EMHEATER

User Manual

EM-GX Series Online Soft Starter

Dongguan EMHEATER Electrical Equipment LTD

Preface

Thanks for your using EMHEATER intelligent motor soft starter, this product is used for three-phase squirrel cage induction motor soft starting and soft stopping control. Before using, please carefully read and understand the contents of this manual.

In the process of using the soft starter, please note the following Safety Clauses:

WARNING

- Installation and maintenance operations shall be strictly in accordance with this manual, relevant national standards and industry practices.
- Before maintenance and repair, the input must be all off-power.
- After installation, carefully check to ensure that no parts (such as wire ends, screws, etc.) fall into the electrical components.
- The control part of this product (including the trigger unit and central processing unit) is with dangerous voltage. The trigger unit has the same high voltage as the main circuit. Improper contact is very dangerous and may cause electric shock casualties.
- After the product is connected to the main power supply, even if the control voltage is disconnected or the starter is stopped, full voltage signals for sampling may still appear at the output of the soft starter.
- The product must be well grounded to ensure the safety of normal operation and prevent accidental electric shock. It is forbidden to connect power factor compensation capacitors or varistors to the output terminal of the soft starter.
- When the soft starter and VFD are used as backups for each other, their output terminals must be isolated from each other.

PRODUCT UNPACKING INSPECTION

Each soft starter has undergone strict inspection and performance testing before out off factory. After receiving the product and unpacking it, please check according to the following steps. If any problem, please contact our company or your supplier promptly.

- Check the product model: Verify the specification label on the product shell to confirm whether the goods you received match the product you ordered.
- Check whether the product is damaged during transportation, such as: internal parts falling off with abnormal noise, shell cracking, deformation, etc.
- Check other items: In addition to the product itself, each soft starter package should be equipped with an operation manual with a qualification certificate.

This user manual content may be changed due to technical reasons or modified.

Version: V1.1.20

Contents

1. Products Information

1.1 Motor Soft Starter Overview

EM-GX series soft starter is a new type of motor starting equipment with advanced international level designed and produced by adopting power electronic technology, microprocessor technology and modern control theory. This product can effectively limit the starting current of asynchronous motors during starting, and adopt a unique protection algorithm to effectively protect the motor and related equipment. It is widely applied in loads such as fans, pumps, conveyors, compressors and so on. It's a new ideal alternative for traditional star triangle starter and self-coupling decompression starter.

1.2 Technical Features

- Well detect load voltage and current to realize double closed-loop control. Realize smooth, vibration-free starting for various loads.
- Multiple starting modes to better match and adapt to the starting performance of various loads.
- Compact structure design, supporting Modbus RTU field BUS function, facilitating user's system integration.
- Multiple protection functions, including over current, overheating, phase failure, motor thermal overload and other comprehensive motor protection functions.
- Multiple control modes: keypad control, external control and communication control.
- With power grid voltage sag function, it has stronger adaptability to poorly power grids.

1.3 Technical Specifications

Input & Output	● Input Voltage:AC 220/380V±15% ● Input Frequency:50/60Hz ● Output Voltage:AC 220/380V±15%
Technical Parameter	● Starting Time:1~100s ● Soft Stopping Time:0~10s ● Starting Current Limiting Multiple:1~5Ie ● Initial Voltage:0.2~0.8Ue
External Interface	● 3 Programmable Digital Inputs ● 2 Relay Outputs ● 1 Analog Output（0~10VDC or 0~20mA or 4~20mA） ● RS485 Communication Output
Protection Function	Fault protection for input/output phase failure, starting timeout,

	overvoltage, overcurrent, undervoltage, underload, three-phase unbalance, overload, etc.
Starting Frequency	Less than 6 starts per hour
Cooling Method	Forced air cooling

1.4 Product Inspection

Each soft starter has undergone strict inspection and performance testing before out off factory. After receiving the product and unpacking it, please check according to the following steps. If any problem, please contact our company or your supplier promptly. Firstly, Check the product nameplate to confirm whether the goods you have received is matching the product you ordered.

Product Nameplate and Model Definition:

EM - GX 3 [I] - 045
❶ ❷ ❸ ❹ ❺

❶	EMHEATER
❷	GX Series online soft starter
❸	Rated voltage: 3: Three phase 380V
❹	I:Cabinet Structure None: Wall-mounted Structure
❺	Matched motor: 045:45KW; 160:160KW

2. Installation

2.1 Installation and Usage Conditions

Usage and environmental conditions have a great impact on the normal use and service life of the soft starter. Therefore, please install the soft starter in a place that meets the following Usage Conditions.

- Power Supply: Mains power, self-provided power station, diesel generator set, three-phase AC: AC 380V (±15%), 50Hz; (Note: The voltage level is selected according to the rated voltage of the motor. For the special voltage level AC 660V, please specify when placing an order).
- Matched Motor: General squirrel-cage asynchronous motor
- Installation Method: Wall-mounted
- Protection Level: IP00
- Environmental Conditions: Altitude below 2000m (the capacity should be reduced if exceeding); Ambient temperature between -25℃ and +40℃; Relative humidity not exceeding 90% (20℃±5℃), no condensation, no flammable, explosive or corrosive gas, no conductive dust; Indoor installation with good ventilation and vibration less than 0.5G.

2.2 Installation requirement

Installation Direction and Distance

To ensure a good ventilation and heat dissipation of the soft starter during use, the soft starter should be installed vertically, with sufficient heat dissipation space left above and below the equipment, as shown in Diagram 2-1.

