SINEPOWER

STB66 Digital

12 Pulse Battery Charge Control Board

（Battery charge control）

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Content in this user manual is just for your reference, we will update the user experiences, like to modify the parameters for better functions. Pls follow our updates on our website, and download the electronic edition freely.

Content

The components of our products:

*** The power transformer adopts industrial grade transformer, epoxy resin potting, high quality products tempered by high temperature aging;**

*** The main control chip adopts NXP 32-bit LPC17 series industrial-grade high-performance processor, which has superior computing processing capability and reliable anti-interference ability;**

*** Passive components are basically our national giant brand Yageo, high temperature resistance, low drift, device working life can achieve more than 10 years;**

*** The key passive components adopt Murata and Infineon brand to ensure that the key parts of the control panel cannot be easily damaged;**

*** Control relay is Omron brand, the number of actions is more than 10 times that of domestic brands;**

*** The terminal block is made of Machiya's DINKLE brand and made of internal copper alloy. Unlike most of the control panel on the market which usually uses iron terminals.**

*** Control board with intrinsically safe design, uses self-recovery fuse at the power supply to limit current output, and to prevent accidental short circuit of external terminal block and damage control board;**

*** Associate with our core control algorithms and SMD placement technology, we assure you with reliable and stable control panels.**

- **Safety regulations and notes before operation：**

>> Safety regulations:

- The wrong use may cause permanent damage to the product or serious personal accidents. Therefore, the operating procedures on must be strictly follow the user manual, National and industry standards and safety regulations.
- The installation, maintenance or guidance installation, maintenance control devices should be charged by professional and technical person with relevant experience.
- Under no circumstances should you plug out the wiring or try to touch the contacts in the socket while it is still on power to prevent electric shock and accidents.
- This machine is designed to be used in a cool and dry environment. It needs to maintain a good ventilation and heat dissipation environment. Please do not soaking in water or exposing under the sun.
- To work outside the temperature range required by electrical characteristics, pls clean the control panel regularly.
- Under no circumstances should the control panel be operated beyond the design limit.
- Please strictly follow the instructions for use. For any equipment or personal injury caused by failure to follow these operating instructions, we do not does not assume any civil and criminal responsibility.
- Trying to repair the damaged control board (regulator) may cause permanent damage to the equipment. If the unit malfunctions, please contact us, we will provide technical support as soon as possible. Please do not attempt to repair the unit all by yourselves.
- This manual can only be applied to its supporting equipment. We will be continuously upgrade and improve our products and to modify the versions of user manual as well. Pls follow our latest updates on website, we won't contact you directly for the latest update technical data.

>> Note:

1. When ordering, pls indicate the exact model and requirement of your required product in PI. Or we may supply with default parameters, namely: voltage level at AC380V, rated frequency at 50Hz, current and voltage feedback signal at DC0-5V and given signal at DC0-5V and potentiometer, non-special design type; Regular products are available in stock, for special design product, pls contact us to determine the specific delivery period when ordering.
2. At the thyristor trigger interface, please note that K1-K6 and G1-G6 are three-phase full-control trigger control ports. If there is a wrong connection, the risk of damage to the device will occur; the thyristor on the main circuit should be settled with proper capacitance absorption and VDR to protect the circuit. RC resistance-capacitance absorption protection device in wiring diagram is convenient for users. We have related RC absorption board STP10 and STP11. Please contact us if you need to order.
3. Before power-on, pls check if the control board is connected according to its actual requirements, then disconnect the control line of the thyristor trigger terminal first, do not connect to the load, power-on after correct operation. And then enter the menu to set and modify the relevant parameters of the control panel according to your own needs. Connect the thyristor trigger regulator to the load after finishing the parameter settings, and the actual operation can be performed.
4. Refer to the wiring diagram of the user manual of this control board for proper wiring. To prevent interference, given the control line and the thyristor trigger line, the main circuit power line is better wired separately. If the wires are not separated, use a twisted shielded wire for the given control line; strictly follow the corresponding relationship between the control board and the thyristor connection at the same time.
5. Before powering on, please check the wiring carefully, disconnect the load, and connect to a small power resistive dummy load test. It is recommended to connect the 1KW bulb for the experimental load. When using the incandescent lamp as the load for debugging, please press the start button to observe the brightness changes of the incandescent lamp. If the incandescent lamp can continuously and smoothly change according to different set values, the control panel wiring is normal; if it is out of control, then is abnormal, please turn off the power and check if there is a wiring errors to avoid burning the device. After the control board is debugged normally, you can access the real load for running.
6. The external control terminal has a corresponding power supply configuration. Do not send active signals to the port. Otherwise, the product may be irreparable.

7. If the thyristor device needs to be tested for insulation, please remove the control board from the device, otherwise the control board may be permanently damaged.

8. We do not responsible for the damages of other components outside the thyristor regulator board.

9. Our Service Commitment: Provide one-year free warranty service and lifetime maintenance within the normal operation of the users. After the expiration of the warranty period, we can continue to provide technical support and assistance, and during this time, the replacement parts are available at our lowest cost price.

>> Circuit wiring control:

If the electromagnetic interference of the control panel is serious, pls follow the measures as below while controlling the circuit wiring in order to prevent the equipment from working abnormally due to electromagnetic interference.

1. When the control cable is long, it is recommended to use a shielded cable. The shield of the cable should be grounded at one end.
2. The analog and digital signal cables should be routed separately;
3. All signal cables should be placed in the steel pipe or cable trough when necessary;
4. The signal cable and the strong electrical equipment should have as much isolation distance as possible;
5. Provide a separate grounding loop for the system;
6. All shielding layers are grounded at the transmitter port;
7. Do not connect wires of different metals to each other;
8. Minimize or eliminate intermediate terminals or connection points;
9. The pipe and cable trough should be grounded reliably and ensure continuous grounding over the entire length.

Before operating this control panel, please read the user manual carefully to avoid incorrect operation and accidents!

I. Introductions:

STB66 battery charge control trigger board adopts 32-bit industrial grade high-performance microprocessor, highly digital military quality design, supports network remote control and on-site control mode. The fuzzy-PID parameter is open-ended, fault alarm and parameters are displayed on the LCD screen or touch screen menu Chinese, parameters are automatically saved after setting. With constant voltage and constant current regulation, the charging operation parameters are set by the LCD screen. The charging can be divided into at most 5 stages, each stage are set independently: charging current, charging voltage, current limit, charging time and jump voltage. Users can set the charging parameters of pre-charging, fast charging, slow charging or floating charging according to the current battery charging curve freely. The operation is reliable, technology is advance, functions are complete, performance is stable, debugging is convenient and easy to maintain. It is suitable for 12 pulse 3 phase full control bridge type rectification or double reversed star shape with interphase reactor 12 pulse rectification trigger methods.

This trigger board adopts industrial-grade high-performance microprocessor, which continues to lead the innovation of core control algorithms and software technology in the industry. The structure of the control software package and the processing speed of the single-chip microcomputer ensures all the adjustment of the control loops to be finished during transform (conversion) time of the six thyristor bridges in the main circuit, so that the voltage and current loop sampling time can be less than 3.33mS (50HZ power supply) or 2.77mS (60HZ power supply) for superior performance.

