SmartGen

MAKING CONTROL SMARTER

HMU15N-EMS

HYBRID ENERGY CONTROL SYSTEM

USER MANUAL

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Table 1 – Software Version

Date	Version	Note
2023-05-06	1.0	Original release.

Table 2 – Symbol Instruction

Symbol	Instruction
NOTE	Highlights an essential element of a procedure to ensure correctness.
CAUTION	Indicates a procedure or practice, which, if not strictly observed, could result in damage or destruction of equipment.
WARNING	Indicates a procedure or practice, which could result in injury to personnel or loss of life if not followed correctly.

CONTENTS

1 OVERVIEW

HMU15N-EMS Hybrid Energy Control System is used for hybrid energy system consists of solar energy, wind energy, energy storage battery, hydrogen fuel cell, mains supply and diesel genset. It can read and display the data and status of various energy, control the power distribution, customize the control policy and support multiple control modes. The communication protocol is customized and the touch screen display LCD is configurable by PC, the operation policy or control logic can be written by using the built-in PLC. It is suitable for hybrid energy systems with flexible configuration and easy operation.

2 PERFORMANCE AND CHARACTERISTICS

Its main characteristics are as follows:

- 15-inch capacitive touch LCD with 1024*768 resolution, optional Chinese and English operation interface;
- With 4-way RS485 communication port, 1-way CAN port, 1-way Ethernet port;
- The logic programming is available by the built-in PLC, operation mode and scheduling method can be changed;
- Customized communication protocols for PV inverter, energy storage converter and BMS;
- Customized communication protocols when connecting to power expansion module, genset controller and low voltage distribution controller;
- The previous data monitoring can be realized via Ethernet port;
- Real-time display parameters and alarm information;
- Real-time clock display, operation history and alarm records functions, which can be exported;
- With USB device port and host port;
- With multi-level brightness, it can be adjusted automatically for different environments;
- With distance sensor, the screen lights up automatically when someone is in front of the display screen;
- The controller is fixed with metal clips;
- Modular design, pluggable wiring terminals, built-in mounting, compact structure with easy installation.

3 SPECIFICATION

Table 3 – Performance Parameter

Item	Content
Working Voltage	DC8.0V~DC35.0V continuous power supply.
Overall Consumption	Up to 15W
RS485	4-way RS485 ports adopt MODBUS-RTU communication protocol, isolated, half-duplex, baud rate can be set
Ethernet	Self-adaption 10/100/1000Mbps
CAN	Isolated, the maximum communication length is 250m, using Belden 9841 cable or equivalent
Vibration	Frequency Range: 5Hz~8Hz: ±7.5mm Frequency Range: 8Hz~500Hz: a ±2g IEC 60068-2-6
Shock	50g, 11ms, pulse waveform, half-sine, complete shock test from three directions, and 18 times shock for each test IEC 60068-2-27
Bump Test	20g, 16ms, half-sine
Production Compliance	According to EN 61010-1 installation category (over voltage category) III, 300V, pollution class 2, altitude 3000m
Overall Dimensions	377mm x 316mm x 76mm
Panel Cutout	359.5mm x 298.2mm
Working Temperature	(-25~+70)˚C
Working Humidity	(20~95)%RH
Storage Temperature	(-30~+80)˚C
Protection Level	Front Panel: IP65
Weight	3.75kg

4 DISPLAY AND OPERATION

4.1 FRONT PANEL

Fig.1 – Front Panel Drawing

Table 4 – Indicator Description

Indicator	Description
Alarm	Using PLC programming to control alarm indicator flash or light off.
Power	Always illuminated after power on and operation for touch screen. Extinguished when touch screen is power off.

4.2 QUICKSTART

This section will introduce how to use the touch scrren from PC configuration.

4.2.1 SOFTWARE DOWNLOAD

Please download and install the configuration software of HMU15N-EMS touch screen by SmartGen official website:

http://smartgen.com.cn/product/451

Note: The IP addresses of PC network card and the slave computer must be on the same network segment, for example, 192.168.0.10, subnet mask: 255.255.255.0, gateway: 192.168.0.1.

4.2.2 CONNECTION SETTING

Using network cable to connect touch screen (slave computer) with PC (host computer),click “Setting” of PC, set the IP as “192.168.0.111”, and the port number as “8080”.

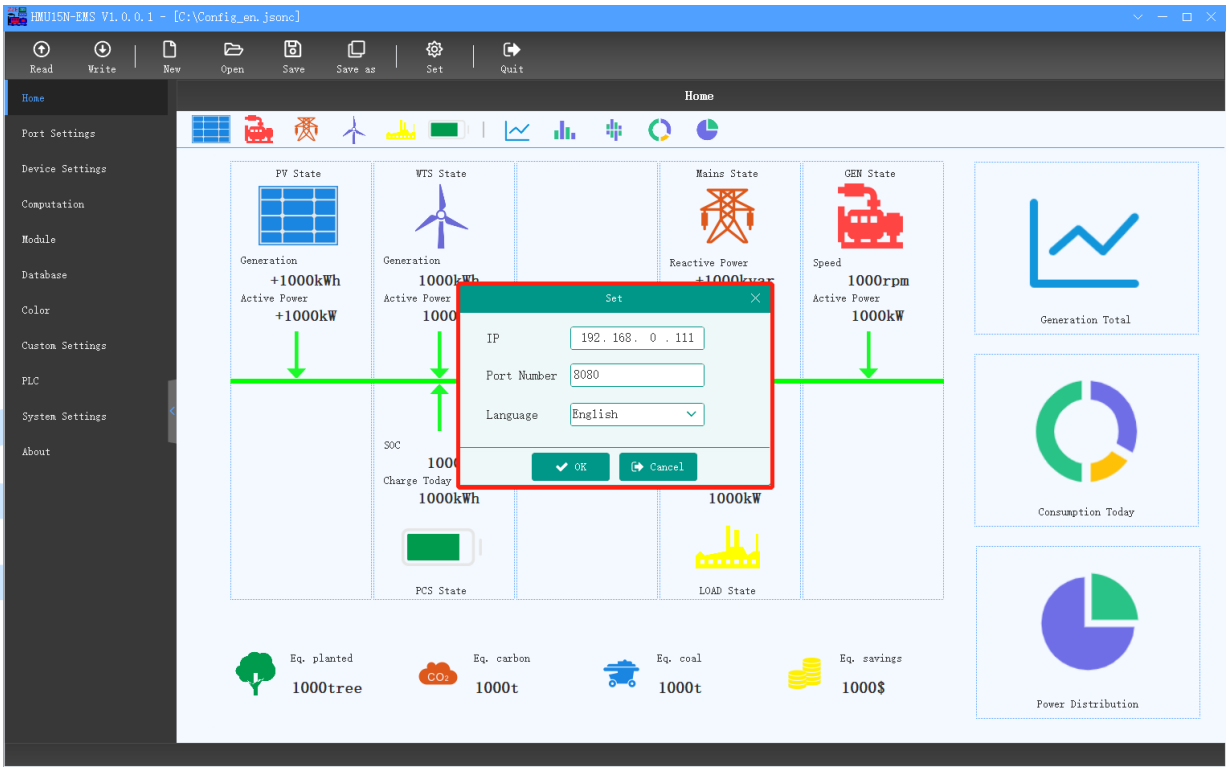


Fig.2 – Connection Setting

Click “Read” of PC, it will display “ Read Configuration Completely”, which means that the communication between PC and slave computer is sucessful.

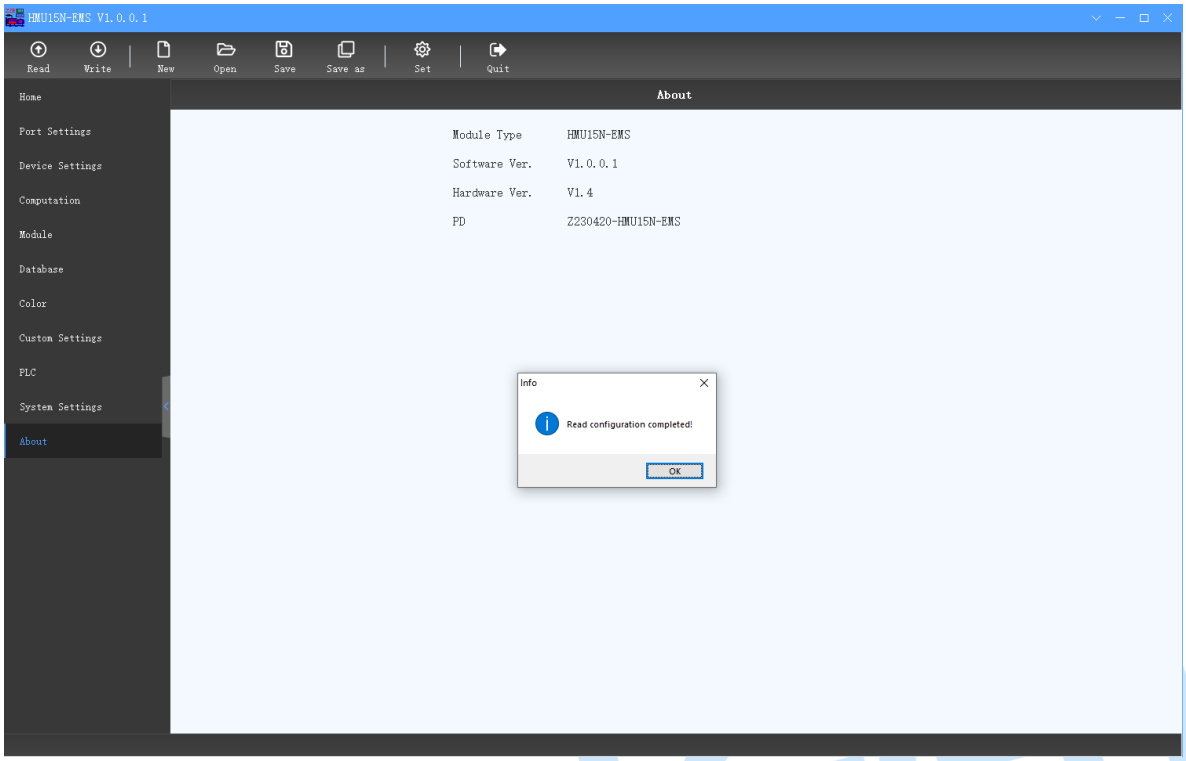


Fig.3 – Successful Communication

4.2.3 PORT SETTING

You can modify the port parameters of slave computer in this section. Modify the port parameters via PC and write the configuration into slave computer, it will take effect as the following figure:

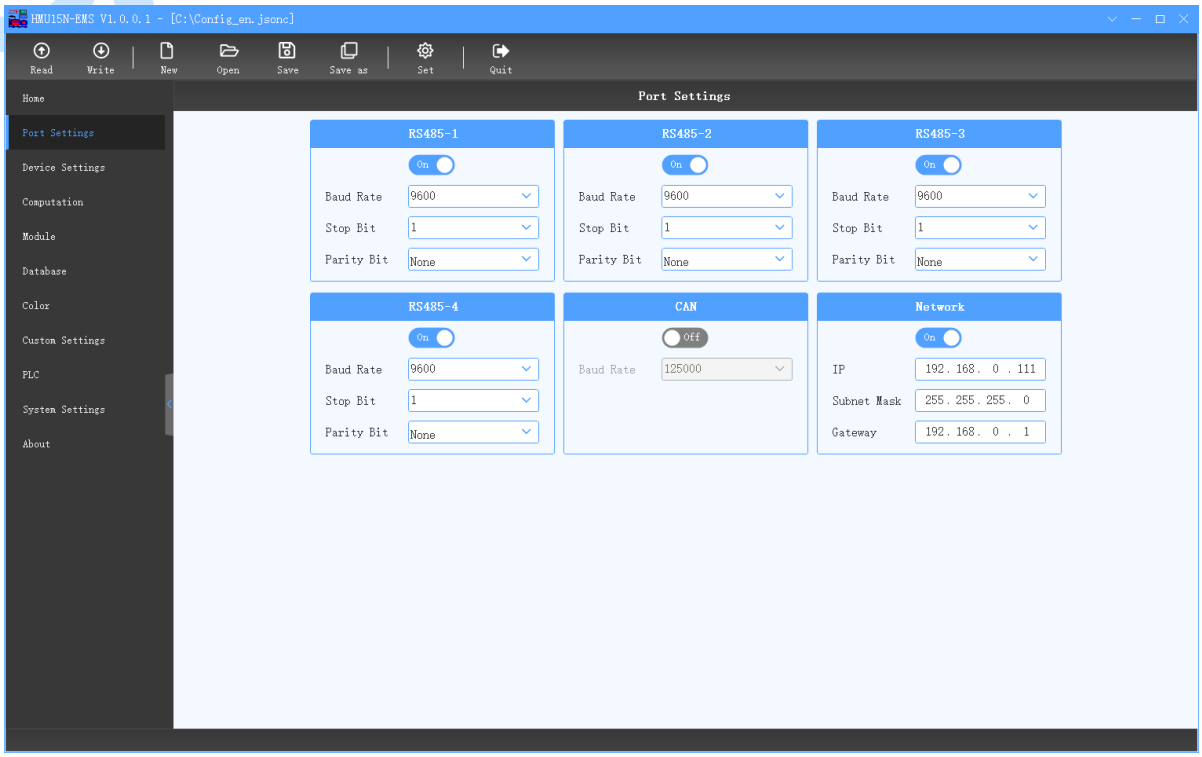


Table 4 – Port Setting (PC)

Note: The modifications will take effect immediately on setting interface of slave computer, as the following figure:

Table 5 – Port Setting (Touch Screen)

4.2.3.1 RS485 PORT SETTING (4 RS485 ports in total)

Enable Status: the port communication is able to be opened and closed.

Baud Rate: 1200bps,2400bps,4800bps,9600bps,19200bps,38400bps,57600bps,115200bps are optional, the default is 9600bps.

Data Bit: 8-bit.

Parity Bit: None, odd parity and even parity, default is None.

Stop Bit: 1-bit, 2-bit are optional, default is 1-bit.

Each port can set its baud rate, stop bit and parity bit separately.

4.2.3.2 ETHERNET PORT SETTING

Eable Status: the port communication is able to be opened and closed.

The default IP address is 92.168.0.111, subnet mask is 255.255.255.0, gateway is 192.168.0.1. They can be modified through PC and take effect after restart.

4.2.3.3 CAN PORT SETTING

Enable Status: the port communication is able to be opened and closed.

Baud Rate: 5kbps,10kbps,20 kbps,50 kbps,100 kbps,125kbps,250kbps,500 kbps,800 kbps,1000 kbps are optional, the default is 125kbps.

4.2.4 EXTERNAL DEVICE MANAGEMENT

Each device here corresponds to a real device, which may be photovoltaic inverter, energy storage converter, genset controller, etc. By setting its port, communication address and message, the system can obtain the real-time data automatically, such as working status, alarm information of the device. At the same time, according to the self-defined PLC logic, the slave computer is able to control the working status of each device, for instance, the power distribution and the start/stop of energy device, closing/opening of circuit breaker, so as to realize the management of whole system.

This section will describe how to configure each external device by wizard mode.

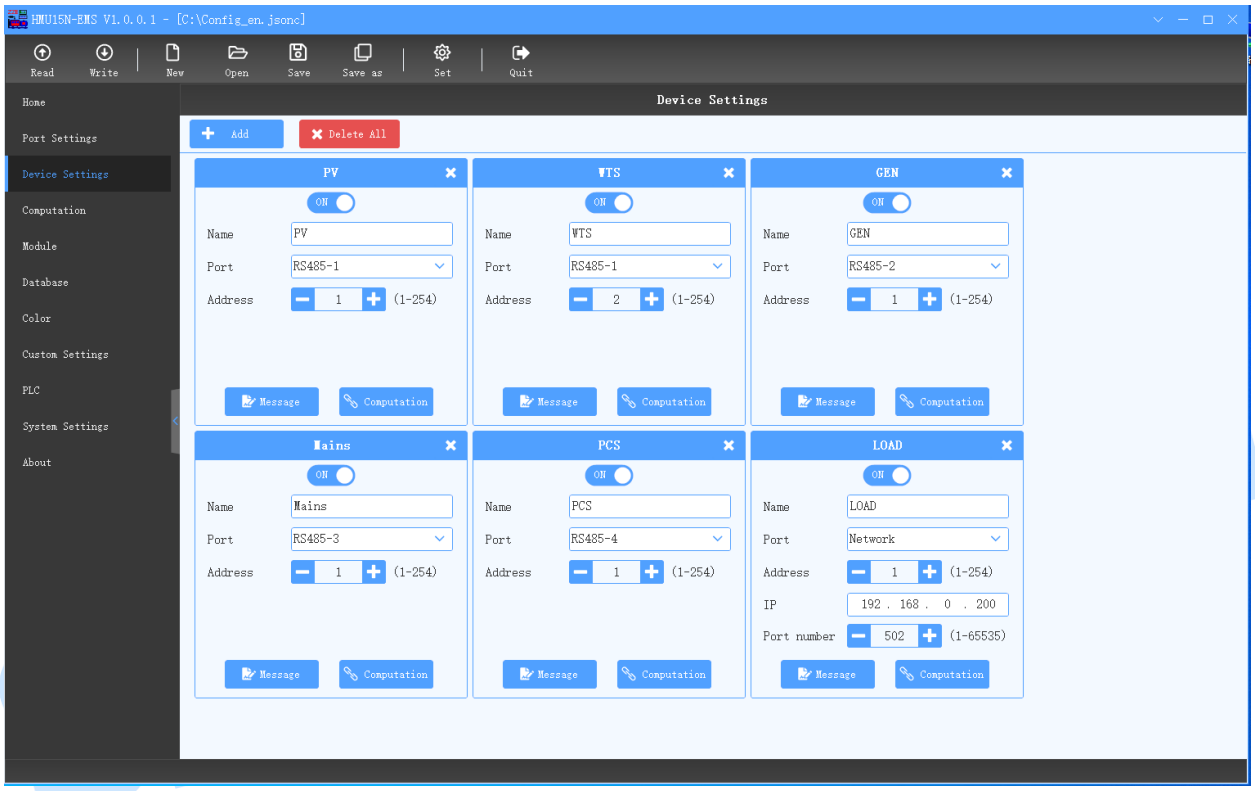


Table 6 – Device Management

4.2.4.1 ADD DEVICE

Click 

to add a new device, which may be photovoltaic inverter, energy storage converter, genset controller, etc. Please name each device properly.

Enable Status: the communication of device is able to be opened and closed.

Device Name: You may customize the display name to distinguish different devices.

Communication Port: Select the communication ports, and the options are: RS485-1,RS485-2,RS485-3,RS485-4, Ethernet port and CAN port.

Module Address: 1-254 is available.

IP: the IP address of the Ethernet port needs to be set and should be on the same network segment as the slave computer.

Port No.: the Ethernet device needs to be set its port number, the default value is 502.

Note: the baud rate, data bit, parity bit, stop bit of all devices with same RS485 port should be the same, while the module address cannot be the same.

4.2.4.2 MESSAGE SETTING

Click Message to display all the Modbus message of the device. When the touch screen is running, it will automaticlly loop to obtain the real-time data of external device based on the message setting.

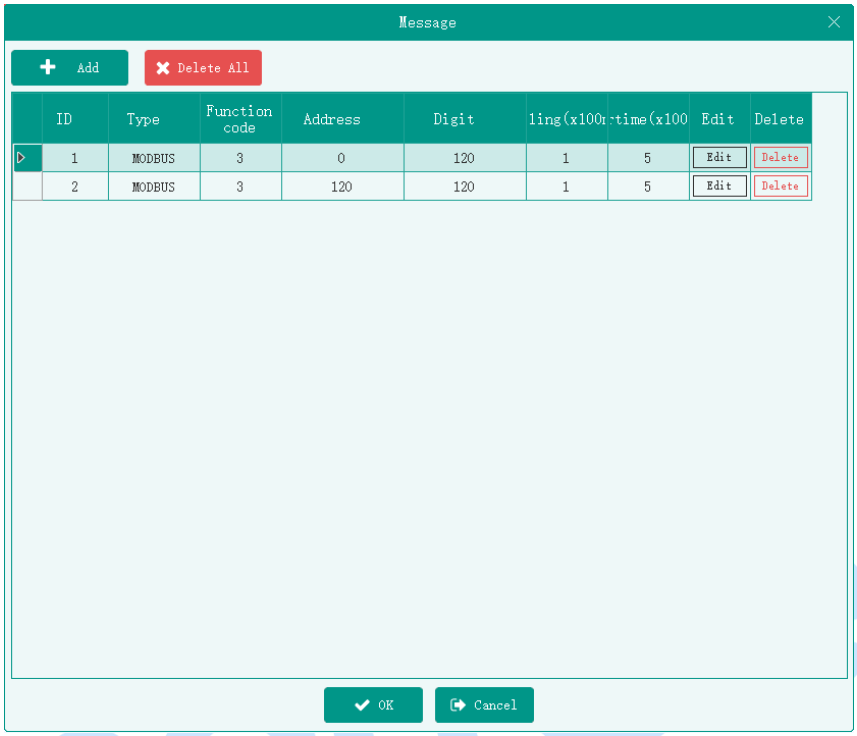


Fig.7– Message Management

Click Add to add Modbus message for external device, include the function code, communication type (only for Modbus-RTU protocol), register start address, register number and timeout interval.

When adding messages, minimum Modbus message (with minimum number of row) is recommended, a row of message had better cover all the data to be obtained. In this way, the loop interval is reduced and the real-time data is enhanced.

Note: If the device is on RS485 port, the timeout interval is 500ms, if the device is on Ethernet port, the timeout interval is 200ms.

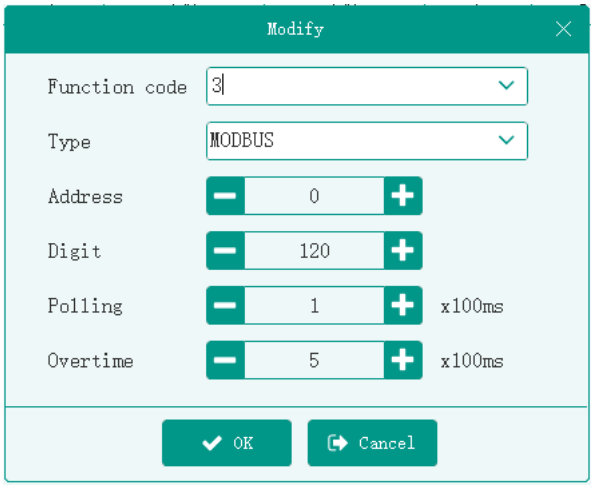


Fig.8– Message Setting

The following is the loop sequence diagram for all devices on the same port:

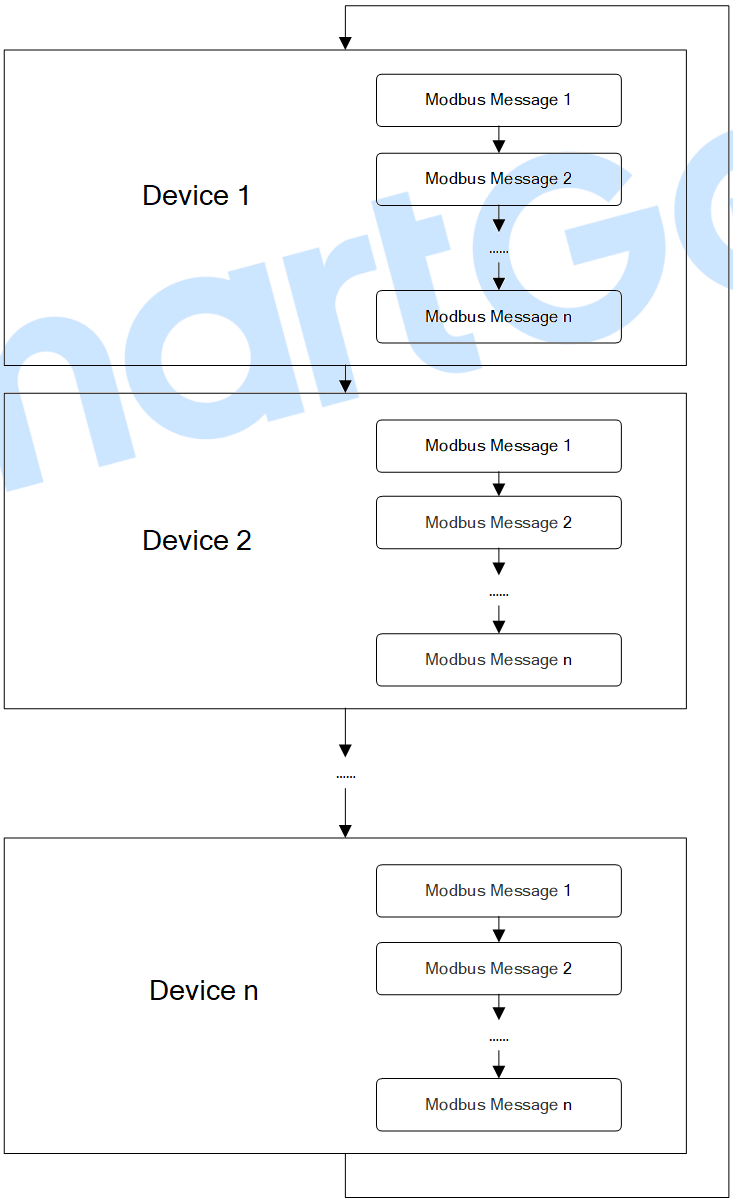


Fig.9– Loop Sequence Diagram

Note: The loop duration depends on the total number of messages access to the device.

4.2.4.3 BOUNDING COMPUTATION

Click Computation to display all the computation bound to the device. The computation are divided into three types: floating-point, string (value), string (bit). The floating-point type is used to display parameters of device (e.g. voltage, power, etc.), the string (value) type is used to display the running status of device (e.g. start countdown, etc.), the string (bit) type is used to display the alarm information and control information (e.g. low battery voltage, start/stop, etc.). Please see more details about the computation in next section.

Computation	Type	Value	String	Method	Func. code	Address	Start	Digit	Rate	Edit	Unbind
[1]-PV State	String(...	400	Display	NONE					1	Edit	Unbind
[2]-PV Alarms	String(...	0	Display	BOOLEANS_BITS_AB	03	0	0	0	1	Edit	Unbind
[3]-PV Warnings	String(...	0	Display	BOOLEANS_BITS_AB	03	0	0	0	1	Edit	Unbind
[4]-PV Running	Float	0		UINT_BITS_AB	03	0	0	0	1	Edit	Unbind
[5]-PV Common Alarm	Float	0		UINT_BITS_AB	03	0	0	0	1	Edit	Unbind
[6]-PV Common Warning	Float	0		UINT_BITS_AB	03	0	0	0	1	Edit	Unbind
[8]-PV Direction	Float	0		UINT_BITS_AB	03	0	0	0	1	Edit	Unbind
[9]-PV Stopped	Float	0		UINT_BITS_AB	03	0	0	0	1	Edit	Unbind
[10]-PV Generation Today	Float	0		UINT32_ABCD	03	0			1	Edit	Unbind
[11]-PV Total Power Generation	Float	0		UINT32_ABCD	03	0			1	Edit	Unbind
[12]-PV Active Power	Float	0		INT16_AB	03	0			1	Edit	Unbind
[13]-PV Reactive Power	Float	0		INT16_AB	03	0			1	Edit	Unbind
[14]-PV Power Factor	Float	0		INT16_AB	03	0			1	Edit	Unbind
[15]-PV DC1 Voltage	Float	0		INT16_AB	03	0			1	Edit	Unbind
[16]-PV DC1 Current	Float	0		INT16_AB	03	0			1	Edit	Unbind
[17]-PV DC1 Power	Float	0		INT16_AB	03	0			1	Edit	Unbind
[18]-PV DC2 Voltage	Float	0		INT16_AB	03	0			1	Edit	Unbind
[19]-PV DC2 Current	Float	0		INT16_AB	03	0			1	Edit	Unbind
[20]-PV DC2 Power	Float	0		INT16_AB	03	0			1	Edit	Unbind
[21]-PV AC-L1 Voltage	Float	0		INT16_AB	03	0			1	Edit	Unbind

Fig.10 – Device Computation

Click Add to add a computation to be bound with the device, after the computation is selected, it will be modified rapidly.

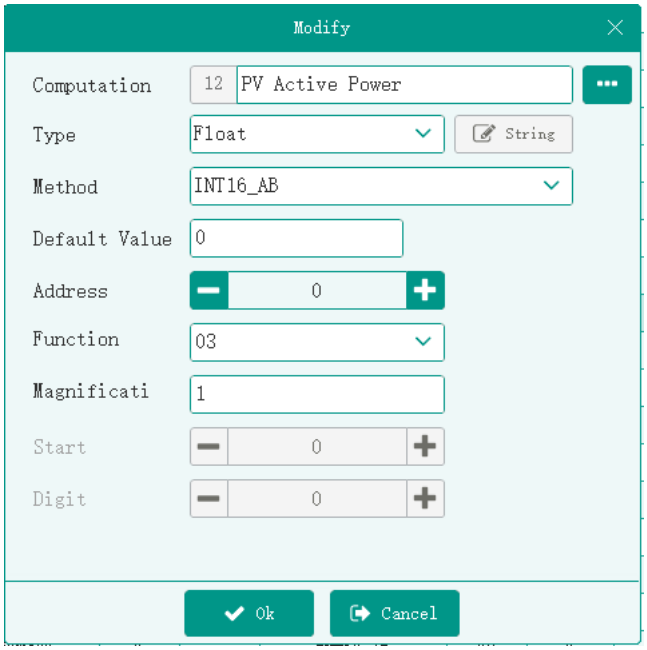


Fig.11 – Bound Computation

Click ▪▪▪ to select the computation needs to be bound with, only the computation that not bound to any device can be selected.

