

FR-DCMG DC System Monitor User Manual (V2.0)

Fonrich (Shanghai) New Energy Technology Co.,Ltd

Address: 1st Floor, Building 5, No.999 Jiangyue Road, Minhang District,Shanghai

Zip Code: 201112

Web: www.fonrich.com

Email: support@fonrich.com, sales@fonrich.com

Service Hotline: +86-21-60717303

Table of contents




Table of contents

I , Important Safety Instructions.....	3
II , Product Brief.....	4
III Mechanical Dimensions & Structure.....	5
FR-DCMG-MMPA /FR-DCMG-MMPB /FR-DCMG-MMPT Main Unit.....	5
FR-DCMG-HS4A /FR-DCMG-AS4A Hall Current Sensor.....	6
FR-DCMG-HS4T /FR-DCMG-AS4T Hall Current Sensor.....	6
FR-PVMA-LHSA Leakage Current Sensor.....	7
FR-PVMG-SHTPA /FR-PVMG-SHTPT Shunt Trip Power Unit.....	7
IV, Connection of Modules and Definition of the Terminals.....	8
Connection of the hall sensor module.....	8
FR-DCMG-MMPA /FR-DCMG-MMPB /FR-DCMG-MMPT Main Unit.....	8
FR-PVMA-LHSA Leakage Current Sensor.....	9
FR-PVMG-SHTPA /FR-PVMG-SHTPT Shunt Trip Power Unit.....	10
Earth connection.....	10
V , Local Operation.....	11
Instruction of buttons operation and display interface.....	11
Mode setting.....	11
MODBUS mode.....	12
Histogram interface.....	12
Parameters setting interface.....	13
Digital displaying interface.....	14
FWB NODE mode.....	15
Histogram interface.....	15
Parameters setting interface.....	15
Digital displaying interface.....	15
FWB GATEWAY mode.....	15
Wireless node connecting status interface.....	16
Histogram interface.....	16
Digital displaying interface.....	16
Parameters setting interface.....	16
Arc Fault Detect Alarm Function.....	17
Arc Fault Detect Alarm picture.....	17
Shunt Tripping Setup Interface.....	18
VI, Definition of the Modbus Protocol.....	19
Configuration of the modbus.....	19
Description of the modbus frame.....	19
Description of the function codes.....	19
Read and write operations of the registers in bit.....	19
Read and write operations of the registers in word.....	20
Description of the registers.....	20
Description of the registers in bit.....	20
Description of the registers in word.....	26
V , Appendix.....	39
Document revision history.....	39

I , Important Safety Instructions

Please read this user manual carefully before product installation. Fonrich reserves the right to refuse warranty claims for equipment damage if the user fails to install the equipment according to the instructions in this manual.

Markings on the product

	<p>HIGH VOLTAGE: The product works with high voltages. All work on the product must only be performed as described in this document.</p>
	<p>DOUBLE INSULATION: The product protected throughout by Double Insulation.</p>
<p>CAT III</p>	<p>MEASUREMENT CATEGORY: MEASUREMENT CATEGORY is CATEGORY III .</p>
	<p>UL MARK: The product is approved by UL certification.</p>

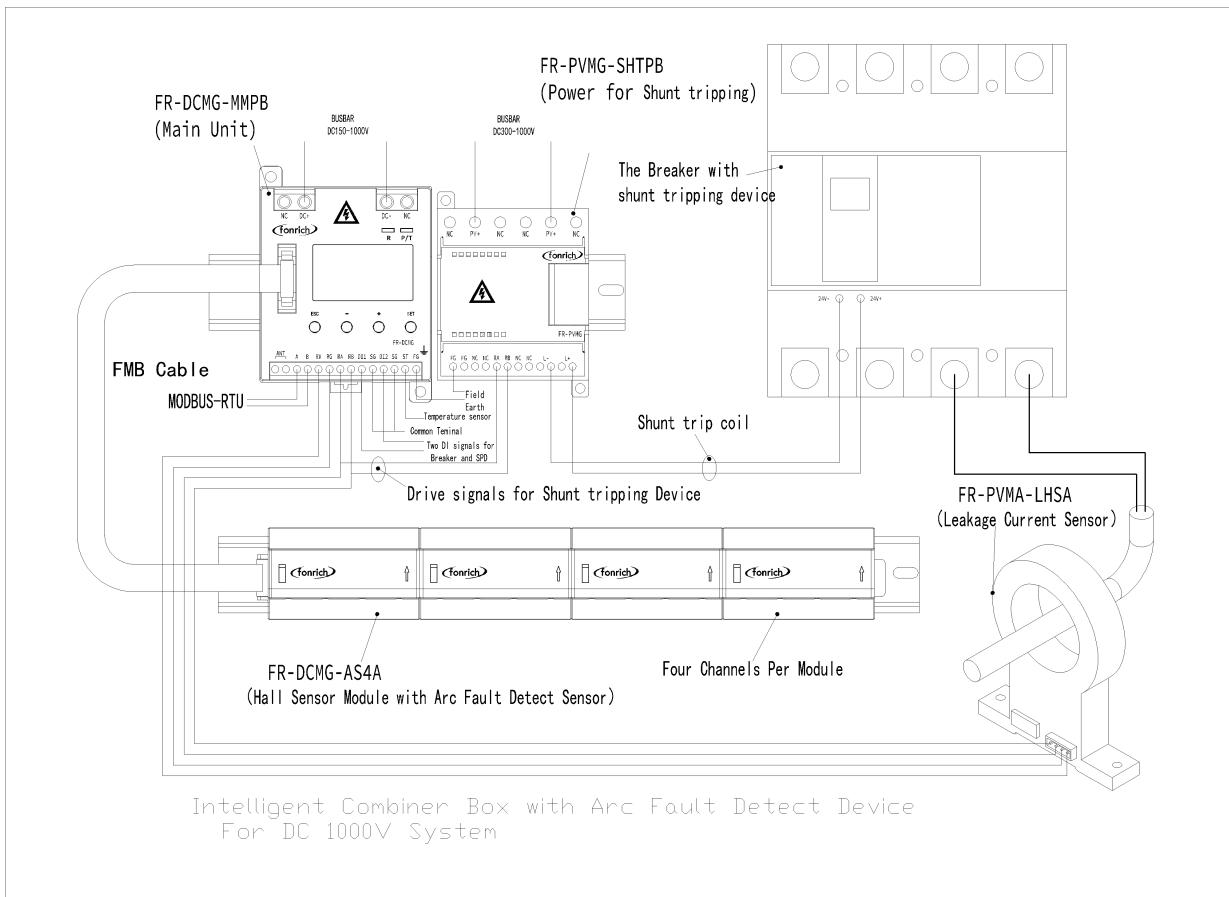
II , Product Brief

FR-DCMG is mainly used in the PV combiner box in PV power plants, to monitor the working status of every PV string and send the status data to the monitor center of the PV power plant through field bus or industrial wireless. Also a new function is detect arc fault in PV string or DC bus-bar. If detected the arc fault, the main unit will send cut-signal to power unit to drive the shunt tripping device. Then the current will cut-off, and avoid fire happen.

