CHINT DTSU666

USER MANUAL

DTSU666
Three-phase Smart Meter

LANDPORT
ENERGY
Powered by Louwman Group

Contents

1. Summary

1.1 The main purpose and the suitable occasions

The DTSU666 three-phase Smart meter (DIN rail), referred to as the "instrument," is designed to meet the power monitoring and energy metering requirements of various industries, including the electric power system, communication industry, and construction industry. It represents a new generation of intelligent instruments that combine measurement and communication functions.

The instrument is primarily used for measuring and displaying electric parameters in the electric circuit, including three voltage, three current, active power, reactive power, frequency, positive and negative energy, and four-quadrant energy. It features a standard DIN35mm din rail mounting and modular design, making it compact, easy to install, and suitable for network integration. It is widely applied for internal energy monitoring and assessment in industrial and mining enterprises, hotels, schools, and large public buildings.

Complied Standards:

- IEC 61010-1:2010 (Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements)
- IEC 61326-1:2020 (Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements)
- MODUS-RTU protocol

1.2 Product features

1. Multiple Power Metering: Characterized with positive and reverse active power, combined active power, combined reactive power, four-quadrant reactive power metering, and a storage function with configurable combination modes.
2. Communication Interface: Equipped with an RS485 communication interface, facilitating data exchange using the MODUS RTU protocol.
3. Compact and Modular Design: Designed with a standard DIN35mm DIN rail mounting and a modular structure, offering a small footprint, easy installation, and seamless networking capabilities.

1.3 Model composition and significance

D	Electric Energy Meter
T	Three-Phase
S	Electronic
U	Guide rail
666	Design Serial Number

1.4 Types and specifications

Model No.	Referenced voltage	Current specification	Constant	Type	Accuracy grade
DTSU666	3*230 /400V	100A/40mA	400imp/kWh	Transformer access	Active power 1
		250A/50mA	400imp/kWh	Transformer access	Active power 1

Table 1 Types and specifications

1.5 Environmental conditions

Operating temperature range:: -25°C~70°C

Relative humidity (average annual): ≤75% non-condensing

Atmosphere: 63.0kPa~106.0kPa (up to 4km altitude), unless specified otherwise for special orders

2. Overall principle block

2.1 Working principle

The instrument is comprised of highly accurate integrated circuits designed specifically for measurement (ASIC)and managing MCU, a memory chip, an RS485 communication module.

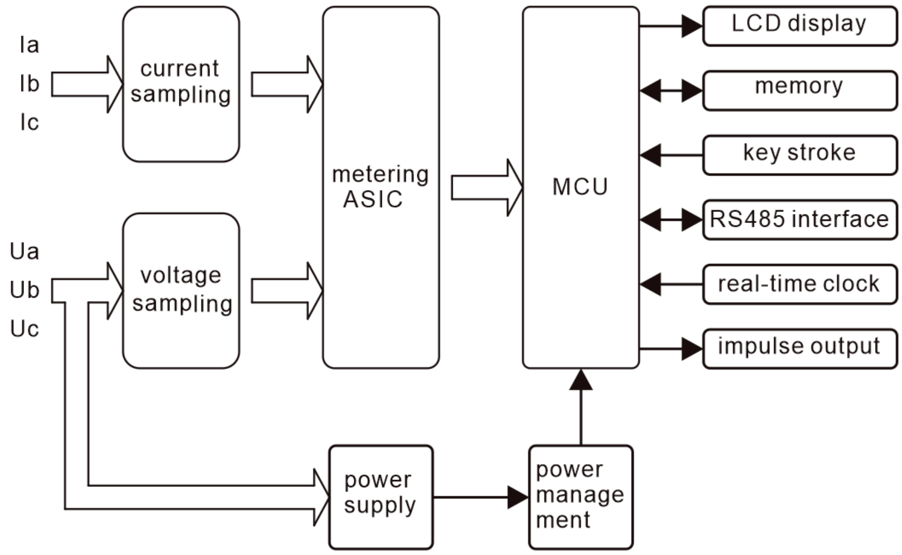


Figure 2 Working principle block

2.2 Main function module principle

The special metering integrated circuit (ASIC) combines six load and two-order ∑-△type A/D conversion. It processes digital signals measured by the voltage circuit, as well as power, energy, effective values, power factor, and frequency.

