

# USER MANUAL

## DTSD545 Three-Phase Smart Electronic Meter

(Version 1.1)



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**Holley Technology Ltd.**

**[www.holleytech.cn](http://www.holleytech.cn)**

### Revision History

Version No	Description of change(s)	By Whom	DATE
V1.0	First release	Holley	2019-10-15
V1.1		Holley	2019-10-22

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# 1. Introduction

This user manual is specially for DTSD545 three-phase smart electronic meter. It used to guide the meter installation, use and maintenance of the technical reference. The meter can support active/reactive energy measurement, multi-tariff function is available by internal control, the status of consumed energy can be read from load profile. Besides common events, meter supports events of open cover and magnetic influence. Besides, meter can also measure a variety of instantaneous quantities. The meter support multi communication methods, such as optical, RS485, G3 PLC, LoRaWAN, GPRS/3G/LTE/NB/Cat-M communications. Meter configuration can be available via the configuration software which is very flexible.

## 2. Reference standards

References	Title
DLMS UA 1000-2 Ed.8.3:2017	DLMS/COSEM Architecture and Protocols, the —Green Book
DLMS UA 1000-1 Ed.12.2:2017	COSEM Identification System and Interface Classes, the —Blue Book
IEC 62056-21	Electricity Metering-Data exchange for meter reading, Tariff and Load Control-Part 21: direct local data exchange
IEC 62056-46	Electricity metering – Data exchange for meter reading, tariff and  load control – Part 46: Data link layer using HDLC protocol
IEC 62056-53	Electricity metering-Data exchange for meter reading, tariff and load control-Part53: COSEM application layer
IEC 62056-61	Electricity metering-Data exchange for meter reading, tariff and load control-Part61: object identification system (OBIS).
IEC 62056-62	Electricity metering – Data exchange for meter reading, tariff and  load control – Part 62: Interface classes
IEC 62056-42	Electricity metering-Data exchange for meter reading, tariff and load control-Part 42: physical layer services and procedures for connection-oriented asynchronous data exchange.
IEC 62053-21	Electricity metering equipment (a.c.) – Particular requirements – Part 21: Static meters for active energy

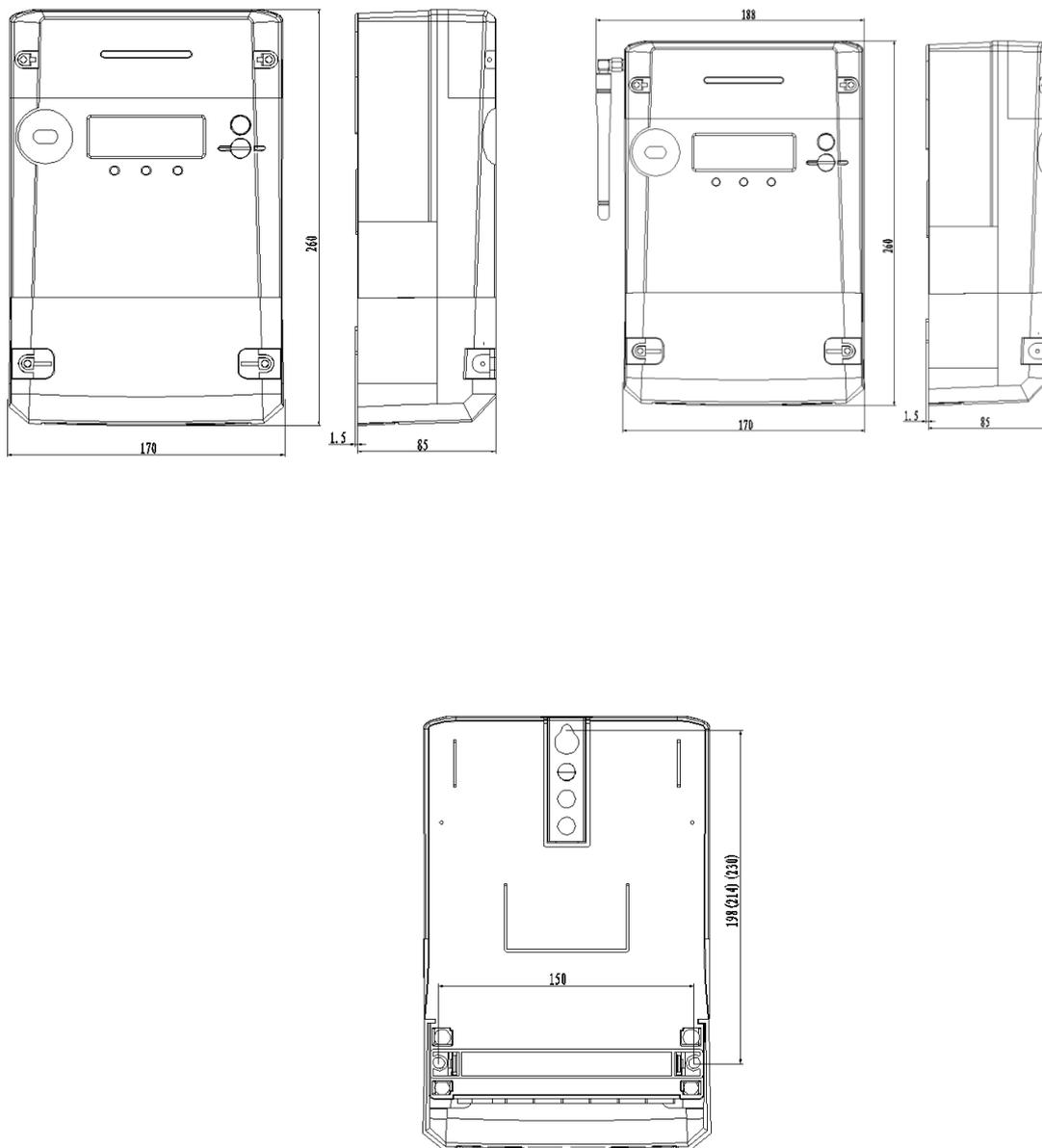
	(classes 1 and 2)
IEC 62053-23	Electricity metering equipment (a.c.) – Part 23: Static meters for reactive energy (classes 2 and 3)
IEC 62052-11	Electricity metering equipment (a.c.) – General requirements, tests and test conditions – Part 11: Metering equipment

### 3. Abbreviations

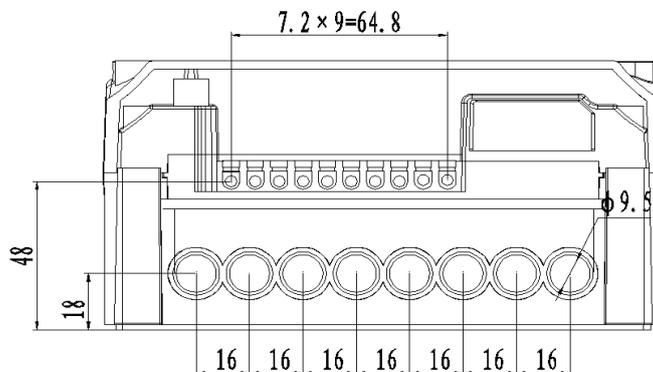
Abbreviation	Description
AEM	Advanced Electricity Meter
CAS	Central AMI System
HES	Head End System
DCU	Data Concentrator Unit
DLMS	Device Language Message Specification
COSEM	Companion Specification for Electricity Metering
OBIS	Object Identification System
FC	Frame Counter
G3	G3 PLC supporting IPv6
HDLC	High-level Data Link Control
HLS	High Level Security
IC	Interface Class
APDU	Application Layer Protocol Data Unit
RLRQ	A-Release Request – an APDU of the ACSE
GPRS	Generalized Packet Radio System
SAP	Service Access Point

