DW9L 3 Phase Intelligent Energy Coulometer User Manual

Features:

⊙Measuring Items: Voltage/Current/Active Power/Reactive Power/Power Factor/Frequency etc, totally 28 parameters

⊙Two ON/OFF input and output, input and output isolation

⊙True-effective value measuring

⊙With Programmable Analog output function, analog output for Voltage,Currnet,Active Power, Reactive Power, Frequency and Power Factor

⊙RS485 communication interface, Standard Modbus RTU protocol

⊙2 energy pulse output, 2 programmable alarm output, display program setting input parameters

⊙With Power fail memory function for Menu Select / Kwh / KvarH

This model coulometer widely used in Control System, SCADA System, Energy Management System, Transformeer Substation Automation, Distributing Net Automation, District Electrical Power Monitor, Industrial Automation, Intelligent Construction, Intelligent Switchboard and Switch Cabinet, etc. Famous for it's Easy Installiation, Simple Wire Connection and Programmable setting parameters on site features.

⚠ Warning An accident may happen and product may be damaged if the coulometer is not operated according to the user manual.

1. Code Illustration

DW9L-□□□□

- Input Measuring Range: B: 5A X 450V D: Others
- Input: 30: 3 Phase 3 Wire or 3 Phase 4 Wire input without RS485 Communication
  38: 3 Phase 3 Wire or 3 Phase 4 Wire input with RS485 Communication
- Alarm Function: C: 2 Alarm A: No Alarm
- Output Function: R: Without 4-20mA output D: Analog output DC 4-20mA
- L: LCD Display
- Dimension (mm): 9: 96W X 96H X 100L
- DW9L 3 Phase Energy Coulometer

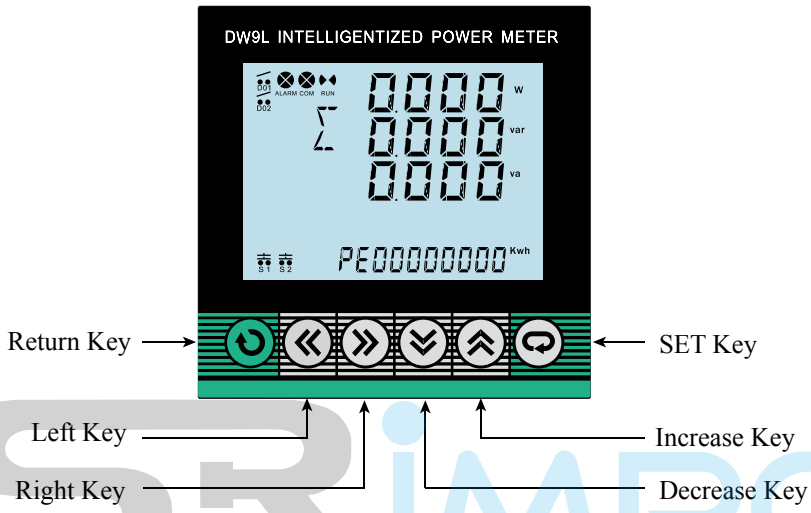
2. Model Indication

Model	Alarm	Analog	Communication	Pulse Output	ON/OFF Output
DW9L-A30B	NO	NO	NO	YES	YES
DW9L-A38B	NO	NO	RS485		
DW9L-RC30B	2	NO	NO		
DW9L-RC38B	2	NO	RS485		
DW9L-DC30B	2	4-20mA	NO		
DW9L-DC38B	2	4-20mA	RS485		