This metering chip is capable of measuring active power, reactive power, apparent power, active energy, reactive power, apparent energy for each phase and combined phases. It also measures current, voltage effective values, power factor, phase angle, and frequency, fulfilling the requirements of a power meter. The chip offers an SPI interface, facilitating the metering parameters and parameter calibration between the management MCU.

3. Main technical parameters

3.1 Percentage error

Table 2 The limit value of the active percentage error of meters on balanced load

Meters for	Value of current	Power factor	Percentage error limits for meters of class		
			Class C	Class B	Class A
Connected through current transformers	$0.01I_n \le I < 0.05I_n$	1	±1.0	±1.5	±2.0
	$0.05I_n \le I \le I_{max}$	1	±0.5	±1.0	±1.2
	$0.02I_n \le I < 0.1I_n$	0.5L, 0.8C	±1.0	±1.5	±2.0
	$0.1I_n \le I \le I_{max}$	0.5L, 0.8C	±1.0	±1.0	±1.2
Direct connection	$0.05I_b \le I < 0.1I_b$	1	-	±1.5	±2.0
	$0.1I_b \le I \le I_{max}$	1	-	±1.0	±1.2
	$0.01I_b \le I < 0.2I_b$	0.5L, 0.8C	-	±1.5	±2.0
	$0.2I_b \le I \le I_{max}$	0.5L, 0.8C	-	±1.0	±1.2
Note	I_n: secondary rated current of the current transformer; I_b: calibrated current of the meter; L: inductive; C: capacitive				

Table 3 The limit value of the reactive percentage error of meters on balanced load

Value of current		sinφ (inductive or capacitive)	Percentage error limits for meters of class
Direct connection	Connection through current transformers		Class A
$0.05I_b \le I \le 0.1I_b$	$0.02I_n \le I < 0.05I_n$	1	±2.5
$0.1I_b \le I \le I_{max}$	$0.05I_n \le I \le I_{max}$	1	±2.0
$0.1I_b \le I < 0.2I_b$	$0.05I_n \le I < 0.1I_n$	0.5	±2.5
$0.2I_b \le I \le I_{max}$	$0.1I_n \le I \le I_{max}$	0.5	±2.0
$0.2I_b \le I \le I_{max}$	$0.1I_n \le I \le I_{max}$	0.25	±2.5

Table 4 The limit value of the reactive percentage error of meters on balanced load

Value of current		Power factor	Percentage error limits for meters of class		
Direct connection	Connection through		Class C	Class B	Class A
$0.1I_b \le I \le I_{max}$	$0.05I_n \le I \le I_{max}$	1	±0.6	±2.0	±3.0
$0.2I_b \le I \le I_{max}$	$0.1I_n \le I \le I_{max}$	0.5L	±2.0	±2.0	±3.0

Table 5 The limit value of the reactive percentage error of meters on imbalanced load

Value of current		Power factor	Percentage error limits for meters of class
Direct connection	Connection through		Class A
$0.1I_b \leq I \leq I_{max}$	$0.05I_n \leq I \leq I_{max}$	1	±3.0
$0.2I_b \leq I \leq I_{max}$	$0.1I_n \leq I \leq I_{max}$	0.5L	±3.0

3.2 Start and no-load condition

3.2.1 Start

Under a power factor of 1.0 and starting current, the instrument can start and continuously measure (in the case of a multiple-phase instrument, it will ensure a balanced load). If the instrument is designed for dual-directional energy measurement, it is applicable for each direction of energy.

Table 6 Start current

Meters for	Class of meter			Power factor
	Class C	Class B	Class A	
Direct connection	-	$0.004I_b$	$0.005I_b$	1
Connected through current transformers	$0.001I_b$	$0.002I_b$	$0.003I_b$	1

3.2.2 Test of no-load condition

When voltage is applied with no current in the current circuit, the meter's test output should not produce more than one pulse. For this test, the current circuit should be open-circuited, and a voltage of 115% of the reference voltage should be applied to the voltage circuits.

The minimum test period Δt should be

$$\Delta t \geq \frac{600 \times 10^6}{k \cdot m \cdot U_n \cdot I_{max}} [\text{min}]$$ for meters of class 0.5S or 1

$$\Delta t \geq \frac{480 \times 10^6}{k \cdot m \cdot U_n \cdot I_{max}} [\text{min}]$$ for meters of class 2

k is the number of pulses emitted by the output device of the meter per kilovarhour(imp/kvar·h);
m is the number of measuring elements;
U_n is the reference voltage in volts;
I_{max} is the maximum current in amperes.

