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**KOC200 series Mode C**  
**Digital AC motor soft starter**  
**User manual**

Before using this product, please read the manual carefully and keep it for future reference.

## Preface

Thanks for using **SHENZHEN KCLY ELECTRIC CO.,LTD** intelligent digital AC motor soft starter-KOC200 series mode C.

Before using, please be carefully read and understand the contents of this manual. To ensure the safety of the operator, please operate and use it correctly according the rules. Please don't hesitate to contact our company or agent if you have any questions when using. Thanks!

## Safety Caution!

1. Technical person only is allowed to install the softs starter
2. To be sure that the motor specification is matched with the soft starter.
3. It is prohibited to connect capacitor at output terminal (U, V, W).
4. Please seal the terminal switch insulation glue after finishing connect them.
5. The soft starter and its enclosures must be fixedly earthed.
6. During the maintenance/repair, the input must be POWER-OFF.
7. Non-professional personnel are forbidden to repair due to high voltage exist in PCB board.

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## 1. KOC200 series mode C soft starter function and features

KOC200 series mode C soft starter which adapt the intelligent digital control and with the single chip processor as the intelligence center, thyristor module for actuators for full automatic control motor. It applies various squirrel-cage asynchronous motor control of load, the motor could smoothly start under any working conditions and protect the drag system and reduce the starting current impact on power grid, ensure reliable motor starting. Smooth soft stopping function could be effectively solve the inertial system surge problem and eliminate the drag system of inertial impact which is the traditional equipment cannot be achieved. Intelligent digital motor soft start equipment system with the complete protection function, extend the service life of the system, reduce the cost of system cost, improve the reliability of system and compatible with all the functions of starting equipment; It is a new ideal alternative for traditional star triangle starter and self-coupling decompression starter.

### The main function:

- Effectively reduce the starting current of the motor; Can reduce the distribution capacity, avoid grid expansion investment.
- Reduce the starting stress of motor and load equipment; Prolong the service life of the motor and related equipment.
- Soft stopping function can effectively solve the parking surge problem of inertial systems; That is a traditional starting equipment cannot be achieved.
- With four unique starting mode; To adapt to the complex motor and load, achieve perfect priming effect.
- With complete and reliable protection function; effectively protect the safety of motor and related production equipment.
- Intelligent motor soft starter, the application of network technology used motor control technology to adapt to the rapid development of electric power automation technology in the higher requirements.

**The main features**

- KOC200 series mode C soft starter adapt high performance micro programing technology with higher performance and wider range input voltage.
- 4 options startup mode and could achieve the optimum starting efficiency of the motor also achieve the soft stop.
- Chinese/English display, easy operating. 7 color backlit LCD display can reflect different working condition of soft starter, fully embodies the humanity design idea.
- Multiple protect and monitor function, thermal overload protection 6 level selection based on the overload. Latest 3 fault records inquire as the bases for fault analysis.
- Provide 4~20mA analog output, RS232 (RS485) interface (Adapt MODBUSRTU communication protocol), could enter the parameter setting, operating and monitoring through the upper control system to achieve high intelligent control.
- Actual power setting: When the power capacity of the soft starter is bigger than the actual load, then could setting the related current of the soft starter according the actual load to ensure the parameter accuracy of the starting, running and protection.
- Programmable output replay: Convenient to achieve interconnected control with other equipment.

## 2. Product model

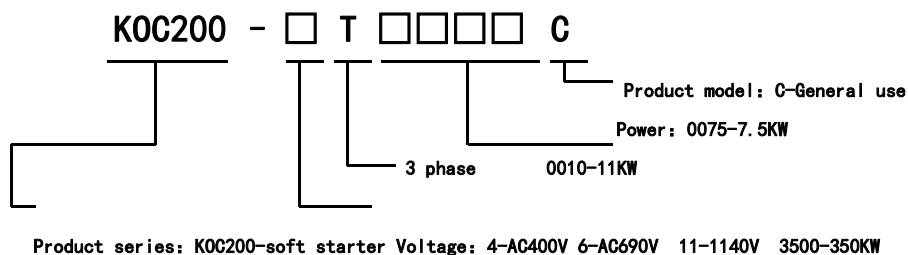
Every HY500 series mode C soft starter have been tested before ship out. Please check according the following steps after receive the goods. If finding problems please contact with your dealer at once.