Main Features

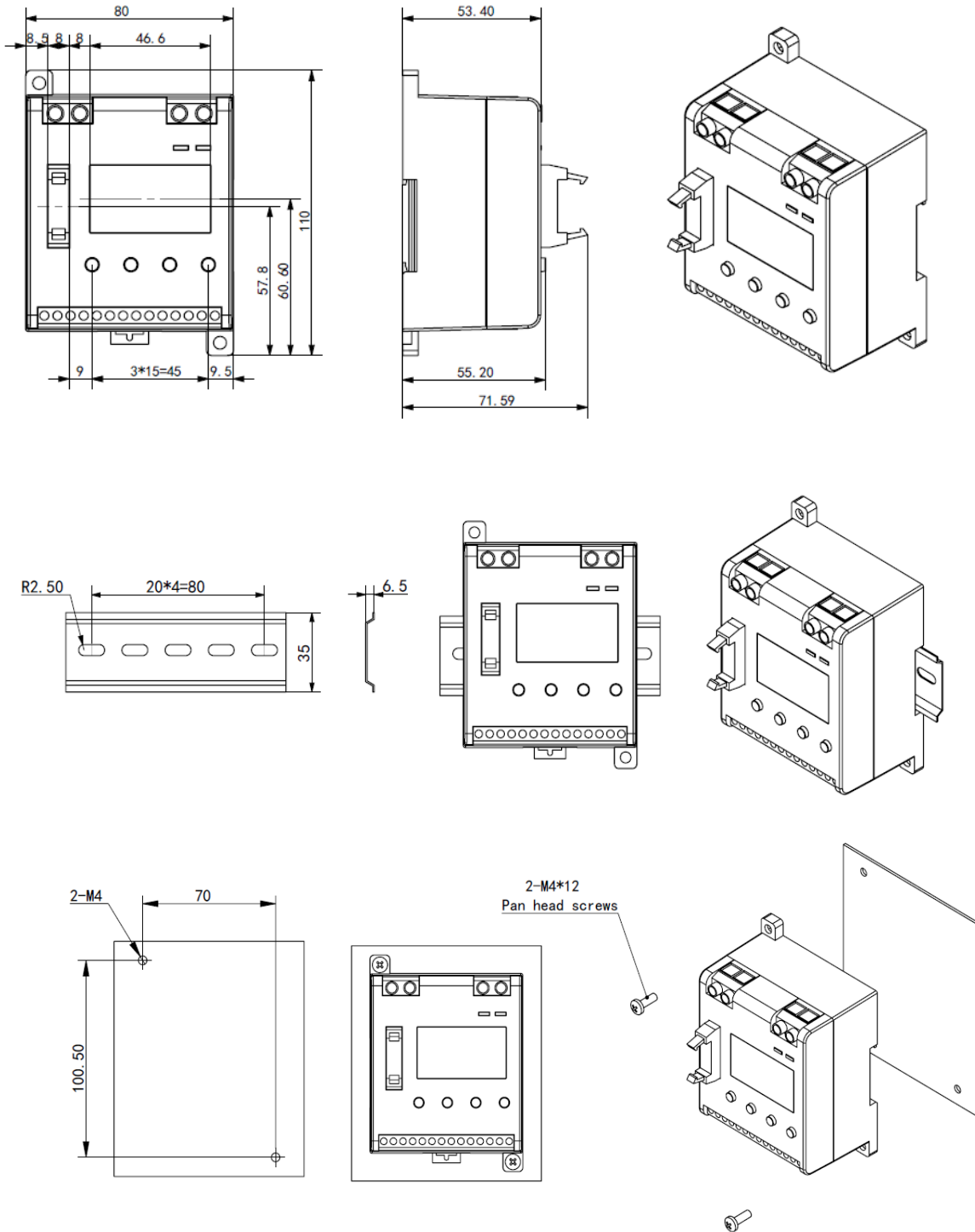
- Arc fault detect: detect arc fault in PV string by channel and bus-bar.
- Monitoring: the current of every PV string, PV bus voltage, combiner box temperature, status of SPD, status of DC circuit breaker.
- Support isolation leakage current monitoring.
- Communication interfaces: Modbus RTU RS485 or robust industrial wireless.
- Max supports 24 channels PV string in Modbus communication mode, 20 channels of PV string in industrial wireless communication mode.
- Local LCD display. FR-DCMG supports current histogram display.

Block diagram:

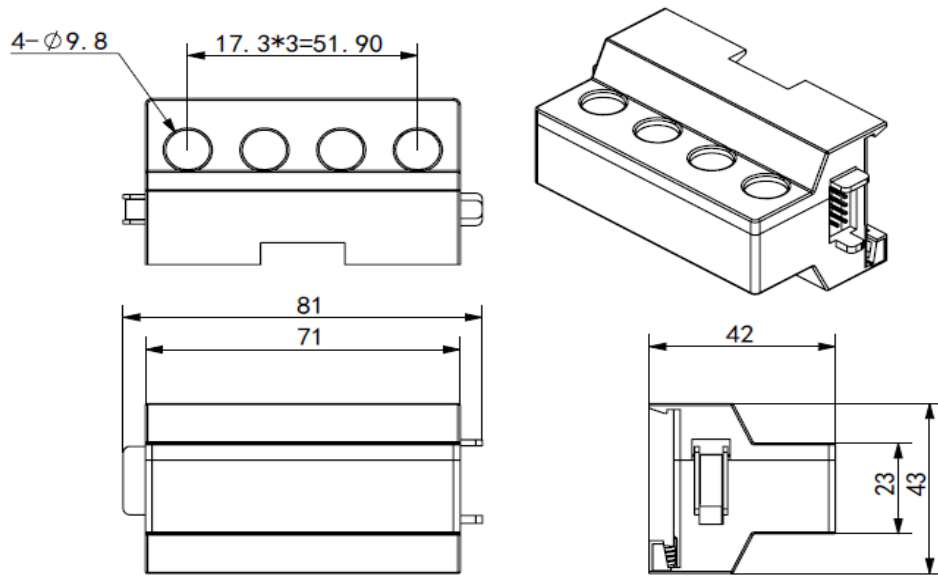


III Mechanical Dimensions & Structure

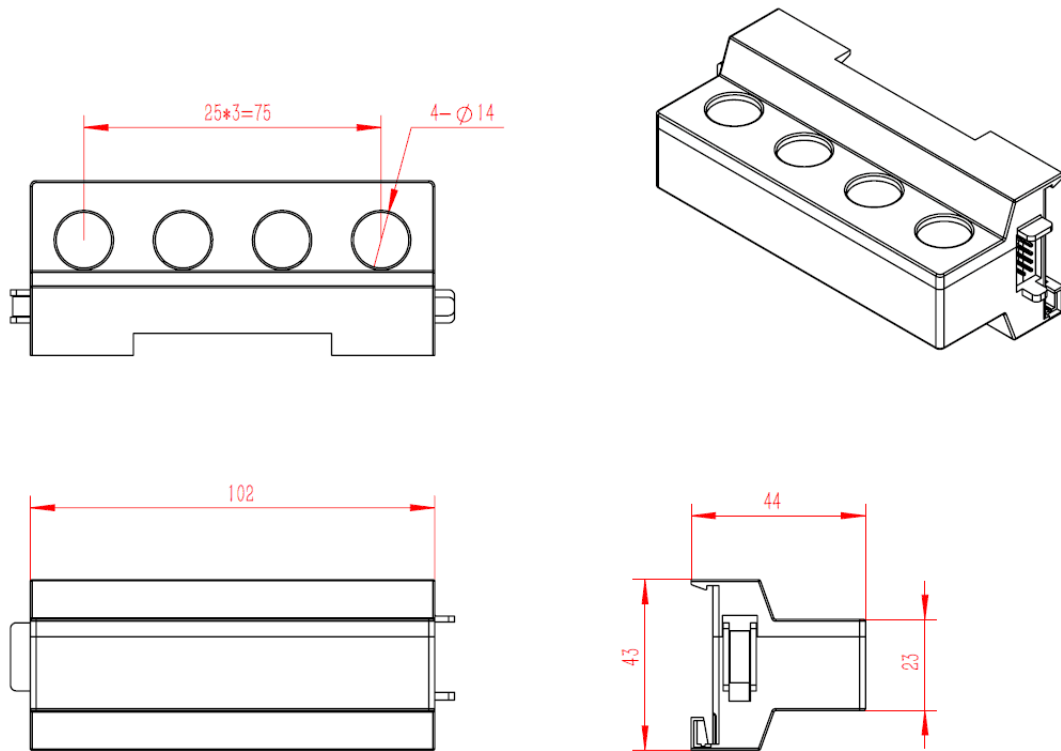
FR-DCMG-MMPA /FR-DCMG-MMPB /FR-DCMG-MMPT Main Unit



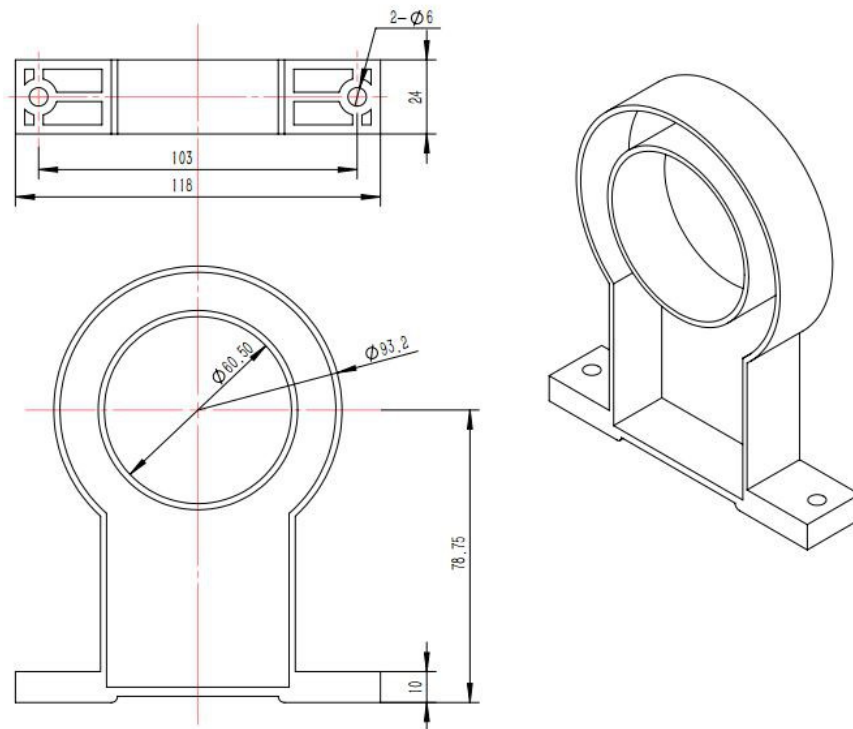
FR-DCMG-HS4A /FR-DCMG-AS4A Hall Current Sensor



