# Instruction Manual of BRN-D513

- Power Quality Monitor
- Multi-functional Power Distribution Instrument

V2.7

**Shanghai Brilliant Automation Technology Co.,Ltd**

# contents

# *1 Main Characteristics of BRN-D513*

## *1.1 Model Selection Guide*

| Application Scenario | | | Simple type | Basic type | Power quality | Electrical degree | All-purpose |
|---|---|---|---|---|---|---|---|
| Real-time measured value | Voltage | V1,V2,V3,VlNavg,V12,V23,V31,VLLavg | ● | ● | ● | ● | ● |
| | Current | I1,I2,I3,Iavg | ● | ● | ● | ● | ● |
| | Active power | P1,P2,P3,Psum | ● | ● | ● | ● | ● |
| | Reactive power | Q1,Q2,Q3,Qsum | ● | ● | ● | ● | ● |
| | Apparent power | S1,S2,S3,Ssum | ● | ● | ● | ● | ● |
| | Power factor | PF1,PF2,PF3,PF | ● | ● | ● | ● | ● |
| | Load character | L/C/R, four-quadrant | ● | ● | ● | ● | ● |
| | Frequency | F | ● | ● | ● | ● | ● |
| Phase angle and sequence | Sequence component of voltage and current | Positive , negative and zero sequence | | | ● | | ● |
| | Phase angle | Voltage phase angle, current phase angle | | | ● | | ● |
| Electric energy | Active electric energy | EP imp, EP exp, EP total, EP net | ● | ● | ● | ● | ● |
| | Reactive electric energy | EQ imp, EQ exp, EQ total, EQ net | ● | ● | ● | ● | ● |
| | Timeshare electric energy | EPF; 6 time zones, time intervals at each time zone, 4 kinds of rates, this month, last month, EP imp, EP exp, EQ imp EQ exp | | | | ● | ● |
| Demand | Real-time current | DmdI1,DmdI2,DmdI3,DmdIavg | | | ● | ● | ● |
| | Real-time power | DmdPsum,DmdQsum,DmdSsum | | | ● | ● | ● |
| | Max current | DmdI1 max,DmdI2 max,DmdI3 max,DmdIavg max | | | ● | ● | ● |
| | Max power | DmdPsum,DmdQsum,DmdSsum | | | ● | ● | ● |
| | Setup parameter | Time interval of sliding window, amount of sliding window | | | ● | ● | ● |
| | Prediction | To predict active and reactive apparent power | | | | | ● |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Maximum and minimum value statistics | Present maximum and minimum value statistics and time tag | VLL,VLN，I，P,Q,S,PF,F,ITHD,VTHD, | | ● | ● | ● | ● |
| Power quality | Unbalance | Three-phase voltage, three-phase current | | | ● | | ● |
| | Harmonic distortion rate of voltage | THD V1,THD V2,THD V3,THD Vavg | ● | ● | ● | ● | ● |
| | Harmonic distortion rate of current | THD I1,THD I2,THD I3,THD Iavg | ● | ● | ● | ● | ● |
| | Each harmonic ratio of voltage | Voltage of each phase, 2 - 63 times; spectrogram and graded numerical value, off at each phase, even at each phase | | | ● | | ● |
| | Each harmonic ratio of current | 2 - 63 times at each phase; spectrogram and graded numerical value, off at each phase, even at each phase | | | ● | | ● |
| | Crest cofficient of voltage of each phase | Crest Factor | | | ● | | ● |
| | Telephone influence factor of voltage of each phase | THFF | | | ● | | ● |
| | K cofficient of current of each phase | K Factor | | | ● | | ● |
| | Senior power quality analysis | voltage sag and dig, fluctuation and flicker, fluctuation of power system frequency and rerord, interharmonics | | | | | ● |
| Alarm | Off-limit alarm | 10 channels, optional parameters, preset value of logical comparison, delay time setting, DO output can be set. | ● | ● | ● | ● | ● |
| | Automatic monitoring | PT phase loss, CT phase loss, PT anti phase, CT anti phase | | | | | ● |
| Time | Real-time clock | year, month, day, hour, minute, second | ● | ● | ● | ● | ● |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Waveform recorder | Real-time waveform | Voltage of each phase, current of each phase, minimum transition: 78 us | | ● | ● | ● | ● |
| | Waveform capture | Voltage of each phase: manual/conditional capture, Current of each phase: manual/conditional capture, | | | | | ● |
| | Records | 10 | | | | | ● |
| Data record | Operation log | Password modification record, the latest power-on time, the latest power-off time, total running time | | | | | ● |
| | Event log | DI status change and time, 20 records of | | | | | ● |
| | Alarm log | 16 records | | | ● | | ● |
| | Data recorder | Time interval (1min-1440min) is adjusstable, the record itself would define 15 variables, default I1, I2, I3, V1, V2, V3, EP total, EQ total, VTHD, ITHD; | | | 40 | | 4000 |
| Wiring adjustment | Electrical polarity | can be adjusted by communication or panel | ● | ● | ● | ● | ● |
| Communication | Basic RS485 | MODBUS-RTU SLAVE | ● | ● | ● | ● | ● |
| | Additional RS485 | MODBUS-RTU SLAVE/MASTER | | | | | ◎ |
| | Wireless 485 | MODBUS-RTU SLAVE | | | | | ◎ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Original special functions | Alarm indicator | upper and lower limit alarm indicator | ● | ● | ● | ● | ● |
| | Status bar | Status bar indicates date, clock, F, PF and EP total | ● | ● | ● | ● | ● |
| | Infrared | Infrared induction based on PIR technology, to cobtrol back and security | ● | ● | ● | ● | ● |
| | ISP | Online software update | ● | ● | ● | ● | ● |
| | Human machine interface | 3.2--inch TFT with true color, wide temperature from -25℃~+70℃ working range, original four-soft-key operation, Chinese and many languages | ● | ● | ● | ● | ● |
| I/O | K4S2 | Passive dry contact DI, silicon controlled SO; standard 4DI2SO | ● | ● | ● | ● | ● |
| | K8S6 | 8DI6SO at maximum | | | ◎ | ◎ | ◎ |
| | Ax | 2-way 4-20mA at most AO analog quantity | ◎ | ◎ | ◎ | ◎ | ◎ |
| | Px | 2-way electric energy pulse output at most | | | | ◎ | ◎ |
| | Dx | 6-way relay output at most | | | ◎ | ◎ | ◎ |
| | | | Symbol ● standard ◎ optional | | | | |

### *1.2 General measuring functions:*

- Access signals directly from current and voltage transformer
- High-accuracy survey
- Set PT/CT transformation ratio freely
- Time-sharing electrical degree function
- Two-way measurement: whether independent power generation or connecting grid power, for measurement points that require accurate measurement of bi-directional power, BRN-D513 power distribution instrument is an ideal choice for monitoring electric quantity of power supply network, service line and transformer substation.

### *1.3 Communication interface*

- 2-way RS485, supporting MODBUS-RTU standard
- Apply to most PLC (Modicon, GE, Simens…)on the market
- Apply to many software (Intouch, Fix, Citec, Kingview) on the market
- One way can be configured as standby communication interface, or as MODBUS-RTU Master for expending I/O

### *1.4 Input/output ports*

- Abundant ports, 8-way DI and 6-way DO at most

### *1.5 Senior power quality analysis*

- Harmonic analysis
- Measurement of sequence component and three-phase voltage unbalance analysis
- Transient capture (80μs)
- Interharmonics analysis TBD.

- Analysis of voltage fluctuation and flicker TBD.
- Admissible deviation of supply voltage TBD.
- Monitoring and record of frequency fluctuation of power system (0.005Hz) TBD.
- Voltage sag and swell monitoring TBD.

### *1.6 Original new functions*

- Industry first power distribution instrument with electrical intelligent platform
- Industry first 3.2-inch TFT full-color display screen, entire-Chinese interface
- Industry first function of oscilloscope, which enables to view real—time signal waveform
- The function of waveform memory can record five cyclic waves before trigger point, and waveform at anytime after the point.
- The function of fault recording can record 10 groups of waveforms of voltage and current.
- Be able to monitor and record automatically: PT break, CT break, PT phase inversion, CT phase inversion, reset of peak demand register, power on/off of electric energy meter, etc.
- Data record
- BRN-D513 RF wireless communication
- PIR infrared human body sensor: pyroelectricity infrared induction automatically opens the backlight, which does great convenience to field data reading, and saves consumption of the facility itself. PIR human body infrared induction status can be used as security signal of field intrusion and remote alarm.
- With the function of upper and lower limit alarm. The alarm variable and upper and lower limit values can be set freely.
- The panel interface has LED electric energy pulse output indicator, which can be used for photoelectric detection and calibrating electrical energy.

### *1.7 Key points of operation*

- This instruction aims to help you rapidly install operate and system integrate of BRN-D513 series intelligent power meter
- Please read following notes carefully before install and operate
- This instruction only supply to the technology engineer whom are responsible for install, maintenance and operate.

### *1.8 Safety Guidelines*

- Only qualified engineer are allowed to install, maintenance and operate BRN-D513 series
- Uncharged work
- Don’t open the face-shell of BRN-D513 for there is no part inside need to be maintenance
- Don’s use it for other purpose besides its origin application

### *1.9 Operating Conditions*

- Temperature: -25 $^0$C~+70$^0$C
- Air conditions: below 90% when the temperature at 20$^0$C
- Environment Conditions: No bombing danger in surrounding media, no gas for insulation destruction and metal corrosion, no conduct dust

- Altitude heights: below 2000m

# 2 Introduction

Multi-functional instrument, also called as net power meter, multi-functional power meter or intelligent instrument, is a kind of digital monitor terminal, with its inner part use of modern computer and digital signal processing technique, can instead of varieties of electrical component as transmitter, instrument and relay.

BRN-D513 Series is the multi-functional instrument which designed for the requirements of the electric system, miners and factories, public facilities, intelligent mansion, which measure all common electric parameter, such as three-phase current, voltage, frequency, etc., and is quite suitable for the real-time power supervisory system.

With a high cost-effective, BRN-D513 series can directly replace of common electric transmitter and measure instruments. As a kind of intelligent and digital advanced front digital acquisition component, BRN-D513 series are already widely used in varieties of control system and resource management system.

## *2.1 Application sites*

BRN-D513 series are widely used in extensive fields and convenient for system integration. All the place with power supply, it can be used, especially the environment with a higher requirement on power quality and safety. The fields BRN-D513 series apply to following fields, with numerous successful application experiments

- Energy control system
- Substation automation
- Distribution automation
- Power supervisory in residential area
- Industrial automation
- Intelligent building
- Intelligent substation and switch-gear

## *3 Brief introduction to functions of BRN-D513*

BRN-D513 series is designed by applying modern microprocessor and digital signal processing technique. Each instrument can measure various parameters and used as front end of remote monitoring system (SCADA). It can be used through networking or be used individually.

BRN-D513 series apply communication interface of RS485 and MODBUS-RTU communication protocol, so as to meet your automatic communication system. Low—cost shielded twisted pair (STP) wiring can be used to create a reliable communication network. Large—size color--screen display provides you clear data display.

For users using multi—functional power distribution instrument BRN-D513 series, they can master local four—key type operation method in a short term. This series provides automatic display, and enables readers read multi parameters without touching keys.

The following are main functions of BRN-D513 series:

- three-phase voltage
- three-phase voltage
- power (three—phase active power, three—phase reactive power, three—phase apparent power)
- power factor
- Frequency
- electric energy (four-quadrant component, accumulation)
- Demand
- 2-63 times of harmonic wave
- upper and lower limit alarm, and record of alarm events
- 8 DI can be selected at most, access by passive dry contact
- 6 DO can be selected at most
- 2 PO can be selected at most
- 2 AO can be selected at most, the configuration of AO output can be defined freely
- One-way electric leakage measurement function can be selected
- Longitude and latitude time--control switch can be selected
- MODBUS-RTU communication protocol

Notes: the total quantity of DO, AO and PO cannot be more than 6 ways, of which each way can be set as any module.

# 4 Specification

## 4.1 Input signal

- Input Voltage

Rated value: 100V or 400VAC, 25% overrun allowed

Overload: 2 times rated value(constantly); 2500VAC/s(non-cycle)

Measure methods: True-RMS;

Load: below 0.2VA

- Input current

Rated value: 5A, 20% overrun allowed;

Starting current(min.): 3mA;

Overload: 2 times rated value; 100A/s(non-cycle)

Measure methods: True-RMS;

Load: below 0.2VA

- Input leakage current

Nominal value: require support of external electric leakage mutual inductor, the turns ratio of mutual inductor is 1000:1.

Measurement form: True-RMS

- Range of input frequency: 45~65HZ

## 4.2 Measurement Accuracy

- Current and voltage: Grade 2;
- Other parameter: 0.5 grade;
- Frequency: 0.1Hz
- Ratio of temperature drift: 50PPM/℃ (0-50℃)

## 4.3 Communication

- RS485 interface;
- Baud rate: 2400bps ~38400bps, can be set randomly
- MODBUS-RTU protocol

## 4.4 Applicable Environment

- Work temperature: －20℃--+75℃;
- Storage temperature: －40℃--+85℃;
- Relative humidity: 5%--95% , non-condensate

## 4.5 Safety

- Insulation resistance: current, voltage input loop>2KV;

Current loop>2.5KV

## 4.6 Size and Weight

- Size 96×96×75mm;
- Weight 0.4Kg

## 4.7 Power supply

- Nominal value: 220VAC (+20% / -50%), 50/60Hz or direct current;

- Power consumption: <2.5W
  Online standby consumption: 0.1W
  DO relay consumption: 0.5W/CH
  DI on-off input consumption: 0.3W/CH
  Back light consumption: 0.3W/CH

### *4.8 PIR infrared human body sensor*

Detection distance: 0～5m

Detection angle: 60°

## *5 Package*

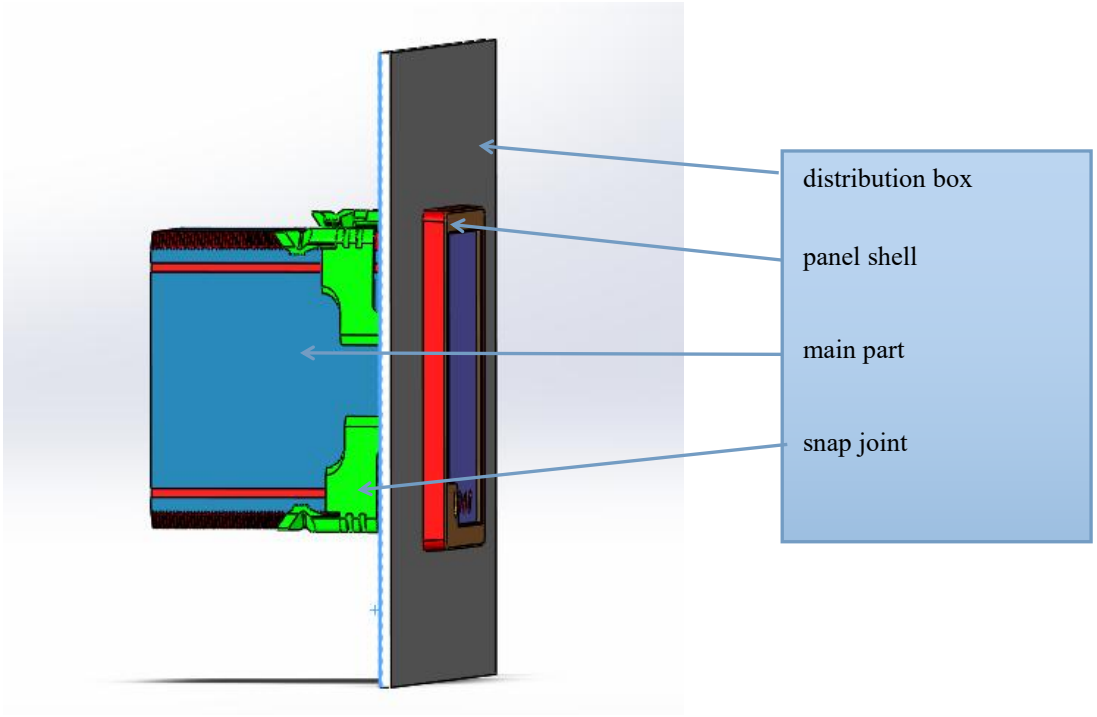
Contains the following items

- Host(with plug-in terminal blocks)
- Installation parts
- Warranty card
- Product manual

# 6 Installation and Wiring

## 6.1 Install sketch

Note: the installation hole is 85*85 spuare.

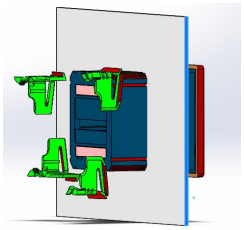



## 6.2 Installation Size

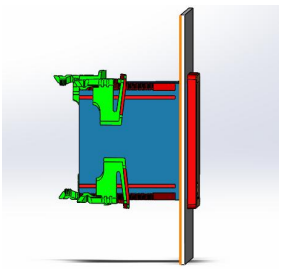
The standard punch size: 85mm×85mm

## 6.3 Installation

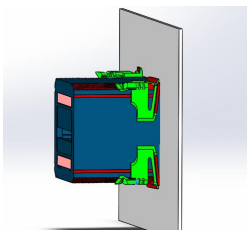
Installation instructions



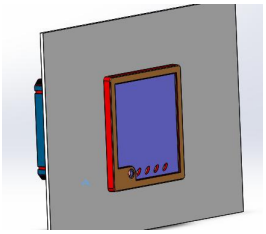
1. Place the main body into the installation hole



2. Install the snap joint, and press the installation plate tightly and ensure there is no looseness.

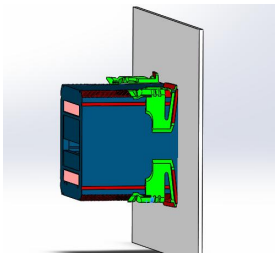
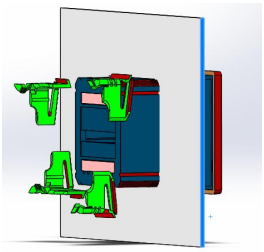
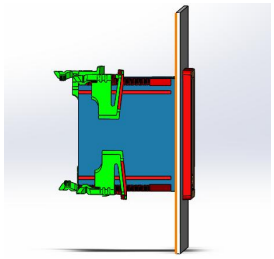


3. The installation work is finished.



design sketch

### *6.4 Disassembly*

| Disassembly instruction | | |
|---|---|---|
|  | 1. Carry it up at this point to separate the tooth from join, and pull the snap joint out. |  |
|  | 2. Pull out the snap joint as shown in the figure | 3. Take out the main body. |

### *6.5 Wiring method*

6.5.1 BRN-D513 series terminal blocks introduction

| Upper terminals | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| ⏚ | L/+ | N/- | DI1 | DI2 | DI3 | DI4 | COM | O11 | O12 | O21 | O21 | O22 | A | B |
| Auxiliary power supply | | | On/ off input | | | | | Optional modules | | | | | RS485 | |

| Middle terminals | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| O31 | O32 | O41 | O42 | O51 | O52 | O61 | O62 | COM | DI1 | DI2 | DI3 | DI4 | A/+ | B/- |
| Optional modules | | | | | | | | On/ off input | | | | | RS485 | |

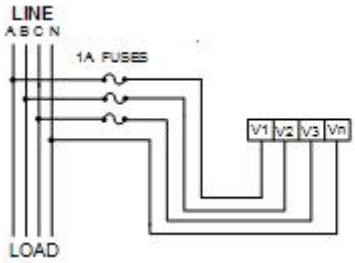
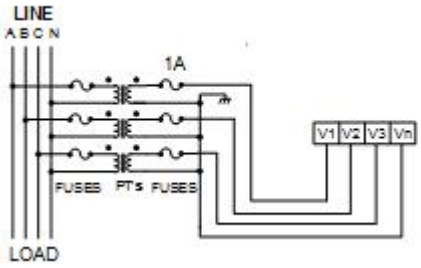
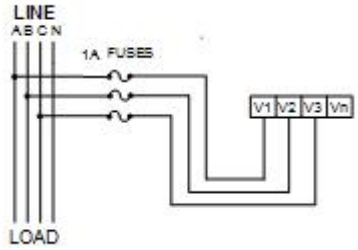
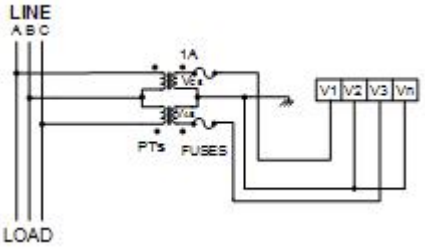
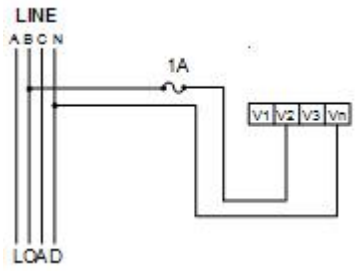
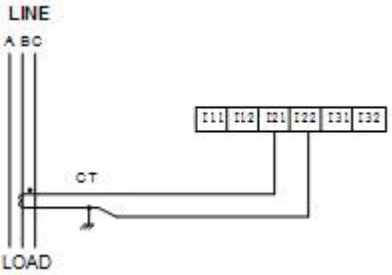
| Lower terminals | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| V1 | V2 | V3 | VN | I11 | I12 | I21 | I22 | I31 | I32 |
| A phase voltage input | B phase voltage input | C phase voltage input | Neutral Line input | A phase current in | A phase current out | B phase current in | B phase current out | C phase current in | C phase current out |

### *6.5.1 Summary of BRN-D513 connection diagram*

Warning: secondary side of PT (or electricity meter terminal of direct conjugation) must join 1A fuse.

