

# APM-96Z

## Multi-Function Power Meter

### User Manual



**Version: 1.10**

**Revision: 2024.12**

## 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**

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## 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 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 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 $\Phi$ | ••      | ••      | ••      | •     |
| 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
- : Only can read in RS485 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, 45-65Hz  
 DC 20-60V (optional)  
 Maximum power consumption 6W

### - Input

Voltage                    Rated 300V L-N, (optional 100V L-N)  
 Current                    Rated 5A (optional 1A)  
 Frequency                45-65Hz  
 Current overload        1.2 times rated continuous; 1 seconds for 10 times the rated  
 Voltage overload        1.2 times the rated continuous; 10 seconds for 2 times the rated

### - Load

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

### - 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         | 0.2      | V1      | V2      | V3      |      |
| Current         | 0.2      | A1      | A2      | A3      |      |
| Active power    | 0.5      | W1      | W2      | W3      | W    |
| Reactive power  | 0.5      | var1    | var2    | var3    | var  |
| Apparent power  | 0.5      | VA1     | VA2     | VA3     | VA   |
| Power factor    | 0.5      | PF1     | PF2     | PF3     | PF   |
| Active energy   | 1.0s     |         |         |         | Wh   |
| Reactive energy | 2.0s     |         |         |         | varh |
| Frequency       | 0.05     |         |         |         | Hz   |

### - Dielectric strength

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

**-. 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            |

**-. Work environment**

Temperature: -20°C ~ +60°C

Humidity: RH 20% ~ 95% (Non-condensation)

