Medium voltage soft start device

SSM series installation and user manual V41

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This manual is for the installation and use of (model sequence) soft start devices.
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This manual has been carefully reviewed before publication, but there is still a possibility of negligence. If any users find errors, please notify us as soon as possible.

The parameters in the manual are only used to describe the product. In order to meet user needs, my company is constantly improving and perfecting the product. Any changes are not notified.

Security

Users should pay attention to the warnings and information prompts mentioned in the manual.
The soft start device is only allowed to be installed and debugged by qualified technical personnel.
This manual should be kept for the convenience of equipment use, operator access, and use.
Before installation and debugging, this manual should be read first.

Security Warning

1. The installation, operation, and maintenance of the soft start device should be strictly carried out in accordance with this manual, relevant national standards, and industry practices;

2. The soft start device is a high-voltage equipment with a high-voltage power supply and control power supply. It must be operated and maintained by authorized and trained personnel. After a high-voltage power outage, there is still danger due to the induced high voltage on the motor, and it should be discharged before operation.

3.Before maintaining the motor and soft start device, all power must be cut off;

4. The interlocking of high-voltage switchgear and soft start cabinet, as well as the interlocking inside the soft start cabinet, are important measures to ensure safety and cannot be ignored;

5. Ensure reliable grounding of the soft start cabinet.

Matters needing attention

1. Professional technicians must install or guide the installation of this equipment;

2. Ensure that the power and specifications of the load motor match the equipment as much as possible;

3. Reactive power compensation capacitors used to improve power factor should not be connected to the output end of the soft start device, otherwise it will damage the thyristor power device in the soft start device;

4. It is prohibited to use a megohmmeter to measure the insulation resistance between the input and output of the soft start device, otherwise the controllable silicon and control board of the soft start device may be damaged due to overvoltage. When measuring motor insulation, the above principles should also be followed.

Catalogue

1. Summary

1.1 Related information of the soft starter

1.2 Installation and Debugging manual

This manual introduces the installation and debugging method of the Soft starter. It introduces how to install the mechanical part, electrical part and communication part of the soft starter. It also introduces how to power on, how to set parameters, how to use and maintain the soft starter.

If you want to use it as soon as possible, please refer to chapter 2 "use fast".

This installation and debugging manual is provided for the personnel who install, debug and maintain the soft starter.

Installation personnel must have the basic knowledge of electrical installation. Debugging and maintenance personnel must have certain experience in using such equipment.

1.3 Chapters

Summary： Introduce this book to the user.

Quick guide: The fastest way to introduce how to install and use the Soft starter and how to make it run. The chapter is suitable for experienced users.

Description: The function and the specific technical matters of the soft starter.

Installation： Introduce the information of unpacking and installation.

Wiring: Electrical and communication connection.

The man-machine interface： Introduce the work of man-machine interface and the related content.

Parameter Settings： Introduce all the functions of the soft starter; include the minimum value, the maximum value and the default value.

The inspection and handling to the fault： Looking for and troubleshooting

Circuit diagram：Circuit diagram and typical application cases。

2. Quick guide

2.1 Installation

Please install the equipment according to the requirements and precautions describe in section 4.

2.2 Wiring

2.2.1 Main circuit wiring:

Terminals R, S, T are connected to the three-phase power, Terminals U, V, W are connected to the motor(Note: The lead wires from the load terminals of the Medium soft starter cabinet needs to pass through the current transformer).

Note that the selected Wire must be matched to the load motor.

2.2.2 The control circuit power supply wiring

Introduce AC 220V power supply into the TX1 terminal row L and N which are in the relay room of the cabinet.

2.2.3 Communication cable connection (optional)

If you need the RS-485 control, please wiring communications cables to the 39, 40 pin of the TX2 terminal row.

2.2.4 Ground protection

To ensure safety, ground terminal of the cabinet must be connected to the ground.

2.3 Parameter Settings

After the control circuit power on, refer to the parameter description in section 7, carefully set various parameters which needed when the equipment is running.

2.4 Operating steps

①Choose start mode (soft start or straight start) through the switch SA1 on the control panel.

② Rotate the switch SA2 on control panel to choose where the start commands come from (local, LCC or Remote). If local and remote control circuit isn't wired, the switch can only be rotated to the "local" position.

③The control circuit power on;

④Set control mode, operation mode, stop mode and running modes by the touch screen; see 7.1;

⑤The main circuit power on;

⑥If " touch screen" is selected, touch "Starting" on the touch screen to start the motor. If the "cabinet button" is selected, press the button "start" on the cabinet to start the motor.

⑦When the motor is needed to stop, touch "stop" on the touch screen or press the button "down" on the control panel;

⑧the main circuit power supply is cut off;

⑨the control circuit power supply is cut off;

In case of emergency, press the "EMS" button on the control panel directly to interrupt the start process, or the motor will be stopped

3. Description

This chapter will introduce general principle and characteristics of the Soft starter.

3.1 Summary

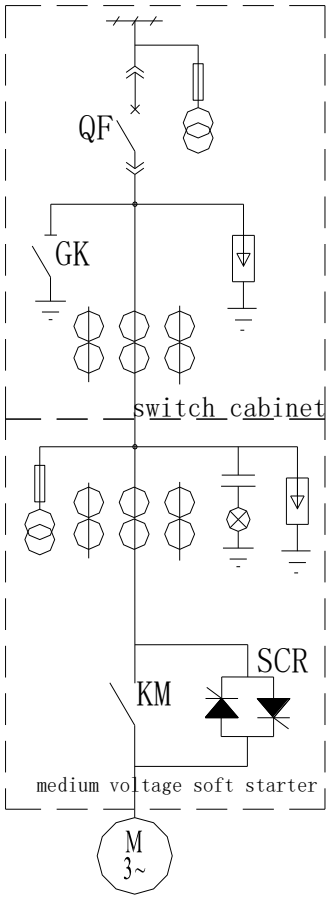
When the three-phase asynchronous motor is started directly, the large starting current will be produced. Along with the configuration of the load and the motor is different, the starting current usually is 5 ~ 9 times than the rated running current, sometimes it is even more than ten times. So a great impact will be caused on power grid, the bus voltage will be dropped. The normal work of the other electrical equipment on the same bus will be influence. In order to solve the increase in peak power supply, the additional investment in transmission and distribution is required. In addition, the high peak torque generated by the large start current will impact on the motor, so the load will be affected. The mechanical wear and tear will be increased; the service life of equipment will be affected also. If the soft starter is use to start and stop the motor, it is possible to control and reduce the current, and the adverse influences mentioned above will be avoided.

Many of the start-stop control technology are used in the SSM series medium voltage solid-state soft starter, such as the high performance computer control, digital signal processing, high power thyristor series, high-frequency switching power supply, the electromagnetic separation control, human-machine interface, the integrated digital communication network, motor protection and so on. Adopting the current limiter or voltage slope start mode, the input voltage of the motor will be controlled, so the starting current of the motor is limited and reduced as also. That can make the motor start and stop smoothly and stably, that can protect the motor to run safely and reliably, the remote monitoring and operation can be achieved also.

Our product is made from medium voltage high power solid state components as current adjustment and control components, there is no mechanical transmission mechanism and liquid material, no electromagnetic devices. Compared with other traditional starter, this device has the advantages of small size, low calorific value, fast response time, high intelligent degree, convenient in display and operation, high

reliability, diverse protection functions, good starting consistency and low maintenance.

In the SSM series solid medium voltage motor soft starter, multiple thyristors are connected serially between the three-phase power supply and three-phase motor. DSP, CPLD chips are used in the control circuit, The triggering signal of the thyristors are transmitted through the final drive board. Change the triggering angle, the input voltage of a three-phase AC motor is changed, So current limiting starting or voltage ramp starting can be achieved. When the starting is completed, the bypass contactor closes automatically. The motor is connected to the power grid for operation (see Figure 1). The voltage waveform and the current waveform during the starting process shows in figure 2.



There are four ways to control the soft starter:

- ○Touch screen (local)
- ○Operation panel (local)
- ○Terminal (external)
- ○RS485 bus (optional)

3.2 function

The medium voltage soft start device has multiple integrated protection and alarm functions. Almost all faults can be detected and displayed. All protection, alarm, and fault displays as follows:

Protection function

·Phase lack ·Over-voltage ·Under-voltage
·Parameters fault ·Zero sequence protection
·Run overload ·Over temperature protection
·SCR fault ·current unbalance ·Start overload
·Operation flow ·Start the flow ·under-load

3.3 Product composition and working principle

The medium voltage solid soft starter mainly consists of the following parts: switch arms connected in series with thyristor components, medium voltage vacuum contactor, signal acquisition circuit, main control board, an isolation drive circuit, human-machine interface, an isolation auxiliary power supply , etc.

The basic working principle is that, firstly accurate detect the zero crossover point of AC voltage in real-time, then based on the zero crossover moment, delay trigger thyristor, by controlling the conduction angle of the alternating current (ac), the voltage applied to the motor winding is controlled, thus the current of the motor is controlled. By setting various parameters and selecting working modes, the voltage and current waveforms required by the user during the starting process can be generated. After the completion of soft starting, the main control board sends a command to close the bypass contactor.

The conductivity passage of the three-phase AC is shown in Figure 2.

The voltage and current during the operation are shown in Figure 3.

