ApoSun

CHD9001 Intelligent Power Quality Analyzer

Installation & Operation Manual

Danger and Warning

- This device can be installed only by professionals.
- The manufacturer shall not be held responsible for any accident caused by the failure to comply with the instructions in this manual.

Risks of electric shocks, burning, or explosion

- This device can be installed and maintained only by qualified people.
- Before operating the device, isolate the voltage input and power supply and short-circuit the secondary winding of all current transformers.
- Put all mechanical parts, doors, or covers in their original positions before energizing the device.
- Always supply the device with the correct working voltage during its operation.

Failure to take these preventive measures could cause damage to equipment or injuries to people.

Contents

1. General Information

CHD9001 Multifunctional Power Meter is designed for monitoring and displaying all kinds of electricity parameters. It's widely used in low voltage and medium voltage distribution/ automation system.

CHD9001 provide the main function as below:

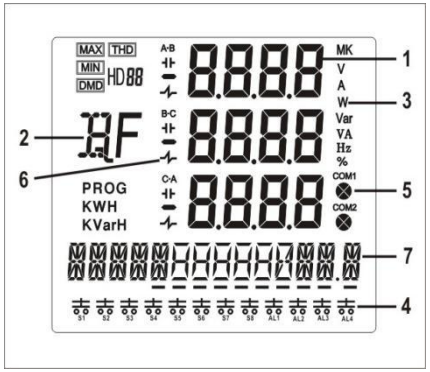
- Real-time measuring data.
- All energy data
- Power quality analysis
- Build-in clock and event log
- Over/ under limit alarm
- Modbus communication
- Digital input/ Digital output (DI/ DO)
- Analog input/ Analog output (AI/ AO, optional)

1.1 Measure

Measuring Function of CHD9001 Basic Unit:

Function	Main	Expand
Three phase line voltage	●	
Three-phase voltage	●	
Three-phase current	●	
Total active power &three phase active power	●	
Total reactive power& three phase reactive power	●	
Total Apparent power&three phase Apparent power	●	
Total power factor &three phase power factor	●	
Frequency	●	
Power quality		
Voltage Deviation	●	
Total voltage/total current harmonic	●	
voltage/current harmonic (2^{nd}~31^{st})	●	
Multi-tariff Energy	●	
Data /time	●	
DO action record	●	
Energy		
Total active energy	●	
Total reactive energy	●	
Three phase input/output active energy	●	
Three phase input/output reactive energy	●	
Multi-tariff Energy	●	
Data /time	●	
Record		
Fifty units SOE record	●	
DI action record	●	
DO action record	●	
Input&output		
DI	2	
DO	2	
AO	2	
Communication		
ModBus communication	●	

1.2 Name of parts



1: Data display

2: Sign

3: Unit

4: DI/DO

5: Communication

6: Load

7: Energy

Explain:

DI/DO is display state. the state is open.

Communication: flash mean is communication state.

Load: ON mean is a capacitive load, ON mean is a inductive load.

1.3 Control and event

CHD9001 provide the main function: Real-time measuring data, Build-in clock and event log, Modbus communication, Digital input/ Digital output (DI/ DO).

Analog input/ Analog output (AI/ AO, optional), Over/ under limit alarm.

2. Terminals and installation

2.1 Environment

2.1.1 Environment request

◇ working temperature：-10℃ ~ +55℃

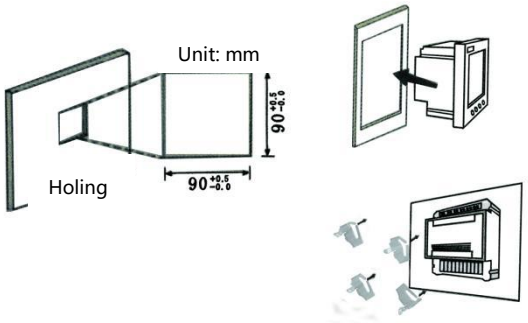
◇ save temperature：-40℃ ~ +70℃

◇ working humidity：5% ~ 95%RH

2.1.2 Installation

Hole size：90*90mm；

Depth：55.5mm



Terminal of Basic Unit：

No.	Mark	Definition
1	V1	Phase A voltage
2	V2	Phase B voltage
3	V3	Phase C voltage
4	Vn	Voltage neutral line
5	I11	In line, phase A current
6	I12	Out line, phase A current
7	I21	In line, phase B current
8	I22	Out line, phase B current
9	I31	In line, phase C current
10	I32	Out line, phase C current
11	G	GND
12	L/+	220VAC firing line or220VDC positive
13	N/-	220VAV Voltage neutral line or 220VDC negative
14	DI1	DI1 input
15	DI2	DI2 input
16	COM	common earth
17	D011/EXAG	Relay1 output 1
18	D012/EXA01	Relay1 output 2
19	D021/EXAG	Relay2 output 1
20	D022/EXA02	Relay2 output 2
21	A	RS485A
22	B	RS485B

2.2 Order Information

CHD9001-□-□-□-□ — Measure parameter: V1: 3×220/380V, 5A

V2: 3×220/380V, 1A

Extend function: H: harmonic T: event record

Module: N: Normal

A: Normal +2 loop switch input

B: Normal +2 loop switch input +2 loop relay output

C: Normal +2 loop4-20mA output

D: Normal +2 loop switch input +2 loop 4-20mA output

Power: default: 85-265Vac/80-300Vdc E: 18-48V DC

CHD9001 size: 96W×96H×55.5Lmm

Example: CHD9001-B-H-V1: 220V/380V, 5A input, harmonic measure, 2 loop switch input, 2 loop relay, power: 85-265VAC.

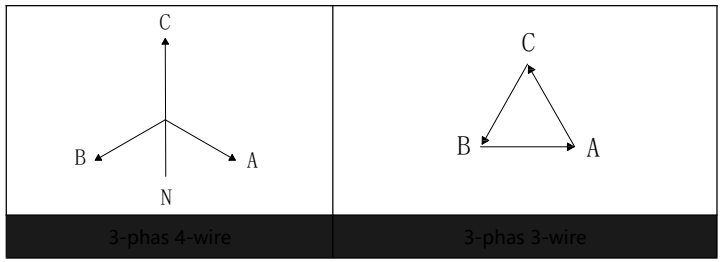
2.3 Power

power: 85Vac ~ 265Vac, 85Vdc ~ 265Vdc, 45-65Hz。

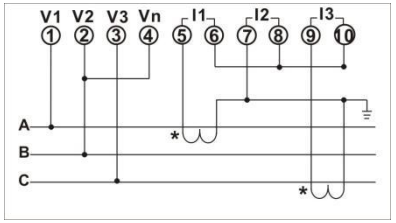
consumption: <5VA

2.4 Terminal

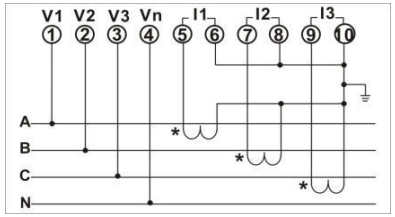
CHD9001 Terminal model.



