Preface

Thanks for purchasing our CDRA soft starter.

As a standard appendix, the Manual should be read carefully and followed strictly before and during use of CDRA series soft starter, in order to avoid operation errors, faults, shortened service life or even personal injuries. Please keep the Manual properly for further inspection & maintenance of soft starter.

The Manual contains operation steps and wiring diagrams for your reference. For any query or special requirements of soft starter, please kindly contact our local offices or dealers, or directly call our customer service center in the Headquarters for receiving wholehearted services.

The Manual is subject to a change without a prior notice.

Do unpacking inspection carefully as follows:

1. Check if there's product damage, part damage and falling and collision of main body during transport.
2. Check if rated values in nameplate are consistent with your order requirements; the packaging box contains the quality certificate, user manual and warranty card you need.

The soft starter is manufactured and packaged by the Company in strict accordance with the quality guarantee system. For any omission of inspection, please contact us or supplier for solution.



Warning

Do not print, spread or use the Manual unless otherwise permitted in writing. Violators will be investigated for the legal liabilities.

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Chapter 1 Safe Running and Notice

As a new and highly advanced starting device developed based on power electronic technique, microprocessor technique and modern control theory technique, the CDRA series soft starter (hereinafter referred to as "the Product") can restrict the startup current of asynchronous motor effectively, be widely applied in heave-load equipment such as fans, water pumps, conveyors and compressors, making it the ideal alternative product for reduced-voltage starting Product, such as star/triangle conversion and self-coupling voltage reduction. Moreover, the Product supports multiple control modes such as keyboard, external terminal and upper computer, supports outputs of fault relay, multi-function relay and analog signals, in order to be integrate into the system easily and flexibly.

Please read the Manual carefully before installation, running, maintenance and inspection of the Product.

Please read the chapter carefully before using the product to keep safety of personnel, equipment and properties. The Manual's precautions of safe running are divided into "warning" and "attention".



Warning

: Potential hazards which, if violated, may lead to major damage of equipment and major personal casualties.

: Potential hazards which, if being violated, may lead to moderate damages of equipment and personal injuries. This also applies to warning of unsafe operation.



Attention

1.1 Acceptance

Unpacking inspection items:

Items	Introduction
1. Check if the Product's model is consistent with that of order.	Check the model on the Product's lateral nameplate.
2. Check if parts are damaged.	Visually inspect the surface and check if there's damage during transport.
3. Check if parts are fastened safely.	Check all visible parts by using appropriate tools.
4. Check if instructions are attached. Check if quality certificate and warranty card are received.	Instructions, quality certificate and warranty card of the Product

The Product is manufactured and packaged by the Company in strict accordance with the quality guarantee system. For any omission of inspection, please contact us or supplier for solution.

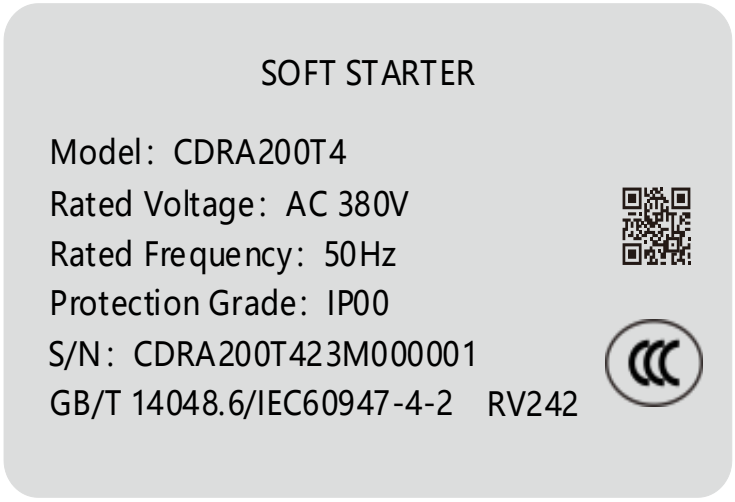
1.2 Safety Information

 Warning	1. Please install the Product on noncombustibles such as metal to avoid fire; Keep the Product far away from combustibles to avoid fire; Do not install the Product in places with explosive gas to avoid explosion.
	2. The Product should be installed and maintained by professional personnel only.
	3. The Product's rated voltage must be consistent with the grade of AC power grade.
	4. Do not connect the Product's input/output end reversely to avoid unexpected action, or damage of the Product and its motor.
	5. Make sure starting circuit has the same phase sequence with that of bypass circuit before starting the bypass contactor; otherwise, inter-phase short circuit, damage or even fire may occur when switching bypass circuit.
 Anti-static	6. Make sure to install the cover plate before connecting input power. Do not remove the cover when power is on; otherwise, electric shock and explosion will occur.
	7. Do not touch the Product's terminals if the Product is power-on to avoid electric shock.
	8. Do not connect or disconnect the conductor and connector if circuit is power-on to avoid electric shock.
	9. Do not handle the Product with wet hands to avoid electric shock.
	10. Spare parts should be replaced by professional technicians only. Do not leave thread residue or metal in the Product to avoid fire.
	11. Do not touch the electronic components that can be easily damaged by static electricity.
	12. User should not apply withstand voltage test to the Product to avoid damage of internal components.
 Attention	1. The reactive power compensation capacitor designed for improving power factor must be connected to the Product's input end instead of output end; otherwise, the SCR power device can be damaged.
	2. Main loop terminal must be connected to conductor nose firmly to avoid damage of properties.
	3. The Product must be derated at places over 1,000 m. For more information, please consult our Technical Department.
	4. Do not modify the Product's default parameters at will to avoid damage.
	5. Once scrapped, the Product should be disposed as industrial waste, for electrolytic capacitor on printed board may explode when being burnt, or plastic parts, such as cover plate, will generate toxic gas when being burnt.

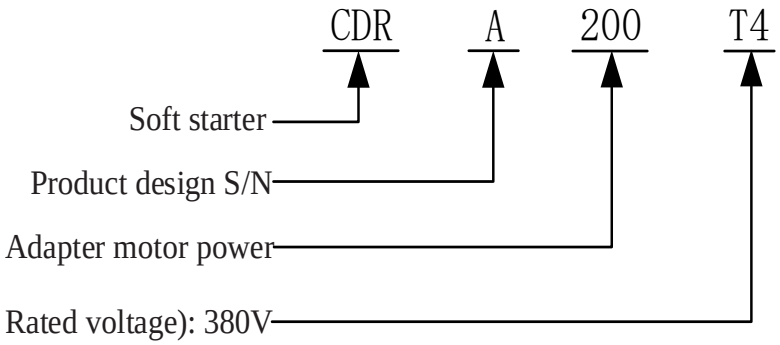
Chapter 2 Product Information

2.1 Data and Coding Rules of Nameplate

Data in nameplate: Take Type CDRA200T4 soft starter as example:



Data and model introduction of nameplate:



2.2 Technical Specification

Operation	Operation control mode		Keyboard/external terminal/RS485 communication		
	Start mode		Current limiting/voltage/heavy load		
	Start/stop period		Digital setting supported		
	Start delay		Digital setting supported		
	Emergency stop		Interrupt output of soft starter		
	Limiting current		Starting current is lower than this value under current limiting and heavy-load mode		
	Initial voltage		Initial voltage supports digital setting under voltage mode		
	Light-load control		Detect accidents such as belt tripping		
	Restart		Support restart in case of shutdown due to a fault		
	Fault output		Contact output - AC 250V 5A, DC 30V 5A		
	Multifunction relay output		Start delay, start, running, stop, complete stop, restart		
	Analog output		0~20mA / 4~20mA, optional		
Protection Function	Soft starter protection		Overcurrent, overload, overheat, three-phase imbalance, default phase, light load, external fault		
	Soft starter alarm		Emergency shutdown, light load and restart		
Display	Keyboard	Running information	Ready condition, start delay, stating process, operation, stop, fault alarm		
		Parameter protection	Set parameters are protected against modification		
Working Conditions	Category of use		AC-53b		
	Rated insulation voltage		660V	Rated impulse withstand voltage	4kV
	Operation frequency		≤ 12 times/h		
	Protection grade	IP20	CDRA011T4~CDRA055T4		
		IP00	CDRA075T4~CDRA600T4 CDRAK3G011T4～CDRAK3G600T4		
	Rated limit short-circuit current		CDRA055T4：6kA； CDRA160T4：12kA；		
			CDRA320T4：20kA； CDRA600T4：48kA；		
			CDRAK3G075T4：9.1kA； CDRAK3G160T4：12kA；		
			CDRAK3G320T4：20kA； CDRAK3G600T4：48kA；		
Environment	Ambient temperature		-10 ℃ ~ 40 ℃		
	Storage temperature		-20 ℃ ~ 65 ℃		
	Ambient humidity		Max. 90 % RH. (no condensation)		
	Height/vibration		Below 1,000 m; below 5.9m/s ₹(=0.6g)		
	Application scenario		No corrosive gas, inflammable gas, oil mist, dust or others		
Cooling Method	Natural air cooling		CDRA011T4~CDRA600T4；CDRAK3G011T4~CDRAK3G075T4		
	Forced air cooling		CDRAK3G093T4~ CDRAK3G600T4		

2.3

1）Model of CDRA Series Soft Starter

Model of Soft Starter	Rated Power (kW)	Rated Current (A)	Model of Circuit Breaker (QF)	Model of Bypass Contactor (KM)	Specification of Primary Wire
CDRA011T4	11	25	CDM1-63L/32	CJ20-25	6mm^2 cable
CDRA015T4	15	32	CDM1-63L/40	CJ20-40	10mm^2 cable
CDRA018T4	18.5	37	CDM1-63L/50	CJ20-40	10mm^2 cable
CDRA022T4	22	45	CDM1-63L/63	CJ20-63	16mm^2 cable
CDRA030T4	30	60	CDM1-100L/80	CJ20-63	25mm^2 cable
CDRA037T4	37	75	CDM1-100L/100	CJ20-100	35mm^2 cable
CDRA045T4	45	90	CDM1-225L/125	CJ20-100	35mm^2 cable
CDRA055T4	55	110	CDM1-225L/160	CJ20-160	35mm^2 cable
CDRA075T4	75	152	CDM1-225L/180	CJ20-160	35mm^2 cable
CDRA093T4	93	176	CDM1-225L/200	CJ20-250	30*3mm^2 copper bar
CDRA110T4	110	210	CDM1-400L/250	CJ20-250	30*3mm^2 copper bar
CDRA132T4	132	253	CDM1-400L/315	CJ20-400	30*4mm^2 copper bar
CDRA160T4	160	300	CDM1-400L/350	CJ20-400	30*4mm^2 copper bar
CDRA200T4	200	380	CDM1-400L/400	CJ20-400	40*4mm^2 copper bar
CDRA250T4	250	480	CDM1-630L/630	CJ20-630	40*5mm^2 copper bar
CDRA320T4	320	600	CDM1-800H/700	CJ40-800	40*5mm^2 copper bar
CDRA400T4	400	750	CDM1-800H/800	CJ40-1000	50*5mm^2 copper bar
CDRA450T4	450	892	CDM1-1250/1000	CJ40-1000	50*5mm^2 copper bar
CDRA500T4	500	930	CDM1-1250/1250	CJ40-1000	50*5mm^2 copper bar
CDRA600T4	600	1100	CDM1-1250/1250	CJ40-1000	50*5mm^2 copper bar

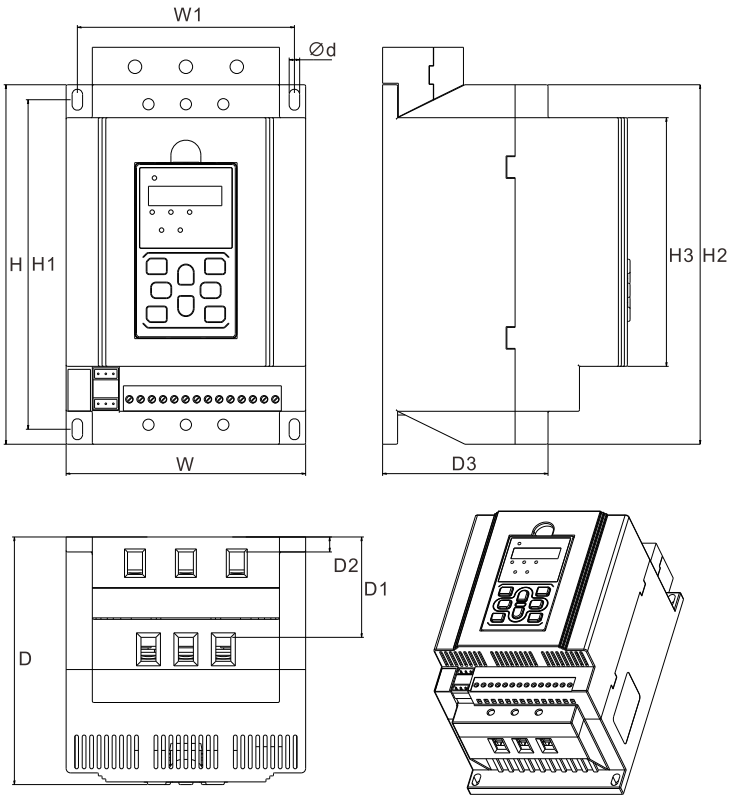
2）Model of CDRAK3 Series Soft Starter

Model of Soft Starter	Rated Power (kW)	Rated Current (A)	Model of Circuit Breaker (QF)	Specification of Primary Wire
CDRAK3G011T4	11	25	CDM1-63L/32	6mm^{2}cable
CDRAK3G015T4	15	32	CDM1-63L/40	10mm^{2}cable
CDRAK3G018T4	18.5	37	CDM1-63L/50	10mm^{2}cable
CDRAK3G022T4	22	45	CDM1-63L/63	16mm^{2}cable
CDRAK3G030T4	30	60	CDM1-100L/80	25mm^{2}cable
CDRAK3G037T4	37	75	CDM1-100L/100	35mm^{2}cable
CDRAK3G045T4	45	90	CDM1-225L/125	35mm^{2}cable
CDRAK3G055T4	55	110	CDM1-225L/160	35mm^{2}cable
CDRAK3G075T4	75	152	CDM1-225L/180	35mm^{2}cable
CDRAK3G093T4	93	176	CDM1-225L/200	30*3mm^2 copper bar
CDRAK3G110T4	110	210	CDM1-400L/250	30*3mm^2 copper bar
CDRAK3G132T4	132	253	CDM1-400L/315	30*4mm^2 copper bar
CDRAK3G160T4	160	300	CDM1-400L/350	30*4mm^2 copper bar
CDRAK3G200T4	200	380	CDM1-400L/400	40*4mm^2 copper bar
CDRAK3G250T4	250	480	CDM1-630L/630	40*5mm^2 copper bar
CDRAK3G320T4	320	600	CDM1-800H/700	40*5mm^2 copper bar
CDRAK3G400T4	400	750	CDM1-800H/800	50*5mm^2 copper bar
CDRAK3G450T4	450	892	CDM1-1250/1000	50*5mm^2 copper bar
CDRAK3G500T4	500	930	CDM1-1250/1250	50*5mm^2 copper bar
CDRAK3G600T4	600	1100	CDM1-1250/1250	50*5mm^2 copper bar

