



# Product Manual

Please read this manual carefully before use.



## **CMC-MX Built-in Bypass Soft Starter**

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## **Safety Notes**

- (1) A dangerous voltage exists when the main circuit is powered.
- (2) The input ends (1L1, 3L2 and 5L3) shall not be connected to the output ends (2T1, 4T2 and 6T3).
- (3) The output ends (2T1, 4T2 and 6T3) of the soft starter shall not be connected with a compensation capacitor or a varistor.
- (4) When the soft starter and the frequency converter are mutual backups, their output ends shall be isolated from each other.
- (5) Do not try to repair the damaged devices, and please contact the Supplier.
- (6) The temperature of the radiator may be high.
- (7) Reverse power transmission is strictly prohibited at the output end of the soft starter.
- (8) When the soft starter is in the starting or stopping state, there is a high voltage at the output side.

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## **Preface**

Thank you for using CMC-MX motor soft starter. In order to give full play to the function of the soft starter, please operate and use it properly according to the regulations and ensure the safety of the operator. Please read this *Product Manual* carefully before use. When you find problems in use and this product manual cannot provide solutions, please contact the agencies and distributors, and we will serve you wholeheartedly.

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# Chapter I Functions and Characteristics of CMC-MX Soft Starter

## 1.1 Functions

CMC-MX motor soft starter is a new type of motor starting and protection device which combines power electronic technologies, microprocessors and automatic controls. It can start/stop the motor stably without step, so as to avoid mechanical and electrical impact, etc. caused by traditional starting modes such as direct starting, star/delta starting and self-adjusting voltage-releasing starting, and it can effectively reduce the starting current and the distribution capacity, so as to avoid the investment in capacity expansion. Meanwhile, CMC-MX soft starter is internally integrated with a current transformer and a contactor, so the user does not need external connection.

## 1.2 Characteristics

### ◆ Multiple starting modes

The user can select current limiting start or voltage ramp start and can apply programmable step start and starting current limit in each mode, so as to meet the requirements on the site to the greatest extent and achieve the best starting effect.

### ◆ High reliability

The high-performance microprocessor digitally processes the signals in the control system, avoiding the excessive adjustment of the previous analog lines, thus achieving excellent accuracy and execution speed.

### ◆ Strong interference immunity

All external control signals are photoelectrically isolated and set with different noise levels, so the products are applicable to special industrial environments.

### ◆ Simple adjustment method

The control system has a wide application range, the adjustment method is simple and intuitive, and it can match various different control objects through various function options.

### ◆ Optimized structure

The unique compact internal structure design is especially convenient for integration into the existing system, saving the costs of current transformers and bypass contactors for users.

### ◆ Settable power frequency

The power frequency 50/60HZ can be set by parameters and it is convenient to use.

### ◆ Analog output

The 4-20mA current output function is convenient to use.

### ◆ MODBUS-RTU communication

When network communication is carried out, 32 sets of equipment can be connected. The user can achieve automatic communication by setting the Baud rate and the communication address. For the communication address, the setting range is 1-32 and the factory default is 1. For the communication Baud rate, the setting range is 0, 2400; 1,

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4800; 2, 9600; and 3, 19200; and the factory default is 2 (9600).

◆ **Perfect protection function**

Various motor protection functions (for example, overcurrent, input/output phase loss, thyristor short circuit, overheat protection, leakage detection, electronic thermal overload, internal contactor fault, phase current imbalance, etc.) ensure that the motor and the soft starter will not be damaged in case of failure or misoperation.

◆ **Simple maintenance**

The monitoring signal coding system composed of 4-digit digital display monitors the working status of the system equipment 24 hours a day and meanwhile provides rapid fault diagnosis.

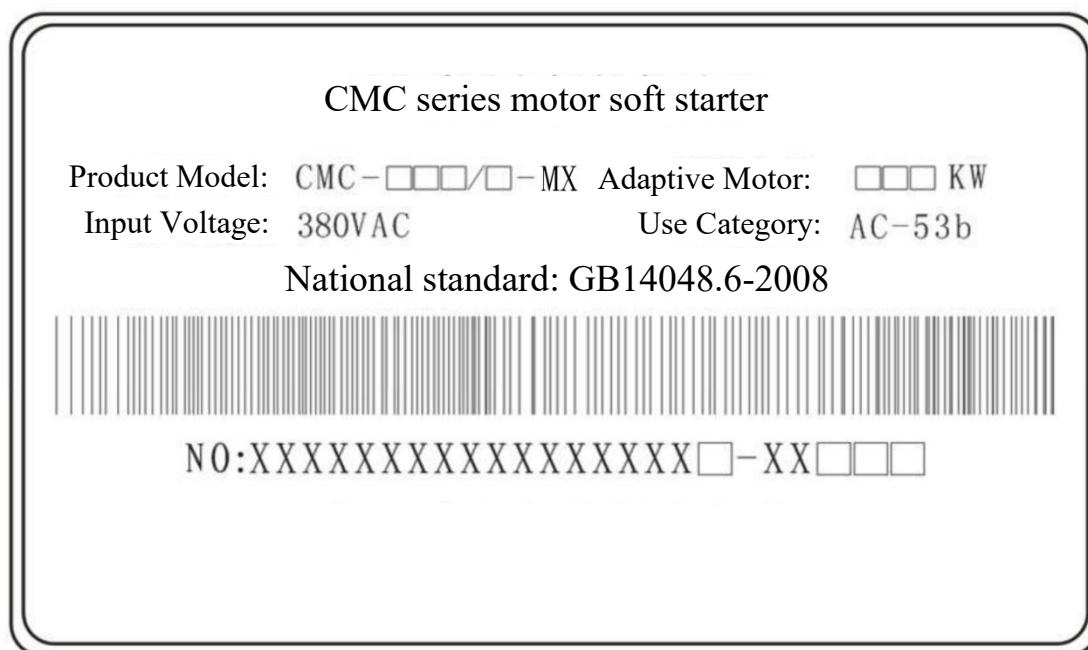
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## Chapter II Receiving Inspection

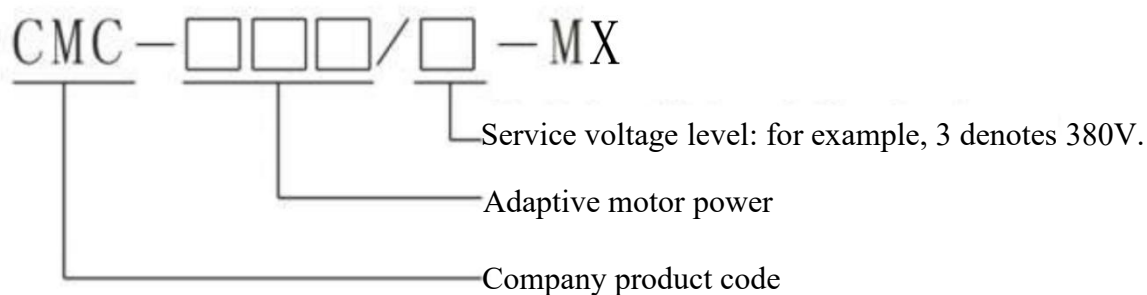
All functions and running tests of each soft starter have been carried out before delivery. After receiving and unpacking the equipment, the user shall check it according to the following steps. If you find any problem, please contact the Supplier immediately.

