DTSU666 series three phase four wire electronic energy meter

DSSU666 series three phase three wire electronic energy meter

Operation Manual

ZTY0.464.1002

Zhejiang Chint Instrument & Meter Co., Ltd.

May., 2019.

1. Brief Introduction

1.1 Main application & applicable range

DTSU666 series three phase four wire and DSSU666 series three phase three wire electronic energy meter (din-rail) (hereinafter referred to as the “instrument”) is designed based on power monitoring and energy metering demands for electric power system, communication industry, construction industry, etc. as a new generation of intelligent instrument combining measurement and communication function, mainly applied into the measurement and display for the electric parameters in the electric circuit including three voltage, three current, active power, reactive power, frequency, positive& negative energy, four-quadrant energy, etc. Adopting the standard DIN35mm din rail mounting and modular design, it is characterized with small volume, easy installation and easy networking, widely applied into the internal energy monitoring and assessment for industrial and mining enterprises, hotels, schools, large public buildings.

Complied standards:

IEC 61010-1:2010《Safety requirements for electrical equipment for measurement， control and laboratory use Part1:General requirements》

IEC 61326-1:2013 《Electrical equipment for measurement， control and laboratory use –EMC requirements Part1:General requirements》

1.2 Product Features

1) Characterized with positive and reverse active power, combined active power, combined reactive power, four quadrant reactive power metering and storage function with combination mode character can be set.
2) RS485 communication interface, easy to exchange data with outside;
3) Adopting the standard DIN35mm din rail mounting and modular design, it is characterized with small volume, easy installation and easy networking

1.3 Model composition and meanings

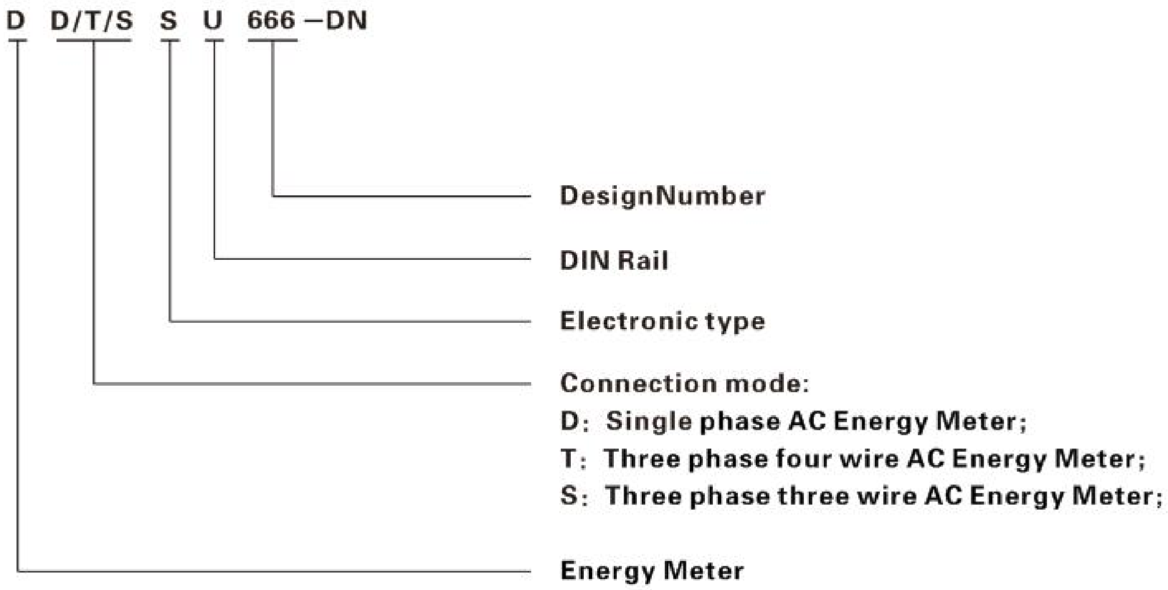


Figure 1 Model No. & meanings

Table 1 product model and specification

Model	Reference voltage (V)	Current specification (A)	Impulse constant		Accuracy class
			imp/kWh	imp/kvarh	
DTSU666-DN	3×220/380	1.5(6)A	6400	6400	Active class 0.5S,reactive class 2
		5(80)A	400	400	Active class 1. Reactive class 2
DSSU666-DN	3×380	1.5(6)A	6400	6400	Active class 0.5S,reactive class 2
		5(80)A	400	400	Active class 1. Reactive class 2

