CA168

Technical Specification

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CA168 Product Overview

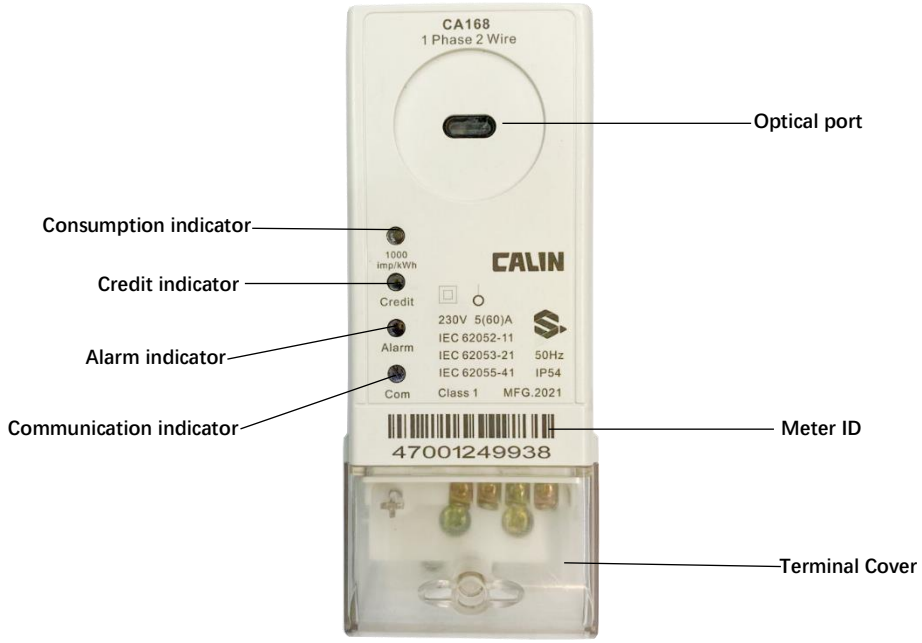
The CA168 meter is a split-type compact Din Rail mounted class 1 accuracy single phase electricity meter built in 35mm international standard housing made of poly-carbonate flame retardant materials. Galvanic isolation wire is basic connection between the meter and keypad. Double circuit measurement and relay are also available on request for reinforced tamper prevention.

The meter consists of two parts, the MCU (Metering & Control Unit) and UIU (User Interface Unit). The MCU and UIU is linked via RF-Lora, PLC or M-bus 2 wires communication module. The UIU is installed within consumer's home, while MCU is installed in a meter cabinet away from consumers.

The CA168 & CIU

Item	Measurement Control Unit (MCU) or Meter	Customer Interface Unit (CIU)
Mounting	DIN RAIL	Bracket
Installation	Meter box, kiosk or similar Outside consumer premises	Wall mounted Inside consumer premises

The Measurement Control Unit



What the LEDs mean

Consumption LED

- This LED is blue in colour and has a dual function. It indicates the rate of consumption and is also used to verify the accuracy of the meter.
- The LED flashes faster to indicate a rapid consumption or high kW flow of electricity.
- The LED pulses 1,000 times for every kWh of energy measured.

Alarm LED

- This LED is yellow in colour and indicates the alarms.
- The LED will be flashing when upper cover opening, terminal cover opening, the door of meter enclosure opening, current/voltage imbalance, over-voltage/current, under voltage, but the relay keeps closed.
- The LED permanently on indicates the relay is opened and customer's load is disconnected.