**-. Storage environment**

Temperature: -25°C ~ +70°C

Humidity: RH 20% ~ 95%

**-. Protection**

Panel: IP54

Case: IP20

**-. Dimensions**

L × W × H =96mm×96mm×75mm

**-. 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.

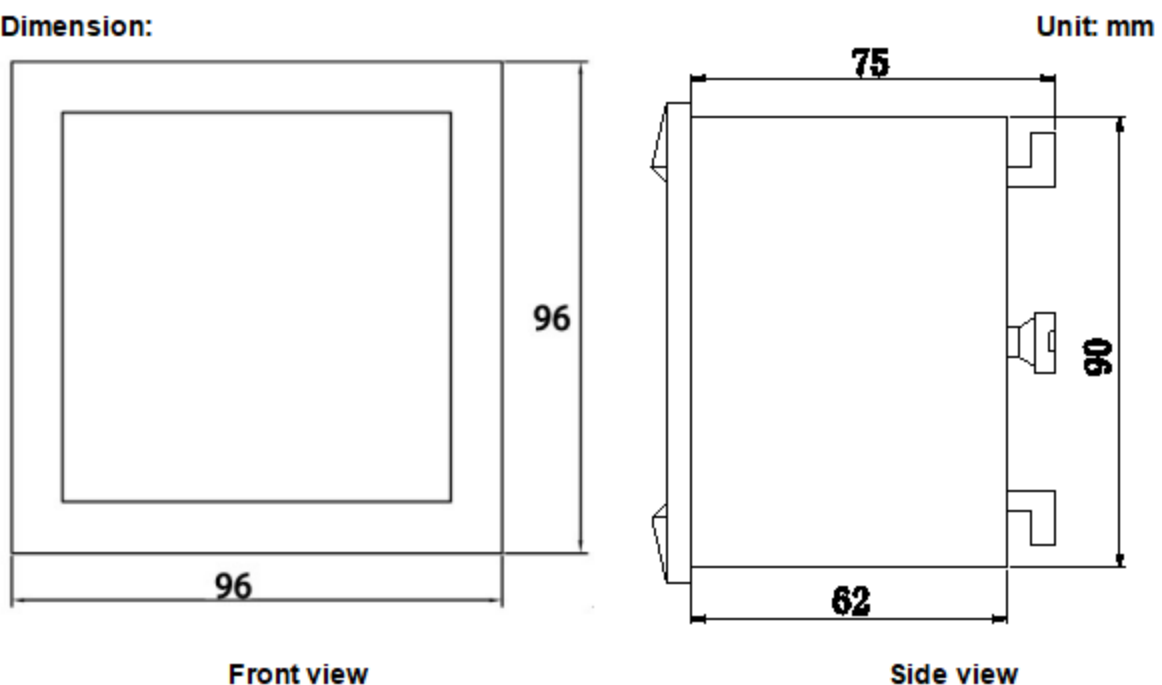
#### 3.1.- Installation

##### Mounting

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

|    |    |     |     |     |     |     |        |        |              |   |
|----|----|-----|-----|-----|-----|-----|--------|--------|--------------|---|
| 15 | 16 | 50  | 49  | 48  | 47  | 60  | 59     | 58     | 2            | 1 |
|    |    | Eq- | Eq+ | EP- | EP+ | GND | RS485B | RS485A | Power supply |   |

47. Total active energy (+)

48. Total active energy (-)

49. Total reactive energy (+)

50. Total reactive energy (-)

1. \*Supply voltage input: 0 V

2. \*Supply voltage input: 220 Vac.

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

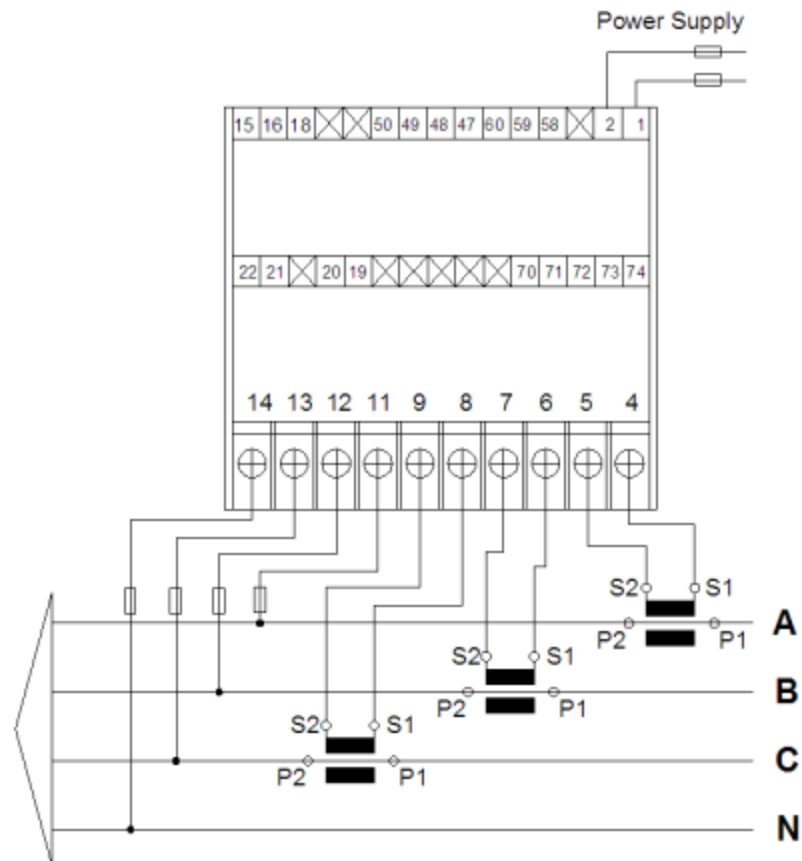
8. Current C-phase - S1 input

9. Current C-phase - S2 input

#### Note:

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

### 3.3.- Typical Wiring (3P4W)



**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 |                               |

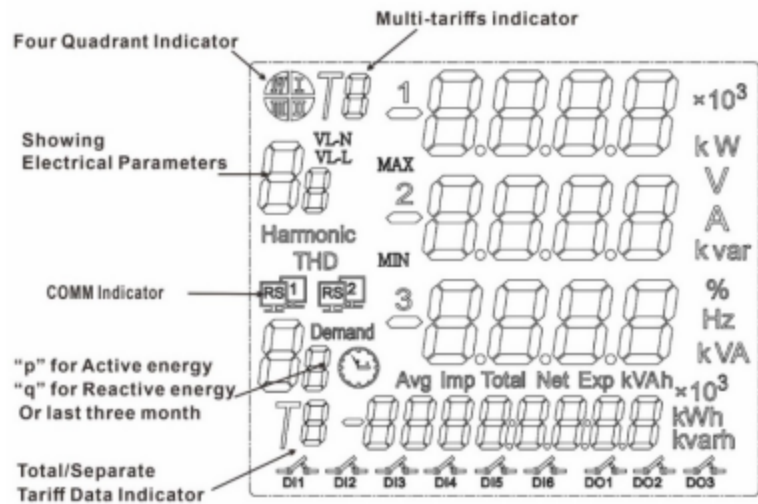
**Note:** In Setup menu, if change the setting value, press  for exit menu, device will call out confirm screen ask "SAVE"

