kwhiq
energy information technology



User Manual

Poly Phase Active and Reactive Smart Energy Meter

Model No.: IQCT04000br1

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Amendment

Version	Date	Remark
1.0	06/03/2023	Draft
1.1	09/03/2023	

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Guidelines for safety and installation



This installation guide must be consulted in all cases when manipulating parts which are marked with the Caution symbol. The installation and the operation of this device and any maintenance must be carried out by a qualified person in accordance with specific local standards and safety regulations.

Failing to obey the "Guidelines for safety and installation", the guarantee no longer applies. Read all safety information and operating instructions before using the meter to avoid personal injury.

Transport and Storage

Refer to clause 14 "Transport and storage".

Installation

Power must be cut off before installation or removal of the meter. Refer to clause 13 "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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Overview

This document is the guideline for users to install, operate and maintain the IQCT04000br1 three phase smart meter connect through current transformer.

IQCT04000br1 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 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.

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

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Reference

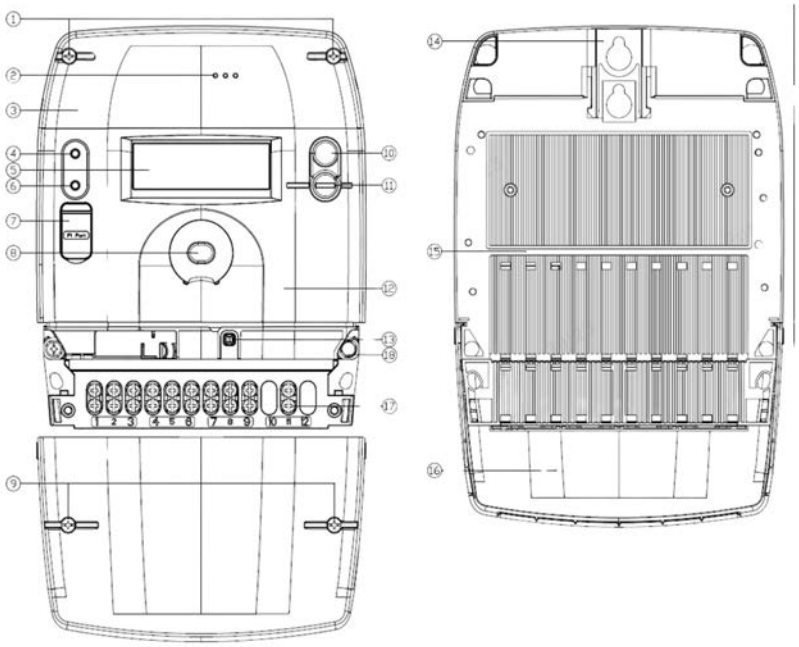
The meter complies with the following standards.

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

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General Description

Front view and rear view



No.	Description
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	Terminal cover seals
10	Push Button
11	Seal button
12	Meter cover
13	Terminal cover detection switch
14	Installation hook
15	Meter base
16	Terminal cover
17	Terminals
18	Meter cover seal

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Measurement System

The meter is designed to measure active/reactive power/energy and equipped with a current transformer for current measurement. The results of the current transformer and the Voltage Divider, which are both analog signals, is then routed to an ASIC with a built-in Analog Digital Converter (ADC) for further processing. The obtained analog-measured signals are digitized in the ADC at a very high sampling rate to guarantee accurate results. Afterwards the ASIC computes the active or reactive powers, sums them to the corresponding energies and converts the accumulated energy to pulse frequency for the "Energy pulse LED". As depicted in figure 2.2, processed results of the ASIC are sent to a MCU to calculate more advanced parameters and aggregated data such as Tariff Management, Maximum Demand, Power Quality, and Load Profile and perform more sophisticated functions such as Event Record, Load Control etc.

