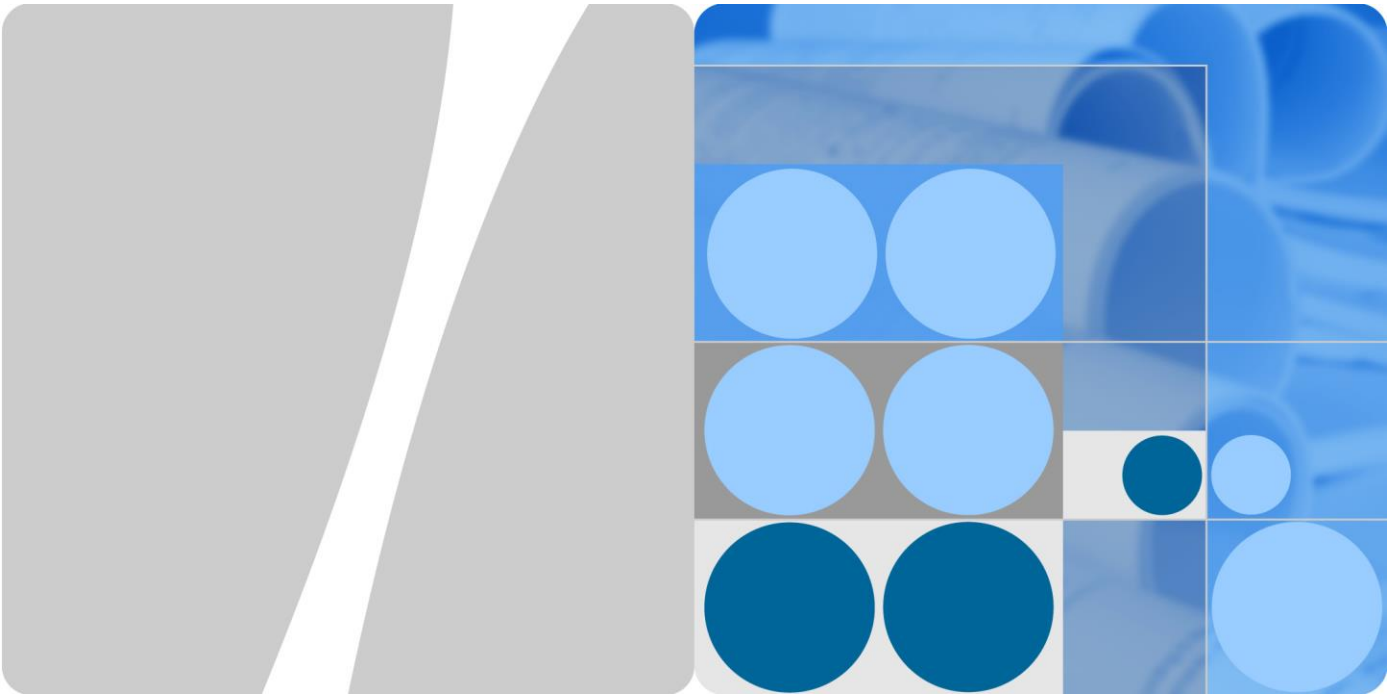

DTSU666-H Smart Power Sensor

User Manual

Issue 01

Date 2018-05-18

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Huawei Technologies Co., Ltd.

Address: Huawei Industrial Base
Bantian, Longgang
Shenzhen 518129
People's Republic of China

Website: http://e.huawei.com

About This Document

Purpose

This document describes the DTSU666-H Smart Power Sensor in terms of its functions, electrical properties, and structure.

Figures provided in this document are for reference only.

Intended Audience

This document is intended for:

- Sales engineers
- Technical support engineers
- Maintenance engineers

Symbol Conventions

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

Symbol Conventions

Symbol	Description
	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results. NOTICE is used to address practices not related to personal injury.

Symbol	Description
NOTE	Calls attention to important information, best practices and tips. NOTE is used to address information not related to personal injury, equipment damage, and environment deterioration.

