire

1. Turn off the power, [Notice: To ensure safety, you should cut-off power before connect wire to meter]
2. Connect power wire according to wiring diagram which marked on the face cover
3. Check wire connect according to wire diagram
4. Resume power supply to meter
5. Check meter self-diagnostic with LCD display include wire connection indication
6. Then close the terminal cover. The CT terminal illustrate as figure 14.5.2.



Connect power lines (Terminal 1~9,11) and fasten screw by PZ 2 screw driver.

NOTICE

To insure the reliable connection, the recommended torque for tightening the screws is 1.2Nm with PZ 2 screwdriver.

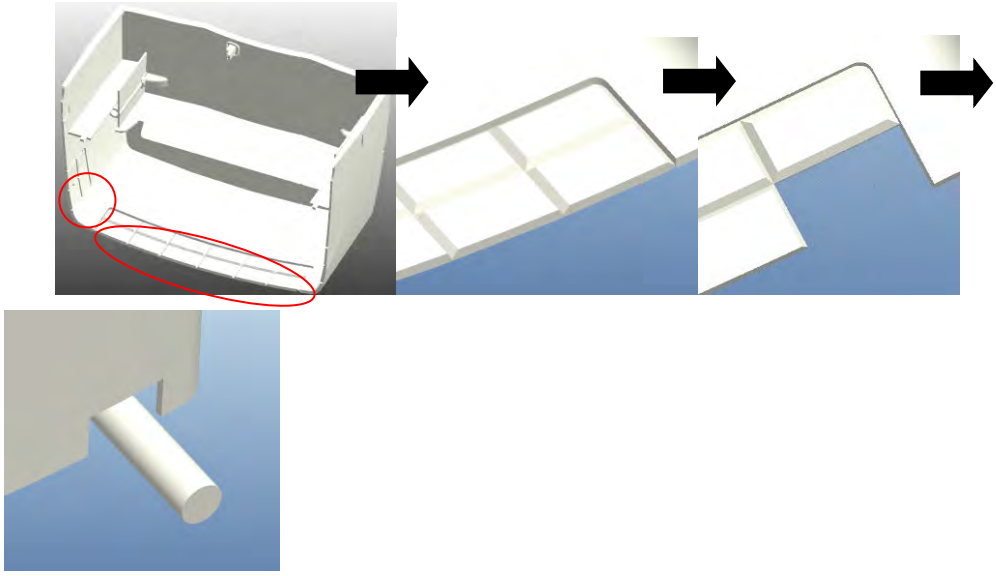
Step 4: Connect auxiliary line

The auxiliary relay terminals are two screw terminals.

Connect power lines and fasten screw by PH 1 screw driver screw driver or 3.0x0.5mm tip head screw driver.

Weakening for cable entry for terminal cover

When the meter is connected the wire for 4-10mm² (CT meter), it needs to cut a large hole as shown below



15.6. GPRS/RF/NBIoT port installation as illustrated below

Adhere to the following procedures when installing or replacing the module.

Installing the module:

Step 1: Break the GPRS/RF cover seals.

Step 2: Remove the screws and take off the cover, shown on picture 14.6-1

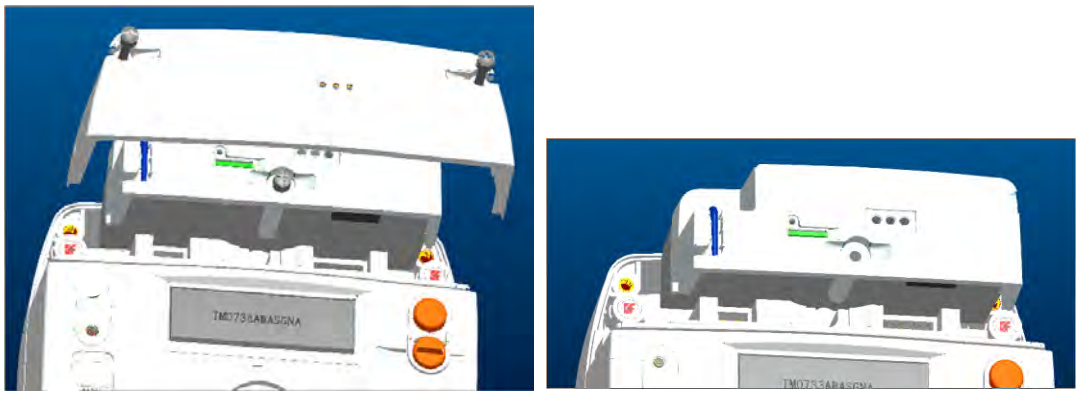
Step 3: If applicable: Firmly grasp the module and pull it from the meter.