1.4 Applicable environmental condition

1.4.1 Temperature range

Indoor type:

Regulated working temperature range: -10℃～+45℃;

Limited working temperature range: -25℃～+75℃;

1.4.2 Relative humidity(Annually average):≤75％；

1.4.3 Atmospheric pressure: 63.0kPa～106.0kPa(altitude 4km and below), excepting the requirements for special orders.

2. Working Principle

The instrument are composed of high accurately integrated circuit specially for measurement (ASIC) and managing MCU, memory chip, RS485 communication module, etc.

The working principle block diagram of the instrument is shown in figure 2

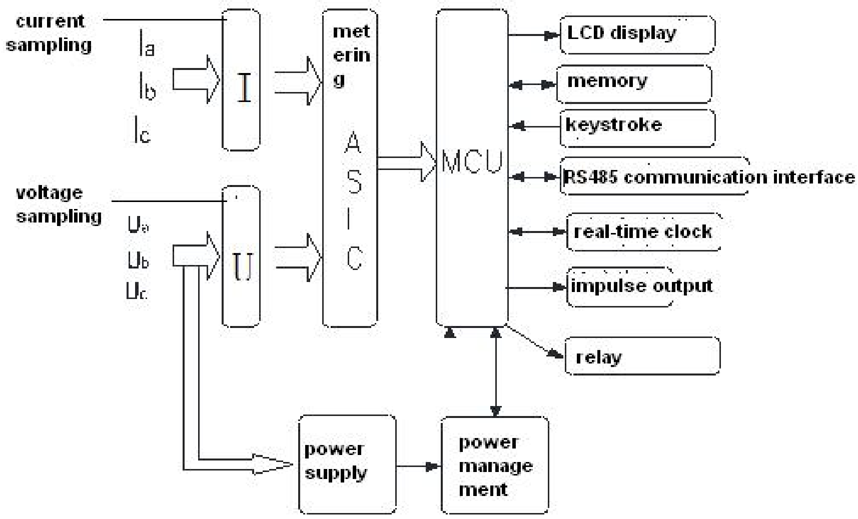


Figure 2 Working principle block diagram

2.1.Principle for the main function module

2.1.1.Metering part

The special metering integrated circuit (ASIC) integrated six load two order ∑-△ type of A/D conversion, please take the digital signal processing measured by the voltage circuit as well as all the power, energy, effective values, power factor and frequency. This metering chip can measure the active power, reactive power, apparent power, active energy, reactive power, apparent energy of each phase and combined phase, and at the same time measuring current, voltage effective values, power factor, phase angle, frequency and other parameters, entirely satisfying the needs of power meter. The chip provides an SPI interface, convenient for metering parameters as well as parameter calibration between the management MCU.

2..1.2.Data processing part

Management MCU will timely read the electrical parameters such as current, voltage, power, etc. in the metering chips, judging the current quadrant based on the read data, and judging the current operated rate based on time and time rate, then adding the energy read from the metering chip to the corresponding quadrant energy and total energy based on the rate and quadrant, at the same time, calculating the corresponding combined energy based on the energy combination mode, and then store and backup the energy.

The management MCU drives LCD module to display and exchange data with the outside through RS485 communication interface.