Then press  *exit without saving;*

press  *save and exit.*

## 5.- SCREEN DISPLAY

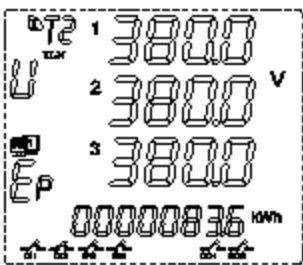



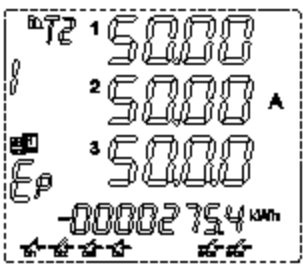
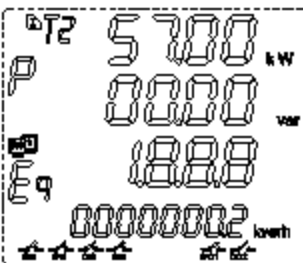

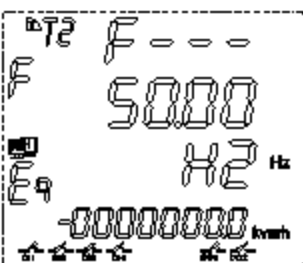
### 5.1.- Overall screen:



#### 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 -      |    | <p>Three phase voltage Ua, Ub, Uc;</p> <p><b>Note:</b> In high voltage measurement, X10<sup>3</sup> mean the showing value multiplied by 1000, in the screen diagram mean the voltage is 10X1,000=10,000volt</p> <p>Bottom character "Ep" show <b>total active energy</b> is 83.6KWh.</p> <p><b>Note:</b> Detail information for each symbol, please refer <a href="#">chapter 5</a>, Surround area shows the system information, in other screen are same:</p> <p>  show DI1, DI2, DI3, DI4 in the closed;<br/>  show DO1, DO2 opened;<br/>  flicker show Communication Rx/Tx normal;         </p> |
| - 2 -      |   | <p>Three-phase current Ia, Ib, Ic.</p> <p>Bottom Ep shows <b>total negative active energy</b>.</p>   |
| - 3 -      |  | <p>Total active power, Total reactive power, and Total factor.</p> <p>Press  can switch to show independent three phase active (P), Reactive(Q), Apparent power(S) value.</p> <p>Bottom Eq shows <b>total reactive energy</b>.</p>  |
| - 4 -      |  | <p>Frequency of grid.</p> <p>Bottom Eq shows <b>total negative reactive energy</b>.</p>  |

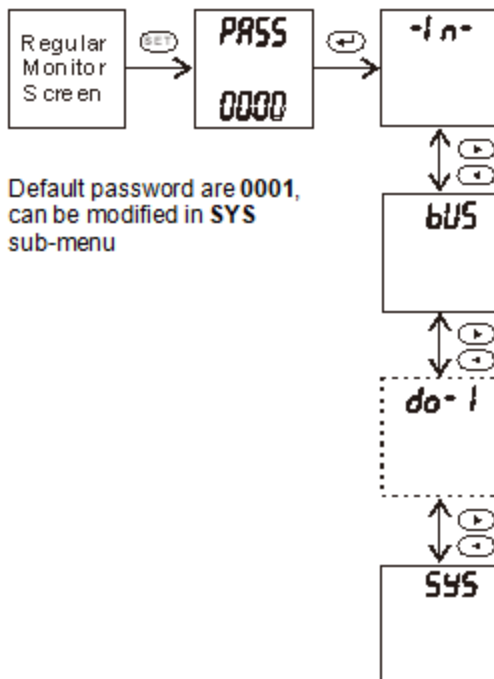
**Note:**

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](#)

