

APM-96Z

Multi-Function Power Meter

User Manual



Version: 1.12

Revision: 2025.05

Read me

When you use APM-96Z Multi-Function Power 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 APM-96Z Multi-Function Power 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) 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	3 -
2.- FEATURES	4 -
2.1.- ELECTRICITY METERING	4 -
2.2.- TECHNICAL PARAMETERS	5 -
3.- INSTALLATION AND START-UP	7 -
3.1.- INSTALLATION	7 -
3.2.- CONNECTION TERMINAL	9 -
3.3.- TYPICAL WIRING	10 -
4.- OPERATION MODE	11 -
5.- SCREEN DISPLAY	12 -
5.1.- OVERALL SCREEN:	12 -
5.2.- DETAIL PARAMETER SCREEN:	13 -
6.- SETUP PROCEDURE	14 -
6.1.- ENTER SETUP MENU	14 -
6.2.- INPUT SIGNAL SETUP	15 -
6.3.- COMMUNICATION PORT SETUP	16 -
6.4.- DIGITAL OUTPUT SETUP (OPTIONAL)	18 -
6.5.- ANALOG OUTPUT SETUP	21 -
6.6.- SYSTEM SETTING	22 -
6.7.- SYSTEM SETTING	23 -
6.8.- MENU CHARACTER DESCRIPTION	25 -
7.- PULSE OUTPUT	27 -
8.- COMMUNICATION INTERFACE	28 -
8.1.- CONNECTION FOR RS485 BUS	28 -
8.2.- MODBUS © PROTOCOL	29 -
8.3.- REGISTER MAP	30 -
8.3.1.- Basic power data- primary side	30 -
8.3.2.- Basic power data- secondary side	31 -
8.3.3.- Meter status data	32 -
8.3.4.- Write operation function definition: Preset Single holding register	32 -
8.4.- EXAMPLE	33 -
9.- SAFETY CONSIDERATIONS	34 -
10.- MAINTENANCE	34 -
11.- TECHNICAL SERVICE	35 -

1.- SUMMARIZE

APM-96Z Multi-Function Power Meter is a digital screen electrical panel power meter. It is the ideal choice for monitoring and measuring of 3P4W or 3P3W power systems.

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

Current,	Active power,	Energy (Active/Reactive),
Voltage,	Reactive power,	Power factor,
Frequency,	Apparent power,	

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, APM-96Z supports the RS485/Modbus-RTU and optional Ethernet/Modbus-TCP/IP communication protocol for reliable and efficient data exchange. Based on this power meters, you can simply set up a monitoring system with the PC 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 voltage 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	•	•	•	/
*Phase-phase voltage	V	•	•	•	/
Current	A	•	•	•	/
Frequency	Hz	/	/	/	•
Power factor	Cos Φ	•	•	•	•
Active power	W	•	•	•	•
Reactive power	Var	•	•	•	•
Active energy	Wh	•	•	•	•
Reactive energy	Varh	•	•	•	•
4-Quadrant electric data	---	•	•	•	•

/: No such function

•: Can read on Display and communication

Notes:

Phase-phase voltage is Uab, Ubc, Uca, voltage data determined by the different wiring;

The APM-96Z 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

- Small 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 type communication to a PC.

2.2.- Technical parameters

-. Working power

AC/DC 85-265V, (DC 48V or AC 380V customized)

45-65Hz

Consumption: 4W

-. Input

Voltage	AC100V, 220V, 380V type 96mm and 42mm support AC690V, please specify when ordering).
Current	AC 1A/5A (please specify when ordering)
Frequency	40~65Hz, accuracy class: $\pm 0.02\text{Hz}$
Current overload	Measurement: 1.2 times Instantaneous: 10 times/1s
Voltage overload	Measurement: 1.2 times Instantaneous: 2 times/10s
Multi-tariff	4 sets rates

- Output

Communication	RS485, Modbus-RTU or Ethernet, Modbus-TCP/IP
Pulse output	1- 2 channels
DI	1-6 channels, dry contact, $R_i < 500\Omega$ turns on, $R_i > 100k\Omega$ turns off
DO	2-4 channels, Relay contact capacity: 5A@250VAC; 5A@30VDC
AO	1-3 channels, Current 4~20mA, load $< 390\Omega$, Voltage 0~10V, load $> 100k\Omega$

- Load

Voltage: $< 0.1\text{VA}$ / phase (rated 220V)

Current: $< 0.4\text{VA}$ / phase (rated 5A)

-. Safety

2kV AC RMS 1 minute, between input / output / case / power supply

Input, output and power supply to the chassis $\geq 100\text{M}\Omega$

-. Reference Standard

Active energy IEC 62053-21:2018

Reactive energy IEC 62053-23:2018

-. Accuracy

Parameter	Accuracy	A phase	B phase	C phase	All
Voltage	0.5	V1	V2	V3	
Current	0.5	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	1.0				Wh
Reactive energy	2.0				varh
Frequency	0.02				Hz

-. EMC test

Parameter	Standard	Test voltage
Discharge immunity test	IEC-61000-4-2 level 4	8kV
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: 4kV

-. Dimensions

Panel installation: 96mm×96mm×75mm (W*H*D)

Hole size: (91±0.8mm) × (91±0.8mm) (W*H)

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.