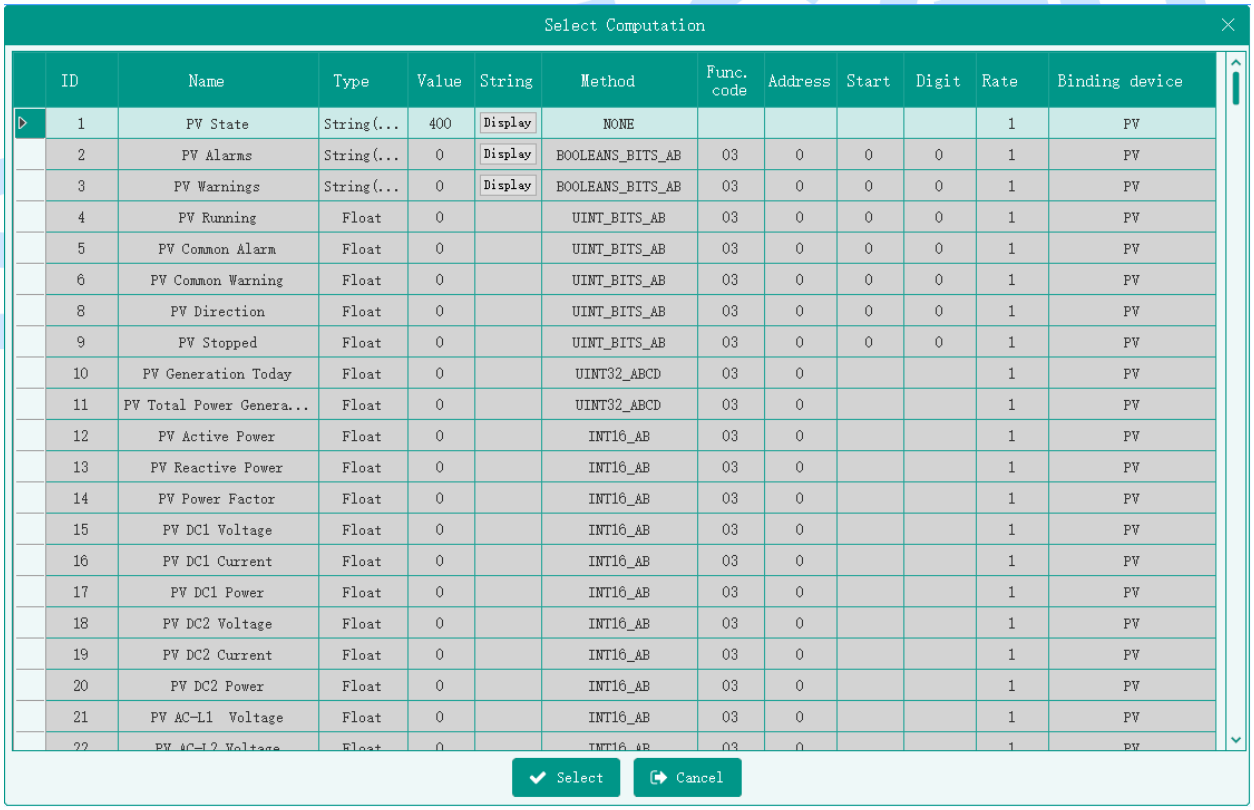


Fig.12 – Computation Selection

After binding, the value of the computation can be obtained through the real-time data calculation of the device according to the set calculation method, or through the mutual calculation among the computation, settings and internal variables according to the internal PLC logic.

The relationship among external device, real-time data and computaion is shown as follows:

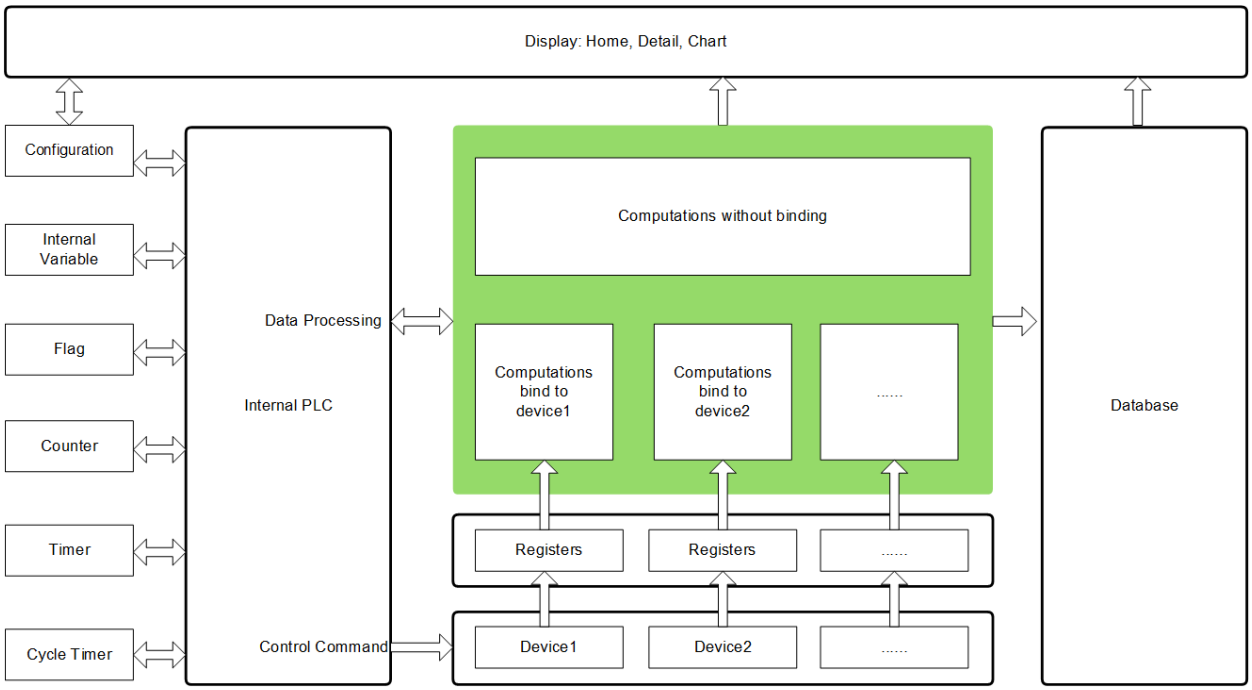


Fig.13 – Software Frame

4.2.5 COMPUTATION MANAGEMENT

As a bridge between external device and touch screen, computation is the data mapping of external physical device, the data source of the touch screen, and the data center of the whole energy management system.

According to the binding relationship between computation and the device, the related configuration of computation, the computation can be calculated and assigned by the real-time data of the device or by the internal PLC logic calculation. The computation may not involved in any calculations.

Computation is devided into floating-point type, string (value), string (bit). Each type has its own using method. The computation value can be used for touch screen display, or participate in the PLC logic calculation, or provide data source for database.

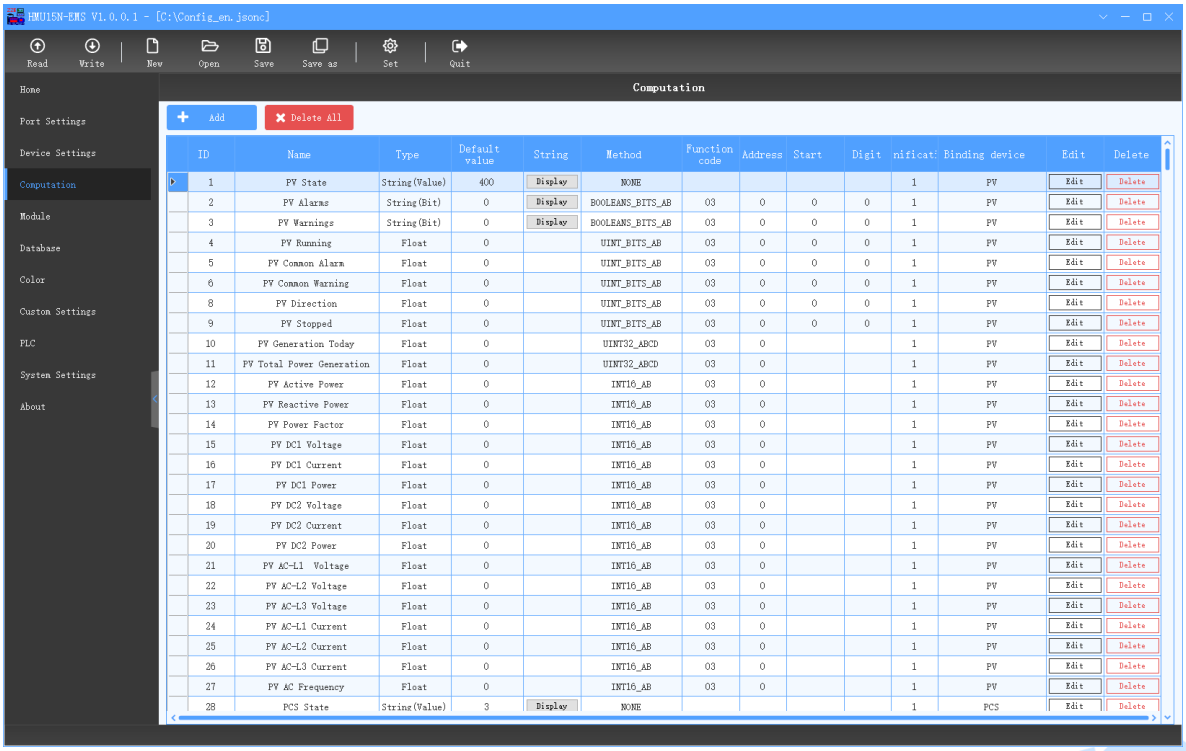


Fig.14 – Computation Management

4.2.5.1 ADD COMPUTATION

Click  to add computation, the system will assign a unique serial number automatically. Click ”Edit” to modify the computation name (Both Chinese and English), type, default value, calculation method, address (decimalism), etc. Click “Delete” to delete the computation, but the serial number of the computation can be used again.

The name of the computation must be unique. In addition, the type and calculation method of the computation should be correctly configured. Otherwise, the correct value cannot be calculated.

For more details of the configuration about the type and calculation method, see the following section.

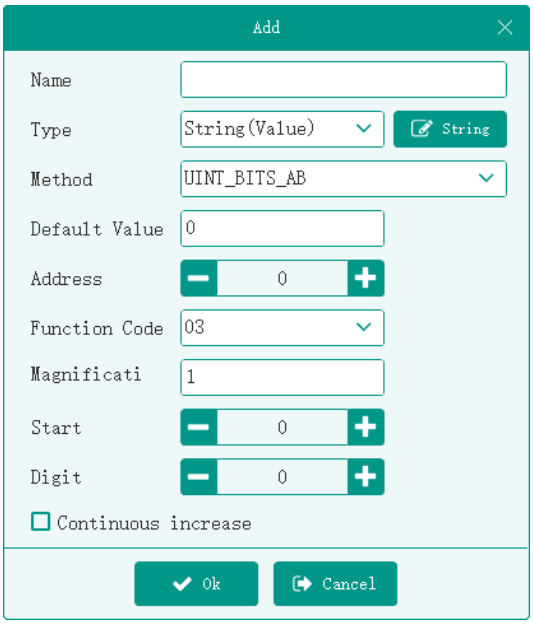


Fig.15 – Add Computation

4.2.5.2 COMPUTATION TYPES

4. 2. 5. 2. 1 FLOAT-POINT TYPE

Its value is a floating-point number, which can be directly displayed on touch screen for displaying various numerical parameters of the device.

If the absolute value of the computation is greater than or equal to 10000, the decimal digit is not displayed; if it is less than 10000, no decimal digit is displayed when the computation multiplier is 1, while 1 decimal digit is displayed when the computation multiplier is 10, 2 decimal digits are displayed when the computation multiplier is 100. And so on, the different number of decimal digits are displayed according to the computation multiplier.

4. 2. 5. 2. 2 STRING （VALUE）TYPE

Its value is an integer, which is used to display the running status of the device. Suppose the string list of computation is configured as the following figure below, and its value is 85, the touch screen displays “ Power Limit Disabled”.

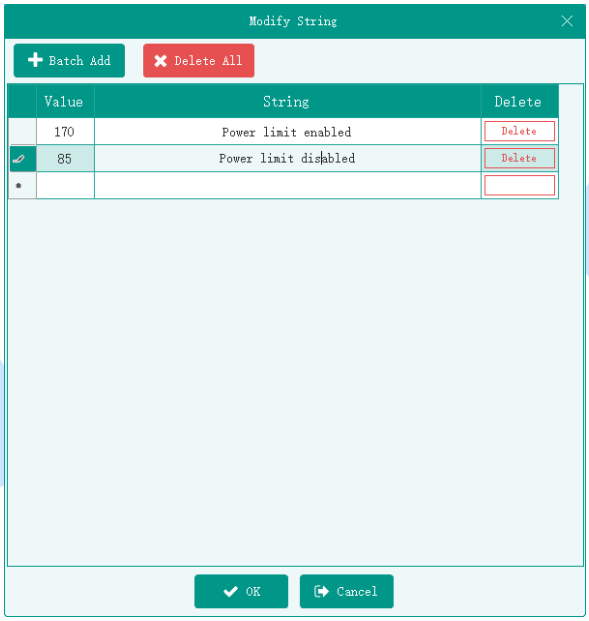


Fig.16 – String (Value) Type

4. 2. 5. 2. 3 STRING (BIT) TYPE

Its value is Boolean array used to display the alarm information of the device. Suppose that the string list of computation is configured as the following figure, and its value is Boolean array [FALSE, TRUE, TRUE, TRUE], the touch screen displays “Loss of Phase of Mains, Low Water Level of Oil Engine, Low OP of Oil Engine”.

In the popup window of the home page, all alarms could be displayed and one piece of alarm information will displayed for each line.

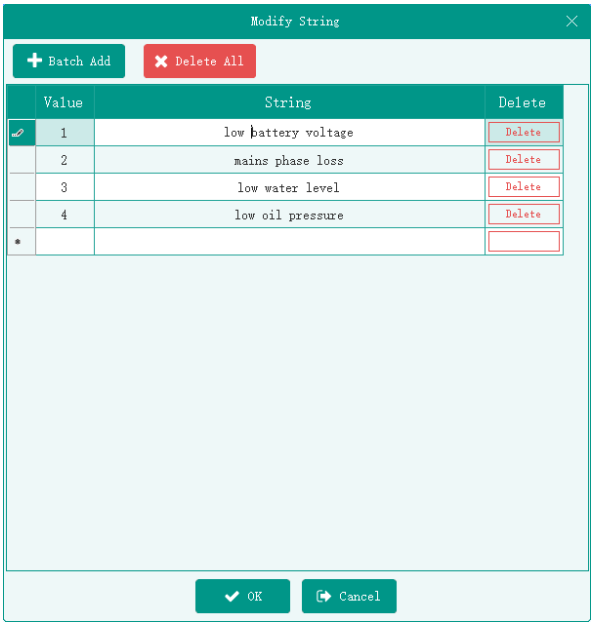


Fig.17 – String (Bit) Type

4.2.5.3 ASSIGNMENT OF COMPUTATION

According to the different binding relationships of computation, its calculation and assignment operation of the value are different.

4. 2. 5. 3. 1 ASSIGNMENT OF UNBOUND DEVICE

Unbound floating-point, string (bit) computations are assigned by coverting computations, settings, internal variables and constants(quantity) according to PLC logic.

The computation of floating-point type only needs to set name, type and default value, other configurations are invalid.

The computation of string (value) type only needs to set name, type, string list, default value, other configurations are invalid.

Conversion operation supported by PLC include: ＋,－,＊, ／,％, absolute value, max., min., mean value, assignment, as the following figure:

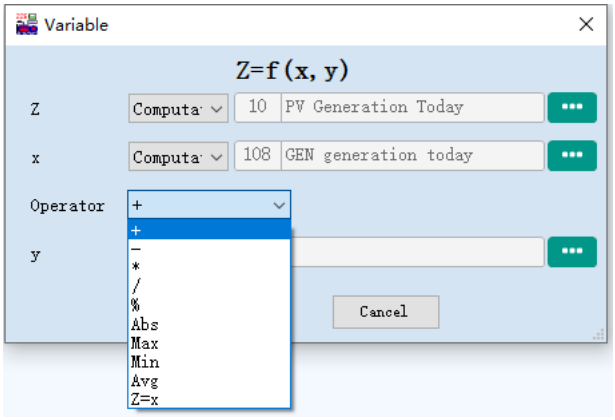


Fig.18 – PLC Conversion Operation

For instance, suppose that there are three computations named “Photovoltaic Power Generation Today”, “Wind Power Generation Today” and “Unit Power Generation Today”. Then define the computation named “Total Power Generation Today”, whose value is the sum of the above threee computations, as shown in the figure below:

ID	Name	Type	Default value	String	Method	Function code	Address	Start	Digit	nificat	Binding device	Edit	Delete
1	PV generation today	Float	0		INT16_AB	03	100			1	PV	Edit	Delete
2	WTS generation today	Float	0		INT16_AB	03	100			1	WTS	Edit	Delete
3	Genset generation today	Float	0		INT16_AB	03	200			1	GENSET	Edit	Delete
4	Generation today	Float	0		NONE					1		Edit	Delete

Fig.19 – Computation Example

The value of "Total Power Generation Today" is assigned by the computation of user-defined PLC logic, as shown in the figure below:

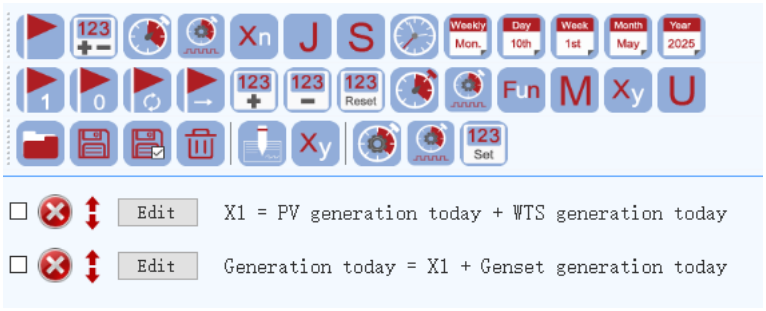


Fig.20 – Example of Computation Coversion

4. 2. 5. 3. 2 ASSIGNMENT OF BOUND DEVICE

The computation bound to the device requires correct configuration of its calculation method. The system calculates and assigns the values according to the real-time data of the device, or assigns values via PLC logic.

The calculation method is valid only for the computation bound to the device, while it is invaild for the computation that is not bound to the device.

If the calculation method configured for the computation bound to the device doesn't match with the type or function code, the default value remains unchanged.

The calculation method is shown as the following table:

Table 5 – Calculation Method

Method	Description	Example
NONE	PLC logic operation assignment or as a constant	Computation 2= Computation 1+ Internal Variable 1
UINT_COIL	Coil Register Status	ON：1, OFF : 0
BOOLS_BITS_AB	Get a Boolean array of multiple bits	Hexadecimal: 0xFEFC Binary System: MSB 1111 1110 1111 1100 LSB Intercept 4 bits from the first bit=> [false, true, true, true]
UINT_BITS_AB	Get an unsigned 16-bit integer of multiple bits	Hexadecimal: 0xFEFC Binary System: MSB 1111 1110 1111 1100 LSB Intercept 3 bits from the first bit 0x110 => 6
INT8_A_AB	Get a signed 8-bit integer of pre-byte	"FEFC" ==> -2
INT8_B_AB	Get a signed 8-bit integer of post-byte	"FEFC" ==> -4

Method	Description	Example
UINT8_A_AB	Get an unsigned 8-bit integer of pre-byte	"FEFC" ==> 254
UINT8_B_AB	Get an unsigned 8-bit integer of post-byte	"FEFC" ==> 252
INT16_AB	Get a signed 16-bit integer of AB sequence	"FEFC" ==> -260
INT16_BA	Get a signed 16-bit integer of BA sequence	"FEFC" ==> -770
UINT16_AB	Get an unsigned 16-bit integer of AB sequence	"FEFC" ==> 65276
UINT16_BA	Get an unsigned 16-bit integer of BA	"FEFC" ==> 64766
INT32_ABCD	Get a signed 32-bit integer of ABCD sequence	"FEDCBAFF" => -19088641
INT32_DCBA	Get a signed 32-bit integer of DCBA sequence	"FEDCBAFF" => -4530946
INT32_BADC	Get a signed 32-bit integer of BADC sequence	"FEDCBAFF" => -587268166
INT32_CDAB	Get a signed 32-bit integer of CDAB sequence	"FEDCBAFF" => -1157628196
UINT32_ABCD	Get an unsigned 32-bit integer of ABCD sequence	"FEDCBAFF" => 4275878655
UINT32_DCBA,	Get an unsigned 32-bit integer of DCBA sequence	"FEDCBAFF" => 4290436350
UINT32_BADC	Get an unsigned 32-bit integer of BADC sequence	"FEDCBAFF" => 3707699130
UINT32_CDAB	Get an unsigned 32-bit integer of CDAB sequence	"FEDCBAFF" => 313733910
FLOAT32_ABCD	Get 32-bit floating-point number of ABCD sequence	"FEDCBAFF" => -1.4670055E38
FLOAT32_DCBA	Get 32-bit floating-point number of DCBA sequence	"0080C842" => 100.25
FLOAT32_BADC	Get 32-bit floating-point number of BADC sequence	"FEDCBAFF" => -5.7420655E17
FLOAT32_CDAB	Get 32-bit floating-point number of CDAB sequence	"FEDCBAFF" => -0.001953091

The details are as follows:

1**) NONE**

Suitable for computions of floating-point type and string (value) type.

If floating-point computation is selected, only need to configure the name, type, calculation method and default value, other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value and string list, other configurations are invalid.

If string (bit) computation is selected, the calculation method does not match with type.

Only when the calculation method of the computation bound to device is set to NONE, the value can be assigned by PLC logic operation; Other methods can only calculate and assign values according to the real-time data of the device, the value is invalid in PLC logic operation.

The PLC logic operation and assignment bound to the device are the same as the compution not bound to the device.

The difference between them is the computation not bound to the device can be assigned by PLC logic operation without any calculation method, while the computation bound to the device must be configured with NONE calculation method before it can be assigned by PLC logic operation.

2)UINT-COIL

Suitable for computions of floating-point type and string (value) type, applicable for 01 function code, the data range is 0 or 1.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, other configurations are invalid.

Coil register status is ON, the compution value is 1, if the status is OFF, the computation value is 0.

3)BOOLS_BITS_AB

Suitable for string (bit) computation, appliable for function code 03.

If string (bit) computation is selected, only need to configure the name, type, string list, calculation method, address, function code, start bit, digit, other configurations are invalid. The data range of start bit is 0~15, the bits number should be the same as the string list.

Suppose that the computation is configured as the figure below, and the register value of address 1 is 0x0044 (MSB 0000 0000 0010 1100 LSB), 4 bits are intercepted from index 0, and the computation value is Boolean data [FALSE, FALSE, TRUE, TRUE].

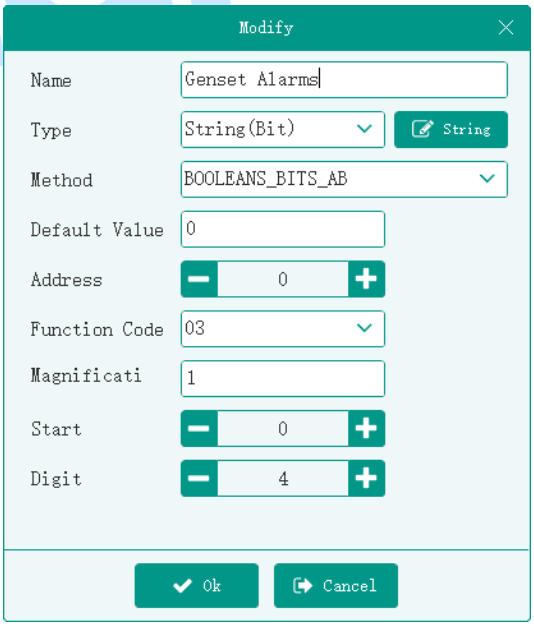


Fig.21 – BOOLS_BITS_AB Calculation Method

4)UNIT_BITS_AB

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is 0~65535.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, start bit, digit, other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, start bit, digit, other configurations are invalid.

The data range of start bit is 0~15, and the data range of digit is 0~16, the sum of start bit and digit number should less than 16, which means the cross-register interception is not supported.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0x0044 (MSB 0000 0000 0010 1100 LSB), 4 bits are intercepted from index 0, and the intercepted hexadecimal number is 0x1100, which is converted into unsigned 16-bit integer decimal number is 12, after multiplying by 1, the computation value is 12.

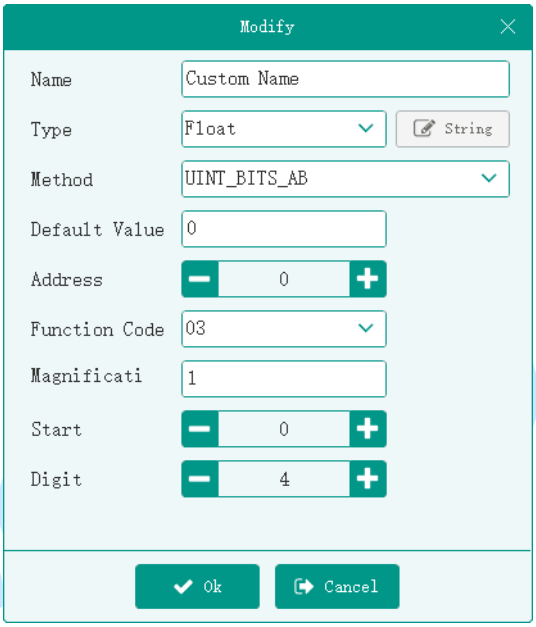


Fig.22 – UINT_BITS_AB Calculation Method

5) INT8_A_AB

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is 128~127.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0x34CC, make the first byte 0x34 convert into the signed 8-bit integer decimal number is 52, after multiplying by 1, the computation value is 52.

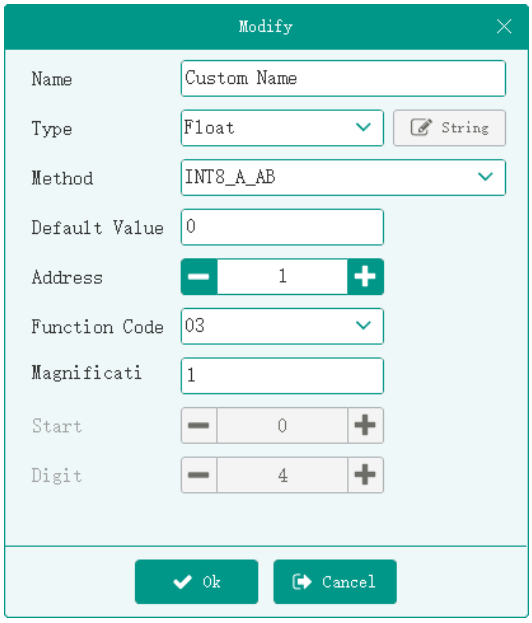


Fig.23 – INT8_A_AB Calculation Method

6) INT8_B_AB

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is 128~127.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0x34CC, make the second byte 0xCC convert into the signed 8-bit integer decimal number is -52, after multiplying by 1, the computation value is -52.

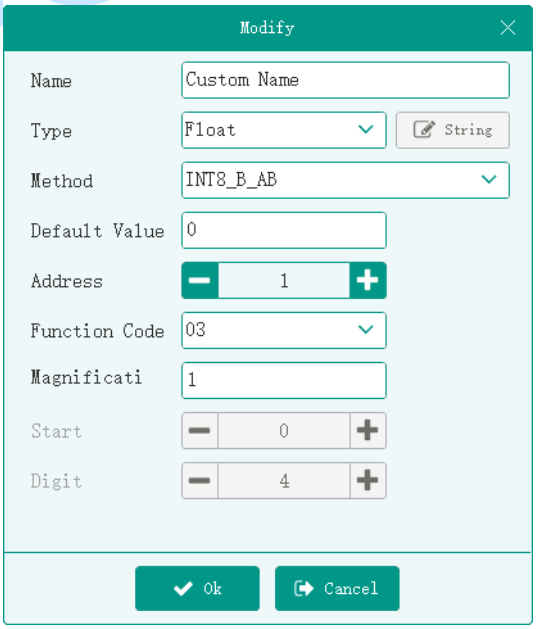


Fig.24 – INT8_B_AB Calculation Method

7)UINT8_A_AB

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is 0~255.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0x34CC, make the first byte 0x34 convert into the unsigned 8-bit integer decimal number is 52, after multiplying by 1, the computation value is 52.

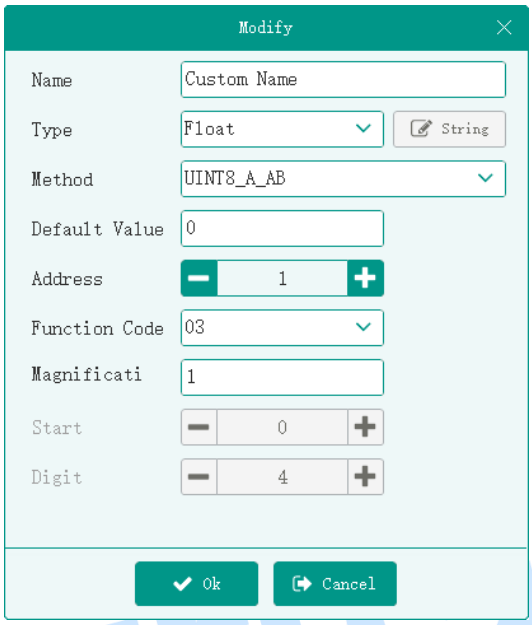


Fig.25 – UINT8_A_AB Calculation Method

8)UINT8_B_AB

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is 0~255.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0x34CC, make the second byte 0xCC convert into the unsigned 8-bit integer decimal number is 204, after multiplying by 1, the computation value is 204.

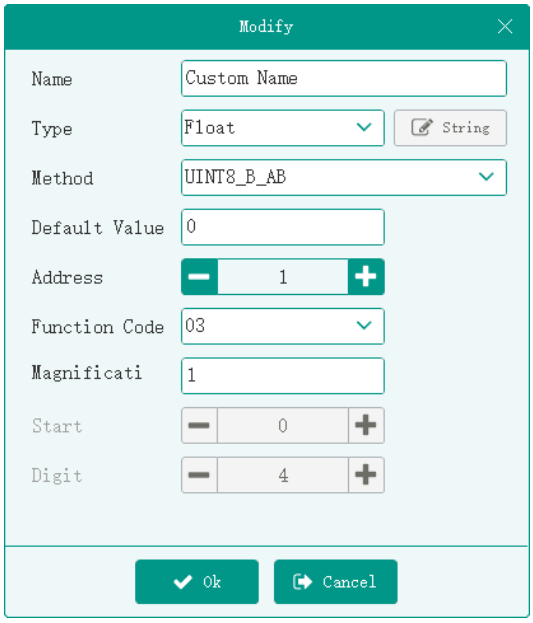


Fig.26– UINT8_B_AB Calculation Method

9)INT16_AB

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is -32768~32767.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0xFEFC, according to the sequence, make (0xFEFC) convert into the signed 16-bit integer decimal number is -260, after multiplying by 1, the computation value is -260.

