

ANDELI

AJR3 Series Soft Starter

User manual

This manual is of great significance to the use and maintenance of the product
Please give this manual to the end user with the product and keep it properly

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The inside picture is for reference only.

Feb. 18th, 2023

ANDELI GROUP CO.,LTD.

Version 2.0

Cautions

Caution



This symbol indicates that the actual operation or environmental factors may cause personal injury, equipment damage or economic loss and others.

Caution



- Please read this operating instructions carefully before installation.
- The size of the motor must be matched to this soft starter.
- Exposed terminals must be covered with insulating tape after installation.
- The soft starter or other related equipment should be grounded reliably.
- The input power must be cut off when the equipment is maintained.
- Do not disassemble, modify or repair this product without permission.

Caution



This soft starter contains electrostatic sensitive (ESD) components and assemblies that require static control measures during installation, testing, operation or maintenance. Failure to follow ESD control procedures can result in component damage. If you are unfamiliar with electrostatic precautions, refer to the appropriate antistatic manual.

Caution



When this product needs to be used with reactive power compensation capacitors, it needs to be connected to the input terminal of the soft starter, and it is forbidden to connect it to the output terminal.

Caution



When delta internal wiring is performed, the dangerous high voltage acting on the RST, UVW and other terminals of the soft starter may cause shock, burn or cause casualties.

Caution



It is strictly forbidden to use a megohmmeter to perform insulation test on the input and output terminals of the soft starter. The insulation withstand voltage test will cause damage to the internal semiconductor devices of the product.

Caution



Only professionals who are familiar with the soft start and its related mechanical systems can plan and install the system, debug and maintain the system, otherwise it may cause personal injury or equipment damage.

Caution



Improper use and installation of the soft starter can damage components and shorten the life of the product.
For example: mismatch of soft starter and motor capacity, incorrect or inappropriate supply voltage, and high ambient temperature, etc., may cause the system to malfunction.

Content

Cautions

Content

Product information

Product model & Dimension

Installation

Connection

Operation

Function parameter

Communication

Fault diagnosis and Countermeasures

Warranty and After Sales Service

Product information

Product description

The L series soft starter is a soft starter developed by our company based on the latest product architecture platform (development code "Leopard") that supports multiple bypass types. Compared with the platform of the previous generation SJR2 series, the "Leopard" architecture has been greatly optimized and improved in software and hardware. Based on the latest 32-bit ARM architecture main control chip, the algorithm performance and functions are further improved. The high-frequency optocoupler-triggered thyristor design replaces the traditional analog pulse drive, which effectively improves the internal conduction efficiency of the thyristor and reduces losses. The built-in power supply design enables the product to adapt to wide voltage fluctuations. The product also has linear temperature detection, adjustable three-phase unbalance tolerance and overload tolerance design, so that it can better adapt to the harsh production environment.

Relevant technical reference

Standards compliant	GB/T 14048.6-2016/IEC 60947-4-2:2011
Three phase power	(AC) 380V±15%/ 220V±15%/660V±15%
Frequency	50Hz/60Hz
Applicable motors	Squirrel cage three-phase asynchronous motor
Start frequency	Depending on the load, no more than 20 times per hour are recommended
Impact resistance	15gms
Seismic ability	The vibration force is below 0.5G with the altitude below 3000m.
Ambient temperature	No derating is needed with the operating temperature between -10°C and +40 (Between +40°C ~+60°C, for every 1°C increase, the current decreases by 1.2%)
Storage temperature	-25°C ~+70°C
Environment humidity	95% No condensation or water droplets
Maximum working height	No derating within 1000 meters (above 1000 meters, the current is reduced by 0.5% for every additional 100 meters)
Relative to vertical	The maximum working angle of the installation location is not required

Operation function

- Current limit mode start
- Voltage ramp start
- Soft stop
- Coast to stop
- Programmable relay output
- Fault relay output
- 4~20mA DC analog output
- RS485 communication I/O
- User password and run lock

Protection

- Soft start overheat protection
- Input phase loss protection
- Output phase loss protection
- Three-phase unbalance protection
- Starting overcurrent protection
- Run overload protection
- Low Power supply voltage protection
- Power over voltage protection
- Underload protection (anti-dry burning)

Caution

- When the load short-circuit current exceeds the tolerance range of the maximum peak effective current of the thyristor module, it will cause the thyristor damaged. The user should consider adding a special fast fuse for semiconductor protection in the main circuit of the soft starter for auxiliary short-circuit protection.

Product model

IP class

Depending on the size, our soft starters may have an IP00 rating and an IP2X degree of protection. Taking into account the surrounding conditions, this unit must be installed in an IP54 (type 2) switchgear enclosure.

Make sure that no dust, liquid or conductive foreign matter can get inside the soft starter. When a soft starter is in operation, waste heat (heat loss) is generated. Regular cleaning can help prolong product life. For details, please refer to the product description.

Model interpretation

□ J R 3 - 3 0 7 5 T M 1 - 4 N

① ② ③ ④ ⑤ ⑥

①	Model	□ JR3 series soft starter
②	Type	2: External bypass 3: Built-in bypass LN: SCR Online without bypass LD: Bypass inside Delta LX: Enhanced Hybrid Bypass
③	Rated power	005~1000: 5.5~1000kW
④	Frame No.	The corresponding dimensions of the frame number refer to the appendix. Due to different product technology iterations and different adaptation scenarios, products of the same power may be adapted to different casings. The specific size should be based on the casing number on the order code.
⑤	Mains voltage class	2: AC220V-240V 4: AC380V-440V 6: AC660V-690V E: AC1140V
⑥	Control voltage level	N: Internal control voltage (default) D2: External control voltage DC24V W2: External control voltage AC220V W4: External control voltage AC380V

Product model

Starter-motor combinations

rated power (kW) voltage+10% to -15%		Rated current (A) Class 10 application	Soft starter model	External dimensions
230V	400V			
4	7.5	15	AJR3-2007	SS1
5.5	11	22	AJR3-2011	
7.5	15	30	AJR3-2015	
9	18.5	37	AJR3-2018	
11	22	43	AJR3-2022	
15	30	60	AJR3-2030	
18.5	37	75	AJR3-2037	
22	45	90	AJR3-2045	
30	55	110	AJR3-2055	
37	75	150	AJR3-2075	
45	90	180	AJR3-2090	SM1
55	115	230	AJR3-2115	
75	132	260	AJR3-2132	
90	160	320	AJR3-2160	
110	200	400	AJR3-2200	
132	250	500	AJR3-2250	SL1
160	315	630	AJR3-2315	
220	400	800	AJR3-2400	
250	500	1000	AJR3-2500	
355	630	1200	AJR3-2630	

1: The above values are given when the maximum ambient temperature of 40°C and the operating environment below 1000m above sea level. The design rated derating caused by high temperature and high altitude should be considered when selecting models.