3. Main Technical Specification

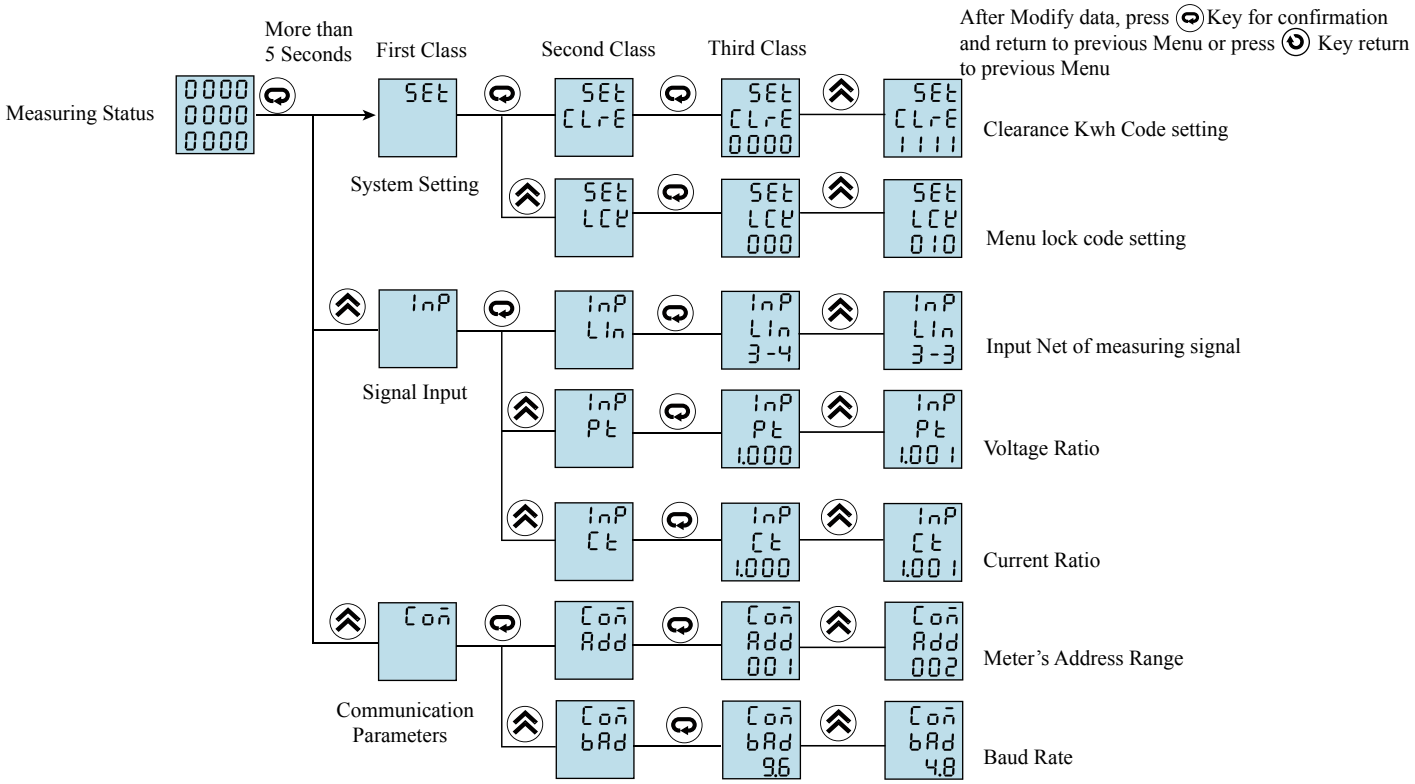
Connection	3 Phase 3 Wires, 3 Phase 4 Wires
Rated voltage value	AC 50-260V Phase Voltage / AC 50-450V Line Voltage
Voltage overload	Continuous: 1.2 times Instantaneous: 2 times/10S
Consumption of voltage	<1VA (each phase)
Voltage imdepance	≥300KΩ
Voltage accuracy	RMS measure, accuracy class 0.5
Rated current value	AC 0.025A -- 5A
Current overload	Continuous: 1.2 times Instantaneous: 10 times/10S
Consumption of current	<0.4VA (each phase)
Current imdepance	<20mΩ
Current accuracy	RMS measure, accuracy class 0.5
Frequency	45-60Hz, accuracy 0.1Hz
Power	Active / Reactive / Apparent power, accuracy 0.5%F.S.
Energy	Accuracy for Active Power and Reactive Power : 1%F.S.
Display	LCD display
Power supply range	AC/DC 100--240V (85--265V)
Power supply consumption	≤7VA

