NO:2024.04

CHINT ELECTRICS

NJR2-D Series Soft-Starter

User Instruction

www.npower.com.vn

Tài liệu được tổng hợp bởi đội ngũ kỹ thuật của **NPOWER**

Powered by **NAVITECH** | www.navitech.co

Standard: IEC 60947-4-2

⚠ Safety Warning

1. The products are strictly prohibited to be installed in the environment containing flammable and explosive gases and moisture condensation.
2. In product work, it is strictly forbidden to touch the conductive part of the product.
3. When installing, maintaining and maintaining products, power must be turned off.
4. It is strictly forbidden for children to play with unpacked products or packages.
5. Sufficient space and safety distance should be reserved around product installation.
6. Do not install in places where gas medium can corrode metals and destroy insulation.
7. When the product is installed and used, it must be equipped with standard wires and meet the requirements of power supply and load.
8. In order to avoid the danger caused by unstable installation of products, the installation and fixing of products must be carried out in strict accordance with the requirements of the specifications.
9. Before the product is officially installed and used after dismantling the package, the product should be inspected for damage and the integrity of the items should be checked.
10. When installing live wire outside the product, in order to prevent accidental electric shock, please insulate the exposed wire parts.
11. After the soft starter is connected to the power supply at the input end, when the load is open, even in the stop state, the output end of the soft starter will have induced voltage, which is caused by the leakage current of the thyristor and belongs to the normal phenomenon.
12. If the reactive power compensation circuit with higher power factor needs to be installed in the distribution circuit, the reactive power compensation capacitor should be connected to the input end of the soft starter and not to the output end, otherwise the power device of the soft starter will be damaged.
13. The closure and release of the bypass contactor must be controlled by the soft starter K1 relay. Especially if the soft starter K1 relay is not used to control the release of the bypass contactor during the soft shutdown, there may be a risk of the front-end switch tripping during the soft shutdown process.
14. The dielectric strength test of the product has been carried out strictly before it is manufactured. In order to prevent accidental leakage of the product shell, the grounding end of the product should be connected reliably to the ground.
15. Installation and maintenance for professional personnel only.

Preface

Thank you for choosing NJR2-D series soft starter developed and produced by ZHEJIANG CHINT ELECTRICS CO., LTD.

NJR2-D series soft starter (hereinafter referred as soft starter) is to control the conduction angle of three-phase reverse parallel thyristor connected in series between the power supply and the controlled motor, so that the terminal voltage of the motor rises from the preset value to the rated voltage, in order to achieve the purpose of reducing the current and starting smoothly during the starting process of the motor, which belongs to the category of step-down starting. Therefore, the starting torque has been reduced, which is suitable for places where the starting torque requirements are not high.

NJR2-D series soft starter is an AC asynchronous motor soft starter which integrates power electronics technology, microprocessor technology and modern control theory technology. This product can effectively limit the starting current of asynchronous motor (hereinafter referred to as motor or motor), and can be widely used in fans, pumps, compressors, ball mills, crushers and other loads. It is an ideal substitute for traditional starter/triangle converter, auto-coupling step-down and magnetron step-down.

In order to make the soft starter play its role better, please read the instructions carefully before using. For your safety and reasonable use, please read and execute the logo " ⚠ ", " ⚠ "in the instructions carefully. If you have any doubts in the use process, please contact our company. Our professionals are happy to serve you.

The company will continuously optimize and improve the NJR2-D series soft starter. The revised data will be updated in the new version of the manual without further notice.

CHINT

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Catalog

1 Main uses and scope of application

1.1 Open inspection

1.1.1 Whether the nameplate model of this machine is consistent with your order form or not, besides the product itself, there should also be a complete set of product inspection certificates and instructions in each soft starter packaging box.

1.1.2 Check whether the soft starter is damaged during transportation. If any damage is found, please contact the transportation company or supplier immediately.

1.2 Main uses

It is mainly used for soft starting of asynchronous motor. By reducing the starting voltage and current, the motor can start steadily and reliably, thus reducing the impact of starting on the equipment, reducing the damage to the equipment and prolonging the service life.

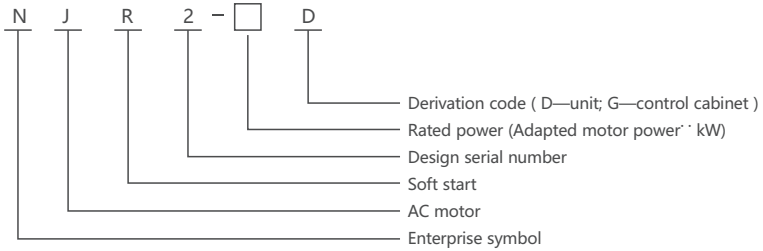
1.3 Scope of application

It is suitable for ordinary squirrel cage three-phase asynchronous motor. The main load types of motor are fan, pump, compressor, ball mill, crusher and so on.

1.4 Characteristic

- Smooth start avoids the problem of switching impulse current during the start of traditional starting equipment.
- The control power supply directly takes electricity from two fire lines, which is suitable for power supply without zero lines.
- Enhanced EMC design, anti-EMS interference, high stability.
- Large screen LCD display, friendly man-machine interface, easy to operate.
- Various starting modes and wide range current and voltage settings can be applied to various load applications.
- Various protection functions, effective protection of motor and related equipment.
- Record 9 fault records for easy troubleshooting, analysis and solution.

1.5 Series model specifications and their Implications



Example: NJR2-75D is suitable for 75kW motor.

Description: NJR2-D is a basic type, which is a product without bypass contactor, i.e. external bypass soft starter.

Specific product model specifications are detailed in Chapter 5.2.

2 Normal operation, installation, transportation and storage conditions

2.1 Conditions of use, transportation and storage

2.1.1 The ambient temperature ranges from -10℃ ~ +40℃, +40℃ ~ +50℃ the use of quotas should be reduced, every increase of 1 ℃, current reduction by 2%.

2.1.2 Storage temperature is -25℃~ +70℃.

2.1.3 Relative humidity does not exceed 95% （20℃~65℃）.

2.1.4 No condensation, no flammable, explosive gas, no conductive dust, good ventilation.

2.1.5 If the elevation is more than 1000m, the quota should be reduced accordingly. If the elevation is over 1000m and less than 3000m, the quota should be reduced by 0.5% for every 100 m increase in current, and more than 3000m should be customized.

2.1.6 The soft starter should avoid vibration as far as possible.

2.1.7 When the soft starter is stored for a long time, it should be electrified once within two years, and the voltage regulator should be slowly raised to the rated value,it should be operated after one hour of electrification.

2.2 Installation conditions

In order to ensure that the soft start has good ventilation and heat dissipation conditions in use, the soft start should be installed vertically, and there is enough heat dissipation space around the equipment, as shown in Figure 2.1.

Read this manual carefully before installation.

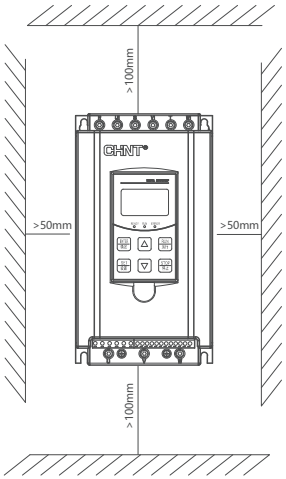


Figure 2.1 Outer space for product installation

3 Main technical parameters and performance

3.1 Technical parameters and performance of main circuit

Table 3.1 Technical parameters and performance

Serial number	Technical parameter	Specification index
1	Main supply voltage	Three phase AC 380V±57V
2	Main power frequency	50Hz±1Hz
3	Applicable motor	Common squirrel cage three-phase asynchronous motor
4	Class of pollution	Level 3
5	Protection level	IP20
6	Rated insulation voltage	660V
7	Cooling mode	Natural air cooling
8	Starting frequency	It is suggested that the starting frequency should be less than 10 times per hour (the heavier the load is, the less frequent the starting frequency should be. If it is necessary to start frequently, it is necessary to ensure that the temperature of the motor and the soft starter is at a lower temperature).
9	Seismic capacity	Vibration less than 0.5g
10	Rated working system	Uninterrupted working system, Intermittent working system
11	Design pattern	Type 1
12	EMC equipment level	Class A (Industrial)
13	Starting voltage	30%Ue~70%Ue
14	Start limited current	50%Ie~500%Ie
15	Overload protection level	Level 2, Level 10A, Level 10, Level 20, Level 30
16	Relay output	Three-way relay output, Bypass relay K1, Programmable relay K2 and fault relay K3

4 Structural characteristics and working principle

4.1 Overall structure and working principle

4.1.1 Overall structure

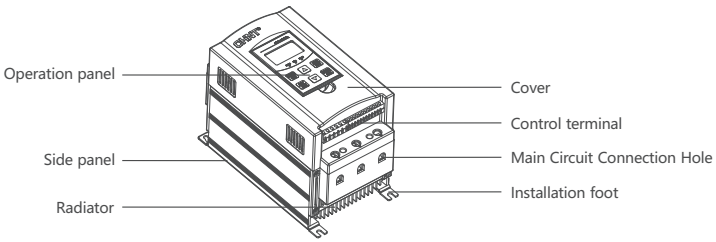


Figure 4.1 Overall Structure Chart

4.1.2 Working principle

The main circuit of NJR2-D series soft starter is connected to the stator circuit of AC motor by six thyristors in reverse parallel. With the function of electronic switch of thyristor, the change of trigger angle is controlled by microprocessor to change the conduction angle of thyristor, so as to change the input voltage of motor, so as to control the soft starting of motor. When the starting is completed, the soft starter output reaches the rated voltage. At this time, the three-phase bypass contactor KM is controlled to suck in, and the motor is put into operation in the power grid. The working principle is shown in Figure 4.2.

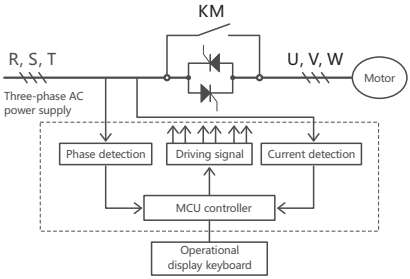
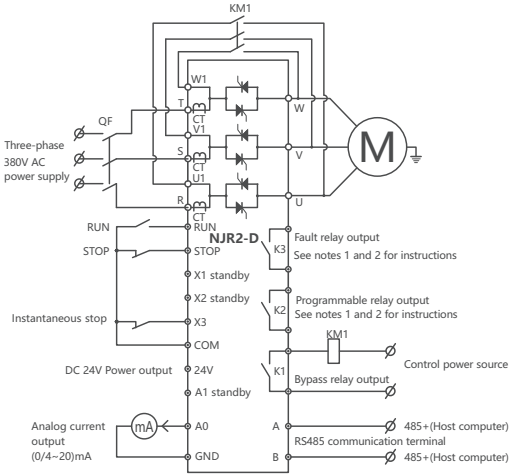


Figure 4.2 Working principle diagram

4.2 The structure, function and working principle of main components or functional units

4.2.1 Basic wiring schematic diagram



Note 1: K3 fault relay is normally closed when the soft starter is powered off, and K3 is normally closed within 0.2 seconds from power on until the CPU inside the soft starter starts to work. If there is no fault K3 becomes normally opend, if there is fault ,K3 will become normally closed again.

Note 2: If a customer requests to control the main input circuit of the product with the normal open signal of the fault relay, it is suggested that the K2 programmable relay be used to control the main input circuit. At the same time, the parameter F17 must be set to 6.

Note 3: When controlled by an external terminal, it is necessary to detect that the RUN terminal signal changes from disconnection to connection after power-on to start the soft start.

Figure 4.3 Basic wiring schematic diagram

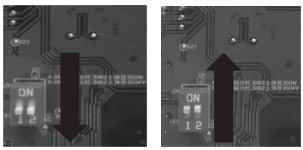
4.2.2 Main circuit terminals definition

R, S, T	Three-phase AC power supply input terminal
U1, V1, W1	Bypass contactor input main terminal
U, V, W	Bypass contactor output main terminal, that is, product output main terminal, connected to the motor

When external bypass contactor is connected, it must be required that the input U1, V1, W1 of each pole of the contactor correspond to the output U, V and W one by one. As shown in Figure 4.3, if the wiring is incorrect, the power supply will be short-circuited when the product is switched to bypass, and the whole system may be burned.

4.2.3 Control terminal definition

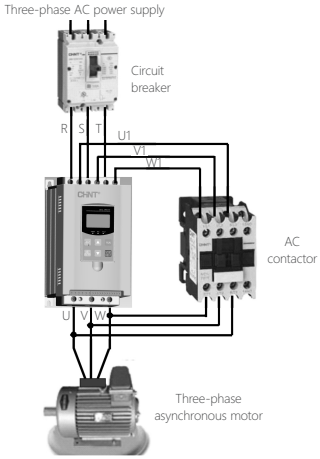
Table 4.1 Control terminal definition

Switching quantity	Terminal code	function	Explain
Input	RUN	Running Terminal	Two-wire and three-wire control can be carried out with COM terminals. The specific wiring method can be seen in the description of two-wire and three-wire system in the functional parameters of F13.
	STOP	Stop/Reset Terminal	
	X1, X2	Spare	Customers do not need wiring in normal use.
	X3	Instantaneous stop terminal	Short connection with COM terminal when leaving factory; when the terminal is disconnected, the product stops output and reports"instantaneous stop terminal open" fault, mainly for emergency shutdown in case of accident.
Power Supply	COM	Common end	DC24V reference site
	DC24V	DC24V Output Power Supply	DC 24V/100mA power supply relative to COM output, no load exceeding 100mA can be accessed between COM terminals. **Note1**: The output of DC24V power supply has a certain deviation. Before using, please make sure that the voltage value meets your requirements. The COM terminal is the reference point of DC24V and cannot be short-connected with the GND terminal. **Note2**: External DC or AC power signals cannot be directly introduced.
Analog output	AO	Analog output	0mA~20mA or 4mA~20mA output: **1)** For output of 0 mA to 20 mA, the CPU dialing can be seen in the lower left figure (that is, all SW2 dialing switches hit non-ON position), 0 times rated current corresponds to output of 0 mA, 1 times rated current corresponds to output of 5 mA, 2 times rated current corresponds to output of 10 mA, and 4 times rated current corresponds to output of 20 mA. 