- Check the nameplate: Make sure the goods you received same as your order.

Use class:AC-53b

Meet standard:GB14048.6-2008

KOC200 series mode C soft starter	
Model:	KOC200-4T0750C
Power:	75KW/150A
Manufacturing date:	
Series number:	



- Check the product if damaged during the transportation, like: inside components fall off, case depressed-deformation and wire disconnected etc.
- Manufacturer' s Certificate and user manual: Every soft starter accompany with a manufacture' s certificate and user manual.

### 3. Operating condition

Working condition effects the working life of the soft starter, please install soft starter in the place which meet the follow conditions:

#### Working condition of the product:

- Input source: Grid power, power station, diesel generator set.
- Input voltage: AC380V (-10%~+15%), 50Hz;
- **Motor:** squirrel cage induction motors(Please inform us when place order if use for wound-rotor motor).
- Start-Stop times: Not more than 30 times start-stop within 1 hour.
- Cooling mode: Natural air cooling
- Installation: Wall mounted
- Using condition: KOC200 series mode C soft starter should connect bypass contactor while using.
- IP Grade: IP20
- Ambient condition:

If attitude >2000m then should lower the capacity.

The environment temperature between -25°C~+40°C.

Relative humidity <95% (20°C±5°C).

No condensate, no inflammable, explosive, corrosive gas, no conductive dust.

Indoor installation and well ventilation.

Vibration less than 0.5G.

### 4. Connection and External Terminal

Diagram 4-1 and diagram 4-2 show all the external terminal of KOC200 series mode C soft starter, please refer to diagram 4-1.

