BJ-194J-(E)

Multi-function Power Monitor

User Manual

Version：3.5

Revision 2022-8

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Read me

When you use BJ-194… series multi-function meter, be sure to read this user manual carefully, and be able to fully understand the implications, the correct guidance of operations in accordance with user manual, which will help you make better use of BJ-194… series multi-function meter, and help to solve the various problems at the scene.

1. Before the meter turning on the power supply, be sure that the power supply within the provisions of the instrument;

2. When installation, the current input terminal must non-open, voltage input terminals must Non-short circuit;

3. Communication terminal (RS232/RS485 or Ethernet) is strictly prohibited to impose on high pressure;

4. Be sure the instrument wiring consistent with the internal system settings;

5. When communicating with the PC, instrument communication parameters must be consistent with the PC.

- **Please read this user manual carefully**
- **Please save this document**

Directory

1. - SUMMARIZE

BJ-194J Multi-Function Power Monitor is a high-end multifunction power meter. It is the ideal choice for monitoring and measuring of power systems.

It can measure all of the power parameters in power grid:

Current,	Apparent power,	Voltage and current THD%,
Voltage,	Energy (Active/Reactive),	Harmonics factor,
Frequency,	Power factor,	Voltage crest factor,
Active power,	Current harmonics 2~31 times,	Current K-factor,
Reactive power,	Voltage harmonics 2~31 times,	Multi- tariffs ratio.

With optional expansion modules, it can also transmit the parameter into 2*Relay output (2DO) and 4*Switch input (4DI), 2*Analog output (2AO). For transformers, generators, capacitor banks and motors of the distributed detection, automatic control system, on-line monitoring display. BJ-194J provide max 50 lists event logging, real-time saving DI/DO acted events.

It can replace the traditional analog or many digital measurement instruments (such as ammeter, voltmeter, power meter, power factor meter, frequency meter, etc.) with the advantages of improving system reliability, making the on-site wiring convenient and reduce system cost.

With serial port, BJ-194J can connect with PC; and use Modbus to set programming and read the data. Based on this power meters, you can simply set up a monitoring system with the IPC and central software.

APPLICATIONS

-. All power parameter measurement;

-. Energy Measurement and electrical fire monitor and control;

-. Replacing the three-phase power meter, three phase electricity transmitter;

-. Transformers, generators, capacitors and electric motors distributed detection;

-. Medium and low pressure systems;

-. SCADA, EMS, DCS integrators.

2. - FEATURES

2.1. - Electricity Metering

By means of an internal microprocessor it simultaneously measures:

Parameter	Symbol	A-phase	B-phase	C-phase	Total
Phase-line voltage	V	**x**	**x**	**x**	/
*Phase-phase voltage	V	**x**	**x**	**x**	/
Current	A	**x**	**x**	**x**	/
Frequency	Hz	/	/	/	**x**
Power factor	Cos Φ	**x**	**x**	**x**	**x**
Active power	W	**x**	**x**	**x**	**x**
Reactive power	Var	**x**	**x**	**x**	**x**
Apparent power	VA	**x**	**x**	**x**	**x**
Active energy	Wh	**x**	**x**	**x**	**x**
Reactive energy	Varh	**x**	**x**	**x**	**x**
Multi- tariffs energy record	Wh	/	/	/	**x**
Max demand (W / var / VA)	MAX	/	/	/	**x**
Voltage / frequency deviation	---	**x**	**x**	**x**	/
Voltage / current unbalance	---	/	/	/	**x**
THD & Harmonic (1~31th)	---	**x**	**x**	**x**	**x**

Note: Phase-phase voltage is Uab, Ubc, Uca, voltage data determined by the different wiring
Available: **x:** Display and communications.

The BJ-194J delivers the visualization of parameters listed above by means of LCD type displays. In the main display area shows 4 power parameters, with other display area show the various parameters and state of meter on each page jump. For more details of measurement parameters please refer to the subsequent for displays introduction and RS485 communication instructions.

OTHER FEATURES

- Low-size (96 x 96 mm), panel-mounting meter.
- True R.M.S. measuring system.
- Instantaneous, maximum and minimum values of each measured parameter.
- Energy measurement (indication through a lighting led)
- RS-485 or Ethernet(optional) type communication to a PC.

2.2. – Specifications

- Reference standard:

Basic electricity: IEC 61557-12:2010
Active energy: IEC 62053-21:2010
Reactive energy: IEC 62053-23:2010

- Accuracy standards

Parameter	Accuracy	A phase	B phase	C phase	All
Voltage	0.2	V1	V2	V3	
Current	0.2	A1	A2	A3	
Active Power	0.5s	W1	W2	W3	W
Reactive Power	0.5s	var1	var2	var3	var
Apparent power	0.5s	VA1	VA2	VA3	VA
Power Factor	0.5s	PF1	PF2	PF3	PF
Active Energy	0.5				Wh
Reactive Energy	2.0				varh
Frequency	0.05				Hz

- Input

Voltage: Rated 300V L-N, (optional 100V L-N)
Current: Rated 5A (optional 1A)
Frequency: 45-65Hz

- Load

Voltage: <0.1VA / phase (rated 220V)
Current: <0.4VA / phase (rated 5A)

- Overload

Current: 1.2 times rated continuous; 1 seconds for 10 times the rated
Voltage: 1.2 times the rated continuous; 10 seconds for 2 times the rated

- Dielectric strength

IEC / EN 61010-1:2010
2kV AC RMS 1 minute, between input / output / case / power supply

- EMC Test

	Standard	Test voltage
Electrostatic discharge immunity test:	IEC-61000-4-2 level 4	8Kv
Electrical fast transient burst immunity test	IEC61000-4-4 level 3	Input 1kV; Power supply 2kV
Surge (Shock) immunity test	IEC61000-4-5 level 4	common mode test voltage 4kV

- Work environment

Temperature: -20°C ~ +60°C
Humidity: RH 20% ~ 95%（No condensation）

- Protection

Panel: IP54
Case: IP20

- Storage Conditions

Temperature: -25°C ~ +70°C
Humidity: RH 20% ~ 95%

- Working Power

AC/DC 90-240V, 45-65Hz
DC 20-60V (Optional)
Maximum power consumption 6W

- Dimensions

L × W × H =96mm×96mm×71mm

- Installation hole size

L × W = (91+0.8mm) × (91+0.8mm)

3.- INSTALLATION AND START-UP

The manual you hold in your hand contains information and warnings that the user should respect in order to guarantee a proper operation of all the instrument functions and keep it in safety conditions. The instrument must not be powered on and used until its definitive assembly is on the cabinet's door.

If the instrument is not used as manufacturer's specifications, the protection of the instrument will be damaged.

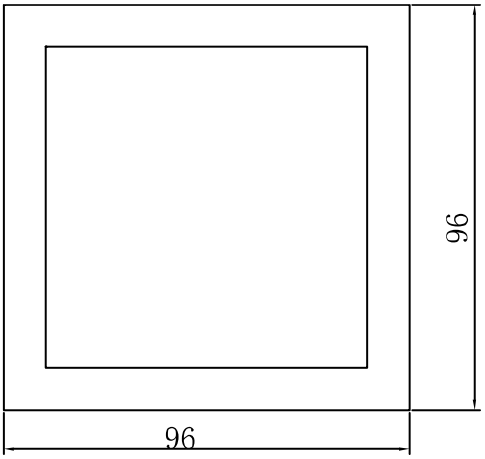
When any protection failure is suspected to exist (for example, it presents external visible damages), the instrument must be immediately powered off. In this case contact a qualified service representative.

3.1.- Installation

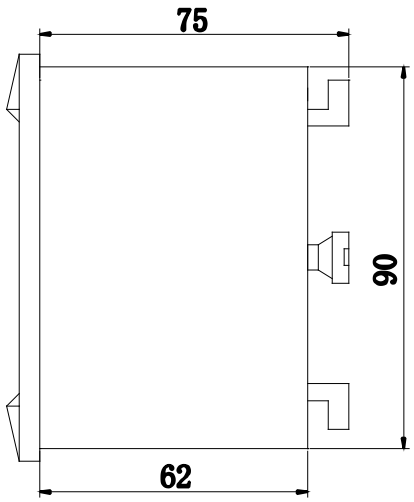
Mounting

Instrument is to be mounted on panel (cut-out *91+0.8 x 91+0.8 mm*). Keep all connections into the cabinet.

Please note that with the instrument powered on, the terminals could be dangerous to touch and cover opening actions or elements removal may allow accessing dangerous parts. Therefore, the instrument must not be used until this is completely installed.



Front view



Side view

Notes:

Input signal: BJ-194… series using a separate acquisition calculate for each measurement channel, to ensure consistent in use, for different load forms, it's a variety of connection mode. Access wire shall be met: the current 2.5 square mm, voltage of 1.5 square millimeters.

Voltage input:

Input voltage should not exceed the rated input voltage products (120Vac or 450Vac),
Otherwise, you should use external CT. Suggest 1A fuse be installed in the voltage input side.

Current Input:

Standard input current is 5A, if greater than 5A should use external CT.
When the CT is connected with other instruments, make sure wiring methods be used in series.

Before remove the current input connection, must be sure to disconnect the primary circuit or shorted secondary circuit of CT. In order to facilitate disassembly, please do not connect to CT directly, and the terminal block is suggested.

Sequence of wire:

Please make sure that the input voltage and current corresponding to the same phase sequence, and the same direction; Otherwise, the Values and symbols will be wrong!! (Power and Energy)

The input network configuration of instrument depends on the CT number of the system:
in the condition of 2 CT, select the three-phase, three-lines two components;
in the condition of 3 CT, select the three-phase, four-lines three component mode.

Instrument connection mode, set of the instrument (programming input network NET) should be the same load wiring as measured wiring. Otherwise, the measurement instrument will lead to incorrect voltage or power.

In three-phase three-wire mode, the measurement and shows the line voltage;
In three-phase four-wire mode, the measurement and shows the phase voltage.

Auxiliary power:

BJ-194… series with universal (AC / DC) power input, if not for a special statement, we provide the 220VAC/DC or 110VAC/DC power interface for standard products. Instruments limit work power supply: AC / DC: 90-240V, please ensure that the auxiliary power can match with BJ-194… series meter to prevent damage to the product.