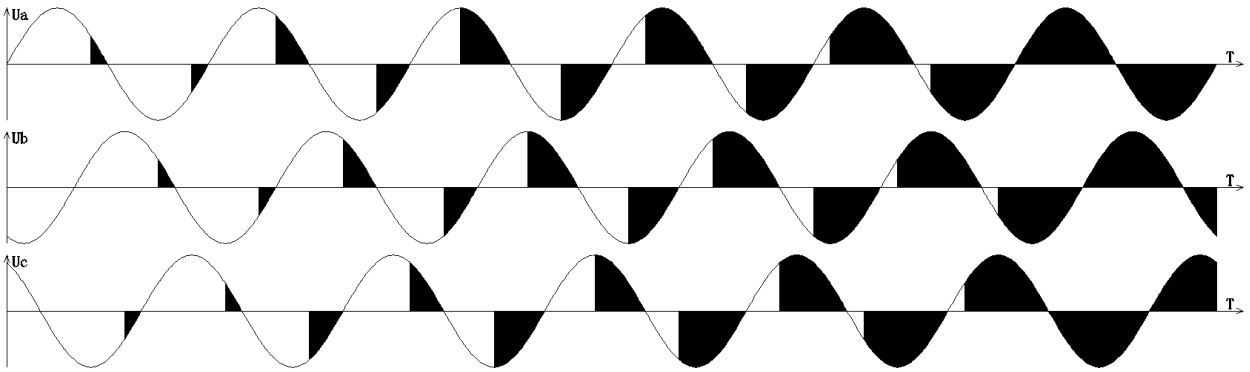


Figure 2. The process of soft starter three-phase voltage conduction process diagram

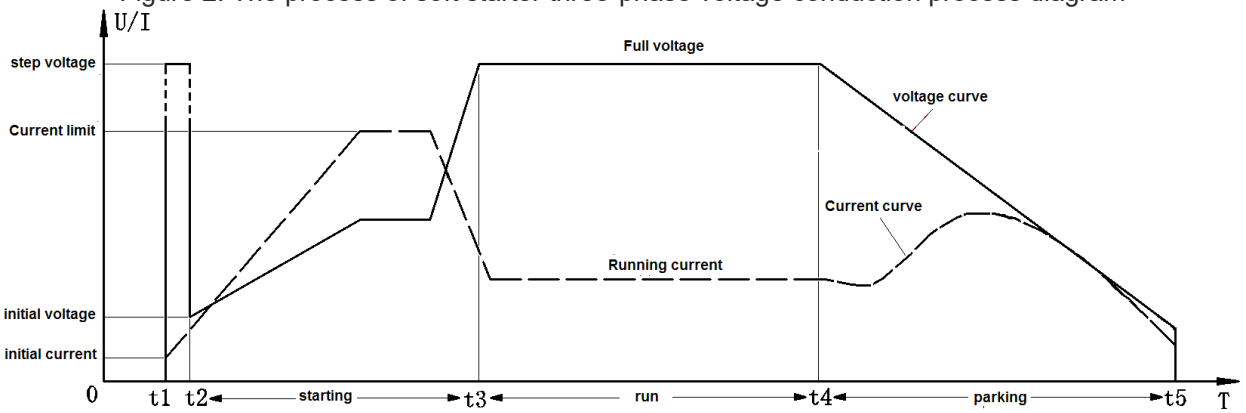


Figure 3. The operation current and voltage

3.4 Structural characteristics

The SSM series medium voltage solid-state soft starter is metal enclosed cabinet device. The cabinet is made of 2.0mm aluminum-zinc coated steel plate. Adopting modular structure is adopted and the incoming and outgoing lines are connected to copper bars, the wiring method is down in (power supply) and down out (motor). This device achieves complete isolation between medium and low voltage in terms of structure and electrical connection. The low-voltage room is completely enclosed and separated from the medium voltage room. The medium voltage cabinet door is equipped with an electromagnetic lock, the use of high voltage electric test device control electromagnetic locks, which is controlled by a medium voltage live detection device. The medium voltage cabinet door cannot be opened when the main circuit is energized. The trigger signal of the thyristor is transmitted by the final drive board, the triggering power supply adopts a medium voltage transformer and high reliability switching power supply (note: high standard electrical isolation technology is used) to extract energy from the low voltage side. The isolating of the voltage and current signal adopts medium voltage transformer.

3.5 Type annotation

SSM-×××- ××- LT

- Integrated machine
- Main circuit voltage (kV)
- Rated power (kW)
- Identification of medium voltage soft start device

3.5.1 Introduction to Integrated Machine:

Terminals R, S, T are connected to the three-phase power, Terminals U, V, W are

The Integrated machine is a soft start device that combines the switchgear, soft start cabinet, and bypass cabinet. It has advantages such as small size, easy installation and space saving. Compared with other brands, the SSM series integrated machine has a volume of 50% -60% that of other soft starters under the same power. SSM series integrated machine are suitable for installation anywhere and have no distance requirements from other equipment arrangements. The Integrated machine with standard configuration includes a grid side vacuum circuit breaker and a bypass vacuum contactor, no need for an upper switchgear, so the high design costs that are gone forever

The cabinet body is made of aluminum zinc coated plate, processed by CNC machine tool, completely metal armored, assembled structure, with a wide range of combination schemes. Advanced multiple folding process is adopted, connected with rivet nuts and bolts, so it has the advantages such as high accuracy, corrosion resistance, light weight, high strength, and strong universality of parts. Domestic ZN63A-12 (VSI) series or imported VD4 series vacuum circuit breakers can be equipped, so the integrated machine has the advantages of wide applicability, high reliability, and long-term maintenance free implementation.

Handcrafts of different specifications are absolutely not allowed to enter.

It has the highly reliable interlocking device. "Five prevention" requirements is fully meted.

Heaters can be installed separately in the circuit breaker room and cable room to prevent condensation and corrosion.

Each high-pressure chamber has a pressure relief channel to ensure personal safety

The front door is equipped with observation windows, so the working status of indoor components can observed.

Protection level: IP40

3.6 Environmental impact

The design of the product minimizes its impact on the environment during manufacturing and use. According to current national laws, the main materials used are recyclable or treatable.

3.7 Range of application

The medium voltage soft starting device can be widely used in various industries that use medium voltage three-phase asynchronous motors to provide power,

The load type:

○pump load ○centrifugal ○pumping unit ○band carrier ○agitator ○Crusher ○plasticator ○Ball mill ○The fan load

○Air compressor, refrigeration compressor ○The elevators, cranes, tractors

3.8Technical conditions

Protection grade	IP40 （main circuit)
Installation position	Vertical installation
Environment temperature	storage：-25℃~+55℃ running： -5℃~+40℃， The daily average temperature does not exceed +35℃。
Relative humidity	No more than 95%, no condensation
Pollution degree	3

altitude	Below an altitude of 2000 m; Capacity should be reduced between 2000m to 4000m, capacity reduction coefficient is 0.007% / m .
vibration	Allow the vibrations with frequencies ranging from 10 Hz ~ 150 Hz acceleration is not exceeding 5 m/s2.
Ac input power supply	The continuous fluctuation of voltage shall not exceed ± 10%, the transient fluctuation shall not exceed+15%~-10%; The frequency fluctuation shall not exceed ± 2%, the frequency change rate shall not exceed ± 10%.
Execution standard	GB311.1-2012《 Insulation co-ordination Part 1: Definitions, principles and rules》 GB3906-2020《Alternating-current metal-enclosed switchgear and control gear for rated voltages above 3.6 kV and up to and including 40.5 kV》 GB/T13422-2013《Semiconductor converters—Electrical test methods》 GB/T3859.1-2013《Semiconductor converters—General requirements and line commutated converters—Part 1-1:Specification of basic requirements》 GB/T3859.2-2013《Semiconductor converters—General requirements and line commutated converters—Part 1-2:Application guide》 GB/T4208-2017《Degrees of protection provided by enclosure(IP code)》 GB7251.1-2013《Low-voltage switchgear and control gear assemblies—Part 1:General rules》 GB/T4025-2010《Basic and safety principles for man-machine interface, marking and identification—Coding principles for indicators and actuators》 GB/T11022-2020《Common Specifications for High-voltage alternating-current switchgear and control gear standards》 GB/T3797-2016《Electronic control equipment》 DL/T478-2013《General Specification for Relaying Protection and Security Automation Equipment》 GB14048.6-2016《Low-voltage switchgear and controlgear—Part 4-2》

3.9 **Technical parameters**

The rated insulation voltage	42 kV/25kV 1min（10kV series /6kV series）
The rated working voltage	three-phase AC2kV~10kV
The rated power output	See the nameplate
Applicable motor	Squirrel-cage three-phase asynchronous motor, synchronous motor
Start frequency	No more than 20 times per hour
Number phases of work	3
Control power supply	AC220V（±10%），50Hz，250W
The cooling	Natural cooling

system	
communication protocol	RS485- RTU
boundary dimension	800 mm×1550 mm×2300 mm
weight	Integrated machine：840kg （With the packing） Standard cabinet: 560kg （With the packing）

4. Installation

4.1 Accept, unpacking and inspection.

Check if the packaging is intact. If there is any breakage, please contact the supplier or transportation company.

Dismantling and removing the packing cases, please keep the base for easy handling.

Check the soft start device, and verify if the order number of the soft start device matches the shipping label.

Check all the terms on the shipping documents.

4.1.1Storage

If there is no installation plan in the short term, please maintain packaging and store in a dry and cool indoor environment.