This three-phase digital rectification thyristor trigger board has good reliability, strong anti-interference ability, unique anti-interference measures, and can working normally even in harsh interference environment. The control board has self-diagnosis and load operation protection functions, with power failure protection，over pressure protection, overload protection and phase failure protection, etc. Therefore, regardless of the external or internal interferences and fault signals, the performance of the control board is safer and more reliable due to the above-mentioned protection functions. The output is completely isolated which made it has a wide application range. It has complete fault detection, alarm indication and protection function, all parameters are digital, no temperature drift changes, which improves the adjustment accuracy and power utilization efficiency.

II. Technical Specifications

Working power supply	380Vac ±15%, 50/60HZ
Main circuit working voltage	50~380Vac ±15%, 50/60HZ
Voltage adjustment range:	1~300V
Current adjustment range:	1~300A
Phase shift range	0~178°
Adjust output resolution	1/4000
Stability accuracy	better than ±1% or ±1 Vac
Trigger current:	≥ 750mA
Trigger capacity	≤ 1000A one-way thyristor
PID dynamic response time:	≤ 50mS
Overshoot:	≤ 10%
Input signal:	DC0-5V, DC0-10V, 0-10mA, 4-20mA, 10K potentiometer adjustment
Three-phase trigger imbalance	≤ 0.3°
Applicable load:	Battery charge and discharge control
Alarm relay contact capacity:	250Vac/10A
Dielectric strength:	3500 VRMS
Ambient (working) temperature:	-20°C~ 60°C

Working Relative humidity:	≤ 90% RH (no frost)
Indoor installation requirements	no flammable, no explosive, no corrosive gas, no conductive dust, and vibration should be less than 0.5G
Dimensions:	240X160X50mm
Dimensions between install holes:	225X145mm
Weight:	1KG
Altitude should be under 3000m, otherwise need to reduce the capacity level.	

STB66 meets the standard:

IEC60947-4-2: Low-voltage switchgear and controlgear. Part 4-2: Contactors and motor-starters. AC semiconductor motor Controllers and starters.

GB14048.6-1998: Low-voltage switchgear and controlgear Part 4-2: Contactors and motor starters AC semiconductor motor controllers and starters.

GB3797-89: Electronic Control Equipment Part II - Electronic Control Equipment with Electronic Devices.

IEC61000-4: Electromagnetic compatibility, test and measurement technology.

IEC65: Safety of household and similar general purpose electronic and related equipment powered by grid power.

III. Features

1. Using 32-bit industrial high-speed microprocessor, LCD screen or touch menu in Chinese, fully automatic SMD process manufacturing, stable and reliable performance.

2. With rectifier function, it can achieve auto constant current and constant voltage charge function, specially used for high power battery charge occasion.

3. The control board can achieve automatic conversion of equalization and floating charge, and the current and voltage can be adjusted as wish;

4. Complete fault detection and alarm function, real-time detection of load status, load current, control signal, feedback signal loss and other parameters;

5. Intelligent PID control scheme, parameter openness, can be flexibly set to any physical quantity, adapt to different nature loads, with good dynamic characteristics;

6. Overload protection: After starting, it will judge whether it is overload. When it continuously overload the settled the protection time, it stops running and the alarm relay outputs;

7. Soft start: At startup, the output voltage will gradually increase from zero to 100% to eliminate the impact on the grid and itself during load operation. The soft start time parameter can be set;

8. Soft stop: When stopping, the output voltage will gradually decrease from 100% to zero to eliminate the impact on the grid and itself when the load stops. The soft shutdown time parameter can be set;

9. It has the function of automatic identification phase sequence, no phase sequence requirement for the power supply of the control board, no debugging, convenient wiring;

10. Current loop (voltage loop) feedback input signal supports various analog input signals such as transformer, Hall current (voltage) sensor, 0-75mV shunt, 0-5V, and etc.

11. It can be remote controlled by PLC or other equipment, with MODBUS field bus communication function and RS485 full isolation control (optional);

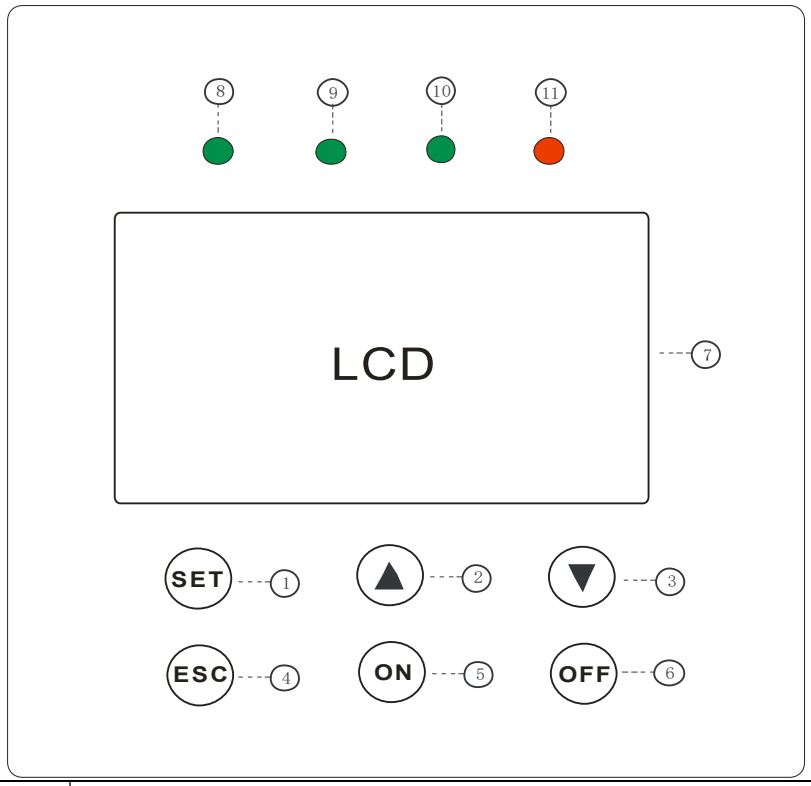
12. It also has a running time query function to record the running time and the accumulated running time;

13. Adopting intrinsically safe design, the control board has protection design of preventing the thyristor trigger interface from burnout, and it supports input and output multi-function expansion board;

14. The thyristor drive interface has double-row LED light indication, the green light indicates whether the trigger board is faulty, and the red light indicates whether the external control line is correct, so that the error position can be quickly checked.

