ApoSun

CHD7002 3 Phase Power Energy Meter

Installation & Operation Manual

Safety Matters and Precautions

Dangers and warnings

- This device can only be installed by professionals.
- The manufacturer is not responsible for any malfunctions caused by failure to follow the instructions in this manual.

Risk of Electric Shock, Fire or Explosion

- Equipment can only be installed and maintained by qualified personnel.
- Before performing any operation on the equipment, the voltage input and power supply should be isolated and the secondary windings of all current transformers should be shorted.
- Use appropriate voltage detection equipment to verify that the voltage has been cut.
- All mechanical parts, doors and covers should be restored to their original condition before energizing the unit.
- The correct voltage rating should be provided for the equipment.

Failure to heed the above precautions may result in serious injury.

Contents

Chapter 1 General Information....4
Chapter 2 Order Information....5
Chapter 3 Dimension & Installation....6
3.1 Dimension....6
3.2 Installation....6
Chapter 4 Display & Keys-press Operation....7
4.1 Key menu definition....8
4.2 Real-time data query interface....10
Chapter 5 Functional description....25
5.1 Basic Measurement....25
5.2 Historical freeze....28
5.3 Demand value....28
5.4 Power parameter....29
5.5 Communication Interface....29
Chapter 6 Main Technical Parameters....30
Chapter 7 Communication....32
Chapter 8 Measuring Instrument Type Approval Certificate (2019E347-44)....32
Chapter 9 Appendix....33
9.1 Terminal definition....33
9.2 Typical Connection....33

Chapter 1 General Information

CHD7002 three-phase multi-function power meter is mainly used for power distribution cabinets, switch cabinets, etc. in low-voltage power distribution systems below AC 400V (phase voltage). It can communicate with the instrument through RS485/ Modbus bus communication to manage the instrument network and realize automatic control.

The product performance meets the relevant technical requirements of Class 0.5S of active energy in GB/T 17215.322-2008 and Class 2 of reactive energy in GB/T 17215.323-2008.

CHD7002 provide the main function as below:

- Real-time measuring data
  (Combined measurement of three phase voltage, current, active power, reactive power, apparent power, power factor, frequency, active energy, reactive energy, etc.)
- Demand caculation
  (Demand for average current, total active power, total reactive power and total apparent power)
- Stores historical power records for the last 31 days and the last 12 months
- 24-hour power freezing
- One RS485, ModBus-RTU protocol, can be set to DL645 protocol

Chapter 2 Order Information

CHD7002 – □ – □ – □ – □ ① ② ③ ④ ⑤
① CHD7002 3 Phase Power Energy Meter, size 72W×72H×80L
② Function mode: N: Basic mode A: Basic mode +2 switch inputs + 2 relay outputs
③ Expansion module: (Optional) H: Harmonic function T: SOE function A0: 4-20mA output
④ Power supply: A: 85~265V AC / 80-300V DC E: 24~48V DC
⑤ Measure range: V1: 3×57.7/100V, 5A V2: 3×57.7/100V, 1A V3: 3×220/380V, 5A V4: 3×220/380V, 1A

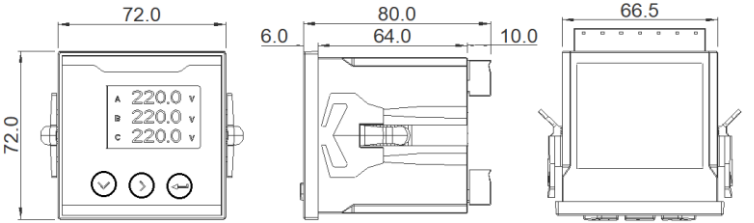
Example: CHD7002-A-H-A-V3

The meter is a multi-function power meter with 3*220/380V 5A measure range, support harmonic function, and with 2 switch inputs & 2 relay outputs. 85-265V AC power supply.