4.2 Installation

4.2.1 **The operation of the installation**

Remove the upper part of the packaging box, remain the base (tap)

Prepare forklifts or lifting equipment, and follow relevant safety regulations for handling and lifting operations.

4.2.2 **Installation requirements**

Due to the structure (main circuit) of outlet and inlet line of soft starter is designed of down in and down out, so the device should be installed on the cable channel, the cable channel size should meet the installation holes on the bottom of the equipment and corresponding to the inlet and outlet holes (see Figure 4). The device must be installed vertically, and keep away from heat sources. The front and the back doors of the device must have a space of not less than 1000 mm for convenient operation and maintenance. Please comply with the electrical construction and standards during installation,

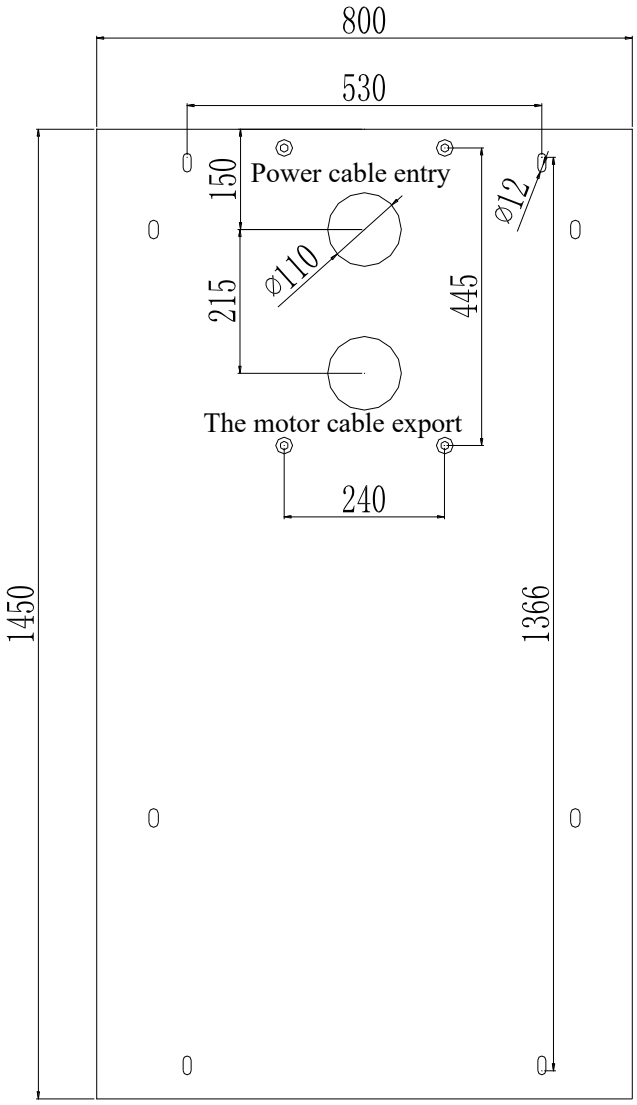


Figure 4. Cabinet in another's position at the bottom of the vertical view

5. Wiring

This chapter introduces wiring of the electrical and communication parts before using the soft start.

5.1 Summarize

Attention: All wiring must be operated by professional personnel and must be carried out in accordance with installation standards and relevant regulations.

5.2 **Electrical wiring**

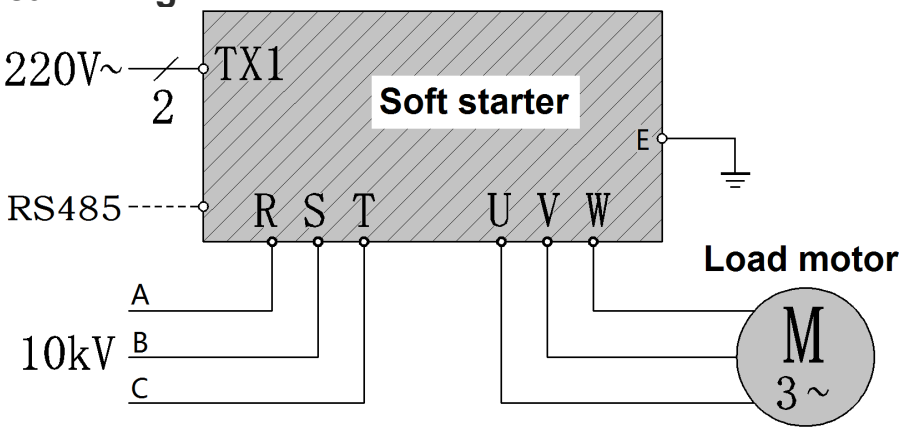


Figure 5. Soft starting device wiring diagram

5.2.1 Main circuits

The main circuits wiring copper bars of the device are located at the back of the cabinet, adopted down in and down out. Three inlet copper bars (power supply side) are marked with label R, S, T, and the outlet copper bars (motor side) are marked with label U, V, W.

Power supply side: The three-phase incoming power supply is introduced through the "inlet hole" at the bottom of the cabinet, passes through the circular current transformer, and is fixed on the yellow (R), green (S), and red (T) incoming copper bars with fastening screws.

Motor side: The three-phase wire cable is threaded through the Φ 100 mm round hole at the bottom of the cabinet, and is fixed on the yellow (U), green (V) and red (W) outlet copper bars , three into copper platoon.

Tighten the screw; torque is not less than 40 nm

5.2.1.2Protective earthing

Do not allow the device to be powered on when the grounding wire is disconnected.

5.2.2The control circuit

Note: the distance between the control power line and the main circuit wire should be greater than 200mm, it is best to route the wiring along the cabinet, The cross-sectional area of the wire shall not be less than 1mm^2, and the voltage resistance shall not be less than 550 vac.

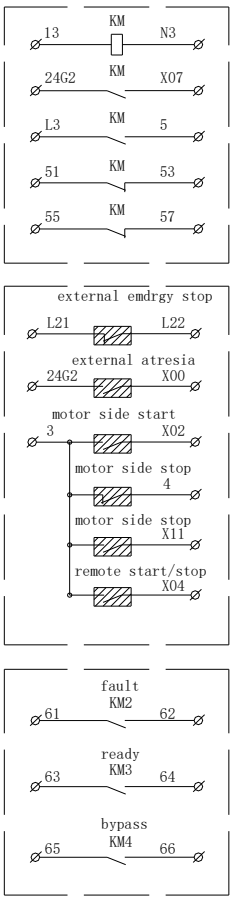
Terminals of the control power supply (AC220V, 50 Hz) are located in the relay room of the cabinet, open the front door of the lower part of the device, thread the line through the Φ 50 mm round hole on the right, connected them to the terminal block labeled L, N.

5.2.2.1 The power switch of control circuit, insurance and intermediate relay

The control circuit power switch is used to connect and disconnect various functional circuits during equipment debugging and fault diagnosis.

The fuse is connected in series to the power supply circuit and voltage signal circuit, which can provide protection in abnormal situations. When replacing, spare parts of the same model and specification should be selected.

5.2.2.2 The reserved terminal row



control power supply AC220V	1	L	
	2	N	
	3	PE	
QF3:4	4	L3	reserved
	5	L3	
	6		
QF3:4	7	L3	reserved
	8	N3	
	9		
QF2:4	10	L2	reserved
QF2:3	11	N2	electromagnetic lock power supply
	12		
QF4:4	13	L4	reserved
QF4:3	14	N4	
	15		
SJ_2	16	L21	external emergy stop (short circuit at factory)
	17	L22	
	18		
SP2:1	19	+24V2	reserved
SP2:2	20	24G2	reserved
	21	24G2	
	22	24G2	external atresia (short circuit at factory)
PLC:X00	23	X00	
KM	24	5	reserved
KM	25	51	
KM	26	53	
KM	27	55	reserved
KM	28	57	

PLC:X02	29	X02	motor side start	(passive pulse signal NO)
SA1	30	3	start/stop common	
	31	3		
SA1	32	4	motor side stop	(passive pulse signal NC)
PLC:X11	33	X11	motor side stop	(passive pulse signal NO)
PLC:X04	34	X04	remote start/stop	(passive long signal)
KA2:6	35	61	fault output	
KA2:10	36	62		
KA3:6	37	63	ready output	
KA3:10	38	64		
KA4:6	39	65	bypass output	
KA4:10	40	66		
MB1:1	41	485A	485 communicate	
MB1:2	42	485B		
TA1:1S1	43	A411	0-5A output	
MB1:3	44	A412		
PD变送+	45	ImA+	4-20mA output	
PD变送-	46	ImA-		
PLC:com	47	com2	start/stop state feedback	
PLC:Y12	48	Y12		
	49			
	50			
	51			
	52			

Figure 6. Reserved terminal row

This terminal block is a standard cabinet terminal block. For non-standard cabinet and integrated machine terminal blocks, please refer to the attached diagram. The user can follow the schematic diagram to wire from the reserved terminal, and install button switch to achieve local or remote (RS485 communication) operation.

5.3 Communications wiring

There is a RS485 communication interface in the device, which can isolate completely in electrical and prevent surge impact.

Slave address: can be set from 1 to 127;

Communication protocol：MODBUS RTU；

Baud rate：19200b/s，9600b/s，4800/s，1200b/s；

Communication interface: 485A and 485B is located on the control room terminals (see figure 7).