2: The rated current of the adapted motor cannot exceed the maximum allowable current for Class 10(IEC 60947-4-2:2011) applications.

Starter-motor combinations

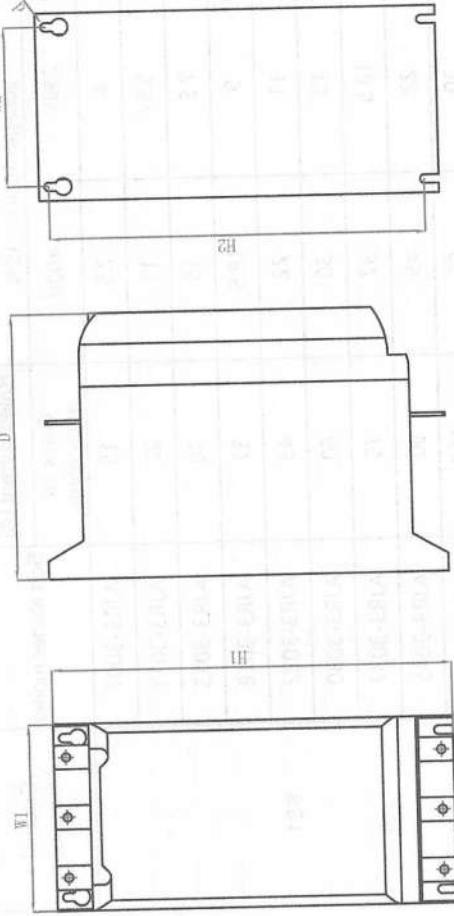
rated power (kW) voltage+10% to -15%		Rated current (A) Class 10 application	Soft starter model	External dimensions
230V	400V			
4	7.5	15	AJR3-3007	SS1
5.5	11	22	AJR3-3011	
7.5	15	30	AJR3-3015	
9	18.5	37	AJR3-3018	
11	22	43	AJR3-3022	
15	30	60	AJR3-3030	
18.5	37	75	AJR3-3037	
22	45	90	AJR3-3045	
30	55	110	AJR3-3055	
37	75	150	AJR3-3075	BSTU
45	90	180	AJR3-3090	
55	115	230	AJR3-3115	SM2
75	132	260	AJR3-3132	
90	160	320	AJR3-3160	
110	200	400	AJR3-3200	

1: The above values are reference values given according to the maximum ambient temperature of 40°C and the operating environment below 1000m above sea level. The design rated derating caused by high temperature and high altitude should be considered when selecting models.

2: The rated current of the adapted motor cannot exceed the maximum allowable current for Class 10(IEC 60947-4-2:2011) applications.

Dimension

Dimension

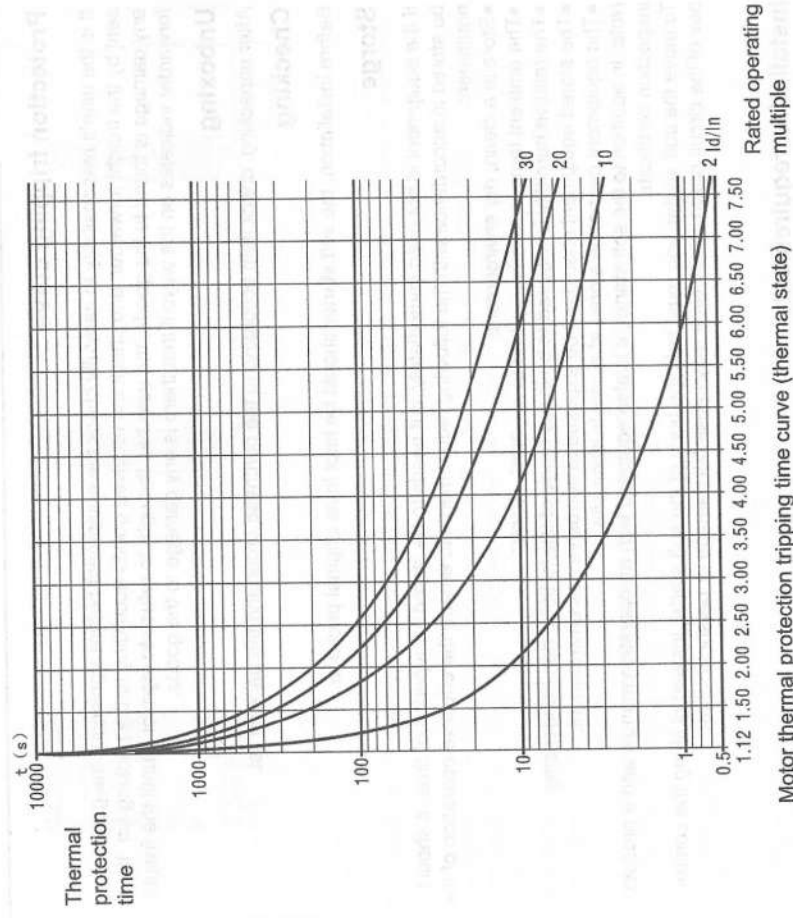


Compatible model	Frame number	Product dimension			Installation size		
		H1	W1	D	H2	W2	Φ
AJR3-LN	GS1	330	155	195	298	95	M6
AJR3-LN	TM1	370	210	260	343	150	M8
AJR3-LN	TL1	380	320	300	350	250	M8
AJR3-LN	TXL	560	395	317	523	300	M8
AJR3-LN	TXXL	810	610	391	770	400	M12
AJR3-2000/ AJR3-3000	SS1	313	155	187	296	128	M6
AJR3-2000	SM1	407	270	245	352	237	M8
AJR3-2000	SL1	461	300	265	393	263	M8
AJR3-3000	SM2	513	270	245	481	237	M8
AJR3-3000	BSTU	340	200	190	-	-	M6
AJR3-LN	GS3	270	160	205	250	145	M6

Product model

Protection tripping curve

The motor thermal protection tripping time curve according to IEC60947-4-2 standard is as follows:



Referring to the IEC standard of thermal protection tripping curve, the motor power marked in the model rule description ③ is the reference power for class 10 applications. When the load is heavy and the tripping class requirement is higher than class 10, the selection of the soft starter should be enlarged.