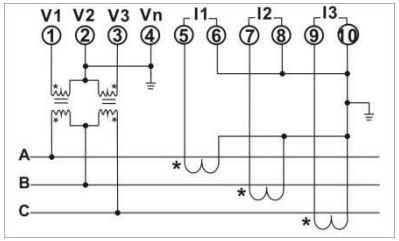
3-phase 4-wire，No PT，3CT:



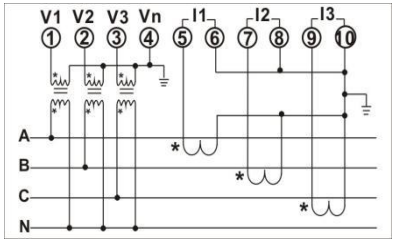
3-phase 4-wire，3PT，3CT:



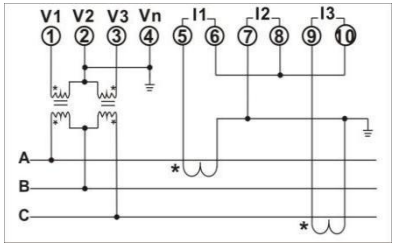
3-phase 3-wire，No PT，3CT:



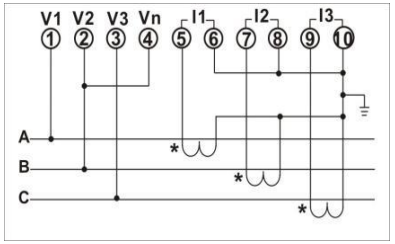
3-phase 3-wire，No PT，2CT:



3-phase 3-wire，2PT，3CT:



3-phase 3-wire，2PT，2CT:



3. Measure parameter

measure	range
voltage	0~100KV
current	0~100KA
Active power	Phase 0~49.99MW
Reactive power	Phase 0~49.99MVar
Apparent power	Phase 0~49.99MVA
frequency	45~65Hz

3.1 voltage

While measuring voltage lower than 300Vph-N / 500Vph-ph, CHD9001 do not need to connect external PTs, it can be input directly. While measuring other higher voltage, CHD9001 need external PTs. If CHD9001 is connected via PTs, the PTs direct affect the measurement accuracy of the meter. So, users should consider the linearity and accuracy rate of PTs.

Normally, Overload capacity of voltage measurement is 120% of rated voltage. Users should pay attention on the voltage input when using the device, and avoid getting wrong data caused by over-scope measurement. Max. rated measuring range is 100KV.

Connection mode of voltage input can be set via panel or communication.

When choose low voltage meter, the connection mode is fixed 3-phase 4-wire.

When choose high voltage meter, user can set the connection mode: 3-phase 4 wire or 3-phase 3-wire.

Tips: It is recommended to clear the energy after change the connection mode

PT primary setting range: 0.1KV to 100KV, and PT primary value should not lower than the rated voltage value.

3.2 current

Only when adopt CTs can CHD9001 measures current. CT secondary rated output must comply with rated current input of CHD9001 (5A or 1A). When connecting external CTs, users must make sure the current is not open circuit. Otherwise, primary excitation will generate high voltage at secondary circuit, causing personal injury or death and equipment damage.

Normally, overload capacity of current measurement is 120% of rated current. Users should pay attention to the current input when using the device, and avoid getting wrong data caused by over-scope measurement. Rated measuring range of current is 0~100KA..

CT primary setting range: 1-50000A, and it shouldn't smaller than the rated current value.

3.3 Active power

Calculates three phase active power Pa，Pb，Pc and total active power. Measuring range: per phase 49.99MW、total phase 100.0MW.

3.4 Reactive power

Calculates three phase reactive power Qa, Qb, Qc and total reactive power. Measuring range: per phase 49.99MVar, total phase 100.0Mvar.

Active power and reactive power with the mark.

Attention
1. Both active power and reactive power value have signs. 2. 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.

3.5 Apparent power

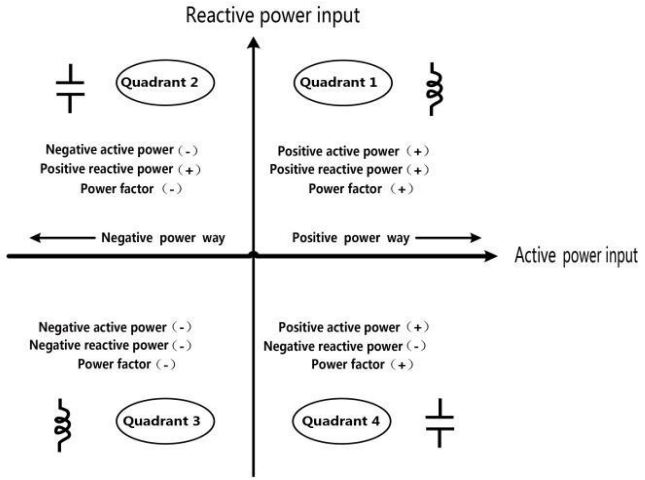
CHD9001 calculates three phase reactive power and total reactive power: Sa, Sb, Sc.

Measuring range: per phase 49.99MVA, total: 100.0MVA

3.6 power factor

CHD9001 measures per phase power factor and total power factor: Measuring range: -1.000 to +1.000.

Like active / reactive power value, the wiring and CTs terminals connecting will affect actual calculated value of power factor.



3.7 Frequency

In different connection modes, CHD9001 samples the system frequency from different channels. In 3-phase 3-wire connection mode, CHD9001 samples the frequency from line AB voltage channel. In other connection modes, it samples frequency from phase A voltage channel. In case phase A voltage is failure, it samples frequency from phase C voltage channel. In case both phase A and C voltage are failure, it samples from phase B voltage channel.

4. Power Quality Analysis

Item	Parameter	Measuring Range	Accuracy
THD	THD for voltage	0~100%	B
	THD for current	0~100%	B
Harmonic Ratio	HR for voltage	2~31st	B
	HR for current	2~31st	B
Other	Voltage deviation	0~100%	B

4.1 General Description

Harmonics are any “non-linear” current or voltage in an electrical distribution system. With these harmonics flowing into the power system, it will affect the reliability of the transformers and protection relays, and it will accelerate the ageing of metalized polyester film, increase the power loss of transmission, and disturb communication or measurement accuracy of instruments.

CHD9001 provides up to 31st harmonics analysis which is strong helpful for power quality analysis.

4.2 THD

CHD9001 measures voltage and current harmonic up to 31st, and calculates THD, TOHD (Odd) and TEHD (Even). Users can read THD data (%) from the LCD or communication. For example, the data is 20.00, the actual THD value is 20.00%.

4.3 Harmonic Ratio for Voltage

CHD9001 measures up to 31st voltage harmonic. Users can read 2~31st voltage harmonic (%) from the LCD or communication. For example, the data is 10.00, the actual harmonic value is 10.00%.

4.4 Harmonic Ratio for Current

CHD9001 measures up to 31st current harmonic. Users can read 2~31st current harmonic (%) from the LCD or communication. For example, the data is 10.00, the actual harmonic value is 10.00%

4.5 Voltage Deviation

CHD9001 calculates 3-phase voltage deviation which is the percentage of deviation compared with its nominal value.

Formula: Voltage Deviation (%) = (Actual voltage – Nominal voltage)/ Nominal voltage×100%

In above formula, the ***Nominal voltage*** is rated voltage. The voltage deviation has a negative or positive sign.

Besides, CHD9001 records the over-limit event for voltage deviation. Users can set a limit value for the voltage deviation.

5. Energy and Multi-tariff Energy Statics

5.1 General Description

According to the direction of power, CHD9001 calculates 4 quadrant kWh/ kvarh, and statics multi-tariff energy and history energy data,

CHD9001 accumulates the energy value since it was powered on at the first time. (In case that users clear the energy to 0, the meter will re-accumulate the energy from 0)

Until the value reach 99, 999, 999.9 kWh/ kvarh, it will auto-turnover.