Continued Table 4.1

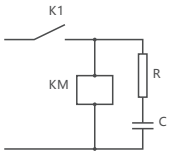
Switching quantity	Terminal code	function	Explain
Analog output	AO	Analog output	**2)** 4 mA to 20 mA output, CPU board dialing is shown in the right upper figure (that is, SW2 dialing switches are all on position), 0 times rated current corresponding to output 4 mA, 1 times rated current corresponding to output 8 mA, 2 times rated current corresponding to output 12 mA, 4 times rated current corresponding to output 20 mA. **Note**: The rated current value is twice the product power value. For example, the power of NJR2-55D is 55 kW. The corresponding rated current of 110A is not necessarily equal to the set value of F19.
	A1	Spare	Customers do not need wiring in normal use.
	GND	Analog Common End	AO reference point
Relay output	K1	Bypass relay	Control bypass contactor, contact capacity 5A 250VAC.
	K2	Programmable relay	The output function of the relay is determined by F17 and F04.
	K3	Fault Relay	The relay operates when there is a fault.
Communicatio-n interface	A, B	RS485 communication port	

4.2.4 Basic wiring diagram



The maximum output capacity of bypass relay K1 of product control terminal is only 5A. It can not directly control high-power AC contactor. For AC contactor larger than 167A, intermediate relay is recommended.

4.2.5 Cautions for Main Circuit Wiring

Safety grade	Matters needing attention
⚡	• It is strictly forbidden to connect capacitors directly at the output terminals of soft starters (U, V, W). • When the motor rotates in the wrong direction, any two-phase wiring in U, V and W can be exchanged, but the input U1, V1 and W1 of the bypass contactor must correspond to the output U, V and W one by one, otherwise the whole system may be burnt down! • The distribution cables (copper bars) and torsion of the main circuit should be executed according to relevant standards. Appendix A has recommended values for reference. • Soft starter must be grounded to meet the relevant leakage current specifications, and the shell must be reliably grounded. If there are several soft starters connected to the same line in the installation, then each soft starter must be grounded separately! • When installation standards require the use of inbound leakage current equipment for protection, a leakage circuit breaker must be used to avoid accidental tripping during power-on, and check its compatibility with other protection equipment! • The closure and release of bypass contactor must be controlled by soft starter K1 relay. Especially when soft shutdown occurs, if the release of bypass contactor is not controlled by soft starter K1 relay, there may be a risk of front-end switch tripping during soft shutdown.
!	• Do not use the ON/OFF method of main circuit power supply to control the operation and stop of the soft starter. After the soft starter is electrified, choose the RUN and STOP keys on the soft starter terminal or keyboard panel to control the operation and stop! • Power cable should be isolated from weak electric signal (detector, PLC, measuring instrument) circuit. It is suggested that the power cable should be more than 20 mm, and be vertically routed to each other as far as possible.
⚡	• It is forbidden to introduce external power to terminals other than K1, K2 and K3. • If there is a command to run, the motor will restart when the power is on or when the fault is manually reset!
!	•Control terminal maximum connection capability:2.5mm^2 ; Maximum tightening moment:0.4N·m! • Control cable and power cable should be kept separated. It is recommended that they should be more than 20mm, and should be routed vertically to each other as far as possible. • When K1, K2 and K3 control the external contactor, it is suggested that a resistor-capacitor circuit be connected in parallel at both ends of the contactor coil to effectively suppress the surge voltage generated when the contactor operates. The following picture:  R：10Ω~100Ω C：0.01μF~1μF

5 Shape and Installation Size and Weight

5.1 Soft Starter Shape and Installation Size

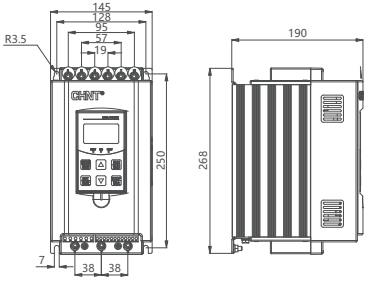


Figure 5.1
NJR2-7.5D~45D Appearance Size Diagram

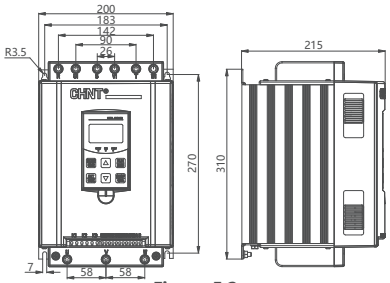


Figure 5.2
NJR2-55D~75D Appearance Size Diagram

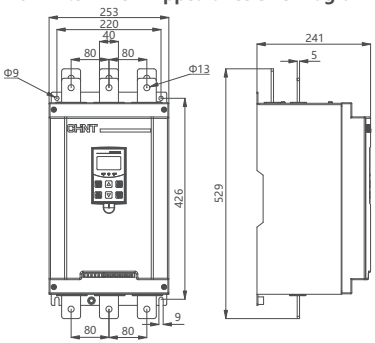


Figure 5.3
NJR2-90D~185D Appearance Size Diagram

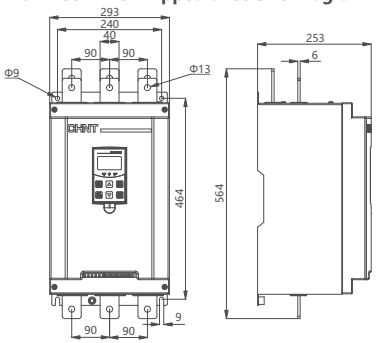


Figure 5.4
NJR2-220D~315D Appearance Size Diagram

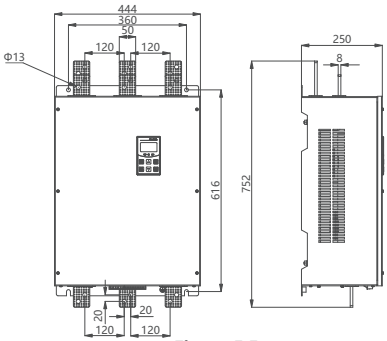


Figure 5.5
NJR2-355D~500D Appearance Size Diagram

5.2 Soft Starter Weight

Table 5.1 Soft Starter Weight

Model	Net weight	Remarks
NJR2-7.5D	5kg	Figure 5.1
NJR2-11D		
NJR2-15D		
NJR2-18.5D		
NJR2-22D		
NJR2-30D		
NJR2-37D		
NJR2-45D		
NJR2-55D	8kg	Figure 5.2
NJR2-75D		
NJR2-90D	20kg	Figure 5.3
NJR2-110D		
NJR2-132D		
NJR2-160D		
NJR2-185D		
NJR2-220D	25kg	Figure 5.4
NJR2-250D		
NJR2-280D		
NJR2-315D		
NJR2-355D	52.5kg	Figure 5.5
NJR2-400D		
NJR2-450D		
NJR2-500D		

6 Installation, commissioning and operation

6.1 Installation Notes

Before installation, it is necessary to read carefully and check the installation conditions and parameters of Chapters 2 and 4.

6.2 Pre-operation inspection

6.2.1 Before switching on the electricity, the following items should be carefully examined:

6.2.1.1 Check whether the connection is correct, especially whether the input and output terminals are correct, whether the bypass contactor is well connected, and confirm that the grounding terminal is well grounded;

6.2.1.2 Confirm that there is no short circuit or ground short circuit between terminals or exposed live parts.

6.2.2 Cautions after power-on:

6.2.2.1 After power on,the keyboard panel should display "Chint Electric Motor Soft Starter" then display" Get Ready" ;

6.2.2.2 Whether the rated current of parameter F19 motor is the same as the rated current on the motor nameplate, if there is mismatch between the motor nameplate and the setting of the value, please modify it, otherwise the motor may burn out.

6.3 Trial operation method

6.3.1 Make sure that there is no abnormal situation, then carry out trial run, default setting is keyboard starting mode when leaving the factory;

6.3.2 Whether the starting direction of the motor meets the requirements;

6.3.3 The starting of the motor is not ideal. The parameters of F00 starting voltage, F06 current limiting value and F11 starting mode can be changed.

6.3.4 Whether the motor rotates smoothly (without vibration and scream);

6.3.5 The soft starter is suitable for starting and stopping of 3-phase asynchronous motors above 7.5kW. It is suggested that the user select 7.5kW 3-phase asynchronous motor for debugging motor.

6.3.6 If the operation of soft starter and motor is abnormal or shows fault, the operation should be stopped immediately, and the cause should be checked according to the actual fault situation.

6.3.7 The ambient temperature of the site is below -10℃. It should be preheated by electricity for more than 30 minutes before operation.

6.3.8 If the fault protection such as "starting current limit overtime", "overheating" and "starting time too long" are reported in the soft starting process, the temperature of the motor may be higher at this time. The motor should be given enough heat dissipation time (usually more than 1 hour) before starting again, otherwise it may cause damage to the motor.

6.4 Panel operation instructions

6.4.1 The operation panel diagram is shown in Figure 6.1a:

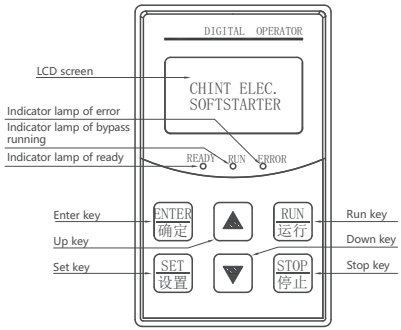


Figure 6.1
a) Operating Panel Diagram

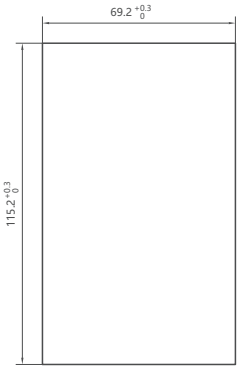


Figure 6.1
b) Opening Dimension Diagram of Cabinet Door Panel

When it is necessary to install the operation panel on the door panel of the cabinet door, remove the operation panel from the top cover of the product and install it on the door panel of the cabinet door (see figure 6.1b for the opening size map), and connect it by lengthening the external lead.

Note 1: The thickness of cabinet door panel (including spray paint thickness) is not more than 2.0 mm, otherwise it is difficult to stick the operation panel.

Note 2: Extended external lead length does not exceed 2m. If necessary, please order separately.

6.4.2 The functions of each key are as follows:

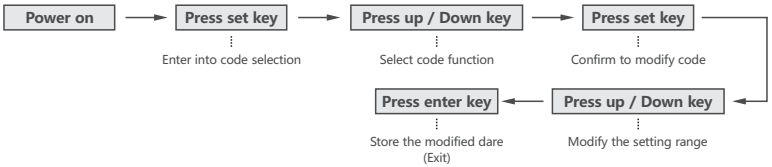
Running Key: Used to Start Running;
Stop key: for stopping operation and fault reset;
Setting key: Used to enter the function parameter group and the choice of data modification;
Up and down keys: used to increase or reduce the required modification parameters;
Enter key: used to save the modified data, and enter the model, failure and other information query and exit.

Soft Start button will be prompted within the sound, otherwise the button is invalid at this time.
Press and hold the"Enter" key to power the product, you can set the parameters to restore the factory value.
First press and hold the"Stop" button to power the product, can clear the fault record.

6.4.3 Parameter Setting Instructions

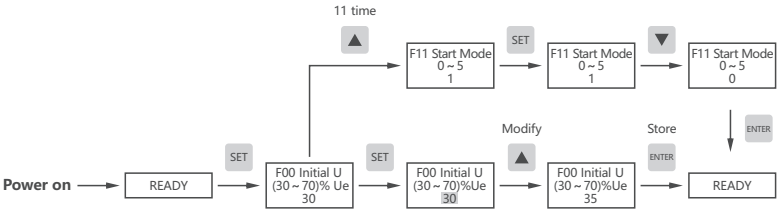
6.4.3.1 Function code parameter modification operation

Note: The modification of parameters can only be carried out on standby or by-pass condition.



Examples are given to illustrate:

Function code parameter setting example:



Examples of information viewing for models, faults, etc:

If the operation key is not pressed for more than 2 minutes in the setting state, the setting state will automatically exit.

6.4.3.2 Machine type, fault information (the parameters can not be modified by the user)

Table 6.1 Machine type and fault information table

Show contents	Explain
Input voltage 380V	Monitoring Three-phase AC Power Supply Voltage
Rated power 22kW	The specification of this soft starter is 22 kW
Error Lookup—1 Over voltage	The last fault information indicates that the last fault occurred was overvoltage.
Error Lookup—2 NO information	Represents no fault
Error Lookup—3 NO information	Represents no fault
Error Lookup—4 NO information	Represents no fault
Error Lookup—5 NO information	Represents no fault
Error Lookup—6 NO information	Represents no fault
Error Lookup—7 NO information	Represents no fault
Error Lookup—8 NO information	Represents no fault
Error Lookup—9 NO information	Represents no fault
Software version	Example:V5.2
Upgrade date (year)	Example:2018
Upgrade Date (Monthly Day)	Example:09-20

6.5 Function code parameter table
(F00~F19 is the basic function parameter, F20~F35 is the advanced function parameter)

Table 6.2 Function code parameter table

Function code	Function name	Set scope	Factory value	Explain
F00	Initial U.	(30~70)%	30%	F11 = 1 is valid. When F11 = 0, the starting voltage is 40%.
F01	Up Time	(2~60)s	16s	Soft start time is not the time of the total process of soft start, but the time factor of soft start acceleration. The smaller the setting value, the faster the output voltage rises.
F02	Down Time	(0~60)s	0s	Equal to 0 means free parking and greater than 0 means soft parking. Soft stop time is not the total process time of soft stop, but the time factor of soft stop deceleration. The smaller the setting value, the faster the output voltage drops.