2.4 Shape and Mounting Dimensions

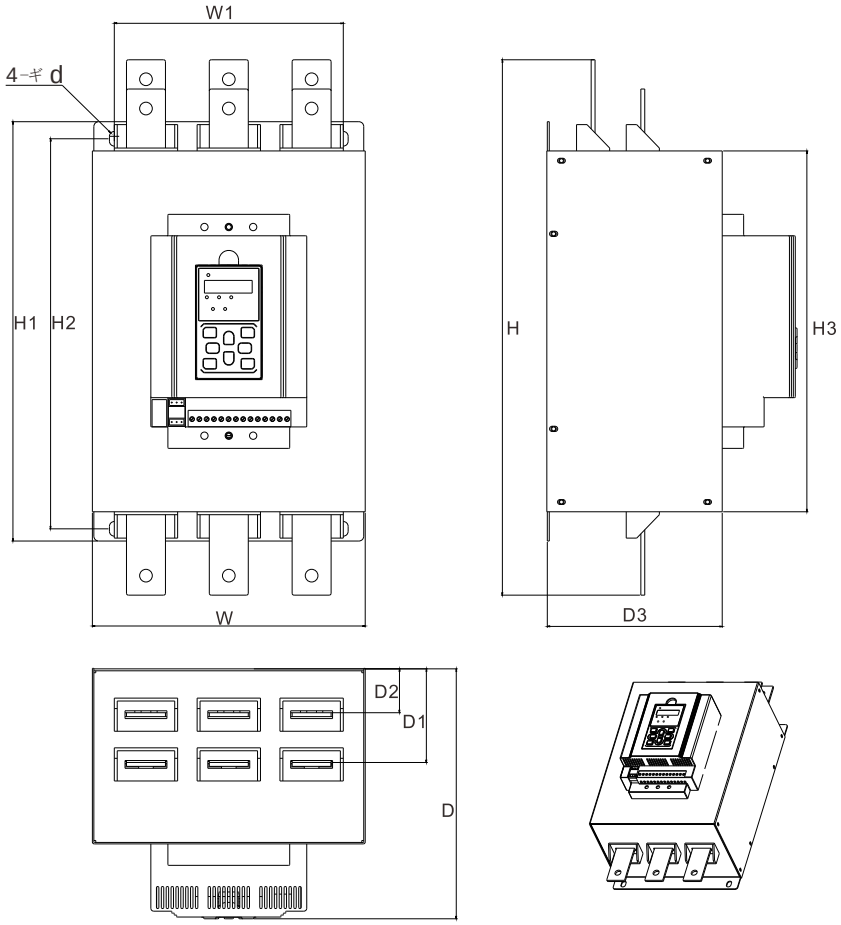
Shape and Mounting Dimensions of CDRA Series Soft Starter (Unit: mm)

Model	W	W1	H	H1	H2	H3	D	D1	D2	D3	¢d
CDRA011T4	160	145	265	220	240	166	165.8	67	10	111	8
CDRA015T4											
CDRA018T4											
CDRA022T4											
CDRA030T4											
CDRA037T4											
CDRA045T4											
CDRA055T4											



CDRA011T4~CDRA055T4

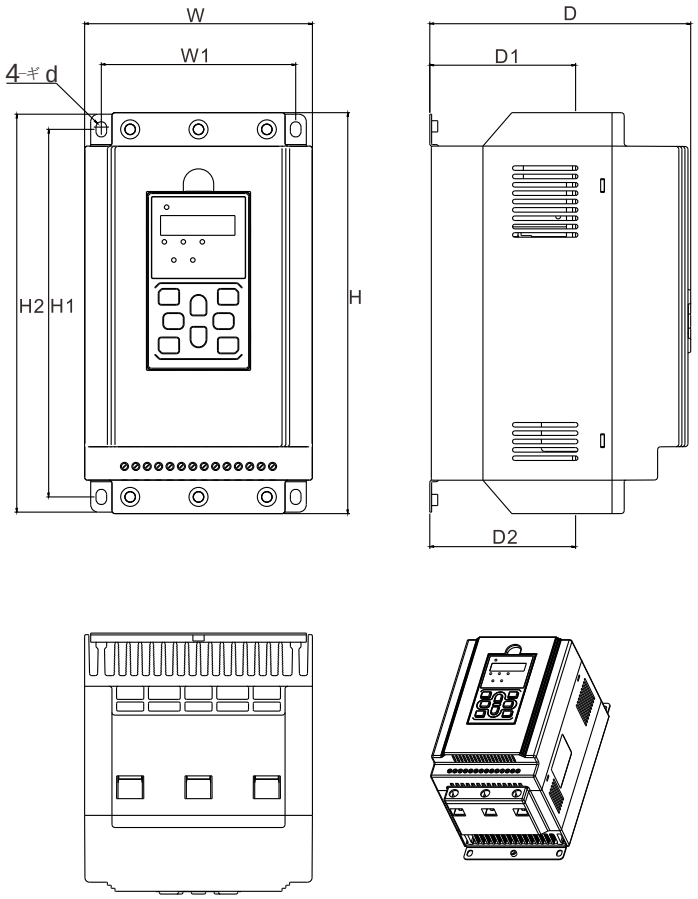
Model	W	W1	H	H1	H2	H3	D	D1	D2	D3	¢d
CDRA075T4	280	230	534	430	395	370	256.8	98	44	180	10
CDRA093T4											
CDRA110T4											
CDRA132T4											
CDRA160T4											
CDRA200T4	310	265	594	475	440	415	256.8	98	44	180	10
CDRA250T4											
CDRA320T4											
CDRA400T4	416	375	740	555	520	495	276.8	106	44	200	10
CDRA450T4											
CDRA500T4											
CDRA600T4											