A. Suggest install 1A fuse in the fire line side.
B. For the areas with poor power quality, suggest install lightning surge suppressor and rapid burst suppressor to prevent lightning strikes.

3.2. - Connection Terminal

Upper connection terminal

15	16	50	49	48	47	60	59	58	2	1
AO-	AO+	RP-	RP+	AP-	AP+	GUD	RS485B	RS485A	Power supply	

16. Analog output (+)
15. Analog output (–)
47. Active energy pulse output (+)
48. Active energy pulse output (-)
49. Reactive energy pulse output (+)
50. Reactive energy pulse output (-)

*1. *Supply voltage input: 0 V*
*2. *Supply voltage input: 220 Va.c.*
58. RS-485 (+)
59. RS-485 (-)
60. RS-485 (GND)

Middle connection terminal

22	21	20	19	70	71	72	73	74
DO2		DO1		COM	DI1+	DI2+	DI3+	DI4+

20. Route 1 digital output (+)
19. Route 1 digital output (-)
22. Route 2 digital output (+)
21. Route 2 digital output (-)

70. Digital input COM pin
71. Route 1 digital input (+)
72. Route 2 digital input (+)
73. Route 3 digital input (+)
74. Route 4 digital input (+)

Lower connection terminal

14	13	12	11	9	8	7	6	5	4
Un	Uc	Ub	Ua	C-phase Current		B-phase Current		A-phase Current	

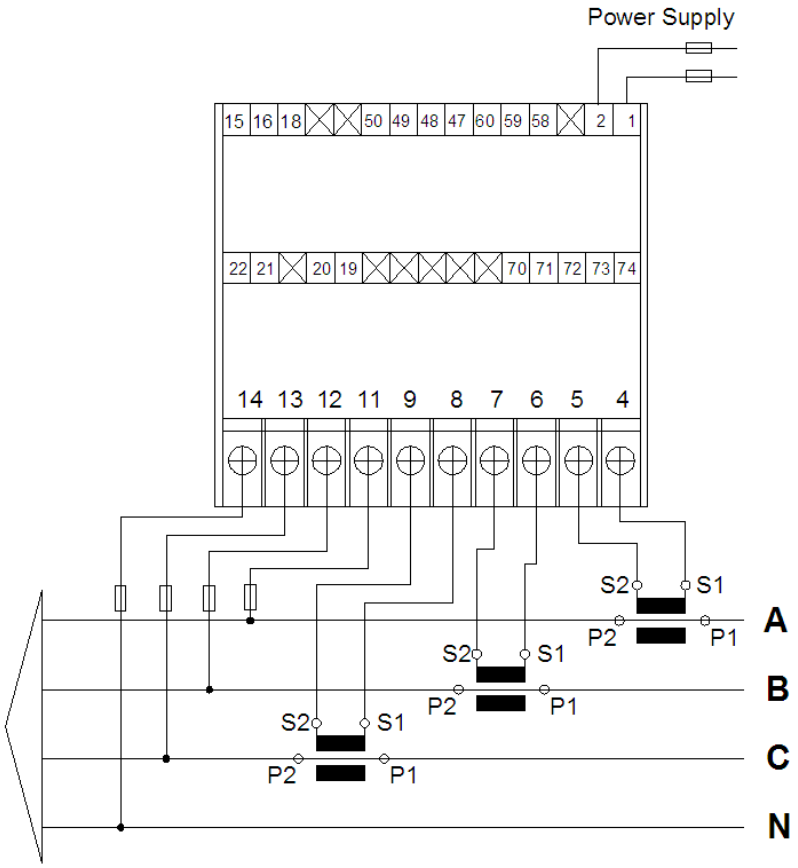
11. Voltage A-phase input
12. Voltage B-phase input
13. Voltage C-phase input
14. Neutral Voltage input

4. Current A-phase - S1 input
5. Current A-phase - S2 input
6. Current B-phase - S1 input
7. Current B-phase - S2 input
8. Current C-phase - S1 input
9. Current C-phase - S2 input

Note:

The terminal pin will change depends on special order requirement; please refer to the sticker on the meter!

3.3. – Typical Wiring (3P4W)



IMPORTANT REMARK!

If power = -0.01 is shown for any of the phases and voltage and current are not zero for this phase, check out following points:

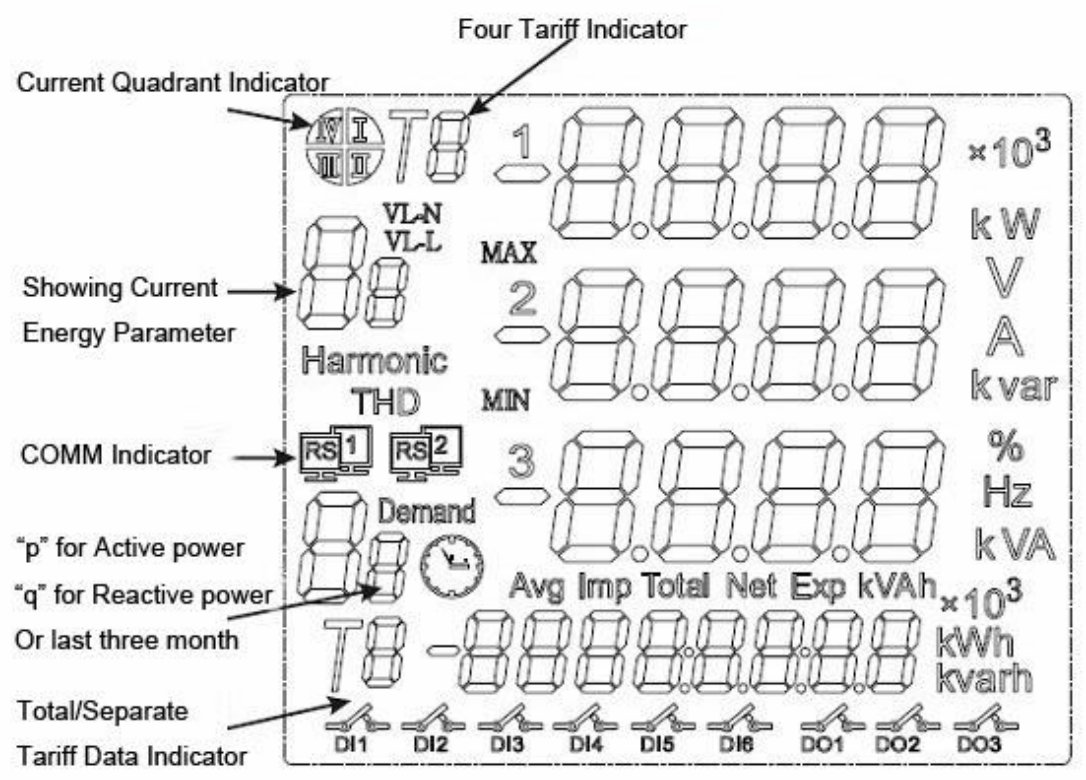
- Assure that A, B and C phases coincide in voltage and current.
- Correct polarity? Reverse the current transformer placed at this phase.

Note:

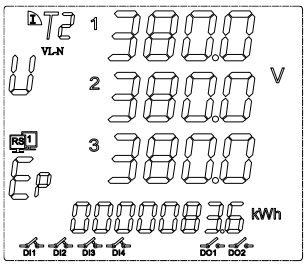
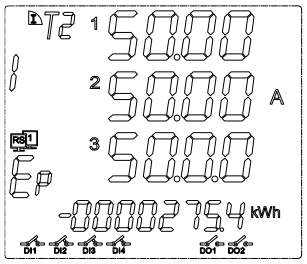
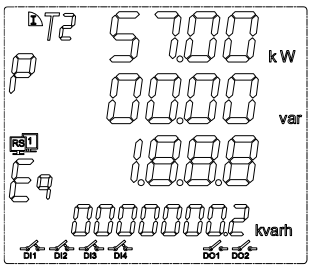
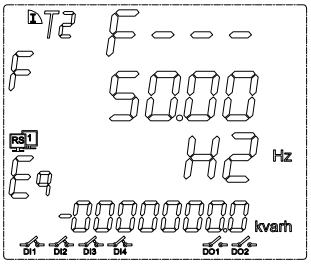
This connection drawing is for reference only; the actual connecting terminal please refer to the label on the rear part.

4. SCREEN DISPLAY

4.1.- Full Symbol in Display Screen



4.2.- Introduction of Screen Pages

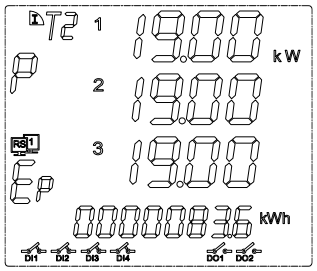
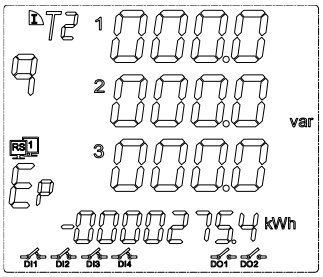
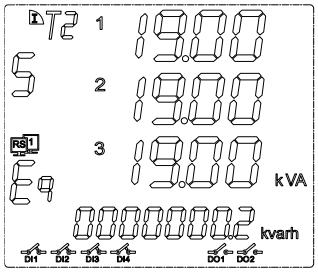
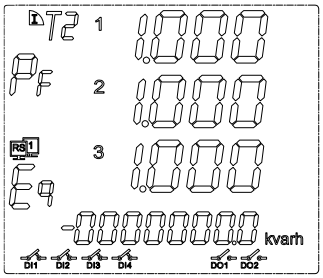
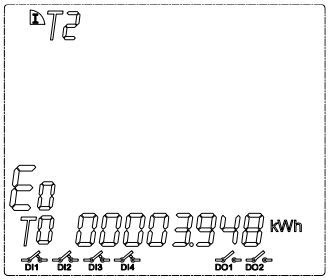
Screen page NO.	Screen interface	Explanation
- 1 -		Three phase voltage Ua, Ub, Uc; **Note:** In high voltage measurement, X10^3 mean the showing value multiplied by 1000, in the screen diagram mean the voltage is 10X1,000=10,000volt Bottom character “Ep” show **total active energy** is 83.6KWh.
- 2 -		Three-phase current Ia, Ib, Ic. Bottom **Ep** shows **total negative active energy**.
- 3 -		Total active power, Total reactive power, and Total factor. Bottom “Eq” shows total active energy.
- 4 -		Frequency of grid. Bottom “**Eq**” shows **total negative reactive energy**.