3. Main Technical Performance & Parameters

3.1. limit of error caused by the current augment

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

type	Range of current	Power factor	Percentage error limit of various grade instruments（%）		
			0.5S	Class 1	Class 2
Access via current transformer	$0.01I_n \le I < 0.05I_n$	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 access instrument	$0.05I_b \le I < 0.1I_b$	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
Remark	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

Current value		sinφ (inductive or capacitive)	Percentage error limit of various grade instruments（%）
Direct access instrument	Access via transformer		2
$0.05I_b \le I < 0.1I_b$	$0.02I_n \le I < 0.05I_n$	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 active percentage error of meters on imbalanced load

Current value		Power factor	Percentage error limit of various grade instruments（%）		
Direct access instrument	Access via transformer		0.5S	Class 1	Class 2
$0.1\ I_b \le I \le I_{max}$	$0.05I_n \le I \le I_{max}$	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	±1.0	±2.0	±3.0

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

Current value		Current value	Percentage error limit of various grade instruments（%）
Direct access instrument	Direct access instrument		Class 2
$0.1\ I_b \le I \le I_{max}$	$0.05I_n \le I \le I_{max}$	1	±3.0
$0.2I_b \le I \le I_{max}$	$0.1I_n \le I \le I_{max}$	0.5	±3.0

3.2. Start

Under the power factor of 1.0 and started current, the instrument can be started and continuously measure (for multiple phase instrument, it will bring balanced load). If the instrument is designed based on measurement for dual directional energy, then it is applicable for each direction of energy.

Table 3 start current

instrument	Instrument rating			Power factor
	0.5S	1	2	
Direct access instrument	-	$0.004I_b$	$0.005I_b$	1
Access via CT	$0.001I_b$	$0.002I_b$	$0.003I_b$	1

3.3. Defluction

When adding voltage while there is no current on the current circuit, the test output of the instrument shall not produce another pulse. When testing, the current circuit shall be opened, and the added voltage for voltage circuit shall be 115% of the referenced voltage.

Shortest testing time Δt：

For instrument of class 0.5S and class1： $$\Delta t \geq \frac{600 \times 10^6}{k \cdot m \cdot U_n \cdot I_{max}} [min]$$

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

From the formula, k represents meter constant (imp/kWh), m represents measuring components, Un represents referenced voltage (V) and Imax represents the maximized current (A).

3.4.Electrical parameters

Table 7 Electrical parameters

Specified operating voltage range	0.9Un～1.1Un	
Extended operating voltage range	0.8Un～1.15Un	
Ultimate operating voltage range	0 Un～1.15Un	
Power consumption of the voltage circuit	≤1.5W and 6VA	
Power consumption of the current circuit	I_b＜10A	≤0.2VA
	I_b≥10A	≤0.4VA
Data save time after power off	≥10 years	

4.Key components adoption

4.1.Metering chip

HT7038.

4.2.Crystal oscillator

5.5296MHz and 32.768kHz

4.3.Printed PCB

ZTY8.067.2266，ZTY8.067.2267，ZTY8.067.2288.

4.4.Power transformer

ZTY6.170.275.

4.5.Current transformer

HLX1 5(80)A /2mA，HLX1 1.5(6)A /0.75mA.

5.Main function

5.1.Displayed function

From the displayed interface, the electrical parameter and energy data are all primary side data (that is, the multiplied by current and voltage ratios). The energy measuring value will be displayed seven bits, with the displaying range from 0.00kWh to 9999999MWh.

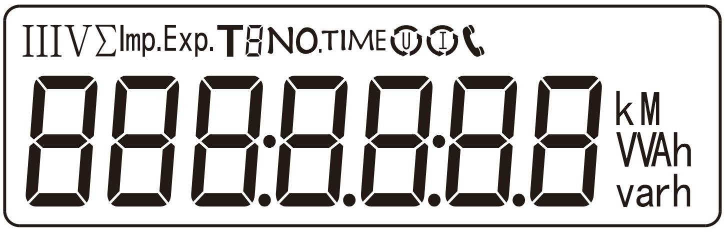


Diagram 2 Liquid crystal display

Table 8 Display interface

No.	Display interface	Instruction	No.	Display interface	Instruction
1		Combined active energy =10000.00kWh	11		Phase C current =5.002A
2		Positive active energy =10000.00kWh	12		Combined phase active power =3.291kW
3		Reserve active energy =2345.67kWh	13		Phase A active power =1.090kW