For BRN-D513 series, the current and voltage circuits to measure circuit connection method can be combined respectively. In other words, the wirings of voltage and current are relatively independent, as long as they accord with the wiring rule, they can work correctly without change software settings.

Notes: when using **three-phase four-wire direct connection**, **three-phase four-wire 3PT**, or **single-phase voltage connection**, the voltage connection shall be set as 3LN. When using **three-phase three-wire direct connection**, the voltage connection shall be set as 3LL. When using **three-phase three-wire 2PT,** the voltage connection shall be set as 2LL.

<table>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>three-phase four-wire direct connection (3LN), low voltage</td><td>three-phase four-wire 3PT (3LN), high voltage</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>three-phase three-wire direct connection (3LL), low voltage</td><td>three-phase three-wire 2PT (V type, 2LL), high voltage</td></tr>
<tr><td> 
</td><td> 
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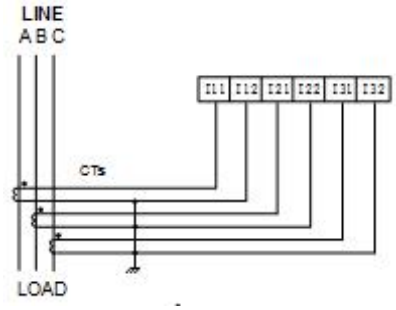
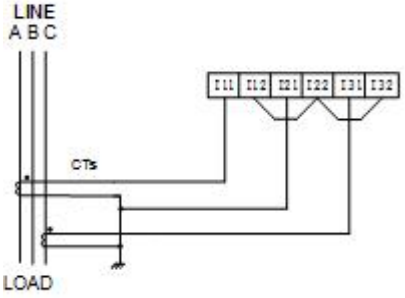
<tr><td>single-phase voltage connection (3LN)</td><td>Single—phase 1PT</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Three—phase 3CT</td><td>Three—phase 2CT (V type)</td></tr>
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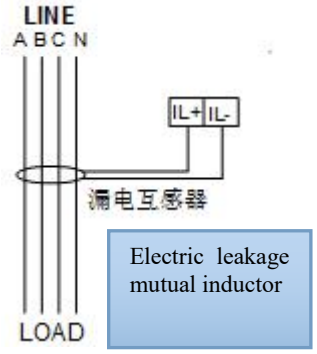
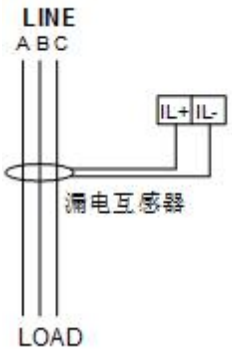



Connection of three—phase four-wire electric leakage mutual inductor

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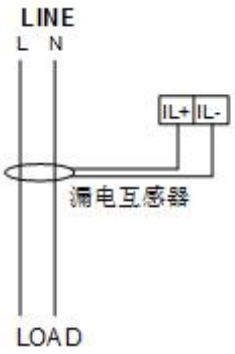
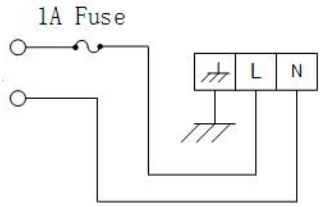
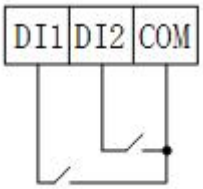
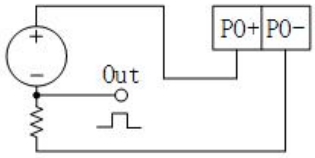
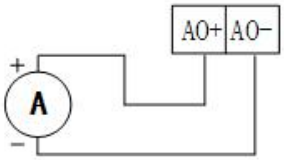



Connection of single—phase electric leakage mutual inductor

Note: for connection of electric leakage mutual inductor, there is no difference in positive and negative polarity. The IL+ and IL- are used only for distinguishing two terminals

| | | | |
|---|---|---|---|
| Power<br>Input |  | |  |
| | auxiliary power supply wiring | | On/off input wiring diagram |
| direct-current power supply |  | Current detection device |  |
| | electric energy pulse output wiring | | Transmitting output wiring |

## *7 Attentions during engineering construction*

### *7.1 Input of auxiliary power supply*

It must be ensured that input 1A fuse before auxiliary power supply.

### *7.2 Input of voltage*

It must be ensured that the input voltage do not higher than the product of the rated input voltage (100 v or 400 v), or consider using PT transformer.

It must be ensured that the input voltage corresponds to the input current, i.e. the phase No. and phase order are corresponding (or else digital and sign errors will happen).

### *7.3 Input of current*

The standard rated input current is 5A, if it is over 5A, external CT shall be used.

If the CT used is connected to other meters or instruments, cascade shall be used for wiring.

Before removing the current input wiring for the product, it must be ensued to cut off the primary circuit of CT or short circuit its secondary circuit!

### *7.4 Installation of CT*

It is suggested to use connector bar, not to wire to CT directly for convenience of disassembly. The users' operation method

### *7.5 Communication wiring*

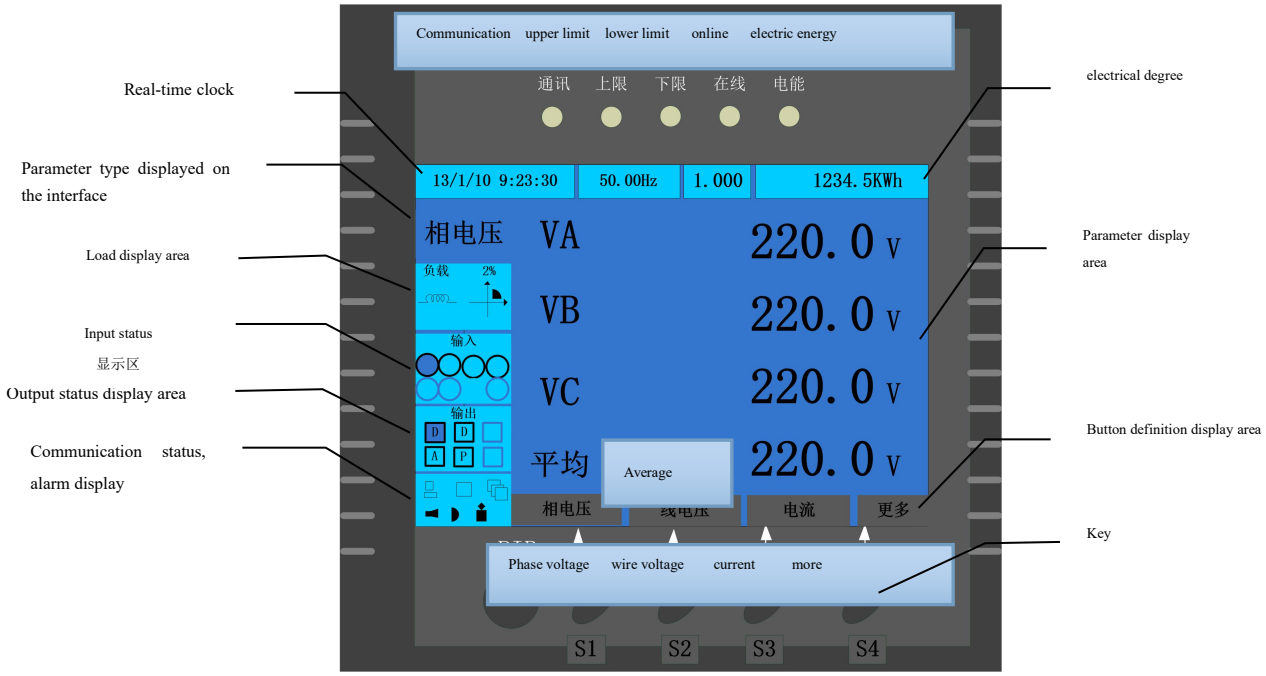
Multi—functional power distribution instrument provides serial asynchronous half-duplex ES485 communication interface, applies MODBUS—RTU protocol. All kinds of data message can be transmitted on the communication line. One line can connect 32 multi—functional power distribution instruments at most at the same time. Each multi—functional power distribution instrument can set its address No., and different instruments have different communication connecting terminal numbers.

Communication connection shall apply shielded twisted pair with cooper grid, of which the wire diameter should be more than 0.5 $mm^2$. During wiring, the communication wire shall be kept from strong current cable or other high--field environments.

# 8 Operation method for users

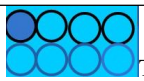
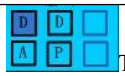
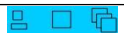
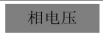
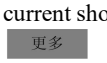
## 8.1 Powering on the system

After the wires are correctly connected according to instruction, switch on the working power, and then the displace interface (display interface of phase voltage parameters) of the first parameter displays:




### 8.1.1 Description

| Name | Example | Description |
|---|---|---|
| Time | **13/1/10 9:23:30** (the first display box at the top of display) | Displays the current time |
| Frequency | **50.00** (the second display box at the top of display) | Displays the current frequent, can show floating point data (4 significant digits) |
| Power factor | **1.000** (the third display box at the top of display) | Displays total power factor, can show floating point data (4 significant digits) |
| electric energy | **1234.5kWh** (the fourth display box at the top of display) | Displays total electric energy |
| Parameter type displayed on the interface | Phase voltage (top left corner of display) | Displays that the displayed value on the interface us parameter of phase voltage |
| A phase voltage | VA 220.0V | Displays value of A-phase voltage |
| B phase voltage | VB 220.0V | Displays value of B-phase voltage |
| C phase voltage | VC 220.0V | Displays value of C-phase voltage |
| Average phase voltage | Average 220.0V | Displays average value of three-phase voltage |
| Load type |  (the top-down first display box at left side of display) | Displays load type<br>  is inductive load<br>  is capacitive load |
| Load rate | 2% (the top-down first display box at left side of display) | The ratio between present current and nominal current |

| | | |
|---|---|---|
| Power sign |  (the top-down first display box at left side of display) |  indicates that active power is positive and reactive power is positive<br>  indicates that active power is negative and reactive power is positive<br>  indicates that active power is negative and reactive power is negative<br>  indicates that active power is positive and reactive power is negative |
| DI input |  The symbols from left to right and from top to down respectively represent DI1 to DI8. (the top-down second display box at left side of display) |  indicates that this way is selected ass DI and semaphore DI status is ON<br>  indicates that this way is selected ass DI and semaphore DI status is ON<br>  indicates that this way is not selected as DI |
| Output status |  The figure represents output of DO1, DO2, AO4 and PO5. (the top-down third display box at left side of display) |  indicates that this way is selected as DO and the output status is ON<br>  indicates that this way is selected as DO and the output status is OFF<br>  indicates that this way is selected as AO and the output status is OFF<br>  indicates that this way is selected as PO and the output status is OFF<br>  indicates that this way is selected as IL (leakage input)<br>  indicates that this way is not selected as any outputs |
| Communication status |  (the top-down third display box at left side of display) |  indicates that there is no communication between this system and client<br>  indicates that this system and client is communicating now<br>  indicates that this system and slave computer is communicating now<br>  indicates that there is no communication between this system and slave computer |
| Loudspeaker |  (the top-down third display box at left side of display) | When loudspeaker sounds,  flickers;<br>When loudspeaker sounds,  is not displayed |
| Alarm sign |  (the top-down third display box at left side of display) | When system gives an alarm,  flickers;<br>When system gives no alarm,  is not displayed |
| Infrared induction |  (the top-down third display box at left side of display) | When  flickers, it indicates that the system detects infrared induction<br>When  is not displayed, it indicates that the system detects no infrared induction |
| Definition of button | <table><tr><td>Phase voltage</td><td>line voltage</td></tr><tr><td>current</td><td>more</td></tr></table> (at the bottom of display) |  corresponds to definition of button S1, press S1 and phase voltage shows<br>  corresponds to definition of button S1, press S1 and line voltage shows<br>  corresponds to definition of button S3, press S3 and current shows<br>  corresponds to definition of button S4 (icon), press S4 and other buttons show |

| | | |
|---|---|---|
| Communication | indicator flickers | communication indication |
| Upper limit | indicator lights up | upper limit alarm |
| Lower limit | indicator lights up | lower limit alarm |
| Online | indicator lights up | indicates that BRN-D513 is in working situation |
| Electric energy | indicator flickers | electrical degree pulse output |

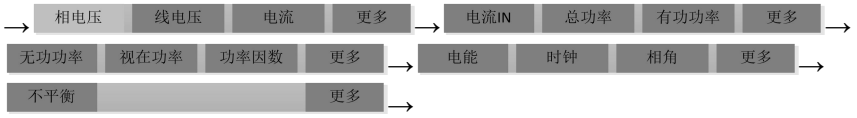
### *8.1.2 Keys*

The system applies four-key operation method:

- Under each display interface, the definition of each key would show in the form of button on the interface's right above color screen.
- In normal mode, please select corresponding key for data.
- In editing mode, please select corresponding key for data.
- Press and hold on (for 2 seconds) (More) key, enter main menu and select the data display mode.

## *8.2 View basic parameters*

After the instrument is powered on, the system enters in the mode of displaying basic measurement parameters. Click corresponding function key to view the parameter. In addition, the background color of the function key is same as that of the main display area; click 更多 (More) key to switch the key function among the following status.



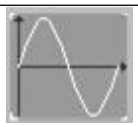
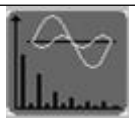
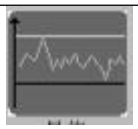
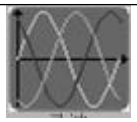
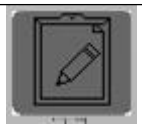

The definitions of each button are as follows.

| | |
|---|---|
| 相电压 phase voltage | split-phase phase voltage and its average value |
| 线电压 line voltage | split-phase line voltage and its average value |
| 电流 current | split-phase current and its average value |
| 电流IN current IN | three-phase current and neutral current |
| 总功率 total power | split-phase active power (P), total reactive power (Q), total apparent power (S), system power factor (PF) |
| 有功功率 active power | split-phase active power and its average value |
| 无功功率 reactive power | split-phase reactive power and its average value |
| 无功功率 reactive power | split-phase apparent power and its average value |
| 功率因数 power factor | split-phase power factor and system power factor |
| 电能 electric energy | four-quadrant electric energy |
| 时钟 cloc | real—time clock |

| | |
|---|---|
| k | |
| 相角 phase angle | phase angle of voltage and current |
| 不平衡 unbalance | unbalance degree of voltage and current |

### *8.3 View other parameters*

Press 更多 (More) and hold it on to enter main menu. In the main menu, select measurement parameter display mode. Click 返回 (Back) to exit the main menu; click 右移 (Shift Right) and 左移 (Shift Left) to select mode; click 确认 (OK) to enter corresponding mode.

| | | | |
|---|---|---|---|
|  |  |  |  |
| Basic Measurement | Harmonic | Extremum | Demand |
|  |  |  |  |
| Time-sharing Electric Energy | Waveform Recorder | Record | Settings |
|  | | | |
| Alarm Silence | | | |

| | | | | |
|---|---|---|---|---|
| | Back | Shift left | Shift right | OK |

### *8.3.1 View harmonic*

Select **harmonic** in the main menu to enter in the mode of viewing harmonic parameters. In this mode, click 更多 (More) to switch among the following status:

→ 电压THD | 电压奇次 | 电压偶次 | 更多 → THFF | 波峰系数 | 电流THD | 更多 →
电流奇次 | 电流偶次 | K系数 | 更多 → 上次谐波 | 下次谐波 | 3次谐波 | 更多 →
VA谐波 | VB谐波 | VC谐波 | 更多 → IA谐波 | IB谐波 | IC谐波 | 更多 →

The definitions of each button are as follows.

| | |
|---|---|
| 电压THD voltage THD | total harmonic distortion rate of voltage |
| 电压奇次 voltage odd | odd harmonic distortion rate of voltage |
| 电压偶次 voltage even | even harmonic distortion rate of voltage |
| THFF THFF | telephone harmonic coefficient of voltage |
| 波峰系数 | crest coefficient of voltage |

| | |
|---|---|
| crest coefficient | |
| 电流THD<br>current THD | total harmonic distortion rate of current |
| 电流奇次<br>current odd | odd harmonic distortion rate of current |
| 电流偶次<br>current even | even harmonic distortion rate of current |
| K系数<br>K coefficient | K coefficient of current |
| 上次谐波<br>last harmonic<br>下次谐波<br>next harmonic<br>3次谐波<br>three--times harmonic | View harmonic ratio of each harmonic |
| VA谐波 VB谐波<br>VC谐波 IA谐波<br>IB谐波 IC谐波<br>VA harmonic<br>VB harmonic<br>VC harmonic<br>IA harmonic<br>IB harmonic<br>IC harmonic | Display harmonic of VA,VB,VC, IA, IB and IC in form of histogram |

### *8.3.2 View extremum*

Select **extremum** in the main menu to enter harmonic parameter viewing mode. In this mode, click 更多 (More) to switch among the following status:

→ VLN最值 VLL最值 电流最值 更多 → UNBL最值 功率最值 PF最值 更多 →
Vthd最值 Ithd最值 复位最值 更多 →

The definitions of each button are as follows.

| | |
|---|---|
| VLN最值 VLN extremum | Maximum and minimum values of phase voltage |
| VLL最值 VLL extremum | Maximum and minimum values of line voltage |
| 电流最值 current extremum | Maximum and minimum values of current |
| UNBL最值 UNBL extremum | Maximum and minimum values of unbalance degree of voltage and current |
| 功率最值 power | Maximum and minimum values of total power |

| | |
|---|---|
| extremum | |
| PF最值 PF extremum | Maximum and minimum values of PF and power factor |
| Vthd最值 Vthd extremum | Maximum and minimum values of total harmonic distortion rate of voltage |
| Ithd最值 Ithd extremum | Maximum and minimum values of total harmonic distortion rate of current |
| 复位最值 reset extremum | Reset maximum and minimum values |

### *8.3.3 View demand*

Select demand in the main menu to enter demand parameter viewing mode. In this mode, click 更多 (More) to switch among the following status:

→ 电流需量 | P总需量 | Q总需量 | 更多 → S总需量 | 复位需量 | 更多 →

The definitions of each button are as follows.

| | |
|---|---|
| 电流需量 current demand | average demand of three-phase current |
| P总需量 total demand of P | demand of total active power |
| Q总需量 total demand of Q | demand of total reactive power |
| S总需量 total demand of S | demand of total apparent power |
| 复位需量 reset demand | reset the current value of demand, and recalculate demand |

### *8.3.4 View time-sharing electric energy*

Select **time-sharing electric energy** in the main menu to enter time-sharing electric energy viewing mode. In this mode, click 更多 (More) to switch among the following status:

→ 本月EPim | 本月EPex | 本月EQim | 更多 → 本月EQex | 上月EPim | 上月EPex | 更多 →

上月EQim | 上月EQex | 更多 →

The definitions of each button are as follows.

| | |
|---|---|
| 本月EPim EPim this month | Active electric energy consumed this month |
| 本月EPex EPex this month | Active electric energy released this month |
| 本月EQim EQim this month | Reactive electric energy imported this month |
| 本月EQex EQex this month | Reactive electric energy exported this month |
| 上月EPim EPim last month | Active electric energy consumed last month |
| 上月EPex EPex | Active electric energy released last month |

| | |
|---|---|
| last month | |
| 上月EQim EQim last month | Reactive electric energy imported last month |
| 上月EQex EQex last month | Reactive electric energy exported last month |

### *8.3.5 View wave forms in waveform recorder*

Select waveform recorder in the main menu to enter mode of viewing wave forms in waveform recorder and real—time waveforms. In this mode, click 更多 (More) to switch among the following status:

→ 实时电压 实时电流 更多 → 电压向上 电压向下 记录1 更多 →
电流向上 电流向下 记录1 更多 →

The definitions of each button are as follows.

| | |
|---|---|
| 实时电压 real—time voltage | Real—time waveform of voltage |
| 实时电流 real—time current | Real—time waveform of current |
| 电压向上 voltage up 电压向下 voltage down 记录1 record 1 | View voltage waveforms in waveforms record |
| 电流向上 current up 电压向下 current down 记录1 record 1 | View current waveforms in waveforms record |

### *8.3.6 View SOE record and alarm record*

Select **Record** in the main menu to enter SOE and alarm records viewing mode. Press (**More**) to select between SOE or alarm record. Press **Up** and **Down** keys to select the date of recording.

