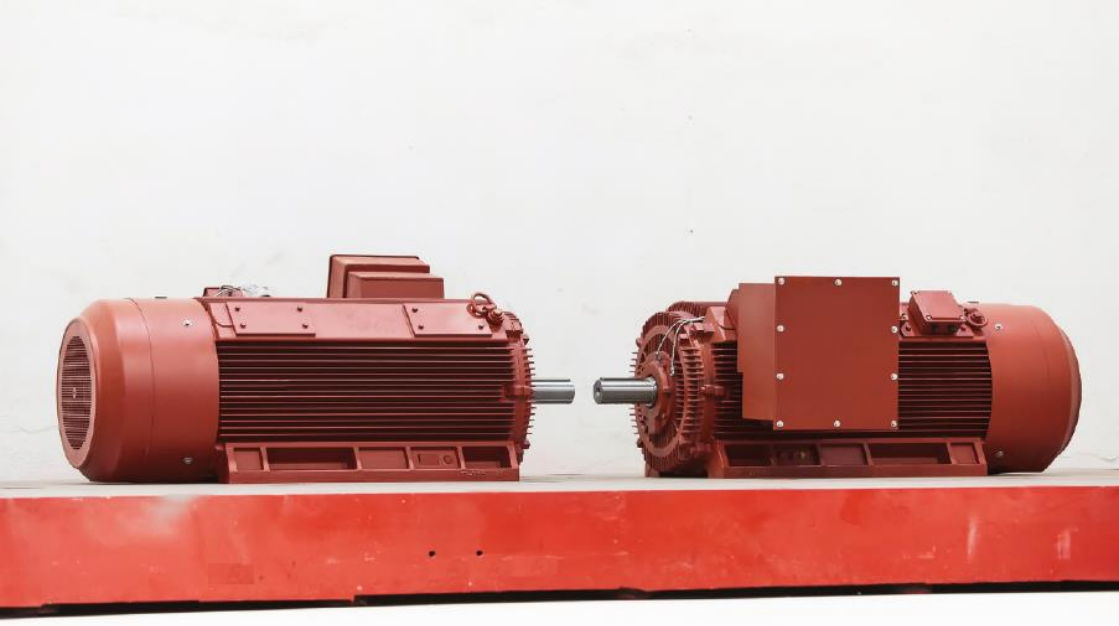


Soft Start Controllers

KINESOFT LV

Installation Manual

Ver. 1.2

VYBO Electric

1. Introduction

This operating and installation manual is intended for KINESOFT intelligent soft starters. It provides all relevant instructions for installation, wiring, setting functional parameters.

In order to use this series soft starter correctly, to guarantee the best performance of the product and to ensure the safety of users and equipment, carefully read this manual for operation, installation and maintenance of the equipment before using and connecting. Improper and unprofessional use of the device can cause abnormal operation and failure of the soft starter, reduce its service life, and even cause injury or death to people due to electric shock.

This user manual is supplied with the device. Please also keep it for maintenance and diagnostics purposes.

The manual is intended to guide qualified workers during the installation and operation of this product. In the case of a registered trademark and commercial property, the right to final interpretation of the manual belongs to VYBO Electric a.s. Any unjustified use, especially reproduction and distribution by third parties, is not permitted.

Due to the continuous improvement of products, some data may be changed without prior notice, therefore, as a precaution, check the presence of new versions of the instructions on the website of VYBO Electric a.s., www.vyboelectric.sk and www.vyboelectric.cz.

Instruction manual for intelligent soft starters of electric motors KINESOFT SSZ.
Version V.1.2
Date of revision: April 2023

2. Safety and safety signs

*Assembly work and work related to the assembly of soft starters can only be performed by authorized persons with qualifications according to § 21 to § 24 of Decree 508/2009 Coll.

**It is strictly forbidden to connect a capacitor to the output terminals (U / V / W) of the soft starter.

Safety signs

Alerts, warnings and notes

- Alert: the activity can lead to injury or death.
- Warning: the action may lead to damage to the device or software.
- Note: reminds the user of some important facts

3. Functions and features of the device

The KINESOFT SSZ and SSN series soft starter is a new type of advanced electric motor starting device. This device is designed and manufactured on the basis of microprocessor and power electronics and on the basis of modern control technologies. The soft starter can effectively limit the starting current after the induction motor starts. It is widely used in the field of winding machines, pumps, conveyors, compressors, etc. It is an ideal product to replace traditional starting methods such as star/delta switching, voltage reduction, etc.

KINESOFT soft starter functions

- Reduces the starting current of the motor; reduces electricity consumption; reduces investment costs.
- It reduces the initial voltage and current surges and thereby extends the life of the motor and connected devices.
- Ensures a smooth and stable start and controlled stop.
- Provides several kinds of starting modes, current and voltage settings in a wide range. It can be used in many load conditions.
- The device can provide perfect and reliable protection; effective protection of the engine and related equipment's.
- It can be used in a mode where the engine starts and stops frequently.

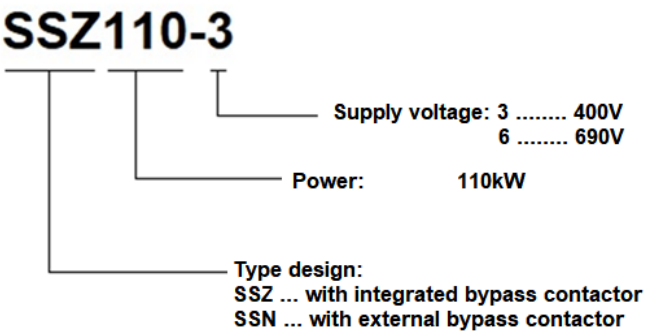
Features of the device

- Start mode: a suitable start mode can be selected based on the load characteristics. In this way, the best starting effect can be achieved.
- Technical performance: more powerful microprocessors and software are used, so the control circuit is simplified. A higher start-up speed can be achieved without adjusting the circuit parameters.
- Reliability: all electronic components of this product are rigorously tested.
- Structure: a modular structure and connection mode is used. The soft starter is easy to use and integrates into the drive control system.
- Multiple protection: no need to add additional motor power protection circuits because this soft starter has built-in multiple protection functions (overcurrent detection, overload detection, phase failure fault, circuit overheating detection, etc.).
- Keyboard: keyboard functions are simple. The user can use the keyboard to set and modify parameters (start, stop, run, protection) according to different load conditions.
- Analog signal output: 4 - 20 mA analog output signal.
- Communication via RS485: MODBUS communication protocol.
- Power adjustment: If the power of the soft starter is higher than the power of the current load, the soft starter can adapt to the actual load by adjusting the relevant parameter. In this way, the parameters related to start, operation and protection will be correctly set.

4. Data sheet

	KINESOFT SSZ / SSN
Supply voltage range, frequency (mains powered)	3PH input / 3 PH output AC 230 - 415 V (+/- 10%); 50/60Hz 3PH input / 3PH output AC 300 - 690 V(+/- 10%); 50/60 Hz
Control method	By changing the switching angle of thyristors
Suitable for driving	Asynchronous motors
Allowed number of restarts	Maximum 20 per 1 hour
Start mode	Voltage ramp / Current limit / Jogging / Heavy load
Indication	Operating status / Alarm / Start mode / Rated current
Digital inputs	5 inputs
Analógový výstup	Output 4-20 mA (impedance ≤ 400Ω)
Relay outputs	2 programmable outputs
Serial interface	RS 485
Communication protocol of RS485	MODBUS
Type designation SSZ	The soft starter has a built-in bypass contactor
Type designation SSN	The soft starter does not have a built-in bypass contactor
Maximum start time	120 sec.
Overloading at start	Max. 600 % In
Method of cooling	Forced air cooling
EMC compatibility	Conforms to IEC 61000-4-4; IEC 61000-4-12; IEC 61000-4-2; IEC 61000-4-3
Altitude	Below 1000 m a.s.l.
Ambient temperature	-25°C to +40°C (without icing)
Vibrations	Max. 0.5 g; IEC 60068-2-6
Degree of electrical coverage	IP 00
Ambient humidity	Max. 95% (without condensation) IEC 60068-2-3
Method of assembly	On the wall or in a switchboard with cooling
Standards	EN/IEC 60947-4-2
Losses in control circuits	30 W
Installation environment	Indoors, avoid direct sunlight, salt, dust, corrosive or flammable gas, smoke, steam. Resistance to chemical pollution: class 3C3 EN/IEC 60721-3-3. Resistance to dust pollution: 3S3EN/IEC 60721-3-3.
EU marking	CE

