



User Manual

Smart Power Sensor LHE34D & LHE34C

Focus on creating value for clients

Document description

Effective coverage:

This user manual only applies to litiot Smart Power Sensor type as mentioned in the document title.

Objective:

This user manual includes the relevant technical information of Smart Power Sensor. User can consult this document for the use and maintenance of the sensor. The manual includes:




- Introduction of Smart Power Sensor's work mechanism, performance and functions.
- Malfunction that may happens during its lifetime and the corresponding precaution.
- Detail description of the sensor functioning during its whole lifetime.

User Object:

- This user manual aims at guiding the personnel responsible for the Smart Power Sensor design, testing, operation etc.
- This user manual is also dedicated for personnel from the electricity company such as the Smart Power Sensor lectotype engineers as well as for the technicians responsible for the sensor installation, operation and maintenance from the electricity company.

Symbol Conventions:

The symbols that may be found in this document are defined as follows.

Symbol	Description
 CAUTION	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
 WARNING	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
 NOTE	Supplements the important information in the main text. NOTE is used to address information not related to personal injury, equipment damage, and environment deterioration.

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Content

.....	1
1 Overview.....	1
2 Appearance.....	1
3 Standard	3
4 Working Principles.....	4
5 Functions.....	4
5.1 Display function.....	4
5.2 Programming function:	6
5.3 Communication function.....	8
6 Application Scenarios	8
7 Overall dimensions and installation.....	9
7.1 Sensor Connection.....	9
7.2 Sensor Dimension.....	11
7.3 Installation Dimension.....	12
8 Installation and un-installation.....	13
8.1 Installation tools	13
8.2 Preparation before installation	14
8.3 Installation procedure	14
8.4 Testing after installation.....	15
8.5 Un-installation	15
9 Service.....	16
9.1 Troubleshooting	16
9.2 Sensor Repair.....	17
10 Maintenance.....	17
10.1 Clean	17
10.2 Error and function check	18
10.3 Reinstall	18
11 Scarp Processing	18
12 Transportation and Storage	19
13 Parameters.....	19

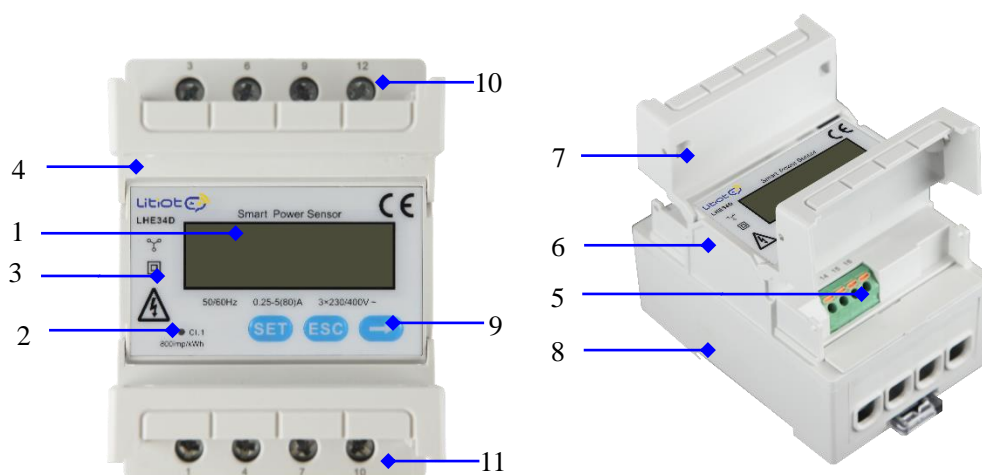
1 Overview

Type LHE34D & LHE34C Smart Power Sensor (hereinafter referred to as the "Sensor ") is specially designed for the distributed photovoltaic system, to be a new Smart Power Sensor, combined with measurement and communication, mainly applied into the measurement for electrical quantity including voltage, current, power ,frequency, power factor, active energy etc. in the electrical circuit. It can realize networking with the external device through RS485 communication interface. Adopting the standard DIN 35mm DIN Rail mounting, structural module design, it is characterized with small volume, easy installation and networking, etc.

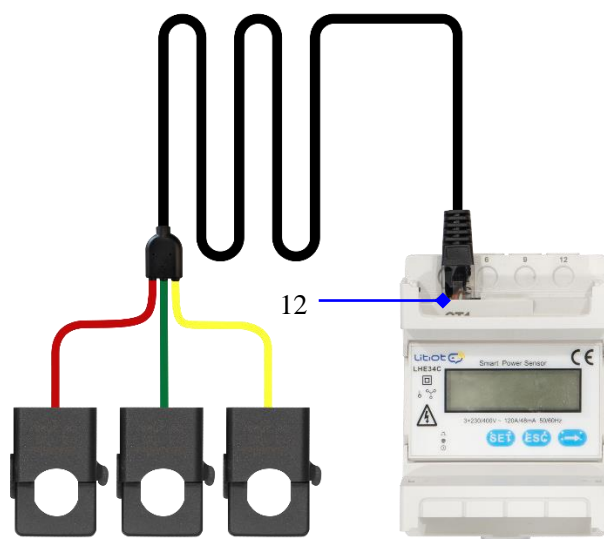
Main Features

- Metering function
- Measurement function of electrical parameter
- Display function
- Cyclic display
- Button display
- Parameter setting function