Credit LED

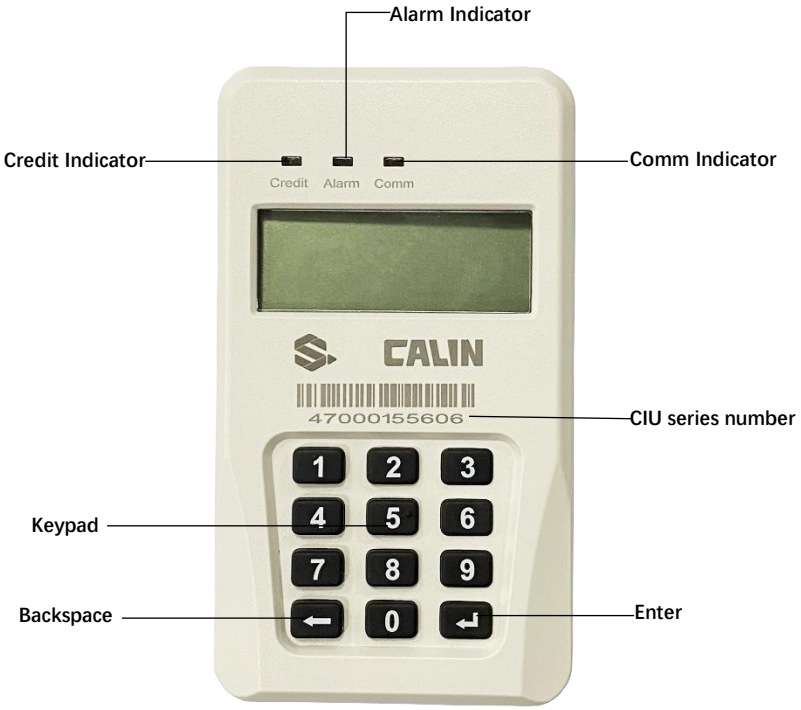
- This LED is three level credit LED display, green, yellow, red in colour by different level of the remaining credit.
- The LED is green and indicates the remaining credit is more than 15 kwh.
- The LED is yellow and indicates the remaining credit is more than 10 kwh, less than 15 kwh. And the buzzer sounds alarm.

- The LED is flashing yellow and indicates the remaining credit is more than 5 kwh, less than 10 kwh. And the buzzer sounds alarm.
- The LED is red and indicates the remaining credit is more than 0 kWh, less than 5 kWh. And the buzzer sounds alarm.
- The LED is flashing red and indicates the remaining credit is 0. And the buzzer sounds alarm.

Com status LED

- This LED indicates that there is communication between the meter and the consumer's keypad or CIU.
- LED is flashing: data is being received and transmitted between the meter and the CIU.
- LED is permanently off: there is no communication between the meter and the CIU.

The Customer interface unit (CIU)



The CIU is installed in the consumer’s premises, connected to the meter though wire/wireless communication (On request). The meter is usually located outside the building.

The CIU has a three-part construction - the body, and the numeric keypad and LCD display. The numeric keypad is used to enter tokens and initiate user functions.

LCD Interface of CIU

① Main Display

This area display energy value, date, time, etc.

② Short Code

This area displays the short code entry.

③ Reversal current

The icon indicates the reversal current, the arrow will display once the current is reversed.

④ Alarm

This icon is an alarm indication, will flashing if voltage imbalance, current imbalance, over-voltage, over-current, super low voltage, etc.

⑤ Battery Status

This icon indicates the battery, will display once low battery.

⑥ Relay Indication

This icon indicates the realy is opened, will display once the relay is disconnected.

⑦ Energy Unit

This icon is unit symbol, it can display kWh, kVarh, Hz, V, A, KW, kvar.

⑧ Magnetic Field

This icon indicates the Magnetic field interference, will display once the meter affected by

magnetic field.

⑨ Type of Credit

This icon indicates the credit type, it will display permanently if the meter is currency credit type.

⑩ Communication

Will flashing once the CIU communicate with the meter.

Product specifications

Voltage ratings		
Nominal voltage (-20% +15%)	220/230/240 V AC	161 – 276 V AC
Supply frequency (±5%)	50 Hz / 60 Hz	
Current ratings		
Base current (I_b)	5 A	
Maximum current (I_{max})	60 A/100A(On request)	
Minimum starting current Class 1 Class 2	 20 mA 25 mA	
Utilization category	UC2	
Minimum start up (230V)	130 V	
Minimum operating (230V)	120 V AC	
Nominal power consumption		
	2 W / 10 VA	
Accuracy		
	Class 1 or 2 (maintained throughout life of product)	
Over voltage rating		
	1.8 times the nominal voltage for 48 hours	
Short circuit rating		
	Short-circuit withstand 3.0 kA	
Protection		
	Power overload	
	Current overload	Line / load reversal
	Over / under voltage	Extreme over current
	Delayed reconnection	
Environmental		
Operating temperature	-10°C to +55°C	
Storage temperature	-25°C to +70°C	
Humidity	95% non-condensing	
IP rating	IP 54 (meter and customer interface unit)	

RF immunity	30 V/m

Status indicators

	Power / load status LED
	MCU / CIU communication status LED
	Rate LED (1 000 pulses / kWh)