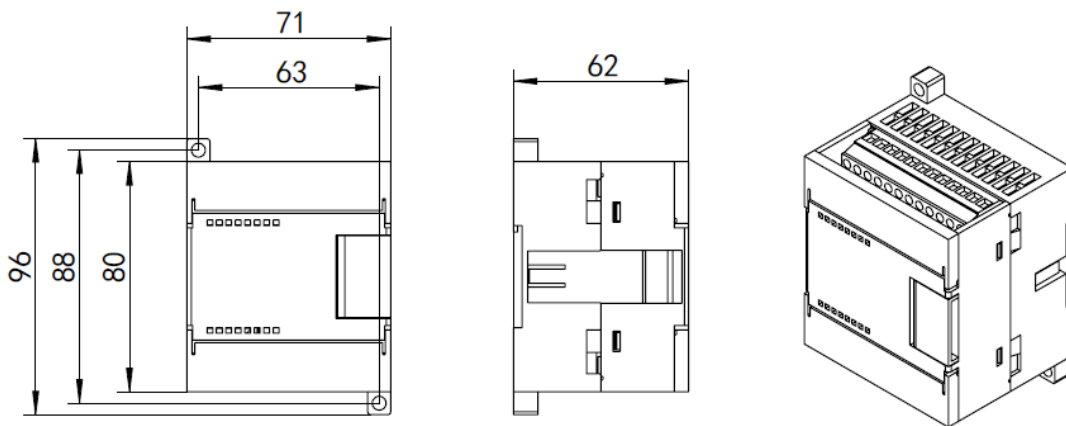
FR-DCMG-HS4T /FR-DCMG-AS4T Hall Current Sensor



FR-PVMA-LHSA Leakage Current Sensor



FR-PVMG-SHTPA /FR-PVMG-SHTPT Shunt Trip Power Unit



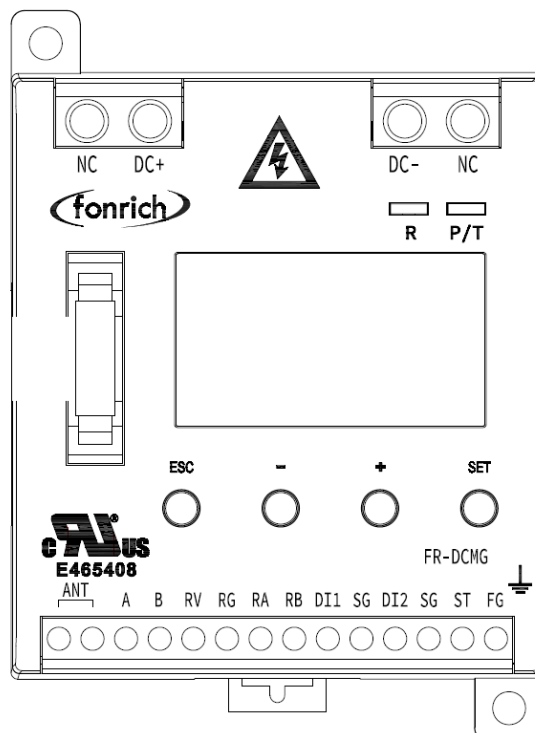
IV, Connection of Modules and Definition of the Terminals

Connection of the hall sensor module

FR-DCMG-HS4A, FR-DCMG-AS4A connect in the way of concatenation, support 4~24 channels current monitoring. Specific connection and instruction refer to the pictures below(take 8 channels as example, the nearest FMB wire is channel 1):



FR-DCMG-MMPA /FR-DCMG-MMPB /FR-DCMG-MMPT Main Unit



Symbol	Definition of the symbol
DC+、 DC-	PV DC bus power supply terminals
NC	No connection
FG	Field Ground terminal
TS	External temperature sensor terminal
SG	Temperature and digital input common terminal (Signal Ground)
DI1、 DI2	Digital Input terminals
A、 B	Modbus communication terminals
RV、 RG	Power supply of the RTM bus
RA、 RB	Communication terminals of the RTM bus, for driver signal if need shunt tripping coil
ANT	SMA wireless antenna port/No connection
FMB bus	Port of the FMB bus

FR-PVMA-LHSA Leakage Current Sensor



Symbol	Definition of the symbol
RTM_V, RTM_G	Power supply from Main Unit, wire to RV, RG terminals in main unit
RTM_A, RTM_B	Communication terminals of the RTM bus, wire to RA, RB terminals in main unit

FR-PVMG-SHTPA /FR-PVMG-SHTPT Shunt Trip Power Unit



Symbol	Definition of the symbol
PV+, PV-	PV DC bus power supply terminals
NC	No connection
FG	Field Ground terminal
RA, RB	Drive terminal from main unit
L+,L-	Drive Out terminal, wire to shunt trip coil, the level is 25VDC, max power is 80W in 10ms

Earth connection

The FG terminal of the FR-DCMG main unit and power unit must be connected to the field ground otherwise the communication will be disturbed, and the reliability of the device will decrease. The FG terminal must connect to the nearby earth ground and the wire that connects FG terminal to bottom board of the combiner box should not be longer than 15cm, less than 10cm is great and the wire should be coarse enough. The bottom board of the combiner must connect to the field ground.

V, Local Operation

Instruction of buttons operation and display interface

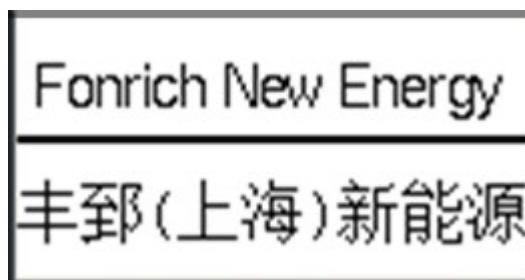
FR-DCMG has four key buttons: "ESC"、"-","+"、"SET"。The key "ESC" is used to return to the default interface or cancel the setting of parameters. The key "SET" is used to enter the parameter setting interface, chose the parameter that to be configured, or confirm the setting. The keys "+" and "-" is used to scroll the screen, or adjust the value of the parameters. Press the keys "SET" and "ESC" at the same time will enter the mode select interface. If no key is pressed in 15 seconds, the LCD will jump to the default interface and the brightness of backlight will decrease. If the key "ESC" is pressed, the interface will jump to the default interface immediately.



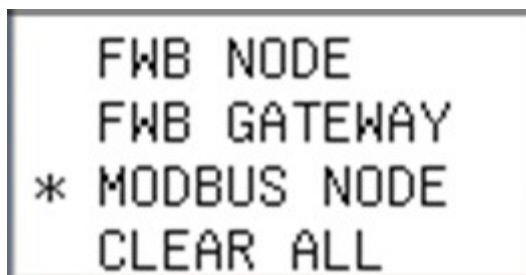
FR-DCMG supports the histogram display of the detected current, digital display of the detected current and generated energy, parameters' setting interface, the wireless node state interface in the FWB GATEWAY mode. The plentiful interfaces make it convenient to operate the device. Here is the description of every mode and the interface in the below.

Mode setting

When FR-DCMG is powered up, the P/T light will be bright to show that the device is working then the LCD monitor will come up with the LOGO picture for about 5 seconds.



When the LOGO disappears FR-DCMG enters the relative mode, if keys "ESC" and "SET" are pressed in the same time, FR-DCMG enters the mode selecting interface as below :



Among which

"*" : The selecting cursor that can be moved through pressing "+" and "-" keys.

FWB NODE: Actually, it is a wireless client mode. FWB means Field Wireless Bus, which is robust filed wireless communication protocol designed by Fonrich. In this mode, the modbus interface is also active.

FWB GATEWAY: In this mode the device is the wireless gateway of FWB network. In this mode, the modbus interface is also active.

MODBUS NODE : In this mode, only the modbus interface is active, and the wireless is disabled.

CLEAR ALL : Actually, it is not a work mode, which is just used to clear the generated energy data that stored in the device in past.