5. Production label



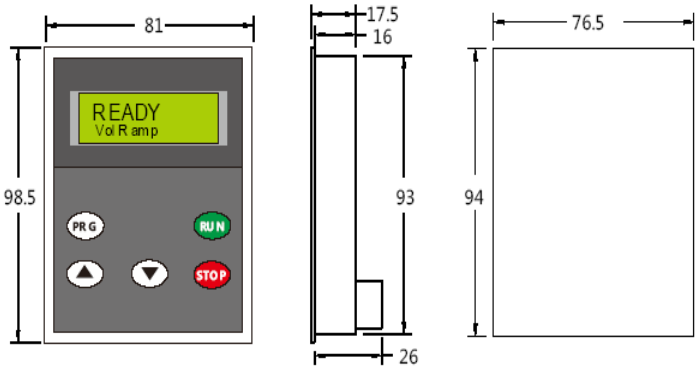
Basic designation:
SSZ = soft starter with built-in bypass (it has its own built-in contactor)
SSN = soft starter with non-built-in bypass (an external contactor must be connected)


PRG
STOP

5.1 Specification and type

Power (kW)	Rated current (A)	SSZ	SSN	Size
15	30	SSZ-015-3	-	A
22	45	SSZ-022-3	-	A
30	60	SSZ-030-3	-	A
37	75	SSZ-037-3	-	A
45	90	SSZ-045-3	-	A
55	110	SSZ-055-3	-	A
75	150	SSZ-075-3	-	A
90	180	SSZ-090-3	-	A
110	220	SSZ-110-3	-	B
132	260	SSZ-132-3	-	B
160	320	SSZ-160-3	-	B
185	375	SSZ-185-3	-	C
200	400	SSZ-200-3	-	C
250	480	SSZ-250-3	-	C
280	550	SSZ-280-3	-	C
320	620	SSZ-320-3	-	C
400	780	-	SSN-400-3	D
450	850	-	SSN-450-3	D
500	1000	-	SSN-500-3	E

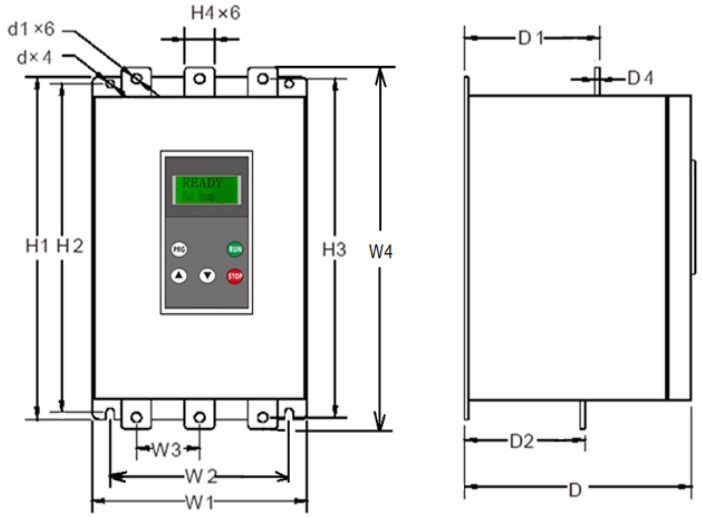
5.2 Shape and dimensions of the keyboard with display



RJ45 connector for connecting the display with a LAN cable

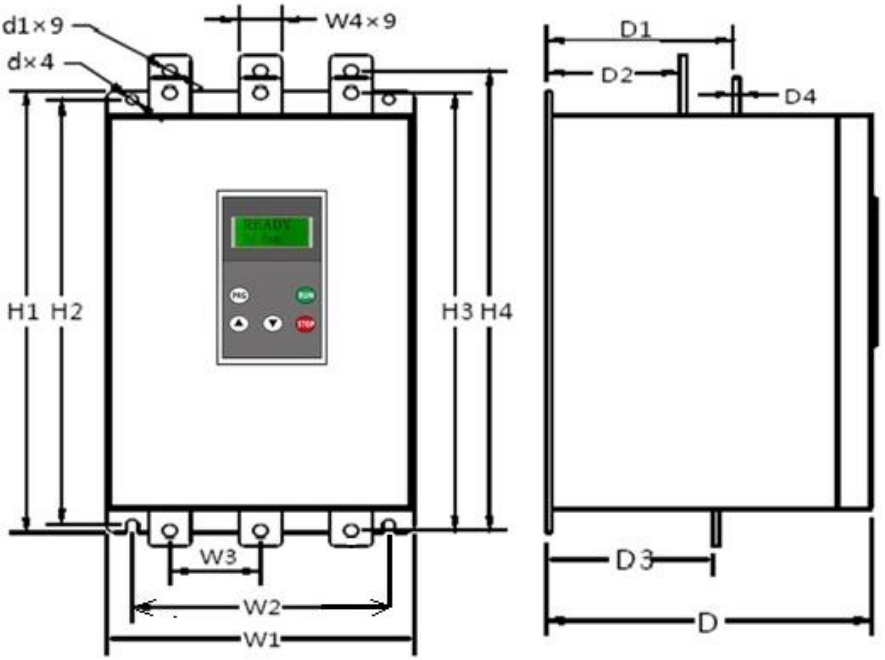
5.3 Dimensions of the SSZ soft starter (built-in bypass contactor)

Type	Outside dimensions (mm)				Installation dimensions (mm)					Dimensions of connection terminals (mm)					Size	Installation method
	W1	H1	D	W4	W2	H2	D1	D2	d	W3	H4	H3	D4	d1		
15 – 90 kW	190	340	220	345	125	325	95	95	Φ6	63	10	320	3	Φ6	A	Hanging on the wall
10 – 160 kW	235	460	220	495	182	435	110	110	Φ9	80	30	445	5	Φ10	B	
185 – 320 kW	300	545	230	615	245	520	110	110	Φ9	90	50	560	5	Φ14	C	



5.4 Dimensions of the SSN soft starter (external bypass contactor)

Type	Outside dimensions (mm)			Installation dimensions (mm)						Dimensions of connection terminals (mm)					Size	Installation method
	W	H1	D	W2	H2	D1	D2	D3	d	W3	W	H3 H4	D4	d1		
400 kW	304	448	211	270	430	143	89	51	Φ8.5	87.5	40	456 486	6	Φ11	D	
450 - 500 kW	472	530	310	400	505	230	55	130	Φ11	150	40	510	5	Φ11	E	



6 Installation

6.1 Position and space

The soft starter must be placed vertically. It should have enough space for heat dissipation as shown in Figure 6.1. There should be a certain distance between the back wall of the soft starter and the wall of the switchboard. It will also allow easier maintenance.

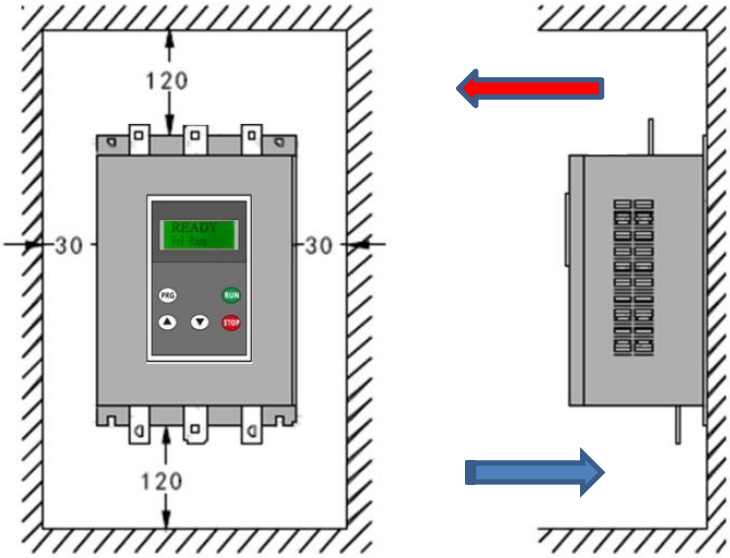
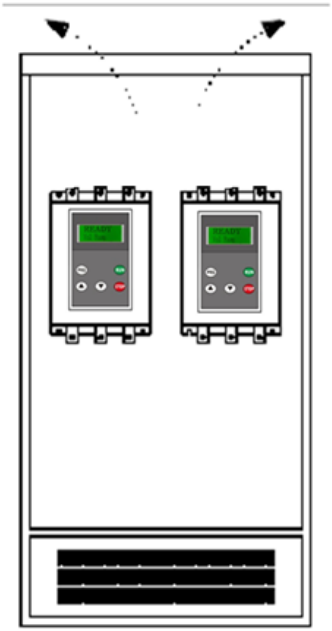


Figure 6.1

6.2 Installation in the switchboard

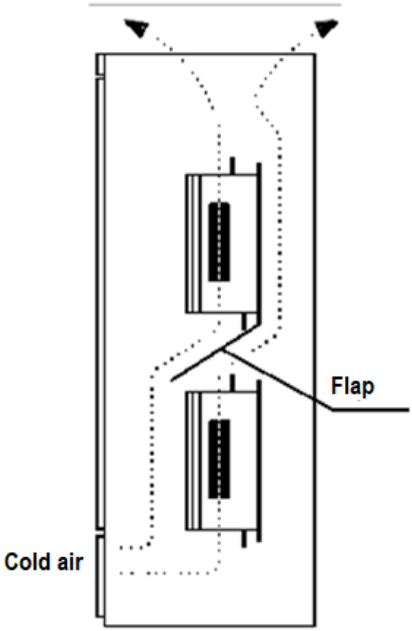
If the soft starter is installed in a switchboard, make sure that it is well ventilated. It is possible to install them above each other vertically or next to each other horizontally. The horizontal arrangement is shown in Figure 6.2. The vertical arrangement is in Figure 6.3. The fitter can choose any arrangement.