Chapter 3 Dimension & Installation

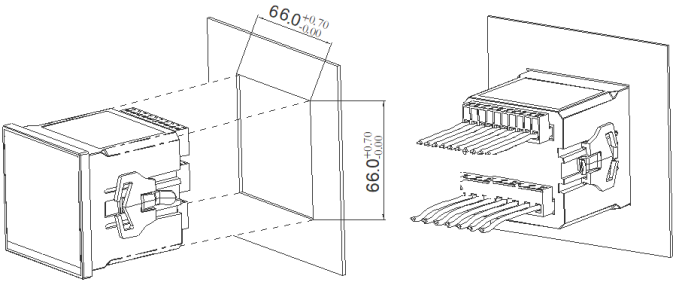
3.1 Dimension

unit：mm



3.2 Installation

unit：mm



Chapter 4 Display & Keys-press Operation

The “RUN” indicator of the meter indicates the device operation at a frequency of 1 Hz. There is a pulse light indicating pulse. Other data is displayed on the LCD. The definition is as follows:

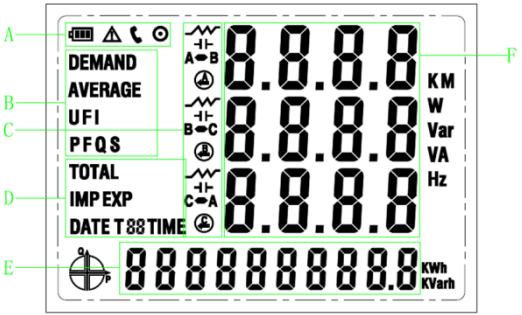


Figure 4-1 Interface Partition Diagram

Character definition:

A: Indicates low battery, internal fault, 485 communication status, etc., if not defined, it is reserved characters;

B: "F" area data type indication;

C: “F” area data inductive and capacitive indication, positive and negative indication, phase sequence indication and circuit reverse or not indication;

D: "E" area data type indication, indication type has total, input, output, date, serial number and time;

E: Auxiliary data area, showing configuration parameters, electrical data,

date and time;

F: The main data area, which can display data such as voltage and current.

4.1 Key menu definition

Display interface can be divided into three categories:

1、Real-time value interface (default interface)

2、Configuration menu

3、Modify the configuration menu

The interface switching relationship is as follows:

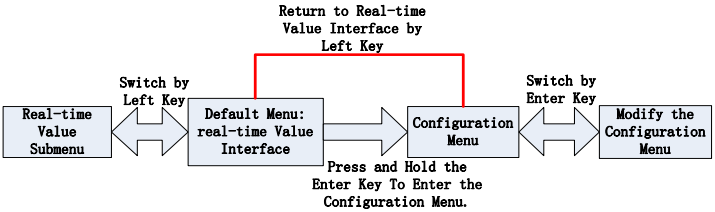


Figure 4-2 Menu Root Directory Switching Relations

Table 4-1 Key Definitions In Each Interface

Interface definition / Key	Real-time value interface	Configuration menu	Modify the configuration menu

Left key	Submenu page turning	Switch to the real-time value interface	Moving cursor position
Upper key	Parent menu page turning	Current interface page turning	Modify bit values
Short press Enter key	Electricity query turning	Switch to Modify Configuration Menu	Enter Modification/Save Modification Switch
Long press Enter key (>5s)	Switch to Configuration Menu		

Note 1: If the password is not entered correctly, the interface will prompt the password error, and the parameters are not allowed to be modified. Wait for 5S and then return to the previously viewed configuration menu (password: 0001)

Note 2: After the password is entered correctly, the validity period remains until the configuration menu is completely exited.

Note 3: If there is no valid key action within 120s after inputting the correct password, the password will be invalid by default and will be returned to the default value of the real-time value.

