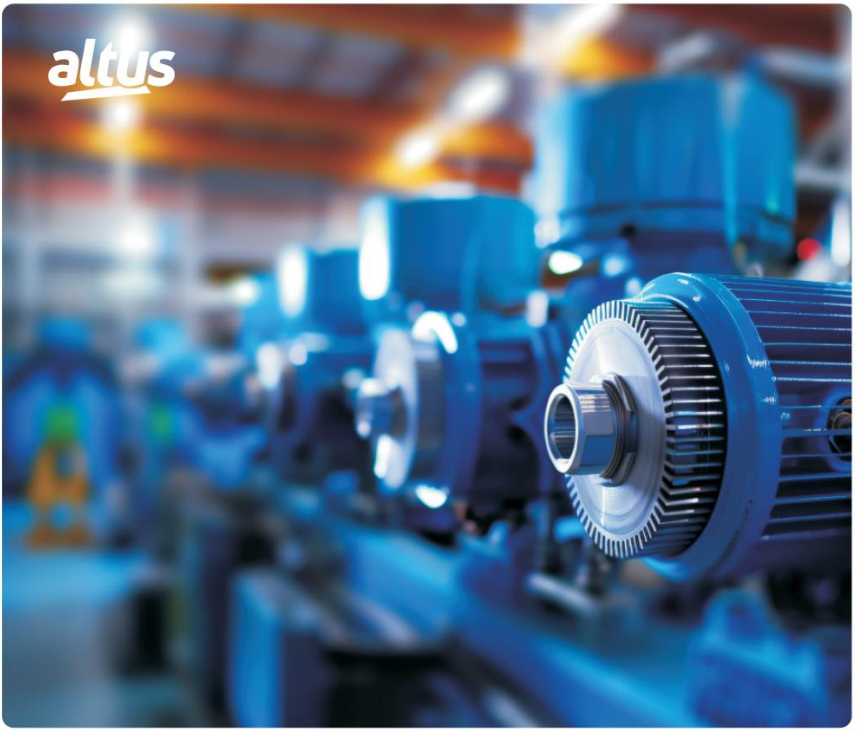


AC motor built in bypass soft starter

AS100 Series

User Manual



http://www.altus.com.br

Preface

SAFETY INSTRUCTIONS

- Before installing or operating this soft starter, please read and understand this manual. Only professionals can install, repair, and maintain the soft starter;
- Installation and maintenance operations should strictly follow this manual, relevant national standards, and industry practices. Otherwise, the manufacturer shall not be responsible for any adverse consequences caused by failure to operate in accordance with the corresponding guidance specifications;
- Before maintaining the soft starter or motor, all power inputs must be disconnected;
- After installation, carefully check and verify that no components (such as wire ends, screws, washers, etc.) have fallen into the live parts.

WARNING INSTRUCTIONS

- The control part of this product (including the triggering unit and the central processing unit control part) is equipped with dangerous voltage. The triggering unit has the same high voltage as the main circuit. If it is illegally touched, it will be very dangerous and may cause electric shock accidents;
- After connecting this product to the main power supply, even if the control voltage is disconnected or the starter is stopped, a full voltage signal for sampling will still appear at the output terminal of the soft starter;
- The product must be well grounded to ensure safe normal operation and prevent accidental electric shock injuries. Do not connect power factor compensation capacitors or varistors to the output terminal of the soft starter;
- When the soft starter and the frequency converter are mutually backup, the output terminals should be isolated from each other;
- Please do not modify the function parameter values arbitrarily. If you need to modify them, please complete them under the guidance of professional personnel, otherwise unexpected situations may occur.

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OVERVIEW

- This manual can help you solve any questions during use, install, debug, and use the product normally;
- In the case where the trademark and commercial ownership have been registered, our company reserves the final interpretation right of this document. Any unreasonable application, especially reproduction and publication by third parties, is not allowed;
- This manual has undergone rigorous preparation and review. If the user finds any errors, please inform us as soon as possible;
- The relevant parameters in the manual are only used to describe the product. In order to meet the needs of customers, our company is constantly improving our products to meet the latest technical standards.

SAFETY

- Users should pay attention to the warnings, information prompts, and notes mentioned in the manual;
- This low-voltage soft starter is only allowed to be installed or guided by qualified professional technicians;
- Incorrect connection of motors or soft starters may cause equipment damage and serious personal accidents. Users must strictly follow the operating procedures and relevant safety regulations in this manual;
- During use, the power and specifications of the load motor should be matched with the soft starter;
- It is strictly prohibited to connect capacitors to the output terminals (U, V, W) of the soft starter;
- The input and output connections of the soft starter should be wrapped with insulating tape;
- The shell of the soft starter must be reliably grounded;
- When repairing equipment, the power must be cut off first.

1. Product features and typical applications

This series of solid-state soft starters for AC motors is a new type of motor starting equipment designed and produced using power electronics technology, microprocessor technology, and modern control theory, which is at the forefront of international standards. This product can effectively limit the starting current of asynchronous motors during startup, and adopts a unique protection algorithm to effectively protect the motor and related equipment. It is widely used in loads such as fans, water pumps, conveyors, and compressors, and is an ideal replacement for traditional star/delta conversion, autotransformer voltage reduction, magnetic control voltage reduction, and other voltage reduction starting equipment.

Product Features

- Detecting load voltage and current to achieve dual closed-loop control, achieving smooth and vibration free starting of each load;
- Multiple starting methods to better match and adapt to the starting performance of various loads;
- Structural optimization: Adopting a unique and compact modular structure, it is very convenient for users to integrate the system;
- It has multiple protection functions: phase loss, reverse sequence, overcurrent, load, three-phase current imbalance, high current, thermal overload, undervoltage, overvoltage, etc., providing comprehensive protection for motors and related equipment;
- Has multiple control modes: keyboard, external control, communication, remote control (order declaration), etc; Floating ball and electric contact pressure gauge connection method;
- Having the function of grid shaking, it has stronger adaptability to poor quality power grids;
- Programmable digital input ports D1 and D2 can achieve functions such as reset, emergency stop, interlock control, start, stop, and jog;
- Programmable relays K2 and K3 have passive outputs, which can achieve outputs such as starting, running, soft stop, fault, thyristor fault, and current upper and lower limit feeding control;
- Real time transmission of 0~20mA/4~20mA analog output;
- Supports Modbus RTU fieldbus function, easy to network;

- The LCD Chinese display and operation keyboard enable human-machine dialogue, displaying real-time data of multiple motors and power grids, and supporting keyboard external input.

Typical applications

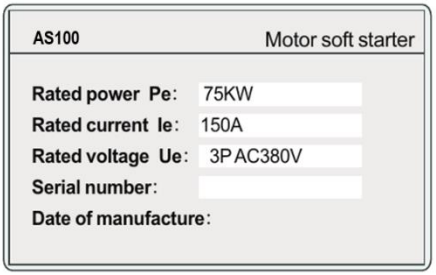
- Fan ------ reduce starting current, alleviate and reduce the impact on the power grid;
- Water pump ------ utilizing soft stop function to alleviate the water hammer effect of the pump and reduce pipeline impact;
- Compressor ------ Reduce mechanical shock during start-up and save on mechanical maintenance costs;
- Belt conveyor ------ achieves smooth and gradual starting through a soft starter, avoiding product displacement and material removal;
- Ball mill ------ reduces gear torque wear, reduces maintenance workload, and lowers maintenance costs.

This series of soft starters is widely used in various industries such as chemical, mining, construction, power transmission and distribution equipment, and hydropower.

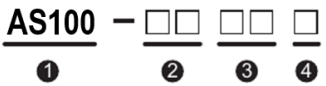
2. Product model and inspection

Each AS100 soft starter has all functions and running tests before leaving the factory. After receiving the equipment, please check the following steps. If you find a problem, please contact the supplier immediately. Check the product nameplate: Verify that the goods you receive match the products you ordered.

2.1 Nameplate



2.2 Soft start model



Name	Meaning
1	Product Name: Soft Starter Name
2	Adapted motor power: for example 075 means 75KW
3	Design number of soft starter
4	Product voltage rating: 3~380V

- Check if the product is damaged during transportation, such as: internal parts falling off, shell depression, deformation and connection Lines fall off and other issues.
- Product certificate and instruction manual: Each soft starter is accompanied by a product certificate and a manual.