Function code	Function name	Set scope	Factory value	Explain
F03	Start Delay	(0~999)s	0s	Start after running command delay F03 setting value.
F04	Program Delay	(0~999)s	0s	Customize the action delay value of relay (K2). Set 0 to absorb immediately.
F05	Interval Delay	(0~999)s	0s	Cooperate with F14.
F06	Start Limit I.	(50~500)% or (1~6000)A	400%	1) When jump start (i.e. when jump time F32 is greater than 0), the starting current may exceed the setting value of starting limit current within the jump time, and the starting current outside the jump time is within the setting value of starting limit current. 2) When starting without sudden jump, the starting current during soft start is not greater than the setting value of starting limit current.
F07	Over L. Value	(50~100)% or (1~6000)A	100%	Users do not need to adjust this parameter, if they need to adjust overload capacity, by modifying the F12 value or F19 value to achieve, but to ensure that the motor will not be damaged.
F08	Display I. Mode	0~3	1	Used for setting selection of current value or percentage.
F09	Under U. Value	(60~90)%	80%	Protection below the set value.
F10	Over U. Value	(100~130)%	120%	Protection above the set value.
F11	Start Mode	0~5	1	0: Current Limitation; 1: Voltage; 2: Standby; 3: Standby; 4: Current Slope; 5: Double Closed Loop.
F12	Over L. Class	0~4	2	0: Level 2; 1: Level 10A; 2: Level 10; 3: Level 20; 4: Level 30.
F13	OPT. Mode	0~7	0	Used for setting selection of panel, external control terminal, etc.
F14	Restart SEL.	0~9	0	0: prohibition; 1-9: automatic restart times.
F15	PARA. Enable &Prt. Shield	0~4	1	0: not allowed; 1: allowed; 2: shielding "three-phase unbalance"; 3: shielding "output default phase "; 4: shielding "output default phase " and shielding " three-phase unbalance".
F16	COM. Address	0~247	1	It is used for communication between multiple soft starters and host computers. 0: Represents the broadcast address.
F17	K2. Program	0~8	2	K2 relay output (3-4) setting.
F18	Stop Limit I.	(20~100)%	100%	Current limiting setting for F02 soft stop.
F19	Motor Rated I.	(4~1000)A	44A	The rated current of the motor equipped with the soft starter is 44A.
F20	Bypass Delay	(0~20)s	0s	It refers to when the current drop signal is detected in the soft start process and the F20 setting value is delayed before switching to bypass operation.
F21	OverL. Hi. Set	0~6	0	0: Indicates that the overload heat integral value (i.e. I^2t) is cumulative. 1: It means that the overload heat integral value is not cumulative. Once the load current is less than 1.1 times the rated motor current (rated motor current refers to the current value set by F19), the heat integral value will be cleared and the overload heat integral value will be counted again.

Function code	Function name	Set scope	Factory value	Explain
F21	OverL. Hi. Set	0~6	0	2: It means that the overload heat integral value is not cumulative. Once the load current is less than 1.2 times the rated motor current (rated motor current refers to the current value set by F19), the heat integral value will be cleared and the overload heat integral value will be counted again. 3: It means that the overload heat integral value is not cumulative. Once the load current is less than 1.3 times the rated motor current (rated motor current refers to the current value set by F19), the heat integral value will be cleared and the overload heat integral value will be counted again. 4: It means that the overload heat integral value is not cumulative. Once the load current is less than 1.4 times the rated motor current (rated motor current refers to the current value set by F19), the heat integral value will be cleared and the overload heat integral value will be counted again. 5: It means that the overload heat integral value is not cumulative. Once the load current is less than 1.5 times the rated motor current (rated motor current refers to the current value set by F19), the heat integral value will be cleared and the overload heat integral value will be counted again. 6: It means shielding overload protection.
F22	OverU. Hi. Set	(0~10)s	5s	0:Represents shielding overvoltage protection. (1-10) s: Represents the delay time of overvoltage filtering. When the voltage is greater than or equal to 380V*F10 setting value and the F22 setting value (1-10) s is maintained, the overvoltage protection is reported.
F23	UnderU. Hi. Set	(0~10)s	5s	0:Indicates shielding under-voltage protection. (1-10) s: Represents the delay time of undervoltage filtering. When the voltage is less than or equal to the 380V*F09 setting value and the F23 setting value (1-10) s is maintained, undervoltage protection is reported.
F24	U.K. Adjust	(90~110)%	100%	In the case of inaccurate voltage calibration, it is used to fine-tune the product voltage display value.
F25	I.K. Adjust	(90~110)%	100%	In the case of inaccurate current calibration, it is used to fine-tune the product current display value.
F26	C. BaudRate	0:2400bps 1:4800bps 2:9600bps 3:19200bps	2	baud rate
F27	C. DataFormat	0:8~1~N RTU 1:8~1~E RTU 2:8~1~O RTU	0	0:8 bits, 1 stop bits, no check bits RTU mode 1:8 bits, 1-stop bits, even-check RTU mode 2: 8 bits, 1-stop bits, odd-check RTU mode
F28	C. Timeout	(0.0~60.0)s	0.0s	0.0s: Invalid. (0.5-60.0) s: Represents the communication timeout time (minimum unit is 0.5 s).

Function code	Function name	Set scope	Factory value	Explain
F29	Fire. ModeEn	0~2	0	0: Normal mode, usually set to this mode. 1:Fire control mode 1. 2:Fire control mode 2.
F30	Se. Limit I. ST	(0~30)s	0s	0: Represents that the secondary current limiting function is invalid. (1-30) s: indicates that the secondary current limiting begins at (1-30) s of the soft start process.
F31	Se. Limit I.	F06~500%	450%	This function parameter represents the second current limiting multiple in the soft start process. The second current limiting multiple value refers to the multiple of rated motor current (i.e. the setting value of parameter F19).
F32	Kick Time Set	(0.0~1.5)s	0.0s	0.0s: indicates that the jump time is 0, and the jump start function is invalid. (0.1-1.5) s: indicates that the jump time is more than 0, allowing jump start.
F33	Point Run En	0~1	0	0: Point operation function is invalid. 1: Point operation function is effective.
F34	Under I. Alarm	(0~90)%	0%	Indicates the alarm setting value for under-load current. 0: No under-load alarm function. 2-90: Indicates the set alarm value of under-load current (minimum unit is 2% Ie).
F35	Under I Time	(0~10)s	5s	Represents the duration of the under-load current.

6.6 Definition and description of functional parameters

F00 Initial U. Settable range: (30-70)%,% refers to the percentage of input line voltage. When F11 is set to 1 or 5, this parameter can be modified. It is mainly used to set the starting moment of soft start. The larger the starting moment is, the larger the starting current is. Generally, when the load is heavy, it should be adjusted appropriately to generate more moments, so as to achieve the purpose of normal starting.

When F11 is set to current mode, F00 cannot be modified.

F01 Up Time Settable range: (2-60) s. The time factor used to set the rising time of output voltage of soft starter is related to the load. The product will automatically detect and judge the switching time. The same is true for the switching time of other startup modes.

F02 Down Time Settable range: (0-60) s. When set to 0, it means free parking. The bypass contactor is disconnected immediately after the soft starter receives an effective stop signal, and the product has no output voltage. When leaving the factory, this parameter is set as free parking, and it is recommended to use free parking for general equipment.

When the setting is greater than 0, the soft stop is indicated. After the soft starter receives the effective stop signal, it first disconnects the bypass contactor, and then applies a voltage to the motor by adjusting the thyristor to slow it down gradually according to the slope, so as to avoid fast stop. Water hammer effect can be reduced when soft parking, but current fluctuation will occur when soft parking time is longer. For example, pumps can be set to 2s-4s.

When using soft stop mode, the current limit value can be set by F18 to reduce the impact of high current during soft stop. The current limit value of soft stop is the product of F06 and F18.

⚠ When the soft starter controls multiple motors, the value is set to "0".

F03 Start Delay Settable range: (0-999) s. This function is similar to timing start, when there is a start command, countdown according to the setting time, when set to 0, start immediately after receiving the effective soft start command.

F04 Program Delay Settable range: (0-999) s. For F17 programmable relay K2 in how long time delay action, such as set to 0 immediate action.

F05 Interval Delay Settable range: (0-999) s. Used for setting the interval of F14.

F06 Start Limit I. Settable range: (50-500)% Ie or (1-6000) A,% refers to the percentage of rated current of motor (i.e. the setting value of parameter F19). (When F08 is set to 0 and 2, the current value is displayed here, not the percentage). This value is used to set the maximum limit current when the soft starter starts with motor. That is, when the output voltage of the soft starter increases, its output current will remain within the set value until the motor starts completely. The current-time is shown in Figure 6.2. Ik is the set value of F06.

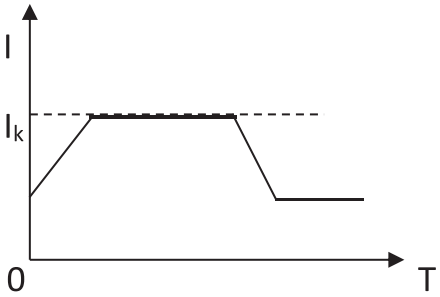


Figure 6.2 Sketch Map of starting current limiting

Note: If F11 is set to 1, the starting limiting current cannot be modified.

F07 Over L. Value Users should not modify this parameter. If the overload capacity needs to be adjusted, it can be achieved by modifying the value of F12 or F19, but to ensure that the motor will not be damaged.

F08 Display I. Mode Settable range: 0-3. This function is used to select the input mode and running state of F06 and F07, Panel display mode.

Function code F08 setting value	0	1	2	3
F06, F07 display mode	Current value	Percentage	Current value	Percentage
Soft Start, run and stop display Mode	Current value	Current value	Percentage	Percentage

Note 1: When F06 and F07 are percentages, they are the percentages of rated current of code F19 motor.

Note 2: When F08 is changed, the settings in F06 are not corresponding to the conversion.

Please make sure that the F06 settings meet the requirements.

F09 Under U. Value The range can be set: (60-90)%. Used to set the action value below the rated voltage percentage. The application of related advanced functions can be described in detail in F23 under-voltage advanced setting instructions.

F10 Over U. Value Settable range: (100-130)%. Used to set the action value of the percentage higher than the rated voltage. The application of related advanced functions can be described in detail in the advanced setting instructions of F22 overvoltage.

F11 Start Mode Settable range: 0 current limit; 1 voltage; 2 reserve; 3 reserve; 4 current ramp; 5 double closed-loop.

This product has four different starting modes (excluding sudden jump modes), suitable for various complex motor and load conditions, users can choose according to different application areas.

1) 0: Current Limiting Mode

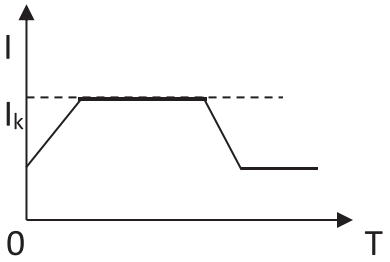


Figure 6.3 Schematic diagram of current limiting mode

Figure 6.3 shows the output current waveform in current limiting mode. Among them, Ik is the starting current limit set by F06. When the motor starts, the output voltage increases rapidly until the motor current reaches the set current limit Ik and keeps the motor current not greater than that value. Then, with the gradual increase of the output voltage, the motor accelerates gradually. When the motor reaches the rated speed, the bypass contactor sucks in and the output current drops rapidly to the motor rating. The starting process is completed if the current is Ie or below.

When the motor load is lighter or the set current limit value is larger, the maximum starting current may not reach the set current limit value, which is normal. The current limit starting mode is generally used in situations where the starting current is strictly required.

2) 1: Voltage mode

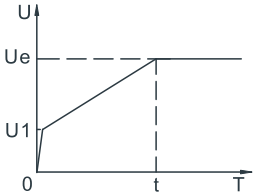


Figure 6.4 Voltage Mode Diagram

Figure 6.4 shows the output voltage waveform of voltage ramp start. U1 is the starting voltage value when starting. When the motor starts, the output voltage of the soft starter rises rapidly to U1 within the range of 400% of the rated current. Then the output voltage rises gradually according to the set starting parameters. The motor accelerates steadily with the rise of the voltage. When the voltage reaches the rated voltage Ue, the motor reaches the rated speed and bypass. The contactor is sucked in and the starting process is completed.

The starting time t is adjusted according to the load size, rather than mechanically controlling the starting time t. When the load is light, the starting time is usually less than the set starting time. Generally speaking, the voltage mode is suitable for situations where the starting current is not strictly required and the starting stability is high.

3) 2: Standby.

4) 3: Standby.

5) 4: Current ramp mode.

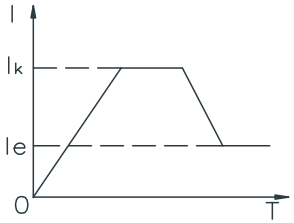


Figure 6.5 Schematic diagram of current ramp mode

Fig. 6.5 is the output current waveform of the current ramp starting mode. Among them, Ik is the current limiting value set by F06. The current ramp starting mode has strong acceleration ability, which is suitable for bipolar motors and can shorten the starting time in a certain range.