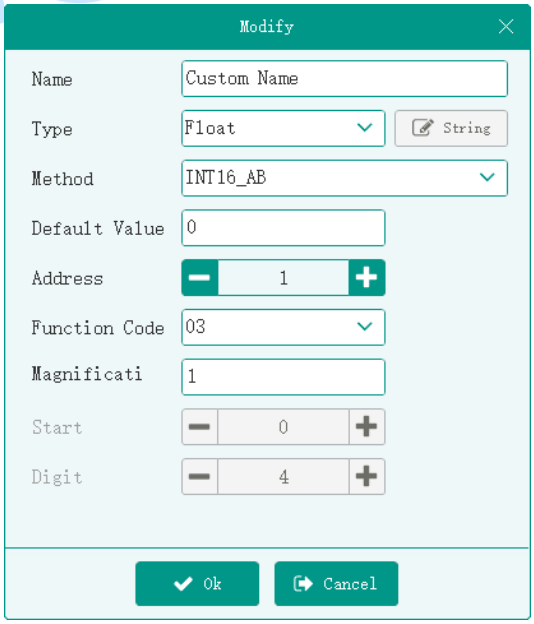


Fig.27– INT16_AB Calculation Method

10) INT16_BA

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is -32768~32767.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0xFEFC, according to the sequence, make (0xFCFE) convert into the signed 16-bit integer decimal number is -770, after multiplying by 1, the computation value is -770.

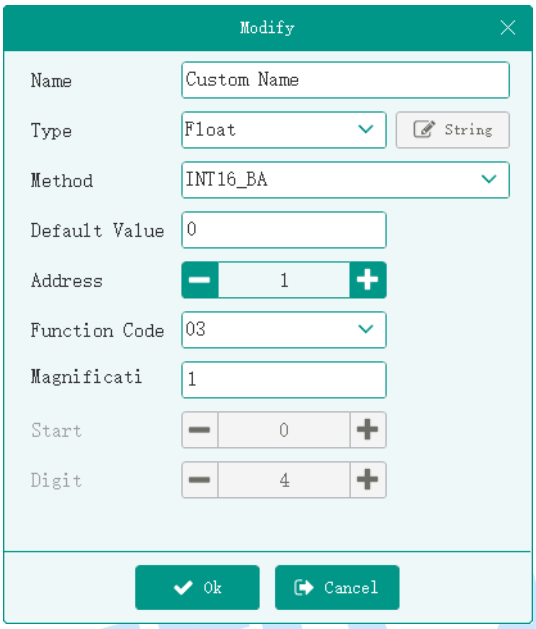


Fig.28– INT16_BA Calculation Method

11)UINT16_AB

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is 0~65535.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0xFEFC, according to the sequence, make (0xFEFC) convert into the unsigned 16-bit integer decimal number is 65276, after multiplying by 1, the computation value is 65276.

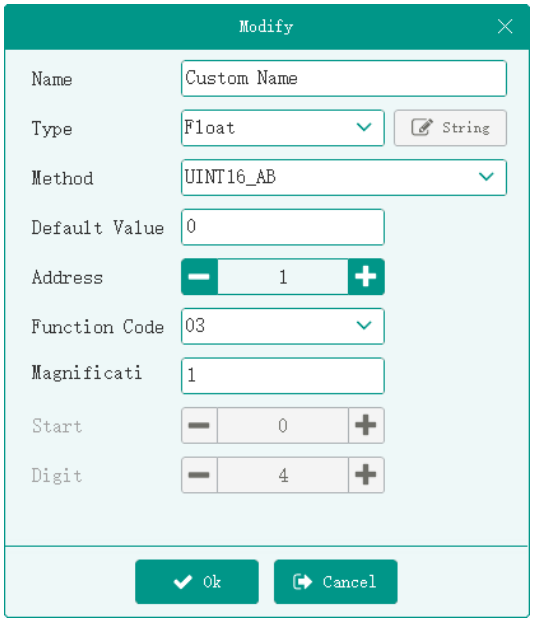


Fig.29– UINT16_AB Calculation Method

12)UINT16_BA

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is 0~65535.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0xFEFC, according to the sequence, make (0xFCFE) convert into the unsigned 16-bit integer decimal number is 64766, after multiplying by 1, the computation value is 64766.

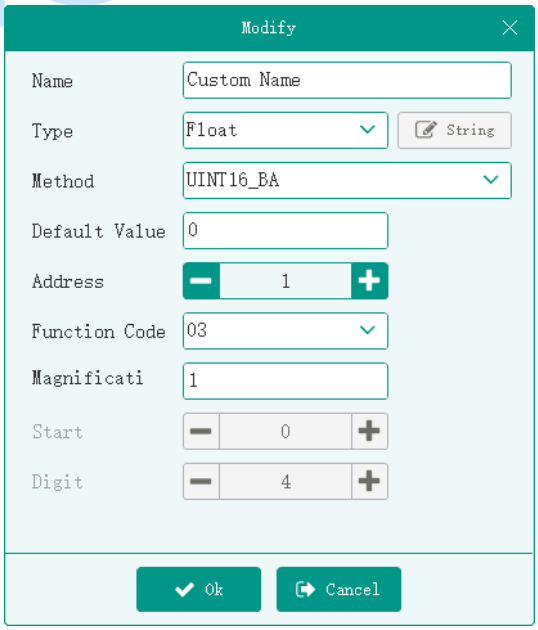


Fig.30– UINT16_BA Calculation Method

13)INT32_ABCD

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is -2147483648~2147483647.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0xFEDC, and the register value of address 2 is 0Xbaff, according to the sequence of ABCD, make (0xFEDCBAFF) convert into the signed 32-bit integer decimal number is -19088641, after multiplying by 1, the computation value is -19088641.

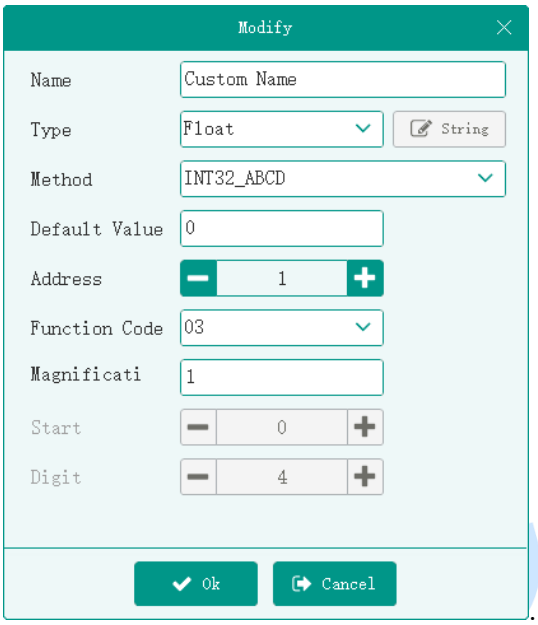


Fig.31– INT32_ABCD Calculation Method

14)INT32_DCBA

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is -2147483648~2147483647.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0xFEDC, and the register value of address 2 is 0xBAFF, according to the sequence of DCBA, make (0xFFBADCFE) convert into the signed 32-bit integer decimal number is -4530946, after multiplying by 1, the computation value is -4530946.

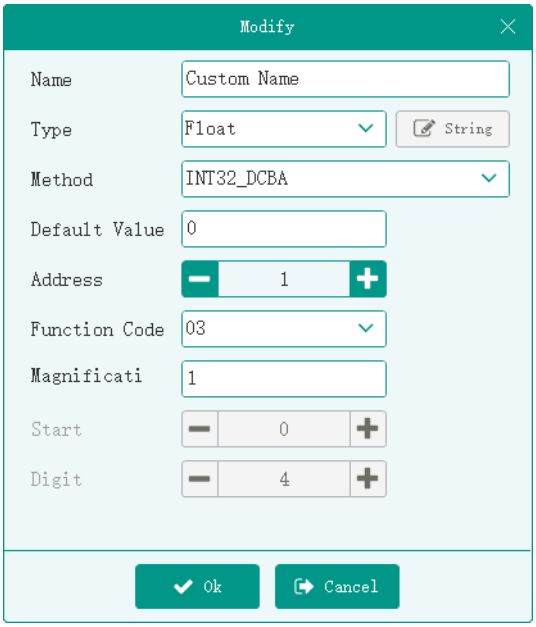


Fig.32– INT32_DCBA Calculation Method

15)INT32_BADC

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is -2147483648~2147483647.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0xFEDC, and the register value of address 2 is 0xBAFF, according to the sequence of BADC, make (0xDCFEFFBA) convert into the signed 32-bit integer decimal number is -587268166, after multiplying by 1, the computation value is -587268166.

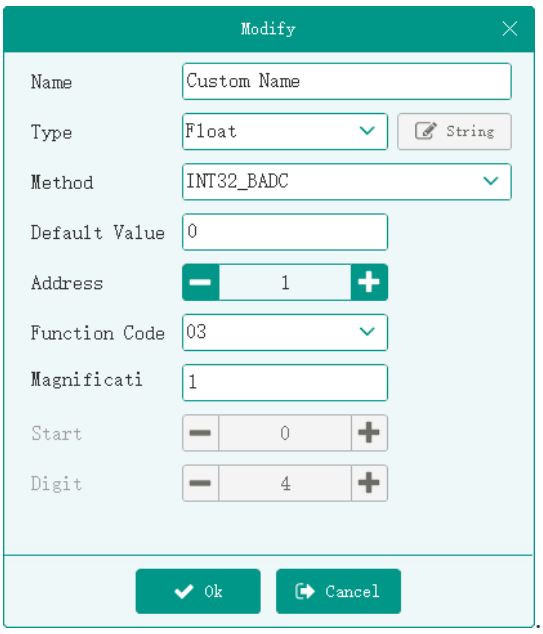


Fig.33– INT32_BADC Calculation Method

16)INT32_CDAB

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is -2147483648~2147483647.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0xFEDC, and the register value of address 2 is 0xBAFF, according to the sequence of CDAB, make (0xBAFFFEDC) convert into the signed 32-bit integer decimal number is -1157628196, after multiplying by 1, the computation value is -1157628196.

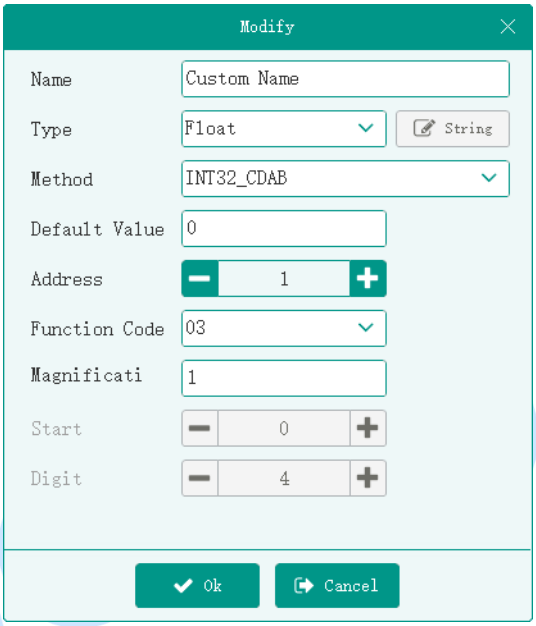


Fig.34– INT32_CDAB Calculation Method

17)UINT32_ABCD

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is 0~4294967295.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0xFEDC, and the register value of address 2 is 0xBAFF, according to the sequence of ABCD, make (0xFEDCBAFF) convert into the signed 32-bit integer decimal number is 4275878655, after multiplying by 1, the computation value is 4275878655.

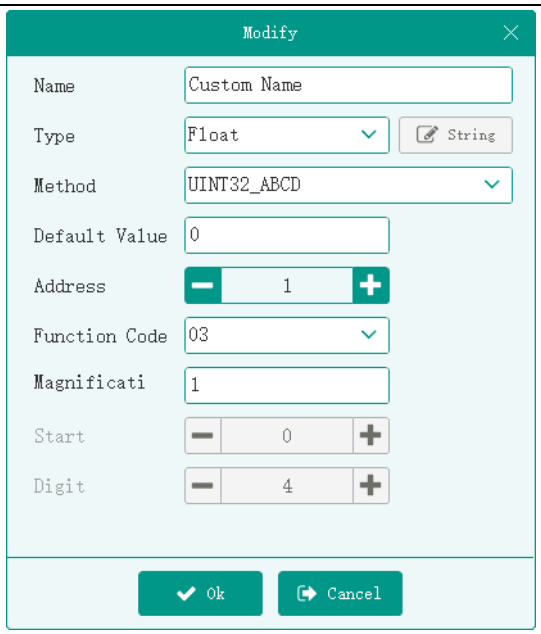


Fig.35– INT32_ABCD Calculation Method

18)UINT32_DCBA

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is 0~4294967295.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0xFEDC, and the register value of address 2 is 0xBAFF, according to the sequence of DCBA, make (0xFFBADCFE) convert into the unsigned 32-bit integer decimal number is 4290436350, after multiplying by 1, the computation value is 4290436350.

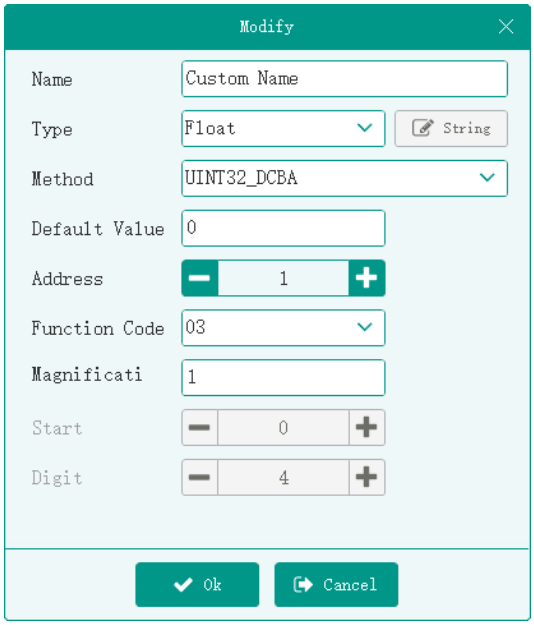


Fig.36– INT32_DCBA Calculation Method

19)UINT32_BADC

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is 0~4294967295.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0xFEDC, and the register value of address 2 is 0xBAFF, according to the sequence of BADC, make (0xDCFEFFBA) convert into the unsigned 32-bit integer decimal number is 3707699130, after multiplying by 1, the computation value is 3707699130.

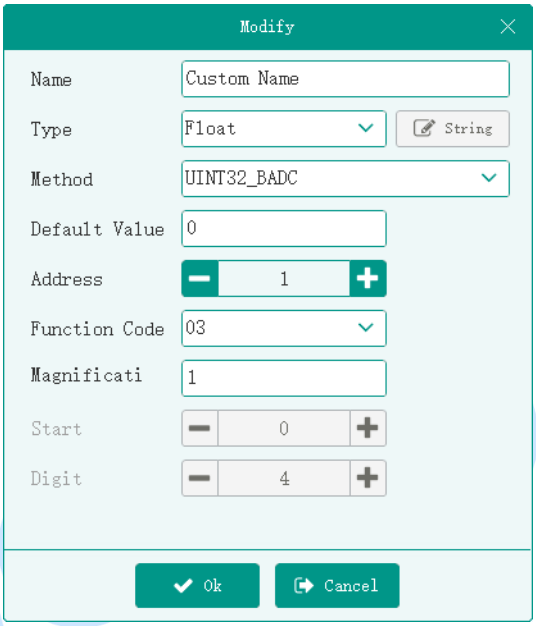


Fig.37– INT32_BADC Calculation Method

20) UINT32_CDAB

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is 0~4294967295.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0xFEDC, and the register value of address 2 is 0xBAFF, according to the sequence of CDAB, make (0xBAFFFEDC) convert into the unsigned 32-bit integer decimal number is 3137339100, after multiplying by 1, the computation value is 3137339100.

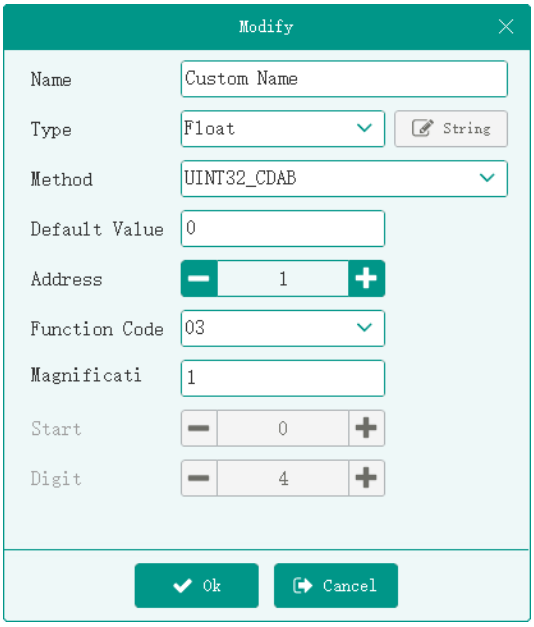


Fig.38– INT32_CDAB Calculation Method

21) FLOAT32_ABCD

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is 1.4E-45F~3.4028235E38.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0xFEDC, and the register value of address 2 is 0xBAFF, according to the sequence of ABCD, make (0xFEDCBAFF) convert into the 32-bit integer decimal number is -1.4670055E38, after multiplying by 1, the computation value is -1.4670055E38.

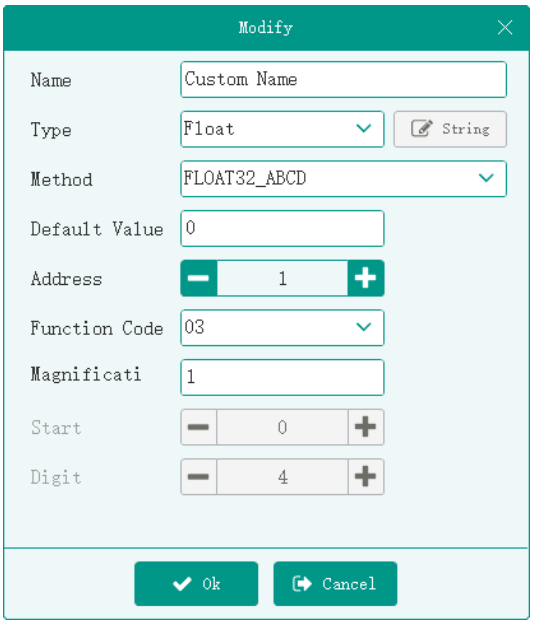


Fig.39– FLOAT32_ABCD Calculation Method

22) FLOAT32_DCBA

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is 1.4E-45F~3.4028235E38.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0x0080, and the register value of address 2 is 0xC842, according to the sequence of DCBA, make (0x42C88000) convert into the 32-bit integer decimal number is 100.25, after multiplying by 1, the computation value is 100.25.

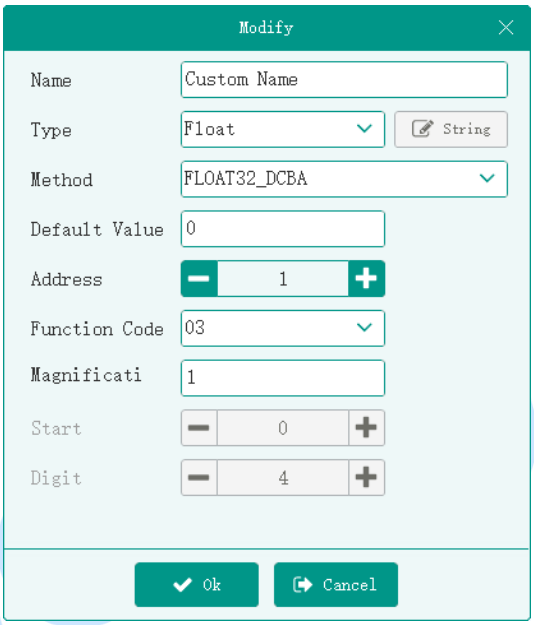


Fig.40– FLOAT32_DCBA Calculation Method

23) FLOAT32_BADC

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is 1.4E-45F~3.4028235E38.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0xFEDC, and the register value of address 2 is 0xBAFF, according to the sequence of BADC, make (0xDCFEFFBA) convert into the 32-bit integer decimal number is -5.7420655E17, after multiplying by 1, the computation value is -5.7420655E17.

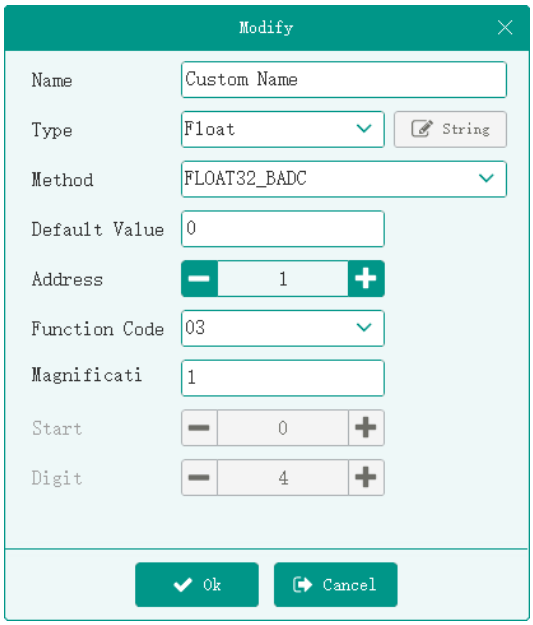


Fig.41– FLOAT32_BADC Calculation Method

24) FLOAT32_CDAB

Suitable for floating-point, string (value) computation, appliable for function code 03 and the data range is 1.4E-45F~3.4028235E38.

If floating-point computation is selected, only need to configure the name, type, calculation method, default value, address, function code, multiple, and other configurations are invalid.

If string (value) computation is selected, only need to configure the name, type, calculation method, default value, string list, address, function code, multiple, other configurations are invalid.

Suppose that the computation is configured as the figure below, the register value of address 1 is 0xFEDC, and the register value of address 2 is 0xBAFF, according to the sequence of CDAB, make (0xBAFFFEDC) convert into the 32-bit integer decimal number is -0.001953091, after multiplying by 1, the computation value is -0.001953091.

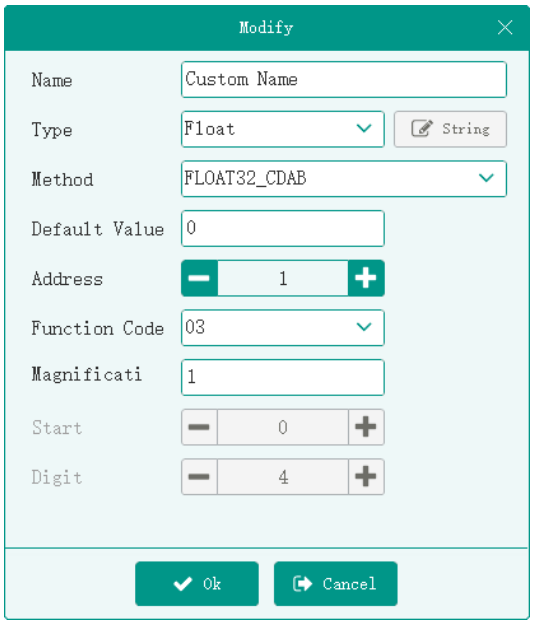


Fig.42– FLOAT32_CDAB Calculation Method

4.2.6 HOMEPAGE SETTING OF TOUCH SCREEN

This section will describe the homepage configuration of touch screen by PC test software, and introduce how to display the various parameters, status and alarm information.

The homepage of touch screen is divided into three parts, which are upper left, lower left and right. Up to 10 energy devices can be configured in upper left part. (Each device is called an energy flow, similar to the followings), four optional data are configured in lower left part, and three diagrams are configured in right part. The configuration of PC is shown as the following figure:

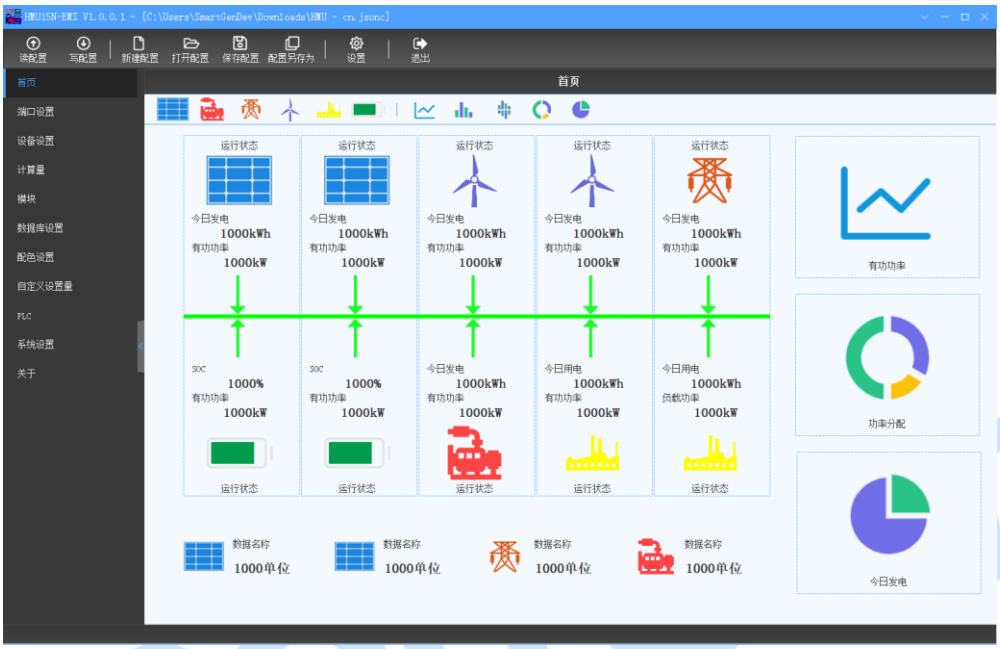


Fig.43 – Homepage Configuration (PC)

Note: the PC data is only used for placeholder display, and the actual data is subject to the display of touch screen.

The display of touch screen is shown as follows:

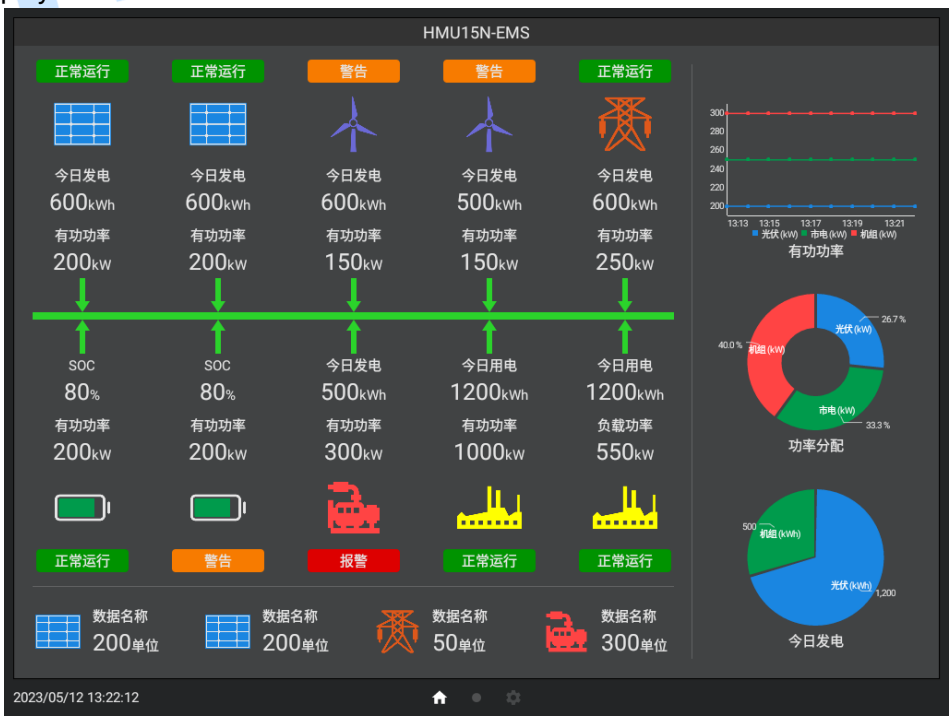


Fig.44 – Homepage Display of Touch Screen

4.2.6.1 HOMEPAGE CONFIGURATION

To add a PV energy flow to the energy flow display area, drag the PV icon in the option area (or other energy flows) to the specified position of the display area. From 1 to 10, the sequence number of the energy flow is where it is located (the sequence number of the first line is 1-5, and the second line is 6-10). The number of energy flow is 2 as shown in the following figure.

Drag the style icon from the digram options part to the display part to add a diagram of the selected style to the corresponding area.

Double-click the icon of the selected data to display any computaion.