Output digital interface	Standard RS-485, MODBUS-RTU Protocol
Pulse output	2 energy pulse output（Optical coupler relay） Normal Pulse Number: 7200imp/kwh
ON/OFF input	2 ON/OFF input (Connection without voltage or current signal)
Alarm output	2 ON/OFF output, 250VAC/3A or 30VDC/5A
Analog output	1 transformed analog output, 4-20mA DC Load＜500Ω
Working environment	Temperature：-10～55℃ Humidity：＜85% RH
Storage environment	-20～75℃
Withstand voltage	Input to power supply: 1600VAC, input to output: 1600VAC, power supply to each output DC 2000V
Isolation	Input / Output / Power Supply to Meter Cover: >5MΩ
Dimension	96W×96H×100L
Weight	0.6kg



Note: 1. Under Measuring Status, "《/》" key for the change of 3 Phase Voltage, 3 Phase Current, Total Power, Power Factor and Frequency
2. Press Key for the change of Total Kwh and KvarH;
3. DO1, DO2
a. Under Alarm Mode: as alarm output status indicate;
b. Under ON/OFF remote control model: as ON/OFF output status indicate;
4. S1, S2 as ON/OFF remote control input status indicate;
5. ALARM flash means alarm output, COM flash means communicating, RUN move means the meter under measuring status;
6.Σmeans measuring 3 phase Total Active Power, Reactive Power, Appearant Power; PE means the Total Active Energy, QE means total Reactive Energy.

5. Menu Operation



6. Menu Operation Illustration

Under Customer Menu Status

1. Press Key more than 3 seconds, enter into customer menu, setting each parameter,
2. If the display is First Class or Second Class, press SET Key , enter into next class display, press key, change other parameters
3. If the display is Second Class or Third Class, press Key, return to previous display
4. If it is Third Class display, press Key for value change, press Key without move, it will change the value continues
press Key for value saving, return to the Second Class display. But press Key, there will be no value setting save, return to the Second Class display directly
5. Press Left Key or Right Key , moving the decimal point
6. After Modifying the parameters, press confirm key more than 5 seconds, retreat customer menu, enter into measuring status

Menu Structure and Function Description

No	Level 1	Display	Level 2	Level 3	Description
1	SEt System Setting SET	CLrE	Clear Energy	Password 0000	Energy can only be cleared when enter into correct password (password:1111)
		LCY	Function Sheild Code	Shield Code 000	If the second digit is "1" (i.e. 010), the value in the menu can be read but not changed.

Host request (Read multi-register)							
1	2	3	4	5	6	7	8
Meter address	Function code	Start address High bit	Start address Low bit	Data byte length High bit	Data byte length Low bit	CRC code Low bit	CRC code high bit
0x01	0x03	0x00	0x00	0x00	0x02	0xC4	0x0B

Meter normal answer (Read multi-register)								
1	2	3	4	5	6	7	8	9
Meter address	Function code	Data byte number	Data 1 High bit	Data 1 Low bit	Data 2 High bit	Data 2 Low bit	CRC code Low bit	CRC code high bit
0x01	0x03	0x04	0x00	0x80	0x71	0x43	0x9E	0x7A

Function code abnormal answer:(For example, host request function code is 0x04)

Meter abnormal answer(Read multi-register)				
1	2	3	4	5
Meter address	Function code	Error code	CRC code Low bit	CRC code high bit
0x01	0x84	0x01	0x82	0xC0

2. Write multi-register

For example：Host reads float data HY1（1st alarm hysteresis value 20.5). The address code of HY1 is 0x0001, because HY1 is float data (4 bytes),seizes 2 data registers. According to IEEE-754 standard, the hexadecimal memory code of decimalist float data 20.5 is 0x0000A441.