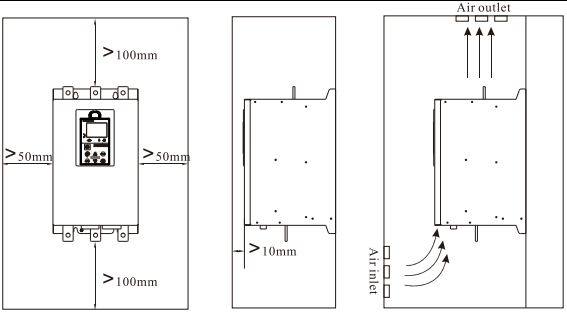


Diagram 2-1

Cabinet Installation

When the soft starter needs to be installed in a distribution cabinet, a cabinet with good ventilation must be selected. The soft starter can be installed in the cabinet in a horizontal layout as shown in Diagram 2-2, or in a vertical layout as shown in Diagram 2-3.

Note: When installing in a vertical layout, an air deflector should be added between the upper and lower soft starters to avoid affecting the heat dissipation of the upper soft starter.

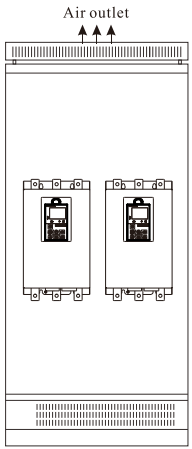


Diagram 2-2 Horizontal Layout Installation

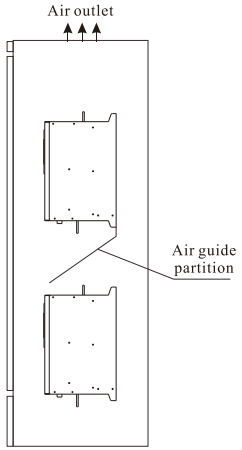


Diagram 2-3 Vertical Layout Installation

2.3 Installation Dimensions

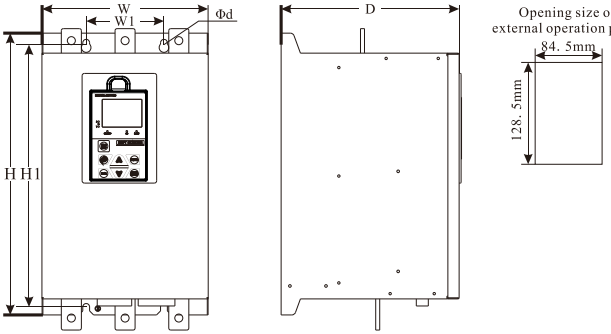


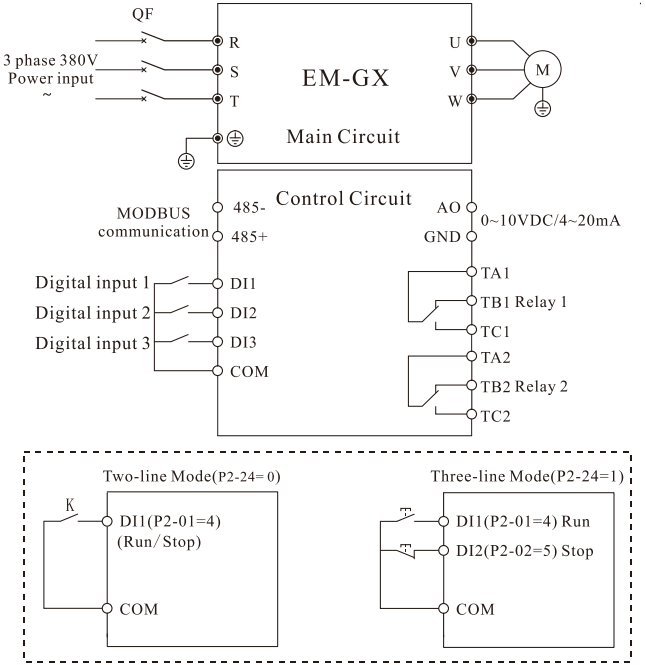
Diagram 2-4 EM-GX Outline and Installation Dimension

Model	Rated Power	Rated Current	External Dimensions (mm)			Installation Dimensions (mm)		
	(KW)	(A)	H	W	D	H1	W1	d
EM-GX3-015	15	30	271	145	204	240	112	M6
EM-GX3-022	22	45						
EM-GX3-030	30	60						
EM-GX3-045	45	90						
EM-GX3-055	55	110						
EM-GX3-075	75	150	376.5	207	222	330	97	M8
EM-GX3-090	90	180						
EM-GX3-110	110	230						
EM-GX3-132	132	264	503	393	235	453	294	M10
EM-GX3-160	160	320						
EM-GX3-200	200	400						
EM-GX3-250	250	500	605	458.5	278.5	532	344	M10
EM-GX3-280	280	560						
EM-GX3-355	355	700						
EM-GX3-400	400	800						
EM-GX3-500	500	1000	695	652.5	325	671	530	M16
EM-GX3-600	600	1200						

Note: Rated power and rated current refer to the maximum rated values of the soft starter. Generally, the corresponding parameters of the adapted motor should not exceed these values.