#### 4.1 Basic Diagram

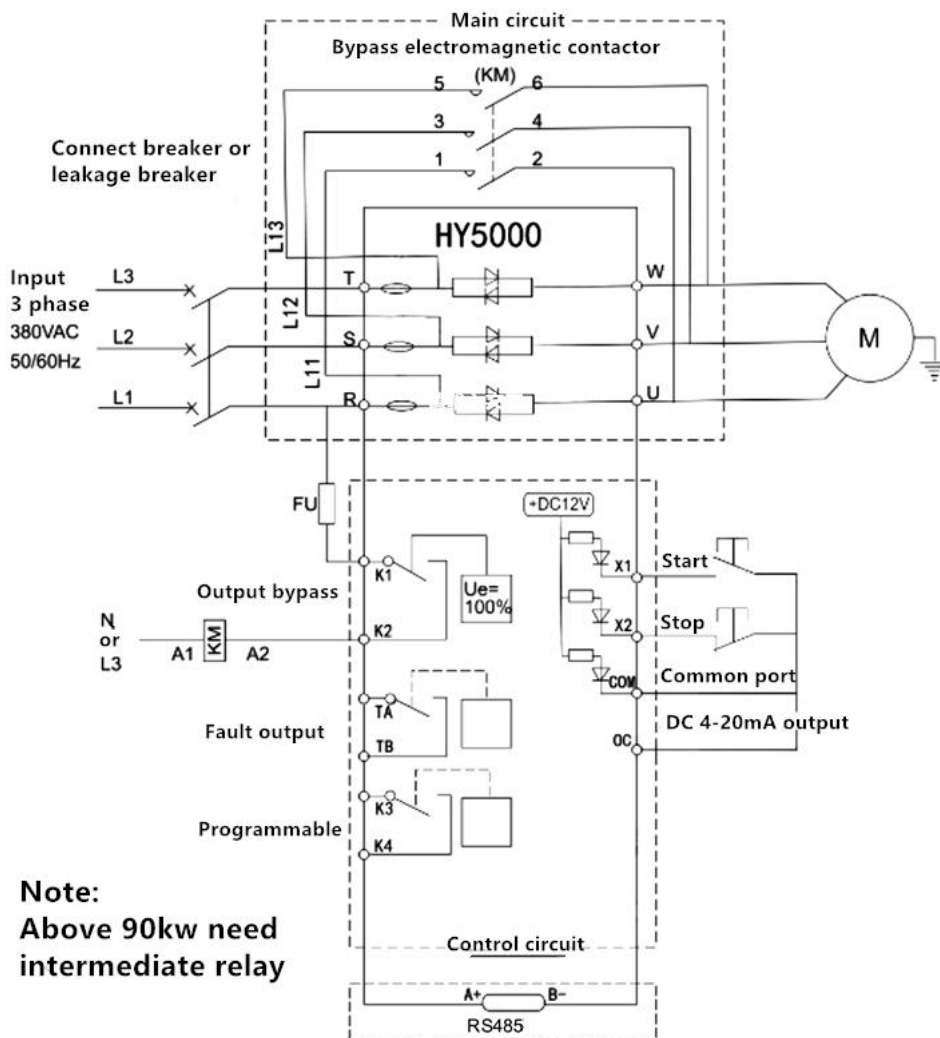


Diagram 4 - 1

KOC200 series mode C soft starter external terminal diagram

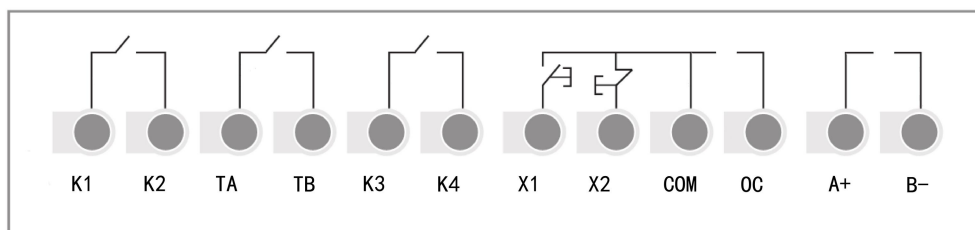


Diagram 4-2

4.3 KOC200 series mode C soft starter external terminal explanation



Terminal explanation		Terminal name		Explanation	
Main circuit	R.S.T	AC input terminal		Connect AC 3PHASE source through breaker	
	U.V.W	Soft starter output terminal		Connect induction motor	
	L11.L12.L13	External bypass contactor		Refer to diagram 4-1	
Control circuit	Digital output	X1	Start		Short X1 and COM ★
		X2	Stop		Short X2 and COM★
		COM	Common port		Internal source parameter point
	Analog output	OC	4~20mA output Load input impedance $\leq 400\Omega$		$I_m = I_e(I_o - 4)/8$ (4~20mA) output current (mA)
		COM	Common port		
	Communication	A+	485+		Communication refer to P15
		B-	485-		
	Relay output	K1	NO	External bypass contactor	After Start: K1-K2 close Contact capacity: AC:10A/250V or 5A/380V DC:15A/30V. Note: Above 90kw need intermediate relay.
		K2			
		TA	NO	Fault output	
		TB			
	Programmable relay output	K3	NO	Programmable output	0-Invalid Valid contact capacity 1-Effective power on AC: 12A/250V 2-Standby or 5A/380V 3-Valid when start DC: 15A/30V 4-Start finish 5-Valid when stop 6-Valid from start to stop 7-Valid when fault
K4					

★ mean have 2 wiring way. X2 terminal not connect wire while use 2-line control, refer details to diagram 10-1.

## 5. KOC200 series mode C soft starter control mode

### 5.1 Starting mode

KOC200 series mode C soft starter owns 4 starting mode:

- Voltage ramp start    ● Current limit start
- Jump voltage ramp start    ● Jog start

#### 5.1.1 Voltage ramp start

After starting, soft starter output voltage and increase to “ramp start initial voltage” value  $U_1$  fastly, then increase voltage step by step according the “voltage ramp start time” till finishing the start: see diagram 5-1.

Voltage ramp start mode suitable for big inertia or not have a strictly request in starting current, just to acheive a smooth starting.

This starting mode could reduce the starting-impact and the mechanical stress. More bigger the initial voltage value  $U_1$ , the more bigger the starting torque, but the instant shock also bigger.