6) 5: Voltage and Current Limiting Double Closed Loop Start

Voltage and current limiting double closed-loop starting mode adopts voltage ramp and current limiting double closed-loop control. It is a comprehensive starting mode that requires both smooth starting and strict current limiting. It uses the prediction algorithm to estimate the working state of the motor to control.

The output voltage waveform of this starting mode will vary according to the different conditions of motor and load.

F12 Over L. Class Settable range: 0:2 level; 1:10A level; 2:10 level (standard application); 3:20 level (heavy-duty application); 4:30 level (overload application). Set the thermal overload protection level of the motor. See Figure 8.1 for the specific curve.

⚠ **When the user sets it, according to the actual thermal overload capacity of the motor, the thermal protection of the motor must conform to the corresponding protection level. If set to 4 (overload application), please make sure that the motor and soft starter are restarted after the cold state.**

F13 OPT. Mode The range can be set from 0 to 7. For choosing the control mode of soft start, the specific configuration is as follows:

F29 setting value	F13 setting value	0	1	2	3	4	5	6	7
0 (normal mode)	Keyboard control	allow	allow			allow	allow		
	External terminal control		allow	allow	allow	allow			
	Signal communication				allow	allow	allow	allow	
1 (Fire control Mode 1) or 2 (Fire control Mode 2)	Keyboard control	allow	allow	allow	allow	allow	allow	allow	allow
	External terminal control	allow	allow	allow	allow	allow	allow	allow	allow
	Signal communication	allow	allow	allow	allow	allow	allow	allow	allow

Note 1: If F29 is set to 0 and F13 is set to 1 and 4, keyboard control is allowed only when STOP is connected to COM.

Note 2: If accidental stop is not allowed after starting, or accidental start is not allowed during maintenance, code F13 can be set to 7, while F29 is set to 0, which prohibits all start or stop operations.

When the external control terminal is allowed, there are two-line control and three-line control.

The specific connection is as follows:

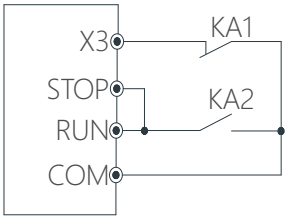


Figure 6.6a) Two-wire control

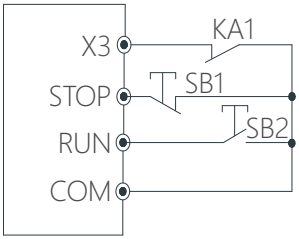


Figure 6.6b) Three-wire control

Two-wire control: wiring as shown in Figure 6.6a. When KA1 is in normal closed state, KA2 runs when it is closed and KA2 stops when it is disconnected.

Three-wire control: as shown in Figure 6.6b, when KA1 is in normal closed state, it runs when SB2 (pulse signal) is pressed, and then stops when SB1 (pulse signal) is pressed.

F14 Restart SEL. The range can be set from 0 to 9. This function is used to set the number of automatic restart. When set to 0, automatic restart is invalid. When set value is greater than 0, it indicates the number of automatic restart.

When the setting value is greater than 0 and the external control mode is two-wire control mode, the power-on or troubleshooting delay is 60 seconds (when the F05 setting value is greater than 60 seconds, press F05 delay) to restart automatically.

The setting of the function parameters is not valid until the power is restarted.

⚠ **This parameter must be used cautiously. When the F14 is set to non-zero, when the power is suddenly cut off and the power is restarted, and the external terminal control mode is effective to start, the motor will start automatically, which may cause accident casualties.**

F15 PARA. Enable&Prt. Shield 0-4 can be set. When set to 0, all parameters except F15 parameter are forbidden to be modified; when set to 1, all data are allowed to be modified except F00 and F06 special processing. When set to 2, it means shielding "three-phase unbalance"; when set to 3, it means shielding "output phase absence"; when set to 4, it means shielding "output phase absence" and "three-phase unbalance"; when set to 2-4, all parameters are allowed to be modified except F00 and F06 special processing.

⚠ **This parameter must be modified with caution. Because of voltage fluctuation and other factors, the three-phase unbalance of the product report can be shielded from corresponding fault protection (by setting parameter F15). After the corresponding fault protection is shielded, it should be confirmed whether the starting operation of the motor is stable or not. If it is not stable, it should stop the operation of the equipment and consult the manufacturer. In the debugging stage, the soft starter can shield the corresponding fault protection because of the three-phase unbalance or output phase absence caused by the small debugging load motor and other factors. After debugging, F15 must be set to 1.**

F16 COM. Address The range can be set from 0 to 247. The host computer controls the address setting of multiple soft starters.

F17 K2. Program The range can be set from 0 to 8. Used to set the action time of programmable output relay (K2), the action can be set according to F04 delay.

Function Code F17 Value	0	1	2	3	4	5	6	7	8
K2 relay action time	When sending a startup command	Start up	Bypass operation	When parking	When the parking is finished	Instant stop	Failure time	Automatic restart end	Under load

F18 Stop Limit I. The range can be set (20-100)%. This soft stop current limiting value is the percentage of F06 starting current limiting value. For example, if F06 is set to 400 and F18 is set to 60, the soft stop current limiting factor is 400%*60%=2.4 times the rated current.

F19 Motor Rated I. Settable range (4-1000) A. It is used to set the rated current of the motor with soft starter, which is in the range of (50-200)% of the rated power (kW). If the rated power of the soft-start model you purchased is 22 kW, then F19 is set in the range of (11-44) A. When the actual operating current of the motor is less than 25% of the original value of F19, the sensitivity error of the protection tripping operation will increase.

⚠ This value will be changed to twice the power value after initialization. Overcurrent and overload of soft start are treated according to this value. In order to ensure the normal and reliable protection of the motor in your system, please set this value according to the motor nameplate used to achieve the best state of protection. If the motor nameplate does not match the setting of this value, the motor may burn out.

F20 Bypass Delay Settable range: (0-20) s. It refers to the current drop signal detected in the soft start process and switching to bypass operation after the delay F20 setting value. In the case of large inertia load motor (such as crusher) and small grid capacity (large voltage drop at soft start), it is recommended that the F20 value be set to (6-20) s.

Note: This function is invalid when debugging small motors with light load or power products below 22kW. No matter F20 is set to any value, bypass switching is not delayed.

F21 OverL. Hi. Set Settable range: 0-6. According to the different parameters, when rated motor current is less than 1.1 times, 1.2 times, 1.3 times, 1.4 times and 1.5 times respectively in bypass operation, the overload heat integral is not calculated. Detailed description of F21 parameters in Table 6.2 is given.

⚠ **Selection of parameter values from 1 to 6 has a good application effect for intermittent fluctuating loads, but there is a risk of damage to peripheral equipment (such as bypass contactors, motors, etc.). Please use it carefully.**

F22 OverU. Hi. Set Settable range: (0-10) s. When F22 is set to (1-10) s, when the voltage is greater than or equal to 380V*F10 setting value and the F22 setting value (1-10) s is maintained, the overvoltage protection is reported. In the case of large voltage fluctuation, this function parameter has a good application effect.

F23 UnderU. Hi. Set Settable range: (0-10) s. When F23 is set to (1-10) s, the voltage is less than or equal to 380V*F09 setting value and the F23 setting value (1-10) s is maintained, undervoltage protection is reported. In the case of large voltage fluctuation, this function parameter has a good application effect.

F24 U.K. Adjust Settable range: (90-110)%. In the case of inaccurate voltage calibration, it is used to fine-tune the product voltage display value.

F25 I.K. Adjust Settable range: (90-110)%. In the case of inaccurate current calibration, it is used to fine-tune the product current display value.

F26 C. BaudRate Settable range: 0-3. This parameter is used to set the data transmission rate between the host and the soft starter.

Note: The baud rate of the host and the soft starter must be the same, otherwise they cannot communicate.

F27 C. DataFormat Settable range: 0-2. This parameter is used to set the communication data format between host and soft starter.

Note: The data format of communication between host and soft starter must be the same, otherwise it can not be communicated.

F28 C. Timeout Settable range: (0.0-60.0) s. When the function parameter is set to more than 0.0s, if the interval between the last communication and the next communication exceeds the communication time, it will show that the communication exceeds the fault. In general, the function parameter is set to 0.0s. If the function parameter is set in the continuous communication system, the communication status can be monitored.

F29 Fire. ModeEn Settable range: 0-2.

Setting to 0 indicates normal mode, which is usually set to this mode.

When set to 1, it means in fire control mode 1. This mode has the following three characteristics:

1) Whether the product is in the parameter setting interface, in the information viewing interface or in the troubleshooting interface, it can start soft when it receives the effective operation command.

2) No matter what kind of operation control mode F13 is set to (including F13 = 7), the product will start as long as it receives the starting signal of external control terminal or keyboard or communication starting signal. Please use it carefully.

3) No matter what kind of operation control mode F13 is set to, the product will stop as long as it receives the outage signal of the external control terminal or the keyboard or the communication outage signal.

When set to 2, it means in fire control mode 2. This mode has three characteristics: besides the three characteristics of fire control mode 1, it will automatically shield three-phase unbalance and fault protection of output phase absence.

⚠ **Since the three-phase unbalance and output phase-out fault protection will be automatically shielded in Fire control Mode 2, be sure to use cautiously.**

F30 Se. Limit I.ST Settable range: (0-30) s. 0: indicates that the secondary current limiting function is invalid; (1-30) s: indicates that the secondary current limiting begins after (1-30) s from soft. The function parameter indicates how long after the soft start to start the secondary current limiting, which has better application effect in heavy load situations, as shown in Figure 6.7.

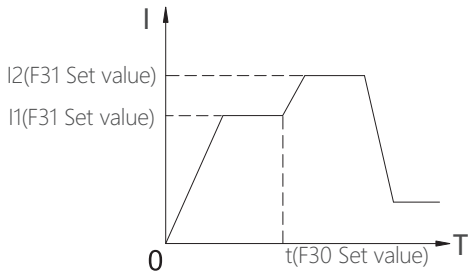


Figure 6.7 Functional schematic diagram of secondary current limiting

F31 Se. Limit I. Settable range: F06-500%, % refers to the percentage of rated current of motor (that is, the setting value of parameter F19). This function parameter represents the second current limiting multiple in the soft start process. The second current limiting multiple value refers to the multiple of rated motor current.

Note: When the following conditions, the secondary current limiting function is invalid.

- When the setting value of F06 >= F31, the secondary current limiting function is invalid.
- When F08 = 0 or 2, the secondary current limiting function is invalid.
- When F30 = 0, the secondary current limiting function is invalid.
- When the slope current mode is used, the secondary current limiting function is invalid.

F32 Kick Time Set Settable range: (0.0-1.5) s. Regardless of setting F11 to any value, when the parameter value of the function code is not 0.0s, sudden jump start will occur in soft start. The sudden jump start has a good application effect in overcoming the load of larger static torque (such as ball mill).

When the point operation makes it effective (F33 = 1, that is, the point operation), the jump start function automatically fails. The schematic diagram is shown in figs. 6.8 and 6.9.

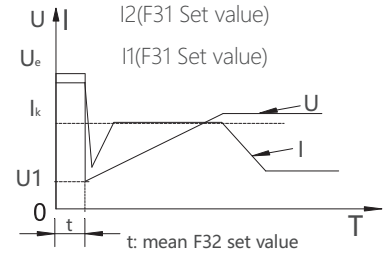


Figure 6.8 Schematic diagram of sudden jump + current limiting mode (i.e. F32 > 0.0, F11 = 0)

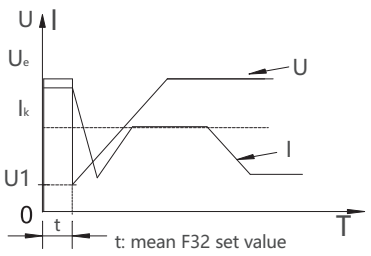


Figure 6.9 Sudden jump + voltage mode diagram (i.e.F32 > 0.0, F11 = 1)

⚠ **Due to the sudden trip period, the current may exceed 8 times the rated motor current, may cause the front-end circuit breaker tripping, please be careful to use.**

F33 Point Run En Settable range: 0-1. When F33 is set to 1, the soft starter will output a lower voltage all the time after receiving the effective soft start command to realize the low-speed start operation of the motor. After receiving the effective stop command, the start operation will end. When the output torque of the soft starter is small during the start-up operation, there is the possibility that the motor can not rotate. Set this parameter to 0 in normal use.

0: Point operation function is invalid.

1: The click-on operation function is effective.

Note 1: When the point motion is running (F33 = 1), the jump start will automatically be invalid regardless of the setting of the jump time of F32 to any value of (0.0-1.5) s. That is to say, only when F32 > 0.0 and F33 = 0 are satisfied, can the sudden jump function be effective.

Note 2: When it is set to jump start (i.e. F32 > 0.0), the function of point operation is automatically invalid regardless of whether F33 point operation makes it 0 or 1. That is to say, when F33 = 1 and F32 = 0.0 are simultaneously satisfied, the start-up operation will be effective. See the table below for details.

F32 (jump time) setting	F33 setting value	Starting condition
= 0.0	0	Non-sudden jump mode and non-point operation
> 0.0	0	Sudden jump mode and non-point operation
= 0.0	1	Non-sudden jump mode and point operation
> 0.0	1	Non-sudden jump mode and non-point operation

F34 Under I. Alarm Setting range: (0-90)%. % refers to the percentage of rated current of the motor (that is, the setting value of parameter F19), Indicating the alarm setting value for under-load current.