2.4 Wiring and Terminal Definition

Basic Wiring Diagram



Terminal Definition

Item	Symbol	Name	Function Description
Main Circuit	R, S, T	Power Input	AC power input terminal
	U, V, W	AC Output	Motor wiring terminal
Digital Input	DI1	Digital Input1	Digital input function, the output mode is set by P2-01~P2-03.
	DI2	Digital Input2	
	DI3	Digital Input3	
	COM	Common Terminal	Control signals Common terminal

Item	Symbol	Name	Function Description
Analog Output	AO1	Analog Output 1	0~10VDC or 0~20mA
	GND	Analog Common Terminal	
Communication Function	485+	485 terminal A	RS485 Communication
	485-	485 terminal B	
Relay Output	TA1-TB1	NC Terminal	Programmable Relay output 1, the output mode is set by parameter P2-04. Contact capacity: 5A/250VAC
	TA1-TC1	NO Terminal	
	TA2-TB2	NC Terminal	Programmable Relay output 2, the output mode is set by parameter P2-06. Contact capacity: 5A/250VAC
	TA2-TC2	NO Terminal	

3. Operation and Display

The motor soft starter has five kinds of working state; Ready ,Run ,Error, Starting and Stopping. The digital tube display makes all working statuses clear at a glance, and parameter modification is simple and easy.

3.1 Instruction of operation and display

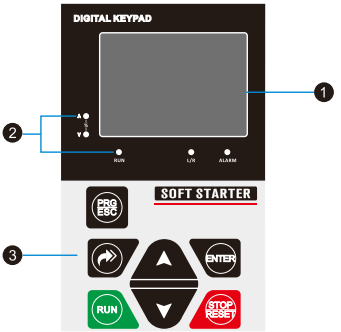


Diagram 3-1 Operation panel diagram

No.	Name	Function	
❶	LED display area	LED display is able to display the parameters, monitoring datas and Error codes	
❷	Unit/Status Indicator area	A	Current unit indicator light.
		V	Voltage unit indicator light.
		%	Both the current (A) and voltage (V) indicator lights are on simultaneously, it indicates %
		RUN	OFF indicates that the soft starter is in the stop state and ON indicates that the soft starter is in the running state.
		L/R	It indicates whether the soft starter is operated by terminals or communication.

			ON indicates terminals operation control state; Blinking indicates communication operation control state.
		ALARM	Fault indicator
❸	Operation key area		Programming key: Enter or exit parameter.
			Shift key: Sequentially switches between input voltage, operating percentage, ABC phase current, and temperature during operation.
			Confirmation key: Used to save parameters.
			Increment key: Increase data or parameter code.
			Decrement key: Decrease data or parameter code.
			Running key: Start the soft starter in the keypad control mode.
			Stop/Reset key: Stop the soft starter when it is in the running state and perform the reset operation when it is in the error state.

Start and stop operation:

After the soft starter is powered on, press  RUN key to start the motor. During startup, you can press  shift key to switch between displaying voltage or startup percentage. Once startup is complete, the current is displayed at the top of the screen, and the voltage is displayed at the bottom. Press  Stop/Reset button to stop the motor.

3.2 Parameter Function Table

The function parameters setting and description are as follows:

3.2.1 Group P0: Basic Function Parameters

P0-00	Motor Rated Current Default value: Depends on model.

Matches the rated current of the soft starter with the corresponding motor's rated current. Set the rated current according to the motor nameplate.

P0-01 Start Mode

Range: 0~ 1【Default:0】

Option: 0: Voltage Ramp

1: Current Ramp

Select soft starter start mode.

P0-02 Initial Start Voltage/Current

Range:20%~80%【Default:30%】

Description: Set the initial start voltage/current of the soft starter

P0-03 Ramp Time

Range: 1s~120s【Default: 15s】

Description: Voltage acceleration time

P0-04 Start-up Current Limiting Factor

Range: 150%~500%【Default:300%】

Description: Set the current limit value for current limited starting , as a percentage of motor rated current.

P0-05 Soft Stop Time

Range:0s~30s【Default:0s】

Description: Set the time required to soft stop the motor , if the value is "0", the motor will free stop.

P0-06 Control Mode

Range:0~2【Default:0】

Option: 0:Keypad control

1:Terminal control

2:Communication control

Set the soft starter control mode.

P0-07 Jump Voltage

Range:30%~80%【Default:80%】

Description: Set the jump voltage value.

P0-08 Jump Time

Range:0s~9999s【Default:0s】

Description: Set the jump duration time

P0-09 Startup Delay

Range:0s~999s【Default:0s】

Description: Set a start countdown.

P0-10 Startup Timeout

Range:5s~120s【Default:60s】

Description: Set the maximum startup time.

P0-11 Startup Interval Time

Range:0min~60min【Default:0min】

Description: Set the soft starter's start-up interval time. When the parameter value is 0, there is no start-up interval time.

Note: If the start-up interval is not 0 and the next start-up time after shutdown does not exceed F11, the motor will fail to start and the soft starter will output fault Err17 (start interval fault).

P0-12 Variable Frequency Start Mode

Range:0~ 1【Default:0】

Option: 0:Disable

1:Fire Inspection Mode (12.5Hz Operation)

2:Variable frequency start mode

P0-13 Fire Inspection Output Voltage

Range:20~80%【Default:35%】

Description: Set the output voltage for fire inspection at 12.5Hz.

P0-14 7-Frequency Division Output Voltage

Range:20~80%【Default:32%】

Description: Set the 7-Frequency division output voltage

P0-15 4-Frequency Division Output Voltage

Range:20%~80%【Default:35%】

Description: Set the 4-Frequency division output voltage.