## *8.4 Input (DI) status indication (inputting display area at the display screen)*

- DI is a wet contact, which means, inside the instrument, there equips 24VDC power source and requires no external power supply. When one external way is selected as DI, corresponding position will show ○. When on external way has signal inputting, corresponding position will show ●. When one external way is not selected as DI, corresponding position will show ⓧ.
- The status of DI can be viewed, but not changed.

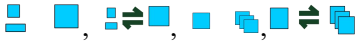
## *8.5 Output (DO, AO, PO) status indication (outputting display area at the display screen)*

- When one way is selected as DO output, corresponding position shows 🄳; when one way

is DO outputting, corresponding position shows D. The status of DO can be set through panel, or through communication.

- When one way is selected as AO output, corresponding position shows A; when one way is AO outputting, corresponding position shows A. The status of AO can be viewed, but not be changed.
- When one way is selected as PO output, corresponding position shows P; when one way is PO outputting, corresponding position shows P. The status of PO can be viewed, but not be changed.
- When one way is not selected as any outputting, corresponding position shows X.

### *8.6 Communication indication (communication status, alarm display area)*

The system uses  icons to indicate communication status.

✓ Ensure the data line of RS485 is correctly connected.

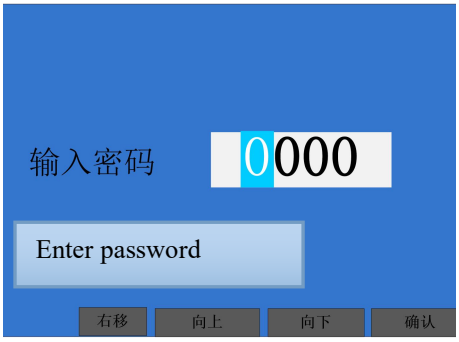
✓ Communication indication icons  are used for indicating data communication status of the internet.

✓ When this machine receives correct data, it shows  or  , and communication indicator flickers. Or, it will show  or  .

# 9 System programming mode

## 9.1 Enter system programming mod

Press and hold on (More) button to enter main menu, select **settings** to enter system programming mode. Before accessing system programming mode, the first thing is to input correct password. The method of entering password is as the following figure.




| | | | |
|---|---|---|---|
| Shift right | Up | Down | OK |

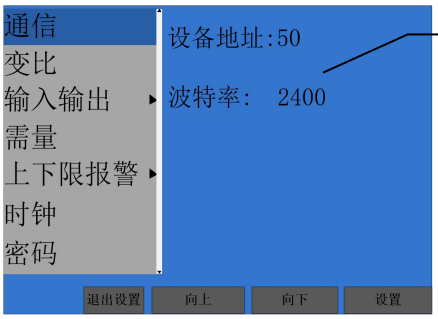
(1) Press (Shift Right) to select a data that needs changing.
(2) Press (Up), then data will increase by one unit, and the data changes from 0 to 9 successively.
(3) Press (Down), then data will decrease one, and the data changes from 0 to 9 successively.
(4) Repeat steps (1) to (3). After setting is completed, press (OK).

- ✓ If the password is correctly entered, the system programming mode begins, or the system returns to regular mode.
- ✓ When the instrument leaves the factory, its default password is 1000.
- ✓ In system programming mode, according to button definition at the display interface, operate corresponding keys will result exiting system programming mode or returning to regular mode.
- ✓ All items in system programming mode are stored in non-volatile memorizer. Once setting is completed, the storage is effective before next setting. The password will not be changed because of power down.

## 9.2 Operation of setting mode

After the system enters setting mode, the display interface of root menu is as following.

The background color of selected item is dark blue




Parameter explanation of selected item.

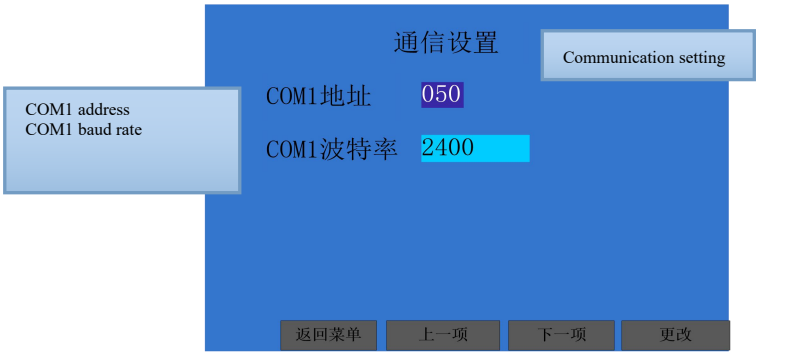
| | | | |
|---|---|---|---|
| communication | | device address: 50 | |
| transformation ratio | | Baud rate: 2400 | |
| input/output | | | |
| demand | | | |
| upper/lower limit alarm | | | |
| clock | | | |
| password | | | |
| Exit Setup | Up | Down | Settings |

### *9.2.1 Operating instructions*

- ✓ The function of each key would show in the form of button on the interface's right above color screen.
- ✓ Press 向上 (Up) and 向下 (Down) to select the option that needs setting. The background color of the selected option is dark blue.
- ✓ The right display area on the display screen will display the current relative parameters of the selected option.
- ✓ Press 退出设置 (Exit Setup) to exit setting mode
- ✓ Press 设置 (Settings) to enter setting display interface of this option
- ✓ In setting mode, the following options can be set.
- ✓ Communication setting: this is to set device communication address and communication baud rate
- ✓ Transformation ratio setting: this is to set values of primary side and secondary side of PT, and values of primary side and secondary side of CT.
- ✓ Input/output setting: this is to set relative parameters of DO and electric energy pulse output.
- ✓ Demand setting: this is to set sliding period and amount of sliding windows.
- ✓ Upper and lower limit alarm setting: this is to set general switch of alarm (on or off) and relative parameters of 16 channels.
- ✓ Clock setting: this is to set real—time clock.
- ✓ Password setting: this is to reset password, which is used to enter setting mode.
- ✓ Reset setting: this can realize reset of extremum, demand and electric energy, or factory reset.

### *9.2.2 Take communication setting as an example*

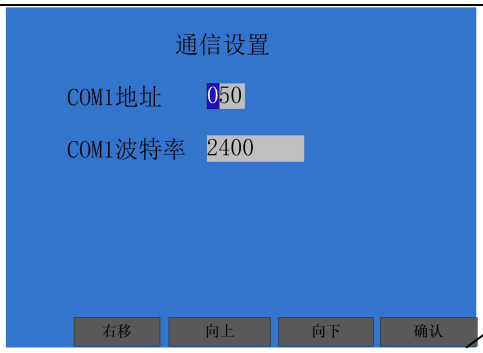
**(1) The display interface of communication setting is as following:**




| Back to menu | Last item | Next item | Change |
|---|---|---|---|

- ✓ Press 返回菜单 (Back to menu) to exit communication setting, and return root menu display interface
- ✓ Press 上一项 (Last item) and 下一项 (Next item) to switch setting options
- ✓ Press 更改 (Change) to change parameters

(2) The display interface to set COM1 address is as following:

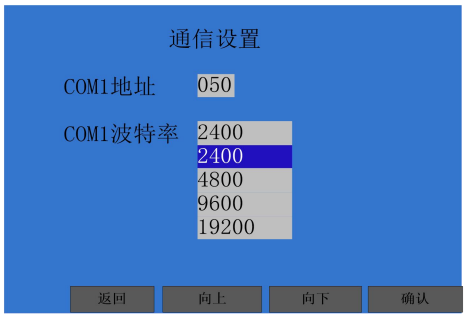



Note: redefine the function of the key. The definitions of key function on each display interface have difference.

| Shift Right | Up | Down | OK |
|---|---|---|---|

- ✓ Press 向上 (Up), then the data increases by 1, and the data switches among 0 to 9.
- ✓ Press 向下 (Down), then the data decreases by 1, and the data switches among 0 to 9.
- ✓ Press 右移 (Shift Right) to confirm data and prepare to change next data
- ✓ Repeat above operating steps until the last one (the lowest digit) is set, then press 确认 (OK) to confirm.

(3) Display interface of setting baud ratio is as following:




| Back | Up | Down | OK |
|---|---|---|---|

- ✓ Press 返回 (Back) to exit baud setting and return to communication setting interface
- ✓ Press 向上 (Up) and 向下 (Down) to select baud rate that require setting.
- ✓ Press 确认 (OK) to confirm setting parameters and return to display interface of communication setting.

So far, the communication setting is completed. Settings of other parameters are similar.

### *9.3 Communication setting*

The setting range of communication address is from 0 to 247. Options of baud rate are: 1200, 2400, 4800, 9600, 19200, 38400. The standard configuration only has one 485 communication (COM1). If the second 485 communication (COM2) is selected, setting item of COM2 will appear on communication setting. The communication address and communication baud rate of COM1 and COM2 are set separately.

### *9.4 Transformation ratio setting*

The transformation ratio of voltage and current is set according to values of primary side and secondary side of mutual inductor.

To avoid zero drift in environment with electromagnetic interference, the zero threshold of current can be set and the setting range is from 0~100mA (value of secondary side).

### *9.5 Current direction*

There is direction requirement on current input. In normal situations, the current flows in from NO. 1

(like I11) terminal to No. 2 terminal (like I12). If there is wiring fault, to avoid rewiring, the method of setting reverse direction of current can be applied.

In regular situation, the directions of three—phase current shall be set as forward direction. If the wires are inversely connected, then the direction of corresponding current shall be set as reverse direction.

### *9.6 Setting of universal ports*

The types of universal ports are configured according to hardware when the products are released. The types of universal port are: DO, PO(electric energy pulse output), AO(4~20mA), IL(electric leakage input), T(temperature measurement).

The options of universal port are 6 at most. Among the 6 options, port 1 and port 2 can be configured as any types of port, and port 3 to port 6 can configure others types of port except PO and AO.

If the port type is DO, the operation mode (level or pulse) of DO shall be set. If operation mode of DO is pulse, then the setting of pulse width shall be completed.

If the port type is PO, then the output electric energy pulse output type shall be selected.

If the port type is AO, then parameters of AO output and measurement values that correspond to 4mA and 20mA shall be selected.

If the port type is IL, the turns ratio of leakage mutual inductor shall be set. The turns of secondary side is fixed to 1.

The electric pulse setting submenu under the menu of universal port setting is used to set PO and pulse constant and pulse width of electric energy light pulse output.

### *9.7 Demand setting*

Sliding period means the duration that the window of calculating demand slides form one point to another. At each time, when the sliding duration of sliding window reaches, then calculate demand once. The setting range is from 1 to 20 minutes.

The amount of sliding windows can confirm the value of demand is average value of how many sliding durations. The setting range is from 1 to 60.

If the sliding interval is set as 3 minutes; the amount of sliding windows are 5, then the demand value shall update every 3 minutes. This value is average value of the 15 minutes before updating.

### *9.8 Upper and lower limit alarm setting*

In total, there are 16 channel alarms. The alarm condition of each channel is set individually. In basic setting of alarm, the logic relation between main alarm switch and alarm channel. The logic relation between channels can be set as “logic and” or “logic or”, “logic and” has higher priority than “logic or”. The adjacent channel is channel between logic and relation, which triggers alarm only when conditions are satisfied at the same time. The logic relation switch can be turn off. After turning off, the relation between channels is logic or relation. They are relatively independent while triggering alarm.

### *9.9 Clock setting*

This is to adjust time. The data range can be set from year 2000 to 2009.

### *9.10 Time—sharing electric energy setting*

One year can be divided into 6 time zones, in which every time zone can independently set day time period and rate of each period. In every day, 12 day periods can be set at most. The rate can be selected by each period are tip and peak, flat, cereal. The settlement time in each month can be appointed. If the settlement time is set as the end of a natural month, then at 00:00, on the first day of each month, monthly settlement of time—sharing electric energy will be conducted.

The enable switch and settlement time of time-sharing electric energy function are in basic settings of time—sharing electric energy.

### *9.11 Waveform recorder setting*

The waveforms of three-phase voltage and current can be recorded. In the menu (waveform recorder->basic settings), sampling number of each cyclic wave, whether manual triggering is allowed, and triggering time is set. Manual trigger means that channel communication gives order to trigger waveform recorder. Triggering time means duration from triggering to the end of waveform record.

### *9.12 Voltage swell/sag setting*

Voltage swell/sag means that voltage is higher or lower than the set value, and triggers swell/dig events after lasting for a time. The first is to set a reference voltage, and set percentage of limit value of voltage swell or sag, as well as delaying time. Voltage swell/sag is related to DO output.

### *9.13 Display setting*

Setting of display theme: the user can select display color based on personal preferences. There are 5 display themes for selection.

Backlight setting: the displayed backlight can be set as constant, or set as turning off backlight after a period without key operation, so as to reduce electric energy consumption. The channel infrared triggering backlight switch is to set whether allow triggering backlight by infrared.

### *9.14 Sound setting*

Key tone: to set whether key operation speaks

Infrared tone: to set whether speaking when detecting infrared triggering event

Alarm tone: to set whether speaking or not in alarm status. If set as speaking, the tone keeps ringing in alarm status, until the alarm condition is cleared or alarm silence is received.

Automatic alarm silencing: if it is enabled, after alarm is recovered, it can turn off the alarm tone.

Manual alarm silencing duration: after manual silencing, during the period of setting, the alarm tone is turned off. Even new alarm event appears, the alarm tone cannot be triggered.

### *9.15 Infrared setting*

In this interface, the time period of infrared security and its viewing counting is set.

Infrared security counting: to use the infrared security counting function, the first is to select the check box of infrared security counting.

The way of counting infrared security: always, and set time period. If the way is set as always, then the set counting period is invalid, and the counting is always on. If set as to set time period, then one certain period in one day is determined to count.

Infrared security counting period: to set starting and ending time of infrared counting period in one day.

### *9.16 Reset*

Reset extremum: this is to reset the maximum and minimum values as the measurement values at current moment, and apply current time as starting time of extremum statistics.

Reset demand: clear the current demand and restart the cycle of demand calculation.

Reset electric energy: to avoid incorrect operation, when power is reset, it requires entering password. The password of clearing electric energy is fixed to 8015.

Reset time--sharing electric energy: clearing time—sharing electric energy also requires entering password. The password is 8015, same as that for resetting electric energy.

Reset security counting: clear the numbers of infrared security counting and start to recount.

Factory reset: some setting parameters will be reset as default values.

### *9.17 Password setting*

To set the password used for entering programming mode. The default password is 1000.

### *9.18 View version number*

In **About** menu, you can view versions number of firmware and the releasing time of that version.

# 10 Instruction for communication and configuration operation

## 10.1 Overview of MODBUS-RTU communication

In this chapter, the main content is about how to apply software to operate BRN-D513 series through communication port. To master the content in this chapter, you shall have knowledge of MODBUS protocol and read all other chapters in this manual, and have a comprehensive understanding on functions and application concepts of this product in advance.

This chapter includes overview of MODBUS protocol, detailed explanation of communication application format, application details of the instrument and parameter address lists.

### 10.1.1 Overview of MODBUS protocol

BRN-D513 series applied MODBUS-RTU communication protocol, which particularly defines check code and data series, etc. , which are all essentials for specific data exchange. MODBUS protocol uses master-slave answering connection (half-duplex) on one communication line. This means that the signal is transmitted in two opposite directions on a single communication line. At first, the signal from master computer addresses to an only terminal device (slave). Then, the answering signal sent by the terminal device is transmitted to the master computer in the reverse direction.

MODBUS protocol only allows communication between master (like PC, PLC, etc.) and terminal devices, but no data exchange between independent terminal devices. In this way, each terminal device would not occupy the line during their initialization, and they are limited to answer inquiry signals arriving at local machine.

### 10.1.2 Inquiry—answer cycle

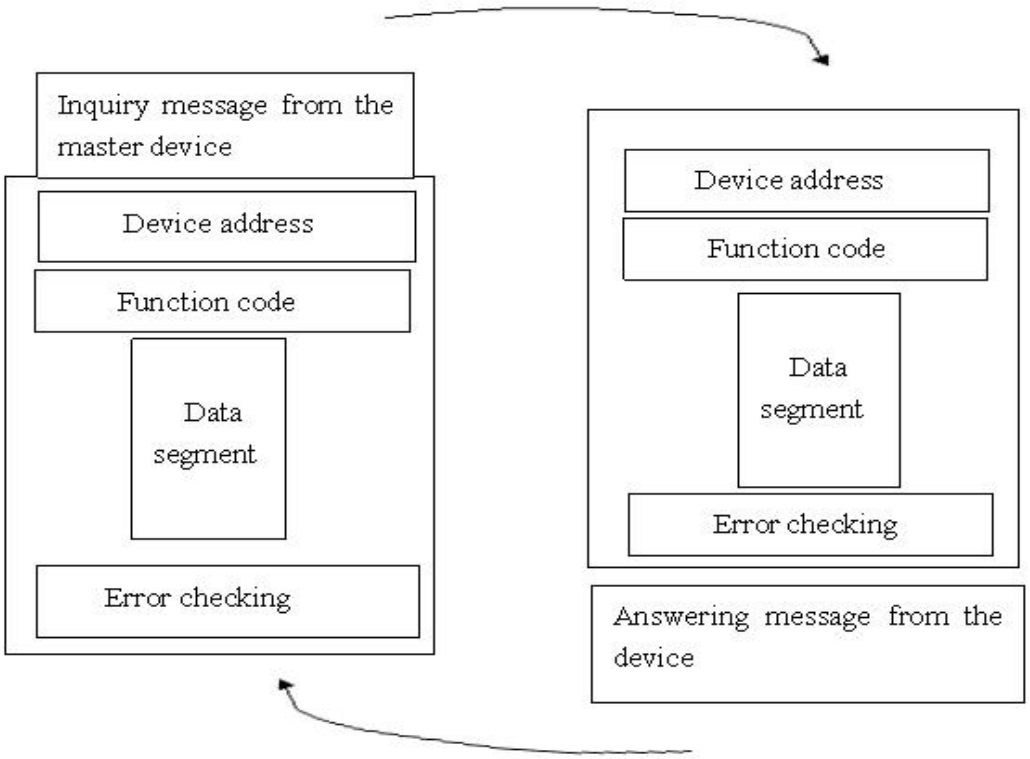



Figure 1 Master—slave inquiry and answer cycle

### 10.1.3 Inquiry

The function code in the inquiry information tells which function that the chosen slave device shall perform. The data segment contains any additional information for slave device to perform the function. For example, function code 03 is the content that slave device shall read from holding register and return to the master device. The data segment must contain information to inform slave device: to start reading at which register and to read how many registers. Error checking domain provides a method for device to verify whether the message is correct.

### *10.1.4 Answer*

If slave device produces a normal answer, the function code in the answering message is a respond to the function code in the inquiry message. The data segment contains data collected by slave device: such as values or status of register. If there is any error, the function code will be modified to indicate error property of answering message, and the data segment will contain code that describes the error message. The error checking domain allows the master device to confirm whether the content of message is available.

### *10.1.5 Transmission mode*

Transmission mode refers to a series of independent data structure and limited rules for transmitting data in one data frame. The following defines transmission mode compatible with MODBUS protocol—RTU mode.

Digit of each byte

- 1 start bit
- 8 data bits, the smallest significance bit is sent first
- No parity check bit
- 1 stop bit

Error checking CRC (cyclic redundancy check)

### *10.1.6 Protocol*

When data frame reaches the terminal device, it enters in the addressed device through a simple “port”. This device will remove the “envelope” (data head”) of the data frame, and reads data. If there is no error, the device will perform the task that the data requires, add the data generated by itself into the obtained “envelope”, and return the data frame back to the sender. The returned answering data contains the following contents: Address of terminal slave device, **Function** being executed, requested Data that is produced due to command execution, and one Check code. Any errors would lead to unsuccessful answering, or a returned error indication frame.

### *10.1.7 Format of data frame*

| Address | Function | Data | Check |
|---|---|---|---|
| 8-Bits | 8-Bits | N x 8-Bits | 16-Bits |

### *10.1.8 Address domain*

The address domain is at the starting part of frame, and it is constituted by one byte (8-bits). The decimalism is 0~255. Our system only uses 1~247, and keeps other addresses. These digits indicate the address of the terminal device that the user appoint. This device would receive the data from the mutual—connected master device. The address of each terminal device must be unique, and only the addressed terminal would answer inquiry that contains its address. When a terminal device returns an answer, the address data of answering salve device tells the master computer which terminal that it is communicating with.