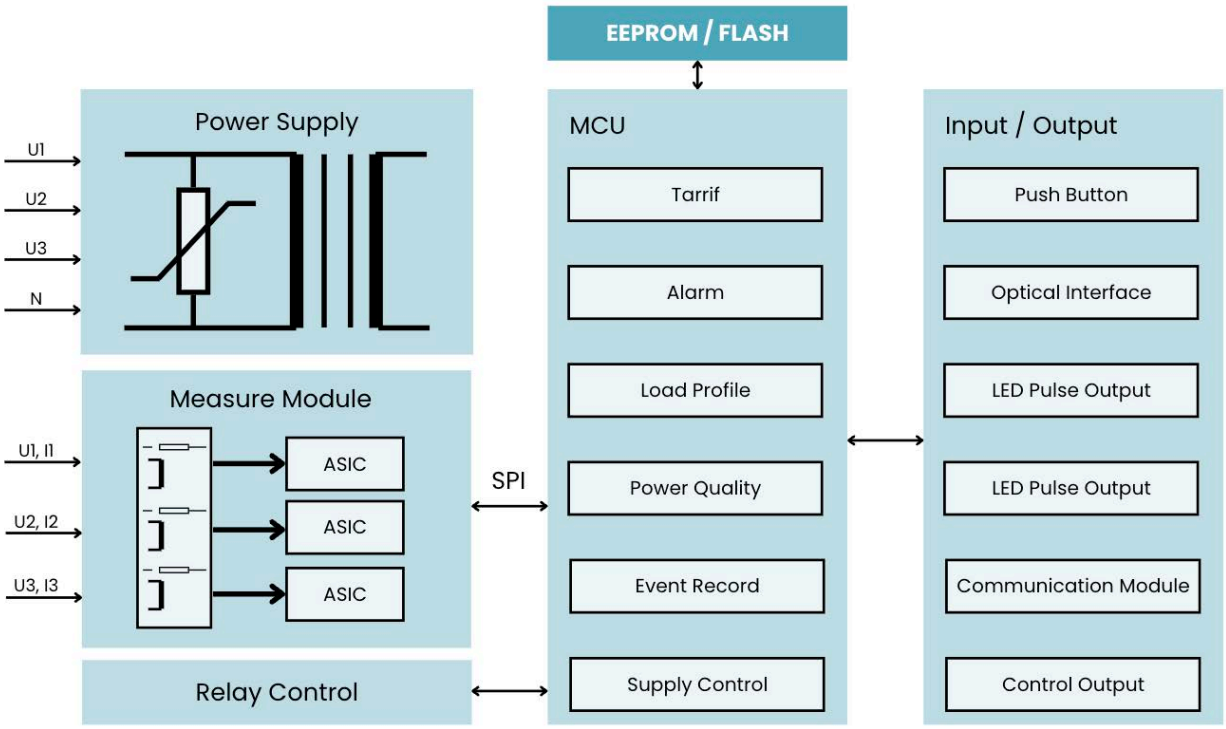


Figure 2.2 Measurement System

Formulas listed below are used to calculate average voltage, current, active power and reactive power.

$$V_{eff} = \sqrt{\frac{1}{T}\int_{t_0}^{t_0+T} v_{inst}^2(t).dt} \qquad I_{eff} = \sqrt{\frac{1}{T}\int_{t_0}^{t_0+T} i_{inst}^2(t).dt}$$

Active power and reactive power measure principium:

Parameter	Phase 1	Phase 2	Phase 3	Algebraic aggr.
Active power	P1 = ∫ v1.i1.cos	P2 = ∫ v2.i2.cos	P3 = ∫ v3.i3.cos	P1 + P2 + P3
Reactive power	Q1 = V1fond.I1fond.sin	Q2 = V2fond.I2fond.sin	Q3 = V3fond.I3fond.sin	Q1 + Q2 + Q3
Apparent power	S1 = V1eff x I1eff	S2 = V2eff x I2eff	S3 = V3eff x I3eff	S1 + S2 + S3

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$$E(t_0) = \int_{t_0}^{t_0+T} u(t) * i(t) dt \quad \text{with T=1 second}$$

Energy cumulative principle:

The meter is programmed to calculate the instantaneous energy by adding the instantaneous energy from each phase. Depending on the sign of the sum, the sum gets accumulated either in the (A+ or R+) or negative (A- or R-) energy register. The meter is designed to accommodate 2 tariffs for each direction.

Instantaneous and average parameters:

The handling of Instantaneous and average parameters follows the definition of the power quality handling in section 12.1 Instantaneous Power values.

Features List

No.	Description
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	0.1%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 manual reset.
Communication interfaces	Optical port, DLMS/COSEM, HDLC on IEC 62056-21. DLMS/COSEM direct HDLC profile. P1 Port GPRS CAT M + NB
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
	Dimension: 249mm×170mm×89.9mm
Environmental	Temperature range of storage and transport: -40°C ~ +80°C.
	Limit temperature range: -40°C ~ +70°C
	Relative humidity: Up to 95% non-condensing

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Function Characteristics

No.	Description
Energy parameters	+A, -A +R, -R Import/Export energy TOU energy
Instantaneous parameters	U, I, P, Q, S, PF, Frequency
Tariff	4 tariffs switching scripts 4 weeks profiles 4 seasons profiles 4 days profiles 30 special days Go 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. Go to **Annexure III** for meter status.
Measure period	The measuring period output (15 min) 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)

Meter Construction

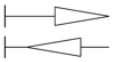
Enclosure

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

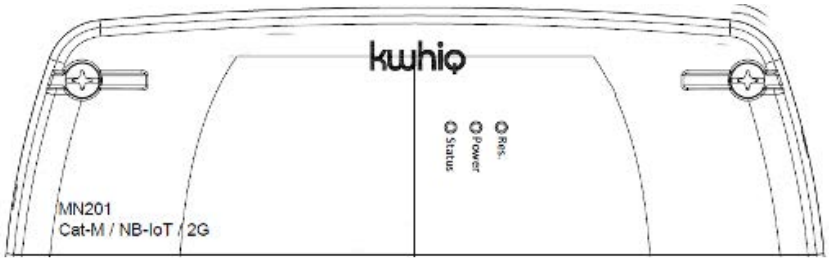
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Marking of the meter

Front plate	
10000 imp/kWh imp/kvarh	Meter constant
3x230/400V **0,01-1(6)A 50Hz** EN 50470-3 Cl.C IEC 62053-23 Cl.2	Metrological parameters and accuracy
-40°C ~ +70°C	Temperature range of operation
	Three phase four wire
	Bidirectional meter
kwhiq	Manufacture logo
IQCT04000br1	Meter type no
 IQOCT400xxxxxxxx	Meter Serial number + Barcode (depend on the customer needs)
T12755 CE M24 0122	MID certificate markings
	Double insulation
dlms	Communication protocol
2024	Year of manufacture

Module plate

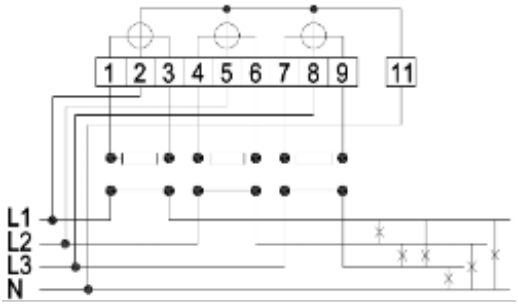
MN201: Communication Module no.



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Wiring diagram

3 phase 4 wires



Sealing of the meter

The meter has two seals for the communication module and 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.