2 Appearance



LHE34D



LHE34C

No.	Description
1	LCD display
2	Pulse LED(active energy)
3	Nameplate
4	Sensor Cover
5	Terminal Auxiliary for RS485
6	Terminal Cover
7	Terminal cover Seal
8	Sensor bottom case
9	Button
10, 11	Terminal block
12	External CT interface (only for LHE34C)

**NOTE**

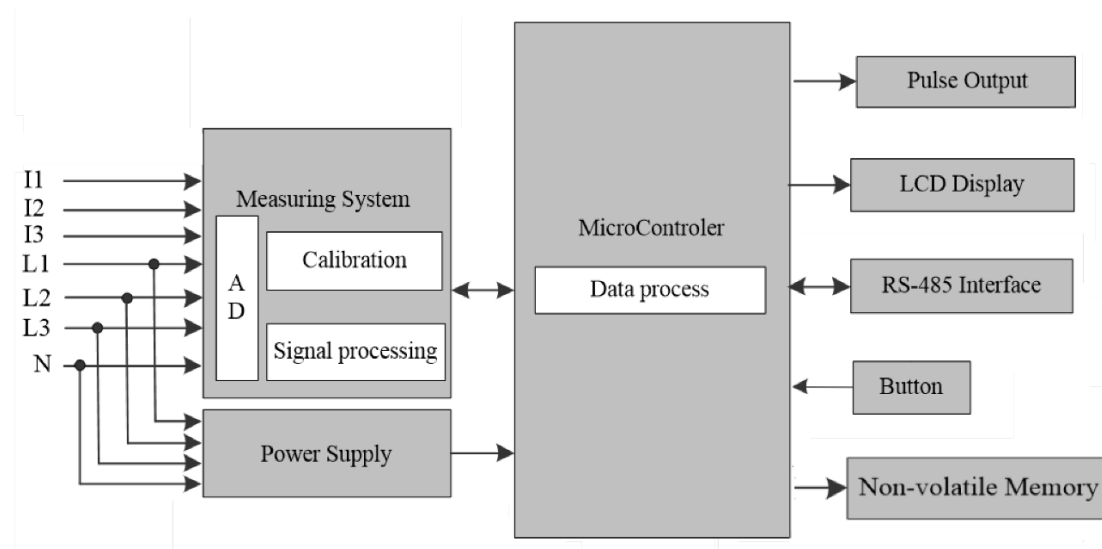
- 1.Figures provided in this document are for reference only.
- 2.External CT interface (only for LHE34C) .
3. LHE34C serial number 10 terminal block hole blocked.

3 Standard

Standard	Description
EN IEC 61326-1:2021	Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements
EN IEC 61326-2-1:2021	Electrical equipment for measurement, control and laboratory use — EMC requirements- Part 2-1: Particular requirements
EN 61010-1:2010/A1:2019	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements
EN IEC 61010-2-030:2021	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 2-030: Particular requirements for equipment having testing or measuring circuits

4 Working Principles

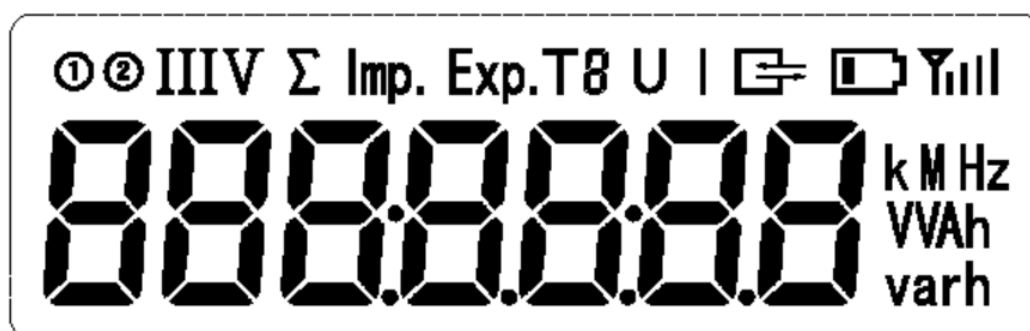
The instrument is composed of highly accurate metering integrated circuit, management MCU, storage chip, RS485 communication module, etc.



5 Functions

5.1 Display function

The displayed interfacial electrical parameter and power data are both for primary side data (which has already multiplied by the current and voltage ratios). The energy measurement value is displayed in seven bits, with the display range from 0.00 kWh to 9999999 kWh.





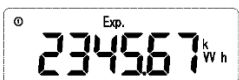
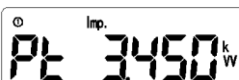
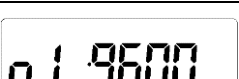
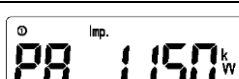
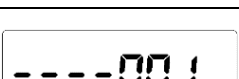
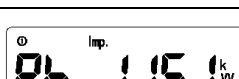
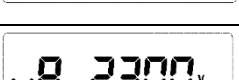
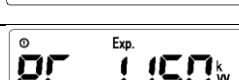

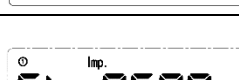





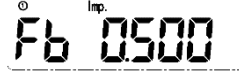
Liquid crystal display



NOTE

LHE34D Liquid crystal display without “①” and “②” symbol.