3. Usage conditions and technical indicators

3.1 Conditions of Use

The conditions of use have an effect on the normal use and life of the soft starter, so install the soft starter in a location that meets the following conditions of use. Product use conditions:

- Power supply: mains power, self owned power station, diesel generator set;
- Three phase AC: AC380V (-10%,+15%), 50Hz; (Note: The voltage level is selected based on the rated voltage of the motor. For special voltage levels of AC660V or AC1140V, please specify when placing an order)
- Applicable motors: general squirrel cage asynchronous motors;
- Bypass contactor: When using an external bypass type soft starter, a bypass contactor should be connected. Online and built-in bypass types do not require additional bypass contactors;
- Starting frequency: Standard products are recommended to start and stop no more than 6 times per hour;
- Cooling method: bypass type: natural air cooling; Online type: forced air cooling;
- Installation method: wall mounted;
- Protection level: IP00;

3.2 Technical indicators

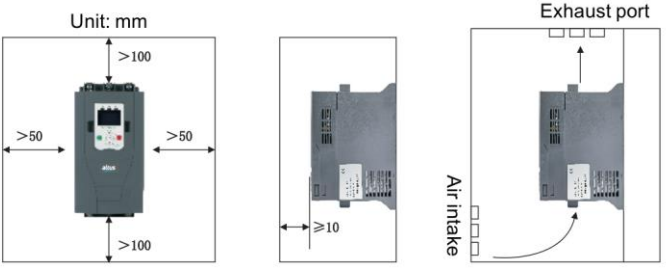
Item	Description
Three-phase power supply	AC 380/660/1140V (-10%, +15%) 50/60Hz
Start mode	Voltage ramp, voltage acceleration ramp, current ramp, current acceleration ramp, etc
Parking method	Soft parking, free parking
Protection function	Input phase loss, output phase loss, power reverse sequence, startup timeout, overvoltage, overcurrent, undervoltage, underload, phase current imbalance, high current, thermal overload, parameter loss, thyristor overheating, interlock abnormality, internal fault protection, etc
Input	Start, stop, programmable D1, D2
Output	Bypass K1, programmable relays K2, K3
Analog Output	1 channel 0~20mA/4~20mA analog output real-time transmission
Communication	Modbus RTU
Starting frequency	Starting times per hour ≤ 6 times
Cooling method	Natural cooling or forced air cooling
Installation method	In order to ensure good ventilation and heat dissipation conditions during use, the soft starter should be installed vertically.
Altitude	If the altitude is below 2000 meters, the capacity should be reduced if exceeded
Ambient temperature	The ambient temperature is between -25 ℃and+40 ℃

Item	Description
Humidity	Relative humidity not exceeding 90% (20 ℃± 5 ℃), no condensation, no flammable, explosive, corrosive gases, no conductive dust
Vibrate	Vibration less than 0.5G

4. Installation requirements

4.1 Installation direction and distance

In order to ensure good ventilation and heat dissipation conditions during use, the soft starter should be installed vertically and leave sufficient heat dissipation space above and below the equipment, As shown in the following figure. Due to its front and rear openable structure, the cabinet type product should have a certain distance between the rear door and the wall for easy maintenance, if conditions permit.



4.2 Installation inside the cabinet

When the soft starter needs to be installed in the distribution cabinet, a well ventilated cabinet must be selected. The soft starter can be installed in a horizontal layout as shown in Figure 4-1 inside the cabinet. Vertical layout installation as shown in Figure 4-2 can also be used.

Note: When installing in a vertical layout (especially for soft starters with forced air cooling), an air guide partition should be added between the upper and lower installed soft starters to prevent the heat from the lower soft starter from affecting the upper soft starter.



Horizontal Layout Installation

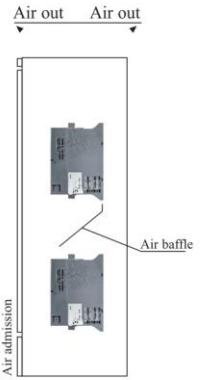


Fig.4-2 Vertical Layout Installatic

5. Working principle

The AS100 motor soft starter uses three pairs of anti-parallel thyristors connected in series to the stator circuit of the AC motor. By using the electronic switch function of the thyristor, the degree of opening of the thyristor is changed by controlling the change of the firing angle, thus changing the input voltage of the motor to achieve the purpose of controlling the soft start of the motor. The soft starter output reaches the rated voltage when the start is completed. At this time, the bypass control signal will be used to automatically control the three-phase bypass contactor KM to pull the motor into the grid, as shown in Figure 5-1.

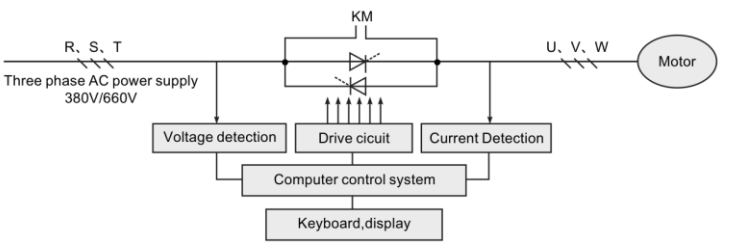


Fig. 5-1

6. Basic wiring and external terminals

6.1 Online 5.5kW~37kW, built-in bypass 5.5kW~22kW:

6.1.1 Basic wiring diagram

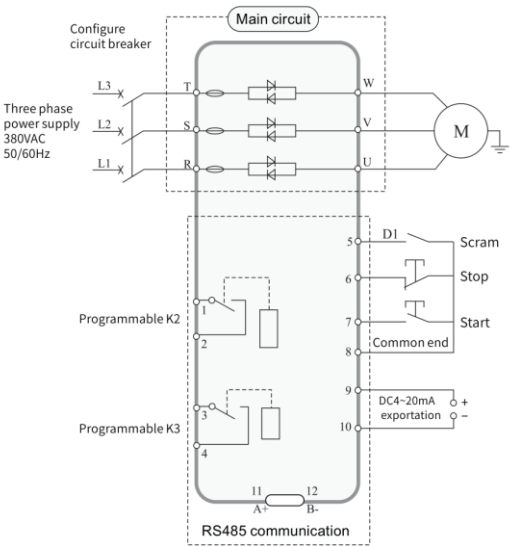


Fig. 6-1 Online

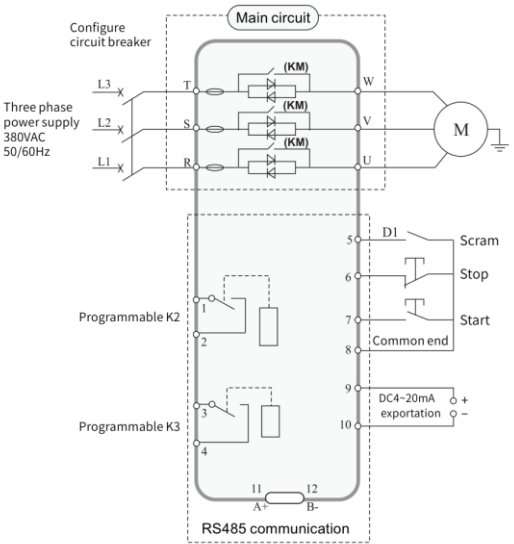


Fig. 6-2 Built-in bypass

6.1.2 Basic wiring diagram

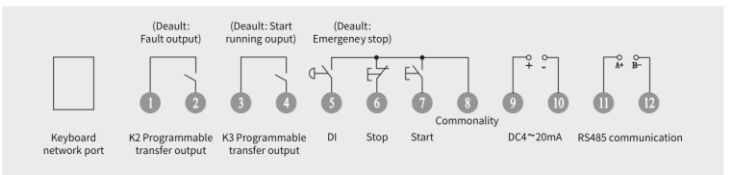


Fig. 6-3

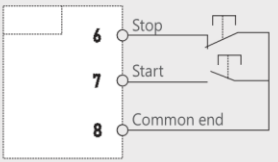
6.1.3 External Terminal Description

Terminal description	No.	Terminal name	Explain
Main circuit	R.S.T	AC power input terminals	Three phase AC power supply through circuit breaker (QF)
	U.V.W	Soft starter output terminal	Connecting three phase asynchronous motor
	L11.L12.L13	Special terminal for external bypass contactor	Refer to figure 6-1 for wiring method