Note: if a vertical arrangement is selected (especially in external fan cooling mode), a damper must be installed between the soft starters to prevent the upper soft starter from being affected by the heat generated by the lower soft starter.



Horizontal arrangement

Figure 6.2



Vertical arrangement

Figure 6.3

7 Principle of operation

Three pairs of anti-parallel thyristors are connected to the motor stator. With the help of electrical switching of thyristors, it is possible to regulate the motor voltage by changing the switching angle of the thyristors. The thyristor switching angle is controlled by a microprocessor. The engine starts more softly and smoothly. After reaching full voltage at the output, the soft starter sends a bypass signal. This signal can be used to control the bridging contactor for powering the motor, version SSN (see fig. 7.2), or the contactor is integrated directly into the soft starter, version (SSZ), see figure 7.1.

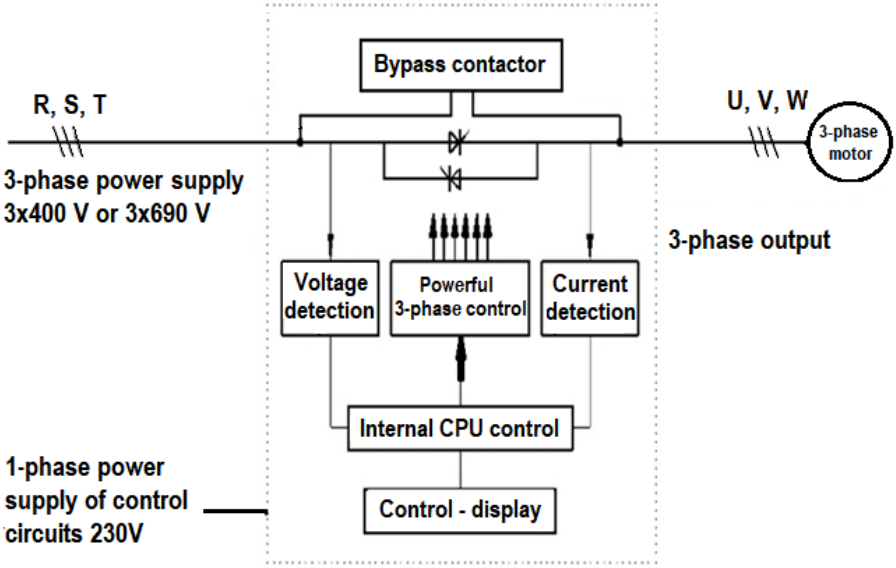


Figure 7.1 SSZ model

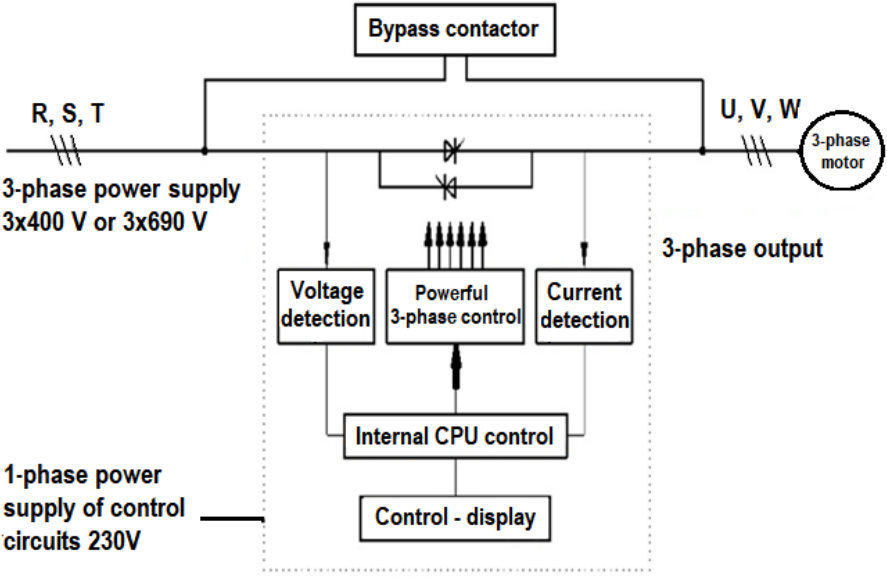


Figure 7.2 SSN model

8 Terminals and circuit diagram

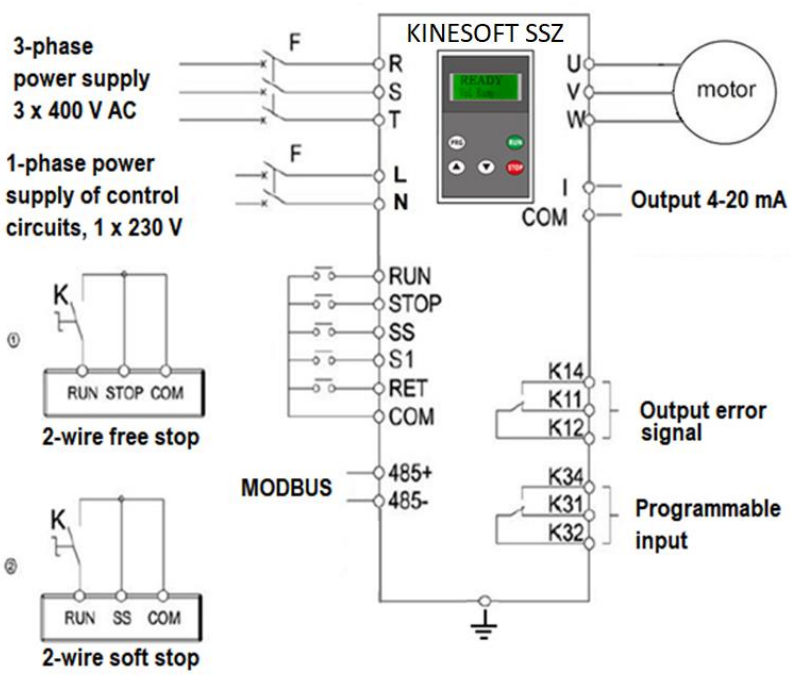


Figure 8.0

There are two ways to control the external start and stop of the soft starter. (See ① and ② in Figure 8.0 above). The start signal is given by connecting the terminals RUN and COM. The stop signal is given by disconnecting the RUN and COM terminals.
Connection according to figure ①, idling STOP (motor stops by inertia). Connection according to figure ②, soft STOP (controlled stop).
In the product of the SSZ series, a bypass contactor is built in as standard.

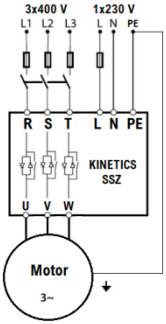


Figure 8.2

9 Terminals

<table>
<tr><th colspan="2">Name of terminal</th><th colspan="3">Function</th><th>Description</th></tr>
<tr><td colspan="2" rowspan="3">Main circuit
3 x 400 V
or
3 x 690 V</td><td>R/S/T</td><td colspan="2">Input</td><td>Connection to a three-phase power source via a circuit breaker (F)</td></tr>
<tr><td>U/V/W</td><td colspan="2">Output</td><td>Connection of a three-phase asynchronous motor</td></tr>
<tr><td>(U1/V1/W1)</td><td colspan="2">(Bypass)</td><td>Model SSN only</td></tr>
<tr><td colspan="2">Auxiliary circuit
1 x 230 V AC</td><td>L/N</td><td colspan="2">Power supply</td><td>Power supply of control circuit</td></tr>
<tr><td rowspan="15">Control circuit</td><td rowspan="6">Digital input</td><td>SS (soft stop)</td><td colspan="2">Soft stop</td><td>Connection of SS and COM, Soft stop ①</td></tr>
<tr><td>RUN</td><td colspan="2">Start</td><td>Connection of RUN and COM, Start ①</td></tr>
<tr><td>STOP</td><td colspan="2">Stop</td><td>Connection of STOP and COM, Start ①</td></tr>
<tr><td>S1</td><td colspan="2">Jog</td><td>Connection of S1 and COM</td></tr>
<tr><td>RET</td><td colspan="2">RESET</td><td>Connection of RESET and COM, reset of error</td></tr>
<tr><td>COM</td><td colspan="2">Common terminal</td><td>Zero potential</td></tr>
<tr><td rowspan="2">Commu nication</td><td>485+</td><td colspan="2">RS485+</td><td rowspan="2">Communication RS485 (Communication protocol Modbus)</td></tr>
<tr><td>485-</td><td colspan="2">RS485-</td></tr>
<tr><td rowspan="2">Analog output</td><td>I</td><td colspan="2">Output 4-20 mA impedance ≤ 400Ω</td><td rowspan="2">Im=In (I-4)/8
Im: output current of motor (A)
In: rated current of motor (A)
I: 4-20 mA output current (mA)</td></tr>
<tr><td>COM</td><td colspan="2">Common terminal</td></tr>
<tr><td rowspan="7">Relay output</td><td>K14</td><td>NO</td><td rowspan="3">Error output terminals ②</td><td rowspan="3">In case of error:
K14 - K12 connected;
K11- K12 disconnected;
Load of the contact:
AC: 10A / 250V DC: 10A / 30V;</td></tr>
<tr><td>K11</td><td>NC</td></tr>
<tr><td>K12</td><td>COM</td></tr>
<tr><td>K24* SSN</td><td>NO</td><td rowspan="2">* Bypass terminals ③ Model SSN only</td><td rowspan="2">K24 - K22 connected;
Load of the contact:
AC: 10A/250V, 5A/ 400V
DC:10A/30V</td></tr>
<tr><td>K22* SSN</td><td>COM</td></tr>
<tr><td>K34</td><td>NO</td><td rowspan="3">Program mable terminals ②</td><td rowspan="3">Optional: start, run, bypass, error, soft stop;
Load of the contact:
AC: 10A/250V, 5A/ 400V
DC:10A/30V</td></tr>
<tr><td>K31</td><td>NC</td></tr>
<tr><td>K32</td><td>OM</td></tr>
</table>