3.3 Electrical parameters

Table 7 Electrical parameters

Specified operating voltage range	0.9Un~1.1Un	
Extended operating voltage range	0.8Un~1.15Un	
Limit voltage range of operation	0.0Un~1.15Un	
Power consumption of voltage	≤1.5W or 6VA	
Power consumption of current	Ib<10A	≤0.2VA
	Ib≥10A	≤0.4VA
Data storage time after power interruption	≥10 years	

Note: meters intended to be used indoors

4. Key components adoption

Table 8 Key components adoption

Model	DTSU666
Metering chip	HT7036
Crystal oscillator	5.5296MHz, 32.768kHz
Printed PCB	ZTY8.067.2267, ZTY8.067.3491, ZTY8.067.2288
Power transformer	EE19-0.9mH-B
Current transformer	HLX1

5. Main functions

5.1 Display

In the displayed interface, the electrical parameters and energy data are all primary-side data (multiplied by current and voltage ratios). The energy measurement value will be displayed with seven digits, ranging from 0.00 kWh to 9,999,999 MWh.

Figure 3 Display

Table 9 Display interface

No.	Display Interface	Instructions	No.	Display Interface	Instructions
1	Σ 10000.00 kWh	Combined active energy =10000.00kWh	11	I C 5.002 A	Phase C current =5.002A
2	Imp. 10000.00 kWh	Positive active energy =10000.00kWh	12	Pt 3.291 kW	Combined phase active power =3.291kW
3	Exp. 2345.67 kWh	Reserve active energy =2345.67kWh	13	PA 1.090 kW	Phase A active power =1.090kW
4	NO. n 1-9.600	Protocol: ModBus-RTU; address =001 Baudrate=9600 None parity, 1 stop bits	14	Pb 1.101 kW	Phase B active power =1.101kW
5	NO. ----001		15	PC 1.100 kW	Phase C active power =1.100kW
6	UA 220.0 V	Phase A voltage =220.0V	16	Ft 0.500	Combined phase power factor PFt=0.500
7	Ub 220.1 V	Phase B voltage =220.1V	17	FA 1.000	Phase A power factor PFa=1.000
8	UC 220.2 V	Phase C voltage =220.2V	18	Fb 0.500	Phase B power factor PFb=0.500
9	I A 5.000 A	Phase A current =5.000A	19	FC -0.500	Phase C power factor PFc=-0.500
10	I b 5.001 A	Phase B current =5.001A			

Note 1: Combined active energy = Positive active energy + Reserve active energy.

Note 2: The communication address of Modbus protocol is 1 decimal data (1 ~ 247), and the factory default baud rate is 9600bps, N.8.1; E1 means even check 1 stop bit, O1 means odd check 1 stop bit Two stop bits, N1 means one stop bits without check.

Note 3: The displayed interface content's meaning is shown above. The display symbols may vary depending on the instrument's functions.

Note 4: During RS485 communication, the telephone sign will flash.

5.2 Programming

5.2.1 Programming functions

Table 10 Programming Parameter

Parameter	Value range	Description
Ct	1~9999	Current ratio, used to determine the input loop current ratio: When the current is connected to the line via the transformer, Ct= the rated current of the primary loop divided by the rated current of the secondary circuit; When the current is directly connected to the line, set Ct to 1.
Pt	0.1~999.9	Voltage ratio, used to determine the voltage ratio of the input loop: When the voltage is connected to the line via the transformer, Pt equals the rated voltage of the primary loop divided by the rated voltage of the secondary circuit. When the voltage is directly connected to the line, set Pt to 1.0.
Prot	1~5	Settings for communication stop bit and parity bits: 1: 645 mode; 2: None parity, 2 stop bits, n.2; 3: None parity, 1 stop bit 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;	Communication baud rate: 0: 1.200 bps; 1: 2.400 bps; 2: 4.800 bps; 3: 9.600 bps; 4: 19.200 bps (customization)
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:n0; 1:E;	1: Clear energy
PLuS	0:P; 1:Q;	Pulse output: 0: active energy pulse; 1: reactive en ergy pulse; 2: Others.
d ISP	0~30	Display in turns(second) 0: Timely display display; 1~30: Time interval of actual display.
b.LCd	0~30	Backlight lighting time control (minutes) 0: Normally light light; 1~30: backlight lighting time without button

5.2.2 Programming operation

Button description:

SET button: confirm, or cursor shift when inputting digits.
ESC button: exit.
→ (right arrow) button: add.