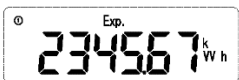


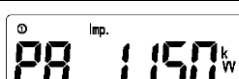
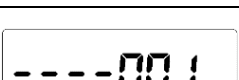
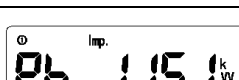
Display (auto loop)


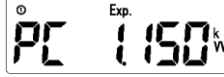


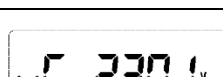
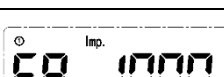
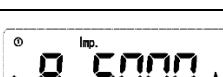



No.	Display interface	Instruction	No.	Display interface	Instruction
1		Positive active energy =10000.00kWh	10		Phase C current=-5.001A
2		Reserve active energy =2345.67kWh	11		Combined phase active power=3.450kW
3		Protocol: MdoBus-RTU; address=001	12		Phase A active power 1.150kW
4		Baudrate=9600 None parity, 1 stop bits	13		Phase B active power 1.151kW
5		Phase A voltage =230.0V	14		Phase C active power 1.150kW
6		Phase B voltage =230.1V	15		Combined phase power factor PFt=0.500
7		Phase C voltage =230.1V	16		Phase A power factor PFa=1.000
8		Phase A current=5.000A	17		Phase B power factor PFb=0.500
9		Phase B current=5.001A	18		Phase C power factor PFc=-0.500

**NOTE**

No button operation backlight is closed for 60 seconds. Auto loop
Switch time =3s.

Display (change by key)

No.	Display interface	Instruction	No.	Display interface	Instruction
1		Positive active energy =10000.00kWh	10		Phase C current=-5.001A
2		Reserve active energy =2345.67kWh	11		Combined phase active power=3.450kW
3		Protocol: MdoBus-RTU; address=001	12		Phase A active power 1.150kW
4		Baudrate=9600 None parity, 1 stop bits	13		Phase B active power 1.151kW

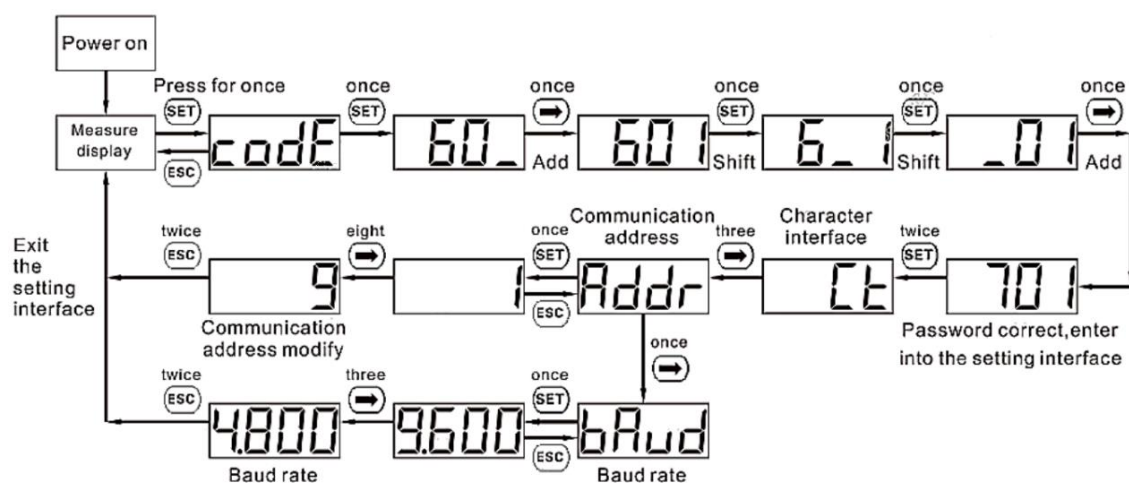
5		Phase A voltage =230.0V	14		Phase C active power 1.150kW
6		Phase B voltage =230.1V	15		Combined phase power factor PFt=0.500
7		Phase C voltage =230.1V	16		Phase A power factor PFa=1.000
8		Phase A current=5.000A	17		Phase B power factor PFb=0.500
9		Phase B current=5.001A	18		Phase C power factor PFc=-0.500

**NOTE**

Turn up key "ESC", turn down by "→".

5.2 Programming function:

Button description: "SET" button represents "confirmation", or "cursor shift" (when input digits), "ESC" button represents "exit", "→" button represents "add". The input code is (default 0020).