4	NO. H000000	Instrument 12 bit Communication address = 000000000001	14	Pb 1.101 kW	Phase B active power =1.101kW
5	NO. L000001		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=0.500L
7	Ub 220.1 V	Phase B voltage =220.1V	17	FA 1.000	Phase A power factor PFa=1.000L
8	UC 220.2 V	Phase C voltage =220.20V	18	Fb 0.500	Phase B power factor PFb=0.500L
9	I A 5.000 A	Phase A current =5.000A	19	Ft-0.500	Phase C power factor PFc=0.500L
10	I b 5.001 A	Phase B current =5.001A			

Remarks: For the default combination characters from the factory, please see 5.4 energy measurement functions.

5.2.Programming function

5.2.1.Programming parameter

Table 9 Programming parameter

Parameter	Value range	Instruction
Ct	1～9999	Current ratio, used for setting the input loop current ratio: When the current is connected to the line via the transformer, Ct=the rated current of the primary loop / the rated current of the secondary circuit; When the current is directly connected to the line, Ct shall be set as 1.
Pt	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, Pt= the rated voltage of the primary loop / the rated voltage of the secondary circuit; When the voltage is directly connected to the line, Pt shall be set as 1.0.
Prot	1：645	Communication protocol switches: 1：Dl/T 645-2007；
bAud	0：1.200； 1：2.400； 2：4.800； 3：9.600；	Communication baud rate: 0 ： Communication baud rate to be 1200bps ； 1 ： Communication baud rate to be 2400bps； 2：Communication baud rate is 4800bps；3：Communication baud rate is 9600bps；
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	The setting is 1, representing the allowed instrument energy data clearance, which will be zero reset after clearing.

PLuS	0:P；1:Q；2:S；	Pulse output: 0：active energy pulse; 1: reactive energy pulse; 2：Others.
dISP	0～30	Display in turns(second) 0：Timely display； 1～30：Time interval of actual display.
bLCd	0～30	Backlight lighting time control（minutes） 0：Normally light； 1～30：backlight lighting time without button operation
codE	1～9999	Programming code settings

5.2.2.Programming operation

Button description: “SET” button represents “confirmation”, or “cursor shift” (when input digits), “ESC” button represents “exit”, “⟶” (“^”) button represents “add”. The input code is (default 701).