1. Check the nameplate to confirm that the received product is consistent with the ordered product.

(1) Description of nameplate of soft starter



(2) Description of model of soft starter

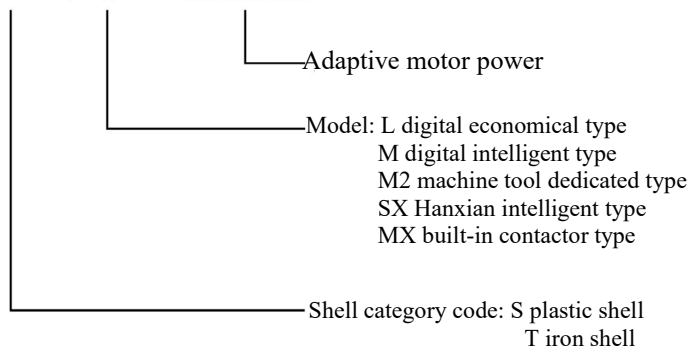


(3) Description of number of soft starter



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NO : XXXXXXXXXXXXXXXXXXXX□-□□-□□□



2. Check whether the product is damaged during transportation for example, depressions and deformations of shells, loosening of internal connecting wires and connectors, etc.
3. Check whether it is equipped with product certificate, warranty card, packing list, *Product Manual*, etc.
4. After delivery, implement the product warranty according to the warranty card. After you receive the goods, please fill in the warranty card carefully and send it to the Supplier.

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## **Chapter III Service Conditions and Installation**

### **3.1 Service conditions**

### **3.2 Installation direction**

In order to ensure that the soft starter has good ventilation and heat dissipation conditions in use, the soft starter shall be installed vertically.

### **3.3 Installation space**

A sufficient space shall be reserved around the equipment for heat dissipation. For the convenience of maintenance, a certain distance shall be kept between the equipment and the wall (see Schedule III). If you need to select the fan, please download the relevant fan size from our website ([www.xichi.cn](http://www.xichi.cn)).

### **3.4 Circuit installation**

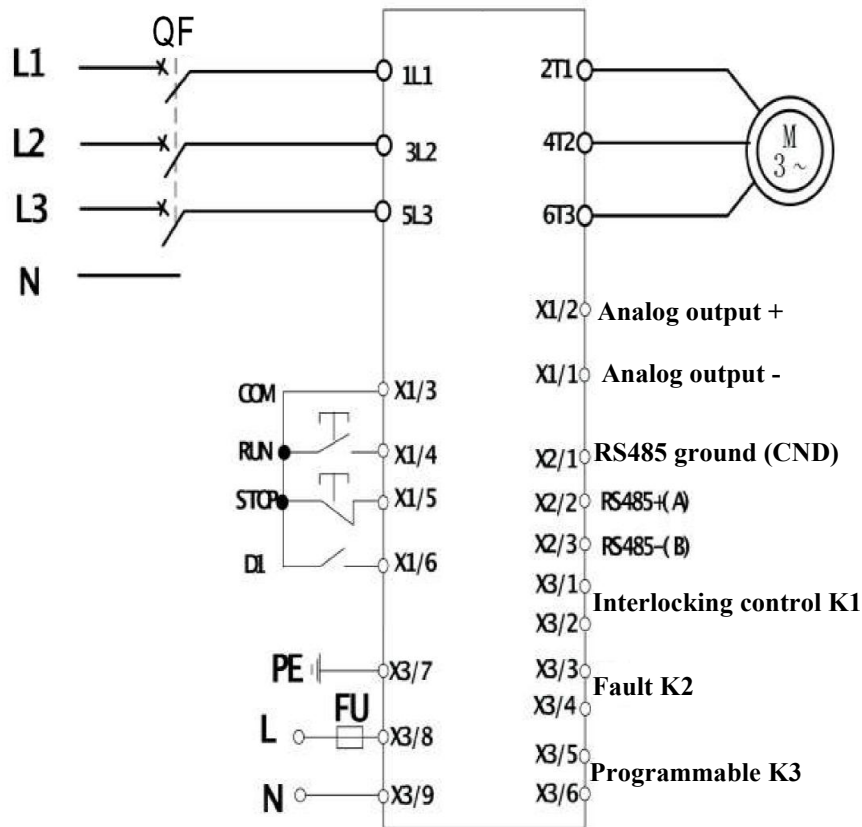
The main circuit adopts the wiring mode of top in and bottom out, and the cable shall ensure enough carrying capacity. For selection of peripheral accessories, please refer to Schedule I.

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## Chapter IV Circuit Connection

### 4.1 Basic wiring diagram

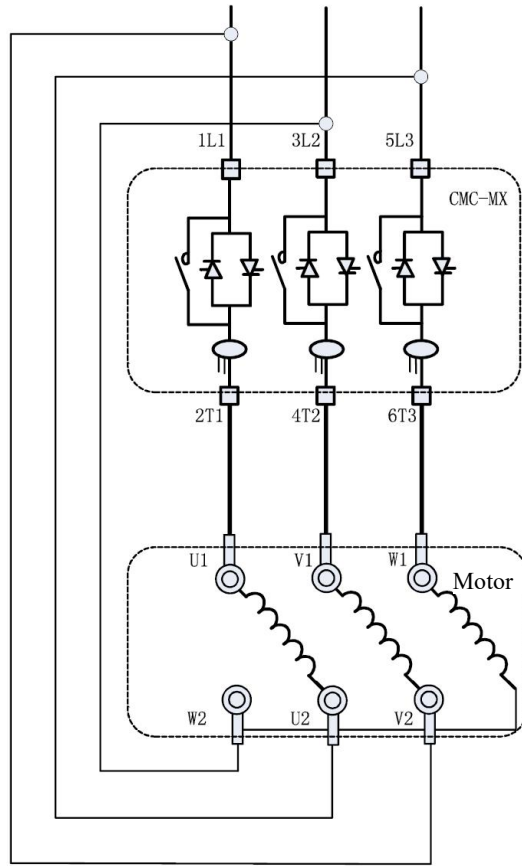
The soft starter terminals 1L1, 3L2 and 5L3 are connected to the three-phase power supply, and 2T1, 4T2 and 6T3 are connected to the motors. Without external bypass contactor, the soft starter can select whether to detect the phase sequence by parameter settings.



Double-node Control Diagram

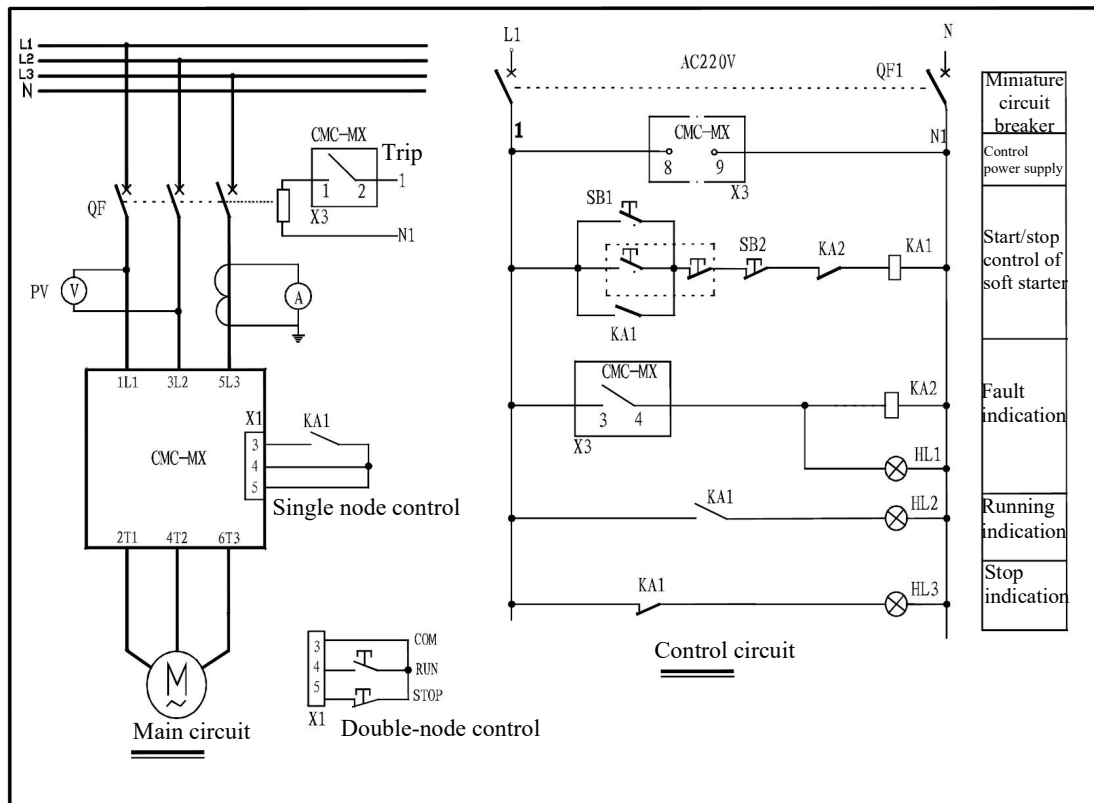
### 4.2 Triangle internal connection diagram

If the user uses the triangular internal connection, the user must conduct connection in strict accordance with the following diagram; otherwise the motor or the soft starter may be damaged. The machine will judge the motor wiring before starting. If the wiring is wrong, the soft starter will report the wiring error fault.