5.2 Active Energy

CHD9001 calculates the active energy according to the accumulated active power. And it distinguishes the direction of active/ reactive power to separately calculate per phase/ total active energy in 4 quadrants.

5.3 Reactive Energy

CHD9001 calculates the reactive energy according to the accumulated reactive power. And it distinguishes the direction of active/ reactive power to separately calculate per phase/ total reactive energy in 4 quadrants.

5.4 Multi-tariff Energy

CHD9001 statistics the import/ export kWh and import/ export kWh in different tariff.

CHD9001 supports 2 tariff lists. Users can set the 2 lists separately. Each tariff list can be set max. 8 periods in one day and 4 different tariff (F1, F2, F3, F4 means 4 kinds of tariff, and F1 for Sharp, F2 for Peak, F3 for Flat, F4 for Valley).

Below example for setting the tariff lists:

Num. of period	Starting time (to end time)
1st period	0:00
2nd period	3:00
3rd period	6:00
4th period	9:00
5th period	12:00
6th period	15:00
7th period	18:00
8th period	21:00

Below example for setting the mode: 5 periods in one day:

Num. of period	Starting time (to end time)
1st period	6:00
2nd period	10:00
3rd period	12:00
4th period	14:00
5th period	20:00

6. Record Function

6.1 SOE Event Log

CHD9001 can record the event of switch and relay position (i.e. ON/ OFF status.) The event is recorded with time stamp which is stored in CHD9001 by UNIX time format. Time resolution is 1ms. The UNIX time is a system for describing instances in time, defined as the number of seconds that have elapsed since the midnight 00:00:00 on January 1, 1970.

From PILOT software, users can see the event as below format:

No.	Event
1	2012-05-20 09:31:34 792ms Relay 1 ON

7 Setpoint Object

7.1 General Description

CHD9001 provides preset alarm for all parameters. It monitors 2 parameters max at the same time.

7.2 Setpoint analysis

7.2.1 Setpoint Model

There are 2 setpoint types: Over-limit and Under-limit. Users can set the limit as per requirement.

7.2.2 Setpoint Object

CHD9001 can monitor 36 kinds of parameters, as below:

	Object			Parameter
Null	No object		power	Phase A active power
Voltage	A phase voltage			Phase B active power
	B phase voltage			Phase C active power
	C phase voltage			Any Phase active power
	Any phase voltage			Total active power
Current	A phase current			Phase A reactive power
	B phase current			Phase A reactive power
	C phase current			Phase A reactive power
	Any phase current			Any Phase reactive power
Power Quality	A phase Voltage deviation			Total reactive power
	B phase Voltage deviation			Phase A power factor
	C phase Voltage deviation			Phase B power factor
	Any phase Voltage deviation			Phase C power factor
	Phase A voltage THD			Any Phase power factor
	Phase B voltage THD			Total power factor
	Phase C voltage THD		Frequency	frequency
	Any Phase voltage THD			
	Phase A current THD			
	Phase B current THD			
	Phase C current THD			
	Any Phase current THD			

7.2.3 Setpoint condition

After set the monitoring object, users need to set the alarm condition, i.e. set the over/ under limit value.

Note: When setting the over/ under limit, if the limit value is out of measuring range, the setting will be invalid.

7.2.4 Setpoint time

After set the over/ under limit, users need to set the delay time. Setting range: 0~99s. Only it satisfy two conditions that, the monitored object over/ under limit and lasting to delay time, will the setpiont channel be activated. If set the delay time to 0, it means setpoint channel will be activated once the object over/ under limit.

7.2.5 Alarm Output

When the setpoint channel of one relay output is activated, the relay will output signal. One SOE event is record.

7.2.6 Example

Users want to monitor phase A voltage and set the over-limit to 120% Ue, linking with relay 1, set the delay time to 30s. If the actual phase A voltage exceed to the limit and lasting to 30s, then the relay 1 will output the signal. If the phase A voltage return to limit value within 30s, the relay 1 will not respond.。

Note
1. If set the delay time to 0, it means setpoint channel will be activated once the object over/ under limit. 2. If no setting the monitor object, it means no relay alarm.

8. Display Operation

8.1 General Information

CHD9001 has a back-light LCD, user-friendly display. Users can query/set different information by 4 keys according to the menu,

If press the keys, the back-light will be on lasting for 60s.

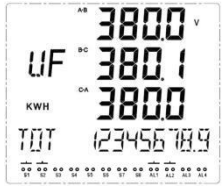
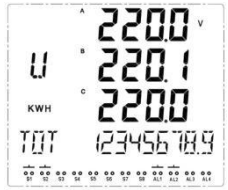
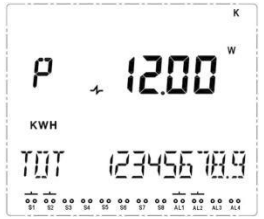
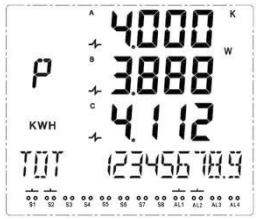
If no continue pressing key, the back-light will be off.

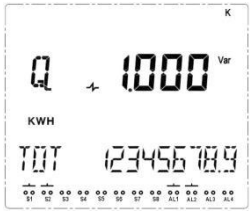
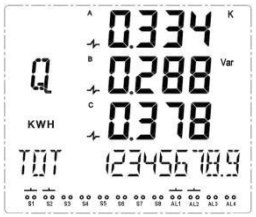
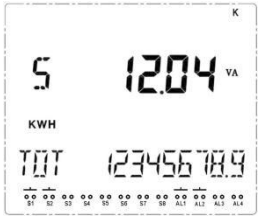
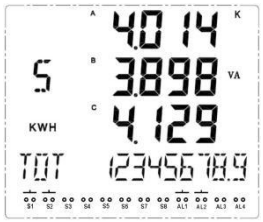
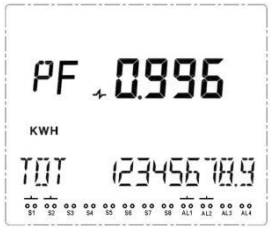
8.2 Keys

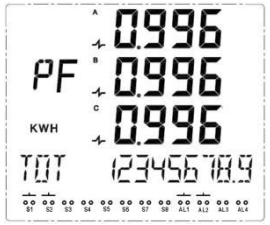
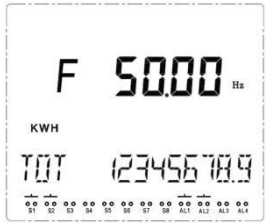
Menu Prompt and Keys Instruction:

Prompt / key	Measure search	menu	Amend menu
left 1st key	Measure value	-	Move cursor
left 2nd key	Power quality	prompt	amend value
left 3rd key	Energy	Into amend	Exit amend
left 4th key	Change menu	Change measure search	-

8.3. Power ON Display

Number	Maps	Mark
neutral voltage		
Phase voltage		When the model is 3P3W then can not this interface.
current		
Total active power		
Phase of active power		When the model is 3P3W then can not this interface.