Terminal description	No.	Terminal name	Explain
Relay output	①②	Normally open – Programmable output terminal K2 (Factory default fault output) ★ Note 2	Contact capacity 5A/250VAC 5A/30VDC
	③④	Normally open – Programmable output terminal K3 (Factory default start/run output) ★ Note 2	Contact capacity 5A/250VAC 5A/30VDC
Digital input	⑤	D1 programmable (factory default emergency stop)	Refer to Parameter Definition No. 28 for details
	⑥	External control stop terminal	⑥Disconnect from ⑧to stop external control
	⑦	External control starting terminal	⑦Close with ⑧to start the external control
	⑧	Control signal common terminal	Internal power parameter points
Analog output	⑨I+	4~20mA output. Load input impedance ≤400 Ω	At 4~20mA: Im=Ie (I-4)/8 — Im: motor output current (A); Ie: rated current of motor (A); I: output current (mA)
	⑩I-	4~20mA output reference point	
Communication	⑪A+	485 communication terminal A	RS485 communication (MODBUS RTU communication protocol)
	⑫B-	485 communication terminal B	

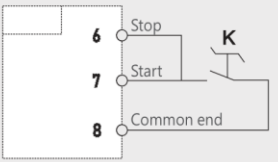
- Note 1: Programmable output terminals K2 and K3 are both passive output terminals;
- Note 2: The output of programmable relays is related to the setting of the parameter "Programmable Relay Function". Please refer to parameters 30~33 in 9-1 for details;
- Note 3: There are three wiring methods for external control start stop signals.

Three-wire control system



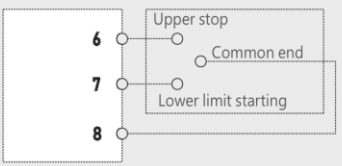
Control terminal conductor0.75~1.25mm^2

Two wire control or float control



Kclosed to start running,Disconnect to stop

Electrical contact pressure control



6 Parameter set to 9

6.2 Online type 45kW~800kW, external bypass type 5.5kW~800kW, internal bypass type 30kW~400kW:

6.2.1 Basic wiring diagram

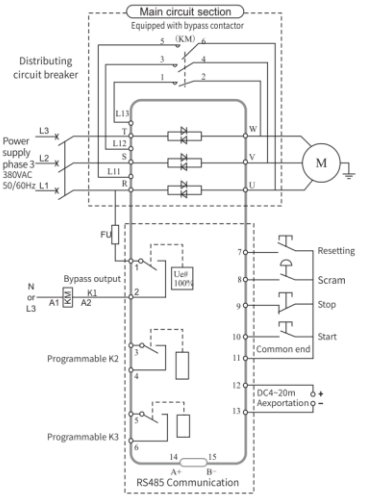


Fig. 6-4 Bypass type

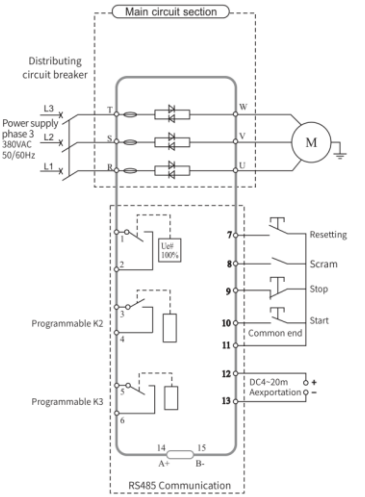


Fig. 6-5 In line form

6.2.2 Basic wiring diagram

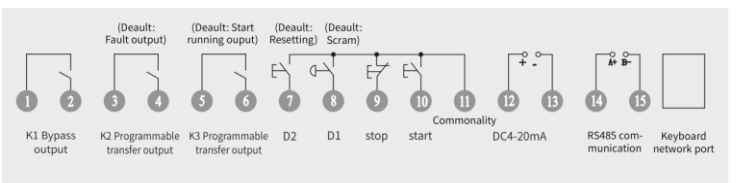


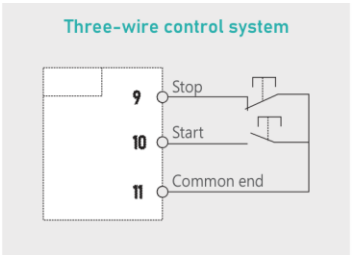
Fig. 6-6

6.2.3 External Terminal Description

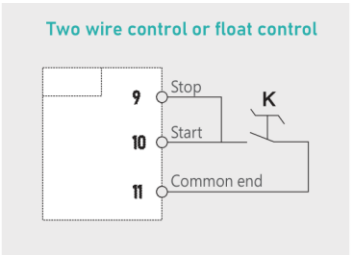
Terminal description	No.	Terminal name	Explain
Main circuit	R.S.T	AC power input terminals	Three phase AC power supply through circuit breaker (QF)

Terminal description	No.	Terminal name	Explain
	U.V.W	Soft starter output terminal	Connecting three phase asynchronous motor
	L11.L12.L13	Special terminal for external bypass contactor	Refer to figure 6-4 for wiring method
Relay output	①②	Normally open – External bypass contactor control terminal K1 ★ Note 1	After startup is completed: ①-②Close; Contact capacity: 10A/277VAC, 12A/125VAC
	③④	Normally open – Programmable output terminal K2 (Factory default fault output) ★ Note 2	Contact capacity 10A/277VAC 12A/125VDC
	⑤⑥	Normally open – Programmable output terminal K3 (Factory default start/run output) ★ Note 2	Contact capacity 10A/277VAC
Digital input	⑦	D2 Programmable (Factory default external control fault reset terminal)	Refer to Parameter Definition No. 29 for details
	⑧	D1 programmable (factory default emergency stop)	Refer to Parameter Definition No. 28 for details
	⑨	External control stop terminal	⑨Disconnect from ⑪to stop external control
	⑩	External control starting terminal	⑩Close with ⑪to start the external control
	⑪	Control signal common terminal	Internal power parameter points
Analog output	⑫I+	4~20mA output. Load input impedance ≤400 Ω	At 4~20mA: Im=Ie (I-4)/8 — Im: motor output current (A); Ie: rated current of motor (A); I: output current (mA)
	⑬I-	4~20mA output reference point	
Communication	⑭A+	485 communication terminal A	RS485 communication (MODBUS RTU communication protocol)
	⑮B-	485 communication terminal B	

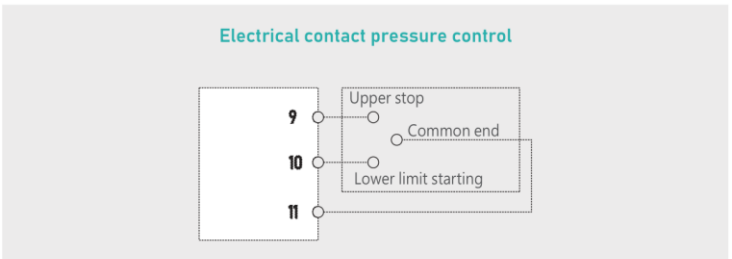
- Note 1: The programmable output terminals K1, K2, and K3 are all passive output terminals;
- Note 2: The output of the programmable relay is related to the settings of the "Programmable Relay Function", as described in 9-1 from parameters 30 to 33;
- Note 3: Parameter 06: External control valid, indicating that there are three wiring methods for the external control start/stop signal.



Control terminal conductor0.75~1.25mm²



K closed for starting operation, open for stopping



6 Parameter set to 9

7. Starting and stopping methods

7.1 Voltage ramp, voltage acceleration ramp soft start mode

Indicates the initial voltage output by the soft starter when starting, When the motor starts, the output voltage of the soft starter rises rapidly to U1,Then gradually rise at the set time T, The motor accelerates continuously with the rise of voltage, and when the voltage reaches the incoming line voltage Ue, The motor reaches the rated speed, Starting process complete, Initial voltage U1 and Starting time t Can be set according to the load, The setting range of U1 is (25~80%) Ue, The setting range of t is 1-120 seconds. When the voltage acceleration ramp is set, the voltage is increased by acceleration before entering the current limiting stage.