Triangular Internal Connection

### 4.3 Wiring diagram for typical application



## Notes:

1. The above diagram is the single-node passive control diagram scheme. When KA1 is normally closed, it starts the soft starter; while when it is disconnected, it stops the soft starter. This wiring mode is invalid during the panel starting and valid during stop.
2. The passive double-node control scheme is optional, the scheme is not given, RUN is the inching signal, STOP is the inching signal, and this wiring mode is valid during the panel starting and stop.
3. Due to the particularity of the built-in bypass soft start, the circuit breaker can be added with the tripping function to protect the equipment.
4. The PE ground wire shall be as short as possible, the ground point shall be at the mounting plate, and this grounding place is function grounding instead of protective grounding.

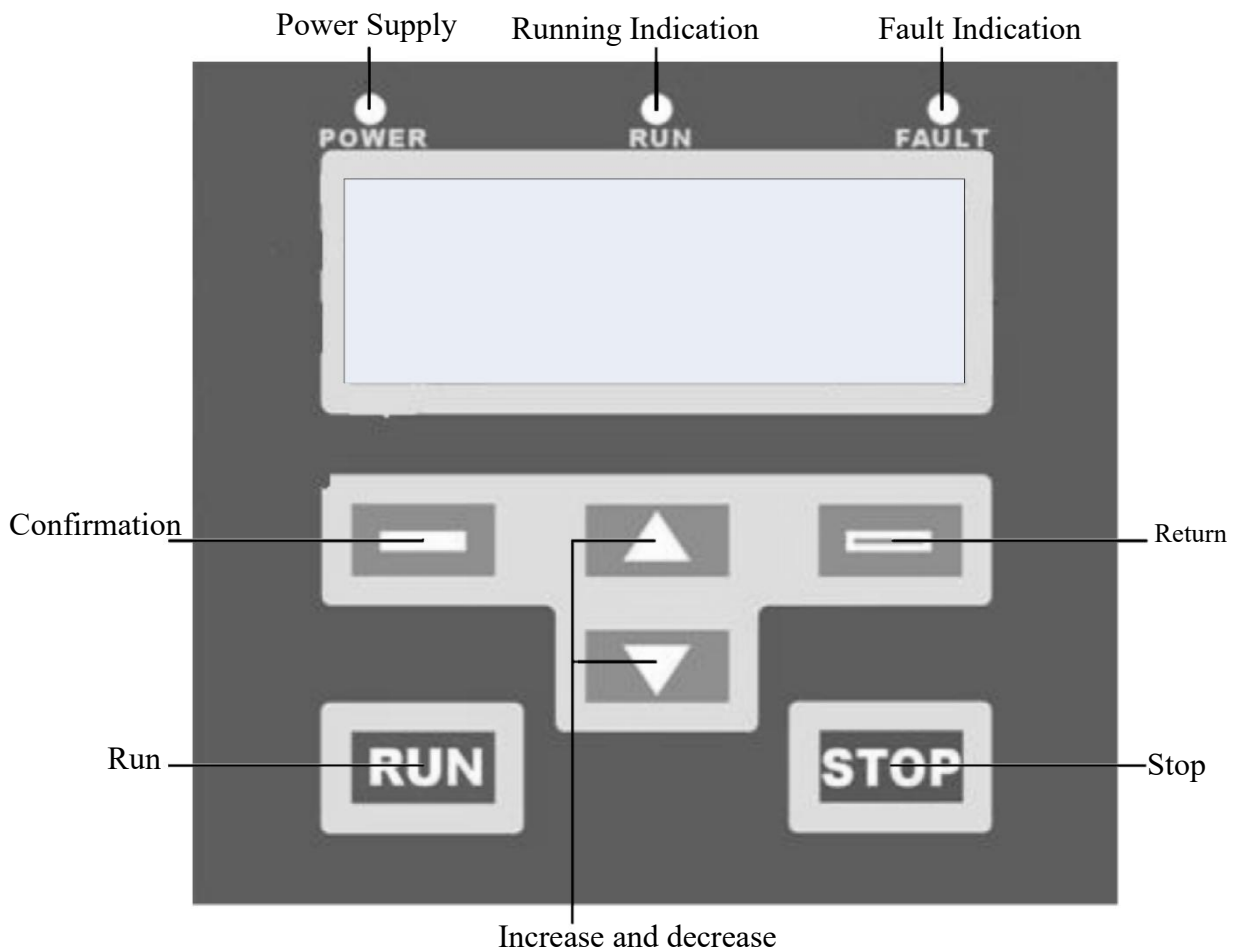
## 4.4 Description of terminal

CMC-MX series soft starter is externally connected with control terminals to provide convenience for users to achieve external signal control, remote control and system control.

Terminal No.	Terminal Name	Description	
Main circuit	1L1, 3L2, 5L3	<b>AC power input terminal</b> <b>Connected to three-phase AC power supply</b>	
	2T1, 4T2, 6T3	<b>Soft start output terminal</b> <b>Connected to three-phase asynchronous motor</b>	
Control circuit	X1/1	Analog output - (AO-) 4~20mA	
	X1/2	Analog output + (AO+) Output load impedance (150-500Q)	
	X1/3	COM Common port	
	X1/4	External control starting terminal (RUN) Start when X1/4 and X1/3 are short-circuited	
	X1/5	External control stop terminal (STOP) Stop when X1/5 and X1/3 are disconnected	
	X1/6	Programmable digital port (D1)	
	X2/1	RS485 ground (GND)	
	X2/2	RS485+ (A)	
	X2/3	RS485- (B)	
	X3/1	Interlocking control relay K1	Passive normally open AC250V/5A, DC30V/5A
	X3/2		
	X3/3	Fault output relay K2	Passive normally open AC250V/5A, DC30V/5A Action in case of fault
	X3/4		
	X3/5	Programmable output relay K3	Passive normally AC250V/5A, DC30V/5A Defined according to the output parameters of the programmable relay
	X3/6		
X3/7	PE PE		
X3/8	L	Control power supply AC110V--AC220V±15%50/60HZ	
X3/9	N		

## Chapter V Display and Operation Instructions

### 5.1 Panel diagram



In the starting process, full voltage and soft stop process, LED panel displays the average current. The panel has 3 LED indicator lights. LED1 indicates POWER and it is normally on when the motherboard voltage is normal; LED2 indicates RUN and it is flashing in the starting and stop process and normally on after completion of starting; and LED3 indicates FAULT and it is on in case of any fault.