①: You can choose two connection modes, see figure 8.0.

②: Fault, bypass and programmable output terminals are de-energized.

③*: Output terminals (K22 / K24) are also used in the SSN product line.

10 Connection of the main circuit

The power supply is connected to the power terminals R / S / T. The output from the soft starter is connected to U / V / W terminals. See figure 10.1.

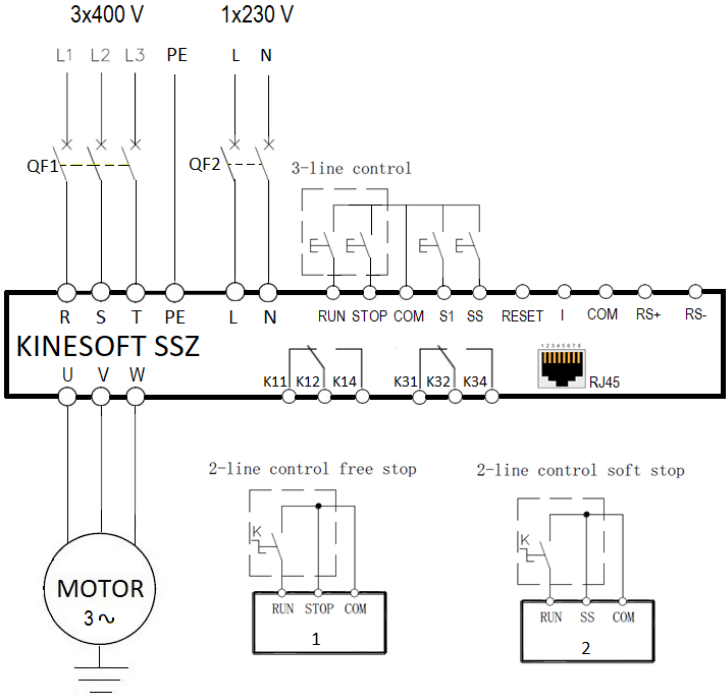
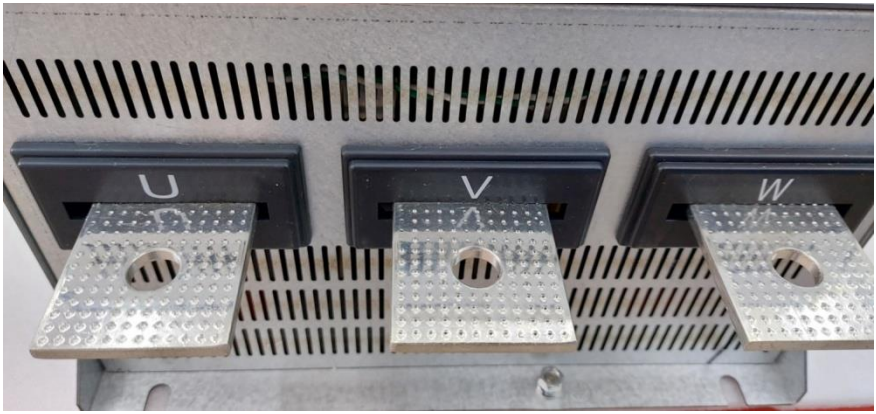
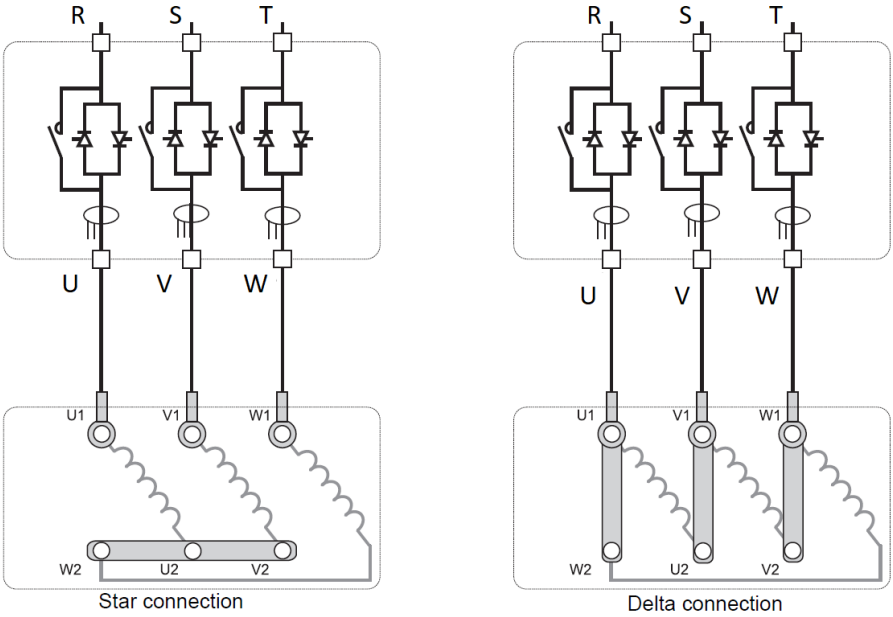


Figure 10.1

R/S/T input power terminals



Output terminals U/V/W



Connecting the electric motor

11 Connecting the control circuit

There are terminals for the control circuit on the main control board. These control circuit terminals provide the user with a simple implementation of remote control and external control. The user can connect the relevant terminals according to the current status. By setting the parameter, the user can choose keyboard mode or terminal mode, through which he can control start and stop. The soft starter has two rows of terminals, X1 (10 positions) and X2 (8 positions), see Figure 11.1 below for details.

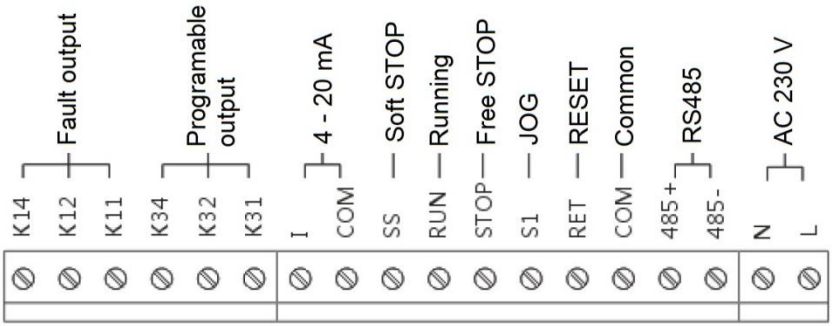
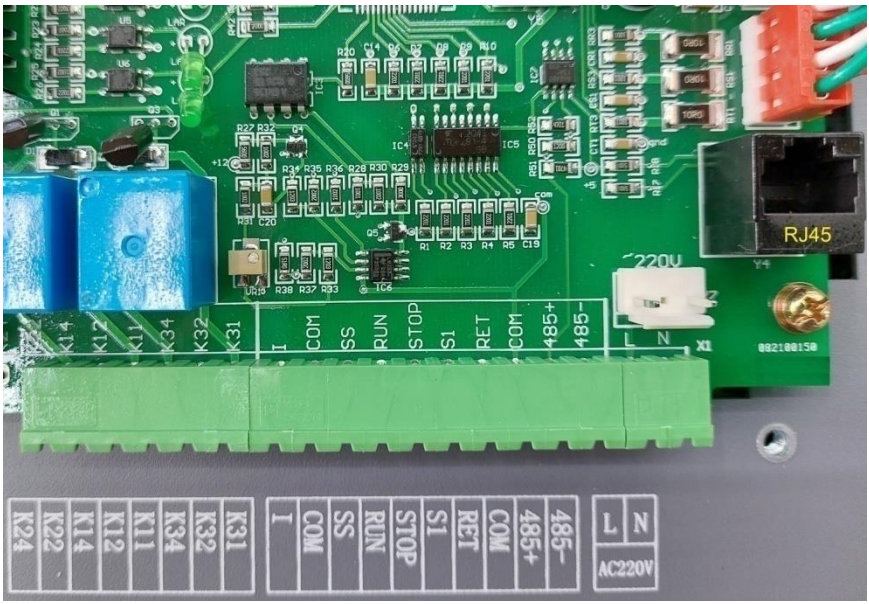


Figure 11.1



RJ45 connector for connecting the display with a LAN cable

12 Control mode

The KINESOFT soft starter has four starting modes: Voltage ramp, current limit, jogging and heavy load. These start-up modes are independent. You can only choose one of them. The text below describes each mode and the conditions under which it should be selected.