When a different mode is selected and the key "SET" is pressed, the device will reboot to enter the selected mode. If the previous mode is MODBUS mode then the parameters of the modbus communication will be reserved for modbus communication.

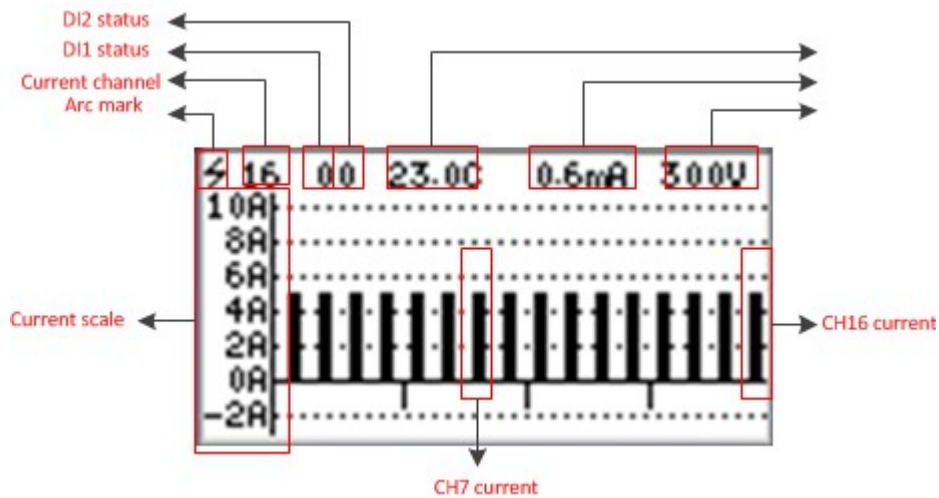
MODBUS mode

The default mode of the device is MODBUS mode, when communicate with PC through RS485, the LED lights R and P/T will twinkle to indicate that the communication is normal.

Histogram interface

The histogram interface will come up after the interface of LOGO, histogram interface is the

default interface of MODBUS mode, it will be shown like below:



The histogram shows the current value of every channel, the current value ranges from -2A to 10A. For the hall sensors are four channel sensors, so in the histogram every four channels will be indicated from another four channels which means that from left to right is channels 1-4, channels 5-8, channels 9-12 and so on. If there is no button operations in 15 seconds, the brightness of the LCD will decrease.

If the 'Arc mark' is show, it means the current sensor is with Arc Fault Detect.

Parameters setting interface

When the key "SET" is pressed in the histogram interface the device will enter MODBUS parameter setting interface, the device can communicate through RS485 in the other two mode also but the modbus related parameter should be set in the MODBUS mode. MODBUS parameter setting interface comes up as below:

```

Modbus Setting
* BPS:      9600
  PARITY:   NONE
  ADDRESS:   1
  
```

Among which

BPS : MODBUS communication baud rate , the selectable rate are 2400、 4800、 9600(default rate), 19200、 38400.

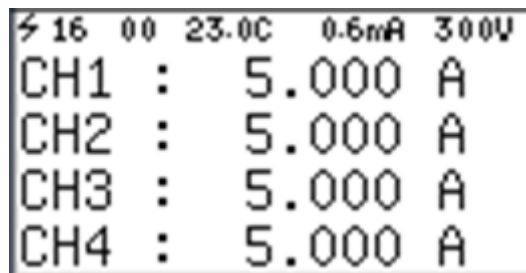
PARITY : The parity of MODBUS communication, the selectable parity none parity(NONE), odd parity(ODD), even parity(EVEN)(default none parity).

ADDRESS : The address of the MODBUS slave device, ranges from 1 to 247(default 1).

Digital displaying interface

When the key "+" or "-" is pressed in the histogram interface, the digital display interface will come up to show the current values and generated energy values. When firstly press key "+" then firstly shows the current value of the first four channels, when firstly press key "-" then firstly shows the generated energy of the last four channels. Then go on pressing the "+" or "-" key will scroll the screen to show current or generated energy value of other channels. The generated energy value will come up at the end of current value, the current value will come up after generated energy value on the reverse direction. Note that the top line is the same with histogram interface.

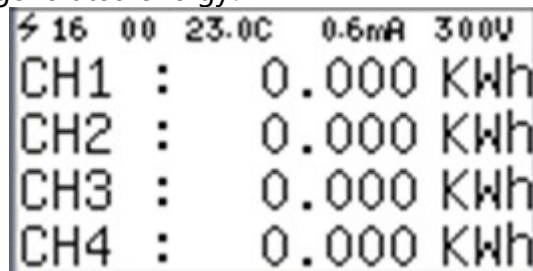
Interface of the digital current :



The screenshot shows a digital display interface for current. At the top, it displays a lightning bolt icon, the number '16', '00', '23.0C', '0.6mA', and '300V'. Below this, it lists four channels: CH1, CH2, CH3, and CH4, each followed by a colon and the value '5.000 A'.

Channel	Value
CH1	5.000 A
CH2	5.000 A
CH3	5.000 A
CH4	5.000 A

Interface of the digital generated energy:



The screenshot shows a digital display interface for generated energy. At the top, it displays a lightning bolt icon, the number '16', '00', '23.0C', '0.6mA', and '300V'. Below this, it lists four channels: CH1, CH2, CH3, and CH4, each followed by a colon and the value '0.000 KWh'.

Channel	Value
CH1	0.000 KWh
CH2	0.000 KWh
CH3	0.000 KWh
CH4	0.000 KWh

FWB NODE mode

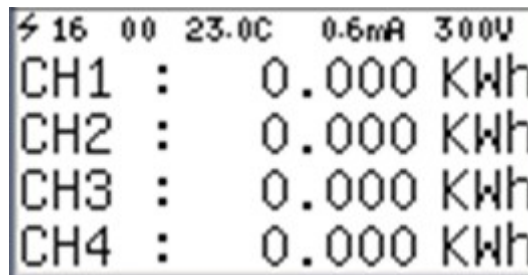
Select FWB NODE mode in the mode selecting interface, if the previous mode is not FWB NODE mode, the device will reboot after pressing the key "SET", and the device will enter FWB NODE mode.

Histogram interface

The histogram interface will come up after the interface of LOGO, histogram interface is also the default interface of FWB NODE mode, it will be shown the same as the MODBUS mode.

Parameters setting interface

When the key "SET" is pressed in the histogram interface the device will enter FWB NODE parameter setting interface. FWB NODE parameter setting interface comes up as below:



```
⚡ 16 00 23.0C 0.6mA 300V
CH1 : 0.000 KWh
CH2 : 0.000 KWh
CH3 : 0.000 KWh
CH4 : 0.000 KWh
```

Among which:

ADDRESS : the address of the wireless node, every device in FWB NODE mode will get an unique address in the frequency indicated by FREQ, the address ranges from 1 to 216.

FREQ : the frequency that the device used to communicate with other device, ranges from 900MHz to 928MHz, step by 200KHz.

Digital displaying interface

When the key "+" or "-" is pressed in the histogram interface, the digital playing interface will come up, which is the same as digital playing interface in MODBUS mode.

FWB GATEWAY mode

Select FWB GATEWAY mode in the mode selecting interface, if the previous mode is not FWB GATEWAY mode the device will reboot after the pressing of the key "SET", and the device enter FWB ATEWAY mode. When communicate with PC through RS485, the LED lights R and

P/T will twinkle to indicate that the communication is normal.

Wireless node connecting status interface

The wireless node connecting status interface will come up after the interface of LOGO, wireless node connecting status interface is the default interface of FWB GATEWAY mode, it will be shown as below:

0	1	2	3	4	5	6	7	8	9
00x	x	0	0	0	0	0	0	0	0
01x	0	0	0	0	0	0	0	0	0
02x	0	0	0	0	0	0	0	0	0
03x	0	0	0	0	0	0	0	0	0
04x	0	0	0	0	0	0	0	0	0
05x	0	0	0	0	0	0	0	0	0

The number 1 on the left side of the top line means the online number of wireless node, the address is composed by the numbers in the left column except the top "1" and the top row also except the left "1", calculate like :

$$\text{address} = xx(xx^*) * 10 + x \text{ (x in the top row beside "1")}$$

take the upper picture as example, the supported number of wireless node is 30 for the position whose address that bigger than 30 shows nothing but blank, there are one node online, whose address is **01(01*) * 10 + 0 = 10** the position of the address shows the state of the wireless node, 1 means the node is online and the distance to gateway is 1, 0 means that the node is offline. Note that the distance dose not means the real distance, it just indicate that weather the node need route transfer to communicate with gateway. Note that if the supported number of wireless node is bigger than 60, you need scroll the screen to check the state of the last node.