The time of starting have relative with load and setting value, have no relative with current limitation times.

The parameter relative with “Voltage ramp start” :

Ramp voltage initial voltage: ( $U_1$ ) 0%~60%

Ramp voltage starting time: ( $t$ ) 1~120s

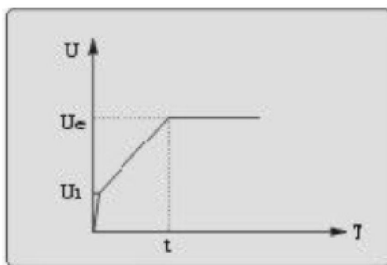


Diagram 5-1

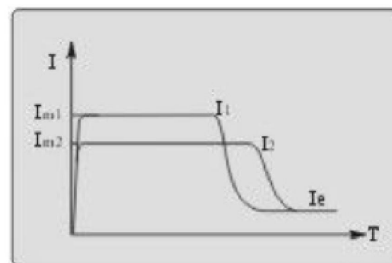


Diagram 5-2

#### 5.1.2 Current limit start

After starting, the current of motor increase the setting current value  $I_m$  fastly, and keep current output not big than this value to speed up the motor gradually, meanwhile the voltage increase gradually, when the motor

speed close to the related speed, the motor current drop down to related current  $I_e$  fastly and finish the starting. See diagram 5-2.

Current limitation mode normally apply for the application which have strictly request in starting current, specially for the small capacity grid power area and need limit the starting capacity. Could set the current limitation times at 2.5~3 times, if set too low value and could not start.

When use current limit start, the starting time have relative with current limitation times. More times shorter starting time.

- The relative parameter with “current limit start” :

Current limit start limitation times: ( $I_m$ ) 20%~400%

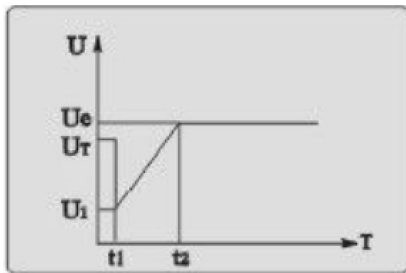


Diagram 5-3

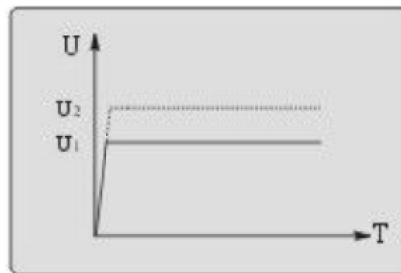


Diagram 5-4

### 5.1.3 Jump voltage ramp start

For some application which have big stiction and could choose this starting mode. When starting, soft starter output a higher voltage instantly (time can be set up) to run the motor, then will start according the voltage ramp start till start finish. See diagram 5-5.

This start mode apply for load which have big stiction.

- The relative parameter with “Jump voltage ramp start” :

Ramp voltage initial voltage ( $U_1$ ): 0%~60%

Ramp voltage starting time ( $t_2$ ): 1~120s

Pulse jump voltage ( $U_T$ ): 0%~80%

Pulse jump time ( $t_1$ ): (0~500)ms

### 5.1.4 Jog start

When use jog start, the soft starter output voltage increase to initial voltage  $U_1$  fastly and keep this voltage. Change the  $U_1$  setting value then

could change the output torque of the motor. This function is very convenient for trial run or some load location. See diagram 5-4.

- The relative parameter with jog start:

Jog voltage 0%~60%

## **5.2 Stop mode**

### **5.2.1 Free stop**

After receive the command for stop, soft starter control the bypass contactor to break. Meanwhile lock the output voltage of the main circuit thyristor and stop the motor according the inertia.