P0-16 3-Frequency Division Output Voltage

Range:20%~80%【Default:35%】

Description: Set the 3-Frequency division output voltage

P0-17 2-Frequency Division Output Voltage

Range:20%~80%【Default:45%】

Description: Set the 2-Frequency division output voltage.

3.2.2 Group P1: Protection Function Parameters

P1-00 Overcurrent Protection Factor

Range:50%~800%【Default: 150%】

Description: Set the multiple of overcurrent of soft starter running

Note: When the parameter value is set to 50%, the overcurrent protection will be ineffective.

P1-01 Overcurrent Protection Delay

Range:0s~60s【Default:2s】

Description: Set the overcurrent protection trigger delay time of soft

P1-02 Current unbalance Allowable Protection Value

Range: 10%~ 100%【Default:40%】

Description: Set the difference percentage of the three-phase current.

P1-03 Current Unbalance Protection Delay

Range:0s~60s【Default:2s】

Description: Set soft starter three phase current unbalance protection trigger delay time.

P1-04 Overload Protection Level

Range:0~4【Default:2】

Option: 0:5

1 :10

2 :20

3 :30

4 :Disabled

Set different protection level.

Level	Overload multiplier							
	1.05Ie	**1.2Ie**	**1.5Ie**	**2Ie**	**3Ie**	**4Ie**	**5Ie**	**6Ie**
5	∞	350s	80s	30s	12s	6s	4s	2.6s
10	∞	500s	180s	60s	22s	13s	8s	5s
20	∞	1800s	360s	140s	46s	25s	15s	10s
30	∞	1800s	500s	170s	57s	30s	20s	15s

Note:∞ means no action.

P1-06 Under Load Protection

Range:20%~ 100%【Default:20%】

Description: Set the underload protection baseline. When the value is 100%, the underload protection function is turned off.

P1-07 Under Load Protection Delay

Range:0s~60s【Default:2s】

Description: Set soft starter under load protection trigger delay time.

P1-08 Phase Loss Protection Delay

Range:0s~5s【Default: 1s】

Description: Set soft starter phase loss protection trigger delay time.

P1-09 Ultra-high Current Protection

Range:0~ 1【Default: 1】

Option: 0:Close

1:Open

Set Ultra-high current function. When the starting current exceeds 5Ie and the

duration exceeds 200ms, the soft starter output Ultra-high current protection fault.

P1-10 Thyristor Protection

Range:0~ 1【Default: 1】

Option: 0:Close

1:Open

Set thyristor protection function. This function is output by a relay.

P1-11 Overheat Protection Value

Range:75-95° C【Default:80° C】

Description: Set the overheat protection temperature threshold for the soft starter.

P1-12 Under Voltage Protection Factor

Range:30%-100%【Default:70%】

Description: Set the multiple of undervoltage for soft starter. When the value is 30%, the undervoltage protection is turned off.

P1-13 Over Voltage Protection Factor

Range: 100%~ 150%【Default: 125%】

Description: Set the multiple of over voltage for soft starter. When the value is 150%, the overvoltage protection is turned off.

P1-14 Under/Over Voltage Protection Delay

Range:0s~10s【Default: 1s】

Description: Set soft starter over voltage and under voltage protection trigger delay time.

P1-15 Fault Count

Range:0~999【Default:0】

Description: Displays the number of soft starter failures. This parameter is read-only and cannot be modified.

P1-16 Fault Code 1

Range:0~9999【Default:0】

Description: Display soft starter fault codes. This parameter is read-only and cannot be modified.

P1-17 Fault Code 2

Range:0~9999【Default:0】

Description: Display soft starter fault codes. This parameter is read-only and cannot be modified.

P1-18 Fault code 3

Range:0~9999【Default:0】

Description: Display soft starter fault codes. This parameter is read-only and cannot be modified.

P1-19 Fault Code 4

Range:0~9999【Default:0】

Description: Display soft starter fault codes. This parameter is read-only and cannot be modified.

P1-20 Fault Code 5

Range:0~9999【Default:0】

Description: Display soft starter fault codes. This parameter is read-only and cannot be modified.

3.2.3 Group P2: Terminals and Communication Parameters

P2-00 Analog Current Factor

Range: 1~ 10【Default: 1】

Description: Set the analog multiple of the soft starter to correspond to the motor current multiple.

P2-01 DI1 Function Selection

Range:0~6【Default:4】

Option: 0:Fault Reset
1:Emergency stop normally open
2:Emergency stop normally closed
3:Interlock control
4:Start
5:Three-wire system enabled

Set the soft starter DI1 terminal function.

P2-02 DI2 Function Selection

Range:0~6【Default:5】

Option: 0:Fault Reset
1:Emergency stop normally open
2:Emergency stop normally closed
3:Interlock control
4:Start
5:Three-wire system enabled

Set the soft starter DI2 terminal function.

P2-03 DI3 Function Selection

Range:0~6【Default:0】

Option: 0:Fault Reset
1:Emergency stop normally open
2:Emergency stop normally closed
3:Interlock control
4:Start

5:Three-wire system enabled

Set the soft starter DI3 terminal function.