Host request (Write multi-register)												
1	2	3	4	5	6	7	8	9	10	11	12	13
Meter address	Function code	Start address High bit	Start address Low bit	Data byte length High bit	Data byte length Low bit	Data byte length	Data 1 high bit	Data 1 low bit	Data 2 high bit	Data 2 low bit	CRC code Low bit	CRC code high bit
0x01	0x10	0x00	0x01	0x00	0x02	0x04	0x00	0x00	0xA4	0x41	0x88	0x93

Meter normal answer (Write multi-register)							
1	2	3	4	5	6	7	8
Meter address	Function code	Start address High 8 bit	Start address Low 8 bit	Data byte length High bit	Data byte length Low bit	CRC code Low bit	CRC code high bit
0x01	0x10	0x00	0x01	0x00	0x02	0x10	0x08

Data position error answer:(For example, host request write address index is 0x0050)

Meter abnormal answer (Write multi-register)				
1	2	3	4	5
Meter address	Function code	Error code	CRC code Low bit	CRC code high bit
0x01	0x90	0x02	0xCD	0xC1

3. DW9L parameter address reflection table

Note: address code is the index of variable array

No.	Address reflection	Variable name	Default value	Byte length	Value range	Read / Write	Remark
0	0x0000	1st alarm value AL1	250	2	-1999～9999	R/W	
1	0x0001	1st alarm hysteresis HY1	10	2	-1999～9999	R/W	
2	0x0002	2nd alarm value AL2	250	2	-1999～9999	R/W	
3	0x0003	2nd alarm hysteresis HY2	10	2	-1999～9999	R/W	
4	0x0004	Voltage transform PT	1. 0	2	1～9999	R/W	
5	0x0005	Current transform CT	1. 0	2	1～9999	R/W	
6	0x0006	Analog output highest value RH	250	2	-1999～9999	R/W	
7	0x0007	Analog output lowest value RL	0. 0	2	-1999～9999	R/W	
8	0x0008	Phase voltage Ua		2	0～9999	R	
9	0x0009	Phase voltage Ub		2	0～9999	R	
10	0x000A	Phase voltage Uc		2	0～9999	R	
11	0x000B	Line voltage Uab		2	0～9999	R	
12	0x000C	Line voltage Ubc		2	0～9999	R	
13	0x000D	Line voltage Uca		2	0～9999	R	

No	Level 1	Display	Level 2	Level 3	Description
2	InP SignalInput Inp	LIn	Network LIn	3-3 3-4	To select the input network of the measured signal
		Pt	Voltage transform Pt	1-9999	To set the voltage signal ratio= Primary coil voltage / Secondary coil voltage
		Ct	Current transform Ct	1-9999	To set the current signal ratio= Primary coil current / Secondary coil current
3	Con Communication parameters	Add	Address Add	0-255	Coulometer address range
		bAd	Baud rate bAd	4.8-9.6	Baud rate: 4.8 means 4800 9.6 means 9600
4	AL ON/OFF value setting	Ad1	1st alarm mode Ad1	1-52	When the value is 0, it is for DO1 function otherwise it is for alarm mode. Please refer to Table 1
		AL1	1st alarm value AL1	-1999-9999	1st alarm value setting
		HY1	1st alarm hysteresis value HY1	-1999-9999	1st alarm hysteresis value setting
		Ut1	1st alarm value unit	1-2	1: means international standard unit K: 1000 times of standard unit the unit of alarm value is the same as alarm hysteresis value.
		Ad2	2nd alarm mode Ad2	1-52	When the value is 0, it is for DO2 function otherwise it is for alarm mode, please refer to Table 1
		AL2	2nd alarm value AL2	-1999-9999	2nd alarm value setting
		HY2	2nd alarm hysteresis value HY2	-1999-9999	2nd alarm hysteresis value setting
		Ut2	2nd alarm value unit	1-2	1: means international standard unit K: 1000 times of standard unit the unit of alarm value is the same as alarm hysteresis value.
5	br Analog output	brn	Transform mode selection	1-26	Please refer to Table 1
		rH	Transform highest value	-1999-9999	Transform analog output 20mA
		rL	Transform lowest value	-1999-9999	Transform analog output 4mA
		Utr	Transform value unit	1-2	1 means international standard unit K means 1000 times of international standard unit.

7. Output function

1. Energy pulse

DW9L provides the function of 4 quadrant energy calculation, 2 energy pulse output and RS485 interface for display and transmit of energy data

The energy pulse of optical couple relay wth open collector enables the long distance transmit of active & reactive energy.