## 4. Installation connection and dimensions

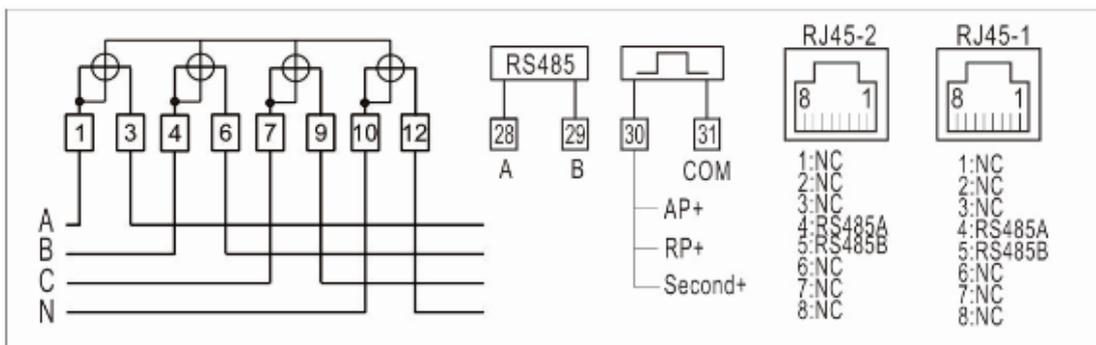
### 4.1 Front view, side view and dimensions



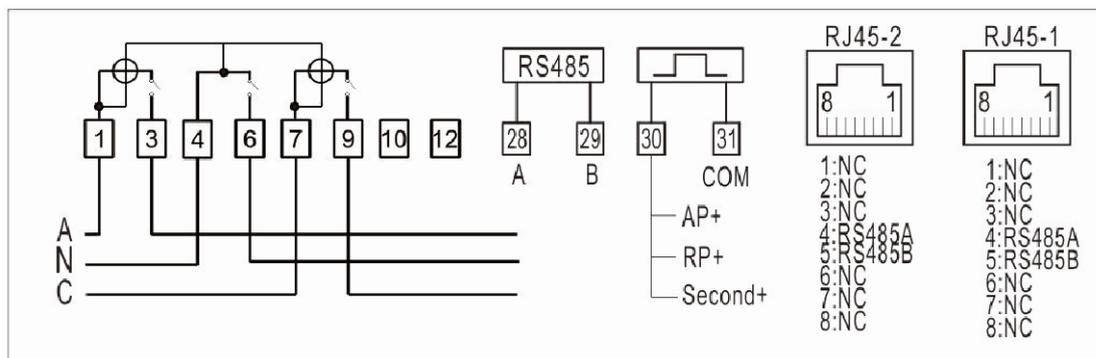
## 4.2 Terminal box dimensions



## 4.3 Connection

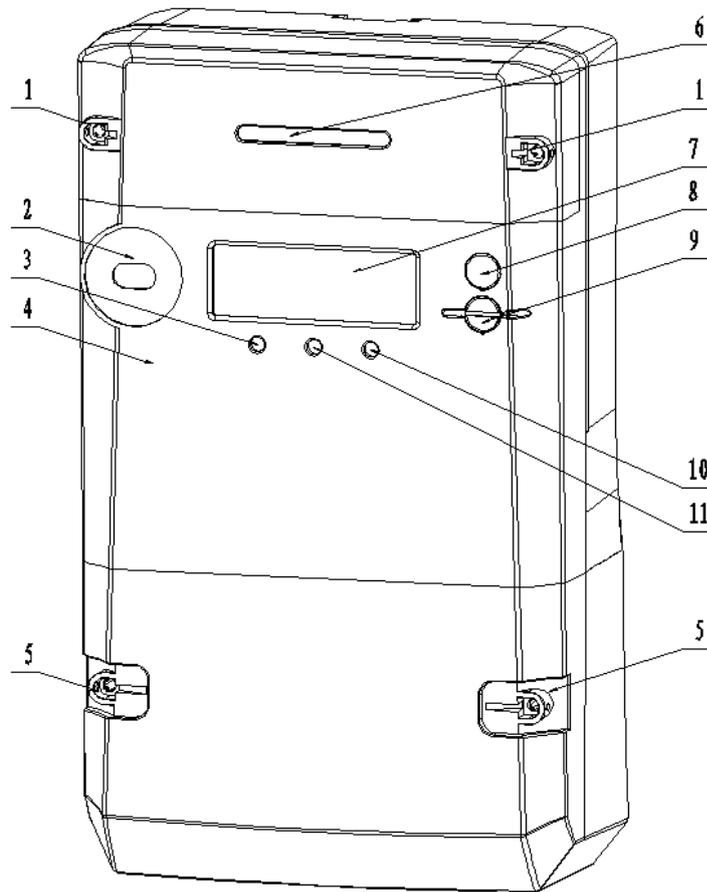


(Three phase four wire)



(Three phase three wire)

## 4.4 Meter layout



1. Communication Module and battery cover seal
2. Optical port
3. Active pulse led
4. Nameplate
5. Terminal cover sealing screw
6. Module indicator window
7. LCD display

8. Display button

9. Billing button

10. Reactive pulse led

11. Alarm led

## 5. Meter Function Introduction

### 5.1 Specifications

Items	Sub-items	Parameter
Basic Parameters	Meter type	3P3W/4W smart meter
	Accuracy	Active: Class 1 (IEC 62053-21) Reactive: Class 2(IEC 62053-23)
	Rated voltage	Rated voltage: 3x230V/3x230/400V Operating voltage range: 0.8Un~1.2Un
	Rated frequency	50Hz
	Measuring current	10(100)A
	Starting current	0.004Ib
	Pulse constant	1000imp/kWh 1000imp/kvarh
	Power consumption	Current circuit: Active power consumption<0.5VA; Voltage circuit: Active power consumption<2W Apparent power consumption<10VA;
	Operating temperature	-25°C ~ +70°C
	Maximum temperature	-40°C ~ +80°C

Type Testing	IEC Standard	IEC 62053-22 IEC 62053-23 IEC 62052-11
Communication	Communication ports	1 optical port 1 RS485 port 1 telecommunication port or G3 PLC port
	Communication protocol	Optical: IEC62056-21 mode E RS485: DLMS HDLC LTE: DLMS TCP/IP PLC: DLMS HDLC LORAWAN
Measurement	Energy measurement	Total active energy(total and each tariff )(15.8.0) Import active energy(total and each tariff )(1.8.0) Export active energy(total and each tariff )(2.8.0) Import reactive energy(total and each tariff )(3.8.0) Export reactive energy (total and each tariff ) (4.8.0) Import apparent energy(total and each tariff ) (9.8.0) Export apparent energy(total and each tariff ) (10.8.0)

	Instantaneous	<p>Voltage(L1~L3)</p> <p>Current(L1~L3)</p> <p>Active power(L1~L3)</p> <p>Reactive power(L1~L3)</p> <p>Apparent power(L1~L3)</p> <p>Power factor(L1~L3)</p> <p>Net frequency</p>
LED&LCD	LED	<p>1 Active pulse output</p> <p>1 Alarm</p> <p>1 Reactive pulse output</p>
	LCD	<p>Energy:5+3/6+2/7+1/8+0 display(configurable), 6+2 default</p> <p>Power(KW): 4 decimals</p> <p>Voltage(V): 1 decimal</p> <p>Current(A): 3 decimals</p>
	Display mode	<p>Auto scroll</p> <p>Button display mode</p> <p>Power-off display mode</p>
	Display time	<p>Auto scroll mode: 3~99s (configurable), 10s default</p> <p>Button display mode: 3s~99s(Configurable), 60s default</p>