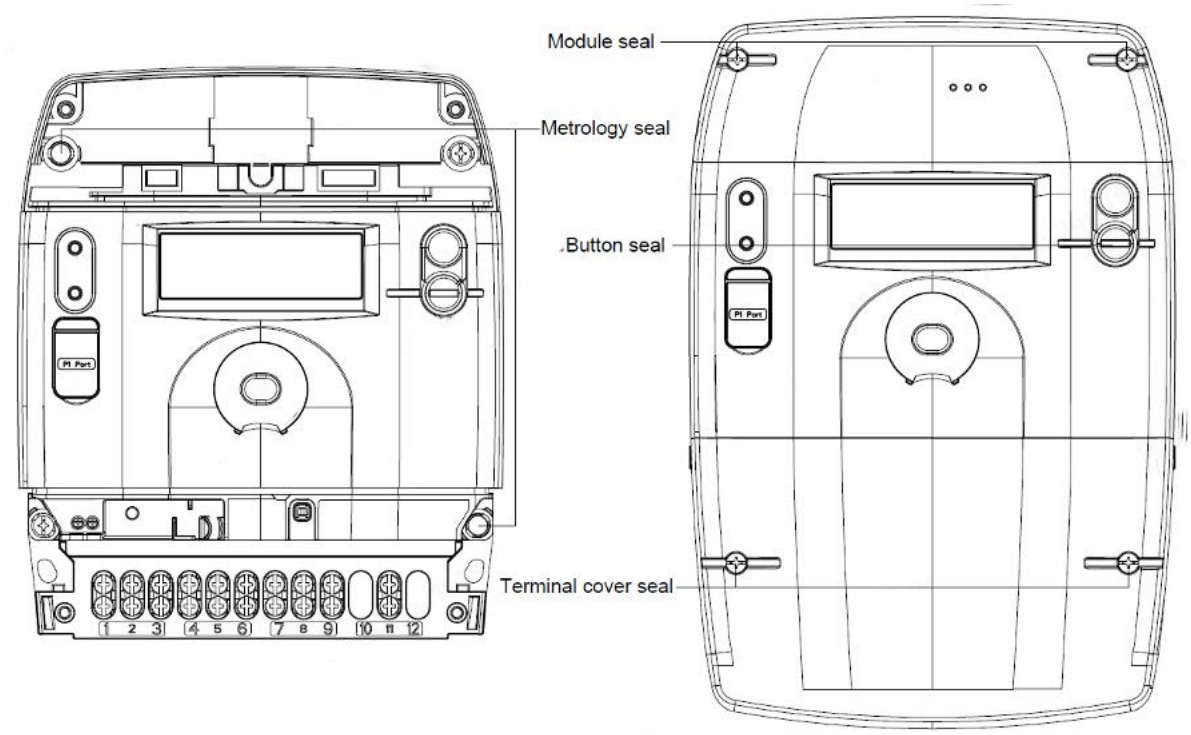


Figure 3.3: Sealing of meter

Push Button

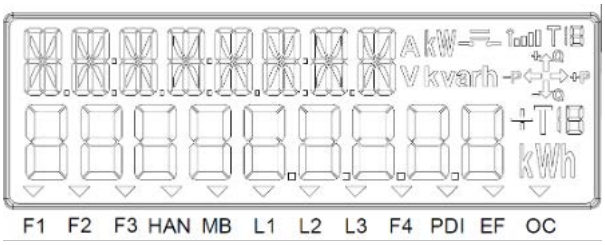
The meter provides buttons. The display button is used to alternate the display parameters manually.

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Display Control

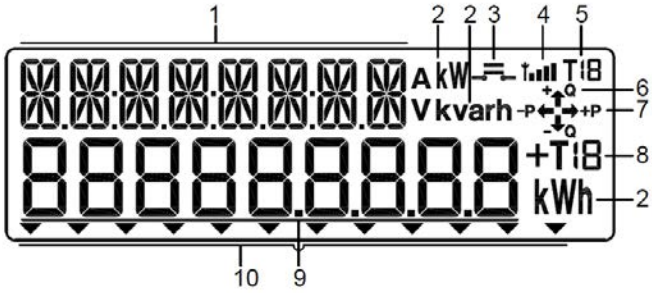
Display introduction

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.



Basic layout

The basic layout shows all indication possibilities of the LCD.



No.	Description
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)

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.

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Auto Scroll Mode (default mode)

In this mode the information on the display is refreshed every 5 seconds. In each mode, the display list is configurable.

Code	Description
1-0:0.9.1.255	Current time
1-0:0.9.2.255	Current date
1-0:1.8.0.255	Active energy import (+A)

In addition, this list is configurable with the proper tool. Normally it will be configured as the following list if the meter is used for MID certificate

Code	Description
1-0:0.2.0.255	Legal Firmware version
1-0:0.2.0.255	Legal Firmware checksum
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 export (-R)

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:

No.	Description
0-0:96.128.0.255	Display all segments (Display test)
1-0:0.9.1.255	Current time
1-0:0.9.2.255	Current date
0-0:96.1.0.255	Meter serial number
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 export (-R)
1-0:1.7.0.255	Instantaneous active import power (+A)
1-0:2.7.0.255	Instantaneous active export power (-A)
1-0:3.7.0.255	Instantaneous reactive import power (+R)
1-0:4.7.0.255	Instantaneous reactive export power (-R)
1-0:32.7.0.255	Instantaneous voltage L1
1-0:52.7.0.255	Instantaneous voltage L2
1-0:72.7.0.255	Instantaneous voltage L3
1-0:31.7.0.255	Instantaneous current L1
1-0:51.7.0.255	Instantaneous current L2
1-0:71.7.0.255	Instantaneous current L3
1-0:13.7.0.255	Power factor
1-0:33.7.0.255	Power factor of L1
1-0:53.7.0.255	Power factor of L2
1-0:73.7.0.255	Power factor of L3
1-0:14.7.0.255	Frequency

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Alphanumeric row

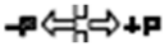
In this mode the information on the display is refreshed every 5 seconds. In each mode, the display list is configurable.

- 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. The decimal for energy and power values are both configurable, the energy decimal is 0 by default as the customer request, and will be configured to 3 when the MID required.