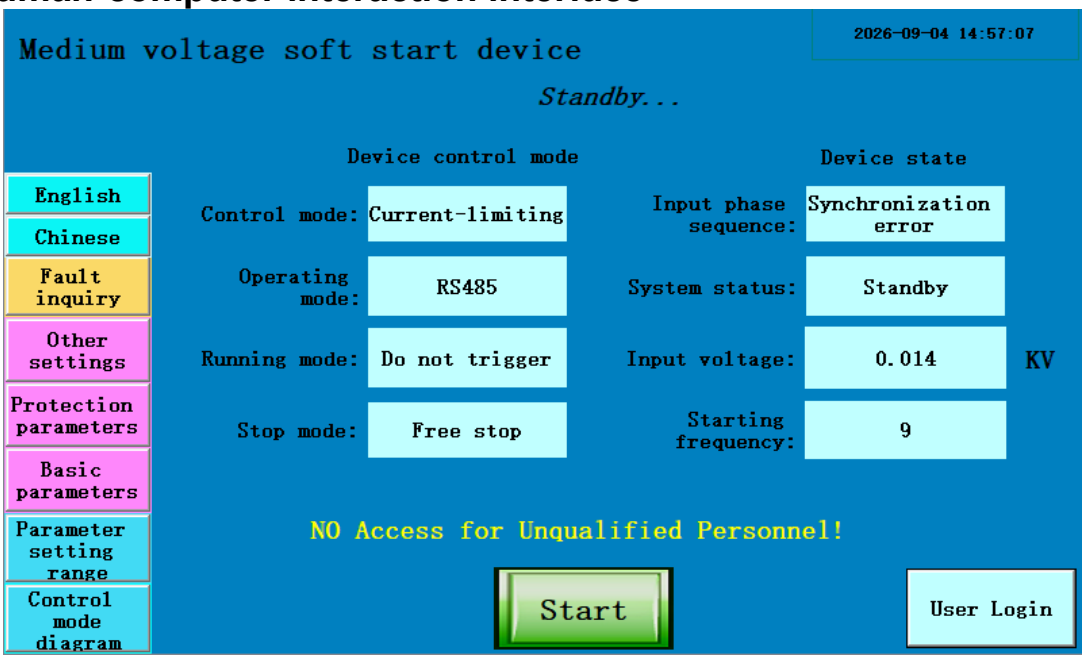
Cable requirements: recommend shielded twisted-pair cable (24 AWG).

6. human-computer interface

6.1 Control panel

A voltmeter and a three-phase ammeter are arranged on the upper door panel of the soft starter cabinet to display the voltage and current at runtime; In addition, there are also equipped with charged indicator, temperature and humidity controller, the control voltage meter, touch screen, state signal light, control and stop button, the buzzer alarm, startup mode selection, and switches for selecting the starting method and control method and so on.

6.2 Human-computer interaction interface



The human-computer interaction interface is touch screen. There are nine screens, include the standby screen, basic parameter settings screen, protection parameter settings screen, other settings screen, fault query screen, parameter setting range screen, startup mode diagram screen, running screen and fault screen.

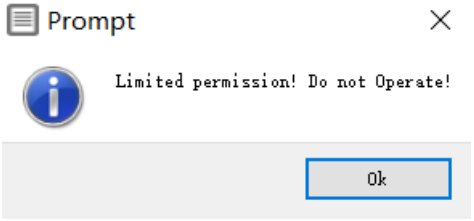
6.2.1 **Standby screen**

Standby screen is shown in the picture on the right, mainly displays the following information of the device: Current control mode, Operation mode, Run mode, Stop mode, Input phase sequence, State of soft start, Input voltage, and Start times, etc. The user login window is on the lower right corner of the screen. It is used to enable users with different permissions to set the permissions of the device. Details are shown in the table below:

Login User No.	login password	Settable parameter limited categories	Specific parameter values
1	1111	basic parameter	See the relevant settings screen for detail
2	2222	Basic and protect parameter	See the relevant settings screen for detail
3	3333	Basic ,protect and others parameter	See the relevant settings screen for detail

The system time is shown at the upper right corner of the standby screen. There are six buttons at the left of the screen. When the password is correct, touch the button, user can enter the corresponding settings screen. The parameter setting range and

startup mode diagram can be accessed for viewing without logging in. When the input phase sequence is the positive sequence and negative sequence, user can click the "start" button, the device operation screen will be shown automatically.

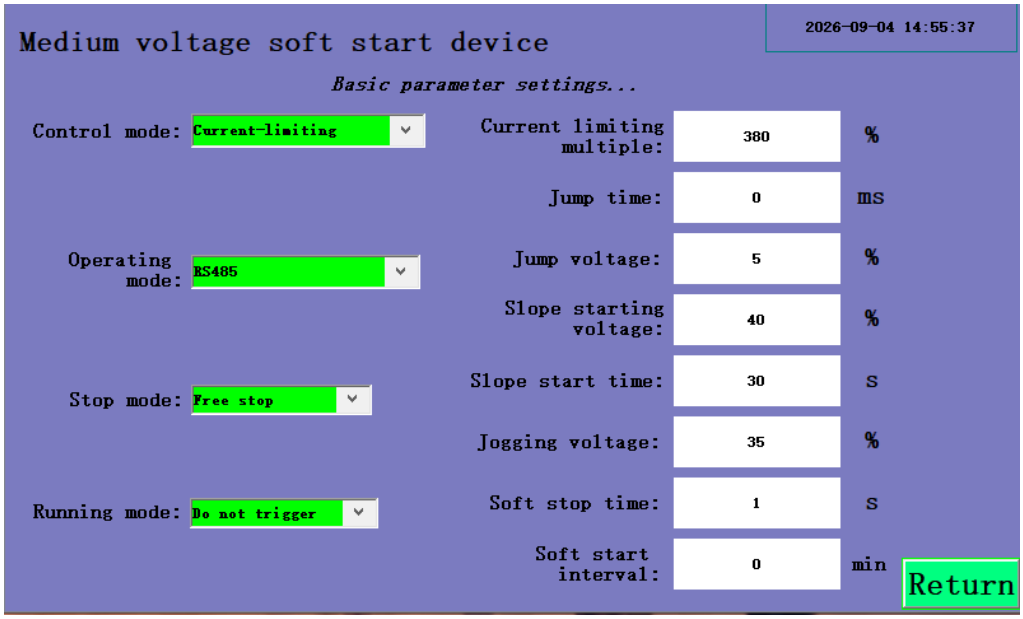


Note 1: After setting the user number or password, user must press the confirm button to exit the setting state. If the user number or password is not correct, the following prompt dialog will pop up:

Note 2: After setting the user parameters and returning to the standby screen, if user needs to reset them, you need to log in again.

6.2.2 Basic parameters setting screen

Its configurable parameters are shown in the following figure, and the relevant definitions of parameters can be found in the table below. After setting up, click the "Return" button to exit.



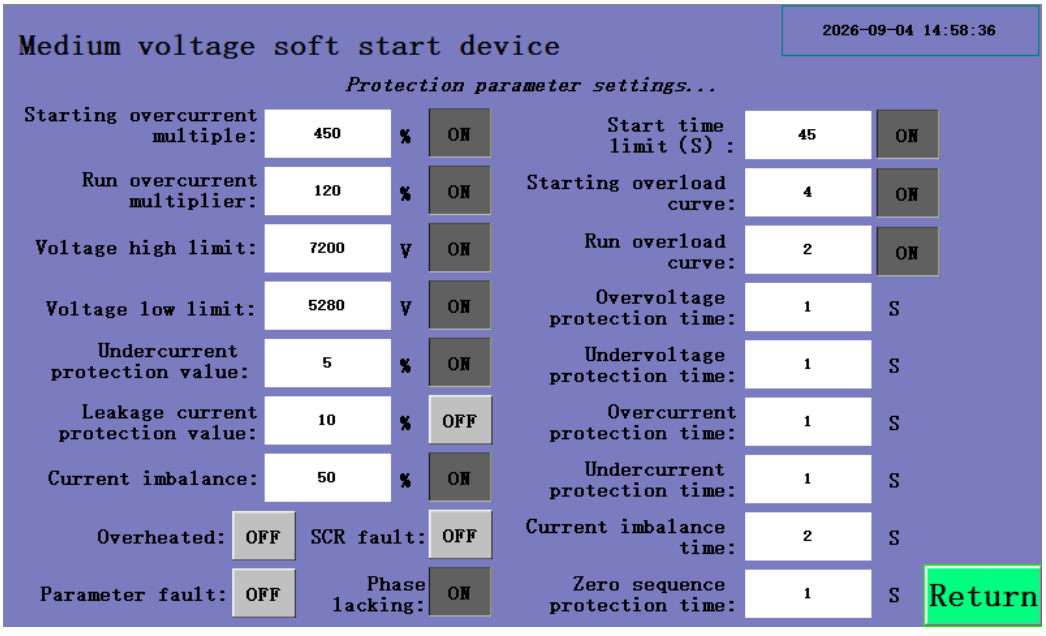
Function argument list

sequence number	project name	Range	Factory	Units	Introductions
1	control mode	Slope+current-limiting			Select start mode (see 7.2), in which the voltage ramp is limited flow function.
		Current-limiting	√		
		jogging			
		jump +Slope			
2	operating mode	Touch screen			Choose the way of soft starter operation
		Cabinet button	√		
		RS485			
3	Stop mode	Free stop	√		Select parking mode (see 7.2)
		Soft stop			
4	Running	Do not trigger			No trigger: close thyristor after bypass

	mode	Trigger	√		Trigger: don't close the thyristor after bypass
5	Current limiting multiple	50～600	300	%	In current limited mode, device starting current limit multiples, which is the percentage of the set values for the motor rated current.
6	jump time	0～5000	0	ms	In slope kick start mode to Set sudden jump time
7	jump voltage	5～100	5	%	In slope kick start mode to set the percentage of the step voltage. It is the percentage of the power supply voltage.
8	Slope starting voltage	5～100	40	%	In voltage ramp mode, the starting voltage of the motor side. It is the percentage of the power supply voltage.
9	Slope start time	5～200	30	s	In voltage ramp mode, set the start-up time
10	Jogging voltage	5～100	30	%	In jog mode, set the voltage. It is the percentage of the power supply voltage.
11	Soft stop time	1～100	1	s	Setting the soft parking time
12	Soft start interval	0～60	0	min	Soft starter's start interval. In this interval time, soft starter can not start again.