CDRA075T4~CDRA600T4

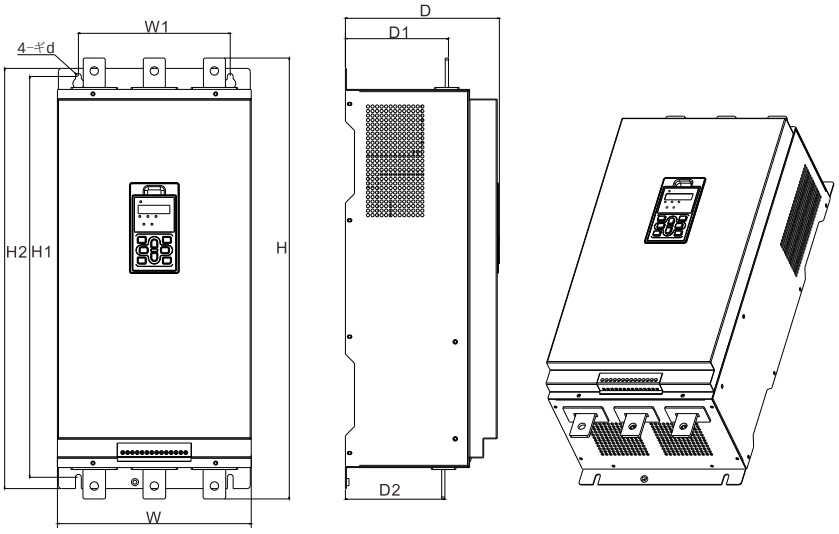
Shape and Mounting Dimensions of CDRAK3 Series Soft Starter (Unit: mm)

Model	H	H1	H2	W	W1	D	D1	D2	⌀d
CDRAK3G011T4	264	242	262	150	128	171.8	96	96	7
CDRAK3G015T4									
CDRAK3G018T4									
CDRAK3G022T4									
CDRAK3G030T4									
CDRAK3G037T4									
CDRAK3G045T4									



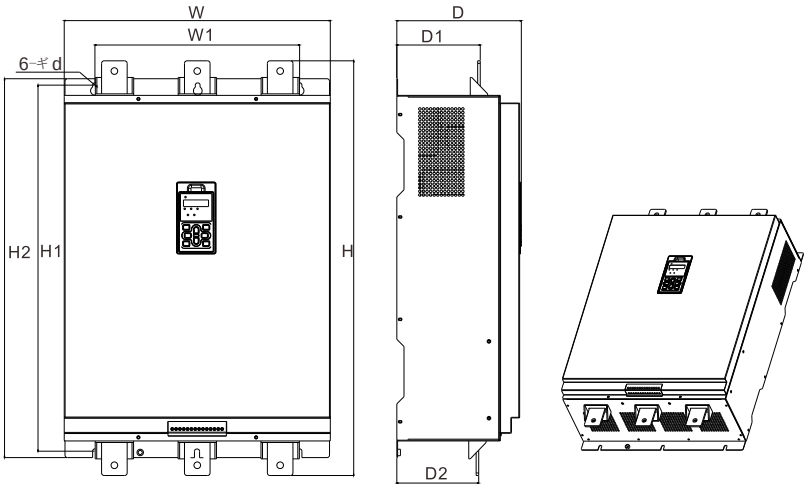
CDRAK3G011T4~CDRAK3G045T4

Model	H	H1	H2	W	W1	D	D1	D2	¢d
CDRAK3G055T4	384	345	360	200	165	229.3	137.5	137.5	7
CDRAK3G075T4									
CDRAK3G093T4	579	520	545	255	180	233.3	160	151	9
CDRAK3G110T4									
CDRAK3G132T4									
CDRAK3G160T4									
CDRAK3G200T4	684	620	650	300	235	238.3	159	154	9
CDRAK3G250T4									
CDRAK3G320T4									



CDRAK3G055T4~CDRAK3G320T4

Model	H	H1	H2	W	W1	D	D1	D2	¢d
CDRAK3G400T4	810	715	740	520	400	243.3	166	163	9
CDRAK3G450T4									
CDRAK3G500T4									
CDRAK3G600T4									



CDRAK3G400T4~CDRAK3G600T4

2.5 Daily Maintenance

(1) Daily Maintenance

The Product should be given daily and regular maintenance against the adverse influences from ambient temperature, humidity, dust and vibration, to avoid reduced insulation grade and creepage distance, arc discharge or short circuit, control circuit failure, accidents, working failure or reduced service life.

Daily inspection items:

A. Whether motor has abnormal sounds at startup, shutdown and running period.
B. Whether motor has vibration in running period.
C. Whether the Product's installation environment is changed.
D. Whether the Product is overheated.

Daily cleaning:

A. Keep the Product clean.
B. Remove the dust on the Product's surface, and prevent dust from entering the Product, especially the metal dust.
C. Prevent moisture or water drop from entering the Product.

(2) Regular Inspection

Please do regular inspection to the inaccessible parts.

A. Check and clean the air duct on a regular basis.
B. Check if screws are loose.
C. Check if the Product is corroded.
D. Check if terminal block has traces of arc discharge.
E. Do insulation test of main circuit.

Prompt: Disconnect the main circuit from the Product before measuring the insulation resistance by using a megger (DC 500V megger). Do not measure the insulation of control circuit by using insulation resistance meter. No high-voltage test is required (for it is conducted before delivery).

(3) Warranty

Free warranty applies to the Product itself.

For any fault or damage of the Product in normal use domestically (subject t to the Manual), the Product may enjoy 18-month free warranty as of the date on bar code.

The Product enjoys 6-month free warranty as of the date of delivery if being sold overseas (excluding domestic market).

The Company's products enjoy life-long services regardless of time and location.

The Product may enjoy after-sales services from the Company's national sales institutes and agents on basis of the following service conditions:

A. "3-level" inspection services (including troubleshooting) are conducted in the place of this institute.
B. Be subject to the standards of after-sales responsibility in contract signed by and between the Company and sales agent.
C. Request for paid after-sales services (whether within warranty period or not) can be sent to the Company's sales agents.

The user should firstly purchase property insurance from the insurance company for acquiring more guarantees on compensation, for the Company bears the sole responsibility of repairing, replacement and return of product if it has quality problem or accident.

The Product may enjoy 18-month free warranty as of the date on bar code.

For any fault due to the following causes, paid maintenance services will be provided even if the Product is within the warranty period:

A. The fault is caused by improper operation (subject to the operation instructions) or unauthorized self-repairing and modification.
B. The fault is caused due to violation of standards.
C. The Product is damaged due to falling or improper handling after purchase.
D. The parts become aged or faulty due to improper ambient environment.
E. The Product is damaged due to earthquake, fire, wind and fire disaster, abnormal voltage, other natural hazards or disaster-related factors.
F. The Product is damaged in transport process (Note: The transport mode is designated by customer; the Company assists in handling the procedure of cargo transfer).
G. The manufacturer's brands, trademark, S/N and nameplates are damaged or fail to be identified.

H. The payment of goods is not made as agreed.
I. Fail to introduce the information of installation wiring, operation, maintenance or other cases to the Company in an objective and real way.

Products enjoying services of repairing, replacement and return must be firstly returned to the Company to determine the attribution of liability before start of return or repairing.

If buyer fails to pay off in time, the Company still owns the Product without bearing the responsibility above and the buyer should have no objection on this.

The service fees should be calculated according to the unified standards of manufacturer. The contract (if any) should prevail.

Chapter 3 Installation and Wiring of Soft Starter

3.1 Selection of Installation Location and Space

Selection of installation location:

Warning	1. Avoid direct sunlight and outdoor use.
	2. Do not use the Product in places with corrosive gas and liquid.
	3. Do not use the Product in places with oil mist and splashed water.
	4. Do not use the Product in places with salt mist.
	5. Do not use the Product in places with rainfall and moisture.
	6. Install a filter if air has metal powder, silk, optical fiber or flying fabric.
	7. Do not use it in places with mechanical impact and vibration.
	8. Cooling measures must be adopted if ambient temperature exceeds 40℃.
	9. Use the Product in the recommended temperature range of -10℃~+40℃ to avoid faults due to overcooling or overheat.
	10. Keep distance with power supply noise; for example, the Product can be affected by electric welder and high-power equipment.
	11. The Product's running will be affected by the radioactive materials.
	12. Keep the Product away from flammable materials, diluents and solvents.