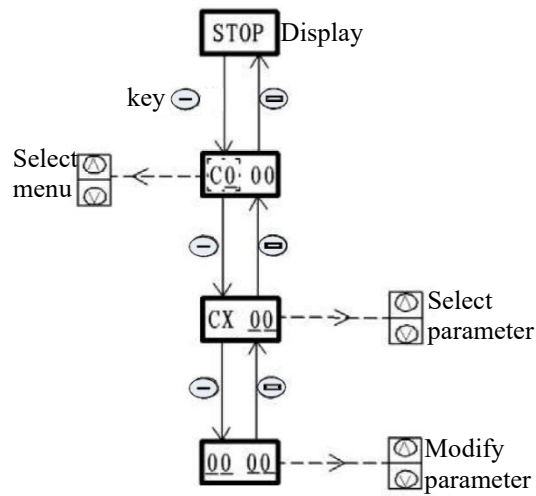
### 5.2 Description of key function

Symbol	Name	Function
	Confirmation key	Enter the menu item and confirm the parameter item to be modified.
	Increase key	Increase the parameter item or data (the current can be calibrated during running).
	Decrease key	Decrease the parameter item or data (the current can be calibrated during running).
	Return key	Confirm the modified parameter data, exit the parameter item, and exit the parameter menu.
	Running key	When the key operation is valid, it is used for running operation, and the terminals 3 and 5 of the terminal strip X1 are short-circuited.
	Stop key	When the key operation is valid, it can be used for stop operation or fault reset running (long-press the key for more than 4 seconds).

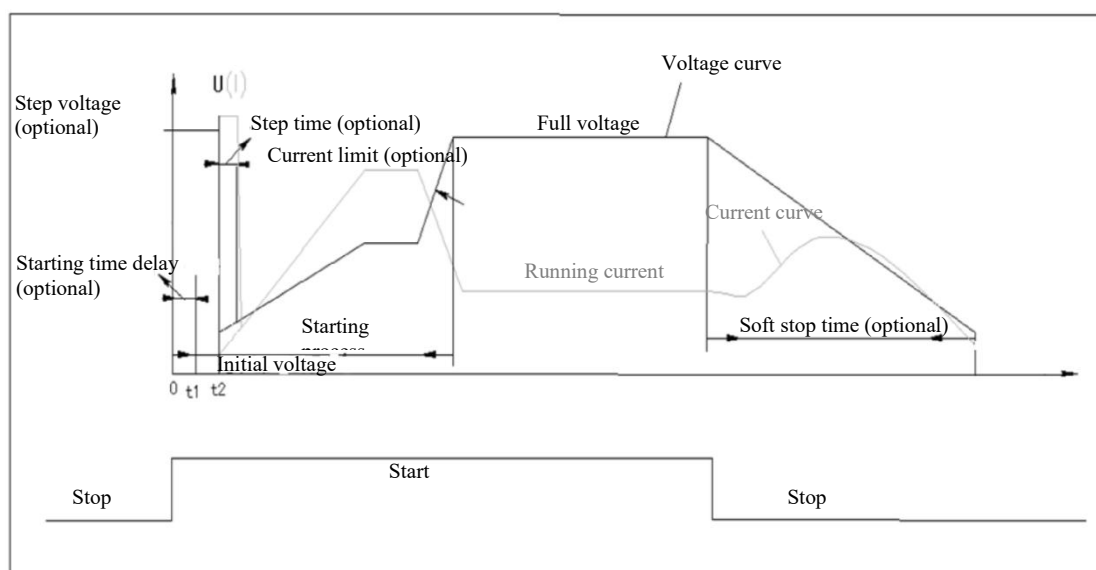
### 5.3 Description of display status

S/N	Display Symbol	Status Description	Description
1	STOP	Stop state	Equipment in stop state
2	C000	Programming state	At this time, you can view and set parameters.
3	7001	Starting countdown state	Equipment in starting countdown state
4	E r 01	Failure state	Equipment in fault state

### 5.4 Operation process of modifying parameter items



## Chapter VI Control Mode of Soft Starter

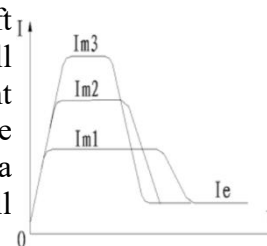


Soft Start\Soft Stop Voltage (Current) Characteristic Curve

CMC-MX soft starter has multiple starting modes: current limiting start and voltage ramp start; and multiple stopping modes: free stop and soft stop. The user can select different starting and stopping modes according to different loads and specific service conditions.

### 6.1 Current limiting soft start

When the current limiting starting mode is adopted, after the soft starter receives the starting command, its output voltage will increase rapidly until the output current reaches the set current limit value  $I_m$ , the output current will not increase any more, the current will start to decrease after the motor accelerates for a certain period, the output voltage will increase rapidly until full voltage output, and the starting process is completed.



Parameter	Name	Scope	Setpoint	Factory Defaults
C000	Starting Mode	0~1	1	0
C004	Ramp time	0~60S	0	10
C005	Current limiting factor	150~500%I <sub>e</sub>	---	350%

Note: "---" indicates that the user can set it as required (the same below).

### 6.2 Voltage ramp start

This starting mode is applicable to large inertia loads. For the occasions with high requirement for the starting stability, it can greatly reduce the starting impact and the mechanical stress.

Parameter	Name	Scope	Setpoint	Factory Defaults
C000	Starting Mode	0---1	0	0
C003	Initial voltage	25~100%U <sub>e</sub>	---	30%
C004	Ramp time	0-60S	---	10
C005	Current limiting factor	150~500%I <sub>e</sub>	---	350%



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## 6.3 Step torque soft start

Step torque soft starting is mainly applied to load motors with large static resistance, and it overcomes large static friction torque by applying an instantaneous large starting torque. In this mode, the output voltage reaches the set step voltage quickly. When the preset step time is up, the machine starts smoothly according to the set initial voltage and ramp time until starting is completed.

Parameter	Name	Scope	Setpoint	Factory Defaults
C000	Start Ramp Mode	0---1	---	0
C001	Step voltage	25~100%Ue	---	20%
C002	Step time	0~200×10mS	---	0
C003	Initial voltage	(25~100%)Ue	---	30%



**When the step torque starting mode is adopted, it must be coordinated with other soft starting modes, and the values of step voltage and step time must be set.**

## 6.4 Free stop

When the soft stop time (C007) is set to zero, it is the free stop mode. When the soft starter receives the stop command, the soft starter blocks the control relay of the bypass contactor and then blocks the output of the main circuit thyristor immediately, and the motor stops freely according to the load inertia.

Parameter	Name	Scope	Setpoint	Factory Defaults
C007	Soft stop time	0~60S	0	0

## 6.5 Soft stop

When the soft stop time is not set to zero, stop in the full voltage state is soft stop. In case of stop in this mode, the soft starter first disconnects the bypass contactor, the output voltage of the soft starter gradually decreases to the set soft stop termination voltage value within the set soft stop time, and the starter is switched to free stop after the soft stop process is completed.

Parameter	Name	Scope	Setpoint	Factory Defaults
C007	Soft stop time	0~60S	10	0
C008	Soft stop termination voltage	25---60%	25	25

## Chapter VII Parameter Items and Descriptions

The parameters of CMC-MX soft starter can be divided into three types according to their functions: start/stop control parameter C0, protection parameter C1, port setting parameter C2 and recording parameter C3.

