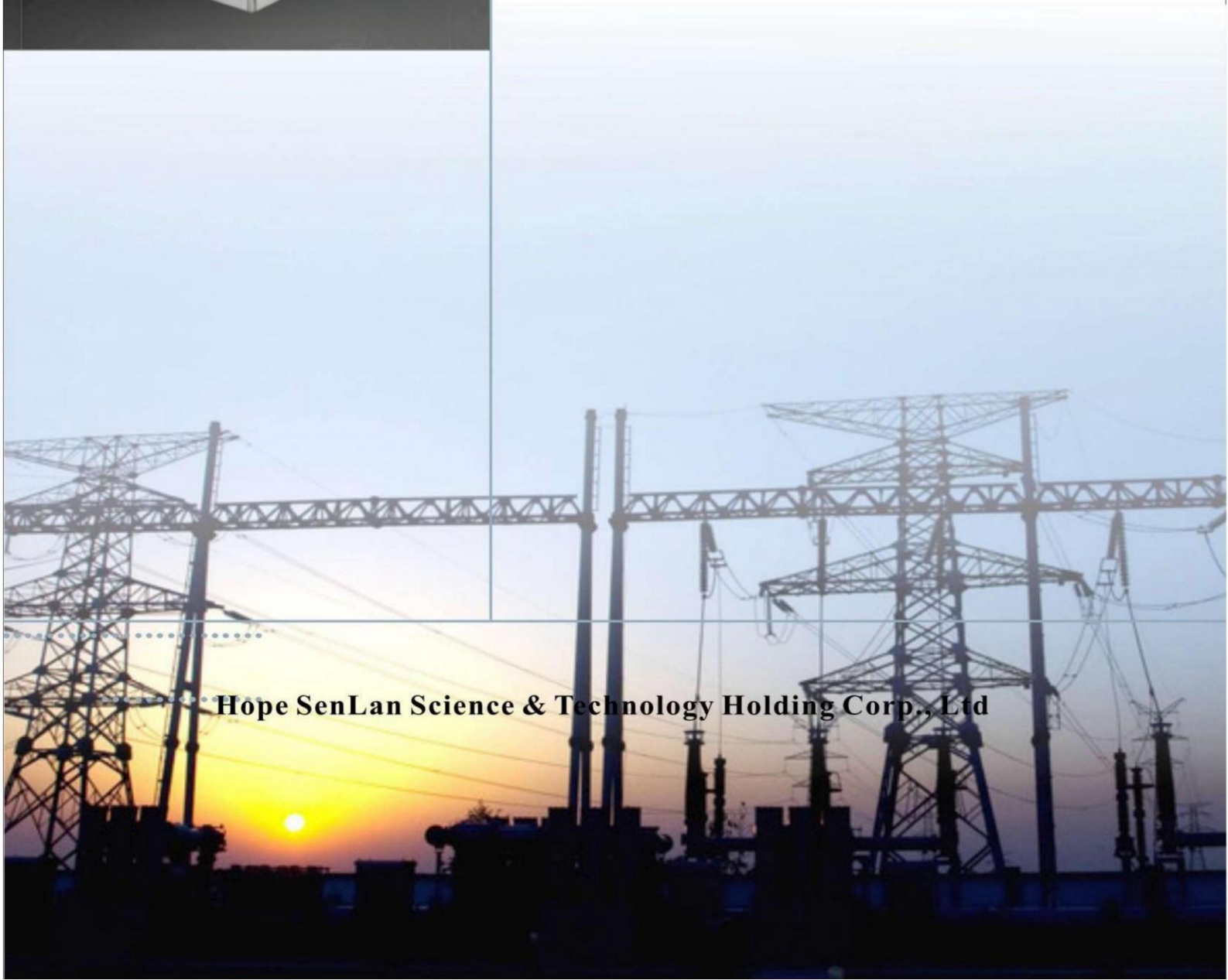
SLANVERT

# HSD2000 Series MV Solid-state Soft Starter

## USER'S MANUAL



Hope SenLan Science & Technology Holding Corp., Ltd

# HSD2000 Series MV Solid-state Soft Starter (V4.0) Instructions for Use

**Hope Senlan Science & Technology Holding Co., Ltd.**

**Please read the instructions carefully before installing, operating, and maintaining the MV AC motor soft starter!**

## Precautions

- This product is designed in accordance with the standard requirements of GB/T34927-2017 "Motor Soft-start Device-General Technical Specifications" and GB/T37405-2019 "Medium Voltage Soft-start Device by Thyristor Phase Control".
- Further information can be found in the technical description.

## Hazards

- Failure to comply with regulations may result in accidents that endanger personal safety.
- After the MV solid-state soft starter is connected to the high-voltage power supply, there will be medium voltage inside the cabinet. Even when the motor is stopped, there is still medium voltage inside. The cabinet door is equipped with an electromagnetic lock, and the high-voltage power supply of the soft starter must be disconnected to verify that only the soft starter has been disconnected from the high-voltage power supply can the front and rear doors of the soft starter be opened. Before conducting any maintenance or repair on the high-voltage part of the soft starter, it is necessary to reliably ground the high-voltage part of the soft starter.
- The microcomputer controller and secondary control circuit of the MV solid-state soft starter are powered up by AC 220V/DC220V, so there is a risk of electric shock when in contact with the terminals of the microcomputer controller and secondary control circuit.
- The cabinet of the soft starter must be reliably grounded.

## Warnings

- Failure to comply with regulations may result in accidents that endanger equipment safety.
- When connecting the reactive power compensation device for the improvement of the power factor of the motor, it may damage the thyristor valve components of the MV solid-state soft starter. If users need to connect the reactive power compensation device, please put it into operation during the bypass operation of the MV solid-state soft starter, and be sure to exit during the start or soft stop process.
- The input and output terminals of the MV solid-state soft starter must not be connected in reverse; otherwise it will cause serious safety accidents.
- When starting a MV solid-state soft starter, the thyristor valve component will generate heat, and the control system can set a starting time interval. Failure to start does not indicate equipment failure, but may indicate that the next allowable starting time has not arrived.
- The working environment of the MV solid-state soft starter is required to be indoor at normal temperature, pollution-free, and corrosion-free. If users have special requirements, please explain to the manufacturer when ordering.

**Due to continuous product updates, our company reserves the right to improve product design and**

**modify relevant technical specifications without prior notice! Please contact us for the latest technical information if needed.**

**6th revision in August 2021.**

# Contents

# Chapter I Overview

## 1. Product Introduction

The HSD2000 series MV solid-state soft starter is intelligent digitally controlled, with a 32-bit microcontroller as the control core and a thyristor valve component as the execution unit, to fully automatically start and stop the motor. It is suitable for the control of squirrel cage high-voltage asynchronous motors and high-voltage synchronous motors with various loads.

The thyristor valve component in the HSD2000 series MV solid-state soft starter is composed of multiple thyristors in series and parallel. During the starting process of the motor, the voltage at the motor end is changed by controlling the trigger angle. By doing so, the soft starter can smoothly accelerate the motor according to the pre-set start curve. When the motor reaches normal speed, the bypass contactor or circuit breaker closes to complete the motor starting process. During the operation of motor, the soft starter provides monitoring, real-time measurement of motor voltage, current, and status, and comprehensive protection functions.

## 2. Performance Indicators

| Category | Explanation |
|---|---|
| AC voltage | AC3KV/6KV/10KV，±10%-15%； |
| Load Type | Three-phase MV AC synchronous motor |
| Frequency | 50 Hz±2Hz, or 60 Hz±2Hz |
| Main circuit composition | 3KV,12SCRS；6KV,18SCRS；10KV，30SCRS； |
| Instantaneous overvoltage protection | Voltage-sharing protector and resistance capacitance absorption network |
| Cooling mode | Natural cooling |
| Bypass contactor | Contactors with straight-up capacity |
| Control mode | Two-wire or three-wire system |
| Environmental conditions | Ambient temperature: -10-40 ℃, altitude: no more than 1000 meters, relative humidity: no more than 90%. |

## 3. Operating Principles

The HSD2000 series MV solid-state soft starter adopts a continuous stepless boost method to increase the stator voltage of the motor from an initial value to full voltage progressively during startup, thereby limiting the increase of current during the boost process. During this process, the RC resistance capacitance absorption unit absorbs the peak voltage when the thyristor is turned off in reverse; the voltage-sharing resistor holds the voltage of the thyristor to ensure that the voltage of each group of thyristor in the series circuit is equal; the fiber trigger ensures electrical isolation between the controller and the high-voltage thyristor, while also ensuring that the triggering signal is not affected by electromagnetic interference.

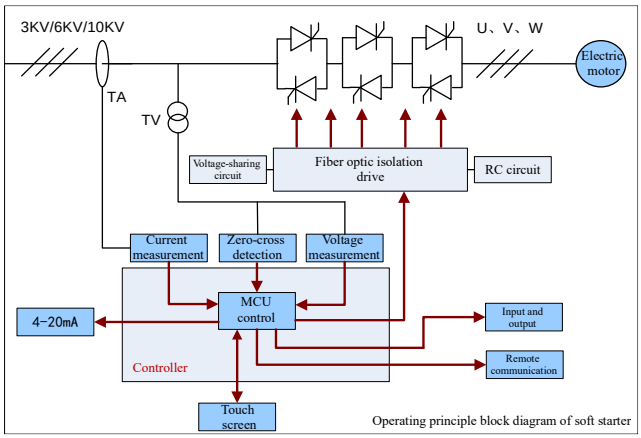



Fig. 1.1 Principle Block Diagram of MV Soft Starter

In the three-phase voltage regulating circuit of the soft starter (as shown in Fig. 1.2), the reverse parallel thyristor is connected between the power supply and the motor. The thyristor features phase control, which means that the thyristor connects the load to the power supply at a selected time during each cycle of the power supply voltage. Changing the selected time can achieve voltage regulation.

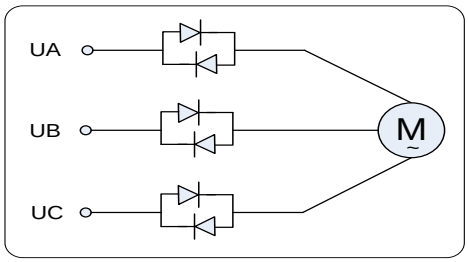



Fig. 1.2 Three-phase AC Voltage Regulating Circuit

The thyristor connected in series in the main circuit of the motor can be regarded as a nonlinear resistor, with low impedance in the on state and high impedance in the off state. The motor adopts three-phase three-wire wiring. Taking phase A as an example, when AB forms a circuit, AC forms a circuit, or AB and AC form a circuit simultaneously, phase A will have current.

**4. Control System**

The HSD2000 system MV solid-state soft starter control system consists of three parts: soft start controller, pulse board, and trigger board.

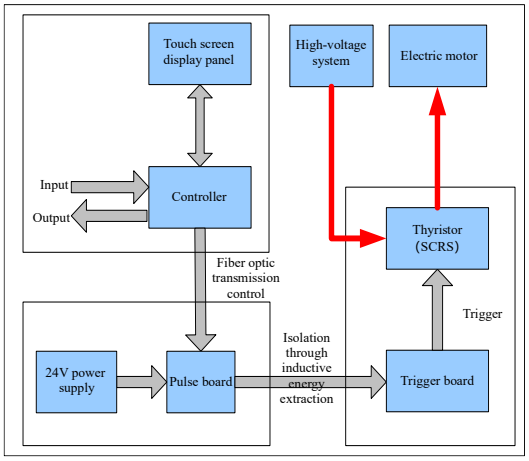



Fig. 1.3 Control System Block Diagram

**1) Soft start controller**

The soft start controller consists of CPU board, fiber trigger board, power and relay board, sampling board and touch screen. The CPU board is the core of the controller, which can achieve photoelectric isolation input and output control, voltage and current signal acquisition, voltage zero-cross signal detection, 4-20mA output, touch screen communication, remote communication, and protection functions.

The touch screen, connected to the controller through RS232, has a bilingual menu in both Chinese and English, allowing for easy setting of various parameters

**2) Pulse board**

The trigger board can convert the fiber trigger signal transmitted by the soft start controller into an electrical trigger signal, and then modulate the electrical trigger signal into a high-frequency pulse current signal. The soft start controller and pulse board are controlled through fiber optic transmission, achieving electrical isolation.

**3) Trigger board**

When the high-frequency pulse current passes through the high-frequency pulse converter, the converter can induce electrical signal and convert it into thyristor trigger signal to trigger the thyristor. There is no direct electrical connection between the pulse board and the trigger board; the trigger board obtains energy through electromagnetic induction for electrical isolation.

**5. Structural Design**

The HSD2000 series MV solid-state soft starter is designed as a cabinet structure, which can be divided into split and integrated types according to product codes. The MV solid-state soft starter cabinet is modified from KYN28-12 cabinet. The cabinet is made of aluminum coated zinc plate processed by CNC machine tool using multiple bending processes and bolted together. The cabinet has a high level of protection, which can prevent the invasion of debris and pests.

**1) Split type**

The split-type MV solid-state soft starter HSD20001, includes components inside the cabinet such as AC contactors, thyristor valve components, lightning arresters, current transformers, voltage transformers and soft start control systems. Its internal structure is simple, with modular design for each part, making maintenance and repair simple and convenient. The layout inside the cabinet is shown in Fig. 1.4.