Remote PC terminal, PLC, DI On-Off output and collector module are applied to collect the pulse of coulometer to enable the energy cumulation calculation.

Besides, this output mode is also the energy accuracy check way (National metrology regulations: Standard meter pulse tolerance comparison method)

（1）Electrical characteristic：the output of optical couple relay with open collector, V ≤ 48V，Iz ≤ 50mA.

（2）Pulse constant：7200imp/KWh. It means: The impulse output no. is 7200 when the coulometer counts up to 1KWH.
The point should be emphasized is that the above 1kWh is for the 2nd coil energy. Supposed that PT and CT is connected, the primary coil energy that 7200 pulse refers to is equal to 1kWh X voltage transform PT X current transform CT.

2. DI/DO function:2 way S1-S2 be used to remote control Electric ON/OFF status, 2 DO function be used to control electric devices, when using DO function and alarm mode is setted as “0”, otherwise, DO1, DO2 will be as AL1, AL2 output; DO1, DO2 function control value is writen via RS485 interface
3. Communication function（Please refer to the Communication protocol）
4. Transform output（Please refer to Table 1)
5. Alarm function（Please refer to Table 1)

8. Communication protocol

DW9L series coulometer adpots Modbus RTU communication protocol,RS485 half duplex communication,read function code 0x03, write function code 0x10, adpots 16 digit CRC check,the coulometer does not feedback check error.

Data frame format:

Start bit	Data bit	Stop bit	Check bit
1	8	1	No

Communication abnormal solution:

When abnormal answer, the highest bit of function code will be set to 1. For example, if the request function code from host is 0x04, the return function code from meter is 0x84.

Error type code

0x01---Function code error: Meter does not support the function code it receives.

0x02---Data position error: The data position assigned by host is out of the range of meter.

0x03---Data value error: The data value sent from host is out of the range of meter.

1. Read multi-register

For example, host reads float data AL1（1st alarm value 241.5)

The address code of AL1 is 0x0000, because AL1 is float data(4 byte),seizes 2 data register. According to IEEE-754, the standard hexadecimal memory code of decimalist float data 241.5 is 0x00807143.

No.	Address reflection	Variable name	Default value	Byte length	Value range	Read / Write	Remark
14	0x000E	Phase current Ia		2	0～9999	R	
15	0x000F	Phase current Ib		2	0～9999	R	
16	0x0010	Phase current Ic		2	0～9999	R	
17	0x0011	Phase A active power Pa		2	0.000～9999	R	
18	0x0012	Phase B active power Pb		2	0.0000～9999	R	
19	0x0013	Phase C active power Pc		2	0.000～9999	R	
20	0x0014	Total active power Ps		2	0.000～9999	R	
21	0x0015	Phase A reactive power Qa		2	0.000～9999	R	
22	0x0016	Phase B reactive power Qb		2	0.000～9999	R	
23	0x0017	Phase C reactive power Qc		2	0.000～9999	R	
24	0x0018	Total reactive power Qs		2	0.000～9999	R	
25	0x0019	Phase A apparent power VAa		2	0.000～9999	R	
26	0x001A	Phase B apparent power VAb		2	0.000～9999	R	
27	0x001B	Phase C apparent power VAc		2	0.000～9999	R	
28	0x001C	Total apparent power VAs		2	0.000～9999	R	
29	0x001D	Power factor PFa		2	0～1.0	R	
30	0x001E	Power factor PFb		2	0～1.0	R	
31	0x001F	Power factor PFc		2	0～1.0	R	
32	0x0020	Total power factor PFs		2	0～1.0	R	
33	0x0021	Frequency		2	45～60	R	
34	0x0022	KWH		2	0.00-999999.99	R	
35	0x0023	KVarH		2	0.00-999999.99	R	
Reserve							
36	0x0050	1st alarm mode Ad1	2	1	0～52	R/W	Table 1
37	0x0051	2nd alarm mode Ad2	2	1	0～52	R/W	
38	0x0052	Analog output mode brM	1	1	1～26	R/W	
39	0x0053	1st alarm value unit	0	1	0～1	R/W	
40	0x0054	2nd alarm value unit	0	1	0～1	R/W	Note④
41	0x0055	Analog output value unit	0	1	0～1	R/W	
42	0x0056	Connection mode Link	0	1	0～1	R/W	Note①
43	0x0057	Baud rate bAUd	1	1	0～1	R/W	Note②
44	0x0058	Meter address Add	1	1	0～255	R/W	
45	0x0059	ON/OFF output DO1， DO2		1	0～3	R/W	Remote Control
46	0x005A	ON/OFF input S1，S2		1	0～3	R	Remote Control
47	0x005B	Meter name	0xD9	1	0xD9	R	
48	0x005C	Measuring status indication		1	0～16	R	Note③