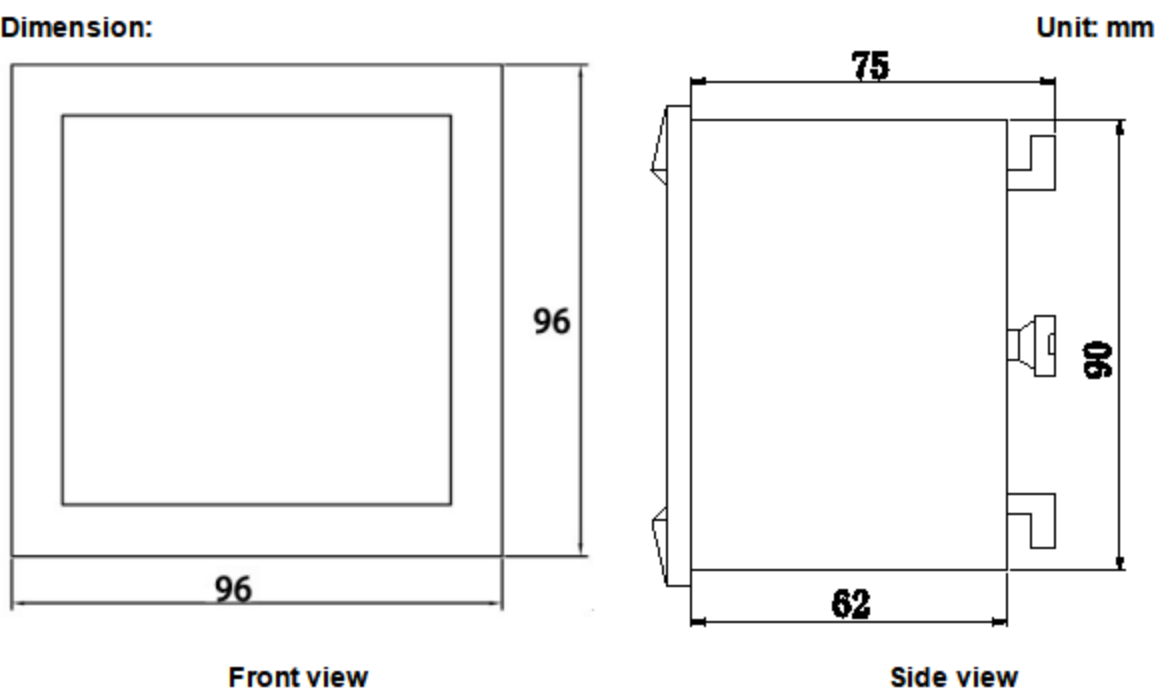
3.1.- Installation

Mounting

Instrument is to be mounted on panel (cut-out $91+0.8 \times 91+0.8 \text{ mm}$). 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.

Dimension:



Notes:

Input signal: APM-96Z 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:

APM-96Z 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 APM-96Z 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-15pin: (Power supply, 2* communications and optional AO)

No.	Marked	Notes
1	L	AUX input 85-265Vac/dc
2	N	
47	EP+/ Ep-	Active energy pulse output+
48		Active energy pulse output-
49	EQ+/ EQ-	Reactive energy pulse output+
50		Reactive energy pulse output-
58	RS485-1	Channel 1 RS485+
59		Channel 1 RS485-
61	RS485-2	Channel 2 RS485+
62		Channel 2 RS485-
15-18	AO 1-3	3 channels analog output

Middle-15pin: Expand I/O module

No.	Marked	Notes
19-20 21-22 23-24 25-26	DO 1-4	4-channel digital output
70-76	DI 1-6	6-channel digital input

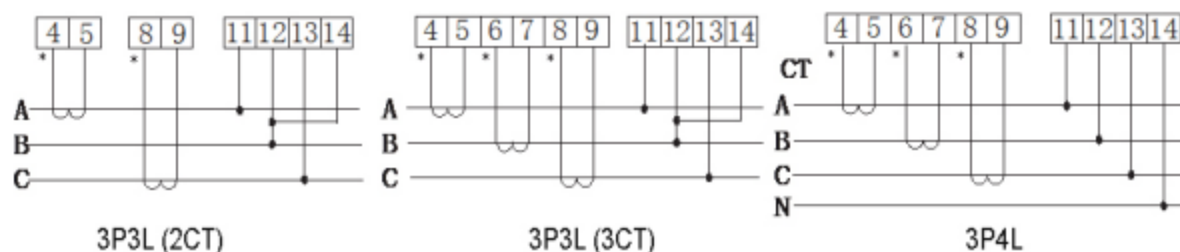
Lower-10pin: Signal

No.	Marked	Notes
11	Ua	Voltage A-phase input
12	Ub	Voltage B-phase input
13	Uc	Voltage C-phase input
14	Un	Neutral Voltage input
8	C-phase Current	Current C-phase - S1 input
9		Current C-phase - S2 input
6	B-phase Current	Current B-phase - S1 input
7		Current B-phase - S2 input
4	A-phase Current	Current A-phase - S1 input
5		Current A-phase - S2 input

Note:

The terminal pin definition may change depends on customer order; please refer to the label on the meter!

3.3.- Typical Wiring



Note:

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

WARNINGS!

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.

4.- OPERATION MODE

When the device is powered on, 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.

Button	In Monitor Screen	In Config Sub-menu	In Parameter Setup
	Screen will move to previous or next page	Move cursor up and down to select function	Move setting cursor to left
			Scroll selection number 0 ~ 9
	Call out password screen	Exit & roll back to up level menu.	
	Call out Sub-screen or Version screen	Confirm the values & Entry or jump to down level menu	

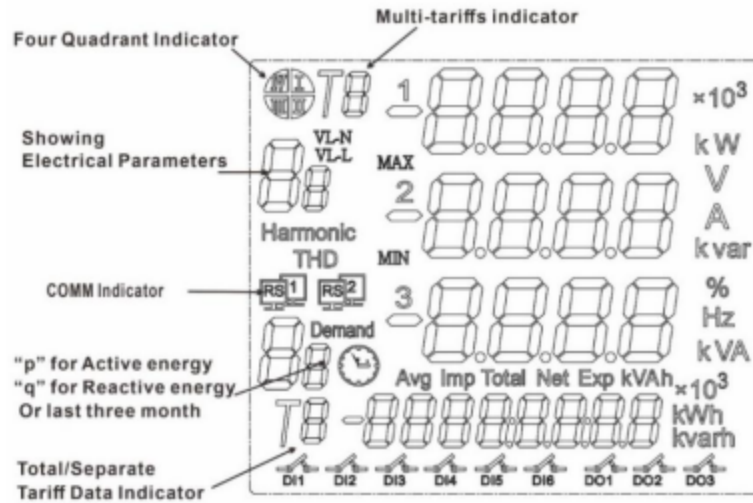
Note: In Setup menu, if change the setting value, press  for exit menu, device will call out confirm screen ask "SAVE"

Then press  *exit without saving;*

press  *save and exit.*

5.- SCREEN DISPLAY

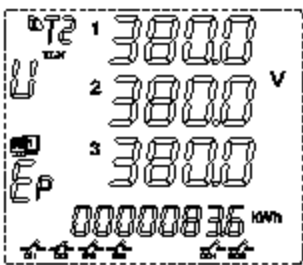
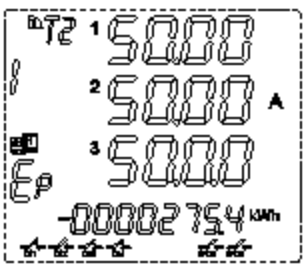
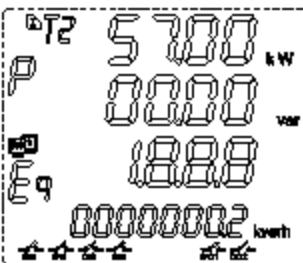
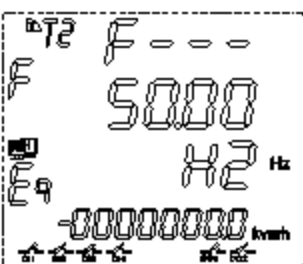
5.1.- Overall screen:



Note:

The screen shows all the functions for reference only. if there is no relevant function, you can ignore it.