Histogram interface

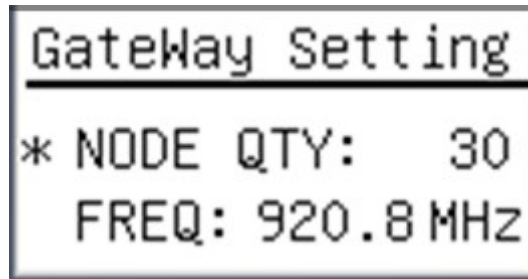
The histogram interface will come up when press the key "+" till the end of wireless node connecting state interface, if the supported number of the wireless node is less than 60 the histogram interface will come up as soon as the key "+" is pressed. The histogram interface will be shown the same as the MODBUS mode.

Digital displaying interface

When the key "+" or "-" is pressed in the histogram interface, the digital playing interface will come up, which is the same as digital playing interface in MODBUS mode.

Parameters setting interface

Press the key "SET" in wireless node connecting state interface will enter FWB GATEWAY setting interface which will be shown as below:



Among which:

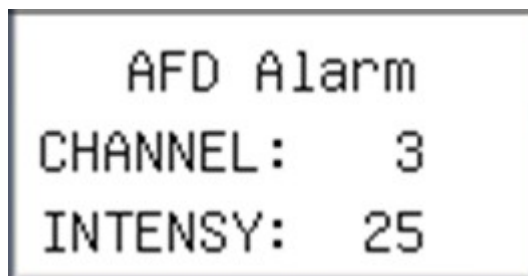
NODE QTY : the supported number of the wireless node by this gateway, default 30 ranges from 1 to 216. Generally, please keep this number as less as possible, because the communication cycle will become longer as this number growing.

FREQ : the frequency that the device used to communicate with other devices ranges from 315MHz to 928MHz, step by 200KHz.

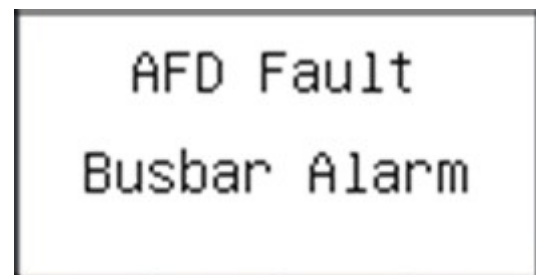
Arc Fault Detect Alarm Function

Arc Fault Detect Alarm picture

When the arc fault detected, the picture will change to alarm picture, which will shows as below:



Channel Arc Fault

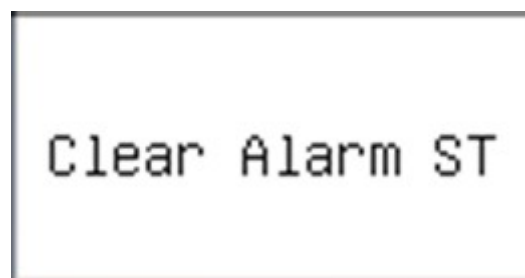


Bus-bar Arc Fault

It shows that: The CH3 has arc fault, the arc intensity is 25.

The arc intensity is a value means arc dangerous level. The default threshold value is 40.

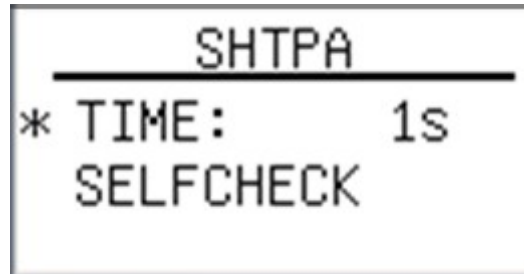
If arc fault has excluded, it is necessary to reset the alarm picture. Press "ESC" key and keep it about 5 seconds.



Then the picture will change to histogram picture.

Shunt Tripping Setup Interface

At default picture, press key "ESC" and "+" in same time, will change to "Shunt Tripping" set interface, shows as below:



Among which:

"TIME" : Set the shunt trip drive hold time, the shunt trip drive signal will be enable when alarm event occurs, and hold on set time, then disable shunt trip drive signal.

"SELFCHECK" : If will start self check arc fault function. Check the arc sensor status and check shunt tripping coil.

VI, Definition of the Modbus Protocol

Configuration of the modbus

Modbus communication mode : RTU mode

Address of the slave device : range from 1 to 247 (default 1)

Baud rate : (bps) 2400、4800、9600(default)、19200、38400

Parity of the byte : odd parity、even parity、none parity(default)

Description of the modbus frame

The byte in the communication frame composed by 1 start bit, 8 bits data bit, 1 parity bit, 1 stop bit like the below table (Refer to standard modbus RTU protocol) :

Address code	Function code	Data field	CRC field
1 byte	1 byte	N*1byte	2 bytes

The address code is the slave device address. The function code tell the slave device how to respond, and what request of the slave device response. N in data field can not be bigger than 252, the CRC field used to check the frame by using cyclic redundancy check.

Description of the function codes

FR-DCMG supports almost all function codes, includes 01, 02, 03, 04, 05, 06, 15 and 16. These modbus function codes are separated to two kinds of operation: bit operation and word operation. In FR-DCMG modbus implementation, all bit operations with different function codes share same bit register address mapping, and all word operations with different function codes share same word register address mapping.

Read and write operations of the registers in bit

- Function code 01 used to read the content of bit-type registers
- Function code 02 used to read the content of bit-type registers

- Function code 05 used to write single bit-type registers
- Function code 15 used to write multiple bit-type registers

the content of the bit-type register could be switches alarm information etc.

Read and write operations of the registers in word

- Function code 03、 04 are used to read multiple word-type registers
- Function code 06 is used to write single word-type registers.
- Function code 16 is used to multiple word-type registers.

The content of the word-type registers can be voltage, current, generated energy, etc.

Description of the registers

Description of the registers in bit

Bit address	Functional description	remark
Input switches and alarm signal(only Available to function code 02)		
0x0000	Digital input 1 status, DI1	The input switch DI1 of the device (0 : break , 1 : close)
0x0001	Digital input 2 status, DI2	The input switch DI2 of the device (0 : break , 1 : close)
0x0011	External temperature high alarm	When the external temperature is higher than the set value, set to 1
0x0020	Voltage too high alarm	When the detected voltage is bigger than the set value, set to 1
0x0021	Voltage too low alarm	When the detected voltage is smaller than the set value, set to 1
0x0030	Channel 1 no current alarm	When current value equal to 0, set 1
0x0031	Channel 1 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x0032	Channel 1current too high alarm	When current value bigger than the set value, set 1
0x0033	Channel 2 no current alarm	When current value equal to 0, set 1
0x0034	Channel 2 current too low alarm	When current value smaller than the set value but not equal to 0, set 1

0x0035	Channel 2 current too high alarm	When current value bigger than the set value, set 1
0x0036	Channel 3 no current alarm	When current value equal to 0, set 1
0x0037	Channel 3 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x0038	Channel 3 current too high alarm	When current value bigger than the set value, set 1
0x0039	Channel 4 no current alarm	When current value equal to 0, set 1
0x003A	Channel 4 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x003B	Channel 4 current too high alarm	When current value bigger than the set value, set 1
0x003C	Channel 5 no current alarm	When current value equal to 0, set 1
0x003D	Channel 5 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x003E	Channel 5 current too high alarm	When current value bigger than the set value, set 1
0x003F	reserved	
0x0040	Channel 6 no current alarm	When current value equal to 0, set 1
0x0041	Channel 6 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x0042	Channel 6 current too high alarm	When current value bigger than the set value, set 1
0x0043	Channel 7 no current alarm	When current value equal to 0, set 1
0x0044	Channel 7 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x0045	Channel 7 current too high alarm	When current value bigger than the set value, set 1
0x0046	Channel 8 no current alarm	When current value equal to 0, set 1
0x0047	Channel 8 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x0048	Channel 8 current too high alarm	When current value bigger than the set value, set 1
0x0049	Channel 9 no current alarm	When current value equal to 0, set 1
0x004A	Channel 9 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x004B	Channel 9 current too high alarm	When current value bigger than the set value, set 1
0x004C	Channel 10 no current alarm	When current value equal to 0, set 1
0x004D	Channel 10 current too low alarm	When current value smaller than the set value but not equal to 0, set 1