Change History

Changes between document issues are cumulative. The latest document issue contains all updates made in previous issues.

Issue 01 (2018-05-18)

This issue is the first official release.

Contents

1 Safety Precautions

General Safety

- Follow the precautions and special safety instructions provided by Huawei when operating this product. Personnel who plan to install or maintain Huawei devices must receive a thorough training, understand all necessary safety precautions, and be able to correctly perform all operations. The manufacturer will not be liable for any consequences that are caused by the violation of general safety regulations and device usage safety standards.
- Before performing operations, read through this manual and follow all the precautions to prevent accidents. The “DANGER”, “WARNING”, “CAUTION”, and “NOTICE” statements in this document do not represent all the safety instructions. They are only supplements to the safety instructions.
- Operation personnel should comply with local laws and regulations. The safety instructions in this document are only supplements to local laws and regulations.
- Do not operate the product or handle cables during thunderstorms.
- Before operating the product, remove any conductors such as jewelry or watches.
- Use insulated tools during operations.
- Bolts should be tightened with a torque wrench and marked using red or blue color. Installation personnel should mark tightened bolts in blue. Quality inspection personnel should confirm if the bolts are tightened and then mark them in red. If screws or bolts used to secure the device are not tightened to the required torque, the device may fall from the mounting bracket.
- Follow specified procedures during installation and maintenance. Do not attempt to alter the device or deviate from the recommended installation procedures without prior consent from the manufacturer.
- Install the product in strict accordance with the quick guide.

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- Follow specified procedures during installation and maintenance. Do not attempt to alter the device or deviate from the recommended installation procedures without prior consent from the manufacturer.
- Install the product in strict accordance with the quick guide.

Disclaimer

The manufacturer shall not be liable for any consequence caused by any of the following events:

- Transportation damage
- The storage conditions do not meet the requirements specified in this document.
- Incorrect installation or use
- Installation or use by unqualified personnel
- Failure to obey the operation instructions and safety precautions in this document
- Operation in extreme environments which are not covered in this document
- The DTSU666-H operates beyond specified ranges.
- Unauthorized modifications to the product or software code or removal of the product
- Device damage due to force majeure (such as lightning, fire, and storm)
- The warranty expires and the warranty service is not extended
- Installation or use in environments which are not specified in related international standards

Personnel Requirements

Only certified electricians are allowed to install, connect cables for, maintain, troubleshoot, and replace the DTSU666-H.

- Operation personnel should receive professional training.
- Operation personnel should read through this document and follow all the precautions.
- Operation personnel should be familiar with the safety specifications about the electrical system.
- Operation personnel should understand the composition and working principles of the grid-tied PV power system and local regulations.
- Operation personnel must wear proper personal protective equipment (PPE).

Protect Labels

- Do not scrawl or damage any warning labels on the DTSU666-H because these labels contain important information about safe operation.
- Do not scrawl or damage the nameplate on the back of the DTSU666-H because it contains important product information.

Installation

- Ensure that the DTSU666-H is not connected to a power supply or powered on before finishing installation.
- To allow proper heat dissipation and installation, maintain appropriate clearances between the DTSU666-H and other objects.

Electrical Connections

DANGER

Before connecting cables, ensure that the DTSU666-H is not damaged in any way. Otherwise, electric shocks or fire may occur.

- Ensure that all electrical connections comply with local electrical standards.
- Ensure that the cables used in a grid-tied PV system are properly connected and insulated and meet all specification requirements.

Operation

DANGER

High voltage may cause an electric shock, which results in serious injury, death, or serious property damage from the DTSU666-H in operation. Strictly comply with the safety precautions in this document and associated documents when operating the DTSU666-H.

- Do not touch an energized DTSU666-H because it has a high temperature.
- Follow local laws and regulations when operating the device.