P2-04 K1 Relay Function Selection

Range:0~7【Default:3】

Option: 0:Running status

1:Start-up status

2:Soft stop state

3: Start-up & running

4: Fault Status

5: Thyristor failure (P1-10 parameter enable function)

6: Standby Status

7: Current Upper/Lower Limit Output (Reference Parameters P3-02, P3-03 for more details)

Set the soft starter's Relay K1 Terminal function

P2-05 K1 Relay Delay

Range:0s~999s【Default Value:0s】

Description: Set the output delay of Relay K1.

P2-06 K2 Relay Function Selection

Range:0~7【Default Value:4】

Option: 0: Running Status

1: Start-up Status

2: Soft Stop Status

3: Start-up & running

4: Fault Status

5: Thyristor failure (P1-10 parameter enable function)

6: Standby Status

7: Current Upper/Lower Limit Output (Reference Parameters P3-02, P3-03 for more details)

Set the soft starter's Relay K2 Terminal function

P2-07 K2 Relay Delay

Range:0s~999s【Default Value:0s】

Description: Set the output delay of Relay K2.

P2-10 Communication Address

Range: 1~64【Default Value: 1】

Description: Set the soft starter communication address.

P2-11 Baud rate Setting

Range:0~2【Default Value: 1】

Option: 0:4800bps

1:9600bps
2:19200bps
Set the communication baud rate for the soft starter.

P2-12 Modbus Data Format
Range:0~3【Default Value:0】
Option: 0: No Parity<8,N, 1>
1: No Parity<8,N,2>
2: Even Parity <8,E, 1>
3: Odd Parity <8,O, 1>

P2-14 AO Zero Offset
Range:0.0%~ 100.0%【Default Value:0.0%】
Description: Set AO zero offset.

P2-15 AO Gain
Range:-10.00%~ 10.00%【Description: 1.00%】
Description: AO gain settings

P2-24 Terminal Control Mode
Range:0~ 1【Default Value:0】
Option:0: Two-line mode
1: Three-line mode
Set the external terminal control mode.

P2-25 DI1 Delay
Range:0.01~5s【Default Value:0.01s】
Description: Set the delay of external terminal DI1.

P2-26 DI2 Delay
Range:0.01~5s【Default Value:0.01s】
Description: Set the delay of external terminal DI2.

P2-27 DI3 Delay
Range:0.01~5s【Default Value:0.01s】
Description: Set the delay of external terminal DI3.

3.2.4 Group P3: Auxiliary Parameters 1

P3-00 Parameter Initialization
Range:0~65535【Default Value:0】
Option: 1: factory Restore parameters
2: Restore parameters to factory defaults (including fault records)
P3-00=1, parameters restored exclude P0-00, P3-09, P3-10.
P3-00=2, parameters restored include P3-09, P3-10 and fault records, excluding P0-00.

P3-01 Grid Frequency

Grid Frequency0~ 1【Default Value:0】

Option: 0:50Hz

1 :60Hz

Set the input power frequency.

P3-02 Current Upper Limit

Range: 10%~300%【Default Value:80%】

Description: Use for start-stop control; set the maximum current value for determining operation. When the current exceeds P3-02 and runs continuously beyond the relay delay, the relay will disconnect and send a stop signal. (This parameter is used in conjunction with relay functions)

P3-03 Current Lower Limit

Current Lower Limit: 10%~300%【Default Value:40%】

Description: Use for start-stop control; set the minimum current value for determining operation. When the current is less than P3-03 and runs continuously beyond the relay delay, the relay will close and send a start signal. (This parameter is used in conjunction with relay functions)

P3-08 Software Version

Description: Software version number of the soft starter

P3-09 Number of Starts

Range:0~999

Description: Display the number of successful starts of the soft starter; parameter is read-only.

P3-10 Operating Time

Range:0~65535h

Description: Display the user's service time; parameter is read-only.

3.2.5 Group U0: Monitoring & Display Parameters

U0-00 Overall Status

Description: Displays the current overall status.

00	Standby	80	Fault	8A	EEPROM Error
01	Emergency Stop	81	Input Phase Loss	8B	Overheating
40	running	82	Phase Loss Error	8C	Thyristor Protection
41	Start Delay	83	Phase Sequence Error	8D	Input Interlock
43	Pulse Start	84	Start Timeout	8E	Drive Fault
44	Running	85	Overcurrent	8F	Overvoltage

	Switchover				
45	Current Limit Mode Operation	86	Underload	90	Undervoltage
46	Normal Operation	87	Current Unbalance	91	Start Interval
47	Soft Stop	88	Short Circuit		
4F	Pre-operation Switchover	89	Overload		

U0-01 Main Status

Description: Displays the current master status.

00	01	02	08
Standby	Emergency Stop	Fault	running

U0-02 A Phase Current

Description: Displays the current of phase A of the motor.

U0-03 B Phase current

Description: Displays the current of phase B of the motor.

U0-04 C Phase Current

Description: Displays the current of phase C of the motor.

U0-05 Average Current

Description: Displays the average current of the motor.

U0-06 Motor Rated Current

Description: Displays the motor's rated current.

U0-07 Input Voltage

Description: Displays the motor's rated current.

U0-08 Module Temperature

Description: Display module temperature

U0-09 Running Percentage

Description: Displays the percentage of soft starter running.

U0-10 Fault Codes

Description: Display the current fault code.

U0-11 Startup Delay

Description: After setting the start delay, the start countdown time will be displayed.

U0-12 Start-up Timing

Description: Displays the start time.

U0-13 Start-up Interval

Description: After setting the start interval, the countdown time for the start

interval will be displayed.