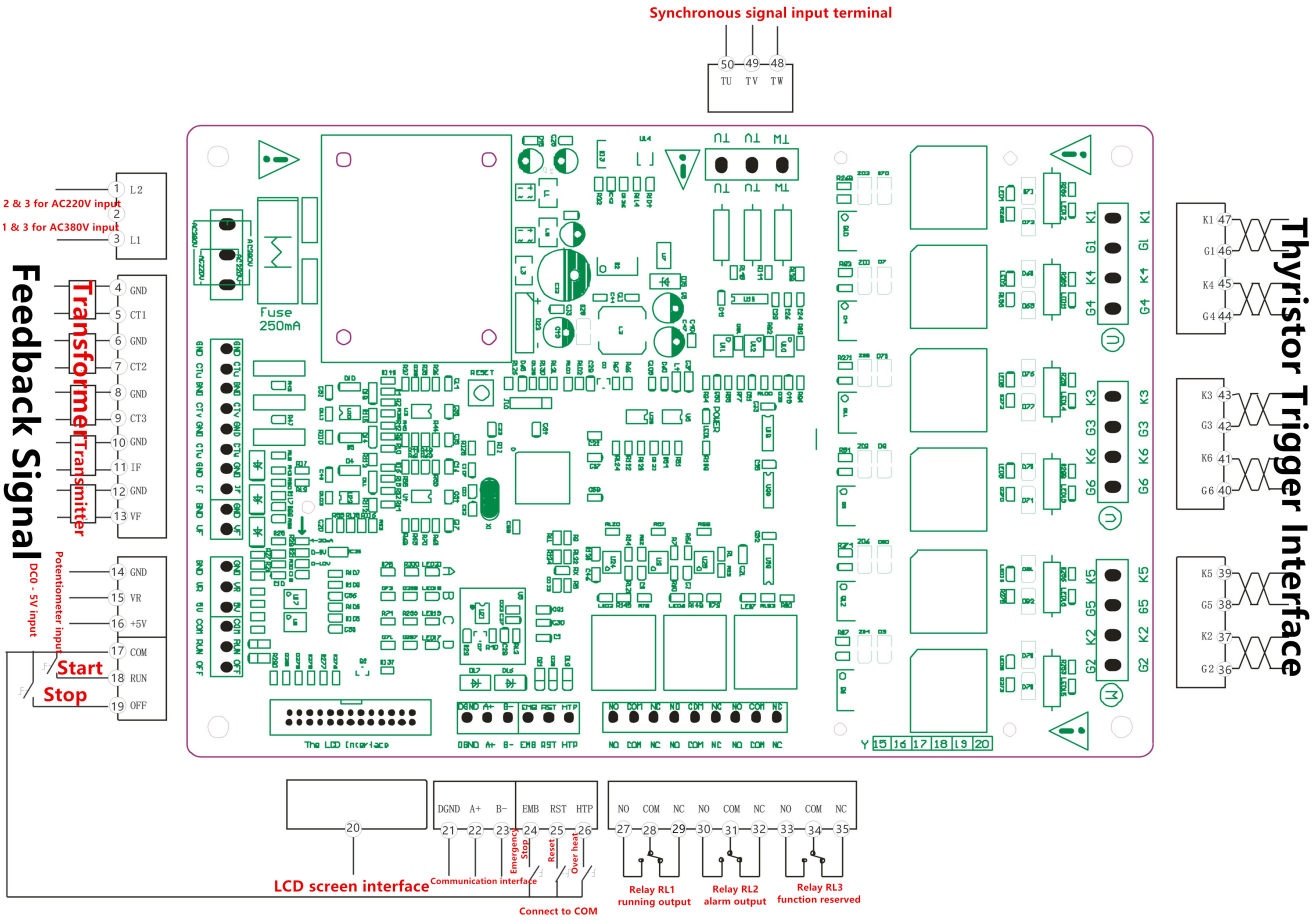
15. All output ports and digital input ports adopt electrical isolation design, which has better electromagnetic anti-interference protection effect

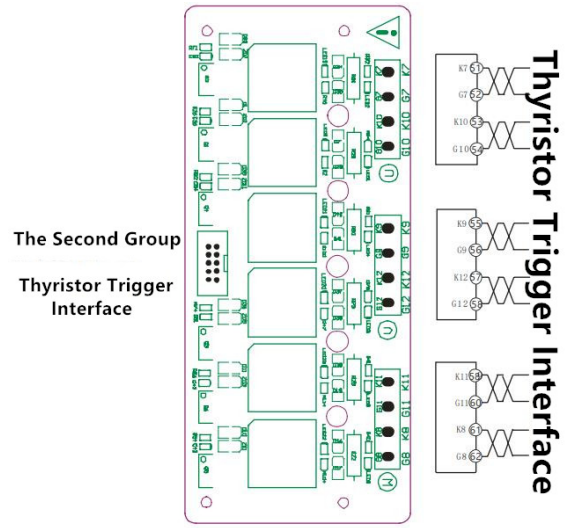
IV. LCD panel operating instructions (i.e. the handheld device):



Parts	Function
SET	Setting button, used as parameter confirm button under the setting mode
▲	To increase the parameter value when modify.
▼	To decrease the parameter value when modify.
ESC	Return button
ON	The start button on the panel
OFF	The stop button on the panel
LCD Display Screen	To display the load mode and parameters.
A Mode indicator (Green)	When it lights, means the control board is in constant voltage adjustment mode; **When both A & B are not in lit, then the control board is in open loop voltage adjustment mode.**
B Mode Indicator (Green)	When it lights, means the control board is in constant current adjustment mode.
C Mode indicator (Red)	Running indicator
D Mode indicator (Red)	Alarm indicator

V. Control board terminal definition：





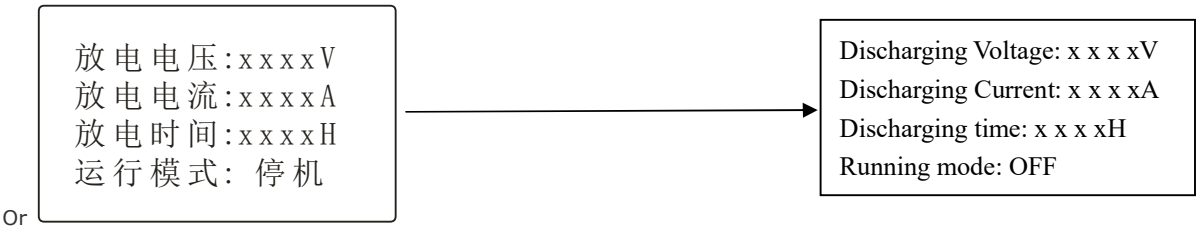
- 1, 2, 3: Power supply input terminal of the control board. Pin 1 with 3 for 380V AC power supply, Pin 2 with 3 for 220V AC power supply, only one of the power supply can be connected, it is recommended to use 380V AC power supply.
- 4, 5: Connection terminal CT1 of the current transformer is corresponding to U phase current display, with overcurrent protection and phase failure protection identification function at the same time. Leave it if don't need to use.
- 6, 7: Connection terminal CT2 of the current transformer is corresponding to V phase current display, with overcurrent protection and phase failure protection identification function at the same time. Leave it if don't need to use.
- 8, 9: Connection terminal CT3 of the current transformer is corresponding to W phase current display, with overcurrent

protection and open-phase protection identification function at the same time. Leave it if don't need to use.