It is recommended to install the Product in the places as recommended above to safeguard its performance, long life and avoid damages.

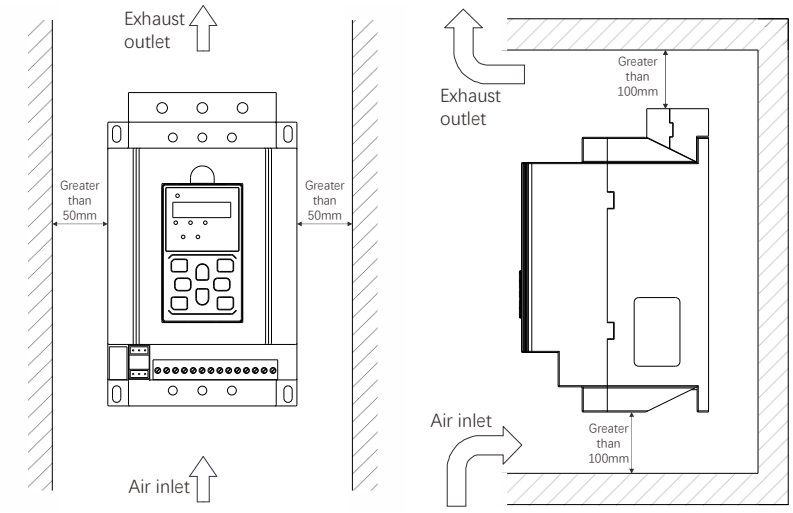
Installation direction: The Product must be installed vertically to ensure good cooling.

Selection of installation space:

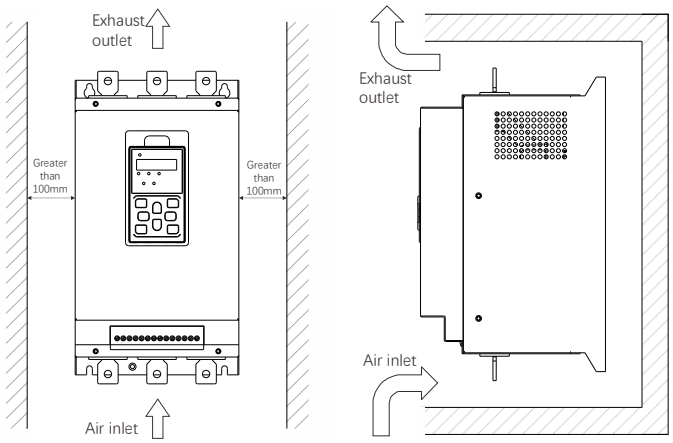
The CDRA series soft starter should be reserved with sufficient cooling space when installed vertically to guarantee effective cooling; see diagram below:

Do not drop any foreign matter into the Product during installation, to avoid reduced insulation grade or even short circuit.

Schematic diagram for installation of CDRA series soft starter



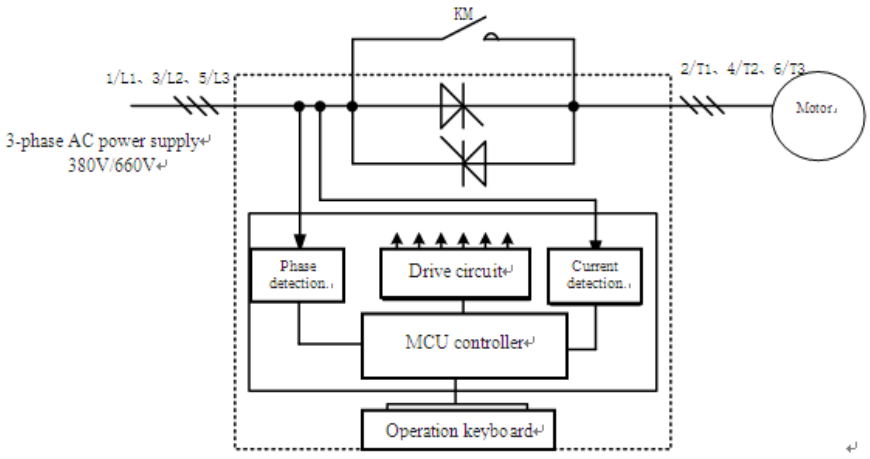
Schematic diagram for installation of CDRAK3 series soft starter