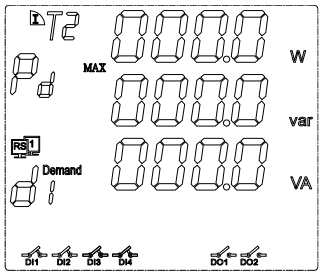
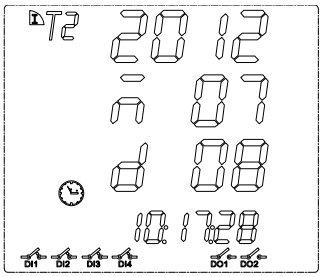
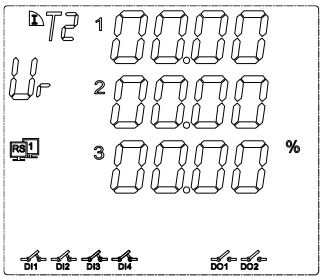
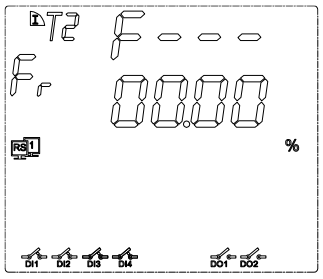
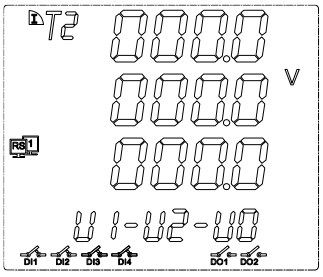
Note: Detail information for each symbol, please refer **chapter 5.1,** Surround area shows the system information, in other screen are same:

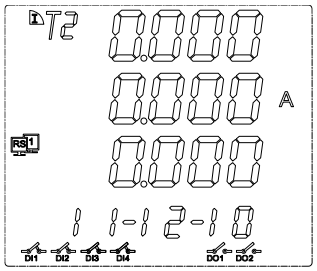
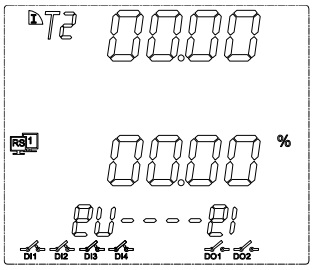
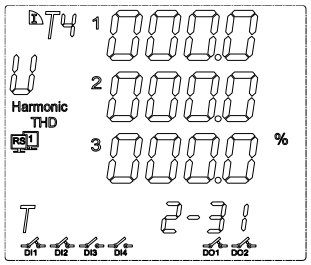
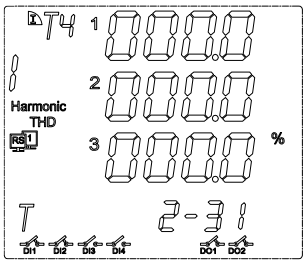
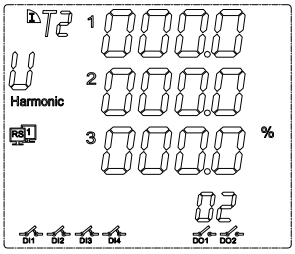
DI1 DI2 DI3 DI4 show DI1, DI2, DI3, DI4 in the closed;

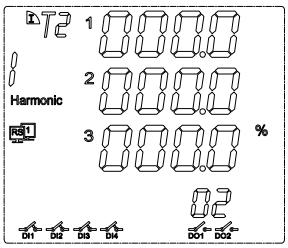
DO1 DO2 show DO1, DO2 opened;

RS1 flicker show Communication Rx/Tx normal;

- 5 -		Independent active phase. (only valid in three-phase 4 wire system) Bottom **Ep** shows **total active energy**
- 6 -		Display independent reactive phase. (only Three-phase 4 wire type) Bottom **Ep** shows **total negative active energy**.
- 7 -		Display independent apparent phase. (only Three-phase 4 wire type) Bottom **Eq** shows **total active energy**.
- 8 -		Display independent power factor. (only Three-phase 4 wire type) In the bottom "**Eq**" shows **total negative reactive energy**.
- 9 -		Multi-tariff energy record (**TOU**). **Bottom area** "E0" ~ "E3" E0: Last three months total **TOU** record E1: Present month **TOU** record E2: Last month **TOU** record E3: Month before last month **TOU** record **Bottom area** "T1" ~ "T4" for 4 types tariff energy sum record. **Note**: Press [↵] can switch Ex / Tx record value

- 10 -		Maximum power demand **Note**: demand record use **Sliding Windows Interval**, slip interval 1 minute, total of 15 minutes. The lower left corner symbol “d1” ~ “d3” "d1" mean display the present month's max demand "d2" for last month max demand "d3" for the month before last month max demand
- 11 -		Real-time clock (RTC) line 1 shows year line 2 shows month line 3 shows date In the bottom line shows: Hour, minute and second
- 12 -		Three phase voltage deviation, unit % Formula: **Vd**= [(**V_rms-V_rate**) / **V_rate**]% **Default V_rate = 220Vac** **Note**: If site power system are other V_rate, please contact our sales team before order
- 13 -		Frequency deviation, unit % Formula: **Fd**= [(**F_rms-F_rate**) / **F_rate**]% **Default F_rate = 50Hz** **Note**: If site power system are other F_rate, please contact our sales team before order
- 14 -		Voltage Vector line 1 for positive sequence voltage(V_{δ}+) line 2 for negative sequence voltage(V_{δ}-) line 3 for zero-sequence voltage(V_0)

- 15 -		Current Vector line 1 for positive sequence current ($I_{\delta}+$) line 2 for negative sequence current ($I_{\delta}-$) line 3 for zero-sequence current (I_0)
- 16 -		Voltage & current unbalance line 1 show eU eU = ($V_{\delta}-$ / $V_{\delta}+$)% line 3 show eI eI = ($I_{\delta}-$ / $I_{\delta}+$)%
- 17 -		Three phase voltage Total Harmonic Distortion (THD_U%) Press ↵ can switch to: **tOhd** (total odd harmonic distortion) **tEhd** (total even harmonic distortion) **tHFF** (telephone harmonic form factor) **CF** (crest factor).
- 18 -		Three phase current Total Harmonic Distortion (THD_I%) Press ↵ can switch to: **tOhd** (total odd harmonic distortion) **tEhd** (total even harmonic distortion) **tHFF** (telephone harmonic form factor) **CF** (crest factor).
- 19 -		Three phase voltage Individual Harmonic 2-31th Press ↵ can switch to different harmonic

- 20 -		Three phase current Individual Harmonic 2-31th Press ↵ can switch to different harmonic

Note:

In special requirement order or firmware iteration, the screen may add or reduce the screen display pages, please ask the sales team to get latest manual.

5. - OPERATION MODE

When the device is powered up, the entire symbol will be on, and the meter starts to self- test. After few seconds, the meter is ready for operation and shows firmware, then automatic jump to The first screen.

◀ ▶

In Monitor screen & Setup sub-menu	press key ◀ or ▶ , screen will move to previous or next page.
In Setup variables configuration menu	press ◀ can move the setting cursor to left; press ▶ can scroll selection the number 0 ~ 9.

SET

Press this key in monitor screen can call out the password screen;
In other screen used as Exit & roll back to up layer menu.

↵

Press this key in monitor screen can call out the firmware screen;
In Setup menu used as confirm the value entry or jump to down layer menu

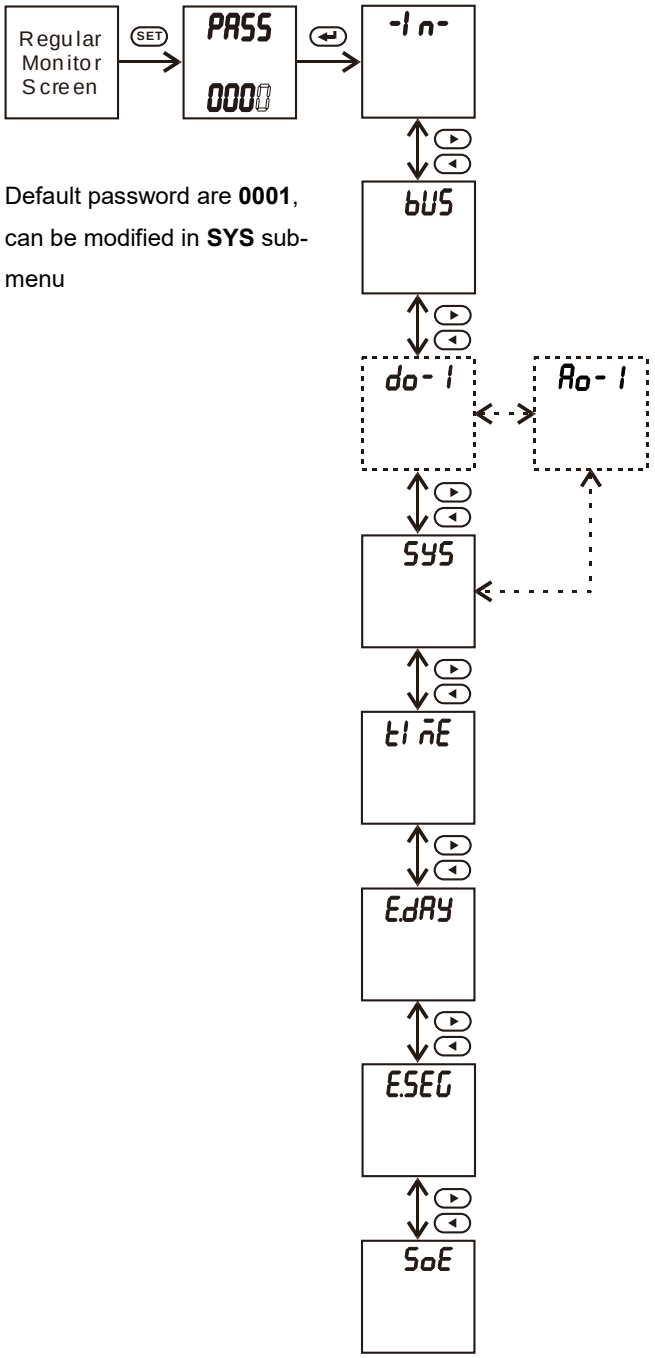
Note: In Setup menu, if changed the setting value, press **SET** for exit menu, device will call out confirm screen ask “SAVE”