In bypass operation, if the actual load current is detected to be less than the set value of F34 during the set time of F35, the product will alarm for under-load. At this time, if the function code parameter F17 is set to 8 (under-load), the K2 relay will be changed from normal open to normal closed. After entering the under-load alarm, the under-load alarm will be lifted when the load current is more than 1.1 times of the under-load alarm current detected in the set time of F35, and the K2 relay (e.g. when the function parameter F17 is set to 8) will be changed from normal closed to normal open. The operation logic of K2 relay is shown in Figure 6.10.

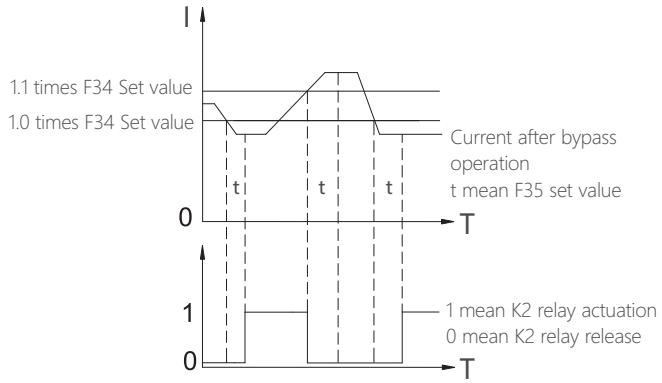


Figure 6.10 Under load Logic Action Diagram

Note: Soft starter will not shut down or report malfunction under load. When F17 is set to 8, the output of K2 relay will be normally closed.

F35 Under I Time Setting range: (0-10) s. Represents the maintenance time of the under-load current or the release and maintenance time of the under-load current.

7 RS485 communication

Soft starter provides RS485 communication interface, master-slave communication using international standard Modbus communication protocol. Users can realize centralized control by computer, PLC or special communication equipment. Through this communication protocol, they can set the operation command of the soft starter, modify or read the function code parameters, read the working status and fault information of the soft starter, etc.

Support RTU transmission mode.

7.1 Communication connection

Communication interface uses RS485, asynchronous communication, data frame sending order is high byte first send, low byte then send (except CRC check code, CRC check code is low byte first send, high byte then send), each single byte sending order is the lowest bit first send, the highest bit last send.

The connection schematic diagram of a soft starter to a computer is shown in Fig. 7.1, and the connection schematic diagram of multiple soft starters to a computer is shown in Fig. 7.2. The "A" and "B" terminals of the external control terminal of the soft starter are connected with the 485+, 485-of the host computer through twisted pairs respectively.

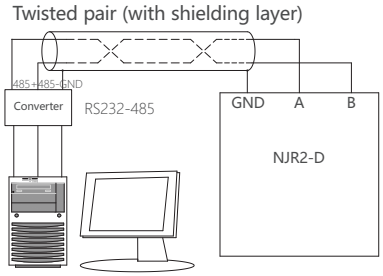


Figure 7.1 Connection of a Soft Starter to a Computer

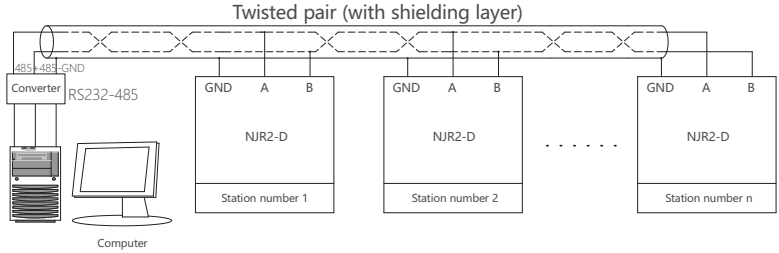


Figure 7.2 Connection of multiple soft starters to computers

Note 1: In general, there is no need to connect terminal resistance at both ends of soft starter A and B. If the distance is long, terminal resistance can be connected at the farthest end of soft starter A and B (terminal resistance value is about 120Ω).

Note 2: In order to reduce external interference of communication signal, twisted-pair shielding wire is recommended for communication connection. If the bus length is long, please connect the "GND" terminal of soft starter external control terminal with the shielding layer of twisted-pair shielding wire.

7.2 Protocol Content and Format

The Modbus serial communication protocol defines the frame content and format of asynchronous transmission in serial communication, including the format of host polling, broadcast frame and slave answering frame. The frame content of host (i.e. host) includes slave address (or broadcast address), function code, data and check code; slave (i.e. slave) response adopts the same structure, including action confirmation, return data and check code. If an error occurs when the slave receives the frame or fails to complete the command required by the host, a fault frame will be generated and fed back to the host as a response. The communication protocol format is shown in Figure 7.3.

The slave address can be set, ranging from 1 to 247, and 0 is the broadcasting address. In single-host multi-slave system and single-host single-slave system, the address of each slave in the network is unique.

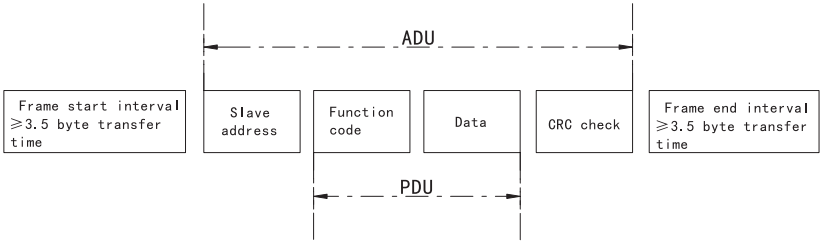


Figure 7.3 Protocol Format Diagram

ADU (Application Data Unit) is the application data unit and PDU (Protocol Data Unit) is the protocol data unit. The 16-bit check code of CRC test is obtained after checking the data of the first three parts of ADU. The low byte is in the front and the high byte is in the back.

7.3 Function Code Description

NJR2-D product Modbus protocol will support functional codes (also known as command codes) with 0x03 and 0x06 functional codes.

7.3.1 0x03 function code

NJR2-D soft starter can read the values of relevant parameters by reading the values of single or multiple slave registers. For example, if the read slave address is 0x01 and a word is read from the functional parameter address is 0x3000 (that is, the register address is 0x3000, hexadecimal), the communication data of the frame is shown in Table 7.1.

Table 7.1 0x03 Functional code communication data

Host command information		Slave response information	
start	3.5Byte Transfer Interval Time	Slave address	3.5Byte Transfer Interval Time
Slave address	0x01	Slave address	0x01
Function code	0x03	Function code	0x03
Register Start Address (High Bytes)	0x30	Byte count	0x02
Register Start Address (Low Bytes)	0x00	Register address 0x0001 (high bytes)	0x00
Number of registers (high bytes)	0x00	Register address 0x0001 (low byte)	0x01e
Number of registers (low bytes)	0x01	CRC Check Code (Low Bytes)	0x38
CRC Check Code (Low Bytes)	0x8b	CRC Check Code (High Bytes)	0x4c
CRC Check Code (High Bytes)	0x0d	End	3.5Byte Transfer Interval Time
End	3.5Byte Transfer Interval Time		

Note 1: The sending order of CRC check codes is low byte first and high byte later.

Note 2: "0x" indicates that the data is hexadecimal, as follows.

7.3.2 0x06 function code

Write a word of data to the slave register, that is, set the value of a single parameter. For example, if the read slave address is 0x01 and a word is written to the functional parameter address is 0x3000 (that is, the register address is 0x3000, hexadecimal), the communication data of the frame is shown in Table 7.2.

Table 7.2 0 X06 Functional Code Communication Data

Host command information		Slave response information	
start	3.5 Byte Transfer Interval Time	Slave address	3.5Byte Transfer Interval Time
Slave address	0x01	Slave address	0x01
Function code	0x06	Function code	0x06
Register Start Address (High Bytes)	0x30	Register Start Address (High Bytes)	0x30
Register Start Address (Low Bytes)	0x00	Register Start Address (Low Bytes)	0x00
Register content (high bytes)	0x00	Register content (high bytes)	0x00
Register content (low bytes)	0x28	Register content (low bytes)	0x28
CRC Check Code (Low Bytes)	0x86	CRC Check Code (Low Bytes)	0x86
CRC Check Code (High Bytes)	0xd4	CRC Check Code (High Bytes)	0xd4
End	3.5Byte Transfer Interval Time	End	3.5Byte Transfer Interval Time

7.4 Check Code Generation Method

Frame checking mainly includes two parts: byte bit checking and frame data checking. In RTU transmission mode, frame data validation includes CRC validation.

7.4.1 Byte Bit Check

Users can choose different bit-checking methods according to their needs, or they can choose no-checking, which will affect the bit-checking settings of each byte.

The meaning of even check: before data transmission, add a bit of even check bit to indicate whether the number of "1" in the data transmitted is odd or even. When it is even, the check position is "0", otherwise it is set to "1" to keep the parity of data unchanged.

The meaning of odd check: before data transmission, an odd check bit is added to indicate whether the number of "1" in data transmission is odd or even. When it is odd, the check position is "0", otherwise it is set to "1" to keep the parity of data unchanged.

For example, we need to transmit "11001110" with five "1" in the data. If we use parity check, its parity bit is "1", if we use odd check, its odd bit is "0". When transmitting data, the parity bit is calculated and placed in the frame's parity bit, and the receiving device also needs parity check. If it is found that the parity of the received data is inconsistent with the preset, it is believed that communication has mistake.

7.4.2 CRC Check Mode

Using RTU frame format, the frame includes frame error detection domain calculated based on CRC method. The CRC domain detects the content of the whole frame. The CRC field is two bytes and contains 16-bit binary values. It is calculated by the transmission device and added to the frame. The receiving device recalculates the CRC of the received frame and compares it with the value in the received CRC domain. If the two CRC values are not equal, the transmission is wrong.

CRC first stores in 0xFFFFFF, then calls a procedure to process more than 6 consecutive bytes in the frame with the value in the current register. Only 8Bit data in each character is valid for CRC, and both start and stop bits and parity bits are invalid. In the CRC generation process, each 8-bit character is different from or (XOR) the contents of the register, and the result moves to the lowest significant bit, and the highest significant bit is filled with 0. LSB is extracted and detected. If LSB is 1, the registers are different from the preset values alone or if LSB is 0, it is not performed. The whole process should be repeated eight times. After the last bit (8th bit) is completed, the next 8th bit byte is different from or (XOR) the contents of the register. The value in the final register is the CRC value after all bytes in the frame are executed. This calculation method of CRC is based on the international standard CRC check rule. When editing the CRC algorithm, users can refer to the relevant standard CRC algorithm and write the CRC calculation program that really meets the requirements. Now a simple function of CRC calculation is provided for user reference (programmed in C language):

```
unsigned int crc_cal_value(unsigned char*data_value,unsigned char data_length)
{
  int i;
  unsigned int crc_value=0xffff;
  while(data_length--)
  {
        crc_value^=*data_value++;
        for(i=0;i<8;i++)
        {
              if(crc_value&0x0001)
                    crc_value=(crc_value>>1)^0xa001;
              else
                    crc_value=crc_value>>1;
        }
  }
  return(crc_value);
}
```

```
return(crc_value);
}
```

In ladder logic, CKSM calculates CRC value according to frame content, and can also be calculated by look-up table method. This method is simple and fast, but the program occupies large ROM space. If there is a requirement for program space, please use it carefully.

7.5 Mailing address

7.5.1 Communication Address of Functional Parameter Class (Communication Address: 0x3000-0x3023)

The communication address of the functional parameter class is shown in Table 7.3 (R/W means readable and writable in read and write attributes), and the data of each functional code is a word (i.e. a 16-bit binary number).

Table 7.3 Communication address of function parameter table

Parameter properties	Function code	Parameter contents	Set scope	Factory value	Read and write properties	Mailing address
Basic Functional Parameter Table	F00	Initial U.	(30~70)%	30%	R/W	0x3000
	F01	Up Time	(2~60)s	16s	R/W	0x3001
	F02	Down Time	(0~60)s	0s	R/W	0x3002
	F03	Start Delay	(0~999)s	0s	R/W	0x3003
	F04	Program Delay	(0~999)s	0s	R/W	0x3004
	F05	Interval Delay	(0~999)s	0s	R/W	0x3005
	F06	Start Limit I.	(50~500)%Ie or (1~6000)A	400%	R/W	0x3006
	F07	Over L. Value	(50~100)%Ie or (1~6000)A	100%	R/W	0x3007
	F08	Display I. Mode	0~3	1	R/W	0x3008
	F09	Under U. Value	(60~90)%Ue	80%	R/W	0x3009
Basic Functional Parameter Table	F10	Over U. Value	(100~130)%Ue	120%	R/W	0x300a
	F11	Start Mode	0~5	1	R/W	0x300b
	F12	Over L. Class	0~4	2	R/W	0x300c
	F13	OPT. Mode	0~7	0	R/W	0x300d
	F14	Restart SEL.	0~9	0	R/W	0x300e
	F15	PARA. Enable&Prt. Shield	0~4	1	R/W	0x300f
	F16	COM. Address	0~247	1	R/W	0x3010
	F17	K2. Program	0~8	2	R/W	0x3011
	F18	Stop Limit I.	(20~100)%	100%	R/W	0x3012
	F19	Motor Rated I.	(4~1000)A	44A	R/W	0x3013
Advanced Functional Parameter Table	F20	Bypass Delay	(0~20)s	0s	R/W	0x3014
	F21	OverL. Hi.Set	0~6	0	R/W	0x3015
	F22	OverU. Hi. Set	(0~10)s	5s	R/W	0x3016
	F23	UnderU. Hi. Set	(0~10)s	5s	R/W	0x3017
	F24	U.K. Adjust	(90~110)%	100%	R/W	0x3018
	F25	I.K. Adjust	(90~110)%	100%	R/W	0x3019
	F26	C. BaudRate	0: 2400bps 1: 4800bps	3	R/W	0x301a

Parameter properties	Function code	Parameter contents	Set scope	Factory value	Read and write properties	Mailing address
Advanced Functional Parameter Table	F26	C. BaudRate	2: 9600bps 3: 19200bps	3	R/W	0x301a
	F27	C. DataFormat	0: 8~1~N RTU 1: 8~1~E RTU 2: 8~1~O RTU	0	R/W	0x301b
	F28	C. Timeout	(0.0~60.0)s	0.0s	R/W	0x301c
	F29	Fire. ModeEn	0~2	0	R/W	0x301d
	F30	Se. Limit I. ST	(0~60)s	0s	R/W	0x301e
	F31	Se. Limit I.	F06~500%Ie	450%	R/W	0x301f
	F32	Kick Time Set	(0.0~1.5)s	0.0s	R/W	0x3020
	F33	Point Run En	0~1	0	R/W	0x3021
	F34	Under I. Alarm	(0~90)%Ie	0%	R/W	0x3022
	F35	Under I Time	(0~10)s	5s	R/W	0x3023

7.5.2 Communication Address of Record and Monitoring Classes (Communication Address: 0x2000-0x200f)

The communication addresses of record and monitor classes are shown in Table 7.4 (R means read-only and cannot write in read-write attributes). The data of each functional code is one word (i.e. a 16-bit binary number).