12.1 Voltage ramp

The voltage curve is shown in Figure 12.1. Us is the initial output voltage. When starting, the output voltage increases up to the Un value according to the setting of the parameter t (initial time). Then the engine accelerates smoothly. When the output voltage reaches Un, the motor speed has reached the rated speed. The start-up process is complete. The initial voltage Us and the start time t are adjusted according to the load. The Us range is from 5% to 75% of Un and the time setting range t is 1s to 120s.
Example: Un= 400 V; Us= 120 V; ts= 30 s

This mode is used in a drive with a large inertial load or in a condition where current is not an important parameter, but stability is important. By using this mode, mechanical stress and starting shocks can be significantly reduced. The greater the initial voltage, the greater the initial torque and starting shock. The start time depends on the load. In this type of start, the current limitation is not solved.

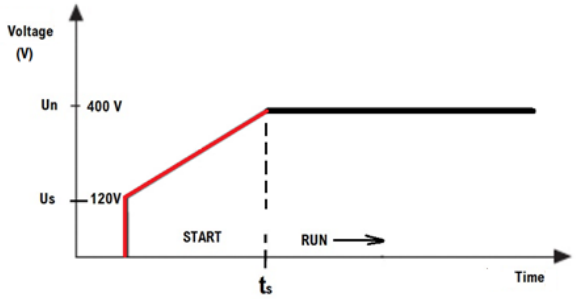


Figure 12.1

12.2 Current limitation - current limit

In current limiting mode, the output voltage increases rapidly until the output current reaches the set value of current I_L. See Figure 12.2. The output current is kept below this value. Then the output voltage gradually increases and the motor accelerates; when the motor speed is close to the rated speed, the output current quickly drops to the rated value In, the starting process is finished. The limit current can be adjusted according to the load. The range of this parameter is 0.2 - 4 In.

This mode is used in a situation where the magnitude of the current is a very important parameter. Especially, under conditions of very low network capacity. The current limit should be set to 2.5-3 times of In. If this value is small, the start can be problematic. In this mode, the start time depends on the set current limit. The higher the limit value, the shorter the start-up time and vice versa.

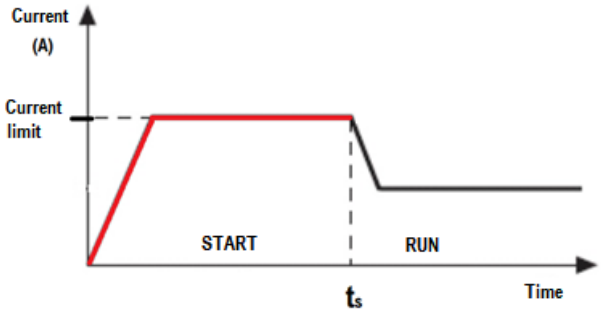


Figure 12.2

12.3 Jogging

In this starting mode, the output voltage quickly reaches the initial default starting voltage U1 and remains unchanged. The drive will rotate slowly. This mode is suitable, for example, when introducing the belt into the line or setting the line at slower speeds. By changing the value of voltage U1, the output voltage and torque of the motor will change. See Figure 12.3.

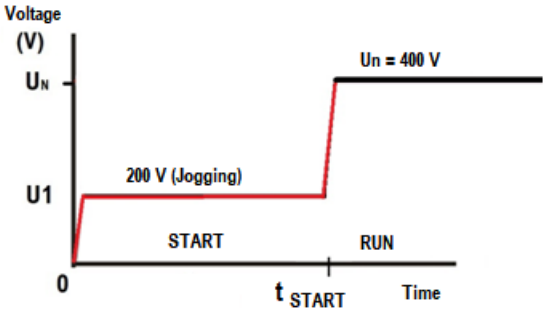


Figure 12.3

12.4 Driving in HEAVY LOAD mode

The Heavy Load control method is suitable for the most demanding applications of heavy starts. In this starting mode, you can combine the voltage ramp control method and the current limit control method. Setting up this control method requires considerable experience in drive parameterization. See Figure 12.4.

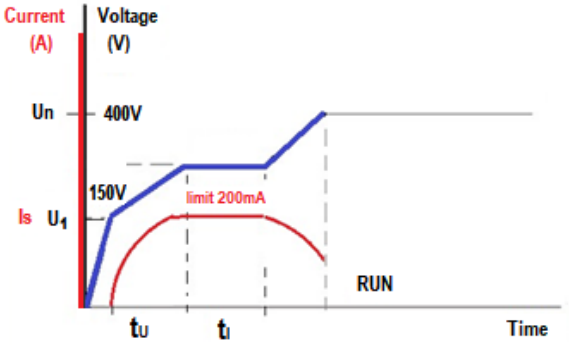


Figure 12.4

13 Stop mode

You can choose two stop modes. The user can set this parameter according to the load and working conditions.

- Free stop the motor will gradually stop by inertia according to the size of the load.
- Soft stop (controlled stop)

The output voltage gradually decreases. Eventually, the engine stops completely. The stop time is related to the load parameter and magnitude and the stop time parameter. If you want to achieve a smooth controlled stop, you should select this mode.

14 Keyboard

14.1 Description of the keyboard

A keyboard with a display is available on the front of the soft starter. The user can control data display, data storage, data inspection, fault display, fault reset, motor start or stop, etc. The construction of the keyboard is shown in Figure 14.1.

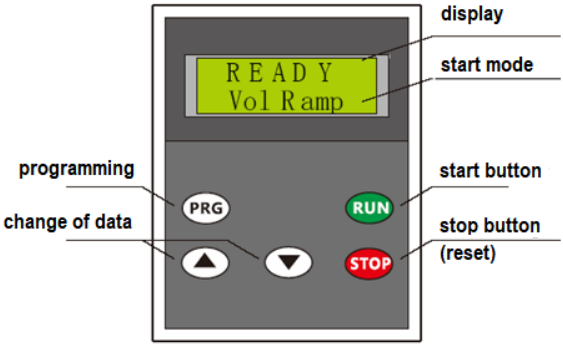


Figure 14.1

14.2 Function of buttons

There are five keys on the keyboard: RUN (start), STOP (stop), PRG (programming) ▲ (increase), ▼ (decrease).

- **RUN:** When the system is in READY state, press this button to activate the engine start in the start mode set by the user.
- **STOP:** When the system is in start mode or running state, pressing this button will stop the engine and the system will go in READY state. When the system is in the Para Group setting mode, after pressing this button, the system will enter into the READY state and the parameters changed by the user will be saved at the same time. When the system is in the FAULT state, a fault code will appear on the display. After pressing this button and holding it for 5 seconds, the system will enter in the READY state.
- **PRG:** Hold this button for 5 seconds in the READY state and the system will enter in the Para Group setting state. In this state, the user can switch between different parameters.
- ▲ (increase): in the setting state, the user can increase the value of the parameter by pressing this button.
- ▼ (decrease): in the setting state, the user can decrease the value of the parameter by pressing this button.

Notes:
1. In the READY state, press the PRG button and use the up/down arrows to change the parameters. After pressing STOP, the changed data is automatically saved.
2. If the user chooses external control, the keyboard can be removed after setting all parameters.