Replacing the module:

Step 1: Firmly grasp the module and push it into the meter until it locks in place.

Step 2: Install the cover and ensure the cover is sealed again.

Step 3: Once the meter is in normal operation mode, the configuration of the module starts automatically.



16. Transport and Storage

The meters should be placed on kickstands and the height should not exceed 4 layers. The storage condition should be clean, with an environmental temperature of between -40°C and +80°C, relative humidity of less than 96% and with an absence of rusty matter in the air.

17. Annexure I Display Item List

Auto-Scroll Display mode list:
{3,1-0:1.8.0.255 } Active energy import (+A)
{3,1-0:2.8.0.255 } Active energy export (−A)
Button Display mode list:
{3,1-0:1.8.0.255 } Active energy import (+A)
{3,1-0:2.8.0.255 } Active energy export (−A)
{3,1-0:3.8.0.255}Reactive energy import (+R)
{3,1-0:4.8.0.255}Reactive energy import (-R)
{3,1-0:14.7.0.255}Frequency
{1.6.6.6.6.255}Display test - All segments on
{3,1-0:1.7.0.255} Active power import
{3,1-0:2.7.0.255} Active power export
{3,1-0:32.7.0.255} Voltage of phase L1
{3,1-0:52.7.0.255} Voltage of phase L2
{3,1-0:72.7.0.255} Voltage of phase L3
{3,1-0:31.7.0.255} Current of phase L1
{3,1-0:51.7.0.255} Current of phase L2
{3,1-0:71.7.0.255} Current of phase L3
{3,1-0:128.7.0.255} Phase L1 Active power ((+P)+(-P))
{3,1-0:129.7.0.255} Phase L2 Active power ((+P)+(-P))
{3,1-0:130.7.0.255} Phase L3 Active power ((+P)+(-P))
{8,0-0:1.0.0.255} Date&Time
Test Dsiplay mode:
{8,0-0:1.0.0.255} Date&Time
{3,1-0:1.8.0.255 } Active energy import (+A)
{3,1-0:2.8.0.255 } Active energy export (−A)
{3,1-0:3.8.0.255}Reactive energy import (+R)
{3,1-0:4.8.0.255}Reactive energy import (-R)
{3,1-0:1.7.0.255} Active power import
{3,1-0:2.7.0.255} Active power export
{3,1-0:32.7.0.255} Voltage of phase L1
{3,1-0:52.7.0.255} Voltage of phase L2
{3,1-0:72.7.0.255} Voltage of phase L3
{3,1-0:31.7.0.255} Current of phase L1
{3,1-0:51.7.0.255} Current of phase L2
{3,1-0:71.7.0.255} Current of phase L3
{3,1-0:128.7.0.255} Phase L1 Active power ((+P)+(-P))
{3,1-0:129.7.0.255} Phase L2 Active power ((+P)+(-P))
{3,1-0:130.7.0.255} Phase L3 Active power ((+P)+(-P))
{3,1-0:14.7.0.255}Frequency

{1,1-0:0.2.0.255} Active FW Version Core
{1,1-0:0.2.8.255} Active FW Core Signature
{1,1-1:0.2.0.255} Active FW Version App
{1,1-1:0.2.8.255} Active FW App Signature
{1,1-3:0.2.8.255} Version information

The following OBIS codes can be configured into the auto display list and manual display list.