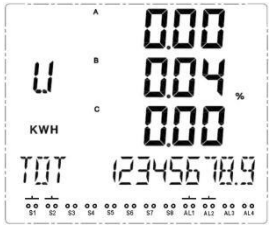
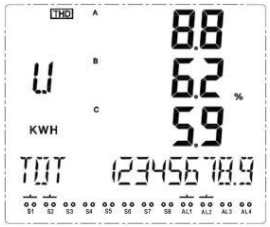
Number	Maps	Mark
Phase of active power		
Total reactive power		When the model is 3P3W then can not this interface.
Total apparent power		
Phase of apparent power		When the model is 3P3W then can not this interface.
Total power factor		

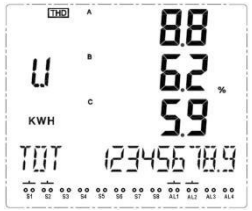
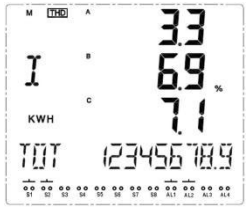
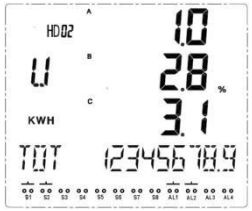
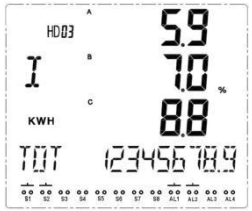
Number	Maps	Mark
Phase of power factor		When the model is 3P3W then can not this interface.
frequency		

Attention 1: preset the 1st key than can see any measure value.

Attention 2: The units and decimal follow measure value change it.

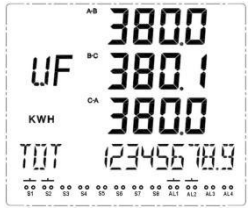
Power quality menu

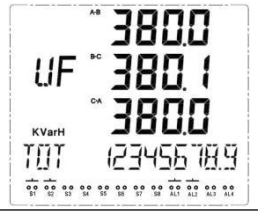
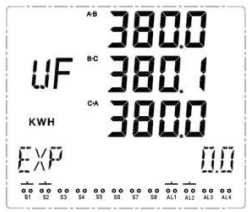
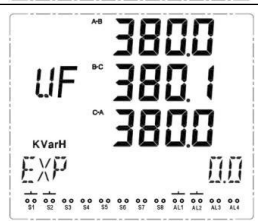
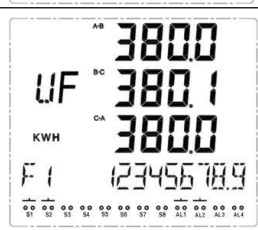
Number	Maps	Mark
Voltage deviation		Voltage deviation = （ture measure value-rated value）/rated value*100% When the model is 3P3W will into line voltage deviation.
Voltage THD		When the model is 3P3W will into line voltage deviation.

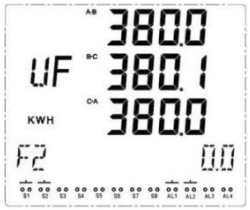
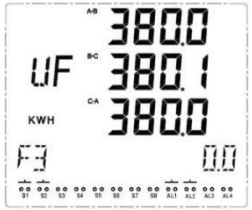
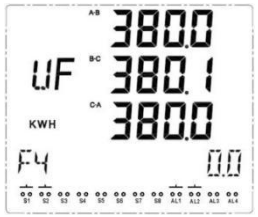
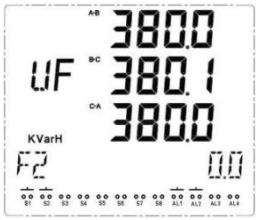
Voltage THD		When the model is 3P3W will into line voltage deviation.
current THD		the value is percent.
phase of voltage THD		When the model is 3P3W will into line voltage deviation. Display 2-31 voltage THD.
Phase of current THD		the value is percent.Display 2-31 current THD.

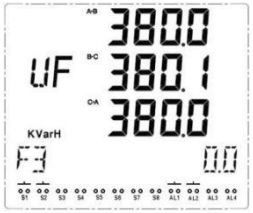
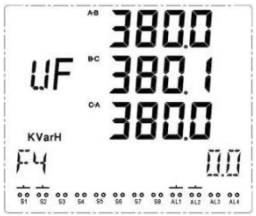
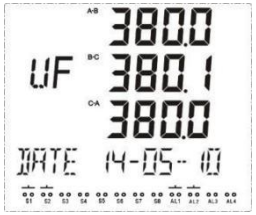
Attention 1: preset the 2nd key than can see any measure value.

Power energy menu

total active energy		Display one decimal，The Max. 99999999.9

Total reactive energy		
Input active energy		
output active energy		
Input reactive energy		
Output reactive energy		
F1 multi-tariff total active energy		

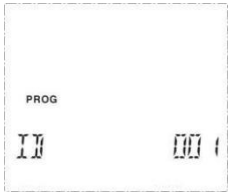
F2 multi-tariff total active energy		
F3 multi-tariff total active energy		
F4 multi-tariff total active energy		
F1 multi-tariff total reactive energy		
F2 multi-tariff total reactive energy		

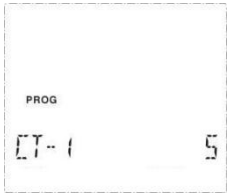
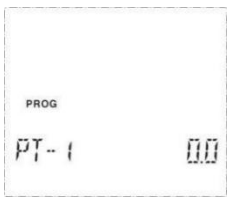
F3 multi-tariff total reactive energy		
F4 multi-tariff total reactive energy		
date		
time		

Attention 1: preset the 3rd key than can see any energy value.

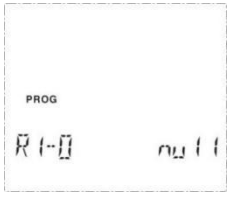
Configuration menu

Number	Maps	Mark
code		Only input the code then can into,preeset left 3rd key can into code interface.

MODBUS		MODBUS address， range 1-247 Default value is 1
MODBUS baud rate		MODBUS baud rate， select 2400, 4800, 9600, 19200, 38400, default 9600
		
		
		
		

CT 1st		CT 1st Range 1-50000，default:5 Unit:A CT 1st multiple is 5
CT 2nd		CT 2nd Select 5 or 1，default:5 Unit:A
		
PT 1st		PT 1st range 0.0-100.0， default :0.0,unit: KV, when set is 0.0 that mean is nope PT
PT 2nd		PT 2nd Range: 10.0-500.0， default: 220.0 unit: V
Connection model		Connection mode, 3P4W star model,3P3W triangle model. default : 3P4W

		
No response the key, wait it.		No response the key, wait it. default: 300s, range: 0-300s, set =0 can not into auto rotation show.
menu space time		menu space time, default:15s, range: 5-60，unit: second
Clear accumulative energy	 	Clear accumulative energy（total energy，input/output energy）User select"YES"and preset confirm key then can clear order.
clear Multi-tariff Energy		

		
Clear SOE	 	Clear multi-tariff energy（multi-tariff active、reactive energy）User select"YES"and preset confirm key then can clear order.
Relay output R1: 1st relay R2: 2nd relay Each relay with R1-M(relay model), R1-0(relay object), R1-H(high relay), R1-L(Low relay), R1-D(relay delay time), R1-R(relay RST)	  	parameter： ■ Into R1-M (relay model)，display the present, “RE” manual work, “AUTO” auto alarm. Into R1-0（relay object) display the present, setting as follow: ■ Into R1-H(high relay), display the high value, range: 0~65535, high value>low value.