15 List of parameters

No	Name	Scope and meaning	Factory setting	Notes			
1	Group of parameters **Para Group**	1: Basic 2: Expanded 3: Communication 4: Rated current 5: Bypass coefficient (for service settings only)	1				**o**
2	Start mode **StartMode**	1: Voltage ramp ▲ 2: Current limit ★ 3: Slow start (Jogging) ■ 4: Heavy load **O**	1	▲	★	■	**o**
3	Initial voltage **InitialVol**	5% - 75% Un	30	▲			**o**
4	JOG voltage **JOG Voltage**	5% - 75% Un	30			■	**o**
5	Ramp start time **Ramptime**	1 – 120 sec	30	▲			**o**

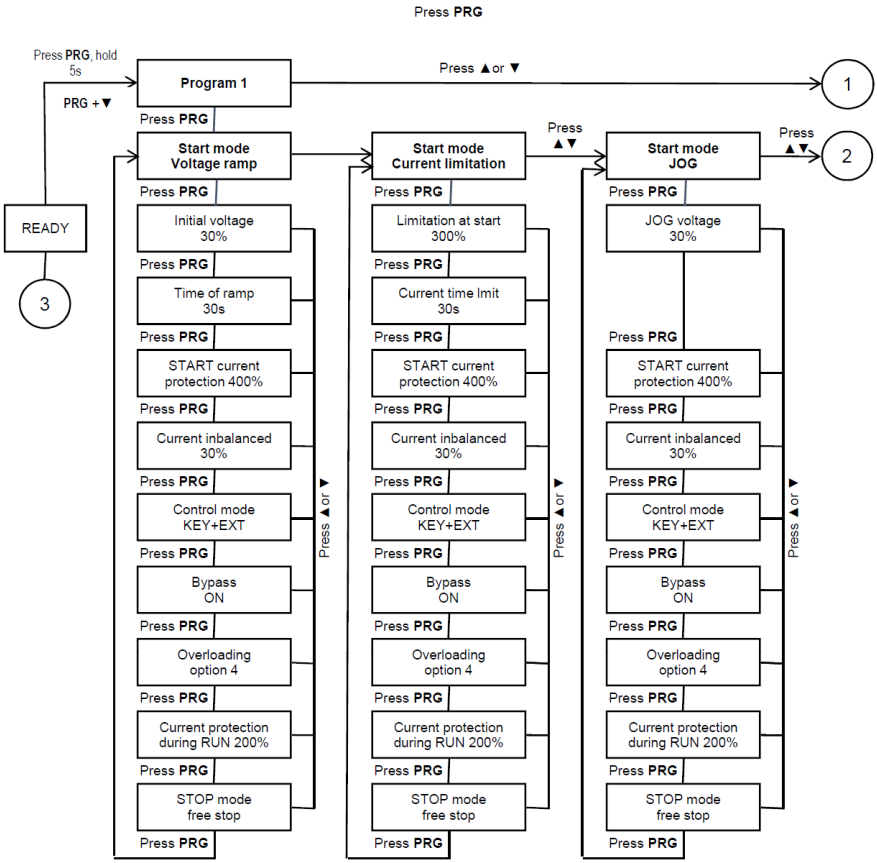
No	Name	Scope and meaning	Factory setting	Notes			
6	Current limit at start **Start C Limit**	100% - 500% In	300		★		o
7	Start timeout **C Limit Time**	1 - 120 sec	30		★		o
8	Current protection at start **Start C Pro**	400% - 600% In	400	▲	★	■	o
9	Current unbalance factor **C Unbalance**	5% - 150% of the set current value	30	▲	★	■	o
10	Control mode **ControlMode**	1: Keyboard 2: External 3: Keyboard + External (KEY+EXT) 4: By RS485 - MODBUS 5: Keyboard + RS485 (KEY+MODBUS) 6: External + RS485 (EXT+MODBUS) 7: All methods of the control	3	▲	★	■	o
11	Bypass start option **TrigBypass**	1: OFF trigger closed 2: ON trigger opened	1	▲	★		o
12	Overloading level at startup **OverloadSel**	1 - 8	4	▲	★		o
13	Current protection during RUN **Run C Pro**	20% - 400% Ie	200	▲	★		o
14	Stop mode selection ① **Stop Mode**	1: Free STOP 2: Controlled stop (by ramp)	1	▲	★		o
15	Protection against current overload during running **Run C Pro**	1: ON 2: OFF	1				
16	Current imbalance **C Unbalance**	1: ON 2: OFF	1				

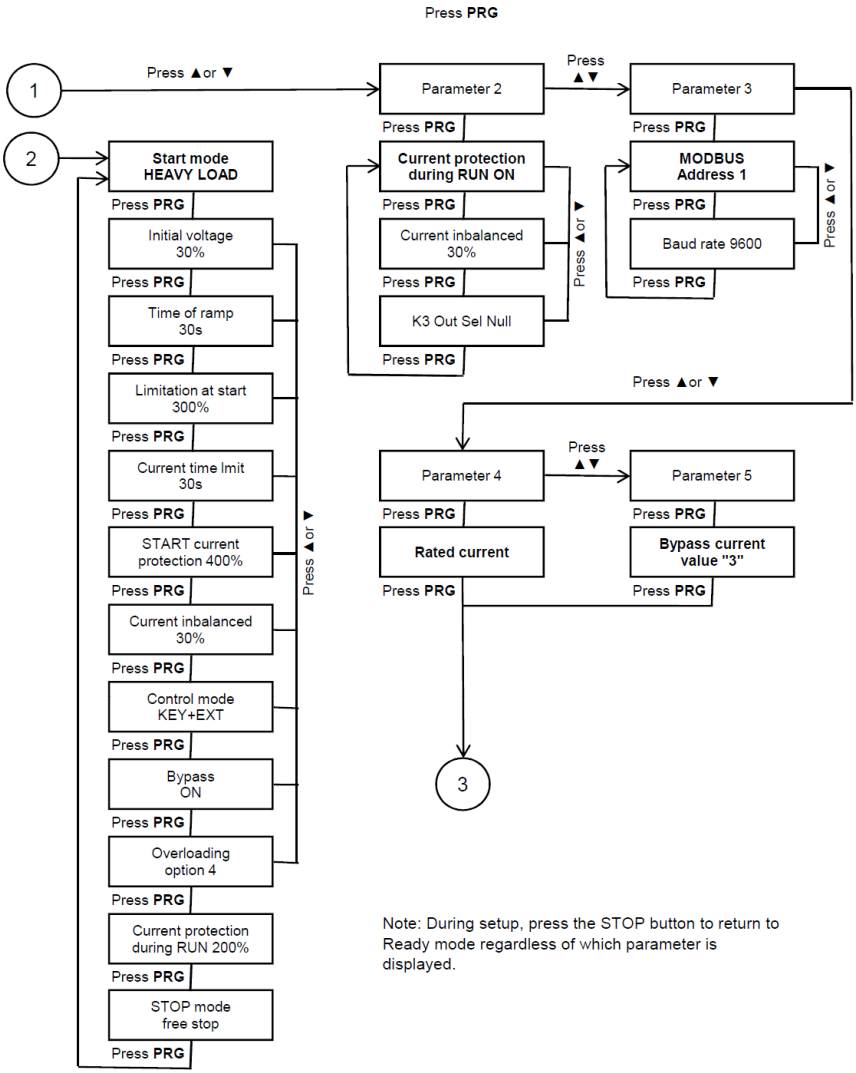
No	Name	Scope and meaning	Factory setting	Notes			
17	Programmable output **K3 OutSel**	0: OFF 1: Start 2: Bypass 3: Running 4: Controlled stop 5: Fault	0				
18	Communication address **ModbusAddr**	1 - 256	1				
19	Baud rate **Baud Rate**	0：2400 1：4800 2：9600 3：14400 4：19200 5：28800	2				
20	Rated current **RatedCurr**	See chapter	By model				
21	Malfunction - Error **Fault**	See chapter	-				

Note:
▲: Applies to voltage ramp mode.
★: Valid in current limiting mode.
■: Valid in JOG mode.
O: Valid in HEAVY LOAD mode

①: The "Selection of stop mode" parameter is active if the control is from the keyboard. If the external control mode is selected, the stop mode is determined by an external signal. See Figure 5-1 for details.
②: If the "SCR Selection" parameter is set to 3, the keyboard will display "b-p" and the product cannot monitor the current and the protection is inoperative.

16 Setting parameters





Note: During setup, press the STOP button to return to Ready mode regardless of which parameter is displayed.

17 Special parameters

17.1 Rated current

The rated current indicates the output current of the soft starter at rated power. This parameter changes with the output power of the soft starter. The user can find out this parameter according to the next procedure. In the READY state, press and hold the ▼ button, the rated current in amperes will appear on the display. Release the button and you will return to the READY state.

For example: the rated current is 150 A

Figure 17.1

17.2 Last fault

In the READY state, press the STOP button and release it after 5 seconds, the display will show the last fault. Release the button and you will return to the READY state.

For example: the last fault is phase 1 failure

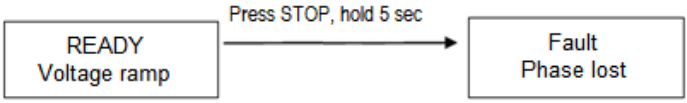


Figure 17.2

17.3 Current calibration display

The current of each soft starter, shown on the display, is calibrated at the factory. If the user finds that the current value shown on the display is not equal to the actual current value, this parameter can be recalibrated.

Calibration method: Set the start mode to JOG and connect the motor to its load, set the Jogging voltage parameter below 40%, hold down the RUN button (you will enter the JOG mode), simultaneously press the PRG buttons and the up ▲ or down ▼ button to change this value , until it matches the current current. Then release the RUN button and the PRG button, the modified parameter will be saved automatically.