U0-14 Maximum Current

Description: Displays the maximum current value when the soft starter is started.

U0-15 Maximum Average Current During Switching

Description: Displays the maximum average current during switching operation.

U0-16 DI&DO Status

Description:0000000~ 1111111

Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
-	K2	K1	-	DI3	DI2	DI1

U0-17 Second Fault Code

Description: Display the previous fault code.

U0-18 Third Fault Code

Description: Display the fault code before the previous one.

3.3 Fault Inspection & Troubleshooting

When a protection condition is detected, the soft starter writes the protection condition into the program and may trip. The soft starter's response depends on the protection level.

Some of these protection responses cannot be adjusted by the user. These trips are usually caused by external events (e.g., phase loss) or internal faults of the soft starter. These trips have no related parameters and cannot be set to warning or ignored.

If the soft starter trips, you need to identify and clear the condition that triggered the trip, reset the soft starter, and then restart it. To reset the starter, press the (Stop/Reset) button on the operation panel or activate the "Stop/Remote Reset Input".

The following table lists the soft starter's protection mechanisms and possible causes of trips. Some settings can be adjusted via protection levels, while other settings are built-in system protections that cannot be set or adjusted:

Display	Name	Causes & Troubleshooting Methods
Err01	Input Phase Loss	1. When a start command is issued, one or more phases of the soft starter are not powered: A: Check if the main circuit has power or not, B:Check if the thyristor and input circuit are opened or not. C:Check if the pulse signal line is poorly connected or not. 2. Main board fault. Related Parameters: None
Err02	Output Phase Loss	1. Check if the thyristor is short-circuited or not. 2. One or more phases of the motor cable are open. Check if

Display	Name	Causes & Troubleshooting Methods
		the motor cable is open or not. 3. Main board fault. Related Parameters: None
Err03	Phase Sequence Fault	1.The phase sequence of the input power supply is inconsistent with the setting: Adjust the power phase sequence or modify parameters. Related Parameters: P1-05
Err04	Start Timeout	The start time is too long: Adjust start parameters (e.g., initial voltage, current limit multiple).
Err05	Overcurrent Fault	1. Overload: Replace with a higher power soft starter. 2. Incorrect parameter settings: Adjust the parameters. Relevant parameters: P1-00, P1-01
Err06	Underload fault	1. The load is too low. 2. The parameters are set incorrectly. Adjust the parameters. Relevant parameters: P1-06, P1-07
Err07	Current unbalance	1. Power supply voltage unbalance: check the power supply voltage. 2. Check if the motor windings are normal or not. 3. Check if the current transformer is open-circuited or not. Relevant parameters: P1-02, P1-03
Err08	High current fault	The motor is stalled or the load is stuck. Please check the motor and load. Relevant parameters: P1-09
Err09	Overload fault	1. The load is too heavy; replace with a soft starter with higher power. 2. The parameters are set incorrectly; adjust the parameters. Relevant parameters: P1-04
Err10	EEPROM error	On-site interference or abnormal internal chip of the soft starter. If the fault persists after power-off and restart, please seek technical support.
Err11	Soft start overheating	1. Check if the temperature switch is faulty or not. 2. the fan is not running; check if the fan works normally or not. 3.The soft starter has been operating for too long; stop the machine and allow the soft starter to cool down.

Display	Name	Causes & Troubleshooting Methods
		Related Parameters: P1-11
Err12	Thyristor protection	1. Thyristor short circuit: Check if the thyristor is short-circuited or not . 2. Circuit board fault. Relevant parameters: P1-10
Err13	DI interlock	Interlock signal error. Please check if the wiring is correct or not.
Err14	Drive failure	Ask for supports.
Err15	Overvoltage fault	1. Input power supply voltage is too high. Check the power supply voltage. 2. Parameter settings are incorrect. Adjust the parameters. Relevant parameters: P1-13, P1-14
Err16	Undervoltage fault	1. Input power supply voltage is too low. Check the power supply voltage. 2. Parameter settings are incorrect. Adjust the parameters. Relevant parameters: P1-12, P1-14
Err17	Start-up interval	The start-up interval is less than the set value. Check if the parameter settings are reasonable. Relevant parameters: P0-11

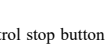
4 Trial Operation & Application

Before power-on operation, carefully check as following:

- Whether the rated power of the soft starter matches the motor.
- Whether the motor's insulation performance meets the requirements.
- Whether the wiring of the input and output main circuits is correct.
- Whether all wiring terminal screws are tightened.。

4.1 Power-on Trial Operation

- When powered on, the display shows "ready". Press the run button 

to start the motor.
- Input the rated current value from the motor nameplate into P0-00 (Motor Rated Current).
- After starting, check if the motor's rotation direction is correct and if it operates normally. If not, press the Stop key to shut down or cut off the power if necessary.
- If the motor's start-up status is not ideal, select the appropriate start mode and start time.
- Do not open the upper cover after the soft starter is powered on to avoid electric shock.
- During power-on trial operation, if abnormal phenomena (e.g., abnormal noise, smoke, or unusual odor) are found, quickly cut off the power and identify the cause.
- If the ALARM light is on after power-on or during start-up, refer to Chapter 3.3 to find the cause based on the displayed fault name.
- Press the Stop & Reset button 

or the external control stop button to reset the fault state.

Notes:

➢ When the ambient temperature is below -10℃, the soft starter should be powered on for preheating for more than 30 minutes before starting.