Setting examples for communication address and baud rate

Parameter	Value range	Description
C_t	1~9999	Current ratio, used for setting the input loop current ratio: When the current is connected to the line via the transformer, C_t =the rated current of the primary loop / the rated current of the secondary circuit; When the current is directly connected to the line, C_t shall be set as 1.
P_t	0.1~999.9	Voltage ratio, used for setting the voltage ratio of the input loop; When the voltage is connected to the line via the transformer, P_t = the rated voltage of the primary loop / the rated voltage of the secondary circuit; 0.1~999.9 When the voltage is directly connected to the line, P_t shall be set as 1.0.
$Prot$	1: 645; 2: n.2; 3: n.1; 4: E.1; 5: O.1;	Settings for communication stop bit and Parity bits: 1: DL/T 645 Even parity, 1 stop bit, E.1; 2: None parity, 2 stop bits, n.2; 3: None parity, 1 stop bit, n.1; 4: Even parity, 1 stop bit, E.1; 5: Odd parity, 1 stop bit, O.1;
$bAud$	0: 1.200; 1: 2.400; 2: 4.800; 3: 9.600; 4: 19.200; 5: 38.400; 6: 115.200;	Communication baud rate: 0: 1.200; 1: 2.400; 2: 4.800; 3: 9.600; 4: 19.200; 5: 38.400; 6: 115.200;
$Addr$	1~247	Communication address
nEt	0: n.34; 1: n.33;	Option for wiring mode: 0: n.34 represents three phase four wire; 1: n.33 represents three phase three wire.
$CLr.E$	0:no; 1:E	The setting is 1, representing the allowed instrument energy data clearance, which will be zero reset after clearing.
$PLuS$	0:P; 1;q;	Pulse output: 0: active energy pulse; 1: reactive energy pulse;

d 15P	1~60	Display in turns (second) 1~60: Time interval of actual display.
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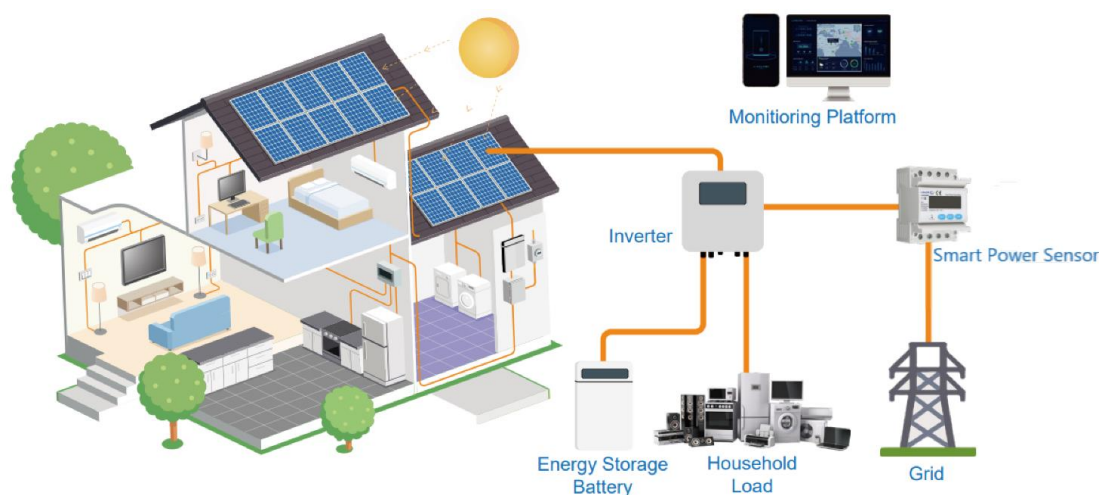
5.3 Communication function

The Sensor has an RS485 communication interface, the baud rate can be changed Between 1200 bps, 2400 bps, 4800 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps and 115200 bps. The default Communication para is 9600 bps, none parity bits and 1 stop bit, and communication addresses (see LCD display), support Modbus RTU protocol.

Modbus – RTU interface definition in document New energy three-phase Smart Power Sensor communication protocol.

6 Application Scenarios

In the residential power station scenario (three-phase grid), sometimes according to the requirements of the grid, it is necessary to limit the active power of the grid-connected point. At this time, the smart power sensor needs to collect the power information of the grid-connected point to control the output power of the inverter. With the cooperation of energy storage batteries, it is also necessary to use Sensors to increase the self-consumption. It adopts RS485 communication, which can realize the electrical quantity measurement and energy metering function, and respond to the upper host for the real-time data query.



7 Overall dimensions and installation

7.1 Sensor Connection

Please follow the instruction to arrange the wire connection:

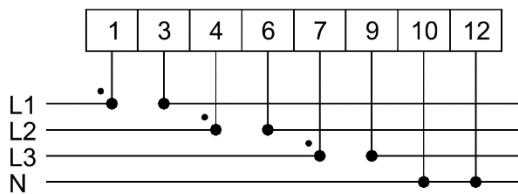
- Use copper cable as the lead-in wire to terminal block.
- Screw out the wire-fasten screw so that the connection wires can be inserted into.
- Open the plastic cover of the connection wire long enough so that the wire-fasten screws can contact each connected wire.
- Screw the wire-fasten screws to fix the connection wires.
- Pull the connected wires to check whether they are connected tightly.
- Open the opening CT clasp and install the CT to the A/B /C current line respectively in the direction of the current arrow.



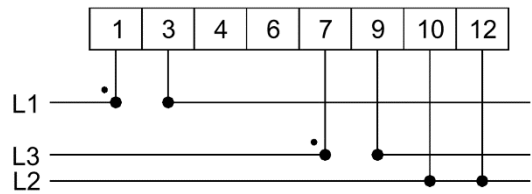
NOTE

- The screws in the terminal block should be screwed down tightly to avoid burnt because of bad contact or thin lead-in wire.
- CT install is only for LHE34C type.
- When installing the open CT, it should be noted that the arrow direction represents the positive power direction, and ensure that the buckle of the open CT is fasten.