Maintenance and Replacement

DANGER

High voltage may cause an electric shock, which results in serious injury, death, or serious property damage from the DTSU666-H in operation. Therefore, before maintenance, power off the DTSU666-H and strictly comply with the safety precautions in this document and associated documents to operate the DTSU666-H.

- Maintain the DTSU666-H with sufficient knowledge of this document and proper tools and testing devices.
- Temporary warning signs or fences must be placed to prevent unauthorized people from entering the site.
- The DTSU666-H can be powered on only after all faults are rectified. Failing to do so may escalate faults or damage the device.
- During the maintenance, observe ESD precautions and wear ESD gloves.

2 Overview

2.1 Product Overview

Type DTSU666-H Smart Power Sensor (here in after referred to as the “sensor”) adopts large-scaled integrated circuit with digital sampling technology, specially designed for power monitoring and energy metering demands including power system, communication industry, construction industry, mainly applied into real-time measurement and display for parameters such as three phase voltage, three phase current, active power, reactive power, frequency, positive and reverse energy, four quadrant electric energy, etc. Adopting the standard DIN35mm din rail mounting, structural module design, it is characterized with small volume, easy installation and networking, etc. As a monitoring terminal product towards energy management system, it can be widely applied into internal power assessment and monitoring of the industrial and mining enterprises, hotels, schools, large public buildings.

This performance index of the meter conforms to the following relevant technical standard:

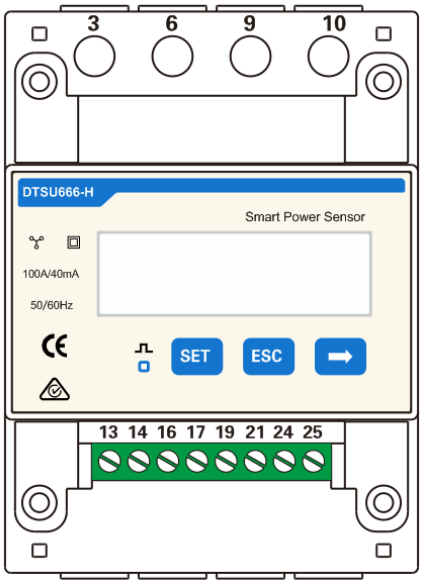
EN 61326-1: 2013; IEC 61326-1: 2012;

EN 61326-2-1: 2013; IEC 61326-2-1: 2012;

EN 61010-1: 2010; IEC 61010-1: 2010;

EN 61010-2-1: 2010; IEC 61010-2-1: 2010;