Table 7.4 Record and Monitoring Communication Addresses

Name	Meaning	Read and write properties	Mailing address
Rated power of soft starter	Company:0.1*kW	R	0x2000
Current fault information 1	0:Represents that the current information is fault-free 1:Represents "X3 terminal Open" fault 2:Represents "Soft starter over heat" fault 3:Represents "Start overtime" fault 4:Represents "Inport default phase" fault 5:Represents "Outport default phase" fault 6:Represents "Three phase unbalance" fault 7:Represents "Limit current overtime" fault 8:Represents "Overloading protect" fault 9:Represents "Under voltage" fault 10:Represents "Over voltage" fault 11:Represents "Parameter set error" fault 12:Represents "Loading short circuit" fault 13:Represents "Restart connect error" fault 14:Represents "Stop terminal connect error" fault 16:Represents "Communication timeout " fault	R	0x2001
Current fault information 2		R	0x2002
Current fault information 3		R	0x2003
Current fault information 4		R	0x2004
Current fault information 5		R	0x2005
Current fault information 6		R	0x2006
Current fault information 7		R	0x2007
Current fault information 8		R	0x2008
Current fault information 9		R	0x2009

Name	Meaning	Read and write properties	Mailing address
Software version	Unit: 0.1* version number The read data is hexadecimal, converted to decimal and multiplied by 0.1.	R	0x200a
Upgrade date (year)	Unit: year The data read is hexadecimal and converted to decimal.	R	0x200b
Upgrade Date (Month, Date)	Unit: month、date The data read is hexadecimal, converted into decimal, the low two-digit in decimal represents the day, the high two-digit or one-digit represents the month. For example, read data is 0x0324, corresponding decimal 824, representing August 4.	R	0x200c
Current working status	Unit: no 0: indicates readiness 1: Represents failure status 2: Indicates bypass operation status 3: Indicates a soft-start state. 4: Soft stop state	R	0x200d
Current input voltage	Unit: 0.1*V The read data is hexadecimal, converted to decimal and multiplied by 0.1. For example, reading data is 0x0e22, corresponding decimal system is 3618, indicating the current input voltage is 361.8V.	R	0x200e
Current Output Current	Unit: 0.1*A The read data is hexadecimal, converted to decimal and multiplied by 0.1. For example, reading data is 0x0099, corresponding decimal is 153, indicating the current output current is 15.3A.	R	0x200f

7.5.3 Control Command Class Communication Address (Communication Address: 0x1000-0x1002)

The communication address of the control command class is shown in Table 7.5 (in the read-write attribute, W means write-only, not read). The data of each function code is a word (that is, a 16-bit binary number).

Table 7.5 Communication address of control command class

control command	Meaning	Read and write properties	Mailing address
Start and stop	0x0000: Represents downtime command or fault reset 0x0001: Represents the startup command	W	0x1000
Parameter Restoration of	0x0000: parameter does not restore factory value 0x0001: parameter restore factory value Note: Operation is effective only in the state of preparation.	W	0x1001
Output Value Fault record clearance	0x0000: Failure record is not clear 0x0001: Clear all fault records Note: Operation is effective only in the state of preparation.	W	0x1002

7.6 Functional Abnormal Code

If the operation request fails, the PDU responds with error code and exception code. The error code is equal to the function code + 0x80, and the exception code indicates the specific cause of the error. The list of the exception function code is shown in Table 7.6. Users can quickly find out the problem points according to the exception function code.

Table 7.6 Implications of Abnormal Function Codes

Abnormal Function Code	Meaning
0x01	Unsupported function codes. At present, only function codes 0x03 and 0x06 are supported. When the system receives other function codes, the function exception code 0x01 will be reported in the response data of the lower computer. For example: Upper computer sends data (hexadecimal):01 04 30 00 00 01 3e ca Lower computer response data (hexadecimal):01 84 01 82 c0 (84: function code + 0x80; 01: response exception code of unsupported function code)
0x02	Illegal communication registration address. When the communication address is not within the prescribed range, the anomaly code 0x02 will be reported in the response data of the lower computer. 1. The communication address range of Writing Function Code 0x06 is 0x1000-0x1002 and 0x3000-0x3023 respectively. For example, write a word of 0x001 to the address of communication register 0x1003. Because the address 0x1003 is not within the communication address of communication write function code 0x06, the anomaly code 0x02 will be reported in the response data of the lower computer. Upper computer sends data (hexadecimal):01 06 10 03 00 01 bc ca Lower computer response data (hexadecimal):01 86 02 c3 a1 (86: Function code + 0x80; 02: Function exception code for illegal communication register address) 2. The communication address range of reading function code 0x03 is 0x2000-0x200f and 0x3000-0x3023 respectively. For example, read a word to the communication register address 0x1002, because the address 0x1002 is not within the communication address of the communication read function code 0x03, the function abnormal code 0x02 will be reported in the response data of the lower computer. Upper computer sends data (hexadecimal):01 03 10 02 00 01 21 0a Lower computer response data (hexadecimal):01 83 02 c0 f1 (Among them, 83: Functional code + 0x80; 02: Functional anomaly code for illegal communication register address)
0x03	Illegal communication registration data value. When writing function code 0x06, when the data written exceeds the set range of function parameters or when reading function code 0x03, when the number of data read is more than 10 words or 0, the function abnormal code 0x03 will be reported in the response data of the lower computer. 1. When writing function code 0x06, when the data written exceeds the set range of function parameters, the function exception code 0x03 will be reported in the response data of the lower computer. For example, write a word of 0x0002 to the address of the communication register 0x1000. Because the data 0x0002 has exceeded the range (normal range is 0x0000-0x0001), the function exception code 0x03 will be reported in the response data of the lower computer.

Abnormal Function Code	Meaning
0x03	Upper computer sends data (hexadecimal):01 06 10 00 00 02 0c cb Lower computer response data (hexadecimal):01 86 03 02 61 (86: Representation function code + 0x80; 03: Representation function exception code of illegal communication register data) 2. When reading function code 0x03, when the number of data read is more than 10 words or 0, the function abnormal code 0x03 will be reported in the response data of the lower computer. For example, read 11-word data to the communication register address 0x3000, and report the function exception code 0x03 in the response data of the lower computer. Upper computer sends data (hexadecimal):01 03 30 00 00 0b 0b 0d Lower computer response data (hexadecimal):01 83 03 01 31 (83: Representation function code + 0x80; 03: Representation function exception code of illegal communication register data)
0x04	Write registers operate too many times. Considering the limited number of erases in the internal memory chip of the soft starter, in order to improve the service life of the internal memory chip, it is stipulated that the number of times to write (i.e., modify) the function code parameters to the soft starter during the power-on to power-off period should not exceed 1000 times (i.e., the number of write operations of the function code 0x06 should not exceed 1000 times), otherwise, the response data of the lower computer will be reported. Functional exception code 0x04.

7.7 Examples of Modbus Communication

Before communication, the relevant communication function parameters should be set up to make the communication address, baud rate and data format of the host computer and the slave computer consistent.

7.7.1 Example 1: The slave address of the soft starter is 0x01. The current working current of the soft starter should be read.

Data sent by host: 01 03 20 0f 00 01 bf c9

Data received by the host:01 03 02 00 7b f8 67

The data received by the host computer is the data responded by the slave computer. In this communication, 00 7b of the data received by the host computer represents the received current value (all hexadecimal), where "00" represents the current high position, and "7b" represents the current low position, which is 123 after conversion to decimal system. Because the unit is 0.1A, the current is 12.3A.

7.7.2 Example 2: The slave address of the soft starter is 0x01, which is realized by communication in two steps.

The first step is to set the function parameter F13 to 5 (in fact, it can be set to 3-6, this example is set to 5).

Data sent by host: 01 06 30 0d 00 05 d7 0a

Data received by the host: 01 06 30 0d 00 05 d7 0a

In this way, F13 is modified to 5, allowing the communication channel to give soft start commands.

Step 2 The host computer sends soft start command to the soft starter.

Data sent by host: 01 06 10 00 00 01 4c ca

Data received by the host: 01 06 10 00 00 01 4c ca

In this way, the soft start command is sent to the soft starter by means of communication to realize the soft start.

8 Fault analysis and troubleshooting

8.1 Maintain

To maintain the soft starter, it is necessary to ensure that the power supply is disconnected before maintenance; only by professional personnel can the soft starter be disassembled and maintained.

a. Clean the dust in the machine regularly.

b. Check whether the screw of each terminal is loose.

c. Check the wires for damage and aging.

d. Check whether the copper bars and the contact parts of each conductor have any heat marks.

8.2 Cause Analysis and Elimination of Common Fault Names

When the soft start is abnormal, the protective function is operated, and the fault name and related contents are displayed on the LCD screen. Please refer to Table 8.1.

Table 8.1 Cause Analysis and Elimination of Common Fault Names

Fault name	Failure Cause Analysis	Troubleshooting Method
Fault removed	It has just occurred under-voltage, overvoltage, overheating and other faults, and now it is back to normal.	Press the "stop" button on the panel or reset after receiving the external stop command.
X3 terminal Open	1. External control X3 and COM terminal are disconnected. 2. The voltage between + 24V and COM is not DC + 22V ~ + 27V. 3. Abnormal CPU or power board.	1. Check whether X3 and COM terminals are reliably connected or whether other protective devices connected to the terminals are normally closed contacts. 2. Check whether the voltage between external terminal + 24V and COM is between DC + 22V ~ + 27V. 3. Replace CPU or power board. 4. Seek technical support.
Soft starter over heat	1. Overweight load or overshoot of starting current limit or long soft start time or input phase absence. 2. The motor power does not match the soft starter. 3. Start frequently. 4. Starting parameter setting and load are not suitable. 5. Cabinet heat dissipation is not good or ambient temperature is too high. 6. CPU board or power board abnormal.	1. Check whether the load is too heavy, fan and pump loads should be as small as possible before starting. 2. Check whether the motor power matches the soft starter, that is, the set value of F19 should be equal to the rated current value on the motor nameplate. 3. Reduce the starting frequency. 4. Lifting current limiting factor F06, raising initial voltage F00 or reducing soft start time F01. 5. Strengthen the heat dissipation effect inside the cabinet. 6. Replace CPU or power board. 7. Seek technical support.
Start overtime	1.Start parameter setting and load are not suitable. 2. Overload.	1. Lifting current limiting factor F06, raising initial voltage F00 or reducing soft start time F01.

Fault name	Failure Cause Analysis	Troubleshooting Method
Start overtime	3. The motor power does not match the soft starter. 4. The capacity of power grid is small.	2. Check whether the load is too heavy, fan and pump loads should be as small as possible before starting. 3. Check whether the motor power matches the soft starter, that is, the set value of F19 should be equal to the rated current value on the motor nameplate. 4. Check whether the power supply capacity is insufficient, as it will causes too large voltage drop at soft start possibly. Normally, the power supply capacity should be 2.5 times larger than the power of the motor. 5. Seek technical support.
Import default phase	1. Three-phase input power supply and input circuit breaker are abnormal. 2. The soft start time is too long (e.g. input phase absence fault occurs in the soft start process). 3. When the generator is powered, the output voltage and frequency are abnormal. 4. Thyristor abnormality. 5. CPU board or power board abnormal.	1. Check whether the three-phase input power supply and input circuit breaker are normal. 2. Check whether the soft start time is too long (e.g. input phase missing fault occurs in the soft start process). 3. When the generator is powered, check whether the output voltage and frequency are normal. 4. Check whether the thyristor is abnormal or not. In the case of power failure, use the multimeter's turn-on gear to measure whether the main circuit terminals R and U, S and V, T and W are turned on respectively. When turning on, it indicates that the thyristor is abnormal. 5. Replace CPU or power board. 6. Seek technical support.
Output default phase or Three phase un-balance	1. Poor connection of output circuit and motor. 2. The bypass contactor is abnormal. 3. Whether thyristor is abnormal. 4. Abnormal CPU or power board	1. Check whether the output circuit and motor connection are normal. 2. Check whether the bypass contactor can be switched on and off normally, and pay special attention to whether there is any abnormal movement of a phase in the contactor. 3. Check whether the thyristor is abnormal or not. In the case of power failure, use the multimeter to measure whether the main circuit terminals R and U, S and V, T and W are on. When on, the thyristor is abnormal. 4. Replace CPU or power board. 5. Seek technical support.
Limit current overtime	1.Start parameter setting and load are not suitable. 2. Overload. 3. The power supply capacity is insufficient.	1. Check whether the setting of starting parameters is inappropriate. According to the situation, the setting value of F00 can be increased appropriately, the setting value of F01 can be reduced and the setting value of F06 can be increased. 2. Check whether the load is too heavy, fan and pump loads should be as small as possible before starting. 3. Check whether the power supply capacity is insufficient, as it will leads to too large voltage drop at soft start. Normally, the power supply capacity should be 2.5 times larger than the power of the motor. 4. Seek technical support.