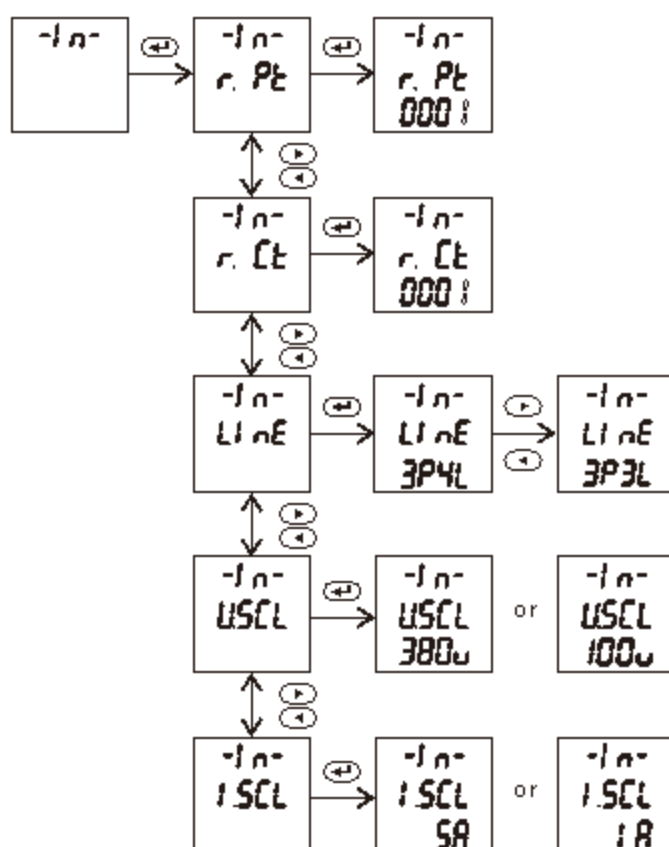
**Note:** If do not select port, no such pages

System parameter setup

Refer to [chapter 6.5](#)