Figure 2-1 DTSU666-H

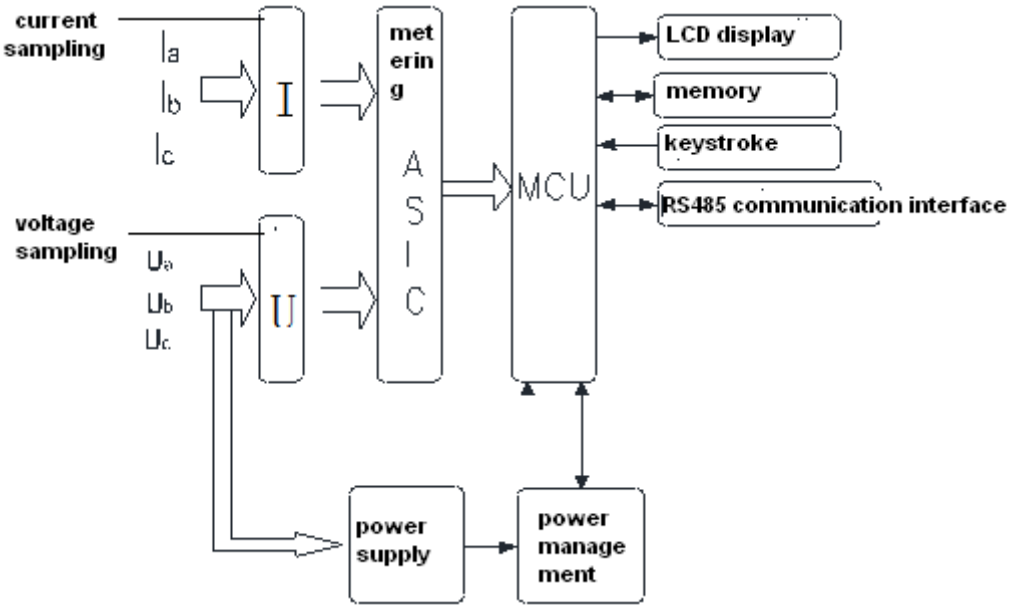


2.2 Working Principles

2.2.1 Conceptual Diagram

The instrument is composed of highly accurate metering integrated circuit (ASIC), management MCU, storage chip, RS485 communication module, etc. The conceptual diagram is shown in Figure 2-2.

Figure 2-2 Conceptual diagram



2.2.2 Functions

- 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 999999.9 kWh.

Figure 2-3 Liquid crystal display

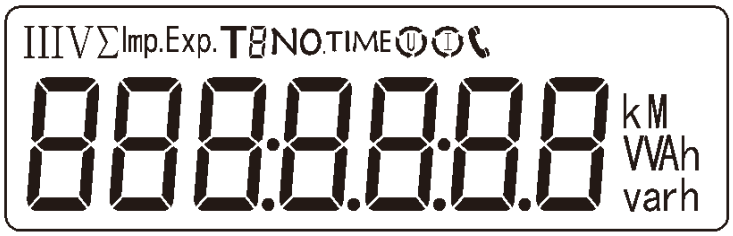
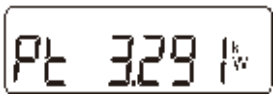
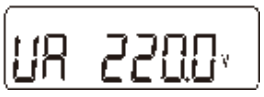
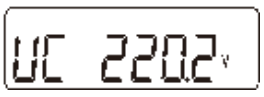


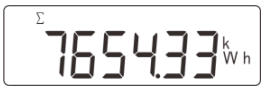
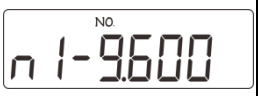
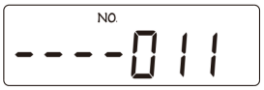
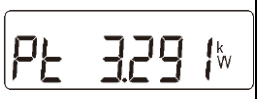
Table 2-1 Display (Auto loop)

No.	Display interface	Instruction	No.	Display interface	Instruction
1		Imp. active power =10000.0kWh	2		Exp. active energy =2345.67 kWh
3		active power =3.291kW	4		Phase A voltage =220.0V
5		Phase B voltage =220.1V	6		Phase C voltage =220.20V
7		Phase A current =5.001A	8		Phase B current =5.001A
9		Phase C current =5.002A	10		Frequency Freq=50.00Hz

NOTE

No button operation backlight is closed for 60 seconds. Auto loop Switch time = 5s.

Table 2-2 Display

No.	Display interface	Instruction	No.	Display interface	Instruction
1		Comb.active energy =7654.33kWh	2		Imp. active power =10000.0kWh
3		Exp. active energy =2345.67kWh	4		None parity,1 stop bit, baud=9600bps
5		Comm.Add =011	6		Phase A voltage =220.0V
7		Phase B voltage =220.1V	8		Phase C voltage =220.20V
9		Phase A current =5.001A	10		Phase B current =5.001A
11		Phase C current =5.002A	12		active power =3.291kW
13		Phase A active power =1.090kW	14		Phase B active power =1.101kW
15		Phase C active power =1.100kW	16		power factor =0.500 inductive
17		Phase A power factor PFa=1.000L	18		Phase B power factor PFb=0.500L
19		Phase C power factor PFc=0.500C	20		Frequency Freq=50.00Hz

