



MR-L | Series Soft Starter

User's Manual

Shanghai Metallurgy General Electric Co. Ltd.

CAUTIONS

- (1) There is dangerous voltage when main circuit is energized.
 - (2) It is forbidden to connect input terminal (1L1, 3L2, 5L3) to output terminal (2T1, 4T2, 6T3) or (B1, B2 and B3).
 - (3) It is forbidden to connect compensation capacitor or piezoresistor to output terminal (2T1, 4T2, 6T3) of soft starter.
 - (4) When soft starter and frequency converter are mutually in standby, their output terminals should be isolated from each other.
 - (5) Do not attempt to repair damaged components and please contact your supplier.
 - (6) Radiator's temperature maybe much higher.
 - (7) Do not reversely feed power at output terminal of soft starter.
 - (8) Output terminal remains high voltage either when soft starter is active or in state of rest.
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Table of contents

Foreword	1
Chapter 1 Function and Characteristic of MR-L Soft Starter	2
1.1 Function	2
1.2 Characteristics.....	2
Chapter 2 Goods Receiving and Inspection.....	4
Chapter 3 Service Conditions and Installation	6
3.1 Service condition	6
3.2 Installation direction	8
3.3 Installation space.....	8
3.4 Circuit wiring.....	8
Chapter 4 Circuit Connection.....	9
4.1 Basic wiring diagram.....	9
4.2 Delta internal connection diagram.....	11
4.3 Wiring diagram for typical application	12
4.4 Description of terminal	13
Chapter 5 Instruction to Display and Operation.....	15
5.1 Panel view.....	15
5.2 Description of key functions.....	16
5.3 Description of display state.....	16
5.4 Flow of modifying parameters.....	17
6.1 Current ramp start	18
6.2 Voltage ramp start	19
6.3 Step torque soft start	19
6.4 Free stop.....	20
6.5 Soft stop.....	20
Chapter 7 Parameter and Description.....	22
7.1 Start/stop control parameter.....	22
7.2 Motor's protection parameter	23
7.3 Port setting parameter	24
7.4 Manufacturer's parameter	25
7.5 Function description	26

Chapter 8 Fault Detection and Clearance	30
8.1 Fault code table	30
8.2 Fault clearance	32
Chapter 9 Communication Control.....	33
9.1 Protocol content	33
9.2 Bus structure	33
9.3 Explanation of protocol	34
9.4 Communication frame structure	34
9.5 Address explanation.....	36
9.6 Control command parameter address.....	38
9.7 Description of function code.....	38
9.8 Communication time interval	39
9.9 Attention	40
9.10 Analysis of communication fault code.....	40
Chapter 10 Daily Maintenance.....	41
Attached table 1:Inner Delta Connection Size and Fitting Selection for Soft Starter (with 380V as an example).....	42
Attached Table 2: Instructions to installation of accessories of MR-L soft starter	45
Attached Table 3:Dimension and Hole Size of Soft Starter (Unit: mm, with 380V as an example)	46
Attached Table 4: Model selection of Soft Starter.....	48

Foreword

Thank you for choosing MR-L motor soft starter produced by Shanghai metallurgy general electric Co., Ltd. In order to make full use of this soft starter, please read through the User' s Manual before starting operation. Please do operate this soft starter in accordance with the instructions for the purpose of ensuring the personal safety. When you have any problem to which the solution is not described in this manual, please contact our agents or dealers. We are always ready to provide perfect service for you. Tech Support: +86-21-34500269.

Chapter 1 Function and Characteristic of MR-L Soft Starter

1.1 Function

MR-L motor soft starter is a sort of new type motor starting protector combining electronic technology, microprocessor and automation. It is able to stably start and stop motor without step change, which perfectly avoids mechanical and electrical impact as a result of using direct start, Y- Δ start and auto-induction voltage-reduced start to start motor and can effectively reduce starting current and distribution capacity. At the same time, as MR-L soft starter has current transformer and contactor built inside, user does not need to externally connect the both to soft starter.

1.2 Characteristics

◆ Unique SCR triggering close-loop control algorithm

The unique SCR close-loop control is specially designed for standard load and heavy load. User can choose current-limit start or voltage ramp start according to load conditions so as to realize absolutely smooth start without torque oscillation.

◆ High control precision

Adoption of high-performance Cortex-M3 32-bit inner core CPU for central control with features of fast speed, high precision and strong capability of anti-interference.

◆ Beautiful appearance

Three-in and six-out structure of main circuit under patent protection and built-in current transformer with easy wiring and high reliability.

◆ **Standard Modbus-RTU protocol**

Customer can choose to use or not use communication modal with standard Modbus-RTU according to the site requirements.

◆ **Fireproof material**

The product of below 90KW is in plastic structure made with inflaming retarding ABS material; for the product of 90KW and above, the upper cover is in plastic structure and main frame is made of aluminium-zinc plate with features of heatproof and corrosion resistance.

◆ **Integrated with advanced protective function**

Protective functions of phase failure, overload, overcurrent, phase current unbalance, thyristor overheat to protect motor and other equipment.

◆ **Movable panel**

The panel can be moved to equipment operating surface through machine interface for remote control.

◆ **Easy maintenance**

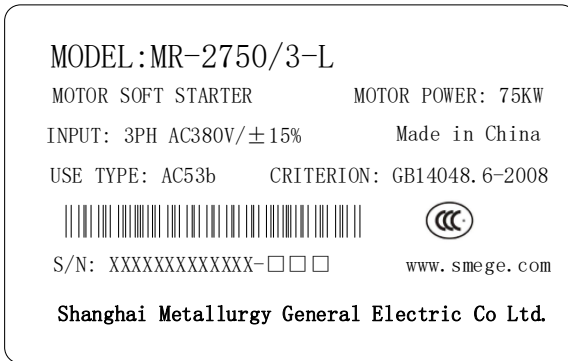
The monitor signal coding system consists of 4-digit display monitors working state of the equipment for 24 hours and provides fast fault diagnosis.

Chapter 2 Goods Receiving and Inspection

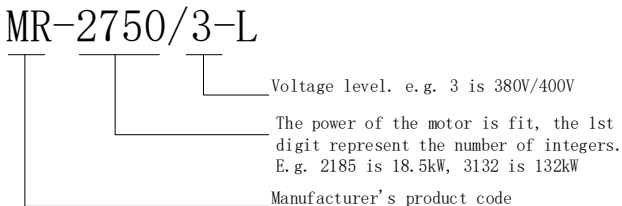
Each soft starter has been functionally tested for normal operation before delivery. After user receives the equipment, please carry out inspection as per the following procedures. For any problem found in inspection, please contact your supplier as soon as possible.