Then press **SET** *exit without saving*
press ↵ *save and exit.*

6. - SETUP PROCEDURE

The SETUP procedure of the BJ-194J is performed by means of several SETUP options. There has a password to protect unexpectedly enter the Setup menu. Once into the Setup menu, use the keyboard to select different options and enter required variables:

6.1.- Enter Setup Menu



Default password are **0001**, can be modified in **SYS** sub-menu

Input signal setup

Refer to chapter 6.2

Communication port setup

Refer to chapter 6.3

Digital output (relay) & Analog output port setup

Refer to chapter 6.4 & 6.5

Note: If do not select port, no such pages

System parameter setup

Refer to chapter 6.6

Real-Time-Clock setup

Refer to chapter 6.7

TOU billing date setup

Refer to chapter 6.7

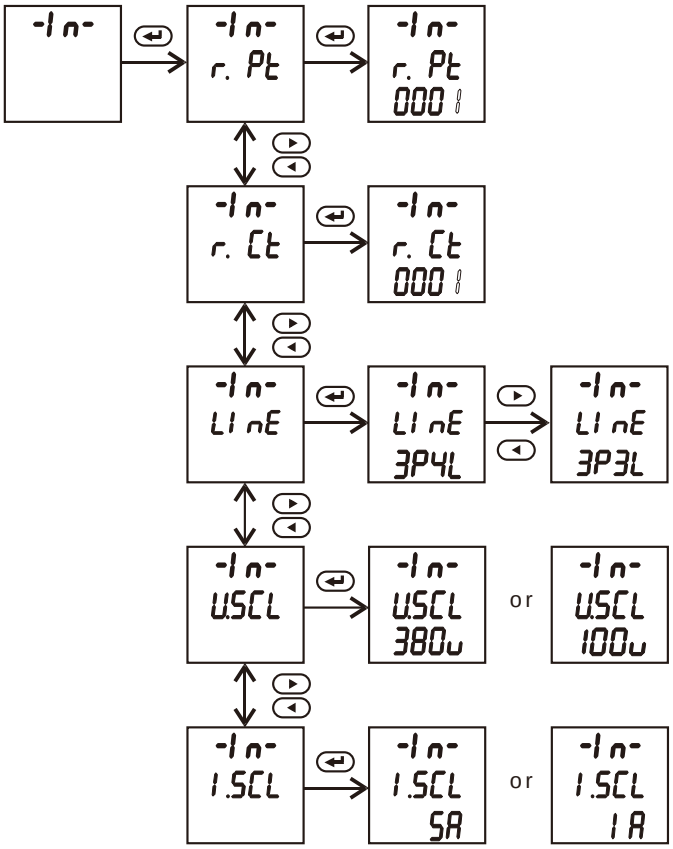
TOU segment setup

Refer to chapter 6.7

Sequence of events record

Refer to chapter 6.8

6.2. - Input Signal Setup



Voltage transformer ratio(1)*

Default **0001**

Current transformer ratio(1)*

Default **0001** or based on order requirement

Power grid mode

Default **3P4L**(2)*

Rated voltage scale

Default **380V**(3)*

Rated current scale

Default **5A**

Notes:

(1) In medium or high voltage system, set this value can expand measuring range, values represent the current transformer (primary side voltage) / (secondary side current). Must set **U.scl** in 100V or other specified VT secondary voltage.

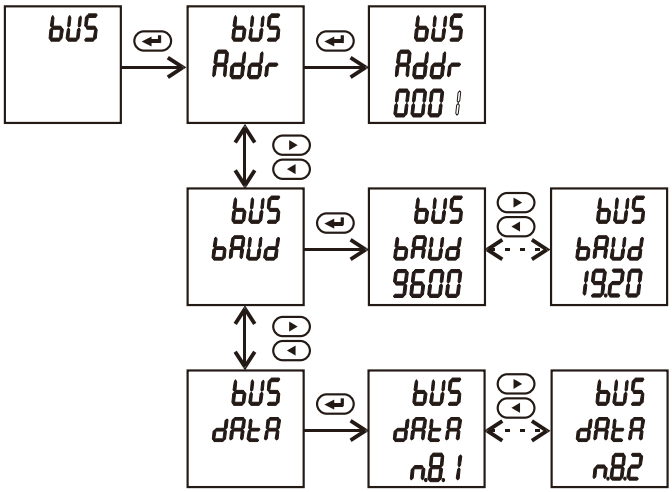
(2) If in order specified power grid are 3P3L, Blue Jay will connect **Un** and **Ub** terminal internally. In screen only show phase to phase parameter

(3) Blue Jay calibrate meter under 380V range, high-quality linearity performance ensures that the meter can accurately measure in the lower voltage range. That can compatible with 120V, 220V, 230V, 240V, 277V system.

If need to use in different voltage scale or different types CT, please contact our sales team for more help.

6.3. - Communication Port Setup

6.3.1.- RS485 communication port



Modbus address (1)*

Default **0001**

Comm port baud ratio (2)*

Default **9600** (2)*

Comm port data format

Default **n.8.1,** can select n.8.1 / E.8.1 / n.8.2

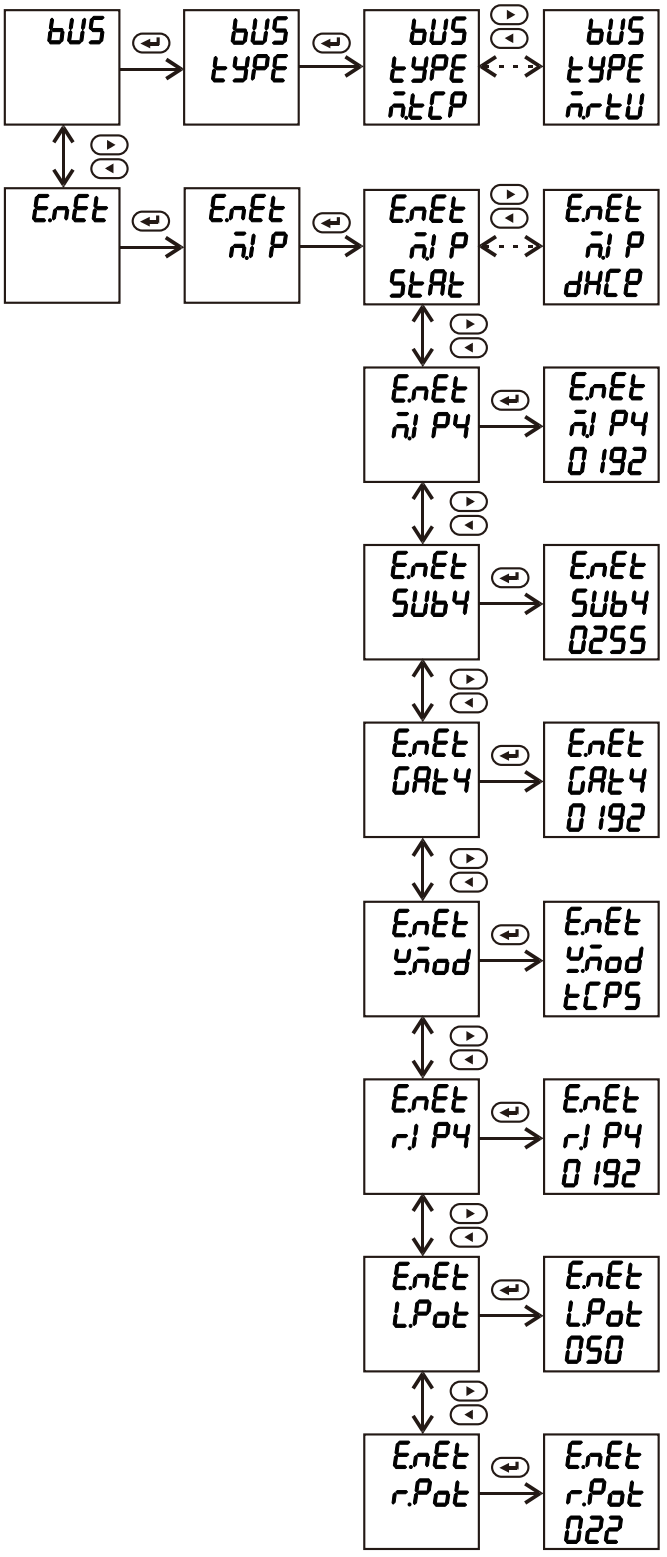
Note:

(1) Modbus address setup range 1-247

(2) Baud ratio can select 1200 / 2400 / 4800/ 9600 / 19200, regular meter equipped communication port max baud ratio are 19200bps, if need higher speed, please contact Blue Jay sales team.