### *10.1.9 Function domain*

The code of function domain indicates what functions the addressed terminal executes. The following table lists the function codes that BRN-D513 series apply, and their meaning and functions.

| Code | Meaning | Behavior |
|---|---|---|
| 01 | Read status of DO | Acquire the current status (ON/OFF) of digital (relay) output |
| 02 | Read status of DI | Acquire current status (ON/OFF) of digital input |
| 03 | Read data register | Acquire current binary values of one or multi registers |
| 05 | Control | Control output status (ON/OFF) of digital (relay) |

| | | |
|---|---|---|
| | | output |
| 16 | Preset multi registers | Set binary values in a series of multi registers |

### *10.1.10 Data domain*

Data domain contains data required by terminal to execute specific function, or data collected by terminal while answering inquiry. The contents of these data could be number, reference address or set values. For example, the function domain code asks the terminal to read a register, so that the data domain shall specify that which register the terminal starts reading and how many data the terminal read. The embedded address and data would be different from each other because of category and differences of slave devices.

### *10.1.11 Error Check domain*

This domain allows error occurred in check and transmission process between master and slave devices. Sometimes, due to electrical noise and other interferences, one set of data may change somehow while being transmitted from one device to another device. Error check can assure the master or terminal would not respond to the data changed during transmission process. This improves security and efficiency of the system. Error check apply the method of 16—bit cyclic redundancy check (CRC16)

### *10.1.12 Error indication frame and error code*

If the slave devices detected logical error in the data that the master device send, like non—existed address or data amount beyond the range, it will send error indication frame to the master device. The definition of error indication frame is: the most significant bit (MSB) of function domain (Function) is set to be 1, and other bits remain same; data domain (Data) defines error type (error code). Please note: if the error is CRC error, the slave device would not return any data.

For example, when the master computer requests to read digital output status but the address it gives is beyond effective range, the slave device would send error code:

| Addr | Fun | Byte count | Err Code | CRC16 lo | CRC16 hi |
|---|---|---|---|---|---|
| 0AH | 81H | 01H | FFH | 12H | 04H |

In this example, the error is FFH and the function domain is 81H(it sets MSB b7 of the requested function code 01H to 1.)

### *10.1.13 Methods of error check*

Cyclic redundancy check (CRC) domain only occupies two bits, which contain a 16—bit binary value. CRC value is calculated by the transmission device, and is attached to the data frame. When the receiving device receives the data, it recalculates CRC value, and compares the value with received value in CRC domain. If these two values are not equal, there is error.

During CRC operation, at first, one 16—bit register is preset as all ones, and compute this value with 8 bits of each byte in the data frame. Only the 8 data bits of each byte participate in producing CRC, when the start bit and stop bit and the parity bit that could be used would not influence CRC. When generating CRC, make 8 bits of each byte have XOR with the content in the register; and shift the result to lower bit, when the higher bits are supplemented by “0”. Then, the least significant bit is shifted out and checked. If it is one, then the register would conduct one XOR operation with a fixed preset value (0A001H). If the LSB is 0, then it would give no objection.

The above processing would be conducted repeatedly, until when 8 shift operations are completed. When the last bit (the eighth bit) is shifted, the next 8-bits byte would conduct XOR operation with the current value of the register and perform another 8—bit shifting XOR operation that is same as the last one. When all bytes in the data frame is processed, the last value being generated is CRC value.

The process to generate a CRC:

1 Preset a 16—bit register to 0FFFFH (all ones); this register is called CRC register.

2 Conduct XOR operation between 8 bits of the first byte and lower bytes in CRC register; and store the result in CRC register;

3 Shift CRC register once to the right, and fill the most significant bit by 0; shift the least significant bit out and detect it.

4 If the LSB is 0: repeat step 3 ( next shifting); if the LSB is 1: conduct XOR operation between CRC register and one fixed preset value (0A001H).

5 Repeat step 3 and step 4 until shift operation of the eighth bit. This is the way of processing a complete 8 bits.

6 Repeat step 2 to step 5 to process next 8 bits, until all bytes are processed.

7 At last, the value of CRC register is the CRC value.

In addition, there is another way of applying preset table to calculate CRC. This method's main characteristic is fast computing speed, but its table requires relatively larger memory space. This method would not be explained here. Please refer to the relevant information.

### *10.1.14 Details of communication application format*

This example in this section would apply the format as shown as much as possible. (The digits are hexadecimal.)

| Addr | Fun | Datastart reg hi | Data start reg lo | Data #of regs hi | Data #of regs lo | CRC16lo | CRC16hi |
|---|---|---|---|---|---|---|---|
| 0AH | 03H | 00H | 00H | 00H | 03H | 04H | B0H |

Address: address of slave device

Fun: function code

Data start reg hi: High byte of data start address register

Data start reg lo: Low byte of data start address register

Data #of reg hi: High byte of data read amount register

Data #of reg lo: Low byte of data read amount register

CRC16 Hi: High of byte of cyclic redundancy check

CRC16 Lo: Low byte of cyclic redundancy check

### *10.1.15 Read digital output status (function code 01)*

- Query data frame

**Query** data frame, the data frame that is send from master computer to slave device. 01 function allows users to acquire assigned address's DO (relay) output status ON/OFF (1=ON, 0 = OFF). Except address and function domain of slave device, the data frame also needs to contain start address of DO (relay) being read and amount of DO (relay) being read in the data domain. In BRN-D513 series, addresses of DO (relay) start from 0000H (DO1=0000H, DO2=0001H).

The following example is status of DO1 and DO2 of slave device, of which the address is 10.

(For example, BRN-D513 series can configure 6Dos at most, and the Dos' addresses are from 0000H to 0005H)

| Addr | Fun | DO start reg hi | DO start reg lo | DO #of regs hi | DO #of regs lo | CRC16lo | CRC16hi |
|---|---|---|---|---|---|---|---|
| 0AH | 01H | 00H | 00H | 00H | 02H | BCH | B0H |

- Response data frame

Response data frame is the data frame that the slave device answers the master computer. It contains slave device's address, function code, data amount and CRC error check. In the data packet, each DO occupies one bit (1=ON, 0 = OFF). The least significant bit of the first byte is DO value being addressed, and the rest are in the back.

The following example is a real example of reading digital output status response.

| Addr | Fun | Byte count | Data | CRC16 lo | CRC16 hi |
|---|---|---|---|---|---|
| 0AH | 01H | 01H | 02H | D2H | 6DH |

Data is DO's status and its definition is:

| 0 | 0 | 0 | 0 | 0 | 0 | DO2 | DO1 |
|---|---|---|---|---|---|---|---|
| b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |

MSB LSB

(DO1 = OFF, DO2=ON)

- Error code

If the address that the master computer requests does not exist, or if the data amount is not correct, error code (FFH) would be returned.

### *10.1.16 Read digital output status (function code 02)*

- Query data frame

This function allows users to acquire assigned address's DI status ON/OFF (1=ON, 0 = OFF). Except address and function domain of slave device, the data frame needs to contain start address of DI being read and amount of DI being read in the data domain. In BRN-D513 series, there are 8 DIs (of which the addresses are from 0000H to 0007H).

The following example is status of DI1 and DI2 of slave device, of which the address is 10.

| Addr | Fun | DI startAddr hi | DI startAddr lo | DI # regs of hi | DI # regs of lo | CRC16 lo | CRC16 hi |
|---|---|---|---|---|---|---|---|
| 0AH | 02H | 00H | 00H | 00H | 02H | F8H | B0H |

- Response data frame

Response data frame contains slave device's address, function code, data amount and CRC error check. In the data packet, each DO occupies one bit (1=ON, 0 = OFF). The least significant bit of the first byte is DI value being addressed, and the rest are in the back.

The following example is a real example of reading digital input status response.

| Addr | Fun | Byte count | Data | CRC16 lo | CRC16 hi |
|---|---|---|---|---|---|
| 0AH | 02H | 01H | 01H | 62H | 6CH |

Data is DI's status and its definition is:

| 0 | 0 | 0 | 0 | 0 | 0 | DI2 | DI1 |
|---|---|---|---|---|---|---|---|
| b7 | b6 | b5 | b4 | b3 | b2 | B1 | b0 |

MSB LSB

( DI1=ON, DI2=OFF)

Figure 4-6: response of reading status of DI1 and DI2

- Error code

If the address that the master computer requests does not exist, or if the data amount is not correct, error code (FFH) would be returned.

### *10.1.17 Read data (function 03)*

- Query data frame

This function allows user to acquire data and system parameter that the device collects and records. For the data amount that the master computer requires once, there is no limit, but it cannot exceed the defined address range.

The following example is that No. 10 slave device reads 3 collected basic data-- F, Va, Vb (every data

is processed as floating point data, when each address in the data frame occupies 2 bytes). In BRN-D513 series, address of F is 4000H and 4001H; Va's address is 4002H and 4003H; Vb's address is 4004H and 4005H.

| Addr | Fun | Data start Addr hi | Datastart Addrlo | Data#of regs hi | Data #of regs lo | CRC16 lo | CRC16 hi |
|---|---|---|---|---|---|---|---|
| 0AH | 03H | 40H | 00H | 00H | 06H | D1H | 73H |

- Response data frame

Response contains lave device's address, function code, data amount and CRC error check. The following example is response of reading F, Va, Vb (F=42480000H(50Hz), Va=42C7CCCDH(99.9v), Vb=42C8051FH(100.1v)).

| Addr | Fun | Bytecount | Data1 hi | Data1 lo | Data2 hi | Data2lo | Data3hi | Data3lo | Data4hi | Data4lo |
|---|---|---|---|---|---|---|---|---|---|---|
| 0AH | 03H | 0CH | 42H | 48H | 00H | 00H | 42H | C7H | CCH | CDH |

| Data5 hi | Data5 lo | Data6 hi | Data6 lo | CRC16 lo | CRC16 hi |
|---|---|---|---|---|---|
| 42H | C8H | 05H | 1FH | 87H | 09H |

- Error code

If the address that the master computer requests does not exist, or if the data amount is not correct, error code (FFH) would be returned.

### *10.1.18 Control DO (relay) (function code 05)*

- Query data frame

This data frame arbitrarily sets an independent DO as ON or OFF. The address of DO of BRN-D513 series starts from 000H (DO1 = 0000H, DO2 = 0001H). Note: the definition of ON may not be close of output circuit. According to difference of setting parameter, when set as ON once, there may output a pulse at the hardware.

Data FF00H will set DO as ON status, when 0000H will set DO as OFF status. All other values will cause slave device to send error code, without influencing DO status.

The following example is about requesting No. 10 slave device to set DO1 as ON status.

| Addr | Fun | DO addr hi | DO addr lo | Value hi | Value lo | CRC16 lo | CRC16 hi |
|---|---|---|---|---|---|---|---|
| 0AH | 05H | 00H | 00H | FFH | 00H | 8DH | 41H |

- Response data frame

Normal response to this command is to send back the received data after changing DO status.

| Addr | Fun | Doaddr hi | Do addrlo | Valuehi | Valuelo | CRC16 lo | CRC16 hi |
|---|---|---|---|---|---|---|---|
| 0AH | 05H | 00H | 00H | FFH | 00H | 8DH | 41H |

Figure 4-10 control response of independent DO

- Error code

If the address that the master computer requests does not exist, or if the data amount is not correct, error code (FFH) would be returned.

### *10.1.19 Preset multi registers (function code 16)*

- Query data frame

Function code 16 allows users to change content of multi registers. For BRN-D513 series, system parameter and electric energy quantity can be written in by this function code. The master computer can write 16 (32 bytes) data once at most.

The following example is to preset No. 10 slave device's importing active electric power (positive and active electric power)(EP_imp as 17807783.3 kWh. The stored electric power is numerical value X

0.1 kWh. Therefore, the written in value is 178077833, of which its hexadecimal is 0A9D4089H. The address of EP_imp is 0156H and 0157H. EP_imp occupies 32 bits, of which are 4 bytes totally.

| Addr | Fun | Data Startreg hi | Data startreg lo | Data#ofregs hi | Data #ofregs lo |
|---|---|---|---|---|---|
| 0AH | 10H | 01H | 56H | 00H | 02H |

| Byte Count | Valuehi | Valuelo | Valuehi | Valuelo | CRC lo | CRC hi |
|---|---|---|---|---|---|---|
| 04H | 0AH | 9DH | 40H | 89H | 3CH | 5DH |

- Response data frame

Normal response to request of presetting single register is answering device address, function code, start and stop addresses of data, data amount, CRC check code after changing register value. As shown.

| Addr | Fun | Data start reg hi | Data startreg lo | Data #of Regs hi | Data #ofRegslo | CRC16 lo | CRC16 hi |
|---|---|---|---|---|---|---|---|
| 0AH | 10H | 01H | 56H | 00H | 02H | A1H | 5FH |

- Error code

If the address that the master computer requests does not exist, or if the data amount is not correct, error code (FFH) would be returned

### *10.2 Application details and parameter address table of BRN-D513 series*

BRN-D513 series' measuring values are read out by 03 command of Modbus-RTU communication protocol. DI's address area are read out by 02 command, when DO's addresses are read out by 01 command and written in by 05 command.

For floating data in 4000H~4047H, their communication value is actual value of primary side. For other addresses, the correspondence between communication values and actual values is as shown below: (Val_t is read—out communication value, Val_s is actual value).

| Available parameter | Correspondence | Unit |
|---|---|---|
| Voltage value V1,V2,V3, Vvavg,V12,V23,V31,Vlavg | Val_s＝Val_t X (PT1 / PT2) /10 | V |
| Current value I1,I2,I3, Iavg, In | Val_s＝Val_t X(CT1/CT2) /1000 | A |
| Power value P1, P2, P3, Q1, Q2, Q3, S1, S2, S3, PLsum, QLsum, SLsum | Val_s＝Val_t X (PT1 / PT2) X (CT1/CT2 /10 | W,<br>var,<br>VA |
| Power value Psum,Qsum,Ssum | Val_s＝Val_t X (PT1 / PT2) X (CT1/CT2) | |
| Electric energy quantity, EP_imp, EP_exp, EP_total, EP_net, EQ_imp, EQ_exp, EQ_total, EQ_net | Val_s＝Val_t /10 | kWh<br>kvarh |
| Power factor value PFa, PFb, PFc, PF | Val_s＝Val_t / 1000 | N/A |
| Frequency F | Val_s＝Val_t / 100 | Hz |
| Device | Val_s＝Val_t / 10 | Celsius degree |
| Harmonic ratio | Val_s＝Val_t / 100 | % |
| Harmonic distortion rate | Val_s＝Val_t / 100 | % |
| Leakage current | Val_s = Val_t | mA |

Note: PT1/PT2 is PT ratio; CT1/CT2 is CT ratio.

Example: Va's is read—out communication value is 2246. PT1 is 100; PT2 is 100, then Va's actual is:

Va = 2246×（100/100）/10 = 224.6V.

| The followings are address areas of DI, 02h read | | | | |
|---|---|---|---|---|
| Address | Parameter | Read-write property | Number range | Data type |
| 0000H | DI1 | 1 = ON , 0 = OFF | BIT | R |
| 0001H | DI2 | 1 = ON , 0 = OFF | BIT | R |
| 0002H | DI3 | 1 = ON , 0 = OFF | BIT | R |
| 0003H | DI4 | 1 = ON , 0 = OFF | BIT | R |
| 0004H | DI5 | 1 = ON , 0 = OFF | BIT | R |
| 0005H | DI6 | 1 = ON , 0 = OFF | BIT | R |
| 0006H | DI7 | 1 = ON , 0 = OFF | BIT | R |
| 0007H | DI8 | 1 = ON , 0 = OFF | BIT | R |

| The followings are address areas of DO, 01H read, 05H write |
|---|

| Address | Parameter | Read-write property | Number range | Data type |
|---|---|---|---|---|
| 0000H | DO1 | 1 = ON , 0 = OFF | BIT | R/W |
| 0001H | DO2 | 1 = ON , 0 = OFF | BIT | R/W |
| 0002H | DO3 | 1 = ON , 0 = OFF | BIT | R/W |
| 0003H | DO4 | 1 = ON , 0 = OFF | BIT | R/W |
| 0004H | DO5 | 1 = ON , 0 = OFF | BIT | R/W |
| 0005H | DO6 | 1 = ON , 0 = OFF | BIT | R/W |

Definition of read-write property: R-readable, W-writable, P-no data loss after power off

| The following is address area of system parameter: 03H function code reading, 10H function code writing, U, I, PQS are values of secondary side values | | | | |
|---|---|---|---|---|
| **Address** | **Parameter** | **Read-write property** | **Number range** | **Data type** |
| 1000H | Protecting Passwords | R/W/P | 0~9999 | word |
| 1001H | High byte, secondary 485(COM2) device address | R/W/P | 1~247 | word |
| | Low byte, main 485(COM1) device address | R/W/P | 1~247 | |
| 1002H | High byte, secondary 485(COM2) baud rate | R/W/P | 0-5: corresponding to 1200,2400,4800, 9600,19200,38400bps | word |
| | Low byte, main 485(COM2) baud rate | R/W/P | 0-5: corresponding to 1200,2400,4800, 9600,19200,38400bps | |
| 1003H~1004H | Save | - | - | - |
| 1005H | PT1 high byte | R/W/P | 0~220. x10000<br>PT1=hi*10000+lo | word |
| 1006H | PT1 low byte | R/W/P | 0~9999<br>PT1:100~2200000 | word |
| 1007H | PT2 | R/W/P | 100, 220, 380 | word |
| 1008H | CT1 | R/W/P | 1~6000 | word |
| 1009H | CT2 | R/W/P | 1or 5 | word |
| 100AH | High 8—bit: IN threshold | R/W/P | 0-100 | word |
| | Low 8—bit: current threshold | R/W/P | 0-100 | |
| 100BH | single sliding window period | R/W/P | 1~20 | word |
| 100CH | Required amount of sliding windows | R/W/P | 1~60 | word |
| 100DH | Save | - | - | - |
| 100EH | Clear demand | W | Write 1 to clear demand | word |
| 100FH | Clear extremum | W | Write 1 to clear extremum | word |
| 1010H | Save | - | - | - |

| | | | | | |
|---|---|---|---|---|---|
| 1011H | Current direction | | R/W/P | Bit0: IA current direction<br>0-positive direction,<br>1-reverse direction<br>Bit1:IB current direction<br>Bit2:IC current direction | word |
| 1012H~1014H | save | | - | - | - |
| 1015H | O1 type | | R | 0-n/a<br>1-DO 2-PO<br>3-AO<br>4-ILelectric leakage measuring<br>5-T temperature measuring | word |
| 1016H | DO | DO1 operation mode | R/W/P | 0-level mode<br>1- pulse mode | word |
| | PO | PO1 pulse output electric energy selection | | 0——Ep_imp<br>1——Ep_exp<br>2——Eq_imp<br>3——Eq_exp<br>4——Ep_total<br>5——Ep_net<br>6——Eq_total<br>7——Eq_net<br>8——no output | |
| | AO | AO1 parameter address | | 0~65535 | |
| 1017H | DO | DO1 pulse width setting | R/W/P | 0~65535 | word |
| | PO | Save | | | |
| | AO | AO1 corresponding value to 4mA | | | |
| 1018H | DO | save | R/W/P | 0~65535 | word |
| | PO | save | | | |
| | AO | AO1 corresponding value to 20mA | | | |
| 1019H~102CH | Setting of O2~O6 is same as setting of O1 | | | | |
| 102DH | Setup of electric energy pulse width | | R/W/P | 1~100<br>1unit is 10ms | word |
| 102EH | pulse constant of DO electrical degree<br>namely, pulse number/kWh | | R/W/P | 1~6000<br>1unit -1 pulse | word |
| 102FH | Save | | | | |
| 1030H | Period of lighting backlight | | R/W/P | 0 –normally on<br>1 – 1 mins<br>2– 5 mins<br>3 – 10 mins<br>4 – 30 mins | word |