- 10, 11: Signal terminal of constant current feedback input, factory default is DC0-5V, GND (-), IF (+), if you need other signals, please express in advance.
- 12, 13: Signal terminal of constant voltage feedback input, factory default is DC0-5V, GND (-), VF (+), if you need other signals, please express in advance.
- 14, 15, 16: Not useful when used for battery charge, function reserved.
- 17, 18, 19: Common COM, ON and OFF control. When the startup mode is "self-locking", short circuit 17 and 18 to start working. And when it is disconnected, the operation stops, and the start-stop button on the handheld device is invalid. When the startup mode is "jog", the connection of 17 and 18 is to start working, and the connection of 17 and 19 is to stop, and the start/stop button on the hand-held device is valid.
- 20: LCD display interface, i.e. the handheld device **(optional, not a standard equipment of the control board, need to purchase additionally).**
- 21, 22, 23: RS485 communication connection interface **(optional, not a standard equipment of the control board, need to purchase additionally, and the version with the function is called ST35C)**.
- 24: The emergency stop input terminal, the other connection terminal is Pin 17 COM, connect pin 17 and 24 is to emergency stop.
- 25: The reset button terminal, the other terminal corresponds to the 17-pin COM connection. When in the fault condition, short circuit 17 and 25 to rest the system.
- 26: The thyristor overheat input terminal, and the other terminal corresponds to the COM connection of 17-pin. It adopts the normal open temperature control switch and automatically stops when it is overheat.
- 27, 28, 29: Running relay output, 27 is normally open terminal, 28 is common terminal, and 29 is normally closed terminal.
- 30, 31, 32: Fault relay output, 30 is normally open terminal, 31 is common terminal, and 32 is normally closed terminal.
- 33, 34, 35: Function reserved.
- 36, 37, 38, 39: W-phase thyristor control trigger interface.
- 40, 41, 42, 43: V-phase thyristor control trigger interface.
- 44, 45, 46, 47: U-phase thyristor control trigger interface.
- 48, 49, 50: Main circuit power supply sync signal input terminal, 48 corresponds to W phase, 49 corresponds to V phase, and 50 corresponds to U phase. (Synchronous transformer is recommended for serious interference occasions)
- 51, 52, 53, 54: The second group U phase thyristor control trigger interface
- 55, 56, 57, 58: The second group V phase thyristor control trigger interface
- 59, 60, 61, 62: The second group W phase thyristor control trigger interface

VI. LCD panel Chinese Menu display and parameter operation instructions:

6.1 In standby mode, the LCD display interface is as below. The first three lines on the display screen is the feedback display value of the current adjusted signal and the voltage and current. And the bottom line shows the load of the operation state: (Warm reminder: the voltage and current feedback display value has a certain mini mistake measurements, this value is for your reference only, please refer to the multimeter.



Or

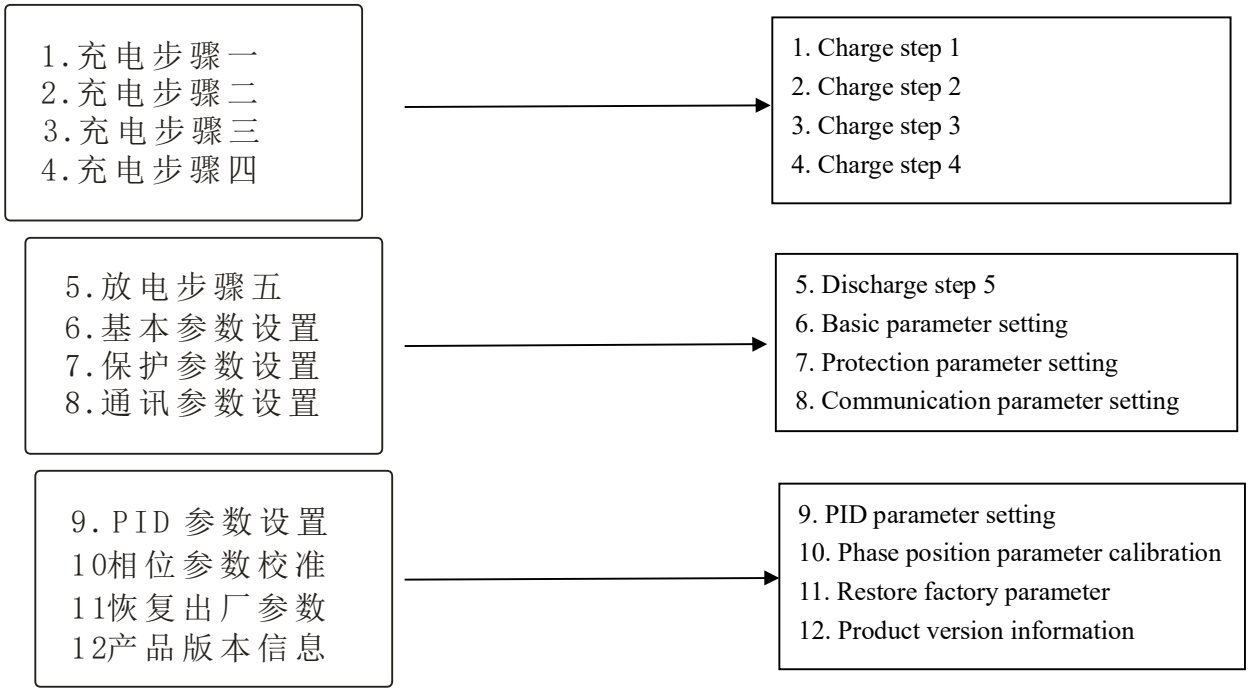
6.2 Button operation and display function

By using LCD screen and other 4 function button, set, ▲, ▼ and ESC to achieve human-computer conversation. Easily to modify the needed parameters, and shows the load running mode in real time as well.

The display parts on the LCD screen shows the present load working mode, users can modify and set the parameters at the first time using it or in the using process according to their needs. The control board enter the standby mode if no abnormal after power on and self-detection, waiting for users to enter operation command. If there is an error, it will shows fault at the running mode. If users need to query the fault, press the ESC to enter the query mode, and press it again back into the standby mode.

6.3 In the standby mode and without fault, short press the ESC switch into the AC-side current query. Short press it again or without any operation in 10 seconds, it will back into standby mode, display as below

6.4 Menu setting operation, in standby mode, short press SET, it will remind you to enter the password like ------(The default password is ▲▲▲▼▼▼), after entering the correct password, press the SET again enters the first user menu, display interface as below.



In first grade menu, by press ▲ or ▼ to choose different function parameters. And then press SET again enter the second grade. In the parameter modification of each level, you can use the ▲ (up) or ▼ (down) key to select, the reverse line is the present chosen line, short press the SET button, the parameter will flash, and enter the current parameter value modification mode, we can use the ▲ (up) or ▼ (down) to set different parameters. Press SET to confirm after setting. Since the LCD screen displays has the limitation of the subtitle width, it displays four consecutive items each time, if we want to select the following options, we can press ▲ (up) or ▼ (down) to select. In the setting mode operation, if the button is not pressed again within ten seconds, it will automatically return to the standby main screen.