1. Check nameplate to confirm that the equipment you receive is consistent with the one you ordered.

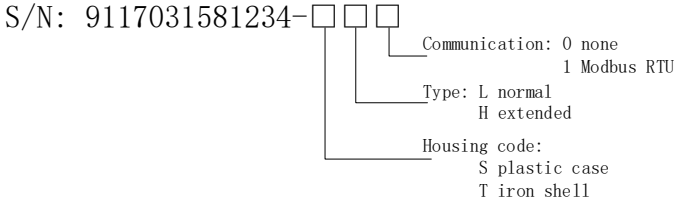
(1) Description of soft starter's nameplate



(2) Description of soft starter's model



(3) Description of soft starter's numbering



2. Check whether product is damaged during transport, such as housing sunken and deformed and inner wiring and connecting fittings are loose.
3. Check whether product certificate, warranty card, package list and user's manual are attached.
4. After delivered, the product's after-sale service shall be subject to warranty card. After receiving the product, please fill in warranty card and mail it back to Shanghai Metallurgy General electric Co., Ltd. or your supplier.

Chapter 3 Service Conditions and Installation

3.1 Service condition

Control power	extern	AC110V--220V±15%, 50/60Hz
	intern	Internal power ,no external connection
Three-phase power supply	Standard wiring AC380V ± 15% Internal delta wiring AC380V±15%	
Nominal current	18 ~ 1000A, 22 rated values in total	
Applicable motor	Ordinary squirrel cage AC asynchronous motor	
Start ramp mode	Voltage ramp start and current ramp start	
Stop mode	Free stop and soft stop	
Logic input	Impedance 1.8KΩ, Power supply +24V	
Start frequency	Frequent or infrequent start available, start is advised not to exceed 10 times each other	
Protective function	Phase failure,overcurrent,short circuit ,SCR protection, overheat, phase current unbalance, wiring and inner fault	
IP	IP00 ,IP20	
Cooling type	Natural cooling or forced air cooling	
Installation type	Wall mounted	
Communication method	RS485 (option)	
Environmental condition	When sea altitude is above 2,000m, soft starter should be derated for use. Ambient temperature: -25-+45°C Relative humidity :less than 95% (20±5°C) Free of flammable, explosive and corrosive gas or conductive dust. Good ventilation for indoor	

	installation and vibration is less than 0.5G
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3.2 Installation direction

To ensure that soft starter has good ventilation and heat dissipation conditions during operation, soft starter should be vertically mounted.

3.3 Installation space

Leave enough space around the equipment for heat dissipation. For convenience of maintenance, please keep a certain distance between the equipment and wall (see attached table 3). To choose air blower, please log on our website www.smege.com to download air blower's size.

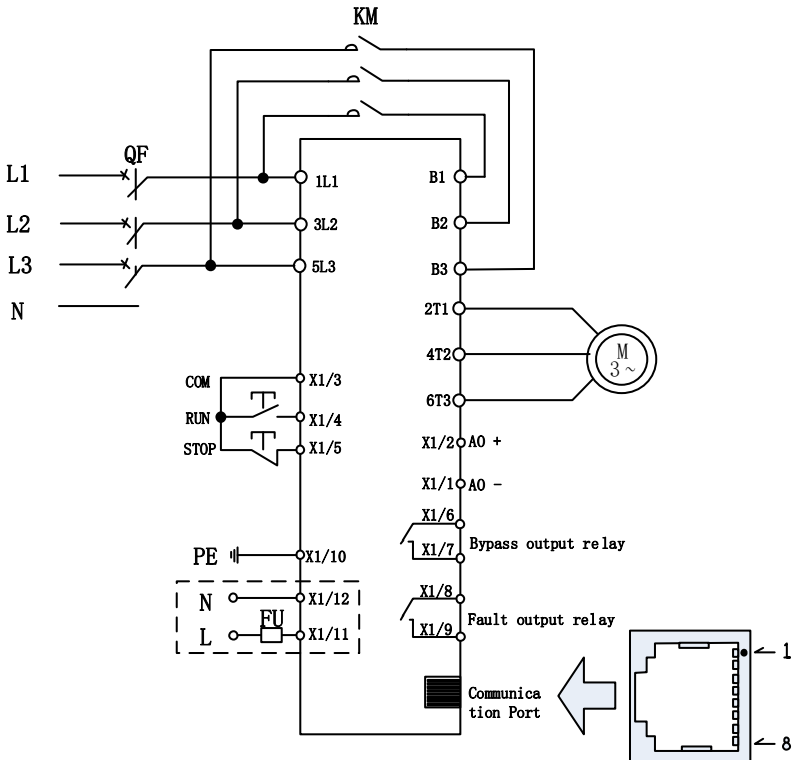
3.4 Circuit wiring

Main circuit uses up-in and down-out wiring and cable should be guaranteed to have enough current-carrying capacity. For selection of supportive fittings, please refer to attached table 1.

Chapter 4 Circuit Connection

4.1 Basic wiring diagram

Soft starter's terminals 1L1, 3L2 and 5L3 are connected to three-phase power supply and terminals 2T1, 4T2 and 6T3 connected to electric motor. Soft starter's detection of phase sequence can be determined by parameter setting. When bypass contactor is used, one end of contactor is connected to terminals 1L1, 3L2, 5L3 of soft starter and the other end connected to terminals B1, B2, B3.

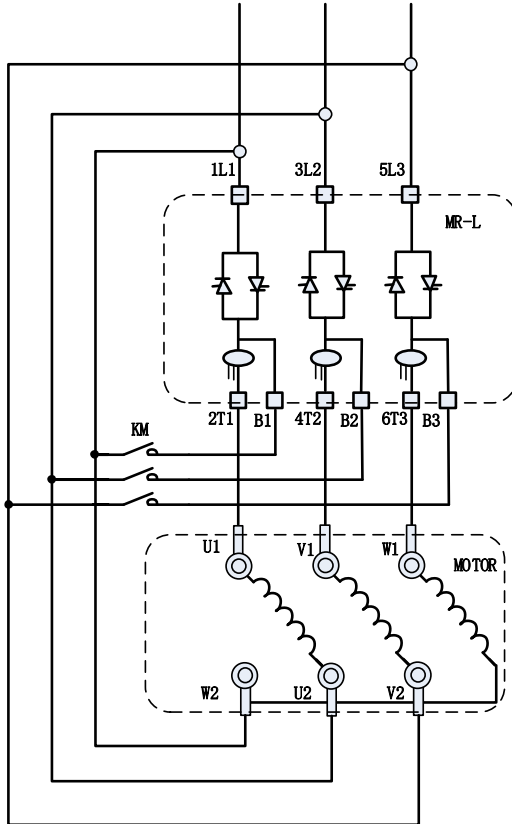


Basic wiring schematic diagram

Note: Communication interface is functional interface using optical fiber crystal head connecting terminal. As is shown in the figure, pins 1-8 are arranged in order from up to down. For specific definition of terminal, please refer to definition of terminal.