6.2.3Protection parameters setting screen

Parameters which can be set are shown in the figure below, relevant definitions of parameters can be found in the table below. After setting up, click the "Return" button to exit.



Function argument list

No.	project name	Range	Factory	Units	Introductions
1	Starting overcurrent multiple	400～850	400	%	It is effective during the start-up process. In the start-up process, if the motor current is greater than the set value, when action time arrived, the over-current protection is

					executed. It is the percentage of rated current of the motor.
2	Run Overcurrent multiple	120～600	120	%	It is effective during the running process. In the running process, if the motor current is greater than the set value, when action time arrived, the over-current protection is executed. It is the percentage of rated current for the motor.
3	voltage high limit	Ue~1.2Ue	7.2	kV	Maximum voltage. When the actual incoming voltage is greater than this set value and maintained for a period of time, and this time exceeds the set protection time, the protection will act
4	Voltage Low limit	0.8Ue~Ue	4.8	kV	Minimum voltage. When the actual incoming voltage is less than this set value and maintained for a period of time, and this time exceeds the set the protection time, the protect will act.
5	Undercurrent protection value	0～90	0	%	When the motor is running, the protection will act when the percentage of actual load current to rated current is less than this value and maintained for a period of time. This time exceeds the set protection time. This parameter is the percentage of the rated current of the motor.
6	Leakage current protection value	1～100	10	%	During the motor is running, when the percentage of the measured zero sequence current to the rated current exceeds this value and exceeds the set protection time and maintained a period time, this time exceeds the set protection time, the protection will act. This parameter is the percentage of the rated current of the motor.
7	current imbalance	10～100	50	%	When the three-phase current is unbalance and the unbalance factor exceeds the set values, the protection will act. The formula：(Imax -Imin/Iav) ×100%。
8	Starting overload curve	1～6	4	class	It is effective during the start-up process. It Express Time limit protection level of protection.
9	Run overload curve	1～6	2	class	

Ban or enabled parameters of failure

No.	project name	Range	Factory	Introductions
1	Starting overcurrent	Off		Don't detect starting over-current
		on	√	detect starting over-current
2	run over-current	Off		Don't detect running over-current
		on	√	detect running over-current
3	Over-voltage	Off		Don't detect overvoltage
		on	√	detect overvoltage
4	under voltage	Off		Don't detect under voltage
		on	√	detect under voltage
5	Under-load	Off		Don't detect under-load

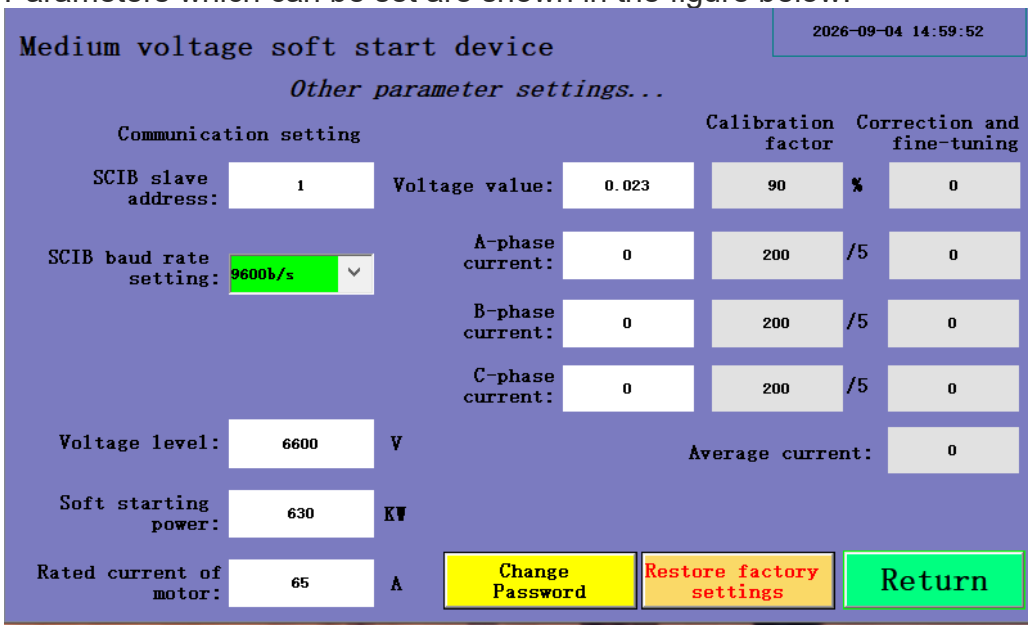
		on	√	detect under-load
6	Leakage current	Off		Don't detect leakage current protection
		on	√	detect leakage current protection
7	current imbalance	Off		Don't detect current unbalance
		on	√	detect current unbalance
8	overheated	Off		Don't detect the valve group temperature
		on	√	detect the valve group temperature
9	Parameter fault	Off		Don't detect parameters fault
		on	√	detect parameters fault
10	SCR fault	Off		Don't detect SCR fault
		on	√	detect SCR fault
11	Phase lacking	Off		Don't detect default phase
		on	√	detect default phase
12	Start time limit	Off		Don't detect Starting timeout
		on	√	detect Starting timeout
13	Starting overload	Off		Don't detect overload
		on	√	detect overload
14	run overload	Off		Don't test run overload
		on	√	test run overload

The action time of the fault

No.	project name	Range	Factory	Introductions
1	starting time limit	1~60S	30S	If the starting time exceeds the set value of the "starting time limit", the protection will act.
2	Overvoltage	1～40S	1	When the incoming voltage exceeds the set value of "voltage high limit" and maintain a period of time, and the time exceeds this set value, the over-voltage protection will act
3	undervoltage	1～40S	1	When the incoming voltage lower the "lower limit" setting and maintains a period of time, and time is Longer than the set value, the under-voltage protection will act.
4	Overcurrent	1～40S	1	When the motor current exceeds the set value of "start-up over current multiple" or "operation over current multiple" and maintains a period of time, and this time is Longer than the set value, the over-current protection will act.
5	undercurrent	1～40S	1	When the motor current is lower than the set value of “under-load protection” setting values and maintains a period of time, and this time is longer than the set value, the under-load protection will act.
6	current imbalance	1～40S	1	When the three phase current unbalance factor exceeds the setting values and maintains a period of time, and this time is Longer than the set value, the current imbalance protection will act.
7	Leakage current	1～40S	1	When the Leakage current of the motor is greater than the setting values and maintains a period of time, and this time is Longer than the set value, the Leakage current protection will act.

6.2.4 Other parameter Setting screen

Parameters which can be set are shown in the figure below:



Function parameters list

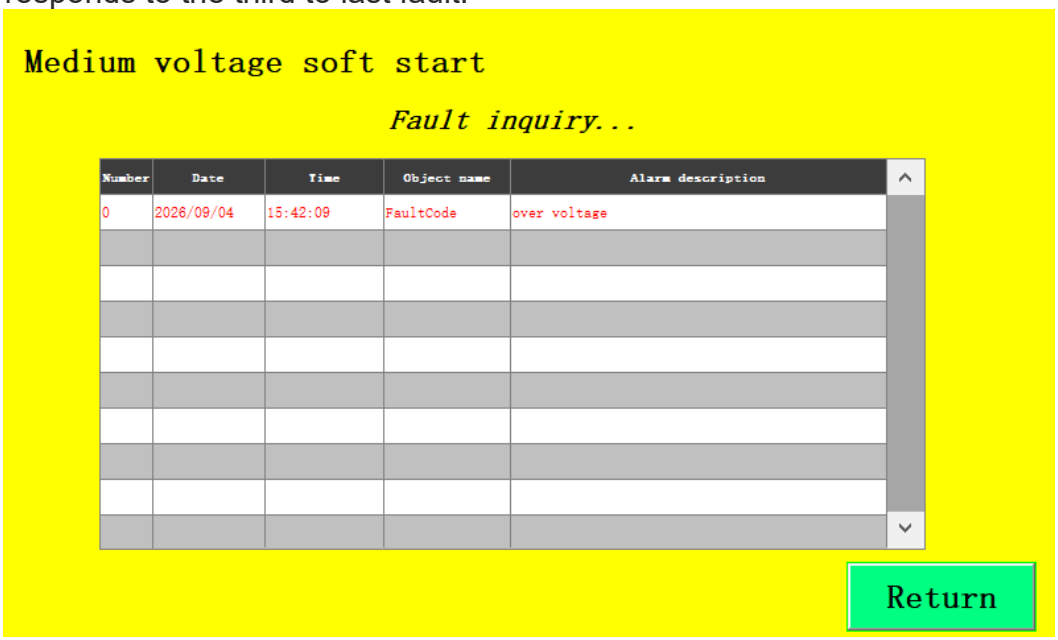
No.	project name	Range	Factory	Units	Introductions
1	SCIB Slave address	1～128	1		For the RS485 communication way, protocol: the MODBUS RTU. The soft starter as from machine, this parameter is set from machine's address.
2	SCIB baud rate		9600	b/s	This parameter is set RS485 communication baud rate. An optional value:
3	voltage class	10 or 6 or 3	6.00	kV	Power voltage class, cannot be modified
4	Soft starter power			KW	Soft starter rated power, cannot be modified.
5	Rated current of motor			A	the motor rated current value of the motor nameplate
6	Voltage calibration factor	10～400	100	%	Calibration value of the voltage display. Factory has been calibrated Settings, modify the value is prohibited.
7	A/B/C phase current calibration factor	10～8000	Current transformer ratio	/5	A, B, C phase current calibration value. Factory has been calibrated Settings, modify the value is prohibited.
8	user 1/2/3 password	Any number of 4			Change user 1/2/3 login password
9	Correction and fine-tuning	0~100	0		When the displayed current and voltage values are smaller than the actual values, set this parameter to make the displayed values consistent with the actual values

When you need to restore all parameters to their factory settings, click "Restore Factory Settings", the following interface for restoring factory settings will pop up:

Click the "retrun" button, the initialization of the parameters listed on the interface is completed.