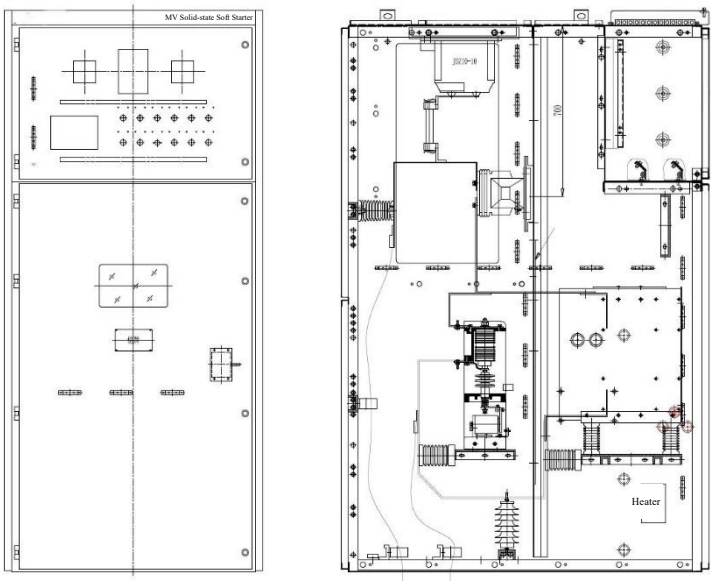



Fig. 1.4 Internal Layout of Split Type (HSD20001) MV Solid-state Soft Starter Cabinet

**2) Integrated type**

The integrated-type MV solid-state soft starter refers to the HSD20003. The circuit breaker is of the handcart type installed in the circuit breaker room; the controller and secondary components are installed in the low-voltage room; the voltage transformer is installed in the busbar room; and the bypass contactor and current transformer are installed in the cable compartment.

The components inside the integrated solid-state soft starter cabinet include vacuum circuit breaker, AC contactor, thyristor valve component, lightning arrester, current transformer, voltage transformer, soft start control system, and microcomputer protection device, etc. The layout inside the cabinet is shown in Fig. 1.5.

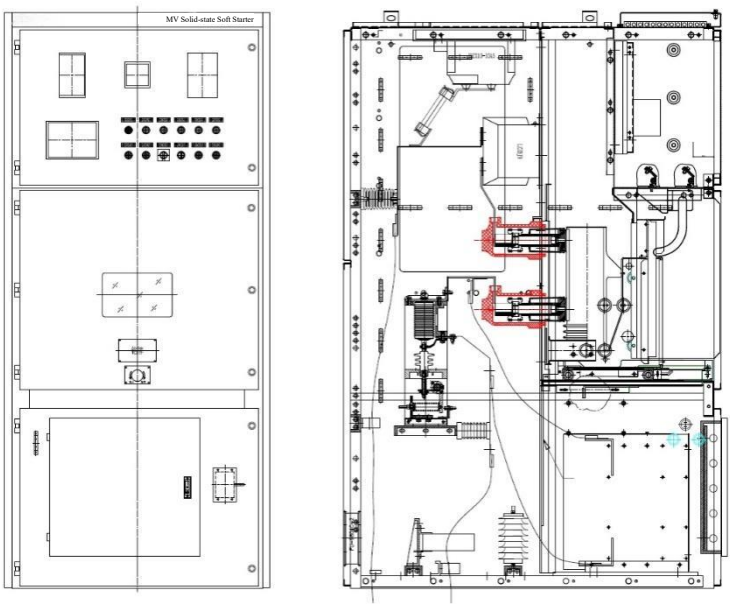



Fig. 1.5 Internal Layout of Integrated (HSD20003) MV Solid-state Soft Starter Cabinet

# Chapter II Function and Model Selection

**1. Product Model Selection**

| Type | Voltage Level | Rated current | Cabinet dimension | | |
|---|---|---|---|---|---|
| | (kV) | (A) | Height (mm) | Width (mm) | Depth (mm) |
| HSD2000-030-500 | 3 | 113 | 2300 | 1000 | 1500 |
| HSD2000-030-900 | 3 | 204 | 2300 | 1000 | 1500 |
| HSD2000-030-1250 | 3 | 283 | 2300 | 1200 | 1500 |
| HSD2000-030-1800 | 3 | 408 | 2300 | 1500 | 1500 |
| HSD2000-030-2000 | 3 | 453 | 2300 | 1500 | 1500 |
| HSD2000-030-2000 above | 3 | ＞450 | Pre-order | | |
| HSD2000-060-500 | 6 | 57 | 2300 | 1000 | 1500 |
| HSD2000-060-1000 | 6 | 113 | 2300 | 1000 | 1500 |
| HSD2000-060-1500 | 6 | 170 | 2300 | 1000 | 1500 |
| HSD2000-060-2000 | 6 | 226 | 2300 | 1000 | 1500 |
| HSD2000-060-2500 | 6 | 283 | 2300 | 1200 | 1500 |
| HSD2000-060-3000 | 6 | 340 | 2300 | 1200 | 1500 |
| HSD2000-060-3500 | 6 | 396 | 2300 | 1500 | 1500 |
| HSD2000-060-4000 | 6 | 453 | 2300 | 1500 | 1500 |
| HSD2000-060-4000 above | 6 | ＞450 | Pre-order | | |
| HSD2000-100-500 | 10 | 34 | 2300 | 1000 | 1500 |
| HSD2000-100-1000 | 10 | 68 | 2300 | 1000 | 1500 |
| HSD2000-100-1500 | 10 | 102 | 2300 | 1000 | 1500 |
| HSD2000-100-2000 | 10 | 136 | 2300 | 1000 | 1500 |
| HSD2000-100-2500 | 10 | 170 | 2300 | 1000 | 1500 |
| HSD2000-100-3000 | 10 | 204 | 2300 | 1200 | 1500 |
| HSD2000-100-3500 | 10 | 238 | 2300 | 1200 | 1500 |
| HSD2000-100-4000 | 10 | 272 | 2300 | 1200 | 1500 |
| HSD2000-100-5000 | 10 | 340 | 2300 | 1500 | 1500 |
| HSD2000-100-6000 | 10 | 408 | 2300 | 1500 | 1500 |
| HSD2000-100-6000 above | 10 | ＞450 | Pre-order | | |

Note: 1) The rated current of the adaptive motor cannot be greater than the rated current of the soft starter.

2) When the rated current of the motor exceeds 450A, the cabinet size needs to be redesigned. Please consult the manufacturer.

3) The MV soft starter cabinet contains a bypass contactor. Please raise any other special requirements if any.

## 2. Functional Description

### 2.1. Protection function

1) Start timeout

2) Overcurrent section 1 protection

3) Overcurrent section 2 protection

4) Negative sequence current section 1

5) Negative sequence current section 2

6) Underload protection

7) Overvoltage protection

8) Undervoltage protection

9) Negative sequence voltage protection

### 2.2 Measuring functions

1) System frequency: display the system frequency value.

2) Voltage measurement: Uab, Ubc, and Uca three-phase voltages and negative sequence voltages.

3) Current measurement: three-phase current and negative sequence currents of motors Ia, Ib, Ic.

### 2.3 Communication interface

1) Communication 1: RS232 communication, connected to the touch screen, for displaying data, parameter settings, etc.

2) Communication 2: RS485 communication with backend monitoring system, standard MODBUS protocol, can be used for controller parameter reading, writing, and control.

### 2.4 Input and output

1) 8 input points, DC24V relay isolation, and photoelectric isolation.

2) 9 output points, contact capacity 6A/250VAC, and passive output.

### 2.5 Cabinet door layout

1) Touch screen for HMI operation.

2) Transfer switch and operating button: direct start/soft start, 2 transfer switches for this cabinet/remote, and 3 buttons for start, stop, and emergency stop.

3) Status indicator lights: 6 indicator lights for power, standby, start/soft stop, bypass/operation, fault, and backup.

Note: The above are standard configurations, which can be adjusted according to user needs in special circumstances.

# Chapter III Installation and Commissioning

## 1. Transportation, Storage and Unpacking Inspection

### 1.1. Lifting and transportation

1) The equipment is packed in a simple manner, and if the user has additional requirements, it will be negotiated separately.

2) During transportation, the equipment and packaging must be reliably fixed to the transportation tool with ropes or other fixtures, and must not be tilted or loose. The fixation of the equipment during transportation must be tightened according to the fixation diagram on the packing. Adequate and appropriate waterproof measures must be taken during transportation to ensure the safety of the equipment during transportation.

3) When lifting equipment, mechanical lifting is generally used. When lifting, attention must be paid to the center of gravity of the equipment. All four lifting points must be used for lifting; only two lifting points are not allowed for lifting operations. During the lifting and hoisting process, the equipment should be ensured to be stable and not tilted or shaken. If the equipment is transported with a forklift, it must be forked according to the forklift holes on the packaging body when using a forklift. When placing equipment, a flat and solid area must be selected for placement, and wooden boards must be added to the soft ground.

### 1.2. Storage

1) Maintain the original packaging.

2) The storage location must be a flat and solid place that can avoid exposure to sunlight, rain, and water. Placing it outdoors requires covering with rainproof and sun proof facilities.

3) Do not crowd or place with other items.

4) The storage time shall not exceed 1 year without special requirements.

### 1.3 Unpacking and inspection

1) Confirm that the specified model specifications are consistent with the received goods.

2) Unpack and check for any damage during transportation carefully. If there is any damage, please contact the manufacturer.

3) Check if the provided equipment product certificate, user manual, equipment factory report, drawings, spare parts, etc. are complete.

4) Check if there are any loose or disconnected mechanical components or loose wiring during transportation and handling, as loose wiring may affect product use.

5) Before starting, check if the rated voltage and current are correct.

## 2. Cabinet Installation and Connection

1) Determine the equipment placement space based on the on-site layout, and the surface of cable trench under the cabinet is subject to cement treatment to ensure its reliability and durability.

2) Necessary embedded parts shall be set up.

3) Before installation, clean the equipment space and ensure that the space is dry.

4) The equipment shall be hoisted in place and fixed with anchor bolts or welded to the fixed channel

steel.

5) Installation and connection of primary and control cables.

**3. Insulation Test**

Insulation resistance test: before testing, short circuit the three-phase input and output of the bypass contactor, remove the primary wiring of the voltage transformer, short circuit both ends of the thyristor (all radiators connected together), or remove the incoming and outgoing lines of the thyristor component, and short circuit the trigger terminal on the trigger board.

Measure the insulation resistance between the circuit and ground for 1 minute with a 2500V megohmmeter. The following table can be referred to for the insulation resistance values:

| Ambient temperature (℃) | 10 | 20 | 30 | 40 |
|---|---|---|---|---|
| Insulation resistance mΩ | 900 | 450 | 220 | 110 |

Power frequency withstand voltage test: based on the insulation resistance test, remove the lightning arrester and use a power frequency withstand voltage tester to perform a withstand voltage test of AC32KV (AC25KV at 6KV) for 1 minute. If the test passes, it is considered normal.

After the test is completed, reinstall the lightning arrester and remove the short wiring.

Attention: The soft starter has undergone a voltage withstand test before leaving the factory, which may not be done on site, but external connection cables and motor voltage withstand tests need to be conducted. When conducting on-site cabinet withstand voltage tests, it is of necessity to contact the manufacturer to avoid damage to valve components caused during the withstand voltage test.

**4. Low Voltage Bulb Test**

Test steps are as follows:

1) Disconnect the incoming and outgoing lines of the MV soft starter;

2) Connect the three-phase three-wire AC380V to the incoming side, and connect three incandescent bulb to the outgoing side, with the neutral point of the bulb connected in a Y-shape.

3) The control power supply for the soft starter cabinet is AC220V/DC220V. After power on, the controller and touch screen should operate normally.

4) Test the resistance value of each GK terminal on the trigger board with a multimeter, which is the resistance value of the thyristor gate and cathode, approximately 15 ohms. If the measured resistance deviates by 50% from the normal value, there may be a problem with the thyristor crimping or the thyristor itself. Test the resistance values of the two K terminals on the left and right sides of the trigger board with a multimeter. This resistance value is the resistance value at both ends of the two anti-parallel thyristors, which is similar to the voltage sharing resistance value, approximately 150K. If the resistance value is severely low, either the thyristor is not installed in reverse parallel, or the thyristor has been broken down.

5) After checking the thyristor, click on the touch screen to enter hardware test page, input debug password and test input, output, and pulse output. If all tests are normal, then the soft start control system and electrical secondary wiring are free of problems and meet the starting conditions.

6) Set the control mode to 2, test mode. It can simulate the action process of soft starter in soft start

mode. If the switch action is normal, change the control mode to 1 (formal start with remote control) or 0 (formal start without remote control).

7) Switch to this cabinet and soft starter, set various parameters on the touch screen, press the start button, and the bulb gradually lights up until the bypass switch is closed to complete the start process.

8) If the debugging process in steps 1-5 is normal, then the MV solid-state soft starter is permissible for high-voltage testing.

9) Restore all wiring after the test is completed.

**Attention: After each soft start, the starter will countdown to the next start. If the countdown is not reached, starting is prohibited. After the countdown time ends, the start lock will be automatically released to allow the starter to have another start.**

**5. Medium Voltage Wiring and Start**

1) After the bulb test is completed, remove the test power supply and equipment, connect the incoming and outgoing high-voltage cables of the MV solid-state soft starter. Pay attention to the phase sequence of the wiring.

2) After the wiring is completed, the primary power supply will be powered on, and the touch screen will display the correct frequency, three-phase voltage value, and negative sequence voltage. The motor phase sequence will be positive phase sequence, and the start and stop parameters and protection parameters are set according to the operating conditions. When the fault light is on, press the stop button signal to reset the fault signal. If there is still a fault, the reset will be invalid.

3) When starting for the first time, set to jog mode for a duration of 3-5 seconds.