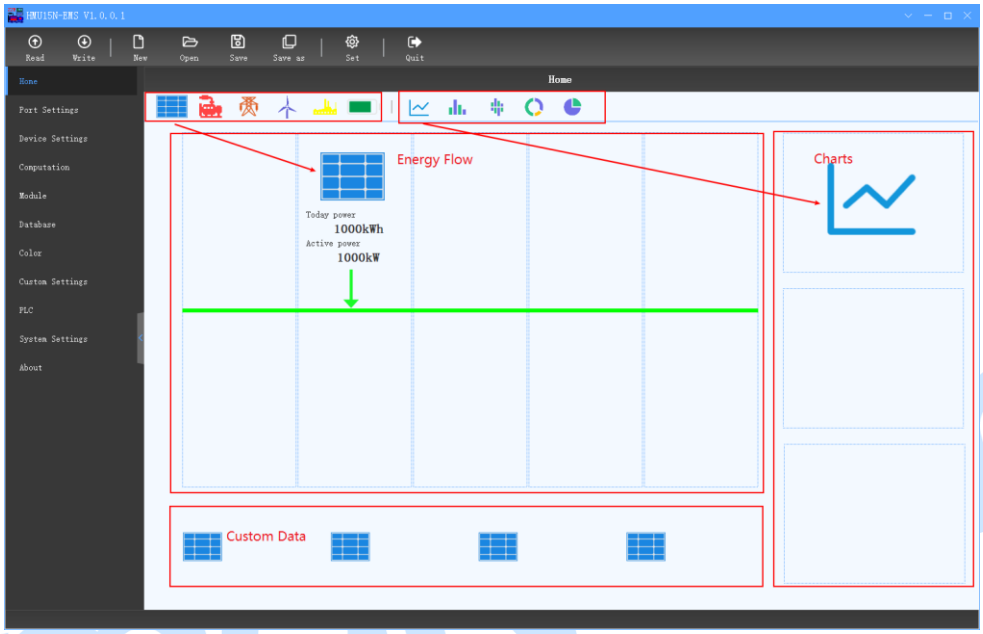


Fig.45 – Hompage Configuration Area (PC)

Write the configuration into the touch screen, and the energy flow, optional data, diagram are displayed in the setting area, as shown in the figure below:

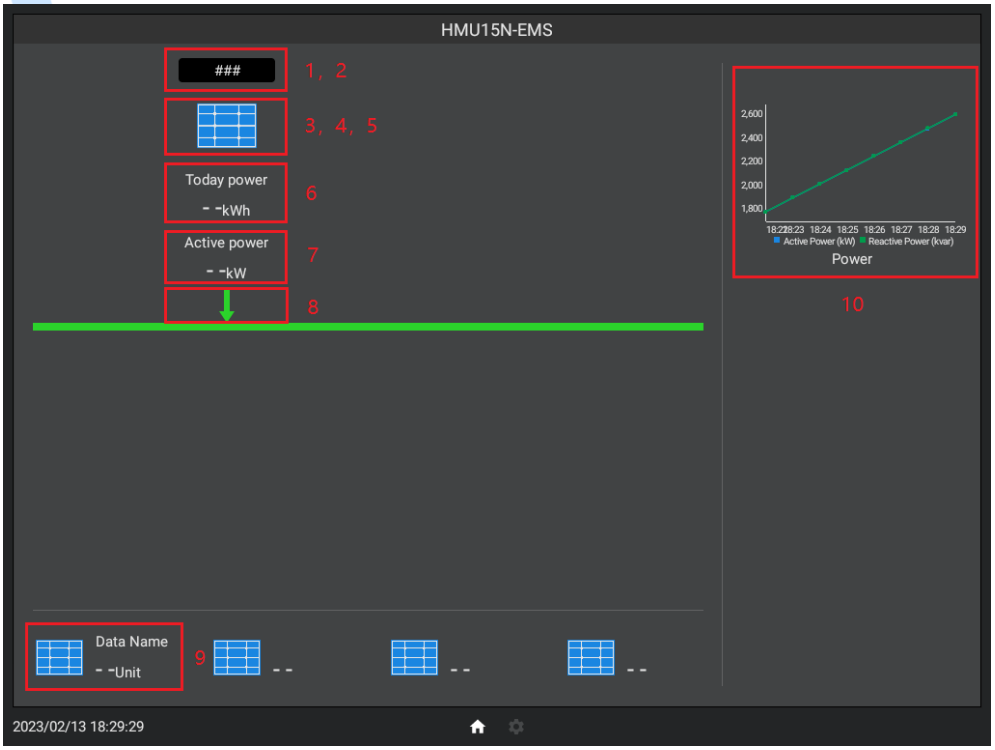


Fig.46 – Homepage Display Area (Touch Screen)

4.2.6.2 ENERGY FLOW CONFIGURATION

Click of PC, or double-click the icon of energy flow to configure the energy flow. Please pay attention to the red marked number in the figure below should correspond to the slave computer:

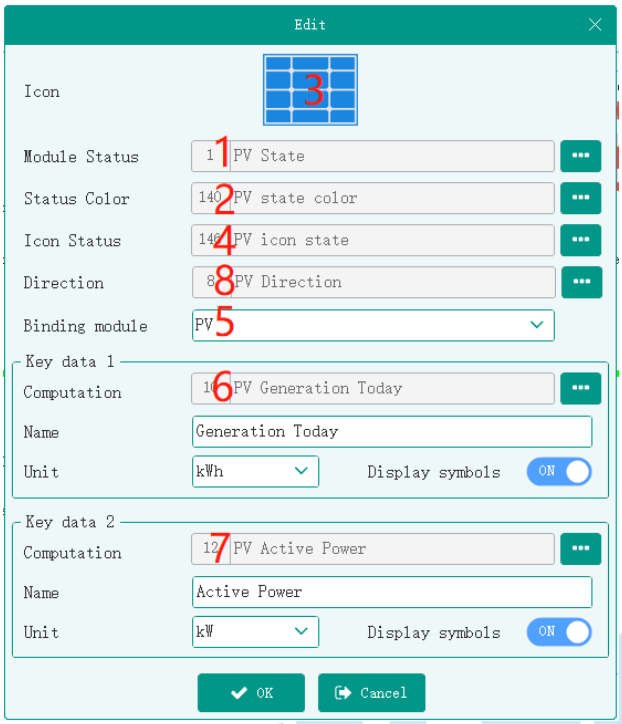


Fig.47 – Energy Flow Configuration

Click ... to pop up computation selection as the following figure, select the computation and click Select to bind the computation.

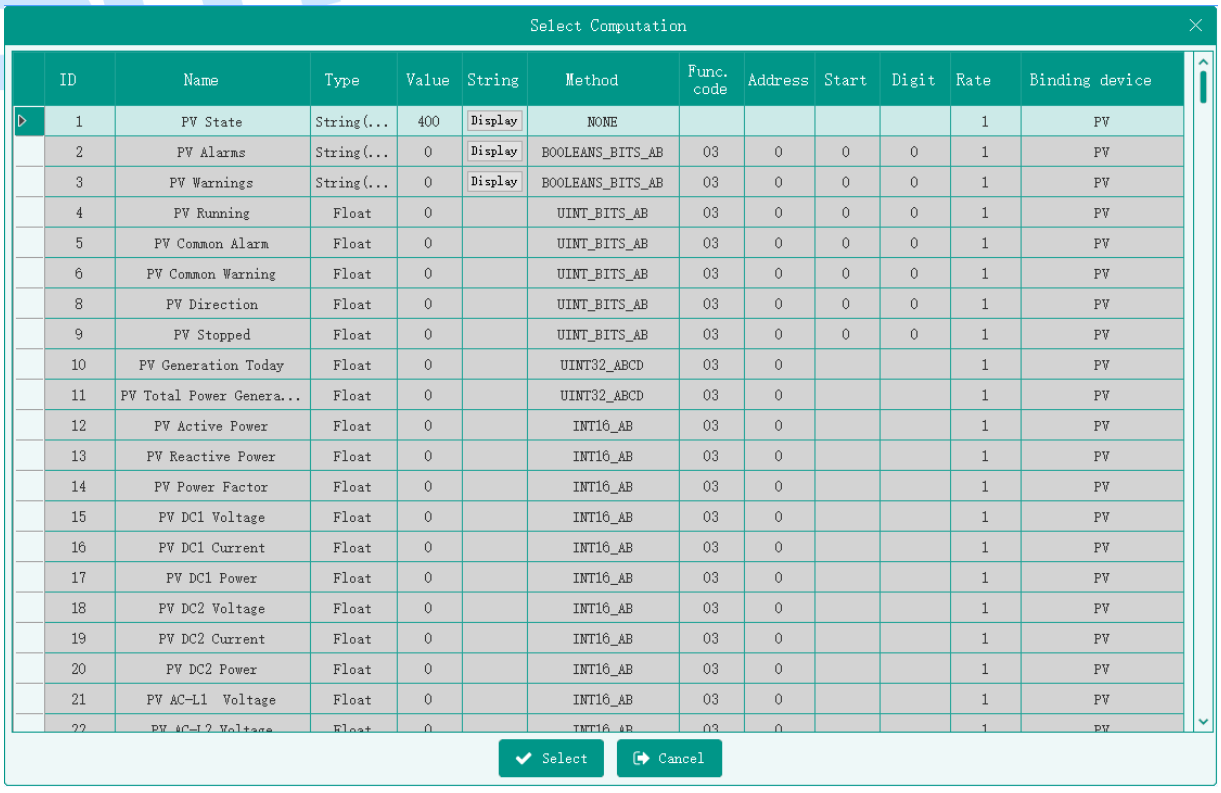


Fig.48 – Computation Selection

1) Energy Flow Status String

It applies to string (value) computation.The strings corresponding to the bound compution are displayed here. Suppose the bound computation is configured as the follwing figure, the slave computer displays “Status 4” by default. If the compution value is 100, “Status 1” is displayed. If the computation value is not within the preset range, “—” is displayed.

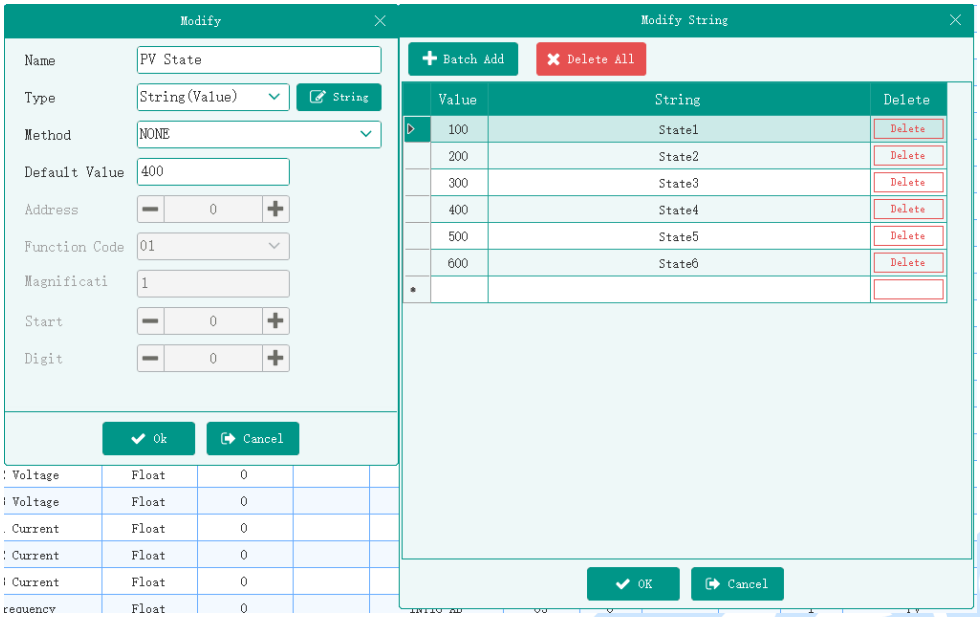


Fig.49 – Status Computation Example

The bound computation can be changed by PLC logic to realize the display of the running status and alarm information of the device during operation. The example of PLC logic is as follows:

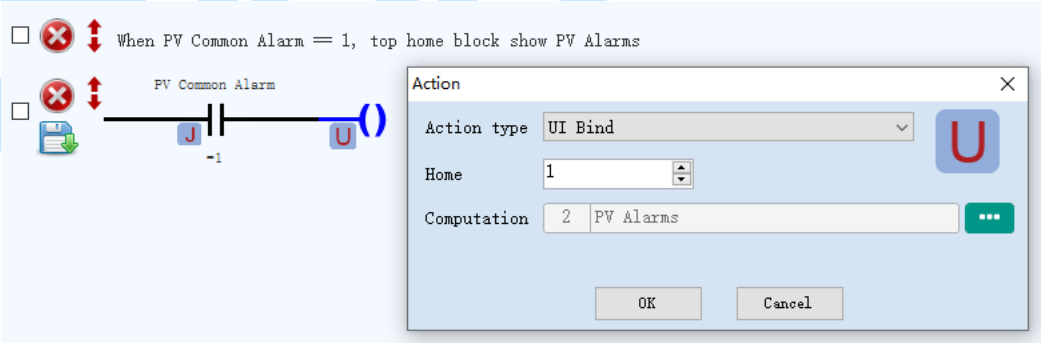


Fig.50 – Example 1 of Status Change Bound Computation

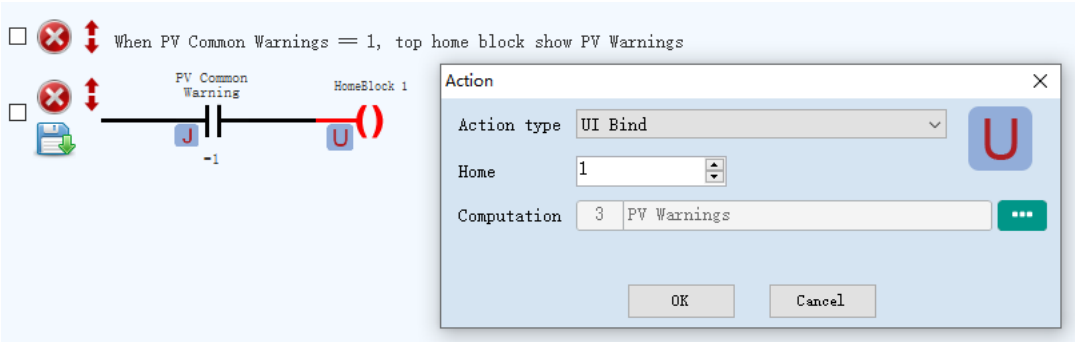


Fig.51 – Example 2 of Status Change Bound Computation

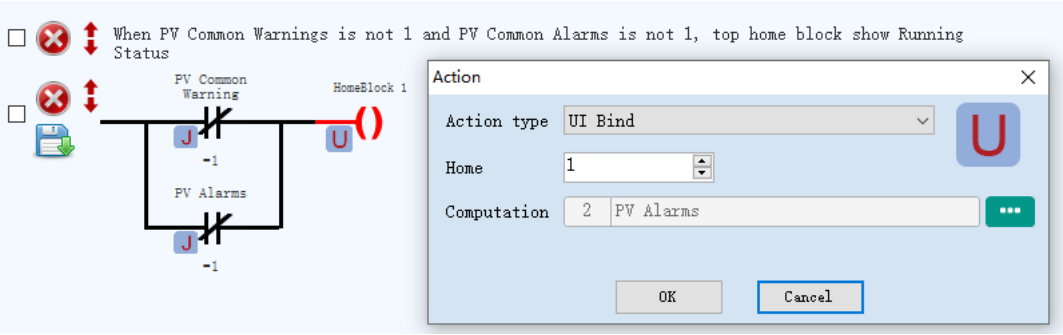
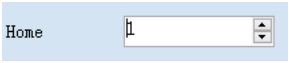


Fig.52 – Example 3 of Status Change Bound Computation



is the serial number correspingding to the energy flow.

2)Background Color of Energy Flow Status

It applies to floating-point computation, the background color of text can be changed according to the bound computation. Suppose that the color matching settings of PC are as follows:

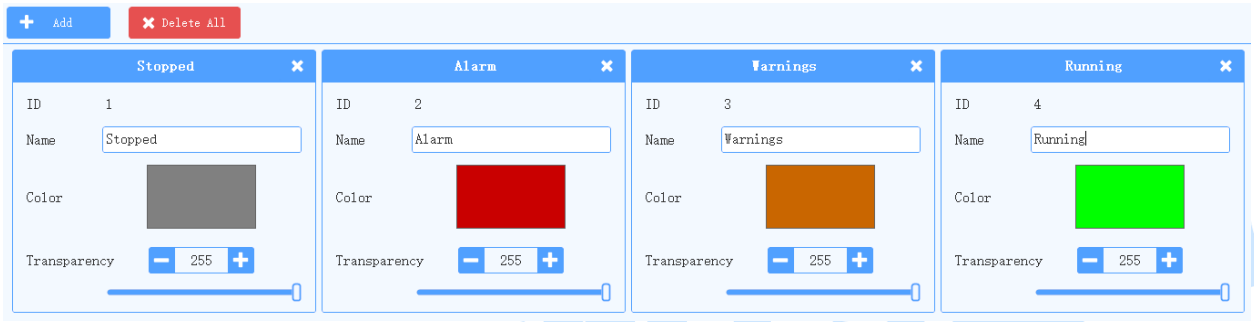


Fig.53 – Color Matching Set

The bound computation is configured as the following figure, the default value is 1, and the color of corresponding ID is the “Stop” color.

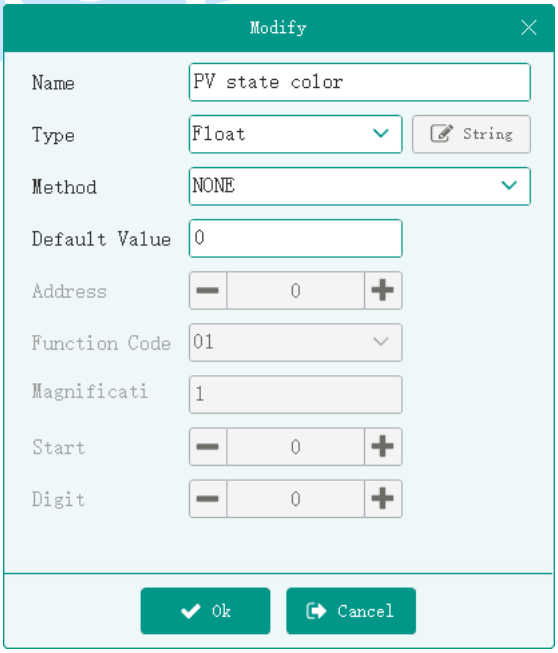


Fig.54 – Example of Status Background Color Computation

The computation is assigned by PLC logic operation, such as the figure of PLC logic below:

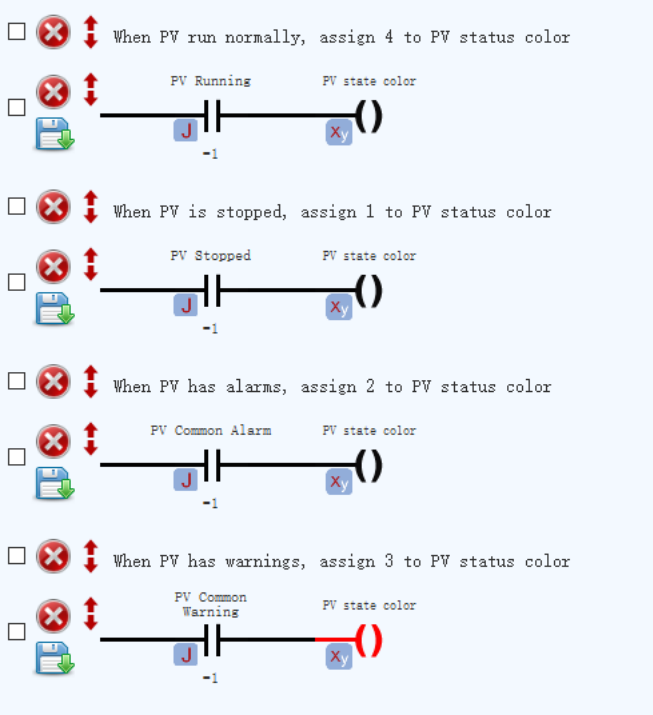


Fig.55 – Example of Status Background Change

When PV is in normal running, the computation value is 4, and the text background color is "Normal Running " color, when PV is stop, the computation value is 1, the text background color is " Stop" color, it displays black if the computation value is not configured with the corresponding color.

3) Energy Flow Icon

Click  to change the energy flow icon, the supported icons are shown below:

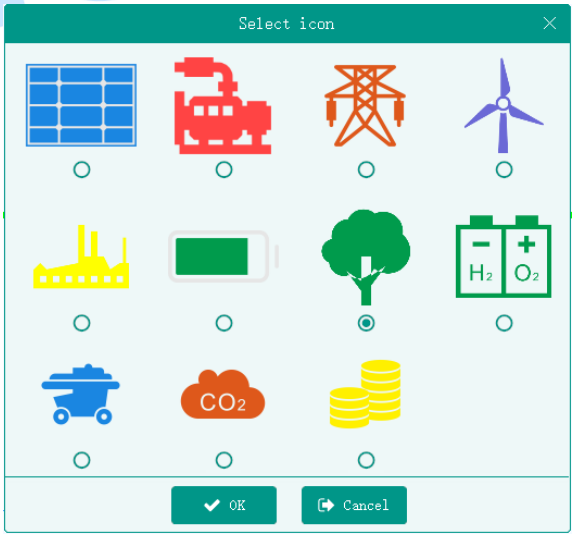


Fig.56 – Energy Flow Icons

4)The Status of Energy Flow Icon

It applies to floating-point computation, icons can be changed flashing or static according to the computation value.

Suppose that the computation is configured as the following figure:

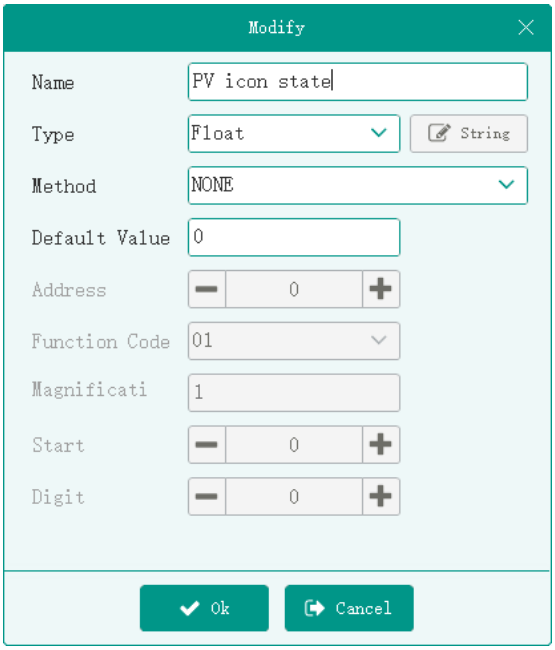


Fig.57 – Example of Icon Status Computation

This computation is assigned by PLC logic, such as the PLC logic of the following figure:

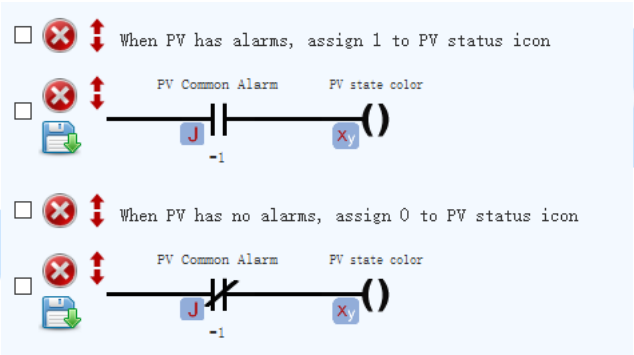


Fig.58 – Example of Icon Status Change

When there is no alarm of PV, the computation value is 0, the PV icon will be static, when the PV icon alarms, the computation value is not 0, the PV icon starts to flash.

5) Click Event of Energy Flow Icon

Click the icon to jump to the details of the corresponding module according to the "Bound Module". If "Bound Module" is not configured, the click will not take effect.

6) Energy Flow Data 1

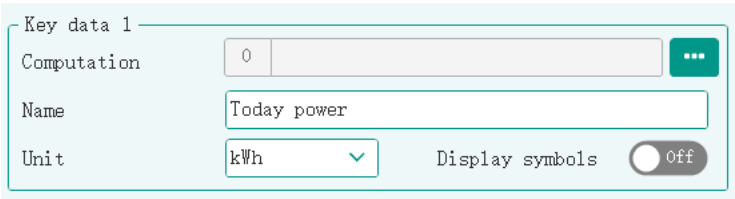


Fig.59 – Energy Flow Data 1

Click ··· to select the bound computation, which applies to the floating-point computation, the value is displyed on slave computer. The name and unit displayed on the slave computer can be customized. If "Data Display Sign" is switched on, both positive and negative signs of the computation value will be displayed. If "Data Display Sign" is switched off, the negative sign will be displayed if the computation value is negative.

7)Energy Flow Data 2

The configuraton method is the same to “Energy Flow Data 1”.

8)Energy Flow Direction

It applies to the bound floating-point computation, according to its value, the energy flow arrow can point to the busbar or icon.

When the value of bound computation is 0, it will point to the busbar, while the value is not 0, it will point to icon. It depends, the bound computation can be calculated and assigned according to the real-time data of the device, or by PLC logic operation.

9) Optinal Data

Click of the self-selected data area of PC, or double-click the icon of the self-selected area to configure the data in detail.

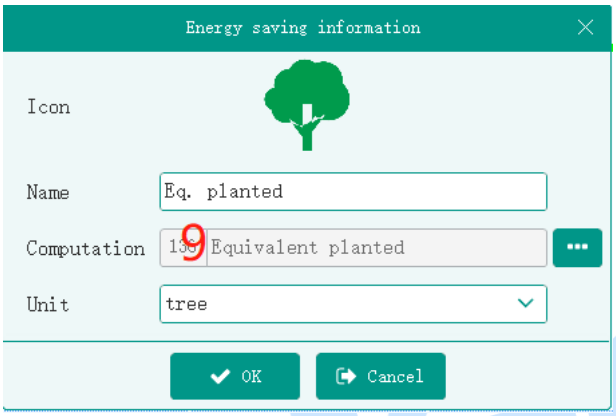


Fig.60 – Optional Data

Click to select the bound computation, it applies to the floating-point computation,the value is displayed on slave computer.The displayed name and unit of the slave computer can be customized.Click to select the icon displayed on slave computer, and supported icons are shown as below:

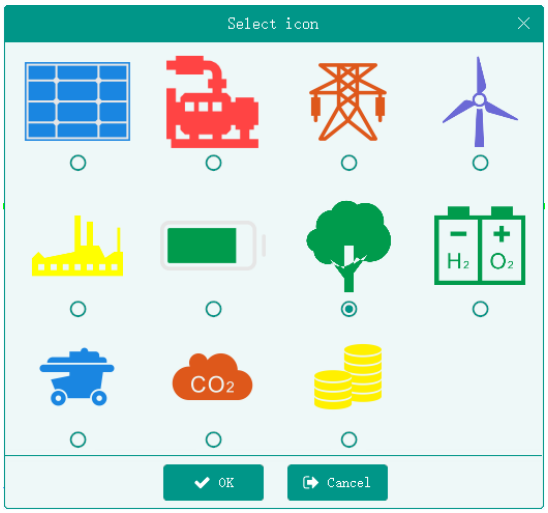


Fig.61 – Optional Data Icon

10)Optional Chart

The data source of the chart is the database. Each chart needs to be bound to a database, and the data is displayed in the form of a chart. See the following detais about the database in next section.

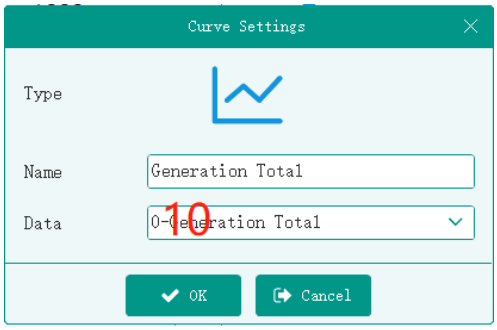


Fig.62 – Optional Chart

The displayed chart name on slave computer can be customized. Click  to select chart style, the supported styles include line chart, histogram, up/down histogram, ring chart (displyed as percentage), pie chart (displayed as specific value), as shown below:

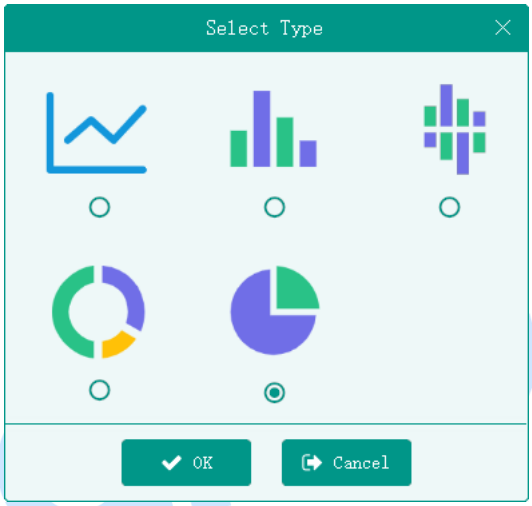


Fig.63 – Chart Styles

4.2.7 MODULE CONFIGURATION

Each module corresponds to a detail page of slave computer, which can customize the name, data display, table header data, digrams. Please pay attention to the red marked number should be matched with the slave computer.

The PC configuration is shown as the following figure:

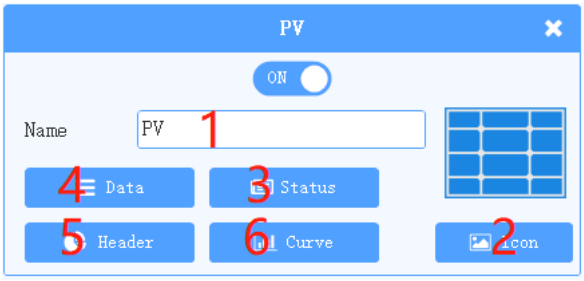


Fig.64 – Module Configuration (PC)

The slave computer is displayed as below:

Fig.65 – Module Display (Touch Screen)

4.2.7.1 TITLE BAR SETTINGS

It includes module icon, module name, module status. Among which the module status can be bound to the computation and display the device running status by the computation value.