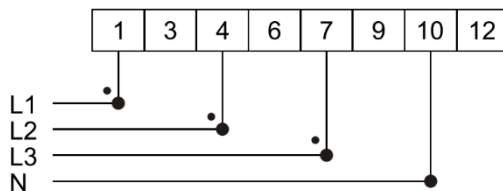
● Connection Diagram:



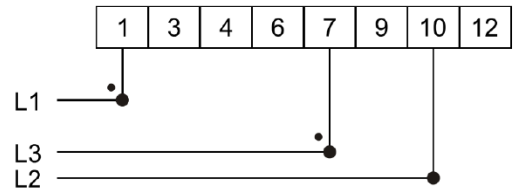
3P4W (LHE34D)



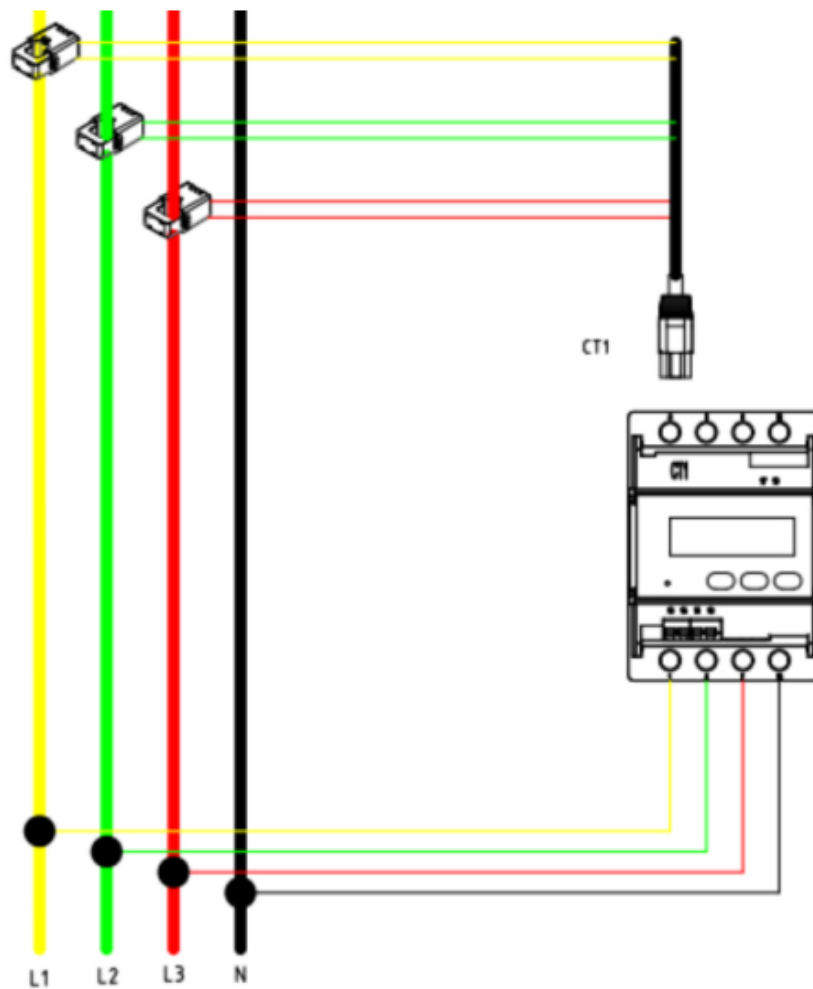
3P3W (LHE34D)



3P4W (LHE34C)



3P3W (LHE34C)



3P4W (LHE34C)

● **Auxiliary terminal wiring diagram**

RS485

15	16
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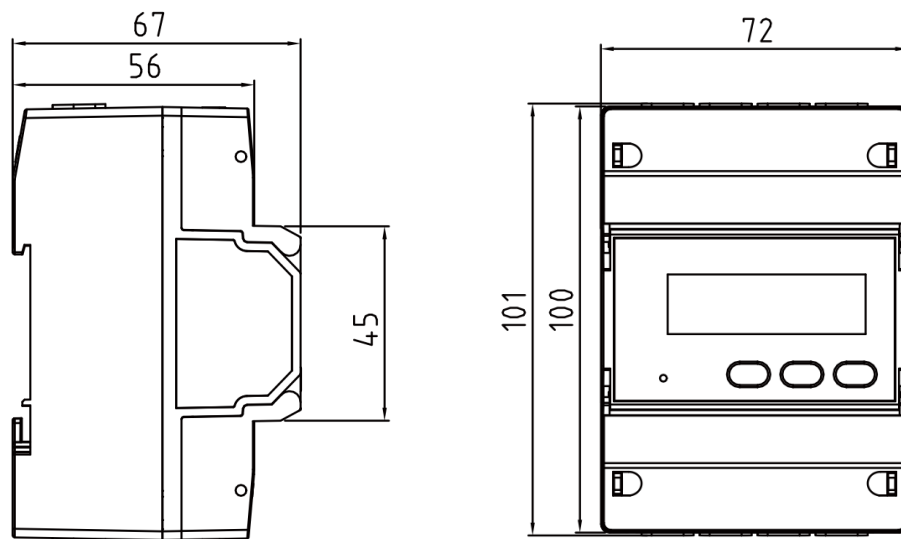
- RS485 port : A (15) and B (16) A B