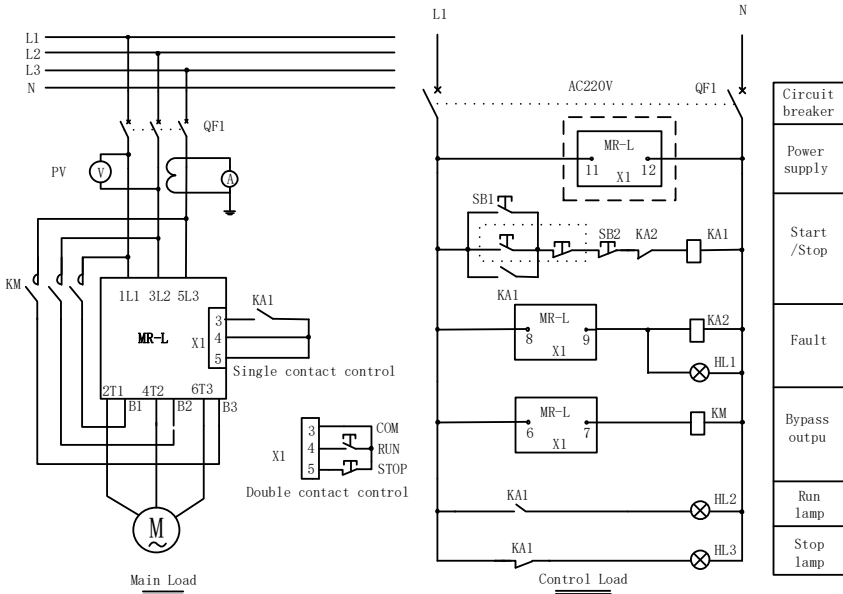
4.2 Delta internal connection diagram

When adopting delta inner connection, user must strictly connect in accordance with the following diagram, otherwise, motor or soft starter may be damaged. Before starting, soft starter will detect motor's wiring. If wiring is false, soft starter will indicate fault of false wiring.



Delta-connected

4.3 Wiring diagram for typical application



Notes:

1. The above diagram shows the single-node control mode. When contact closes, soft starter starts, otherwise, it stops. But it needs to be noted that LED panel's start is ineffective with this type of wiring. Terminals 3, 4 and 5 start and stop signal is a passive node.
2. PE grounding wire should be as short as possible. It should be connected to an earth connection point close to soft starter. The proper earth connection point should be on installation board and close to soft starter. Installation board should be grounded too. This earth connection is for function rather than protection.

4.4 Description of terminal

MR-L series soft starter has 10~14 external control terminals which help user realize external signal control, remote control and system control.

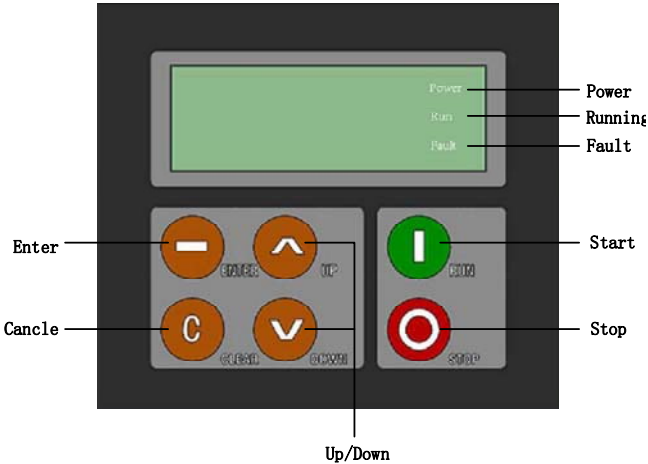
Main circuit	1L1 3L2 5L3	AC power input terminal	Connected to three-phase AC power supply and bypass contactor	
	2T1 4T2 6T3	Soft start output terminal	Connected to asynchronous motor	
	B1 B2 B3	Bypass contactor	Bypass contactor	
Control circuit	X1/1	Analog output+ (AO+)	0~20mA or 4~20mA Output loaded impedance (150--500Ω)	
	X1/2	Analog output+ (AO+)		
	X1/3	COM	Common terminal	
	X1/4	Externally-controlled start terminal (RUN)	Start when X1/4 and X1/3 are short circuited	
	X1/5	Externally-controlled stop terminal (STOP)	Stop when X1/5 and X1/3 break	
	X1/6	Bypass output relay (K11 K12)	K11-K12 close when output is available and contact capacity AC250V/5A, DC30V/5A	
	X1/7			
	X1/8	Fault output relay (K21 K22)	K21-K22 close when output is available and contact capacity AC250V/5A, DC30V/5A	
	X1/9			
	X1/10	PE	PE	
	X1/11	L	Control power	AC110V--AC220V±15% 50/60Hz
X1/12	N			
COM	1 2	GND	Power	Definition of terminal

interface			GND	coordinates basic wiring diagram from chapter 4.
	3 4	A +	RS485	
	5 6	B -		
	7 8	+ 24V	Power +	

Note: When control power is built inside, there is no X1/X11,X1/12.

Chapter 5 Instruction to Display and Operation







5.1 Panel view






During start, full voltage and soft stop, LED panel indicates average current. There are three LED indicator lamps on panel. LED1 indicates POWER and it is normally on when main board's voltage is normal; LED2 indicates RUN and it flashes during start or stop. It is normally on after start finishes; LED3 indicates FAULT and it lights up when there is fault.

When panel is separately used, it provides indicator lamps with the same function under the panel to indicate working state.

5.2 Description of key functions

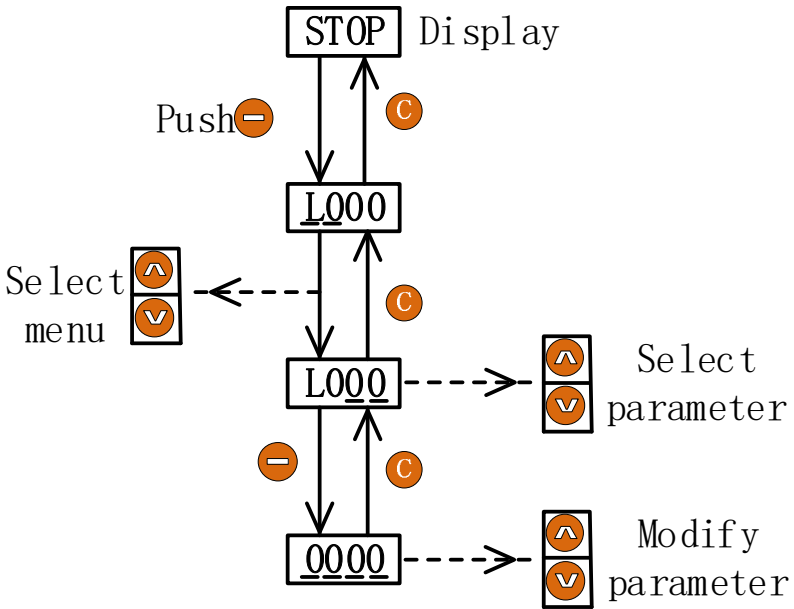
Symbol	Item	Functional description
	Enter	Enter menu to confirm parameters needed to be modified
	Add	Increase parameter or data value (available to calibrate current in operation)
	Minus	Decrease parameter or data value (available to calibrate current in operation)
	Back	Enter modified parameter, exit parameter and parameter menu
	Start	When key operation is available, it is used for starting operation and X1's terminals 3 and 5 of terminal block are short circuited
	Stop	When key operation is available, it is used for stopping operation. Press STOP for more than 4 seconds in fault state to reset current fault