5.2.- Detail parameter screen:

Screen No.	Screen interface	Explanation
- 1 -		Three phase voltage Ua, Ub, Uc; Note: In high voltage measurement, $\times 10^3$ mean the showing value multiplied by 1000, in the screen diagram mean the voltage is $10 \times 1,000 = 10,000$ volt Bottom character "Ep" show total active energy is 83.6KWh. Note: Detail information for each symbol, please refer chapter 5, Surround area shows the system information, in other screen are same:  show DI1, DI2, DI3, DI4 in the closed;  show DO1, DO2 opened;  flicker show Communication Rx/Tx normal;
- 2 -		Three-phase current Ia, Ib, Ic. Bottom Ep shows total negative active energy.
- 3 -		Total active power, Total reactive power, and Total factor. Press  can switch to show independent three phase active (P), Reactive(Q), Apparent power(S) value. Bottom Eq shows total reactive energy.
- 4 -		Frequency of grid. Bottom Eq shows total negative reactive energy.

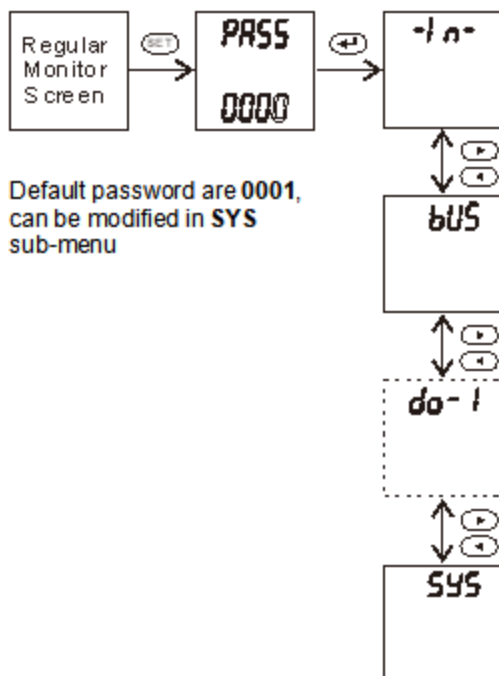
Note:

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

6.- SETUP PROCEDURE

The SETUP procedure of the APM-96Z 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



Input signal setup

Refer to [chapter 6.2](#)

Communication port setup

Refer to [chapter 6.3](#)

Digital output (relay) port setup

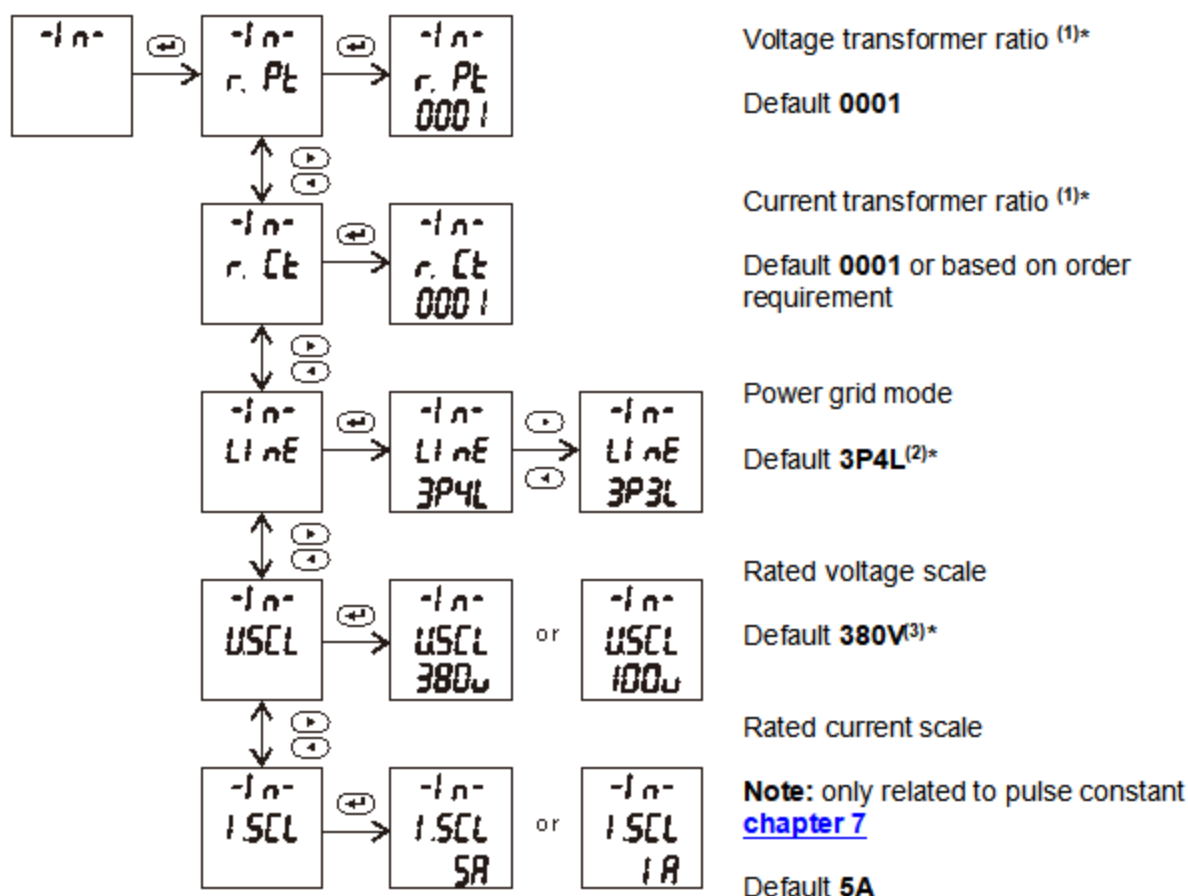
Refer to [chapter 6.4](#)