		Power-off display mode: 30s
	Backlight (Optional)	Activated by pressing button, after 30s will be off
	Display content	See 【Attachment】 A: Display Item List
TOU	TOU	8 tariff 12 daily time spans 12 day schedules 12 week schedules 10 season schedules
	RTC	≤0.5s/day (in 23°C)
	DST	Configurable &Auto-switch
	Battery	Life time of more than 10 years RTC maintenance more than 3 years
Load Profile	Energy load profile	Interval: 1、5、10、15、30、60mins (Configurable). 30 minutes default; Storage capacity: Based on 15 channels, with interval of 15 mins, datas of more than 4 months can be conserved(11,520 times, each time with 15 channels) Selective access: by range and by entry; Sorted method: unsorted (FIFO); Capture objects: See Load Profile part

	<p>Instantaneous load profile</p>	<p>Interval: 1、5、10、15、30、60mins (Configurable). 15 minutes default;</p> <p>Storage capacity: Based on 15 channels, with interval of 15 mins, datas of more than 4 months can be conserved(11,520 times, each time with 15 channels)</p> <p>Selective access: by range and by entry;</p> <p>Sorted method: unsorted (FIFO);</p> <p>Capture objects: See Instantaneous Load Profile part</p>
<p>Billing</p>	<p>Daily billing</p>	<p>Storage capacity: Datas of more than 93 days;</p> <p>Billing method: Billing automatically at 00:00:00;</p> <p>Selective access: by range and by entry</p> <p>Sorted method: unsorted (FIFO)</p> <p>Billing content: See Daily billing part</p>
	<p>Monthly billing</p>	<p>Storage capacity: Billing datas of last 14 months;</p> <p>Billing method:</p> <ol style="list-style-type: none"> <li>1) When a contract starts or end, the meter will trigger a billing and save current contract data.</li> <li>2) Automatic billing based on RTC (Real Time Clock).The billing date and time is programmable by the object end of billing period/ MDI reset, default time is 00:00:00 of</li> </ol>

		<p>the 1st day in every month.</p> <p>3) By a remote or local billing command.</p> <p>4) Button billing</p> <p>Selective access: by range and by entry.</p> <p>Sorted method: unsorted (FIFO).</p> <p>Billing content: See Billing part</p>
Demand	Demand	<p>Demand interval:</p> <ul style="list-style-type: none"> <li>- 300 seconds</li> <li>- 600 seconds</li> <li>- 900 seconds</li> <li>- 1200 seconds</li> <li>- 1800 seconds (default)</li> <li>- 3600 seconds</li> </ul> <p>Demand calculating method: Block mode</p>
Event	Event log	<p>Standard Event Log;</p> <p>Fraud Event Log;</p> <p>Disconnecter Control Event Log;</p> <p>Firmware Upgrade Event Log;</p> <p>Power Failure Event Log;</p> <p>Communication Event Log;</p> <p>Clock Adjust Event Log;</p>

		<p>Tariff Event Log;</p> <p>Configuration Event Log;</p> <p>Power Quality Event Log;</p> <p>Daily Event Log</p>
	Push	<p>Push is triggered by an event. When any bit in the above event log filters is set to push, it means the event will be sent to HES, using the data notification service, initiated by the meter itself.</p>
Upgrade	Upgrade	<p>1. Locally by optical communication</p> <p>2. Locally by RS485 communication</p> <p>3. Remotely by PLC/telecommunications</p>
Mechanical	Enclosure protection	IP54
	Seal	<p>2 for communication module cabinet</p> <p>2 for meter cover</p> <p>1 for configuration button</p> <p>2 for terminal cover</p>
	Meter material	Polycarbonate
	Terminal standard	BS standard
	Against mechanical stroke and shake	<p>IEC62052-11</p> <p>parts 5.2.2.1, 5.2.2.2 &amp; 5.2.2.3</p>
Dimensions (LxWxH)	<p>260X170X85(mm)</p> <p>260X188X85(mm) with vertical antenna</p>	

	Weight	Approx. 2.2kg
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## 5.2 Meter function

### 5.2.1 Measurement

#### Energy measurement

1) Measurement mode:

(15.8.0)  $\Sigma Li$  Active power (abs(QI+QIV)+(abs(QII+QIII)) Time integral 1

(1.8.0)  $\Sigma Li$  Active power+ (QI+QIV) Time integral 1

(2.8.0)  $\Sigma Li$  Active power-(QII+QIII) Time integral 1

(3.8.0)  $\Sigma Li$  Reactive power+ (QI+QII) Time integral 1

(4.8.0)  $\Sigma Li$  Reactive power-(QIII+QIV) Time integral 1

(5.8.0)  $\Sigma Li$  Reactive power QI Time integral 1

(6.8.0)  $\Sigma Li$  Reactive power QII Time integral 1

(7.8.0)  $\Sigma Li$  Reactive power QIII Time integral 1

(8.8.0)  $\Sigma Li$  Reactive power QIV Time integral 1

(9.8.0)  $\Sigma Li$  Apparent power+ (QI+QIV) Time integral 1

(10.8.0)  $\Sigma Li$  Apparent power-(QII+QIII) Time integral 1

2) Meter accuracy: Active class 1.0, Reactive class 2.0;

3) Measuring content:

Object / Attribute Name	OBIS code
Active energy(A1)	1-0:15.8.x.255(x = 0~8)

Active energy import(+A)	1-0:1.8.x.255(x = 0~8)
Active energy export(-A)	1-0:2.8.x.255(x = 0~8)
Reactive energy import(+R)	1-0:3.8.x.255(x = 0~8)
Reactive energy export (-R)	1-0:4.8.x.255(x = 0~8)
1st phase Reactive Energy	1-0:5.8.x.255(x = 0~8)
2st phase Reactive Energy	1-0:6.8.x.255(x = 0~8)
3st phase Reactive Energy	1-0:7.8.x.255(x = 0~8)
4st phase Reactive Energy	1-0:8.8.x.255(x = 0~8)
Apparent energy import (+E)	1-0:9.8.x.255(x = 0~8)
Apparent energy export (-E)	1-0:10.8.x.255(x = 0~8)
Import active energy(A/B/C)	1-0:x.8.0.255(x = 21,41,61)
Export active energy(A/B/C)	1-0:x.8.0.255(x = 22,42,62)
Import Reactive energy(A/B/C)	1-0:x.8.0.255(x = 23,43,63)
Export Reactive energy(A/B/C)	1-0:x.8.0.255(x = 24,44,64)

### Instantaneous data measurement

Object / Attribute Name	OBIS code
Instantaneous active import power (+P)	1-0:1.7.0.255
Instantaneous active export power (-P)	1-0:2.7.0.255
Instantaneous reactive import power (+Q)	1-0:3.7.0.255
Instantaneous reactive export power (-Q)	1-0:4.7.0.255
Instantaneous apparent import power (+S)	1-0:9.7.0.255
Instantaneous apparent export power (-S)	1-0:10.7.0.255
Instantaneous power factor total	1-0:13.7.0.255
Instantaneous active import power (+P) L1~L3	1-0:x.7.0.255(x= 21,41,61)
Instantaneous active export power (-P) L1~L3	1-0:x.7.0.255(x= 22,42,62)
Instantaneous reactive import power (+Q) L1~L3	1-0:x.7.0.255(x= 23,43,63)
Instantaneous reactive export power (-Q) L1~L3	1-0:x.7.0.255(x= 24,44,64)

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Instantaneous apparent import power (+S) L1~L3	1-0:x.7.0.255(x= 29,49,69)
Instantaneous apparent export power (-S) L1~L3	1-0:x.7.0.255(x= 30,50,70)
Instantaneous voltage L1~L3	1-0:x.7.0.255(x= 32,52,72)
Instantaneous current L1~L3	1-0:x.7.0.255(x= 31,51,71)
Instantaneous power factorL1~L3	1-0:x.7.0.255(x= 33,53,73)

## Demand measurement

When a demand period ends, the demand is compared with the channel's maximum demand register. If it is larger, the new maximum demand register and the time of maximum demand is updated to the current time.