PULSE

13	14
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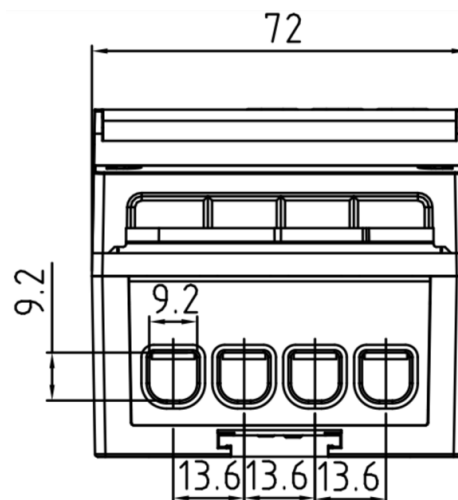
- PULSE port: P+(13) and P-(14) + -

7.2 Sensor Dimension

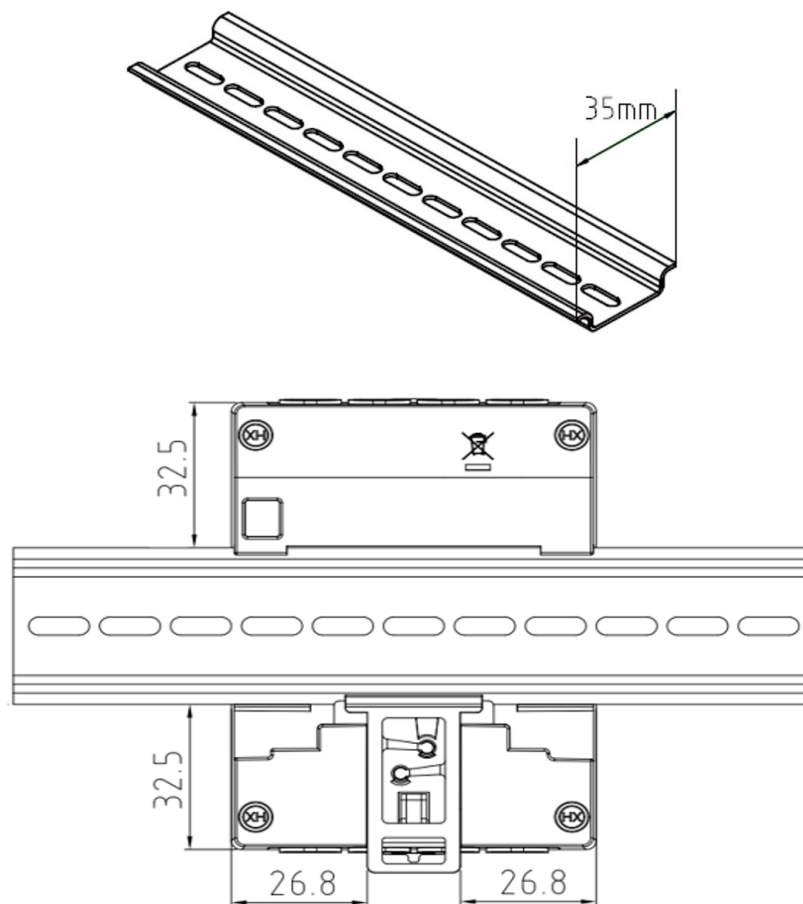


Short terminal cover

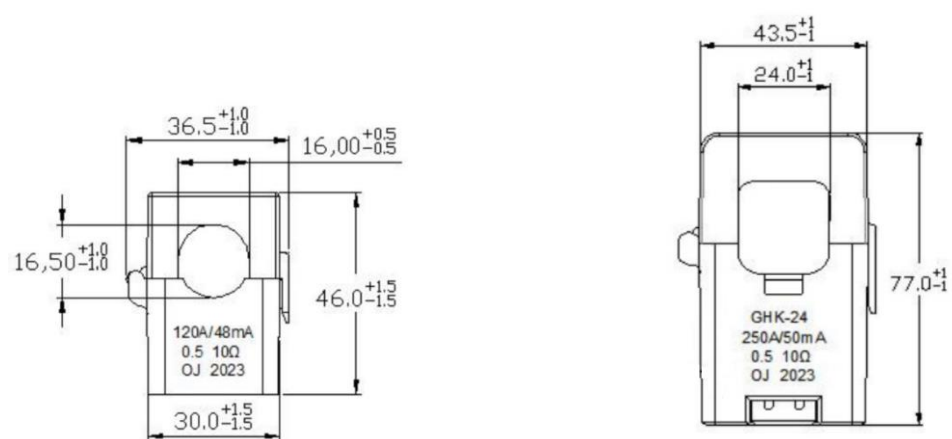
● Terminal drawing



7.3 Installation Dimension



LHE34D & LHE34C









LHE34C 120A/48mA CT

LHE34C 250A/50mA CT

8 Installation and un-installation

8.1 Installation tools

Cross screwdriver		
Electric drill		
Wire stripper		
Lead sealing pliers		
Hairsprings		
Screw		

8.2 Preparation before installation

- ◆ The sensor should be installed in ventilated and dry place to ensure the sensor's safety and reliability. In the dirty or risky area, the sensor should be installed in the meter box meeting the requirements of IP51.
- ◆ The unit should be installed with a certificated circuit breaker.
- ◆ Sensor should be fixed on a 35mm DIN Rail.
- ◆ Before installation, please check if the sensor has been damaged during the transportation (damage of sensor cover, hanger, seal, and LCD display, etc)
- ◆ As the internal part of the sensor is composed by the delicate electronic components, the sensor should be carefully protected during the installation in order to avoid any damage.