Item	Class ID	OBIS	Attribute	Description	Format
1	8	0-0:1.0.0.255	2	Date&Time	YYYY:MM:DD HH:MM:SS
2	3	1-0:1.8.0.255	2	Active energy import (+A)	XXXXXX.XXX kWh
3	3	1-0:2.8.0.255	2	Active energy export (−A)	XXXXXX.XXX kWh
4	3	1-0:3.8.0.255	2	Reactive energy import (+R)	XXXXXX.XXX kvarh
5	3	1-0:4.8.0.255	2	Reactive energy import (-R)	XXXXXX.XXX kvarh
11	1	1-0:0.2.0.255	2	Active FW Version Core	XX.XX.XX
12	1	1-0:0.2.8.255	2	Active FW Core Signature	XX.XX.XX
13	1	1-1:0.2.0.255	2	Active FW Version App	XXXXXXXX
14	1	1-1:0.2.8.255	2	Active FW App Signature	XXXXXXXX
15	3	1-0:1.7.0.255	2	Active power import	XX.XXXkW
16	3	1-0:2.7.0.255	2	Active power export	XX.XXXkW
17	3	1-0:32.7.0.255	2	Voltage of phase L1	XXX.X V
18	3	1-0:52.7.0.255	2	Voltage of phase L2	XXX.X V
19	3	1-0:72.7.0.255	2	Voltage of phase L3	XXX.X V
20	3	1-0:31.7.0.255	2	Current of phase L1	XXX.XX A
21	3	1-0:51.7.0.255	2	Current of phase L2	XXX.XX A
22	3	1-0:71.7.0.255	2	Current of phase L3	XXX.XX A
23	1	1-3:0.2.8.255	2	Version information	XX
24	3	1-0:128.7.0.255	2	Phase L1 Active power ((+P)+(-P))	XX.XXXkW
26	3	1-0:129.7.0.255	2	Phase L2 Active power ((+P)+(-P))	XX.XXXkW
28	3	1-0:130.7.0.255	2	Phase L3 Active power ((+P)+(-P))	XX.XXXkW
29	7	1-0:99.1.0.255	2	Load profile	Menu display
30	3	1-0:14.7.0.255	2	Frequency	Hz
31				Display test - All segments on	

18. Annexure II Default Tariff Table

The default tariff table will be initialized during the manufacture process. It can be changed according to customer's order.

Season Table:

Season Profile Name	Start Date	Week Profile Name
S01	January1st	W0
S02	April1st	W1
S03	July1st	W2
S04	October1st	W3

Week Table:

Week Profile Name	Mon	Tues.	Wed.	Thur.	Fri.	Sat.	Sun.
W0	0	0	0	0	0	0	0
W1	0	0	0	0	0	0	0
W2	0	0	0	0	0	0	0
W3	0	0	0	0	0	0	0

Special Day Table:

Holiday index	Month	Day	Day ID
0	01	01	0
1	01	06	0
2	12	24	0
3	12	25	0
4	12	26	0

Day Table:

Day ID	Time duration(Hour : Minute)	Energy Tariff (T)
0	Daily from 22.00 till 6.00	T1
0	Daily from 6.00 till 22.00	T2

19. Annexure III Error and Alarm

0-0:97.98.0.255	Group	Meaning
Byte0	Mesh and P2P	Clock invalid
		Phase disorder indication
		Power Up
		L1 Power interruption start
		L2 Power interruption start
		L3 Power interruption start
		Power failure in any phase
		Power back in any phase
Byte1	Mesh and P2P	Program memory error
		RAM Error
		NV memory Error
		Measurement System Error
		Watchdog error
		Fraud attempt
		Meter reconfigured
		Neutral Fault
Byte2	Mesh and P2P	Communication error M-Bus
		New M-Bus device discovered
		Open breaker pressing button
		Close breaker pressing button
		not used
		L1 Power interruption ends
		L2 Power interruption ends
		L3 Power interruption ends
Byte3	Mesh and P2P	Communication success with modem
		Power quality alert
		Change of clock outside allowed limit
		Frequency offset start
		Frequency offset end
		Phase 1 Reverse
		Phase 2 Reverse
		Phase 3 Reverse

0-0:97.98.4.255	Group	Meaning
Byte0	P2P only	THD start L1
		THD start L2
		THD start L3
		THD end L1
		THD end L2
		THD end L3
		L1 Long term under voltage start
		L2 Long term under voltage start
Byte1	P2P only	L3 Long term under voltage start
		L1 Long term under voltage ends
		L2 Long term under voltage ends
		L3 Long term under voltage ends
		L1 Short term under voltage start
		L2 Short term under voltage start
		L3 Short term under voltage start
		L1 Short term under voltage ends
Byte2	P2P only	L2 Short term under voltage ends
		L3 Short term under voltage ends
		Voltage unbalance start
		Voltage unbalance ends
		L1 Long term over voltage start
		L2 Long term over voltage start
		L3 Long term over voltage start
		L1 Long term over voltage ends
Byte3	P2P only	L2 Long term over voltage ends
		L3 Long term over voltage ends
		L1 Short term over voltage start
		L2 Short term over voltage start
		L3 Short term over voltage start
		L1 Short term over voltage ends
		L2 Short term over voltage ends
		L3 Short term over voltage ends