6.3.2.- RJ45 Ethernet port

If meter equipped RJ485 port, the Bus configuration will follow this chart:



Modbus-TCP / Modbus-RTU

Meter can send data to remote IP/TCP, working logic same as standard RS485, Ethernet port work as bridge

Static IP* / DHCP

*User need to set IP address and subnet mask

Meter IP address

IP4.IP3.IP2.IP1 for XXX.XXX.XXX.XXX

Subnet mask

SUB4.SUB3.SUB2.SUB1 XXX.XXX.XXX.XXX

Gateway

GAT4.GAT3.GAT2.GAT1 XXX.XXX.XXX.XXX

TCP working mode

tCPS Tcp-server
HtPL UDP-server
UdPC UDP-Client
tCPC TCP-Client

Destination IP
Meter send data to remote IP address

IP4.IP3.IP2.IP1 for XXX.XXX.XXX.XXX

Meter local TCP port

Meter send data to remote TCP port

Note: In MODBUS-TCP mode are invalid

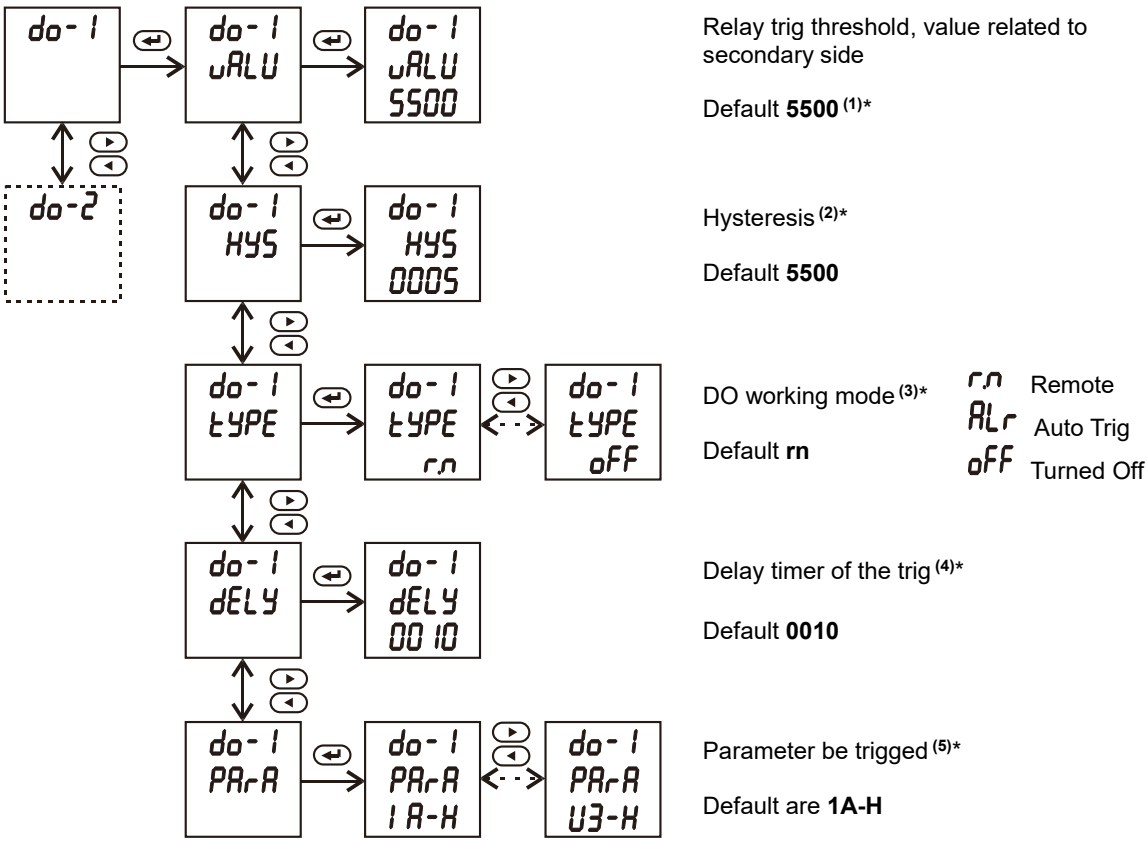
Note: To avoid unnecessary remote write failure, TCP port cannot configuration or read via register operation, only can manually configuration!

6.4. - Digital Output Setup

DO port is optional module, if do not choose this external port, in Setup menu do not have this sub-menu, and this chapter are invalid.

When device has more than one DO port, you can set the DO-2, as same step.

The physical DO relay standard is 5A 250VAC / 5A 30VDC



Notes:

(1) Relay trig threshold value have different units:

Voltage - 0.1V	Active power - 0.1W	Power factor - 0.001
Current - 0.001A	Reactive power - 0.1VAR	Frequency- 0.01HZ

(2) Hysteresis value is for prevent unexpected relay release, only the measurement parameter falls back lower / over a certain difference value from trig threshold, the DO can be released.

Formula: **Xm** < **X** - **Xr** (Upper edge trig) or **Xm** > **X** + **Xr** (Lower edge trig)

Xr = uALU **x** HYS / 10000

Xm is measurement rms value of electrical parameter

Example: Trig threshold value 3.700A; hysteresis value 0.03; After relay trigged, when measured value **Xm** < 3.589A (3.700-3.700*0.03), the relay will be released.

(3) DO port preset 2 types of working mode, and can be **Turned Off**

Auto Trig – When the measurement parameter over or lower the preset uALU, the DO relay act, terminal of DO+ / DO- shorted. After the measurement parameter fall back to a certain value can be released relay coil.

Remote - DO relay act by RS-485 control command, user can use function code 05 to trig single relay, device RS-485 port follow MODBUS-RTU protocol, command as following:

Host inquiry:

01	05	00 01	FF 00	DD FA
Address	Code	No.1 Relay register	Relay value (FF00:close; 0000: open)	CRC

Slave answer:

01	05	00 01	FF 00	DD FA

(4) In **Auto trig** mode, after **Xm** > uALU in the specified delay time, DO relay act. Setting value from 0.000sec (no delay) to 999.9 sec, default 0010 = 1sec

In **Remote** mode, if setup value = 0, output is **Level type**,

If set value = 0, output is **Pulse type**, value = pulse width

(5) Parameter of the DO can be set, preset 52 types parameter that can be used in auto trig mode

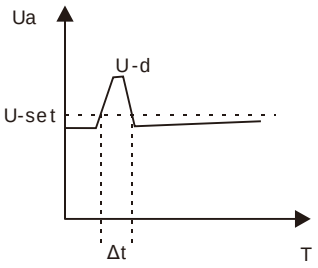
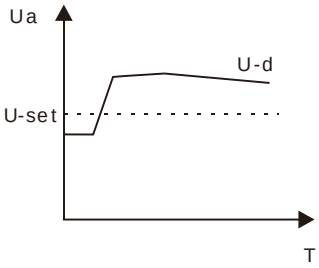
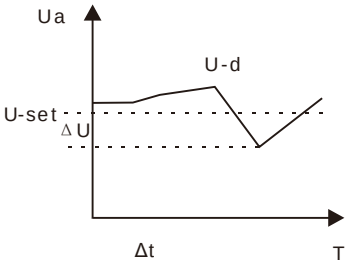
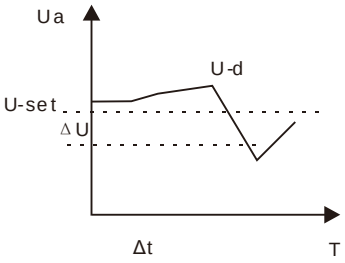
UA-H	A phase voltage upper trig	9b-H	B phase reactive power upper trig
Ub-H	B phase voltage upper trig	9C-H	C phase reactive power upper trig
UC-H	C phase voltage upper trig	95-H	Total reactive power upper trig
U3-H	Any one of Ua / Ub / Uc3 upper trig	SA-H	A phase apparent power upper trig
IA-H	A phase current upper trig	Sb-H	B phase apparent power upper trig
Ib-H	B phase current upper trig	SC-H	C phase apparent power upper trig
IC-H	C phase current upper trig	SS-H	Total apparent power upper trig
I3-H	Any one of Ia / Ib / Ic3 upper trig	PF-H	Total power factor upper trig
PA-H	A phase active power upper trig	Fr-H	Frequency upper trig
Pb-H	B phase active power upper trig	dI 1H	DI1 closed trig
PC-H	C phase active power upper trig	dI 2H	DI2 closed trig
PS-H	Total active power upper trig	dI 3H	DI3 closed trig
9A-H	A phase reactive power upper trig	dI 4H	DI4 closed trig

Note: If in screen show "XX -L" mean lower limit trig, for DI port mean open loop trig

*** Delay & Hysteresis logic**

Example in upper limit alarm of A phase voltage:

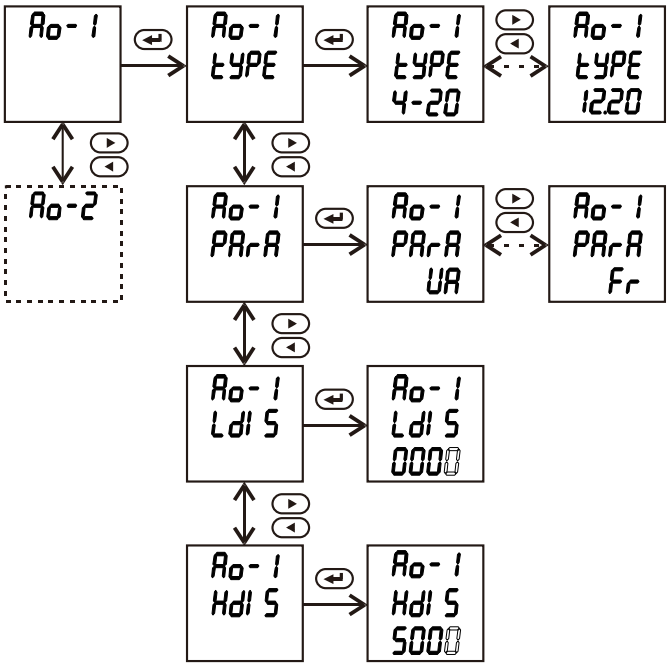
U-d mean detected Ua
U-set mean Alarm value of A phase

Alarm will not trigged		If Δt < Delay setting value, The Alarm will not trig, that can avoid influence of the transient electrical parameters
Alarm trigged		When U-d over U-set, and after delay setting time cool down, the value still over U-set, the alarm trigged
Alarm will not released		If ΔU < Hysteresis value The Alarm will not release, that can avoid influence of parameter unexpected fluctuations
Alarm released		When U-d lower than (U-set -Hysteresis) The Alarm will release

6.5. - Analog Output Setup

AO port is optional module, if do not choose this external port, in Setup menu do not have this sub-menu, and this chapter are invalid. When device has more than one AO port, you can set the AO-2…, as same step. Basic specification of AO port:

Accuracy class	0.5S
Overload	120% effective output, the maximum current of 24mA, voltage 15V
Load	R_{max} = 420Ω
Isolation	1KV to other terminal (Between AO-AO port non-isolation)



Analog output signal range [1]*

Default **4-20mA**

Analog output signal parameter [2]*

Default **Ua**

Transfer parameter value of zero span

Default **0000**[3]*

Transfer parameter value of full span

Default are **5000**[3]*

Notes:

(1) Signal range default are ampere output, rang 4-20mA, 12-20mA, optional voltage signal output, optional 0-5V, 10-5V, (please contact Blue Jay sales team before order).