- 1) Demand interval: 300、600、900、1200、1800 (default)、3600;unit: second.
- 2) Calculating method: Block mode

### **NOTICE**

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**The demand will be recalculated in the following cases:**

- **Power off;**
  - **RTC configuration;**
  - **Change of demand interval;**
  - **Monthly billing;**
-

## 3) Demand calculating content:

Object / Attribute Name	OBIS code
Demand active import(+P)	1-0:1.4.0.255
Demand active export(-P)	1-0:2.4.0.255
Demand active import(+Q)	1-0:3.4.0.255
Demand active export(-Q)	1-0:4.4.0.255
Demand Apparent import(+S)	1-0:9.4.0.255
Demand Apparent export(-S)	1-0:10.4.0.255
Maximum demand active import(+P)	1-0:1.6.x.255
Maximum demand active export(-P)	1-0:2.6.x.255
Maximum demand reactive import(+Q)	1-0:3.6.x.255
Maximum demand reactive export(-Q)	1-0:4.6.x.255
Maximum demand Apparent import(+S)	1-0:9.6.x.255
Maximum demand Apparent export(-S)	1-0:10.6.x.255

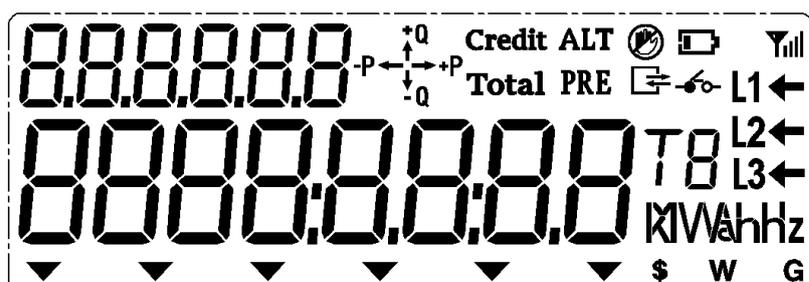
**NOTICE**

x = 0~8. 0 means the total demand for the related contract;

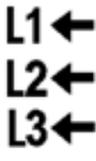
## 5.2.2 Display

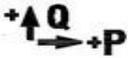
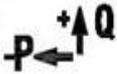
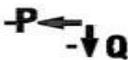
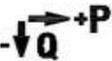
### LCD display

1) The LCD full-screen display as below:



## 2) LCD Symbol

LCD Symbol	Description
	Main display area, display value, energy, instantaneous value.
	OBIS code display
	Communicating symbol, flashes when data exchange
	kWh, kvarh, VA, V, A, W Unit
	L1/L2/L3 Phase Voltage Current Reverse indicator  (When lose phase, L1/L2/L3 symbol will not be displayed; when over-voltage / under-voltage, the symbol flashes)
	From left to right(default):  The 1st ▼ : module remove (historical indicator)  The 2nd ▼ : terminal cover open(historical indicator)  The 3rd ▼ : meter cover open(historical indicator)  The 4th ▼ : magnetic influence(historical indicator)  The 5th ▼ : reverse phase sequence (historical indicator)  The 6th ▼ : bypass(historical indicator)

	Tariff indicator
	Q1: current active power >0 Reactive power >0
	Q2: current active power <0 Reactive power >0
	Q3: current active power <0 Reactive power <0
	Q4: current active power >0 Reactive power <0
	Battery under voltage alarm
	Tamper event occurs
	Relay disconnected
	Relay connected
<b>Credit ALT</b> <b>Total PRE</b>	Reserved
	Signal strength
<b>\$ W G</b>	Reserved

## Display mode and time

- 1) Auto scroll mode: 3~99s (configurable), 10s default
- 2) Button display mode: 3s~99s(Configurable), 60s default
- 3) Power-off display mode: 30s

## Display content

Auto-scroll display mode and button display mode, each of them corresponds one display table, both support maximum 48 display items configurable, for more details please see attachment A

## LED

LED	Colour	Indicating Status
Active impulse	Red	For active impulse indication, can be switch to second signal output by command
Reactive impulse	Red	Reactive impulse output
Alarm led	Red	For tampering event indication(Meter cover open, terminal cover open, module remove, magnetic influence, by-pass, etc)

### 5.2.3 RTC

- 1) Auto-switch of leap year;
- 2) The entity error<0.5s/day (in 23℃);

- 3) Battery with life time of more than 10 years;
- 4) Clock status:

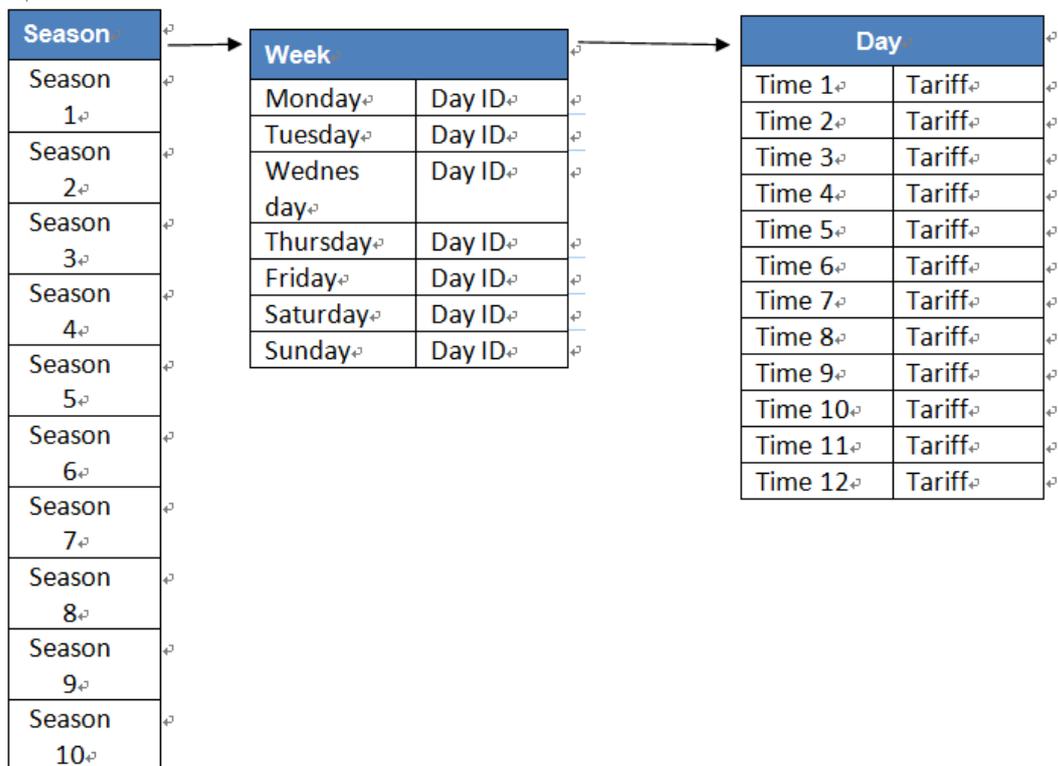
Bit #	Status
0	Invalid value
1	Doubtful value
2	Reserved
3	invalid clock status
4	Reserved
5	Reserved
6	Reserved
7	daylight saving active

## 5.2.4 TOU

- 1) Each tariff scheme supports up to:

Item	Value
Tariff Number	8
Daily Time Span	12
Daily Schedule	12
Weekly Schedule	12
Season Schedule	10

2) Tariff structure:



**NOTICE**

- 1) when time is doubtful or invalid, the meter will use the tariff T 1;
- 2) The meter supports 2sets of tariff scheme (One is for active tariff, another is for passive tariff).