The above figure is only for selection and protection setting reference, not for protection action reference. The specific overload protection action time should refer to the function list setting. The figure above is the reference curve of the thermal state, which is shorter than the cold state curve. Due to the space limitation of this manual, the detailed standard description will not be repeated. If necessary, please search and check the relevant standard documents.

Caution



Confirm that the input phase number and rated input voltage value of the soft starter should be consistent with the phase number and voltage value of the AC power supply. AC power cannot be connected to the output terminals (U, V, W) otherwise damage may occur.

Protection tripping curve

It is the user's responsibility to carefully check the equipment before signing for the goods sent by the freight forwarder, and check the received goods according to the packing list. If any damage is found to the goods, the user has the right to refuse to sign for it until the freight forwarder indicates on the waybill that there is any damage to the goods.

Unboxing

After unpacking, check item according to the purchase order and the packing list.

Checking

Before installation, the soft starter should be kept in its original package.

Storage

If the equipment is not used immediately, but needs to be stored for a period of time, it should be stored in accordance with the following requirements to ensure the effective operation of the equipment.

- Store in a clean, dry environment.
- The ambient temperature is required to be $-20^{\circ}\text{C} \sim +75^{\circ}\text{C}$.
- The relative humidity is required to be in the range of 0% to 95%, non-condensing.
- The stored equipment should not be exposed to corrosive gas environment.
- The equipment cannot be stored at a construction site.
- The equipment should be stored with an operation manual and a product inspection certificate.

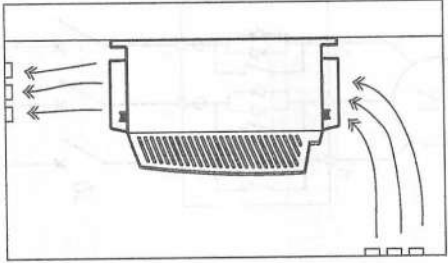
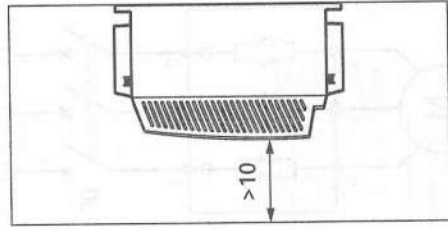
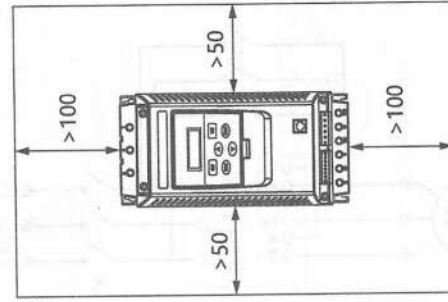
Note: In addition to the soft starter, it is also equipped with an operation manual and a product inspection certificate.

To move the soft starter, you must hold the body of the soft starter instead of lifting the control box of the circuit board, otherwise it may cause fall damage or personal injury.

Installation requirements

- ① The soft starter should be installed vertically. Do not install it upside down, obliquely or horizontally. Please install it on a solid structure with screws.
- ② The soft starter will generate heat during operation. To ensure the passage of the flowing air, a certain space is reserved in the design. The heat generated will dissipate upwards, so do not install under heat-labile equipment.

Installation

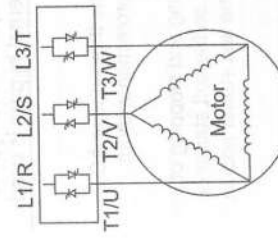


The soft starter (230~400V) is connected to the delta winding of the motor, in series with each winding

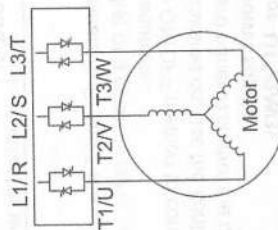
The soft starter can be connected in series to the delta winding of the motor. They are driven by a current of $1/\sqrt{3}$ wire current, which allows the use of underrated starters.

Example: a motor of 400V-110kW, line current 195A (rated current for delta connection). The current in each winding is equal to $195/1.7$, that is 114A.

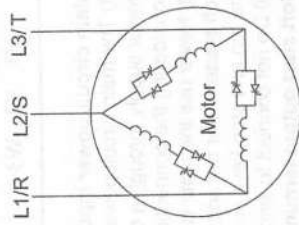
Select the maximum allowable current rating that is slightly larger than this current, i.e. 140A as the rating (SJ3-075 is used for standard applications).



direct delta connection



direct star connection



inner delta

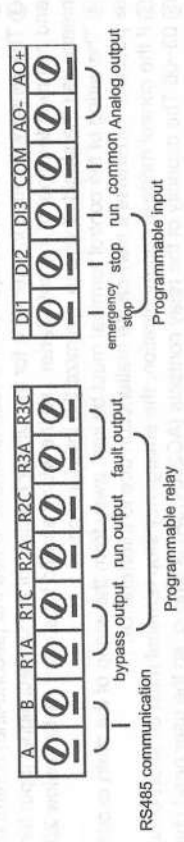
In the AJR3 series products, only the LD model supports the motor inner delta connection.

Caution

Overheating of solid state power switching elements can result from motor failure. To avoid personal injury or equipment damage, the following recommendations are made:
On the line of the soft starter, use an isolating contactor or a shunt trip circuit breaker. The device should be able to prevent additional locked rotor current of the motor. Connect this isolation device to the auxiliary contact on the soft starter, which should be programmed for the normal position.