Click Icon to select the module icon, the supported icons are as the following figure:

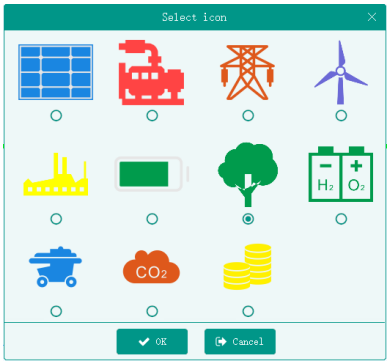


Fig.66 – Module Icons

Click Status to select any computation, which is suitable for string (value) computation and displayed on the title bar of the details, as is shown below:

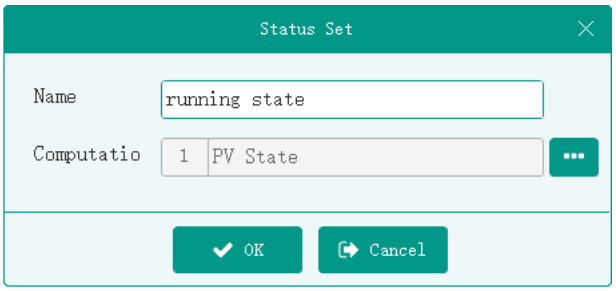


Fig.67 – Title Bart Setting

4.2.7.2 DATA DISPLAY

Click Data to display all the data, as the following figure:

Fig.68 – Computation Selection

Click Add to add a data option, of which the display name and unit can be customized and bound to a computation to display the computation value or the corresponding string. If the bound computation is string (value) or string (bit), the click the detailed information displayed by slave computer. Click Edit to modify the existing data, as is shown below:

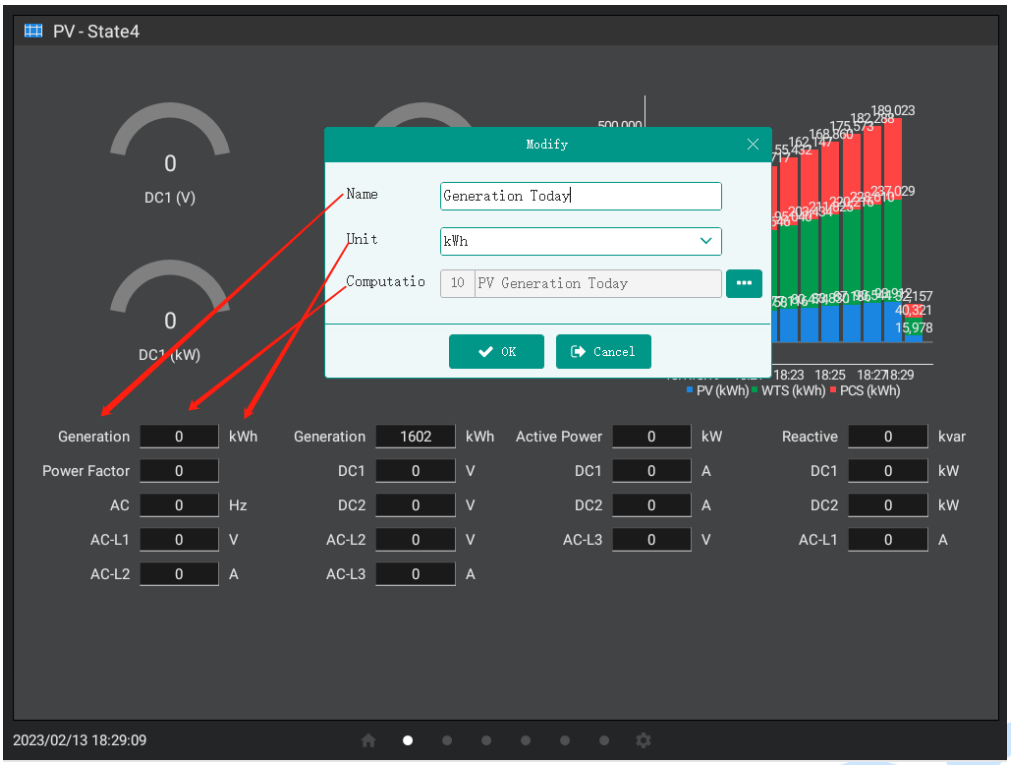


Fig.69 – Module Data

4.2.7.3 TABLE HEADER MANAGEMENT

Click Header to set four table headers. The data source is the data item added to the detail page, and the max. value and min. value of the dial plate need to be set , as shown in the following figure:

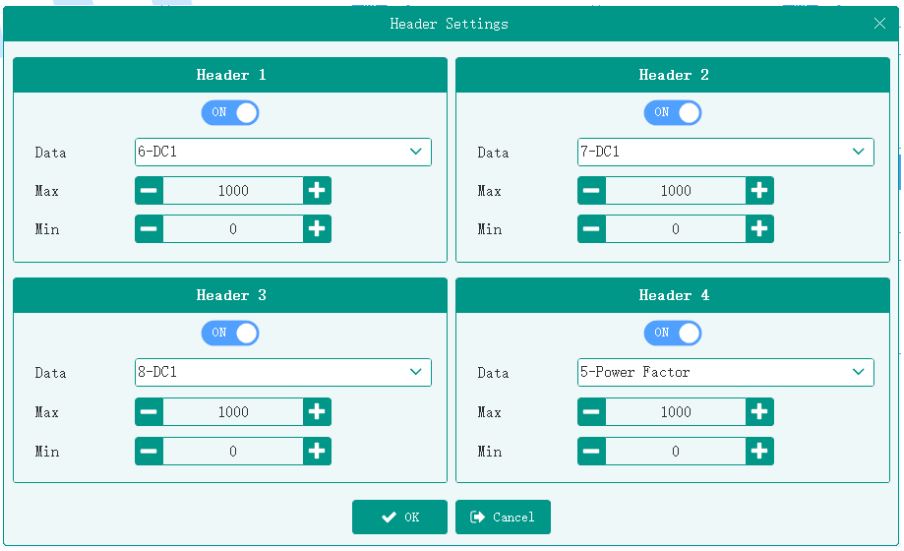


Fig.70 – Table Header Management

4.2.7.4 CHART SETTINGS

Click 

to set a chart and selecct the style, the data source is bound to a data base that in form of chart display. The specific configuration is the same as the chart selected on the homepage. The details can refer to the following section.

4.2.8 DATABASE SETTINGS

The database is used to display the line charts, bar charts, ring charts or pie charts. Each chart has only one database bound to it, and the chart is updated in real-time as the database changes.

Databases are divied into minute database, hour database, day database, month database, year database. Each database can be set as single point data or cumulative data.

4.2.8.1 SINGLE POINT DATA

Single point data is time record data.

Table 6 – Types of Single Point Database

Types	Description
Minute	Data is read and stored at 0s/min. The database points to the next data address. Circularly cover the data and save the latest 60 items.
Hour	Data is read and stored at each hour. The database points to the next data address. Circular over the data and save the latest 24 items.
Day	Data is read and stored at every 0’ o clock. The database points to the next data address. Circular over the data and save the latest 30 items.
Month	Data is read and stored at the beginning of each month. The database points to the next data address. Circular over the data and save the latest 12 items.
Year	Data is read and stored at the beginning of each year. The database points to the next data address. Circular over the data and save the latest 50 items.

It is assumed that a computation of PV active power is added to the minute database as the data source, which is calcuted and assigned through the real-time data of the device. The system reads the value of the PV active power every minute and stores the data. The database points to the next data, and so on, and saves the latest 60 items.

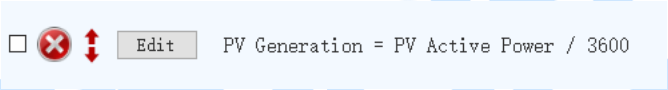
Other types of database are similar.

4.2.8.2 ACCUMULATED DATA

Table 7 – Types of Accumulated Data

Types	Description
Minute	Data is stored at 0s/min. The database points to the next data address and clears the accumulated data. Circularly cover the data and save the latest 60 items.
Hour	Data is stored at a clock by each hour. The database points to the next data address and clears the accumulated data. Circular over the data and save the latest 24 items.
Day	Data is read and stored at every 0’ o clock. The database points to the next data address and clears the accumulated data. Circular over the data and save the latest 30 items.
Month	Data is read and stored at the beginning of each month. The database points to the next data address and clears the accumulated data. Circular over the data and save the latest 12 items.
Year	Data is read and stored at the beginning of each year. The database points to the next data address and clears the accumulated data. Circular over the data and save the latest 50 items.

It is assumed that a computation of PV generation is added to the minute database as the data source, which is calcuted and assigned by PLC logic. The PV active power is calculated and assigned by real-time data of device. As shown in the following figure:



4.2.8.3 DATA SOURCE

Click Edit Data to add up to 5 computations as the data source, the string (bit) value computation is not supported, as shown in the following figure:

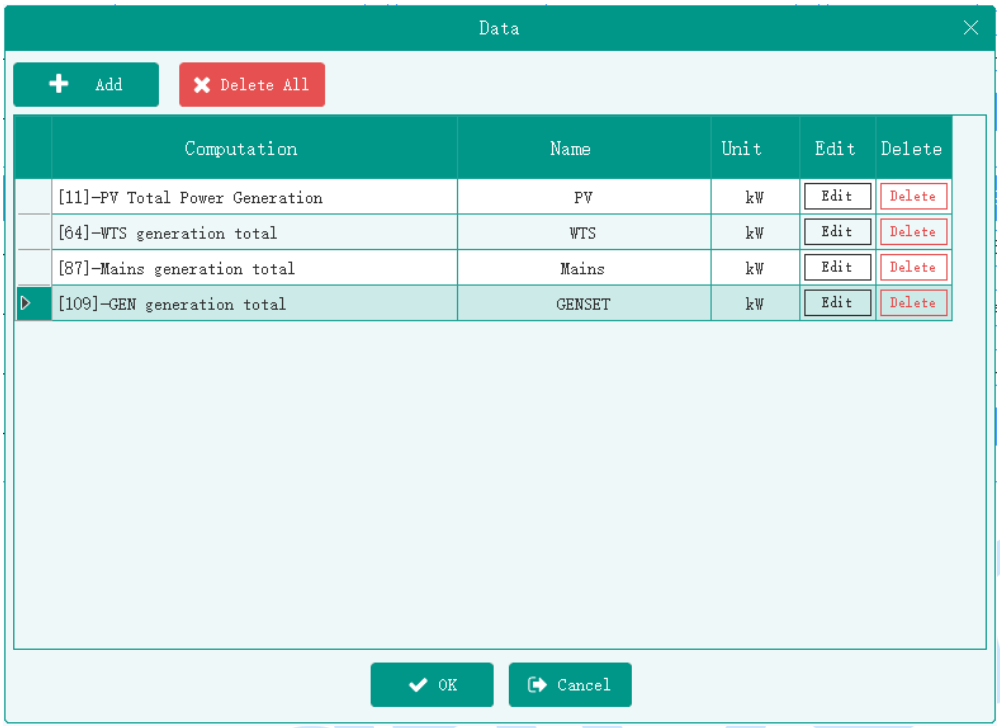


Fig.71 – Data Source

Each database corresponds to a chart, and each computation corresponds to a curve or category in chart. Click Edit to customize each curve or the name and unit of the category as the figure note, as shown in the following figure:

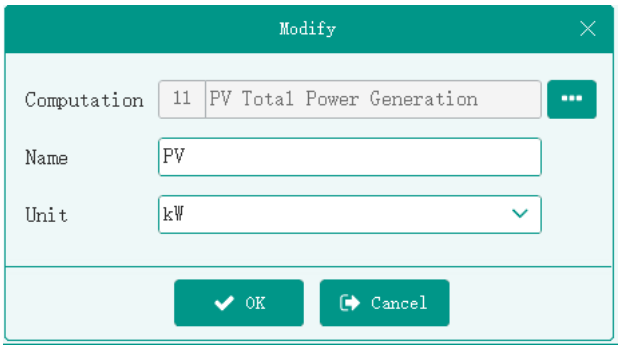


Fig.72 – Chart Option Settings

4.2.8.4 CHART TYPES

Line chart, a computation corresponds to a curve, the slave computer displys as the following figure:

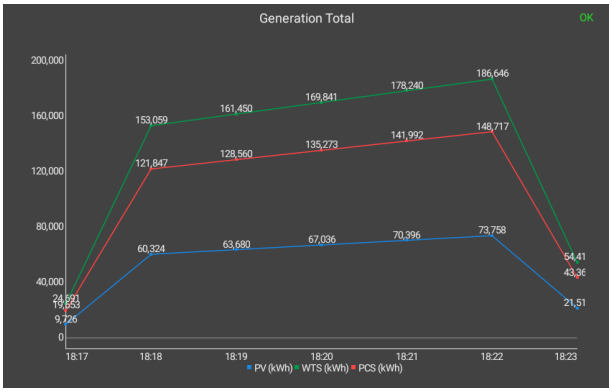


Fig.73 – Line Chart

Histogram, the slave computer displys as the following figure:

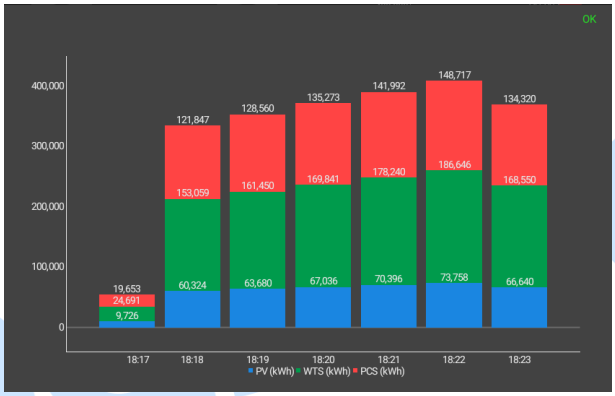


Fig.74 – Histogram

Compared with the histogram, only the first two items of data in the database, the slave computer displys as the following figure:

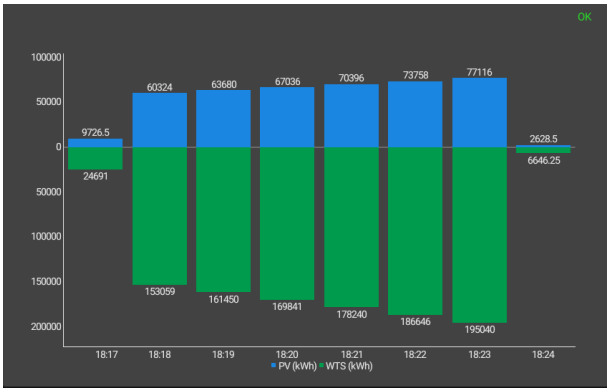


Fig.75 – Histogram Comparison

Pie Chart: take the most approximate value of each data in the database, the slave computer displys as the following figure:

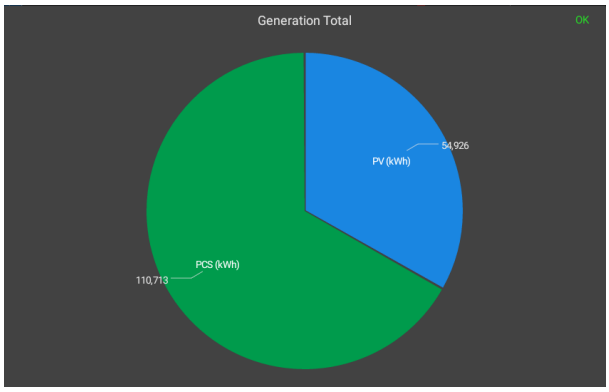


Fig.76 – Pie Chart

Ring Chart: take the most approximate value of each data in the database, the slave computer displays as the following figure:

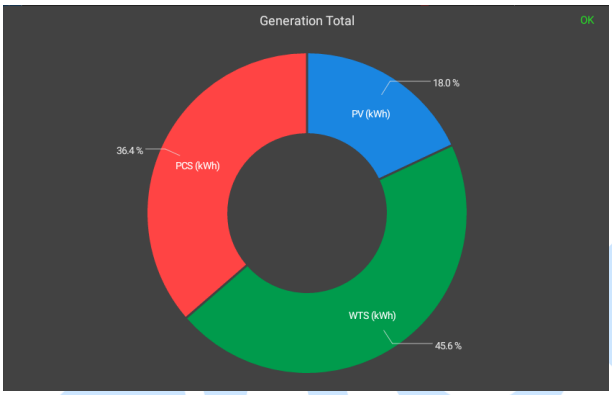


Fig.77 – Ring Chart

4.2.9 SETTING MANAGEMENT

Settings are the supplement to the computation, the values can be saved after a power failure, which can be used to save the coefficient, threshold, status, etc. It can be divided into key type, value type, and both of them are floating-point value and can take part in the PLC logic operation. In addition to the floating-point value, the key type also has the corresponding string.

The functional-related settings can be put in the same group when adding. Click “Edit” to modify the name, type, default value, authority, unit of the setings, and click “Delete” to delete the computation.

The setting value can be manually modified in setting page of slave computer, or assigned by PLC logic operation, or modified by PC. The figure of PC setting screen is shown as follows:

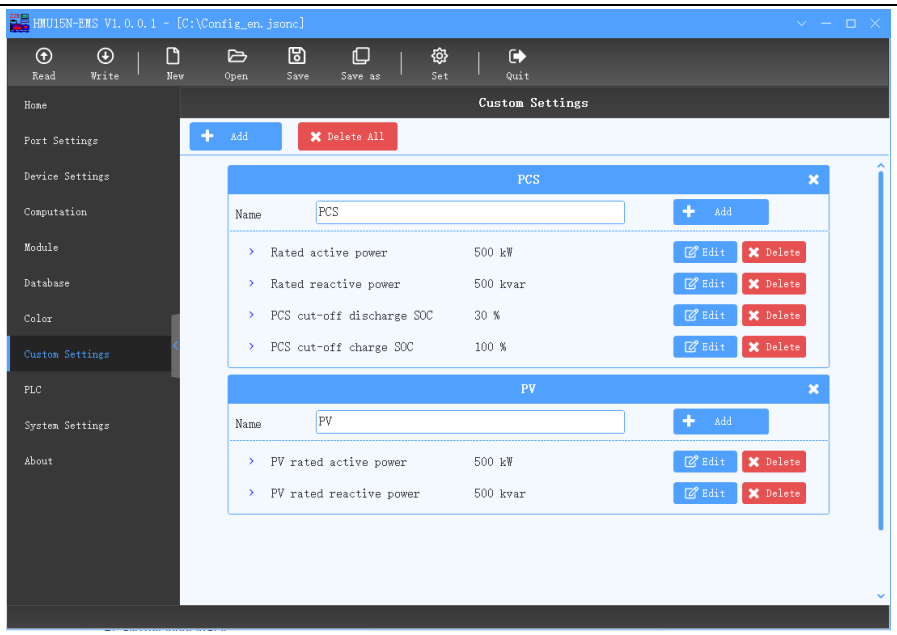


Fig.78 – Setting Management (PC)

The figure of slave computer screen is shown as follows:

Fig.79 – Setting Management (Touch Screen)

4.2.9.1 FLOATING-POINT TYPE SETTING

The value of setting is floating-point, and can be set as default value, custom unit.

Suppose the setting is configured as the following figure:

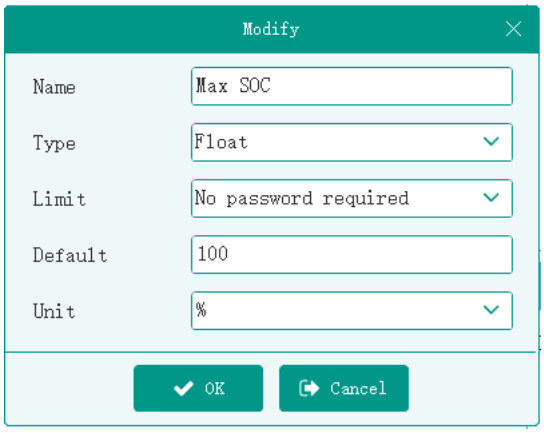


Fig.80 – Example of Floating-point Setting 1

This setting can be used as threshold value, when the storage energy SOC is less than or equal to 30%, the discharge will be stopped, as shown in the figure below:

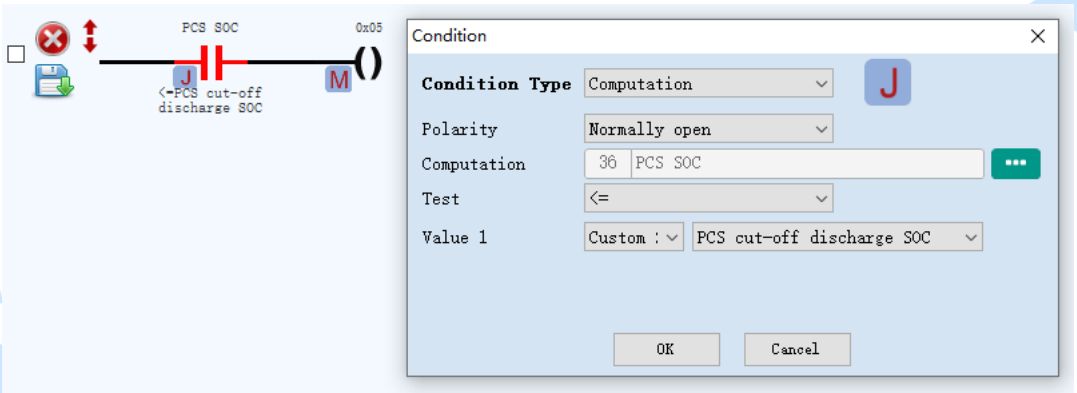


Fig.81– Example of Setting Usage 1

Suppose the setting is configured as the following figure:

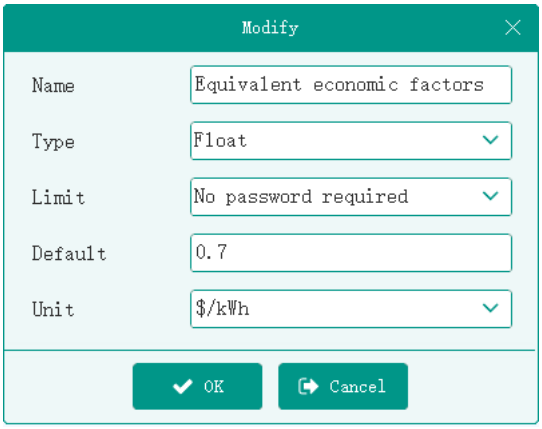


Fig.82– Example of Floating-point Setting 2

This setting can be used as a coefficient to calculate the equivalent economic income of PV power generation today, as shown in the following figure:

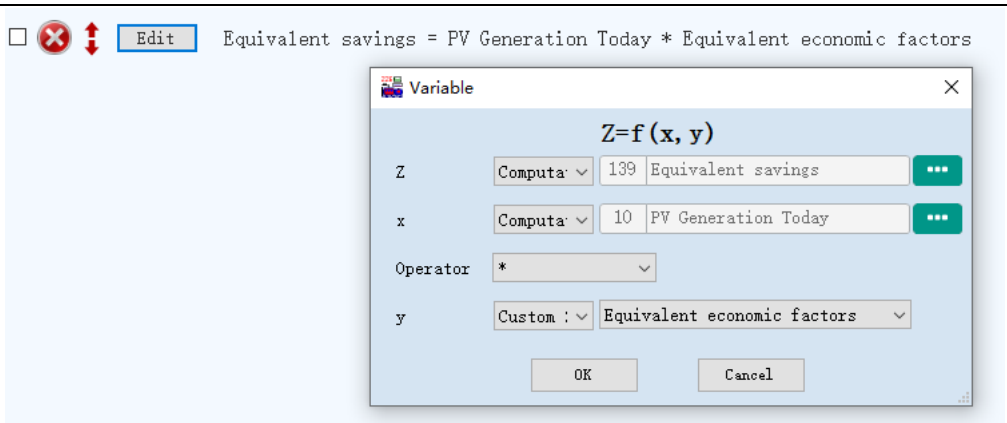


Fig.83– Example of Setting Usage 2

4.2.9.2 KEY TYPE SETTING

The value of the setting is the index value of the option, from 0 to display the corresponding string. In key option settings, the selected option is the default value.

Suppose the setting is configured as the following figure:

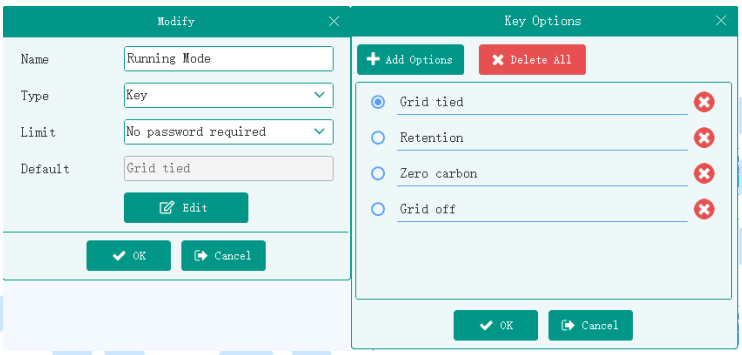


Fig.84– Key Type Setting

The setting can be used as a condition, and according to the different states of the condition to perform different PLC logic operations, as shown below:

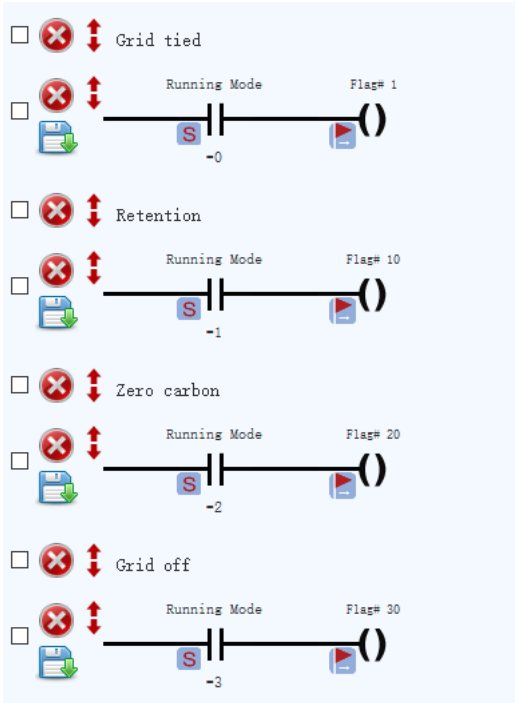


Fig.85 – Usage Example of Key Type Setting

4.2.9.3 PERMISSION MANAGEMENT

There are three modification permissions for setting: “No Password”, “Only Confirm”, “Password Confirm”. If the permission to change the setting value is “ No Password”, the value can be modified directly. If the permission to change the setting value is “Only Confirm”, click “confirm” to modify its value, shown as below:

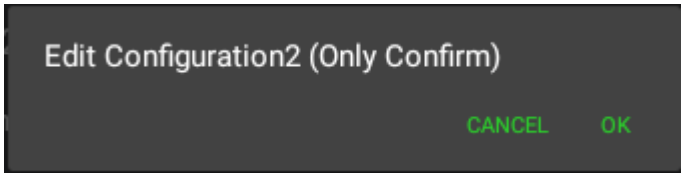


Fig.86 – Only Confirm

If the modification permission is “Password Confirm”, the value can be modified after entering the correct password. The management password is “318” as default, it can be modified via PC and the password input box is as follows:

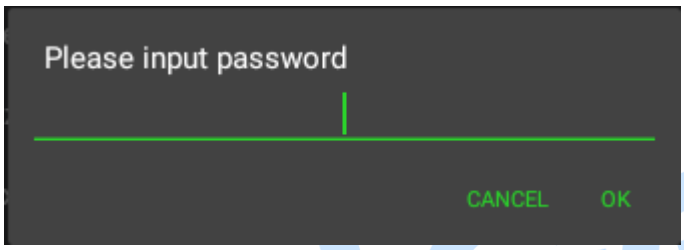


Fig.87 – Password Confirm

4.2.10 COLOR SETTING

The color value and name and be preset. The system automatically assigns serial number to each color value, it starts from 1. According to the floating-point computation value, the corresponding color value can be selected.

Add the setting as the following figure, if the computation is 2, the corresponsing color value is “Alarm Color”.

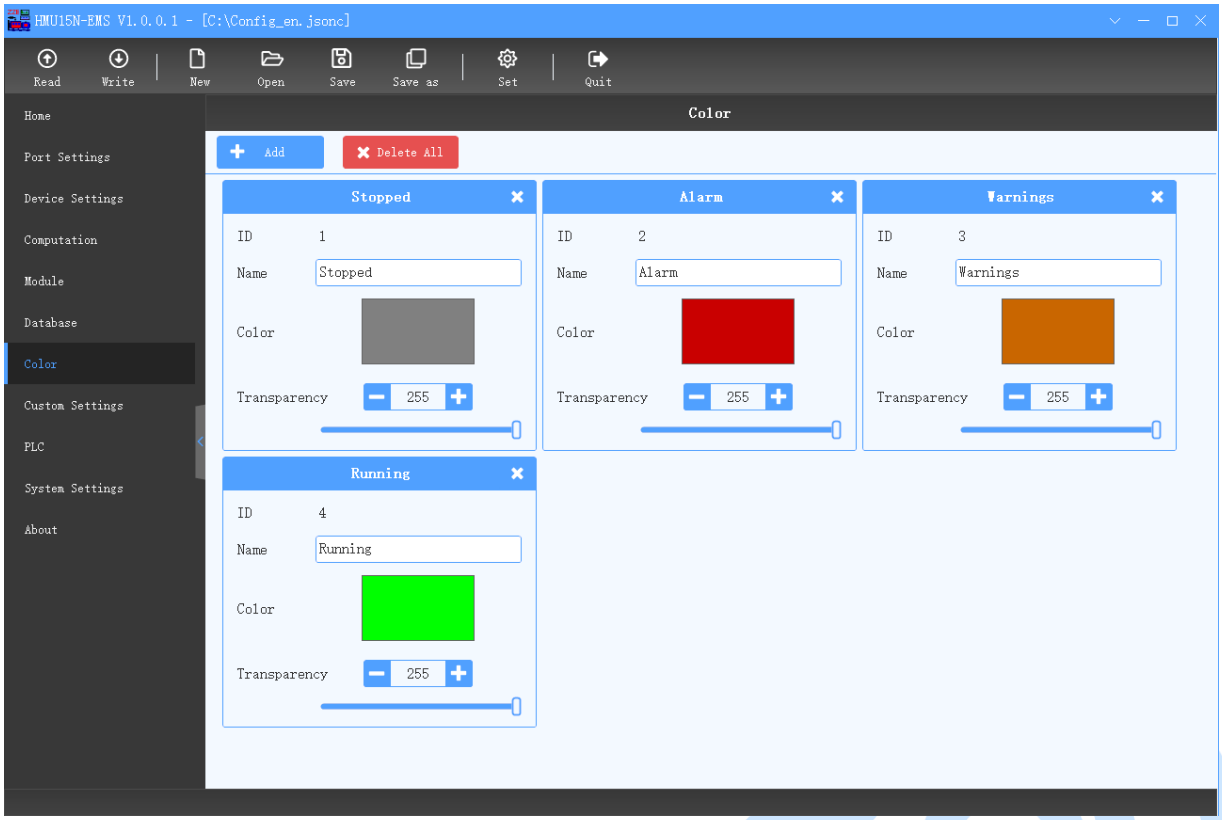


Fig.88 – Color Management

4.2.11 PLC INTRODUCTION

As the introduction of the above section, after the communication establishement between PC and external device, the real-time data is obtained continuously, including various parameters, running status, alarm information, etc, which is converted into the computation and displayed on slave computer to realized the remote monitoring of the external device.