4.2 Real-time data query interface

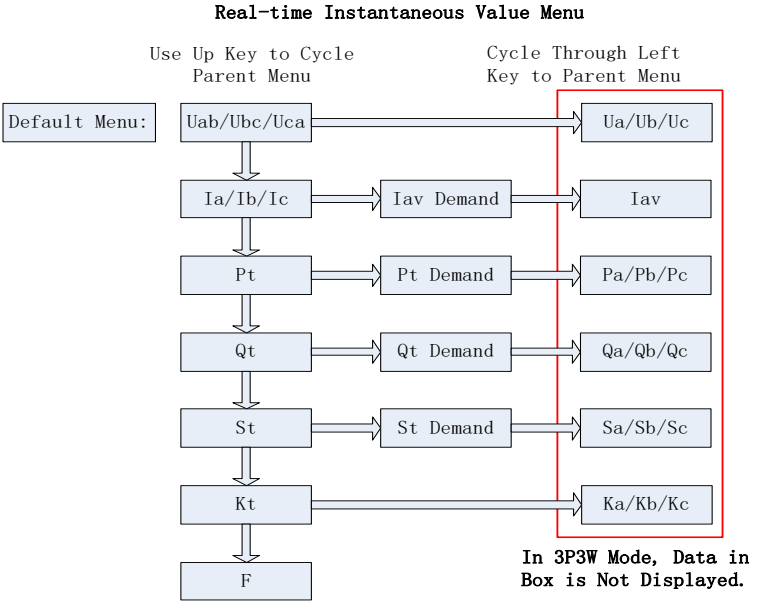
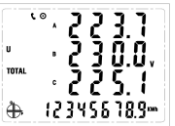


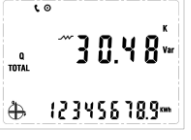
Figure 4-3 Real-time instantaneous value menu

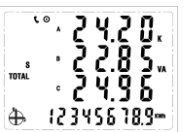
Note: In 3P3W mode, the phase-splitting data in the box is not displayed.

Table 4-2 Real-time instantaneous value menu interface legend

Name	Parent menu legend (upper key)	Submenu legend (Left key)	Remarks

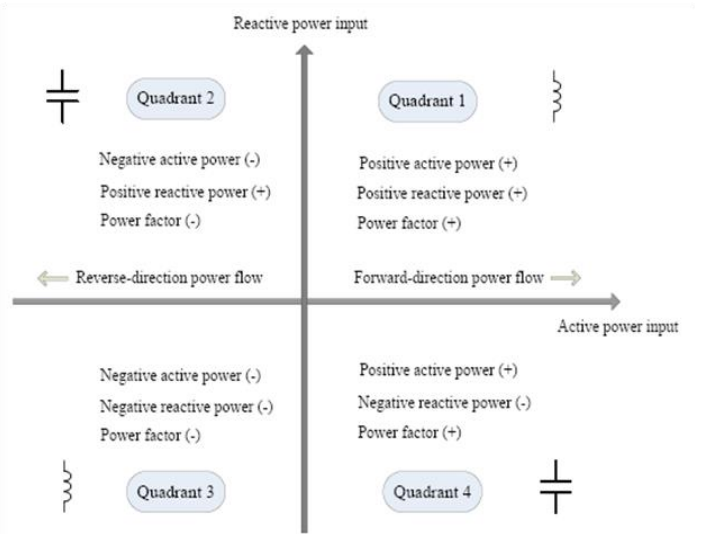
V		Line voltage:  Phase voltage: 	Voltage unit: V; Unsigned number; Default display line voltage; No phase voltage display item in 3P3W mode;
I		Phase current:  Average current demand:  Average current: 	Current unit: A, when it exceeds 1000A, the unit is switched to KA; Unsigned number; Default display phase current;

Active power		Total active power:  Total active power requirement:  Phase active power: 	Active power unit KW, when it exceeds 1000KW, the unit is switched to MW; Signed number; Default display total active power; NO phase active power display item in 3P3W mode;
Re-active power		Total reactive power:  Total reactive power demand:	Reactive power unit Kvar, when it exceeds 1000Kvar, the unit is switched to Mvar; Signed number;