4) Switch the switch to the cabinet and soft start position, press the start button, and the motor will start. You can continuously observe the current value displayed on the ammeter or touch screen, the motor will automatically stop after starting for 3-5 seconds.

The jog method is available for observing the rotating direction of the motor. If the direction is correct, the next start can be carried out. If the direction is not correct, stop the high-voltage power supply and adjust the motor wiring sequence.

5) If confident, you can skip steps 3-4 and set the starting mode to voltage ramp starting or current limiting starting. Click the start button to start the motor. After the motor has reached full speed, the current begins to decrease, and then the bypass contactor will be closed to complete the start. If there is any fault during startup, the protection trip will act. If there is an abnormal fluctuation in the current during the starting process, press the stop or emergency button to stop the unit until the fault is resolved before starting.

# Chapter IV Menu and Settings

The display interface of the HSD2000 series MV solid-state soft starter is equipped with a 7-inch high-performance industrial touch screen, with a 65536 color display and a high resolution of 800 x 480, making the screen display more delicate and exquisitely clear.

**1. Main Interface Description**

The main interface covers date, time, system frequency, three-phase voltage, negative sequence voltage, three-phase current, negative sequence current, average current, load rate, voltage current difference angle, power factor, start time, remaining time of locking, start mode, stop mode, control mode, operation status, locking status, company information, etc., as well as operating buttons for system settings, event records, start curve, hardware settings, other settings and use instructions.

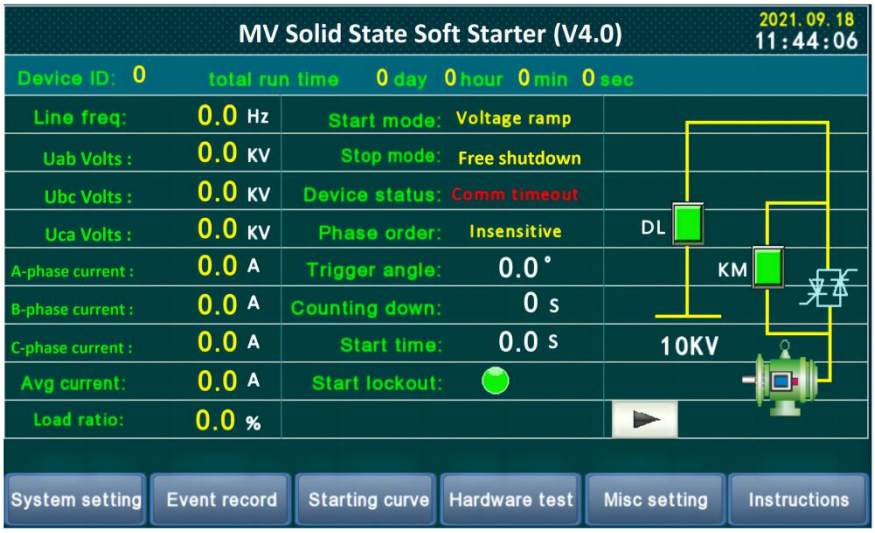



Fig. 4.1 Main Interface

**System frequency**: system power frequency, this setting supports 50HZ and 60HZ power systems.

**Three-phase voltage**: the effective value of Uab, Ubc and Uca three-phase line voltage;

**Negative sequence voltage**: the effective value of negative sequence voltage;

**Angular phase difference**: the phase difference between ABC three-phase voltage and current;

**Power factor**: real-time power factor value;

**Three-phase current**: the effective value of Ia, Ib and Ic three-phase current;

**Average current**: the average values of the three-phase currents Ia, Ib, and Ic;

**Negative sequence current**: the effective value of negative sequence current;

**Load rate**: the ratio of the average three-phase current to the rated current;

**Transmission current**: the real-time transmission current output value;

**Trigger angle**: the real-time triggered angle during the start and soft stop of soft starter;

**Starting time**: the starting time for this soft start is reset to zero before the next start.

**Circuit breaker**: the circuit breaker status of the main circuit of soft starter, with the switch closed turning red and the open turning green. The circuit breaker in the integrated soft starter is the vacuum circuit breaker inside the cabinet.

**Bypass contactor**: in the soft starter, the status of the bypass contactor turns red when the switch is closed and green when the switch is opened.

**Start blocking**: after the soft starter is started, if the blocking time for the next start is not reached, the blocking status is red and starting is not allowed; after the locking time expires, the locking status will turn green and start is allowed.

**Starting mode**: the current selected starting mode for the soft starter, such as voltage ramp, current limiting ramp, sudden jump ramp, jog start, and two-stage voltage ramp;

**Shutdown method**: the current shutdown method selected by the soft starter, such as free shutdown and soft shutdown;

**Operating status**: the current operating status of the soft starter, such as communication interruption, readiness, start, operation, soft stop, fault, testing, emergency stop, and standby;

**Motor phase sequence**: the phase sequence currently connected to the ABC three-phase power supply of the soft starter. When there is no voltage, the unknown phase sequence is displayed. When there is a positive sequence, it is displayed as positive phase sequence, and when there is a negative sequence, it is displayed as reverse phase sequence.

**Time remaining**: the countdown time from the next start after the soft starter has started.

**Operation**: after the soft starter is started, it starts counting and the start time is reset before the next start.

**Equipment number**: the numbering of the soft starter on site, and the signal can be set by oneself.

When click the Chinese/English button in the upper left corner, you can switch the language between Chinese and English.

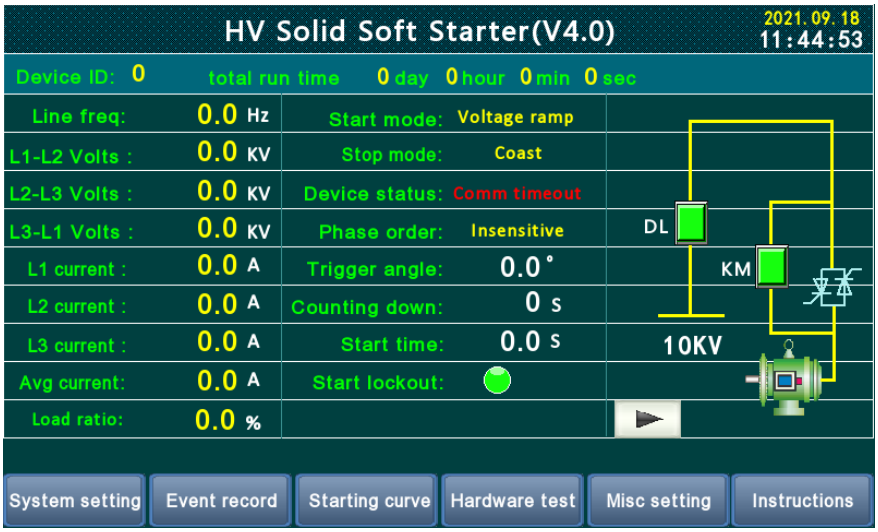



Fig. 4.2 Main Interface in English

**2. System Settings**

Click the system settings button on the main interface to enter the system parameter setting interface.

**Status description**: 1) Reset button; after pressing the reset button, the system exits the debug mode and the indicator light turns green. 2) The indicator light turns red and flashes when the system is in debug mode. 3) When the button text color is yellow, indicating the page corresponding to the current button. 4) When there are setting instructions for the corresponding page number, you can access the parameter setting instructions.

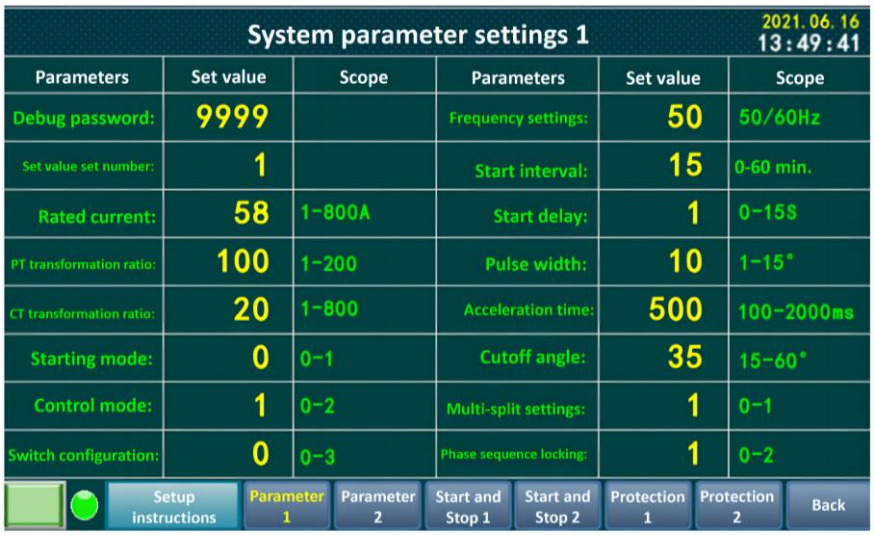



Fig. 4.3 System Parameter Settings 1

**Debug password**: the system debug password is 102. After entering the correct password, the displayed value is 9999. The light in the lower left corner starts to flash, entering the debug mode where parameter modifications can be made.

Note: the debug mode can only be entered in standby, ready, and fault states, and cannot be entered in other states.

After modifying the parameters, press the button in the bottom left corner to exit the debug mode and enter normal operating mode.

**Set value set number**: the device can set 4 sets of set values, usually using the first set of set values by default. After using either set of set values for the equipment, please do not modify the set number, as it may cause incorrect motor parameters.

**Rated current**: the parameter setting is ranged 1-800, and the system default value is 100. The setting value is the rated current value of the motor, and rounding is used when there are decimals in the rated current.

**PT transformation ratio**: the parameter setting range is 1-200, and the system default value is 100. The setting value is the ratio of the primary and secondary voltage of the voltage transformer, such as 10000V/100V=100.

**CT transformation ratio**: the parameter setting range is 1-800, and the system default value is 100. The setting value is the ratio of the primary and secondary voltage of the current transformer, such as 200A/5A=40.

**Starting mode**: the parameter setting range is 0-1, and the system default value is 0. 0 stands for button start, and 1 stands for feedback start (feedback start refers to the linkage start stop after the circuit breaker is closed and the circuit breaker position comes over, without the need to press the start stop button again).

**Control mode**: the parameter setting range is 0-2, and the system default value is 1. 0 stands for local control mode, 1 stands for local control+remote control, and 2 stands for analog control (analog control can only be tested in standby mode).

**Switch configuration**: the parameter setting is ranged 0-3, and the system default value is 0. 0 only refers to bypass contactor, 1 refers to the bypass contactor+main circuit contactor, 2 refers to the bypass contactor+main circuit isolation switch, and 3 refers to the bypass contactor+isolation contactor.

**Frequency setting**: the parameter setting range is 50HZ/60HZ, with the 50HZ is set to 50 and the 60HZ is set to 60. If set to other numbers, the default is the 50HZ system.

**Start interval**: the parameter setting range is 0-60 minutes, and the conventional setting is 15 minutes. The soft starter can only start again after an interval of 15 minutes, and users can modify it to other intervals according to actual needs.

**Start delay**: the parameter setting range is 0-15 seconds, and the conventional setting is 1; and the waiting time is from the start signal to the actual start of the start action.

**Pulse width**: the parameter setting range is 0-15, and the system default value is 10 °. 1 ° represents the cycle time t/360 °. In a 50HZ system, 1 °=55.5us, and in a 60HZ system, 1 °=46.3us.

**Acceleration time**: the parameter setting range is 100-2000ms, usually it is set to 500ms. After the motor starts at full speed, the motor current begins to decrease. At this point, the motor terminal voltage is not at full voltage. At this point, it is necessary to quickly increase the voltage to full voltage and bypass it to avoid motor oscillation when the motor is not bypassed at full speed.

**Cutoff angle**: the parameter setting range is 15-60 °, usually it is set to 35 °. The cutoff angle is the minimum angle that can be reached by the trigger angle during the soft start process.

**Multi-split settings**: the parameter setting range is 0-1, and the system default value is 1. 0 represents multi-split settings, and 1 represents one-for-one setting.

**Phase sequence locking**: the parameter setting range is 0-2, usually it is set to 1. 0 indicates no locking, 1 indicates positive sequence locking, and an alarm is triggered when the system detects reverse sequence locking. 2 indicates reverse sequence locking, and an alarm is triggered when the system detects positive sequence locking.

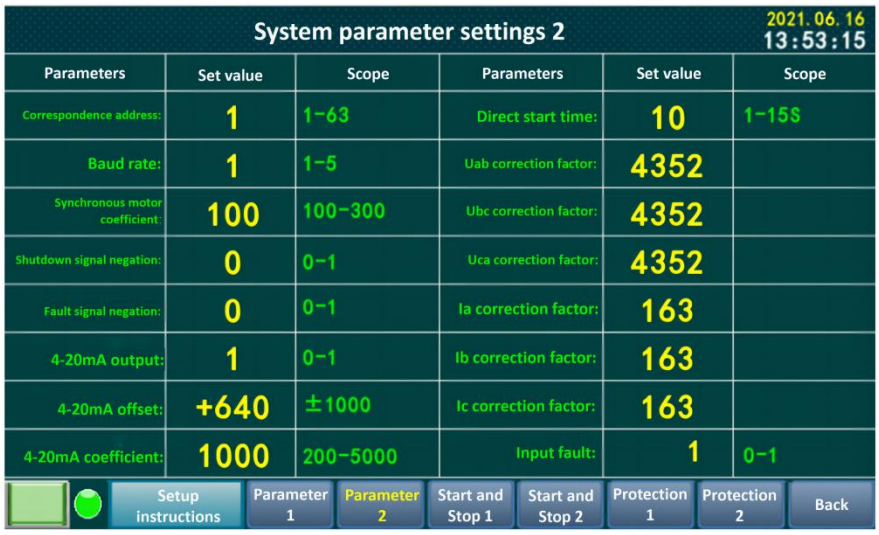



Fig. 4.4 System Parameter Settings 2

**Communication address**: the parameter setting range is 1-63, and the system default value is 1. RS485 address is used for backend communication.