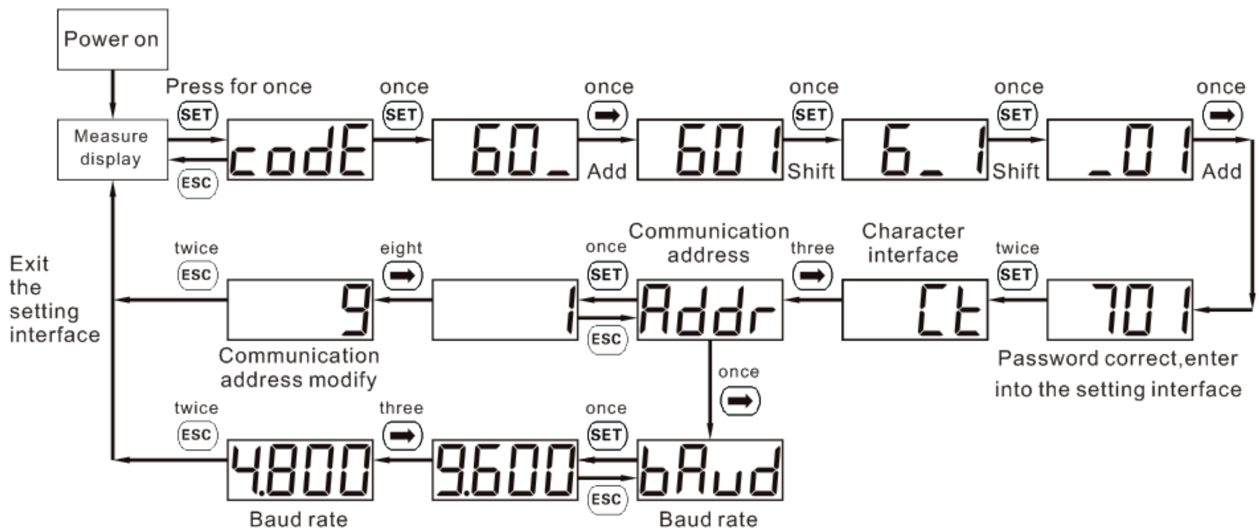


Figure 4 Setting examples for communication address and Baud rate

When inputting digits, you can use SET as a cursor and as a motion button. (right arrow) represents the "add" function. ESC is used to exit the programming operation interface or switch from the digit modification interface to the character interface. After setting the digit to the maximum value, you can add from the beginning.

5.3 Communication

Equipped with an RS485 communication interface, it allows for adjustable baud rates: 1200bps, 2400bps, 4800bps, and 9600bps.
The factory default communication parameters feature the ModBus-RTU protocol with a baud rate of 9600bps, a calibration bit, and a stop bit set to n.1, and an instrument address of 1.
In the ModBus-RTU protocol, the read command is 03H, and the write command is 10H.