Note: If do not select port, no such pages

System parameter setup

Refer to [chapter 6.5](#)

6.2.- Input Signal Setup



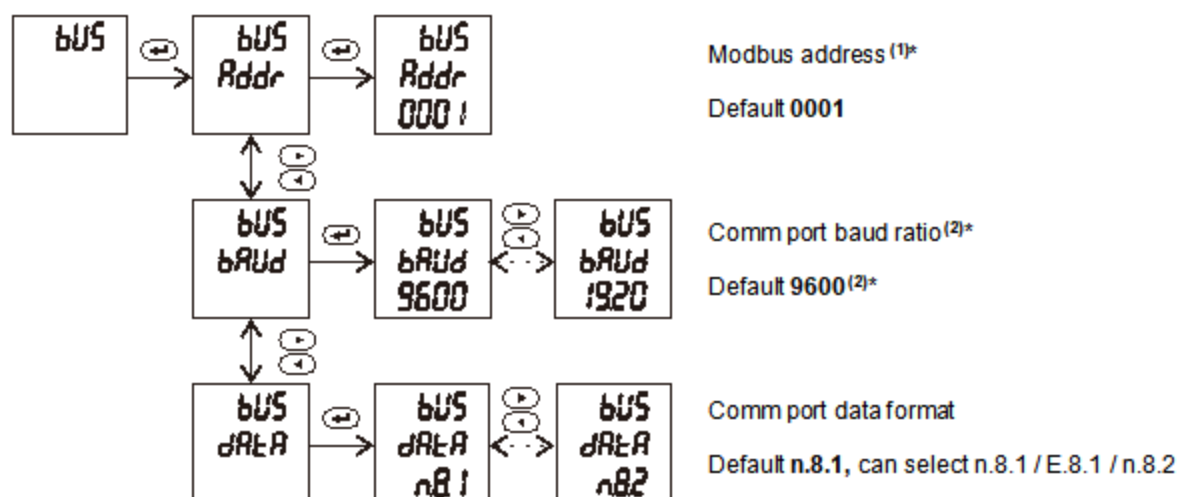
Notes:

- (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 setting

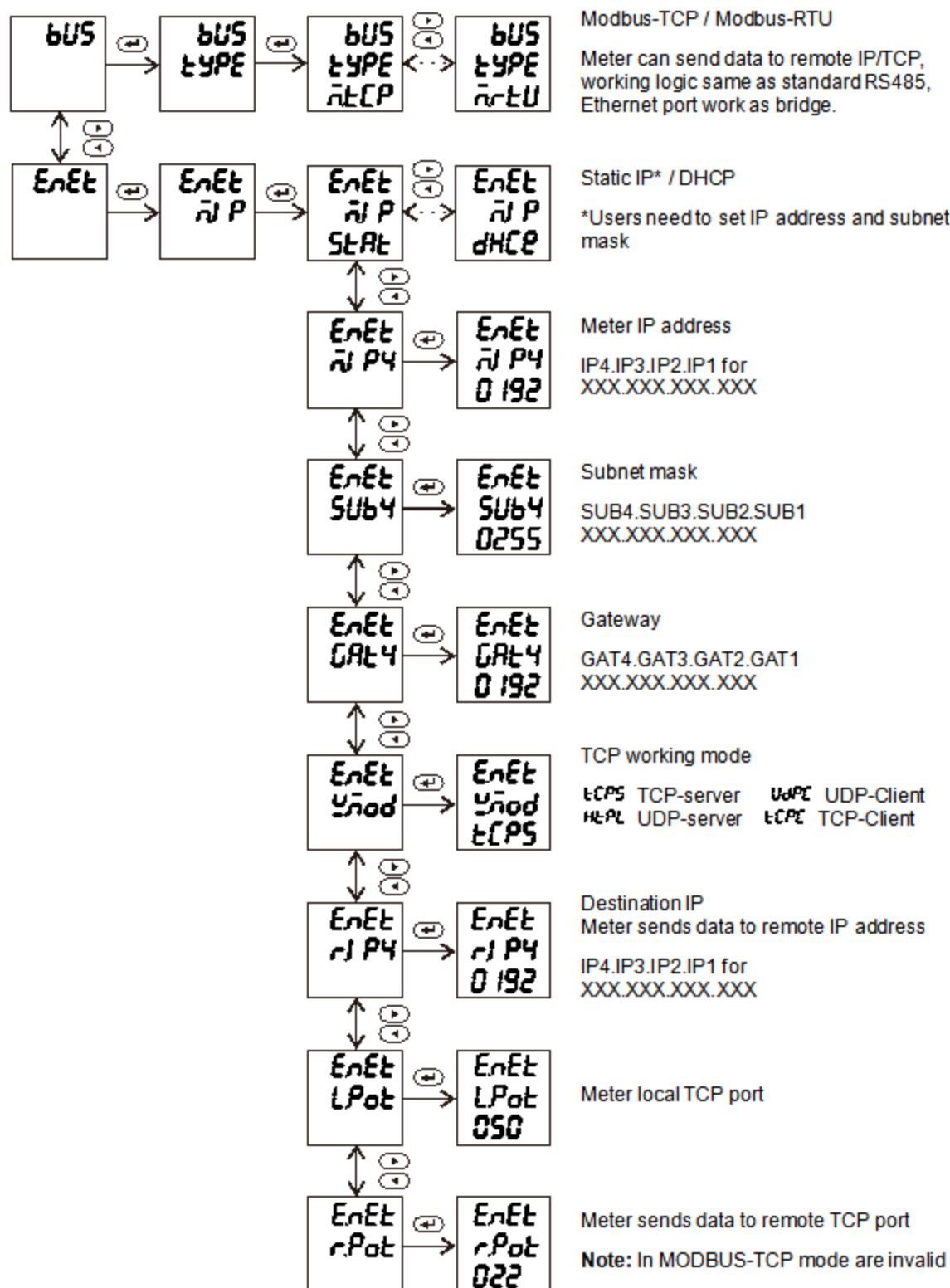


Note:

- (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.- Ethernet communication setting