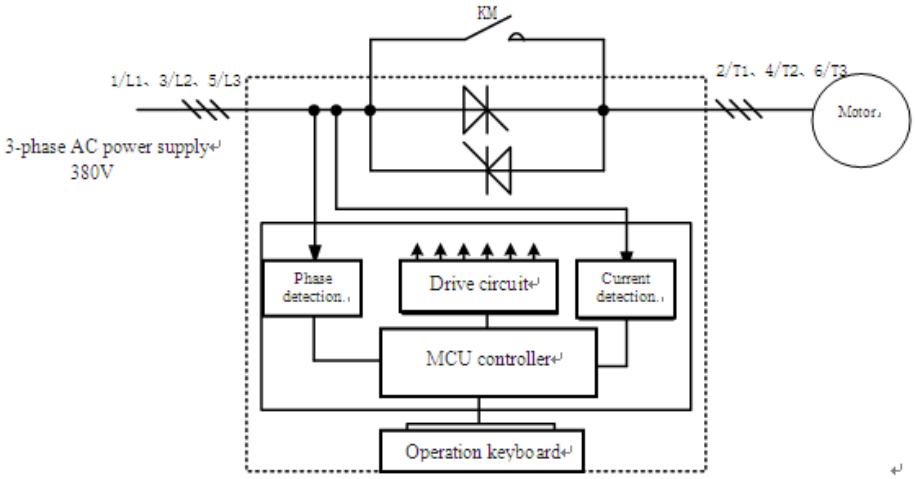
3.2 Wiring

3.2.1 How it Works and Schematic Diagram for Basic Wiring

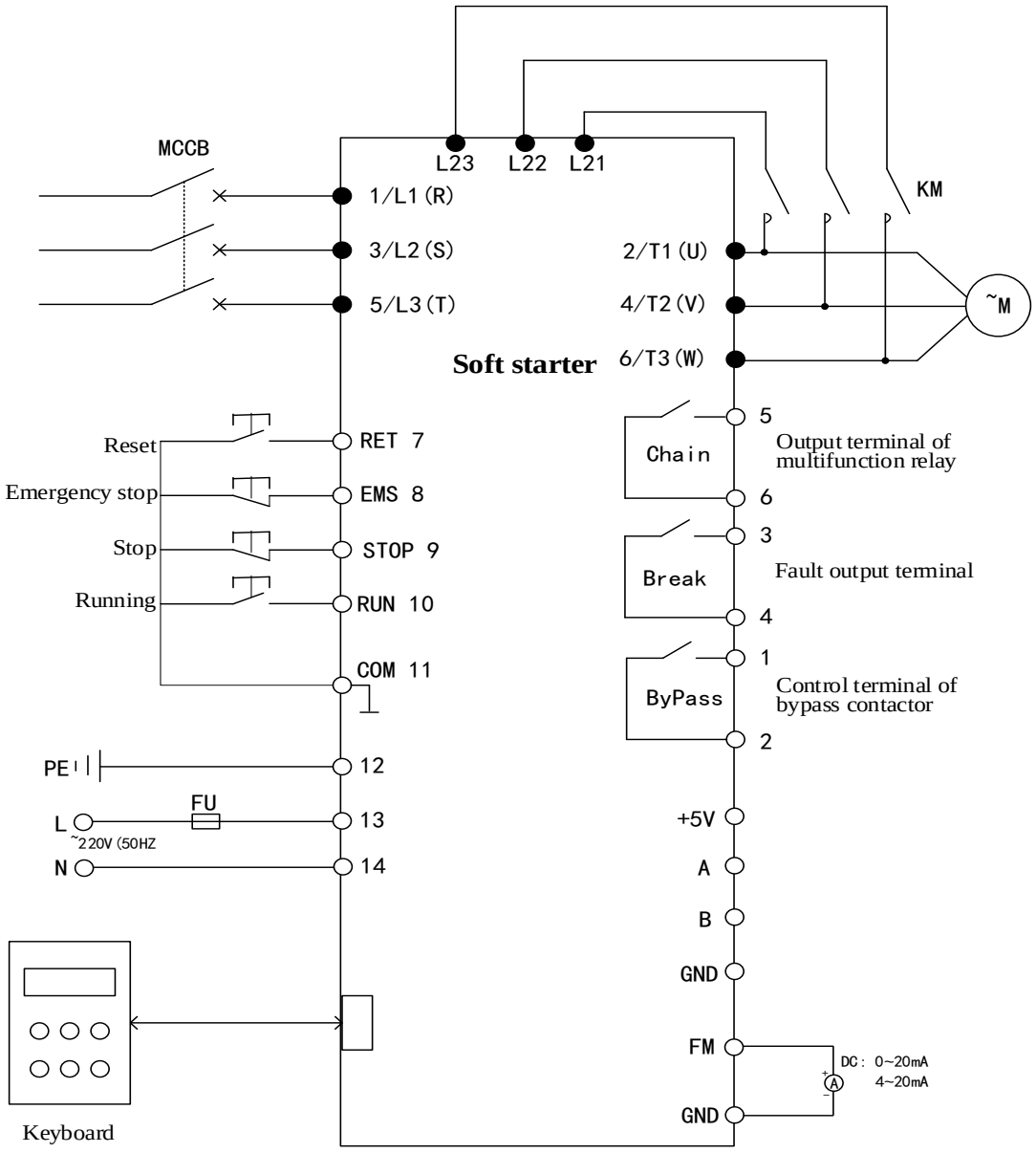
The main circuit of CDRA soft starter is given inverse parallel connection via 6 thyristors before being given tandem connection to the stator loop on the AC motor. The soft start of motor is controlled by using the electronic switching of thyristor, changing the conduction angle of thyristor by controlling the variation of trigger angle through microprocessor, in order to change the input voltage of motor. Once started, the Product will output rated voltage, external 3-phase bypass contactor KM will be connected and the motor will be connected to power grid for connection.



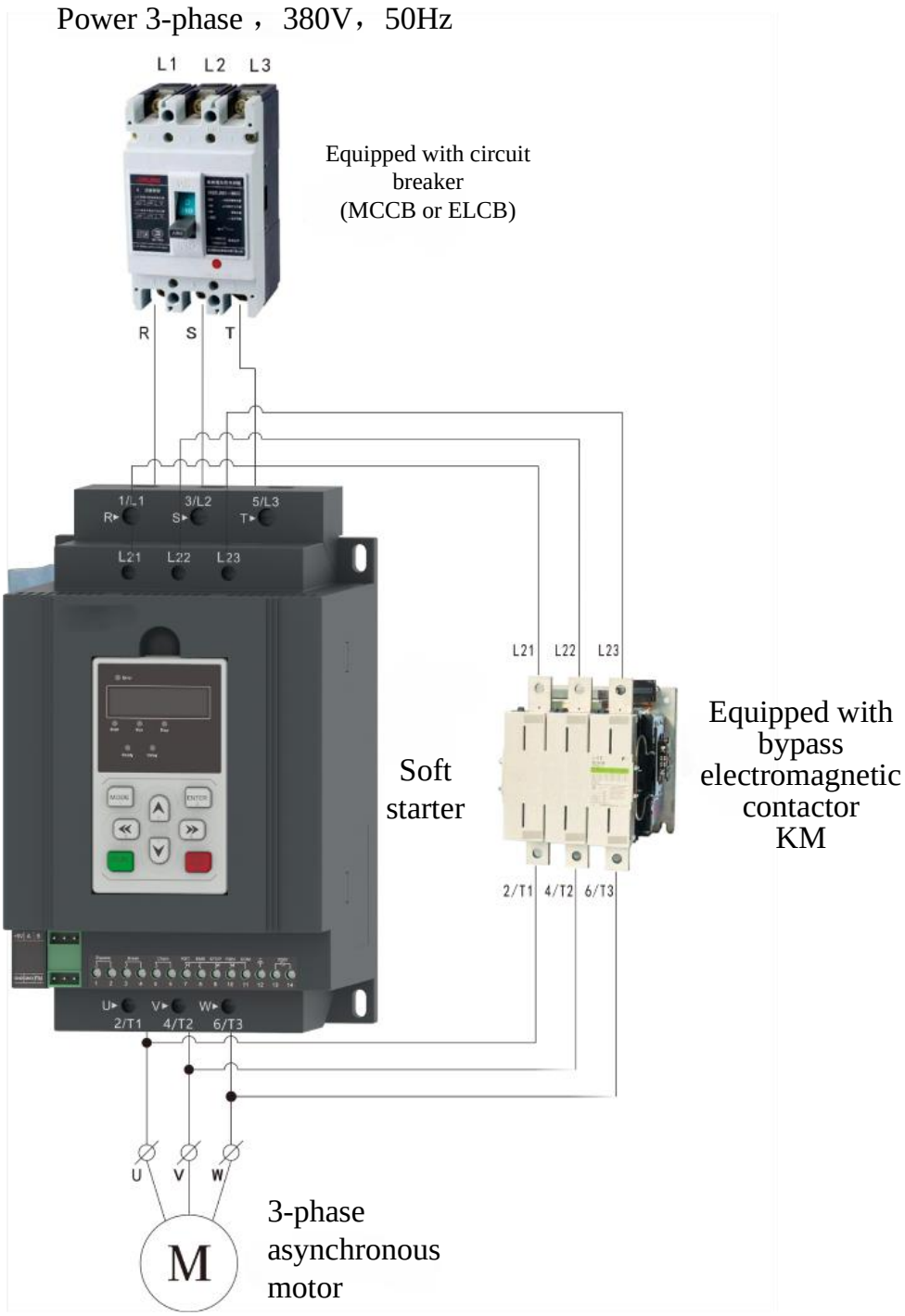
The main circuit of CDRAK3 series motor soft starter is provided with reverse parallel connection through six thyristors before it has tandem connection to the stator loop. Based on the electronic switching function of thyristor, the microprocessor controls the change of trigger angle to change the conduction angle of thyristor, in order to change the motor input voltage and control the soft start of motor. After start is finished, the soft starter output will reach the rated voltage. At this time, the built-in bypass contactor KM will be on, to connect the motor to power grid and start running.