Table 11 ModBus protocol address table

Parameter address	Parameter code	Instructions of parameters	Data type	Data length word	Read Write
Keyboard parameters (specific parameters: see the instructions of programming parameters, the actual value with (*) parameter = communication parameter value × 0.1)					
0000H	REV.	Software version	Signed	1	R
0001H	UCode	Programming code codE(19999)	Signed	1	R/W
0002H	CLr.E	Energy reset CLr.E(1:energy clear)	Signed	1	R/W
0003H	net	Network selection (0:three phase four wire,1:three phase three wire)	Signed	1	R/W
0006H	IrAt	Current transformer rate IrAt(1~9999)	Signed	1	R/W
0007H	UrAt	Voltage transformer rate UrAt (*) (1~9999 represents voltage ratio 0.1~999.9)	Signed	1	R/W
000AH	Disp	Rotating display time (s)	Signed	1	R/W
000BH	B.LCD	Backlight time control (m)	Signed	1	R/W
000CH	Endian	Reserve	Signed	1	R/W
002CH	Protocol	Protocol switching (1:DL/T645;2:n.2;3:n.1;4:E.1;5:o.1)	Signed	1	R/W
002DH	bAud	Communication baud rate bAud (0:1200;1:2400;2:4800;3:9600)	Signed	1	R/W
002EH	Addr	Communication address Addr(1~247)	Signed	1	R/W
Electricity data					
2000H	Uab	Three phase line voltage data, Unit V (×0.1V)	float	2	R
2002H	Ubc		float	2	R
2004H	Uca		float	2	R
2006H	Ua	Three phase phase voltage data, Unit V (×0.1V) (Invalid for three phase three wire)	float	2	R
2008H	Ub		float	2	R
200AH	Uc		float	2	R
200CH	Ia	Three phase current data, Unit A (×0.001A)	float	2	R
200EH	Ib		float	2	R
2010H	Ic		float	2	R
2012H	Pt	Combined active power, Unit W (×0.1W)	float	2	R
2014H	Pa	A phase active power, Unit W (×0.1W)	float	2	R
2016H	Pb	B phase active power, Unit W (×0.1W) (Invalid for three phase three wire)	float	2	R
2018H	Pc	C phase active power, Unit W (×0.1W)	float	2	R
201AH	Qt	Combined reactive power, Unit var (×0.1var)	float	2	R
201CH	Qa	A phase reactive power, Unit var (×0.1var)	float	2	R
201EH	Qb	B phase reactive power, Unit var (×0.1var) (Invalid for three phase three wire)	float	2	R
2020H	Qc	C phase reactive power, Unit var (×0.1var)	float	2	R
202AH	PFt	Combined power factor(positive number inductive negative number capacitive) (×0.001)	float	2	R

202CH	PFa	A phase power factor (positive number inductive negative number capacitive) (Invalid for three phase three wire) (x0.001)	float	2	R
202EH	PFb	B phase power factor (positive number inductive negative number capacitive) (Invalid for three phase three wire) (x0.001)	float	2	R
2030H	PFc	C phase power factor (positive number inductive negative number capacitive) (Invalid for three phase three wire) (x0.001)	float	2	R
2044H	Freq	Frequency, Unit Hz (×0.01Hz)	float	2	R
Energy data					
101EH	ImpEp	(current) Total Forward active energy (kWh)	float	2	R
1020H	ImpEpA	(current) A Forward active energy (kWh)	float	2	R
1022H	ImpEpB	(current) B Forward active energy (kWh)	float	2	R
1024H	ImpEpC	(current) C Forward active energy (kWh)	float	2	R
1026H	NetImpEp	(current) Net Forward active energy (kWh)	float	2	R
1028H	ExpEp	(current) Total Reverse active energy (kWh)	float	2	R
102AH	ExpEp A	(current) A Reverse active energy (kWh)	float	2	R
102CH	ExpEp B	(current) B Reverse active energy (kWh)	float	2	R
102EH	ExpEp C	(current) C Reverse active energy (kWh)	float	2	R
1030H	NetExpEp	(current) Net Reverse active energy (kWh)	float	2	R

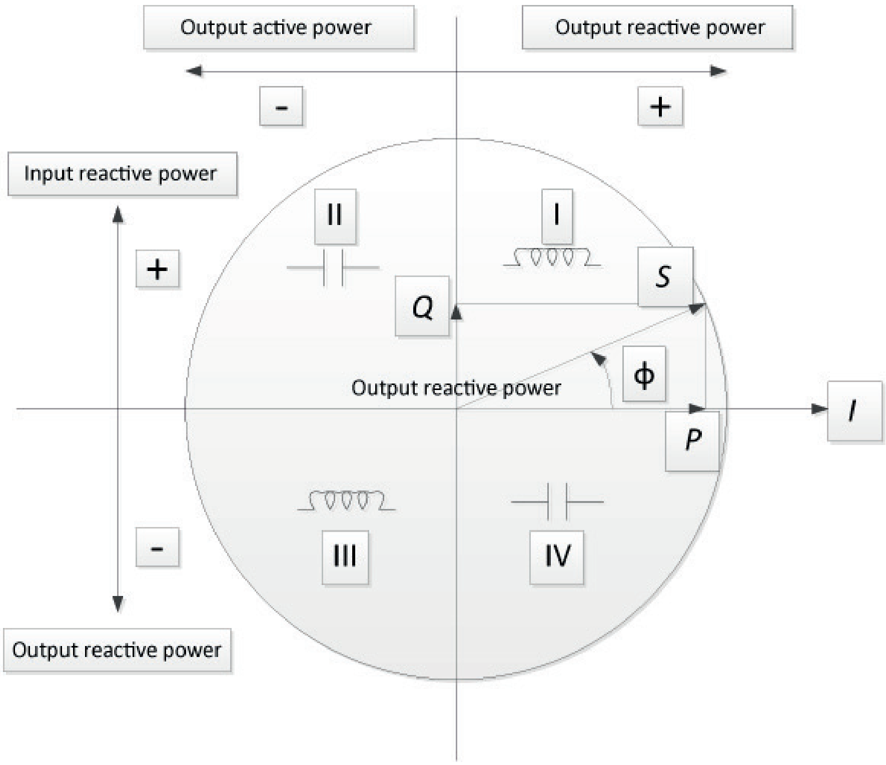
Note 1: Single precision floating point uses the standard IEEE754 format, which consists of a total of 32 bits (4 words). It is in ABCD format, with the high byte in the front and the low byte behind.