R/W---Read and Write both R--Read Only

Reference Table 1: Reference table for Alarm Output and Analog Output

No	Parameter	ON/OFF output Code Low Alarm	ON/OFF output Code High Alarm	Analog output Code 4-20mA
1	Ua(A Phase Voltage)	1	2	1
2	Ub(B hase Voltage)	3	4	2
3	Uc(C hase Voltage)	5	6	3
4	Uab(AB wire Voltage)	7	8	4
5	Ubc(BC wire Voltage)	9	10	5
6	Uca(CA wire Voltage)	11	12	6
7	Ia(A wire Current)	13	14	7
8	Ib(B wire Current)	15	16	8
9	Ic(C wire Current)	17	18	9
10	Pa(A Phase Active Power)	19	20	10

No	Parameter	ON/OFF output Code Low Alarm	ON/OFF output Code High Alarm	Analog output Code 4-20mA
11	Pb(B Phase Active Power)	21	22	11
12	Pc(C Phase Active Power)	23	24	12
13	Ps(Total Active Power)	25	26	13
14	Qa(A Phase Reactive Power)	27	28	14
15	Qb(B Phase Reactive Power)	29	30	15
16	Qc(C Phase Reactive Power)	31	32	16
17	Qs(Total Reactive Power)	33	34	17
18	Sa(A Phase Appearant Power)	35	36	18
19	Sb(B Phase Appearant Power)	37	38	19
20	Sc(C Phase Appearant Power)	39	40	20
21	Ss(Total Appearant Power)	41	42	21
22	PFa(A Phase Power Factor)	43	44	22
23	PFb(B Phase Power Factor)	45	46	23
24	PFc(C Phase Power Factor)	47	48	24
25	PFs(Total Power Factor)	49	50	25
26	Frequency	51	52	26

Note ①: Connection mode

Communication value	0	1
Menu display	3-4	3-3

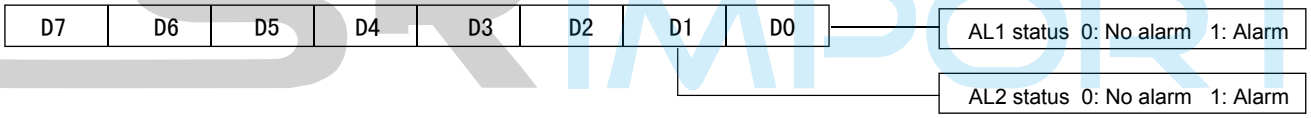
Note ②: Baud rate

Communication value	0	1
Menu display	4.8	9.6

Note④:Alarm / Analog Unit

Com Value	0	1
Menu Display	1	K

Remark ③: Measure status indication



The program of 4 byte character code float data converting to decimalist float data

```
float BytesToFloat(unsigned char*pch)
{
      float result;
      unsigned char *p;
      p=(unsigned char*)&result;
    * p=*pch;*(p+1)=*(pch+1);*(p+2)=*(pch+2);*(p+3)=*(pch+3);
     return result;
}
```

The program of decimalist float data converting to 4 byte character code float data as per IEEE-754 standard