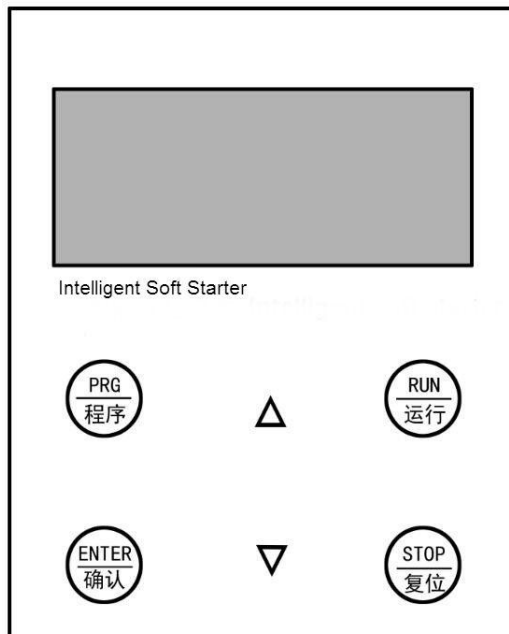
### **5.2.2 Soft stop**

In this stop mode, the motor power source change from bypass contactor to main circuit thyistor and control the output voltage. Voltage decrease step by step till the motor stop.

Soft stop time: 1s~10s

## 6. Control Panel and Operation

KOC200 series mode C soft starter control panel adapt 128 x 32 point LCD display and inching membrane switches, Chinese/English display mode, 6 inching button and could achieve start, stop, parameter setting, modifier, fault inquiry, fault reset. See diagram 6-1.



**Diagram 6-1**

1. Press button PRG to enter the parameter group, press  $\Delta$ ,  $\nabla$  to switch F0、F1、F2、F3 parameter group.
2. Parameter change: enter the F parameter group according the 1 step, press ENTER to enter, press  $\Delta$ ,  $\nabla$  to change the setting value, press ENTER to save the parameter. Press PRG to return back and show F parameter group, press again PRG to go back to main interface.
3. Press button RUN to start the soft starter.
4. Press STOP to stop or fault reset.

## 7. Parameter setting

KOC200 series mode C soft starter parameter setting, see diagram 7-1.

Number	Function code	Name	Setting range	Default
1	F0.00	Starting mode	Voltage ramp start. Current limit start. Jump voltage ramp start. Jog start.	Current limit start
2	F0.01	Stop mode	Free stop. Soft stop.	Free stop
3	F0.02	Control mode	Keypad. External. Communication.	External
4	F0.03	Voltage ramp start voltage	0-80	30
5	F0.04	Voltage ramp start time	1-100	30
6	F0.05	Current limit start times	50-400	300
7	F0.06	Jog voltage	0-100	30
8	F0.07	Soft stop time	0-30	0
9	F0.08	Jump voltage	0-100	0
10	F0.09	Jump time	0-2000	0
11	F0.10	Drive option	Keep trigger after bypass Stop trigger after bypass	Stop trigger after bypass
12	F0.11	Programmable relay function	Run valid. Stop valid. Bypass valid. Start valid. Fault valid. Standby valid.	Run valid
13	F0.12	Current calibration value	50-300	94%
14	F0.13	Voltage calibration value	50-300	56%

**Diagram 7-1**

Number	Function code	Name	Setting range	Default
15	F1.00	Starting over current curve	400-600	400%
16	F1.01	Running over current curve	40-400	200%
17	F1.02	Starting overload curve	1-6	4
18	F1.03	Running overload curve	1-6	2
19	F1.04	Current imbalance	5-150	65
20	F1.05	Over voltage value	380-470	450
21	F1.06	Under voltage value	300-370	320
22	F2.00	Soft starter related current		
23	F2.01	Motor related current		
24	F2.02	Slave address	1-63	1
25	F2.03	Baud rate	19200 9600 4800 2400 1200	9600
26	F3.00	Fault 1		
27	F3.01	Fault 2		
28	F3.02	Fault 3		