Note 2: This table provides regular correspondence addresses. For primary data addresses and other addresses, refer to the detailed communication protocol for energy measurement functions.

5.4 Energy measurement four quadrant

The horizontal axis of the measurement plane represents the fixed current vector I, and the instantaneous voltage vector represents current power transmission. The phase angle ϕ is measured in the counterclockwise direction, with a positive value.

Figure 5 Schematic diagram Measurement for energy four quadrants



6. Dimensions

Table 12 Installation size

Model	Modulus	Outline size (length× width× height)	Installation size (DIN rail)
DTSU666	4	100 x 72 x 65 mm	DIN35 DIN rail
DSSU666	4		

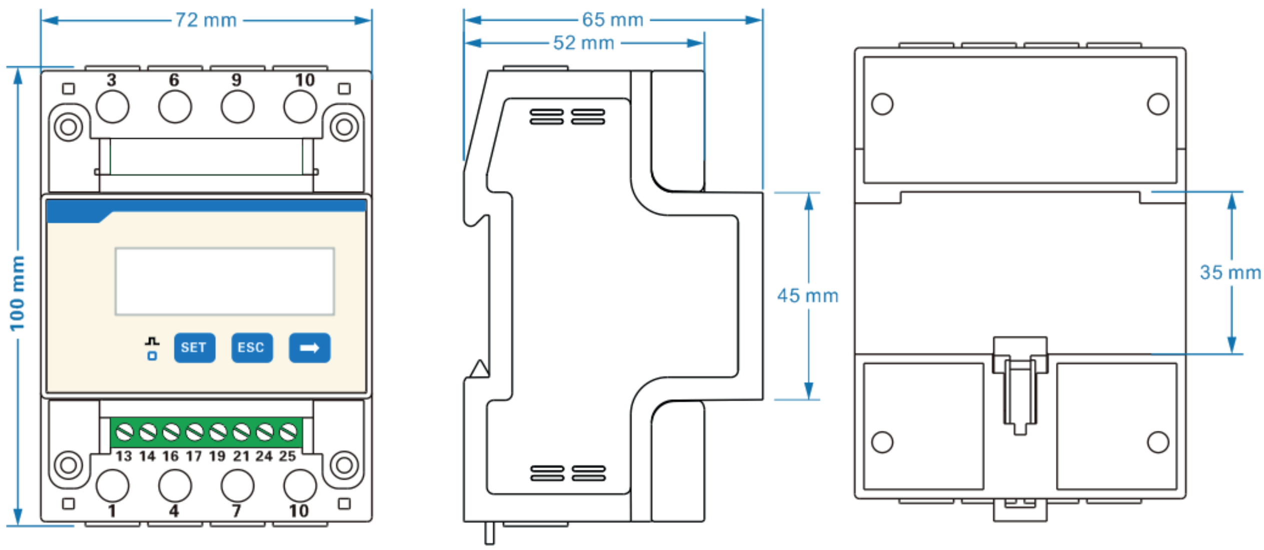


Figure 6 Outline size diagram

Note 1: The undeclared tolerance is ± 1 mm.
Note 2: This note only pertains to size; the shape may vary slightly among different specifications.