If meter is equipped with RJ45 port, the Bus configuration is as shown below:

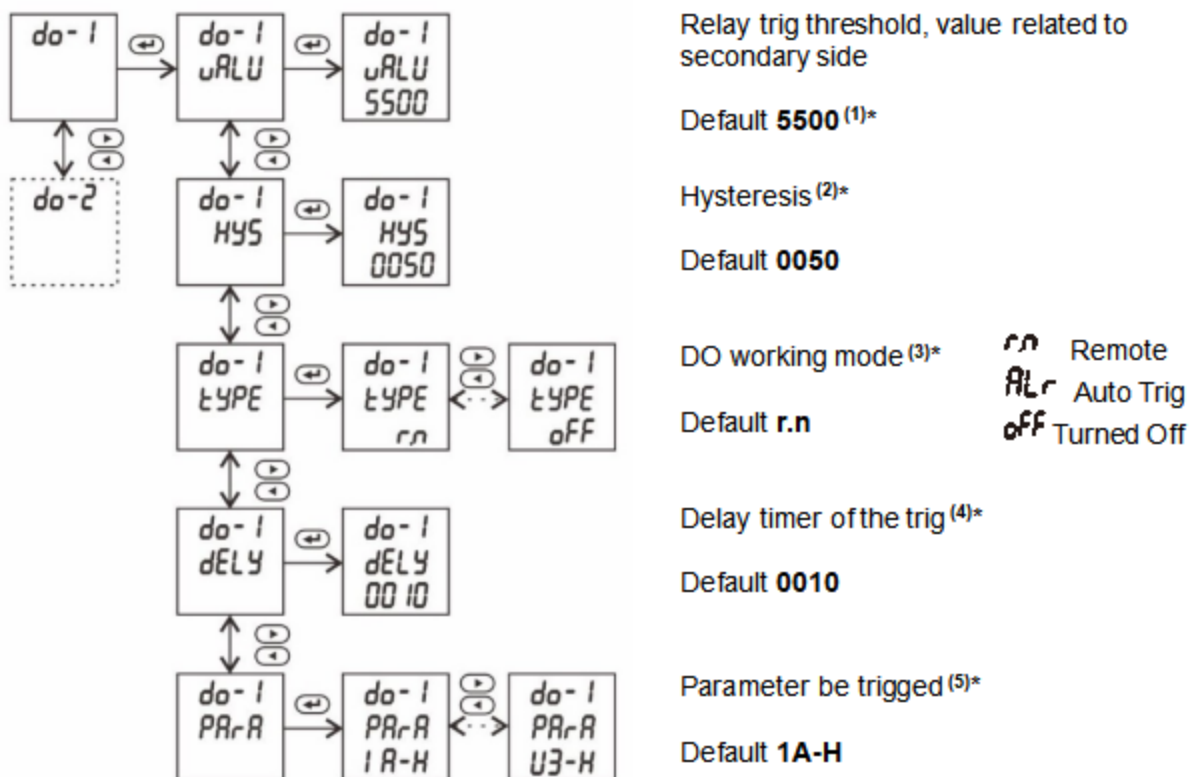


6.4.- Digital Output Setup (Optional)

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: $X_m < X - X_r$ (Upper edge trig) or $X_m > X + X_r$ (Lower edge trig)

$$X_r = \boxed{uRLU} \times \boxed{HYS} / 10000$$

X_m is measurement rms value of electrical parameter

Example: Trig threshold value 3.700A; hysteresis value 0.03; After relay triggered, when measured value **X_m** < 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 U_{RL}U, 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:

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

Slave response:

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

- (4) In **Auto trig** mode, after **Xm** > U_{RL}U 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

U_A-H	A phase voltage upper trig	q_b-H	B phase reactive power upper trig
U_b-H	B phase voltage upper trig	q_c-H	C phase reactive power upper trig
U_c-H	C phase voltage upper trig	q_S-H	Total reactive power upper trig
U₃-H	Any one of U _a / U _b / U _c 3 upper trig	S_A-H	A phase apparent power upper trig
i_A-H	A phase current upper trig	S_b-H	B phase apparent power upper trig
i_b-H	B phase current upper trig	S_c-H	C phase apparent power upper trig
i_c-H	C phase current upper trig	S_S-H	Total apparent power upper trig
i₃-H	Any one of I _a / I _b / I _c 3 upper trig	P_F-H	Total power factor upper trig
P_A-H	A phase active power upper trig	f_r-H	Frequency upper trig
P_b-H	B phase active power upper trig	d₁-H	DI1 closed trig
P_c-H	C phase active power upper trig	d₂-H	DI2 closed trig
P_S-H	Total active power upper trig	d₃-H	DI3 closed trig
q_A-H	A phase reactive power upper trig	d₄-H	DI4 closed trig