0x004E	Channel 10 current too high alarm	When current value bigger than the set value, set 1
0x004F	reserved	
0x0050	Channel 11 no current alarm	When current value equal to 0, set 1
0x0051	Channel 11 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x0052	Channel 11 current too high alarm	When current value bigger than the set value, set 1
0x0053	Channel 12 no current alarm	When current value equal to 0, set 1
0x0054	Channel 12 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x0055	Channel 12 current too high alarm	When current value bigger than the set value, set 1
0x0056	Channel 13 no current alarm	When current value equal to 0, set 1
0x0057	Channel 13 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x0058	Channel 13 current too high alarm	When current value bigger than the set value, set 1
0x0059	Channel 14 no current alarm	When current value equal to 0, set 1
0x005A	Channel 14 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x005B	Channel 14 current too high alarm	When current value bigger than the set value, set 1
0x005C	Channel 15 no current alarm	When current value equal to 0, set 1
0x005D	Channel 15 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x005E	Channel 15 current too high alarm	When current value bigger than the set value, set 1
0x005F	reserved	
0x0060	Channel 16 no current alarm	When current value equal to 0, set 1
0x0061	Channel 16 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x0062	Channel 16 current too high alarm	When current value bigger than the set value, set 1
0x0063	Channel 17 no current alarm	When current value equal to 0, set 1
0x0064	Channel 17 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x0065	Channel 17 current too high alarm	When current value bigger than the set value, set 1
0x0066	Channel 18 no current alarm	When current value equal to 0, set 1
0x0067	Channel 18 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x0068	Channel 18 current too high alarm	When current value bigger than the set value, set 1
0x0069	Channel 19 no current alarm	When current value equal to 0, set 1

0x006A	Channel 19 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x006B	Channel 19 current too high alarm	When current value bigger than the set value, set 1
0x006C	Channel 20 no current alarm	When current value equal to 0, set 1
0x006D	Channel 20 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x006E	Channel 20 current too high alarm	When current value bigger than the set value, set 1
0x006F	reserved	
0x0070	Channel 21 no current alarm	When current value equal to 0, set 1
0x0071	Channel 21 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x0072	Channel 21 current too high alarm	When current value bigger than the set value, set 1
0x0073	Channel 22 no current alarm	When current value equal to 0, set 1
0x0074	Channel 22 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x0075	Channel 22 current too high alarm	When current value bigger than the set value, set 1
0x0076	Channel 23 no current alarm	When current value equal to 0, set 1
0x0077	Channel 23 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x0078	Channel 23 current too high alarm	When current value bigger than the set value, set 1
0x0079	Channel 24 no current alarm	When current value equal to 0, set 1
0x007A	Channel 24 current too low alarm	When current value smaller than the set value but not equal to 0, set 1
0x007B	Channel 24 current too high alarm	When current value bigger than the set value, set 1
0x0080	Channel 1 current reversed alarm	When current is reversed, set 1
0x0081	Channel 2 current reversed alarm	When current is reversed, set 1
0x0082	Channel 3 current reversed alarm	When current is reversed, set 1
0x0083	Channel 4 current reversed alarm	When current is reversed, set 1
0x0084	Channel 5 current reversed alarm	When current is reversed, set 1
0x0085	Channel 6 current reversed alarm	When current is reversed, set 1
0x0086	Channel 7 current reversed alarm	When current is reversed, set 1

0x0087	Channel 8 current reversed alarm	When current is reversed, set 1
0x0088	Channel 9 current reversed alarm	When current is reversed, set 1
0x0089	Channel 10 current reversed alarm	When current is reversed, set 1
0x008A	Channel 11 current reversed alarm	When current is reversed, set 1
0x008B	Channel 12 current reversed alarm	When current is reversed, set 1
0x008C	Channel 13 current reversed alarm	When current is reversed, set 1
0x008D	Channel 14 current reversed alarm	When current is reversed, set 1
0x008E	Channel 15 current reversed alarm	When current is reversed, set 1
0x008F	Channel 16 current reversed alarm	When current is reversed, set 1
0x0090	Channel 17 current reversed alarm	When current is reversed, set 1
0x0091	Channel 18 current reversed alarm	When current is reversed, set 1
0x0092	Channel 19 current reversed alarm	When current is reversed, set 1
0x0093	Channel 20 current reversed alarm	When current is reversed, set 1
0x0094	Channel 21 current reversed alarm	When current is reversed, set 1
0x0095	Channel 22 current reversed alarm	When current is reversed, set 1
0x0096	Channel 23 current reversed alarm	When current is reversed, set 1
0x0097	Channel 24 current reversed alarm	When current is reversed, set 1
0x00A0	Channel 1 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00A1	Channel 2 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00A2	Channel 3 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00A3	Channel 4 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00A4	Channel 5 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00A5	Channel 6 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00A6	Channel 7 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00A7	Channel 8 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00A8	Channel 9 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00A9	Channel 10 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00AA	Channel 11 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00AB	Channel 12 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00AC	Channel 13 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00AD	Channel 14 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00AE	Channel 15 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00AF	Channel 16 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00B0	Channel 17 under current alarm	When, current < I(average)- I(min-threshold), set 1

0x00B1	Channel 18 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00B2	Channel 19 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00B3	Channel 20 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00B4	Channel 21 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00B5	Channel 22 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00B6	Channel 23 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00B7	Channel 24 under current alarm	When, current < I(average)- I(min-threshold), set 1
0x00C0	Leakage Current high alarm	When I(leakage)> I(leakage current threshold),set 1
0x00CF	Shunt trip status	When shunt trip is enable, set 1
0x00D0	Channel 1 arc fault alarm	When arc fault occurs in channel, set 1
0x00D1	Channel 2 arc fault alarm	When arc fault occurs in channel, set 1
0x00D2	Channel 3 arc fault alarm	When arc fault occurs in channel, set 1
0x00D3	Channel 4 arc fault alarm	When arc fault occurs in channel, set 1
0x00D4	Channel 5 arc fault alarm	When arc fault occurs in channel, set 1
0x00D5	Channel 6 arc fault alarm	When arc fault occurs in channel, set 1
0x00D6	Channel 7 arc fault alarm	When arc fault occurs in channel, set 1
0x00D7	Channel 8 arc fault alarm	When arc fault occurs in channel, set 1
0x00D8	Channel 9 arc fault alarm	When arc fault occurs in channel, set 1
0x00D9	Channel 10 arc fault alarm	When arc fault occurs in channel, set 1
0x00DA	Channel 11 arc fault alarm	When arc fault occurs in channel, set 1
0x00DB	Channel 12 arc fault alarm	When arc fault occurs in channel, set 1
0x00DC	Channel 13 arc fault alarm	When arc fault occurs in channel, set 1
0x00DD	Channel 14 arc fault alarm	When arc fault occurs in channel, set 1
0x00DE	Channel 15 arc fault alarm	When arc fault occurs in channel, set 1
0x00DF	Channel 16 arc fault alarm	When arc fault occurs in channel, set 1
0x00E0	Channel 17 arc fault alarm	When arc fault occurs in channel, set 1
0x00E1	Channel 18 arc fault alarm	When arc fault occurs in channel, set 1
0x00E2	Channel 19 arc fault alarm	When arc fault occurs in channel, set 1
0x00E3	Channel 20 arc fault alarm	When arc fault occurs in channel, set 1
0x00E4	Channel 21 arc fault alarm	When arc fault occurs in channel, set 1

0x00E5	Channel 22 arc fault alarm	When arc fault occurs in channel, set 1
0x00E6	Channel 23 arc fault alarm	When arc fault occurs in channel, set 1
0x00E7	Channel 24 arc fault alarm	When arc fault occurs in channel, set 1
0x00EE	Bus-bar arc fault alarm	When arc fault occurs in bus-bar, set 1
Output switch(only Available to function code 01,05,15)		
0x0101	Shunt trip enable control	Write "1" will enable shunt trip, and auto clear after hold time.

Note : No current means that the detected current is in range -250mA ~ +250mA.