Control terminal connection



The terminal functions marked in the above figure are only the default settings, and the actual functions can be changed by parameter setting

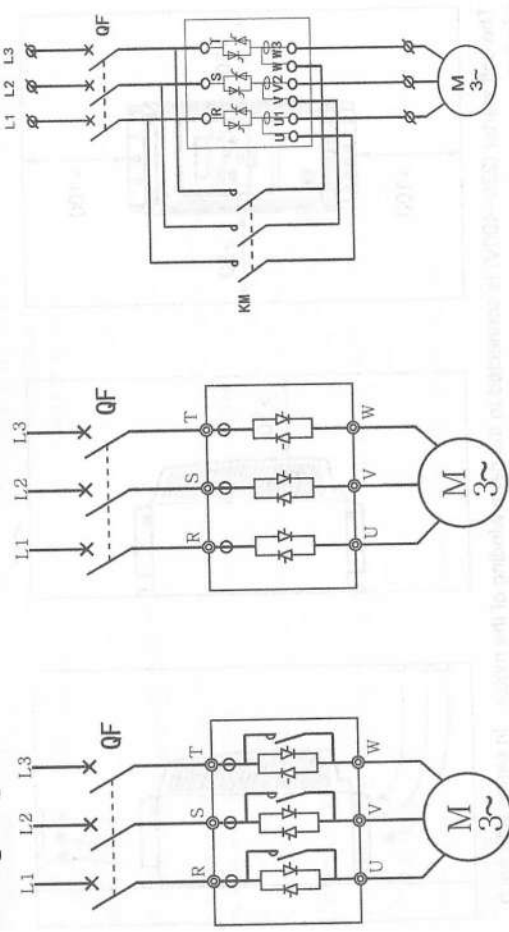
Control circuit terminal description

Terminal mark		Function description
A	RS485-A	RS485 communication port
B	RS485-B	
01	R1A	K1, Programmable relay output (default bypass output)
02	R1C	
03	R2A	K2, Programmable relay output (default run output)
04	R2C	
05	R3A	K3, Programmable relay output (default fault output)
06	R3C	
07	D11	DI1, Programmable input (default emergency stop input)
08	D12	DI2, Programmable input (default stop input)
09	D13	DI3, Programmable input (default start input)
10	COM	Programmable input common terminal
11	AO-	Analog output -
12	AO+	Analog output +

01, 02: When LN series is selected, connecting the bypass may cause the current online detection to fail.
03, 04: Programmable relay output is an open point normally. It is closed when the output is valid.
05, 06: Programmable fault relay output is closed when the soft starter fails or when the power

Connection

Wiring diagram



AJR3-3000 built in bypass AJR3-LN SCR Online AJR3-2000 external bypass

Main circuit and ground terminal function

Terminal mark	Terminal name	description
L1/R, L2/S, L3/T	Main circuit power input	Connect three phase power supply
T1/U, T2/V, T3/W	Soft Start Output Connection	AJR3-3000 and AJR3-LN series are used to connect three-phase motors, LE series are used to connect the bypass contactor output
U1, V2, W3	Soft start output	Used to connect the output of the bypass contactor when the external bypass is used

Main circuit power input(R/S/T)

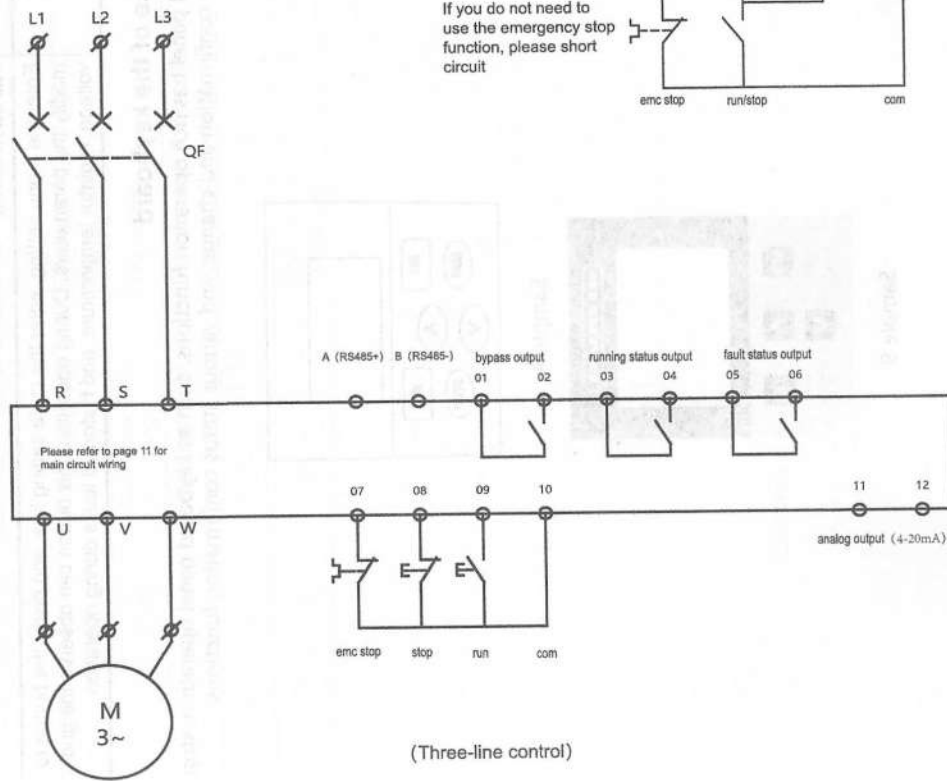
- ① The main circuit power input terminals R, S, and T are connected to the three-phase AC power supply through a circuit breaker or a circuit breaker with leakage protection without considering the connection phase sequence.
- ② Never use the main circuit power ON/OFF method to control the running and stopping of the soft starter. After the soft starter is powered on, use the control terminals on the soft starter or the run and stop keys on the keyboard panel to control the operation of the soft starter and stop.
- ③ Do not connect to single-phase power supply.

Soft start output terminal(U/V/W or U1/V2/W3)

- ① The output terminals of the soft starter are connected to the three-phase motor in the correct phase sequence. If the rotation direction of the motor is wrong, the connection of any two phases of U, V and W can be exchanged.
- ② Capacitors and surge absorbers cannot be connected to the output side of the soft starter.
- ③ When the wire between the soft starter and the motor is very long, the distributed capacitance between the wires will generate a large high-frequency current, which can cause the soft starter to trip over current, increase the leakage current, and have poor current display accuracy. Therefore, it is recommended that the motor connection does not exceed 50m.