(2) The analog parameter can set Ua, Ub, Uc, Uab, Ubc, Uca, Ia, Ib, Ic, Pa, Pb, Pc, PS, Qa, Qb, Qc, Qs, Sa, Sb, Sa, SS, PF, Fr.

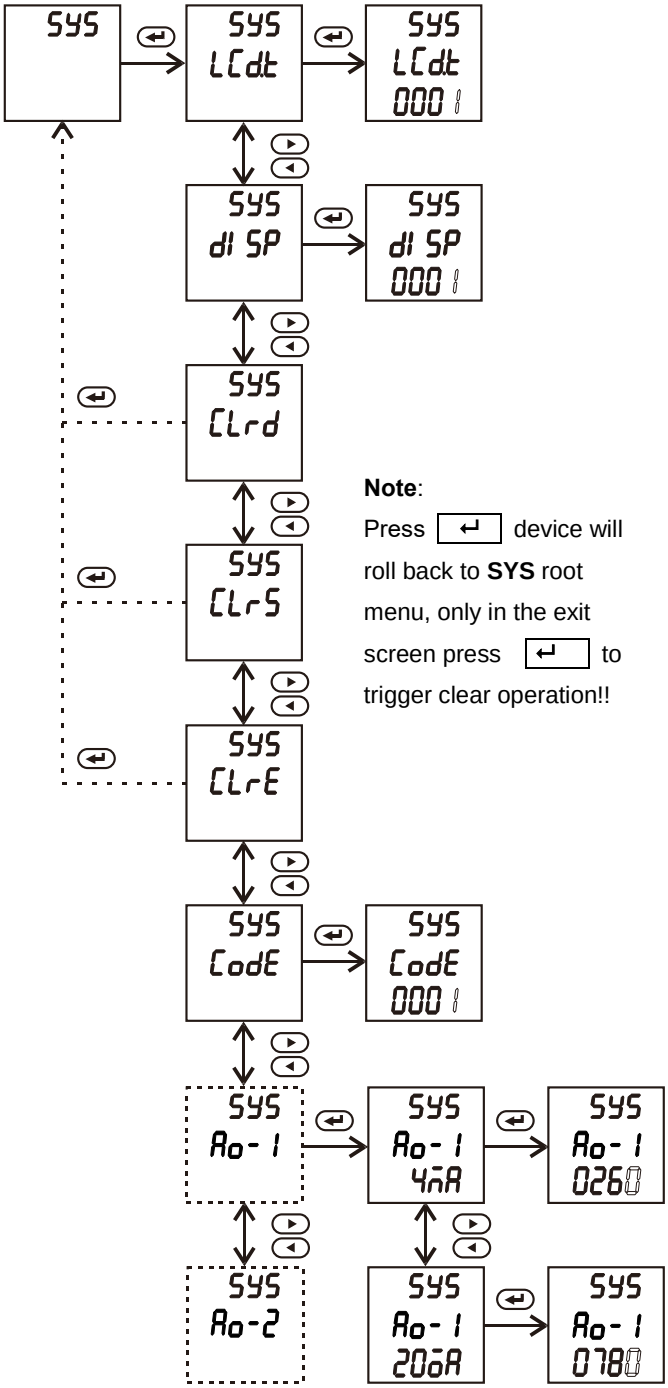
(3) Transfer parameter related secondary side value (such as AC100V, AC5A), units as following.

Voltage - 0.1V	Active power - 0.1W	Power factor - 0.001
Current - 0.001A	Reactive power - 0.1VAR	Frequency- 0.01HZ

Example: Setup variable: **TYPE** 4-20mA **PARA** Ia **LdIS** 0000 **HdIS** 5000

Mean transfer A-phase current is 0.000A output 4mA, current is 5.000A output 20mA;

6.6. - System Setting



Duration of LCD backlight, unit: **Min**

Default **0005**

Screen scroll interval, unit: **sec**

Default **0000**(1)*

Reset demand record

Note:
Press ↵ device will roll back to **SYS** root menu, only in the exit screen press ↵ to trigger clear operation!!

Reset SOE record

Reset energy counter record

Change password (2)*

Analog output zero span calibration setup(3)*

Analog output full span calibration setup(3)*

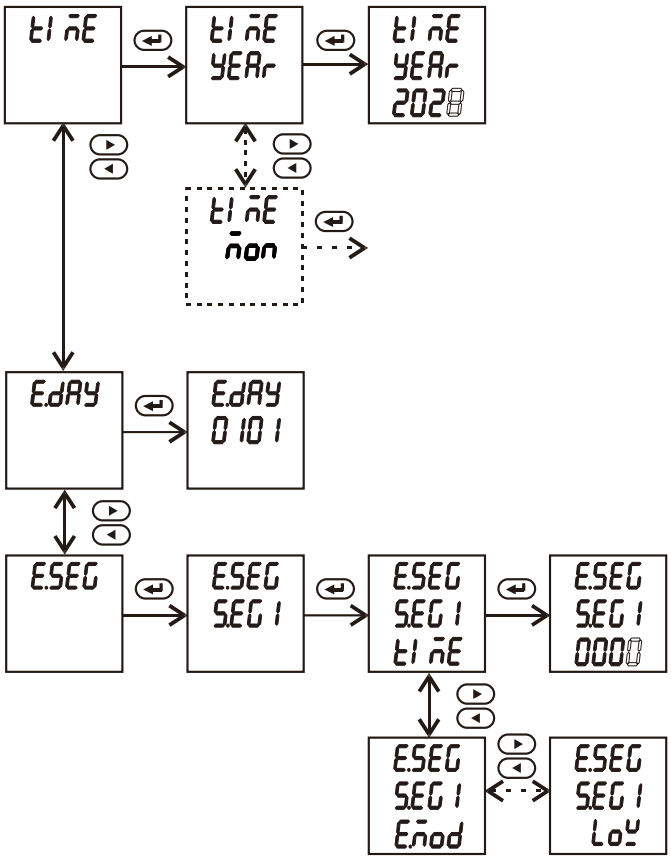
Notes:

(1) Set 0000 mean manually switch each monitor screen pages

(2) If change the password, please keep the password in safety, or only return to Blue Jay for reset new password!

(3) Variable step value is 2/1000. Blue Jay already do calibration before shipping, please use high precision ammeter or voltmeter as reference standard.

6.7. – RTC and TOU Setup



RTC setup

YEAr	Year
non	Month
dAY	Weekday(1)*
dAtE	Date
HoUr	Hour
nIn	Minute
SEC	Second

TOU billing date Setup

Left 2 digital for “Date” of a month
Right 2 digital for “Hour” in the billing day

TOU segment setup(2)*

TOU tariff type setup(3)*

Notes:

(1) The weekday is independent data, only loops from 1-7, and does not linked to date information, only can be read in register map and used as data identity.

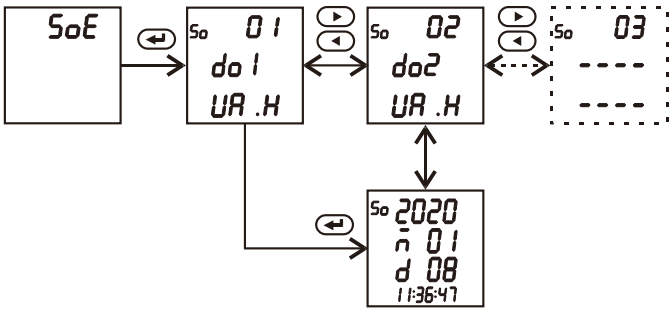
(2) BJ-194J provides last 3 months of TOU energy record. The TOU function separate one day in to 12 segments billing interval. SEG1 for record starting time point in one day.

(3) Device used 4 different words to indicate 4 types tariff (T1-T4) energy consumption in different time segment and record in memory. correspondence is as follows:

Sharp	tIME	T1
Peak	PEAK	T2
Flat	FLAt	T3
Valley	LoY	T4

6.8.- SOE Record Screen

SOE record are folded under Setup menu, in this sub-screen user can review the all the 50 log event record.



Event of sequence information (1)*

Time of event happened(2)*

Note:

(1) In above demo show SOE_No.1 trigged by DI_1 port, A phase upper limit.

Symbol of the event type meaning please refer to chapter "**Digital Output Setup**"

(2) Please ensure RTC setup are correctly, or the timestamp or error. If change RTC in, the already time stamp does not auto modify to new RTC!

7.- PULSE OUTPUT

BJ-194J provides 2* pulse output for the total active energy & total reactive energy.

The host / PLC / DI module can cumulative the data of both the active and reactive power energy sent by the pulse from opt coupler relay.

1). Electrical specification: voltage VCC ≤ 48V, Iz ≤ 50mA.

2). Pulse: 5000 imp / kWh, pulse up to 80ms.
This means: When the device detects 1 kWh, the port will generate 5000 pulse

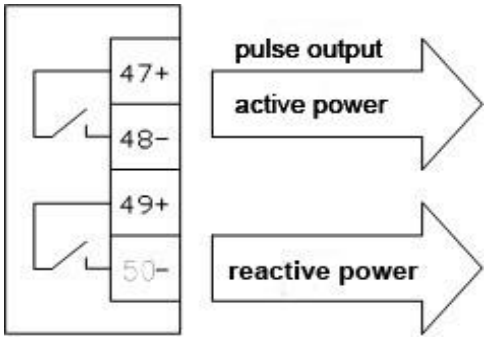
Note: 1 kWh energy is for *secondary side energy data*, if there have PT and CT accessed; primary side energy data is "1 kWh ×PT ratio× CT ratio".