**Baud rate**: the parameter setting range is 1-5, and the system default value is 1. 1 represents 9600; 2 represents 19200; 3 represents 38400; 4 represents 57600 and 5 represents 115200.

**Synchronous motor coefficient**: the parameter setting range is 100-300, and the system default value is 100. When the synchronous motor starts asynchronously without excitation, the current is relatively high and does not meet the bypass conditions. By setting the synchronous electric coefficient, the synchronous motor meets the bypass conditions.

The synchronous motor coefficient in asynchronous motors is set to 100.

The synchronous click coefficient in synchronous motors is set to 150-200.

**Signal negation**: the parameter setting range is 0-1, and the system default value is 1. 0 stands for not negated, and 1 stands for negated. Some equipment shutdown signals and fault signals are inverted signals, which need to be negated before use.

4-20mA **output**: the parameter setting range is 0-1, and the system default value is 1. 0 indicates that the output is not enabled, and 1 indicates that the output is enabled.

4-20mA **offset**: the parameter setting range is ± 1000, and the system default value is+640. This parameter is used for correcting the fixed deviation value in 4-20mA.

4-20mA **coefficient**: the parameter setting range is 200-5000, and the system default value is 1000. This parameter is used for correcting fixed linear deviation in 4-20mA.

**Direct start time**: the parameter setting range is 1-15S, and the system default value is 10S. When the motor is for a direct start, it skips the soft start process, causing potential malfunction of the overcurrent section 1 protection, overcurrent section 2 protection, negative sequence current section 1 protection and negative sequence current section 2 protection. After setting the direct start time, during the direct start time, the protection values of overcurrent section 1 and negative sequence current section 1 increase, and the overcurrent section 2 and negative sequence current section 2 protection functions are locked.

**Voltage correction coefficient**: the voltage coefficient of the soft start controller has been calibrated at the factory. It is generally not allowed to have the voltage coefficient modified.

**Current correction coefficient**: the current coefficient of the soft start controller has been calibrated at the factory. It is generally not allowed to have the current coefficient modified.

When modifying the voltage correction coefficient and current correction coefficient, it is necessary to enter the protection password before making the modification. If it is necessary to modify the coefficient, please contact the manufacturer to provide the password. The consequences caused by modifying the coefficient shall be borne by the user.

**Input fault**: the parameter setting range is 0-1, and the system default value is 1. 0 represents invalid,

and 1 represents valid. When there are no special requirements, the input fault must be set to 1.

**3. Start and Stop Settings**

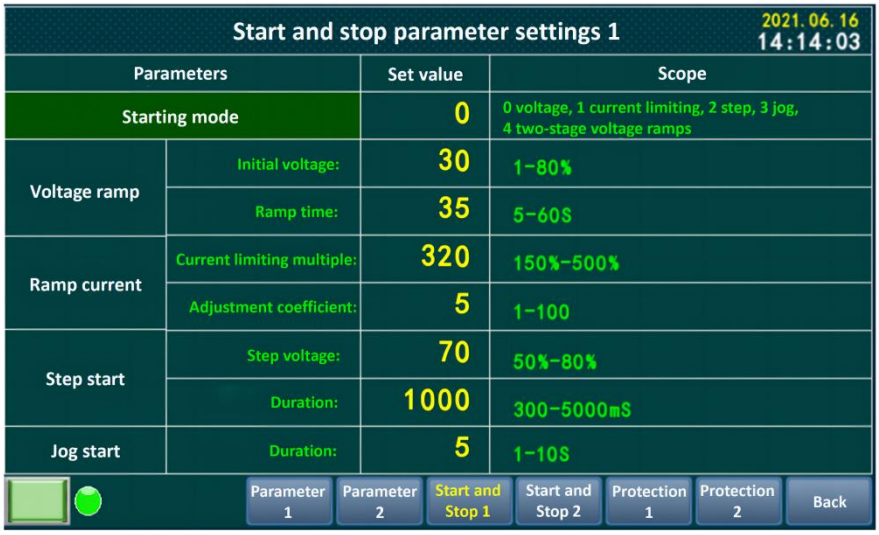



Fig. 4-5 Start Parameter Settings 1

**Starting mode:** 0 represents voltage ramp, 1 represents current limiting, 2 represents step, 3 represents jog, and 4 represents two-stage voltage ramping.

**3.1 Voltage ramping start**

When starting by voltage ramping, the voltage rises at a set ramp starting from the initial voltage. When the motor speed reaches full speed, the current begins to decrease. At this point, the soft starter will quickly step up to full voltage and then bypass.

The voltage ramping includes two parameters: initial voltage and ramp time;

**Initial voltage**: the parameter setting range is 30-80%, and the system default value is 30, which is the percentage of system voltage;

**Ramp time**: the parameter setting range is 5-60S, and the system default value is 30. The ramp time is the time from the initial voltage to the full voltage under ideal conditions.

Regarding the actual starting time of the motor, if the initial voltage is set to 30%, the ramp time is 35s. The slope of voltage ramping is (100% -30%) ÷ 35=2%/S, which means that the voltage increases by 2% per second. If a certain motor can be started at 70% voltage, the actual starting time is (70% -30%) ÷ 2%=20S. For general motors, the actual starting time is much shorter than the ramp time before the full voltage motor has been started, and the starting time can be automatically adjusted according to the load.

The left figure t1-t2 in Fig. 4.6 shows the fast step-up section, with its time corresponding to the **acceleration time** parameter.

The right figure t1-t2 in Fig. 4.6 shows the difference in starting time under different ramp time settings. Under the same initial voltage, the longer the ramp time setting, the longer the starting time, but the smaller the maximum starting current.

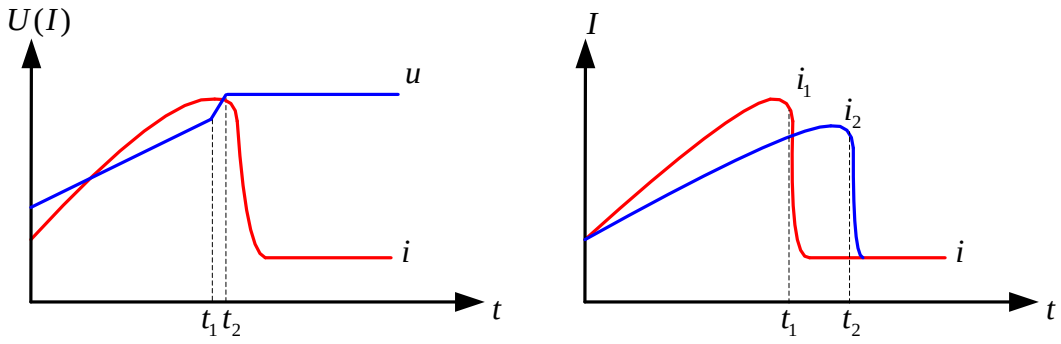



Fig. 4.6 Voltage for Ramping Start and Current Curve

### 3.2. Current-limited start

During current-limited start, the initial stage starts in a voltage ramp manner. When the current reaches the set current limiting multiple, the current enters the regulating stage and remains at the current limiting value. When the motor speed reaches full speed, the current begins to decrease. At this point, the soft starter will quickly step up to full voltage and then bypass.

Current-limited start includes two parameters: current limiting multiple and adjustment coefficient.

**Current limiting multiple**: the parameter setting range is 150-400%, the default setting is 350%, percentage of motor rated current;

**Adjustment coefficient**: the parameter setting range is 1-100, with a default setting of 10. After the starting current reaches the limit value, the PI adjustment is used for maintaining the current near the limit value. The adjustment coefficient is the amplitude of current regulation. If the value is set too high, the sensitivity increases, but with an excessive large current regulation amplitude; if the value is set too low, the sensitivity decreases, and the fluctuation of current regulation amplitude will be too small. Generally, it is recommended to set it to 5-10.

The 0-t1 section in the left figure of Fig. 4.7 represents the voltage ramp starting time period, and the t1-t2 section represents the current regulation section.

The t1-t2 section in the right figure of Fig. 4.7 shows the difference in starting time under different current limiting multiples. The smaller the current limiting value, the longer the starting time.

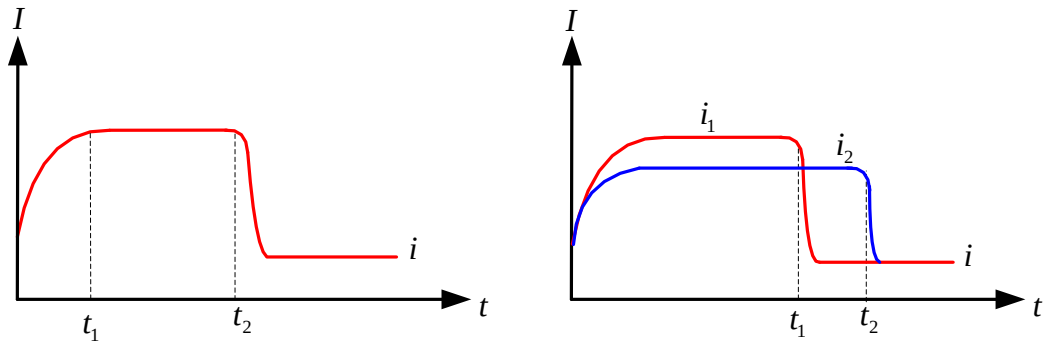



Fig. 4.7 Current Curve during Current-limited Start

### 3.3. Step start

The step start is used in situations with high initial static friction. Initially, step voltage is applied for a period of time to allow the motor to rotate and then start according to the voltage ramp.

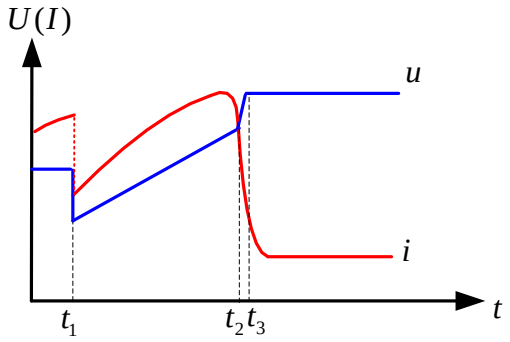



Fig. 4.8 Step Start Voltage and Current Curve

The ramp start includes two parameters: the step voltage and duration;

**Step voltage**: the parameter setting range is 50-80%, the default setting is 60, the percentage of rated voltage;

**Duration**: the parameter setting range is 300-5000ms, with a default setting of 1000.

As shown in Fig. 4.8, during the 0-t1 time period, a higher voltage is applied to generate a larger torque, allowing the motor to rotate, but accompanied by a larger impulse current. During the t1-t3 time period, there is a voltage ramp starting process. When the motor reaches full speed, the current begins to decrease. At this time, the soft starter quickly steps up to full voltage and then bypasses. The t2-t3 time period is a period for a rapid step-up.

### 3.4. Jog start

The jog start adopts a voltage ramp method for starting, but the duration is relatively short. The main purpose is to allow the motor to start for a few seconds and observe the rotating direction of the motor. This starting mode is only applicable for initial debugging.

**Duration**: the parameter setting range is 1-10s, with a default setting of 5, indicating the continuous starting time of the motor;

The jog start is a soft start under voltage ramp mode, not a full voltage start.

### 3.5. Two-stage voltage ramp start

The two-stage voltage ramp start is a starting process that divides the voltage ramp into two different slopes. The voltage rises at a set ramp starting from the initial voltage. When the motor speed reaches full speed, the current begins to decrease. At this point, the soft starter will quickly step up to full voltage and then bypass.

**Two-stage voltage**: the parameter setting range is 10-80%, with a default setting of 50. The two-stage voltage must be higher than the initial voltage;

**Two-stage time**: the parameter setting range is 5-60S, with a default setting of 15.


Fig. 4.9 Start Parameter Settings 2

Two-stage ramp calculation, assuming the initial voltage is set to 30% and the ramp time is 20 seconds. The two-stage voltage is set to 50% and the ramp time is 20s. The one-stage voltage ramp is (50% -30%) ÷ 20=1%/S, and the two-stage voltage ramp is (100% -50%) ÷ 20=2.5%/S. The ramp of two-stage voltage is much faster than that of the one-stage voltage, so we can use parameter settings to make the motor running fast at the beginning and slow later or slow at the beginning and fast later during the startup process.

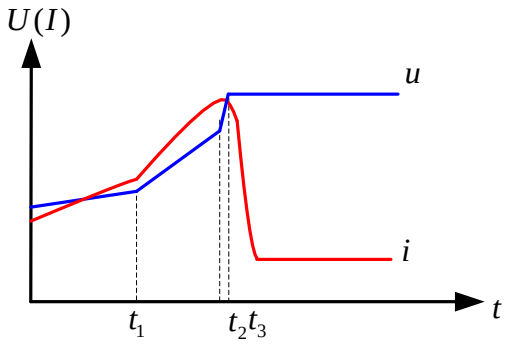



Fig. 4.10 Starting Voltage and Current Curve of Two-stage Voltage Ramp

### 3.6 Shutdown method

**Shutdown method**: the parameter setting range is 0-1, and the system default value is 0. 0 represents free shutdown, and 1 represents soft shutdown.