- After the soft starter is powered on, do not open the top cover to avoid electric shock.
- In the process of power-on test run, if any abnormal phenomenon is found, such as abnormal sound, smoke or peculiar smell, etc., the power should be cut off quickly and the cause should be found out.
- If a fault occurs after power-on or during startup, you can find the cause according to the page table corresponding to the displayed fault code.
- Press the stop key or the external control stop button to reset the fault state.

Standard Application Wiring Diagram



Connection

is off, and disconnected when the power is on.

07, 10: The motor stops immediately when it is disconnected (or the normally closed contacts of other protectors are connected in series)

08, 10: The motor performs deceleration soft stop when disconnected. (or stop by itself, refer to the setting value of F02)

09, 10: The motor starts to run when it is closed.

11, 12: 4~20mA DC analog output, used to monitor the motor current in real time, when the full scale is 20mA, it indicates that the motor current is 100% of the nominal rated current of the soft starter (the range can be adjusted by code F27), and an external 4~20mA DC meter can be connected for observation, and the output load resistance value is 300 ohms.

- ① When using the external terminal to control the start and stop functions of the soft starter, please use the code F00 to set the terminal valid.
- ② When remote control is required, it is recommended to use the (second-line) control method.
- ③ The wiring will cause interference for the ON/OFF action of the contact signal input terminal and common terminal of the soft starter, so the wiring should be shorter (better below 20m) and please use the shielded wire to minimize the interference.
- ④ The wiring of the control terminal must be kept away from the wiring of the main circuit as far as possible, otherwise it may cause malfunction due to interference.
- ⑤ If the control mode is communication, the emergency stop terminal must be short-circuited.
- ⑥ 03~06 The capacity of the relay contacts (AC250V/3A) is limited, so the user need check the working limitation of the relay contacts when connecting it to high-rated contactors.
- ⑦ According to different function settings, the function of the control terminal and the logic of normally closed and normally open are also different, which need to be adjusted according to the actual situation.

Checking before operation

Before starting the operation, check and prepare the following items

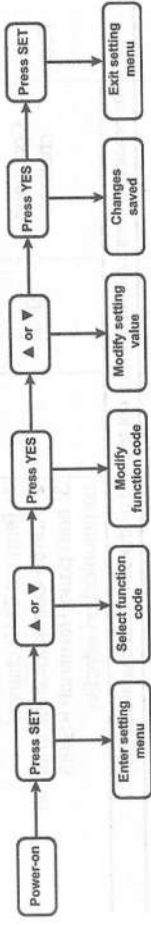
- (1) Check whether the wiring is correct, especially the output terminal cannot be connected to the power supply.
- (2) Confirm that there is no short circuit or short circuit to ground between the terminals or exposed live parts.
- (3) After connecting to the power supply, the keyboard panel displays the status of **[READY]**.

operation

Select the appropriate operation mode according to the requirements, and set it as terminal control (function code F00) at the factory.

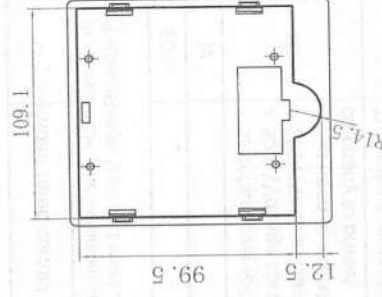
- When the power is turned on, the status of **[Ready]** is displayed, and the motor can be started by pressing the start key (only when F00 is 0 or 3).
- Enter setting item F07 according to the rated current value marked on the motor nameplate.
- After starting, check whether the rotation direction of the motor is correct. If it is not correct, press the stop button to stop or cut off the power supply if necessary, and then exchange any two of the wires (UVW) of the motor.
- If the starting state of the motor is not ideal, please refer to the starting mode and application column of the soft starter to select the appropriate setting item.
- When the torque cannot achieve the proper effect, you can change the starting voltage code F03 (in voltage mode) or the current limit value code F04 (in current mode) to increase the motor starting torque.

Operation steps



Example: Modify the startup mode to current limiting mode, that is, set the code F01 to 01.

No.	Operation	Display	Explanation
1	Power-on	【READY】	【READY】
2	Press SET	» Command channel F00 01	Enter the setting menu function code option status
3	Press ∇	» Start Mode F01 00	Enter code F01 (Start mode) Feature option status
4	Press YES	Start Mode F01 » 00	The setting range can be modified
5	Press ∇	Start Mode F01 » 01	Indicates that it is modified to current limiting mode control
6	Press YES	» Start Mode F01 01	Changes saved
7	Press SET	【READY】	Exit the function code option status of the setting menu



External keyboard compartment size (optional)

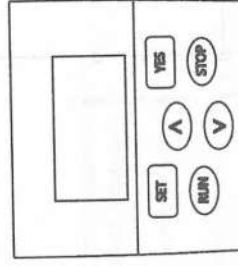
Operation

Function of the operation keys

key name	The main function
RUN	Display 【Ready】 Press this key to start, and display 【Startup】
STOP	When it is running normally, it will display 【Running】 , press this key to stop, and it will display 【Soft Stop】 when it is in a soft stop. This key has the function of resetting the fault state.
SET	Press this key to enter the menu setting, and press it again to exit the menu interface.
YES	In the setting menu interface, press this key to modify the parameters, the display arrow points to the code setting line, After modifying the parameters, press this key to save, meaning the data has been saved.
Δ ∇	Enter the menu setting, enter the code setting line, and press the button to modify the parameters. During operation, this button can observe the grid voltage, radiator temperature, and historical faults during operation.

Appearance of the keyboard

The keyboard panel has rich operation functions, such as keyboard panel operation, stop function data confirmation and change, and various status confirmation functions.