		 Phase reactive power: 	Default display total reactive power; NO phase reactive power display item in 3P3W mode;
Appa-rent power		 	Apparent power unit KVA, when it exceeds 1000KVA, the unit is switched to MVA; Default display total apparent power; NO phase apparent power display item in 3P3W mode;
Power factor			Power factor fixed display three decimal, signed number

			Default display total power factor; NO phase power factor display item in 3P3W mode;
Frequency			Frequency fixed display two decimal places, unit Hz, unsigned number

Note: The active power, reactive power and power factor symbols are defined as follows:



In any Real-time Value Interface, the Following Parameter Menus can be Cycled Through the F Key

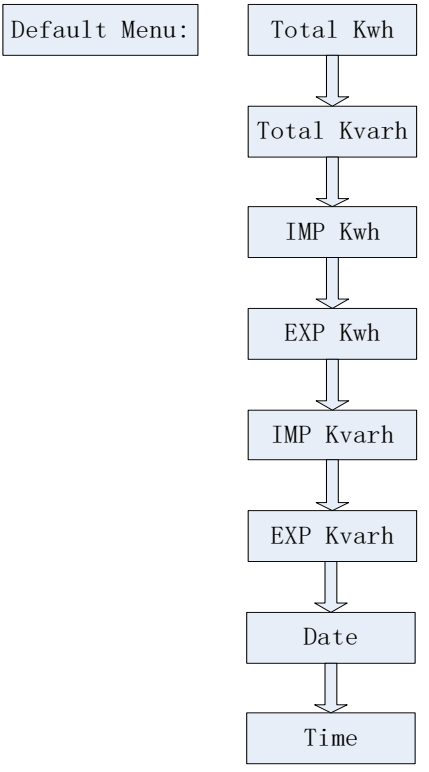


Figure 4-5 Real-time cumulative value menu

Table 4-3 Real-time cumulative value menu interface legend

Name	Legend (short press Enter)	Remarks
Total active power		Electric meter fixed display one decimal, up to 99,999,999.9
Total reactive power		
Input active power		
Output active power		
Input reactive power		

Output reactive power		
Date		
Time		

4.3 Configuration and modification

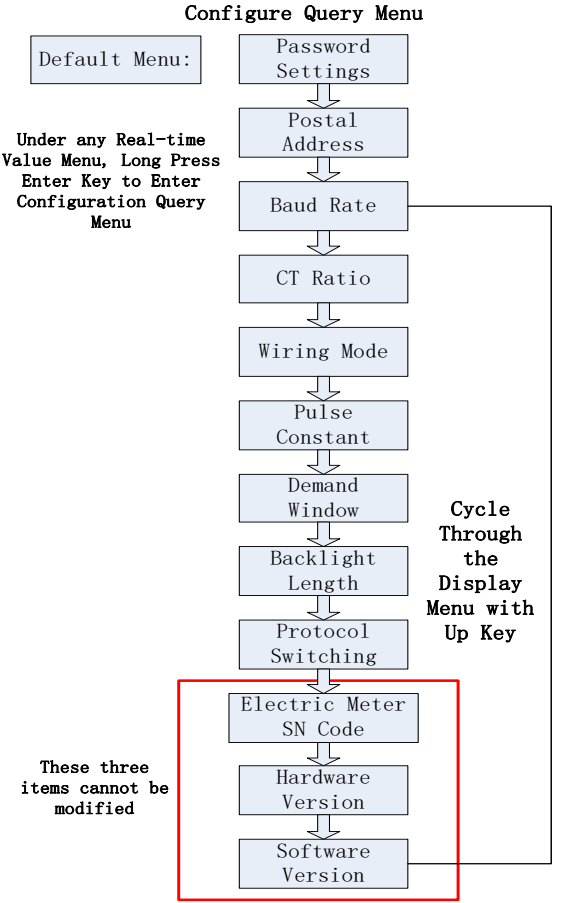


Table 4-4 Configuration query menu interface legend

Name	Legend	Remarks
01: MODBUS Address		MODBUS address, allowable range 1-247 Factory default: 1
02: MODBUS Baud rate	  	MODBUS Baud rate，allowed to choose 9600, 4800, 2400, factory default: 9600
03: CT ratio		CT ratio is the ratio of primary to secondary. The menu can only be queried (cannot be modified) Range 1-5000, factory default: 1