## 6.2.- Input Signal Setup



Voltage transformer ratio <sup>(1)\*</sup>

Default **0001**

Current transformer ratio <sup>(1)\*</sup>

Default **0001** or based on order requirement

Power grid mode

Default **3P4L**<sup>(2)\*</sup>

Rated voltage scale

Default **380V**<sup>(3)\*</sup>

Rated current scale

**Note:** only related to pulse constant [chapter 7](#)

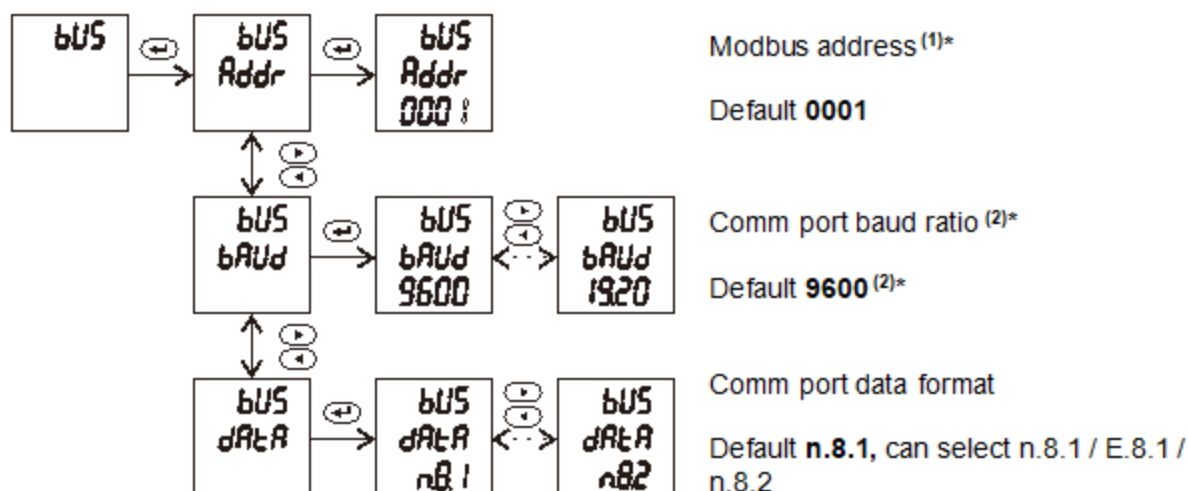
Default **5A**

### 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



**Note:**

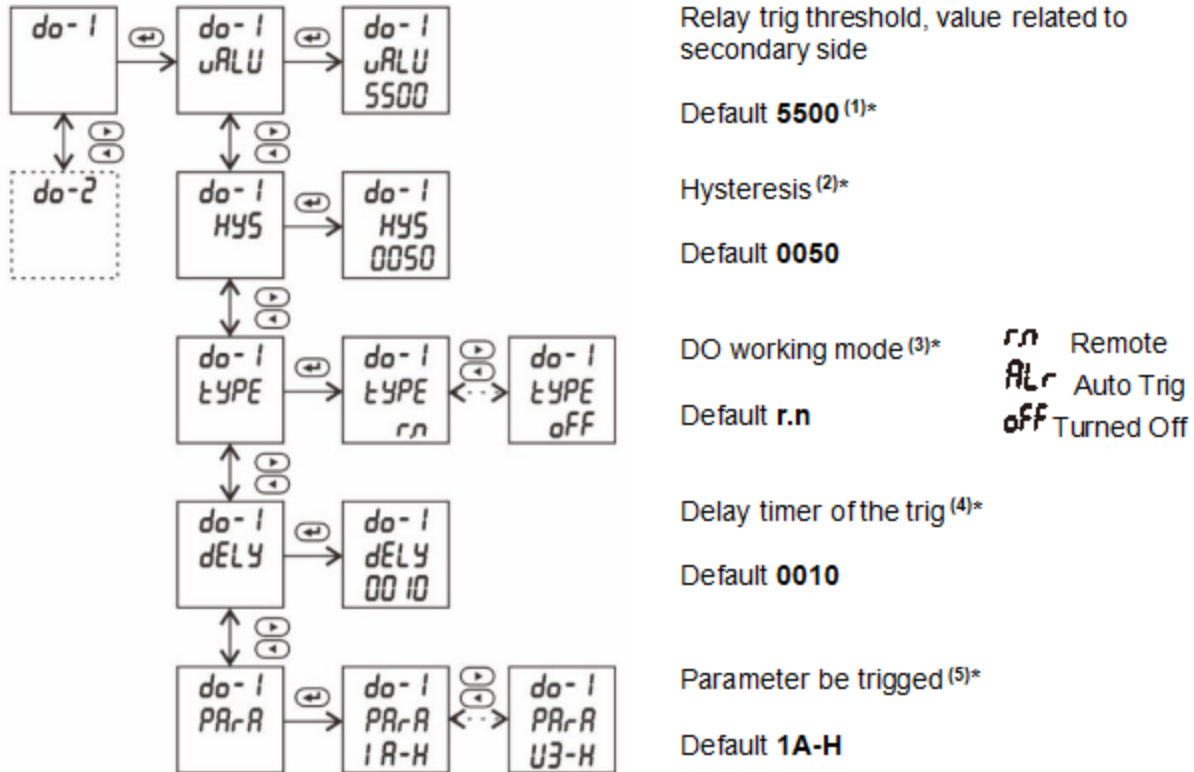
- (1) Modbus address setup range 1-247.
- (2) Baud ratio can select 1200 / 2400 / 4800/ 9600 / 19200, regular meter equipped communication port max baud ratio are 19200bps, if need higher speed, please contact Blue Jay sales team.