Installation

Footprint	DIN RAIL, bottom in & bottom out
Insulation class	Double insulation

Terminals

	Live	Neutral
Type	Cage clamps	Cage clamp
Size	25mm²	16mm²

Interrogation

Type	Direct probe, DISCAAA9 (on request)

Security

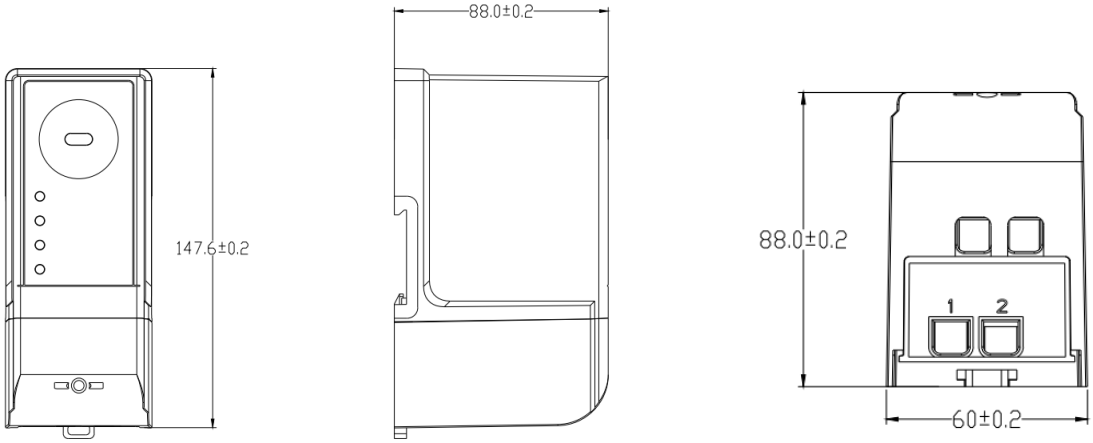
	Security seals
	Terminal cover
	Tamper detection

Packaging

Units per carton	18 per carton
Carton weight (including box)	16.5 kg
	For further packaging information, please contact Calin.

Installing the meter

Meter Dimensions



Installing the meter device (MCU)

Important
Before installing the meter, take note of the following precautions:

- The wiring must be performed by a certified installation electrician and must conform to the prevailing government standards and safety regulations.
- This product is not a protection device and so requires the use of a suitable upstream and downstream breaker.
- When wiring the meter, ensure that the incoming supply is isolated by switching off the upstream breaker.
- We recommend that if you are connecting aluminum cables to this product, you use bi-metal lugs.
- We recommend that the meter is installed in an enclosure with an IP54 rating or higher.
- For installation of the CIU, see the *Installing the Customer Interface Unit (CIU)* section.

Cabling specification	
Cable	Size
Live wire	Maximum 35 ㎡
Neutral wire	Maximum 35 ㎡
Din Rail	35mm

Tools and accessories for a mounting

1 x 6mm insulated terminal screwdriver
1 x insulated side cutters
2 x security seals

To install the meter:

1. Remove the terminal cover and retainer by sliding it outwards.(Figure 1)

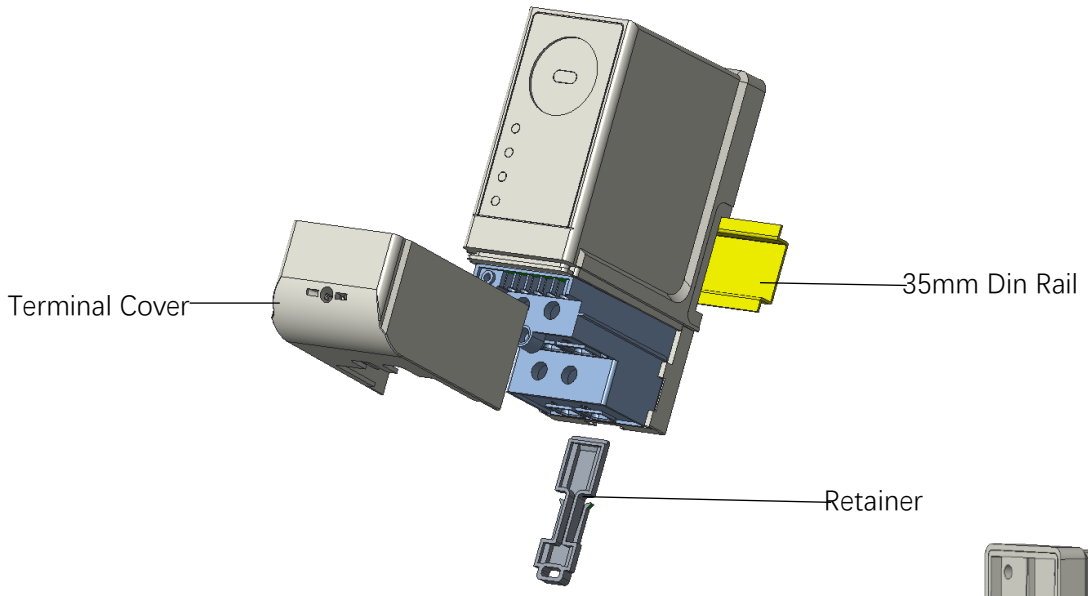


Figure 1

2. Install the meter into the 35mm Din Rail (Figure 2)
3. Insert the retainer completely, make sure the meter won't shake.

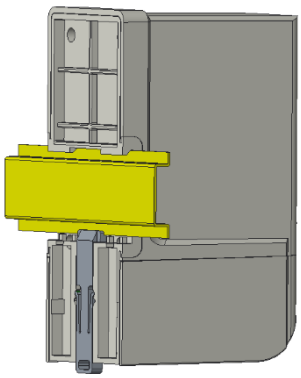


Figure 2

4. Connect the electric wires according into the wire connect diagram. (Figure 3)
5. Install the terminal cover back.

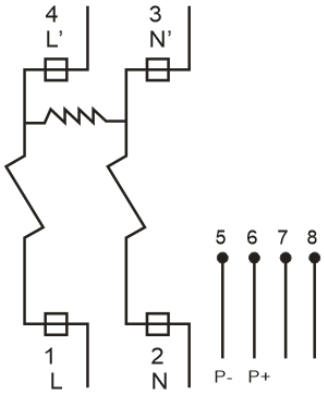


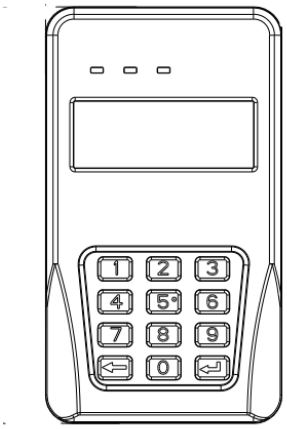
Figure 3

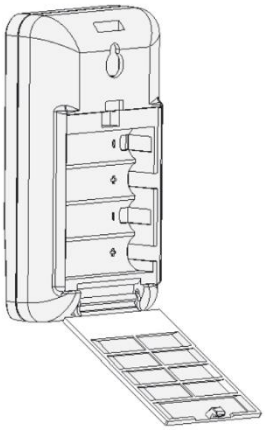
Installing the Customer interface unit (CIU)

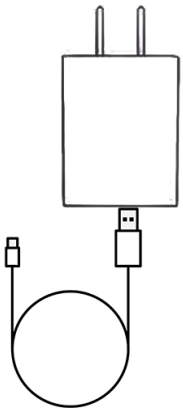
The CIU can be a portable device, unnecessary to install it on the wall.

To install the CIU:

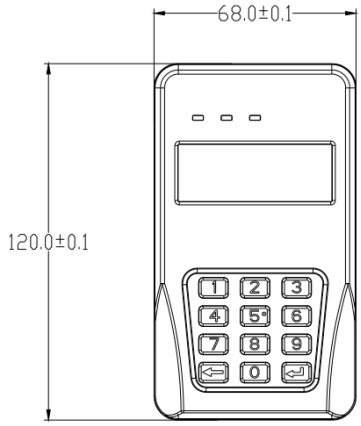
1. Mark and drill 6mm holes for the one mounting hole on the proper location of wall.
2. Insert the top screw and tighten until 5mm is protruding.
3. Hang the CIU on the top screw.
4. The CIU can be powered by power cable or 4 AA batteries.

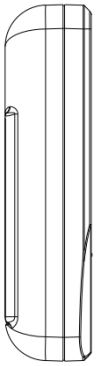


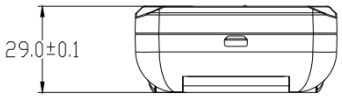




CIU Dimensions







Commission the meter

Important

- If the meter is un-commissioned, the consumer's electricity supply remains disconnected, regardless of the credit state of the meter.