**WARNING**

Make sure that the power is cut off before the sensor installation, otherwise it will cause a threat to life. The fuse should be disconnected and put it in a safe place to avoid the accidental power-on.

8.3 Installation procedure

1. Select the proper position according to the sensor dimensions, the position which is easy to install is selected, and the fixed point position of the DIN Rail is marked on the installation panel.
2. Place the DIN Rail horizontally and fix it with two self-tapping screws (make sure there is no cable behind before punching to avoid damaging the cable and causing personal safety).
3. Move the sensor horizontally into the DIN Rail and press it into the hanging climb to fix the sensor.

**NOTE**

The hanger is adjusted to low position by default when it leaves the factory, in order to match the packing box and prevent damage during transportation.

4. Cut the cable to the required length and use the wire stripper to uncover the cable. The recommended bare metal length after stripping is 15mm for this series of products.

**WARNING**

We insist on the recommended length of the stripped wire to ensure that the bare metal part is long enough and can be fixed by two connection screws at the same time. However the bare part should not exceed the terminal box wiring holes, ensure the safety and insulation effect.

5. When using a small sectional cable, such as 4mm squared, the cable must be placed in the medium to ensure that the screw is well tightened without deviation.
6. The cables should be connected correctly according to the wiring diagram and the terminals should be tightened during the installation in order to avoid any damage caused by bad connection. The CT was installed according to the wiring diagram.

**NOTE**

The bad fixing of connection screws will lead to the raise of resistance, which can lead to electrical energy loss and heating of terminals. The heating of component is risky. Besides, 1mΩ contact resistance in a circuit of 80A will result in 6.4 W power losses. CT clasp is not installed properly, which will lead to poor accuracy. Installing the wrong direction will cause the current to reverse

7. Check connecting wire carefully and avoid any error (such as the reverse wiring for the incoming and outgoing lines, the wrong connection of live and neutral, the bad fixing of screws). Confirm that the opening CT clap is well closed. The RJ12 is well connected to the CT interface.

**NOTE**

To ensure the correct wiring, it is recommended to use the appropriate testing tools (such as multi-meters) for input/output test. RJ12 interface is only for LHE34C.

8. Close the terminal cover, and sealed it.

8.4 Testing after installation

Power on the sensor, the LCD display properly.

8.5 Un-installation

1. Remove the fuse and power off the sensor.

**WARNING**

Make sure that the power is cut off before the sensor un-installation, otherwise it will cause a threat to life. The fuse should be disconnected and put it in a safe place to avoid the accidental power-on.

2. Cut off the terminal cover seal, and remove the terminal cover.
3. Use the voltage test equipment (such as multi-meter) to test sensor connecting wire and confirm power-off before go to the next operation.
4. Use the appropriate screwdriver to unscrew the current connection screws and remove the connecting wires.
5. Using the appropriate screwdriver to unscrew the sensor fixing screws.
6. Take off the sensor.

**CAUTION**

The sensor un-installation should be done according to the above mentioned order. Be attention to prevent sensor from dropping down, which will cause injuries and damage the sensor itself.

7. If necessary, please replace a new sensor.

**WARNING**

If a new sensor cannot be installed for the moment, please envelop the voltage and current connection cables in insulating material and avoid exposing any bare metal part, otherwise it will pose a threat to life.

9 Service

9.1 Troubleshooting

Fault Phenomenon	Factor Analysis	Troubleshooting
No display after the instrument being powered on	<ol style="list-style-type: none"> 1. Incorrect wiring mode. 2. Abnormal voltage supplied for the instrument 	<ol style="list-style-type: none"> 1. If the wiring mode is incorrect, please connect based on the correct wiring mode. 2. If the supplied voltage is abnormal, please supply the voltage on the instrument specification.
Abnormal RS485 communication	<ol style="list-style-type: none"> 1. The RS485 communication cable is disconnected, short circuit or reversely connected. 2. The address, baud rate, data bit and parity bit of the instrument is not in accordance with the inverter. 	<ol style="list-style-type: none"> 1. If any problems for the communication cable, please change the cable. 2. Set the address, baud rate, data bit and parity bit of the instrument to be the same as the inverter through buttons and so as the "parameter setting".

Power Metering inaccuracy	<ol style="list-style-type: none"> 1. Wrong wiring, please check whether the corresponding phase sequence of voltage and current is correct. 2. Check whether the high & low end of current transformer inlet is reversely connected. Please observe the power, to be abnormal if any negative values. 3. Check whether the clasp of the CT is closed well and that the current direction is correct. 	<ol style="list-style-type: none"> 1. For wrong wiring, please connect based on the correct wiring mode.. 2. If a negative value is displayed, change the cable connection mode of the current transformer to ensure that the high and low ends are connected properly. 3. If a negative value is displayed, change the CT installation direction. If a poor accuracy, may closed CT clasp well.
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**NOTE**

Contact the installation vendor if all failure analysis procedures listed above are completed and the fault still exists.