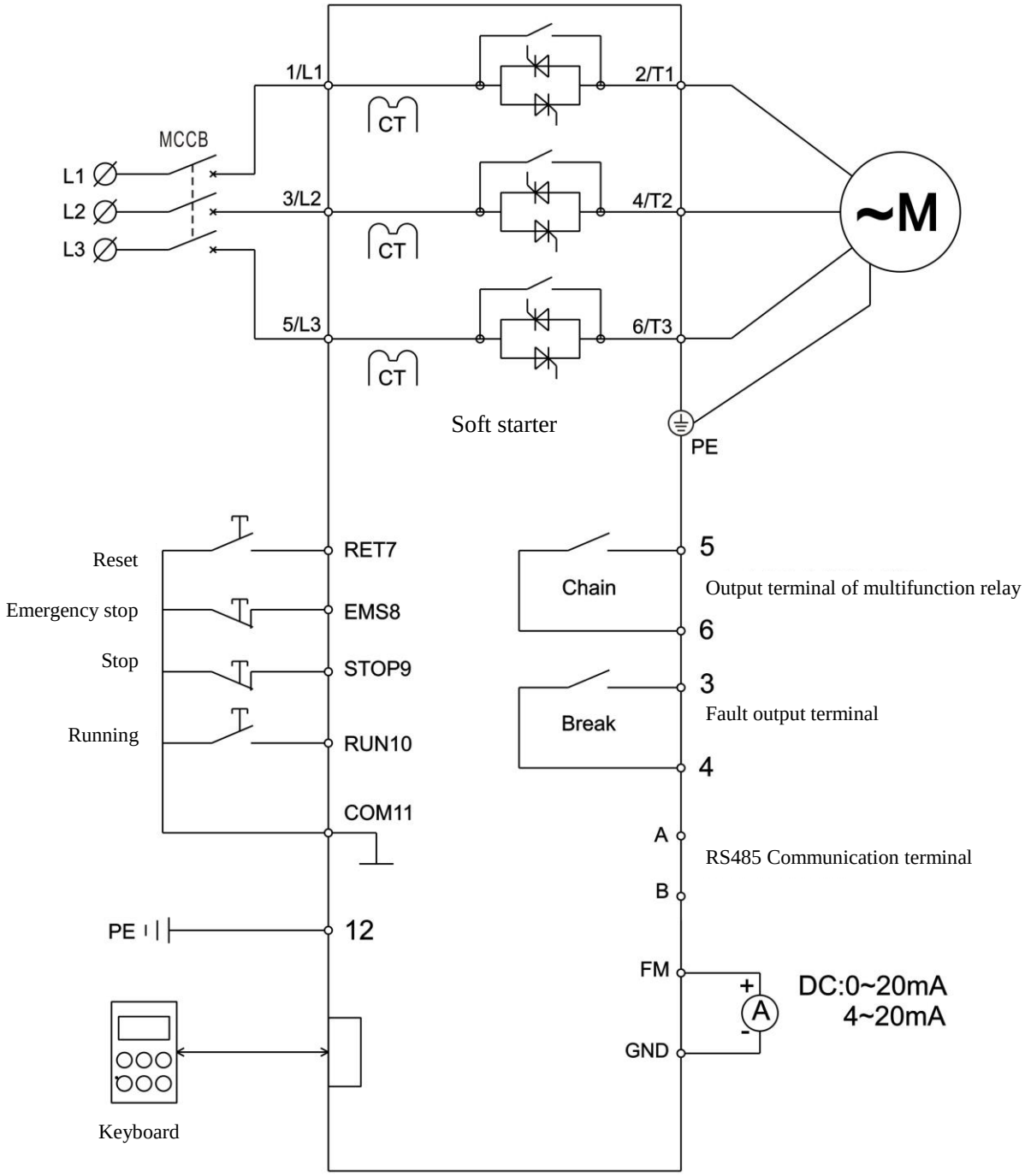
Schematic Diagram for Basic Wiring of CDRA



Basic Wiring Diagram of CDRA



Schematic Diagram for Basic Wiring of CDRAK3



Basic Wiring Diagram of CDRAK3



Precautions of Wiring:

 Warning	1. Make sure to power off before wiring.
	2. Check if the Product's rated voltage is consistent with voltage grade of AC power supply.
	3. Do not connect the Product's input/output end reversely to avoid unexpected action, or damage of the Product and its motor.
	4. Make sure starting circuit has the same phase sequence with that of bypass circuit before starting the bypass contactor; otherwise, inter-phase short circuit, damage or even fire may occur when switching bypass circuit.
	5. Do not touch the electronic components that can be easily damaged by static electricity.
	6. User should not apply withstand voltage test to the Product to avoid damage of internal components.

3.2.2 Introduction to CDRA External Terminals

Classification		Terminal Symbol	Terminal Name	Introduction
Main circuit		1/L1.3/L2.5/L3	Power input of AC main circuit	Connect 3-phase AC power supply via circuit breaker
		2/T1.4/T2.6/T3	Output terminal of soft starter	Connect 3-phase asynchronous motor
		L21.L22.L23	Specific terminal of external bypass contactor	Connect bypass contactor **(CDRAK3 no such terminal)**
Control power supply		13	Input terminal of control power supply	Connect to AC 220V, 50Hz **(CDRAK3 no such terminal)**
		14		
		12	Ground terminal	Grounding
Control Circuit	Relay output	1	Bypass	Closed after startup Capacity: AC 220V 5（DC 30V 5A） **(CDRAK3 no such terminal)**
		2	Control terminal of bypass contactor Bypass	
		3	Break	Action in case of fault (method is settable) Capacity: AC 220V 5A（DC 30V 5A）
		4	Output terminal of fault relay Break	
		5	Chain	Action mode is programmable Capacity: AC 220V 5A（DC 30V 5A）
		6	Output terminal of multifunction relay Chain	
	Digital input	7	External reset terminal RET	External terminal sends reset signal in case of fault
		8	Emergency stop control terminal EMS	Emergency control signal is controlled by external signal
		9	External and stop terminal STOP	Under external control mode, STOP and COM are closed, RUN and COM are closed to realize effective running; otherwise, shutdown is enabled.
		10	External running terminal RUN	
		11	Common port of external signal terminal COM	Public terminal of digital input
	RS45 communication	A	Positive signal of 485 communication	RS485 communication terminal
		B	Negative signal of 485 communication	
	Power interface	+5V	+5V power supply	Power supply
		GND	GND terminal	Power ground
	Analog output	GND		0-20mA, 4-20mA output signal of analog quantity can be selected via programming
		FM	Output terminal of current signal	

3.2.3 Connection and Use of CDRA Control Terminal

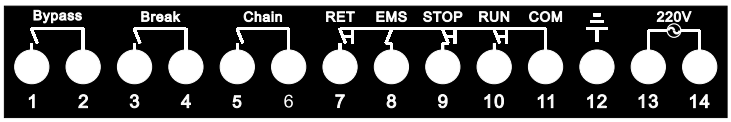
1. Precautions of terminal wiring

Please connect the control terminal using multi-core shielded cable or stranded wire. If shielded cable is used, the near end (the end closer to the Product) should be connected to the Product's ground terminal PE. In process of wiring, the control cable should be over 20 cm away from the main circuit and high-voltage line (including power wire, motor wire, relay wire and contactor wire), avoid parallel arrangement and be provided with vertical wiring as recommended, in order to avoid malfunction of the Product due to interference.