Special characters on display

No.	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. Reserved for future use. L1: Phase 1 has voltages L2: Phase 2 has voltages L3: Phase 3 has voltages F4: Not used. Reserved for battery alert. PDI: Phase disorder indication EF: Errors found. OC: Optical communication

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Display Mode and Menu

The following display modes are available using 1 push buttons:
- Auto-Scroll Display mode
- Button Display mode

The push buttons provide the following functionality: [A]-Button: for stepping through the menu structure and display items.

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.

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.

Alarm and Error Registers

Assignment of Error Register/Alarm Register 1 bits

No.	Alarm	Triggering event ID
0	Clock invalid	7
1	Reserved for Battery replace	-
2	Reserved for future use	-
3	Reserved for future use	-
4	Reserved for future use	-
5	Reserved for future use	-
6	Reserved for future use	-
7	Reserved for future use	-
8	Program memory error	12
9	RAM error	13
10	NV memory error	14
11	Measurement system error	16
12	Watchdog error	15
13	Fraud attempt	40,42,44,46,49,50
14	Reserved for future use	-
15	Reserved for future use	-
16	Reserved for M-Bus communication error ch1	100
17	Reserved for M-Bus communication error ch2	110
18	Reserved for M-Bus communication error ch3	120
19	Reserved for M-Bus communication error ch4	130
20	Reserved for M-Bus fraud attempt ch1	103

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No.	Alarm	Triggering event ID
21	Reserved for M-Bus fraud attempt ch2	113
22	Reserved for M-Bus fraud attempt ch3	123
23	Reserved for M-Bus fraud attempt ch4	133
24	Reserved for Permanent error M-bus ch1	106
25	Reserved for Permanent error M-bus ch2	116
26	Reserved for Permanent error M-bus ch3	126
27	Reserved for Permanent error M-bus ch4	136
28	Reserved for Battery low on M-bus ch1	102
29	Reserved for Battery low on M-bus ch2	112
30	Reserved for Battery low on M-bus ch3	122
31	Reserved for Battery low on M-bus ch4	132

Assignment of Alarm Register 2 bits

No.	Alarm	Triggering event ID
0	Power failure	1
1	power_up	2
2	Voltage missing in phase 1	82
3	Voltage missing in phase 2	83
4	Voltage missing in phase 3	84
5	Voltage normal in phase 1	85
6	Voltage normal in phase 2	86
7	Voltage normal in phase 3	87
8	Reserved for missing neutral	-
9	Current asymmetry	90
10	Current Reversal	91
11	Wrong Phase Sequence	88
12	Reserved for Unexpected Consumption	52
13	Key Exchanged	48
14	Reserved for Bad Voltage Quality L1	-
15	Reserved for Bad Voltage Quality L2	-
16	Reserved for Bad Voltage Quality L3	-
17	Reserved for External Alert	-
18	Local communication attempt	158
19	Reserved for New M-Bus Device Installed Ch1	105
20	Reserved for New M-Bus Device Installed Ch2	115
21	Reserved for New M-Bus Device Installed Ch3	125
22	Reserved for New M-Bus Device Installed Ch4	135
23	Reserved for future use	-
24	Reserved for future use	-
25	Reserved for future use	-
26	Reserved for future use	-
27	Reserved for Reserved for M-Bus valve alarm Ch1	-
28	Reserved for Reserved for M-Bus valve alarm Ch2	-
29	Reserved for Reserved for M-Bus valve alarm Ch3	-
30	Reserved for Reserved for M-Bus valve alarm Ch4	-
31	Reserved for Disconnect/Reconnect Failure	-

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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	10	clock_time; disconnect event code; active threshold	unsorted (FIFO)
Power Quality log	100	clock_time; Power Quality event code	unsorted (FIFO)
Power Fail Event Log	10	clock_time; event code;duration time;Instant active power and vrms	unsorted (FIFO)
Communication Event Log	100	clock_time; Communication event code	unsorted (FIFO)

Standard event log

Event name	Even code	Trigger corresponding event	Trigger corresponding alarm
Power off	1	Power Down	Power failure
Power on	2	Power Up	Power Up
Daylight saving time enabled or disabled	3	Daylight saving time enabled or disabled	None
Clock adjusted (old date/time)	4	Clock adjusted (old date/time)	None
Clock adjusted (new date/time)	5	Clock adjusted (new date/time)	None
Clock invalid	6	Clock invalid	None
TOU activated	9	TOU activated	None
Error register cleared	10	Error register cleared	None
Alarm register cleared	11	Alarm register cleared	None
Program memory error	12	Program memory error	Program memory error
RAM error	13	RAM error	RAM error
NV memory error	14	NV memory error	NV memory error
Watchdog error	15	Watchdog error	Watchdog error
Measurement system error	16	Measurement system error	Measurement system error
Firmware ready for activation	17	Firmware ready for activation	None
Firmware activated	18	Firmware activated	None
Passive TOU programmed	19	Passive TOU programmed	None
End of non-periodic billing interval	21	End of non-periodic billing interval	None
One or more parameters changed	47	One or more parameters changed	None
Global key(s) changed	48	Global key(s) changed	Key Exchanged
FW verification failed	51	FW verification failed	None
Phase sequence reversal	88	Phase sequence reversal	Wrong Phase Sequence
Firmware activation failed	226	Firmware activation failed	None
Phase sequence reversal end	229	Phase sequence reversal end	None
Load profile cleared	254	Load profile cleared	None
Event log cleared	255	Event log cleared	None