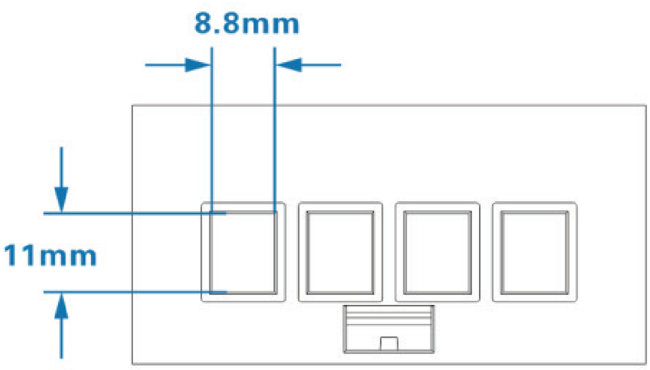


Figure 7 Current cable terminal (conductor cross-sectional area range ≤16 mm²)

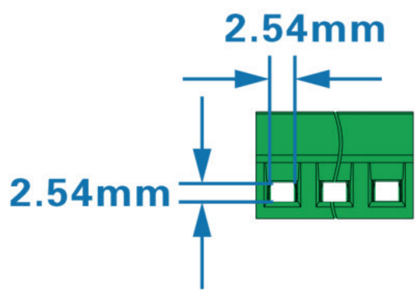


Figure 8 RS485 cable terminal (conductor cross-sectional area range 0.25-1mm²)

7. Installation and operation

7.1 Inspection

When unpacking the carton, if you notice any obvious signs of severe impact or damage caused by falling on the shell, please contact the supplier as soon as possible.

After removing the instrument from its packaging, place it on a flat and secure surface with the front side facing up. Avoid stacking it with more than five layers. If the electric meter is not going to be installed or used immediately, it should be packed and stored in its original packaging box.

The front panel of the meter has a waterproof and dustproof rating of IP51 and should be used in a meter box that meets the IP51 requirements.

7.2 Installation

7.2.1 Installation and inspection

1. If the model number or configuration in the original packing box does not meet the requirements, please contact the supplier.
2. If the inner packaging or the instrument's shell is damaged after removing it from the packing box, do not install or power on the instrument. Instead, contact the supplier as soon as possible.

7.2.2 Installation

Installation of this product requires an experienced electrician or professional personnel, and it is essential to thoroughly read this operation manual. If, during the installation process, you observe any obvious damage or marks on the shell resulting from violent impact or falling, please refrain from installation or powering it on, and promptly contact the supplier.