18 Detailed description of parameters

Start mode	The soft starter has four start modes. The user can set this parameter using the keyboard according to chapter 14.2.
Initial voltage	This parameter applies to voltage ramp mode. The parameter indicates the initial output voltage at the start moment and the initial voltage. The greater this parameter, the greater the torque. The default value is 30%. When loaded with a fan or pump, this parameter should not be greater. For a larger initial static load, the parameter can be increased. The parameter can be set in the range of 20-50%. If Current Limit mode is selected, this parameter is invalid.
JOG voltage	In this mode, the range of the parameter is 5 to 75%. In JOG mode, the output voltage remains unchanged (it is a set parameter). If this parameter is too low, the motor cannot rotate. This is normal. The user can set this parameter using the keyboard according to chapter 14.2.
Ramp time	This parameter indicates the maximum time between the start and the end of the start. The factory default value is 30 seconds. If, after reaching this time, the starting current is not less than 125% of the rated current, the soft starter will automatically enter the protection state after 3 seconds. This parameter is set according to the type of load. With heavy loads, this value can be increased. For light loads, the start time may be shorter than the set time. The parameter is invalid in current limiting mode.
Current limitation at start	In current limiting mode, this parameter indicates the maximum current during start. The parameter setting range is 20% - 500% In. The default value is 300%, that is, the starting current is three times the rated current. It's fine under pump or fan load. With another type of load, the user can adjust the parameter according to the nature of the load. It is better to set the value between 250% to 350%. The parameter is invalid in voltage ramp mode.
Current limiting time	The setting range of the current limitation time is 1 - 120 seconds. The factory default value is 30 seconds. In the current limit mode, if the actual starting time is longer than this set value and the starting current is not less than 125% of the rated motor current, the system will automatically enter the protection state.
Start/Stop current protection	The parameter setting range is 400 - 600% In. The parameter is used due to the protection function against large current at start. The default value is 400%. If the load is high, this parameter should be increased.
Current unbalance factor	This parameter is used for protection, which is focused on the differential current in the phases during operation. The default value is 30%. The smaller the parameter, the greater the sensitivity of the set protection. The parameter should not be too small to avoid that the protection will be too sensitive in the normal operation of the equipment and will often react (declare a fault). Note: This protection function is only active when the average current is greater than 20% of the rated current. Calculation of the current unbalance factor: current unbalance factor $\triangle I\% = (I_{max} - I_{min}) / I_{average}$ $I_{average} = (I_u + I_v + I_w)/ 3$

Control mode	By changing this parameter, the user can choose control via keyboard, terminal block or communication from PLC (PC). The default factory value is 3. The set value is 2 - control via the terminal block, 3 - control is via the terminal block and from the keyboard, 4 - control is via RS485, 5 - control is from the keyboard and via RS485, 6 - control is via the terminal block and via RS485, 7 - control is from the keyboard and from the terminal board and via RS485.
SCR trigger option	After closing the bypass contactor, the next operation is governed by the SCR setting mode. 1 – the bypass contactor is closed; the SCR trigger is blocked. The display shows the current while running and all protection functions are on. 2 - the bypass contactor is closed; the SCR trigger is not blocked. The display shows the current while running and all protection functions are on.
Congestion level at start-up	There are 8 levels of protection. The protection time of each level is different. The relationship between overload multiples and protection time is given in chapter .... The default value is 4 (corresponds to IEC60947-4-2, class 15). Note: Overload protection is the inverse time after the bypass contactor is turned on.
Current protection during running	This protection function is activated immediately if the instantaneous current is greater than the set value. The factory default value is 200% In. It means that the protection value is twice the rated current.
Stop mode selection	There are two stop modes: "soft" stop and idle stop. Default value is 1 - idle stop. Function 2 - soft stop is a controlled stop along a curve.
Soft stop factor	This parameter is only valid when the "free stop" mode is not selected. Sets the time and effect of the soft stop. If the parameter is set correctly, a smooth stop effect is achieved.
Current overload while running	This parameter ensures protection against overcurrent during operation (running). 1: ON 2: OFF
Current imbalance	This parameter ensures protection against current imbalance in individual phases. 1: ON 2: OFF
Choice of programmable relay output function	The parameter determines which status can be "reported" via the programmable output relay 0: OFF 1: START 2: Bypass 3: Running 4: Controlled stop 5: Fault
Communication address	MODBUS communication address: 1 to 256
Baud rate	MODBUS communication baud rate 0: 2400 1: 4800 2: 9600 3: 14400 4: 19200 5: 28800

19 Working mode

READY

When the soft starter is switched on, the device performs a self-check. This includes: testing parameters that the user has changed (protection against parameter setting failure), checking the power supply phases (missing phase protection) and checking if the system temperature is not too high (overheating protection), etc. If any abnormality is detected, the system will immediately enter the fault mode. If no error is detected, the system enters the READY state and the READY message appears on the display.

Setting

When the soft starter is in the READY state, press the PRG button and hold it for 5 seconds, or press the PRG button and the ▼ button at the same time, the system will enter the SETUP (Para Group) state. You can edit all parameters in this state. See Chapter 9 for details.

Start

When the soft starter is in the READY state and the engine start is enabled, then the user can press the RUN button to start the engine according to the user setting. At the same time, the display shows the current value of the set parameter. During the start or run process, the user can press the STOP button at any time to stop the engine and the system will go into the READY state.

In this state, the system detects power phases, current overload (including short circuit, blocked or overloaded motor), start-up time and system temperature, etc. While the motor is running, the soft starter can protect the motor from overload and phase failure.

Failure

When the soft starter is in the process of starting, operating or ready, the system monitors all protection parameters. If the measured value is higher than the user-set limiting value, the trigger signal of the SCR module is disconnected and the system goes into a fault state. The display shows information about the fault.

20 Fault reporting

KINESOFT has 11 protective elements installed. When a fault is detected, the soft starter immediately stops the drive and the fault information is shown on the display. The user should check the cause of the fault and remove it before restarting the drive. After solving the fault, press the STOP button (hold for 3 seconds) or connect the RET and COM terminals to reset the error and enter the standby state.

More detailed information can be found in Table 21.1.

Displayed information	The cause of the error Solution	Solution
PARA ERROR	Loss of parameter	Check the parameters and reset them
LACK-PHASE	Power is not connected One phase is missing	Check the power and output cables
MOTOR STALL	Instantaneous current at start is greater than allowed	Check the load The initial voltage is high the set current limit is high
OVER HEAT	The cooler is overheated	Checking the fan Checking the load of the bypass contactor
START T LONG	The load is too great. The start-up time is too short	Check the load Increase the start time Increase the current limit
OVERLOAD	Overloading	Check that the load current has not exceeded the set limit
RUN OVER C	Sudden increase in load The load fluctuation is too large	Adjust the load
C UNBALANCED	Motor fault The imbalance factor parameter is too small	Check the motor Set the imbalance factor higher
START OVER C	The starting current is above the limit	Adjust the current protection limit and value
STOP OVER C	The soft stop current is above the limit	Adjust the current limit Set current protection Set the soft stop factor
NO BYPASS C (models SSN)	The bypass contactor is not connected	Connect the bypass contactor
INTERFERENCE	External interference	Remove the source of the interference

Note:

①: Read the last error information

②: If a fault occurs, the user can reset the fault in 3 ways shown below:

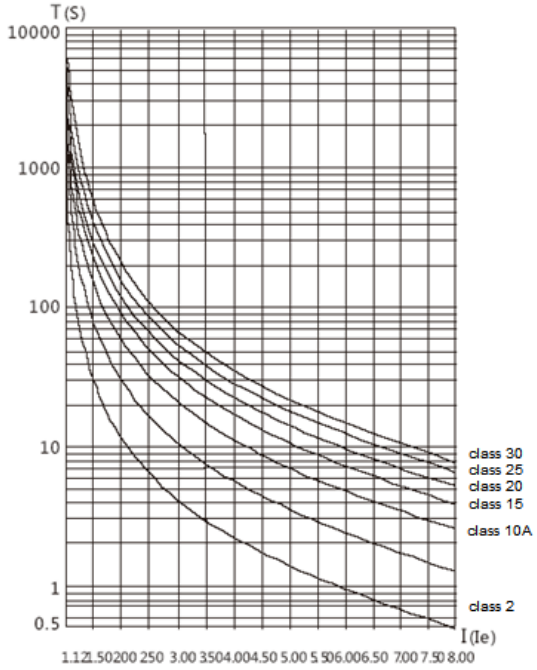
- Press the STOP button and hold it for 3 seconds.
- Connect the RET and COM terminals for at least 3 seconds.
- Turn the device off and on again.

21 Overloading

An overload protection function is used during the start-up and start-up process.

- There are 8 levels of protection. The default value is 4 (in accordance with IEC60974-4-2, class 15). The user can set this parameter according to the load condition. The smaller the value of the parameter, the shorter the time until the start of protection and vice versa.
- Level 2 cannot be selected (according to 10A standard IEC60974-4-2). See Table 21.1, Chart IEC60974-4-2 for details.