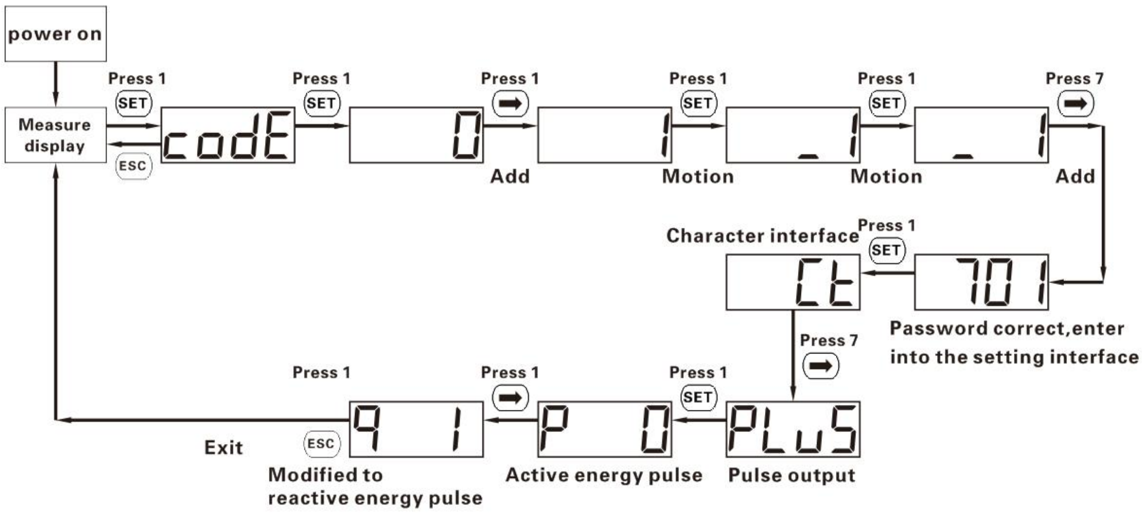


Diagram 3 Setting examples for active or reactive energy pulse switching

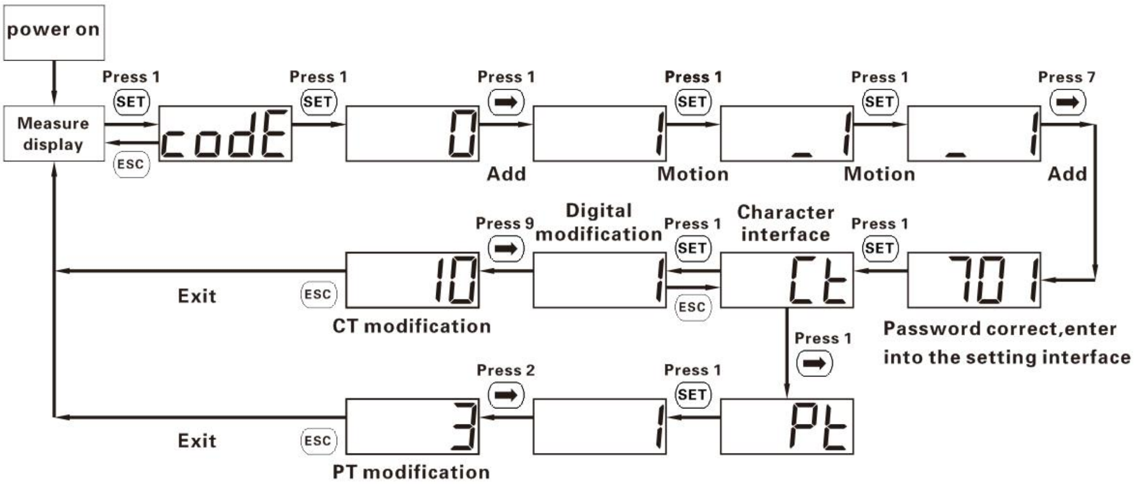


Diagram 4 Setting examples for current ratio

When input digits, "SET" can be used as cursor " _ "motion button; "➡"is "add" button, "ESC"is Exit the programming operation interface or switch to the character interface from digit modification interface, add from the beginning after setting the digit to the maximum value.

6. Communication function

Characterized with a RS485 communication interface, the baud rate can be changed between 1200bps, 2400bps, 4800bps and 9600bps. The default baud rate is 2400bps, with the calibration bit and stop bit to be E.1, and instrument address (please see instrument factory number or crystal display screen).

Communication protocol: complied with the requirement of DL / T645—2007 Multifunctional meter communication protocol

7. Energy measurement function

7.1.Energy measurement four quadrant

The horizontal axis of the measurement plane represents the current vector I (fixed on the horizontal axis), and the instantaneous voltage vector is used to represent the current power transmission. Compared with the current vector I, it has phase angle Φ.

The counter-clockwise direction Φ angle is positive. A schematic diagram of the four-quadrant is shown in Figure 2.