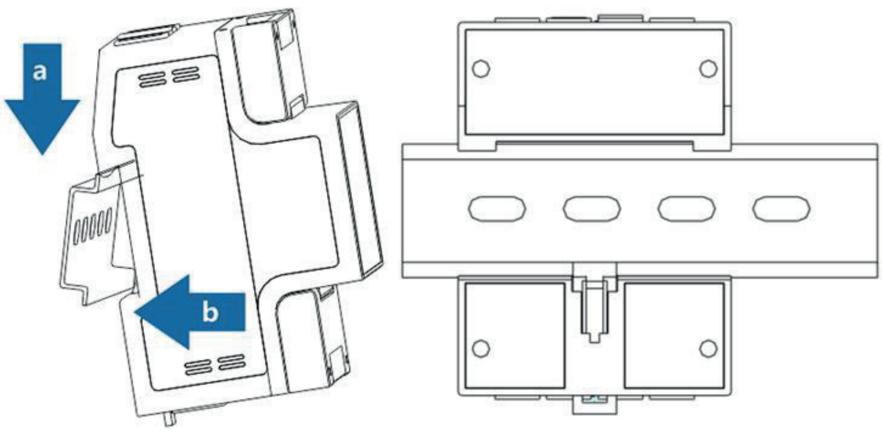


Figure 9 Installation picture

7.3 Types of wiring

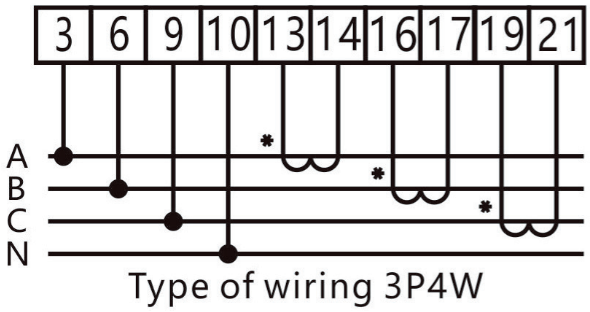


Figure 10 Three phase four wires
Connection through current transformers

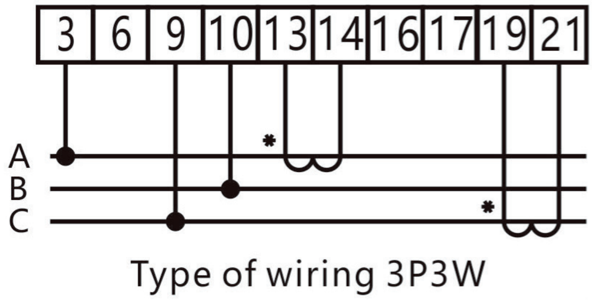


Figure 11 Three phase three wires
Connection through current transformers

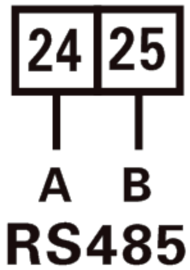


Figure 12 RS485

Voltage signal:
3-------UA (Phase A voltage input terminal)
6-------UB (Phase B voltage input terminal)
9-------UC (Phase C voltage input terminal)
10 -------UN (Phase N voltage input terminal)

Current signal:
13----IA*(Phase A current input terminal)
14----IA (Phase A current output terminal)
16----IB*(Phase B current input terminal)
17----IB (Phase B curren t output terminal)
19----IC*(Phase C current input terminal)
21----IC (Phase C current output terminal)

RSA485 Communication wire:
24-------A (RS485 Terminal A)
25-------B (RS485 Terminal B)

NOTE:
In figures 10 and 11 phase A, phase B, and phase C correspond to L1, L2, and L3.

8. Diagnosis, analysis and elimination for common faults

Fault	Cause	Solution	Note
No display when powered on	1. Incorrect wiring 2. Abnormal voltage for the instrument	1. If the connections are incorrect, refer to the wiring diagram and reconnect appropriately. 2. In case of abnormal supplied voltage, select the specified voltage. 3. If the issue is not one of the above, please contact your local supplier.	/
Abnormal RS485 communication	1. RS485 communication cable is opened, short-circuited, or reversely connected. 2. Address, baud rate, data bits, and check bits are not in accordance with the host computer. 3. The end of the RS485 communication cable has not been matched with resistance (when the distance is more than 100 meters). 4. Not in compliance with the communication protocol order of the host computer.	1. If there's an issue with the communication cable, replace it. 2. Ensure that the address, baud rate, data bits, and check bits match those of the host computer. Set the operation to "parameter settings." 3. If the communication distance exceeds 100 meters and the parameters match, but communication fails, either lower the baud rate or add a 120Ω resistance at both the starting and ending terminals.	/
Abnormal data for the electrical parameter (voltage, current, power, etc.)	1. The transformer ratio hasn't been configured, and the instrument displays secondary-side data. 2. Incorrect wiring.	1. To configure the transformer ratio, set the voltage and current ratios using the "parameter setting." 2. If connected incorrectly, ensure that the voltage and current of phases A, B, and C are correctly connected to the instrument's wiring terminals.	/
Abnormal data for the electrical parameter read by communication (voltage, current, power, etc.)	1. Data obtained through communication displays secondary-side data, without considering the transformer ratio. 2. Incorrect analysis of the data frame.	1. Multiply the communication-read data by the voltage and current ratios. 2. Analyze the data frame according to the communication protocol format, paying attention to the byte order (big and little end).	/

9. Packaging, Transportation and Storage

Packaging:
The packaging of the meter should be made from materials that meet environmental requirements.

A complete set of packaging products should include the following:

1. Chint Electric Energy Meter
2. User manual
3. Packet of desiccant
4. Certificate

Transportation and Unpacking:
When transporting and unpacking the products, please ensure that they are not severely impacted. Follow the guidelines outlined in "Transportation, Basic Environmental Conditions, and Testing Methods for Instruments and Meters" as per JB/T9329 1999.

Storage Conditions:
Store the instrument and accessories in a dry and well-ventilated location to prevent exposure to humidity and corrosive gases. The recommended environmental storage temperature is between -40°C and +70°C, with relative humidity not exceeding 85%.

10. Maintenance and Repair

If users encounter any quality problems within 18 months from the date of dispatch, our company is responsible for free repair or replacement, provided that users operate in accordance with the manual's instructions and the factory seal remains intact.

When our products reach the end of their usable life, we kindly request your assistance in recycling the products or their component materials to protect the environment. Please also dispose of materials that cannot be recycled properly.

11. Notes

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