04: Wiring mode	 	Connection mode (four-line star mode and three-line triangle mode). The menu can only be queried (cannot be modified) Factory default mode: four-line star mode
05: Pulse constant		Pulse output constant Allowable range 100-9900, adjustment step size is 100 Factory default 3200

06: Demand window	     	Used to set the period of demand calculation, allowed to choose 5min, 15min, 30min, 45min, 60min Default period: 15min
07: Backlight length	 	Used to set the backlight holding time Allowable range 0-300s, adjustment Step size: 1s Factory default: 30s

08: Protocol switching	 	Used to set the communication protocol type, allowed to choose MODBUS protocol, DL645-2007 protocol Factory default: MODBUS protocol.
09: Ammeter SN code		SN code is the factory serial number of the meter and cannot be changed. When the communication protocol is DL645, it is used as address code.
10: Hardware version information		The instrument version has four digits. First digit upgrade: major version change. Second digit upgrade: general version change. Last two digits upgrade: bug improve. (Cannot be modified)
11: Software version info		

Under the Configuration Query Menu, long press (>5s) Enter to enter the modify configuration menu.

Table 4-5 Password and its error message interface legend

Password	legend Enter the password interface for the first time:  Password error prompt:  	Four-digit password, 9999 for super passwords to log in directly at any time Factory default password: 0001 Parameters can only be modified when user enters the correct password Otherwise, keep 5S back to the previous configuration menu

Note 1: Only under the configuration query interface, you can press Enter key to enter the modified configuration state. If it is the first time to enter the modified state, it will jump to the password input interface. By default, it will be in the input password state (the rightmost bit "0" flickers at 1Hz frequency). Press the left key to move the flashing digit, press the up key to modify the flashing digit value (upward accumulation, over 9 flip to 0)

Note 2: If the password input is incorrect, it is not allowed to modify the parameters, prompt the password error, and keep 5S back to the previous configuration menu.

Note 3: If the password is entered correctly, it will jump back to the configuration menu that was viewed before. By default, it will be in a modifiable state (you can select the rightmost bit to flash at 1Hz or the whole

item to flash at 1Hz). At this time, it will be possible to move the flicker bit by pressing the left key (the selector does not respond to the shift operation), and it will be possible to change the flicker bit value by pressing the up key (accumulating up, flipping over 9 to 0) or switch the selector

Note 4: After entering the correct password, press the Enter key to enter the modification or exit the modification state (save by default).

Note 5: The value can be modified only when the corresponding item is flashing.

Note 6: Press the left key to exit to the real-time value display interface only when it is in a non-modified state.

Chapter 5 Functional description

5.1 Basic Measurement

CHD7002 can measure three-phase voltage, line voltage, phase current, average current, three-phase total active power, active power of each phase, three phases total reactive power, reactive power of each phase, three phases total apparent power, and phase apparent power, three-phase total power factor, phase power factor, frequency.

5.1.1 Real-time basic electrical parameters

CHD7002 measures basic parameters: voltage, current, power, and frequency etc.