5.3 Description of display state

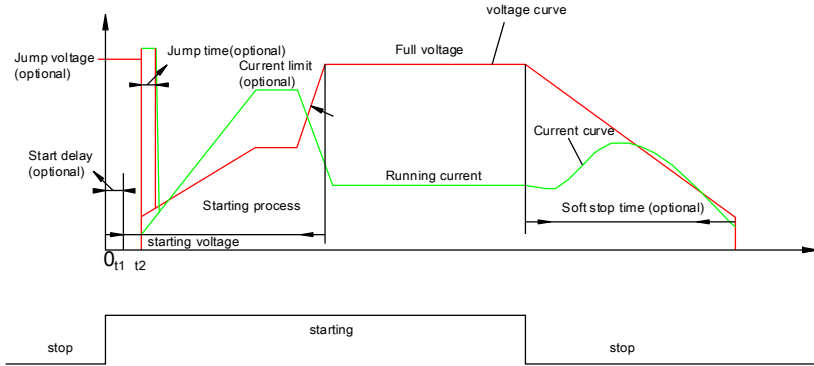
No.	Symbol	State	Description
1		Stop state	Equipment is in stop state
2		Programming	Check and set parameters
3		Start countdown	Equipment is in start countdown state

4	E r 0	Faulty state	Equipment is in fault condition
5	- 0 -	Start interval	Equipment is in start interval countdown state

5.4 Flow of modifying parameters



Chapter 6 Control Mode of Soft Starter

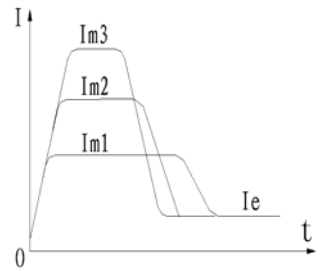


Characteristic curve of soft start/stop voltage (current)

MR-L soft starter has multiple start modes including voltage ramp start and current ramp start; multiple stop modes including free stop and soft stop. User can choose different start and stop modes according to different loads and specific application conditions.

6.1 Current ramp start

When current ramp start mode is used, after soft starter receives command to start, its output current will increase as per the given curve until output current reaches limit value I_m of the given current, and output current will



no longer increase. After electric motor runs and accelerates for a period of time, current starts to decrease and output voltage rapidly increases until total voltage output and start process completes.

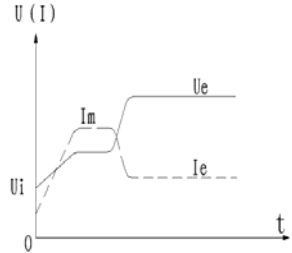
Parameter	Item	Range	Set value	Factory
-----------	------	-------	-----------	---------

				default
L000	Start type	0 .voltage ramp 1. current ramp	1	0
L004	Ramp time	0 ~ 120s	0	10
L005	Current-limiting times	100 ~ 500%Ie	---	350%

NOTE: “---” means that user can set value according to the need (the same below).

6.2 Voltage ramp start

This start mode is applicable to load with big inertia. For the application requiring high tranquility can largely reduce start impact and mechanical stress.



parameter	Item	Range	Set value	Factory default
L000	Start type	0. voltage ramp 1 .current ramp	0	0
L003	Initial voltage/current	20 ~ 100%Ue /20 ~ 100%Ie	---	30%
L004	Ramp time	0 ~ 120s	---	10
L005	Current-limiting times	100 ~ 500%Ie	---	350%

6.3 Step torque soft start

Step torque soft start is mainly used for loaded motor with large stiction by applying an instant greater start torque to overcome the great stiction torque. In this mode, output voltage rapidly reaches the preset step

voltage. After it reaches the preset step time, it smoothly starts according to preset Initial voltage and ramp time until start completes.

Parameter	Item	Range	Set value	Factory default
L000	Start type	0 .voltage ramp 1 .current ramp	---	0
L001	Step voltage	20 ~ 100%Ue	---	20%
L002	Ramp time	0 ~ 2000ms	---	0
L003	Current-limiting times	20 ~ 100%Ue /20 ~ 100%Ie	---	30%



Step torque start mode must be used together with other soft start modes and it is required to set step voltage and step time.

6.4 Free stop

When soft stop time (L008) is set to be zero, free stop mode is enabled. When soft starter receives command to stop, soft starter blocks bypass contactor's control relay and subsequently blocks output of main circuit's thyristor, then motor freely stops by inertial load.

Parameter	Item	Range	Set value	Factory default
L008	Stop time	0 ~ 120s	0	0

6.5 Soft stop

When stop time is not set to be zero, it is soft stop in full voltage condition. To stop with this method, soft starter firstly breaks bypass contactor, then output voltage of soft starter gradually reduces to soft stop final voltage within the given soft stop time. After soft stop process

finishes, starter converts to free stop.

Parameter	Item	Range	Set value	Factory default
L007	Stop type	0. free stop 1 .soft stop 2. pump stop	1 2	0
L008	Stop time	0 ~ 120s	10	0
L009	Stop final voltage	20 ~ 80% U _e	30%	30%

Chapter 7 Parameter and Description

Parameters for MR-L soft starter are divided into Four categories in terms of function: start/stop control parameter L0, protection parameter L1, port setting parameter L2, and manufacturer's parameter L3.

7.1 Start/stop control parameter

totaling 17 parameters L000-L016

Parameter	Item	Range	Factory default
L000	Start mode	0. Voltage ramp 1. Current ramp	0
L001	Step voltage	20 ~ 100%Ue	20%
L002	Step time	0 ~ 2000ms	0
L003	Initial voltage/current	20 ~ 100%Ue / 20 ~ 100%Ie	30%
L004	Ramp time	0 ~ 120s	10
L005	Current-limit times	100 ~ 500%Ie	350%
L006	Start time delay	0 ~ 120s	0
L007	Stop mode	0. free stop 1. soft stop 2. pump stop	0
L008	Stop time	0 ~ 120s	0
L009	Stop final voltage	20 ~ 80%Ue	30%
L010	Second-start permission	0 ~ 60s	0
L011	Second current-limiting times	150 ~ 500%Ie	400%
L012 ~L016	Undefined parameter	---	---

7.2 Motor's protection parameter

totaling 17 parameters L100-L116

Parameter	Item	Range	Factory default
L100	Rated current of motor	15 ~ 9999 A	---
L101	Overcurrent protection setting	100 ~ 500%Ie	150%
L102	Overcurrent duration	0 ~ 10s	2
L103	Phase current unbalanced protection	0 ~ 100%	70%
L104	Current unbalanced time	0 ~ 10s	2
L105	Overload protection class	10A 10 15 20 25 30 OFF	20
L106	SCR protection	0. OFF 1. Start	0
L107	Phase sequence detection	0. OFF 1. Start	0
L108	Frequency selection	0. 50Hz 1. 60Hz	0
L109	Start time limit	10 ~ 250s	80
L110	Motor wiring type	0. external 1. internal 2. undefined (internal-wiring direct start)	0