### 7.1 Start/stop control parameter menus C000-C016 have 17 parameters in total.

Parameter	Name	Scope	Factory Defaults
C000	Starting Mode	0-voltage ramp 1-current limit	0
C001	Step voltage	20%---100%Ue	20%
C002	Step time	0-200*10mS	0
C003	Initial voltage	25%-100%Ue	30%
C004	Ramp time	0---60S	10
C005	Current limiting factor	150%-500%Ie	350%
C006	Second starting allowed	0---60S	0
C007	Soft stop time	0---60S	0
C008	Soft stop termination voltage	25---60%	25%
C009	Starting time delay	0-250S	0
C010	Secondary current limiting factor	150%-500%Ie	400%
C011-C016	Undefined parameter		

### 7.2 Motor protection parameter menus C100-C116 have 17 parameters in total.

Parameter	Name	Scope	Factory Defaults
C100	Motor rated current	15.0~9999A	---
C101	Overcurrent protection	Closed when (100~500)%Ie100	150%
C102	Overcurrent duration	1—60S	1
C103	Phase current imbalance	10-100%	70
C104	Current imbalance delay	1—60S	1
C105	Electronic thermal overload	10A, 10, 15, 20, 25, 30, OFF	20
C106	SCR protection option	0-SCR protection, 1-SCR protection disabled	0
C107	Phase sequence detection	0. detection; 1. no detection	1
C108	Frequency protection setting	0, 50Hz1, 60Hz	0
C109	Starting time limit	0---120S	80
C110	Motor wiring setting	0-external connection; 1-internal connection; 2-internal connection (no detection of wiring).	0
C111-116	Undefined parameter		

### 7.3 Port setting parameters C200-C216 have 17 parameters in total.

Parameter	Name	Scope	Factory Defaults
C200	Selection of control	0. Keyboard control 1. Communication control 2. Keyboard and communication control  <b>Note: The above is valid only for the terminal double-contact connection method.</b>	0
C201	D1 port input mode	0. Fault clear input 1. Emergency stop input	0

C202	Programmable relay output mode	0. Full voltage output 1. Starting process output 2. Soft stop process output 3. Fault output	1
C203	Relay output delay	0—250s	0
C204	Correspondence Address	1---32	1
C205	Communication Baud rate	0, 24001, 4800 2, 96003, 19200	2
C206	Undefined		
C207	Undefined		
C208	Analog output mode	0. Average current 1 (0---200Ie)% 1. Average current 2 (0---400Ie)%	0
C209-C213	Undefined parameter		
C214-C216	Analog current correction parameter		

#### 7.4 Recording function parameters C300-C316 have 17 parameters in total.

Parameter	Name	Scope	Factory Defaults
C300	Soft start rated current	----	----
C301	Software version	----	----
C302	Current display precision	----	----
C303	Current correction	----	----
C304	User starting times	----	----
C305	Manufacturer's parameters	----	----
C306	Manufacturer's parameters	----	----
C307-C316	Undefined parameter		

#### 7.5 Function description

◆ **Start/stop control parameter C0** (see Chapter VI for description of the starting control mode)

The user can select the starting curve by the parameter C000, so that the starting curve is well coordinated with the actual load, so as to achieve the best starting effect. If the step voltage and the step time are set, an instantaneous large starting torque will be applied at the beginning of starting, and then starting will be conducted according to the set initial voltage and ramp time. If the value of the parameter C006 is not zero, when starting is not completed after the set time is up, the second starting will be conducted according to the set initial voltage and ramp time until starting is completed. In the starting process, the starting current is limited below the value set by the parameter C005 and the second starting current is limited below the value of the parameter C010.

Note: When the starting mode is voltage ramp starting, the corresponding parameter C003 represents the initial voltage;

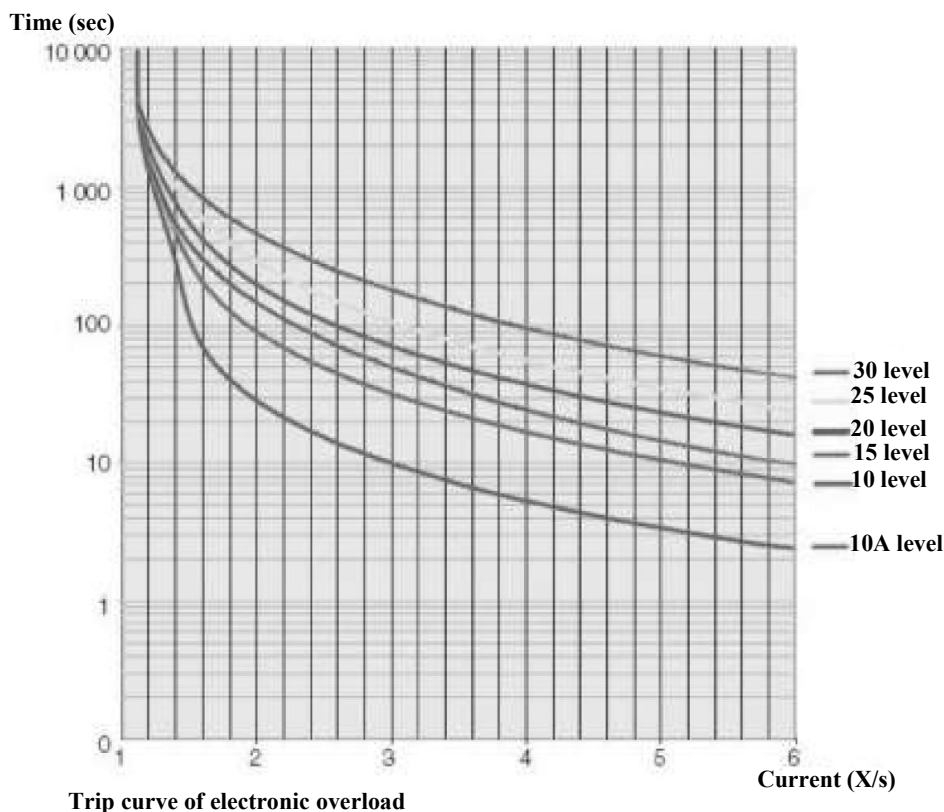
The ramp time of the parameter C004 determines the time when the starting torque rises to the final torque. When the ramp time is long, it will produce a small acceleration torque in the starting process of the motor. In this way, the long-time soft acceleration of the motor can be achieved. The length of the ramp time shall be properly selected to enable the motor to conduct soft acceleration until it reaches the rated speed. When the acceleration time is up before the motor acceleration is completed, the torque will be limited to the set limit torque for a certain period. Therefore, the ramp time here represents the change rate of speed and it is not exactly equivalent to the starting time of the motor.

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### ◆ Protection parameters

The user can set the rated current of C100 motor according to the power of the motor, so that the soft starter can match the motor well and protect the motor perfectly. If the current in the running process exceeds the overcurrent protection value set by the parameter C101, the soft starter will conduct overcurrent protection. If the electronic thermal overload level and the tripping time set by the parameter C105 are exceeded, the soft starter will conduct overload protection. During protection, the corresponding fault type will be displayed on the interface for the user to search. (The rated current of the motor shall not be lower than 50% of the rated current of the controller.)

If there is no requirement for the phase sequence of the power supply during use, the parameter C107 will be set to not detection of phase sequence; otherwise, it will be set to detection of phase sequence. If SCR is not protected during use, the parameter C106 will be set to 1; otherwise, it will be set to 0. If the user uses the phase current imbalance protection, the user can set the parameters C103 and C104.



### ◆ Port setting parameters

➤ The start/stop operation of the soft starter can be selected by the parameter C200. The parameter C009 coordinates with the starting function item for starting. If the starting delay is set, the soft starter will start when the delay time set by parameter C009 is up after a valid starting command is given.

➤ The parameter C201 is used to set the input type of the programmable input terminal D1.

Note: 1. When the port D1 is set to fault clear, the soft starter will start again if the

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starting command exists after the fault is cleared.

2. When the port D1 is set to emergency stop input, the soft starter may stop running in the process of starting, stop or full voltage.

➤ Programmable relay: The parameter C202 is used for output of the programmable relay.

Full voltage output: The output will be closed when the starting output of the soft starter reaches the rated voltage.

Starting process output: The output will be closed when the soft starter is in the starting process.

Soft stop process output: Output will be provided when the soft starter is in the soft stop process.

Output in case of fault: The output will be closed when the soft starter detects any fault.

➤ 4-20mA analog output: The parameter C208 is used to set the current value corresponding to the analog output. The user can select 0-2Ie or 0-4Ie corresponding to 4-20mA as required.

**Note:** If the user finds that the analog current output is not consistent with the actual value during use, the current can be corrected by modifying the value of C216: when the value of C216 is set to 1, the 4mA output point is corrected by modifying the value of C214; when the value of C216 is set to 2, the 20mA output point is corrected by modifying C215. Exit the menu after completion of correction.