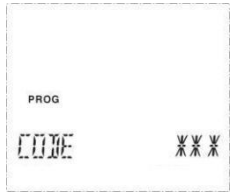
mark	name
null	null
U1	Phase A voltage
U2	Phase B voltage
U3	Phase C voltage
I1	Phase A current
I2	Phase B current
I3	Phase C current
--U--	Any phase voltage
--I--	Any phase current
P1	Phase A active power
P2	Phase B active power
P3	Phase C active power
--P--	Any Phase active power
PTOT	Total active power

- Into R1-L(low relay), display the low value, range: 0~65535, Low value<high value
- Into R1-D(relay delay) , display the delay time, range: 0~1200s (manual work).
- Into R1-R(relay RST), display relay RST, range: 0~1200s (manual work)

	Q1 Phase A reactive power Q2 Phase B reactive power Q3 Phase C reactive power --Q-- Any phase reactive power QTOT Total reactive power PF1 Phase A power factor PF2 Phase B power factor PF3 Phase C power factor PF-- Any Phase power factor PFTOT total power factor F frequency U1DE Phase A voltage deviation U2DE Phase B voltage deviation U3DE Phase C voltage deviation U--DE Any Phase voltage deviation	
Analogue output	  mark / name null / null UAn / Phase A voltage	AO1: 1st analog output AO2: 2nd analog output Parameter: Into AO1(analogue output object), display present analog output

	UBn Phase B voltage UCn Phase C voltage UAB AB line voltage UBC BC line voltage UCA CA line voltage IA Phase A current IB Phase B current IC Phase C current PA Phase A active power PB Phase B active power PC Phase C active power PTOT Total active power QA Phase A reactive power QB Phase B reactive power QC Phase C reactive power QTOT Total reactive power PFA Phase A power factor PFB Phase B power factor PFC Phase C power factor PFTOT Total power factor F frequency	
Version information		four kinds of version

code and wrong interface

code		3 bit code, 999 is super code, default: 001 only input the correct code then can amend it.

Attention 1: *press left 3rd key can into code interface, press Left key can remove and amend it.(0-9 number)*

Attention 2: *only input the correct code then can amend the parameter,Hold"*"state*

Attention 3: *input the correct code then can amend the parameter.press Up key can remove the number.if parameter object is by select then can not remove the number.*

attention4: amend interface press left 3rd key can into amend and exit.

8.4 Programme

CHD9001 parameter via display amend it,The more parameter need via communication setting.

8.4.1 Parameter search

Press SET key into programme interface, operation as 8.3.

8.4.2 Parameter amend

Into programme only the input correct code you can enter the program and amend. The input correct code, **D9001,** default code 1, operation as 8.3.

■ address

Communication address, CHD9001 is MODBUS, range 1 ~ 247.

■ communication bit

CHD9001with 2400, 4800, 9600, 19200, 38400Bps.

■ PT 1st

it's must set correct PT value then measure and display can be correct.

If without PT that PT default is 0.0. PT 1st range: 0.0kV~100.0kV.

■CT 1st

It's must set correct CT value then measure and display can be correct.

CT 1st range : 1A ~ 50000A.

■measure model

It's must set correct measure model that power and other parameter can be correct.

CHD9001 with 3P3W and 3P4W.

■ clear energy

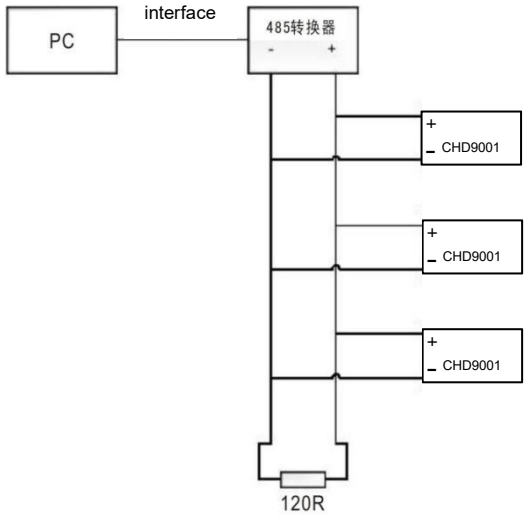
CHD90001 with clear energy function that convenience user.

9 Auxiliary Function

9.1 Communication

CHD9001 provides one RS485 port in basic module, and provides another one as optional function. The two RS485 ports are independent from each other. Normally, on site, one RS485 is enough. Please refer to below connection diagram.

Attention: In the field, in order to avoid signal reflecting, it's common to connect a 120Ω resistance at the end of RS485 network for signal matching.



9.1.1 Communication Medium

The communication medium is No. 22 STP (Shielded twisted pair). Maximum 32 units of meters can be connected in one RS485 circuit. If there is no repeater, the communication bus should not longer than 1,200m.

9.1.2 Communication Protocol

CHD9001 support standard Modbus-RTU protocol. For more details, please refer to CH*D9001 Modbus Register List.*

9.1.3 Communication Parameters

Communication between master and slave device will be available under correctly setting the communication parameters.

The parameters include:

◇ Address: Every meter has its exclusive address. Setting range: 1~247.

◇ Baud rate of RS485 port 1: 2400, 4800, 9600, 19200, 38400 (programmable)

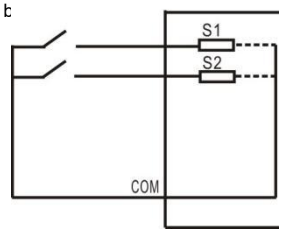
9.1.4 Strong Power Prevention

The RS485 terminals of CHD9001 have the strong power burning prevention function. It means that, even there is 220VAC access to the RS485 terminals (within 5 minutes), the communication board will not be burnt. And the communication will be recovered once cut off the power.

9.2 Status Input

CHD9001 provides 2 status input as basic feature apply to monitor the ON/ OFF position of breakers or switchers etc..

The example of connection as b



Generally, when external contact is ON, the linking status input channel on CHD9001 LCD will be ON. When external contact is OFF, the linking status input channel on CHD9001 LCD will be OFF.

From the communication, 0 means OFF, 1 means ON.

9.3 Relay Output

CHD9001 basic unit provides 2 relay output, and Users can add one optional Relay Output Module which provides the other 2 relay output.

Relay node capacity: 250VAC/5A. There are 2 kinds of relay control mode: Local control and Remote control.

Under local mode, the reply is used for the setpoint function to monitor the parameter. In case the parameter is over/ under limit, the relay will respond, and output signal. (Please refer to ***Chapter 13 Setpoint Alarm*** for more description).

Under remote control mode, users can remote control the relay according to requirement.

The action of relay is different in two modes. So, users should firstly distinguish the relay is in remote control mode or in local control mode.

The default relay control mode of CHD9001 is remote control. Users can change the mode by keys on panel or via communication.

- **Remote control (external):** The relay is controlled by a PC or PLC using commands through communication.

  Release time: Release time is defined as the time since from the relay status is changed by PC or PLC to the relay recover. If set the release time to 0, it means that the relay will not recover. User can set the release time by keys on panes or via communication.

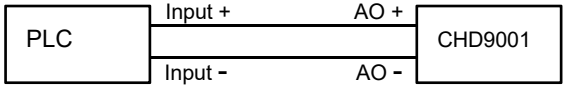
- **Local control (internal)** - The relay will respond once the electrical parameters satisfy alarm conditions. (Please refer to ***Chapter 13 Setpoint Alarm*** for more description).

  Delay time: Delay time is defined as the time since over/ under limit happens. If set the delay time to 0, it means the relay responds as soon as over/ under limit happens.

When the relay is under remote control mode, even though the local control conditions have been set, the relay will not respond. The relay mode must be set to local control mode, otherwise, it will not alarm for over/ under limit.