Sample A



Sample B

Function parameter

Code	Name	Range	Default	Description
F00	Command channel	0~3	1	0: Operation panel CMD channel 1: Terminal CMD channel 2: RS485 Communication channel 3: both panel+terminal+RS485 communication effective
				the reading of communication data is not affected by the command channel setting.
F01	Start mode	0~2	0	0: voltage ramp mode 1: Current limiting mode 2: heavy load mode
F02	stop mode	0, 1	0	0: soft stop mode 1: Coast to stop mode
F03	Start voltage	30~60%	40%	Voltage ramp mode valid; current mode starting voltage 40% as default
F04	current limiting	50~500%	400%	The current limit mode is valid: the maximum current limit value of the voltage arbitrary slope mode is 400%
				When the current limiting multiple exceeds 400%, the set motor current (F07) shall be met $\times 125\%$ $\leq$ rated current of soft start. If it is not satisfied, higher specification shall be selected.
F05	start time	1~30s	10s	Voltage ramp start time (current limit mode disabled)
F06	stop time	0~30s	10s	Coast to stop when set to 0
				When the circuit design needs to use a soft starter for one-to-many switching startup (cascading), this value should be set to 0.
F07	rated current	0~rated value	-	Motor rated current
F08	step voltage	50~100%	50%	Please refer to the motor nameplate to set this value. The maximum setting range should be less than the rated current value of the soft starter. Range: $[\text{soft start rated current} \times 0.4] < [\text{set current (F07)}] < [\text{soft start rated current}]$.
F09	step time	0~30s	1s	The default overvoltage threshold is $> 500\text{V}$ (Voltage class 380V), $> 280\text{V}$ (Voltage class 220V), if you need to adjust, please contact our company to preset.
F10	OV delay (over voltage)	0~600s	30s	The default undervoltage threshold is $< 250\text{V}$ (Voltage class 380V), $< 185\text{V}$ (Voltage class 220V), if you need to adjust it, please contact our company to preset.
F11	UV delay (under voltage)	0~600s	60s	

Function parameter

Code	Name	Range	Default	Description
F12	load unbalance	0~50%	20%	Allowable range of deviation between output three-phase currents
				This parameter should not be set too high, and unreasonable setting will cause the protection to fail.
F13	time unbalance	0~600s	20s	Delay time of protection action after reaching the set value of F12
				This value needs to be set appropriately, unreasonable setting will cause the protection to fail.
F14	UL enable (under load)	0, 1	1	0: Underload protection is valid, 1: Underload is allowed, protection is invalid
F15	UL time (under load)	0~600s	10s	
F16	under load factor	0~100%	20%	When the running current is lower than the percentage of motor rated current (F07) and reaches the underload protection delay time (F15), it will return to fault (ERR09) and stop.
F17	over current time	0~600s	60s	This parameter should not be set too high, and unreasonable setting will cause the protection to fail.
F18	start interval	0~300s	0s	The interval between two consecutive starts. Continuous uninterrupted start up can cause the system to overheat.
F19	OL threshold (Motor overload)	50~300%	150%	The judging value of motor overload state, the judging threshold is the percentage of motor rated current (F07).
				Invalid threshold during startup: This parameter should not be set too high. Improper setting will lead to protection failure. When the current reaches and exceeds the set value, the F17 overcurrent protection delay time of a continuous cycle will be used for overload protection, shutdown and prompt the fault code Err06; This parameter can be combined with the overload protection level setting of function code F58.
F20	fan control mode	0, 1	0	0: The fan runs continuously during operation, 1: Run after the temperature reaches the warning value ($40^{\circ}\text{C} / 104^{\circ}\text{F}$)
F21	language select	0, 1	0	0: Chinese 1: English
				Even after setting F39 to restore factory settings, the language setting will not be restored.
F22	SCR mode	0~2	0	0: online working; 1: Thyristor on after bypass valid 2: Thyristor off after bypass valid
F23	DI01 select	0~4	0	0: Emergency stop, 1: shutdown,
F24	DI02 select		1	2: start,
F25	DI03 select		2	3: reset, 4: External fault input
F26	AO mode	0, 1	0	0: 4~20mA, 1: 0~20mA

Function parameter

Code	Name	Range	Default	Description
0: Activate protection 1: Disable protection For example, if overheating protection and overvoltage protection need to be turned off, the binary code is "0000101" and the corresponding decimal number is '5'. Important note: disabling the protection function may cause equipment damage. Please use this function as appropriate. This manual has fulfilled the obligation to inform. Our company is not responsible for the loss caused by disabling the protection. This function can be applied to occasions requiring emergency start, such as fire fighting.				
F41	backup			function code reserved
F42	fault 1	err01-18	-	
F43	fault 1 voltage	-V	-	(Last time) Display fault record and the voltage, the current and the temperature during the fault. If the fault of the last two times is of the same type, only the latest record is displayed.
F44	fault 1 current	-A	-	
F45	fault 1 temperature	-°C	-	
F46	fault 2	err01-18	-	
F47	fault 2 voltage	-V	-	Display fault record and the voltage, the current and the temperature during the fault.
F48	fault 2 current	-A	-	
F49	fault 2 temperature	-°C	-	
F50	fault record3	err01-18	-	
F51	fault record3 voltage	-V	-	Display fault record and the voltage, the current and the temperature during the fault.
F52	fault record3 current	-A	-	
F53	fault record3 temperature	-°C	-	
F54	number of runs	0-65535	-	The totally accumulated number of runs
F55	run time(h)	0-65535	-	This function code is used to record the total running time of the soft start after leaving the factory. When the factory parameters are reset, the value remains unchanged.
F56	run time(m)	0-60	-	The total runtime format is: F55(hour/h);F56(minute/m);F57(second/s)
F57	run time(S)	0-60	-	
F58	Overload protection class	0-4	1	0=class2 1=class10a 2=class10 3=class20 4=class30
Inverse time limit protection curve of tripping protection level of motor in hot state based on IEC60947-4-2; In case of heavy load operation (above class 20), the soft starter with larger specification shall be selected, otherwise the soft starter may be overloaded or unable to start.				
F59-F64	backup			function codes reserved
F65	software version	-	-	