The voltage ramp starting mode is suitable for large inertial load, or the starting current is not strict, but the starting stability is required. This starting mode can

greatly reduce the starting impact and mechanical stress. The larger the initial voltage U1 is, the larger the initial starting torque is, but the larger the starting instant impact is. When the voltage ramp starting mode is adopted, the length of the starting process is related to the setting value of the starting time and the weight of the load, but has nothing to do with the current limiting multiple.

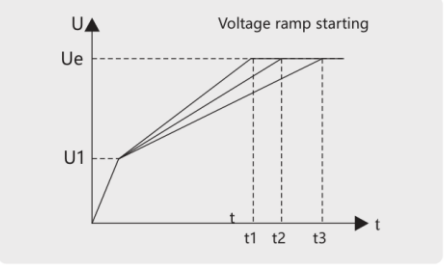


Fig. 7-1

7.2 Current ramp, current acceleration ramp soft start mode

In the current ramp starting mode, when the motor starts, its output voltage value rapidly increases until the output current reaches the set current limit value Im, as shown in Figure 7-2. And maintain the output current not greater than this value, gradually increase the voltage, and gradually accelerate the motor.

When the motor approaches the rated speed, the output current quickly drops below the rated current Ie, completing the starting process. The current limit amplitude can be set according to the actual load situation, with a range of 1-5 times the rated current Ie of the motor. When set as a current acceleration ramp, after starting, the current accelerates and rises until entering the current limiting stage.

The current ramp mode is generally used in situations where strict requirements are placed on the starting current, especially when the grid capacity is small and the starting capacity needs to be limited. The current limiting factor can be set according to the requirements, usually at 2 Between 5-4 times, setting too small may also cause abnormal startup. When using current limiting starting, the starting time is related to the current limiting multiple. The larger the current limiting multiple, the shorter the starting time, and vice versa.

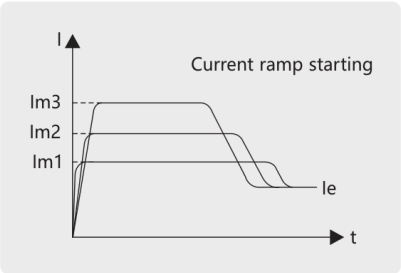


Fig. 7-2

7.3 Point operation mode (When the input mode D1 and D2 is changed to tap)

Under the control of this mode, the output voltage of the soft starter is rapidly increased to the point voltage U1 and is protected unchanged. By changing the set value of U1, the output voltage and output torque of the motor can be changed when it is started (Figure 7-3). This function is very convenient for the test to judge the motor steering or the positioning of some loads.

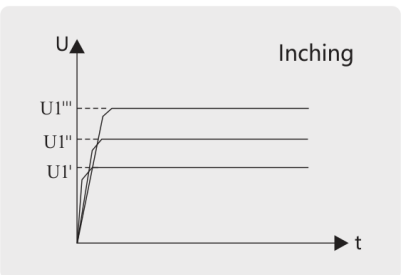


Fig. 7-3

7.4 Voltage ramp + jump starting mode (08 Parameter: When the jump time is not 0)

Voltage ramp + jump starting is to apply a high fixed voltage to the motor at the beginning of the starting stage and maintain the set time, and then start the motor in accordance with the voltage ramp. This method can overcome the

static friction force of the motor load and make the motor start smoothly. Figure 7-4 shows the waveform of the voltage ramp + jump starting mode.

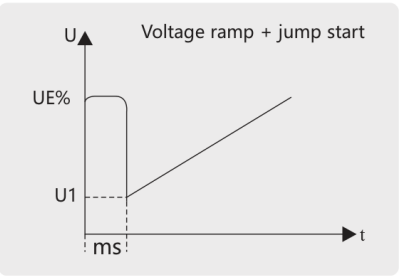


Fig. 7-4

7.5 Parking mode

This series of soft starter has two kinds of parking modes: free parking and soft parking. Users can choose and set according to the requirements of load and working conditions.

Free parking

When the stop command is received, the soft starter issues the command to disconnect the bypass contactor (bypass type) and block the output of the main circuit thyristor, and the motor stops gradually according to the inertia of the load.

Soft stop

In this stopping mode, after receiving the soft stop instruction, the power supply of the motor is switched from the bypass contactor (bypass type) to the main circuit thyristor, and the output voltage of the soft starter gradually decreases until the motor stops running.

The stop time is related to the load and the set value of "soft stop time". For different loads, the user needs to modify the set value of "soft stop time" accordingly in debugging to achieve smooth soft stop of the motor.

8. Keyboard operation

8.1 Operating keyboard instructions

The soft starter of this series can operate the soft starter through an operation keyboard with LCD display function. These operations include: data display, data setting storage, data query, fault protection display, fault reset, motor start and stop control, etc. The structure of the display keyboard is shown in Figure 8-1.

Opening size: (Wide)60*(High)93mm

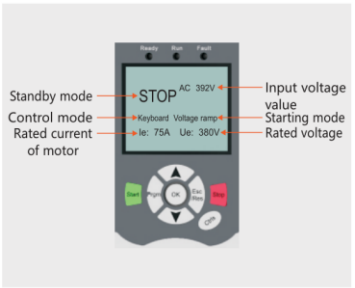


Figure 8-1a Standby mode

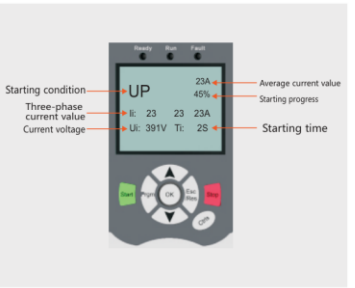


Figure 8-1b Starting condition



Figure 8-1c Running state



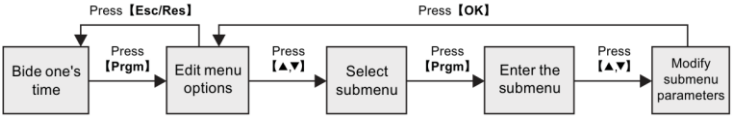
Figure 8-1d Fault state

8.2 Key description

Button	Function Description
Start	Starting motor, control mode setting and terminal wiring are reasonable and effective
Stop	Stop motor

Button	Function Description
Prgm	In standby mode, press this key to enter the Edit menu, and then press this key to enter the parameter options
▲	Parameter value increment key, parameter value increment key
▼	Parameter decrement key, parameter value decrement key
OK	After parameters are modified, press this key to save the parameter data and return to the menu editing state
Esc/Res	When editing menu options, press this key to exit and return to standby. When a fault is displayed, hold down this key for more than 2 seconds to reset the fault.
Ctrls	06 Parameter: One-click quick switching control mode

8.3 Parameter modification keyboard operation method



9. Function parameter table

9.1 Parameter list

No.	Main menu LCD display	Submenu LCD display	Set range	Factory default	Parameter description
00	Motor Ie		5~9999A	---	ADAPTS the rated current of the motor
01	Start mode	0.Volt Peace 1.Volt Speed 2.Curr Peace 3.Curr Speed	0~3	0	0.Voltage Peace ramp 1.Voltage Speed ramp 2.Current Peace ramp 3.Current Speed ramp
02	Start level		25~80%	40	Initial starting voltage/current value
03	Ramp time		1~120s	10	Voltage acceleration time
04	limit level		100~500%	350	The maximum current percentage relative to the rated current of the motor during the starting process
05	stop time		0~30s	0	When set to 0, it is free parking
06	Control	0.Keyboard 1.Extern 2.Key+Ext 3.Com 4.Key+Com 5.Key+Ext+Com 6.Wireless 7.Key+E+C+W 8.Electric 9.Disable	0~9	2	0.Keyboard 1.Extern 2.Key+Ext 3.Communicate 4.Key+Com 5.Key+Ext+Com 6.Wireless (Order declaration) 7.Key+E+C+W 8.Electric 9.Disable