9.2 Sensor Repair

If the Sensor repair is necessary, please operate in accordance with the following process:

1. If the Sensor has been installed, then uninstall the Sensor (see section 8.5 "Un-installation"), and reinstall an alternative Sensor.
2. Describe the fault phenomenon as much as possible, offer the name, phone number of the responsible person for the follow-up maintenance. Please indicate the serial number and complete Sensor model (Sensor model can be obtained from the Sensor nameplate)
3. Package the Sensor, ensure the Sensor will not be damaged during the transport. Try to use the original package. Don't put in a Sensor with missing part.
4. Send the electric Sensor to a certified litiot service center.

10 Maintenance

There is no need to verify the Sensor within the life cycle. Sensor maintenance can be executed based on local regulations. Recommended every 5~10 years.

10.1 Clean

Use dry cloth to clean the surface of the Sensor and wipe the stains and insects.

**WARNING**

Warning: Flowing water and high pressure water equipment is not allowed to clean the Sensor, which may lead to short circuit.

10.2 Error and function check

The following process can be performed to realize error and function check

1. Insert the Sensor to the corresponding terminal of error test bench. (Electric Sensor wiring hole number detailed in chapter 7.1 "Connection diagram"), tighten the connection screws (maximum torque is 3Nm)

**NOTE**

Attention: If the error test bench can't support the independent current inductor of the direct Sensor, the voltage connection tick need to be disconnected. User can choose internal connection tick (protected by the Sensor cover, only can reach after open the cover) and external tick (can reach under the start button). After the error test, reconnect the tick. Ensure the correct and stable connection.

2. Put the pulse testing part of the error testing bench align to the LED on the Sensor.
3. Start the error test bench. Put on rate voltage but no current. Confirm no current indicator display on LED. Check whether the electric Sensor is displayed correctly.
4. Start the error testing bench
5. Take off the Sensor from the error test bench after test complete.

10.3 Reinstall

In order to avoid the change of asset management, it's recommended to reinstall the Sensor at the former position.

The installation process detailed in chapter 8 "Installation and un-installation".

11 Scarp Processing

This chapter describes the right method of Sensor scarp processing.

Compliant ISO 14001 environmental certification specification, the components of the Sensor is maximum extent separable, thus to provide corresponding abandoned and recycling station after disassembled.

**NOTE**

Attention: Sensor scarp processing reference to local waste and environmental protection laws and regulations.

Sensor can be disassembled into different parts, the recommended waste treatment

methods are as follows:

Parts	Recommend scarp processing method
PCB board	Electronic waste, scarp according to local regulations
Metal parts, including iron part of optical communication, terminal connection copper bar, internal current cables etc.	Provided to the metal material recycling
Plastic	Recycle bin for plastic materials, otherwise can burn

12 Transportation and Storage

During the transportation and packing process, the products shall not be dramatically shocked, and shall be transported and stored according to the regulations. Inventory and storage should be made in a shelf with original package. The piling height should be not more than eight layers. The storage place shall be clean, in which the ambient temperature shall be $-40^{\circ}\text{C} \sim 85^{\circ}\text{C}$ and relative humidity not more than 95%. And there are no harmful substances in the air that might cause corrosion.

13 Parameters

Electrical	
Voltage	3x120/210V or 3x 230/400V or 3x 240/415 V 0.7~1.3Un
Basic current	LHE34D:5A LHE34C:10A
Maximum current	LHE34D:80A LHE34C:120A/250A
Starting current	$\leq 0.4\%I_b(\text{Active})$, $\leq 0.5\%I_b(\text{Reactive})$
Frequency	50Hz or 60Hz
Current / Voltage Accuracy update period	$\pm 0.5\%$ $\leq 100\text{ms}$
Power Accuracy update period	$\pm 1\%$ $\leq 100\text{ms}$
Burden in current circuit	$<1\text{VA}$
Burden in voltage circuit	$<2\text{W}/10\text{VA}$
Sensor life	10 years
Impulse constant	LHE34D: 800imp/kWh, 800imp/kvarh (configurable) LHE34C: 400imp/kWh, 400imp/kvarh (configurable)
Measurement category	Class II
Overvoltage category	III
Pollution degree	2
Altitude	≤ 2000 meter
Wire	16mm^2 to 25mm^2

External influence	
Protection	IP51(with box) IP20 (without box)
Operating temperature	-25℃~60℃
Storage temperature	-40℃~85℃
Relative humidity	Up to 95% non-condensing

Mechanical parameters	
Connection type	Direct connection
Network type	3P4W or 3P3W
Weight of Sensor	LHE34D: Approx.0.41kg LHE34C: Approx.0.6kg (with 120A CT) Approx.0.9kg (with 250A CT)
Dimension(H x W x D)	101mmx72mmx67mm
Mounting	DIN Rail, 35mm
Sealing	Sealing provisions for terminal
Terminal hole diameter	8.5mm x 8.5mm (DC)
Terminal cover	Short terminal cover
Sensor Cover material	Recycled Opaque PC+ glass fiber with a transparent window
Sensor Base material	Recycled Opaque PC
Terminal Cover material	Recycled PC transparent
Terminal Box material	Recycled Opaque PC

Technical parameters	
Measuring range	0.00—99999999 kWh/kvarh
Display mode	LCD



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