➤ Communication function: The machine supports MODBUS-RTU standard communication mode. The parameter C204 can set the local communication address, and the parameter C205 can set the local communication Baud rate.

For the specific parameter address, see Chapter IX for details!

➤ Internal triangle function: The parameter C110 sets the motor wiring mode, 0 is external connection mode, and 1 and 2 are internal connection starting modes. When set to 1, the machine will detect whether the internal triangular wiring is correct before the machine starts, and then execute the starting command of the internal triangular wiring; when set to 2, the machine will not detect whether the wiring is correct and will start directly according to the internal triangular control mode.






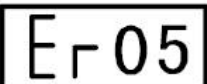


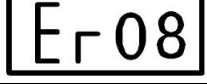

### ◆Recording parameter C3

This parameter records the working and status information of the soft starter and cannot be modified by the user.

## Chapter VIII Fault Detection and Troubleshooting

### 8.1 List of fault codes

When the soft starter protection function acts, the soft starter will stop immediately, and the display will display the current fault. The user can analyze the fault based on the fault content.

Display	Status description	Solutions
	When the starting signal is given, the motor doesn't respond to it.	<ol style="list-style-type: none"> <li>1. Check whether 3 and 5 of the terminal XI are connected.</li> <li>2. Check whether the control circuit is connected correctly and whether the control switch is normal.</li> <li>3. Check whether the control power supply is too low.</li> <li>4. Check whether the C200 parameter setting is wrong.</li> </ol>
No display		<ol style="list-style-type: none"> <li>1. Check whether 6 and 7 of the terminal X3 are connected.</li> <li>2. Check whether the control power supply is normal.</li> </ol>
	Phase loss when the motor starts	<ol style="list-style-type: none"> <li>1. Check each phase voltage of the three-phase power supply and judge and eliminate phase losses.</li> </ol>
	SCR overheating	<ol style="list-style-type: none"> <li>1. Check the ventilation of the installation environment of the soft starter and vertical installation.</li> <li>2. Check whether the radiator is overheated or the overheat protection switch is disconnected.</li> <li>3. Reduce the starting frequency if it is too high.</li> <li>4. Check whether the control power supply is too low. The power drop is too large in the starting process.</li> </ol>
	Starting failure	<ol style="list-style-type: none"> <li>1. Check the set values of various working parameters one by one and verify whether the set parameter values and the actual parameters of the motor are matched.</li> <li>2. In case of starting failure (not completed within the set time of C109), check whether the current limiting factor is set too small.</li> </ol>
	Short circuit of input and output ends of soft starter	<ol style="list-style-type: none"> <li>1. Check whether the internal contactor is stuck at the closed position.</li> <li>2. Check the SCR for breakdown or damages.</li> </ol>
	Open circuit of motor connecting wire (C106 is set to 0)	<ol style="list-style-type: none"> <li>1. Check whether the output end of the soft starter is correctly and reliably connected to the motor.</li> <li>2. Judge whether the interior of the motor is open-circuited.</li> <li>3. Check the SCR for breakdown or damages.</li> <li>4. Check the incoming line for phase losses.</li> </ol>
	Failure of current limiting function	<ol style="list-style-type: none"> <li>1. View whether the setting of the parameter C100 is correct.</li> </ol>
	Motor running overcurrent	<ol style="list-style-type: none"> <li>1. Check whether the output end of the soft starter is short-circuited.</li> <li>2. Check for sudden increase of loads.</li> <li>3. Check whether the load fluctuation is too large.</li> </ol>
	Electronic thermal overload	<ol style="list-style-type: none"> <li>1. Check for overload running.</li> </ol>
	Phase sequence error	<ol style="list-style-type: none"> <li>1. Check the settings of the incoming line phase sequence and the parameter C107.</li> </ol>
	Phase current imbalance	<ol style="list-style-type: none"> <li>1. Check whether the main circuit current or voltage is balanced and C103 parameter settings.</li> </ol>
	Parameter loss	<ol style="list-style-type: none"> <li>1. After re-energization, if such phenomenon persists, please contact the manufacturer.</li> </ol>

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<b>Er 11</b>	Wiring error	1. View the settings of the wiring and the parameter C110.
<b>Er 12</b>	Internal fault	1. Re-energize the control power supply. 2. Check whether the input and output terminals of the main circuit of the soft starter are short-circuited. 3. Please contact the manufacturer.

## 8.2 Troubleshooting

The fault has memory, so after troubleshooting, it is reset through the key STOP (long-press it for more than 4 seconds) or external fault clearing input (D1 multi-function input) terminal to restore the soft starter to the starting ready state.

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## Chapter IX Communication Control

CMC-MX motor soft starter provides RS485 communication interface and adopts international standard Modbus communication protocol for master/slave communication. The user can achieve centralized control by PC/PLC, controlling the upper computer, etc., so as to meet the specific application requirements.

### 9.1 Protocol content

The Modbus serial communication protocol defines the frame content of asynchronous transmission in serial communication and the format of the slave response frame. The frame content of the master organization includes: slave address, execution command, data, error check, etc. The slave response adopts the same structure and the content includes running qualification, return data, error check, etc. If the slave has errors in receiving frames or it cannot complete the actions required by the master, it will organize a fault frame as a response fed back to the master.

### 9.2 Bus structure

#### (1) Interface mode

RS485 hardware interface

#### (2) Transmission mode

Asynchronous serial, half duplex transmission mode. Between the master and the slave, only one sends data and the other receives data at a time. In the process of serial asynchronous communication, data are sent in the form of messages one frame by one frame.

#### (3) Topology

Single-master multi-slave system. The setting range of the slave address is 1-32 and each slave address in the network is unique. This is the basis for ModBus serial communication.

### 9.3 Protocol specification

CMC-MX soft starter communication protocol is an asynchronous serial master/slave ModBus communication protocol. Only one set of equipment in the network can establish the protocol. Other equipment can only respond to the master's "query/command" by providing data or take the corresponding action according to the master's "query/command". The master here refers to the personal computer (PC), industrial control equipment or programmable logic controller (PLC), etc. The slave refers to CMC-MX soft starter or other control equipment with the same communication protocol.

### 9.4 Communication frame structure

The ModBus protocol communication data format of the CMC-MX soft starter is RTU (Remote Terminal Unit) mode. In RTU mode, the format of each byte is as follows:

Encoding system: 8-bit binary, hexadecimal 0-9, A-F, in each 8-bit frame field, including two hexadecimal characters.

In this mode, the new one always starts with a transmission time silence of at least 3.5 bytes. On a network where the transmission rate is calculated in Baud rate, the transmission time of 3.5 bytes can be easily grasped. The following transmission data



fields are as follows in turn: slave address, operation command code, data and CRC check word, each field transmission byte is hexadecimal 0... 9, A... F. The network equipment always monitors the activity of the communication bus, even during the silent interval time. When the first field (address information) is received, each set of network equipment acknowledges that byte. After completion of transmission of the last byte, there is a similar transmission interval time of 3.5 bytes to identify the end of the frame, after which the transmission of a new frame will start.

The information of a frame must be transmitted as a continuous data stream. If an interval time more than 1.5 bytes elapses before completion of the entire frame transmission, the receiving equipment will clear the incomplete information.