No.	Main menu LCD display	Submenu LCD display	Set range	Factory default	Parameter description
07	Pulse level		50~100%	80	Sudden jump voltage value
08	Pulse time		0~9999mS	0	Jump duration
09	Delay time		0~999s	0	Start countdown
10	Time limit		5~120s	60	Maximum starting time
11	Time Period		0~60min	0	=0 No-start interval. After the motor is started, the starting interval timer is put into operation. When the stopping time exceeds the set interval time, the next start can be performed. Otherwise, it cannot be started and the over-frequency fault of starting is reported.
12	Overcurrent		50~800%	150	Current protection value during operation. =50 Disable overcurrent protection
13	Over I Time		0~60s	2	Delay the protection time when overcurrent occurs during operation
14	I Imbalance		10~100%	40	=100 Disable phase current unbalance detection. Current unbalance degree =(Imax-Imin)*2/Ip, Among them, Imax is the largest current value in the three phases, Imin is the smallest current value in the three phases, and Ip is the average value of the three phases. After the motor starts, when the current imbalance reaches the set value and lasts for parameter 15 time, the soft start stops and reports the fault of the over-phase current imbalance. Note: After starting, when the average current Ip>3A, the current unbalance degree is detected.
15	Imbalance T		0~60s	2	Delay protection time when current imbalance occurs during starting and running
16	Over curve		0~4	2	0.10A 1.10 2.20 3.30 4.OFF — See Chapter 13 for details
17	Sequence		0~1	0	=0 Off; =1 ON: The power supply can be started only when the phase sequence of the power supply meets the "U, V, W" phase sequence
18	Lesscurrent		30~100%	100	=100 Turn off the underload protection motor after operation. When the motor current value is lower than the set underload protection value and continues to parameter 19 value, the soft stop and underload fault is reported.
19	Less I Time		0~60s	2	Delay protection time of underload (see parameter 18)
20	Phasic Time		0~5s	1	=0 Turn off the shock protection. After the motor starts, when the power grid continuous phase loss time exceeds the set, the soft start stops and reports the phase loss fault. Mainly for the poor quality of the power grid field use.

No.	Main menu LCD display	Submenu LCD display	Set range	Factory default	Parameter description
21	Big current	=0 OFF =1 ON	0~1	1	=0 OFF =1 ON. Starting current over 5.5Ie, duration over 200ms, high current protection
22	SCR Protect	=0 OFF =1 ON	0~1	0	=0 OFF =1 ON. Thyristor fault refers to the two thyristors through with No. 30, No. 32 parameters, used to control the upper end circuit breaker trip
23	HOT Protect	=0 OFF =1 ON	0~1	1	=0 OFF =1 ON. Overheating refers to the temperature of the thyristor radiator is too high
24	Less voltage		30~100%	70	=30 Turn off the undervoltage protection
25	Over voltage		100~150%	130	=150 Turn off overvoltage protection
26	Voltage Time		0~60s	2	Delay protection time when undervoltage occurs
27	Language	0. Chinese 1. English	0~1	0	0. Chinese 1. English
28	D1 Function	0. Reset 1. EMER Open 2. EMER Close 3. Chain 4. Start 5. Stop 6. Point 7. Fire Mode	0~7	7	0. Reset 1. Scram Open 2. Scram Close 3. Chain 4. Start 5. Stop 6. Point. =0: If the soft starter is faulty, short-circuit D1 and COM to reset the fault. =1: When the soft start is in the start, running, or soft stop state, short-connect D1 and COM. The soft start is in the emergency stop state immediately, and the emergency stop is displayed. =2: When the soft start is in the start, running, or soft stop state, disconnect D1 from COM, and the soft start is immediately in the emergency stop state, indicating emergency stop. =3: When D1 and COM are not short-circuited, if there is an effective starting signal, the soft start will report the chain control fault, and the chain control is valid when D1 and COM are closed. 7. Fire Mode (see Chapter 15).
29	D2 Function	0. Reset 1. EMER Open 2. EMER Close 3. Chain 4. Start 5. Stop 6. Point	0~6	0	0. Reset 1. Scram Open 2. Scram Close 3. Chain 4. Start 5. Stop 6. Point. =0: If the soft starter is faulty, short-circuit D2 and COM to reset the fault. =1: When the soft start is in the start, running, or soft stop state, short-connect D2 and COM. The soft start is in the emergency stop state immediately, and the emergency stop is displayed. =2: When the soft start is in the start, running, or soft stop state, disconnect D2 from COM, and the soft start is immediately in the emergency stop state, indicating emergency stop. =3: When D2 and COM are not short-circuited, if there is an effective starting signal, the soft start will report the chain control fault, and the chain control is valid when D2 and COM are closed.

No.	Main menu LCD display	Submenu LCD display	Set range	Factory default	Parameter description
30	K2 Function	0. Run 1. Start 2. Softstop 3. Start+Run 4. Fault 5. SCR fault 6. Power up 7. I control	0~7	4	0. Run stage 1. Start stage 2. Softstop stage 3. Output when starting, running, soft stop state 4. Fault 5. SCR fault (Match parameter 22) 6. Power up 7. I control (For details, see parameters 38 and 39)
31	K2 delay		0~999s	0	---
32	K3 Function	0. Run 1. Start 2. Softstop 3. Start+Run 4. Fault 5. SCR fault 6. Power up 7. I control	0~7	3	0. Run stage 1. Start stage 2. Softstop stage 3. Output when starting, running, soft stop state 4. Fault 5. SCR fault (Match parameter 22) 6. Power up 7. I control (For details, see parameters 38 and 39)
33	K3 delay		0~999s	0	---
34	Address		1~64	1	---
35	Baud rate		0~2	1	0. 4800 1. 9600 2. 19200
36	Com Format	0. None 1 1. None 2 2. Odd Parity 1 3. Even Parity 1	0~3	0	0. None 1 1. None 2 2. Odd Parity 1 3. Even Parity 1
37	Frequency	0.50Hz 1.60Hz	0~1	0	0. 50Hz 1. 60Hz
38	I upper		10~300%	80	For the start and stop control of the "feeder": its working principle is to determine whether to run or stop the feeding mechanism by the size of the current of the crusher. When the current is less than the "lower current limit" and continues to reach the "programmable relay output delay", the relay closes and informs the feeder to run; When the current is greater than the "upper current limit" and continues to reach the "programmable relay output delay", this relay is disconnected and the feeder is notified to stop.
39	I lower		10~300%	40	See parameter 38
40	Debugging	0. No Operation 1. Parm Reset 2. Test Mode	0~2	0	0. No Operation 1. Parm Reset 2. Test Mode
41	Point Vol		25~80%	30%	---
42	Point Time		5~60s	10s	---
43	MA Setup	0. 0~20mA 1. 4~20mA	0~1	1	0. 0~20mA 1. 4~20mA (20mA = 2Ie)
44	Version		100~999	---	Motherboard software version
45	Machines Ie		15~9999A	---	*User unmodifiable
46	Machines Ue		110~1500	---	*User unmodifiable
47	Soft type	0. Out-Bypass 1. In-Bypass 2. On-Line	0~2	---	0. Out-Bypass 1. In-Bypass 2. On-Line *User unmodifiable

No.	Main menu LCD display	Submenu LCD display	Set range	Factory default	Parameter description
48	I ratio		1~1000	---	When there is a deviation between the displayed current and the actual current value, the value can be modified, and the display will increase when the value is turned up and decrease when the value is turned down
49	U ratio		100~1500	1000	---
50	Ma ratio		100~1500	1000	---
51	I zero cut		1~10	5	Rated current * The current below this value /100 is displayed as 0, and the minimum soft-start display current is 5A
52	Inby-online	=0 OFF =1 ON	0~1	0	=0 OFF =1 ON
53	Run number		0~9999	---	---
54	Run time		0~99999H	---	---
55	Err number		0~9999	---	---
56~60	Err record 1~5		0~22	---	---
61	Manufactur		0~9999	---	*User unmodifiable
62	Manufactur		0~9999H	---	*User unmodifiable
63	Restore		0~9999	---	*User unmodifiable
64	Manufactur		0~9999	---	*User unmodifiable
65	Moto Hot			---	After the online operation stops, the cooling fan delays closing time
66	Fan Ontime			---	In bypass mode, the delay time K1 is closed
67	Point			---	---
68	Fan Offtime		0~5Min	1Min	---
69	Bypass time		0~60s	3s	---

9.2 Real-time parameter

Name	Symbol	Instructions	Address
State	---	Current soft startup status, including stop, fault, edit, start, run, etc	116
R-phase current	Ir	Motor R phase current	117
S-phase current	Is	Motor S phase current	118
T-phase current	It	Motor T phase current	119
Average current	Ip	Average current of motor	120
Rated current of motor	Ie	Rated current of motor	121

Name	Symbol	Instructions	Address
Voltage value	Ui	BC voltage value	122
Output voltage value	Uo	Percentage of the voltage output after starting	124
Fault code 1	E1	After power-on, the last fault code	125
Start countdown	Td	After setting the start delay, start countdown time	126

10. Fault protection and display

This series of soft starters has multiple protection functions. When the fault protection function of the soft starter is activated, the soft starter immediately stops, and the LCD operation keyboard displays the fault type in English. Users can analyze and handle the fault according to the corresponding cause. Do not blindly rush to reset and restart. After troubleshooting, you can reset it by pressing the "Esc/Res" button on the keyboard or by the external control terminal. Return the soft starter to standby mode, as shown in Table 10-1.