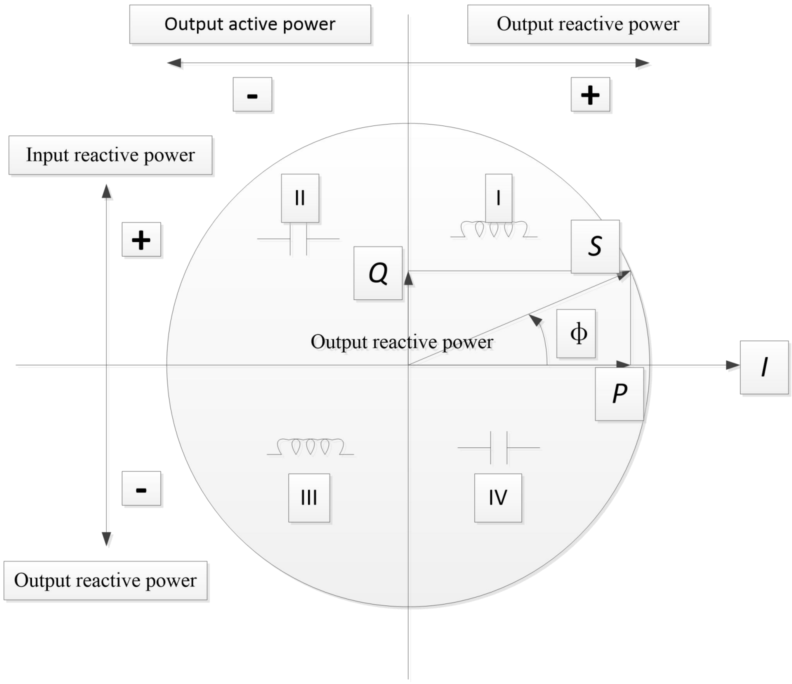


Table 10 Measurement schematic diagram for energy four quadrants

Remarks 1: The measurement method for the combined active energy depends on the contents of character words of the active combined mode.

Character words of active combined mode：

Table 11 Character words of active combined mode

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reserved	Reserved	Reserved	Reserved	Reverse active (0 no less， 1 less)	Reverse active (0 not added， 1 added)	Positive active (0 no less， 1 less)	Positive active (0 not added， 1 added)

Example: when the content of the active combination mode is 05,

Combined active energy=positive active energy + reverse active energy

Factory default value: combined active energy= positive active energy

Remarks 2: The combined reactive energy four quadrant can be respectively measured and the reactive energy can be set as the sum of arbitrarily four quadrant energy, with its measurement mode depending on the contents of character word 1 and 2 of the reactive combination mode.

Table 12 Character words of the combined reactive combination mode

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0

IV quadrant (0 no less， 1 less)	IV quadrant (0 not added， 1 added)	III quadrant (0 no less， 1 less)	III quadrant (0 not added， 1 added)	II quadrant (0 no less， 1 less)	II quadrant (0 not added， 1 added)	I quadrant (0 no less， 1 less)	I quadrant (0 not added， 1 added)

0bit：I quadrant reactive; 0-Not counted into combined reactive; 1-Counted into combined reactive;

First bit：I quadrant reactive; 0- Not counted into combined reactive; 1-Minus the quadrant reactive;

Second bit: II quadrant reactive; 0- Not counted into combined reactive; 1- Counted into combined reactive

Third bit: II quadrant reactive; 0- Not counted into combined reactive; 1- Minus the quadrant reactive;

Fourth bit：III quadrant reactive; 0- Not counted into combined reactive; 1- Counted into combined reactive

Fifth bit：III quadrant reactive; 0- Not counted into combined reactive; 1- Minus the quadrant reactive;

Sixth bit：IV quadrant reactive; 0- Not counted into combined reactive; 1- Counted into combined reactive

Seventh bit：IV quadrant reactive;0- Not counted into combined reactive; 1- Minus the quadrant reactive; For example: when the content of the reactive combination mode is A5;

Combined reactive energy= I quadrant reactive +II quadrant reactive –III quadrant reactive-IV quadrant reactive

Factory default value: combined reactive 1 energy= Ⅰ+Ⅳ,combined reactive 2 energy= Ⅱ+Ⅲ.

8. Outline and installation size

Table 13 Installation size

Model	modulus	Outline size (length× width× height) mm	Installation size (din rail)
DTSU666-DN	4	100×72×65.5	DIN35 Standard din rail
DSSU666-DN	4		