4.2 Special Applications

- **Parallel Motor Starting**

If the total motor current does not exceed the rated current of the soft starter, the motors can be parallel connection. But at this time should be also provides for each motor thermal protection device.

- **Double speed motor**

  Motor soft starter can cooperate with double speed motor starting, must go through demagnetization delay period before change from low speed to high speed, to avoid anti-phase current generated between the lines and motor.

- **Extra-Long Cables**

  If the cable is too long, the cable voltage drop will be high, and that will increase current loss and reduce starting torque, so please use big KW soft starter and motor.

- **Soft starter parallel connected with one power-line**

  If several soft starters parallel installed in the one power line, the input line reactor should be installed in the middle of the transformer and the soft starter circuit. Reactor should be installed at each line input side between circuit breaker and soft starter.

- **The application of surge protection device (SPD)**

  The surge protection device should be considered to installed in the application case, where is easily caused trouble by lightning or other reasons, such as over voltage, over-current, surge interference. Please refer to SPD related documents for details.

Appendix I Modbus Communication Protocol

1 Overview

The EM-GX series soft starter is equipped with an RS485 communication interface and supports the Modbus-RTU slave communication protocol. Users can implement centralized control via a computer or PLC.

Hardware Interface: Terminals 485+ and 485- serve as the Modbus communication interface.

2 Soft Starter-Related Settings

2.1 Supported Codes

The soft starter only supports the following codes. Using other codes will trigger an exception code 01.

Code	03	06
Function Description	Read multiple registers	Write in one register

Communication Data Format for Function Code 03 (Read Multiple Holding Registers)

Slave Address	Function Code	Start Address	Length of the data	CRC Check
1 byte	1 byte	2 byte	2 byte	2 byte

Note: The maximum number of registers that can be read at one time is 50.

Communication Data Format for Function Code 06 (Write Single Register)

Slave Address	Function Code	Start Address	Data to Write	CRC Check
1 byte	1 byte	2 byte	2 byte	2 byte

Note: Register write operations can only be performed when the soft starter is not in the starting Status; otherwise, the operation will be invalid.

2.2 Definition of Communication Parameter Addresses

Control Command Input:

Address	Command Function
0x1000	0001:Fault Reset 0002:Stop 0004:Start

Reading Soft Starter Overall Status:

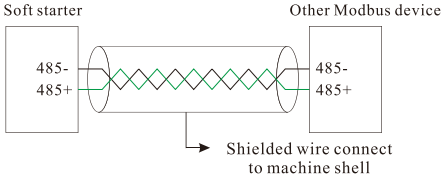
Address	Command Function	
0x00EF	0x00:Standby Status 0x01:Emergency Stop 0x40:Running Status 0x41:Start Delay 0x44:Operation Switching 0x45:Current-Limiting Mode Operation 0x46:Normal Operation 0x47:Soft Stop 0x4C:Fault 0x4F:Pre-Operation Switching 0x60:Jog Status 0x80:Fault Status 0x81:Input Phase Loss 0x82:Phase Loss Error	0x83:Phase Sequence Error 0x84:Start Timeout 0x85:Overcurrent 0x86:Underload 0x87: Current Imbalance 0x88:Short Circuit 0x89:Overload 0x8A:EEPROM Error 0x8B:Overheating 0x8C: Thyristor Protection 0x8D:Input Interlock 0x8E: Drive Fault 0x8F:Overvoltage 0x90:Undervoltage 0x91:Start Interval

Reading Soft Starter Main Status:

Address	Command Function
0x00F0	0x00:Standby 0x01:Emergency Stop 0x02:Fault Status 0x08:Running Status

Notes:

- The soft starter's communication address, baud rate, and parity mode must match the corresponding settings of the controller.
- If no response data is received, check the above parameter settings and the correctness of terminal wiring
- When communicating with multiple soft starters: If the communication cable is long (usually exceeding 500 meters), a 120-ohm resistor should be connected between the 485+ and 485- terminals of the last soft starter.
- When connecting to other MODBUS devices, follow the wiring diagram below:



Appendix II Parameter Function Summary Table

Note: Parameters marked with "*" are read-only and cannot be modified.

Code	Name	Function Description	Default	Address
P0-00	Motor Rated Current	-	-	0x0000
P0-01	Start Mode	0: Voltage Ramp 1: Current Ramp	0	0x0001
P0-02	Initial Start Voltage /Current	20%~80%	30%	0x0002
P0-03	Ramp Time	1s~120s	15s	0x0003
P0-04	Start-up Current Limiting Factor	150%~500%	300%	0x0004
P0-05	Soft Stop Time	0s~30s	0s	0x0005
P0-06	Control Mode	0 : Keypad Control 1: Terminal Control 2 : Communication Control	0	0x0006
P0-07	Jump Voltage	30%~80%	80%	0x0007
P0-08	Jump Time	0s~9999s	0s	0x0008
P0-09	Startup Delay	0s~999s	0s	0x0009
P0-10	Startup Timeout	5s~120s	60s	0x000A
P0-11	Startup Interval Time	0min~60min	0min	0x000B
P0-12	Variable Frequency Start mode	0: Disabled 1: Fire Inspection Mode (12.5Hz Operation) 2. Variable frequency Start Mode	0	0x000C
P0-13	Fire Inspection Output Voltage	20~80%	35%	0x000D
P0-14	7-Frequency Division Output Voltage	20~80%	32%	0x000E
P0-15	4-Frequency Division Output Voltage	20~80%	35%	0x000F
P0-16	3-Frequency Division Output Voltage	20~80%	40%	0x0010