L111	Start interval	0 ~ 60s	0
L112 ~L116	Undefined parameter	---	---

7.3 Port setting parameter

totaling 17 parameters L200-L216

Parameter	Item	Range	Factory default
L200	Control selection	0、 Keyboard control 1、 Communication control 2、 Keyboard and communication control Note: The above is available when double contacts are connected	0
L201 ~L203	Undefined parameter	---	---
L204	Communication address	1 ~ 32	1
L205	Baud rate	0. 1200 1. 2400 2. 4800 3. 9600 4. 19200	3
L206	Manufacturer's parameter	---	---
L207	Manufacturer's parameter	---	---
L208	Analog output mode	0. 4-20mA corresponds to 0-2Ie 1. 4-20mA corresponds to 0-4Ie 2. 0-20mA corresponds to 0-2Ie 3. 0-20mA corresponds to 0-4Ie 4. Set to be current correction state Note: Ie is motor's rated current	0
L209	Undefined	---	---

~L215	parameter		
L216	Analog current correction parameter	1-----1000 (it needs to set C208 to 4. It must be reset to be the value other than 4 after correction)	---

7.4 Manufacturer's parameter

totaling 17 parameters L300-L316

parameter	Item	Range	Factory default
L300	Rated current for soft start	15 ~ 9999 A	---
L301	Software version	Mark the current software version number	---
L302	Current display precision	0. No decimal point 1. 1. One decimal point	1
L303	Current correction	1 ~ 255	---
L304	Manufacturer's parameter	---	---
L305	Manufacturer's parameter	---	---
L306	Manufacturer's parameter	---	---
L307	Manufacturer's parameter	---	---
L308	Manufacturer's parameter	---	---
L309	Manufacturer's parameter	---	---
L310 ~L316	Undefined parameter	---	---

7.5 Function description

- ◆ Start/stop control parameter L0(for description of start control mode,refer to Chapter 6)

User may select start curve by parameter L000 to enable start curve to properly match with actual load so as to ensure optimal start. If step voltage and step time are given, a greater instantaneous starting torque shall be applied to the initial start and then it shall start based on the given initial voltage and ramp time. If parameter L010 is not zero, when start is still not completed within the given time, second start shall be made based on initial voltage and ramp time till start is completed. During start process, start current is limited to the range below the value of parameter L005, and second start current is limited to the range below the value of parameter L011.

Note: If voltage ramp start is selected as start mode, the corresponding parameter L003 shall be initial voltage.

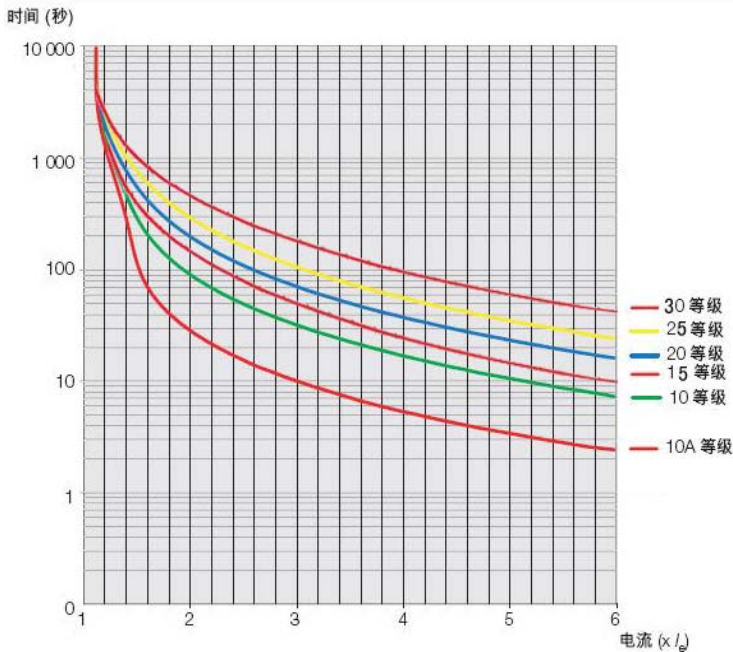
Parameter L004 ramp time determines the time at which the starting torque is up to final torque. If ramp time is longer, smaller accelerating torque shall be generated in starting process of motor, in this way, the motor shall be subject to soft acceleration in longer time, thus, ramp time shall be properly selected to make motor able to be subject to soft acceleration till its rated speed is achieved. If acceleration time is over before completion of motor acceleration, the torque shall be limited to the set ultimate torque in specified time. Accordingly, the ramp time indicates

rate of change of rotary speed, it is not completely equal to starting time of motor.

◆ **Protection parameter L1**

User may set rated current of L100 motor based on motor power to enable soft starter to properly match with motor and protect motor. If current in operation process is in excess of over current protection value set by parameter L101 and duration is greater than the value set by parameter L102, soft starter shall carry out over current protection. If electronic thermal overload grade and tripping time set by parameter L105 are exceeded, soft starter shall carry out over current protection, with fault category displayed on interface to make it easy for user to find the fault. (Rated current of motor shall be no lower than 50% of rated current of control).

During operation, if there is no requirement of phase sequence for power supply, parameter L107 shall be set to be phase sequence not subject to detection, otherwise, it shall be set as phase sequence subject to detection. If SCR is not subject to protection in operation, then parameter L106 shall be set to be zero, otherwise it shall be set to be 1, if user adopts phase current unbalance protection, user may set parameter L103 and L104.



The release curve of electronic thermal overload

◆ Port setting parameter L2

➤ **Start/stop:** start/stop can be selected by parameter L200. Parameter L006 works with starting function to start, if start time delay is given, after valid command to start is given and time delay set by parameter L009 is expires, soft starter shall start.

➤ **Analog output:** parameter L208 is used to set current value for analogy output. User may select 0--2Ie or 0--4Ie for 4-20mA and 0--2Ie or 0--4Ie for 0-20mA as required.

Note: When L208 is set to be 4, analog output can be corrected by adjusting parameter L216. When analog output is 20mA, the value

of L216 is saved and the value of L208 is restored.

➤ **Inner delta function:** motor connection mode is set by parameter L110, 0 is external connection mode, 1 and 2 are start mode based on internal connection. In case of 1, the soft starter, prior to starting, shall detect internal delta connection and then execute command to start from internal delta connection; in case of 2, the soft starter shall not detect connection and directly start according to internal delta control mode.

➤ **Communication function:** This soft starter supports MODBUS-RTU standard communication mode. The communication address may be set by parameter L204 and the communication baud rate may be set by parameter L205. Detailed parameter address is as shown in chapter 9.




◆ **Manufacturer's parameter L3**

The parameter records information on operation and state of soft starter and user is not permitted to modify it.

Chapter 8 Fault Detection and Clearance

8.1 Fault code table

When protective function of soft starter is in operation, soft starter shall be stopped immediately, with fault displayed on display screen. User may carry out fault analysis according to fault message.