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Fraud detection event log

Event name	Even code	Trigger corresponding event	Trigger corresponding alarm
Terminal cover removed	40	Terminal cover removed	Fraud attempt
Terminal cover closed	41	Terminal cover closed	None
Strong DC field detected	42	Strong DC field detected	Fraud attempt
No strong DC field anymore	43	No strong DC field anymore	None
Meter cover removed	44	Meter cover opened	Fraud attempt
Meter cover closed	45	Meter cover closed	None
Association authentication failure (n time failed authentication)	46	authentication failure when establish a new association	Fraud attempt
Decryption or authentication failure	49	Decryption or authentication failure	Fraud attempt
Replay attack	50	Replay attack	Fraud attempt
Current Reversal	91	Current Reversal in any phase	None
Current Reversal L1	204	Current Reversal L1	None
Current Reversal L2	205	Current Reversal L2	None
Current Reversal L3	206	Current Reversal L3	None
Current Reversal L1 end	207	Current Reversal L1 end	None
Current Reversal L2 end	208	Current Reversal L2 end	None
Current Reversal L3 end	209	Current Reversal L3 end	None
current reversal end	228	Current Reversal end in all phase	None
Event log cleared	255	Event log cleared	None

Power quality log

Event name	Even code	Trigger corresponding event	Trigger corresponding alarm
Undervoltage L1	76	45%Un < Voltage <= 90%Un for 30s in L1	
Undervoltage L2	77	45%Un < Voltage <= 90%Un for 30s in L2	
Undervoltage L3	78	45%Un < Voltage <= 90%Un for 30s in L3	
Overvoltage L1	79	Voltage >= 110% Un for 30s in L1	
Overvoltage L2	80	Voltage >= 110% Un for 30s in L2	
Overvoltage L3	81	Voltage >= 110% Un for 30s in L3	
Missing voltage L1	82	Voltage <= 45%Un for 30s in L1	
Missing voltage L2	83	Voltage <= 45%Un for 30s in L2	
Missing voltage L3	84	Voltage <= 45%Un for 30s in L3	
Phase Asymmetry(current unbalance start)	90	current unbalance in each phase	
Under Voltage end L1	217	Under Voltage end L1	
Under Voltage end L2	218	Under Voltage end L2	
Under Voltage end L3	219	Under Voltage end L3	
Overvoltage end L1	220	Overvoltage end L1	
Overvoltage end L2	221	Overvoltage end L2	
Overvoltage end L3	222	Overvoltage end L3	
Missing Voltage end L1	223	Missing Voltage end L1	
Missing Voltage end L2	224	Missing Voltage end L2	

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Event name	Even code	Trigger corresponding event	Trigger corresponding alarm
Missing Voltage end L3	225	Missing Voltage end L3	
Phase Asymmetry end(current unbalance end)	230	current unbalance end	
Event log cleared	255	Event log cleared	None

Power failure log

Event name	Even code	Trigger corresponding event	Trigger corresponding alarm
Long power failure in phase1	211	Long power failure in phase1	
Long power failure in phase2	212	Long power failure in phase2	
Long power failure in phase3	213	Long power failure in phase3	
Event log cleared	255	Event log cleared	None

Communication event log

Event name	Even code	Trigger corresponding event	Trigger corresponding alarm
No connection timeout	140	No connection timeout	
Modem Initialization failure	141	Modem Initialization failure	
SIM Card failure	142	SIM Card failure	
SIM Card ok	143	SIM Card ok	
GSM registration failure	144	GSM registration failure	
GPRS registration failure	145	GPRS registration failure	
PDP context established	146	PDP context established	
PDP context destroyed	147	PDP context destroyed	
PDP context failure	148	PDP context failure	
Modem SW reset	149	Modem SW reset	
Modem HW reset	150	Modem HW reset	
Signal quality low	156	Signal quality low	
Local communication attempt	158	Local communication attempt	
Event log cleared	255	Event log cleared	None

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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.

Tarrif 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
- 5 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 30 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.

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Load Profiles

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.

Load profile status word

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

Event name	Even code
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.

Load profile list

The meter supports following load profiles:

Load profile	Interval	Capacity	Capture objects
Cumulative energy load profile (1-0:99.1.0.255)	15 Minutes	5760	8,0-0:1.0.0.255,2,0} (Date Time) Time in load profile include the time zone {1,0-0:96.10.1.255} (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) 0:1.0.0.255,2,0} (Date Time) Time in load profile include the time zone
Daily energy load profile (1-0:99.2.0.255)	12 hours	31	{8,0-0:1.0.0.255,2,0} (Date Time) {0-0:96.10.2.255}(AMR Profile Status Code E meter) {3,1-0:1.8.0.255,2,0} (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

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Load profile	Interval	Capacity	Capture objects
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)

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]: 7.5.8 Events

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.

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):

Load profile	Interval	Capacity	Capture objects
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

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

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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

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

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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

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

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

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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.

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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]: 6.9 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.

Communication interfaces and communication

The meter provides up to 3 communication interfaces:

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

The optical port on the base meter. NBIoT or GPRS 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.

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.

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 communication profiles and service is available in the P2P WAN Implementation Guide [3].