## 9.5 Address description

Name	Variable type	Register No.	Data type	R/W characteristics
Starting Mode	I/O integer	0000	Uint	R/W
Step voltage	I/O integer	0001	Uint	R/W
Step time	I/O integer	0002	Uint	R/W
Initial voltage	I/O integer	0003	Uint	R/W
Ramp time	I/O integer	0004	Uint	R/W
Current limiting factor	I/O integer	0005	Uint	R/W
Second starting allowed	I/O integer	0006	Uint	R/W
Soft stop time	I/O integer	0007	Uint	R/W
Soft stop termination voltage	I/O integer	0008	Uint	R/W
Starting time delay	I/O integer	0009	Uint	R/W
Secondary current limiting factor	I/O integer	0010	Uint	R/W
Motor rated current	I/O integer	0017	Uint	R/W
Overcurrent protection	I/O integer	0018	Uint	R/W
Overcurrent duration	I/O integer	0019	Uint	R/W
Phase current imbalance	I/O integer	0020	Uint	R/W
Phase current imbalance delay	I/O integer	0021	Uint	R/W
Electronic thermal overload	I/O integer	0022	Uint	R/W
SCR protection option	I/O integer	0023	Uint	R/W
Phase sequence detection	I/O integer	0024	Uint	R/W
Frequency protection setting	I/O integer	0025	Uint	R/W
Starting time limit	I/O integer	0026	Uint	R/W
Motor wiring setting	I/O integer	0027	Uint	R/W
Selection of control	I/O integer	0034	Uint	R/W
D1 port input mode	I/O integer	0035	Uint	R/W
Relay output mode	I/O integer	0036	Uint	R/W
Relay output delay	I/O integer	0037	Uint	R/W
Correspondence Address	I/O integer	0038	Uint	R/W
Communication Baud rate	I/O integer	0039	Uint	R/W
Analog output mode	I/O integer	0044	Uint	R/W
4mA correction parameter	I/O integer	0048	Uint	R
20mA correction parameter	I/O integer	0049	Uint	R

Name	Variable type	Register No.	Data type	R/W characteristics
Correction point setting	I/O integer	0050	Uint	R
Soft start rated current	I/O integer	0051	Uint	R
Software version	I/O integer	0052	Uint	R
Current display precision	I/O integer	0053	Uint	R
Current correction	I/O integer	0054	Uint	R
Current output correction	I/O integer	0058	Uint	R
Working status word of soft starter	I/O integer	0100	Uint	R
Fault code	I/O integer	0101	Uint	R
Motor rated current	I/O integer	0102	Uint	R
Average current of motor	I/O integer	0103	Uint	R
Percentage of analog output	I/O integer	0104	Uint	R
Countdown time of soft start	I/O integer	0105	Uint	R

**Note: definition of working status word of soft starter**

Value	Description
0X00	Stop state
0X80	Failure state
0X20	Edit state
0X40	Run State

## 9.6 Control command parameter address

Name	Variable Type	Register No.	Data	R/W Characteristics
Stop	I/O integer	0200	0x00C8	W
Start	I/O integer	0202	0x00CA	W
Reset	I/O integer	0203	0x00CB	W

Note: If the control command is invalid, view C200 parameter to determine whether to enable the communication control function; and view whether the terminals X1/3 and X1/5 are short-circuited.

## 9.7 Overview of function code

(1) Function code "03" (read multiple holding registers)

Data Sent by Master	Qty. of Bytes	Routine	Data Returned by Slave	Qty. of Bytes	Routine
Slave address	1	01	Slave address	1	01
Function code	1	03	Function code	1	03
Start address	2	006D	Number of bytes returned	1	02
Data length	2	0001	Data 1	2	4100
CRC	2	15D7	CRC	2	8814

Note: The number of registers read at each time is at most 50.

(2) Function code "06" (write single register)

Sent data	Qty. of bytes	Routine	Data returned by slave	Qty. of bytes	Routine
Slave address	1	01	Slave address	1	01
Function code	1	06	Function code	1	06
Start address	2	0001	Number of bytes returned	2	0001
Upload Data	2	001E	Data 1	2	001E
CRC	2	5802	CRC	2	5802

Note: When you use the 06 command to modify the parameters of the soft starter, the

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soft starter must be in the stop or edit state, and other states cannot be modified successfully. When a certain parameter is modified, the modified parameter must be within the range specified in the manual. If the parameter is beyond the range, it cannot be modified successfully.

## 9.8 Communication time interval

### (1) Time interval for using "03" command:

Time interval =  $(17 + \text{number of registers} * 2) * 8 / \text{Baud rate} * 1000 * 1.2\text{ms}$ ;

For example, Baud rate 9600, read the value of one register, time interval =  $(17+1*2)*8/9600*1000*1.2 = 19\text{ms}$ .

### (2) Time interval for using "06" command:

Time interval =  $20*8 / \text{Baud rate} * 1000 * 1.2\text{ms}$ ;

For example, Baud rate 9600, time interval =  $20*8/9600*1000*1.2 = 20\text{ms}$ .

## 9.9 Precautions

➤ When multiple machines communicate with each other, the addresses of the CMC-MX soft starters must be unique, i.e., the addresses of any two soft starters must be different (set by the parameter C204).

➤ The communication Baud rate of CMC-MX soft starter must be equal to that of the controller (set by the parameter C205).

➤ When multiple CMC-MX soft starters communicate with each other, both ends A and B of the last one shall be connected to 120Ω resistors.

## 9.10 Communication fault code analysis

### (1) Address writing error: equipment address +0x86+0x02+CRC

- ① The address exceeds 59.
- ② It is not the specified writable register.
- ③ It is not in stop or edit state.
- ④ Communication control start/stop is not enabled when the control command is written.

### (2) Data writing error: equipment address +0x86+0x03+CRC

- ① Data beyond the specified data range are written into the specified writable register.
- ② The command data are incorrect when the starting command is sent.

### (3) Address reading error: equipment address +0x83+0x02+CRC

- ① The read address exceeds 59.

### (4) Function code error: equipment address + (0x80 + error function code)+0x01+CRC

- ① The function code is not specified by the soft starter.

## Chapter X Routine Maintenance

1. Dust: If there is too much dust, the insulation level of the soft starter will be reduced and the soft starter may fail to work normally.

(1) Brush gently with a clean and dry brush to remove dust.

(2) Blow dust away with compressed air.

2. Condensation: If condensation occurs, the insulation level of the soft starter will be reduced and the soft starter may fail to work normally.

(1) Blow dry with a hair dryer or an electric stove.

(2) Dehumidify the power distribution room.

3. Regularly check whether the components are intact and can work normally.

4. Check the cooling channel of the soft starter to ensure that it is not blocked by dirt and dust.



**The maintenance inspection must be carried out after all power supplies at the incoming side of the soft starter are cut off!**

### Schedule I: Standard Wiring Specifications and Models of Soft Starters and Selection of Accessories (380V as an example)

Adaptive Motor (KW)	Motor Current (A)	Model of Soft Starter	Specification of Primary Wire (copper wire)
7.5	18	CMC-MX008/3	6mm <sup>2</sup>
11	24	CMC-MX011/3	10mm <sup>2</sup>
15	30	CMC-MX015/3	16mm <sup>2</sup>
18.5	39	CMC-MX018/3	16mm <sup>2</sup>
22	45	CMC-MX022/3	16mm <sup>2</sup>
30	60	CMC-MX030/3	25mm <sup>2</sup>
37	76	CMC-MX037/3	25mm <sup>2</sup>
45	90	CMC-MX045/3	35mm <sup>2</sup>
55	110	CMC-MX055/3	50mm <sup>2</sup>
75	150	CMC-MX075/3	70mm <sup>2</sup>
90	180	CMC-MX090/3	20×3 copper bars
110	218	CMC-MX110/3	20×3 copper bars
132	260	CMC-MX132/3	25×3 copper bars
160	320	CMC-MX160/3	30×3 copper bars
185	370	CMC-MX185/3	30×4 copper bars
220	440	CMC-MX220/3	40×5 copper bars
250	500	CMC-MX250/3	40×5 copper bars

**Note:** Standard wiring refers to triangle or star connection of the motor winding, and the thyristor is connected between the power supply and the motor.