Display	Communication code	State description	Disposal
	---	When start signal is given, the motor fails to act.	<ol style="list-style-type: none"> 1. Check 3 and 5 of X1 to see whether they are in connection. 2. Check whether connection in control circuit is correct and whether control switch is in normal operation 3. Check whether control power is too low 4. Incorrect L200 parameter is set
No display	---	---	<ol style="list-style-type: none"> 1. Check 6 and 7 of X3 to see whether they are in connection. 2. Check whether control power is in normal operation
	0x01	Lack of phase in motor start	<ol style="list-style-type: none"> 1. Check every phase voltage of three phase power supply to determine whether there is lack of phase and remove the problem.
	0x02	Thyristor Overheat	<ol style="list-style-type: none"> 1. Check whether environment in which the soft starter is installed has good ventilation and whether it is vertically installed. 2. Check whether radiator is overheated or whether overheating protection switch is disconnected. 3. Start frequencies are too high

			and reduce starting frequencies. 4. Control power is too low, power drops too much in starting process.
Er03	0x03	Start failure	1. Check each set value for working parameters and verify whether the set parameter value matches with actual parameter value. 2. Starting failure (it is incomplete within time set by L109), check whether current limiting magnification is too small.
Er04	0x04	Short circuit between input and output of Soft starter	Check whether thyristor is broken or damaged.
		Open circuit in wire in motor (L106 is set as 1)	1. Check whether output of soft starter is properly and reliably connected to motor. 2. Check whether there is open circuit in motor. 3. Check whether thyristor is broken and damaged. 4. Check whether incoming line is phase loss.
Er05	0x05	Current limiting function failure	1. Check whether setting of parameter L100 is correct.
		Motor shows over current in operation	1. Check whether connection of soft starter's output terminal is short circuited. 2. Load increases suddenly. 3. Fluctuation of load is too large.
Er06	0x06	Electronic thermal	1. Whether operation is overloaded.

		overload	
Er07	0x07	Phase sequence error	1. Check phase sequence of incoming line and setting of L107.
Er08	0x08	Phase current imbalance	1. Check whether current or voltage in main circuit is balanced and setting of parameter L103.
Er10	0x0A	Parameter loss	1. If there is such problem after power on again, please contact manufacturer.
Er11	0x0B	Connection error	1. Check connection and setting of parameter L110.

8.2 Fault clearance

Fault has memory, therefore, after fault clearance, resetting shall be carried out by key STOP (pressing it for more than 4 seconds) to make soft starter recover to ready state for start.

Chapter 9 Communication Control

MR-L motor soft starter is equipped with RS485 communication interface, which adopts international standard Modbus communication protocol for master-slave communication. User may implement centralized control by PC/PLC and upper computer control to satisfy requirement of application in special condition.

9.1 Protocol content

Modbus serial communication protocol defines frame content and slave response frame format of asynchronous transmission in serial communication, frame content of master includes: slave address, command of execution, data and error checkout etc. slave response also adopts the same architecture, including: operational qualification, returning data and error checkout. If slave has an error in receiving frames or fails to complete task required by master, it shall organize an error frame as response and feedback to master.

9.2 Bus structure

- (1) Interface mode: RS485 hardware interface
- (2) Transmission mode

Asynchronous serial, half-duplex transmission mode: at the same time, one sends data while the other receives data for master and slave machines. Data in serial asynchronous communication shall be transmitted in the form of message frame by frames.

(3) Topological structure

Single-master multi-slave system: Setting range of slave address is from 1 to 32, every slave in network has unique address, which shall be the base for ModBus serial communication.

9.3 Explanation of protocol

Communication protocol for MR-L soft starter is asynchronous serial master-slave ModBus communication protocol; there is only one device able to set up protocol in network. The other devices shall only respond to “Inquiry/order” of master by data or function by “Inquiry/order” of master. Master means personal computer (PC), industrial control equipment or programmable logical control (PLC). Slave means MR-L soft starter or other control equipment having the same communication protocol.

9.4 Communication frame structure

Data format of ModBus protocol for MR-L soft starter is RTU(Remote terminal unit) mode. Each byte in RTU mode is as follows:

Coding system: 8-digit binary system, hexadecimal system 0—9 and A—F, each 8-digit frame domain contains two hexadecimal characters.

In the mode, new one is always silent in transmission time of no less than 3.5 bytes as start. In network to calculate transmission rate based on baud rate, it is easy to control in transmission time of 3.5 bytes. The next data domain in transmission: slave address, operating command code, data and CRC, byte in transmission in every domain is hexadecimal 0...9,

A...F.

Network device is always monitoring the operation of communication bus even in silent interval time. When receiving first domain (Address information) , each network device shall affirm the byte, with completion of transmission of the last byte, there is another similar transmission time interval of 3.5 bytes to identify completion of the frame, later, a new frame transmission starts.

A frame information shall be transmitted in a continuous data stream, if interval time before completion of entire frame transmission is in excess of 1.5 bytes, receiving device shall remove these incomplete information.

9.5 Address explanation

Menu	Type	Register code (Decimal)	Data type	R/W feature
Start mode	I/O Int	0001	Uint	R/W
Step voltage	I/O Int	0002	Uint	R/W
Step time	I/O Int	0003	Uint	R/W
Initial voltage/current	I/O Int	0004	Uint	R/W
Ramp time	I/O Int	0005	Uint	R/W
Current limit times	I/O Int	0006	Uint	R/W
Start time delay	I/O Int	0007	Uint	R/W
Stop mode	I/O Int	0008	Uint	R/W
Stop time	I/O Int	0009	Uint	R/W
Stop final voltage	I/O Int	0010	Uint	R/W
Second start permission	I/O Int	0011	Uint	R/W
Second current limit times	I/O Int	0012	Uint	R/W
undefined	---	0013 ~ 0017	---	---
Rated current of motor	I/O Int	0018	Uint	R/W
Setting of operation overcurrent protection	I/O Int	0019	Uint	R/W
Operation overcurrent time	I/O Int	0020	Uint	R/W
Phase current imbalanced protection	I/O Int	0021	Uint	R/W
Current imbalance time	I/O Int	0022	Uint	R/W

Overload protection level	I/O Int	0023	Uint	R/W
SCR protection	I/O Int	0024	Uint	R/W
Phase sequence detection	I/O Int	0025	Uint	R/W
Frequency selection	I/O Int	0026	Uint	R/W
Start time limit	I/O Int	0027	Uint	R/W
Motor's wiring mode	I/O Int	0028	Uint	R/W
Start interval	I/O Int	0029	Uint	R/W
undefined	---	0030 ~ 0034	---	---
Control selection	I/O Int	0035	Uint	R/W
undefined	---	0036 ~ 0038	---	---
Communication address	I/O Int	0039	Uint	R/W
Baud rate	I/O Int	0040	Uint	R/W
Manufacturer parameter	---	0041 ~ 0042	---	---
Analog output mode	I/O Int	0043	Uint	R/W
undefined	---	0044 ~ 0050	---	---
Analog current correction parameter	I/O Int	0051	Uint	R/W
Rated current of soft start	I/O Int	0052	Uint	R
Software version	I/O Int	0053	Uint	R
Current display precision	I/O Int	0054	Uint	R
Current correction	I/O Int	0055	Uint	R
Undefined	---	0056 ~ 0068	---	---
Operating state word of soft start	I/O Int	0141	Uint	R

Fault code	I/O Int	0142	Uint	R
Average current of motor	I/O Int	0146	Uint	R
Count down time for start	I/O Int	0152	Uint	R
Start interval countdown time	I/O Int	0153	Uint	R

Note: Definition of operating state word of soft start

Register code (Decimal)	value (Decimal)	description
0141	0	Stop
	128	Fault state (it needs to read the value of register 0142 for specific fault code)
	32	Edit state
	64	Operating state

9.6 Control command parameter address

Name	Type	Register code	Value (Decimal)	Specification
Stop	I/O Int	0200	200	W
Start	I/O Int	0202	202	W
Reset	I/O Int	0203	203	W

Note: if control command is invalid, check parameter L200, whether communication control function is activated, check whether terminal X1/3 and X1/5 are in short circuit.