9.4 4~20mA Analog Input (optional module)

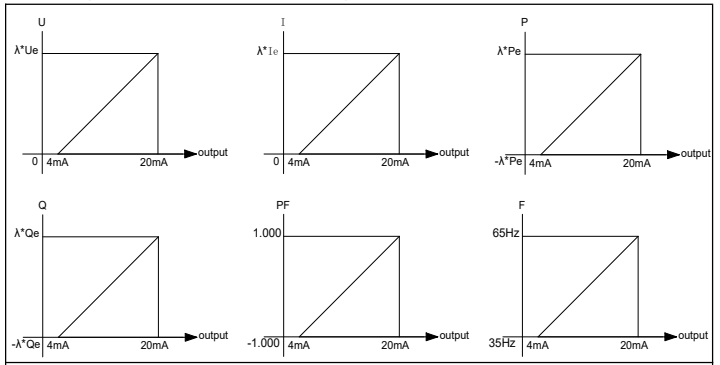
In some projects, for example where request to monitor the main transformers, to measure the non-electric parameters such as the temperature or pressure, users can choose one AI module. Each AI module provides 2 channels of 4~20mA analog input. Each meter can only support one AI module.



The analog output channels can be defined to associate with any one of below parameters:

Voltage	Phase voltage: Va, Vb, Vc
	Line voltage: Vab, Vbc, Vca
current	Ia, Ib, Ic
Active power	Ptot A Ptot B Ptot C total Ptot
Reactive power	Qtot A Qtot B Qtot C total Qtot
Power factor	PFtot A PFtot B PFtot C total PFtot
frequency	F

The Analog Output Curve as below, Magnification factor is λ:



Analog the relationship:

Phase voltage: PT 2nd, 0=4mA, rated value=20mA, over range=20mA

line voltage: PT 2nd , value 1.732， 0=4mA, rated value=20mA, over range =20mA

Current: CT 2nd, 0=4mA， rated value=20mA， over range =20mA

phase power: positive rated value=20mA, minus rated value= 4mA, over range select 20mA or 4mA.

total power: positive rated value=20mA, minus rated value= 4mA, over range select 20mA or 4mA.

Power factor: +1.000=20mA, -1.000=4mA, over range, select 20mA or 4mA.

Frequency: 65Hz=20mA, 35Hz=4mA, over range, select 20mA or 4mA

Null: output is 0

10. Maintenance and Trouble Shooting

Possible problem	Possible cause	Possible solution
The meter has no indication after power NO	The power supply fails to be imposed on the meter.	*Check if the correct working voltage has been imposed on the L/+ and N/- terminals of the meter. *Check if the fuse for the control power supply has been burnt down.
The measured value is not correct or does not conform to the expectation.	The voltage measurement is not correct.	*Check if the neutral point has been connected reliably. *Check if the measured voltage matches the rated parameter of the meter. Check if PT ratio has been set correctly.
	The current measurement is not correct.	*Check if the measured current matches the rated parameter of the meter. *Check if CT ratio has been set correctly.
	The power measurement is not correct.	*Check if the connection mode has been set correctly. *Check if the phase sequence corresponding to the voltage and the current is correct. *Check if the wiring of current terminals are correct
The DI status is not change	The DI operating voltage is not correct.	*Check if the types of external nodes match the rated parameters of the meter. *Check if the external connection is correct.
The relay no respond	The relay does not receive the control command.	*Check if the communication link is correct.
	The working mode of the relay is not correct.	*Check if the current relay is under the correct control mode.
The upper end device can not communicate with the meter	Communication address error	*Check if the address of the meter is consistent with its definition or if there are more than two identical addresses in the same network.
	Baud rate error	*Check if the baud rate setting on the meter is consistent with the upper end device.
	The communication link has not been connected to the terminal resistor.	*Check if the 120-Ohm resistor has been connected.
	The communication link suffers interference.	*Check if the communication-shielding layer has been earthed effectively.
	The communication line is interrupted.	*Check if the communication cable has been disconnected.

11. Technical Specification

size	panel：96mm（L）× 96mm（W）× 16mm（H） Cut-out：96mm（L）× 96mm（W）× 55.5mm（H）	
IP index	front panel：	IP52
	case：	IP30
measure	2 phase Y model	
	3 phase △ model	
power	Require external power supply	

Parameter	Measuring Range	accuracy	mark
power(> 30V)	5% ~ 120%	±0.2%	resolution ratio：0.01V
current	1% ~ 120%	±0.2%	resolution ratio：0.001A
Apparent power	1% ~ 120%	±1%	resolution ratio：0.001kVA
Active power	1% ~ 120%	±1%	resolution ratio：0.001kW
Reactive power	1% ~ 120%	±1%	resolution ratio：0.001kvar
Power factor	-1 ~ 1	±0.5%	0.001
frequency	35 ~ 65 Hz	±0.5%	resolution ratio：0.01HZ
Active energy	0 ~ 99999999	0.5s	GB/T17215.322-2008
Reactive energy	0 ~ 99999999	2 class	GB/T17215.323-2008
Time error	0 ~ 24hour	±1 S	
Event log	1ms		
Power quality		B Class	

Item	Standard	Level
Oscillatory waves immunity test	GB/T17626.12-1998 (IEC61000-4-12:1995)	III
Electrostatic discharge immunity	GB/T17626.2-2006 (IEC61000-4-2:2001)	III
Radiated,radio-frequency, Electromagnetic field immunity test	GB/T17626.3-2006 (IEC61000-4-3:1998)	IV
Electrical fast transient/burst immunity test	GB/T17626.4-2008 (IEC61000-4-4:1998)	III
Surge immunity test	GB/T17626.5-2008 (IEC61000-4-5:2005)	III
Immunity to conducted disturbances, induced by radio-frequency fields	GB/T17626.6-2008 (IEC61000-4-6:1998)	III
Power frequency magnetic field immunity test	GB/T17626.8-2008 (IEC61000-4-6:2001)	III
Electromagnetic emission limit value	GB/T14598.16-2002 (IEC60255-25:2000)	OK
Power frequency immunity test	GB/T17626.8-2008 (IEC61000-4-8:2001)	A

CHD9001_MODBUS-RTU

1. 【General Information】

All communications on the RS-485 loop confirms to a MASTER/SLAVE scheme, in this scheme, information and data is transferred between a MODBUS MASTER device and up to 32 SLAVE monitoring devices.

The address field is 1-byte long and identifies which salve device the packet is for valid addresses range between 1 and 247. the slave device whose address matches the value in this field will perform the command specified in the packet.

The packages from MASTER are named request, the packages from SLAVE are named response.

Function supported as below:

Function code	meaning	action
0x03	Read registers	Obtains the current value in one or more holding registers of the CHD9001
0x10	Preset multiple registers	Places specific binary values into a series of consecutive holding registers of the CHD9001
0x05	Relay control	Write 0×FF00 to close(ON) the relay

data：8bit

stop：1bit

calibration:Null

【exception response】

If a modbus master device sends a noneffective command to a CHD9001 or attempts to read a noneffective holding register, an exception response will be generated. The exception response consists of the slave address,function code, error code and error check field. The high order bit of the function code is set to 1 to indicate that the packet is an exception response.

Below list describes the meaning of exception codes:

Illegal function code	
Slave address	1 byte
Function code	1 byte
defect code	2 bytes
CRC code	2 bytes

The function code is set to 1 to indicate that the packet is an exception response.