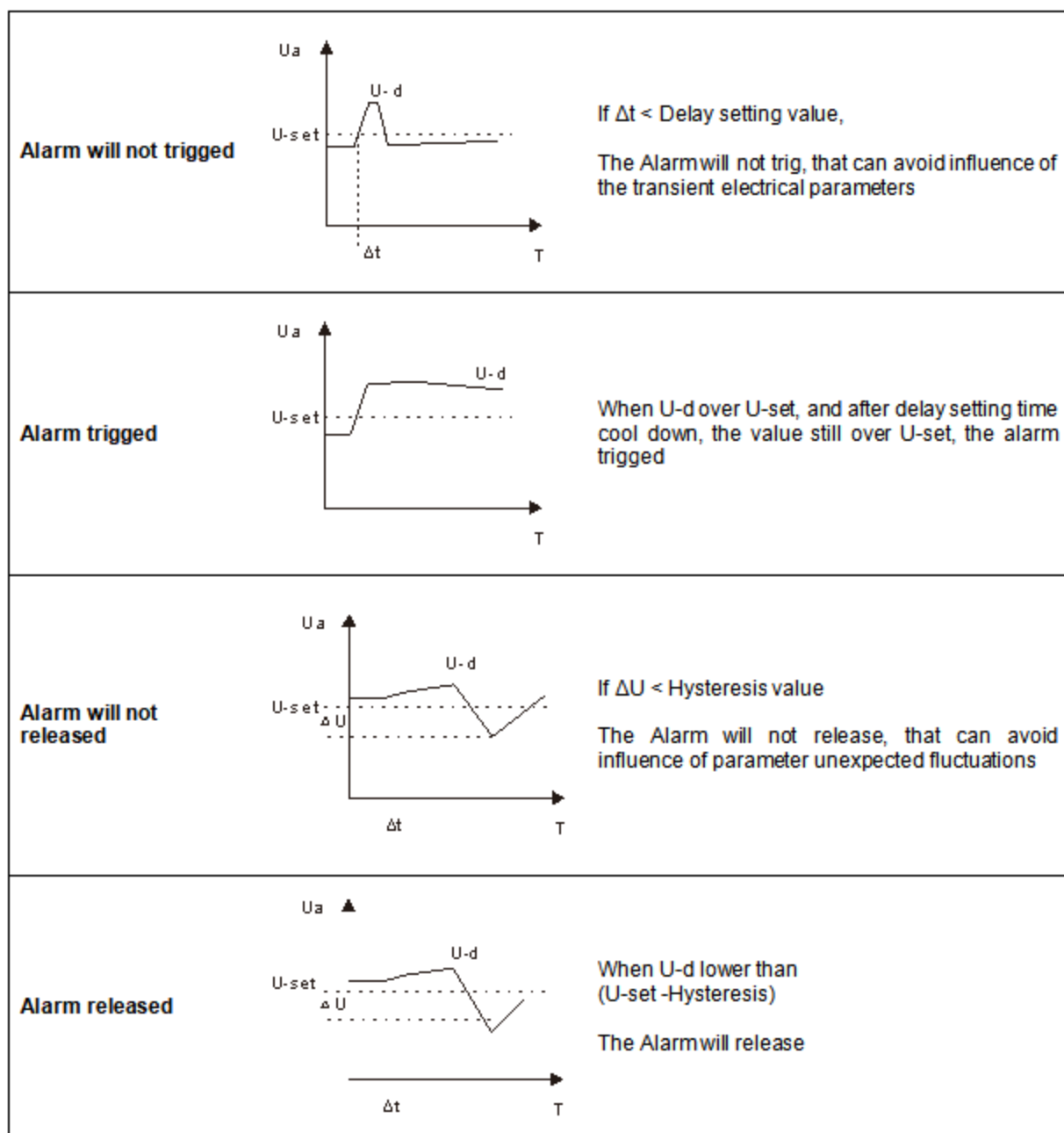
Note: If in screen show "XX -L" mean lower limit trig, for DI port mean open loop trig

* Delay & Hysteresis logic

Example in upper limit alarm of A phase voltage:

U-d mean detected Ua

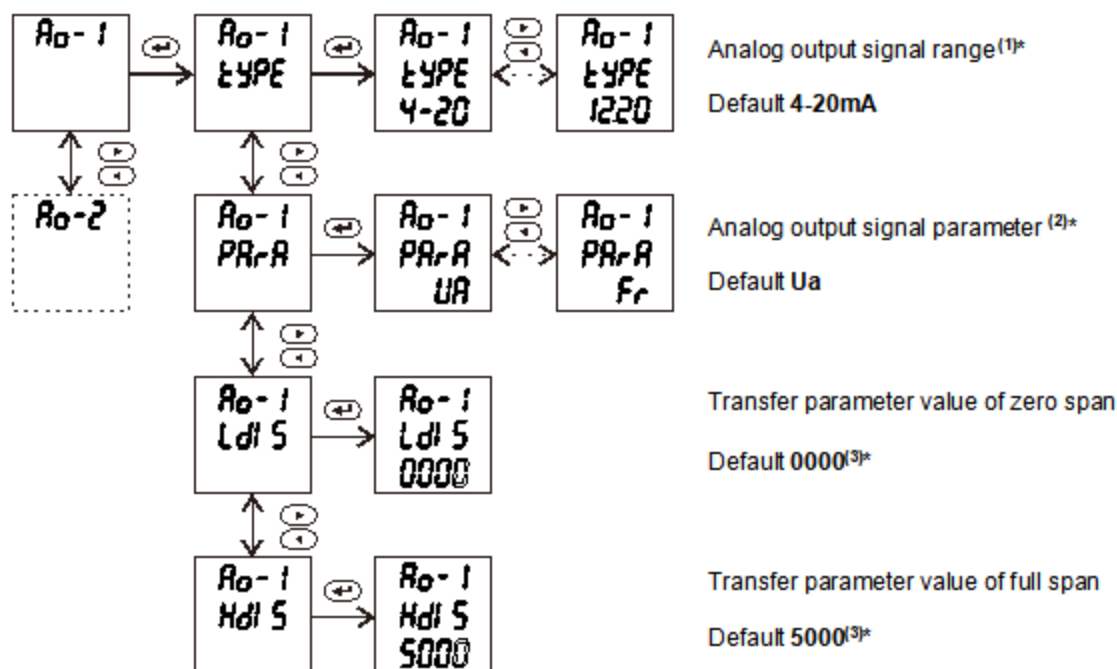
U-set mean Alarm value of A phase



6.5.- Analog Output Setup

AO port is an 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	$R_{max} = 420\Omega$
Isolation	1KV to other terminal (Between AO-AO port non-isolation)



Notes:

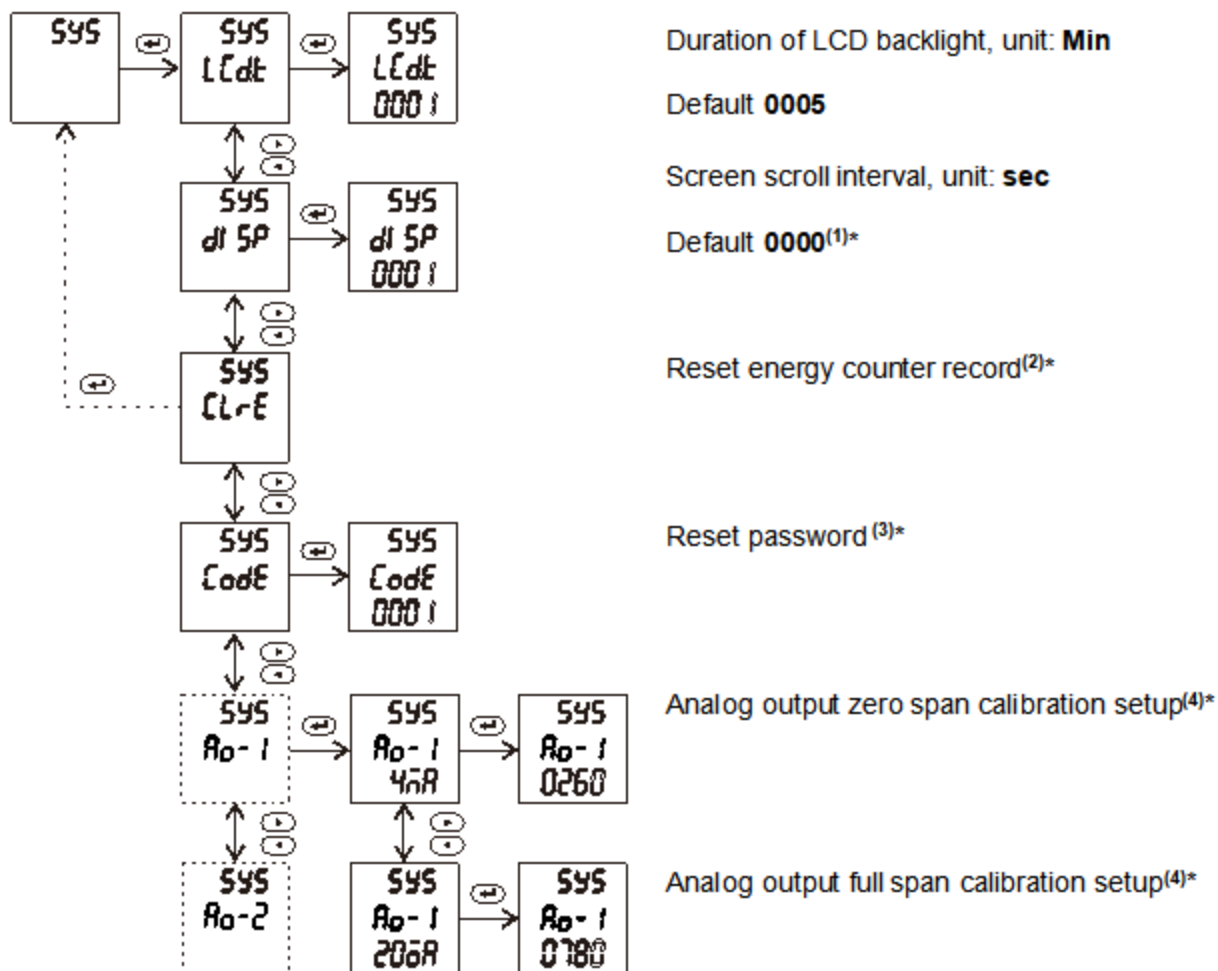
- (1) Signal range default are ampere output, rang 4-20mA, 12-20mA, optional voltage signal output, optional 0-5V, 10-5V, (please contact Blue Jay sales team before order).
- (2) The analog parameter can set Ua, Ub, Uc, Uab, Ubc, Uca, Ia, Ib, Ic, Pa, Pb, Pc, PS, Qa, Qb, Qc, Qs, Sa, Sb, Sa, SS, PF, Fr.
- (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



Notes:

- (1) Set 0000 mean can manually switch each monitor screen pages.
- (2) Press  device will roll back to **SYS** root menu, only in the exit screen press  to trigger clear operation!
- (3) If reset the password, please keep the password in safety, or only return to Blue Jay for reset new password!
- (4) Variable step value is 2/1000. Blue Jay already do calibration before shipping, please use high precision ammeter or voltmeter as reference standard.
- (5) 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.

6.7.- System Setting

Layer 1	Layer 2	Layer 3	Layer 4	Description
-SYS-	Code	Default 0001		Set password
	DISP	0		Select manual switching
		Display of non-zero values: 1,2....99.....		Switching time, unit is seconds. For example, displaying '1' means that the switching time between screens is 1 second.
	LCdt	Default 0005		LCD backlight time settings
	AO-1	4MA	(Default 0290)	Analog zero span calibration
		20MA	(Default 0850)	Analog full span calibration
	AO-2	4MA	(Default 0290)	Analog zero span calibration
		20MA	(Default 0850)	Analog full span calibration
	U.SIG	Default 0020		Voltage small signal shielding value
-IN-	I.SIG	Default 0010		Current small signal shielding value
	CLRE			Energy reset
	Lin.e	3P4L,3P3L		Wiring method
	U.SCL	100V,380V		Range of input voltage signal
	I.SCL	5A,1A		Range of input current signal
-BUS-	r.Pt	Default 0001	Range 1~9999	Set voltage signal ratio
	r.Ct	Default 0001	Range 1~9999	Set current signal transformation ratio
	ADDR	Default 0001	Range 1~247	Set meter communication address
-DO-	BAUD	1200,2400,4800,9600 (Default 9600)		Set communication speed (baud rate)
	DATA	n.8.1, o.8.1, e.8.1 (Default n.8.1)		Set communication data format
	TYPE	r.n, Alr, OFF (Default r.n)		DO mode:  Remote  Auto Trig  Turned Off
-DO-	DELY	Default 0010		The setting value of 0000 indicates level mode, and when it is not zero, it indicates pulse mode. The value inside is the pulse width.
	PARA	I3-H, PS-H...U3-H		Details see chapter 6.4
	VALU	Default 5500		Set the corresponding alarm value. The alarm value is set according to the secondary value and has nothing to do with the transformation ratio.
	HYS	Default 0050		Set the corresponding hysteresis
	TYPE	12.20, 4-20, 0-20 (Default 4-20)		Select the output method
-AO-	PARA	UA, UB, UC...FR (Default UA)		Select the corresponding parameters
	LdIS	Default 0000		Analog output zero span calibration
	HdIS	Default 5000		Analog output full span calibration

Notes:

Not all APM series multi-function meters have complete menu settings; please confirm your purchased Multi-function Meter has the corresponding extension module. Without the module, the corresponding part of the menu is not valid.