Function parameter

Code	Name	Range	Default	Description			
F27	AO offset factor	0~200%	100%	This function code is used to correct the zero drift of the analog output and the deviation of the output amplitude. If the zero offset is represented by b, the gain is represented by k, the actual output is represented by Y, the standard output is represented by X, X= the rated current of the soft starter , the actual output is: Y=kX+b.			
F28	AO amplify factor	1~500%	100%				
F29	K1 select (R1A-R1C)	1	1	0: Fault status (normally open) 5: Fault status (normally closed)			
F30	K2 select (R2A-R2C)	0~9	2	1: Bypass status (normally open) 6: Bypass operation (normally closed)			
F31	K3 select (R3A-R3C)	0~9	0	2: Running status (normally open) 7: Running status (normally closed)			
F32	Start process K1 bypass output delay time	0~600s	0s	8: Soft start status (normally open) 9: Soft stop status (normally closed)			
F33	K2 delay time	0~600s	0s	Multi-function relay output delay time			
F34	K3 delay time	0~600s	0s				
F35	Stop process K1 bypass output delay time	0~4s	1s				
F36	uart address	0~128	1	Broadcast when set to 0			
F37	uart Baudrate (bps)	0~3	2	0: 2400, 1: 4800, 2: 9600, 3: 19200			
F38	uart data format	0~2	0	0: N.8.1 1: 0.8.1 2: E.8.1			
F39	recover factory	0~1	0	1: Restore factory defaults			
F07; F21; F26; F27; F28; F32; F37; F35 Parameters such as fault record and cumulative operation record cannot be recovered							
F40	Disable protection	-	0	It is used to turn off the protection function. If the protection function is turned off, set the corresponding position in the following table to 1, and then turn the binary value into decimal and enter F40. This parameter will cause protection failure. Please use this parameter carefully.			
Bit0	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7
Inverse time overload (18)	Running overload (6)	phase unbalance (10)	Underload (9)	Startup overtime (3)	over voltage (7)	Low voltage (8)	overheat (4)
0	0	0	0	0	0	0	0

Communication

Code	Name	Range	Default	Description
F66	user password	0-65535	-	
F67	factory password	-	-	For our internal use only
F68	Integrator password	-	-	
F69	runnumber set	-	-	The number of operations is set. After reaching the set operation, the product locks and alarms Err17
F70-F99	Manufacturer parameters	-	-	For our internal use only

RS485 communication

MODBUS communication, 9600.n.8.1, byte transmission, hexadecimal representation, question and answer transmission. There is a communication terminal resistance jumper J1 inside the main board of this machine.

1. Data and Status Monitoring

Host send: (function code =03, read all data), read up to 10 registers

slave address	function code	Register's high address	Register's low address	high order of data QTY	low order of data QTY	CRC
01	03	10	00~2C	00	X	CRC

The device returns:

slave address	function code	high order of data QTY	low order of data QTY	DATA 0	DATA 1	DATA X	CRC
01	03	00	2~2*X	0H	0L	xH	xL

register address table:

address	name
1000H	Phase A current
1001H	Phase B current
1002H	Phase C current
1003H	Input voltage
1004H	Temperature
1005H	Error code
1006H	System status
1007H	Terminal input and output status
1008H	Analog output (AO)
1009H	-

system status: 1006H

system code	status
0001	startup
0002	Operating
0003	soft stop
0004	stop

Communication

0005	fault
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Terminal status:1007H (0: no input/output, 1: input/output)

No.	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
Content	NC	NC	BYPASS	PROG	FAULT	E-STOP	S-STOP	RUN
Initial	0	0	0	0	0	0	0	0

2. parameter query(EEPROM)

Host send: (function code =03, read EEPROM data), read up to 10 registers

slave address	function code	Register's high address	Register's low address	high order of data QTY	low order of data QTY	CRC
01	03	00	00~FF	00	1~10	CRC

The device returns:

slave address	function code	high order of data QTY	low order of data QTY	DATA 1	DATA X	DATA X	CRC
01	03	00	1~12	1H	1L	xH	xL

3. Parameter setting(EEPROM)

Host send: (function code 06, write EEPROM data)

slave address	function code	Register's high address	Register's low address	high order of data QTY	low order of data QTY	CRC
01	06	00	00~FF			CRC

The device returns:

slave address	function code	Register's high address	Register's low address	high order of data QTY	low order of data QTY	CRC
01	06	00	00~FF			CRC

4. The control command

Host send:(function code 06)

slave address	function code	Register's high address	Register's low address	high order of data QTY	low order of data QTY	CRC
01	06	20	00	00	00	CRC

The device returns:

slave address	function code	Register's high address	Register's low address	high order of data QTY	low order of data QTY	CRC
01	06	20	00	00	00	CRC

Control command input to soft start

Address	Command data	function
2000H	0001	start
	0002	Coast to stop
	0003	Soft stop
	0004	fault reset

Fault diagnosis and Countermeasures

List of protection actions

When the soft starter is abnormal, the protection function will act and trip immediately, and the LCD will display the alarm name and related content, please refer to the description in the table below.

Code	Fault name	Possible causes	Suggested solutions
Err01	out phase loss	Since the phase loss detection is affected by many related factors, the input and output side circuits should be comprehensively checked during inspection. 1. Abnormal three-phase input power 2. The line from the soft start output to the motor is abnormal 3. Soft starter thyristor failure 4. Motor failure 5. The startup current limit setting is too low	1. 2. Check and eliminate the problems of the power line, including but not limited to abnormal power frequency (not 50/60Hz), lack of phase or high-frequency harmonics in the line. Check the output wiring and check the isolation devices (contactors, fuses, circuit breakers, etc.) present between the main circuits 3. Seek technical support 4. Check the motor 5. Adjust the current limiting multiple (F04) to an appropriate range
Err02	in phase loss		
Err03	overtime starting	1. Mechanical abnormality at the end load 2. The setting value of startup time is too small 3. The soft starter selection does not match the load characteristics or power 4. The current limiting multiple is set too low	1. Eliminate possible blockage, wear, mechanical clearance and lubrication problems 2. Increase the startup time (F35) 3. Adjust the starting voltage (F03) or use the current limiting mode. When the parameter setting adjustment cannot meet the performance requirements, a soft starter with a larger power level should be selected. 4. Adjust the current limit (F04) setting, and it is recommended not to exceed 400% of the rated value of the motor
Err04	overheat starter	1. Start too frequently 2. The soft starter selection does not match the load characteristics or the power rate 3. The ambient temperature is too high 4. The air duct is blocked or the fan is damaged 5. The module temperature sensor is damaged	1. Reduce the start and stop frequency to a reasonable range 2. Use a soft starter with a larger power level 3. Reduce the ambient temperature, or consider reducing the capacity selection (refer to the description of electrical parameters) 4. Clean the air duct or replace the faulty fan 5. Replace the temperature sensor
Err05	OC (over-current) starting	1. The load is too heavy or the motor is blocked 2. Soft starter selection is too small 3. Internal short circuit of soft starter 4. Bypass contactor adhesion 5. Soft starter output short circuit	1. Reduce the load and check the motor and mechanical condition 2. Use a soft starter with a larger power level 3. Check the thyristor 4. Check the bypass contactor 5. Exclude whether there is a short circuit of the output to the ground or check the motor insulation