6.4.1 Secondary menu under charging step parameter setting options:

充电阶段: 预充
充电模式: 恒压
给定电压: 100V
限制电流: 100A

Charge period: Pre-charge
Charge mode: Constant voltage
Given voltage: 100V
Current limit: 100A

充电时间: 100M
跳转电压: 100V
跳转电流: 100A
下一步骤: 1

Charge time: 100M
Jump voltage: 100V
Jump current: 100A
Next step: 1

6.4.2 Secondary menu under the basic parameter setting:

控制方式: 本地
电压量程: 100V
电流量程: 100A
互感器比: 100A

Control Method: Local
Voltage range: 100V
Current range: 100A
Transformer ratio: 100A

软起时间: 10S
软停时间: 10S
相位限制: 0度
主从偏移: 0度

Soft start time: 10S
Soft stop time: 10S
Phase angle limit: 0 degree
Host/slave shift: 0 degree

启动方式: 点动
反馈设置: 关闭
手自启动: 手动
起止相位: 120度

Start method: Jog
Feedback setting: Off
Manual auto start: Manal
Start & stop phase angle: 120 degree

6.4.3 Secondary menu under the protection parameter setting:

1.过压保护:关闭 2.过压时间:10S 3.欠压保护:关闭 4.欠压时间:10S	1. Over voltage protection: Off 2. Over voltage time: 10S 3. Under voltage protection: Off 4. Under voltage time: 10S
IF过载保护:关闭 IF过载时间:10S CT过载保护:关闭 CT过载时间:10S	IF over load protection: Off IF over load time: 10S CT over load protection: Off CT over load time: 10S
9.缺相保护:开启 10三相平衡:关闭	9. Phase loss protection: On 10. 3 phase unbalance: Off

6.4.4 Secondary menu under the communication parameter setting:

1.通讯地址: 1 2.波特率: 9600 3.校验位:无校验 4.通讯检测:关闭	1. Communication add: 1 2. Baud rate: 9600 3. Parity: no check 4. Communication test: Off

6.4.5 Under the Factory Reset Settings option:

Prompts to enter the password, (factory password: ▲ ▲ ▲ ▲ ▲ ▲) After the password verification, the factory recovery operation will be automatically performed, and the control system will be restarted after completion.

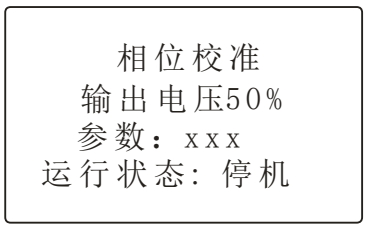
6.4.6 Under PID parameter setting:

1.PID参数:中速 2.P参数: 80 3.I参数: 60 4.D参数: 自动	1. PID parameter: Medium speed 2. P parameter: 80 3. I parameter: 60 4. D parameter: Auto

When users uses different loads, different dynamic parameters can be adjusted according to the load characteristics to achieve the best or stable operation adjustment mode. At this time, users need to enter the PID parameter setting.

Functional parameter	Settled parameter	Default	Remark
PID parameter setting	Refer to Remark	Medium speed	PID parameter setting has fast PID adjustment (suitable for resistive load constant voltage and constant current), medium speed PID adjustment, slow speed PID adjustment (suitable for Inductive and capacitive load constant voltage and constant current) and user-defined PID adjustment. Under the user-defined mode, users can adjust the P and I parameters, but cannot adjust in other three kinds of mode.
P parameter	1～128	--	
I parameter	1～128	--	
D parameter	Not adjustable	--	

6.4.7 Under phase parameter calibration setting: (i.e. adjust the hour)



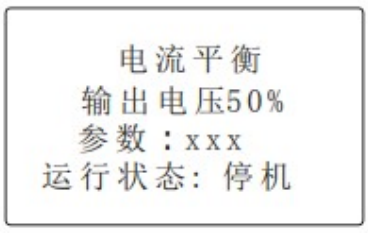
Phase angle calibration
Output voltage 50%
Parameter: x x x
Running mode: Off

When users changes the main circuit voltage, access the transformer to the pre-stage access or connect the synchronous transformer to the synchronous signal terminal, then users need to enter the phase parameter calibration at this time.

In the phase calibration mode, it is recommended to access a 1~10KW resistive dummy load to test. The default output voltage of the system is 50% of the voltage on the main circuit. Press the start key to run the work. At this time, press ▲ or ▼ to adjust the output voltage into half of the main loop circuit voltage, then the calibration is completed. It is default calibrated by AC380V voltage when out of factory. If users uses AC380V on the main circuit, then do not need to be calibrated again.

* The main circuit AC380V output correspond is about DC256V, AC220V correspond is about DC150V.
* Phase calibration value is 0, when AC380V is not connected to the synchronous transformer.
* Phase calibration value is -250 when AC380V, 660V, or 1140V plus synchronous transformer.

6.4.8 Current balance manual adjust (Current sharing function) setting



Current balance:
Output voltage 50%
Parameter value：
Running mode: OFF

Due to transformer has 2 groups of secondary output, in Start or triangle wiring diagram, the 12 pulse will has current imbalance, at this moment, users need to enter the current balance manual adjust mode.

Under current sharing adjust mode, users can adjust the parameters under OFF mode to test: For example, the system is default the output voltage as 50% of the rectified main circuit power voltage. Press On button to work, and by pressing the Up and Down key to adjust the output, and this is to manually adjust the current of the 2 groups.

6.4.9 Under the product version information option:

Under this option, the system displays the model, software version, manufacturer and phone number of the related product, so that the user can check whether the related software is updated and the technical support phone, it cannot be changed.

Some tips on menu settings:

1. If users presses the ESC button under each level menu, it will return to the previous menu mode.
2. If there is no operation within ten seconds in the setting mode, it will automatically return to the standby state.
3. The menu setting can only be entered during standby or fault mode, and cannot be entered after starting.
4. After entering the menu, press the start button is invalid. It can only be started after exiting the menu.

6.5. Overview of the user menu:

6.5.1. Charging step parameter (for discharge step parameter please refer to charge parameter setting

Parameter	Setting range	Default value
1、Charging period	Pre-charge, fast charge, slow charge, average charge and floating charge	Pre-charge
2、Charging mode	Constant voltage, constant current and adjustment	Constant voltage
3、Given voltage or current	1~300V or 1~300A	100V
4、 Limited voltage or current	1~300A or 1~300V	100A
5、Charging time	1~9999M or H	100M
6、Jump voltage	Close, 1~300V	Close
7、Jump current	Close, 1~300A	Close
8、Next step	1, 2, 3, 4, 5, down	1

Charging period setting

The charging period is set by the user according to the charging characteristics of the battery.

※ Charging mode setting

The charging mode is divided into three modes: constant voltage, constant current and adjustment (i.e. open loop).

※ Given voltage or current setting

In constant voltage is a given voltage, and in constant current is a given current.

※ Limit voltage or current setting

In constant voltage, the current is limited. In constant current, the voltage is limited. When in open loop (adjustment), there is no current and voltage limit function.

※ Charging time setting

The charging time is the requirement in the current charging step. When the time is up, it will automatically change into the next step. In floating charging, the unit is hour, and other modes are minute.

※ Jump voltage setting

The jump voltage is the charge voltage under the present charge step, it will automatically change to the next step when the charging voltage is greater than the jump voltage for one minute.