### 6.4.- 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)

$$X_r = \frac{\omega ALU \times HYS}{10000}$$

**X<sub>m</sub>** is measurement rms value of electrical parameter

**Example:** Trig threshold value 3.700A; hysteresis value 0.03; After relay triggered, when measured value  $X_m < 3.589A$  ( $3.700 - 3.700 \times 0.03$ ), 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  $\omega RL U$ , 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<br>(FF00:close; 0000: open) | CRC   |
|-------|------|---------------------|---|-------|
| 01    | 05   | 00 01               | FF 00                                   | DD FA |

**Slave response:**

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

- (4) In **Auto trig** mode, after  $Xm > \omega RL U$  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

|  |  |
|--|--|
| $Ua-H$ A phase voltage upper trig            | $Qb-H$ B phase reactive power upper trig |
| $Ub-H$ B phase voltage upper trig            | $Qc-H$ C phase reactive power upper trig |
| $Uc-H$ C phase voltage upper trig            | $QS-H$ 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       | $Fc-H$ Frequency upper trig              |
| $Pb-H$ B phase active power upper trig       | $d1-H$ DI1 closed trig                   |
| $Pc-H$ C phase active power upper trig       | $d2-H$ DI2 closed trig                   |
| $PS-H$ Total active power upper trig         | $d3-H$ DI3 closed trig                   |
| $QA-H$ A phase reactive power upper trig     | $d4-H$ DI4 closed trig                   |

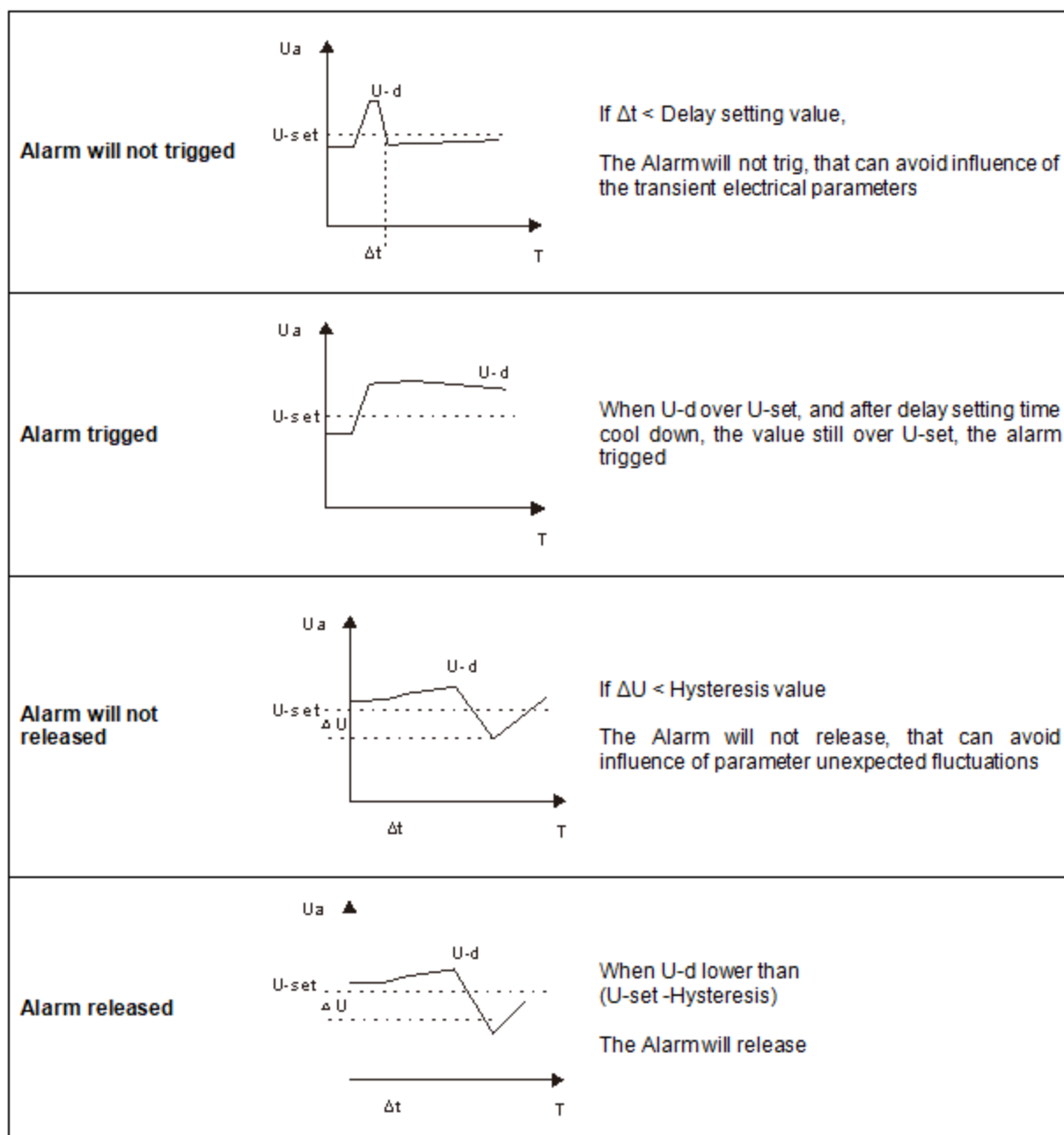
**Note:** If in screen show "XX -L" mean lower limit trig, for DI port mean open loop trig