Description of the registers in word

Word address	content	Data type	instruction	R/W
State and control information of the combiner box				
0x0000	Voltage of the bus-bar	Short	Unit V	R
0x0001	Temperature	Short	The detected value of temperature sensor ,unit 0.1°C	R
0x0002	State of the input switch	Unsigned short	Bit0 indicate the first input switch, bit1 indicate the second input switch, so on and so forth. 0 means break 1 means close	R
0x0004	Temperature	Short	The detected value of temperature sensor ,unit 0.1°C. The same value to "0x0001"	R
0x0005	The quantity of the channels	Unsigned short	The detected number of current channels	R
0x0006	Total current	Short	The total current of all channels, unit 10mA	R
0x0009	Distance to gateway	Unsigned short	When the device is used as wireless node, this indicate the distance to gateway, 0 means offline. In other mode this equal to 0	R
0x000A	Leakage current value	Short	The detected value of leakage current sensor ,unit 0.1mA	R
0x000B	Current of channel 1	Short	Unit 1mA , symbol means direction	R

0x000C	Current of channel 2	Short	Unit 1mA , symbol means direction	R
0x000D	Current of channel 3	Short	Unit 1mA , symbol means direction	R
0x000E	Current of channel 4	Short	Unit 1mA , symbol means direction	R
0x000F	Current of channel 5	Short	Unit 1mA , symbol means direction	R
0x0010	Current of channel 6	Short	Unit 1mA , symbol means direction	R
0x0011	Current of channel 7	Short	Unit 1mA , symbol means direction	R
0x0012	Current of channel 8	Short	Unit 1mA , symbol means direction	R
0x0013	Current of channel 9	Short	Unit 1mA , symbol means direction	R
0x0014	Current of channel 10	Short	Unit 1mA , symbol means direction	R
0x0015	Current of channel 11	Short	Unit 1mA , symbol means direction	R
0x0016	Current of channel 12	Short	Unit 1mA , symbol means direction	R
0x0017	Current of channel 13	Short	Unit 1mA , symbol means direction	R
0x0018	Current of channel 14	Short	Unit 1mA , symbol means direction	R
0x0019	Current of channel 15	Short	Unit 1mA , symbol means direction	R
0x001A	Current of channel 16	Short	Unit 1mA , symbol means direction	R
0x001B	Current of channel 17	Short	Unit 1mA , symbol means direction	R
0x001C	Current of channel 18	Short	Unit 1mA , symbol means direction	R
0x001D	Current of channel 19	Short	Unit 1mA , symbol means direction	R
0x001E	Current of channel 20	Short	Unit 1mA , symbol means direction	R
0x001F	Current of channel 21	Short	Unit 1mA , symbol means direction	R
0x0020	Current of channel 22	Short	Unit 1mA , symbol means direction	R
0x0021	Current of channel 23	Short	Unit 1mA , symbol means direction	R
0x0022	Current of channel 24	Short	Unit 1mA , symbol means direction	R
0x0023	Total power	Unsigned short	Unit 100W	R
0x0024	Power of channel 1	Unsigned short	Unit W	R
0x0025	Power of channel 2	Unsigned short	Unit W	R
0x0026	Power of channel 3	Unsigned short	Unit W	R

0x0027	Power of channel 4	Unsigned short	Unit W	R
0x0028	Power of channel 5	Unsigned short	Unit W	R
0x0029	Power of channel 6	Unsigned short	Unit W	R
0x002A	Power of channel 7	Unsigned short	Unit W	R
0x002B	Power of channel 8	Unsigned short	Unit W	R
0x002C	Power of channel 9	Unsigned short	Unit W	R
0x002D	Power of channel 10	Unsigned short	Unit W	R
0x002E	Power of channel 11	Unsigned short	Unit W	R
0x002F	Power of channel 12	Unsigned short	Unit W	R
0x0030	Power of channel 13	Unsigned short	Unit W	R
0x0031	Power of channel 14	Unsigned short	Unit W	R
0x0032	Power of channel 15	Unsigned short	Unit W	R
0x0033	Power of channel 16	Unsigned short	Unit W	R
0x0034	Power of channel 17	Unsigned short	Unit W	R
0x0035	Power of channel 18	Unsigned short	Unit W	R
0x0036	Power of channel 19	Unsigned short	Unit W	R
0x0037	Power of channel 20	Unsigned short	Unit W	R
0x0038	Power of channel 21	Unsigned short	Unit W	R
0x0039	Power of channel 22	Unsigned short	Unit W	R
0x003A	Power of channel 23	Unsigned	Unit W	R

		short		
0x003B	Power of channel 24	Unsigned short	Unit W	R
0x0040	Shunt trip enable	Unsigned short	When shunt trip is enable, set 1 Write 1 will enable shunt trip one time, and auto reset to 0 after hold time	R/W
0x0041	Channel 1-16 arc fault alarm	Unsigned short	"Bit0" is the channel 1 status "Bit15" is the channel 16 status set 1 means arc fault at channel	R
0x0042	Channel 17-24 arc fault alarm	Unsigned short	"Bit0" is the channel 17 status "Bit7" is the channel 24 status "Bit8~Bit14" reserved "Bit15" is the bus-bar status set 1 means arc fault at channel	R
0x005E	Channel arc fault threshold value	Unsigned short	Value range: 0~128, default 40 when channel arc intensity over threshold value, arc fault will detect	R/W
0x0060	Shunt trip hold time	Unsigned short	Set shunt trip enable signal hold time. Unit 1S	R/W
0x0079	Arc fault alarm clear	Unsigned short	Write 1 to clear arc fault alarm. Always 0 when read	R/W
0x007A	Bus-bar arc fault threshold value	Unsigned short	Value range: 0~128, default 50 when bus-bar arc intensity over threshold value, arc fault will detect	R/W
0x00A0	Electricity data reset	Unsigned short	Write 1 to reset electricity data.	W
0x00A1	Reset all arc fault alarm counter	Unsigned short	Write 1 to reset alarm counter	W
0x00A2	Channel 1 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00A3	Channel 2 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00A4	Channel 3 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R

	counter	short		
0x00A5	Channel 4 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00A6	Channel 5 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00A7	Channel 6 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00A8	Channel 7 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00A9	Channel 8 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00AA	Channel 9 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00AB	Channel 10 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00AC	Channel 11 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00AD	Channel 12 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00AE	Channel 13 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00AF	Channel 14 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00B0	Channel 15 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00B1	Channel 16 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00B2	Channel 17 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00B3	Channel 18 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00B4	Channel 19 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00B5	Channel 20 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00B6	Channel 21 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00B7	Channel 22 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R

0x00B8	Channel 23 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00B9	Channel 24 arc fault alarm counter	Unsigned short	Record arc fault occurs in channel	R
0x00BA	Bus-bar arc fault alarm counter	Unsigned short	Record arc fault occurs in bus-bar	R
0xXX** type registers is used to store the data that received from the wireless node. XX means the address of the wireless node which can not bigger than the supported wireless node number, FWB NODE and NODBUS mode do not support these registers.				
0xXX00	Voltage of the bus wire of the wireless node	Short	Unit V	R
0xXX01				
0xXX02	state of the input switch of the wireless node	Unsigned short	Bit0 indicate the first input switch, bit1 indicate the second input switch, so on and so forth. 0 means break 1 means close	R
0xXX03	Arc fault alarm flag	Unsigned short	Has arc fault in this node.	R
0xXX04	Temperature of the wireless node	Short	The detected value of temperature sensor ,unit 0.1°C	R
0xXX05	The quantity of the channels of the wireless node	Unsigned short	The detected number of current channels	R
0xXX06	Distance to gateway of the wireless node	Unsigned short	When the device is used as wireless node, this indicate the distance to gateway, 0 means offline. Other mode this equal to 0	R
0xXX07	Leakage current value	Short	The detected value of leakage current sensor ,unit 0.1 mA	R
0xXX08	Current of channel 1 of the wireless node	Short	Unit mA , symbol means direction	R
0xXX09	Current of channel 2 of the wireless node	Short	Unit mA , symbol means direction	R
...	...			

0xXX1B	Current of channel 20 of the wireless node	Short	Unit mA , symbol means direction	R
System information				
0x00F7	The supported wireless node number by gateway	Unsigned short	The support max number of wireless node, only available in gateway mode.	R
0x00F8	The online number of the wireless node	Unsigned short	The online wireless node number only available in gateway mode	R
0xFF0A	FMB current direction configure register1	Unsigned short	Bit0: the current direction of channel 1 bit1 the current direction of channel 2 ... bit15 the current direction of channel 16 0: positive direction , 1 negative direction	WR
0xFF0B	FMB current direction configure register2	Unsigned short	Bit0: the current direction of channel 17 bit1: the current direction of channel 18 ... bit7: the current direction of channel 24 0: positive direction , 1 negative direction	WR
0xFF0C	Temperature too high alarm	Unsigned short	Bit0 : on board temperature too high alarm bit1 : external temperature too high alarm 0: normal , 1: alarm	R
0xFF0D	Voltage alarm	Unsigned short	Bit0 : voltage too high alarm bit1 : voltage too low alarm 0: normal , 1: alarm	R
0xFF0E	Current alarm1	Unsigned short	bit0-bit2: channel 1 , no current , current low , current high alarm bit3-bit5:channel 2 , no current , current low , current high alarm bit6-bit8 :channel 3 , no current , current low , current high alarm bit9-bit11: channel 4 , no current	R