| | | | | |
|---|---|---|---|---|
| 1031H | Infrared, phonic control | R/W/P | Bit0: infrared triggering backlight<br>0-disable, 1-enable<br>Bit1: infrared security count<br>0-disable, 1-enable<br>Bit2: security count mode<br>0-always; 1-set period<br>Bit3: infrared tone<br>0-off, 1-on<br>Bit4: key tone<br>0-off, 1-on<br>Bit5: alarm tone<br>0-off, 1-on<br>Bit6: Automatic alarm silencing<br>0-off, 1-on<br>Bit7-15: save | word |
| 1032H | Display themes color plan | R/W/P | 0~4 | word |
| 1033H | Enable voltage swell/sag | R/W/P | Bit0:enable swell<br>0-disable, 1-enable<br>Bit1:VB enable swell<br>Bit2:VC enable swell<br>Bit3:VA enable sag<br>Bit4:VB enable sag<br>Bit5:VC enable sag | word |
| 1034H | Reference value of measuring voltage | R/W/P | 0~999 | word |
| 1035H | Voltage sag threshold (%) | R/W/P | 10~90 | word |
| 1036H | Voltage sag delay time | R/W/P | 0~3000<br>1 unit-10ms | word |
| 1037H | Voltage sag and output to relay | R/W/P | 0-no output<br>1-DO1<br>2-DO2 | word |
| 1035H | Voltage swell threshold (%) | R/W/P | 110~190 | word |
| 1036H | Voltage swell delay time | R/W/P | 0~3000<br>1 unit-10ms | word |
| 1037H | Voltage swell and output to relay | R/W/P | 0-no output<br>1-DO1<br>2-DO2 | word |
| 1038H~103FH | save | | | |
| 1040H | Real—time clock (year) setup | R/W/P | 2000 ~ 2099 | word |
| 1041H | Real—time clock (month) setup | R/W/P | 1 ~ 12 | word |
| 1042H | Real—time clock (day)setup | R/W/P | 1 ~ 31 | word |
| 1043H | Real—time clock (hour) setup | R/W/P | 0~24 | word |
| 1044H | Real—time clock (minute) setup | R/W/P | 0~59 | word |
| 1045H | Real—time clock (second) setup | R/W/P | 0~59 | word |
| 1046H | Main alarm switch | R/W/P | 0-disable, 1-enable | word |
| 1047H | save | | | |

| | | | | |
|---|---|---|---|---|
| 1048H | on-off switch of each alarm channel | R/W/P | 0~65535<br>Bit0: control channel 1, 0-disable, 1-enable.<br>Bit1: control channel 3,<br>and so on<br>Bit15: control channel 16 | word |
| 1049H | Logic switch between alarm channels | R/W/P | 0~65535<br>Bit0: logic relation between channel 1 and channel 2,<br>0-and, 1-or.<br>Bit1: logic relation between channel 2 and channel 3,<br>and so on<br>Bit14: logic relation between channel 15 and channel 16,<br>Bit15: logic switch,<br>0-disable logic relation, 1-enable logic relation | word |

| The following is address area of single alarm record setting: 03H function code reading, 10H function code writing | | | | |
|---|---|---|---|---|
| **Address** | **Parameter** | **Read-write property** | **Number range** | **Data type** |
| 104EH | Group 1: selection of parameter numbers | R/W/P | 0~46, please refer to explanation of off-limit alarm function | word |
| 104FH | Group 1: comparison method | R/W/P | 0~alarm set-up value | word |
| 1050H | Group 1: alarm setup value | R/W/P | 0~65535 | word |
| 1051H | Group 1: delay time | R/W/P | 0~3000（x 10ms） | word |
| 1052H | Group 1: output to relay | R/W/P | 0-no output<br>1-DO1<br>2-DO2 | word |
| 1053H~109DH | setup of group 2 to group 16 is same as setup of group 1 | | | |

| The following is address area of time-sharing electric energy setup: 03H function code reading, 10H function code writing | | | | |
|---|---|---|---|---|
| **Address** | **Parameter** | **Read-write property** | **Number range** | **Data type** |
| 1100H | Enable time—sharing electric energy | R/W/P | 0-disable, 1-enable | word |
| 1101H | Time—sharing electric energy settlement method | R/W/P | 0-end of natural month<br>1-according to fixed date | word |
| 1102H | Time—sharing electric energy settlement date | R/W/P | 1~31 | word |
| 1103H | Settlement tome, minute number in one day | R/W/P | 0~1439 | word |
| 1104H | End time of time zone 1 | R/W/P | High 8 bits: month | word |

| | | | | |
|---|---|---|---|---|
| | | | Low 8 bits: date | |
| 1105H | rate of day period 1 in time zone 1 | R/W/P | 0-tip<br>1- peak<br>2-cereal<br>3-flat | word |
| 1106H | End time of day period 1 in time zone 1 (minutes number in one day) | R/W/P | 0~1439 | word |
| 1107H~111CH | Setup of day period 2 to period 12 in time zone 1 is same as setup of day period 1 in time zone 1 | | | |
| 111DH~1135H | Setup of time zone 2 is same as setup of time zone 1 | | | |
| 1136H~114EH | Setup of time zone 3 is same as setup of time zone 1 | | | |
| 114FH~1167H | Setup of time zone 4 is same as setup of time zone 1 | | | |
| 1168H~1180H | Setup of time zone 5 is same as setup of time zone 1 | | | |
| 1181H~1199H | Setup of time zone 6 is same as setup of time zone 1 | | | |
| 119AH | Rate currency amount at tip period | R/W/P | 1~4000 ￥0.001/kwh | word |
| 119BH | Rate currency amount at peak period | R/W/P | 1~4000 ￥0.001/kwh | word |
| 119CH | Rate currency amount at cereal period | R/W/P | 1~4000 ￥0.001/kwh | word |
| 119DH | Rate currency amount at flat period | R/W/P | 1~4000 ￥0.001/kwh | word |

| The following is address area of time—sharing electric energy parameter of current month: 03H function code reading, 10H function code writing | | | | |
|---|---|---|---|---|
| **Address** | **Parameter** | **Read-write property** | **Number range** | **Data type** |
| 119AH~119BH | consume active power (tip) | R/W | 0~999999999 | Dword |
| 119CH~119DH | release active power (tip) | R/W | 0~999999999 | Dword |
| 119EH~119FH | absorb reactive power (tip) | R/W | 0~999999999 | Dword |
| 11A0H~11A1H | release reactive power (tip) | R/W | 0~999999999 | Dword |
| 11A2H~11A3H | consume active power (peak) | R/W | 0~999999999 | Dword |
| 11A4H~11A5H | release active power (peak) | R/W | 0~999999999 | Dword |
| 11A6H~11A7H | absorb reactive power (peak) | R/W | 0~999999999 | Dword |
| 11A8H~11A9H | release reactive power (peak) | R/W | 0~999999999 | Dword |
| 11AAH~11ABH | consume active power (cereal) | R/W | 0~999999999 | Dword |
| 11ACH~11ADH | release active power (cereal) | R/W | 0~999999999 | Dword |
| 11AEH~11AFH | absorb reactive power (cereal) | R/W | 0~999999999 | Dword |
| 11B0H~11B1H | release reactive power (cereal) | R/W | 0~999999999 | Dword |
| 11B2H~11B3H | consume active power (flat) | R/W | 0~999999999 | Dword |
| 11B4H~11B5H | release active power (flat) | R/W | 0~999999999 | Dword |
| 11B6H~11B7H | absorb reactive power (flat) | R/W | 0~999999999 | Dword |
| 11B8H~11B9H | release reactive power (flat) | R/W | 0~999999999 | Dword |
| 11BAH~11BBH | consume active power (total) | R/W | 0~999999999 | Dword |
| 11BCH~11BDH | release active power (total) | R/W | 0~999999999 | Dword |
| 11BEH~11BFH | absorb reactive power (total) | R/W | 0~999999999 | Dword |
| 11C0H~11C1H | release reactive power (total) | R/W | 0~999999999 | Dword |

| The following is address area of time—sharing electric energy parameter of last month: 03H function code reading, 10H function code writing | | | | |
|---|---|---|---|---|
| **Address** | **Parameter** | **Read-write property** | **Number range** | **Data type** |
| 11C2H~11C3H | consume active power (tip) | R/W | 0~999999999 | Dword |
| 11C4H~11C5H | release active power (tip) | R/W | 0~999999999 | Dword |
| 11C6H~11C7H | absorb reactive power (tip) | R/W | 0~999999999 | Dword |
| 11C8H~11C9H | release reactive power (tip) | R/W | 0~999999999 | Dword |
| 11CAH~11CBH | consume active power (peak) | R/W | 0~999999999 | Dword |
| 11CCH~11CDH | release active power (peak) | R/W | 0~999999999 | Dword |
| 11CEH~11CFH | absorb reactive power (peak) | R/W | 0~999999999 | Dword |
| 11D0H~11D1H | release reactive power (peak) | R/W | 0~999999999 | Dword |
| 11D2H~11D3H | consume active power (cereal) | R/W | 0~999999999 | Dword |
| 11D4H~11D5H | release active power (cereal) | R/W | 0~999999999 | Dword |
| 11D6H~11D7H | absorb reactive power (cereal) | R/W | 0~999999999 | Dword |
| 11D8H~11D9H | release reactive power (cereal) | R/W | 0~999999999 | Dword |
| 11DAH~11DBH | consume active power (flat) | R/W | 0~999999999 | Dword |
| 11DCH~11DDH | release active power (flat) | R/W | 0~999999999 | Dword |
| 11DEH~11DFH | absorb reactive power (flat) | R/W | 0~999999999 | Dword |
| 11E0H~11E1H | release reactive power (flat) | R/W | 0~999999999 | Dword |
| 11E2H~11E3H | consume active power (total) | R/W | 0~999999999 | Dword |
| 11E4H~11E5H | release active power (total) | R/W | 0~999999999 | Dword |
| 11E6H~11E7H | absorb reactive power (total) | R/W | 0~999999999 | Dword |
| 11E8H~11E9H | release reactive power (total) | R/W | 0~999999999 | Dword |

| The following is address area of time--control switch setup parameter: 03H function code reading, 10H function code writing | | | | |
|---|---|---|---|---|
| **Address** | **Parameter** | **Read-write property** | **Number range** | **Data type** |
| 1200H | Allow time--control switch | R/W | Bit0: allow DO1 time--control 0-off, 1-on<br>Bit1: allow DO2 time--control<br>Bit2~Bit15 save | word |
| 1201H | Allow control of DO1 sunrise and sunset in every week | R/W | Bit0:Monday 0-off, 1-on<br>Bit1~Bit6: Tuesday to Sunday<br>Bit7~Bit15: save | word |
| 1202H | Enable control of DO2 sunrise and sunset in every week | R/W | Same as above | word |
| 1203H~1204H | save | | | |
| 1205H | longitude | R/W | 0~18000 | word |
| 1206H | latitude | R/W | 0~6000 | word |
| 1207H | DO1 channel 1 open time | R/W | Bit15: allow channel 1 to open<br>Bit14: save<br>Bit13: Sunday allow group 1<br>Bit12: Saturday allow group 1<br>Bit11: Friday allow | word |

| | | | | |
|---|---|---|---|---|
| | | | group 1<br>Bit10~Bit0: DO1 open time (minute number since zero hour) | |
| 1208H | DO1 channel 1close time | R/W | Bit15: allow channel 1 to close<br>Bit14: Thursday allow<br>Bit13: Wednesday allow<br>Bit12: Tuesday allow<br>Bit11: Monday allow<br>Bit10~Bit0: DO1 close time | word |
| 1209H | DO1 channel 2 open time | R/W | same as channel 1 | word |
| 120AH | DO1 channel 2 close time | R/W | | word |
| 120BH | DO1 channel 3 open time | R/W | same as channel 1 | word |
| 120CH | DO1 channel 3 close time | R/W | | word |
| 120DH | DO1 channel 4 open time | R/W | same as channel 1 | word |
| 120EH | DO1 channel 4 close time | R/W | | word |
| 120FH | DO1 channel 5 open time | R/W | same as channel 1 | word |
| 1210H | DO1 channel 5 close time | R/W | | word |
| 1211H | DO1 channel 6 open time | R/W | same as channel 1 | word |
| 1212H | DO1 channel 6 close time | R/W | | word |
| 1213H | DO1 channel 7 open time | R/W | same as channel 1 | word |
| 1214H | DO1 channel 7 close time | R/W | | word |
| 1215H | DO1 channel 8 open time | R/W | same as channel 1 | word |
| 1216H | DO1 channel 8 close time | R/W | | word |
| 1217H | DO1 channel 9 open time | R/W | same as channel 1 | word |
| 1218H | DO1 channel 9 close time | R/W | | word |
| 1219H | DO1 channel 10 open time | R/W | same as channel 1 | word |
| 121AH | DO1 channel 10 close time | R/W | | word |
| 121BH | DO1 channel 11 open time | R/W | same as channel 1 | word |
| 121CH | DO1 channel 11 close time | R/W | | word |
| 121DH | DO1 channel 12 open time | R/W | same as channel 1 | word |
| 121EH | DO1 channel 12 close time | R/W | | word |
| 121DH~1234H | Open and close time of channel 1 to channel 12 of DO2 is set same as DO 1. | | | |
| 1235H～123FH | save | | | |
| 1240H～1241H | EP's total fee of tip period of current month | R/W | unit: 0.1 yuan | Dword |
| 1242H～1243H | EP's total fee of peak period of current month | R/W | unit: 0.1 yuan | Dword |
| 1244H～1245H | EP's total fee of cereal period of current month | R/W | unit: 0.1 yuan | Dword |
| 1246H～1247H | EP's total fee of flat period of current month | R/W | unit: 0.1 yuan | Dword |
| 1248H～1249H | EP's total fee of tip period of last month | R/W | unit: 0.1 yuan | Dword |
| 124AH～124BH | EP's total fee of peak period of last month | R/W | unit: 0.1 yuan | Dword |
| 124CH～124DH | EP's total fee of cereal period of last month | R/W | unit: 0.1 yuan | Dword |
| 124EH～124FH | EP's total fee of flat period of last month | R/W | unit: 0.1 yuan | Dword |

| The following is address area of basic measuring parameter: 03H function code reading |
|---|

| Address | Parameter | Read-write property | Number range | Data type |
|---|---|---|---|---|
| 130H | Frequency F | R | 4500～6500 | word |
| 131H | Phase voltage V1 | R | 0～65535 | word |
| 132H | Phase voltage V2 | R | 0～65535 | word |
| 133H | Phase voltage V3 | R | 0～65535 | word |
| 134H | Phase voltage average value VLNavg | R | 0～65535 | word |
| 135H | Line voltage V12 | R | 0～65535 | word |
| 136H | Line voltage V23 | R | 0～65535 | word |
| 137H | Line voltage V31 | R | 0～65535 | word |
| 138H | Line voltage average value VLLavg | R | 0～65535 | word |
| 139H | phase (line) current I1 | R | 0～65535 | word |
| 13AH | phase (line) current I2 | R | 0～65535 | word |
| 13BH | phase (line) current I3 | R | 0～65535 | word |
| 13CH | Three—phase current average current Iavg | R | 0～65535 | word |
| 13DH | neutral current In | R | 0～65535 | word |
| 13Eh | split-phase active power P1 | R | -32768～32767 | Integer |
| 13Fh | split-phase active power P2 | R | -32768～32767 | Integer |
| 140H | split-phase active power P3 | R | -32768～32767 | Integer |
| 141H | system active power Psum | R | -32768～32767 | Integer |
| 142H | spilt--phase reactive powerQ1 | R | -32768～32767 | Integer |
| 143H | spilt--phase reactive powerQ2 | R | -32768～32767 | Integer |
| 144H | spilt--phase reactive powerQ3 | R | -32768～32767 | Integer |
| 145H | system reactive power Qsum | R | -32768～32767 | Integer |
| 146H | spilt--phase apparent power S1 | R | 0～65535 | word |
| 147H | spilt--phase apparent power S2 | R | 0～65535 | word |
| 148H | spilt--phase apparent power S3 | R | 0～65535 | word |
| 149H | system apparent power Ssum | R | 0～65535 | word |
| 14AH | spilt--phase power factor PF1 | R | -1000～1000 | Integer |
| 14BH | spilt--phase power factor PF2 | R | -1000～1000 | Integer |
| 14CH | spilt--phase power factor PF3 | R | -1000～1000 | Integer |
| 14DH | system power factor PF | R | -1000～1000 | Integer |
| 14EH~14FH | system active power PLsum | R | -65535～65535 | Long |
| 150H~151H | system reactive power QLsum | R | -65535～65535 | Long |
| 152H~153H | system apparent power SLsum | R | -65535～65535 | Long |

| The following is address area of electric energy parameter: 03H function code reading | | | | |
|---|---|---|---|---|
| **Address** | **Parameter** | **Read-write property** | **Number range** | **Data type** |
| 156H~157H | active electric energy Ep_imp | R | 0～999999999 | Dword |
| 158H~159H | active electric energy Ep_exp | R | 0～999999999 | Dword |
| 15AH~15BH | Inductive reactive electric energy Eq_imp | R | 0～999999999 | Dword |
| 15CH~15DH | Capacitive reactive electric energy Eq_exp | R | 0～999999999 | Dword |
| 15EH~15FH | net active electric energy Ep_total | R | 0～999999999 | Dword |
| 160H~161H | Internet active electric energy Ep_net | R | 0～999999999 | Dword |
| 162H~163H | net reactive electric energy Eq_total | R | 0～999999999 | Dword |
| 164H~165H | Internet reactive electric energy Eq_net | R | 0～999999999 | Dword |

| The following is address area of basic measuring parameters: 03H function code reading, U, I, PQS are values of primary side values | | | | |
|---|---|---|---|---|
| **Address** | **Parameter** | **Read-write property** | **Number range** | **Data type** |
| 3FFFH | Infrared triggering count | R/P | 0~65535 | word |
| 4000H~4001H | Frequency F | R | 4500～6500 | float |
| 4002H~4003H | Phase voltage V1 | R | 0～65535 | float |
| 4004H~4005H | Phase voltage V2 | R | 0～65535 | float |
| 4006H~4007H | Phase voltage V3 | R | 0～65535 | float |
| 4008H~4009H | Phase voltage average value VLNavg | R | 0～65535 | float |
| 400AH~400BH | Line voltage V12 | R | 0～65535 | float |
| 400CH~400DH | Line voltage V23 | R | 0～65535 | float |
| 400EH~400FH | Line voltage V31 | R | 0～65535 | float |
| 4010H~4011H | Line voltage average value VLLavg | R | 0～65535 | float |
| 4012H~4013H | phase (line) current I1 | R | 0～65535 | float |
| 4014H~4015H | phase (line) current I2 | R | 0～65535 | float |
| 4016H~4017H | phase (line) current I3 | R | 0～65535 | float |
| 4018H~4019H | Three—phase current average current Iavg | R | 0～65535 | float |
| 401AH~401BH | neutral current In | R | 0～65535 | float |
| 401CH~401DH | split-phase active power P1 | R | -32768～32767 | float |
| 401EH~401FH | split-phase active power P2 | R | -32768～32767 | float |
| 4020H~4021H | split-phase active power P3 | R | -32768～32767 | float |
| 4022H~4023H | system active power Psum | R | -32768～32767 | float |
| 4024H~4025H | spilt--phase reactive powerQ1 | R | -32768～32767 | float |
| 4026H~4027H | spilt--phase reactive powerQ2 | R | -32768～32767 | float |

| | | | | |
|---|---|---|---|---|
| 4028H~4029H | spilt--phase reactive powerQ3 | R | -32768～32767 | float |
| 403AH~402BH | system reactive power Qsum | R | -32768～32767 | float |
| 402CH~402DH | spilt--phase apparent power S1 | R | 0～65535 | float |
| 402EH~402FH | spilt--phase apparent power S3 | R | 0～65535 | float |
| 4030H~4031H | system apparent power Ssum | R | 0～65535 | float |
| 4032H~4033H | spilt--phase power factor PF1 | R | 0～65535 | float |
| 4034H~4035H | spilt--phase power factor PF2 | R | -1～1 | float |
| 4036H~4037H | spilt--phase power factor PF3 | R | -1～1 | float |
| 4038H~4039H | system power factor PF | R | -1~1 | float |
| 403AH~403BH | system active power PLsum | R | -1～1 | float |
| 403CH~403DH | unbalance degree of Voltage U | R | 0%~100% | float |
| 403EH~403FH | unbalance degree of Current I | R | 0%~100% | float |
| 4040H~4041H | load property (L/C/R) | R | 76.0/67.0/82.0 (ASCII 码) | float |
| 4042H~4043H | Demand of active power | R | -32768～32767 | float |
| 4044H~4045H | Demand of reactive power | R | -32768～32767 | float |
| 4046H~4047H | Demand of apparent power | R | -32768～32767 | float |

The following is address area of electric energy parameter: 03H function code reading, 10H function code writing

| Address | Parameter | Read-write property | Number range | Data type |
|---|---|---|---|---|
| 4048H~4049H | active electric energy Ep_imp | R/W/P | 0～999999999 | Dword |
| 404AH~404BH | active electric energy Ep_exp | R/W/P | 0～999999999 | Dword |
| 404CH~404DH | reactive electric energy Ep_imp | R/W/P | 0～999999999 | Dword |
| 404EH~404FH | reactive electric energy Ep_exp | R/W/P | 0～999999999 | Dword |
| 4050H~4051H | active electric energy TOTAL | R/W/P | 0～999999999 | Dword |
| 4052H~4053H | active electric energy NET | R/W/P | 0～999999999 | Dword |
| 4054H~4055H | reactive electric energy TOTAL | R/W/P | 0～999999999 | Dword |
| 4056H~4057H | reactive electric energy NET | R/W/P | 0～999999999 | Dword |
| 4058H~4059H | save | - | - | - |