Real-time metering	Measuring range
Current	
Single phase	0 ~ 65，000A
Zero sequence	0 ~ 65，000A
Unbalance (%)	0 ~ 100%
Voltage	
Line-line	0 ~ 650kV
Line-neutral	0 ~ 650kV
Active power/Reactive power /Apparent power	
Single phase	0 ~ ± 9999MW/var/VA
Total	0 ~ ± 9999MW/var/VA
Power factor	
Single phase	-1.000 ~ +1.000
Total	-1.000 ~ +1.000
Frequency	
35 ~ 65Hz	35 ~ 65Hz

5.1.2 Voltage

CHD7002 maximum measurement for phase voltage is 400V. In 3P3W system, maximum measurement for line voltage is 500V. Users should be noted this to prevent internal measuring circuit saturation, avoid inaccurate measurements. The voltage wiring mode can be set via panel or communication, supporting 3P4W and 3P3W mode.

Note: After change the wiring mode, users must clear energy value to 0 and re-energize the energy.

5.1.3 Current

CHD7002 must be connected by CT to measure current. CT secondary rated output required to meet the input requirements of CHD7002 rated current (1.5A or 5A). When using an external CT, wiring should prevent open, otherwise it will generate a higher voltage in the secondary role. In the primary excitation effect, causing no casualties or damage to equipment.

Measuring range: 0 ~ 6.5 A (CT secondary).
CT ratio setting range: 1~10000
Users should be noted above range to prevent internal measuring circuit saturation, avoid inaccurate measurements.

5.1.4 Frequency

In different wiring mode, the device measures the frequency from different channel.

In triangle mode, it defaults to measuring the frequency from AB line voltage channel. In 3-phase 4-wire, it measure frequency signal from A phase voltage channel.

In case Line A voltage loss, it measures from Line C voltage input. In case both Line A & C loss, it measures from Line B voltage input.

5.1.5 Power

CHD7002 calculates three-phase active power, reactive power, apparent power, power factor and total active / reactive / apparent power/ power factor.

Power measuring range: 0 ~ ± 9999 MW/Mvar/MVA

(More than 9999 MW/Mvar/VA, it also shows 9999 MW/Mvar/MVA)

Power factor measuring range: -1.000 to +1.000.

Active power, reactive power, and power factor are signed. Users should pay attention to this when querying active/reactive power, and power factor.

Note
When wiring, users should pay attention to the phase sequence of voltage and current. Otherwise, it may cause wrong measuring data. Besides, it is necessary to connect the CTs terminals correctly; otherwise there will be negative power value.

5.2 Historical freeze

Freeze the historical data of the last 31 days of daily electricity consumption.

Freeze monthly historical data for the last 12 months.

It can freeze the historical data of electricity consumption within 24 hours of the day, with a resolution of 15 minutes.

It can freeze the historical data of electricity consumption in the last 2 hours of yesterday, with a resolution of 15 minutes.

5.3 Demand value

Demand value is accumulated value during a specified period divided by the length of that period.

The CHD7002 offers two demand modes: fixed mode and slip mode. In either mode, the demand cycle can be set (5 minutes, 10 minutes, 15 minutes, 30 minutes, 60 minutes can be set). In the fixed mode, the slip time is meaningless; in the slip mode, the slip time can be set (1 minute, 2 minutes, 3 minutes, 4 minutes can be set), and the demand period is 5n times the slip time (n is an integer). The relationship of integer multiples is shown in the following table.

Calculation period (min.)	Can set sliding window size (minutes)
5	1
10	1、2
15	1、3
30	1、2、3
60	1、2、3、4

The demand value can be viewed by display or communication. In non-volatile memory, the CHD7002 holds the maximum value of the demand and provides a demand clearing operation.

CHD7002 provides the following demand data and measuring ranges:

Demand reading	Measuring range
Demand current	
Per phase current	0 ~ 65，000A
Max. peak demand	0 ~ 65，000A
Active power	
Per phase power Total power	0 ~ ± 9999 MW 0 ~ ± 9999 MW
Max. peak of per phase Max. peak demand of total power	0 ~ ± 9999 MW 0 ~ ± 9999 MW

5.4 Power parameter

CHD7002's active and reactive input and output power, depending on the power, can be accumulated up to 99999999.9, displaying one decimal place, when the maximum value is accumulated, it will automatically flip.