Below list describes the meanings of exception codes:

Illegal code	meaning
01H	Receive the error command
02H	The requested register number is too long
03H	Receive the address referenced in the data field an invalid address

2、【Function code】

2.1 Read registers

Read one or more registers.

registers（Master-CHD9001）			Response(CHD9001-Master)	
Slave address	1 byte		Slave address	1 byte
function code 03H	1 byte		function code 03H	1 byte
Start address	2 bytes		Number of byte（2*registers）	1 byte
Number of registers	2 bytes		1st registers	2 bytes
CRC code	2 bytes		2nd registers	2 bytes
			……	
			CRC code	2 bytes

Attention:it can read forty registers one time.

2.2 setting registers(0x10 function code)

Setting one or more registers.

write registers(master-CHD9001)			response(CHD9001-master)	
Slave address	1 byte		Slave address	1 byte
function code 10H	1 byte		function code 10H	1 byte
Start address	2 byte		Start address	2 bytes
Number of registers	2 bytes		Number of registers	2 bytes
Number of byte（2*registers）	1 byte		CRC code	2 bytes
1st registers				
2nd registers				
……				
CRC ode	2 bytes			

2.3 Relay control (function Code 05H)

Use 05 command to control the relay.relay are address starting at 0: relay 1 is addressed as 0.

request the relay to be ON: 0xFF00

request the relay to be OFF: 0x0000

all other values are illegal and will not affect the relay.

Request packet（master→CHD9001）			Response packet（CHD9001→master）	
Slave address	1 byte		Slave address	1 byte
05H(function code)	1 byte		05H(function code)	1 byte
Start register address	2 bytes		Start register address	2 bytes
Data field	2 bytes		Data field	2 bytes
CRC check code	2 bytes		CRC check code	2 bytes

3、【registers list】

3.1 measure registers list

Slave address	meaning	mark
40001	AB line voltage	×0.01, unit:V
40002	BC line voltage	
40003	CA line voltage	
40004	Phase A current	×0.001 unit:A
40005	Phase B current	
40006	Phase C current	
40007	3rd quadrant total Ptot(Low)	×0.1, unit:W
40008	3rd quadrant total Ptot(high)	
40009	3rd quadrant total Qtot(Low)	×0.1, unit:W
40010	3rd quadrant total Qtot(high)	
40011	3rd quadrant total apparent power(low)	×0.1, unit:W
40012	3rd quadrant total apparent power(High)	
40013	3rd quadrant total power factor	×0.001
40014	frequency	×0.01，unit:HZ
40015	Phase A voltage	×0.01，unit:V
40016	Phase B voltage	No value in 3P3W
40017	Phase C voltage	system.

40018	Phase A active power	×0.1，unit:W
40019	Phase B active power	No value in 3P3W
40020	Phase C active power	system.
40021	Phase A reactive power	×0.1，unit:W
40022	Phase B reactive power	No value in 3P3W
40023	Phase C reactive power	system.
40024	Phase A apparent power	×0.1，unit:W
40025	Phase B apparent power	No value in 3P3W
40026	Phase C apparent power	system.
40027	Phase A power factor	×0.001
40028	Phase B power factor	No value in 3P3W
40029	Phase C power factor	system.
40030	switch	Bit0 meaning D1
40031	relay	0 meaning OFF,1 meaning ON,

Attention 1:only read as above registers

Attention 2:total Ptot、Qtot with 32 bytes.

Attention 3:total apparent power without 32 bytes.

Attention 4:phase Ptot、Qtot and total phase Pftot all with 16 bytes.

Attention 5:the other registers all is 16 bytes.

3.2 energy list

registers	meaning	mark
40501	total active energy(low)	×0.1， unit:kWh
40502	total active energy(high)	
40503	total reactive energy(low)	×0.1， unit:kWh
40504	total reactive energy(high)	
40505	Input active energy(low)	×0.1， unit:kWh
40506	Input active energy(high)	
40507	Output active energy(low)	
40508	Output active energy(high)	
40509	Input reactive energy(low)	×0.1， unit:kWh
40510	Input reactive energy(high)	
40511	Output reactive energy(low)	
40512	Output reactive energy(high)	
40513	Total active energy(Low) of tariff 1#	×0.1， unit:kWh
40514	Total active energy(high) of tariff 1#	
40515	Total active energy(Low) of tariff 2#	
40516	Total active energy(high) of tariff 2#	
40517	Total active energy(Low) of tariff 3#	
40518	Total active energy(high) of tariff 3#	
40519	Total active energy(Low) of tariff 4#	
40520	Total active energy(high) of tariff 4#	
40521	total reactive energy(Low) of tariff 1#	×0.1， unit:kWh
40522	total reactive energy(high) of tariff 1#	
40523	total reactive energy(Low) of tariff 2#	
40524	total reactive energy(high) of tariff 2#	
40525	total reactive energy(Low) of tariff 3#	
40526	total reactive energy(high) of tariff 3#	
40527	total reactive energy(Low) of tariff 4#	
40528	total reactive energy(high) of tariff 4#	

Attention 1:only read as above registers

Attention 2:energy data all with 32 bytes.

3.3 power quality registers

registers	meaning	mark
41001	phase A/AB line voltage deviation	×0.1
41002	phase B/BC line voltage deviation	unit: %
41003	phase C/CA line voltage deviation	
41004	save	
41005	save	
41006	save	
41007	Phase A/AB line voltage THD	×0.1
41008	Phase B/BC line voltage THD	unit: %
41009	Phase C/CA line voltage THD	

41010	Phase A current THD	
41011	Phase B current THD	
41012	Phase C current THD	
41013	Phase A/AB line voltage 2nd harmonic component	×0.1
41014	Phase B/BC line voltage 2nd harmonic component	unit: %
41015	Phase C/CA line voltage 2nd harmonic component	
41016	2nd harmonic component for Ia	
41017	2nd harmonic component for Ib	
41018	2nd harmonic component for Ic	
41019-41021	3rd harmonic component for voltage	
41022-41024	3rd harmonic component for current	
41025-41027	4th harmonic component for voltage	
41028-41030	4th harmonic component for current	
41031-41033	5th harmonic component for voltage	
41034-41036	5th harmonic component for current	
41037-41039	6th harmonic component for voltage	
41040-41042	6th harmonic component for current	
41043-41045	7th harmonic component for voltage	
41046-41048	7th harmonic component for current	
41049-41051	8th harmonic component for voltage	
41052-41054	8th harmonic component for current	
41055-41057	9th harmonic component for voltage	
41058-41060	9th harmonic component for current	
41061-41063	10th harmonic component for voltage	
41064-41066	10th harmonic component for current	
41067-41069	11th harmonic component for voltage	
41070-41072	11th harmonic component for current	
41073-41075	12th harmonic component for voltage	
41076-41078	12th harmonic component for current	
41079-41081	13th harmonic component for voltage	
41082-41084	13th harmonic component for current	
41085-41087	14th harmonic component for voltage	

41088-41090	14th harmonic component for current	
41091-41093	15th harmonic component for voltage	
41094-41096	15th harmonic component for current	
41097-41099	16th harmonic component for voltage	
41100-41102	16th harmonic component for current	
41103-41105	17th harmonic component for voltage	
41106-41108	17th harmonic component for current	
41109-41111	18th harmonic component for voltage	
41112-41114	18th harmonic component for current	
41115-41117	19th harmonic component for voltage	
41118-41120	19th harmonic component for current	
41121-41123	20th harmonic component for voltage	
41124-41126	20th harmonic component for current	
41127-41129	21st harmonic component for voltage	
41130-41132	21st harmonic component for current	
41133-41135	22nd harmonic component for voltage	
41136-41138	22nd harmonic component for current	
41139-41141	23rd harmonic component for voltage	
41142-41144	23rd harmonic component for current	
41145-41147	24th harmonic component for voltage	
41148-41150	24th harmonic component for current	
41151-41153	25th harmonic component for voltage	
41154-41156	25th harmonic component for current	
41157-41159	26th harmonic component for voltage	
41160-41162	26th harmonic component for current	
41163-41165	27th harmonic component for voltage	
41046-41048	27th harmonic component for current	
41169-41171	28th harmonic component for voltage	
41172-41174	28th harmonic component for current	
41175-41177	29th harmonic component for voltage	
41178-41180	29th harmonic component for current	
41181-41183	30th harmonic component for voltage	

41184-41186	30th harmonic component for current	
41187-41189	31st harmonic component for voltage	
41190-41192	31st harmonic component for current	

Attention 1:only read as above registers

Attention 2: Voltage deviation is 16 bytes.