6.8.- Menu character description

PASS	(Password) User password
Erro	(Error) Input information error
-I n-	(Input) User Display data settings menu
bUS	(Bus) Communication settings menu
SYS	(System) System settings menu (for factory debugging, not open yet)
Code	(Code) Enter password
dAtA	(Data) Communication parameter setting
Addr	(Address) Local communication address setting
bAUD	(Baud) Communication baud rate
oB.1	(o.8.1) Indicates 8 data bits, 1 stop bit, odd parity
EB.1	(e.8.1) Indicates 8 data bits, 1 stop bit, even parity
nB.1	(n.8.1) Indicates 8 data bits, 1 stop bit, no parity bit
SURE	(Sure) Confirm changes or not
USCL	(U.scl) Select the rated input voltage
ISCL	(I.scl) Select the rated input current
r. Ct	(R.ct) Set the current ratio
r. Pt	(R.pt) Set the voltage ratio
LI nE	(line) Select the phase line
do-1	Channel 1 analog output setting

do-2	Channel 2 analog output setting
AO-1	Analog output settings
TYPE	Parameter type selects
PAR-R	Para Corresponding parameter selection
VALU	(Value) Set the corresponding alarm value
Ld1 S	Show low alarm setting
Hd1 S	Show high alarm setting
HYS	Hysteresis

7.- PULSE OUTPUT

APM-96Z provides 1-2 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 $VCC \leq 48V$, $I_z \leq 50mA$.

2). Pulse: 5000 imp / kWh, pulse up to 80ms.

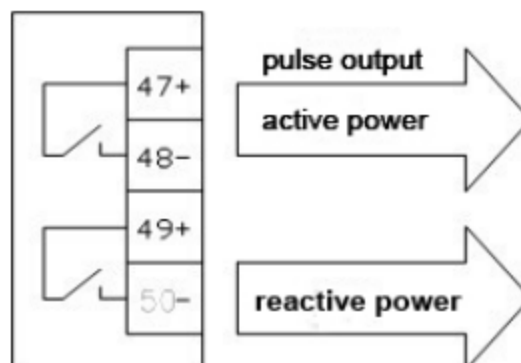
This means: When the device detects 1 kWh, the port will generate 5000 pulse

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

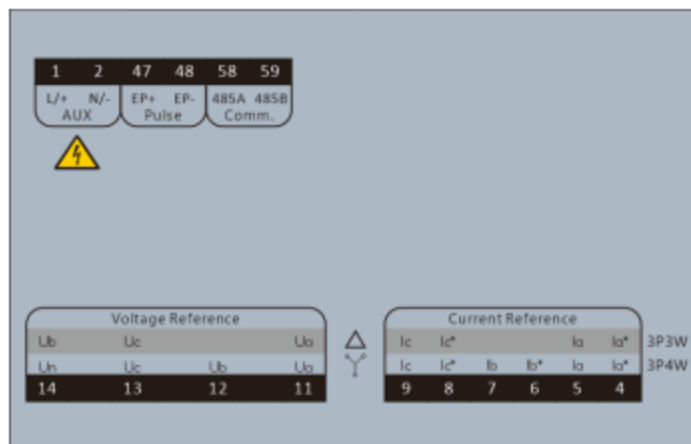
In the time "T", energy accumulated is: $N / 20000 \times 100 \times 80$



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 0.5mm², with a maximum distance of 1,200 m between the APM-96Z... and the master unit. This Bus may connect a maximum of 32pcs APM-96Z...



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 APM series meter RS485 PIN number is 58,59;
- 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	<i>Slave device address 1-247</i>
Function code	1 BYTE	<i>Indicates the function codes like read coils / inputs</i>
Data code	4 BYTE	<i>Starting address, high byte Starting address, low byte Number of registers, high byte Number of registers, low byte</i>
Error Check code	2 BYTE	<i>Cyclical Redundancy Check (CRC)</i>

MODBUS FUNCTIONS:

Code	Meaning	Description
FUNCTION 01	Read Coil Status	<i>Only valid when equipped DO port</i>
FUNCTION 02	Read Input Status	<i>Only valid when equipped DI port</i>
FUNCTION 03	Reading of n Words	<i>This function permits to read all the electrical parameters of the APM-96Z</i>
FUNCTION 05	Force Single coil	<i>Details see chart 6.4 When DO in remote control mode can work</i>
FUNCTION 06	Preset Single holding register	<i>There is an upper limit for writing, please be sure to check the upper limit of the host computer to avoid exhausting the life of the storage machine.</i>

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_{Σ}	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_{Σ}	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_{Σ}	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_{Σ}	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	$P\Sigma$	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	$Q\Sigma$	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	$S\Sigma$	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	$PF\Sigma$	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 1 and 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

8.3.4 - Write operation function definition: Preset Single holding register

Register	Data	Byte mode		Instruction
0x900	Line	int	1	Wiring method: 0: 3-phase 4-wire 1: 3-phase 3-wire 2CT 2: 3-phase 3-wire 3CT
0x901	U.SCL	int	1	Voltage range 0:100V 1:380V
0x902	I.SCL	int	1	Current range 0:1A 1:5A
0x903	PT	int	1	Voltage ratio
0x904	CT	int	1	Current ratio
0x905	RS485 address	int	1	1-247
0x906	Baud rate	int	1	0: 2400 1: 4800 2: 9600 3: 19200
0x907	Data format	int	1	0: n.8.1 1: o.8.1 2: e.8.1 3: n.8.2
0x908	Screen switching time	int	1	0: Manual button switch Other numbers are automatic switch cycles, in seconds
0x90A	Menu password	int	1	1-9999
0x90A	Communication address 2	int	1	1-247
0x90B	Communication baud rate 2	int	1	0: 2400 1: 4800 2: 9600 3: 19200
0x90C	Communication data format 2	int	1	0: n.8.1 1: o.8.1 2: e.8.1 3: n.8.2

Notes:

1. The data can be read out depends on your multi-function meter model, please refer to the corresponding product manual before build your software.
2. 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.

8.4.- Example

Host inquiry slave device

Addr.	Func.	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 response

Addr.	Func.	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	CRC16 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 APM-96Z 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 Cos Φ 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 PROCEDURE**).
- 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 PROCEDURE**).

Calculation formula of electrical parameter

Formula	Parameter
$U = \sqrt{\frac{1}{N} \sum_{n=0}^N u_n^2} \quad n = 0, 1, 2, \dots, N$	Voltage RMS value
$I = \sqrt{\frac{1}{N} \sum_{n=0}^N i_n^2} \quad n = 0, 1, 2, \dots, N$	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 90°)
$W = \int P * dt$	Electric energy

Note: In above formula, N for sampling points in one AC wave, In standard APM-96Z, the N=128

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

Blue Jay - After-sales service

E-mail: tech@cqbluejay.com