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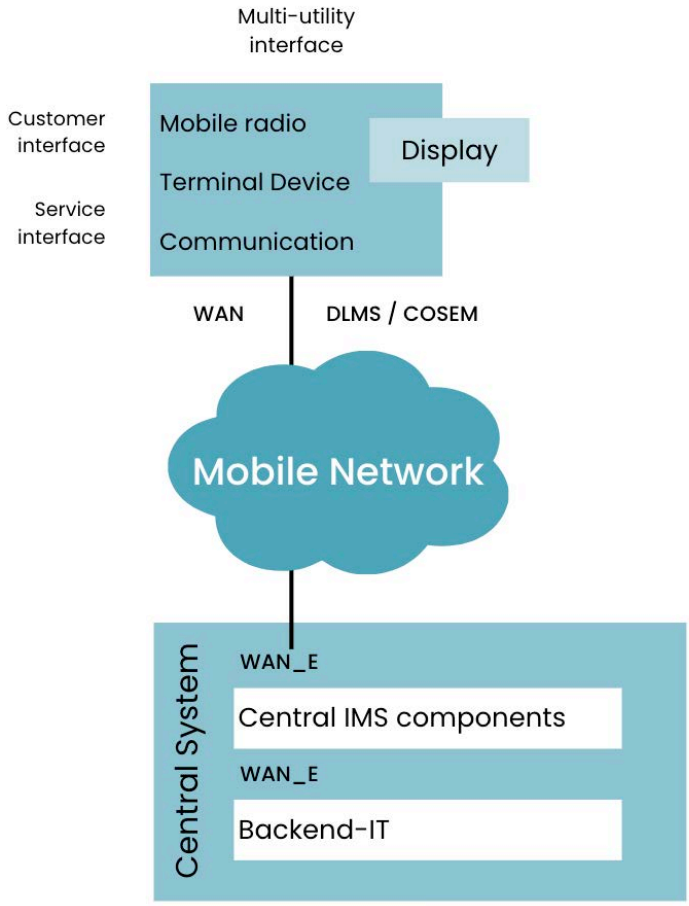


Figure 12.2.1 P2P-based metering profile

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).

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

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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

Security

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 two 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 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.

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).

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.

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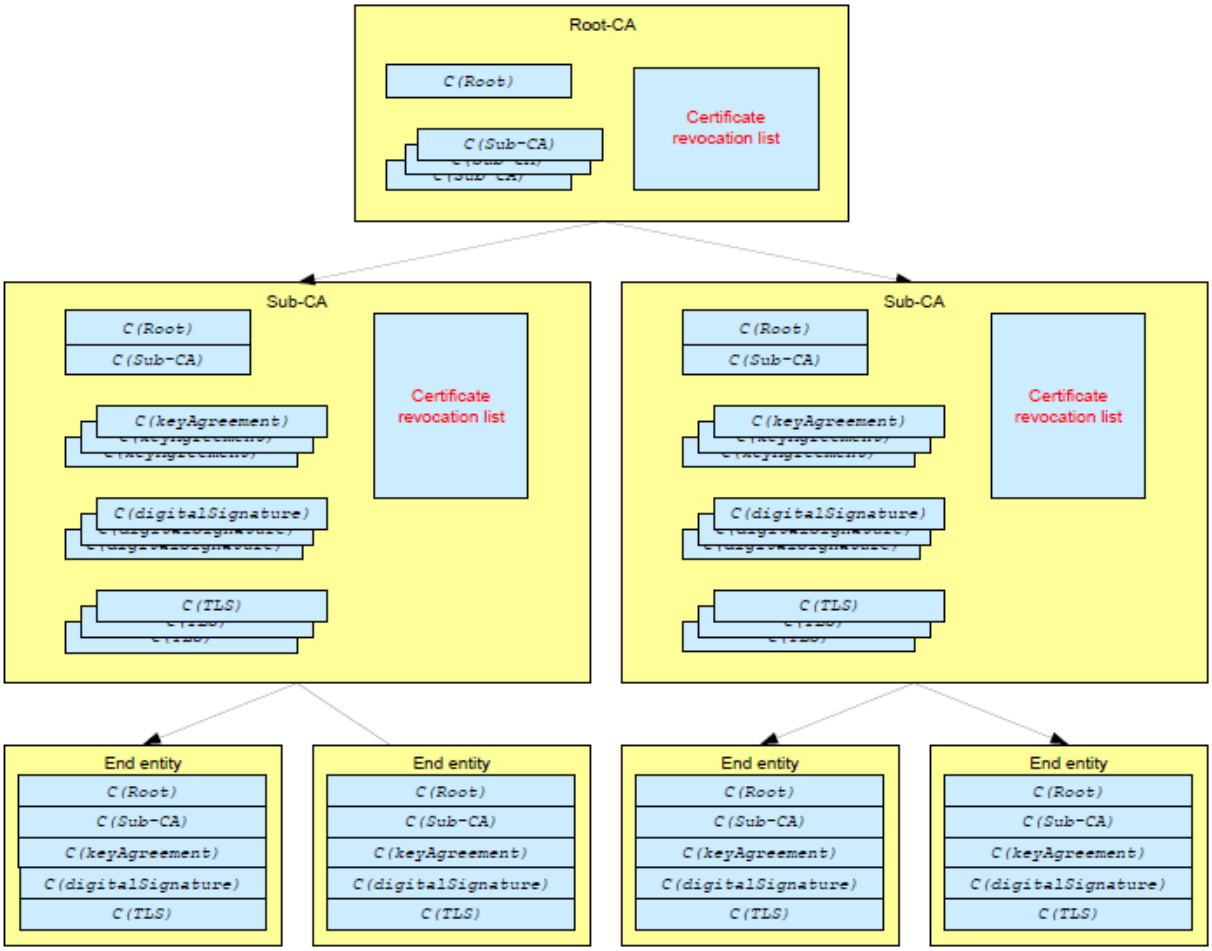


Figure 13.3.1 Architecture of a public key infrastructure

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

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

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.

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

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 require the support of Public Key certificates.
6	LLS key	Used in LLS association

Each meter has its own individual keys once out of factory. Please check the shipment file for the details of keys.

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

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Client	SPA ID	Access port	Mandatory Services	Establishment	Security setting
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	LLS	LLS Key
Data Readout	2	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

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.

Meter dimension

The dimension of is 249mm×170mm×89.9mm, illustrate to figure 14.1.