Fault name	Failure Cause Analysis	Troubleshooting Method
Over-loading protect	1. Whether the load is too heavy. 2. The parameters of F12 or F19 are not suitable.	1. Check whether the load is too heavy, fan and pump loads should be as small as possible before starting. 2. Check whether the parameter setting of F12 or F19 is inappropriate. 3. Seek technical support.
Under voltage	1. Low input voltage. 2. The parameter setting of F09 is not suitable.	1. Check whether the input power supply voltage is too low. 2. Check whether the parameter setting of F09 is inappropriate. 3. Seek technical support.
Over voltage	1. High input voltage. 2. The parameter setting of F10 is not suitable. 3. There are strong interference sources.	1. Check whether the input power supply voltage is too high. 2. Check whether the parameter setting of F10 is inappropriate. 3. Check whether there are strong interference sources around, such as medium frequency furnace, etc. 4. Seek technical support.
Para-meter set error	CPU board anomaly	1. Modify the settings or press the "OK" button to turn on and restore the factory value. 2. Replace CPU board. 3. Seek technical support.
Loading short circuit	1. The coil of the motor is short-circuit to the ground. 2. CPU board or power board abnormal.	1. Investigate the short circuit between the coil and the ground of the motor. 2. Replace CPU or power board. 3. Seek the support of motor manufacturers.
Restart connect error	Check whether the external control starting and stopping terminals are connected by two-wire control mode.	1. Check whether the starting and stopping terminals of external control are connected by two-wire control mode. 2. Seek technical support.
Stop terminal connect error	When the external control mode is allowed, the external stop terminal is in the open state and can not start the motor.	1. Check whether the external stop terminal is open when the external control mode is allowed. 2. Seek technical support.

8.3 Cause Analysis and Elimination of Common Abnormal Phenomena

The causes and elimination methods of abnormal phenomena are shown in Table 8.2.

Table 8.2 Reasons for Common Abnormal Phenomena and Removal Methods

Common abnormal phenomena	Failure Cause Analysis	Troubleshooting Method
Can't start or stop with keyboard control	1. X3 and COM terminals are open. 2. Code F13 is not set correctly.	1. Short-connect X3 with COM. 2. Set the code F13 correctly. 3. Seek technical support.
External control can not start	1. Error setting of code F13. 2. External wiring error.	1. The external control terminal is set to be effective, and the connection mode described in F13 function is adopted. 2. Check whether the wiring is normal. 3. Seek technical support.

Common abnormal phenomena	Failure Cause Analysis	Troubleshooting Method
Although the motor rotates, its speed remains unchanged.	1.Start parameter setting and load are not suitable. 2. Overload.	1. Lifting current limiting factor F06, raising initial voltage F00 or reducing soft start time F01. 2. Check whether the load is too heavy, fan and pump loads should be as small as possible before starting. 3. Seek technical support.
Sudden stop in operation	Check the external input terminal.	1. Check whether the connection of X3 and COM terminals is loose. 2. If there is an external protector, please check the normal closing point for action. 3. Check whether the connection line of the external stop button is loose. 4. Seek technical support.

8.4 Safety protection device and precautions

Soft starter has perfect protection function to protect the use safety of soft starter and motor. The protection level and parameters should be set appropriately according to different conditions in use.

8.3.1 Soft Start Overheat Protection: When the temperature rises to 85 C, take protective action. When the temperature falls to about 65 C (the temperature of the temperature control switch's return temperature), the overheat protection is relieved.

8.3.2 Input phase-out protection: When there is input phase-out, the product will be protected by input phase-out protection in operation, and the protection lag time is less than 3s.

8.3.3 Output phase-out protection: When there is output phase-out, the product will be protected by output phase-out protection in operation, and the protection lag time is less than 3s.

8.3.4 Three-phase unbalanced protection: When the current deviation of each phase is large, the product will be protected by three-phase unbalanced protection, and the protection lag time is less than 3s.

8.3.5 Load Short Circuit Protection: When the output current is greater than 12 times the rated current of the motor, the product will be protected by load short circuit, and the protection lag time is less than 20 ms.

⚠ **Due to the long turn-off time of the thyristor (determined by the inherent characteristics of the turn-off), there is a possibility that the thyristor will burn out when the load short circuit occurs.**

8.3.6 Overvoltage or under-voltage protection: When the power supply voltage is higher than the set value of F10, or lower than the set value of F09, product protection, protection action time see the set value of F22 and F23.

8.3.7 Start current limiting protection time: When the soft starter starts with motor, when the current is greater than 2.75 times the rated current, the current limiting overtime protection is carried out according to Table 8.3.

Table 8.3 Installation Dimensions and Weights of Products

F12 setting value / Actual current	0:Level 2	1:Level 10A	2 :Level 10	3 :Level 20	4:Level 30
4.75Ie≤Ir≤5.0Ie	23	23	23	23	29
4.25Ie≤Ir<4.75Ie	30	30	30	30	36
3.75Ie≤Ir<4.25Ie	35	35	35	35	45
3.25Ie≤Ir<3.75Ie	47	47	47	47	60
2.75Ie≤Ir<3.25Ie	63	63	63	63	80

Note: When less than 2.75 times and the starting time is more than 65 seconds, starting current limiting protection will be adopted, in which Ir is the actual current value.

8.3.8 Running Overload Protection Time: Reverse Time Thermal Protection Based on the Set Value of Code F07 or F19, The standard thermal overload protection curve is shown in Figure 8.1, and the typical value is shown in Table 8.4.

Table 8.4 Typical values of operating overload protection time

Standard application (level 10) release time		Release time of overload application (level 20)	
3Ie	5Ie	3.5Ie	5Ie
23s	8s	32s	15s

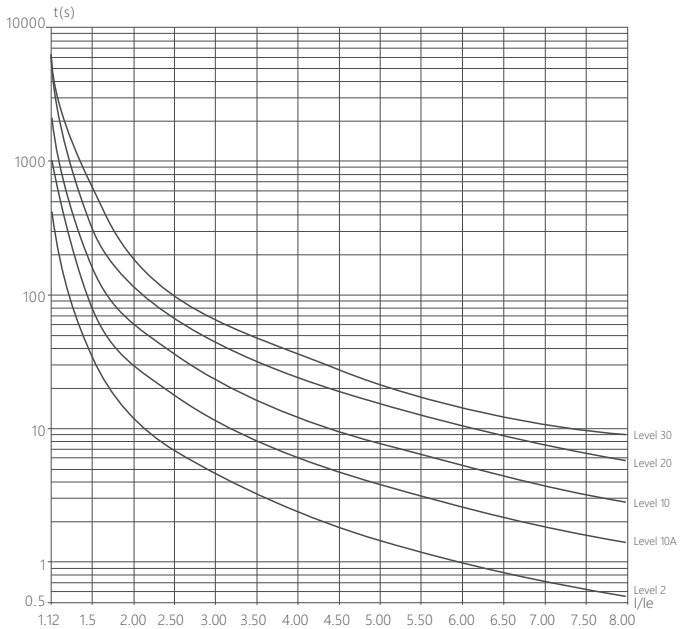


Figure 8.1 Standard thermal overload protection curve

9 Environmental Protection

9.1 Environmental protection

In order to protect the environment, when the product or its parts are scrapped, please properly dispose of them as industrial wastes; or be sent to the recycling station for assortment, dismantling and recycling.

Appendix A Peripheral Device Configuration Table

The peripheral matching table of this product is as follows. The voltage is AC 380V.

Motor parameters	Soft starter		Circuit breaker	AC contactor	Cable/Copper Bar	Short Circuit	Fuse (SCPD)
Power (kW)	Rated current (A)	Model specification	Model specification	Model specification	Copper core specification (mm^2)	Test current	Model specification
7.5	15	NJR2-7.5D	NM1-63/20	CJX2-25	4	Retain	Retain
11	22	NJR2-11D	NM1-63/32	CJX2-32	6	Retain	Retain
15	29	NJR2-15D	NM1-63/40	CJX2-40	10	Retain	Retain
18.5	36	NJR2-18.5D	NM1-63/50	CJX2-50	10	Retain	Retain
22	42	NJR2-22D	NM1-63/63	CJ40-63	16	Retain	Retain
30	57	NJR2-30D	NM1-100/80	CJ40-80	25	Retain	Retain
37	70	NJR2-37D	NM1-100/100	CJ40-100	35	Retain	Retain
45	84	NJR2-45D	NM1-250/125	CJ40-125	35	3kA	NGT1-160A
55	103	NJR2-55D	NM1-250/160	CJ40-160	35	Retain	Retain
75	140	NJR2-75D	NM1-250/200	CJ40-200	50	5kA	NGT2-250A
90	167	NJR2-90D	NM1-250/225	CJ40-250	30×3	Retain	Retain
110	207	NJR2-110D	NM1-400/315	CJ40-250	30×3	Retain	Retain
132	248	NJR2-132D	NM1-400/315	CJ40-315	30×4	Retain	Retain
160	300	NJR2-160D	NM1-400/350	CJ40-400	30×4	Retain	Retain
185	349	NJR2-185D	NM1-630/500	CJ40-400	40×4	5kA	RS77C-630A
220	404	NJR2-220D	NM1-630/630	CJ40-500	40×4	Retain	Retain
250	459	NJR2-250D	NM1-630/630	CJ40-630	40×5	Retain	Retain
280	514	NJR2-280D	NM1-630/630	CJ40-630	40×5	Retain	Retain
315	579	NJR2-315D	NM1-800/700	CJ40-630	40×6	10kA	RS77C-900A
355	630	NJR2-355D	NM1-800/700	CJ40-800	40×8	Retain	Retain
400	720	NJR2-400D	NM1-800/800	CJ40-800	40×8	Retain	Retain
450	810	NJR2-450D	NM1-1250/1250	CJ40-1000	40×10	Retain	Retain
500	900	NJR2-500D	NM1-1250/1250	CJ40-1000	40×10	Retain	Retain

Appendix B Scope of Application

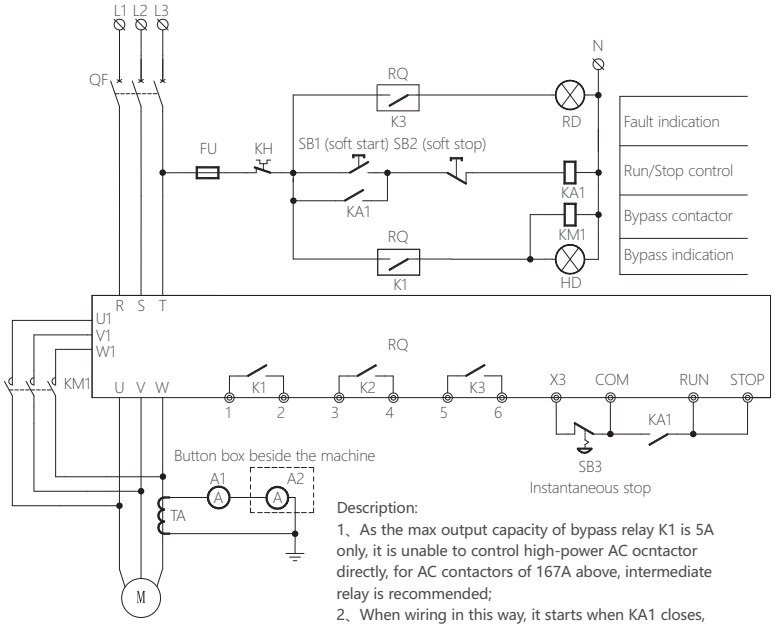
Soft starter meets the requirements of most motor loads. The following table is only for reference.

Application Load Type	Soft start time (seconds)	Soft stop time (seconds)	Starting voltage	Voltage Start (Maximum Current Value)	Current Limiting Start (Minimum Current Limit Value)
Centrifuge	16	20	40%	400%Ie	250%Ie
Ball mill	20	6	60%	400%Ie	350%Ie
Fan	26	4	30%	400%Ie	350%Ie

Application Load Type	Soft start time (seconds)	Soft stop time (seconds)	Starting voltage	Voltage Start (Maximum Current Value)	Current Limiting Start (Minimum Current Limit Value)
Light-duty motor	16	2	30%	400%Ie	300%Ie
Piston compressor	16	4	40%	400%Ie	300%Ie
Blender	16	2	50%	400%Ie	300%Ie
Crusher	16	10	50%	400%Ie	350%Ie
Screw compressor	16	2	40%	400%Ie	300%Ie
Screw conveyor	20	10	40%	400%Ie	200%Ie
Belt conveyor	20	10	40%	400%Ie	250%Ie
heat pump	16	20	40%	400%Ie	300%Ie
Note: Ie means rated current of motor, which is consistent with F19 value.					