The free shutdown refers to stopping the equipment by directly disconnecting the switch.

The soft shutdown refers to the gradual reduction of motor terminal voltage through thyristor control during shutdown, thereby providing a decreasing output torque during the shutdown process. By doing so, it can prolong the downtime and reduce the mechanical impact during loaded shutdown.

Among pump loads, when stopping directly, the upper water inside the pump will fall freely, and the backflow water will generate strong vibration waves, causing damage to pipelines, valves, and other related equipment. By implementing soft shutdown, the water will not generate vibration waves during the shutdown process, and water hammering will basically disappear.

Note: The soft shutdown is suitable for water pump loads with a certain elevation. Please use the soft shutdown function with caution in other situations.

**Cutoff voltage**: the parameter setting range is 30-70%, and it is recommended to set it to 50 as a percentage of the rated voltage;

**Soft shutdown time**: the parameter setting range is 5-30S, and it is recommended to set it to 10. The time from soft shutdown output to soft stop should not be set too long.

## 4. Protection Settings

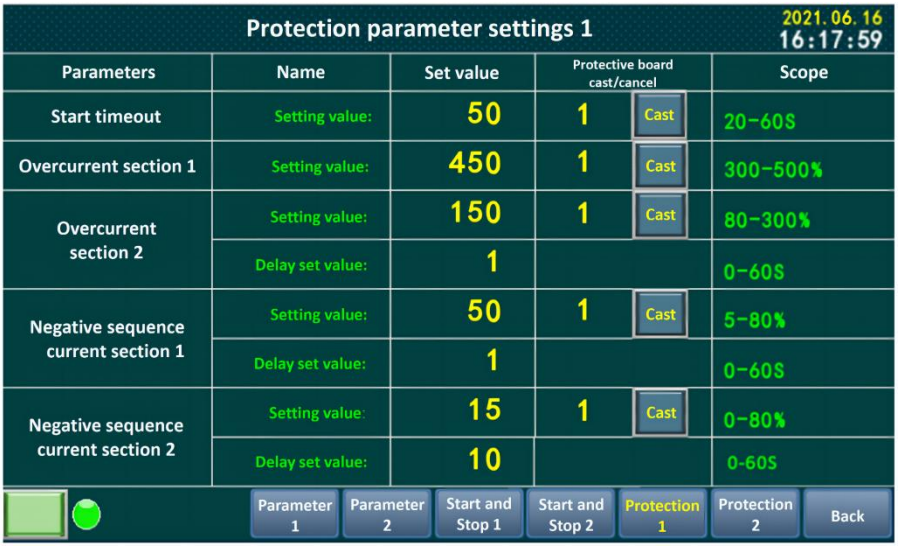



Fig. 4.11 Protection Parameter Settings 1

**Start timeout**: the parameter setting range is 20-60S, and it is recommended to set it to 50. The protective board is effectively put into operation. When the motor start time exceeds the set start time, the protection trips and sends a signal.

If the motor fails to start within the specified time, the soft starter will report a failure shutdown. Under normal load, the starting time of the motor is much shorter than the start timeout protection time. However, during current-limited start, if the current limiting value is too small, it will lead to insufficient output torque of the motor and delay in reaching full speed, which will trigger the start timeout protection action.

**Overcurrent section 1**: the parameter setting range is 300% -500%, and it is recommended to set it to 450. The protective board is effectively put into operation, and the overcurrent section 1 protection is effective in standby, ready, startup, operation, and soft stop. If any phase of the three-phase current exceeds the set value, there is no delay protection trip and a signal will be sent.

During soft start, overcurrent section 1 during the starting process is the setting value. When starting directly, the set value of overcurrent section 1 increases to twice the setting value during the starting process. After the start time, the set value of overcurrent section 1 is restored to its original value.

**Overcurrent section 2**: the parameter setting range is 80% -300%, with a default setting of 120. The protective board is effective when put into operation, and the overcurrent section 2 protection is effective when in standby, ready, and running. If any phase of the three-phase current exceeds the set value, the delay protection trips and sends a signal.

**Delay set value**: the parameter setting range is 0-60S, and it is recommended to set it to 3. If any phase of the three-phase current exceeds the set value, the delay protection trips and sends a signal. During the delay time, the current value decreases and the protection is released.

**Negative sequence current section 1**: the parameter setting range is 5% -80%, and it is recommended to set it to 50. The protective board is effective when put into operation, and the negative sequence current section 1 protection is effective when in standby, ready, start, running and soft stop. When the three-phase current is in reverse phase sequence, the incoming and outgoing lines of a certain phase or two phases are reversed, and the three-phase current is unbalanced, negative sequence current will be generated, and the negative sequence current will also increase with the increase of the three-phase current. The negative sequence current section 1 is commonly used as a protection in case of reverse phase sequence, reverse current incoming and outgoing lines, and phase loss. If the negative sequence current value exceeds the protection value, the delay protection trips and sends a signal.

During soft start, soft stop, or direct start, the set value of negative sequence current section 1 increases to four times the setting value. During the operation phase, the value of negative sequence current section 1 is restored to its original value.

**Delay set value**: the parameter setting range is 0-60S, and it is recommended to set it to 1. If the negative sequence current value exceeds the protection value, the delay protection trips and sends a signal. Within the delay time, the negative sequence current value decreases and the protection is released.

**Negative sequence current section 2**: the parameter setting range is 0-80%, the default setting is 15. The protective board is effective when put into operation, and the negative sequence current protection of section 2 is effective when in standby, ready, and running. Negative sequence current section 2 is commonly used as protection when three-phase current is unbalanced. If the negative sequence current value exceeds the protection value, the delay protection trips and sends a signal.

During soft start, soft stop, or direct start, the negative sequence overcurrent section 2 protection function is blocked, and the protection is activated during operation.

**Delay set value**: the parameter setting range is 0-60S, and it is recommended to set it to 5. If the negative sequence current value exceeds the protection value, the delay protection trips and sends a signal. Within the delay time, the negative sequence current value decreases and the protection is released.

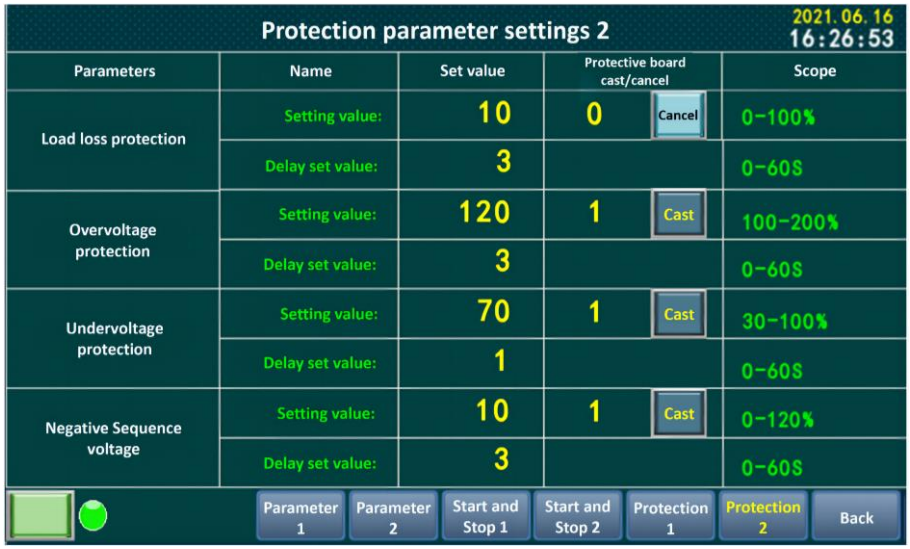



Fig. 4.12 Protection Parameter Settings 2

**Load loss protection**: the parameter setting range is 0-100%, with a default setting of 10. It is a type of protection that effectively applies the protective board and is lower than the normal load, commonly used for belt conveyor closure. During the operation of the motor, if the average three-phase current value is less than the set current value, the delay protection trips and sends a signal.

**Delay set value**: the parameter setting range is 0-60S, and it is recommended to set it to 3. If the current value is lower than the protection value, the delay protection trips and sends a signal. Within the delay time, the current value increases and the protection is released.

**Overvoltage protection**: the parameter setting range is 100-200%, with a default setting of 120. The protective board is effective when put into operation, and the overvoltage protection is effective when in standby, ready, start, running, and soft stop. If any phase of the three-phase voltage exceeds the set value, the delay protection trips and sends a signal.

**Delay set value**: the parameter setting range is 0-60S, with a default setting of 3. If the voltage exceeds the protection value, the delay protection trips and sends a signal. Within the delay time, the voltage drops and the protection is released.

**Undervoltage protection**: the parameter setting range is 30-100%, with a default setting of 70. The protective board is effective when put into operation, and the overvoltage protection is effective during start, running, and soft stop. If any phase of the three-phase voltage is lower than the set value, the delay protection trips and sends a signal.

**Delay set value**: the parameter setting range is 0-60S, with a default setting of 3. If the voltage is lower

than the protection value, the delay protection trips and sends a signal. Within the delay time, the voltage rises and the protection is released.

**Negative sequence voltage protection**: the parameter setting range is 0-120%, with a default setting of 10. The protective board is effectively put into operation, and the three-phase voltage is in reverse phase sequence. When there is a phase loss or imbalanced three-phase voltage, a negative sequence voltage will be generated. The negative sequence voltage protection is effective during standby, ready, start, running, and soft stop. If the negative sequence voltage exceeds the set value, the delay protection trips and sends a signal.

**Delay set value**: the parameter setting range is 0-60S, with a default setting of 3. If the negative sequence voltage exceeds the protection value, the delay protection trips and sends a signal. Within the delay time, the negative sequence voltage drops and the protection is released.

**5. Event Records**

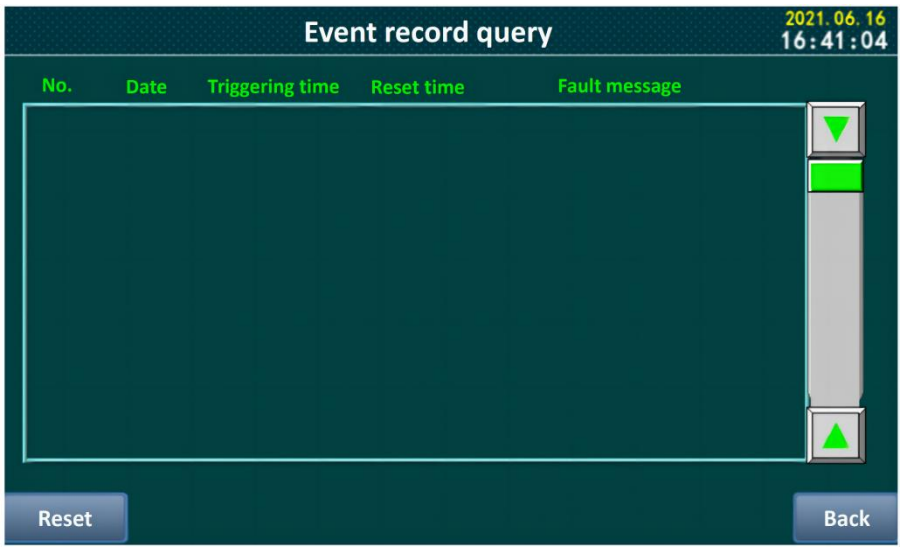



Fig. 4.13 Event Record Query

Click the **Event Records** button on the main interface to enter the fault status query interface. The fault setting interface is shown in Fig. 4.13.

Each fault message includes: serial number, date, fault time, reset time, and fault information; when there are many fault records, you can browse the history through the green navigation bar on the right and the up and down triangle buttons.

**Reset**: after a fault occurs, you can click the reset button to reset the fault.

**6. Start Curve**

Click the **Start Curve** button on the main interface to enter the start curve page. The start curve records

the average current within 50 seconds after starting, and automatically stops after 50 seconds. Before the next start, the previous current record data will be cleared, and then the current start current will be recorded.

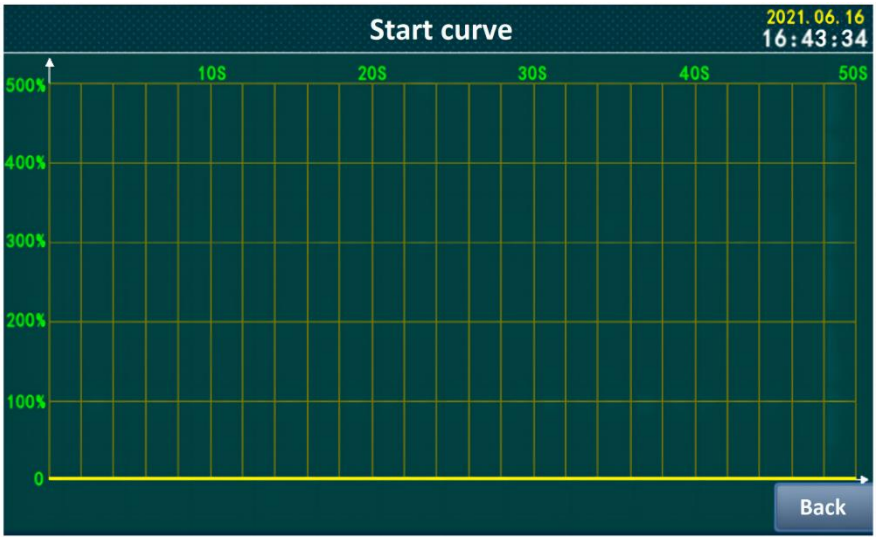



Fig. 4.14 Start Curve

**7. Hardware Test**

Click the **Hardware Test** button on the main interface to enter the input/output test page. When conducting input and output tests, password is required to enter the debug mode. When in debug mode, the debug status light will flash.