NOTE

1. Change By Key " ➡ "
2. Comb. active energy = Imp. active energy - Exp. active energy

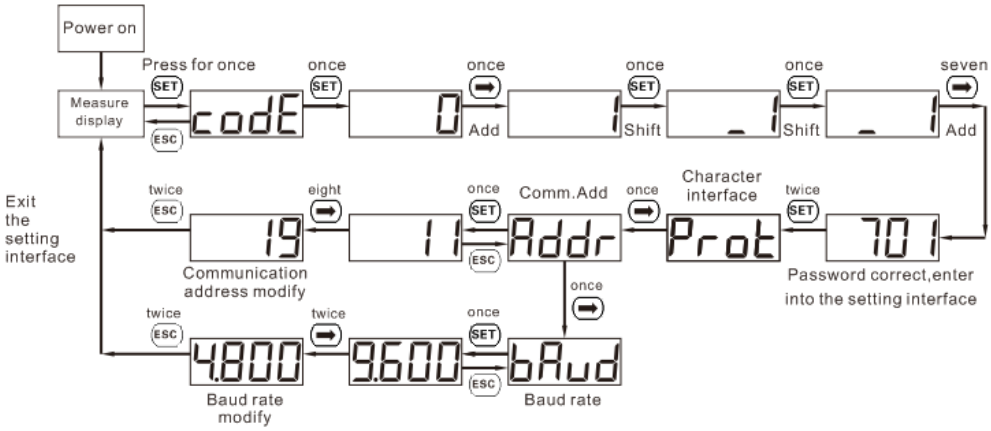
- Programming function:

Table 2-3 Programming function

Parameter	Value range	Description
Prot	1: 645; 2: n.2; 3: n.1; 4: E.1; 5: O.1;	Settings for communication stop bit and Parity bits: 1: Factory mode; 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: 4.800; 1: 9.600;	Communication baud rate: 0: 4800bps; 1: 9600bps;
Addr	11-19	Communication address

- Programming operation: button description: "SET" button represents "confirmation", or "Cursor shift"(when input digits), "ESC" button represents "Exit", " ➡ " button represents "increase". The input password is (default to be 701).

Figure 2-4 Setting example for Modify communication address or baud rate



When modify digits," SET "can be used as cursor shift button; " ➡ "is "add"button; " ESC "represents exiting the setting interface or switch to the character interface from digit modification interface, restarting adding from zero after setting the digits to be the maximum value.

- Communication function

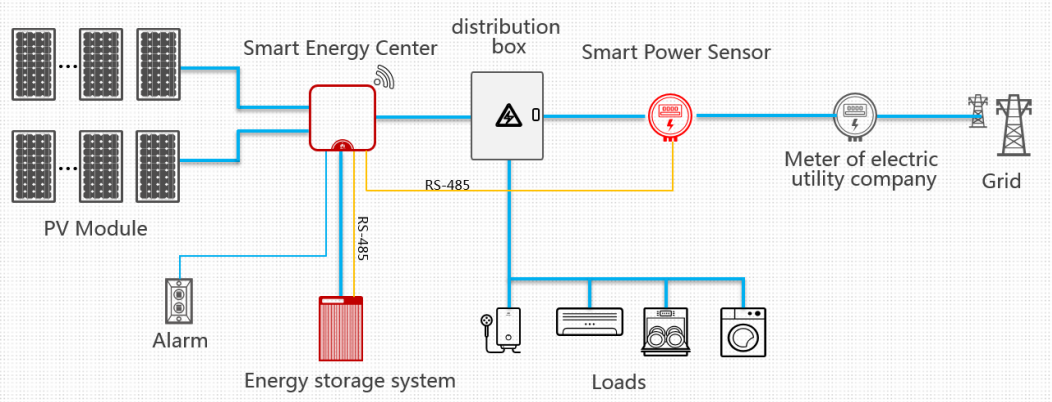
  The Sensor has a RS485 communication interface, the baud rate can be changed between 4800bps and 9600bps. The default Communication parameters is 9600bps, none parity bits and 1 stop bit, and communication addresses (see factory numbers or LCD display), support ModBus RTU protocol.