The following is address area of harmonic parameters: 03H function code reading

| Address | Parameter | Read-write property | Number range | Data type |
|---|---|---|---|---|
| 405AH | V1 or V12 total harmonic distortion rate THD_V1 | R | 0～10000 | word |
| 405BH | V2 or V31 total harmonic distortion rate THD_V2 | R | 0～10000 | word |
| 405CH | V3 or V23 total harmonic distortion rate THD_V3 | R | 0～10000 | word |
| 405DH | Phase/line voltage average total harmonic distortion rate THD_V | R | 0～10000 | word |
| 405EH | I1 total harmonic distortion rate | R | 0～10000 | word |

| | | | | |
|---|---|---|---|---|
| | THD_I1 | | | |
| 405FH | I2 total harmonic distortion rate THD_I2 | R | 0～10000 | word |
| 4060H | I3 total harmonic distortion rate THD_I3 | R | 0～10000 | word |
| 4061H | Line voltage average total harmonic distortion rate THD_I | R | 0～10000 | word |
| 4062H~407FH | V1 or V12 harmonic ratio (2~31 times) | R | 0～10000 | word |
| 4500H~451FH | V1 or V12 harmonic ratio (32~63 times) | R | 0～10000 | word |
| 4700H~473FH | V1 or V12 harmonic ratio (64~127 times) | R | 0～10000 | word |
| 4080H | V1 or V12 odd harmonic distortion rate | R | 0～10000 | word |
| 4081H | V1 or V12 even harmonic distortion rate | R | 0～10000 | word |
| 4082H | V1 or V12 crest coefficient | R | 0～65535 | word |
| 4083H | V1 or V12telephone harmonic waveform factor | R | 0～10000 | word |
| 4084H~40A1H | V2 or V31 harmonic parameter | Same as V1 | | word |
| 4520H~453FH | V2 harmonic ratio (32~63 times) | R | 0～10000 | word |
| 4740H~477FH | V2 harmonic ratio (64~127 times) | R | 0～10000 | word |
| 40A2H | V2 or V31 odd harmonic distortion rate | R | 0～10000 | word |
| 40A3H | V2 or V31 even harmonic distortion rate | R | 0～10000 | word |
| 40A4H | V2 or V31 crest coefficient | R | 0～65535 | word |
| 40A5H | V2orV31 telephone harmonic waveform factor | R | 0～10000 | word |
| 40A6H~40C3H | V3 or V23 harmonic parameter | Same as V1 | | word |
| 4540H~455FH | V3 harmonic ratio (32~63 times) | R | 0～10000 | word |
| 4780H~47BFH | V3 harmonic ratio (64~127 times) | R | 0～10000 | word |
| 40C4H | V3 or V23 odd harmonic distortion rate | | | |
| 40C5H | V3 or V23 even harmonic distortion rate | | | |
| 40C6H | V3 or V23 crest coefficient | | | |
| 40C7H | V3 or V23telephone harmonic waveform factor | | | |
| 40C8H~40E5H | I1 harmonic ratio (2~31 times) | R | 0～10000 | word |
| 4520H~457FH | I1 harmonic ratio (32~63 times) | R | 0～10000 | word |
| 47C0H~47FFH | I1 harmonic ratio (64~127 times) | R | 0～10000 | word |
| 40E6H | I1 odd harmonic distortion rate | R | 0～10000 | word |
| 40E7H | I1 even harmonic distortion rate | R | 0～10000 | word |
| 40E8H | I1 K coefficient | R | 0～65535 | word |
| 40E9H~4106H | I2 harmonic parameter | Same as I1 | | word |
| 4580H~459FH | I2 harmonic ratio (32~63 times) | R | 0～10000 | word |
| 4800H~483FH | I2 harmonic ratio (64~127 times) | R | 0～10000 | word |
| 4107H | I2 odd harmonic distortion rate | R | 0～10000 | word |
| 4108H | I2 even harmonic distortion rate | R | 0～10000 | word |
| 4109H | I2 K coefficient | R | 0～65535 | word |
| 410AH~4127H | I3 harmonic parameter | Same as I1 | | word |
| 45A0H~45BFH | I3 harmonic ratio (32~63 times) | R | 0～10000 | word |
| 4840H~487FH | I3 harmonic ratio (64~127 times) | R | 0～10000 | word |
| 4128H | I2 odd harmonic distortion rate | R | 0～10000 | word |
| 4129H | I2 even harmonic distortion rate | R | 0～10000 | word |

| | | | | |
|---|---|---|---|---|
| 412AH | I2 K coefficient | R | 0～65535 | word |

| The following is address area of extremum record (maximum value, minimum value and occurring time) parameters: 03H function code reading | | | | |
|---|---|---|---|---|
| **Address** | **Parameter** | **Read-write property** | **Number range** | **Data type** |
| 4136H | V1 maximum value | R | -32768~32767 | Integer |
| 4137H~413CH | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 413DH | V2 maximum value | R | -32768~32767 | Integer |
| 413EH~4143H | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 4144H | V3 maximum value | R | -32768~32767 | Integer |
| 4145H~414AH | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 414BH | V12 maximum value | R | -32768~32767 | Integer |
| 414CH~4151H | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 4152H | V23 maximum value | R | -32768~32767 | Integer |
| 4153H~4158H | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 4159H | V31 maximum value | R | -32768~32767 | Integer |
| 415AH~415FH | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 4160H | I1 maximum value | R | -32768~32767 | Integer |
| 4161H~4166H | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 4167H | I2 maximum value | R | -32768~32767 | Integer |
| 4168H~416DH | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 416EH | I3 maximum value | R | -32768~32767 | Integer |
| 416FH~4174H | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 4175H | Maximum value of system active power | R | -32768~32767 | Integer |
| 4176H~417BH | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 417CH | Maximum value of system reactive power | R | -32768~32767 | Integer |
| 417DH~4182H | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 4183H | Maximum value of system apparent power | R | -32768~32767 | Integer |
| 4184H~4189H | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 418AH | Maximum value of system power factor | R | -32768~32767 | Integer |
| 418BH~4190H | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 4191H | Maximum value of frequency | R | -32768~32767 | Integer |
| 4192H~4197H | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 4198H | Maximum value of active demand | R | -32768~32767 | Integer |
| 4199H~419EH | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 419FH | Maximum value of reactive demand | R | -32768~32767 | Integer |
| 41A0H~41A5H | occurring time: year, month, day, hour, minute, second | R | time | Integer |

| | | | | |
|---|---|---|---|---|
| 41A6H | Maximum value of apparent power demand | R | -32768~32767 | Integer |
| 41A7H~41ACH | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 41ADH | Voltage unbalance degree's maximum value | R | -32768~32767 | Integer |
| 41AEH~41B3H | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 41B4H | Current unbalance degree's maximum value | R | -32768~32767 | Integer |
| 41B5H~41BAH | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 41BBH | V1（V12） harmonic distortion rate's maximum value | R | -32768~32767 | Integer |
| 41BC~41C1H | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 41C2H | V2（V31） harmonic distortion rate's maximum value | R | -32768~32767 | Integer |
| 41C3~41C8H | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 41C9H | V3（V23） harmonic distortion rate's maximum value | R | -32768~32767 | Integer |
| 41CA~41CFH | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 41D0H | I1 harmonic distortion rate's maximum value | R | -32768~32767 | Integer |
| 41D1~41D6H | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 41D7H | I2 harmonic distortion rate's maximum value | R | -32768~32767 | Integer |
| 41D8~41DDH | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 41DEH | I3 harmonic distortion rate's maximum value | R | -32768~32767 | Integer |
| 41DF~41E4H | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 41E5H~4293H are minimum values of the above parameters and they share same format with the maximum values. | | | | |

| The following is address area of sequence component parameter: 03H function code reading<br>U1 (or U12), I1 fundamental positive sequence, negative sequence and zero sequence, expressed by real and imaginary parts. | | | | |
|---|---|---|---|---|
| **Address** | **Parameter** | **Read-write property** | **Number range** | **Data type** |
| 4294H | U1 positive sequence (real part) | R | -32768~32767 | Integer |
| 4295H | U1 positive sequence (imaginary part) | R | -32768~32767 | Integer |
| 4296H | U1 negative sequence (real part) | R | -32768~32767 | Integer |
| 4297H | U1 negative sequence (imaginary part) | R | -32768~32767 | Integer |
| 4298H | U1 zero sequence (real part) | R | -32768~32767 | Integer |
| 4299H | U1 zero sequence (imaginary part) | R | -32768~32767 | Integer |
| 429AH | I1 positive sequence (real part) | R | -32768~32767 | Integer |
| 429BH | I1 positive sequence (imaginary part) | R | -32768~32767 | Integer |
| 429CH | I1 negative sequence (real part) | R | -32768~32767 | Integer |
| 429DH | I1 negative sequence (imaginary | R | -32768~32767 | Integer |

| | | | | |
|---|---|---|---|---|
| | part) | | | |
| 429EH | I1 zero sequence (real part) | R | -32768~32767 | Integer |
| 429FH | I1 zero sequence (imaginary part) | R | -32768~32767 | Integer |

The following is address area of phase angle parameters: 03H function code reading

This area stores phase angles that each voltage and current lag behind V1 (or V12). These parameters can be used to judge phase—sequence relation.

| Address | Parameter | Read-write property | Number range | Data type |
|---|---|---|---|---|
| 42A0H | Phase angle that V2 lags behind V1 V1/V2 | R | 0~3600 | word |
| 42A1H | Phase angle that V3 lags behind V1 V1/V3 | R | 0~3600 | word |
| 42A2H | Phase angle that I1 lags behind V1 V1/I1 | R | 0~3600 | word |
| 42A3H | Phase angle that I2 lags behind V1 V1/I2 | R | 0~3600 | word |
| 42A4H | Phase angle that I3 lags behind V1 V1/I3 | R | 0~3600 | word |
| 42A5H | Phase angle that V23 lags behind V12 V12/V23 | R | 0~3600 | word |
| 42A6H | Phase angle that I1 lags behind V12 V12/I1 | R | 0~3600 | word |
| 42A7H | Phase angle that I2 lags behind V12 V12/I2 | R | 0~3600 | word |
| 42A8H | Phase angle that I3 lags behind V12 V12/I3 | R | 0~3600 | word |

The following is address area of alarm event record parameters: 03H function code reading

| Address | Parameter | Read-write property | Number range | Data type |
|---|---|---|---|---|
| 42A9H | No. 1 group: alarm status | R | 0~65535 | word |
| 42AAH | Group 1: serial number of parameter | R | 0~50 | word |
| 42ABH | Group 1: off-limit or recovery value | R | Relevant to specific parameters | word |
| 42ACH~42B2H | Group 1: occurring time: year, month, day, hour, minute, second, millisecond | R | Time | word |
| 42B3H~42BCH | No. 2 group's alarm record | same as group one | | |
| 42BDH~42C6H | No. 3 group's alarm record | same as group one | | |
| 42C7H~42D0H | No. 4 group's alarm record | same as group one | | |
| 42D1H~42DAH | No. 5 group's alarm record | same as group one | | |
| 42DBH~42E4H | No. 6 group's alarm record | same as group one | | |
| 42E5H~42EEH | No. 7 group's alarm record | same as group one | | |
| 42EFH~42F8H | No. 8 group's alarm record | same as group one | | |
| 42F9H~4302H | No. 9 group's alarm record | same as group one | | |
| 4303H~430CH | No. 10 group's alarm record | same as group one | | |
| 430DH~4316H | No. 11 group's alarm record | same as group one | | |
| 4317H~4320H | No. 12 group's alarm record | same as group one | | |
| 4321H~432AH | No. 13 group's alarm record | same as group one | | |
| 432BH~4334H | No. 14 group's alarm record | same as group one | | |
| 4335H~433EH | No. 15 group's alarm record | same as group one | | |
| 433FH~4348H | No. 16 group's alarm record | same as group one | | |

| The following is address area of SOE record: 03H function code reading | | | | |
|---|---|---|---|---|
| **Address** | **Parameter** | **Read-write property** | **Number range** | **Data type** |
| 4399H | SOE first record's year | R | 2000~2099 | word |
| 439AH | SOE first record's month | R | 1~12 | word |
| 439BH | SOE first record's day | R | 1~31 | word |
| 439CH | SOE first record's minute | R | 0~23 | word |
| 439DH | SOE first record's minutes | R | 0~50 | word |
| 439EH | SOE first record's second | R | 0~59 | word |
| 439FH | SOE first record's millisecond | R | 0~999 | word |
| 43A0H | SOE first record's DI status | R | 0~65535 | word |
| 43A1H~4438H | SOE second to twentieth record | Same as first record | | |

| The following is address area of current demand parameters: 03H function code reading including real—time current demand and its occurring time | | | | |
|---|---|---|---|---|
| **Address** | **Parameter** | **Read-write property** | **Number range** | **Data type** |
| 4600H~4601H | A—phase current demand | R | | float |
| 4602H~4603H | B—phase current demand | R | | float |
| 4604H~4605H | C—phase current demand | R | | float |
| 4606H~4607H | Average value of current demand | R | | float |

| The following is address area of demand forecasting parameters: 03H function code reading including real—time current demand and its occurring time | | | | |
|---|---|---|---|---|
| **Address** | **Parameter** | **Read-write property** | **Number range** | **Data type** |
| 4608H~4609H | Active power demand | R | | float |
| 460AH~460BH | Reactive power demand | R | | float |
| 460CH~460DH | Apparent power demand | R | | float |
| 460EH~460FH | A—phase current demand | R | | float |
| 4610H~4611H | B—phase current demand | R | | float |
| 4612H~4613H | C—phase current demand | R | | float |
| 4614H~4615H | Average value of three—phase current demand | R | | float |

| The following is address area of demand extremum (including occurring time of counting) parameters: 03H function code reading | | | | |
|---|---|---|---|---|
| **Address** | **Parameter** | **Read-write property** | **Number range** | **Data type** |
| 4620H | A—phase current's maximum demand | R | | word |
| 4621H~4626H | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 4627H | B—phase current's maximum demand | R | | word |
| 4628H~462DH | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 462EH | C—phase current's maximum demand | R | | word |
| 462FH~4634H | occurring time: year, month, day, hour, minute, second | R | time | Integer |

| | | | | |
|---|---|---|---|---|
| 4635H | Average value of three—phase current maximum demand | R | | word |
| 4636H~463BH | occurring time: year, month, day, hour, minute, second | R | time | Integer |
| 463CH~4642H | Occurring time of counting demand extremum: year, month, day, hour, minute, second | R | time | Integer |

| The following is address area of electric leakage parameters: 03H function code reading | | | | |
|---|---|---|---|---|
| **Address** | **Parameter** | **Read-write property** | **Number range** | **Data type** |
| 4649H | electric leakage | R | 0-1000 （mA） | Integer |

| The following is address area of waveform record setup: 03H function code reading, 16 function code writing | | | | |
|---|---|---|---|---|
| **Address** | **Parameter** | **Read-write property** | **Number range** | **Data type** |
| 5000H | sampling number per cycle | R/W | 0-256 points<br>1-128 points<br>2-64 points<br>3-32 points<br>4-16 points<br>5-8 points | word |
| 5001H | Waveform storage mode | R/W | 0-keep full memory,<br>1- circulating memory | word |
| 5002H | Allowing triggering channel | R/W | BIT0-triggering condition1<br>BIT1-triggering condition2<br>BIT2-triggering condition3<br>BIT3-triggering condition4<br>BIT4-triggering condition5<br>BIT5-triggering condition6 | word |
| 5003H | Allow manual triggering | R/W | 0-off, 1-on | word |
| 5004H | Manual triggering time | R/W | 0-1000（x10ms） | word |
| 5005H | Selection of channel of triggering condition 1 | R/W | 0~15: Alarm1~Alarm16<br>16~23: DI1~DI8 | word |
| 5006H | Triggering time of triggering condition 1 | R/W | 0-1000 (x10ms) | word |
| 5007H~5010H | Triggering conditions 2 to 6, same as triggering condition 1 | R/W | Time | word |

| The followings are address areas of waveform record: 03H function code reading | | | | |
|---|---|---|---|---|
| **Address** | **Parameter** | **Read-write property** | **Number range** | **Data type** |
| 5040H | Record 1status | R | 0 - record is blank | word |

| | | | | |
|---|---|---|---|---|
| | | | 1- record is valid | |
| 5041H | record 1triggering condition | R | 0- manual triggering<br>1~6: number of triggering condition | word |
| 5042H | record 1 triggering time (year) | R | 2000~2099 | word |
| 5043H | record 1 triggering time (month) | R | 1~12 | word |
| 5044H | record 1 triggering time (day) | R | 1~31 | word |
| 5045H | record 1 triggering time (hour) | R | 0~23 | word |
| 5046H | record 1 triggering time (minute) | R | 0~59 | word |
| 5047H | record 1 triggering time (second) | R | 0~59 | word |
| 5048H | record 1 triggering time (millisecond) | R | 0~999 | word |
| 5049H | save | | | |
| 504AH | Record 1 V1 total harmonic distortion rate of waveform | | 0~65535 | word |
| 504BH | record 1 V1 odd harmonic distortion rate | | 0~65535 | word |
| 504CH | record 1 V1 even harmonic distortion rate | | 0~65535 | word |
| 504DH | record 1 V2 total harmonic distortion rate of waveform | | 0~65535 | word |
| 504EH | record 1 V2 odd harmonic distortion rate | | 0~65535 | word |
| 504FH | record 1 V2 even harmonic distortion rate | | 0~65535 | word |
| 5050H | record 1 V3 total harmonic distortion rate of waveform | | 0~65535 | word |
| 5051H | record 1 V3 odd harmonic distortion rate | | 0~65535 | word |
| 5052H | record 1 V3 even harmonic distortion rate | | 0~65535 | word |
| 5053H | record 1 I1 total harmonic distortion rate of waveform | | 0~65535 | word |
| 5054H | record 1 I1 odd harmonic distortion rate | | 0~65535 | word |
| 5055H | record 1 I1 even harmonic distortion rate | | 0~65535 | word |
| 5056H | record 1 I2 total harmonic distortion rate of waveform | | 0~65535 | word |
| 5057H | record 1 I2 odd harmonic distortion rate | | 0~65535 | word |
| 5058H | record 1 I2 even harmonic distortion rate | | 0~65535 | word |
| 5059H | record 1 I3 total harmonic distortion rate of waveform | | 0~65535 | word |
| 505AH | record 1 I3 odd harmonic distortion rate | | 0~65535 | word |
| 505BH | record 1 I3 even harmonic distortion rate | | 0~65535 | word |
| 505CH~505FH | save | | | |
| 5060H~519FH | record 1 V1 waveform (320 points) | | -32768~32768 | Integer |
| 51A0H~52DFH | record 1 V2 waveform (320 points) | | -32768~32768 | Integer |
| 52E0H~541FH | record 1 V3 waveform (320 points) | | -32768~32768 | Integer |
| 5420H~555FH | record 1 I1 waveform (320 points) | | -32768~32768 | Integer |
| 5560H~569FH | record 1 I2 waveform (320 points) | | -32768~32768 | Integer |

| | | | | |
|---|---|---|---|---|
| 56A0H~57DFH | record 1 I3 waveform (320 points) | | -32768~32768 | Integer |
| 57E0H~5F7FH | waveform record 2, same as waveform record 1 | | | |
| 5F80H~671FH | waveform record 3, same as waveform record 1 | | | |
| 6720H~6EBFH | waveform record 4, same as waveform record 1 | | | |
| 6EC0H~765FH | waveform record 5, same as waveform record 1 | | | |
| 7660H~7DFFH | waveform record 6, same as waveform record 1 | | | |
| 7E00H~859FH | waveform record 7, same as waveform record 1 | | | |
| 85A0H~8D3FH | waveform record 8, same as waveform record 1 | | | |
| 8D40H~94DFH | waveform record 9, same as waveform record 1 | | | |
| 94E0H~9C7FH | waveform record 10, same as waveform record 1 | | | |

Note:

- Data: “BIT” refers to 1—bit binary digit; “word” means 16—bit unsigned integer; “integer” means 16—bit signed integer; “Dword” means 32—bit unsigned integer; “float” means 32—bit floating data.
- Read-write property: “R” means only reading, and it applies 02H command to read DI, 01H command to read DO, and 03H to read other parameters; “R/W” means “read and write”, and it applies 05H command to write (control) DO, and 10H command to write system parameter, and it prohibits writing in unlisted address or address without writable property. P refers to no data loss when powered off.
- Electric energy quantity and basic measuring parameters are 32—bit floating data, which occupies 2 addresses. Upper-computer software shall transfer the hexadecimal number that will be read from two addresses to floating data to acquire this parameter value. For electric energy quantity, it shall consider the relation between communication value and actual value to get the parameter value, and divide this value by 10, so as to obtain conclusion of the actual value of this parameter. In addition, when the electric energy quantity adds up 999999999 (communication value, the actual value is 99999999.9kWh or kvarh), it would be cleared automatically. Every electric energy quantity would not influence each other. Besides, electric energy parameter is writable, which means, it can be cleared manually or be written into a value that you require.
- The setup range of baud rate: 1200 bps, 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps. Setup out of this range is disallowed. If setup value beyond range is written in, the instrument will invoke default baud rate: 9600 bps.
- Setup of DO: at present, DO can select relay output mode and pulse output mode.
- Operation mode of relay output: if set as pulse mode, when DO outputs 1, the system will output pulse with corresponding width according to setup of pulse width, and reset relay. After that, DO’s status being read would turn to 0.
- Time interval of electric energy storage is 5 minutes.
- The displayed value of electric energy is net active electric energy/net reactive electric energy. Other components need to be read out from communication or be customized.
- The false actuation test standard of electric energy is 0.5%: 0.5V creeping voltage, 0.025A creeping current. Only when voltage and current are both higher than the creeping values, the electric energy will start counting.
- Numerically, PLsum=10*Psum, QLsum=10*Qsum, QLsum=10*Qsum. This is because, some clients have high requirements on accuracy of power. This usually happens in conditions with weak signals. But some clients have contrary requirements. Processing high—accuracy numbers is relatively more complex; the client can choose based on specific condition.