Perform input and output tests in standby and ready modes.

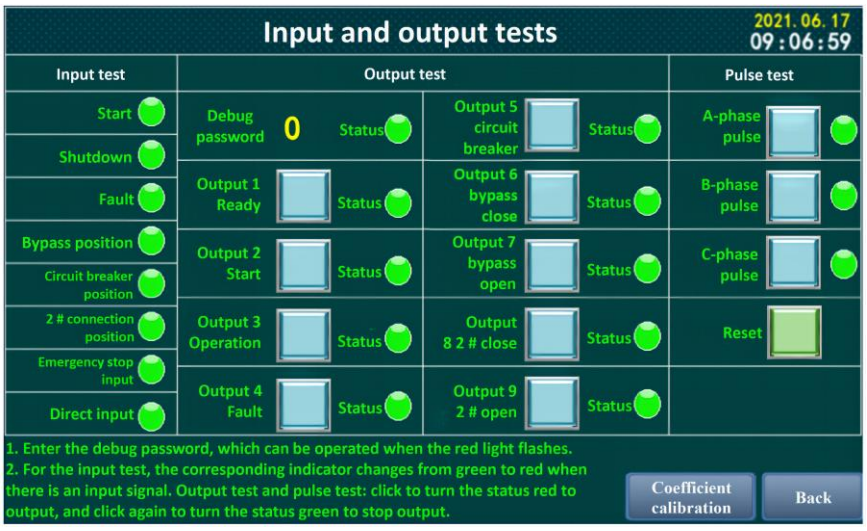



Fig. 4.15 Input and Output Tests

**Input test**: apply an input signal externally or on a terminal, the corresponding input status changes from green to red.

**Output test:** click the corresponding output button, the corresponding output status changes from green

to red, and the external relay acts. Click the corresponding output button again to reset the status. The corresponding output status changes from red to green, and the external relay is reset.

**Pulse test**: before the action pulse test, first click on the "2" button to supply power to the pulse trigger. Click the A-phase pulse trigger button firstly, the A-phase pulse status changes from green to red, corresponding to the indicator light on the A-phase trigger board. Click the A-phase pulse trigger button again, and the A-phase pulse status will reset. The corresponding output status will change from red to green, and the corresponding indicator light on the A-phase trigger board will be off. Test the B-phase and C- phase pulses using the same method.

After completing the pulse test, click the corresponding output 2 button again to reset the status.

After all input and output tests are completed, click the reset button to exit the debug mode.

Note: The coefficient calibration is used for voltage and current coefficient calibration at the factory and will not provide users with any operation.

**8. Other Settings**

Click on the **Other Settings** button on the main interface to enter the version information page.

**Firmware version**: the internal CPU program version number of the controller.

**Operating voltage**: the input operating voltage supported by the controller.

**PT/CT configuration**: the corresponding PT/CT secondary parameters of the controller have two working modes: PT: 100V, CT: 5A, and PT: 100V, CT: 1A.

**Product serial number:** composed of year, month, day, and serial number.

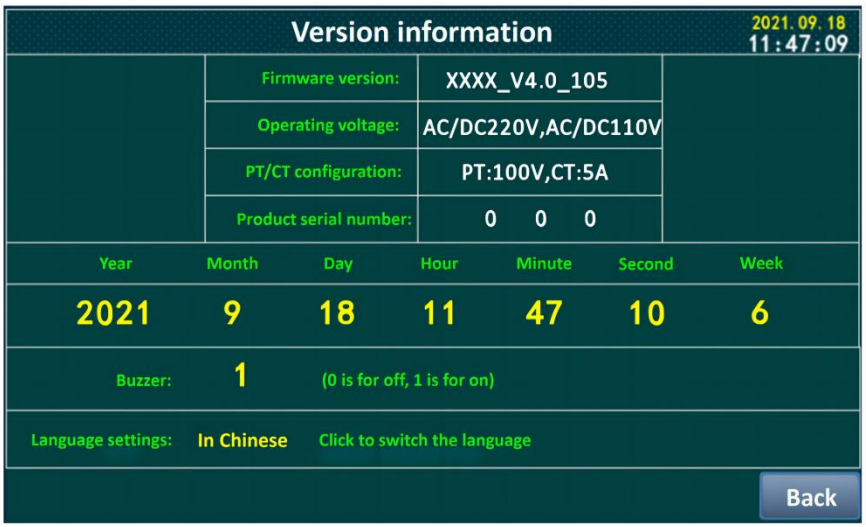



Fig. 4.16 Version Information

**Time setting**: when the touch screen time needs to be calibrated, it can be modified by setting the time.

**Buzzer**: 0 is for off, 1 is for on. When the buzzer is turned on, there is a prompt sound when touching, and an alarm signal will be accompanied with a prompt sound.

**Language settings**: the touch screen is provided with bilingual language in both Chinese and English. When selecting Chinese, the Chinese interface is displayed, and when selecting English, the English interface is displayed.

**9. Use Instructions**

Click the **Use Instructions** button on the main interface to enter the Use Instructions page.

The Use Instructions covers:

1) Start/stop parameter description 2) Protection parameter description 3) Startup operation process 4) Debugging and maintenance instructions

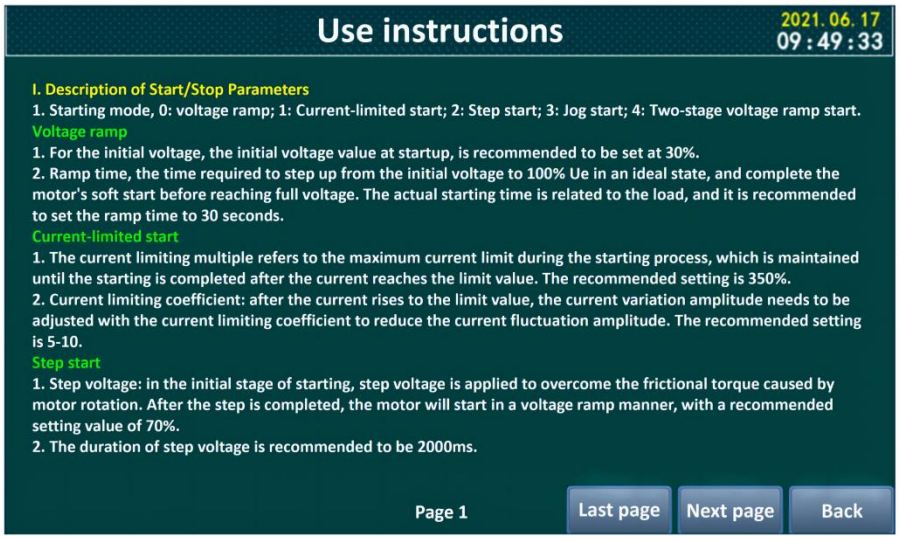



Fig. 4.17 Use Instructions Page

# Chapter V Soft Start Controller

The soft start controller is a domestically advanced controller developed by our company specifically for the HSD2000 series of MV solid-state soft starter, featuring advanced technology, good universality and strong expansibility.

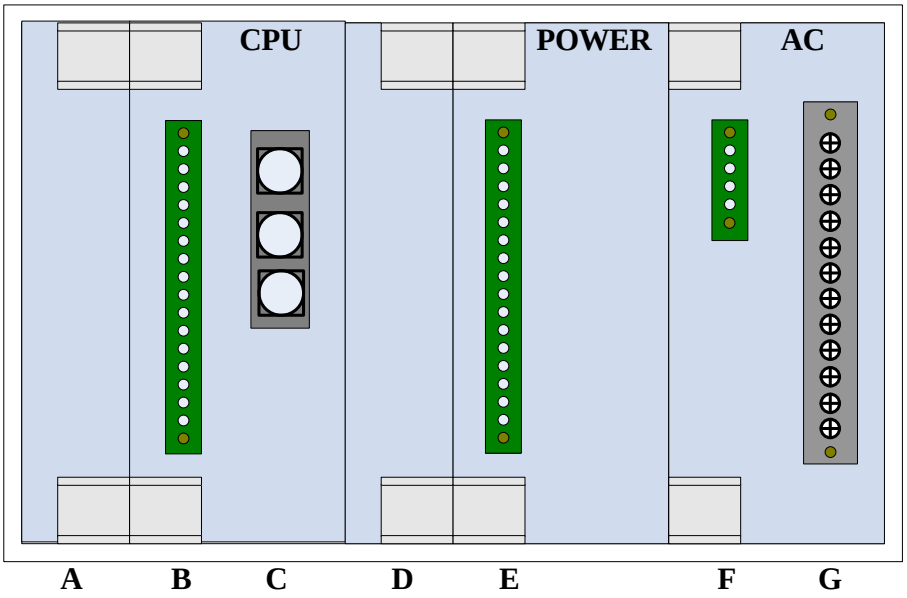



Fig. 5.1 Soft Start Controller Terminal Diagram

The description of soft start controller terminal is as follows:

**1. Input and Communication**

It is for the input of external control signals, the input terminal is B1-B8.

B1: Start signal, soft start starts after input, jogging input signal.

B2: Stop, soft stop, or reset signal. When the starter is set to free shutdown, the shutdown input will result in free shutdown; when the soft start controller is set to soft stop, the shutdown input will trigger a soft stop; when the starter is in a fault state, the shutdown switch has a fault reset function.

B3: External fault signal. After the external fault is inputted to the controller, it will directly report failure shutdown.

B4: Bypass input signal to detect the position of the bypass contactor.

B5: Circuit breaker input signal to detect the position of the circuit breaker.

B6: Input signal of 2 # contactor to detect its position if there are additional contactors.

B7: Emergency stop/multi-split, when the device is set to single machine mode, it is an emergency stop input signal.

B8: Direct start/multi-split, when the device is set to single machine mode, it is a direct start input signal.

When the device is set to multi-machine mode, B7/B8 together form the unit selection for multi-level mode.

When B7=0 and B8=0, select unit 1#, and the corresponding set number is 1;

When B7=1 and B8=0, select unit 2#, and the corresponding set number is 2;

When B7=0 and B8=1, select unit 3#, and the corresponding set number is 3;

When B7=1 and B8=1, select unit 4#, and the corresponding set number is 4;

B9: Input the common terminal and connect it to 24V-.

B10-B12: RS232RX/232TX/GND, communication connection between controller and touch screen.

B13-B14: RS485A/RS485B, the controller is connected to the backend communication.

B15-B16: 4-20mA output terminal, no need for positive or negative identification.

**2. Fiber Trigger**

C1: TXA, phase-A triggers control signal.

C2: TXB, phase-B triggers control signal.

C3: TXC, phase-C triggers control signal.

**3. Power Supply and Output**

E1：AC220V/DC220V，L。

E2：AC220V/DC220V，N。

E3: Standby.

E4: Ready signal, output when ready.

E5: Start/soft stop, output during the start or soft stop process.

E6: Bypass/Run, output in running state.

E7: Fault, output when a fault occurs.

E8: Output when circuit breaker opens.

E9: Output when the bypass contactor is closed, output when the bypass is closed.

E10: Bypass contactor electric opening, normally closed output point, normally close changes to normally open when bypass contactor opens.

E11: Output when bypass contactor opens.

E12: Output when contactor 2 # is closed, output when contactor 2 # is closed.

E13: 2# contactor electric opening, normally closed output point, normally close changes to normally open when 2# contactor opens.

E14: Output when 2# contactor opens.

E15: Output common point, 24V-.

E16: Output common point, 24V-.

**4. AC Acquisition**

F1: Ua, voltage signal of Ua on the secondary side of the voltage transformer, used for voltage measurement and synchronous detection.

F2: Ub, voltage signal of Ub on the secondary side of the voltage transformer, used for voltage measurement and synchronous detection.

F3: Uc, voltage signal of Uc on the secondary side of the voltage transformer, used for synchronous detection.

F4: Un, voltage signal of Un on the secondary side of the voltage transformer, which can be disconnected during VV connection.

G1-G2: IA-IA', current signal of Ia on the secondary side of the current transformer, used for A-phase current measurement.

G3-G4: IB-IB', current signal of Ib on the secondary side of the current transformer, used for B-phase current measurement.

G5-G6: IC-IC', current signal of Ic on the secondary side of the current transformer, used for C-phase current measurement.

G7-G12: Standby

# Chapter VI Communication Protocol

To meet the diverse communication needs of users, the HSD2000 series MV solid-state soft starter provides RS485 communication interface and backend communication function.

The standard MODBUS protocol is used for backend communication. The MODBUS protocol provides detailed definitions of verification codes, data sequences, and other necessary contents for specific data exchange. The MODBUS protocol features master-slave response connection (half-duplex) on a communication line. When the computer addresses a unique terminal device number, the terminal device will send a reply signal to the host.

The MODBUS protocol only allows communication between the host and terminal devices, and does not allow data exchange between terminal devices.

**1. Transmission Method**

The MODBUS protocol information transmission is asynchronous and in bytes, the communication data transmitted between the master and slave includes 1 start bit, 8 data bits, check bit, and 1 stop bit.

**2. Parameter Settings**

Communication parameters can be set on the touch screen, as follows:

Communication address: 1-63 can be set, and it is recommended to set the address in sequence starting from 1.

Baud rate: 1-5 can be set, 1 represents 9600, 2 represents 19200, 3 represents 38400, 4 represents 57600, and 5 represents 115200. If the distance is long and there is no requirement for communication speed, it is recommended to set the baud rate to 9600.