5.5 Communication Interface

The device provides 1 RS485 communication interface. The default is MODBUS communication protocol. It can also be modified to DL645 protocol. The communication baud rate can be configured as 2400, 4800 or 9600pbs.

Chapter 6 Main Technical Parameters

Parameter		Range	
Rated parameters	Rated working power	AC 85~265V，DC 100~300V	
	Rated input current	5A or 1A	
	Rated input voltage	3x220/380V	
	Active switching input voltage	220V, open when less than 60V, closed when greater than 178V, maximum input 300V	
	Relay output rated contact capacity	AC 250V/5A or DC 30V/5A	
Parameter		**Range**	**Accuracy**
Parameter accuracy	Voltage	10V~400V	0.2%
	Current	5%~120%	0.2%
	Power factor	-1~1	0.5%
	Active energy	0~99999999.9	Level 0.5S
	Reactive energy	0~99999999.9	Level 2
	Active power	One-phase ： 0~±9999 MW/var/VA Total：0 ~±9999 MW/var/VA	0.5%
	Reactive power		1.0%
	3-phase current unbalance degree	0%~100%	1%
	Harmonic ratio	0%~100%	Level B
Parameter		**Performance**	
Ambient temperature	Power consumption	≤ 2W/4VA	
	Normal operating temperature	-20℃ ~ +60℃	
	Extreme working temperature	-25℃ ~ +75℃	
	Storage temperature	-40℃ ~ +80℃	

	Working humidity	5% ~ 95%, no condensation	
Insula-tion perfor mance	Power frequency withstand voltage	2000VAC	
	Insulation resistance	≥ 100MΩ	
	Impulse voltage	6000V	
IP index	Front panel	IP52	
	Case	IP20	
Project		**Standard**	**Test level**
EMC	Electrostatic Discharge Immunity	GB/T17626.2-2006 (IEC61000-4-2:2001)	Level 4
	Radiated immunity	GB/T17626.3-2006 (IEC61000-4-3:2002)	Level 3
	Electrical fast transient/burst immunity	GB/T17626.4-2008 (IEC61000-4-4:2004)	Level 4 Class B
	Surge immunity	GB/T17626.5-2008 (IEC61000-4-5:2005)	Level 4
	RF field immunity induced mass	GB/T17626.6-2008 (IEC61000-4-6:2006)	Level 3
	Radiated emissions limit	GB 4824-2013 (CISPR11：2010)	Pass
	Voltage dips, short interruptions immunity test	GB/T17626.11-2008 (IEC61000-4-11:2004)	Pass
	Power frequency withstand voltage	GB/T 17215.211-2006	Rated insulation voltage ≤300V. Test voltage 2000V. Rated insulation voltage ≤60V. The test voltage 1000V. 1 min leakage current < 10mA.

Note 1: for the value of starting current, please refer to the relevant provisions of GB / T17215.322-2008 according to the instrument level.

Chapter 7 Communication

See “MODBUS Serial Communication Protocol V1.0” for details.

Chapter 8 Measuring Instrument Type Approval Certificate （2019E347-44）

Chapter 9 Appendix

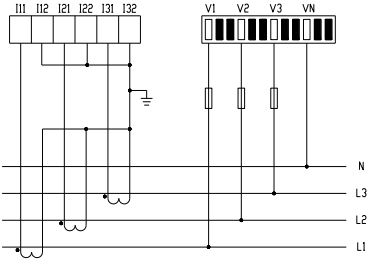
9.1 Terminal definition

No.	Def.	Instruction	No.	Def.	Instruction
1	I3-	Phase A current outgoing line	2	I3+	Phase A current incoming line
3	I2-	Phase B current outgoing line	4	I2+	Phase B current incoming line
5	I1-	Phase C current outgoing line	6	I1+	Phase C current incoming line
7	P1-	Pulse signal-	8	P1+	Pulse signal+
9	485-	RS485 negative pole	10	485+	RS485 positive pole
11	NC	Null	12	V1	Phase A voltage
13	V2	Phase B voltage	14	V3	Phase C voltage
15	VN	Neutral line	16	N/-	Negative pole of power supply
17	L/+	Positive pole of power supply			