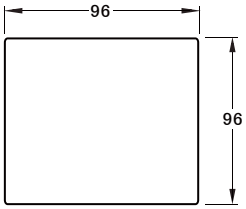
```
void FloatToChar(float Fvalue,unsigned char*pch)
{
     unsigned char*P;
     p=(unsigned char*)&Fvalue;
    *pch=*p;*(pch+1)=*(p+1);*(pch+2)=*(p+2);*(pch+3)=*(p+3);
}
```

The program of achieving 16 bit CRC check code

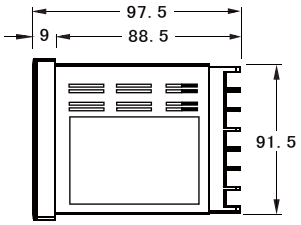
```
unsigned int Get_CRC (uchar*pBuf,uchar num)
{
     unsigned i,j;
unsigned int wCrc=0xFFFF;
for(i=0;i<num;i++)
    {
wCrc^=(unsigned int)(pBuf[i]);
for(j=0;j<8;j++)
          {
if(wCrc &1){wCrc>>=1;   wCrc=0xA001;}
else wCrc>>=1;
          }
    }
    return wCrc;
}
```

9. Dimension and Mounting Size

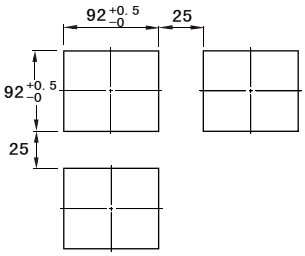
Panel Size



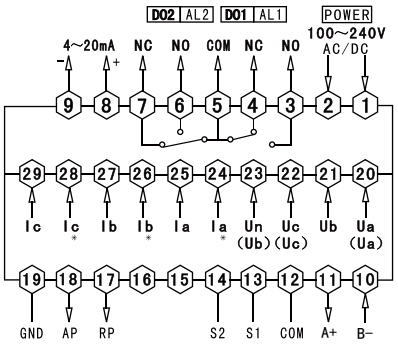
Side-face Size



Mounting Size

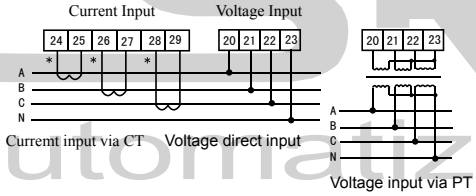


10. Connection Drawing

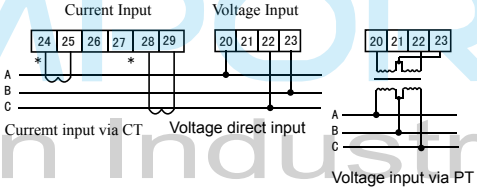


Note: Voltage input connection terminal, it shows 3 phase 3 wire connection method, if there is any change, please turn to the correct diagram on the Meter!

Mode 1 (3 pcs CT): 3 phase 4 wire working mode with central line



Mode 2 (2 pcs CT): 3 phase 3 wire working mode



Explanation：

A.Voltage input：Input voltage should not be higher than the rated input voltage of meter，otherwise a PT should be used.

B.Current input：Standard rated input current is 5A. A CT should be used when the input current is bigger than 5A. If some other meters are connected with the same CT, the connection should be serial for all meters.

C.Please make sure that the input voltage is corresponding to the input current, they should have the same phase sequence and direction，otherwise data and sign error may occur (power and energy).

D.The connection mode of meter which is connected to power network should depend on the CT quantity. For 2pcs of CT，it should be 3 phase 3 wire connection. For 3 pcs of CT，it should be 3 phase 4 wire connection.
Meter wire connection, the input network Link setting in the software menu should accord to the connection mode of the measured load. Otherwise, the measured voltage or power is incorrect.

E. Please pay high attention on the difference between 3 phase 3 wire and 3 phase 4 wire connection. Becasue wrong connection may lead to incorrect calculation of power factor, power and energy.

Caution：

1.Power supply connection must be correct.
2.Pay attention on the phase sequence of voltage signal input.
3.Current signal input should be connected as per the connection drawing.
4.Connection mode should accord to the setting of user menu Link.
5.Energy pulse output is open collector output.
6.Isolation between power supply and circuid board, in cause of leakage switch mis-action