  ModBus-RTU interface definition is defined in document “Huawei inverter matching meter Modbus interface definition description”, Article 2.1 general signal definition table (Float), document version V100, release date 2018-01-29.

2.3 Application Scenarios

Scenario 1: The smart power sensor is used to realize power restriction of the power grid with charge and discharge control towards energy storage in the household inverter scheme, which is the core component for household energy management. It adopts RS485 communication, which can realize the electrical quantity measurement, energy metering function and in respond to the upper host for the real-time data query.

Figure 2-5 Application Scenarios



2.4 Model Naming Conventions

Figure 2-6 Model naming conventions

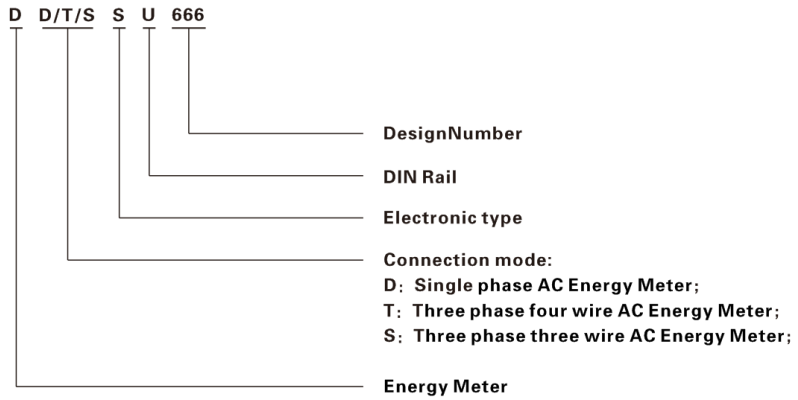


Table 2-4 Model specification

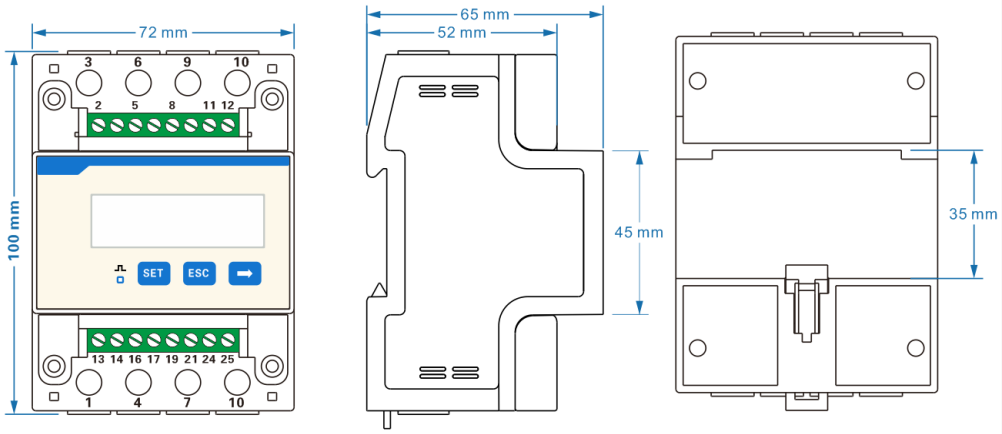
Model No.	Accuracy grade	Referenced voltage	Current specification	Instrument constant	Type
DTSU666-H	Active class 1	3×220/380 V	100 A/40 mA	800 imp/kWh	Via transformer

NOTE
Please take the physical label as standard.