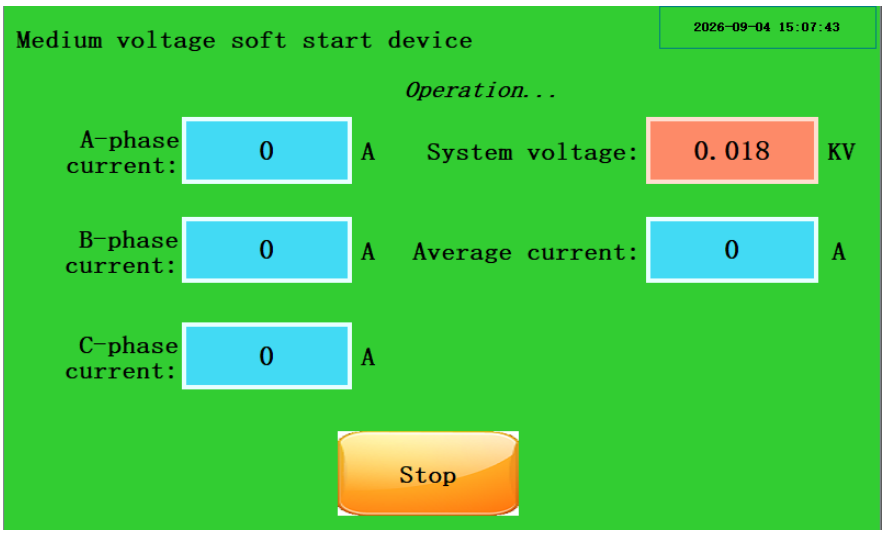
6.2.5 Fault query screen

When clicking the "Fault Query" button on the standby interface, the following dialog box will pop up. The names of the latest three faults are displayed. Fault 1 corresponds to the latest fault, fault 2 corresponds to the second to last fault, and fault 3 corresponds to the third to last fault.



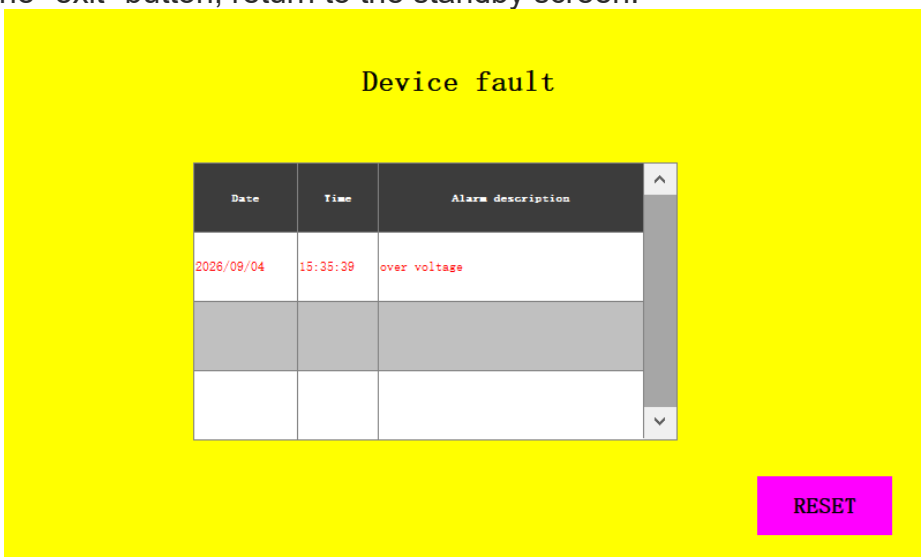
6.2.6 Operation screen

Click the "start" button on the standby interface, if the positive or negative sequence is detected and show in the phase sequence text box, the operation screen pops up automatically, as shown in the following figure:



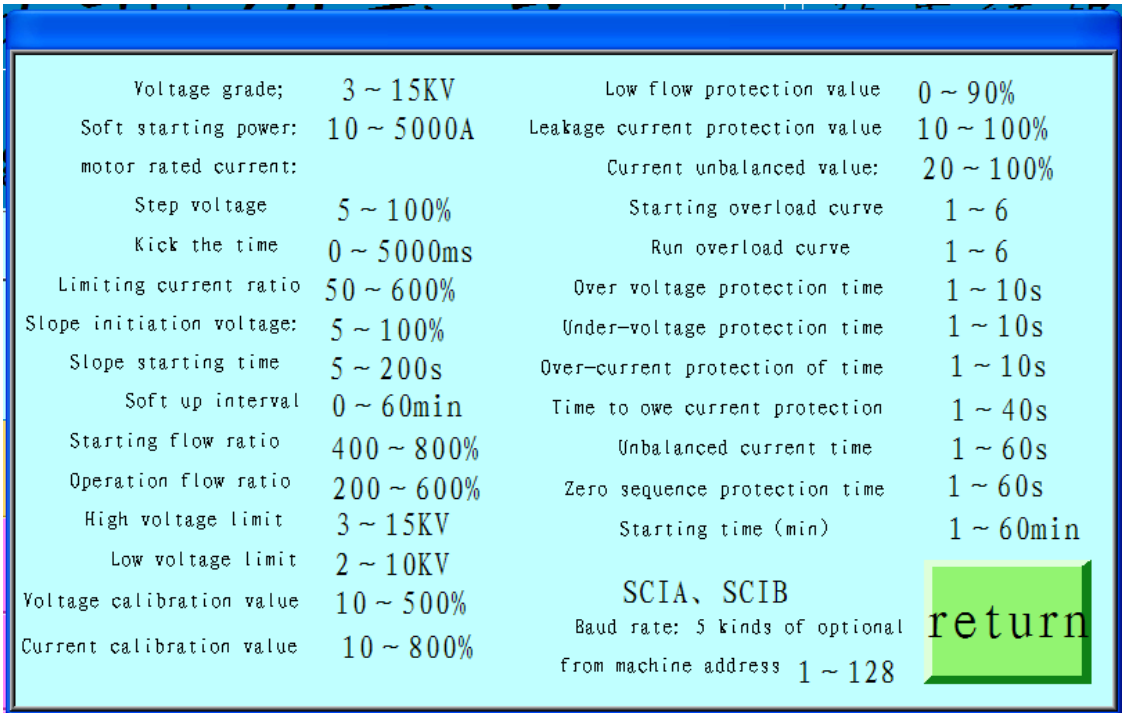
6.2.7 **Device failure screen**

When the operation screen shows, if a fault is detected, and the time which the fault maintained is reached the set value, the fault screen will pop up immediately, as shown in the figure below, the real-time fault information shows in the fault screen. Click on the "exit" button, return to the standby screen.



6.2.8 Parameter range screen

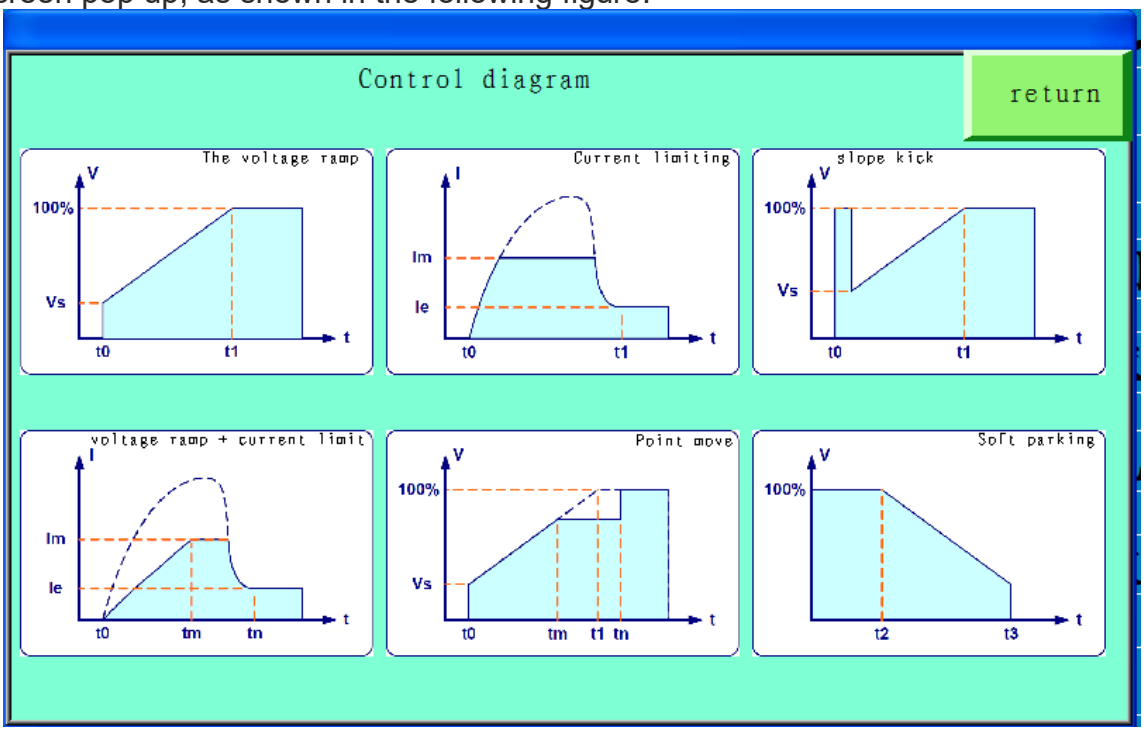
In the standby screen, click on the "parameter setting" button, parameter range screen pops up, as shown in the following figure:



The setting range of various related parameters are listed in this screen. If the value is beyond the scope of relevant parameters, it can not be set.

6.2.9 Control mode diagram screen

In standby screen, click on the "control mode diagram" button, control mode diagram screen pop up, as shown in the following figure:



Detailed description can be found in chapter 7.1 –“soft starter control mode”, click the "return" button to return to the standby screen.

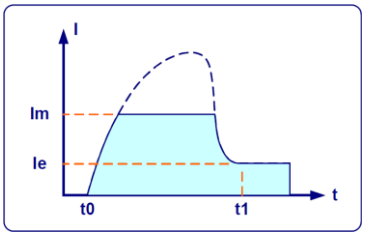
Note: If there is no operation on the touch screen for more than 10 minutes, the display screen will be turned off; when screen is touched by hand again, it will light up again.

7 set

7.1 The soft starter control mode

There are multiple starting methods for medium voltage soft start devices: current-limiting starting, voltage ramp + current limit flow , jog, kick + voltage ramp startup mode, etc; A variety of parking: parking free and parking soft. The user can choose the different ways to start and stop the starter according to the differences of load and the specific conditions of use.

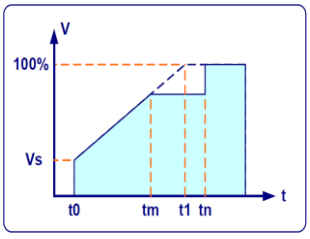
7.1.1Current limited start

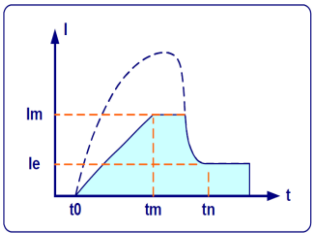


After receiving the start command, the output voltage rapidly increase and the current increases accordingly. The soft start detects the current and adjusts the output voltage until the output current reaches the setting value of the parameter “current limit amplitude” Im, and the output current no longer increases. After the motor accelerates for a period of time, the current begins to decrease and the output voltage rapidly increases until it reaches full voltage output. The bypass contactor is put into operation and the starting process is completed. The figure on the right shows the process of the current variation. Under current limited mode, the actual starting time is related to the current limit amplitude and the load. In current limited mode, large inertia loads can be started and accelerated with minimal current, and it is also suitable for starting many constant torque loads, ensuring these loads can be started and operated in the situations with limited grid capacity.

The parameter types	name	scope	The factory value
The fifth Function parameters	Current limiting factor (%Ie)	50～500	300

7.1.2 Voltage ramp + current limited





The output voltage starts from the initial voltage and increases exponentially with the set starting time, while the output current increases at a certain rate until the start is completed. During the startup process, the current is limited below the set value of the current limiting multiple. The figure on the right shows the process of the voltage and the current variation. Under the voltage ramp + current limited mode, the actual starting time is related to the current limited multiple, load, initial starting voltage, and starting time. This method has the advantages of small initial current and controllable maximum current; it is suitable for starting loads such as pumps and fans under limited power grid capacity.

The parameter types	name	scope	The factory value
The fifth Function parameters	Current limiting factor	50～500%Ie	300%Ie
The sixth Function parameters	The starting voltage	5～100%	30%
The seventh Function parameters	The startup time	5～200S	30S

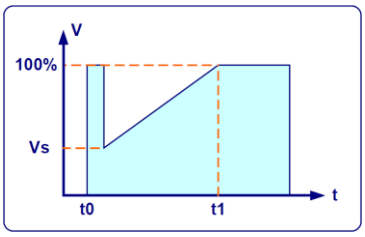
7.1.3 Jogging

Press start button to start jog, the out voltage increased to the set voltage as the fixed rate, press the stop button, the motor stops. After starting, the output voltage is a constant value (the set value of "jog voltage"), and the motor rotates at this voltage. The jog mode is mainly used for the debugging stage.

The parameter types	name	scope	The factory value
The eighth Function parameters	jog voltage	5～100%	30%

7.1.4kick + voltage ramp

In order to overcome relatively large static friction, a large pulse torque is applied to the load motor in the initial stage of starting, and its amplitude and maintenance time are determined by the parameters "step voltage" and "step time". Then, the motor is started in a voltage ramp starting manner.



The parameter types	name	scope	The factory value
The tenth function parameters	Step voltage	5～100%	5%
The eleventh function parameters	Kick the time	0～5000mS	0
The sixth function parameters	The starting voltage	5～100%	30%
The seventh function parameters	The startup time	5～200S	30S

7.1.5 Free stop

After receiving the shutdown command, the soft start device first blocks the control relay of the bypass contactor and then blocks the output of the main circuit thyristor, allowing the motor to stop freely with the inertia of the load.

7.1.6 Soft stop

If the value of the parameter soft stop time is not zero, soft stop mode is selected. in this stop mode, the soft start device first disconnects the bypass contactor, and the output voltage of the soft start device gradually decreases within the set soft stop time until the motor stops. The voltage curve during the parking process is shown in the figure on the right. In this mode, the reverse torque impact during stop can be effectively reduced. It is commonly used to alleviate the water hammer effect of the pump loads.

The parameter types	name	scope	The factory value
The ninth function parameters	Soft stop time	0～100S	0

8. The fault inspection and handling

serial numbers	The fault name	The cause of the problem	Identify and exclude the problem
1	Lack of phase	The power lacks	Check whether the power is in the range of performance requirements
		The supply of poor quality	
2	current unbalance	Thyristor trigger line contact undesirable	Check the thyristor
		Thyristor open circuit	
		three phase current of the Motor unbalance	Detection of electric load machine
		Three current transformers problem	Check the main circuit transformer
3	Starting Over-current	Current limiting, start over current, start time, initial voltage setting values	Check the parameter Settings
		Whether the load is overweight	Check the actual working condition of the load
4	Running over-current	The load fluctuation is serious	Check the load
		Power grid voltage is too low	Check the power
5	Starting overload	Start in the heavy load	Adjust the load
		Start the overload level Settings	Reset overload level
6	Running overload	In the operation of the heavy load	Adjust the level of overload
		The setting of the overload operation level	Adjust the load
7	Under voltage	Low power grid voltage	Check the power supply
		Owe voltage Settings	Reset the parameters
8	overvoltage	High power grid voltage	Check the power supply
		High voltage range value Settings	Reset the parameters
9	SCR fault	Thyristor breakdown	Check the thyristor
10	underload	Underload value is Improper setting	According to the actual working condition of the setting of the load change
11	overheating	Start too frequently	Reduce the starting frequency
		Start time is too long	Check the load
12	Parameter error	Parameters exceed the limit	Check the parameters and set up again
		Internal storage failure	Contact the manufacturer
13	Zero sequence protection	Motor single-phase earth fault	Check current transformer connection
		Zero sequence parameter is set too low	Reset the parameters
		Current transformer fault	Detection circuit
14	Starting timeout	With load starting or parameter setting is not reasonable	No-load starting or adjusting parameters

9. RS485 Communications specification

Serial port Settings：The default baud rate: 9600b/s、**Data bits:** 8、**Parity bit odd parity、Stop bit** :1

serial number	Functional specifications	address	The data instructions	Reading and writing features
1	Control mode selection	0000H	0001H：The voltage ramp	W/R
			0002H：Current limited	
			0003H：Point move	
			0004H：Slope kick	
2	Mode of operation	0001H	0001H：The keyboard	W/R
			0002H：External control	
			0003H：RS485	
3	Stop mode	0002H	0001H：Free stop	W/R
			0002H：Soft stop	
4	Operation mode	0003H	0001H：Don't trigger	W/R
			0002H：Trigger	
5	Current limited factor	0004H	50~600%	W/R
6	Slope initiation voltage	0005H	5~100%	W/R
7	Slope starting time	0006H	5~200S	W/R
8	jog voltage	0007H	5~100%	W/R
9	Soft stop time	0008H	0~60S	W/R
10	Step voltage	0009H	5~100%	W/R
11	Kick time	000AH	0~5000mS	W/R
12	The current imbalance degree	000BH	20~100%	W/R
13	Voltage grade	000CH	3000~15000V	W/R
14	Soft starter power	000DH	10~5000A	W/R
15	The motor power	000EH	5~2500A	W/R
16	Starting over current value	000FH	400~800%	W/R
17	Running over current value	0010H	200~600%	W/R
18	Starting acceleration curve	0011H	1~6	W/R
19	Run overload curve	0012H	1~6	W/R
20	up limited of voltage	0013H	3000~15000V	W/R
21	lower limited of voltage	0014H	2000~10000V	W/R
22	SCIA slave address	0015H	1~128	W/R
23	SCIA Baud rate	0016H	0001H：1200b/s	W/R
			0002H：2400b/s	W/R
			0003H：4800b/s	W/R
			0004H：9600b/s	W/R
			0005H：19200b/s	W/R
24	SCIB slave address	0017H	1~128	W/R
25	SCIB Baud rate	0018H	0001H：1200b/s	W/R
			0002H：2400b/s	W/R
			0003H：4800b/s	W/R
			0004H：9600b/s	W/R