  The commissioning token number is **12345** and is not meter-specific. This means that it can be used with all Calin STS meters.

  The meter will commission automatically if the meter be powered exceed 1 hour.

The decision to configure a meter with commissioning or not, is made when the meter order is placed and the meter is manufactured at Calin.
The benefit of an un-commissioned meter is that you can conclude the installation and apply the incoming electricity supply, without the meter going into a tamper state. This means you do not need to carry meter specific tamper tokens, and won't experience unnecessary delays in concluding an installation.
After you have verified the installation, as described in the Testing the meter installation and sealing the device section, enter the commissioning token or shortcode on the meter's CIU keypad. Once this is entered, tamper detection is active and the consumer’s electricity supply is connected.
If the meter is in a tamper state, the commissioning process will not be accepted.

Features of the meter

Energy Measurement

Power Measurement
The CA168 meter uses a direct connection shunt measurement type. The power measurement is calculated per second.

Power Factor Measurement
The power factor measurement is an estimate only and is derived by dividing the average power by the apparent power.

Under and over voltage measurement
This setting is a trip threshold that suspends electricity supply when an under or overvoltage condition exists. The supply is suspended until the voltage conditions return to normal. The trip

threshold can be configured for both under and overvoltage supply conditions. The average voltage is calculated per second.

Current measurement

Current measurement is calculated per second and is derived from the average power and the average voltage and is used for the over current trip evaluation.

Demand

Demand measurement will record active demand, inactive demand, apparent demand; Reversal demand (active, inactive, apparent).

Interval data

Monthly Profile

The meter records total kWh consumption, remaining credit, maximum demand, time&date at the interval of monthly basis.
The meter will store 24 months of monthly data.

Daily Profile

The meter records total kWh consumption, remaining credit, maximum demand, time&date at the interval of daily basis.
The meter will store 31 days of daily data.

20 minutes Profile

The meter records voltage, current, PF(power factor), total kWh consumption, remaining credit, maximum demand, time&date at the interval of 20 minutes basis.
The meter will store 31 days of 20 minutes profile.

*The interval data can be retrieved through the optical port by manual, or remotely in wireless installations (for wireless meter only).

Load Control

Meter Protection

The CA168 meter incorporates a 90A (100A on request) latching relay to connect and disconnect the consumer supply, whilst safeguarding the meter.

Power overload

Short Code: 14
This code displays the load limitation threshold.

Shortcode: 31

The real-time active power in kW

If the instantaneous power measured by the meter is higher that the power load limit setting, the meter disconnects the consumer's supply. The trip limit can be changed through the use of a meter specific token from a vending unit

Under and over voltage

Under voltage

If the average supply voltage measured by the meter is less than the minimum voltage limit, the meter disconnects the consumer's supply. The electricity supply remains disconnected until the voltage rises above this limit.

You can configure the minimum voltage trip limit and disable this feature by setting the limit to 0 VAC.

Over voltage

If the average supply voltage measured by the meter is higher than the maximum voltage limit, the meter disconnects the consumer's supply. The electricity supply remains disconnected until the voltage drops below this limit.

The default maximum voltage trip limit is configurable. You can disable this feature by setting the limit to the maximum value, for example, 420 V AC.

Tamper

The CA168 meter has optional tamper protection, that is configured in production.

If the tamper feature is enabled, any attempt to tamper with the meter can result in the consumer’s supply being disconnected, if so configured. The supply is only reconnected when a STS clear tamper token is entered into the meter. The STS tamper token is meter specific.

When enabled, tamper is only active once the meter is commissioned. For information on commissioning the meter, see the Commissioning the meter section.

Important

If the terminal cover is not properly fixed, the meter will not be restored from the tamper state even after it accepts the clear tamper token.

Tamper status

This indicates if the meter has registered a tamper condition.

The icon will be flashing when the upper cover, terminal cover is opening.

The icon will display permanently if the upper cover, terminal cover is opened, and the meter record the tamper event.

Event Record

Event	Maximum number of Records
Open terminal cover	100
Open meter enclosure cover	100
Open Modular shell	100
Over load	100
Over voltage	100
Under voltage	100
Over current	100
Reverse current	100
Current imbalance	100
Magnetic field interference	100
Power off	100
Key-Change-Token (KCT) input	100
Technical token input	100
Credit token input	100
Credit amount	100

Communication

Optical Port

This port is compliant with the DLMS HDLC protocol, for reading and configuring locally

RF wireless communication

The communication between the meter and the CIU.