9.7 Description of function code

(1) Function code “03”(Read multiple registers)

Master send data	Bytes	Code	Data returned from slave	Bytes	Code
------------------	-------	------	--------------------------	-------	------

Slave address	1	0x01	Slave address	1	0x01
Function code	1	0x03	Function code	1	0x03
Start address H	1	0x00	Returned bytes	1	0x02
Start address L	1	0x6D	Data H	1	0x41
Data length H	1	0x00	Data L	1	0x00
Data length L	1	0x01	CRC_L	1	0x88
CRC_L	1	0x15	CRC_H	1	0x14
CRC_H	1	0xD7			

(2) Function code “06” (Write one register)

Send data	Bytes	Code	Data returned from slave	Bytes	Code
Slave address	1	0x01	Slave address	1	0x01
Function code	1	0x06	Function code	1	0x06
Address H	1	0x00	Address H	1	0x00
Address L	1	0x01	Address L	1	0x01
Data H	1	0x00	Data H	1	0x00
Data L	1	0x1E	Data L	1	0x1E
CRC_L	1	0x58	CRC_L	1	0x58
CRC_H	1	0x02	CRC_H	1	0x02

Note: When command 06 is adopted to modify parameter for soft starter, soft starter shall be in stop or edit state, other states are not available for modification. In case of modification of a parameter, the parameter to be modified shall be within the range defined in the specification, parameter beyond the range of specification shall not be modified.

9.8 Communication time interval

(1) “03” command service time interval :

Time interval= (17+number of register *2) *8/ baud rate*1000*1.2ms;

Example: 9600 baud rate, read 1 register value, time interval = $(17+1*2)$
 $*8/9600*1000*1.2=19\text{ms}$.

(2) “06” command service time interval:

$$\text{period} = 20*8/\text{baud rate}*1000*1.2\text{ms}$$

For example: baud rate is 9600, $t = 20*8/9600*1000*1.2 = 20\text{ms}$

9.9 Attention

- Multi-computer communication, MR-L soft starter address is unique, any two soft starters shall not be identical in address (To be set by parameter L204).
- Communication baud rate for MR-L soft starter shall be identical to that of control (To be set by parameter L205)
- In case of multiple MR-L soft starters are in communication, 120 Ω resistor shall be connected to both ends of AB on the final soft starter.

9.10 Analysis of communication fault code

(1) Error in writing address: device address+0x86+0x02+CRC

- ① Address is in excess of 68.
- ② Other than the defined writable register.
- ③ Other than stop or edit state.
- ④ Communication control start/stop fails to open in writing control command.

(2) Error in writing data: device address+0x86+0x03+CRC

① Data written in specified writable register is beyond the defined range of data.

- ② Command data is wrong in sending start command.

(3) Error in reading address: device address+0x83+0x02+CRC

- ① Read address is in excess of 68.
- (4) Function code error: device address+ (0x80+erroneous function code) +0x01+CRC
- ① Function code is not the function code defined for soft starter.

Chapter 10 Daily Maintenance

1. Dust: Too much dust is likely to reduce insulation level of soft starter and make soft starter unable to properly operate.

- (1) Adopt clean and dry brush to brush over the dust.
- (2) Adopt compressed air to blow dust away.

2. Dewing: Dewing is likely to reduce insulation level of soft starter and make soft starter unable to properly operate.

- (1) Adopt electric drier or electric heater to blow dry.
- (2) Dehumidification of distribution room.

3. Check the elements so as to confirm whether they are in good condition and whether they are able to properly operate.

4 Check the cooling channel of soft starter to prevent it from being blocked by dirt and dust.



Maintenance inspection shall be carried out after all powers on the side of the incoming line of soft starter are cut off!

Attached table 1: Inner Delta Connection Size and Fitting Selection for Soft Starter (with 380V as an example)

Motor (KW)	Mode of soft starter	Rated current (A)	Model of bypass contactor	Primary line (copper line)
7.5	MR-1750/3-L	18	CJX4-25	4mm ²
11	MR-2110/3-L	24	CJX4-32	6mm ²
15	MR-2150/3-L	30	CJX4-32	10mm ²
18.5	MR-2185/3-L	39	CJX4-40	10mm ²
22	MR-2220/3-L	45	CJX4-50	16mm ²
30	MR-2300/3-L	60	CJX4-63	25mm ²
37	MR-2370/3-L	76	CJX4-80	35mm ²
45	MR-2450/3-L	90	CJX4-95	35mm ²
55	MR-2550/3-L	110	CJX4-115F	35mm ²
75	MR-2750/3-L	150	CJX4-150F	50mm ²
90	MR-2900/3-L	180	CJX4-185F	30×3 Copper bar
110	MR-3110/3-L	218	CJX4-225F	30×3 Copper bar
132	MR-3132/3-L	260	CJX4-265F	30×4 Copper bar
160	MR-3160/3-L	320	CJX4-330F	30×4 Copper bar
185	MR-3185/3-L	370	CJX4-400F	40×4 Copper bar
220	MR-3220/3-L	440	CJX4-500F	40×4 Copper bar
250	MR-3250/3-L	500	CJX4-500F	40×4 Copper bar
280	MR-3280/3-L	560	CJX4-630F	40×4 Copper bar
315	MR-3315/3-L	630	CJX4-630F	40×5 Copper bar

400	MR-3400/3-L	780	JWCJ20-800	50×5 Copper bar
470	MR-3470/3-L	920	JWCJ20-1000	50×6 Copper bar
530	MR-3530/3-L	1000	JWCJ20-1000	50×6 Copper bar

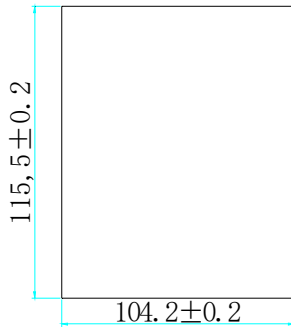
Note: Standard wiring means delta or star connection in motor winding, thyristor is connected between power supply and motor.

Internal delta connection means delta-thyristor and winding are in series in motor winding. The advantage of internal delta is to derate in selection of soft starter, the current in soft starter and motor inner delta connection is $1/\sqrt{3}$ of line current. Soft starter is selected according to rated current of line current/1.5 times in the above mentioned list. User may further derate in selection of soft starter according to practical situation.

Instruction to order






- ◆ To place an order, please provide product model, specification, load and application condition to your supplier.