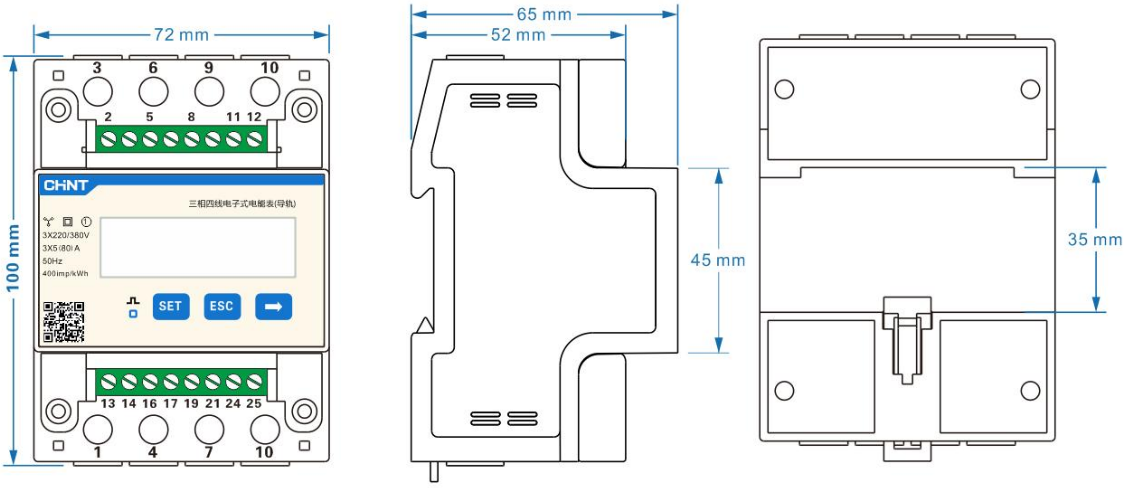


Diagram 5 Outline size diagram (four modulus)

9. Installation and operation manual

9.1. Inspection Tips

When unpacking the carton, if the shell has obvious signs caused by severe impact or falling, please contact with the supplier as soon as possible.

After the instrument being removed from the packing box, it should be placed on a flat and safe plane, facing up, not overlaying for more than five layers. If not installed or used in a short time, the electric meter shall be packed and placed to the original packing box for storage.

9.2. Installation and tips

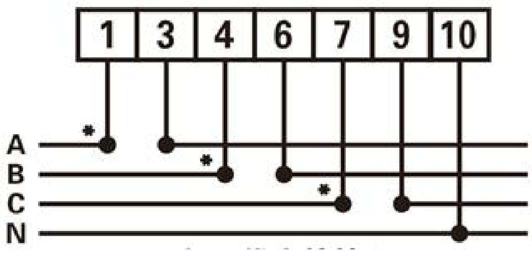
9.2.1. Installation and Inspection

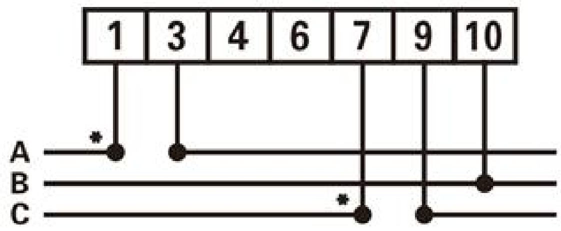
If the model No or configuration in the original packing box is not in accordance with the requirement, please contact with the supplier. While, if the inner package or shell has been damaged after removing the instrument from the packing box, please do not install, power on the instrument, please contact with the supplier as soon as possible, instead.

9.2.2.Installation

It requires experienced electrician or professional personnel to install it and you must read this operation manual. During the installation, if the shell has obvious damage or marks caused by violent impact or falling, please do not install it or power on and contact with the supplier as soon as possible.

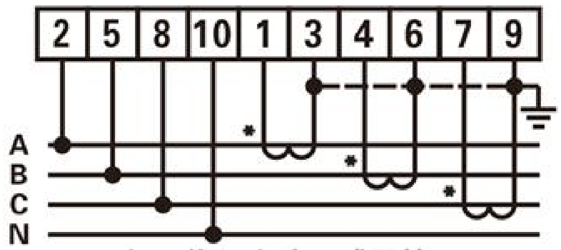
Typical wiring

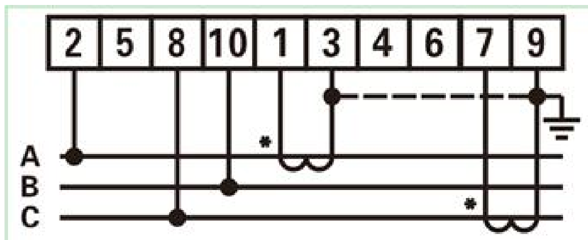




Three phase four wire: direct connect　Three phase three wire: direct connect

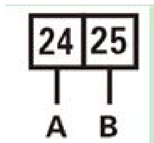
Diagram 1　Diagram 2

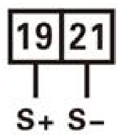




Three phase four wire: via current transformer　Three phase three wire: via current transformer