Remote features

Remote reading

Remotely read out the meter measurement data, relay status, and credit balance. This applies to

wireless installations only.

Remote disconnect / reconnect
Remotely disconnect or reconnect the meter. This applies to wireless installations only.

Automatic meter reading
This applies to wireless installations only. A DCU (data concentrator unit) is connected with the HES (head-end system) via 4G / GPRS / Ethernet. The HES enables a meter data capture on a row call basis once every day through the DCU.

Remote Upgrade (on request only)
The meter firmware can be remotely upgraded from the head-end system GPRS communication.

TOU Tariff (on request only)

The meter supports TOU(Time of Use) tariffs. Maximum 8 tariffs.
The meter supports friendly time/date, the meter will supply power in the friendly time/date even though no credit.
The meter supports stepped tariff.

Buzzer

Button press
Low battery
No battery
Over load
Accept/reject token

Switching between pre-paid and post-paid modes

Pre-paid and postpaid mode

The CA168 meter is configured to operate as either a pre-paid or post-paid meter. In the pre-paid configuration, all accounting functionality is as per standard pre-paid requirements. The CA168 meter is configured as a pre-paid meter by default.
In the post-paid configuration, the meter operates in credit mode and the consumer is billed in arrears for electricity consumed. No pre-paid accounting functionality is performed.
Credit features, such as a credit token or clear credit token, are not supported in post-paid mode. However, all other STS functions are available.

Troubleshooting

Disconnection of Supply

Automatic disconnection

The CA168 meter automatically disconnects the consumer's supply in the event of a trip. The meter supports different trip events that are registered and saved when the meter trips.

Trip event	How to reconnect / close the relay
Credit exhausts	Automatic reconnection by entering a new credit token.
Tamper	Automatic reconnection by entering a clear tamper token.
Current overload	Manual or automatic reconnection, depending on the configuration set at the time of production.
Power overload	Manual or automatic reconnection, depending on the configuration set at the time of production.
Under voltage	Manual or automatic reconnection, depending on the configuration set at the time of production.
Over voltage	Manual or automatic reconnection, depending on the configuration set at the time of production.

If more than one trip event is detected, only the trip event with the highest priority is recorded. For more information on these trip events, see the Meter protection section.

Automatic reconnection of supply

This follows a reconnection algorithm where the consumer's supply is only reconnected 30 seconds after a trip event occurs. If the trip event still exists, the consumer's supply is disconnected for a further 30 seconds. Only four reconnection attempts are permitted before a 30-minute lockout is imposed.

If a trip condition exists, the five 30 second reconnection attempts followed by the 30-minute lockout cycle, repeats indefinitely.

Timed reconnection occurs with the following trip conditions:

Power overload

Current overload

Over voltage

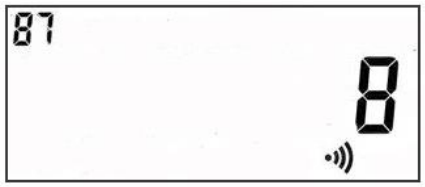
Under voltage

Line / load reversal

Consumption restriction

Reason for last disconnect

Short code: 87



This short code will display the last trip event that caused the consumer’s load to be

disconnected.

Solution for unusual disconnection

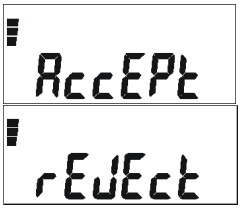
Code Display	Cause	Solution
00	Relay Closed	----
1	No Credit	Eneter a credit token
3	Over Power	Reduce the load or turn off the appliance
4	Relay Test	Contact management
5	Open upper cover	Restore the cover, and enter a clear tamper token
6	Open terminal cover	Restore the cover well, and enter a clear tamper token
7	Remote Disconnect	Remote connect from the backend
8	Not-active	Enter commissioning code 12345
9	Over Current	---
11	Over voltage	---
12	Under voltage	---
13	Current Reverse	Contact management
14	Open meter enclosure cover	Restore the cover, and enter a clear tamper token
15	Magnetic field interference	Enter a clear tamper token
16	Current imbalance	Contact management
17	Neutral line interference	Contact management
18	Bypass	Contact management
21	Voltage imbalance	Contact management
22	Thermal overload	Contact management
23	Low power factor	Contact management
24	Tariff Error	Contact management
25	Remote Reconnect, but still disconnect due to other local disconnect	Contact management