**3. Information Frame Format**

| Address code | Function code | Data area | CRC check code |
|---|---|---|---|
| 1 byte | 1 byte | N bytes | 2 bytes |

Address code: consisting of 1 byte, this device uses address numbers 1-63. When multiple devices are connected to a host, each device address number must be unique.

Data area:

01H, read coil command

02H, read input coil command

03H, read register

04H, read input register

05H, write single coil

06H, write single register

CRC check code: to verify whether the received data is correct.

**4. Data Point Table**

During external communication, the specific data and address are shown below.

4.1、01H/05H

| Function code | Modbus address | Data name |
|---|---|---|
| Read 01H/write 05H | 0X0000 | Allow to write set value |
| Read 01H/write 05H | 0X0001 | Ready state |
| Read 01H/write 05H | 0X0002 | Soft start/soft stop status |
| Read 01H/write 05H | 0X0003 | Running state |
| Read 01H/write 05H | 0X0004 | Fault status |
| Read 01H/write 05H | 0X0005 | Bypass closing status |
| Read 01H/write 05H | 0X0006 | Bypass opening status |
| Read 01H/write 05H | 0X0007 | 2# contactor closing status |
| Read 01H/write 05H | 0X0008 | 2# contactor opening status |
| Read 01H/write 05H | 0X0009 | Circuit breaker opening action |
| Read 01H/write 05H | 0X000A | A-phase pulse start output |
| Read 01H/write 05H | 0X000B | B-phase pulse start output |
| Read 01H/write 05H | 0X000C | C-phase pulse start output |
| Read 01H/write 05H | 0X000D | Status reset |
| Read 01H/write 05H | 0X000E | Spare point |
| Read 01H/write 05H | 0X000F | Working in 1# set value area |
| Read 01H/write 05H | 0X0010 | Working in 2# set value area |
| Read 01H/write 05H | 0X0011 | Working in 3# set value area |
| Read 01H/write 05H | 0X0012 | Working in 4# set value area |
| Read 01H/write 05H | 0X0013 | Working in the first set of set values |
| Read 01H/write 05H | 0X0014 | Working in the second set of set values |
| Read 01H/write 05H | 0X0015 | Working in the third set of set values |
| Read 01H/write 05H | 0X0016 | Working in the fourth set of set values |
| Read 01H/write 05H | 0X0017 | Working in the fifth set of set values |
| Read 01H/write 05H | 0X0018 | Backup |
| Read 01H/write 05H | 0X0019 | Backup |
| Read 01H/write 05H | 0X001A | Backup |
| Read 01H/write 05H | 0X001B | Calibration of three-phase voltage coefficient |
| Read 01H/write 05H | 0X001C | Calibration of three-phase current coefficient |
| Read 01H/write 05H | 0X001D | A-phase voltage coefficient calibration |
| Read 01H/write 05H | 0X001E | B-phase voltage coefficient calibration |
| Read 01H/write 05H | 0X001F | C-phase voltage coefficient calibration |
| Read 01H/write 05H | 0X0020 | A-phase current coefficient calibration |
| Read 01H/write 05H | 0X0021 | B-phase current coefficient calibration |
| Read 01H/write 05H | 0X0022 | C-phase current coefficient calibration |
| Read 01H/write 05H | 0X0023 | Restore default values for shared area set value |
| Read 01H/write 05H | 0X0024 | Restore the current set value of the unit to the default value |
| Read 01H/write 05H | 0X0025 | Set value not cured |
| Read 01H/write 05H | 0X0026 | Coefficient set 1 |

4.2、02H

| Function code | Modbus address | Data name |
|---|---|---|
| 02H | 0X0000 | Device heartbeat |
| 02H | 0X0001 | Starting signal input |
| 02H | 0X0002 | Shutdown signal input |
| 02H | 0X0003 | External fault input |
| 02H | 0X0004 | Bypass position input |

| | | |
|---|---|---|
| 02H | 0X0005 | Circuit breaker position input |
| 02H | 0X0006 | 2 # contactor input |
| 02H | 0X0007 | Emergency stop input/multi-split |
| 02H | 0X0008 | Direct start input/multi-split |
| 02H | 0X0009 | Start timeout |
| 02H | 0X000A | Overcurrent section 1 |
| 02H | 0X000B | Overcurrent section 2 |
| 02H | 0X000C | Negative sequence current section 1 |
| 02H | 0X000D | Negative sequence current section 2 |
| 02H | 0X000E | Running load loss |
| 02H | 0X000F | Overvoltage |
| 02H | 0X0010 | Undervoltage |
| 02H | 0X0011 | Negative sequence voltage |
| 02H | 0X0012 | External fault |
| 02H | 0X0013 | Emergency stop fault |
| 02H | 0X0014 | Starting current not decreasing |
| 02H | 0X0015 | Bypass conditions not met |
| 02H | 0X0016 | Failure shutdown during startup |
| 02H | 0X0017 | Undefined fault |
| 02H | 0X0018 | A-phase synchronization signal loss |
| 02H | 0X0019 | B-phase synchronization signal loss |
| 02H | 0X001A | C-phase synchronization signal loss |
| 02H | 0X001B | Start prohibited, locking time not up yet |
| 02H | 0X001C | Start prohibited, circuit breaker not closed |
| 02H | 0X001D | Start prohibited, bypass not in position |
| 02H | 0X001E | Start prohibited, 2 # contactor position error |
| 02H | 0X001F | Start prohibited, fault not eliminated |
| 02H | 0X0020 | Start prohibited, not in ready state |
| 02H | 0X0021 | Starting prohibited, no voltage signal |
| 02H | 0X0022 | Bypass closing fault |
| 02H | 0X0023 | Bypass opening fault |
| 02H | 0X0024 | Starting prohibited, excessive current |
| 02H | 0X0025 | 2 # contactor closing fault |
| 02H | 0X0026 | 2 # contactor opening fault |
| 02H | 0X0027 | Test start prohibited when in ready state |
| 02H | 0X0028 | Circuit breaker opening fault |
| 02H | 0X0029 | Soft stop timeout |
| 02H | 0X002A | Spare point |
| 02H | 0X002B | Starting prohibited, phase sequence not measured |
| 02H | 0X002C | Starting prohibited, not a positive sequence alarm |
| 02H | 0X002D | Starting prohibited,not a negative sequence alarm |
| 02H | 0X002E | Backup |
| 02H | 0X002F | Protection resultant signal |
| 02H | 0X0030 | Starting prohibited, phase sequence alarm |
| 02H | 0X0031 | Starting prohibited, frequency error |
| 02H | 0X0032 | Direct start allowed |
| 02H | 0X0033 | FLASH master partition table is bad |

| | | |
|---|---|---|
| 02H | 0X0034 | FLASH backup partition table is bad |
| 02H | 0X0035 | Manual shutdown during soft start process |
| 02H | 0X0036 | Unexpected trip of circuit breaker during soft start process |
| 02H | 0X0037 | Unexpected trip of bypass contactor during soft start process |
| 02H | 0X0038 | Unexpected trip of 2 # contactor during soft start process |
| 02H | 0X0039 | Unexpected trip of circuit breaker when running |
| 02H | 0X003A | Unexpected trip of bypass contactor when running |
| 02H | 0X003B | Unexpected trip of 2# contactor when running |
| 02H | 0X003C | Unexpected trip of circuit breaker during soft stop process |
| 02H | 0X003D | Unexpected trip of bypass contactor during soft stop process |
| 02H | 0X003E | Unexpected trip of 2 # contactor during soft stop process |
| 02H | 0X003F | Incorrect bypass closing in ready state |
| 02H | 0X0040 | Incorrect closing of 2 # contactor in ready state |
| 02H | 0X0041 | Record waveform |
| 02H | 0X0042 | Clear waveform |

4.3、03H/06H

| Function code | Modbus address | Data type | Ratio | Data name |
|---|---|---|---|---|
| Read 03H/write 06H | 0X0000 | ushort | ×1 | Heartbeat counter |
| Read 03H/write 06H | 0X0001 | ushort | ×1 | RS485 communication address |
| Read 03H/write 06H | 0X0002 | ushort | ×1 | RS485 communication baud rate |
| Read 03H/write 06H | 0X0003 | ushort | ×1 | Debug mode password |
| Read 03H/write 06H | 0X0004 | ushort | ×100 | Reference value for calibration |
| Read 03H/write 06H | 0X0005 | ushort | ×1 | System frequency setting |
| Read 03H/write 06H | 0X0006 | ushort | ×1 | System phase sequence setting |
| Read 03H/write 06H | 0X0007 | ushort | ×1 | Output pulse width |
| Read 03H/write 06H | 0X0008 | short | ×1 | 4-20mA output enable |
| Read 03H/write 06H | 0X0009 | ushort | ×1000 | 4-20mA output offset value |
| Read 03H/write 06H | 0X000A | ushort | ×1000 | 4-20mA output coefficient |
| Read 03H/write 06H | 0X000B | ushort | ×1 | Start interval time |
| Read 03H/write 06H | 0X000C | ushort | ×1 | Start delay |

| | | | | |
|---|---|---|---|---|
| Read 03H/write 06H | 0X000D | ushort | ×1 | Linkage startup |
| Read 03H/write 06H | 0X000E | ushort | ×1 | Shutdown signal negation |
| Read 03H/write 06H | 0X000F | ushort | ×1 | Fault signal negation |
| Read 03H/write 06H | 0X0010 | ushort | ×1 | Single machine/multi-machine mode |
| Read 03H/write 06H | 0X0011 | ushort | ×1 | Selected set value group number |
| Read 03H/write 06H | 0X0012 | ushort | ×1 | Selected set value set number |
| Read 03H/write 06H | 0X0013 | ushort | ×1 | Current recording during startup |
| 03H | 0X0014 | ushort | ×1 | Device type |
| 03H | 0X0015 | ushort | ×1 | Firmware version |
| Read 03H/write 06H | 0X0016 | ushort | ×1 | Year of Manufacture |
| Read 03H/write 06H | 0X0017 | ushort | ×1 | Date of Manufacture |
| Read 03H/write 06H | 0X0018 | ushort | ×1 | Product serial number |
| Read 03H/write 06H | 0X0019 | ushort | ×10000 | A-phase voltage coefficient |
| Read 03H/write 06H | 0X001A | ushort | ×10000 | B-phase voltage coefficient |
| Read 03H/write 06H | 0X001B | ushort | ×10000 | C-phase voltage coefficient |
| Read 03H/write 06H | 0X001C | ushort | ×10000 | A-phase current coefficient |
| Read 03H/write 06H | 0X001D | ushort | ×10000 | B-phase current coefficient |
| Read 03H/write 06H | 0X001E | ushort | ×10000 | C-phase current coefficient |
| 03H | 0X001F | ushort | ×1 | Group number of the set value |
| 03H | 0X0020 | ushort | ×1 | Set number of the set value |
| Read 03H/write 06H | 0X0021 | ushort | ×1 | Rated current |
| Read 03H/write 06H | 0X0022 | ushort | ×1 | PT transformation ratio |
| Read 03H/write 06H | 0X0023 | ushort | ×1 | CT transformation ratio |
| Read 03H/write 06H | 0X0024 | ushort | ×1 | Configuration method of 2 # contactor |
| Read 03H/write 06H | 0X0025 | ushort | ×1 | Bypass acceleration time |
| Read 03H/write 06H | 0X0026 | ushort | ×1 | Trigger cutoff angle |
| Read 03H/write 06H | 0X0027 | ushort | ×1 | Synchronous motor coefficient |
| Read 03H/write 06H | 0X0028 | ushort | ×1 | Starting mode |
| Read 03H/write 06H | 0X0029 | ushort | ×1 | Initial voltage |

| | | | | |
|---|---|---|---|---|
| Read 03H/write 06H | 0X002A | ushort | ×1 | Ramp time |
| Read 03H/write 06H | 0X002B | ushort | ×1 | Current limiting multiple |
| Read 03H/write 06H | 0X002C | ushort | ×1 | Current regulation coefficient |
| Read 03H/write 06H | 0X002D | ushort | ×1 | Step voltage |
| Read 03H/write 06H | 0X002E | ushort | ×1 | Step duration |
| Read 03H/write 06H | 0X002F | ushort | ×1 | Jog start time |
| Read 03H/write 06H | 0X0030 | ushort | ×1 | Two-stage voltage |
| Read 03H/write 06H | 0X0031 | ushort | ×1 | Two-stage time |
| Read 03H/write 06H | 0X0032 | ushort | ×1 | Shutdown method |
| Read 03H/write 06H | 0X0033 | ushort | ×1 | Soft stop cutoff voltage |
| Read 03H/write 06H | 0X0034 | ushort | ×1 | Soft stop time |
| Read 03H/write 06H | 0X0035 | ushort | ×1 | Start timeout set value |
| Read 03H/write 06H | 0X0036 | ushort | ×1 | Set value of overcurrent section 1 |
| Read 03H/write 06H | 0X0037 | ushort | ×1 | Set value of overcurrent section 2 |
| Read 03H/write 06H | 0X0038 | ushort | ×1 | Overcurrent section 2 delay |
| Read 03H/write 06H | 0X0039 | ushort | ×1 | Set value of negative sequence current section 1 |
| Read 03H/write 06H | 0X003A | ushort | ×1 | Negative sequence current section 1 delay |
| Read 03H/write 06H | 0X003B | ushort | ×1 | Set value of negative sequence current section 2 |
| Read 03H/write 06H | 0X003C | ushort | ×1 | Negative sequence current section 2 delay |
| Read 03H/write 06H | 0X003D | ushort | ×1 | Load loss set value |
| Read 03H/write 06H | 0X003E | ushort | ×1 | Load loss delay |
| Read 03H/write 06H | 0X003F | ushort | ×1 | Overvoltage set value |
| Read 03H/write 06H | 0X0040 | ushort | ×1 | Overvoltage delay |
| Read 03H/write 06H | 0X0041 | ushort | ×1 | Undervoltage set value |
| Read 03H/write 06H | 0X0042 | ushort | ×1 | Undervoltage delay |
| Read 03H/write 06H | 0X0043 | ushort | ×1 | Set value of negative sequence voltage |
| Read 03H/write 06H | 0X0044 | ushort | ×1 | Negative sequence voltage delay |
| Read 03H/write 06H | 0X0045 | ushort | ×1 | Start timeout cast/cancel protective board |