**Diagram 7-1**

## 8. Fault protection function and trouble shooting

### 8.1 Fault display and trouble shooting

Number	Fault display	Failure reason	Trouble shooting
1	Power-on phase loss	Input wire source phase loss?	This fault could not be reset. Power-off and check the input source and the breaker.
2	Running phase loss	Input source phase loss while running Thyristor open circuit	Check if phase loss in the input source Check the thyristor or trigger circuit
3	Starting over current	Current limit mode: Current limitation times more? Ramp mode: Starting time is suitable?	Proper adjust parameter Initial voltage higher
4	Over current while running	Sudden increase load? Big fluctuation? Grid voltage decrease due to increase load?	Adjust load and check the grid voltage Adjust current protection value
5	Over load while starting	Over load while starting?	Reduce the load Check the over load curve and adjust
6	Over load while running	Over load while running? Feedback inaccuracy? (What is value of the real current and display?)	Adjust load under related value Calibration keypad display with real current value Check if the over load curve suitable or not
7	Current imbalance	Thyristor trigger outlet bad contact? Thyristor open circuit? Motor 3 phase current imbalance	Check trigger signal or thyristor Handle with input source imbalance
8	Over heat protection	Starting frequently? Fan not work? Bypass contactor broken?	Reduce start times Check the fan Check and replace bypass contactor
10	Communication blackout	Communication failure (no effect for running)	Check communication system

Diagram 8-1



## 8.2 Overload protection level and selection

KOC200 series mode C soft starter owns electronic overload protection while starting and running. Inverse-time characteristic and divide into 6 level, Higher level, higher protection. Means at same class over load times, the shorter time protection action. Mode C already set when manufacturing as follow:

Over load protection level while starting: 4

Over load protection level while running: 2

User could adjust according the load while using.

Over load protection level (thermal to cold state takes 180 seconds)

Over load times \ Over load level	6Ie	5Ie	4Ie	3Ie	2Ie	1.5Ie	1.2Ie	1.05Ie
1	1s	3s	6s	8s	10s	15s	150s	3600s
2	3s	8s	12s	16s	20s	30s	300s	3600s
3	6s	15s	22s	30s	40s	60s	350s	3600s
4	10s	22s	35s	48s	60s	90s	400s	3600s
5	15s	35s	55s	75s	90s	120s	450s	3600s
6	20s	45s	70s	95s	120s	150s	500s	3600s

Diagram 8-2

Motor over load protection curve

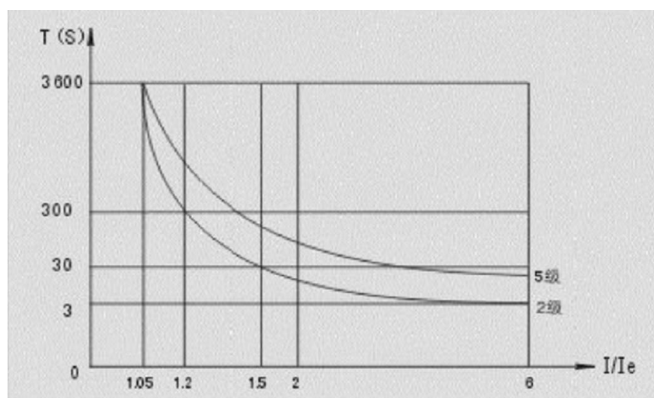


Diagram 8-3

## 9. Communication function

KOC200 series mode C soft starter' s MODBUS protocol is RTU. In RTU mode, the format of the bytes:8 binary code, can be represented by two hexadecimal characters. Hexadecimal characters:0~9, A,B,C,D,E,F.

RTU frame standard structure:

Frame header START	T1-T2-T3-T4(3.5 byte transmit time)
Slave address ADDR	Communication address:1~63 (decimal) ,0 is broadcast address
Function CMD	03H: read slave parameter.06H write slave parameter
DATA	2*N byte data
CRC verify low-order	CRC verify value
CRC verify high-order	
Frame footer END	T1-T2-T3-T4(3.5 byte transmit time)

### 9.1 Command code and communication data description

- Command word 03H (0000 0011b) :read N word (2N byte)

RTU upper command information:

Start, 3.5 byte time	T1-T2-T3-T4
Slave address ADDR	Slave address number
Function CMD	03H
Data area	Start address
	Data number
CRC	CRC verify
Stop, 3.5 byte time	T1-T2-T3-T4

----Slave address: Upper address must recognize the selected slave address:unmatched slave address could only receive the information but not response. Byte:1

--Function code:the read command function code is 03H. Byte:1.