Meter error codes

Error code	Condition	Description
ERR_02	Credit token	KEN overtime
	Setting token	KEN overtime
ERR_03	Credit token	KT=1, don’t support recharge credit token
ERR_04	Set max power limitation	Limitation Data length overrun
	Credit token	Credit Data length overrun
	Credit token	The total kwh value exceeds 999999.9 after inputting this credit token
ERR_05	Input KCT	KT error
ERR_06	Input token	Token invalid
ERR_07	Input clear tamper token	Illegal parameter of clear tamper token
ERR_08	Input test token	Don’t support this function
	Input setting token	Don’t support this function

Token&Code Input

Input purchase TOKEN into CIU



(1)Input 20 digits TOKEN into the CIU or meter.
(2) Confirm the number on the LCD.
(3) If token input is not correct, please use the keypad "back button" to delete.
(4) After input 20 digits TOKEN, please click "Enter button", so that the token is confirmed.
(5) If token input is correct, the LCD will display "accept" and buying power succeeds.
(6) If token input is not correct, the LCD will display "reject".

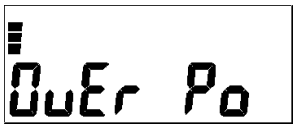
Data display on LCD of CIU

Power purchase TOKEN is correct. It will be accepted and “accept” will be displayed.

Power purchase TOKEN is incorrect. It will be rejected and “reject” will be displayed.

When “old” is displayed, it means TOKEN is out of date.

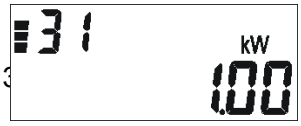
When “used” is displayed, it means the TOKEN has been used.



Overload consumption—When consumption load is over the load threshold set, “over po” will be displayed and the power will be cut off within specified time.

It shows that energy consumption is 100.00kWh and displays item code 01.

It shows the residual energy is 100.00kWh and displays item code 07.



It shows meter’s current power is 1.00kW and the display item code

STS class setting & service tokens (meter specific)

These are meter specific tokens that require encryption and are generated at a vending system; this excludes Calin meter specific service tokens.

- Maximum load limit
  Set the maximum load limit on the meter.
- Clear credit
  Clear all existing credit from the meter, such as in the case of a tenancy change.
- Key change token
  Change the meter coding parameters, such as the supply group code or tariff index.
- Clear tamper
  Remove a tamper event on the meter and reconnect the consumer's supply.

Accessing information through short codes

Example:
Press 07 and enter, The current residual credit will display in the LCD
The current total active power

Short code list

Code	CIU	Code	CIU
01	Cumulative total active kWh consumption	**02**	Cumulative total reverse active kWh consumption
03	Cumulative total reactive kWh consumption	**04**	Cumulative total reverse reactive kWh consumption
06	Cumulative purchased amount	**07**	Residual amount
09	Date	**10**	Time
11	The alarm threshold 1	**12**	The alarm threshold 2
13	The alarm threshold 3	**14**	Load threshold
19	Power consumption of last month	**20**	Power consumption of last 2nd month
21	Power consumption of last 3rd month	**22**	Power consumption of last 4th month
23	Power consumption of last 5th month	**24**	Power consumption of last 6th month

25	Power consumption of last 7th month	**26**	Power consumption of last 8th month
27	Power consumption of last 9th month	**28**	Power consumption of last 10th month
29	Power consumption of last 11th month	**30**	Power consumption of last 12th month
31	The current total active power	**32**	The current A phase active power
33	The current B phase active power	**34**	The current C phase active power
35	The current total power factor	**36**	The current A phase power factor
37	The current B phase power factor	**38**	The current C phase power factor
40	The number of meter cover open	**41**	The last cover open time
42	The last 2nd cover open time	**43**	The last 3rd cover open time
44	The last 4th cover open time	**45**	The last 5th cover open time
46	The number of overload break power	**47**	the last overload time
48	the last 2nd overload time	**49**	the last 3rd overload time
50	the last 4th overload time	**51**	the last 5th overload time
52	The number of power down	**53**	The last power downtime
54	The last 2nd power down time	**55**	The last 3rd power down time
56	The last 4th power down time	**57**	The last 5th power down time
58	The number of phase down	**59**	The last KCT token
60	The last 2nd KCT token	**61**	The last 3rd KCT token
62	The last 4th KCT token	**63**	The last 5th KCT token
65	Meter Address	**70**	A phase voltage