### Schedule II: Specifications and Models of Inner triangular Wiring of Soft Starters and Selection of Accessories (380V as an example)

Adaptive motor (KW)	Motor current (A)	Model of soft starter	Specification of Primary Wire (copper wire)
7.5	18	CMC-MX008/3	6mm <sup>2</sup>
11	24		10mm <sup>2</sup>
15	30	CMC-MX011/3	16mm <sup>2</sup>
18.5	39		16mm <sup>2</sup>

Adaptive motor (KW)	Motor current (A)	Model of soft starter	Specification of Primary Wire (copper wire)
22	45	CMC-MX015/3	16mm <sup>2</sup>
30	60	CMC-MX018/3	25mm <sup>2</sup>
37	76	CMC-MX022/3	25mm <sup>2</sup>
45	90	CMC-MX030/3	35mm <sup>2</sup>
55	110	CMC-MX037/3	50mm <sup>2</sup>
75	150	CMC-MX045/3	70mm <sup>2</sup>
90	180	CMC-MX075/3	20×3 copper bars
110	218		20×3 copper bars
132	260	CMC-MX090/3	25×3 copper bars
160	320	CMC-MX110/3	30×3 copper bars
185	370		30×4 copper bars
220	440	CMC-MX132/3	40×5 copper bars
250	500	CMC-MX185/3	40×5 copper bars
280	560		40×5 copper bars

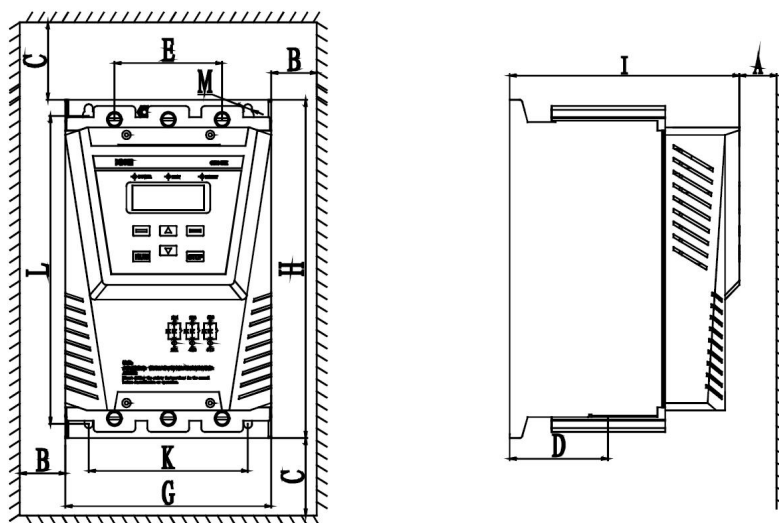
**Note:** Internal triangular wiring refers to triangular connection of the motor winding - serial connection between the thyristor and the winding. The main advantage of the internal triangular control is that the soft starter can be derated. The current flowing through the soft starter and the motor in the internal triangular connection method is of the main current.  $1/\sqrt{3}$

### Ordering instructions

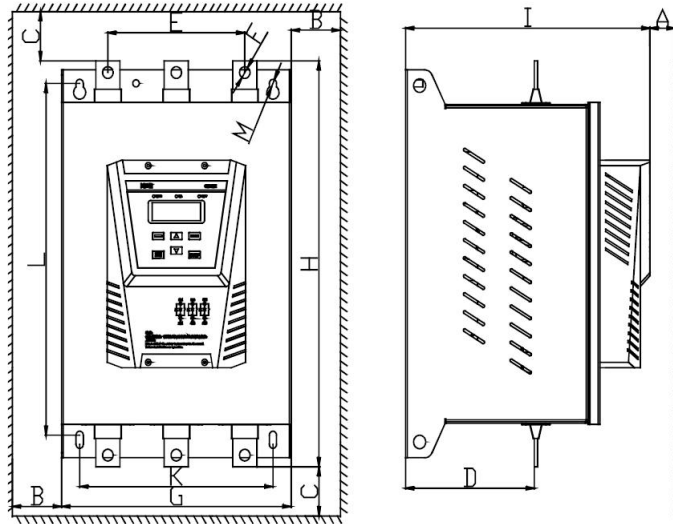
- ◆ When placing an order, the user shall inform the Supplier of the product model, specification, load and service conditions for correct selection of products.
- ◆ The standard configuration of the soft starter includes a built-in current transformer and a built-in contactor. The user does not need to connect any external current transformer and bypass contactor.
- ◆ The accessories in the above table are for reference only.

### Schedule III: Appearance and Opening Size of Soft Starter (unit: mm, 380V as an example)

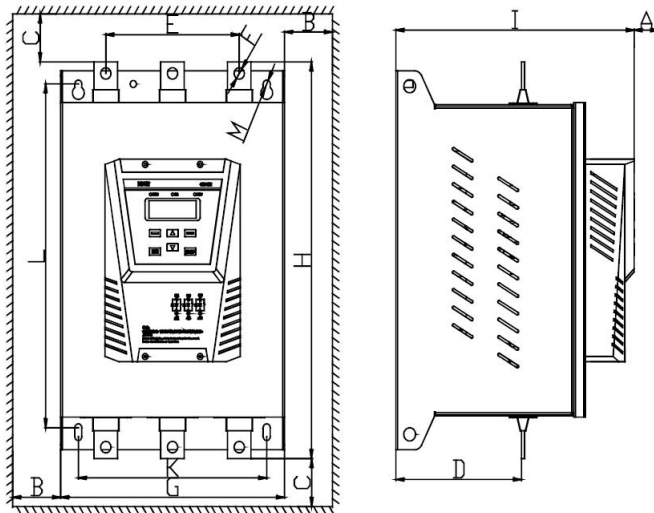
Model	G	H	I	K	L	M	E	D	A/B/C
CMC-008-55	173	275	192	133	250	7	90	86	50
CMC-075-160	285	450	305	230	390	9	170	158	50
CMC-185-250	320	523	330	270	415	9	195	158	50



Outline dimension below 55KW



Outline dimension of 75KW-160KW



Outline dimension of 185KW-250KW

### Schedule IV: Type Selection of Soft Starter

S/N	Rated current (A)	380V	Size (mm)
		Adaptive power (KW)	
1	18	7.5	173×275×192 (width × height × thickness), weight: 6.3kg
2	24	11	
3	30	15	
4	39	18.5	
5	45	22	
6	60	30	
7	76	37	
8	90	45	
9	110	55	
10	150	75	285×450×305 (width × height × thickness), weight: 25kg
11	180	90	
12	218	110	
13	260	132	

S/N	Rated current (A)	380V	Size (mm)
		Adaptive power (KW)	
14	320	160	320×523×330 (width × height × thickness), weight: 31.5kg
15	370	185	
16	440	220	
17	500	250	

**Schedule V: Basic Settings of Different Applications (the following settings are for reference only)**

Load Type	Initial Voltage (%)	Start Ramp Time sec	Stop Ramp Time sec	Current Limit ILIM
Foeship propeller	25	10	0	2.5
Centrifugal fan	25	20	0	3.5
Centrifugal pump	25	6	6	3
Piston compressor	25	15	0	3
Hoisting machinery	30	15	6	3.5
Mixer	40	15	0	3.5
Crusher	30	15	6	3.5
Screw compressor	20	15	0	3.5
Spiral conveyor belt	25	10	6	3.5
No-load motor	25	10	0	2.5
Conveyor belt	25	15	10	3.5
Heat pump	25	15	6	3
Escalator	25	10	0	3
Air pump	25	10	0	2.5



**XI'AN XICHI ELECTRIC CO., LTD.**

HQ Add:15/F, block B, Xi'an National Digital Publishing Base, No.996 Tianguqi Road,  
High-tech Zone, Xi'an

Factory address: No.2 West Qinlingsi Road, Caotang Technology Industrial Base,  
High-tech Zone, Xi'an

Tel: +86-29-88626546

Web: [www.xichielectric.com](http://www.xichielectric.com)

**Please read this manual carefully before use.**