# *11 User guide for main functions and common problems*

## *11.1 Application of BRN-D513 PIR infrared human body induction function:*

Main applications:

- To record site—staff intrusion warning situation; security function
- To record attendance of working staffs; work attendance journal function
- Staff triggering specific function or display backlight, to reduce self energy consumption

BRN-D513 PIR is realized by Fresnel lens on the instrument panel through detecting pyroelectric infrared signal of human body. See the sketch map above. Please do not shelter this lends in any ways, to ensure normal operation of PIR.

BRN-D513 PIR function with upper—computer software can realize function of complex on—site operation status record.

| Address | Parameter | Read-write property | Number range | Data type |
|---|---|---|---|---|
| 3FFFH | Infrared triggering counting | R/P | 0~65535 | Word |

3FFF H register records occurring times of on—site infrared detection. Every time when personnel come in the site, this variance data of this register will change. The upper—computer only needs to poll the instrument in a fixed time interval. When triggering technique has change, it means that there is person coming in the site.

The counting data of 3FFF H register will not loss after powering off. To check this data to know how many the times are that this data is read on site.

It can coordinate with clock record, event record or alarm treatment of upper—computer. This record can be used as intrusion alarm of unauthorized personnel coming to the site, or as automatic working log of working staffs on—site and on--time checks.

## *11.2 Electric energy pulse output*

In BRN-D513's standard configuration, there is one way of optical signal pulse output, which can be seen it the above figure, and can be used to realize check of electric energy or electric energy signal output through photo electricity check device.

The electric energy parameters corresponding to optical signal pulse output include total active electric energy, pulse width and pulse constant, which are influenced by the following registers:

| Address | Parameter | Read-write property | Number range | Data type |
|---|---|---|---|---|
| 102DH | Setup of electric energy pulse width | R/W/P | 1~100<br>1 unit is 10ms | word |
| 102EH | electric energy pulse constant<br>namely pulse number/kWh | R/W/P | 1~6000<br>1unit-10 pulses | word |

## *11.3 Harmonic*

This instrument can measure and analyze harmonic parameters including total harmonic distortion rate, 2—63 times of harmonic ratio, odd harmonic distortion rate, even harmonic distortion rate, crest coefficient, and telephone waveform factor.

## *11.4 Waveform record*

This instrument can provide 10 waveform records. Every record contains waveforms of three—phase current and voltage. Every waveform contains 320 points of sampling data. Each cycle's sampling points being record can be set according to demand. The sampling ratio for selection are 8, 16, 32, 64, 128, 256 points/cycle.

Waveform record can be set as manual triggering or conditional triggering. Manual triggering means to start recording waveform by sending command through 485 interface. Condition triggering can be set to start waveform record when alarm occurs or when DI turns from OFF to ON. The parameters relevant to

waveform recording:

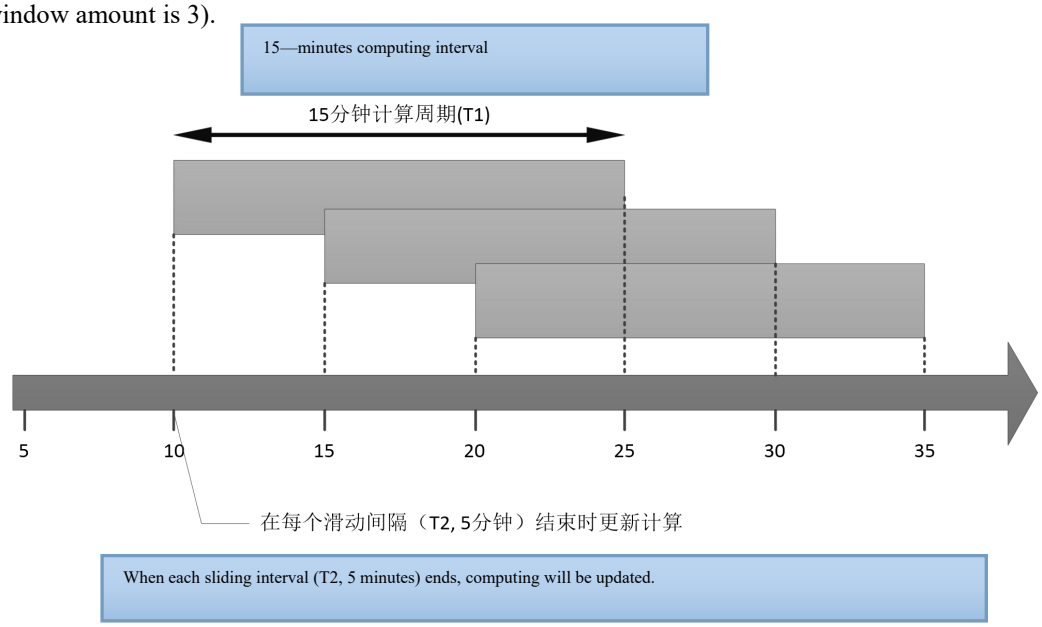
Storage mode: set as keep full memory or circulating memory.

Sampling points of each cycle: can be set as 8/16/32/64/128/256. Since the points of waveform recording is fixed at 320 points, when lower the sampling rate is set, more cycle amount is record.

Triggering time: refers to time duration since waveform recording is triggered until waveform recording ends. The set range of triggering time is 0~10000ms.

### *11.5 Demand*

Demand means average value of demand (usually about power) in a specified time interval (T1). The way to calculate average value is moving average method. Sliding interval (T2) can be set as 1—20 minutes, and its default value is 5 minutes. T1 is set through sliding window amount (T1=sliding interval x sliding window amount). T1 can be set as 1—60 minutes, and its default value is 15 minutes (the sliding window amount is 3).




This model of smart power distribution instrument provides various demand readings, including synchronous value, predicted value and maximum value.

**Synchronous value** refers to real-time demand computation value in every T1 cycle, and it will refresh the last value when every T2 cycle ends.

**Predicted value** refers to the demand value of next cycle being predicted according to transformation trend of original electric parameters when every T1 interval cycle ends.

**Maximum value** refers to the recorded maximum synchronous value after last reset.

Demand can be cleared. Clearing demand means to set all variances in the demand record and demand computing processes as 0. After clearing, it is same as the instrument is re--powered on (according to demand function).

### *11.6 Extremum counting*

This instrument can count maximum and minimum values of relevant parameters (phase/line voltage, current, active power, reactive power, apparent power, power factor, demand, unbalance degree, harmonic distortion rate) and their occurring time in real time. Extremum records are stored in nonvolatile memory, and will not lose after powering off.

### *11.7 Off—limit alarm function*

This instrument has the function of off—limit alarm. When one parameter's change goes beyond the set range, and lasts longer than the set duration limit, the off—limit alarm will be started. When alarm occurs, parameter serial number, numerical value, alarm status, and alarm occurring time will be recorded and stored as events. There can be a maximum of 16 of such records. When the records are full, the newest record will cover the earliest record.

If the logic relation between channels are enabled, it can set the condition that alarm can only be triggered when some channel conditions are all satisfied. The logic relation between adjacent channels can be set as two logic relations, "**and**" and "**or**". The priority of **logic and** is higher than priority of **logic or**. **Logic or** relation divides 16 channels into some groups. The logic relation between these groups is relatively independent. Only when conditions of all channels in the group are satisfied, the alarm will be triggered. In alarm condition, as if condition of one channel does not hold, the alarm will go back to regular condition.

| Address | Parameter | Number range | Read-write property |
|---|---|---|---|
| 104eH | Group 1: parameter serial number | 0～47 | R/W |
| 104fH | Group 1: comparison method | 1:greater than, 2:equal to, 3: less than | R/W |
| 1050H | Group 1: setup value | related to specific parameters | R/W |
| 1051H | Group 1: delay time | 0～3000 (×10ms) | R/W |
| 1052H | Group 1: output to DO | 0:no output 1-2: output to DO serial number | R/W |

Parameter serial number: to select relative parameter of this group alarm, like 0—frequency, then this group alarm will perform conditional judge on this parameter. The list of serial number of alarm parameters is at below:

| parameter name | F | V1 | V2 | V3 | $VLN_{avg}$ | V12 | V23 | V31 | $VLL_{avg}$ | I1 |
|---|---|---|---|---|---|---|---|---|---|---|
| parameter serial No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| parameter name | I2 | I3 | $I_{avg}$ | IN | P1 | P2 | P3 | $P_{sum}$ | Q1 | Q2 |
| parameter serial No. | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| parameter name | Q3 | $Q_{sum}$ | S1 | S2 | S3 | $S_{sum}$ | PF1 | PF2 | PF3 | PF |
| parameter serial No. | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| parameter name | UNBL-V | UNBL-I | Load type | THD-V1 | THD-V2 | THD-V3 | THD-V | THD-I1 | THD-I2 | THD-I3 |
| parameter serial No. | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 |
| parameter name | THD-I | DMD-P | DMD-Q | DMD-S | DMD-I1 | DMD-I2 | DMD-I3 | | | |
| parameter serial No. | 40 | 41 | 42 | 43 | 44 | 45 | 46 | | | |

Comparison method, setup value: to create alarm condition, like greater than, equal to or less than setup value.

Delay time: means how long alarm condition holds for is considered as satisfied event.

Output to DO: set as 0, then the alarm of this group will not output from DO when it occurs; set as 1, then the alarm of this group will output o DO1 when it occurs, namely DO1 closure. DO1will be turned off until all alarms output to DO1are recovered.

### *11.8 Time—sharing electric energy*

Time—sharing electric energy refers to dividing time into several continuous periods, of which each period can set different rate (tip, peak, cereal or flat). The instrument will confirm which rate it is for the electric energy at current moment according to its internal clock time, and calculate electric energy with different rates respectively, to achieve application requirement of time—sharing counting and charging.

Time—sharing electric energy time zone setup: 6 time zones can bet set at most; each time zone has one day period table; in every day, 12 day periods can be set at most. Each day period can assign one rate among four rates (tip and peak, flat, cereal).

Setup of time zone: setup date is the date that this time zone stops. Time zone setup must conform to the order from day to night. If the ending date of next time zone is earlier than the last time zone, it would be considered as ending of time zone setup.

Day period setup: the setup time is the time that this day period ends. Period setup must follow the order from day to night. If the stop time of a period is earlier than the previous period, it would be considered as ending of period.

### *11.9 Currency settlement function of time—sharing electric energy*

The pricing mode can be set directly through rate setting in the setting interface. In the display interface, it will count summarized data of different periods and rate, and display then visually.

### *11.10 SOE record*

There are 20 groups of SOE records. Every group has same format, contains time when DI transforms (year, month, day, hour, minute, second, millisecond) and DI status.

### *11.11 Longitude and latitude time--control switch*

- Main applications

Longitude and latitude time—control function is applied to applications like street lamp control. After setup of longitude and latitude in the area, the instrument will count everyday sunrise and sunset time in a year, and control on and off of switching value according to this sunrise and sunset time.

Time—control switches are for two channels, DO1 and DO2. Each channel's time—control function can be independently turned on or off. Each channel has 2 groups of time—control on/off, and 1 group of sunrise and sunset control on/off. Time—control on/off controls DO output status according to set—up on or off time point. Sunrise and sunset control automatically adjusts DO's on/off time according to current date of set—up longitude and latitude. When the sunrise time arrives, DO's output will be turned off. When the sunset time comes, DO output is turned on.

Time—control switch setup steps: set information of latitude and longitude; turn on main switch of time—control channel function; set the specific days in every week to perform sunrise and sunset control; set period of time—control channel. The followings are specific steps:

- Enter setting menu

Press **More** key, until there is **settings** key on the soft key occurs. Press **setting** key to enter the interface of entering the password; the default password is 1000. After entering the password, press OK key to enter settings menu.

- Setup of longitude and latitude

Select menu, input and output->time—control switch-> longitude and latitude longitude and latitude. You can quickly enter longitude and latitude information through selecting a city. If the required city is not in the options, you can directly enter data of longitude and latitude to set. The setup range of longitude and latitude is east longitude 0—180 degrees, the setup range of latitude is northern latitude 0—60 degrees. The information of longitude and latitude is sued for calculating sunrise and sunset time of the day. The calculated sunrise and sunset time is according to Beijing time.

- Turn on main switch of open time—control channel function

Select menu, input and output->time—control switch->DO1 channel->allow channel, select yes in time—control allow, to turn on DO1 channel's time—control function.

- Sunrise and sunset control setup

Select menu, input and output->time—control switch->DO1 channel->allow channel. According to requirements, choose specific days of a week to perform sunrise and sunset control. If there is selection, then turn off the sunrise and sunset control function of this channel.

- Time—control channel's time period setup

Each channel has 12 pairs on/off times to set. Each period can independently choose specific days to be effective in one week. Select menu, input and output->time—control switch->DO1 channel->period n, to enter setup of period n of DO1 channel.

- Setup of DO on time in one period

Select **Yes** in **Allow on,** and set what time DO turns on in **On Time**.

- Setup of DO off time in one period

Select **No** in **Allow off,** and set what time DO turns on in **Off Time**.

- Setup of specific operation days of one period in one week

Tick which days that this period would be operated in one week.

### *11.12 Combination of wiring ways*

For wiring of measuring circuits of BRN-D513 series, current and voltage circuits can combine respectively, which means, voltage wiring and current wiring is mutually independent. As long as wiring conforms to the wiring rule in the figure, the instrument can work correctly without modifying software setup. For actual on—site condition, all works must follow wiring requirements in this manual.

### *11.13 Single—phase measurement*

For single—phase measurement, voltage and current connects at B phase (refer to 6.5). The function and display content of system will not display any parameters related to three-phase system or A phase or C phase. The read content of modbus address has no significance here.

### *11.14 One—way electric leakage function*

The system can configure one—way electric leakage function (while ordering, please assign hardware support). The port of this leakage function can be configured to one of 6—way optional module. This requires to set turns ratio (the turns of secondary side is fixed to 1) according to turns of leakage mutual inductor. The content of setting turns ratio is: menu->universal port->port n (configured as port of electric leakage).

Cooperating with upper and lower limit alarm function, this function can realize off—limit alarm and trip. Alarm trip can be configured through two—way DO and upper and lower alarm function, so as to correspond to behaviors of two ports.

- Relative chapaters

  6.5.1，9.6，9.8

- Relative MODBUS register address:

4649H. This register's read—out value is the value of leakage current, of which the unit if mA and does not need to multiply by transformation ratio.

### *11.15 Phase angle*

Phase angle is used to confirm whether there is wiring error. When voltage wiring mode is set as 3LN, please measure V2, V3, I1 and I3's phase angle relative to V1; When voltage wiring mode is set as 2LL or 3LL, please measure V23, I1, I2 and I3's phase angle relative to V12.

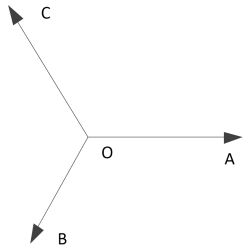
Phase angle is not displayed on the interface, but it can be read through communication.

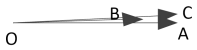
### *11.16 Sequence component*

The reason of applying positive sequence, negative sequence and zero sequence is to analyze decomposition of three—phase asymmetrical components into symmetrical component (positive and negative sequence) and parallel zero sequence component when system voltage and current have asymmetrical situations. This instrument measures positive, negative and zero sequence components of V1 (or V12) and I1. Sequence component is not display on the interface, but it can be read through communication.

#### *11.16.1 Positive sequence component*

Positive sequence component rotates B phase 120° in anti-clockwise direction, and rotates C phase 120° in clockwise direction, and remains A phase still. On third of the sum of the rotated phasor is positive sequence component.



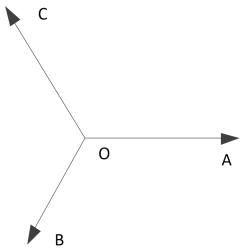



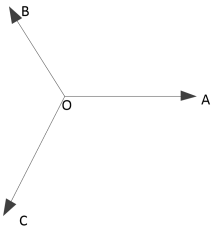


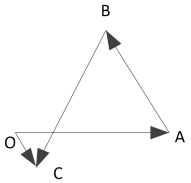
Original three—phase fundamental component | Component after rotation | Sum of three—phase component after rotation (OC)

#### *11.16.2 Negative sequence component*

Negative sequence component rotates B phase 120° in clockwise direction, and rotates C phase 120° in anti-clockwise direction, and remains A phase still. On third of the sum of the rotated phasor is negative sequence component.



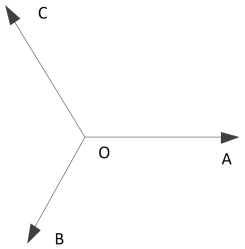



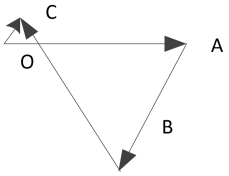

Original three—phase fundamental component | Component after rotation | Sum of three—phase component after rotation (OC)

#### *11.16.3 Zero sequence component*

One third of the sum of fundament component of three—phase voltage or current is zero sequence component.




Original three—phase fundamental component




Sum of three—phase fundamental component (OC)

### *11.17 One variable corresponding to multi MODBUS register address*

BRN-D513's some variables have the characteristic of corresponding to multi registers. This design aims to solve the following problems:

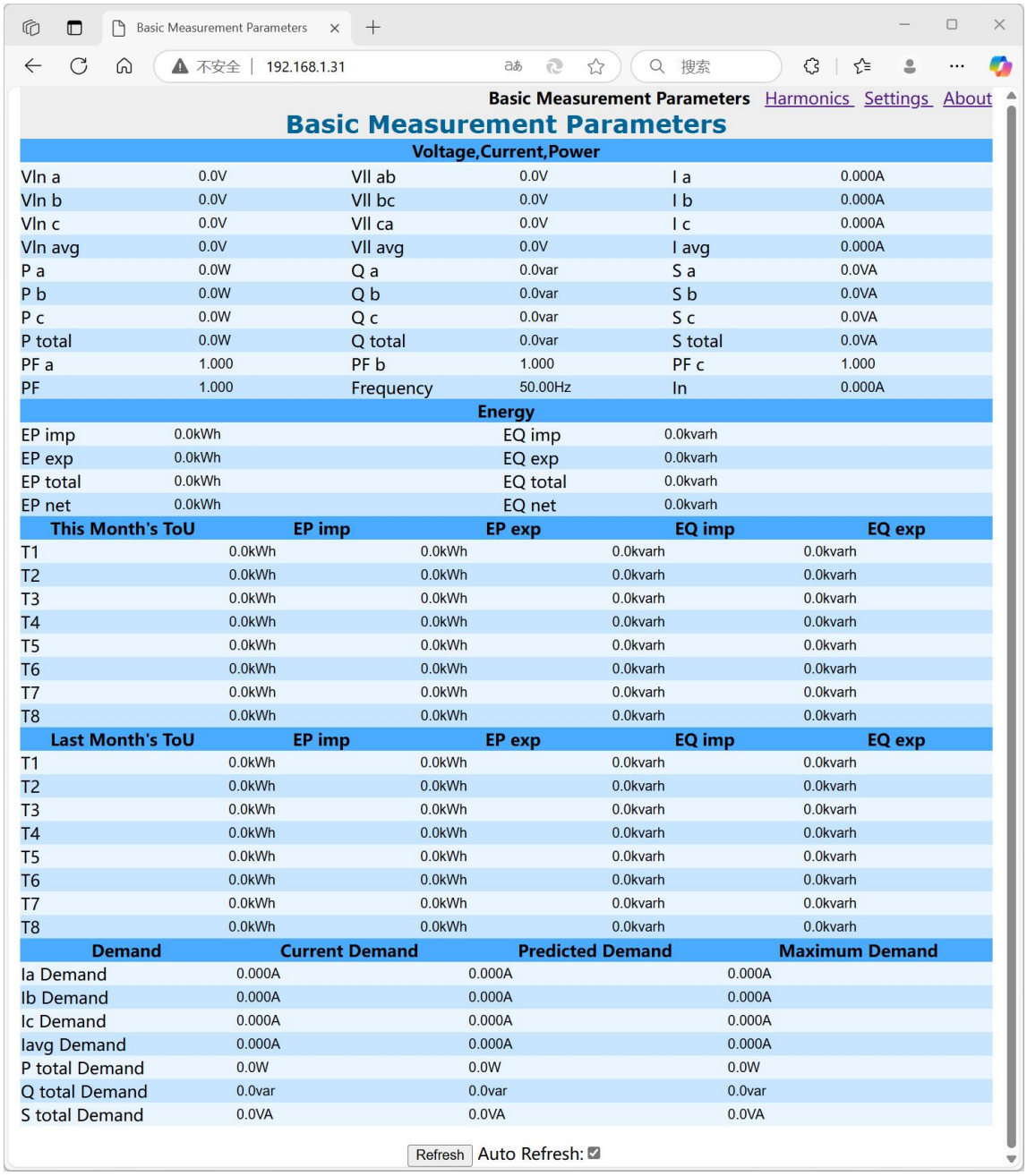
- Compatibility with other BRN product series
- To meet users' demand on reading both primary side value and secondary side value; for example, U, I, POS, these secondary side data are stored in form of floating data. The data being read is visual. The Modbus register area of floating—point storage is: 4000H~4047H.
- To improve resolution (discernable ratio) of numerical value, for example, PLsum is stored in Dword(Long) type, and its unit is 0.1W. Psum is stored in Integer type, and its unit is 1W.
- Users can apply relative addresses to store based on own requirements.
- No matter which address is applied, its read—out value comes from one measuring result inside the instrument, and it would not influence final computing and accuracy. However, users shall pay attention that numerical values of different register may need to be converted.