Fault diagnosis and Countermeasures

Code	Fault name	Possible causes	Suggested solutions
Err06	overload running	1. The load is too heavy or the motor is blocked 2. Soft starter selection is too small 3. The overload threshold is set too low	1. Reduce the load and check the motor and mechanical condition 2. Use a soft starter with a larger power level 3. Adjust the overload threshold to an appropriate range
Err07	OV(over-voltage) grid	1. The input grid voltage is too high	1. Adjust the voltage to the range required by the specification
Err08	UV(under-voltage) grid	1. The input grid voltage is too low 2. Instantaneous power failure	1. Adjust the voltage to the range required by the specification 2. Reset fault
Err09	under load	1. The operating current is lower than the set value 2. Mechanical abnormality at the load end 3. The operation output connection is abnormal 4. Abnormal current detection	1. Adjust relevant parameters of underload protection (F14/F15/F16) 2. There is a mechanical failure in the load, such as loss of pressure in the pipeline, reverse rotation, loose conveyor belt and mechanical clearance, which lead to unloading or underloading 3. Check the connection between the soft start and the motor load. 4. Seek technical support
Err10	unbalance load	1. The grid voltage is abnormal 2. The motor or the cable connected to the motor is abnormal 3. The allowable range of three-phase unbalance is too small 4. Detect circuit hardware abnormalities	1. Check the main circuit voltage 2. Check the motor and motor cable 3. Moderately adjust the allowable range of three-phase unbalance (code F12) and the three-phase unbalance protection delay (code F13) 4. Seek technical support
Err11	EEProm fault	1. The software setting is abnormal in reading and writing 2. Register hardware failure	1. After power off, power on again, if the fault is still not eliminated, try restoring the factory value (code F39) 2. Seek technical support
Err12	current sensor fault	1. Hardware failure	1. Seek technical support
Err13	temperature sensor fault	1. Hardware failure	1. Seek technical support
Err14	emc terminal open	1. The emergency stop terminal is not short-circuited	1. Short-circuit the external instantaneous terminal ⑦ with the common terminal ⑩, or connect it to the normally closed contact of other protection devices.
Err15	stop terminal open	1. The stop terminal is not closed when it is not normally closed combine	1. Check the secondary circuit
Err16	external fault	1. There is an external input fault signal at the DI1 to DI3 terminals	1. Check the input point of the corresponding external fault signal, and remove the external fault
Err17	run number reached	1. Set the number of runs to lock	1. Contact the integrator to modify

Fault diagnosis and Countermeasures

Code	Fault name	Possible causes	Suggested solutions
Err18	Inverse time overload protection	1. Running overload 2. F58 overload protection level is set improperly	1. Reduce load 2. Increase the protection level appropriately

Remarks: Some fault phenomena are related to one another. For example, when the Err04 soft starter is overheated, it may be related to starting overcurrent or load short circuit. Therefore, when checking the fault, it should be comprehensively considered and the fault point should be accurately judged.

Other common faults and solutions

No.	fault phenomenon	possible reason	Solution
1	After starting, the motor does not rotate or rotates with hysteresis, and the current is large	1. Small starting torque 2. The load is too heavy, stalled or locked	1. Properly adjust the starting voltage and starting time, adjust the starting current in the current limiting mode or use other starting modes 2. Check the load
2	Abnormal sound when the machine is shut down	Improper setting of soft stop time	Adjust the soft stop settings (may have to make multiple adjustments for optimal results)
3	The starting current is too large when a load is a compressor	1. The startup time is set too long	1. Some compressors are equipped with air valve devices. If the start-up is too slow, the air valve may not be opened. It should be adjusted appropriately according to the actual situation.
4	Sudden stop during operation and no alarm code display	1. Abnormal external input terminal	1. Check whether the emergency stop signal terminal, the external stop terminal and the connected button wiring are abnormally connected. If there is an external protector, please check whether it works
5	The output is powered when the soft start is not started		The induced voltage at the output end of the soft starter is a normal phenomenon when it is no-load, and it does not affect the use. The induced voltage is generated by the leakage current of the thyristor (solid-state semiconductor devices such as thyristor, GTR, and IGBT have different degrees of leakage) and the AC path of the dv/dt RC filter circuit. Use a voltmeter to set the zero value, about 100~220V, the load capacity of this induced voltage is very small, and disappears after the output is connected to the load.
6	At low ambient temperature, it displays temperature deviation.		The effective temperature monitoring range of the L series soft starter is 0 to 110° C. When the detected temperature is lower than 0° C, it will display 0° C. The factory default temperature protection action threshold is 85° C.

Warranty and After Sales Service

Thank you very much for purchasing the soft starter produced by our company. This product is manufactured under the perfect quality management system. For your convenience, we promise the warranty period and after-sales service as follows:

1. Warranty Scope

The warranty period of the product is 12 months from the date of purchase and 24 months from the date of manufacture recorded on the nameplate, any of which exceeds the warranty period. However, if the failure is caused by the following reasons, it will be repaired at the purchaser's cost even within the warranty.

- 1) Due to wrong use, self-modification and inappropriate maintenance.
- 2) Use in excess of standard specifications.
- 3) Due to falling after purchase and damage during transportation, etc.
- 4) Earthquakes, fires, wind disasters, lightning strikes, abnormal voltages, other force majeure disasters and secondary disasters.

2. After-sales service

- 1) When the use state is not good, please check it first. Please read and check the instruction manual again.
- 2) In the event of a malfunction, please contact the dealer, or the "after-sales service window of our company's office" described in the instruction manual.
- 3) Repairs within the warranty period: Free repairs will be made in the event of failures caused by the company's manufacturing problems. However, the contents in the "Soft Starter Warranty" must be filled in correctly and in detail. Otherwise, it will be repaired at the purchaser's cost.
- 4) Exceeding the warranty period: In the case where the function can be recovered after repair, the repair payment is to be made by the customer accordingly.

3. Service commitment

- 1) Technical support for customers in the use and operation of the soft starter: In the initial stage of use, the company will provide customers with free training of relevant technical personnel and instruct customers to use them.
- 2) The company guarantees to respond within 24 hours to the technical service and maintenance service requirements put forward by customers.