10.1 Fault display and solution

No.	LCD display	Fault Reason	Solution
01	Power lose	1. Phase loss in the power grid; 2. The power supply incoming line is not reliably connected.	1. Check whether the power grid and soft starter incoming lines are reliably connected
02	Output lose	1. The motor is not connected reliably; 2. Thyristor breakdown condition; 3. The contactor is stuck (Bypass type).	1. Check whether the motor is reliably connected; 2. Use a multimeter to check whether there is a thyristor breakdown; 3. Check whether the contactor is stuck.
03	Phase Reverse	The phase sequence is incorrect	Adjust any two incoming wires
04	Start overtime	The starting time is too long	Adjust the starting parameters and restart, focusing on the initial voltage, current limiting multiple and other parameters
05	Over current	1. The operation parameter setting is not reasonable; 2. The load instability suddenly increases.	1. Based on the actual load situation, check whether the overcurrent parameter Settings are reasonable; 2. If the load has the characteristics of continuous increase, the overcurrent time can be adjusted appropriately.

No.	LCD display	Fault Reason	Solution
06	Lose load	The load is light	Adjust underload and other parameters to adapt to the load condition
07	Current Imbalance	1. The setting of unbalance parameters is unreasonable; 2. The motor is abnormal.	1. Readjust parameters; 2. Check the motor.
08	Big current	The motor is blocked and the load is stuck	Check motor and load system
09	Hot overload	1. Parameter setting is not reasonable; 2. Heavier load.	1. Check whether the rated current of the motor and the electronic thermal overload curve match the load type; 2. Adjust the value of electron thermal overload curve appropriately.
10	Parameter Lose	1. The field interference is large; 2. The internal soft chip is abnormal.	After the fault occurs, power it on again. If the fault persists, contact the distributor or manufacturer.
11	SCR Overheat	Overload	Check whether the starting time is very long. If so, adjust the starting parameters according to the load type.
12	SCR fault	An internal soft-lift exception occurs	Please contact the distributor or manufacturer
13	Chain Error	Chain signal error	Check whether the soft start of the chain signal cable is correct
14	Inside Error	An internal soft-lift exception occurs	Please contact the distributor or manufacturer
15	Over voltage	1. The real-time parameter display is not consistent with the grid voltage; 2. The parameters are not properly set.	1. Check whether the grid voltage is consistent with the real-time parameter display; 2. Reset the parameter values according to the network conditions.
16	Less voltage	1. The real-time parameter display is not consistent with the grid voltage; 2. The parameters are not properly set.	1. Check whether the grid voltage is consistent with the real-time parameter display; 2. Reset the parameter values according to the network conditions.
17	Start Often	The starting interval is less than the set value	Check whether the parameters and setting interval are reasonable

11. Trial operation of the equipment

In order to operate safely, the following checks should be carried out before power-on:

- The soft starter shell is grounded reliably？

- Whether the soft starter power is consistent with the motor power？
- Motor insulation meets the requirements？
- Main circuit input and output wiring is correct？
- All connection nuts are tight？
- Use a multimeter to check the three-phase power supply（R. S. T)Whether there is a short circuit？

Power-on trial run

- When the soft starter is powered on, the standby state displayed on the operating keyboard indicates that everything is normal, and the liquid crystal display indicates the starting mode of the soft starter. Different starting modes can be selected according to the specific load type.
- Under normal conditions, press 【Start】 to start the motor. After the motor starts, the operating keyboard displays the actual current when the motor starts or runs in bypass mode. In the running condition, press the 【Stop】 key to stop the machine and make the soft starter return to the standby state.
- During the test run, if the external control operation is used, you need to press 【Ctrls】 key or set "06: Control" to "external control" or "External control + keyboard".
- When the output end of the soft starter is not connected to the motor, the above starting and stopping operation tests can also be carried out, so as to preliminarily check whether the wiring of the secondary control loop such as system operation, bypass contactor switching and various indicators is correct.

Trial operation precautions and safety

- If a fault protection occurs during the power-on and running process, the fault protection code is displayed, as shown in Table 10-1. Handle the fault as prompted.
- Warning: After the soft starter is powered on, do not open the boot cover to avoid electric shock.
- Warning: In the process of trial operation, if abnormal phenomena are found, such as abnormal starting sound of the motor, abnormal sound of

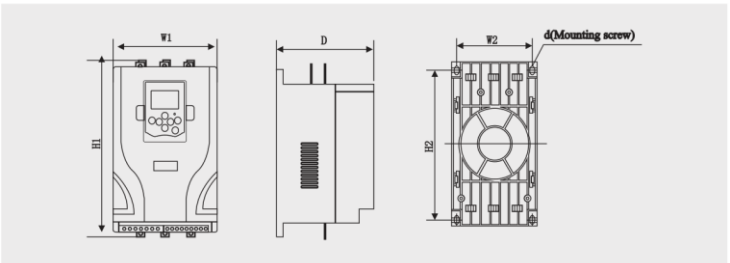
the soft starter, smoke or odor should be stopped quickly, cut off the power supply, and check the cause.

- When the soft starter output is not connected to the motor, the U. V.W threephase induction voltage is normal, and the induction voltage can disappear after the motor is connected.
- In the process of trial operation, if the motor starting state is not ideal, it can be modified according to the starting mode and current, voltage, time and other parameters in Chapter 9.

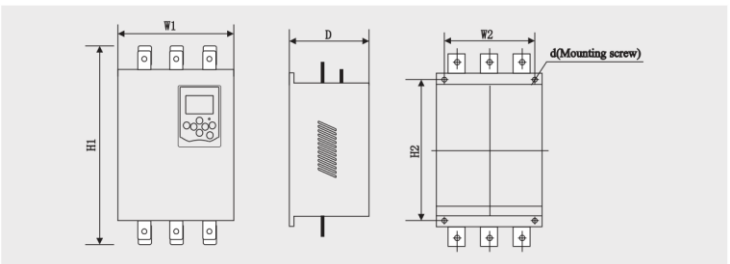
12. Product size

12.1 External bypass structure and dimensions

◆ **5.5kW~75kW (Fig. 12-1)**



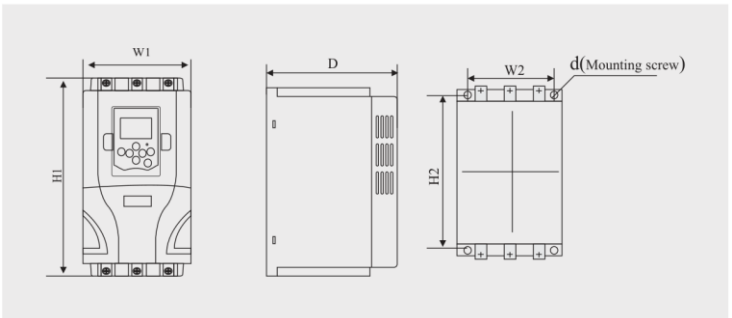
◆ **90kW~800kW (Fig. 12-2)**



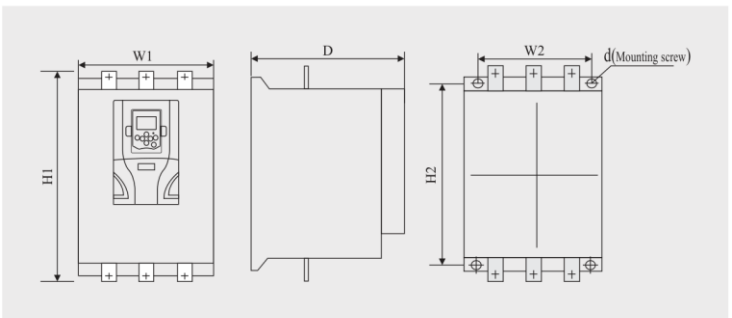
Rated Power (kW)	Outline Dimension (mm)			Install Dimension (mm)			External drawing
	H1	W1	D	H2	W2	d	
5.5~75(light)	285	146	163	250	133	M6	Fig.12-1
75	300	150	175	260	126	M6	Fig.12-1
90~220	435	260	204	360	225	M8	Fig.12-2
250~350	460	290	204	390	255	M8	Fig.12-2
400~500	480	330	204	405	295	M8	Fig.12-2
630~800	620	420	214	550	380	M10	Fig.12-2