Overload protection levels	IEC60947-4-2	5Ie	4Ie	3Ie	2Ie	1.5Ie	1.2Ie	1.05Ie
1	Class 2	1.5s	2.5s	4.5S	13S	35S	180S	—
2	Class 10A	4s	6S	12S	30S	80S	460S	—
3	Class 10	8s	13S	23S	60S	180S	800S	—
4	Class 15	12s	18S	32S	90S	230S	1200S	—
5	Class 20	16s	25S	46S	130S	320S	1650S	—
6	Class 25	18s	30S	58S	170S	520S	2200S	—
7	Class 30	23s	36S	68S	190S	650S	2800S	—
8	Special class	28s	45S	82S	224S	—	—	—



IEC609 74-4-2 Motor thermal protection curve

22 Pre-start inspection, start-up and test operation

- Check before start

For a safe start, the user should check the following:

  - Does the power of the soft starter correspond to the power of the motor?
  - Does the insulation of the motor winding meet the standard requirements?
  - Is the power supply and motor connected correctly?
  - Are all nuts properly tightened?
  - Measure the input voltage of phases R \ S \ T (combined and phase voltage). Check the wiring for a short.

- Switching on and test operation
  - When the power is turned on, the system will go into READY mode, the READY message on the display means that everything is correct. On the left side of the keyboard are two indicators that indicate the start mode (voltage ramp or current limiting). The user selects the mode according to the load.

Note: do not forget to connect the power supply of the control circuits 1x230V AC. Even without a connected 1x230V power supply, the display will light up, the device can also be programmed, but it will not turn on the bypass internal circuits and will not work properly.

  - If the display shows READY, press the RUN button to start the motor, then the actual current will be displayed. In the start state, press the STOP button to stop the engine and return to the READY state.

- Warnings and security
  - If the device detects a malfunction (fault), a fault code will appear on the display. See table 21.1, remove the error according to the relevant recommendations.
  - Warning: If the soft starter is under voltage, do not open the cover to avoid electric shock!
  - Warning: If any abnormal phenomenon such as unusual noise, smoke or smell occurs during the test run, please disconnect the power supply immediately!
  - If during the test run you find that the starting process is not smooth, you can change parameters such as starting mode, starting current, voltage, time, etc.

23 Warranty and warranty period

23.1 Soft starter tests

The soft starter was thoroughly tested and pre-programmed by the manufacturer before shipping. The properties of the KINESOFT SSZ and SSN product correspond to the technical documentation, provided that it is installed and used in accordance with the instructions and recommendations given in the technical documentation and in the user manual.

Tested circuit		Test result	The relevant standard
Insulation resistance		>1MΩ	GB12668
Insulation strength		2.5kV AC. 60s, leakage current < 1mA	GB12668
ESD	Constant discharge	+/- 4kV	EN61000-4-2
	Air discharge	+/- 8kV	
	Discharge in connections	+/- 4kV	
EFT		+/- 2kV	EN61000-4-4
		+/- 2.5kV	
	Signal paths	+/- 4kV	
Overvoltage in wires	Phase-to-phase	+/- 2kV	EN61000-4-5
	Counter-direction	+/- 4kV	
CS test (freq. range 150kHz - 80Mhz)		10 V (e.m.f)	EN61000-4-6

23.2 Warranty period

The warranty period for the consumer is 12 months from the date of sale of the product.

23.3 Warranty conditions

The warranty applies only to malfunctions and defects caused by a manufacturing error or the materials used. The warranty is extended by the time during which the device was under repair. The customer claims the warranty repair at the manufacturer. The buyer will deliver the device to the seller for repair at his own expense.

23.4 The warranty does not cover defects caused:

1. Due to the fault of the buyer - user, in the event of mechanical damage (e.g. during transport or falling), or during use in violation of the technical documentation, incorrect connection, incorrect insurance, or if the defect was caused by unprofessional intervention in the product.
2. When the device is damaged by external influences (dusting of the internal parts of the device, wetting of the internal circuits) and natural events (effects of high overvoltage's, e.g. as a result of lightning strikes, fire, water flooding, etc.)
3. Improper storage, connection contrary to the recommended connection, damage caused by external influences, especially the effects of electrical quantities of an inadmissible size.

24 Communication protocol

1. Modbus protocol communication

The KINESOFT series soft starter is equipped with a Modbus communication interface. The Modbus communication protocol is used for Master-Slave communication. In order to meet the specific requirements of the application, the user can use the PC/PLC/touch screen as the main computer to realize the central control.

The communication protocol of the KINESOFT series soft starter is an asynchronous serial Master-Slave Modbus communication protocol. Only one device that can create a protocol can be a host on a network. Other devices intelligently respond to the host to take the corresponding

action. Host refers to PC, touch screen or PLC. A soft starter or other communication device with a communication protocol is connected as Slave.

Communication data in RTU mode:
The encoding system is 8-bit binary;
Data format: 1 start bit, 8 data bits, 1 check bit, 1 stop bit, no parity;
Address range for Slave: 1-256;
Baud rate: 28800 (b/s), 19200 (b/s), 14400 (b/s), 9600 (b/s), 4800 (b/s), 2400 (b/s).

2. Description of communication data

2.1 Reading data from the soft starter

Communication request format

Idle time	3.5 characters
Slave address	Number Slave
Command code	03H
Starting address, high byte	
Starting address, low byte	
Data size, higher byte	
Data size, lower byte	
CRC, lower byte	
CRC, higher byte	
Idle time	3.5 characters

Example: 01 03 10 04 00 01 c1 0b, read start mode

Response format
Accepted correct response format: (2 data and 4 bytes)

Idle time	3.5 characters
Slave address	Number Slave
Command code	03H
Number of bytes	04H
First data, higher byte	
First data, lower byte	
Second data, higher byte	
Second data, lower byte	
CRC, lower byte	
CRC, higher byte	
Idle time	3.5 characters

Example: 01 03 02 00 01 79 84, start mode is 1.

2.2 Writing data to the soft starter

Communication request format

Idle time	3.5 characters
Slave address	Number Slave
Command code	06H
Starting address, high byte	
Starting address, low byte	
Data size, higher byte	
Data size, lower byte	
CRC, lower byte	
CRC, higher byte	
Idle time	3.5 characters

Example: 01 06 10 02 00 02 ad 0b, writes the start-up mode to 2 2.

01 06 20 00 00 01 43 ca, start

01 06 20 00 00 02 03 cb, stop

Response format

Correct response format accepted

Idle time	3.5 characters
Slave address	Number Slave
Command code	03H
Number of bytes	04H
First data, higher byte	
First data, lower byte	
Second data, higher byte	
Second data, lower byte	
CRC, lower byte	
CRC, higher byte	
Idle time	3.5 characters

Example: 01 03 02 00 01 79 84, start mode is 1.

Definition of the address corresponding to the parameter (see specification for details and range)

No	Address	Name of parameter	R/W
1	1000H	Rated current	R
2	1001H	Reserve	06H
3	1002H	Working current	04H
4	1003H	Fault (see instructions)	
5	1004H	Start Mode (1. Ramp, 2. Limit I, 3. Jog, 4. Heavy load)	
6	1005H	Initial ramp voltage (5-75%)	
7	1006H	Ramp time (1 – 120s)	
8	1007H	Limit value of starting current (20-400%)	
9	1008H	Start time limit (1 – 120s)	
10	1009H	Voltage during JOG (5 – 75%)	
11	100AH	Control mode: 1. Keyboard, 2. External, 3. Keyboard + external, 4. Communication interface, 5. Keyboard + communication interface, 6. External +communication interface, 7. Keyboard +external +communication interface	
12	100BH	START/STOP overcurrent protection (400-600%)	
13	100CH	Operation of overcurrent protection (20-400%)	
14	100DH	3-phase current unbalance factor (5-50%)	
15	100EH	Choice of STOP mode (1. free stop, 2. soft stop)	
16	100FH	Soft stop time factor (1 - 10S)	
17	1010H	SCR trigger selection (1. close 2. not close)	
18	1011H	Start overload level (1-8)	
19	1015H	Overcurrent protection ON/OFF (1. ON, 2. OFF)	
20	1016H	Current imbalance protection ON/OFF (1. ON, 2. OFF)	
21	1017H	Programmable relay mode selection (1. start; 2. bypass; 3. run; 4. soft stop; 5. fault)	
22	1018H	Communication address (1 – 256)	
23	1019H	Baud rate (0: 2400; 1: 4800; 2: 9600; 3: 14400; 4: 19200; 5: 28800)	
24	101EH	Status (bit0 - start; bit1 - bypass; bit2 - run; bit3 - soft stop; bit4 - fault. All bits = zero - stop)	
25	102BH	Current through phase A	
26	102CH	Current through phase B	
27	102DH	Current through phase C	
28	1036H	Penultimate fault	
29	1037H	The third penultimate fault	
30	2000H	START/STOP control (=1 - start; = 2 - stop, reset)	