**\* Delay & Hysteresis logic**

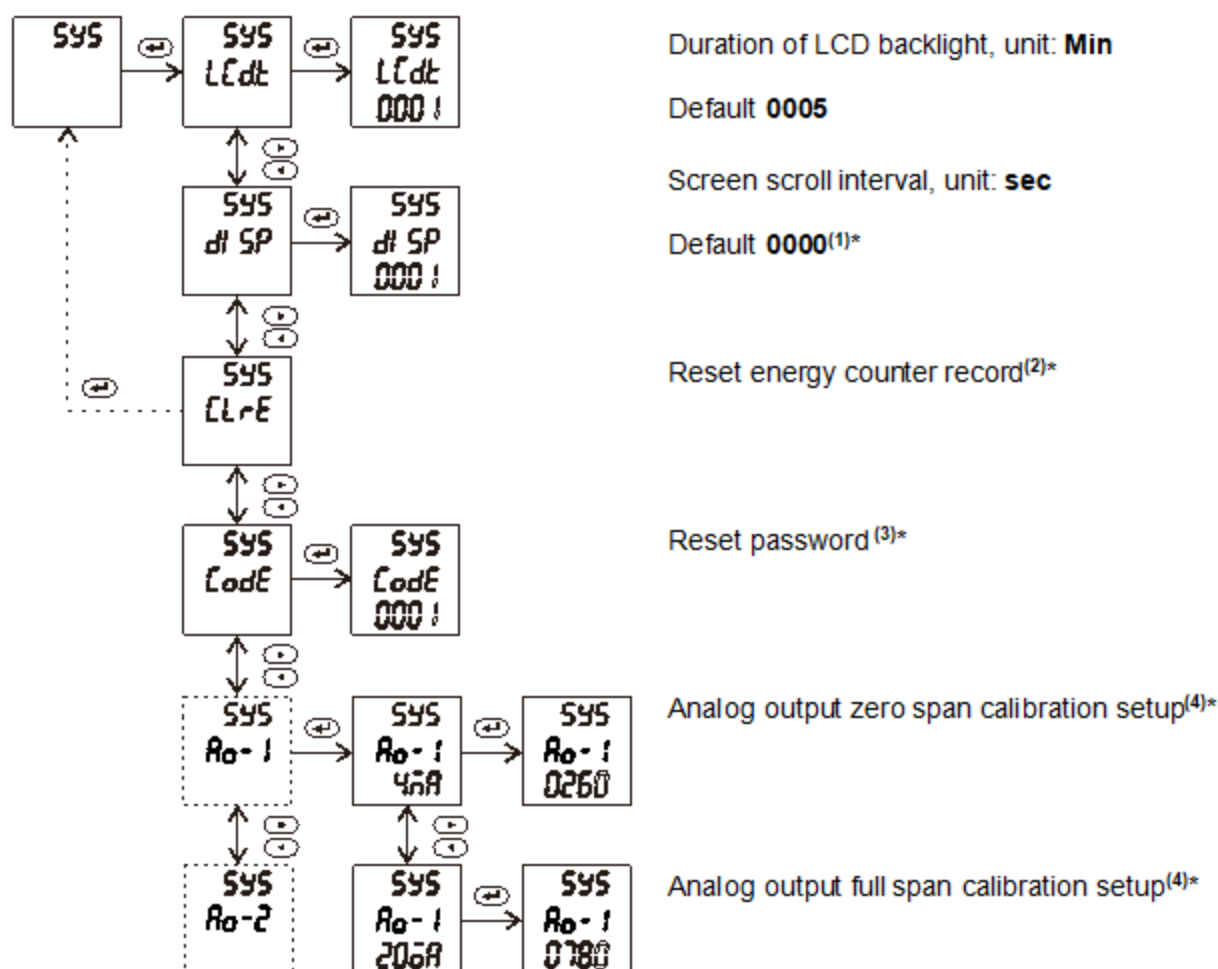
Example in upper limit alarm of A phase voltage:

U-d mean detected Ua



U-set mean Alarm value of A phase



## 6.5.- 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.

## 7.- PULSE OUTPUT

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

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

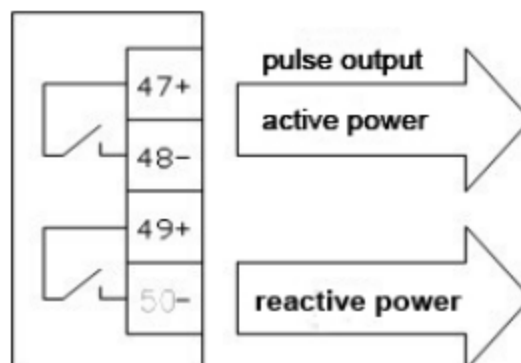
This means: When the device detects 1 kWh, the port will generate 5000 pulse

**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.

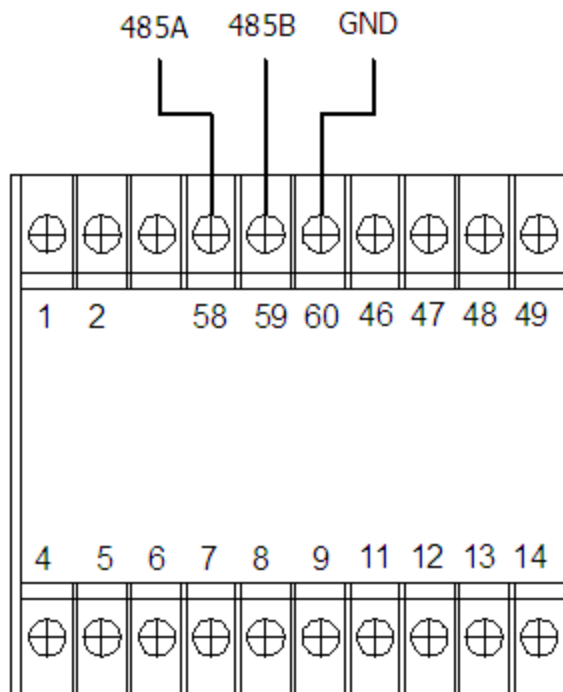
In the time "T", energy accumulated is:  $N / 20000 \times 100 \times 80$



## 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 0.5mm<sup>2</sup>, 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-96Z... 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:

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

### MODBUS FUNCTIONS:

| <b>Code</b>        | <b>Meaning</b>                 | <b>Description</b>  |
|--------------------|--------------------------------|---|
| <b>FUNCTION 01</b> | Read Coil Status               | <i>Only valid when equipped DO port</i>   |
| <b>FUNCTION 02</b> | Read Input Status              | <i>Only valid when equipped DI port</i>   |
| <b>FUNCTION 03</b> | Reading of n Words             | <i>This function permits to read all the electrical parameters of the APM-96Z</i>   |
| <b>FUNCTION 05</b> | Force Single coil              | <i>Details see <a href="#">chart 6.4</a><br/>When DO in remote control mode can work</i>  |
| <b>FUNCTION 06</b> | 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     | $P\Sigma$  | 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     | $Q\Sigma$  | 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     | $S\Sigma$  | 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     | $PF\Sigma$ | 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<br>0 for open, 1 for closed |
| 0x201    | DI   | int       | 1 | Bit 0~3 show channel 1 to channel 4 status<br>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:<br>0: 3-phase 4-wire<br>1: 3-phase 3-wire 2CT<br>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   |

#### 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 $\Phi$  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<br>(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*

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