Voltage (V)	Current (A)	Pulse constant (imp / kWh)
380 or 220	5	5000
	1	20000
100	5	20000
	1	80000

Example:

In measure time "T", the received total pulse is "N",
Primary side input of voltage is 10Kv
Primary side input of current is 400A.
Secondary side measurement range is 100V and 5A.

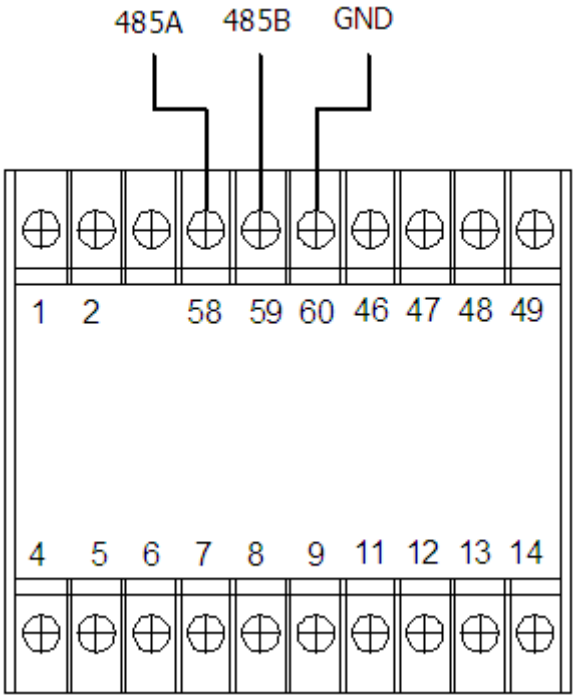
In the time "T", energy accumulated is: N / 20000 × 100 × 80



8.- COMMUNICATION INTERFACE

8.1.- Connection for RS485 BUS

The composition of the RS-485 cabling must be carried out with a meshed screen cable (minimum 3 wire), diameter of not less than 0.5mm^2, with a maximum distance of 1,200 m between the BJ-194… and the master unit. This Bus may connect a maximum of 32pcs BJ-194…



Notes:

-. For communication with the master unit, user can choose RS-485 to RS-232 converter or RS485 to USB adapter to use.
-. For expand the number of devices in the communication network, a signal repeater can be used.
-. Full range of BJ-194… meter RS485 PIN number is 58,59,60
-. Due to product modifications or special requirements, the interface pin place may be change. For details, please refer to product label on the rear side

8.2.- MODBUS © protocol

Modbus RTU Frame Format:

Address code	**1 BYTE**	*Slave device address **1-247***
Function code	**1 BYTE**	*Indicates the function codes like read coils / inputs*
Data code	**4 BYTE**	*Starting address, high byte* *Starting address, low byte* *Number of registers, high byte* *Number of registers, low byte*
Error Check code	**2 BYTE**	*Cyclical Redundancy Check (**CRC**)*

MODBUS FUNCTIONS:

Code	Meaning	Description
FUNCTION 01	Read Coil Status	*Only valid when equipped DO port*
FUNCTION 02	Read Input Status	*Only valid when equipped DI port*
FUNCTION 03	Reading of n Words	*This function permits to read all the electrical parameters of the BJ194…series.*
FUNCTION 05	Force Single coil	*Details see chart 6.4* *When DO in remote control mode can work*
FUNCTION 06	Preset Single register	***Disable in default*** *If need valid this code, please contact Blue Jay Sales Team before your order!*

Note: Float data follow **IEEE754**, float low bit first, high bit next. (**CD AB**)

8.3. - Register map

8.3.1- Basic power data—Primary Side

Register	Data	Byte mode		Instruction
0x00	Ua	float	2	Phase to Line Voltage, Unit: V
0x02	Ub	float	2	
0x04	Uc	float	2	
0x06	Uab	float	2	Phase to Phase Voltage, Unit: V
0x08	Ubc	float	2	
0x0a	Uca	float	2	
0x0c	Ia	float	2	Three phase Current, Unit: A
0x0e	Ib	float	2	
0x10	Ic	float	2	
0x12	Pa	float	2	Individual phase active power, Unit: kW
0x14	Pb	float	2	
0x16	Pc	float	2	
0x18	P∑	float	2	Total active power, Unit: kW
0x1a	Qa	float	2	Individual phase reactive power, Unit: kVar
0x1c	Qb	float	2	
0x1e	Qc	float	2	
0x20	Q∑	float	2	Total reactive power, Unit: kVar
0x22	Sa	float	2	Individual phase apparent power, Unit: kVA
0x24	Sb	float	2	
0x26	Sc	float	2	
0x28	S∑	float	2	Total apparent power, Unit: kVA
0x2a	PFa	float	2	Individual phase power factor, 0~1.000
0x2c	PFb	float	2	
0x2e	PFc	float	2	
0x30	PF∑	float	2	Total power factor, 0~1.000
0x32	FR	float	2	Frequency, Unit:0.01Hz
0x34	Ep+	float	2	Positive active energy, Unit: kWh
0x36	Ep-	float	2	Negative active energy, Unit: kWh
0x38	Eq+	float	2	Inductive reactive power, Unit: kVarh
0x3a	Eq-	float	2	Capacitive reactive power

8.3.2 - Basic power data—Secondary Side

Register	Data	Byte mode		Instruction
0x100	Ua	int	1	Phase to Line Voltage, Unit: 0.1V
0x101	Ub	int	1	
0x102	Uc	int	1	
0x103	Uab	int	1	Phase to Phase Voltage, Unit: 0.1V
0x104	Ubc	int	1	
0x105	Uca	int	1	
0x106	Ia	int	1	Three phase Current, Unit: 0.001A
0x107	Ib	int	1	
0x108	Ic	int	1	
0x109	Pa	int	1	Individual phase active power, Unit: W
0x10a	Pb	int	1	
0x10b	Pc	int	1	
0x10c	P∑	int	1	Total active power, Unit: W
0x10d	Qa	int	1	Individual phase reactive power, Unit: Var
0x10e	Qb	int	1	
0x10f	Qc	int	1	
0x110	Q∑	int	1	Total reactive power, Unit: Var
0x111	Sa	int	1	Individual phase apparent power, Unit: kVA
0x112	Sb	int	1	
0x113	Sc	int	1	
0x114	S∑	int	1	Total apparent power, Unit: VA
0x115	PFa	int	1	Individual phase power factor, 0~1.000
0x116	PFb	int	1	
0x117	PFc	int	1	
0x118	PF∑	int	1	Total power factor, 0~1.000
0x119	FR	int	1	Frequency, Unit:0.01Hz
0x11a	Ep+	int	2	Positive active energy, Unit: Wh
0x11c	Ep-	int	2	Negative active energy, Unit: Wh
0x11e	Eq+	int	2	Inductive reactive power, Unit: Varh
0x120	Eq-	int	2	Capacitive reactive power

8.3.3- Meter status data

Register	Data	Byte mode		Instruction
0x200	DO	int	1	Bit 0~1 show channel 1and channel 2 status 0 for open, 1 for closed
0x201	DI	int	1	Bit 0~3 show channel 1 to channel 4 status 0 for open, 1 for closed
0x20A	TIME.year	int	1	Internal RTC real time clock: Year - Month - Day - Time - minutes - seconds
0x20B	TIME.month	int	1	
0x20C	TIME.date	int	1	
0x20D	TIME.hour	int	1	
0x20E	TIME.minute	int	1	
0x20F	TIME.second	int	1	
0x210	TIME.day	int	1	

8.3.4- Advanced electrical parameter

Register	Data	Byte mode		Instruction
0x300	Pde	float	2	Present active power demand, Unit: W
0x302	Qde	float	2	Present reactive power demand, Unit: var
0x304	Sde	float	2	Present apparent power demand, Unit: VA
0x306	Pd_Mi	float	2	Active power demand in present month
0x308	Qd_Mi	float	2	Reactive power demand in present month
0x30a	Sd_Mi	float	2	Apparent power demand in present month
0x30c	Pd_Mii	float	2	Active power demand in last month
0x30e	Qd_Mii	float	2	Reactive power demand in last month
0x310	Sd_Mii	float	2	Apparent power demand in last month
0x312	Pd_Miii	float	2	Active power demand in month before last month
0x314	Qd_Miii	float	2	Reactive power demand in month before last month
0x316	Sd_Miii	float	2	Apparent power demand in month before last month
0x318- 0x31F	/	float	2	Reversed
0x320	$V_{\delta}+$	float	2	Positive sequence voltage in primary side
0x322	$V_{\delta}-$	float	2	Negative sequence voltage in primary side
0x324	V_0	float	2	Zero sequence voltage in primary side
0x326	$I_{\delta}+$	float	2	Positive sequence current in primary side
0x328	$I_{\delta}-$	float	2	Negative sequence current in primary side
0x32A	I_0	float	2	Zero sequence current in primary side
0x32C	eU	float	2	Voltage unbalance, eU = ($V_{\delta}-$ / $V_{\delta}+$)%
0x32E	eI	float	2	Current unbalance, eI = ($I_{\delta}-$ / $I_{\delta}+$)%
0x330	Va_d	float	2	A phase voltage deviation
0x332	Vb_d	float	2	B phase voltage deviation
0x334	Vc_d	float	2	C phase voltage deviation
0x336	F_d	float	2	Frequency deviation

8.3.5- Multi- tariffs ratio data

Register	Data	Byte mode		Instruction
0x400	Cumulative_tol	long	2	Total cumulative energy
0x402	Cumulative_T1	long	2	T1-T4 cumulative Energy record
0x404	Cumulative_T2	long	2	
0x406	Cumulative_T3	long	2	
0x408	Cumulative_T4	long	2	
0x40a	Current_tol	long	2	Total energy of present month
0x40c	Current_T1	long	2	T1-T4 Energy record of present month
0x40e	Current_T2	long	2	
0x410	Current_T3	long	2	
0x412	Current_T4	long	2	
0x414	Last_tol	long	2	Total energy of last month
0x416	Last_T1	long	2	T1-T4 Energy record of last month
0x418	Last_T2	long	2	
0x41a	Last_T3	long	2	
0x41c	Last_T4	long	2	
0x41e	Prior_tol	long	2	Total energy of the month before last month
0x420	Prior_T1	long	2	T1-T4 Energy record of the month before last month
0x422	Prior_T2	long	2	
0x424	Prior_T3	long	2	
0x426	Prior_T4	long	2	