## 5.2.5 Load profile

### Energy load profile

- 1) Storage capacity: Based on 15 channels, with interval of 15 mins, datas of more than 4 months can be conserved(11,520 times, each time with 15 channels)
- 2) Capture interval: 1/5/10/15/30/60minutes, (30 minutes default)
- 3) Selective access: by range and by entry
- 4) Sorted method: unsorted (FIFO)
- 5) Capture objectives:

Capture Objects
Clock
Energy profile status
Active demand import (+P)
Active demand export (-P)
Reactive demand import (+Q)
Reactive demand export (-Q)
Apparent demand import (+S)
Apparent demand export (-S)
Meter internal status

### Instantaneous load profile

- 1) Storage capacity: Based on 15 channels, with interval of 15 mins, datas of more than 4 months can be conserved(11,520 times, each time with 15 channels)
- 2) Capture interval: 1/5/10/15/30/60 minutes, (15 minutes default)
- 3) Selective access: by range and by entry

4) Sorted method: unsorted (FIFO)

5) Capture objective:

Capture Objects
Clock
Power Quality profile status
Average voltage L1
Average voltage L2
Average voltage L2
Average voltage L3
Max voltage L1
Max voltage L2
Max voltage L3
Min voltage L1
Min voltage L2
Min voltage L3
Average current L1
Average current L2
Average current L3
Average power factor all phase
Average power factor L1
Average power factor L2
Average power factor L3
Frequency

#### Load profile status word:

Bit #	Description
Bit 7 PDN	Power down: This bit is set to indicate that a total power outage has been detected during the affected capture period.
Bit 6	Reserved: The reserved bit is always set to 0.

Bit 5 CAD	Clock adjusted: The bit is set when the clock has been adjusted by more than the synchronization limit.
Bit 4	Reserved
Bit 3 DST	Daylight saving: 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).
Bit 2 DNV	Data not valid: Indicates that the current entry may not be used for billing purposes without further validation because a special event has occurred.
Bit 1 CIV	Clock invalid: The power reserve of the calendar clock has been exhausted. The time is declared as invalid. At the same time the DNV bit
Bit 0 ERR	Critical error: 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.

## 5.2.6 Billing

### Monthly billing

- 1) Storage capacity: Datas of last 14 times;
- 2) Selective access: by range and by entry
- 3) Sorted method: unsorted (FIFO)
- 4) Capture objectives:

Billing Objects
Clock time
Meter internal status
Active energy import(+A)
Active energy export(-A)
Reactive energy import(+R)
Reactive energy export(-R)
Active energy import (+A) rate1

Active energy import (+A) rate2
Active energy import (+A) rate3
Active energy import (+A) rate4
Active energy export (-A) rate1
Active energy export (-A) rate2
Active energy export (-A) rate3
Active energy export (-A) rate4
Reactive energy import (+R) rate1
Reactive energy import (+R) rate2
Reactive energy import (+R) rate3
Reactive energy import (+R) rate4
Reactive energy export (-R) rate1
Reactive energy export (-R) rate2
Reactive energy export (-R) rate3
Reactive energy export (-R) rate4
Maximum demand active import (+P)total
Maximum demand active import (+P) Time total
Maximum demand active import (+P) rate1
Maximum demand active import (+P) Time rate1
Maximum demand active import (+P) rate2
Maximum demand active import (+P) Time rate2
Maximum demand active import (+P) rate3
Maximum demand active import (+P) Time rate3
Maximum demand active import (+P) rate4
Maximum demand active import (+P) Time rate4

5) Billing method

- Billing automatically: Billing at predefined time, default time is 00:00:00 of the 1st day in every month.
- Billing by communication: Billing by local or remote command

- Billing by button: Press the configuration button continually 3 seconds
- Active tariff table

## NOTICE

Once a billing completes, it doesn't allow to repeat the billing again during a programmable interval. This function is supported by the object Billing period reset

lock out time. The default value is 24hours, including power down.

## Daily billing

- 1) Storage capacity: datas of last 93 days can be stored;
- 2) Selective access: by range and by entry
- 3) Sorted method: unsorted (FIFO)
- 4) Capture objective:

Object / Attribute Name	OBIS code
Clock	0-0:1.0.0.255
Meter internal status	0-0:96.10.3.255
Active energy import(+A)	1-0:1.8.0.255
Active energy export(-A)	1-0:2.8.0.255
Reactive energy import(+R)	1-0:3.8.0.255
Reactive energy export(-R)	1-0:4.8.0.255
Active energy import (+A) rate1	1-0:1.8.1.255
Active energy import (+A) rate2	1-0:1.8.2.255
Active energy import (+A) rate3	1-0:1.8.3.255
Active energy import (+A) rate4	1-0:1.8.4.255
Active energy export (-A) rate1	1-0:2.8.1.255
Active energy export (-A) rate2	1-0:2.8.2.255

Active energy export (-A) rate3	1-0:2.8.3.255
Active energy export (-A) rate4	1-0:2.8.4.255
Reactive energy import (+R) rate1	1-0:3.8.1.255
Reactive energy import (+R) rate2	1-0:3.8.2.255
Reactive energy import (+R) rate3	1-0:3.8.3.255
Reactive energy import (+R) rate4	1-0:3.8.4.255
Reactive energy export (-R) rate1	1-0:4.8.1.255
Reactive energy export (-R) rate2	1-0:4.8.2.255
Reactive energy export (-R) rate3	1-0:4.8.3.255
Reactive energy export (-R) rate4	1-0:4.8.4.255

(Maximum demand and occurrence time is optional)

5) **Billing method:**

The meter has a daily profile at 00:00:00 every day.

## 5.2.7 Communication

### Communication port

Interface	Purpose	Protocol
Optical port	Local communication	IEC62056-21 MODE E
RS485 port	Multiple purpose port	DLMS/COSEM HDLC profile
LTE port	Remote communication	DLMS/COSEM, TCP/IP profile
G3-PLC port	Remote communication	DLMS/COSEM HDLC profile

## Client/Server Architecture

The meter acts as a DLMS sever. It supports 3 association clients:

- 1) **Public client.** The Public client is used to read the meter's general information (e.g. logical device name) to reveal the structure of the meter. It is not allowed to read metering data and set the meter parameters due to that it has lowest level security (no security).
- 2) **Read client.** The Read client is used to read the data and parameters from the meters. It can't set the meter parameters. The Read client applies the highest level security which is HLS mechanism id 5.
- 3) **Management client.** Except to read the data and parameters as that of Read client, the Management client is allowed to set the parameters and control the objects in the meters.

The following table describes the features of each client.

Client Name	SAP	Service	Security level	Release
Public client	016	<ul style="list-style-type: none"> <li>• Block-transfer-with-get</li> <li>• Get</li> <li>• Selective Access</li> </ul>	<ul style="list-style-type: none"> <li>• Lowest Level Security</li> </ul>	<ul style="list-style-type: none"> <li>• RLRQ service</li> <li>• Closing or losing transport layer connection</li> <li>• A power-down will automatically close the association</li> </ul>

Read client	002	<ul style="list-style-type: none"> <li>• Block-transfer-with-get</li> <li>• Get</li> <li>• Get-with-list</li> <li>• Selective Access</li> </ul>	<ul style="list-style-type: none"> <li>• HLS 5GMAC</li> <li>• Security suite0</li> </ul>
Management client	001	<ul style="list-style-type: none"> <li>• Block-transfer-with-get</li> <li>• Block-transfer-with-set</li> <li>• Get</li> <li>• Get-with-list</li> <li>• Set</li> <li>• Selective Access</li> </ul>	<ul style="list-style-type: none"> <li>• HLS 5GMAC</li> <li>• Security suite0</li> </ul>

## Communication Security

### 1) Security Algorithm

The meter uses DLMS security suite 0. The following objects are required for the management of security:

Object / Attribute Name
Association LN - Current Client Association
Association LN – Public Client
Association LN – Read Client
Association LN – Management Client
Current Security setup
Security setup – Read Client
Security setup – Management Client

- **Association LN - Current Client Association**

This object contains the information of the current association.

- **Association LN - Public Client/ Read Client/ Management Client**

The Association LN objects support the association management of the individual client. The most important information in the association is the object list, through which the client is able to download the whole set of the object model supported by the meter including the access right of each attribute and method.