--Data area:

---Start address: The start address in soft start inner storage of “To be read” .Byte:2.

---Data number: the data number of “To be read” .Byte:2.

--CRC verify: Byte:2.

The response frame format when slave receive right information:

Start, 3.5 byte time	T1-T2-T3-T4
Slave address ADDR	Slave address number
Function code CMD	03H
Data area	Byte
	Data value
CRC	CRC verify
Stop, 3.5 byte time	T1-T2-T3-T4

--Slave address: The response slave address should be same as which the upper address requested. Byte:1.

--Function code:Return back function code 03H which was write the comand. Byte:1.

--Data area:

---Starting address:Return back the Starting address that has been read. Byte:1.

---Data bulk:Return back the number of data that has been read

--CRC verify:Byte:2.

The response frame format when slave receive wrong information:

Starting, 3.5 byte time	T1-T2-T3-T4
Slave address ADDR	Slave address number
Erroneous code	83H
Exception code	
CRC	CRC verify
End, 3.5 byte time	T1-T2-T3-T4

--Slave address:The response slave address should be same as which the upper address requested. Byte:1

--Erroneous code:83H,mean slave receive wrong information. Byte:1

--Exception code;Mean wrong information. Byte:1

01H:Illegal function code

02H:Illegal Starting address or nonsupported “Starting address+ Data number”

03H:The number of nonsupported data

--CRC verify:Byte:2

● Command word 10H (0001 0000b) :Write N word(2N byte)

RTU upper machine command informaton:

Start, 3.5 byte time	T1-T2-T3-T4
Slave address ADDR	Slave address number
Function code CMD	10H
Data area	Starting address
	Data bulk
	Byte
	Data value
CRC	CRC verify
End, 3.5 byte time	T1-T2-T3-T4

--Slave address: Upper address must recognize the selected slave address:unmatched slave address could only receive the information but not response.Byte:1

--Function code:10H is the function code for write command: Byte:1

--Data area:

---Starting address: The start address in soft start inner storage of “To be writen”. Byte:2.

---Data bulk: To be written.Byte:2.

---Number of bytes: To be written.Byte:1.

---Data value:To be written.Byte:2.

-- CRC verify:Byte:2.

The response frame format when slave receive right information:

Starting, 3.5 byte time	T1-T2-T3-T4
Slave address ADDR	Slave address number
Function code CMD	10H
Data area	Starting address
	Data bulk
CRC	CRC verify
End, 3.5 byte time	T1-T2-T3-T4

--Slave address: The response slave address should be same as which the upper address requested.Byte:1.

--Function code:Return back function code 10H which was write the comand. Byte:1.

--Data area:

---Starting address:Return back the Starting address that has been written. Byte:2.

---Data bulk: Return back the number of data that has been written

--CRC verify:Byte:2.

The response frame format when slave receive wrong information:

Starting, 3.5 byte time	T1-T2-T3-T4
Slave address ADDR	Slave address number
Erroneous code	90H
Exception code	
CRC	CRC verify
End, 3.5 byte time	T1-T2-T3-T4

--Slave address:The response slave address should be same as which the upper address requested. Byte:1

--Erroneous code:90H,mean slave receive wrong information. Byte:1

--Exception code;Mean wrong information. Byte:1

01H:Illegal function code

02H:Illegal Starting address or nonsupported “Starting address+ Data number”

03H:The number of nonsupported data

--CRC verify:Byte:2

## 9.2 Communication address definition

Address	Definition	Read/Write
1000	Control mode	R/W
1001	Startup mode	R/W
1002	Stop mode	R/W
1003	Soft starter power capacity	R
1004	Motor related power	R/W
1008	Jog voltage	R/W
1005	Current limit Starting times	R/W