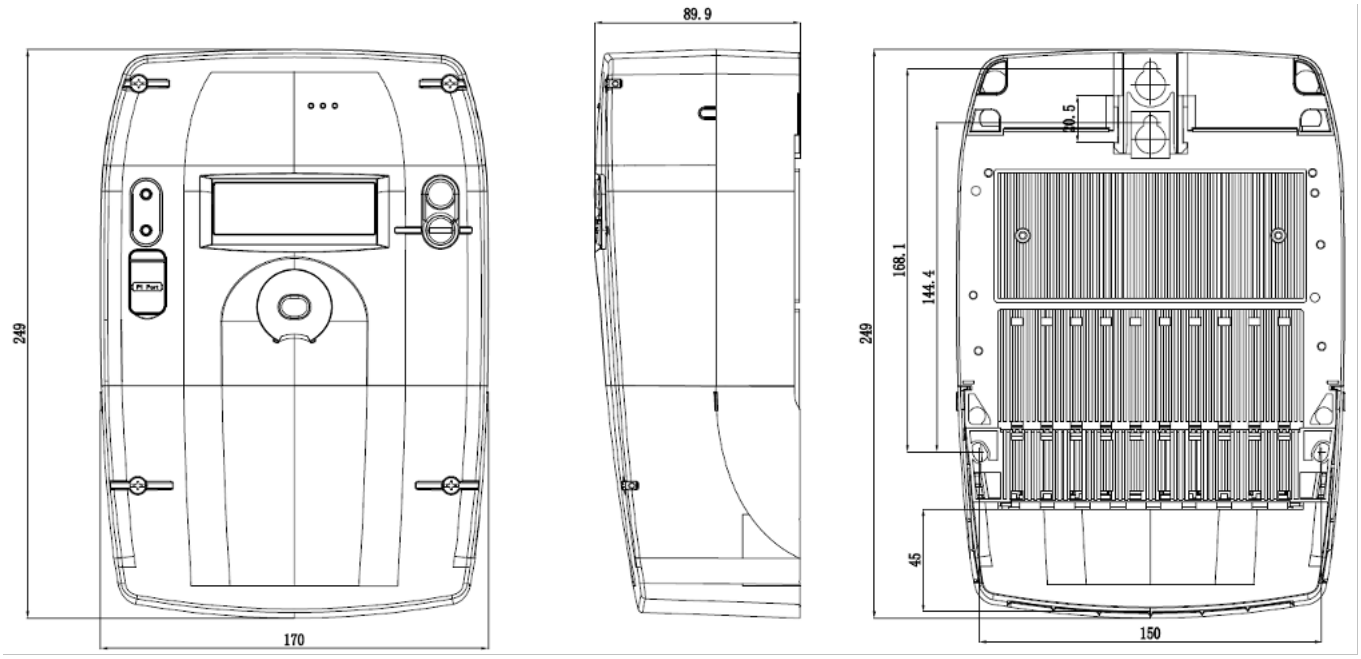


Figure 14.1 Dimension of meter

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Wiring diagram

The wiring diagram of meter in figure 14.2:

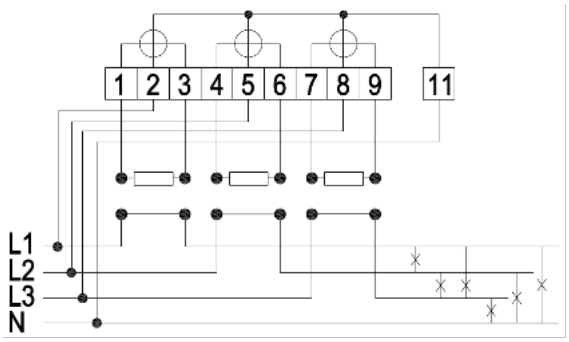
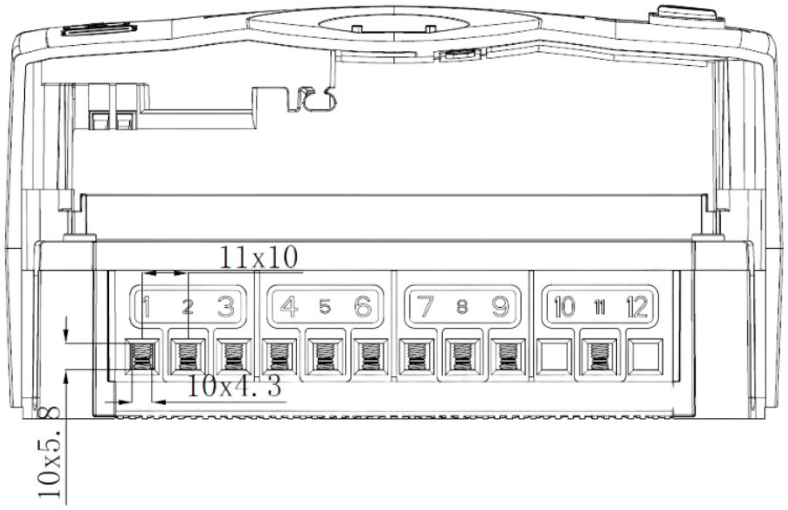


Figure 14.2 Wiring diagram

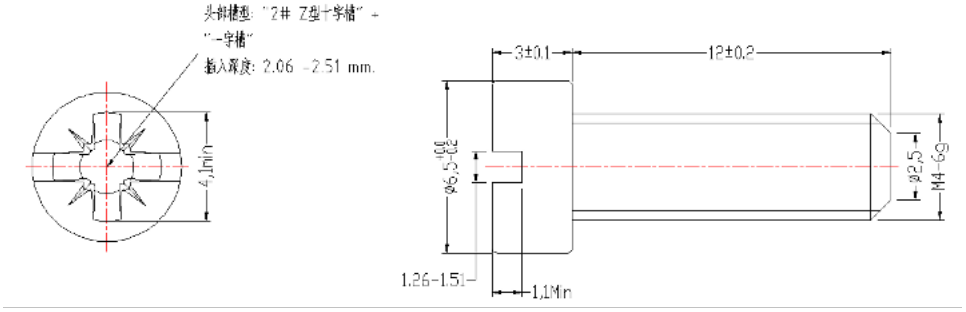
Requirements on wires

The terminal block allows inserting wires with varying cross-sectional area ranging from 4 to 10 mm2. The cable diameters shown are calculated for a conducting area of 10 mm2, 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.