- **Security Setup**

The management client is the highest authority within the DLMS server.

For the other clients, individual security setup objects exist that allow the management client to change the settings and keys for these clients.

The keys except dedicated key can be changed via the “key\_transfer” method of “Security Setup”.

## 2) **Security policy**

The security policy can be combination of the following options (“Security setup” version 1):

Bit0 - unused Bit1 –unused

Bit2 - authenticated request Bit3 - encrypted request

Bit4 –unused (only for security suite 1 and 2) Bit5 - authenticated response

Bit6 - encrypted response

Bit7 - unused (only for security suite 1 and 2)

## 3) **Usage of Keys**

Depending on the security policy set and the individual access right definition of the

attributes and methods, the following keys will be used according to their security context:

- 1) Global unicast encryption key (EK)
- 2) Global authentication key (AK)
- 3) Global broadcast encryption key (BK)
- 4) Master key(KEK)
- 5) Dedicated Key

The meters must accept a single AA established with or without a dedicated key.

When the keys are changed, the AES key wrap algorithm is used. This algorithm is using the master key to encrypt the key that is being changed.

The lifetime of the Global Keys of each security context is limited by the range of the associated Frame Counters. A global key may be a unicast encryption key (EK), a broadcast encryption key (BK) or an authentication key (AK);

Dedicated keys are valid during the lifetime of an association; i.e. the dedicated key is generated and taken in use with the opening of the association. The key is destroyed automatically by the server upon closing of the association.

#### **NOTICE**

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When FC is the maximum values ,it will roll back to 0

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### **GPRS -WAN Interface**

The COSEM TCP-UDP/IP based communication is used for the GPRS WAN interface.

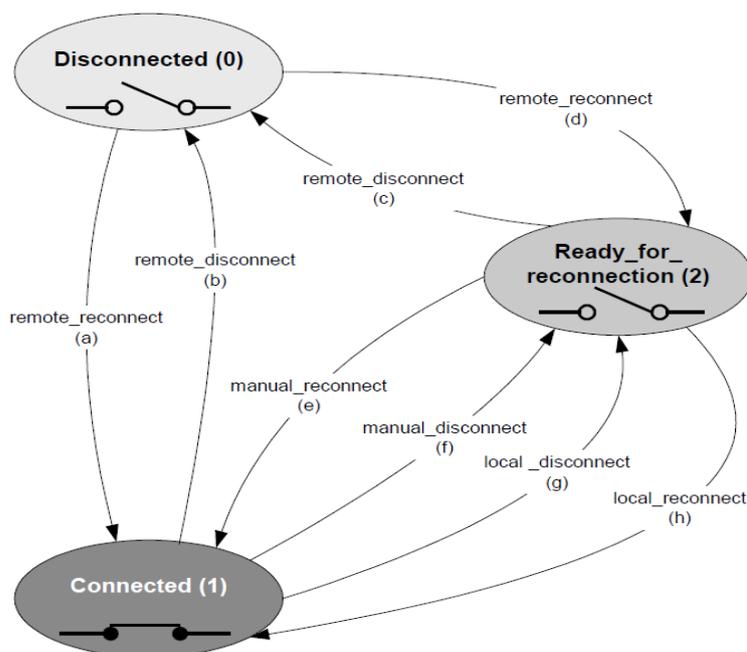
It includes the protocol layers as follows:

- COSEM Application Layer;
- COSEM TCP-UDP Wrapper Layer;
- TCP/UDP Transport Layer;
- Internet Protocol (IPv4) Network Layer;
- IPv4 Supporting Data Link Layer;
- Physical Layer;

COSEM application layer (and COSEM Clients/Logical Device) uses the services of TCP or UDP Transport layers via COSEM Wrapper sub-layer. The Transport layer (TCP or UDP) and COSEM wrapper together is called COSEM Transport layer. The meter should support both TCP and UDP transport layer.

## 5.2.8 Relay control

The state diagram for disconnector and the possible state transitions are shown in the figure below:



## Disconnect control

The behavior of the relay includes remote, local and manual disconnection or reconnection. These commands are dependent by the control\_mode setting of the Disconnect control object.

control_mode	Disconnection				Reconnection			
	Remote		Manual	Local	Remote		Manual	Local
enum:	(b)	(c)	(f)	(g)	(a)	(d)	(e)	(h)
(0)	–	–	–	–	–	–	–	–
(1)	x	x	x	x	–	x	x	–
(2)	x	x	x	x	x	–	x	–
(3)	x	x	–	x	–	x	x	–
(4)	x	x	–	x	x	–	x	–
(5)	x	x	x	x	–	x	x	x
4) (6)	x	x	–	x	–	x	x	X
NOTE 3	In Mode (0) the disconnect control object is always in 'connected' state.							
NOTE 4	Local disconnection is always possible unless the corresponding trigger is inhibited.							

The meter can support mode 0-6. Default control mode: 5.

If the state transition is not allowed by the control mode, then the action is ignored.

### NOTICE

If the current relay status is not connected, if the manual operation relay switch is turned off at this time, send the remote connection command, it can be closed immediately (even if the mode is not supported) (except for tampering type)

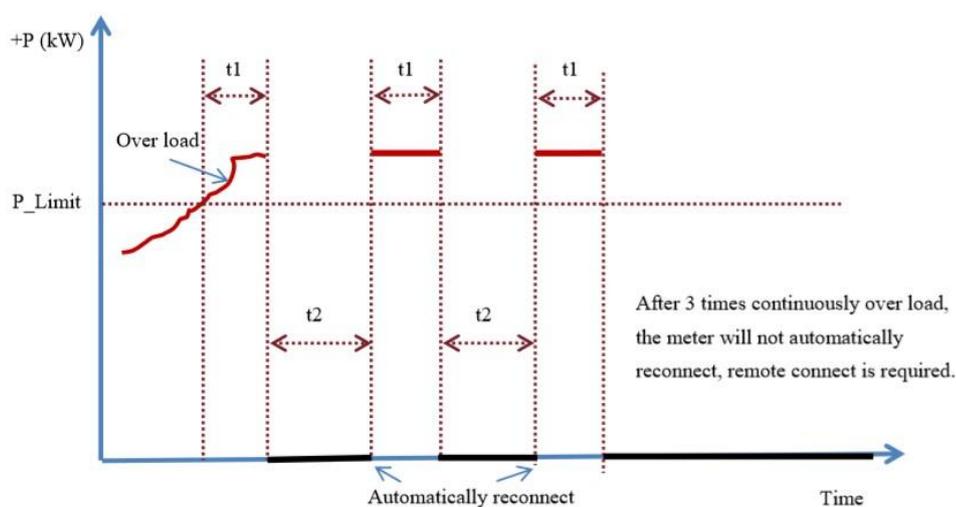
## Power Limitation

The meter measures the active power every second. If the **import active power** is larger than the active power thresholds for specified period t1, the meter will disconnect the supply. After disconnect last for auto-reconnect time t2, the meter will automatically

connect the supply. During the disconnection period  $t_2$ , pressing the display button, the meter will connect the supply. If the customer does not reduce the load, the over load will be detected again, then the meter will disconnect the supply again. After counter of auto-reconnect reaches Max Number of Auto- reconnect, if it is disconnected once again due to over load, the meter will keep in disconnection status in which pressing the push button also cannot connect the supply. Only a remote or local connect command can connect the supply.

The meter records a counter of auto-reconnect attempted. The counter will be reset after the power below the power threshold 1, or after a power off, or after executing an effective supply connect command from remote central system or local hand-held device. Here is a example:

Here below picture show the load control process for one power threshold.



#### 1) Power limit enable/disable

- The function to monitor the active power can be switched on/off. The default state is enable
- If all the power thresholds are zero, the active power limitation is disabled.