12.2 Built in bypass structure and external dimensions

◆ **5.5kW~45kW (Fig. 12-3)**



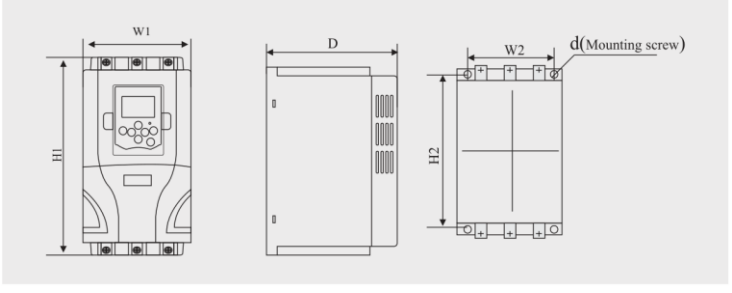
◆ **55kW~630kW (Fig. 12-4)**



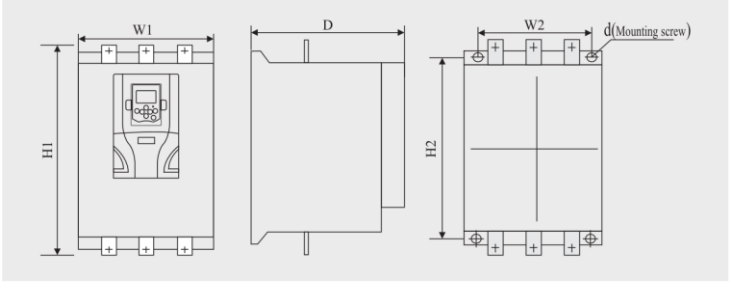
Rated Power (kW)	Outline Dimension (mm)			Install Dimension (mm)			External drawing
	H1	W1	D	H2	W2	d	
5.5~22	240	106	176	218	75	M5	Fig.12-3
30~75	295	143	190	278	110	M6	Fig.12-3
90~220	513	260	235	460	206	M8	Fig.12-4
250~400	577	300	235	525	246	M8	Fig.12-4

12.3 Online structure and external dimensions

◆ **5.5kW~45kW (Fig. 12-5)**



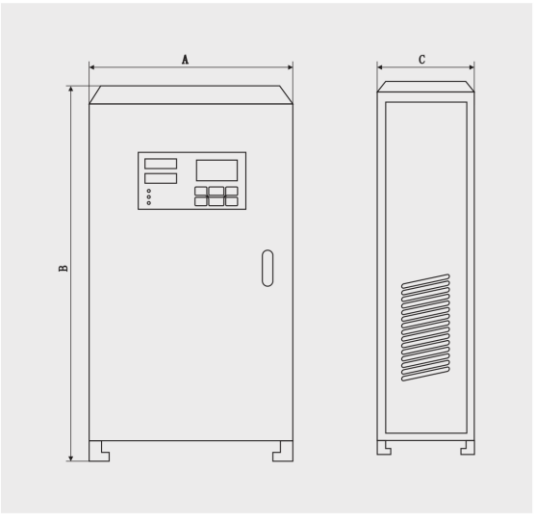
◆ **55kW~630kW (Fig. 12-6)**



Rated Power (kW)	Outline Dimension (mm)			Install Dimension (mm)			External drawing
	H1	W1	D	H2	W2	d	
5.5~37	240	106	176	218	75	M5	Fig.12-5
45~75	295	143	190	278	110	M6	Fig.12-5

Rated Power (kW)	Outline Dimension (mm)			Install Dimension (mm)			External drawing
	H1	W1	D	H2	W2	d	
90~115	350	200	225	300	140	M8	Fig.12-6
132~200	430	230	225	370	170	M8	Fig.12-6
220~350	480	466	270	430	335	M8	Fig.12-6
400~500	550	466	295	500	335	M8	Fig.12-6
630~800	650	620	320	650	560	M10	Fig.12-6

12.4 Motor soft starter cabinet dimensions



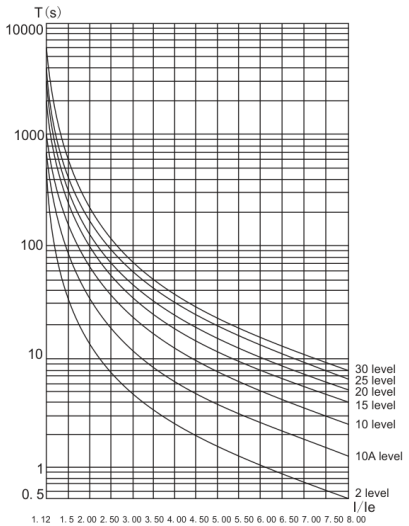
Rated Power (kW)	Outline Dimension (mm)		
	A (Wide)	B (High)	C (Deep)
7.5~115	300	850	300
132~200	450	1100	400
250~400	600	1460	500
450~800	600	1700	500

13. Motor overload inverse time protection characteristics

The starting and running process of the soft starter has overload protection function.

- Starting overload is divided into 6 levels, and the factory value is 4 (corresponding to level 15 of the IEC60947-4-2 standard). Can be set according to the load requirements, the smaller the level, the shorter the protection action time, vice versa, the longer.
- The operating overload is level 2 (Level 10A corresponding to the IEC60947-4-2 standard). For details, see Table, Fig.13-1 and IEC60947-4-2 standard curves.

Electronic thermal overload parameter value	Corresponding curve	6Ie	5Ie	4Ie	3Ie	2Ie	1.5Ie	1.2Ie	1.05Ie
0	10A level	2.6s	4s	6s	12s	30s	80s	350s	3600s
1	10 level	5s	8s	13s	22s	60s	180s	500s	3600s
2	20 level	10s	15s	25s	46s	140s	360s	1800s	3600s
3	30 level	15s	20s	30s	57s	170s	500s	1800s	3600s



IEC60974-4-2 Motor hot state protection curve

14. RS485 Communication protocol

The motor soft starter provides RS485 communication interface, and adopts international standard Modbus communication protocol for master/slave communication. Users can achieve centralized control through PC/PLC, control host computer, etc., to adapt to specific application requirements.

14.1 Agreement content

The Modbus-Rtu serial communication protocol defines the frame content of asynchronous transmission in serial communication and the format of the slave answer frame. The frame content organized by the host includes: slave address, execution command, data and error check. The response of the slave machine also adopts the same structure, including: run confirmation, return data and error check. If the slave makes an error while receiving the frame, or is unable to perform the action required by the host, it will organize a fault frame as a response to the host.

14.2 Bus structure

- Interface: RS485 hardware interface;
- Transmission mode: asynchronous serial, half duplex transmission mode. At the same time, only one host and slave can send data and the other can receive data. In the process of serial asynchronous communication, data is sent frame by frame in the form of message.
- Topological structure: single-host multi-slave system. Slave addresses range from 1 to 64. Each slave address on the network is unique. This is the basis for ensuring serial communication over ModBus.
- Support communication commands: "03" (read multiple hold registers), function code "06"(write a single register).