※ Jump current setting

When the charging current is in the charging, pre-charging, fast charging, slow charging, and equalizing processes, it will automatically change into the next step when the charging current is less than the jump current for one minute.

※ Next step setting

The next step is the setting step that is automatically switched into after reaching a certain setting requirement under the current charging step.

6.5.2. Basic parameter options

Parameters	Setting range	Default
1、Control methods	Local, communication	Local
2、Voltage range	1~300V	100V
3、Current range	1~300A	100A
4、Transformer ratio	1~300A	100A
5、Soft start time	1~200S	10S
6、Soft stop time	0~200S	10S
7、Phase limitation	0~180 degree	0
8、Master-slave migration	-60~60 degree	0
9、Start methods	Jog, self-locking	Jog
10、Feedback setting	Off, detection	Off
11、Manual and self-start	Manual, self-start	Manual
12、Start and stop phase	0~180 degree	150

Control mode setting

The control mode has two states: "local" or "communication". Users can select according to their needs, and the factory default is "local". The "local" mode is the external signal control of the potentiometer end; the "communication" mode is the remote control of the related computer (remote control the power on or off, and analog quantity), and if there is an external control signal, it will be invalid.

※ Voltage range setting

Set according to the DC voltage rectified by thyristor, the actual load maximum voltage or voltage sensor full scale corresponds to the voltage feedback terminal VF5V, and the constant voltage value, overvoltage value and undervoltage value are all set according to this parameter.

※ Current range setting

Set according to the DC current rectified by the thyristor, the actual load maximum current or current sensor full scale corresponds to the current feedback terminal IF5V, and the constant current value, overload value and overcurrent value are all set according to the parameter.

※ Transformer ratio setting

Set according to the current transformer ratio sampled by the AC terminal of the previous stage, CT1-3 is connected to the transformer with a secondary current measurement of 1A, which has the overcurrent protection or the three-phase current imbalance protection function of the preamplifier. If you don't need it, you can leave it alone.

※ Soft start time setting

The soft start time adjust range is from 1~200 seconds.

※ Soft stop time setting

The soft stop time adjust range is adjustable from 0 to 200 seconds. If the soft stop time is set to "0", the soft stop function is off.

※ Phase limit setting

To limit the phase shift angle of the thyristor output. When the angle is 0 degrees, the angle is fully open and unlimited, and the highest voltage is output; at 60 degrees, it is half of the rectified voltage output.

※ Master-slave offset setting

Parameter is the number from -30 ~ 30 degree, it is the phase difference of second group trigger pulse with the first group trigger

pulse, the phase of these 2 groups of transformer is 30 degree advance or delay.

※ Startup mode selection

The startup mode is divided into two states: "jog" or "self-locking". For details, please refer to part V. "Control board terminal definition". Users can choose according to their own needs. The factory default is "jog".

※ Feedback setting selection

The feedback setting has two states: "off" or "detect".

※ Manual and self-starting settings

※ The initial mode setting after power on, "manual" is the shutdown mode after power-on, and "automatic" is the automatic operation of the control panel after power-on.

※ Start and stop phase setting

The start and stop phase is the phase shift angle control of the thyristor from 0 to 180 degrees. When start, the output voltage starts from the settled phase value. When stop, the output voltage value drops to the settled phase value and close down directly; This parameter is needed when discharge in order to let it in the inverter mode.

6.5.3. Protection parameter

Parameter	Setting range	Default
1.Over voltage protection range	Close, 1～6000V	Close
2.Over voltage protection time	0～200 seconds	10 seconds
3.Under voltage protection range	Close, 1～6000V	Close
4.Under voltage protection time	0～200 seconds	10 seconds
5.IF over load protection option	Close, 1～6000A	Close
6.IF over load protection time	0~200 seconds	10 seconds
7.CT over load protection option	Close, 1～6000A	Close
8.CT over load protection time	0~200 seconds	10 seconds
9.Phase lost protection option	Close, open	Open
10.Three phase balance protection	Close, 10～60%	Close

※ Overvoltage protection selection (less than the settled maximum voltage range)

VF voltage signal feedback terminal. It will generates an overvoltage protection fault after the overvoltage time delay when the output voltage is too high. The overvoltage protection of the factory preset is close.

※ Overvoltage protection time

The delay time for overvoltage protection, can be adjust from 0 to 200 seconds and the factory default is 10 seconds.

※ Undervoltage protection selection (less than the settled maximum voltage range)

VF voltage signal feedback terminal, when the output voltage is too low, an undervoltage protection fault occurs after the undervoltage time delay. The factory default of the long-time protection is close.

※ Undervoltage protection time

The delay time for undervoltage protection, can be adjust from 0 to 200 seconds, and the factory default is 10 seconds.

※ IF overload protection option

The IF current signal feedback terminal. It will generates an overload protection fault after the overload time delay when the load current is too large. The factory preset of the overload protection is close.

※ IF overload protection time

The delay time of the IF over load protection, can be adjusted from 0 to 200 seconds and the factory default is 10 seconds.

※ CT overload protection option

The transformer signal input detection protection. It will generates an overcurrent protection fault after the overload time delay when the load current is too large. The factory preset of the overload protection is close.

※ CT overload protection time

The delay time of the transformer overload protection, can be adjusted from 0 to 200 seconds, and the factory default is 10 seconds.

※ Phase loss protection option

When a phase current disappears, it enters phase loss protection. The phase loss protection function can be close or open by choice.

※ Three-phase balance protection setting

This function is used to detect the balance state of the three-phase current during the running, representing the percentage between the two-phase current difference and the maximum value. The adjustable range is 10%~60%. When users choose close, the current unbalance protection is canceled.

6.5.4. Communication parameter (For specific communication protocol please ask for communication protocol attachment instruction)

Parameter	Setting range	Default
1.Communication address	1～247	1
2.Baud rate	2400、4800、9600、14400、19200、38400、57600、115200	9600
3.Parity bit	None, odd, even	None
4.Communication detection	Close, open	Close

※ Communication address selection

Adopt RS485 communication mode, comply with MODBUS RTU bus protocol, communication address parameters is 1~247.

※ Baud rate selection

Baud rate has 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200.

※ Parity bit selection

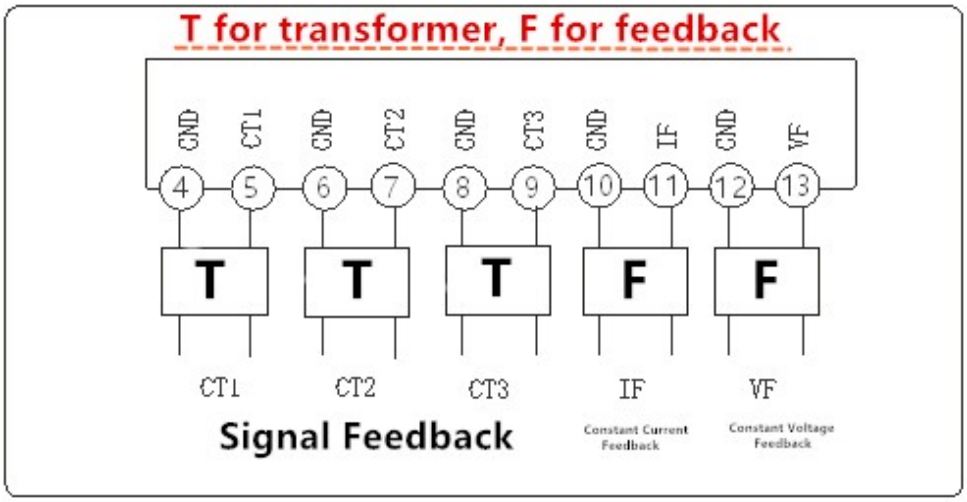
The parity bits has three ways, no parity, odd parity, and even parity.