71	B phase voltage	**72**	C phase voltage
73	A phase current	**74**	B phase current
75	C phase current	**76**	the last 1 power purchase TOKEN
77	the last 2nd power purchase TOKEN	**78**	the last 3rd power purchase TOKEN
79	the last 4th power purchase TOKEN	**80**	the last 5th power purchase TOKEN
81	Last credit kWh	**82**	Last 2nd credit kWh
83	Last 3rd credit kWh	**84**	Last 4th credit kWh
85	Last 5th credit kWh	**87**	Reason for relay disconnecting
88	Key version number	**89**	TI number
90	SGC	**138**	KRN

Industrial standards

IEC 62051-1	Electricity metering - Glossary of terms
IEC 62052-11	Electricity metering - General requirements, Tests and test conditions - Part 11: Metering equipment
IEC 62053-21	Electricity metering equipment (a.c.) - Part 21: Particular requirements - Static meters for active energy (classes 1 and 2)
IEC 62055-21	Electricity metering - Payment systems - Part 21: Framework for standardisation
IEC 62055-31	Electricity payment metering systems - Part 31: Particular requirements - Static payment meters for active energy (classes 1 & 2)
IEC 62055-41	Electricity metering - Payment systems - Part 41: Standard transfer specification (STS) - Application layer protocol for one-way token carrier systems
IEC 62055-51	Electricity metering - Payment systems - Part 51: Standard transfer specification - Physical layer protocol for one-way numeric and magnetic card token carriers
IEC 62055-52	Electricity metering - Payment systems - Part 52: Standard transfer specification - Physical layer protocol for a two-way virtual token carrier for direct local connection
IEC 62056-21	Electricity metering - Data exchange for meter reading, tariff and load control Part 21: Direct local data exchange
SANS 1524-1	Electricity payment systems - Part 1: Payment meters
SANS 1524-1-1	Electricity payment systems - Part 1-1: Mounting and terminal requirements for payment meters
SANS 1524-1-2	Electricity payment systems - Part 1-2: Specification for surge arresters for the protection of electricity dispensers
SANS 1524-4	Electricity payment systems - Part 4: National prepayment electricity meter cards
SANS 15417	Information technology: Automatic identification and data capture techniques - Code 128 bar code symbol specification
STS 101-1	Interface specification - STS 101-1: Standard transfer specification (STS) - Physical layer mechanical and electrical interface for virtual token carriers
STS 201-15.1.0	Companion specification - STS 201-15.1.0: Standard transfer specification (STS) - Meter function object: Register Table for electricity payment meters
DSP 34-749	Eskom specification: Standard for sealing metering equipment
DSP 34-1527	Eskom specification: Procedure for producing software process assessment documents
DSP 34-1635	Eskom specification: Particular requirements for pre-payment meters
ISO 9001	Quality Management Systems
ISO 14001	Environmental Management

Company Overview

Calin, as derived from China League of Innovation, dates back to the year 2006 when our team developed the new generation of CPU card electronic prepaid kilo-watt hour meter for China State Grid. Now there are over 1,000,000 pcs this type of smart prepayment electric meters operating as key revenue protection devices for utilities and service providers in and out of China.

Each member of Calin R&D team ever served in top rank Chinese meter companies and contributed to the rapid development of smart metering industry in China. With vast forefront field experience and expertise, Calin offer a broad metering product range, comprising of conventional electric meters, water meters, prepaid meters, wireless communication meters, vending and management systems, AMR / AMI smart metering solutions, consulting, training and support.

Calin is the forerunner of prepaid metering industry in China. Our products and solutions are all developed on the concept of revenue protection and better management, and thus enjoy very high reputation in the industry. Even now China is supplying components, complete products as in OEM, and meter electronic design to many other meter manufacturers. With this OEM and trade partners, Calin's business has expanded to over 30 countries and regions worldwide.

To share with our clients the benefit from our constant innovation and commit to our clients' request is Calin's forever unchanging principle. Running away from responsibility is always condemned. Calin will keep servicing our clients with our best innovation and commitment to create best mutual benefit.