Special note: If client needs keyboard box to be externally placed, it is necessary to order the mounting accessories from manufacturer. When keyboard box is externally placed, it needs to lock the mounting fittings of external keyboard box onto door panel with its hole size of 115.5(H) × 104.2(W), which is as shown in the following figure. For specific installation steps, please refer to attached table 2.



- ◆ As the standard configuration of soft starter contains built-in current transformer, user does not need to externally connect the both.
- ◆ Accessories shown in above table are only for reference.

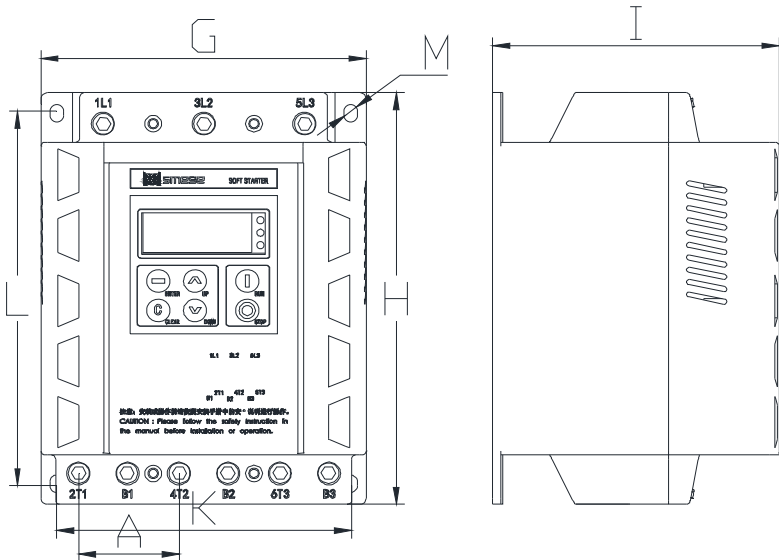
Attached Table 2: Instructions to installation of accessories of MR-L soft starter

 <p style="text-align: center;">Picture 1</p>	 <p style="text-align: center;">Picture 2</p>	<p>The steps for mounting accessories of MR-L soft starter are as follows:</p> <ol style="list-style-type: none"> 1. Lock keyboard box's fixing base onto door panel, as is shown in figure1 2. Remove keyboard box from soft starter and dismount tapping screws at the back of keyboard box, as shown in figure 2 3. Insert keyboard box into fixing base as shown in figure 1, which is shown in figure 3 4. Use M3X15 tapping screws to fix keyboard box at the back of door panel, as shown in figure 4 5 Screw hex screws into DB9 female head of keyboard box and Insert connection line of keyboard box into DB9 female head, as shown in figure 6 6. Installation complete.
 <p style="text-align: center;">Picture 3</p>	 <p style="text-align: center;">Picture 4</p>	
 <p style="text-align: center;">Picture 5</p>	<p>Note: Accessories for installation are as follows:</p> <ul style="list-style-type: none"> Fixing base of keyboard box—1 pc Cross round head tapping screw M3X15—2 pcs External keyboard connection line—1 pc <p>△ All accessories are enclosed in packing bag. Please check the number before installation.</p>	

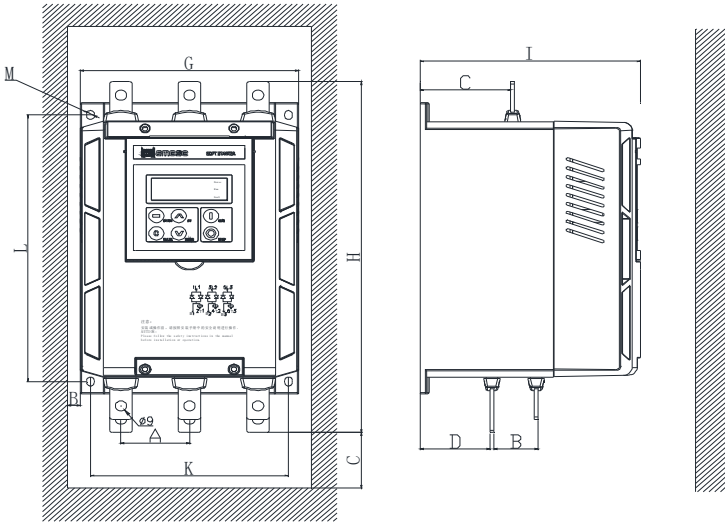
Attached Table 3: Dimension and Hole Size of Soft Starter (Unit: mm, with 380V as an example)

Type	Mode	G	H	I	K	L	M	A	B	C	D	Gross (Kg)
MR-1750~2300/3-L	F010	155	200	139	140	180	6	--	--	--	--	2.6
MR-1750~2220/3-L	F005	172	320	172	156	240	6	54	35	72	55	4.5
MR-2300~2450/3-L												4.7
MR-2550~2750/3-L												5.1
MR-2900~3185/3-L	F006	285	474	235	230	390	9	97	60	101	39	20.6
MR-3220~3315/3-L	F007	320	512	235	270	415	9	97	60	101	39	25.6
MR-3400~3530/3-L	F008	400	647	235	330	495	9	97	60	101	39	37.6

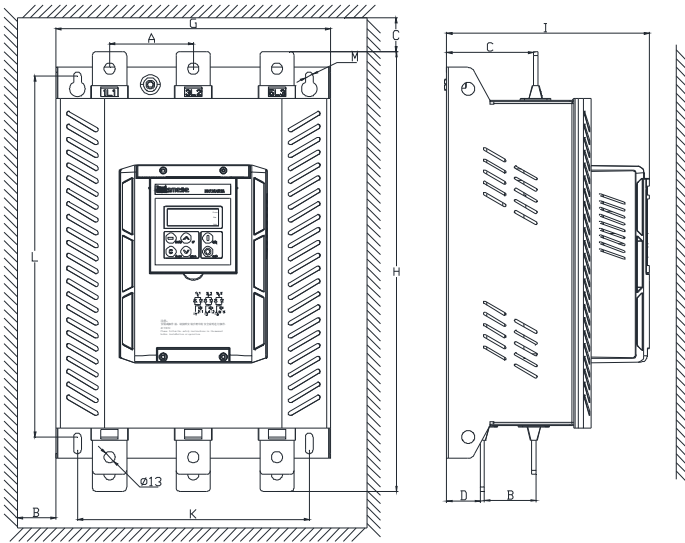
Size note: Wide (G) × Height (H) × Thick (I)



Products of F010



Products of F005



Products of F006 F007 F008

Attached Table 4: Model selection of Soft Starter

No.	Rated current / A	380V	
		Applicable power / KW	Size / mm
1	18	7.5	F005/F010
2	24	11	
3	30	15	
4	39	18.5	
5	45	22	
6	60	30	
7	76	37	F005
8	90	45	
9	110	55	
10	150	75	
11	180	90	F006
12	218	110	
13	260	132	
14	320	160	
15	370	185	
16	440	220	F007
17	500	250	
18	560	280	
19	630	315	
20	780	400	F008
21	920	470	
22	1000	530	

2017.10. The contents are subject to change without notice.
Please visit www.smege.com for the latest product information



Shanghai Metallurgy General Electrical Co. Ltd.