Through the PLC logic operation, the computation, internal variables and settings can be converted to each other to control the display of the slave computer, and can be sent to the external device the Modbus request to realize the remote control of external device, which is more flexible and convenient to meet the business requirements.

4.2.11.1 PLC EDITING INTERFACE

PLC editing interface is divided into condition area, action area, setting area and logic editing area, as shown below:

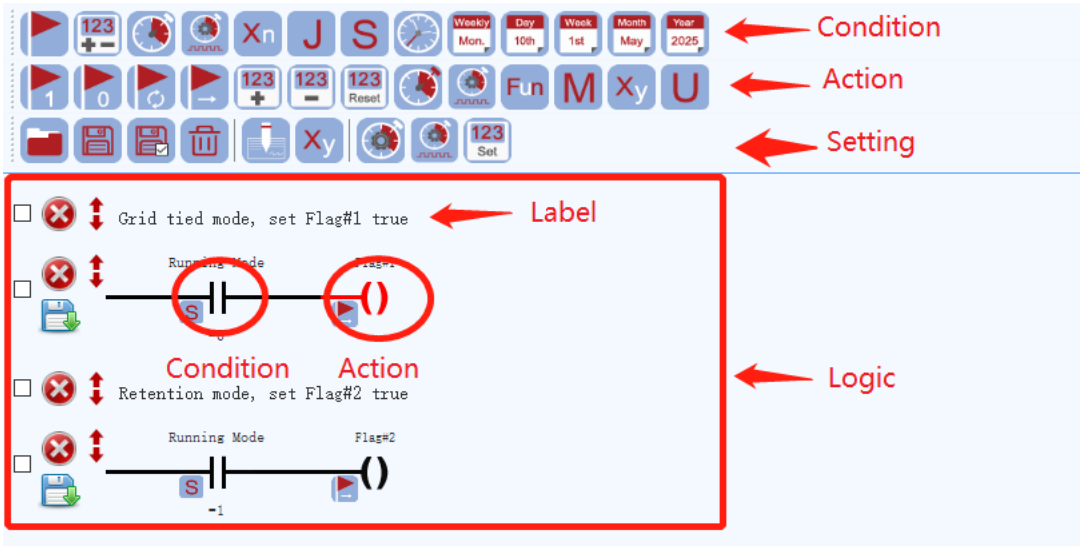
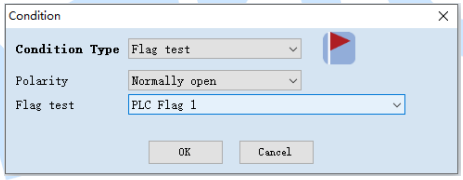
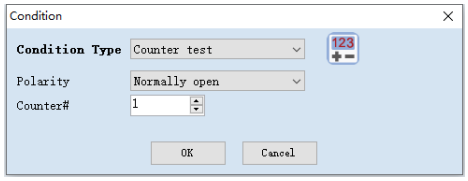
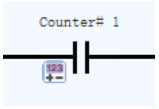
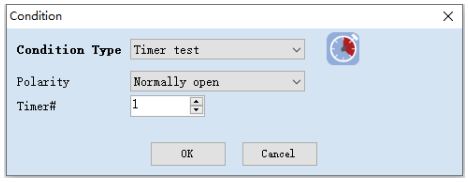
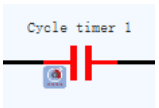


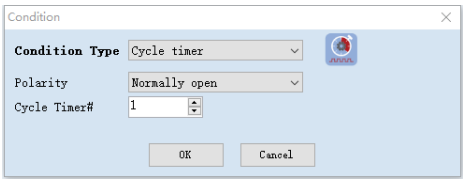
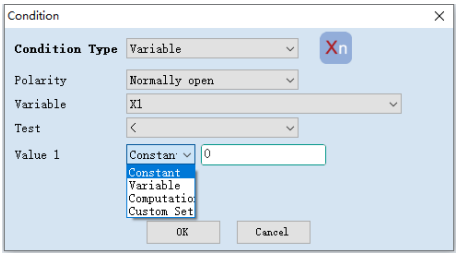
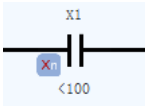
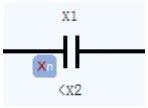
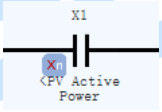
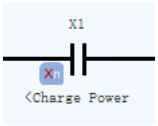
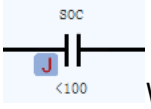
Fig.89 – PLC Editing Interface

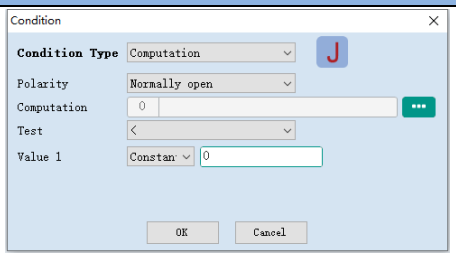
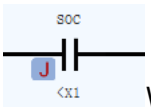
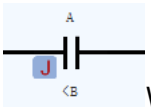
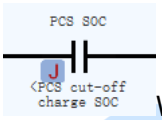
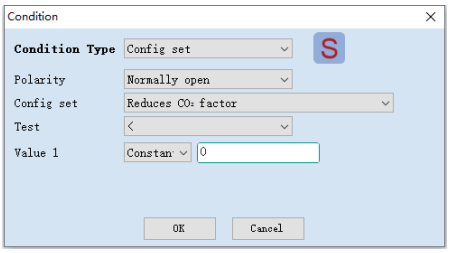
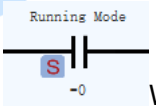
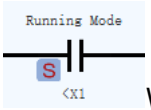
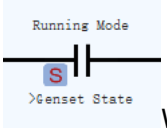
4.2.11.2 CONDITIONAL ELEMENTS

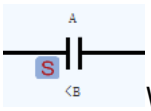
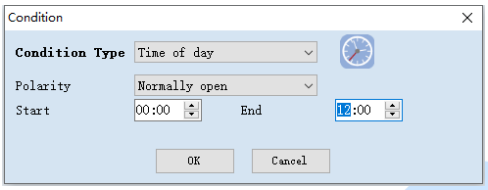
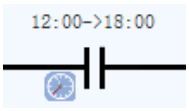
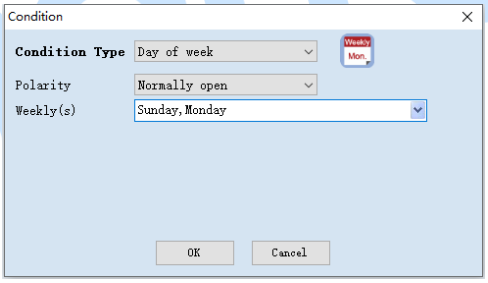
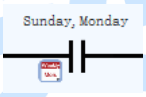
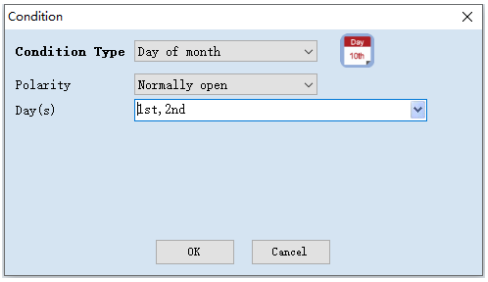
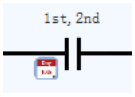
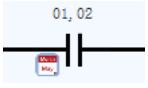
Drag the corresponding condition icon to the logic editing area for logical editing. The conditional elements are shown as the following table:

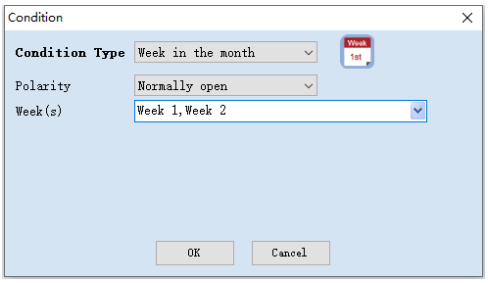
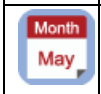
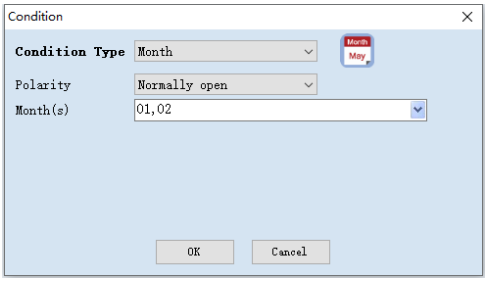
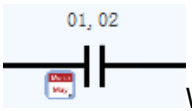
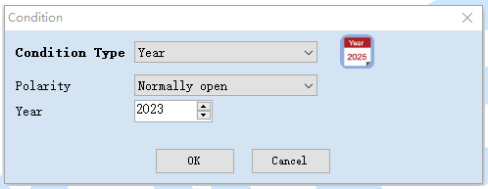
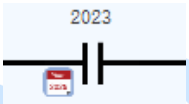
Table 8 – Elements of PLC Conditional Area

Icon	Condition Name	Description	Example
	Flag	To test whether the flag is valid. 	 When Flag 1 is true, condtion is valid; otherwise the condition is invalid.
	Counter	To test wheter the counter value reaches the set value. Click on  of the setting area to set the counter. 	 When the value of Counter 1 reaches the set value, condition is valid; otherwise the condtion is invalid.
	Timer	To test whether the delay time of timer reaches the set value. Click on  of setting area to set the timer. 	 When the delay time of Timer 1 reaches the set value, condition is valid, otherwise the condition is invalid.
	Cycle Timer	To test whether the cycle timer and positive pulse reach the set value.Click on  of setting area to set the value	 When the delay

Icon	Condition Name	Description	Example
		of cycle timer. 	time of Cycle Timer 1 is less than the set value of positive pulse time, condition is valid; otherwise the condtion is invalid.
Xn	Internal Variable	To test whether the internal variable meets the set condtions, and can be compared with the internal variable, settings, computation, constant in pairs. 	 When internal variable X1 is less than constant 100, condition is valid; otherwise condition is invalid.  When internal variable X1 is less than the value of X2, condition is valid; otherwise the condition is invalid.  When internal variable X1 is less than the active power value of computaion, condition is valid; otherwise the condition is invalid.  When internal variable X1 is less than the charging power value of custom setting, condition is valid; otherwise the condition is invalid.
J	Computation	To test whether the computation meets the set condtions, floating-point type and string (value) type are supported, and can be compared with the internal variable, settings, computation, constant in pairs.	 When the value of computation SOC is less than the constant 100, condition is valid; otherwise the condition is invalid.

Icon	Condition Name	Description	Example
			 When the value of computation SOC is less than the value of internal variable X1, condition is valid; otherwise the condition is invalid.  When the value of compuation A is less than the value of compuation B, condition is valid; otherwise the condition is invalid.  When the value of computation SOC is less than charge SOC value, condition is valid; otherwise the condition is invalid.
S	Setting	To test whether the setting is meet the set conditions, and can be compared with the internal variable, settings, computation, constant in pairs. 	 When the value of running mode is equal to the constant value 0, condition is valid; otherwise the condition is invalid.  When the value of running mode is less than the value of internal variable X1, condition is valid; otherwise the condition is invalid.  When the value of running mode is greater than the value of genset status, condition is valid; otherwise the condition is invalid.

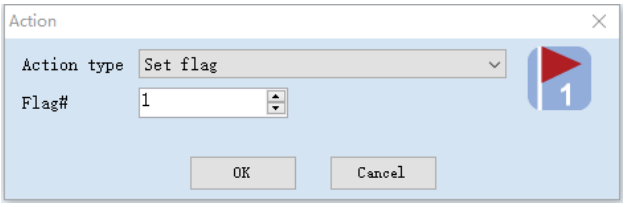
Icon	Condition Name	Description	Example
			 When the value of setting A is less than the value of setting B, condition is valid; otherwise the condition is invalid.
	Time	To test whether the current time meets the specific time period of setting, including start time,but not the end time. The start time should be earlier than the end time, and both of them should be on the same day. 	 When the time of slave computer is between 12:00 and 18:00, condition is valid; otherwise the condition is invalid.
	Week	To test whether the time of the day meets the condition of the specific day. 	 When the day of slave computer is Sunday or Monday, condition is valid; otherwise the condition is invalid.
	日期 Date	To test whether the current date meets the conditon of specific date. 	 When the date of slave computer is the first or second day of each month, condition is valid; otherwise the condition is invalid.
	Week No.	To test whether the number of current week of a month meets the set number condition.	 When the date of slave computer is the first or second week of each month, condition is valid; otherwise the condition is invalid.

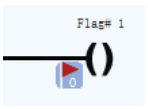
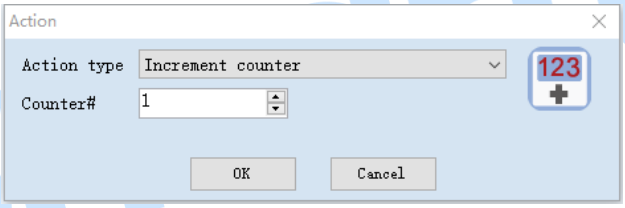
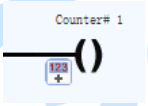
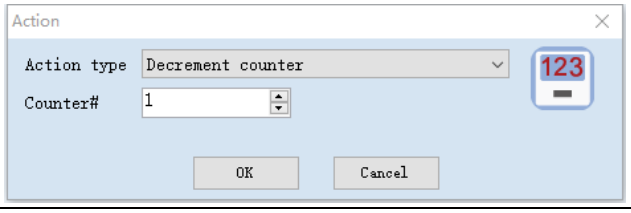
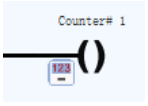
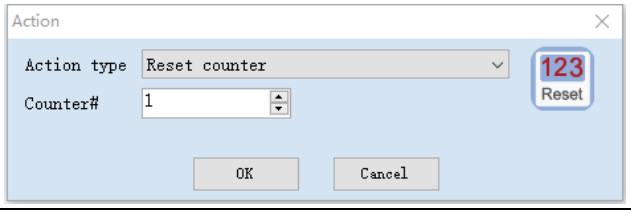
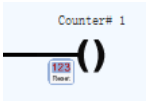
Icon	Condition Name	Description	Example
			
	Month	To test whether the current month meets the set month condition. 	 When the month of slave computer is Jan. or Feb., condition is valid; otherwise the condition is invalid.
	Year	To test whether the current year meets the set year condition. 	 When the year of slave computer is 2023, condition is valid; otherwise the condition is invalid.

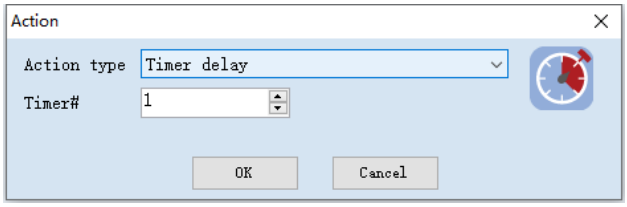
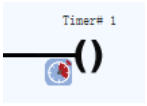
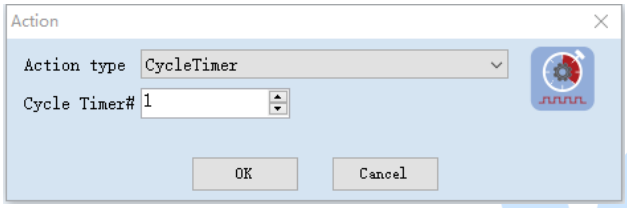
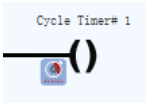
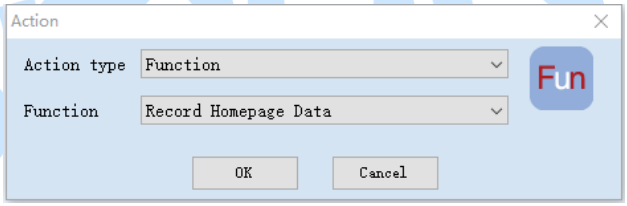
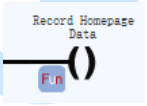
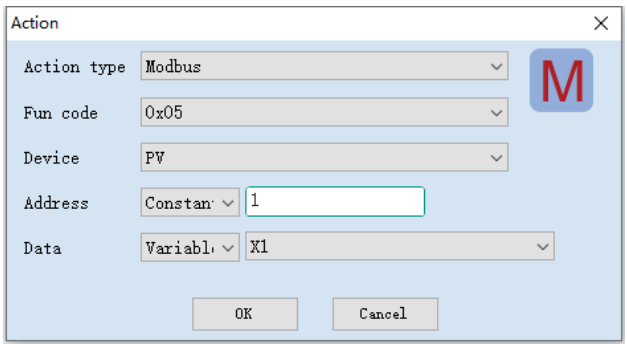
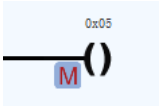
4.2.11.3 ELEMENTS OF ACTION AREA

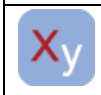
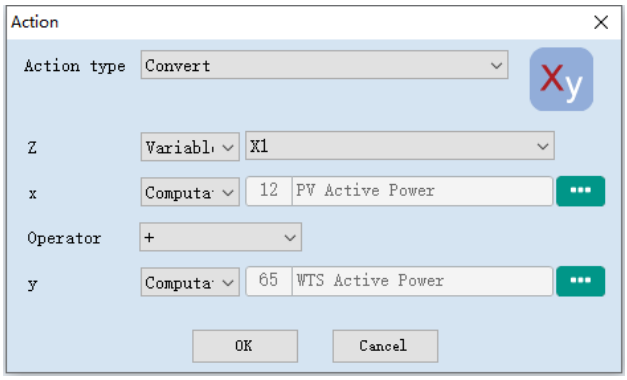
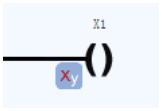
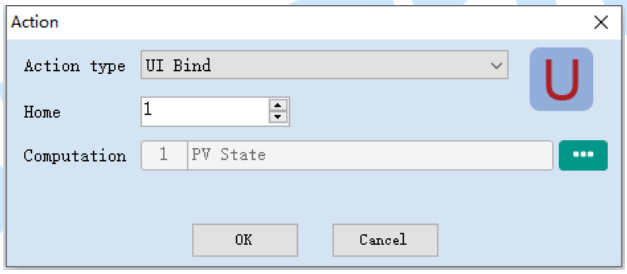
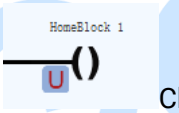
Drag the corresponding action icon to the logic editing area for logical editing. The logic conditon can have multiple logic actions.

Table 9 – Elements of PLC Action Area

Icon	Action Description	Example
	Action: Set flag to 1. Trigger Mode: Triggered when condition is valid. 	 Act when condition is valid: set flag to 1; act when condition is invalid: flag keeps the original state.
	Action: Set flag to 0. Trigger Mode: Triggered when condition is valid. 	 Act when condition is valid: set flag to 0; act when condition is invalid: flag keeps the original state.

Icon	Action Description	Example
	Action: Toggle flag (if the original flag is 1,it turns to 0; if the original flag is 0, it turns to 1.). Trigger Mode: Triggered when condition changes from invalid to valid (edge trigger) . 	 Act when condition changes from invalid to valid: toggle flag.
	Action: Drive flag (set flag to 1 when condition is avtive; set flag to 0 when condition is invalid). Trigger Mode: Triggered when condition are valid and invalid. 	 Act when condtion is valid: set flag to 1; act when condition is invalid: set flag to 0.
	Action: Add 1 to the counter. Trigger Mode: Triggered when condition changes from invalid to valid (edge trigger). 	 Act when condition changes from invalid to valid: counter increases by 1.
	Action: Minus 1 to the counter. Trigger Mode: Triggered when condition changes from invalid to valid (edge trigger). 	 Act when condition changes from invalid to valid: counter minus by 1.
	Action: Rest counter (reset the value of the counter to 0). Trigger Mode: Triggered when then condition is valid. 	 Act when condition is valid: reset the counter, and the value of counter is reset to 0.

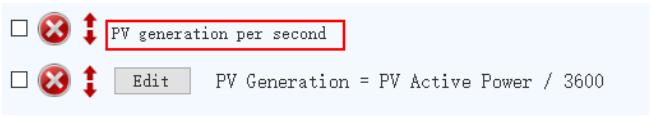
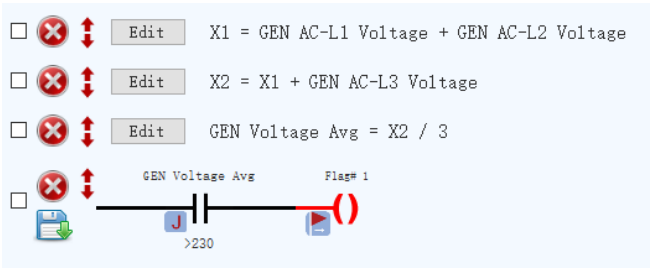
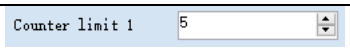
Icon	Action Description	Example
	Action: Drive delay (timer keeps working if condition is valid; timer stops delay when condition is invalid, and resets the timer to 0.) Trigger Mode: Triggered when the conditions are valid and invalid. 	 Act when condition is valid: timer continuous keeps working; act when condition is invalid: timer stops delay and resets to 0.
	Action: To trigger cycle timer (the cycle timer continuous keeps working if condition is valid: the cycle timer stops delay when the condition is invalid, and resets to 0). Trigger Mode: Triggered when condition is valid. 	 Act when condition is valid: the cycle timer is cycle working: act when condition is invalid: cycle timer stops deay and resets to 0.
	Action: To trigger function (trigger function when condition is valid). Trigger Mode: Triggered when condition is valid. 	 Executes the selected function when condition is valid. Optional functions include: 1)Record the homepae data, and the minimum recording interval is 500ms 2)Turn on the buzzer and the alarm indicator is flashing 3）Turn off the buzzer and the alarm indicator is distinguished.
	Action: Send the Modbus request to external device. Trigger Mode: Triggered when condition changes from invalid to valid(edge trigger).  Optional Function Code: 0x05、0x06、0x10.	 Send the Modbus request to external device when condition changes from invalid to valid.

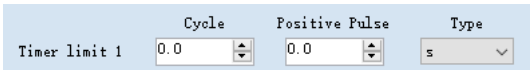
Icon	Action Description	Example
	Address and data can be filled in constant, or use the computation, settings , internal variable value (floating-point is strongly coverted to integer).	
	Action: numerical conversion and conversions among computation, internal variable and settings in pairs. Trigger Mode: Triggered when condition is valid.  X, Y are parameters, Z is the output value, X, Y, Z are floating-point types.	 Conversions among computation, internal variable and settings in pairs when condition is valid.
	Action: Interface binding, to change the computation bound to the homepage energy flow. Trigger Mode: Triggered when condition is valid.  The homepage is the sequence number of energy flow, see section 4.2.5.1.2.	 Change the computation bound to the energy flow of homepage when the condition is valid.

4.2.11.4 ELEMENTS OF SETTING AREA

It can open, save, delete the PLC configuration, add label and variable change, set counter, timer and cycle timer.

Table 10 – Elements of PLC Setting Area

Icon	Description	Example
	Open: Click the icon to open the edited PLC file.	
	Save: Save all the logic editing areas to PLC file.	
	Selected Save Save the selected logic code to PLC file.	
	Clear: Clear the logic editing area.	
	Save the Single Line: Save the PLC logic of the line to PLC file.	
	Move: Drag up and down to change the position of the PLC logic in the whole PLC logic.	
	Delete: Delete the line.	
	Label: Drag the icon to logic editing area for labeling. Save the comments or notes about the PLC logic in this section.	 As shown in the red box.
	Numerical Conversion: Drag the icon to logic editing area for adding the conversions among computation, internal variable and settings in pairs.	 X1 and X2 are internal variables, Gen Ua, Gen Ub, Gen Uc and average voltage are computations.
	Counter Setting: Click icon to set the counter, and there are 100 built-in counters.	 Set the upper limit times of Counter 1 is 5.

Icon	Description	Example
	Timmer Setting: Click the icon to set the timer, and there are 100 built-in timers, the type can be s or min.	 设置定时器 1 的延时时间为 10.0s。 Set the delay time of Time 1 as 10.0s.
	Cycle Timer Setting: Click the icon to set the cycle timer, there are 100 built-in cycle timers, the type can be s or min.	 Set the cycle time of the timer as 10.0s, and the positive pulse as 1s.

4.2.11.5 LOGIC INTRODUCTION

4. 2. 11. 5. 1 "OR" LOGIC

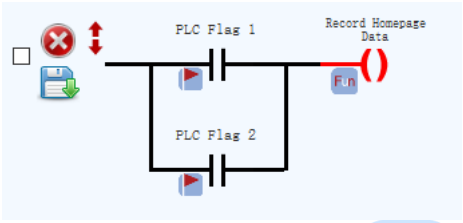


Fig.90 – "OR" Logic

When flag 1 is true or flag 2 is true, perform the function.

4. 2. 11. 5. 2 "AND" LOGIC

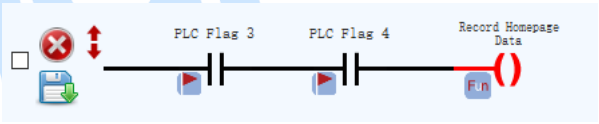


Fig.91 – "AND" Logic

When flag 3 is true and flag 4 is true, perform the function.

4. 2. 11. 5. 3 "NOT" LOGIC

Fig.92 – "Not" Logic

When flag 5 is false, perform this function.

4. 2. 11. 5. 4 COMBINATION LOGIC

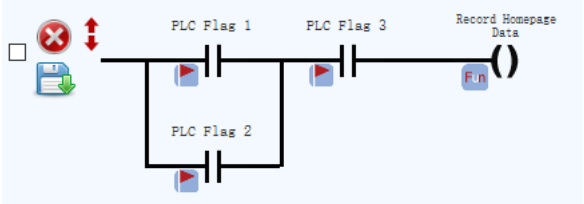


Fig.93 – Combination Logic

In the state when flag 3 is true, flag 1 is true or flag 2 is true, perform this function.

4.2.11.6 APPLICATION EXAMPLES

Suppose the service logic is as follows: system is composed of PV1, PCS1, BMS1, Mains 1, Wind 1, Load 1.

Grid-tied Running

In grid-tied operation, PV and wind energy are always at the highest power generation.

Safety Power Running Mode

The goal is to make the energy storage as the backup power supply, which could support a maximum power supply time during the whole micro-grid is in off-grid running mode due to the failure of external power grid.

Table 11 – Safety Power Mode

SOC >= 98%	SOC < 95%
PCS stop charging	PCS start charging

Zero-carbon Economy Running Mode

The goal is to use PV, wind, storage energy as the clear energy to the fullest and to supply power for load at the demand.

If the total output of the three energy sources is less than the load, the differential load will be supplied by external grid. Meanwhile, considering the peak and off-peak hours of the power price, the charge and discharge of energy storage will be economically scheduled to realize the zero-carbon economy running of the system.

Table 12 – Zero-carbon Economy Mode

<table>
<tr><td rowspan="2"></td><td colspan="2">PV + Wind Energy >= Load</td><td colspan="2">PV + Wind Energy < Load</td></tr>
<tr><td>SOC >= 95%</td><td>SOC < 95%</td><td>SOC > 10%</td><td>SOC <= 10%</td></tr>
<tr><td>Valley Power
2:00-4:00
11:00-17:00</td><td rowspan="3">Excess Power is connected to the grid.</td><td rowspan="3">Charging
The charging power is the excess power.</td><td rowspan="3">Discharging
The discharging power is the load power – PV power – wind power</td><td rowspan="3">No charging and discharging.</td></tr>
<tr><td>Flat Power
0:00-2:00
4:00-7:00
10:00-11:00
17:00-18:00</td></tr>
<tr><td>Peak Power
7:00-10:00
18:00-24:00</td></tr>
<tr><td>Uniform Recharge
16:00-17:00</td><td colspan="4">SOC < 40%, full power 100kW charge;
SOC >= 40%, No recharge.</td></tr>
</table>

Off-grid Running

The off-grid mode operation only happened during special circumstances (such as trips of external grid maintenance power failure, overcurrent, short circuit, voltage loss protection)

Table 13 – Off-grid Mode

PV + Wind Energy >= Load		PV + Wind Energy < Load	
SOC >= 98%	SOC < 98%	SOC > 10%	SOC <= 10%
To limit the power generation, first to limit the wind energy, then to limit the PV.	Charging Full power generation of PV and wind energy	Discharging Full power energy of PV and wind energy	Storage energy at rest, and the whole system is power off.