Appendix C Application Atlas

C.1 Basic wiring diagram of one-drive-one



Description:

1、As the max output capacity of bypass relay K1 is 5A only, it is unable to control high-power AC ocntactor directly, for AC contactors of 167A above, intermediate relay is recommended;

2、When wiring in this way, it starts when KA1 closes, stops when KA1 opens;

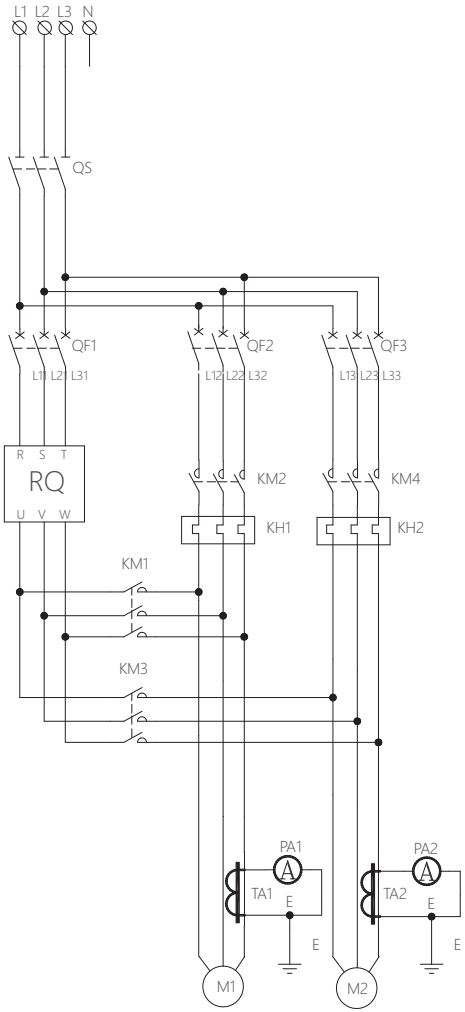
3、Three-wire control mode can be used, which could leave out the KA1 intermediate relay;

4、KH thermal relay can be omitted (soft starter itself already has overload protection function);

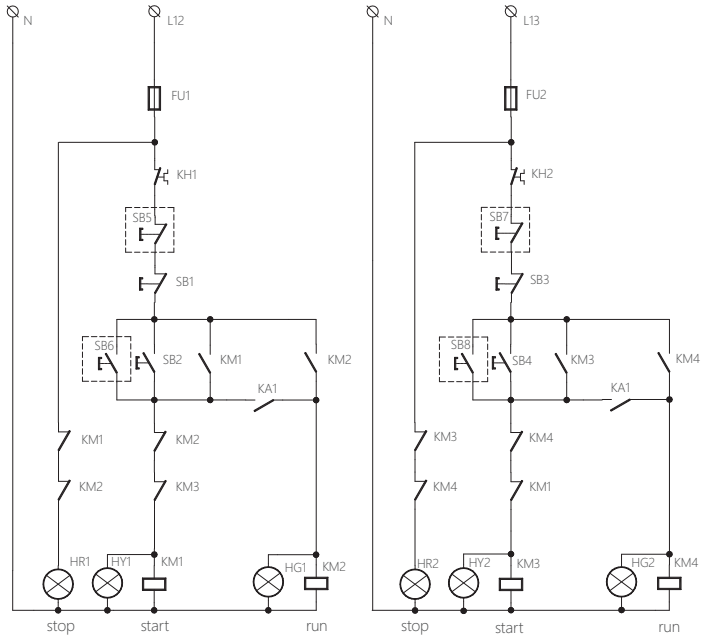
5、Terminal number accords with the description of control terminals.

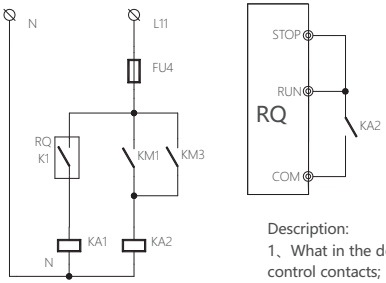
C.2 Basic wiring diagram of one-drive-two

C.2.1 Main circuit diagram of one-drive-two



C.2.2 Control circuit diagram of one-drive-two

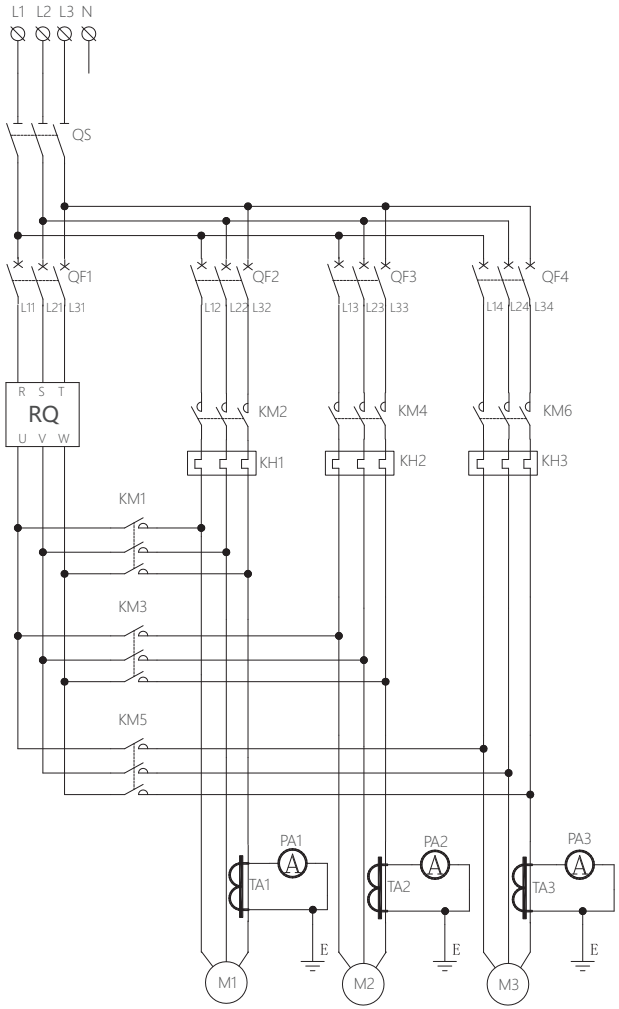




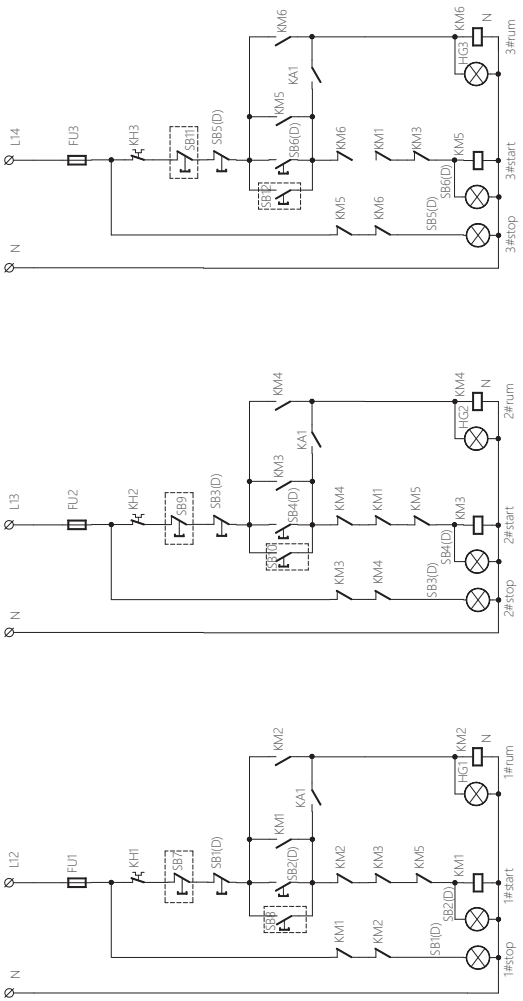
Description:
1、What in the dotted line frame are remote control contacts;
2、K1 is the soft starting bypass output relay;
3、Each set of motor must be equipped with KH thermal overload protection elements separately.

C.3 Basic wiring diagram of one-drive-three

C.3.1 Main circuit diagram of one-drive- three



C.3.2 Control circuit diagram of one-drive-three

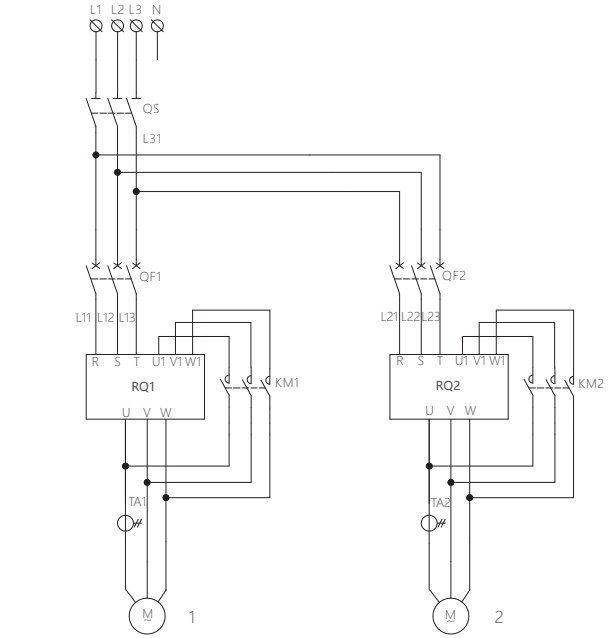


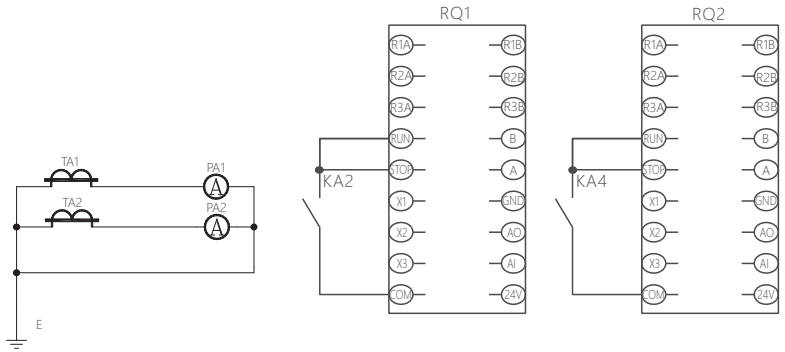
Description:

1. What in the dotted line frame are remote control contacts;
2. K1 is the soft starting bypass output relay;
3. Each set of motor must be equipped with KH thermal overload protection elements separately.

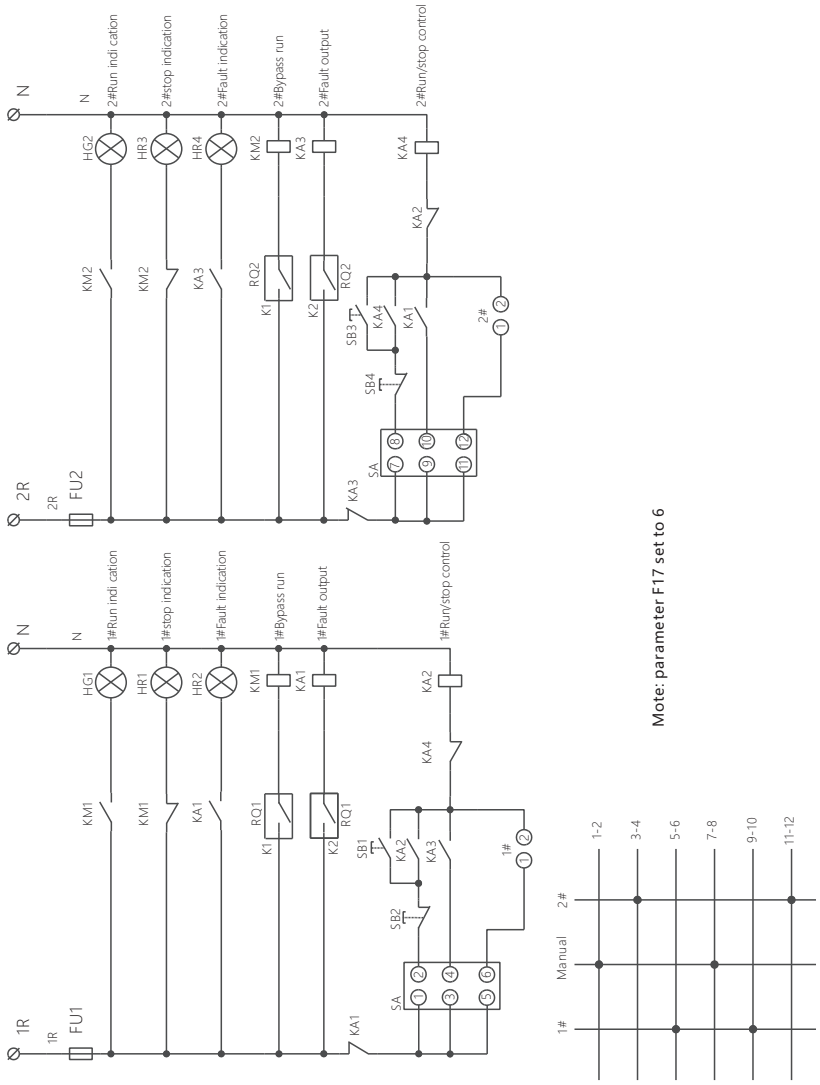
C.4 Basic wiring diagram of one use one standby

C.4.1 Main circuit diagram of one use one standby





C.4.2 Control circuit diagram one use one standby



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QC PASS

NJR2-D Series
Soft-Starter
IEC 60947-4-2

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Test date: Please see the packing

ZHEJIANG CHINT ELECTRICS CO., LTD.

CHINT ELECTRICS

NJR2-D Series
Soft-Starter
User Instruction

Zhejiang Chint Electrics Co., Ltd.

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E-mail: global-sales@chint.com
Website: http://en.chint.com