| | | | | |
|---|---|---|---|---|
| Read 03H/write 06H | 0X0046 | ushort | ×1 | Overcurrent section 1 cast/cancel protective board |
| Read 03H/write 06H | 0X0047 | ushort | ×1 | Overcurrent section 2 cast/cancel protective board |
| Read 03H/write 06H | 0X0048 | ushort | ×1 | Negative sequence overcurrent section 1 cast/cancel protective board |
| Read 03H/write 06H | 0X0049 | ushort | ×1 | Negative sequence overcurrent section 2 cast/cancel protective board |
| Read 03H/write 06H | 0X004A | ushort | ×1 | Load loss cast/cancel protective board |
| Read 03H/write 06H | 0X004B | ushort | ×1 | Overvoltage cast/cancel protective board |
| Read 03H/write 06H | 0X004C | ushort | ×1 | Undervoltage cast/cancel protective board |
| Read 03H/write 06H | 0X004D | ushort | ×1 | Negative sequence voltage cast/cancel protective board |
| Read 03H/write 06H | 0X004E | ushort | ×1 | Input fault cast/cancel protective board |
| Read 03H/write 06H | 0X004F | ushort | ×1 | Direct start time |
| Read 03H/write 06H | 0X0050 | ushort | ×1 | Control mode |
| 03H | 0X0051 | ushort | ×1 | Group number 1 set value sector number |
| 03H | 0X0052 | ushort | ×1 | Group number 2 set value sector number |
| 03H | 0X0053 | ushort | ×1 | Group number 3 set value sector number |
| 03H | 0X0054 | ushort | ×1 | Group number 4 set value sector number |
| 03H | 0X0055 | ushort | ×1 | Reading set value error counter |

4.3、04H

| Function code | Modbus address | Data type | Ratio | Data name |
|---|---|---|---|---|
| 04H | 0X0000 | float | ×1 | Uab coefficient |
| 04H | 0X0002 | float | ×1 | Ubc coefficient |
| 04H | 0X0004 | float | ×1 | Uca coefficient |
| 04H | 0X0006 | float | ×1 | Ia coefficient |
| 04H | 0X0008 | float | ×1 | Ib coefficient |
| 04H | 0X000a | float | ×1 | Ic coefficient |
| 04H | 0X000c | float | ×1 | Voltage Uab |
| 04H | 0X000e | float | ×1 | Voltage Ubc |
| 04H | 0X0010 | float | ×1 | Voltage Uca |
| 04H | 0X0012 | float | ×1 | Current Ia |
| 04H | 0X0014 | float | ×1 | Current Ib |
| 04H | 0X0016 | float | ×1 | Current Ic |
| 04H | 0X0018 | float | ×1 | Three-phase average current |

| | | | | |
|---|---|---|---|---|
| 04H | 0X001a | float | ×1 | Load rate |
| 04H | 0X001c | float | ×1 | System frequency |
| 04H | 0X001e | float | ×1 | Trigger angle |
| 04H | 0X0020 | float | ×1 | Power factor |
| 04H | 0X0022 | float | ×1 | UaIa angular phase difference |
| 04H | 0X0024 | float | ×1 | UbIb angular phase difference |
| 04H | 0X0026 | float | ×1 | UcIc angular phase difference |
| 04H | 0X0028 | float | ×1 | Negative sequence current |
| 04H | 0X002a | float | ×1 | Negative sequence voltage |
| 04H | 0X002c | ulong | ×1 | Duration of device being powered on this time |
| 04H | 0X002e | uint16 | ×1 | Device reset counter |
| 04H | 0X002f | uint16 | ×1 | Device operating status |
| 04H | 0X0030 | uint16 | ×10 | Voltage Uab |
| 04H | 0X0031 | uint16 | ×10 | Voltage Ubc |
| 04H | 0X0032 | uint16 | ×10 | Voltage Uca |
| 04H | 0X0033 | uint16 | ×10 | Current Ia |
| 04H | 0X0034 | uint16 | ×10 | Current Ib |
| 04H | 0X0035 | uint16 | ×10 | Current Ic |
| 04H | 0X0036 | uint16 | ×10 | Three-phase average current |
| 04H | 0X0037 | uint16 | ×10 | Load rate |
| 04H | 0X0038 | uint16 | ×100 | System frequency |
| 04H | 0X0039 | uint16 | ×10 | Trigger angle |
| 04H | 0X003a | int16 | ×1000 | Power factor |
| 04H | 0X003b | int16 | ×10 | UaIa angular phase difference |
| 04H | 0X003c | int16 | ×10 | UbIb angular phase difference |
| 04H | 0X003d | int16 | ×10 | UcIc angular phase difference |
| 04H | 0X003e | int16 | ×10 | Negative sequence current |
| 04H | 0X003f | int16 | ×10 | Negative sequence voltage |
| 04H | 0X0040 | uint16 | ×10 | Duration for startup |
| 04H | 0X0041 | uint16 | ×1 | Countdown length |
| 04H | 0X0042 | uint16 | ×1 | Running time in days |
| 04H | 0X0043 | uint16 | ×1 | Running time in hours |
| 04H | 0X0044 | uint16 | ×1 | Running time in minutes |
| 04H | 0X0045 | uint16 | ×1 | Running time in seconds |
| 04H | 0X0046 | uint16 | ×1 | 20mA full range value |
| 04H | 0X0047 | uint16 | ×100 | 20mA output value |
| 04H | 0X0048 | uint16 | ×100 | 20mA-PWM ratio |
| 04H | 0X0049 | uint16 | ×1 | Current phase sequence |
| 04H | 0X004a | uint16 | ×1 | Phase sequence alarm |
| 04H | 0X004b | uint16 | ×1 | Backup for debugging |
| 04H | 0X004c | uint16 | ×1 | Backup for debugging |
| 04H | 0X004d | uint16 | ×1 | Backup for debugging |
| 04H | 0X004e | uint16 | ×1 | Backup for debugging |

Note: In the running state, 0 represents communication interrupted, 1 represents ready, 2 represents start, 3 represents running, 4 represents soft stop, 5 represents fault, 6 represents testing, 7 represents emergency stop, and 8 represents standby.

## 5. Communication Applications

An example of reading data message is as follows:

01H command

| Address code | Function code | Start address | Number of Registers | CRC check code |
|---|---|---|---|---|
| 01 | 01 | 00 00 | 00 27 | 7C10 |

An example of a callback message is as follows

| Address code | Function code | Data length | Data | CRC check code |
|---|---|---|---|---|
| 01 | 01 | 05 | Data1-data5 | HSD2000 |

02H command

| Address code | Function code | Start address | Number of registers | CRC check code |
|---|---|---|---|---|
| 01 | 02 | 00 00 | 00 43 | 39FB |

An example of a callback message is as follows

| Address code | Function code | Data length | Data | CRC check code |
|---|---|---|---|---|
| 01 | 02 | 09 | Data1-data9 | HSD2000 |

03H command

| Address code | Function code | Start address | Number of registers | CRC check code |
|---|---|---|---|---|
| 01 | 03 | 00 00 | 00 56 | C5F4 |

An example of a callback message is as follows

| Address code | Function code | Data length | Data | CRC check code |
|---|---|---|---|---|
| 01 | 03 | AC | Data1-data86 | HSD2000 |

04H command

| Address code | Function code | Start address | Number of registers | CRC check code |
|---|---|---|---|---|
| 01 | 04 | 00 00 | 00 4F | B1FE |

An example of a callback message is as follows

| Address code | Function code | Data length | Data | CRC check code |
|---|---|---|---|---|
| 01 | 04 | 9E | Data1-data79 | HSD2000 |

05H command

| Address code | Function code | Register address | Written value | CRC check code |
|---|---|---|---|---|
| 01 | 05 | 00 1D | FF00 | 1C3C |

Set the coil status to ON or OFF and write 0XFF00.

06H command

| Address code | Function code | Register address | Written value | CRC check code |
|---|---|---|---|---|
| 01 | 06 | 00 1D | 0064 | 1827 |

# Chapter VII Maintenance and Troubleshooting

**1. Daily Maintenance**

The HSD2000 series MV solid-state soft starter is designed to be a maintenance-free product. Like other electronic devices, the product shall be subject to regular inspection for air contamination, moisture and industrial production pollution. Product contamination can cause high-voltage discharge or affect equipment heat dissipation. Bolts shall be checked for looseness every year; and screws must be tightened with appropriate torque. The air gap of the vacuum contactor shall be checked to ensure that it meets the requirements according to the manufacturer's technical manual.

For equipment not in use over an extended period of time, cabinet surfaces, instruments and indicator lights shall be kept clean; the grounding of cable casing shall be checked and the insulation pad and the cabinet inside shall be cleaned. The grounding shall be checked, the lightning arresters shall be cleaned and inspected, the grounding resistance shall be measured, and the cable sleeves and support insulators shall be cleaned and inspected.

**2. System Self-test**

The HSD2000 series MV solid-state soft starter requires regular self-inspection to maintain a good condition.

**2.1 Communication check**

If the device is powered on, the touch screen data display is normal and there is no communication alarm, then the communication is normal.

**2.2. Thyristor test**

Test the resistance value of each GK terminal on the trigger board with a multimeter, which is the resistance value of the thyristor gate and cathode, approximately 15 ohms. If the measured resistance deviates by 50% from the normal value, there may be a problem with the thyristor crimping or the thyristor itself. Test the resistance values of the left and right K terminals on the trigger board with a multimeter, which are approximately 190K. If the resistance value is severely low, it is possible that the thyristor has broken down.

**2.3. Input and output tests**

After testing the thyristor, click on the touch screen to enter Hardware Test and enter the debug password. Conduct input and output tests according to the description in Section 7 of Chapter 4 in the Manual. If all tests are normal, the soft start control system and electrical secondary wiring are normal.

**3. Fault Analysis**

When fault occurs, the display screen and indicator light will have corresponding fault indications. When restarting the motor, it is necessary to have the existing fault solved. When coming across any fault that cannot be resolved, the manufacturer should be contacted in a timely manner for assistance in troubleshooting.

| Fault phenomenon | Causes | Solutions |
|---|---|---|
| Thyristor fault | Thyristor breakdown or damage | Disconnect the high-voltage power supply of the previous stage, connect the grounding wire, and measure the resistance value of the left and right K terminals of the trigger board with a multimeter. The normal value is 190K, if it is too small, the thyristor will break down and replacement is required. |
| Unable to start and stop normally | 1) There are faults<br>2) Not in ready state<br>3) Starting interval blocked | 1) Troubleshooting the cause of the malfunction<br>2) Check the controller status<br>3) The time interval between two starts is not up, please wait |
| Motor unable to complete | The starting limit current is too small, and the starting torque is insufficient | Set appropriate current limiting multiples |
| Motor cannot be bypassed | 1) Parameter setting error<br>2) Starting current does not decrease | 1) Pay attention to the mechanical or electrical retention of the contactor<br>2) Increase the starting current |
| Start timeout | Unreasonable setting of starting parameters | The current limit value is too low. |
| Negative sequence current | 1) Phase-loss starting<br>2) CT secondary wiring fault<br>3) Phase sequence error<br>4) Motor fault<br>5) PT wiring error | 1) Thyristor one or half phases not conducting<br>2) Loose or reverse CT wiring<br>3) Current phase sequence error<br>4) Motor maintenance<br>4) PT wiring error leads to synchronization signal error, triggering mismatch and disordered starting current. |
| Inaccurate measurement of current and voltage | 1) PT/CT transformation ratio setting error<br>2) Current channel coefficient error<br>3) Hardware failure | 1) Change to correct transformation ratio<br>2) Change to the correct coefficient<br>3) Replace the corresponding hardware circuit board |

# Chapter VIII Warranty and After-sales Service

**1. Warranty Period**

The warranty period of the HSD2000 series MV solid-state soft starter is 12 months, calculated from the completion of debugging or 18 months from the delivery date, whichever comes first. If parts and components are damaged or cannot be used normally due to equipment quality issues within the warranty period, the manufacturer is responsible for providing timely and free maintenance or replacement of the parts and components.

**2. Warranty Information**

1) Our company's products are free of charge for maintenance during the warranty period; however, losses caused by human error, natural disasters such as fires, floods, earthquakes, or typhoons, etc., are not within this scope.

2) Beyond the warranty period, our company provides lifelong free technical consultation and paid maintenance services for the products we produce.

**3. Maintenance Instructions**

1) Inspect and repair faults according to the product manual.

2) When the cause cannot be determined, please contact our company's technical support department in a timely manner to provide feedback on the fault phenomenon, or conduct on-site inspections according to the guidance of our company's technical personnel to accurately identify the cause of the fault and handle the problem promptly.

3) When the guidance provided is not conducive to solving the problem, we will make a judgment based on the user's description or known situation, and delegate personnel to provide field service as soon as possible. For field services beyond the warranty period, users should pay the service fee first.

**The contents of this manual are subject to change without notice**

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