Note: In screen display the T1-T4 will display as following in screen and setup:

Sharp	tInE	T1
Peak	PEAt	T2
Flat	FLAt	T3
Valley	LoU	T4

8.3.6- THD and individual harmonic (Max 31 times)

Register	Data	Byte mode		Instruction
0x500	THDUa	int	1	A-phase Voltage THD, unit 0.1%
0x501	THDUb	int	1	B-phase Voltage THD
0x502	THDUc	int	1	C-phase Voltage THD
0x503	THDia	int	1	A-phase Current THD, unit 0.1%
0x504	THDib	int	1	B-phase Current THD
0x505	THDic	int	1	C-phase Current THD
0x508-0x545	HUa	int	32	Each phase voltage individual Harmonic 2~31th, unit 0.1%
0x548-0x586	HUb	int	32	
0x588-0x5C5	HUc	int	32	
0x5C8-0x605	HIa	int	32	Each phase current individual Harmonic 2~31th, unit 0.1%
0x608-0x645	HIb	int	32	
0x648-0x685	HIc	int	32	
0x688	TOHDUa	int	1	Each phase Voltage total odd harmonic distortion, unit 0.1%
0x689	TOHDUb	int	1	
0x68a	TOHDUc	int	1	
0x68b	TEHDUa	int	1	Each phase Voltage total even harmonic distortion, unit 0.1%
0x68c	TEHDUb	int	1	
0x68d	TEHDUc	int	1	
0x68e	THFFUa	int	1	Each phase voltage telephone harmonic form factor, unit 0.1%
0x68f	THFFUb	int	1	
0x690	THFFUc	int	1	
0x691	CFUa	int	1	Three phase voltage crest factor, unit 0.001
0x692	CFUb	int	1	
0x693	CFUc	int	1	
0x694	TOHDIa	int	1	Each phase current total odd harmonic distortion, unit 0.1%
0x695	TOHDIb	int	1	
0x696	TOHDIc	int	1	
0x697	TEHDIa	int	1	Each phase current total even harmonic distortion, unit 0.1%
0x698	TEHDIb	int	1	
0x699	TEHDIc	int	1	
0x69a	KFIa	int	1	Three phase current K factor, unit 0.01
0x69b	KFIb	int	1	
0x69c	KFIc	int	1	

8.3.7- SOE record (Max 50 list)

Register	Data	Byte mode		Instruction
0X700-0X7F9	SOE_1~50	int	1	Byte 0: Fault channel Byte 1: Fault event Byte 2,3: Fault value Byte 4: Fault time: Year Byte 5: Fault time: Month Byte 6: Fault Time: Day Byte 7: Fault time: Time Byte 8: Fault time: Minute Byte 9: Fault time: Seconds

Byte 0	Byte 1	
1:DI1	100:Remote control	
2:DI2	101:UA upper alarm	132:UA lower alarm
3:DI3	102:UB upper alarm	133:UB lower alarm
4:DI4	103:UC upper alarm	134:UC lower alarm
5:DI5	104:UAB upper alarm	135:UAB lower alarm
6:DI6	105:UBC upper alarm	136:UBC lower alarm
101:DO1	106:UCA upper alarm	137:UCA lower alarm
102:DO2	107:UA/UB/UC upper alarm	138:UA/UB/UC lower alarm
103:DO3	108:IA upper alarm	139:IA lower alarm
104:DO4	109:IB upper alarm	140:IB lower alarm
	110:IC upper alarm	141:IC lower alarm
	111:IA/IB/IC3 upper alarm	142:IA/IB/IC3 lower alarm
	112:PA upper alarm	143:PA lower alarm
	113:PB upper alarm	144:PB lower alarm
	114:PC upper alarm	145:PC lower alarm
	115:total active power upper alarm	146:total active power lower alarm
	116:QA upper alarm	147:QA lower alarm
	117:QB upper alarm	148:QB lower alarm
	118:QC upper alarm	149:QC lower alarm
	119:total reactive power upper alarm	150:total reactive power lower alarm
	120:SA upper alarm	151:SA lower alarm
	121:SB upper alarm	152:SB lower alarm
	122:SC upper alarm	153:SC lower alarm
	123:total apparent power upper alarm	154:total apparent power lower alarm
	124:total power factor upper alarm	155:total power factor lower alarm
	125:frequency upper alarm	156:frequency lower alarm
	126:DI1 close alarm	157:DI1 open alarm
	127:DI2 close alarm	158:DI2 open alarm
	128:DI3 close alarm	159:DI3 open alarm
	129:DI4 close alarm	160:DI4 open alarm
	130:DI5 close alarm	161:DI5 open alarm
	131:DI6 close alarm	162:DI6 open alarm

Notes:

1. Not all of the data above can be read by RS485, the reading address will be unsuccessful
2. The data can be read out depends on your multi-function meter model, please refer to the corresponding product manual before build your software.
3. Some software has different definitions of the start bit of register address, there will be offset, please add 1 for the right address. To get more info, please contact technical support **tech@cqbluejay.com**

8.4.- Example

Host inquiry slave device

Addr	Fun	Data Address (high)	Data Address (low)	Data Number (high)	Data number (low)	CRC16 (low)	CRC16 (high)
0CH	03H	00H	00H	00H	06H	C4H	D5H

PC user ask upload UA, UB, UC, IA, IB, IC

Slave device answer

Addr	Fun	Byte count	Data1 high	Data1 low	Data2 high	Data2 low	Data3 high	Data3 low
0CH	03H	0CH	03H	E8H	03H	E9H	03H	E8H
Data4 high	**Data4 low**	**Data5 high**	**Data5 low**	**Data6 high**	**Data6 low**	**CRC16 low**	**CRC1 6 high**	
13H	84H	13H	88H	13H	8AH	A6H	D6H	

Show the data:

UA=3E8H (100.0)
UB=3E9H (100.1)
UC=3E7H (99.9)
IA=1384H (4.996)
IB=1388H (5.000)
IC=138AH (5.002)

Notes:

1. Blue Jay disable the 06 function in default setting, if Activated the write command, please check the host device program to avoid the meaningless write operation, that may reduce the reduce the register working life.
2. When the write is unsuccessful, no return data from the slave device. In this addition, please re-send write inquiry again

9. - SAFETY CONSIDERATIONS

All installation specification described at the previous chapters named: **INSTALLATION AND STARTUP, INSTALLATION MODES and SPECIFICATIONS.**

Please note that with the instrument powered on, the terminals could be dangerous to touching and cover opening actions or elements removal may allow accessing dangerous parts. This instrument is factory-shipped at proper operation condition.

◆ The device must have a professional installation and maintenance
◆ Any operation of the device, you must cut off the input signal and power;

10. - MAINTENANCE

The BJ194… series meter does not require any special maintenance. No adjustment, maintenance or repairing action should be done when the instrument is open and powered on, should those actions are essential, high-qualified operators must perform them.

Before any adjustment, replacement, maintenance or repairing operation is carried out, the instrument must be disconnected from any power supply source.

When any protection failure is suspected to exist, the instrument must be immediately put out of service. The instrument's design allows a quick replacement in case of any failure.

11. - TECHNICAL SERVICE

FAQ's

1.- Once cabled and connected is seen to give a correct voltage and current reading, but shows negative values for active power (generation).

This is an error with the cabling for the current transformer secondary; the direction of the transformer current has to be respected as shown in the connection diagram. The current transformers have a two face primary; the current must pass from P1 to P2 giving the result in secondary (S1 and S2) of 5 amps.

The error stems from:

a). The current transformers have been incorrectly installed. As a result, it gives the direction of the current as passing from P2 to P1; to resolve this problem, the current transformer does not have to be dismantled and installed again, but the transformer secondary (S1 and S2) just has to be inverted.

b). The connection of the current secondary in the current transformers have been incorrectly connected; to resolve this problem just connect the S1 transformer secondary to the S1 on the meter and the S2 on the current transformer to the S2 on the meter

2.- Once cabled and connected, is seen to give an incoherent Power factor and CosΦ reading (-0.01 or similar).

This is again a current transformer and voltage phase connection error phase A, must correspond to the current transformer installed in phase A; phase B, must correspond to the current transformer installed in phase B; and phase C, must correspond to the current transformer installed in phase C.

This connection terminal is clearly shown on the area side of the device.

3.- The measuring voltage and is displaying the secondary voltage (for example 110 volts). Ensure that the voltage Transformer ratio has been correctly set (Please refer to voltage PT ratio setting section in chapter **SETUP PROCEDUCE**).

4.- Device does not correctly display the current reading. It shows values varying between 0 to 5 amps of current.
Ensure that the Current Transformer ratio has been correctly set; (Please refer to current CT ratio setting section in chapter **SETUP PROCEDUCE**).

Calculation formula of Electrical parameter

Formula	Parameter
$U = \sqrt{\frac{1}{N}\sum_{n=0}^{N} u_n^2} \quad n = 0,1,2 \ldots \ldots N$	Voltage RMS value
$I = \sqrt{\frac{1}{N}\sum_{n=0}^{N} i_n^2} \quad n = 0,1,2 \ldots \ldots N$	Current RMS value
$P = \frac{1}{N}\sum_{n=1}^{N}(i_{an}u_{an} + i_{bn}u_{bn} + i_{cn}u_{cn})$	Total active power cycle average
$P_s = UI$	Single-phase apparent power cycle average
$\cos\theta = \frac{P_p}{P_S}$	Power factor
$P_q = \sqrt{P_S^2 - P_P^2}$	Reactive power (Pq is positive and the direction cannot be determined; P algorithm can be used to shift the voltage component by 90o)
$W = \int P * dt$	Electric energy

Note: In above formula, N for sampling points in one AC wave, In standard BJ-194J, the N=128

For any inquiry about the device performance or any failure,
contact to Blue Jay's technical service.

Blue Jay - After-sales service