Code	Name	Function Description	Default	Address
P0-17	2-Frequency Division Output Voltage	20~80%	45%	0x0011
P1-00	Overcurrent Protection Factor	50%~800%	150%	0x0015
P1-01	Overcurrent Protection Delay	0s~60s	2s	0x0016
P1-02	Current Unbalance Allowable Protection Value	10%~100%	40%	0x0017
P1-03	Current Unbalance Protection Delay	0s~60s	2s	0x0018
P1-04	Overload Protection Level	0:5 1:10 2:20 3:30 4: Disabled	2	0x0019
P1-06	Under Load Protection	30%~100%	100%	0x001B
P1-07	Under Load Protection Delay	0s~60s	2s	0x001C
P1-08	Phase Loss Protection Delay	0s~5s	1s	0x001D
P1-09	Ultra-Current Protection	0: Disabled 1:Enabled	1	0x001E
P1-10	Thyristor Protection	0: Disabled 1:Enabled	0	0x001F
P1-11	Overheat Protection Value	75-95℃	80℃	0x0020
P1-12	Under Voltage Protection Factor	30%-100%	70%	0x0021
P1-13	Overvoltage Protection Factor	100%~150%	125%	0x0022
P1-14	Under/Over Voltage Protection Delay	0s~10s	1s	0x0023
*P1-15	Fault Count	0~999	0	0x0024
*P1-16	Fault Code 1	0~9999	0	0x0025
*P1-17	Fault Code 2	0~9999	0	0x0026

Code	Name	Function Description	Default	Address
*P1-18	Fault Code 3	0~9999	0	0x0027
*P1-19	Fault Code 4	0~9999	0	0x0028
*P1-20	Fault Code 5	0~9999	0	0x0029
P2-00	Analog Current Factor	1~10	1	0x002F
P2-01	DI1 Function Selection	0: Fault reset 1: Emergency Stop (NO) 2: Emergency Stop (NC) 3: Interlock Control 4: Start 5: Three-Wire Enable 6: Jog	4	0x0030
P2-02	DI2 Function Selection		5	0x0031
P2-03	DI3 Function Selection		0	0x0032
P2-04	K1 Relay Function Selection	0: Running Status 1: Starting Status 2: Soft Stop Status 3: Starting & Running 4: Fault Status 5: Thyristor Fault (P1-10) 6: Standby Status 7: Current Upper/Lower Limit Output(See P3-02、P3-03)	3	0x0033
P2-05	K1 Relay Delay	0s~999s	0s	0x0034
P2-06	K2 Relay Function Selection	0: Running Status 1: Starting Status 2: Soft Stop Status 3: Starting & Running 4: Fault Status 5: Thyristor Fault (P1-10) 6: Standby Status 7: Current Upper/Lower Limit Output(See P3-02、P3-03)	4	0x0035
P2-07	K2 Relay Delay	0s~999s	0s	0x0036
P2-10	Communication Address	1~64	1	0x0039
P2-11	Baud Rate Setting	0:4800bps 1:9600bps	1	0x003A

Code	Name	Function Description	Default	Address
		2:19200bps		
P2-12	Modbus Data Format	0: No Parity <8,N,1> 1: No Parity <8,N,2> 2: Even Parity <8,E,1> 3: Odd Parity <8,O,1>	0	0x003B
P2-14	AO Zero Offset	0.0%~100.0%	0.0%	0x003D
P2-15	AO Gain	-10.00%~10.00%	1.00%	0x003E
P2-24	Terminal Control Mode	0: Two-line Mode 1: Three-line Mode	0	0x0047
P2-25	DI1 Delay	0.01~5s	0.01s	0x0048
P2-26	DI2 Delay	0.01~5s	0.01s	0x0049
P2-27	DI3 Delay	0.01~5s	0.01s	0x004A
P3-00	Parameter Initialization	1: Restore factory defaults 2: Restore factory defaults (Including Fault Records)	0	-
P3-01	Grid Frequency	0:50Hz 1:60Hz	0	0x004D
P3-02	Current Upper Limit	10%~300%	80%	0x004E
P3-03	Current Lower Limit	10%~300%	40%	0x004F
P3-08	Software Version	0~999	-	-
*P3-09	Number of Starts	0~999	0	-
*P3-10	Operating Time	0~65535	0	-
*U0-00	Overall Status			0x00EF
*U0-01	Main Status			0x00F0
*U0-02	A Phase Current			0x00F1
*U0-03	B Phase Current			0x00F2
*U0-04	C Phase Current			0x00F3
*U0-05	Average Current			0x00F4
*U0-06	Motor Rated Current			0x00F5
*U0-07	Input Voltage			0x00F6
*U0-08	Module Temperature			0x00F7
*U0-09	Running Percentage			0x00F8
*U0-10	Fault Code			0x00F9
*U0-11	Startup Delay			0x00FA
*U0-12	Startup Timing			0x00FB

Code	Name	Function Description	Default	Address
*U0-13	Startup Interval			0x00FC
*U0-14	Maximum Current			0x00FD
*U0-15	Maximum Average Current During Switching			0x00FE
*U0-16	DI&DO Status			0x00FF
*U0-17	Second Fault Code			0x0100
*U0-18	Third Fault Code			0x0101

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