			, current low , current high alarm bit12-bit14: channel 5 , no current , current low , current high alarm 0: normal , 1: alarm	
0xFF0F	Current alarm2	Unsigned short	bit0-bit2: channel 6 , no current , current low , current high alarm bit3-bit5:channel 7 , no current , current low , current high alarm bit6-bit8 :channel 8 , no current , current low , current high alarm bit9-bit11: channel 9 , no current , current low , current high alarm bit12-bit14: channel 10 , no current , current low , current high alarm 0: normal , 1: alarm	R
0xFF10	Current alarm3	Unsigned short	bit0-bit2: channel 11 , no current , current low , current high alarm bit3-bit5:channel 12 , no current , current low , current high alarm bit6-bit8 :channel 13 , no current , current low , current high alarm bit9-bit11: channel 14 , no current , current low , current high alarm bit12-bit14: channel 15 , no current , current low , current high alarm 0: normal , 1: alarm	R
0xFF11	Current alarm4	Unsigned short	bit0-bit2: channel 16 , no current , current low , current high alarm bit3-bit5:channel 17 , no current , current low , current high alarm bit6-bit8 :channel 18 , no current , current low , current high alarm bit9-bit11: channel 19 , no current , current low , current high alarm bit12-bit14: channel 20 , no current , current low , current high alarm	R

			0: normal , 1: alarm	
0xFF12	Current alarm5	Unsigned short	bit0-bit2: channel 21 , no current , current low , current high alarm bit3-bit5:channel 22 , no current , current low , current high alarm bit6-bit8 :channel 23 , no current , current low , current high alarm bit9-bit11: channel 24 , no current , current low , current high alarm 0: normal , 1: alarm	R
0xFF13	Leakage current high alarm	Unsigned short	0: normal, 1: alarm	R
0xFF14	Channel current reversed alarm register 1	Unsigned short	Bit0: Channel 1 Bit15: Channel 16 0: normal, 1: alarm	R
0xFF15	Channel current reversed alarm register 2	Unsigned short	Bit0: Channel 17 Bit7: Channel 24 Bit8~Bit15 not used 0: normal, 1: alarm	R
0xFF16	Channel under current alarm register 1	Unsigned short	Bit0: Channel 1 Bit15: Channel 16 0: normal, 1: alarm	R
0xFF17	Channel under current alarm register 2	Unsigned short	Bit0: Channel 17 Bit7: Channel 24 Bit8~Bit15 not used 0: normal, 1: alarm	R
0xFF8D	Alarm high threshold of the external temperature	Short	Unit 0.1°C, default 600*0.1°C	RW
0xFF8E	Alarm high threshold of the on board temperature	Short	Unit 0.1°C, default 800*0.1°C	RW
0xFF8F	Alarm low threshold of the voltage	Short	Unit 1V, default 300V	RW
0xFF90	Alarm high threshold of the voltage	Short	Unit 1V, default 1000V	RW
0xFF93	Alarm low threshold of the current	Short	Unit 1mA, default 4000mA	RW
0xFF94	Alarm high threshold of the current	Short	Unit 1mA, default 10000mA	RW
0xFF95	The higher 16bit of the generated energy of	Unsigned short	Unit Wh	R

	channel1			
0xFF96	The lower 16bit of the generated energy of channel1	Unsigned short	Unit Wh	R
0xFF97	The higher 16bit of the generated energy of channel 2	Unsigned short	Unit Wh	R
0xFF98	The lower 16bit of the generated energy of channel 2	Unsigned short	Unit Wh	R
0xFF99	The higher 16bit of the generated energy of channel 3	Unsigned short	Unit Wh	R
0xFF9A	The lower 16bit of the generated energy of channel 3	Unsigned short	Unit Wh	R
0xFF9B	The higher 16bit of the generated energy of channel 4	Unsigned short	Unit Wh	R
0xFF9C	The lower 16bit of the generated energy of channel 4	Unsigned short	Unit Wh	R
0xFF9D	The higher 16bit of the generated energy of channel 5	Unsigned short	Unit Wh	R
0xFF9E	The lower 16bit of the generated energy of channel 5	Unsigned short	Unit Wh	R
0xFF9F	The higher 16bit of the generated energy of channel 6	Unsigned short	Unit Wh	R
0xFFA0	The lower 16bit of the generated energy of channel 6	Unsigned short	Unit Wh	R
0xFFA1	The higher 16bit of the generated energy of	Unsigned short	Unit Wh	R

	channel 7			
0xFFA2	The lower 16bit of the generated energy of channel 7	Unsigned short	Unit Wh	R
0xFFA3	The higher 16bit of the generated energy of channel 8	Unsigned short	Unit Wh	R
0xFFA4	The lower 16bit of the generated energy of channel 8	Unsigned short	Unit Wh	R
0xFFA5	The higher 16bit of the generated energy of channel 9	Unsigned short	Unit Wh	R
0xFFA6	The lower 16bit of the generated energy of channel 9	Unsigned short	Unit Wh	R
0xFFA7	The higher 16bit of the generated energy of channel 10	Unsigned short	Unit Wh	R
0xFFA8	The lower 16bit of the generated energy of channel 10	Unsigned short	Unit Wh	R
0xFFA9	The higher 16bit of the generated energy of channel 11	Unsigned short	Unit Wh	R
0xFFAA	The lower 16bit of the generated energy of channel 11	Unsigned short	Unit Wh	R
0xFFAB	The higher 16bit of the generated energy of channel 12	Unsigned short	Unit Wh	R
0xFFAC	The lower 16bit of the generated energy of channel 12	Unsigned short	Unit Wh	R
0xFFAD	The higher 16bit of the generated energy of channel 13	Unsigned short	Unit Wh	R
0xFFAE	The lower 16bit of the generated energy of channel 13	Unsigned short	Unit Wh	R
0xFFAF	The higher 16bit of the	Unsigned	Unit Wh	R

	generated energy of channel 14	short		
0xFFB0	The lower 16bit of the generated energy of channel 14	Unsigned short	Unit Wh	R
0xFFB1	The higher 16bit of the generated energy of channel 15	Unsigned short	Unit Wh	R
0xFFB2	The lower 16bit of the generated energy of channel 15	Unsigned short	Unit Wh	R
0xFFB3	The higher 16bit of the generated energy of channel 16	Unsigned short	Unit Wh	R
0xFFB4	The lower 16bit of the generated energy of channel 16	Unsigned short	Unit Wh	R
0xFFB5	The higher 16bit of the generated energy of channel 17	Unsigned short	Unit Wh	R
0xFFB6	The lower 16bit of the generated energy of channel 17	Unsigned short	Unit Wh	R
0xFFB7	The higher 16bit of the generated energy of channel 18	Unsigned short	Unit Wh	R
0xFFB8	The lower 16bit of the generated energy of channel 18	Unsigned short	Unit Wh	R
0xFFB9	The higher 16bit of the generated energy of channel 19	Unsigned short	Unit Wh	R
0xFFBA	The lower 16bit of the generated energy of channel 19	Unsigned short	Unit Wh	R
0xFFBB	The higher 16bit of the	Unsigned	Unit Wh	R

	generated energy of channel 20	short		
0xFFBC	The lower 16bit of the generated energy of channel 20	Unsigned short	Unit Wh	R
0xFFBD	The higher 16bit of the generated energy of channel 21	Unsigned short	Unit Wh	R
0xFFBE	The lower 16bit of the generated energy of channel 21	Unsigned short	Unit Wh	R
0xFFBF	The higher 16bit of the generated energy of channel 22	Unsigned short	Unit Wh	R
0xFFC0	The lower 16bit of the generated energy of channel 22	Unsigned short	Unit Wh	R
0xFFC1	The higher 16bit of the generated energy of channel 23	Unsigned short	Unit Wh	R
0xFFC2	The lower 16bit of the generated energy of channel 23	Unsigned short	Unit Wh	R
0xFFC3	The higher 16bit of the generated energy of channel 24	Unsigned short	Unit Wh	R
0xFFC4	The lower 16bit of the generated energy of channel 24	Unsigned short	Unit Wh	R
0xFFC5	The higher 16bit of the total generated energy of	Unsigned short	Unit Wh	R
0xFFC6	The lower 16bit of the total generated energy	Unsigned short	Unit Wh	R
0xFFC9	Alarm high threshold of the leakage current	Unsigned short	Unit 0.1mA, default 400(40mA)	R/W
0xFFCA	Alarm under current threshold of the channel	Unsigned short	Unit 1mA, default 2000(2A)	R/W

V, Appendix

Document revision history

Modification	Instruction	Date
0.1	Draft from the user manual of Gilgal1	2013-12-10
0.2	Modify some of the Modbus registers; modify the operation of interface	2014-03-25
0.3	Add Size chart of the main unit	2014-04-02
1.0	Release	2014-04-16
1.1	Some modify of the modbus registers and instruction of the interface.	2014-05-09
1.2	Add the leakage current sensor function	2014-06-09
2.0	Add arc fault detect function	2016-01-06