### *11.18 Ethernet interface*

BRN-D513 has an optional Ethernet interface. Real-time measurement of parameters via web browsing. Supports Modbus-TCP and Modbus-RTU protocols to communicate with the meter. The default IP address of the meter is 192.168.1.31. IP can be modified in the settings interface.

#### *11.18.1 Browse measuring parameter via web*

Open IE browser, input IP in Address column, press " enter" and then enter basic measuring parameter interface. On this interface, you can check important measuring parameters such as voltage, current, power, electric power , periodical electric power and demand. The parameter will be renewed every 2 seconds, you can stop automatic renew by eliminating auto renew check box.The display interface as following:




Basic Measurement Parameters Harmonics Settings About

# Basic Measurement Parameters

| Voltage,Current,Power | | | | | |
|---|---|---|---|---|---|
| Vln a | 0.0V | Vll ab | 0.0V | I a | 0.000A |
| Vln b | 0.0V | Vll bc | 0.0V | I b | 0.000A |
| Vln c | 0.0V | Vll ca | 0.0V | I c | 0.000A |
| Vln avg | 0.0V | Vll avg | 0.0V | I avg | 0.000A |
| P a | 0.0W | Q a | 0.0var | S a | 0.0VA |
| P b | 0.0W | Q b | 0.0var | S b | 0.0VA |
| P c | 0.0W | Q c | 0.0var | S c | 0.0VA |
| P total | 0.0W | Q total | 0.0var | S total | 0.0VA |
| PF a | 1.000 | PF b | 1.000 | PF c | 1.000 |
| PF | 1.000 | Frequency | 50.00Hz | In | 0.000A |

| Energy | | | |
|---|---|---|---|
| EP imp | 0.0kWh | EQ imp | 0.0kvarh |
| EP exp | 0.0kWh | EQ exp | 0.0kvarh |
| EP total | 0.0kWh | EQ total | 0.0kvarh |
| EP net | 0.0kWh | EQ net | 0.0kvarh |

| This Month's ToU | EP imp | EP exp | EQ imp | EQ exp |
|---|---|---|---|---|
| T1 | 0.0kWh | 0.0kWh | 0.0kvarh | 0.0kvarh |
| T2 | 0.0kWh | 0.0kWh | 0.0kvarh | 0.0kvarh |
| T3 | 0.0kWh | 0.0kWh | 0.0kvarh | 0.0kvarh |
| T4 | 0.0kWh | 0.0kWh | 0.0kvarh | 0.0kvarh |
| T5 | 0.0kWh | 0.0kWh | 0.0kvarh | 0.0kvarh |
| T6 | 0.0kWh | 0.0kWh | 0.0kvarh | 0.0kvarh |
| T7 | 0.0kWh | 0.0kWh | 0.0kvarh | 0.0kvarh |
| T8 | 0.0kWh | 0.0kWh | 0.0kvarh | 0.0kvarh |

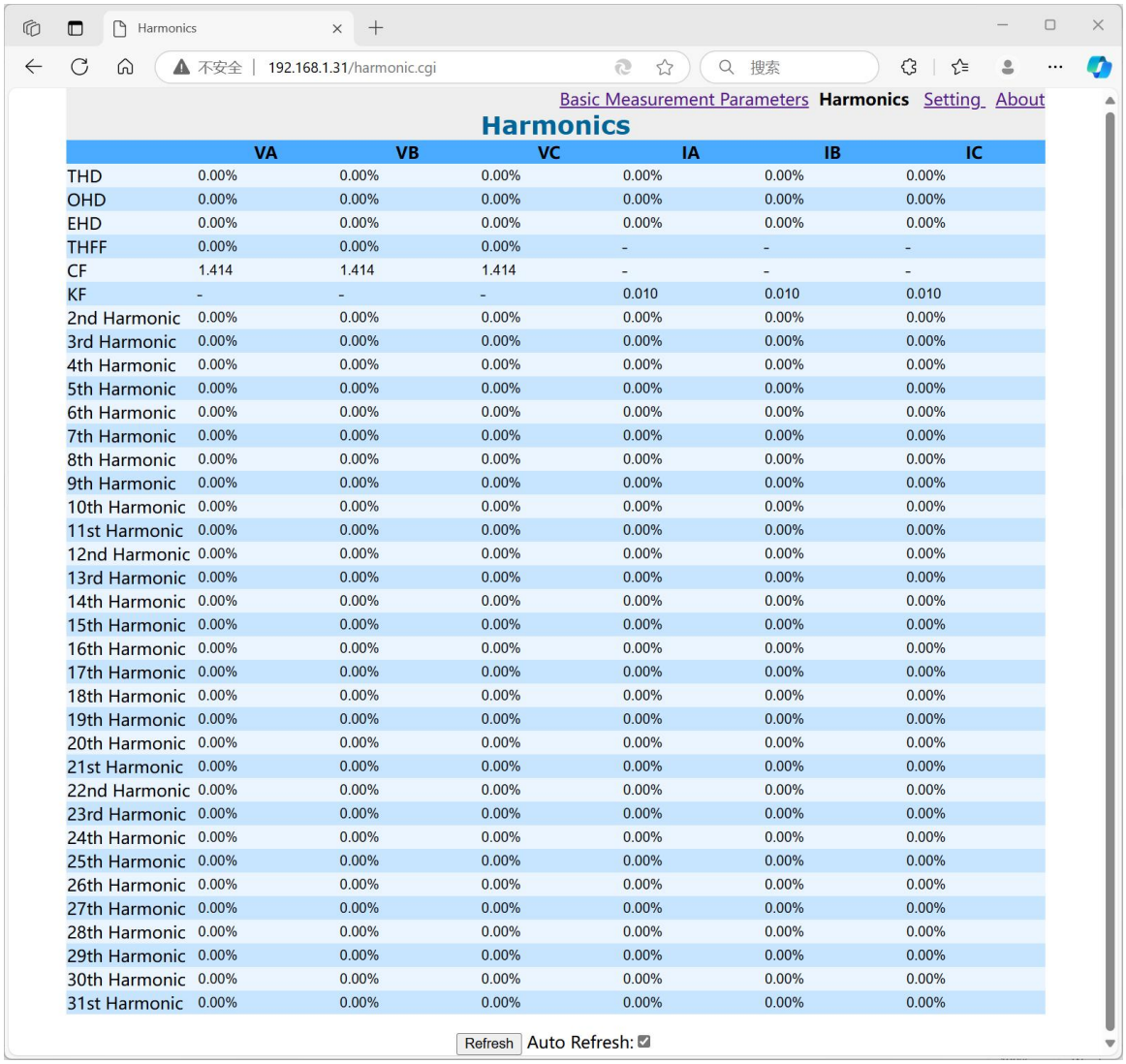
| Last Month's ToU | EP imp | EP exp | EQ imp | EQ exp |
|---|---|---|---|---|
| T1 | 0.0kWh | 0.0kWh | 0.0kvarh | 0.0kvarh |
| T2 | 0.0kWh | 0.0kWh | 0.0kvarh | 0.0kvarh |
| T3 | 0.0kWh | 0.0kWh | 0.0kvarh | 0.0kvarh |
| T4 | 0.0kWh | 0.0kWh | 0.0kvarh | 0.0kvarh |
| T5 | 0.0kWh | 0.0kWh | 0.0kvarh | 0.0kvarh |
| T6 | 0.0kWh | 0.0kWh | 0.0kvarh | 0.0kvarh |
| T7 | 0.0kWh | 0.0kWh | 0.0kvarh | 0.0kvarh |
| T8 | 0.0kWh | 0.0kWh | 0.0kvarh | 0.0kvarh |

| Demand | Current Demand | Predicted Demand | Maximum Demand |
|---|---|---|---|
| Ia Demand | 0.000A | 0.000A | 0.000A |
| Ib Demand | 0.000A | 0.000A | 0.000A |
| Ic Demand | 0.000A | 0.000A | 0.000A |
| Iavg Demand | 0.000A | 0.000A | 0.000A |
| P total Demand | 0.0W | 0.0W | 0.0W |
| Q total Demand | 0.0var | 0.0var | 0.0var |
| S total Demand | 0.0VA | 0.0VA | 0.0VA |

Refresh Auto Refresh:

### *11.18.2 Browse Harmonic via web*

Click Harmonic link on the upper left side, enter Harmonic browsing interface. On this interface,you can check the distortion rate of general Harmonic and check Harmonic from the first to the 31st time. The Harmonic interface e is shown as following:




| | VA | VB | VC | IA | IB | IC |
|---|---|---|---|---|---|---|
| THD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| OHD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| EHD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| THFF | 0.00% | 0.00% | 0.00% | - | - | - |
| CF | 1.414 | 1.414 | 1.414 | - | - | - |
| KF | - | - | - | 0.010 | 0.010 | 0.010 |
| 2nd Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 3rd Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 4th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 5th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 6th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 7th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 8th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 9th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 10th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 11st Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 12nd Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 13rd Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 14th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 15th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 16th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 17th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 18th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 19th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 20th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 21st Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 22nd Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 23rd Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 24th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 25th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 26th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 27th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 28th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 29th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 30th Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| 31st Harmonic | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |

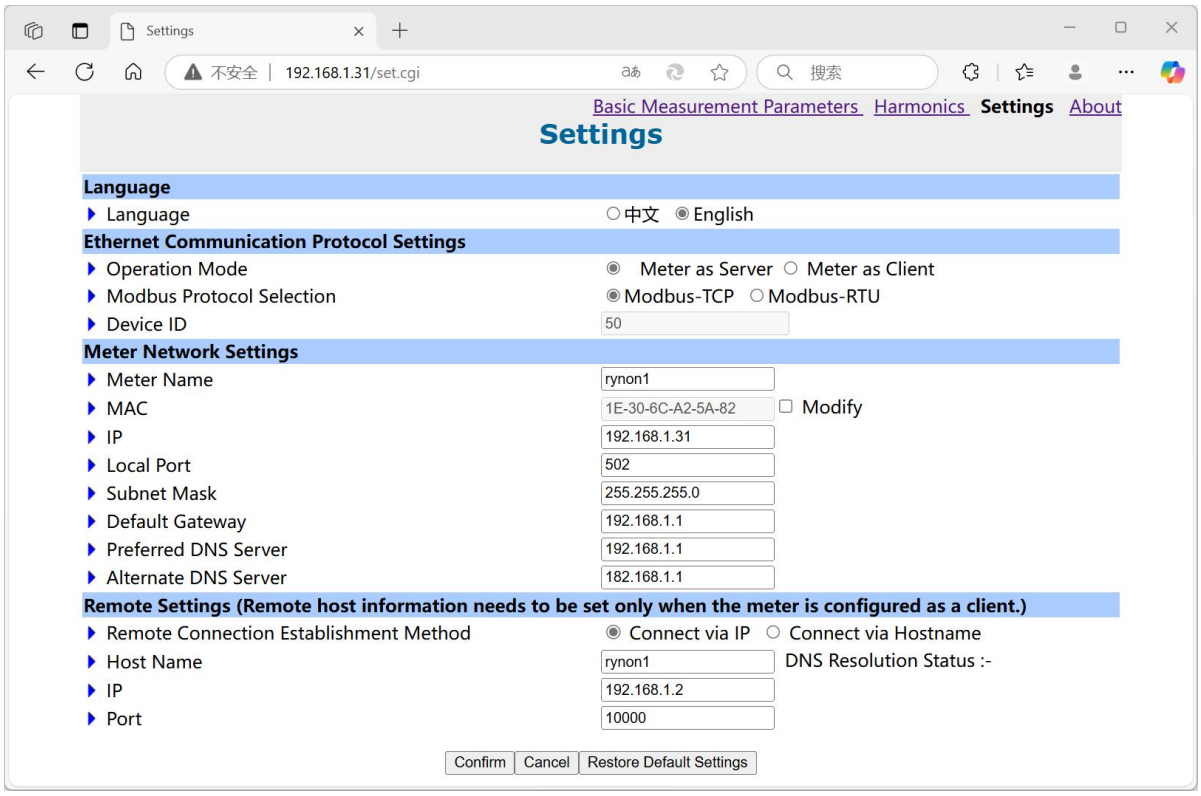
### *11.18.3 Set Ethernet Parameter*

Click the link on the upper left side of the website, enter the set inter fee e of Ethernet.

There are two function styles for Ethernet: Meter serves as the server end or meter serves as client end. If Modbus-TCP agreement is used, usually meter will serve as server end (The default port is 502), the upper computer will serve as client end. If Modbus-RTU agreement is used , the working style should be set according to virtual serial port software.

The names of devices are used to separate different devices. The names can have 16 letters or number characters.

If the meter serves as client end, the information of remote server should be set. You must input the Servers IP address and port number when connect the IP. If conduct connection through the Host name, you should input the name or the domain name of the Host as well as the port number




### *11.18.3 Virtual serial port set*

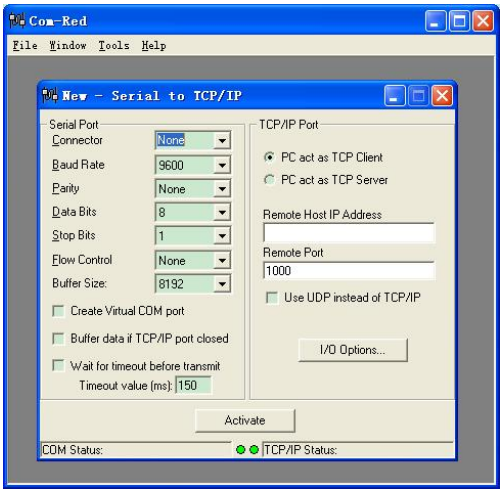
If the agreement is set as Modbus-RTU , conduct use through cooperating with virtual serial port software, , the upper computer software communicate with meters through virtual serial port.

#### *11.18.4.1 Install Drive program of virtual serial port*

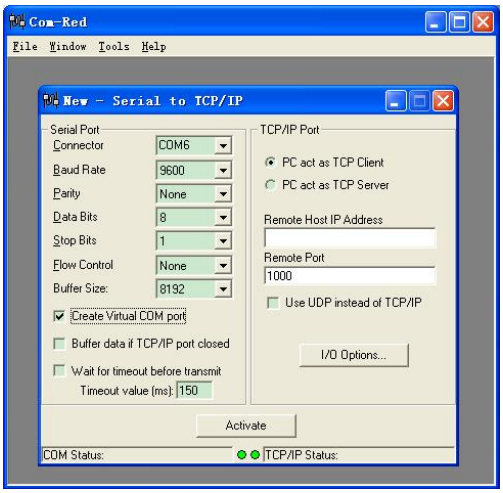
1) System requirement: Windows XP/WIN7
2) Run " Drive program of virtual serial port.EXE" ， install it on system

#### *11.18.4.2 Set drive program*

When the drive program is installed, double click the Image, chose the Menu File -> New, A Serial to TCP/IP Pop-up window show up as following:




Virtual serial port set interface




Serial port parameter set interface

### *11.18.4.3 Set virtual serial port*

Set the required serial port number, set the Baud Fate as 9600, Data Bits as 3, Stop Bits as 1, choose Create Virtual Com Port Check Box . refer to “Serial port parameter set.”

### *11.18.4.4 Set TCP/IP*

■ PC serves as TCP client end, meter serves as server end

1) Choose PC as TCP Client
2) Set Remote Host IP Address as the IP of Ethernet interface in the meter
3) Set the remote Port as the end of Ethernet interface
4) Click Active button, create virtual serial port

Notes:

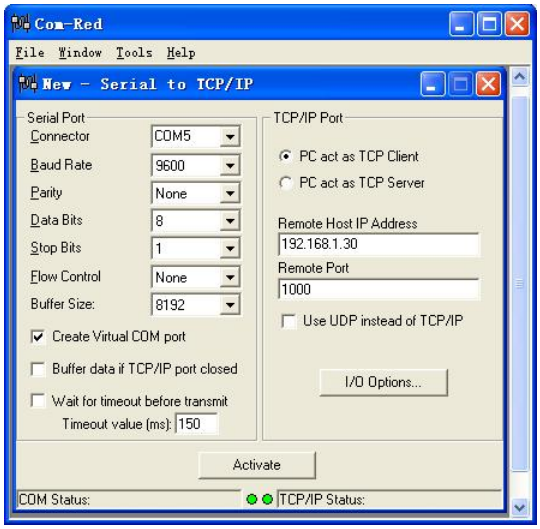
Use UDP instead of TCP/TP, use TCP agreement. Set “meter as server end” as the Ethernet working style.

■ PC serves as the server end, meter serves as the client end

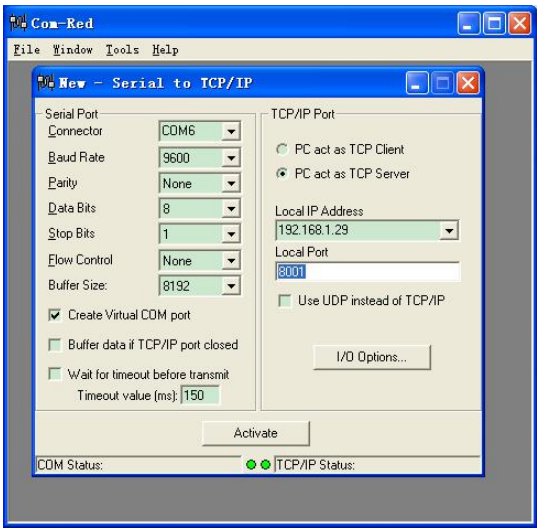
1) Choose PC Act as TCP Server
2) Choose the IP address of PC in Local IP Address
3) Set the Port of the PC in Local Port
4) Click Active Button ， create virtual serial port

Notes:

Do not tick “Use UDP instead of TCP/IP.” Set Client as the Ethernet interface working method




PC server as client end




PC serves as server end

### *11.18.5 The relation between "meter Ethernet interface" and "PC end virtual serial port"*

PC end serves as server end

| | Meter-end Ethernet interface | PC-end virtual serial port |
|---|---|---|
| Working method | Meter serves as server end, Modbus-RTU agreement | Choose PC act as TCP Server<br>Do not tick Use UDP instead of TCP/IP |
| Local IP | 192.168.1.30(can be modified) | 192.168.1.79 (IP of PC) |
| Local IP (Module self port) | 20108(can be modified) | 1000(can be modified) |
| Remote IP | 192.168.1.79<br>(the same as the Local IP of PC end) | - |
| Remote IP (Aim connection port) | 1000<br>(the same as the local port of PC end)) | - |

Meter end serves as the server end

| | Meter-end Ethernet interface | PC-end virtual serial port |
|---|---|---|
| Working method | Meter serves as server end, Modbus-RTU agreement | Choose PC act as TCP Server<br>Do not tick Use UDP instead of TCP/IP |
| Local IP | 192.168.1.30(an be modified) | 192.168.1.79(IP of PC) |
| Local IP (Module self port) | 1000(an be modified) | - |
| Remote IP | - | 192.168.130<br>(the same as the Local IP of Meter end) |
| Remote IP (Aim connection port) | - | 1000<br>(the same as the Local IP of Meter end) |