			0005H：19200b/s	W/R
26	Voltage calibration value	0019H	10-500 （%）	W/R
27	current calibration value of Phase A	001AH	10-800（%）	W/R
28	current calibration value of Phase B	001BH	10-800 （%）	W/R
29	current calibration value of phase C	001CH	10-800（%）	W/R
30	Under-current protection value	001DH	0-90（%）	W/R
31	Zero sequence (leakage) protection value	001EH	10-100（%）	W/R
32	Starting time interval	001FH	0-60（min）	W/R
33	Over voltage protection time	0020H	1-10s	W/R
34	Under-voltage protection time	0021H	1-10s	W/R
35	Over-current protection	0022H	1-10s	W/R
36	Under current protection time	0023H	1-40s	W/R
37	The current imbalance protection time	0024H	1-60s	W/R
38	The grounding current protection time	0025H	1-60s	W/R
39	Failure can make/byte is prohibited	0026H	b0(bit)：Lack of phase (1：enabled；0：ban)	W/R
			b1(bit)：current unbalance (1：enabled；0：ban)	
			b2(bit)：Starting flow (1：enabled；0：ban)	
			b3(bit)：Operation flow (1: enabled；0：ban)	
			b4(bit)：Starting overload (1: enabled；0：ban)	
			b5(bit)：Run overload (1: enabled；0：ban)	
			b6(bit)：SCR fault (1: enabled；0：ban)	
			b7(bit)：overpressure (1: enabled；0：ban)	
			b8(bit)：Under voltage (1: enabled；0：ban)	
			b9(bit)：Parameters of the fault (1: enabled；0：ban)	
			b10(bit)：underload (1：enabled；0：ban)	
			b11(bit)：current unbalance (1：enabled；0：ban)	
			b12(bit)：overheating (1：enabled；0：ban)	
			b13(bit)：Starting a timeout (1：enabled；0：ban)	
40	Control command	0027H	0001H：PRG detection	W
			0002H：EXIT detection	
			0004H：UP detection	
			0008H：DOWN detection	

			0010H：RUN detection	
			0020H：STOP detection	
41	RS485 Control command	0028H	0001H：PRG detection	W
			0002H：EXIT detection	
			0004H：UP detection	
			0008H：DOWN detection	
			0010H：RUN detection	
			0020H：STOP detection	
42	Fault code 1	0029H	0001H：Lack of phase	R
			0002H：current unbalance	
			0003H：Starting flow	
			0004H：Operation flow	
			0005H：Starting overload	
			0006H：Run overload	
			0007H：SCR fault	
			0008H：overpressure	
			0009H：Under voltage	
			000AH：Parameters of the fault	
			000BH：Underload fault	
			000CH：Zero sequence fault	
			000DH：Overheating fault	
			000EH：Starting a timeout fault	
43	Fault code 2	002AH	0001H：Lack of phase	R
			0002H：current unbalance	
			0003H：Starting flow	
			0004H：Operation flow	
			0005H：Starting overload	
			0006H：Run overload	
			0007H：SCR fault	
			0008H：overpressure	
			0009H：Under voltage	
			000AH：Parameters of the fault	
			000BH：Underload fault	
			000CH：Zero sequence fault	
			000DH：Overheating fault	
			000EH：Starting a timeout fault	
44	Fault code 3	002BH	0001H：Lack of phase	R
			0002H：current unbalance	
			0003H：Starting flow	
			0004H：Operation flow	
			0005H：Starting overload	
			0006H：Run overload	
			0007H：SCR fault	
			0008H：overpressure	

			0009H：Under voltage	
			000AH：Parameters of the fault	
			000BH：Underload fault	
			000CH：Zero sequence fault	
			000DH：Overheating fault	
			000EH：Starting a timeout fault	
45	SCR state of phase A	002CH	0000H：no fault	R
			0001H：fault	
46	SCR state of phase B	002DH	0000H：no fault	R
			0001H：fault	
47	SCR state of phase C	002EH	0000H：no fault	R
			0001H：fault	
48	Soft starter state	002FH	0000H：standby	R
			0001H：starting	
			0002H：run	
			0003H：stop	
			0004H：editor	
			0005H：fault	
49	Voltage value displayed	0030H		R
50	A phase current value displayed	0031H		R
51	B phase current value displayed	0032H		R
52	C phase current value displayed	0033H		R
53	average current value displayed	0034H		R
54	zero sequence currents displayed	0035H		R
55	starting times	0036H		R
56	Phase sequence information display	0037H	0001H：Positive phase sequence	R
			0010H：Negative phase sequence	
			0000H：Synchronization is wrong	
57	Flag bit	0038H	b0（bit）：Restore the factory Settings（1:yes;0:no）	W
			b1（bit）:485 Modify the system parameters（1: yes;0:no）	W/R
			b2（bit）: keyboard /RS232 Modify the system parameters（1: yes;0: no）	
58	Starting protection time	0039H	1—60min	W/R

Appendix one: Instructions for Using Temperature and Humidity Controllers

1、Power on: After the controller is powered on, it flashes and displays "--", followed by "L" (indicating lower temperature limit), “L set value”, "H" (indicating upper humidity limit), and “H set value”. Finally, it flashes and displays "--". It is means the setting process is end. Then the actual temperature is display.

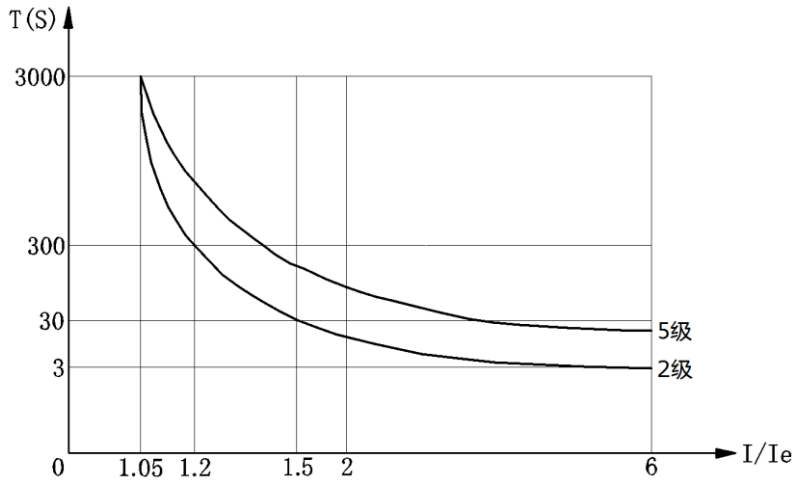
2、Parameter setting: Press "set" key, "L" displays, followed by the value of the current setting. The temperature control lower limit value can be adjusted by pressing the [▲] and [▼] key; Press the "set" key again, "H" displays, user can adjust the upper limit value of humidity control by pressing the [▲] and [▼] key. Press the "set" key; exit the parameter setting state and the actual ambient temperature displays.

3、Automatic temperature and humidity control: When the ambient temperature is less than the set value of L or the ambient humidity is greater than the set value of H, the controller starts resistance heating and the "load" indicator light is on; When the ambient temperature is greater than or the humidity is less than the set value, the resistance heating stops and the "load" indicator light goes out.

4、Forced heat：press【set】+【▲】key at the same time，the "Forced" and "Load" indicator lights will light up, indicating that the heater has started. Then press the 【set】+【▲】 keys to exit forced heating, and the indicator lights will go off.

Appendix two: overload level reference curve

Inverse time protection：When the motor malfunctions, the larger the fault current, the smaller the delay of relay protection action, that is, the fault current is inversely proportional to the action time. The medium voltage soft start device has a motor inverse time characteristic protection function. There are two sets of protection level setting functions for the start-up and operation stages. According to the overload level setting, the soft start device can protect the motor according to the overload multiple within the time set by the protection curve. The higher the setting level, the shorter the protection action time, as shown in the following



Motor overload protection characteristic curve

Appendix three: typical load application reference set

The load type	The voltage ramp start			Current limiter		
	The initial voltage (%)	startup time (s)	Soft stop time (s)	Current limiting factor	timeout (s)	Soft stop time (s)
water pump	20	10	10	3.0	30	10
fan	25	40	0	3.0	60	0
compressor	20	10	0	3.0	30	0
blender	25	15	0	3.5	30	0
crusher	25	15	0	3.5	30	0
conveyor belt	20	10	0	3.0	30	0
hoist	20	10	0	3.5	30	0