3.4 SOE (Event Log) registers list

Register Address	Description	Remarks
42001–42004	No. 1 event	
42005–42008	No. 2 event	
42009–42012	No. 3 event	
42013–42016	No. 4 event	
42017–42020	No. 5 event	
42021–42024	No. 6 event	
42025–42028	No. 7 event	
42029–42032	No. 8 event	
42033–42036	No. 9 event	
42037–42040	No. 10 event	
42041–42044	No. 11 event	
42045–42048	No. 12 event	
42049–42052	No. 13 event	
42053–42056	No. 14 event	
42057–42060	No. 15 event	
42061–42064	No. 16 event	
42065–42068	No. 17 event	
42069–42072	No. 18 event	
42073–42076	No. 19 event	
42077–42080	No. 20 event	
42081–42084	No. 21 event	
42085–42088	No. 22 event	

42089–42092	No. 23 event	
42093–42096	No. 24 event	
42097–42100	No. 25 event	
42101–42104	No. 26 event	
42105–42108	No. 27 event	
42109–42112	No. 28event	
42113–42116	No. 29 event	
42117–42120	No. 30 event	
42121–42124	No. 31 event	
42125–42128	No. 32 event	
42129–42132	No. 33 event	
42133–42136	No. 34 event	
42137–42140	No. 35 event	
42141–42144	No. 36 event	
42145–42148	No. 37 event	
42149–42152	No. 38 event	
42153–42156	No. 39 event	
42157–42160	No. 40 event	
42161–42164	No. 41 event	
42165–42168	No. 42 event	
42169–42172	No. 43 event	
42173–42176	No. 44 event	
42177–42180	No. 45 event	
42181–42184	No. 46 event	
42185–42188	No. 47 event	
42189–42192	No. 48 event	
42193–42196	No. 49 event	
42197–42200	No. 50 event	

SOE format

Register Address	Description	Remarks
1	SOE model	Bit15-Bit8: event object(1 with valid)

1	SOE model	Bit13: relay 2 Bit12:relay 1 Bit9:DI 2 Bit8:D1 1 Other save Bit0： action model 1:ON 0:OFF
2	UNIX time Low	
3	UNIX time High	
4	UNIX time MS	
4250	SOE number	0-59999

Attention 1: as above register only can read it.

3.5 time register list

Register Address	Description	Remarks
43001	second	0 – 59
43002	minute	0 – 59
43003	time	0 – 23
43004	date	1 – 31
43005	month	1 – 12
43006	year	0 – 99
43007	UNIX time Low	
43008	UNIX time High	
43009	UNIX time MS	0 – 999

Attention 1: as above register all can read and write.

3.6 command data registers list

Register Address	Description	Remarks
46001	Communication address	1 – 247 Default:1
46002	Communication baud rate	0: 2400 1: 4800 2: 9600 3: 19200 4: 38400 9600 Default: 9600
46003	CT 1st	range1-50000, Default: 5 unit: A
46004	CT 2nd	unit: A Default: 5 select 5 or 1
46005	PT 1st	range: 0.0-100.0, Default : 0.0 ratio 0.1 Unit: KV Setting=0 without PT.
46006	PT 2nd	Ratio: 0.1 unit: V Default: 220.0 range: 10.0-500.0
46007	Measure model	0: 3P4W 1: 3P3W Default: 3P4W
46008	wait	0-300, unit: S
46009	Interval time	5-60, unit: S
46010-46016	reserve	Reserve
46017	Clear energy	write 1234 can clear
46018	clear tariff	write 2345 can clear
46019	clear SOE	write 3456 can clear
46020-46025	reserve	reserve
46026	Object relay model	0: Auto control 1: manual working

46027	Relay-output object	0: null 1: Va 2: Vb 3: Vc 4: Ia 5: Ib 6: Ic 7: any phase voltage 8: any phase current 9: phase A active power 10: phase B active power 11: phase C active power 12: any phase active power 13: total active power 14: phase A reactive power 15: phase B reactive power 16: phase C reactive power 17: any phase reactive power 18: total reactive power 19: phase A power factor 20: phase B power factor 21: phase C power factor 22: any phase power factor 23: total power factor 24: frequency 25: phase A voltage deviation 26: phase B voltage deviation 27: phase C voltage deviation 28: any phase voltage deviation 29: Phase A voltage THD 30: phase B voltage THD 31: PHASE C voltage THD 32: any phase voltage THD

		33: Phase A current THD 34: phase B current THD 35: phase B current THD 36: any phase current THD reserve
46028	upper limit,relay 1	0-65535.
46029	Lower limit,relay 1	
46030	delay time,relay 1	0 – 1200s, 0 meaning immediately
46031	Release time, relay 1	0 – 1200s
46032-46037	relay 2 register	name relay register 6026-46031s
46038	Analog output -1	0: forbid output 1: phase A voltage 2: phase B voltage 3: phase C voltage 4: B line voltage 5: BC line voltage 6: CA line voltage 7: phase A current 8: phase B current 9: phase C current 10: phase A active power 11: phase B active power 12: phase C active power

		13: total active power 14: phase A reactive power 15: phase B reactive power 16: phase C reactive power 17: total reactive power 18: phase A power factor 19: phase B power factor 20: phase C power factor 21: total power factor 22: frequency Other: reserve
46039	Analog output-2	Same Analog output-1

3.7 TOU(Multi-tariff) data register list

Register Address	Description	Remarks
47001	total segment of tariff	Range: 1-8, default: 8
47002	Previous 1st segment of tariff	Range: 0-47, default: 0
47003	1st segment of billing	Range: 0-3, default: 0
47004	previous 2nd segment of tariff	Range: 0-47, default: 6
47005	2nd segment of billing	Range: 0-3, default: 1
47006	Previous 3rd segment of tariff	Range: 0-47, default: 12
47007	3rd segment of billing	Range: 0-3, default: 2
47008	Previous 4th segment of tariff	Range: 0-47, default: 18
47009	4th segment of billing	Range: 0-3, default: 3
47010	Previous 5th segment of tariff	Range: 0-47, default: 24
47011	5th segment of billing	Range: 0-3, default: 0
47012	Previous 6th segment of tariff	Range: 0-47, default:30
47013	6th segment of billing	Range: 0-3, default: 1
47014	Previous 7th segment of tariff	Range: 0-47, default:36
47015	7th segment of billing	Range: 0-3, default: 2
47016	Previous 8th segment of tariff	Range: 0-47, default: 42
47017	8th segment of billing	Range: 0-3, default: 3

3.8 Devise information register list

Register Address	Description	Remarks
49001	version	CHD9001 update version no.

Notice:

- CHD9001 reserves the right to modify this manual without prior notice in view of continued improvement.