Diagram 3　Diagram 4





RS485　Pulse output

Diagram 5　Diagram 6

◆ Voltage signal (only for connection via current transformer)

2-------UA (Phase A voltage input terminal)　5 -------UB (Phase B voltage input terminal)

8-------UC (Phase C voltage input terminal)　10------UN (Phase N voltage input terminal)

◆ Current signal:

1-------IA*(Phase A current input terminal)　3------IA (Phase A current output terminal)

4-------IB*(Phase B current input terminal)　6------IB (Phase B current output terminal)

7-------IC*(Phase C current input terminal)　9------IC(Phase C current output terminal)

◆ RS485 Communication wire

24-------A（RS485 Terminal A）　25-------B（RS485 Terminal B）

◆ Auxiliary function

19------ Active energy and reactive energy output high terminal

21------ Active energy and reactive energy output low terminal

10.Diagnosis, analysis and elimination for common faults

Fault phenomenon	Reason analysis	Elimination
No display when powered on	1. Incorrect wiring 2. Abnormal voltage for the instrument	1. If it is wrongly connected, please reconnect based on the right wiring mode (see the wiring diagram). 2. If the supplied voltage is abnormal, please choose the specified voltage. 3. If not the above problems, please contact with the local supplier.
Abnormal RS485 communication	1. RS485 communication cable is opened, short circuit or reversely connected. 2. Address, baud rate, data bit and check bit is not in accordance with the host computer. 3. The end of RS485 communication cable has not been matched with resistance (when the distance over than 100 meters) 4. Not matched with the communication protocol order of the host computer	1. If there is any problem with the communication cable, please change it. 2. Set the address, baud rate, data bit and check bit through buttons and confirm it is the same with the host computer, then set the operation to be "parameter settings". 3. If the communication distance is over than 100 meters, and the communication parameter settings are the same as the host computer, but cannot be communicated, then please lower the baud rate or add a resistance of 120Ω at the

		start terminal and ending terminal.
Abnormal data for the electrical parameter (voltage, current, power, etc.)	1. The transformer's ratio hasn't been set, and the instrument displays the secondary side data. 2. Wrong wiring.	1. If setting the transformer ratio, please set the voltage ratio and current ratio based on "parameter setting" 2. If wrongly connected, please connect the voltage and current of phase A, B and C to the wiring terminal of the instrument.
Abnormal data for the electrical parameter read by communication (voltage, current, power, etc.)	1. Data read by communication is secondary side data, without transformer ratio. 2. Wrong analysis for data frame	1. Multiply the data read by communication with the voltage ratio and current ratio. 2. Analyze the data frame based on the format of the communication protocol, please pay attention to the mode of the big and small end of data.

11. Transportation & Storage

When transporting and unpacking the products, please confirm they are not severely impacted, transporting and storing based on *Transportation, basic environmental conditions and testing methods for instrument and meters* of JB/T9329-1999.

The instrument and accessories shall be stored in the dry and ventilated places, to avoid humidity and corrosive gas erosion, with the limited environmental temperature for storage to be -40℃～+70℃ and relative humidity not exceeding 85%.

12. Maintenance & Service

We guarantee free reparation and change for the multi-meter if found any unconformity with the standard, under circumstance of that the users fully comply with this instructions and complete seal after delivery within 18 months.

Dear clients,

Please assist us: when the product life is end, to protect our environment, please recycle the product or components, while for the materials that cannot be recycled, please also deal with it in a proper way. Really appreciate your cooperation and support.

Name of Company: Zhejiang Chint Instrument & Meter Co., Ltd.

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