1006	Ramp voltage Starting voltage	R/W
1007	Ramp voltage Starting time	R/W
1009	Jump voltage	R/W
100a	Jump time	R/W
100b	Ramp current limitation	R/W
100c	Ramp current Starting time	R/W
100d	Soft stop time	R/W
100e	Drive selection	R/W
1019	Programmable output function	R/W
100f	Current calibration value	R/W
Address	Definition	Read/Write
1010	Voltage calibration value	R/W
1011	Starting current times	R/W
1012	Running current times	R/W
1013	Starting overload curve	R/W
1014	Running overload curve	R/W
1015	Current unbalance	R/W
1017	Over voltage value	R/W
1018	Under voltage value	R/W
101a	Slave address	R/W
101b	Baud rate	R/W
1027	Control command	W
1029	Soft starter condition	R
102a	IVAG	R
102e	Voltage value	R
1033	First fault	R
1034	Second fault	R
1035	Third fault	R

★Cautions:

- 0x1027: Control command, bit7:Stop bit, Bit6:Start bit, Bit5: Fault reset. Other bit without definition. '1' mean valid, '0' mean invalid.
- 0x1029: Soft starter condition. 0-Standby, 1-Start, 2-Bypass, 3-Stop; 4-Edit, 5-Fault.

## 10. Structure and dimentions

Model	Related power (KW)	Related current (A)	Dimension			Installation size			N. W (kg)
			H	W	D	A	B	d	
KOC200-4T0055C	5.5	11	277	147	165	255	132	M6	<3.5
KOC200-4T0075C	7.5	15	277	147	165	255	132	M6	<3.5
KOC200-4T0110C	11	22	277	147	165	255	132	M6	<3.5
KOC200-4T0150C	15	30	277	147	165	255	132	M6	<3.5
KOC200-4T0185C	18.5	37	277	147	165	255	132	M6	<3.5
KOC200-4T0220C	22	44	277	147	165	255	132	M6	<3.5
KOC200-4T0300C	30	60	277	147	165	255	132	M6	<3.5
KOC200-4T0370C	37	75	277	147	165	255	132	M6	<3.5
KOC200-4T0450C	45	90	277	147	165	255	132	M6	<3.5
KOC200-4T0550C	55	110	277	147	165	255	132	M6	<3.5
KOC200-4T0750C	75	150	390	225	225	340	180	M6	<10
KOC200-4T0900C	90	180	530	262	200	438	195	M8	<20
KOC200-4T1150C	115	230	530	262	200	438	195	M8	<20
KOC200-4T1B20C	132	264	530	262	200	438	195	M8	<20
KOC200-4T1600C	160	320	530	262	200	438	195	M8	<20
KOC200-4T2000C	200	400	530	262	200	438	195	M8	<20
KOC200-4T2500C	250	500	560	285	202	409	255	M10	<23
KOC200-4T3200C	320	640	560	285	202	409	255	M10	<23
KOC200-4T4000C	400	800	590	325	202	438	295	M10	<31

Diagram 10-1

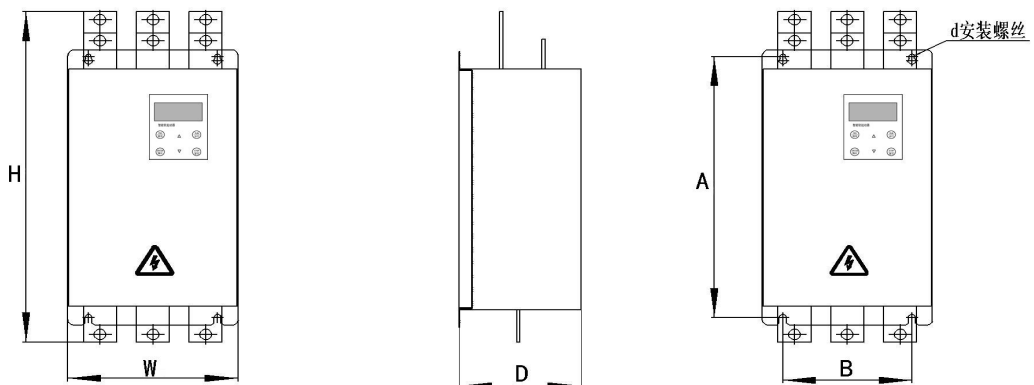


Diagram 11-1