2.5 Product Structure

Model No.	Module	Outline dimension (H×W×D) mm	Installation dimension (Din-rail)
DTSU666-H	4	72×100×65.5	DIN35 standard din-rail

Figure 2-7 Product dimensions



3 System Maintenance

3.1 Troubleshooting

Table 3-1 Common alarms and troubleshooting measures

Fault phenomenon	Factor analysis	Elimination method
No display after the instrument being powered on	1. Incorrect wiring mode; 2. Abnormal voltage supplied for the instrument;	1. If the wiring mode is incorrect, please connect based on the correct wiring mode (see the wiring diagram). 2. If the supplied voltage is abnormal, please supply the voltage on the instrument specification.
Abnormal RS485 communication	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 host computer;	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 host computer through buttons and so as the “parameter setting”.
Power metering inaccuracy	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.	For wrong wiring, please connect based on the correct wiring mode (see Connecting Diagram).

NOTE

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

A Technical Specifications

A.1 Environmental Specifications

Item	Specifications
Regulated working temperature range	-25ºC to +60ºC
Limited working temperature range	-40ºC to +70ºC
Relative humidity (Annual average)	≤75% RH
Atmospheric pressure	86-106 kPa

A.2 Main technical performance and parameter

A.2.1 Electrical parameter

Regulated working voltage range	0.9-1.1 Un	
Extended working voltage range	0.8-1.15 Un	
Power consumption of voltage	≤ 1.5 W and 6 VA	
Power consumption of current	Ib < 10 A	≤ 0.2 VA
	Ib ≥ 10 A	≤ 0.4 VA
Data storage time after power interruption	≥ 10 years	

A.2.2 Percentage error

Table A-1 Limited value of active percentage error of the energy meter on balanced load

Type	Current range	Power factor	The limited value of percentage error towards various grade of instruments
Connect via current transformer	$0.01I_n \leq I < 0.05I_n$	1	±1.5
	$0.05I_n \leq I \leq I_{max}$	1	±1.0
	$0.02I_n \leq I < 0.1I_n$	0.5L, 0.8C	±1.5
	$0.1I_n \leq I \leq I_{max}$	0.5L, 0.8C	±1.0
Notes	I_n: Secondary rated current of the current transformer I_b: calibrated current of energy meter L: inductive; C: capacitive;		

Table A-2 Limited value of active percentage error of the energy meter on unbalanced load

Type	Current range	Power factor	The limited value of percentage error towards various grade of instruments
Connect via current transformer	0.05In ≤ I ≤ Imax	1	±2.0
	0.1In ≤ I ≤ Imax	0.5 L	±2.0
Notes	In: Secondary rated current of the current transformer Ib: calibrated current of energy meter L: inductive; C: capacitive;		

A.2.3 Start

Under the power factor of 1.0 and 2‰In, the instrument can be started with continuous metering (if it is multiple phase instrument, then it has balanced load). If the instrument is designed based on measurement for bi-directional energy, then it is suitable for each direction of energy.

A.2.4 Defluction

When applying voltage while the current circuit has no current, the test output of the instrument shall not produce a superfluous pulse. When testing, the current circuit shall be disconnected and the applied voltage of the voltage circuit shall be 115% of the referenced voltage.

The shortest testing time $\triangle t$:

For instrument of class 1: $$\triangle t \geq \frac{600 \times 10^6}{k \cdot m \cdot U_n \cdot I_{max}} [min]$$

From the formula: k represents energy meter constant (imp/kWh), m represents the testing component quantity, U_n represents the referenced voltage (V), I_{max} represents the large current (A).

A.2.5 Other technical parameter

Scale range	0-999999.9 kWh
Communication protocol	Modbus-RTU

A.3 EMC Specifications

EMC performance of the meter conforms to the following relevant technical standard:

IEC 61326-1:2012, IEC 61326-2-1:2012

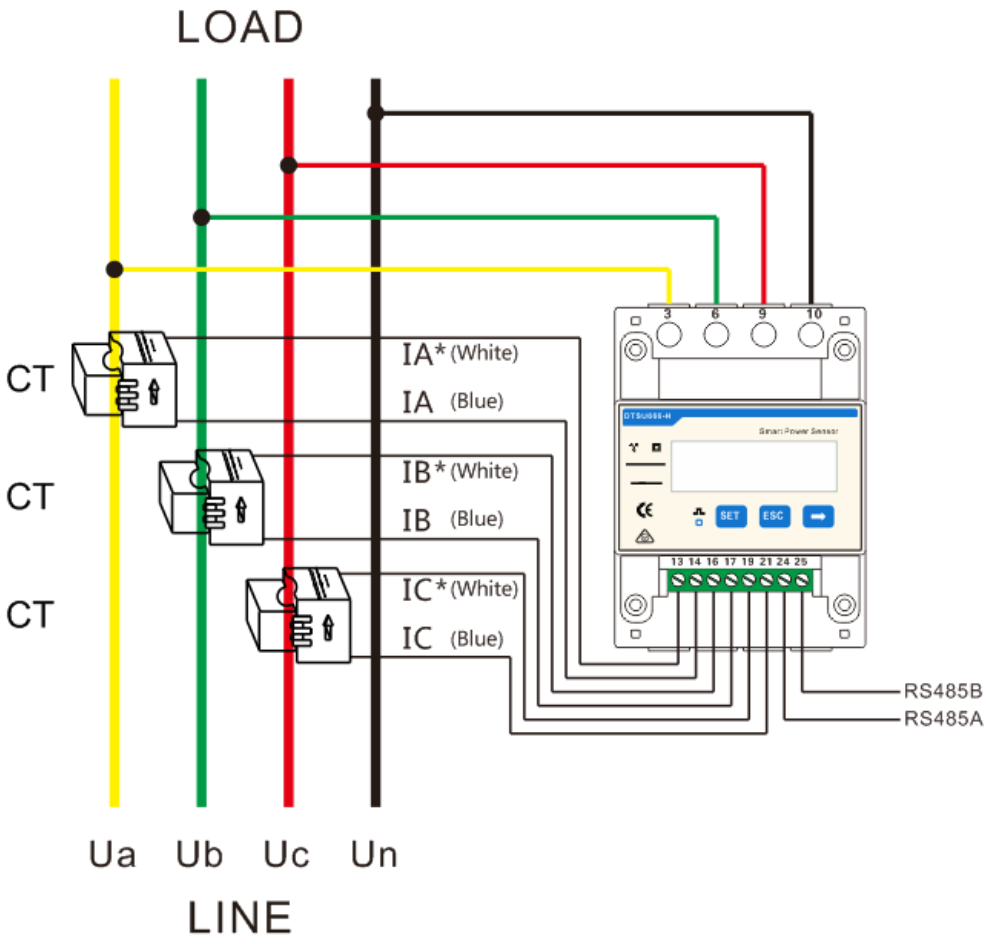
EN 61326-1:2013, EN 61326-2-1:2013

EN61000-3-2:2005/A2:2009, EN61000-3-3:2008

A.4 Structure Specifications

Item	Specifications
Installation mode	Directly stuck the sensor on the din rail and finally install it on the power distribution box. 1) When installing, please firstly stuck one side of the card slot and then forcibly stuck it on the din rail. 2) When disassembling, please use a screwdriver to forcibly hold the flexible card and then take out the sensor.
Dimensions (H x W x D)	72 mm x100mm x 65.5 mm (±0.5 mm)
Weight	≤ 0.8 kg

A.5 Wiring terminal instruction



1. Connect the Ua, Ub, Uc, Un voltage lines to the 3, 6, 9 and 10 terminals of the collector.
2. Connect current transformer outlets IA*, IA, IB*, IB, IC*, IC to terminals 13, 14, 16, 17, 19, 21 of the collector.Connect.
3. RS485A and RS485B to the communication host.

B Acronyms and Abbreviations B

D	
DC	direct current
E	
EFT	electrical fast transient
EMI	electromagnetic interference
EMS	electromagnetic susceptibility
ESD	electrostatic discharge
M	
MPPT	maximum power point tracking
P	
PLC	power line communication
R	
RE	radiated emission
RS	radiated susceptibility