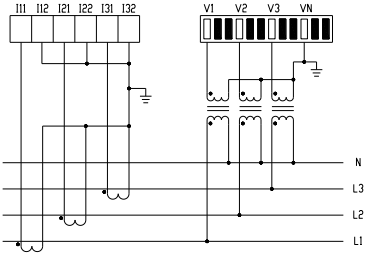
9.2 Typical Connection

CHD7002 supports multiple connection modes of measurement, the following methods were used icons explained.

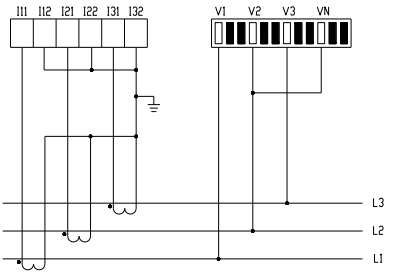
■3-phase 4-wire system, no PT, 3CT



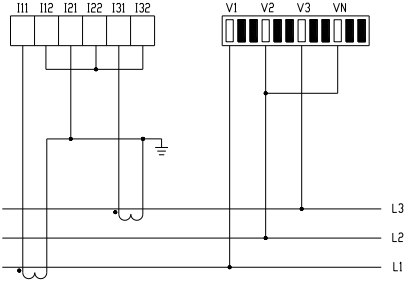
■3-phase 4-wire system，3PT，3CT:



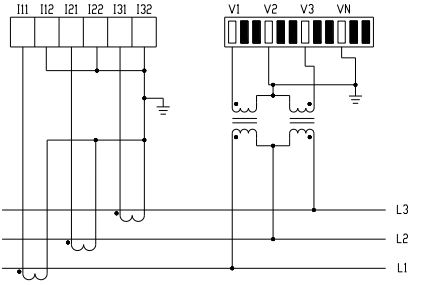
■3-phase 3-wire system, no PT, 3CT



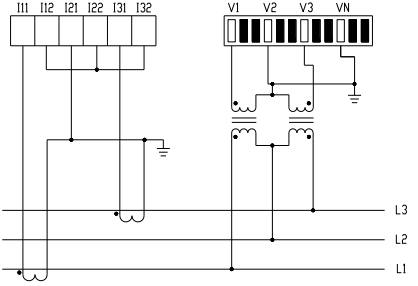
■3-phase 3-wire system, no PT, 2CT



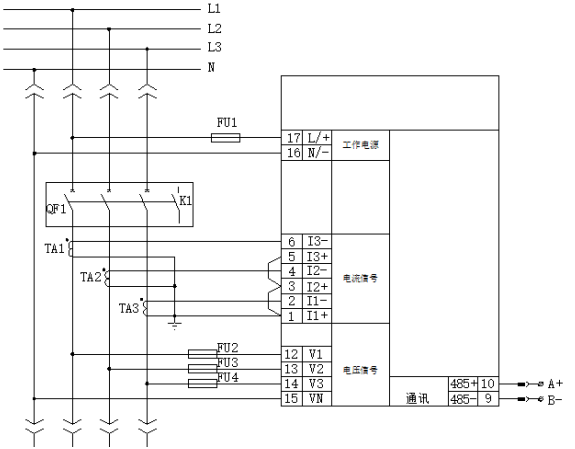
■3-phase 3-wire system, 2PT, 3CT



■3-phase 3-wire system，2PT，2CT:



CHD7002 Typical wiring: 3-phase 4-wire system



CHD7002Typical wiring: 3-phase 3-wire system