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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. 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.

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 14.5.1.
- To fix meter, hang the meter by hook then fasten two fixing screws.
-

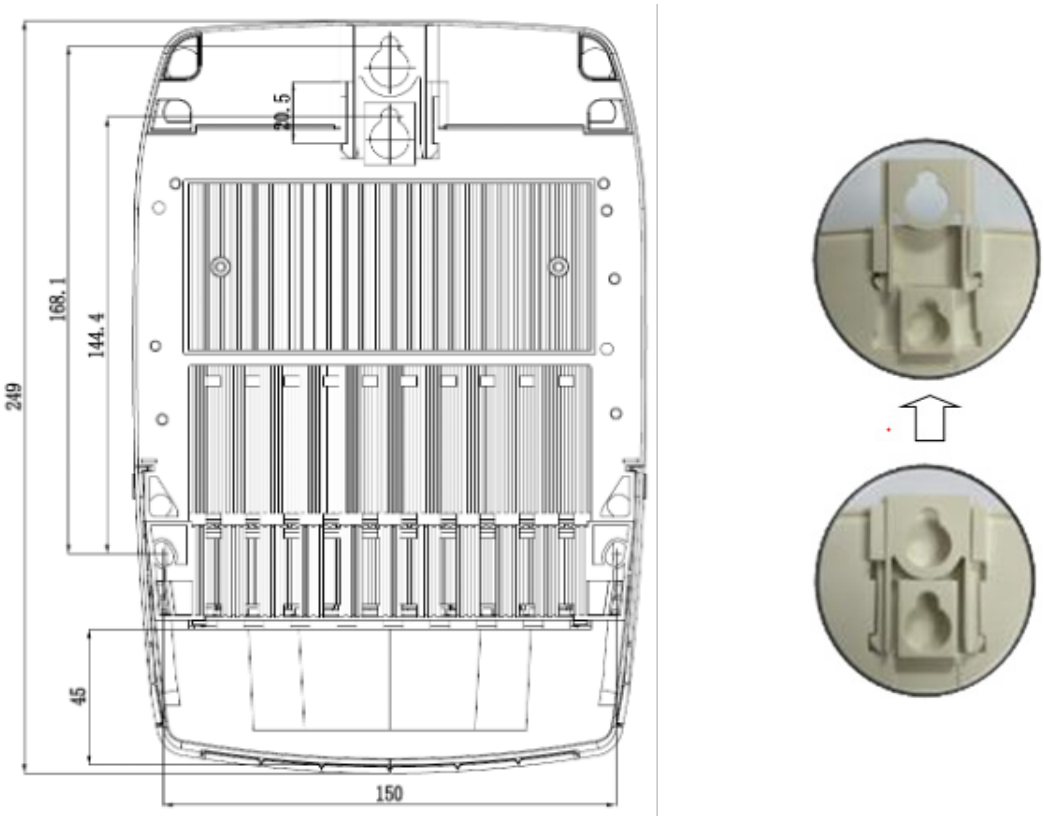


Figure 14.5.1 Installation hook

Step 3: Connect power wire

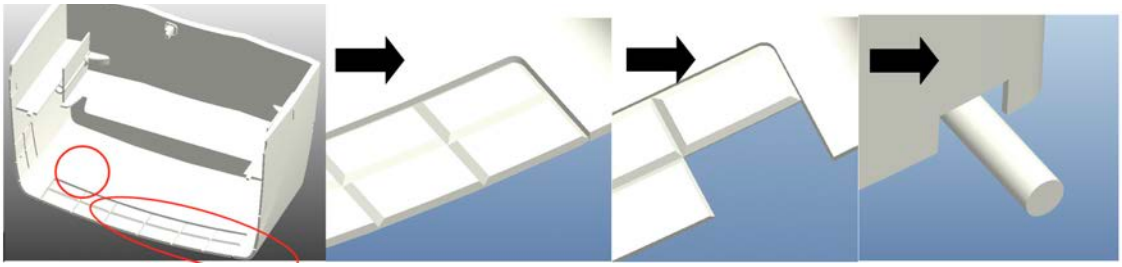
1. Turn off the power, [Notice: To ensure safety, you should cut-off power before connect wire to meter]
2. Connect power wire according to wiring diagram which marked on the face cover
3. Check wire connect according to wire diagram
4. Resume power supply to meter
5. Check meter self-diagnostic with LCD display include wire connection indication
6. Then close the terminal cover. Connect power lines (Terminal 1~9,11) and fasten screw by PZ 2 screw driver.

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NOTICE

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

Step 4: 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



GPRS/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.



Figure 14.6. Removal of the modem cover

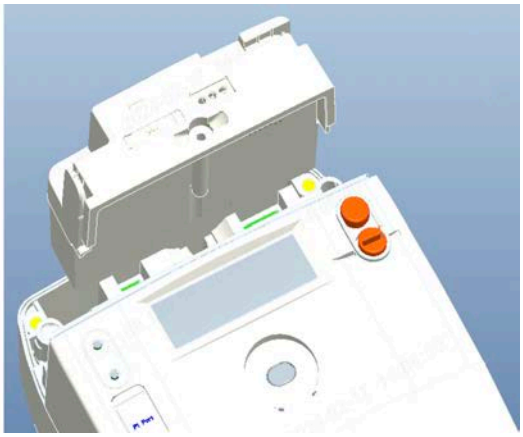


Figure 14.6.2 Removal of the mode

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.

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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

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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	

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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

Week Table

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

Special Day Table

Holiday index	Month	Day	Day ID

Day Table

Day ID	Time duration (Hour : Min.)	Energy Tariff (T)
0	Daily from 00.00 till 24.00	T1

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