※ Communication detection setting

The communication detection function is to judge whether the communication between the control computer and the control board is normal. When the function is open, the control board detects if the upper computer has send a command every 1 minute, and automatically close the output if no command received after timeout, and prompts “communication error”.

VII. Output feedback control connection instruction:

7.1. Constant voltage and constant current feedback terminal refers to the following diagram.



During constant voltage feedback, the feedback voltage signal is DC0-5V (factory default). If the load is added with transformer isolation control, the load terminal can take the feedback voltage by adding two resistors to divide the voltage and obtain the signal. Connect the resistors to VF and GND, please refer to the connection diagram below; Or using the rated output voltage of 0-5V Hall voltage sensor, we also have the constant voltage acquisition module used with this trigger board, please consult our sales for details.

In the voltage divider circuit of the diagram below, generally, R2 takes 1K and the power is no less than 2W. The calculation formula of the resistance value (unit KΩ) and power P (unit W) of the voltage dividing resistor R1:

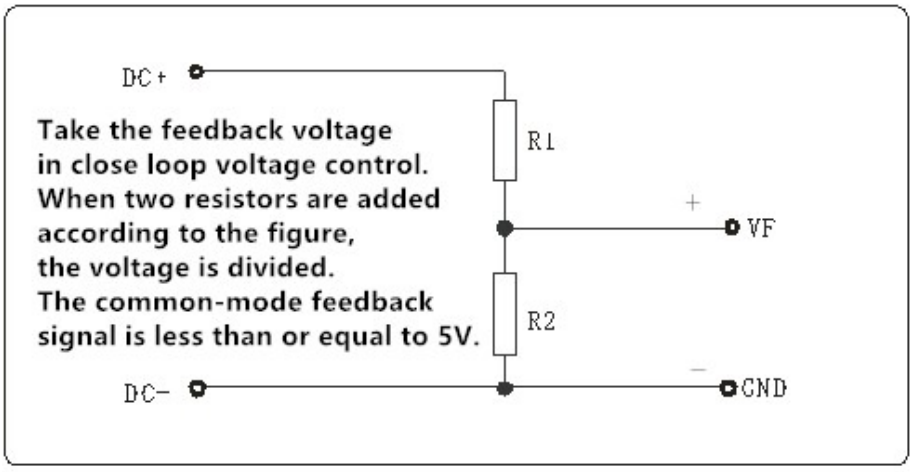
R1=V0/5-1(KΩ) P=0.2×R1(W)

V0 in this formula is the rated rectified output voltage, unit is Vdc

E.G. Rated rectified output voltage V0=500V, to calculate the resistance value and power of the divider resistor R1.

R1=500/5-1=99(KΩ) P=0.2×99=19.8(W)

Select divider resistor R1 with 100K resistance value and 20W power.



For constant current feedback, please use Hall current sensor, and connect to IF and GND constant current feedback interface, the feedback voltage signal is DC0-5V (factory default); if using 0-75mV divider to sampling current signal and connect to port, please explain in advance. For other transformer signals, please directly connect the transformer with the secondary 1A at the CT port.

7.2. Optional current transformer ：

When the main circuit is380V/660V/1140V, the current transformer of the load can be selected according to the recommend value in the form below.

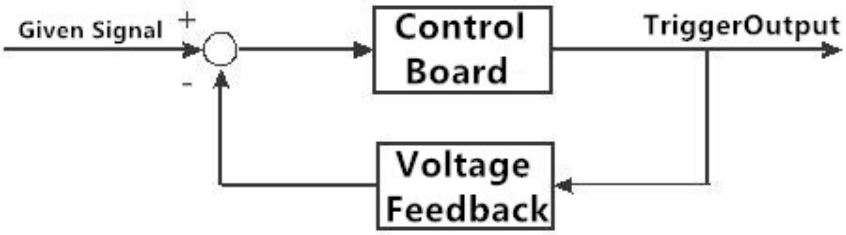
Rated current	660V load power	1140V load power	Transformer
More than 480A	More than 425KW	More than 720KW	2000:1
120A< rated current ≤480A	110KW< load power ≤425KW	185KW＜ load power ≤720KW	1000:1
15A< rated current ≤120A	11KW< load power ≤110KW	22KW＜ load power ≤185KW	200:1
15A and lower	11KW and lower	22KW and lower	100:1

7.3. Notes on three-phase synchronous signals:

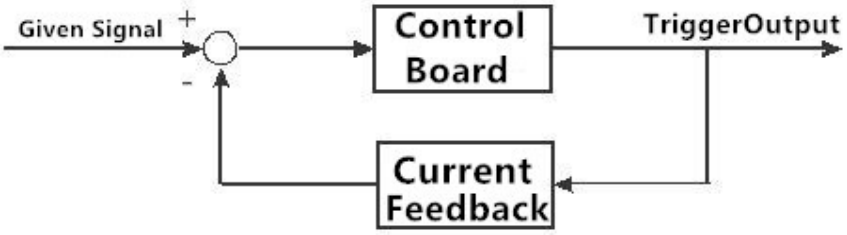
Since the controller has a phase sequence self-applying function, the connection of the rectifying device to the incoming power source does not have to distinguish the phase sequence. However, the connection relationship inside the device must strictly follow the correspondence. It is necessary to ensure that the wiring of the TU terminal corresponds to the wiring of the SCR1, SCR4, SCR7 and SCR10 thyristors; the wiring of the TV terminal corresponds to the wiring of the SCR3, SCR6, SCR9 and SCR12 thyristors; the wiring of the TW terminal corresponds to the wiring of the SCR5, SCR2, SCR11 and SCR8 thyristors. When there is a transformer in the main circuit, the primary/secondary of the transformer adopts Δ/Y connection or Y/Δ connection. It is necessary to pay attention to the correspondence between the secondary winding of the transformer and each thyristor, corresponding to the TU. , TV, TW signal.