The PLC logic figure is shown as below:

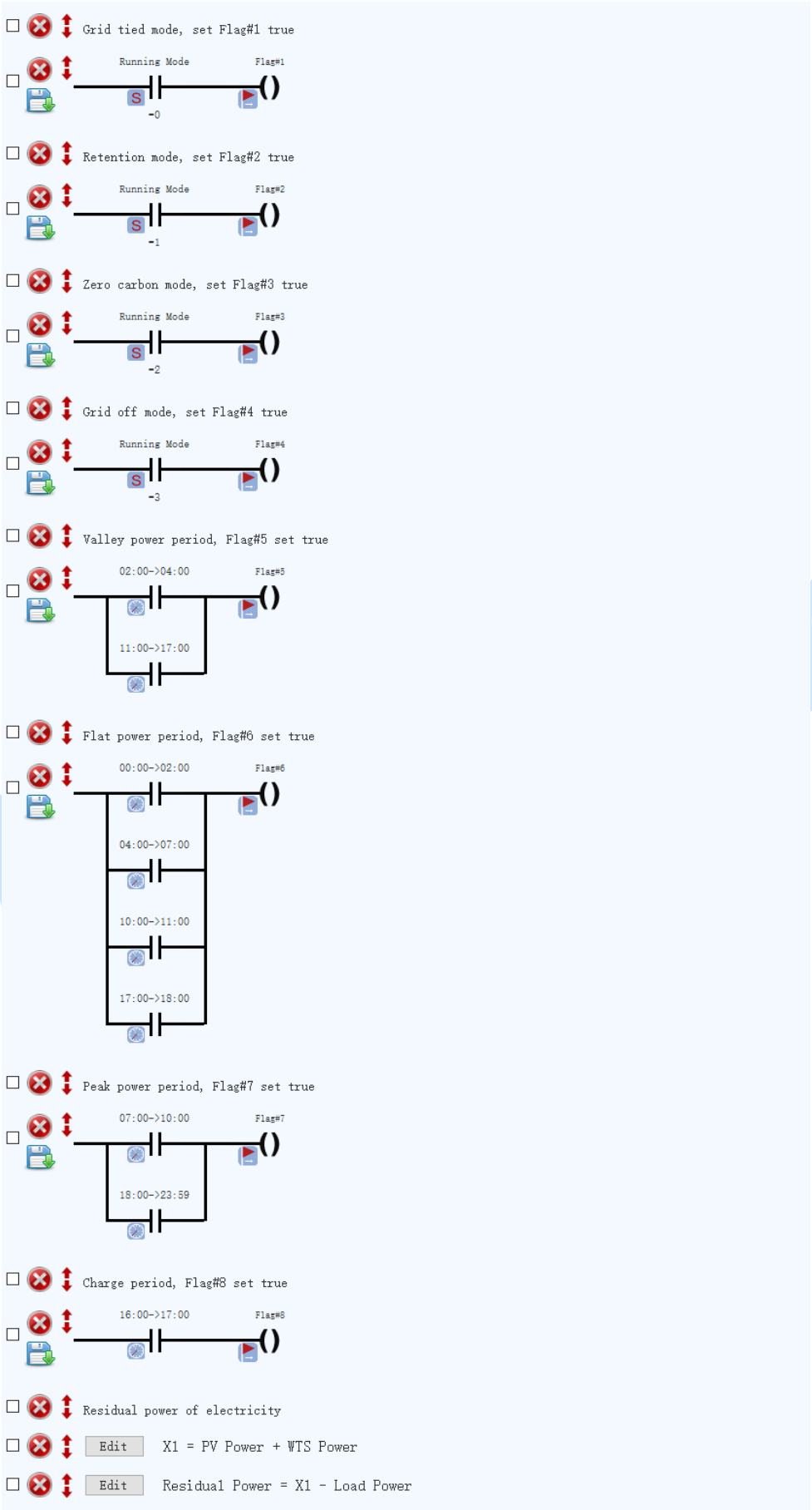


Fig.94 – PLC Logic Example (Part 1)

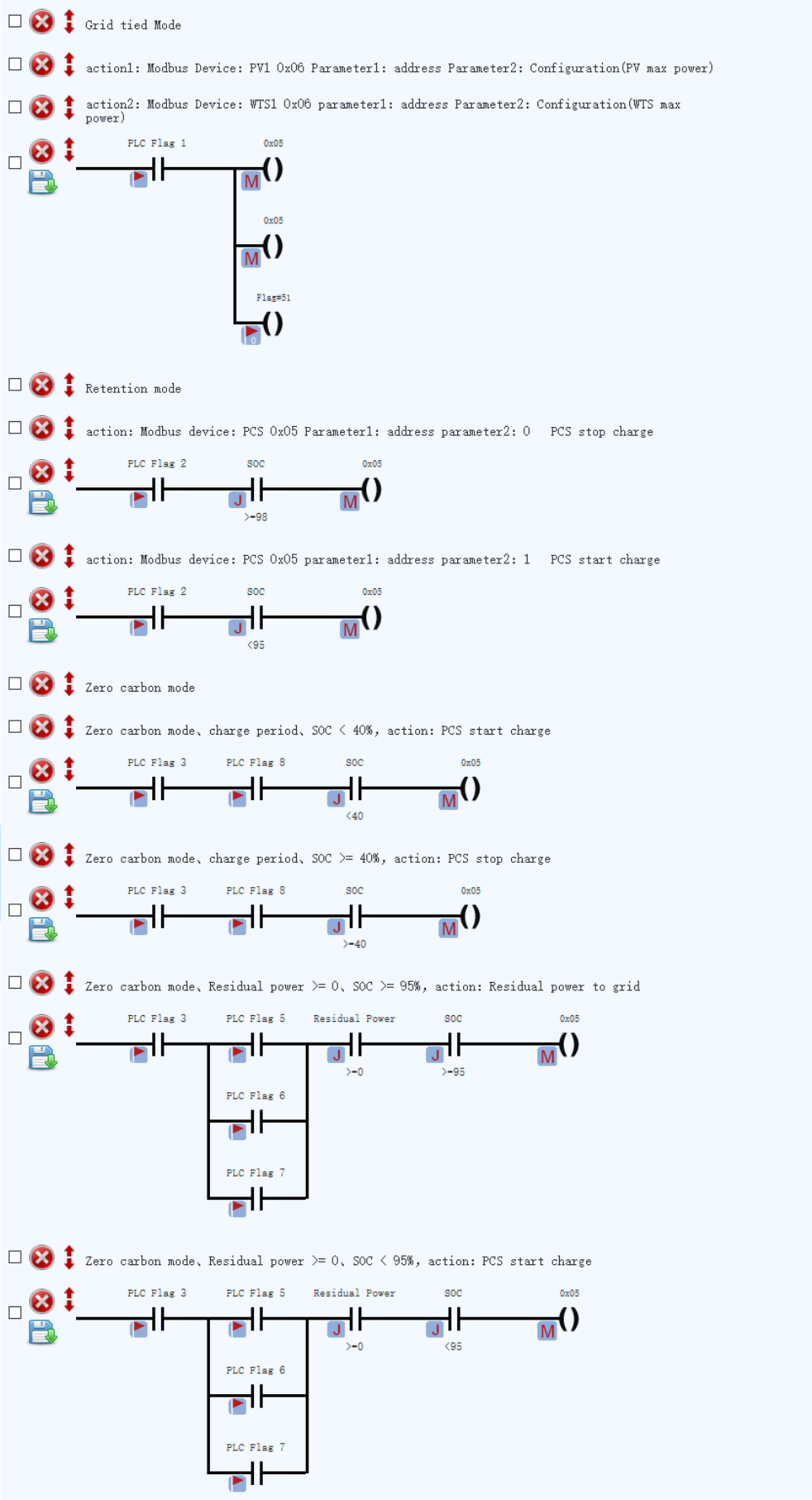


Fig.95 – PLC Logic Example (Part 2)

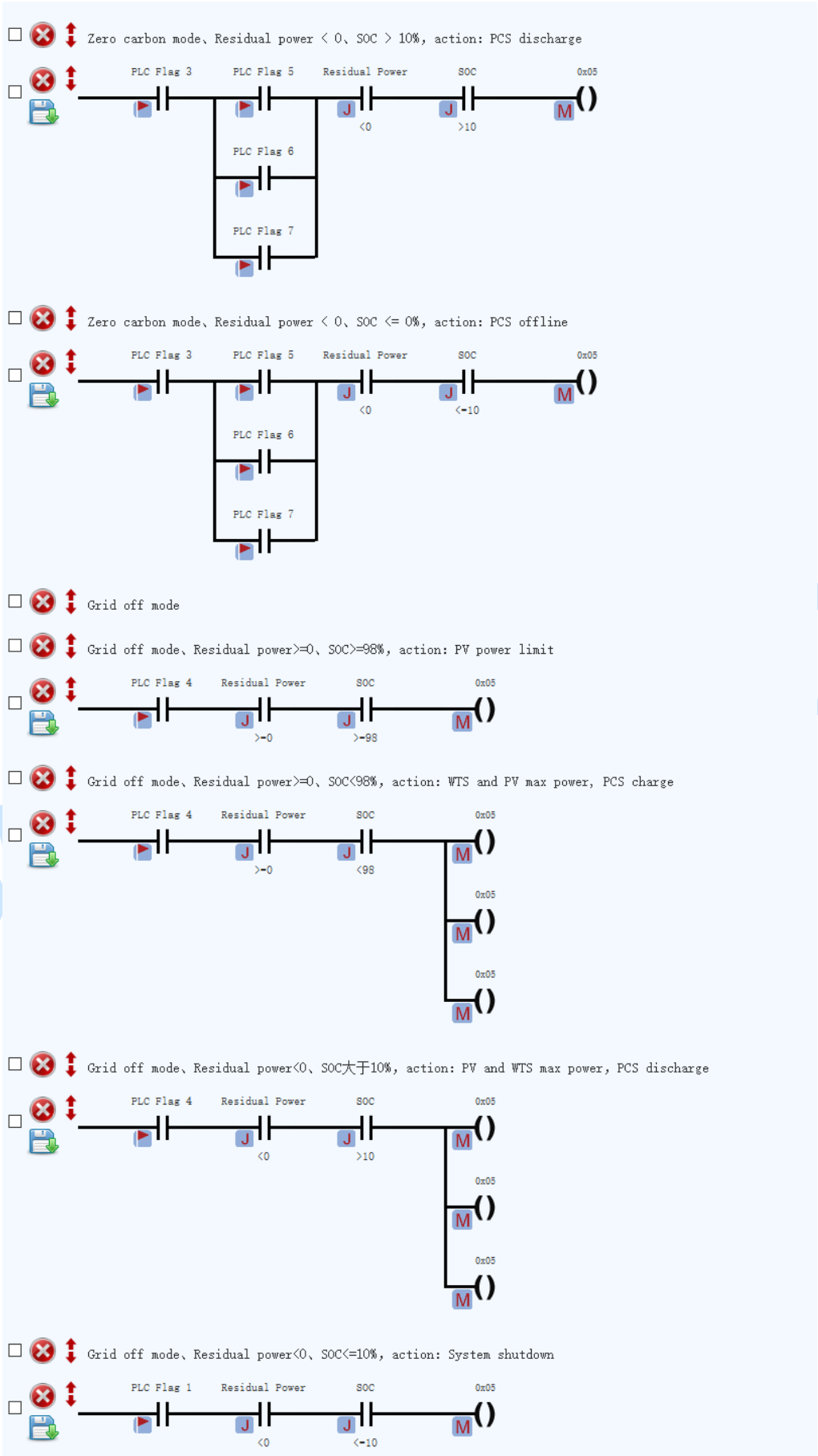


Fig.96 – PLC Logic Example (Part 3)

4.2.12 DEBUG MODE

Display the status of flag ,computation, settings, internal variable, counter, timer and cycle timer of PLC in real-time.

4. 2. 12. 1. 1 FLAGS

As shown in the figure below, there are 100 flags, the green boder means the flag is used in PLC, and the green filling means that the flag is used in PLC and the status is true.

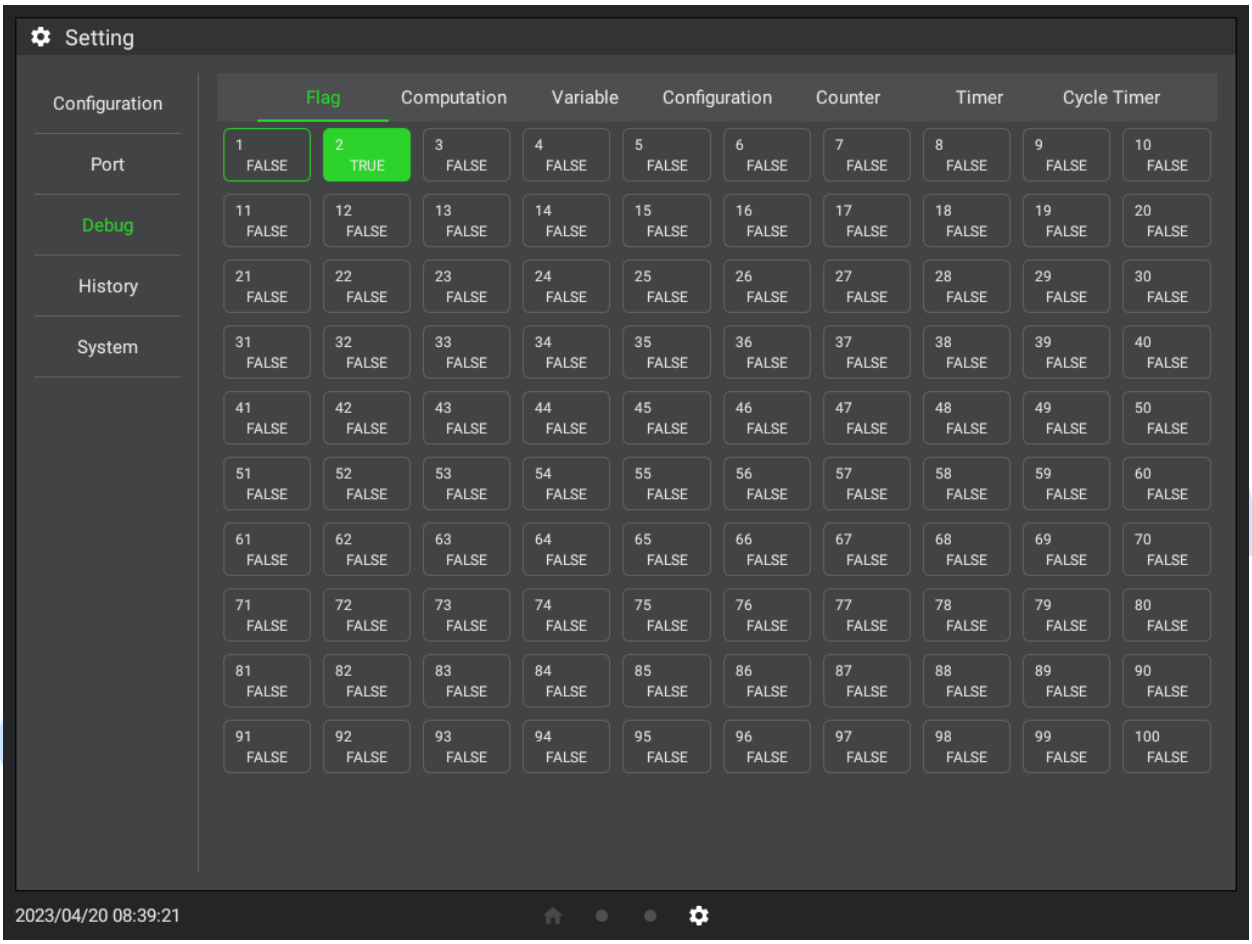


Fig.97 – Flags

4.2.12.2 COMPUTATION

As shown in the figure below, each item displays computation ID, device name (if bound to device), computation name, current value, and the green border means that the computation is used in PLC.

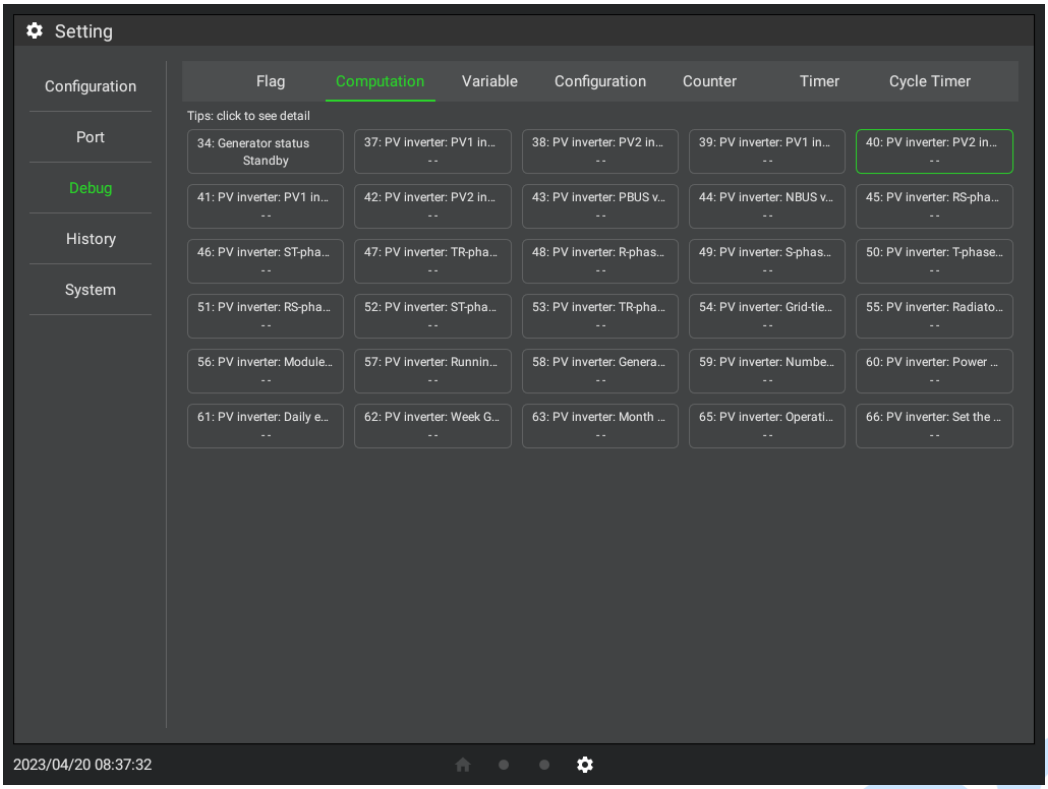


Fig.98 – Computation

Click it to display the computation details, and the floating-point type is shown as the following figure:

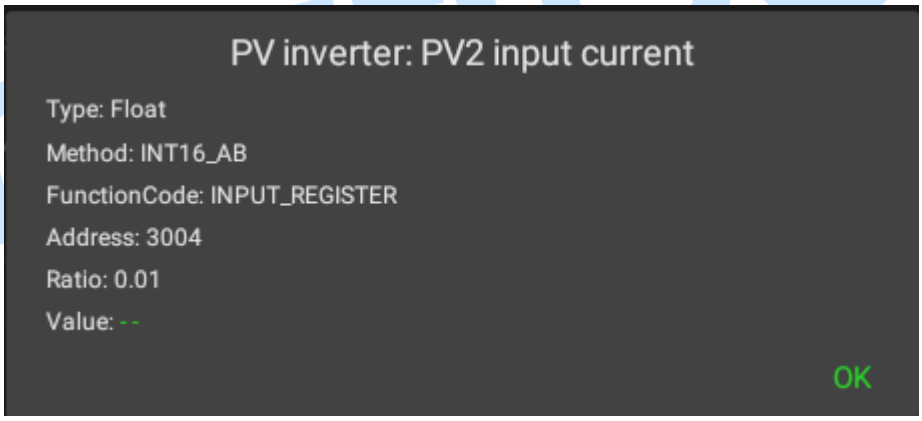


Fig.99 – Floating-point Type Computation

The string (value) type is shown as the following figure, including value and its corresponding string, the green is the current value:

Fig.100 – String (Value) Type Computation

The string (bit) type is shown as the following figure, including register address, bits and its corresponding string, the green is the current bit:

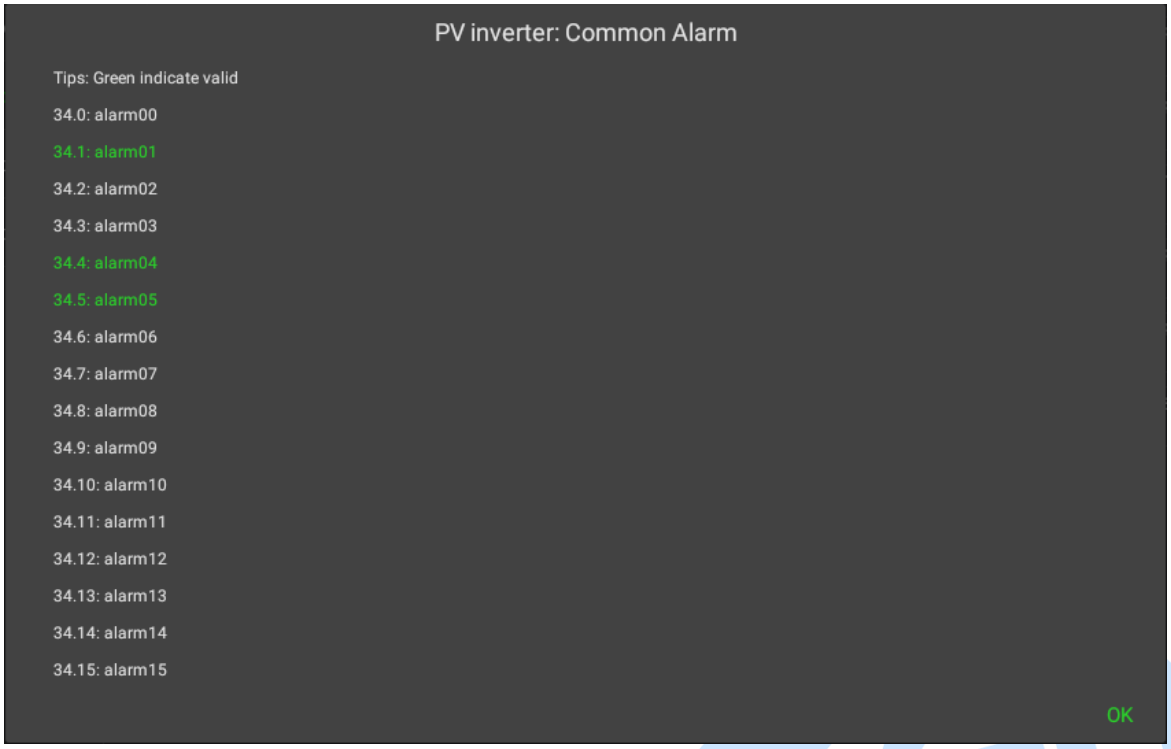


Fig.101 – String (bit) Type Computation

4.2.12.3 SETTINGS

As shown below, each item displays the setting ID, name, current value, and the green border means the setting is used in PLC.

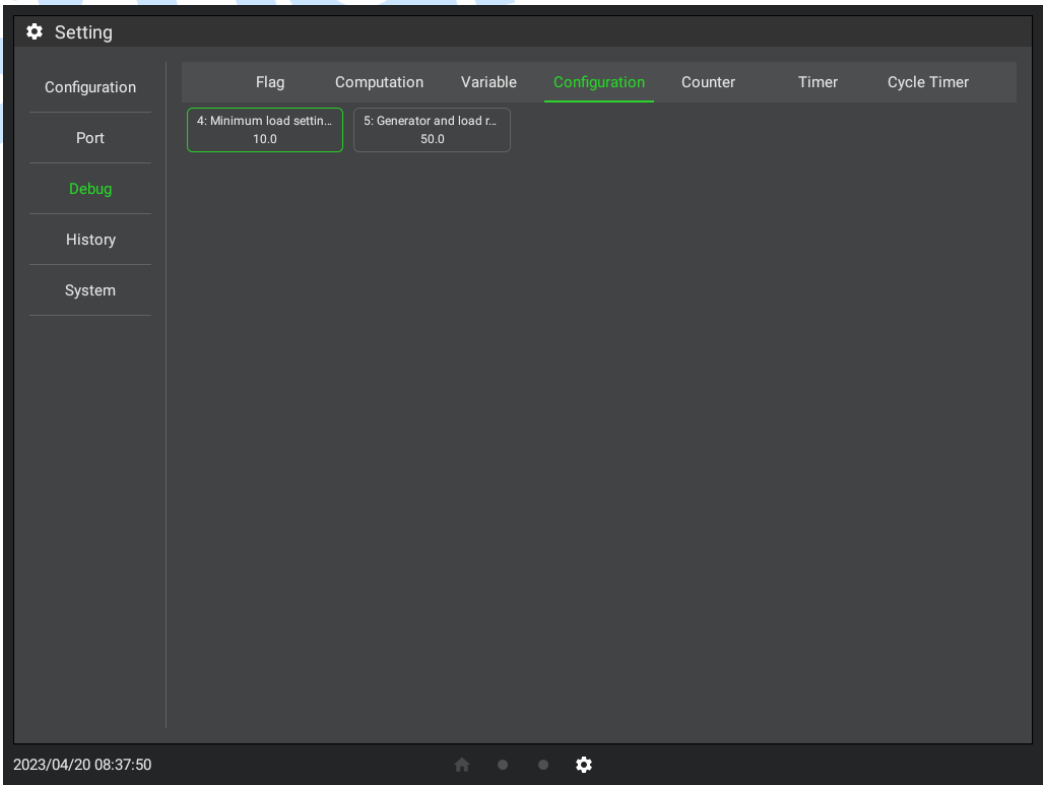


Fig.102 – Settings

4.2.12.4 INTERNAL VARIABLE

There are 100 internal variables and the default value is 0. The green border means the parameter is used in PLC.

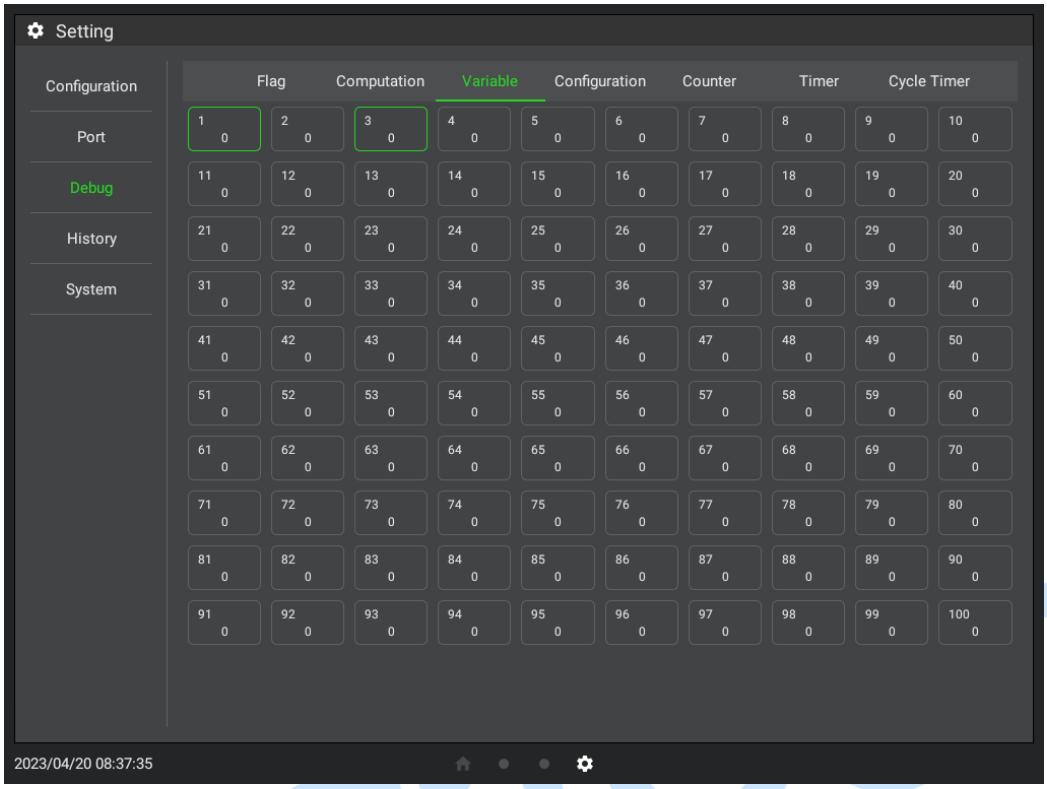


Fig.103 – Internal Variable

4.2.12.5 COUNTER

There are 100 counters, each item displays the set value and the current value of the counter. The green border means the counter is used in PLC, the green filling means the counter is used in PLC and the counter value reaches to the set value, shown as the following figure:

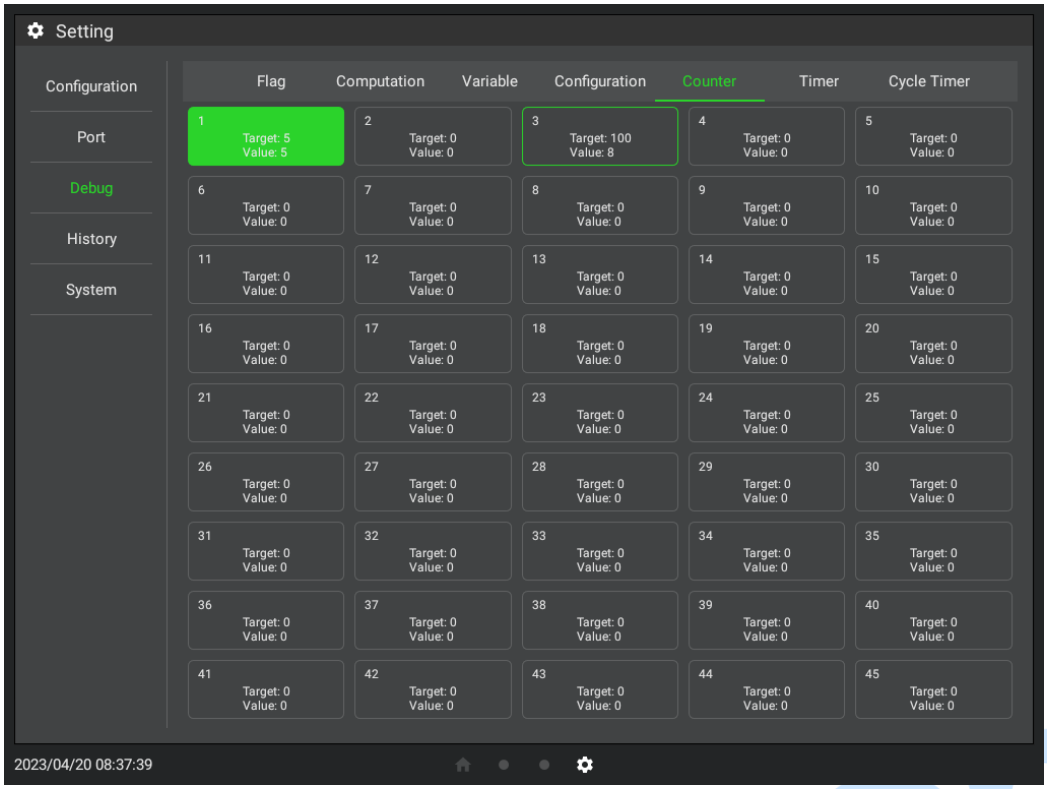


Fig.104 – Counter

4.2.12.6 TIMER

There are 100 timers, each item displays the set value and the current value of the timer. The green border means the timer is used in PLC, the green filling means the timer is used in PLC and the delay time reaches to the set value, shown as the following figure:

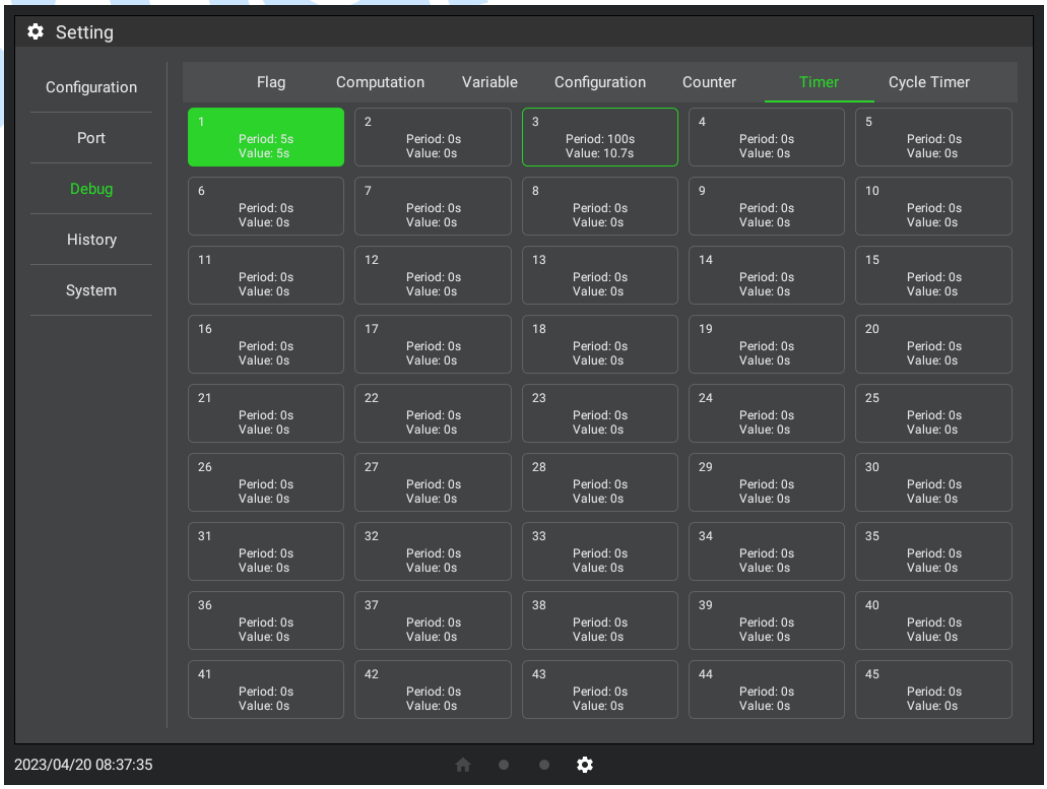


Fig.105 – Timer

4.2.12.7 CYCLE TIMER

There are 100 cycle timers, each item displays the set value, curren value, positive pulse set value of the cycle timer. The green border means the cycle timer is used in PLC, and the green filling means the cycle timer is used in PLC and the delay time is less than the positive pulse set value, shown as the following figure:

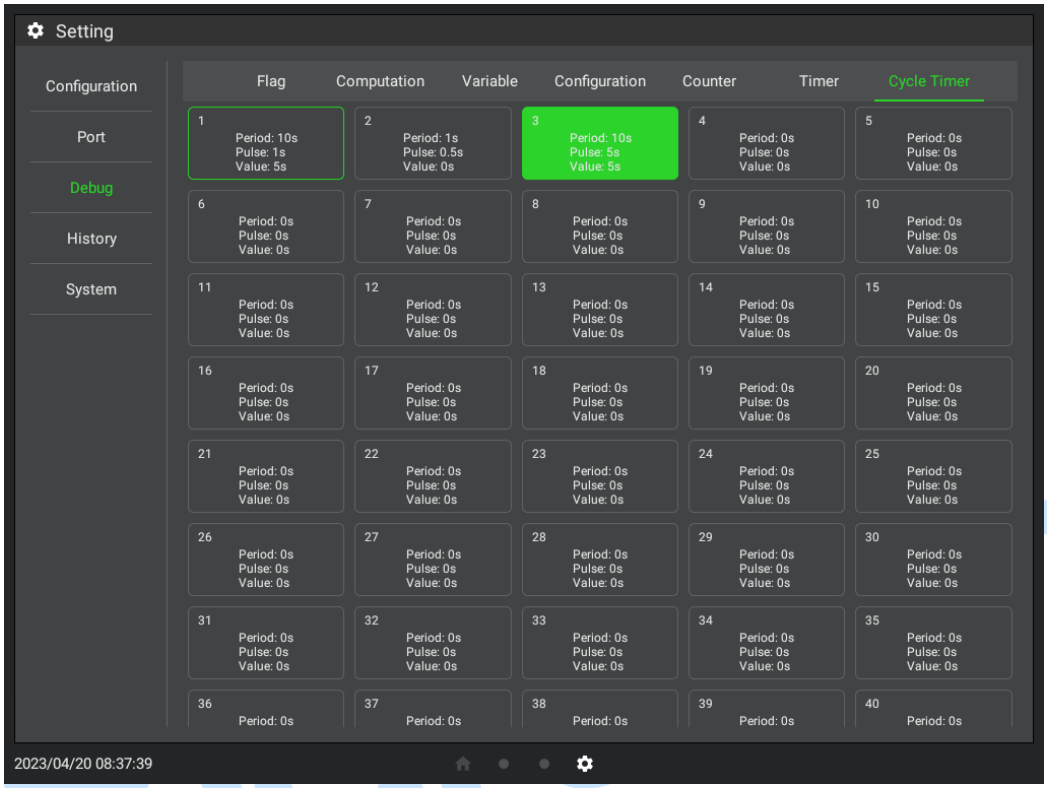


Fig.106 – Cycle Timer

4.2.13 EVENT LOG

Event log includes the operation records of manual modification of settings, port setting, system setting and homepage data snapshots automatically recorded in PLC. Up to 10000 piecs of data are supported to be saved in a local database, which can be exported by a USB flash drive. As shown below:

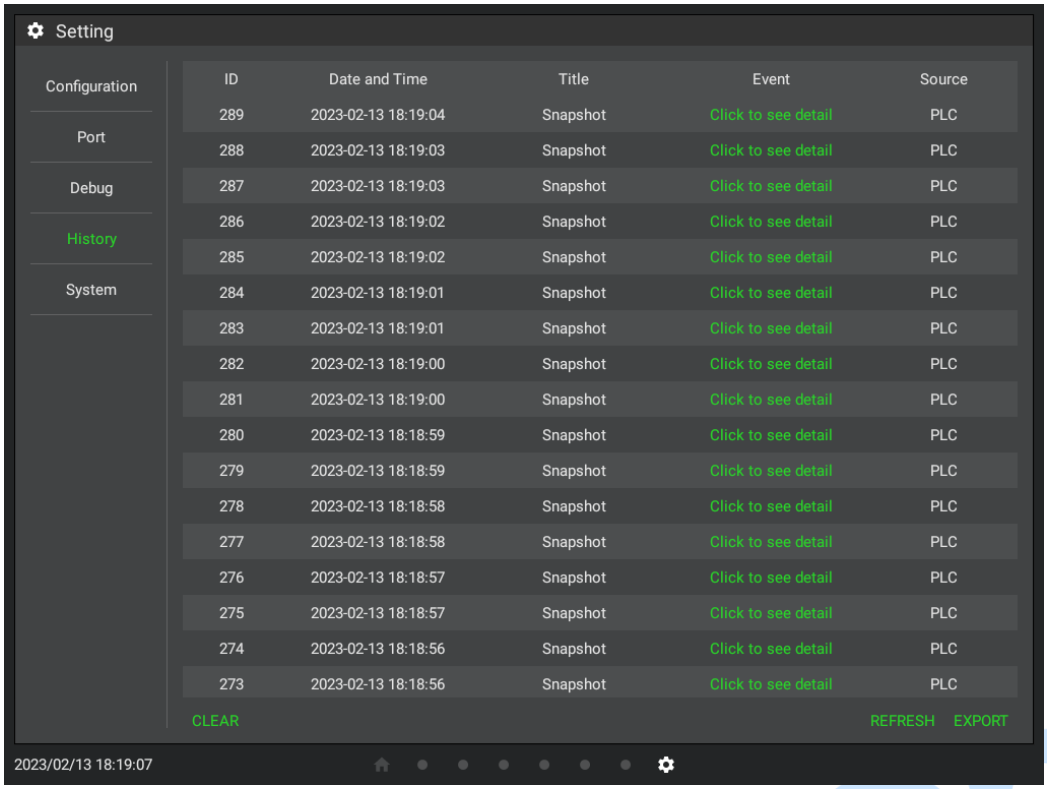


Fig.107 – Event Log

Click “Clear” to clear up all the historical data and click “Refresh” to obtain the latest historical data.

After connecting the USB flash drive, click “Export” to export the historical records, the export operation supports the data with a maximum of one month. Note: The partition table of USB flash drive must be in MBR format and file system must be FAT32 format.

Click “ View Details” to display the data of snapshot, including the homepage data and settings, shown as the following figure:

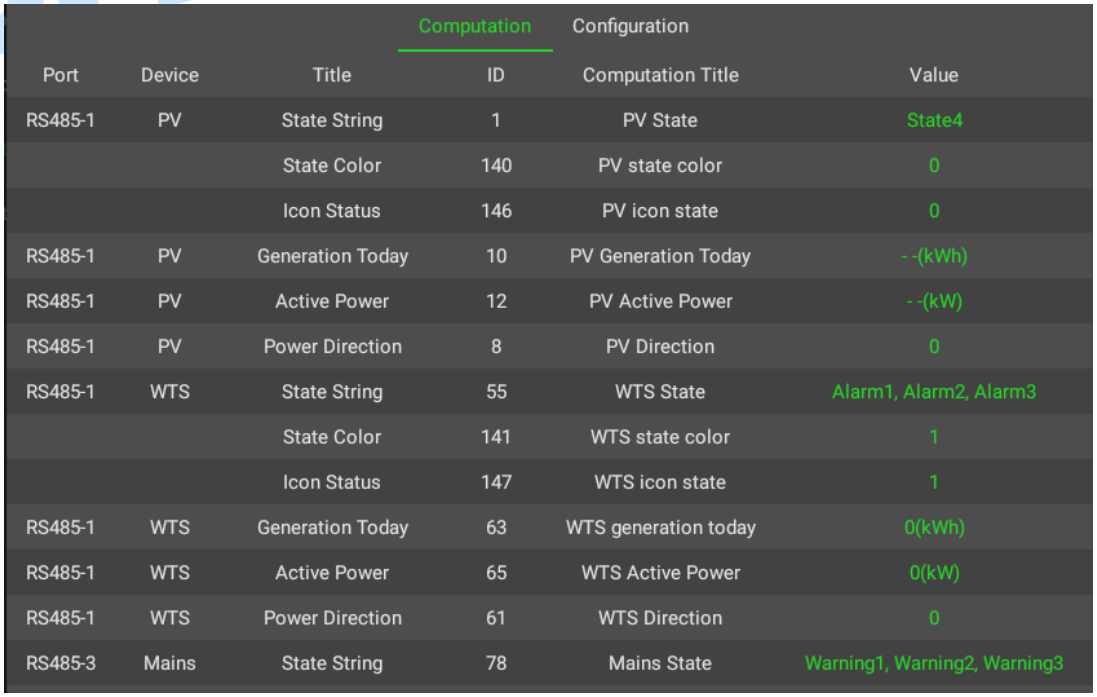


Fig.108 – Event Log

4.2.14 SYSTEM SETTING

The system settings include date and time, buzzer switch, distance sensor switch, automatic brightness switch, manual brightness ajustment and software update, shown as the following figure:

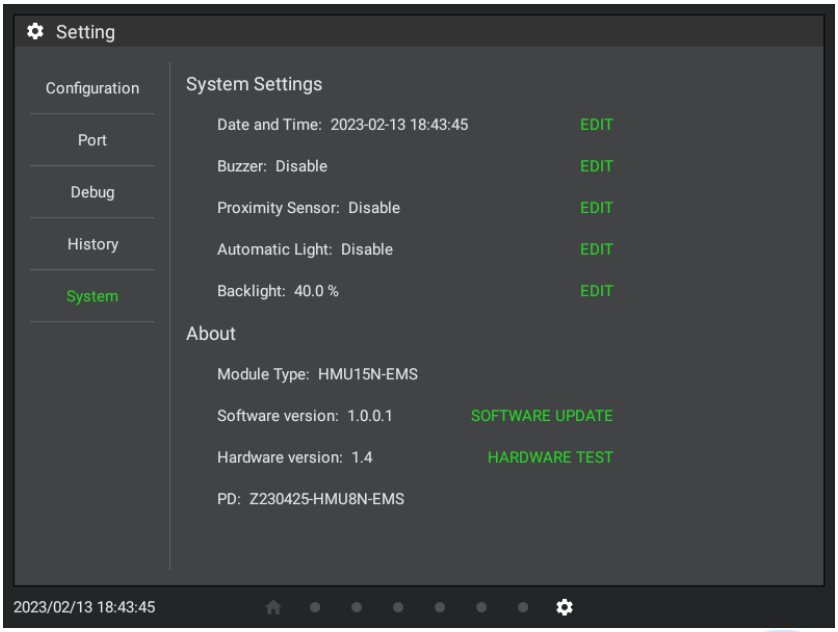


Fig.109 – System Settings

After the buzzer is enabled, the buzzer can be turned on or turned off by the function in PLC.

When distance sensor is enabled, if no one is in front of the screen for 60s within 1.5m, the screen brightness will decrease to the lowest level.

After the automatic brightness is enabled, the system will automatically adjust the screen brightness according to the environment. If manually adjust the brightness, the automatic brightness function will be disabled.

Update the software: save the updated file into U flash drive, click " Update Software" and enter the management password to pop up the menu of U flash drive, as shown below. Select and click update file to update the program. The default mangement password is 318, which could be changed through PC.

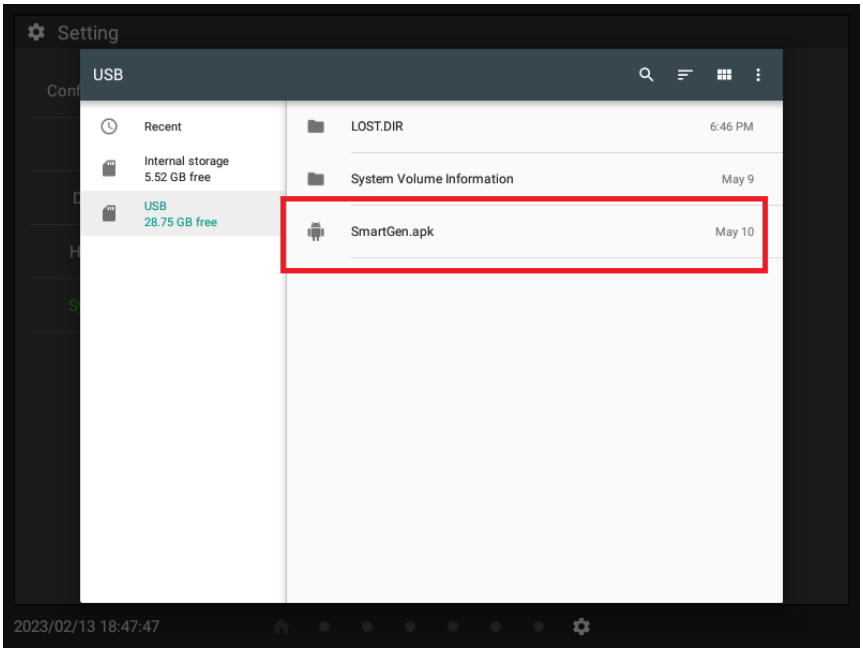


Fig.110 – Update Software

5 WIRING CONNECTION

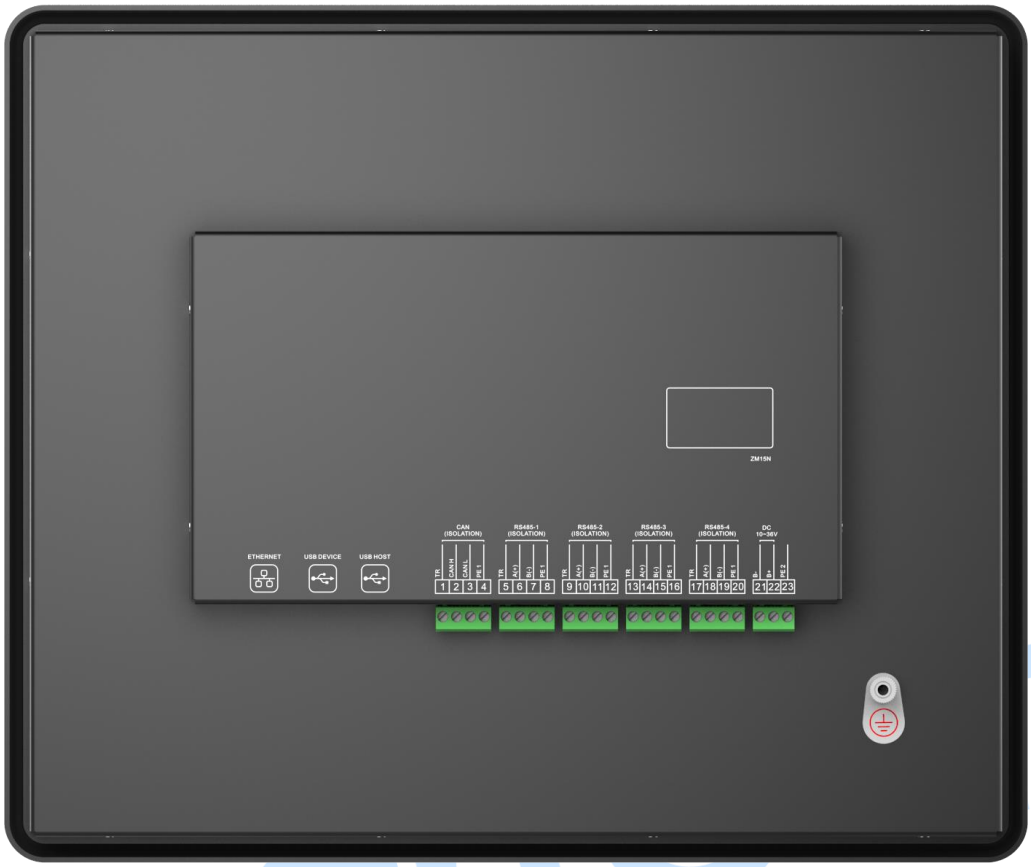


Fig.111 – Back Panel Drawing

Table 14 – Terminal Connection Description

No.	Function	Cable Size	Description
1	Terminal Matching Resistance (120Ω)	/	Impedance-120Ω shielding wire is recommended and its single end grounded.
2	CAN H	0.5 mm^2	
3	CAN L	0.5 mm^2	
4	PE1	/	
5	Terminal Matching Resistance (120Ω)	/	Impedance-120Ω shielding wire is recommended and its single end grounded.
6	RS485A-1(+)	0.5 mm^2	
7	RS485B-1(-)	0.5 mm^2	
8	PE2	/	
9	Terminal Matching Resistance (120Ω)	/	Impedance-120Ω shielding wire is recommended and its single end grounded.
10	RS485A- 2(+)	0.5 mm^2	
11	RS485B- 2(-)	0.5 mm^2	
12	PE3	/	
13	Terminal Matching Resistance (120Ω)	/	Impedance-120Ω shielding wire is recommended and its single end grounded.
14	RS485A- 3(+)	0.5 mm^2	
15	RS485B- 3(-)	0.5 mm^2	
16	PE4	/	

No.	Function	Cable Size	Description
17	Terminal Matching Resistance (120Ω)	/	Impedance-120Ω shielding wire is recommended and its single end grounded.
18	RS485-4A(+)	0.5 mm²	
19	RS485-4B(-)	0.5 mm²	
20	PE5	/	
21	B-	1.0 mm²	Connect to battery negative.
22	B+	1.0 mm²	Connect to battery positive.
23	PE	/	

Note 1: ETHERNET port can be directly connected to conntroller via network cable, or multiple controllers via a switch. The default IP address of touch screen is 192.168.0.111, and the IP address of controller must be in the same network segment but different from that of big screen.

Note 2: USB-HOST is used for rapid upgrade and data export of the USB flash drive. The partition table of the USB flash drive must be in the MBR format and the file system must be in FAT32 format.

Note 3: USB-DEVICE port is used to connect PC to upgrade the firmware. There are two pinholes on the left side of the big screen, the upper one is RESET key and the lower one is MODE key.

The upgrade steps are as follows:

1. Power on the monitoring screen;
2. Press the MODE key;
3. Press the RESET key;
4. Release the RESET key;
5. Release the MODE key, and then the touch screen enters the burning mode;
6. Connect to PC via USB-DEVICE of the big screen;
7. Decompress the upgrade package, and double-click the file of "**mftool2.vbs**";
8. If "Vendor-defined device in line with HID standard" appears, it indicates a successful identification.

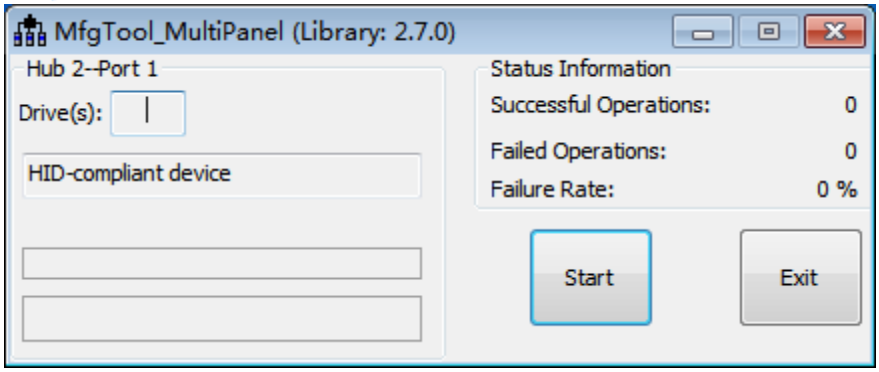


Fig.112 – Burn Mode

9. Click "Start" button to start burning the image, click "Stop" to stop burning after successful burning, and click "Exit" to exit the burning software;

10. Disconnect the big screen from the PC, press the RESET button and release it to restart the big screen.

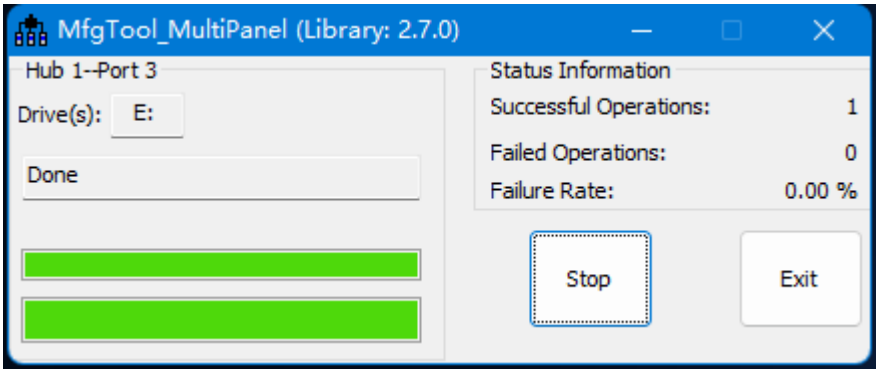


Fig.113 – Successful Firmware Upgrade

6 TYPICAL APPLICATION

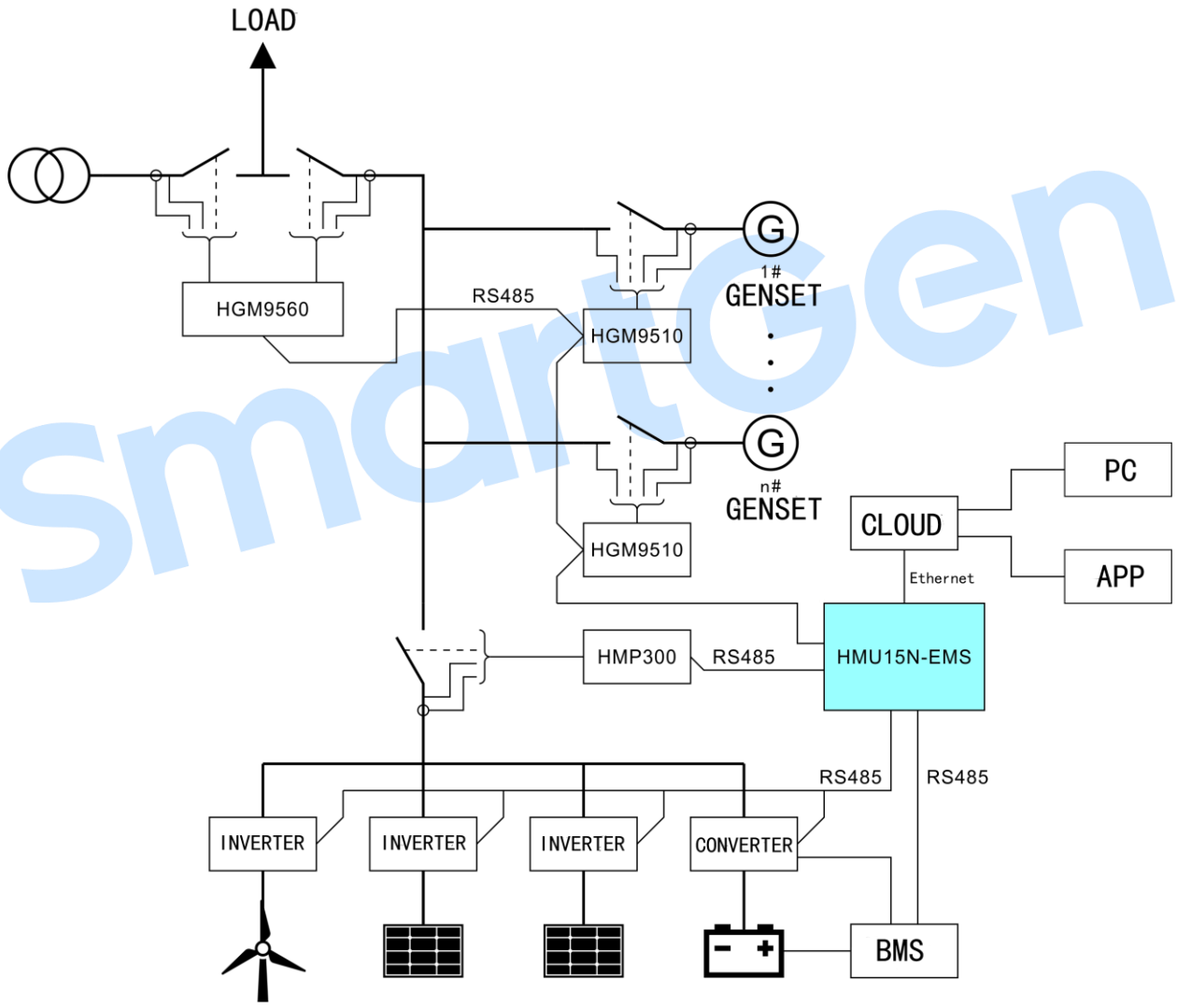


Fig.114 – Typical Application Diagram

7 OVERALL DIMENSIONS AND PANEL CUTOUT

Unit:mm

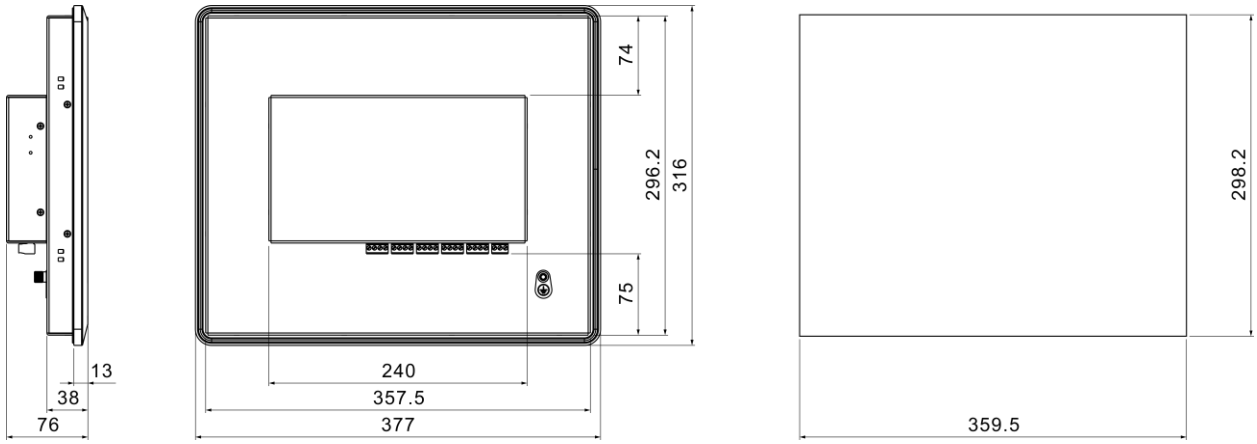


Fig.115 – Overall Dimensions and Panel Cutout

8 TROUBLE SHOOTING

Check whether the PC network adapter connection speed and duplex mode are 100Mbps full duplex;

Check whether the PC network and HMU15N-EMS are on the same network segment;

Check whether the IP address and port set by PC are the same with HMU15N-EMS;

Check the baud rate, stop bit, parity bit of RS485 port are correct or not;

Check whether the register address, number and timeout period of the device message are correct;

Check Whether the communication address and calculation method of the computation are correct;

Check whether the partition table of the USB flash drive is in MBR format and the file system is in FAT32 format;

Ensure that all cable connectors are firmly connected to HMU15N-EMS;

Please do not press the display screen of HMU15N-EMS with force or hard object.