14.3 Protocol specification

The soft starter communication protocol is an asynchronous serial master-slave ModBus communication protocol, and only one device in the network can establish the protocol. Other devices can only respond to the query/command of the host by providing data, or take corresponding actions according to the query/command of the host. A mainframe is a personal computer (PC), an industrial control device, or a programmable logic controller (PLC). Slave refers to a soft starter or other control device with the same communication protocol.

14.4 Communication frame structure

The ModBus protocol communication data format of the soft starter is RTU (Remote Terminal Unit) mode. In RTU mode, the format of each byte is as follows: Encoding system: 8-bit binary, hexadecimal 0-9,A-F, each 8-bit frame field, including two hexadecimal characters.

In this mode, new ones always start with a transmission time silence of at least 3.5 bytes. On a network where the transmission rate is calculated at baud rate, the transfer time of 3.5 bytes can be easily grasped. The following data fields are: slave address, operation command code, data and CRC check word, each field transmission byte is hexadecimal 0. 9, A... F. The network device always monitors the activity of the communication bus, even during silent intervals. When the first field (address information) is received, each network device acknowledges the byte. As the last byte is transferred, there is a similar 3.5-byte transfer interval to indicate the end of the frame, after which a new frame

is transferred. The information of a frame must be transmitted in a continuous data stream, and the receiving device will clear the incomplete information if the interval time exceeds 1.5 bytes before the end of the entire frame transmission.

14.5 Address specification

The parameter values and real-time parameter addresses are shown in Chapter 9.

14.6 Soft start status description(address D:116)

Value	0X00	0X02	0X04	0X08
Describe	Stopped state	Fault state	Edit status	Starting and running status

See Chapter 10 for fault status codes.

14.7 Control command

Name	Instructions	Address
Reset	Write 200 valid	200
Start	Write 201 valid	201
Stop	Write 202 valid	202

14.8 Function code overview

Function code "03" (read multiple hold registers)

Host sending data	Number of bytes	Routine	Return data from slave	Number of bytes	Routine
Slave address	1	01	Slave address	1	01
Function code	1	03	Function code	1	03
Origin address	2	0001	Return bytes	1	02
Data length	2	0001	Data 1	2	0000
CRC	2	D5CA	CRC	2	B844

Note: A maximum of 50 registers can be read each time.

Function code "06" (write a single register)

Host sending data	Number of bytes	Routine	Return data from slave	Number of bytes	Routine
Slave address	1	01	Slave address	1	01
Function code	1	06	Function code	1	06
Origin address	2	0002	Origin address	2	0002
Data length	2	0019	Data 1	2	0019
CRC	2	E9C0	CRC	2	E9C0

Note: The write operation to the register can only be operated in the non-starting state, otherwise the operation is invalid.

14.9 Matters needing attention

- In multi-machine communication, the addresses of the soft starters are unique, that is, the addresses of any two soft starters cannot be the same (Set by parameter 34);
- The baud rate of the soft starter must be the same as that of the controller (set by parameter 35).
- When multiple soft starters or multiple communication devices communicate, if the communication cable is long (usually greater than 500 meters), the AB ends of the last platform should be connected to 120 ohms of resistance.

15. Fire mode

- Parameter 28 (D1 function) is set to Fire mode by default. This parameter defines the D1 terminal function as fire mode;
- By continuously closing the D1 terminal and COM terminal using an external relay normally open contact or a self-locking button, fire mode is activated. Once activated, fire mode shields all faults. Disconnecting the D1 terminal and COM terminal restores normal fault protection;
- The Fire Mode terminal for the built-in bypass soft starter are different for 5.5-22kW and 30kW-400kW models. Please strictly follow the wiring diagram below!

15.1 Online 5.5kW~37kW, built-in bypass 5.5kW~22kW:

15.1.1 Basic wiring diagram

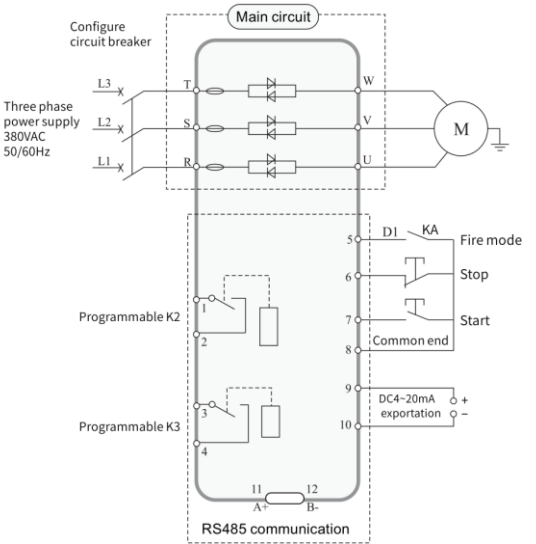


Fig. 15-1 Online

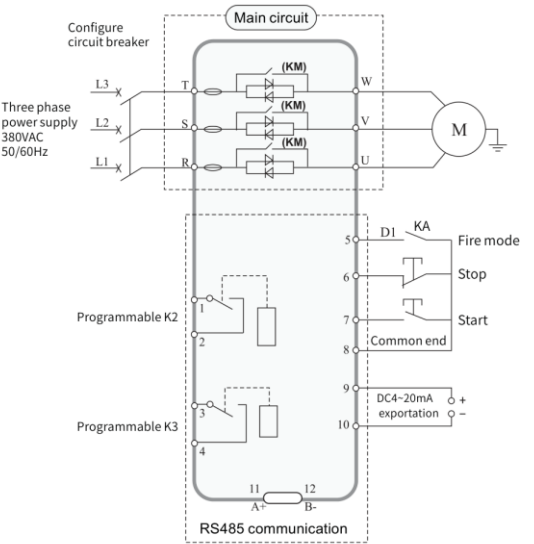
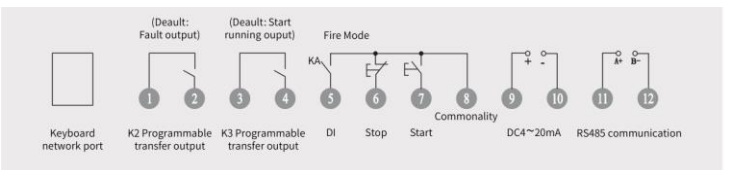


Fig. 15-2 Built-in bypass

Built-in bypass type 5.5kW~22kW:



15.2 Online type 45kW~800kW, external bypass type 5.5kW~800kW, internal bypass type 30kW~400kW:

15.2.1 Basic wiring diagram

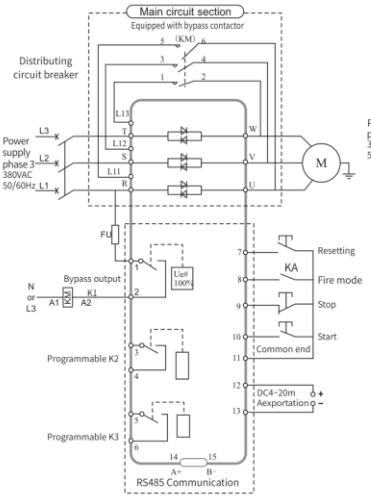


Fig. 15-4 Bypass type

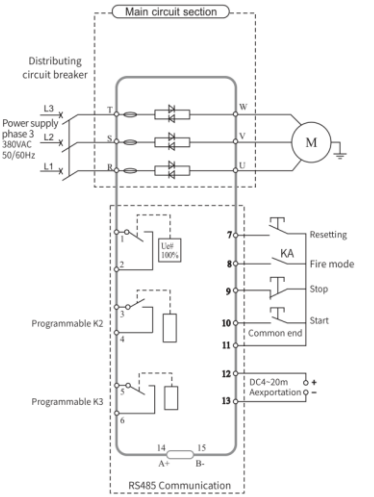
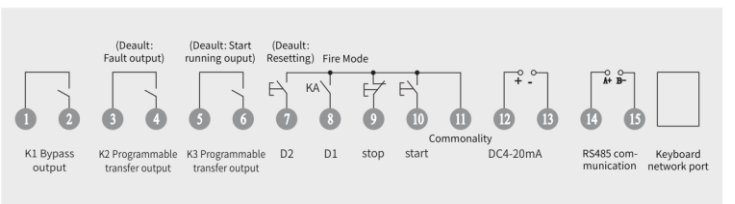


Fig. 15-5 In line form

Built-in bypass type 30kW~400kW:



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