VIII. The related principles schematic in rectification control process

8.1. Closed loop constant voltage mode: When the load current is less than the current limit parameter, the microprocessor will compares the voltage feedback signal with the given signal. When the voltage feedback signal is less than the given signal, the microprocessor will increase the output till the voltage feedback signal and the given signal are equal. When the voltage feedback signal is greater than the given signal, the microprocessor will reduce the output till the voltage feedback signal is equal to the given signal. In this adjustment method, if the input signal stay unchanged, even if the power supply voltage changes or the load impedance changes, the load voltage remains unchanged (excluding the sudden change of the grid and load impedance), and it has a current limiting function, and the current limit has priority. The schematic is as follows:

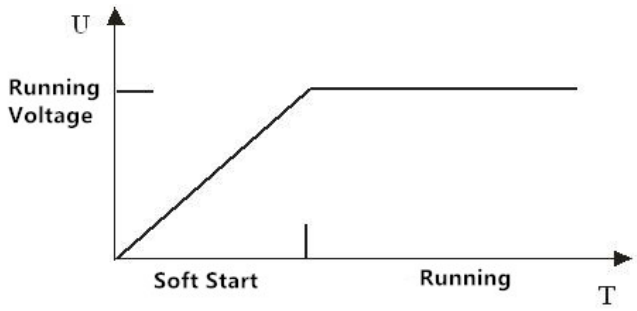


8.2. Closed-loop constant current mode: When the load voltage is less than the voltage limit parameter, the microprocessor of the control board compares the current feedback signal with the given signal. When the current feedback signal is less than the given signal, the microprocessor will increase the output till the current feedback signal equal to the given signal, when the current feedback signal is greater than the given signal, the microprocessor will reduce the output till the current feedback signal is equal to the given signal. In this adjustment, if he input signal stay unchanged, even if the power supply voltage changes or the load impedance changes, the load current remains unchanged (excluding the sudden change of the grid and load impedance). It is with voltage limiting function, the voltage limit has priority. The schematic is as follows:



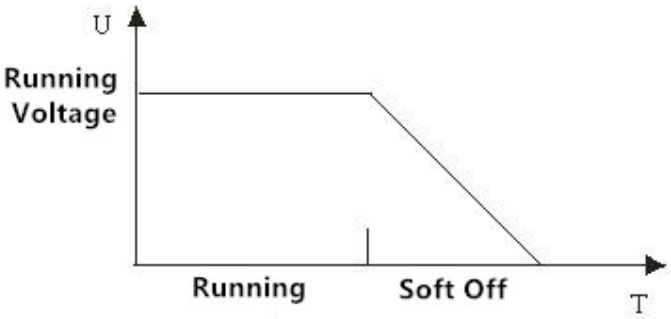
8.3. Adjustment open loop control mode: that is, the open-loop control mode, the microprocessor of the control board linearly converts the input signal into a thyristor conduction angle trigger output, in this adjustment mode, the output of the control board changes with the power or power supply voltage. It is with overvoltage and overcurrent protection. The schematic is as follows:

8.4. Soft start: At start-up, it is starts from the zero voltage, and gradually rises into the settled operating voltage during the starting time.



Soft Start Process Diagram

8.5. Soft off: At the stop time, the operating voltage will gradually reduce into the ending voltage of 0V.



Soft Off Process Diagram

IX. Fault display and dealing methods

When the fault occurs during operation, the display screen will display the cause of the fault in real time. The figure below shows the cause of the fault during the query operation.

When a fault occurs, the fault relay output a signal, the running relay and the load output are disconnected, and the text on the lower right of the LCD screen is the fault display. If you need to query the fault, press the ESC key to enter the fault display mode. At this time the fault is displayed in the middle of the screen. We provide the following troubleshooting methods for the possible failures:

※ Overvoltage fault: Check the voltage protection level and overvoltage protection selection setting. If the parameters are normal, then check if the power supply voltage exceeds the set value.

※ Undervoltage fault: Check the voltage protection level and undervoltage protection selection setting. If the parameters are normal, then check if the power supply voltage is lower than the set value.

※ Phase loss protection: The protection circuit operates when any phase of the main circuit power supply is disconnected.

Maintenance method: Check if the main circuit input is disconnected or the load is too light. If the load current is too small, then the transformer needs to be replaced.

※ Overcurrent protection: The protection circuit operates instantaneously when any phase current exceeds 8 times the rated current.

Maintenance method: Check if there is a short circuit in the main circuit or the overload protection parameter setting is too low.

※ Overload protection: Uses overload reverse time protection.

Maintenance method: Reduce the load.

※ Three-phase unbalance protection: When two of the phase current values differ bigger than the set value, the protection take action after three seconds.

Maintenance method: Check if there is any abnormality in the power supply or in the load.

※ Overheat protection: Protection acts when the thyristor is over temperature.

Maintenance method: Check if the radiator is too small or the load current is too large.

※ Feedback fault: There is no signal input to the VF or IF feedback terminal from voltage sensor or current sensor during the constant voltage or constant current.

Maintenance method: Check if the voltage sensor or current sensor didn't output feedback signal, or if it is damaged or the line is disconnected.

X. Analysis and elimination of common problems:

Number	Fault	Possible Reason	Solution
1	No display on the display screen	1.No connection of AC power	1.Check if the power is on, or the fuse is fused
		2.AC power voltage is too low	2.Check input voltage of the control power
		3.Display screen interface is broken	3.Return to factory for replacement
2	No output on from the control	1.Control wire on the trigger port is	1.Follow the wiring diagram, check the

	board	connected wrong	wiring of the control wire
		2.The thyristor is damaged	2.Replace the thyristor
		3.There is an indicator light (six red lights) not lit on the trigger port	3.The related indictor of certain road is not lit, check if the thyristor on this road is connected right
		4.There is an indicator light (six green lights) not lit on the trigger port	4.Return to factory for replacement
3	The output voltage is unstable	1.Open load	1.Check if the load is wired
		2.Power of the load is low	2.Change for a high power load, please take >1000W for experiment
		3.One of the thyristor is not conductive	3.Replace the thyristor
		4.PID parameter is wrong	4.Reset the PID parameters according to the feature of the load
4	The differ ratio between the input signal value and the actual output voltage is too big.	1.Constant current or constant voltage does not match with feedback signal	1.Check if the feedback signal is DC0-5V
5	Output voltage can't adjust to the rated value.	1. Feedback signal of constant current or constant voltage does not match.	1.Check if the feedback signal is DC0-5V
		2.The settled value of limit voltage or limit current is too low	2.Reset the value of limit voltage or limit current
		3.The main circuit is not with 380V or synchronous transformer	3.Re-phase calibration, adjust parameters

XI. Main circuit and control circuit wiring diagram

The wiring diagram below is a schematic diagram of the main circuit, the trigger terminal of the control board and the thyristor when the three-phase full-controlled rectifier control board is combined with other components. In the process of wiring the control panel trigger terminal and the thyristor, it should be noted that the correspondence of the position between the cathode (K) and the gate (G) as the diagram below, users should avoid the misconnection and reverse connection, otherwise a short-circuit will occur to burnout the device or damage the control board; The main circuit must be added with the necessary protection components, such as using fast-melting for over-current protection and piezoresistor for over-voltage protection, and both side of thyristor connected to the RC to absorption circuit and so on.

Note: 1. Transformers, circuit breakers, contactors, fast-melting and thyristors, etc., needs to be purchased by users.

2. Hall voltage sensor, Hall current sensor, transformer and shunt needs to be purchased by the user.

3. Thyristor RC absorption components are optional accessories, need to be purchased by user.

Three Phase Rectifier Reversible Control Wiring (With transformer to reduce the voltage)