**NOTICE**

If in this moment the disconnection is due to the load control. At this time, the auto-reconnection time threshold is modified, and the meter connect automatically after the previous delay time executed.

**Tamper Disconnect**

Some events may trigger the meter disconnect the power supply. A Tamper Disconnect Filter object is used to enable or disable the disconnect control once the corresponding events happens.

Description
Current reversal L1
Current reversal L2
Current reversal L3
Current un balance
Main cover is open
Terminal cover is open
Communication module is removed
Reserve
Strong DC magnetic field detected
Phase Sequence Reversal
Voltage missing of phase L1
Voltage missing of phase L2
Voltage missing of phase L3
Over temperature
High voltage

The bit in the above filter is set to 1, that means, when the event happens, the relay will automatically disconnect. Only the remote/local command can reconnect the relay, if the event is still existed, the relay will keep the is connected.

**NOTICE**

- 
- The operation of connection and disconnection of tampering type is independent of (mode 1-6);
  - Over temperature, High voltage belong to local events;
  - If the connection command is sent in the case that tampering event hasn't recovered, the meter will execute the connection operation firstly, than execute the disconnection of tampering;
  - When send the connection command, the historical tampering status word will be deleted automatically;
- 

### 5.2.9 Event

Event is categorized in different group. Each group has different events and stored in an event log objects. Each group of event has a filter objects with a bits mask for each event to define whether the corresponding events shall be logged (0: disable, 1: enable), and whether the corresponding events shall be pushed (0: disable, 1: enable) to the HES once it occurs.

#### Standard Event Log

- 1) Min capacity: minimum of 50 entries

- 2) Structure: clock.time, value
- 3) Buffer encoding: normal: clock with every entry
- 4) Selective access: by range and by entry
- 5) Sorted method: unsorted (FIFO)
- 6) Event Code:

Description
Power off(long)
Power on(long)
Low battery occurrence
Low battery restoration
Power off(short)
Power on(short)
Watch dog reset
Measurement system error
NVM error
RTC reset
Program memory error
Global meter reset

**NOTICE**

- Power off (long), judgment precondition: power off more than 3 minutes;

**Fraud Event Log**

- 1) Min capacity: minimum of 50 entries

- 2) Structure: clock.time, value
- 3) Buffer encoding: normal: clock with every entry
- 4) Selective access: by range and by entry
- 5) Sorted method: unsorted (FIFO)
- 6) Event Code:

Description
Phase – R CT reverse –occurrence
Phase – R CT reverse –restoration
Phase – Y CT reverse –occurrence
Phase – Y CT reverse –restoration
Phase – B CT reverse –occurrence
Phase – B CT reverse –restoration
Bypass occurrence
Bypass restoration
Main cover opened
Main cover closed
Terminal cover opened
Terminal cover closed
Communication box removed
Communication box closed
Strong DC magnetic field detected
No strong DC magnetic field anymore
Phase Sequence Reversal occurrence
Phase Sequence Reversal restoration
Handling of phase & neutral occurrence
Handling of phase & neutral restoration
Voltage missing of phase L1 Occurrence
Voltage missing of phase L1 Restoration

Voltage missing of phase L2 Occurrence
Voltage missing of phase L2 Restoration
Voltage missing of phase L3 Occurrence
Voltage missing of phase L4 Restoration
Over temperature occurrence
Over temperature restoration
High voltage occurrence
High voltage restoration

### Disconnecter Control Event Log

- 1) Min capacity: minimum of 50 entries
- 2) Structure: clock.time, value
- 3) Buffer encoding: normal: clock with every entry
- 4) Selective access: by range and by entry
- 5) Sorted method: unsorted (FIFO)
- 6) Event Code:

Description
Remote disconnection(command)
Remote connection(command)
Relay disconnect due to high voltage
Relay auto connect due to high voltage
Relay disconnect due to over power
Relay auto connect due to over power
Relay disconnect by push button
Relay connect by push button
Relay disconnect due to tamper

Relay disconnect due to current reverse
Relay disconnect due to current reverse
Relay disconnect due to current reverse
Relay disconnect due to current
Relay disconnect due to face cover
Relay disconnect due to terminal cover removal
Relay disconnect due to module cover removal
Relay disconnect due to strong DC magnetic field
Relay disconnect due to phase reverse
Relay disconnect due to phase L1 current without voltage
Relay disconnect due to phase L2 current without voltage
Relay disconnect due to phase L3 current without voltage
Relay disconnect due to over temperature

### **Firmware Upgrade Event Log**

- 1) Min capacity: minimum of 10 entries
- 2) Structure: clock.time, value
- 3) Buffer encoding: normal: clock with every entry
- 4) Selective access: by range and by entry
- 5) Sorted method: unsorted (FIFO)

6) Event Code:

Description
Application firmware upgrade successful
Communication module firmware upgrade successful

### Power Failure Event Log

- 1) Min capacity: minimum of 50 entries
- 2) Structure: clock.time, value
- 3) Buffer encoding: normal: clock with every entry
- 4) Selective access: by range and by entry
- 5) Sorted method: unsorted (FIFO)
- 6) Event Code:

Description
Power failure of L1 occurrence
Power failure of L1 restoration
Power failure of L2 occurrence
Power failure of L2 restoration
Power failure of L3 occurrence
Power failure of L3 restoration

**NOTICE**

Power failure threshold is configurable

**Communication Event Log**

- 1) Min capacity: minimum of 10 entries
- 2) Structure: clock.time, value
- 3) Buffer encoding: normal: clock with every entry
- 4) Selective access: by range and by entry
- 5) Sorted method: unsorted (FIFO)
- 6) Event Code:

Description
Access meter with incorrect password
Change module
DLMS key auth client data writing change
DLMS key auth client data writing changed
DLMS key encryption client data writing
DLMS key encryption client data writing
Modem initial failure
Sim card failure
Sim card OK
GSM registration failure
GPRS registration failure
PDP context established
PDP context destroy

PDP context failure
Modem software reset
User initial failure
Signal quality low
Auto answer number of calls exceed

### **Clock Adjust Event Log**

- 1) Min capacity: minimum of 20 entries
- 2) Structure: clock.time, value
- 3) Buffer encoding: normal: clock with every entry
- 4) Selective access: by range and by entry
- 5) Sorted method: unsorted (FIFO)
- 6) Event Code:

Description
Clock synchronization over threshold
Set RTC

### **Tariff Event Log**

- 1) Min capacity: minimum of 50 entries
- 2) Structure: clock.time, value
- 3) Buffer encoding: normal: clock with every entry
- 4) Selective access: by range and by entry
- 5) Sorted method: unsorted (FIFO)

## 6) Event Code:

Description
Automatic closure billing date change
Modify seasons passive profile
Modify week passive profile
Modify day passive profile
Modify activity calendar time
Passive calendar activated

**Configuration Event Log**

- 1) Min capacity: minimum of 50 entries
- 2) Structure: clock.time, value
- 3) Buffer encoding: normal: clock with every entry
- 4) Selective access: by range and by entry
- 5) Sorted method: unsorted (FIFO)
- 6) Event Code:

Description
Change auto scroll display list
Change manual scroll display list
Change the display time of each
Change the return time to the auto scroll
Change demand integration period
Change profile capture period
Change over voltage threshold

Change under voltage threshold
Change voltage missing threshold
Change power control (over load)
Change high voltage threshold
Change the channels configuration of the load profile
Change the time threshold for over load control
Change the time threshold for high voltage
Change the minimum time between billing end

### Power Quality Event Log

- 1) Min capacity: minimum of 50 entries
- 2) Structure: clock.time, value
- 3) Buffer encoding: normal: clock with every entry
- 4) Selective access: by range and by entry
- 5) Sorted method: unsorted (FIFO)
- 6) Event Code:

Description
Under voltage of phase L1 Occurrence
Under voltage of phase L1 Restoration
Under voltage of phase L2 Occurrence
Under voltage of phase L2 Restoration
Under voltage of phase L3 Occurrence
Under voltage of phase L3 Restoration

Over voltage of phase L1 Occurrence
Over voltage of phase L1 Restoration
Over voltage of phase L2 Occurrence
Over voltage of phase L2 Restoration
Over voltage of phase L3 Occurrence
Over voltage of phase L3 Restoration

## 7) Event parameter

Object / Attribute Name
Power quality event duration
Power quality event voltage
Reference Voltage for power quality
Threshold for voltage sag
Time threshold for voltage sag
Threshold for voltage swell
Time threshold for voltage swell
Number of voltage sags in phase L1
Number of voltage swells in phase L1
Number of voltage sags in phase L2
Number of voltage swells in phase L2
Number of voltage sags in phase L3
Number of voltage swells in phase L3

**Daily Event Log**

- 1) Min capacity: minimum of 300 entries
- 2) Structure: clock.time, value
- 3) Buffer encoding: normal: clock with every entry
- 4) Selective access: by range and by entry
- 5) Sorted method: unsorted (FIFO)

**NOTICE**

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The events of last day will be recorded at 00:00:00, everyday the last 100 items can be stored, 300 items can be stored in total.

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### **Push Operations**

Push is triggered by an event. When any bit in the above event log filters is set to push, it means the event will be sent to HES, using the data notification service, initiated by the meter itself.

## 6. Attachment A: Display Item List

OBIS code	Description	Display format	Unit
1.8.0~1.8.8	Import active total and each tariff	xxxxxx.xx	kWh
2.8.0~2.8.8	Export active total and each tariff	xxxxxx.xx	kWh
3.8.0~3.8.8	Import reactive total and each tariff	xxxxxx.xx	kVarh
4.8.0~4.8.8	Export reactive total and each tariff	xxxxxx.xx	kVarh
15.8.0~15.8.8	Total active energy of total and each tariff	xxxxxx.xx	kWh
9.8.0~9.8.8	Import apparent total and each tariff	xxxxxx.xx	kVAh
10.8.0~10.8.8	Export apparent total and each tariff	xxxxxx.xx	kVAh
1.6.0~1.6.8	Maximum demand active import (+P)	xxx.xxx	kW
1.6.0~1.6.8	Maximum demand active import (+P)  (2 screens display)	DD-MM-YY hhmm	
2.6.0~2.6.8	Maximum demand active export (-P)	xxx.xxx	kW
2.6.0~2.6.8	Maximum demand active export (-P)  (2 screens display)	DD-MM-YY hhmm	

3.6.0~3.6.8	Maximum demand reactive import (+Q)	xxx.xxx	kvar
3.6.0~3.6.8	Maximum demand reactive import (+Q) (2 screens display)	DD-MM-YY hhmm	
4.6.0~4.6.8	Maximum demand reactive export (-Q)	xxx.xxx	kvar
4.6.0~4.6.8	Maximum demand reactive export (-Q)(2 screens display)	DD-MM-YY hhmm	
9.6.0~9.6.8	Maximum demand Apparent import (+S)	xxx.xxx	kVA
9.6.0~9.6.8	Maximum demand Apparent import (+S)(2 screens display)	DD-MM-YY hhmm	
10.6.0~10.6.8	Maximum demand Apparent export (-S)	xxx.xxx	kVA
10.6.0~10.6.8	Maximum demand Apparent export (-S)(2 screens display)	DD-MM-YY hhmm	
1.8.0.101~1.8.8.101	Import active total and each tariff (last 1st month)	xxxxxx.xx	kWh
2.8.0.101~2.8.8.101	Export active total and each tariff(last 1st month)	xxxxxx.xx	kWh
3.8.0.101~3.8.8.101	Import reactive total and each tariff (last 1st month)	xxxxxx.xx	kVarh
4.8.0.101~4.8.8.101	Export reactive total and each	xxxxxx.xx	kVarh

	tariff(last 1st month)		
15.8.0.101~15.8.8.101	Active energy total and each tariff(last 1st month)	xxxxxx.xx	kWh
9.8.0.101~9.8.8.101	Import apparent total and each tariff (last 1st month)	xxxxxx.xx	kVAh
10.8.0.101~10.8.8.101	Export apparent total and each tariff(last 1st month)	xxxxxx.xx	kVAh
1.6.0.101~1.6.8.101	Maximum demand active import (+P) (last 1st month)	xxx.xxx	kW
1.6.0.101~1.6.8.101	Maximum demand active import (+P) (last 1st month)(2 screens display)	DD-MM-YY hhmm	
2.6.0.101~2.6.8.101	Maximum demand active export (-P) (last 1st month)	xxx.xxx	kW
2.6.0.101~2.6.8.101	Maximum demand active export (-P) (last 1st month)(2 screens display)	DD-MM-YY hhmm	
3.6.0.101~3.6.8.101	Maximum demand reactive import (+Q) (last 1st month)	xxx.xxx	kvar
3.6.0.101~3.6.8.101	Maximum demand reactive import (+Q) (last 1st month)(2 screens display)	DD-MM-YY hhmm	
4.6.0.101~4.6.8.101	Maximum demand reactive export (-Q) (last 1st month)	xxx.xxx	kvar
4.6.0.101~4.6.8.101	Maximum demand reactive export (-Q) (last 1st month)(2 screens display)	DD-MM-YY	

	display)	hhmm	
9.6.0.101~9.6.8.101	Maximum demand Apparent import (+S) (last 1st month)	xxx.xxx	kVA
9.6.0.101~9.6.8.101	Maximum demand Apparent import (+S) (last 1st month)(2 screens display)	DD-MM-YY hhmm	
10.6.0.101~10.6.8.101	Maximum demand Apparent export (-S) (last 1st month)	xxx.xxx	kVA
10.6.0.101~10.6.8.101	Maximum demand Apparent export (-S) (last 1st month)(2 screens display)	DD-MM-YY hhmm	
0.9.2	Local Date	DD-MM-YY	
0.9.1	Local Time	Hh: mm: ss	
C.1.0	Device ID 1: Serial number(0-0:96.1.0.255)	xxxxxxxx	
1.7.0	Instantaneous active import power (+P)	xx.xxxx	kW
2.7.0	Instantaneous active export power (-P)	xx.xxxx	kW
3.7.0	Instantaneous reactive import power (+Q)	xx.xxxx	kvar
4.7.0	Instantaneous reactive export power (-Q)	xx.xxxx	kvar
9.7.0	Instantaneous apparent import power (+S)	xx.xxxx	kVA

10.7.0	Instantaneous apparent export power (-S)	xx.xxxx	kVA
x.7.0	Instantaneous voltage L1/L2/L3(x=32,52,72)	xxx.x	V
x.7.0	Instantaneous current L1/L2/L3(x=31,51,71)	xxx.xxx	A
x.7.0	Instantaneous active import power (+P) L1/L2/L3(x=21,41,61)	xx.xxxx	kW
x.7.0	Instantaneous active export power (-P) L1/L2/L3(x=22,42,62)	xx.xxxx	kW
x.7.0	Instantaneous reactive import power (+Q) L1/L2/L3(x=23,43,63)	xx.xxxx	kvar
x.7.0	Instantaneous reactive export power (-Q) L1/L2/L3(x=24,44,64)	xx.xxxx	kvar
x.7.0	Instantaneous apparent import power (+S) L1/L2/L3(x=29,49,69)	xx.xxxx	kVA
x.7.0	Instantaneous apparent export power (-S) L1/L2/L3(x=30,50,70)	xx.xxxx	kVA
13.7.0	Instantaneous power factor total	x.xxx	
x.7.0	Instantaneous power factor L1/L2/L3(x=33,53,73)	x.xxx	
91.7.0	Current N	xxx.xxx	A
14.7.0	Frequency	xx.xx	Hz