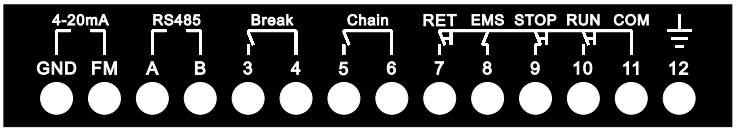
2. Wiring of external control terminals

Make sure to cut off power supply before wiring to avoid hazardous voltage.

Schematic Diagram of CDRA Series Control Terminal:



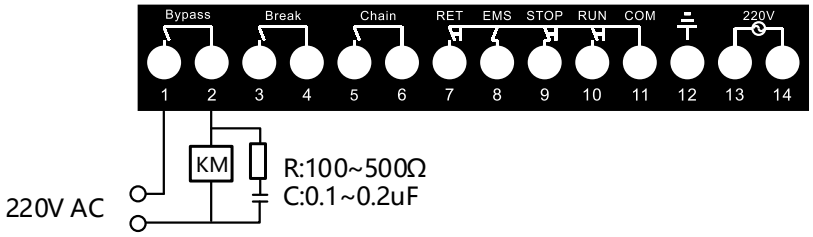
Schematic Diagram of CDRAK3 Series Control Terminal:



(1) Bypass terminal 1 and 2 are controlled by bypass contactor **(CDRAK3 не имеет этого терминала)**

Upon finishing startup, close the internal contacts and connect the bypass contactor KM; the internal contacts will be opened when stop commands are given out.

Suggestion: Install a RC absorption circuit near the both ends of contactor coil to absorb the surge voltage generated by the disconnection of contactor coil and reduce the interference of starter on the control circuit.



(2) Break terminal 3 and 4 of fault output relay

The relay, which will act if the Product becomes faulty, can be set to be normally open or closed through parameter setting. The contactor capacity is AC 250V 5A.

(3) Output Chain terminal 5, 6 of multifunction relay

This contactor can be connected to other control equipment, with its action mode being selected via parameter setting. Contactor capacity: AC 250V 5A.

(4) Reset input RET terminal 7, 11

The fault status can be relieved when external reset terminal RET is connected to public terminal COM.

(5) Emergency stop input EMS terminal 8, 11

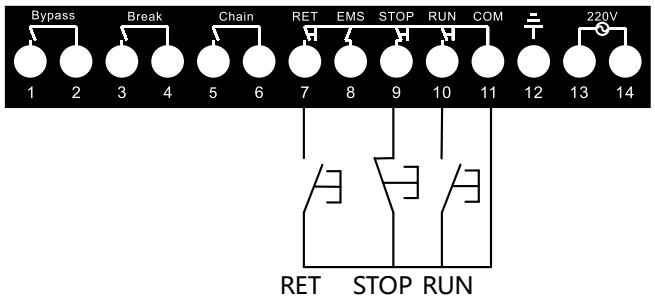
Designed for inputting the external signal of emergency stop, the terminal can be connected to external emergency stop button and thermal relay, in order to protect the normally closed contacts of circuit. The Product will not work until both of EMS and COM are connected and, if they are disconnected, the Product will shut down within 2s. This function can be disabled by user via parameter setting.

(6) Operation control STOP, RUN, COM terminal 9, 10, 11

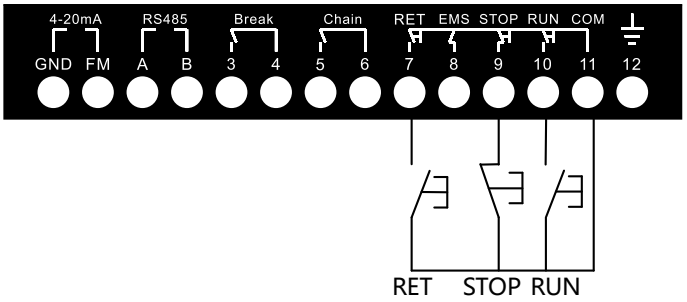
Designed for inputting running and stop signals during external control, these three terminals are not enabled until the external control mode is entered. Under external control mode, the Product will enter running status if STOP-COM and RUN-COM are closed, or enter shutdown status under other control signal modes.

The following picture shows the common three-wire connection methods of external buttons:

Schematic Diagram of CDRA Series Three-wire Connection:

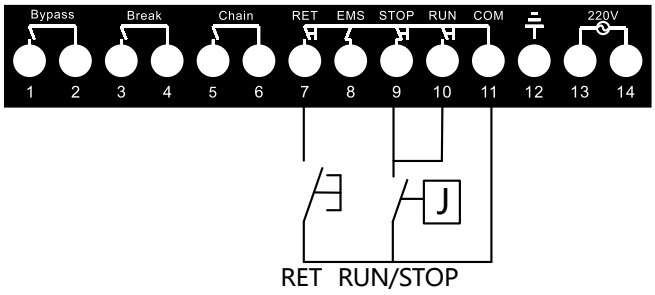


Schematic Diagram of CDRAK3 Series Three-wire Connection:

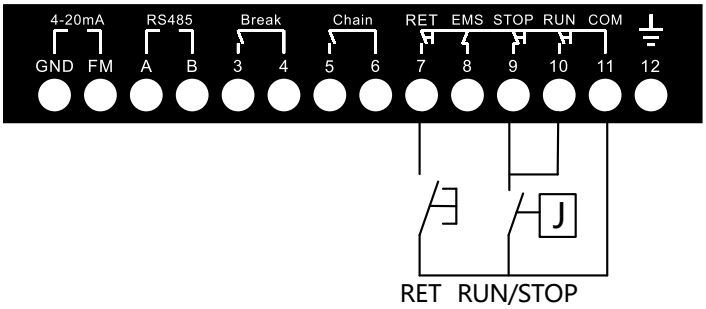


The following picture shows the two-wire connection method:

Schematic Diagram of CDRA Series Two-wire Connection:



Schematic Diagram of CDRAK3 Series Two-wire Connection:

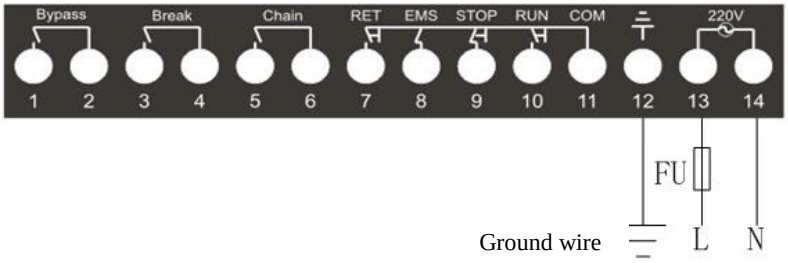


(7) Ground terminal 12

Please connect effective ground wire to this terminal and use multi-core cable.

(8) Control power terminal 13, 14 **(CDRAK3 не имеет этого терминала)**

Connect to external control power supply, AC 200v for supplying power to the control board.



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(9) Analog current output terminal FM, GND

Output the 4-20mA or 0-20mA current signals of reaction main circuit and output modes can be set via parameters.



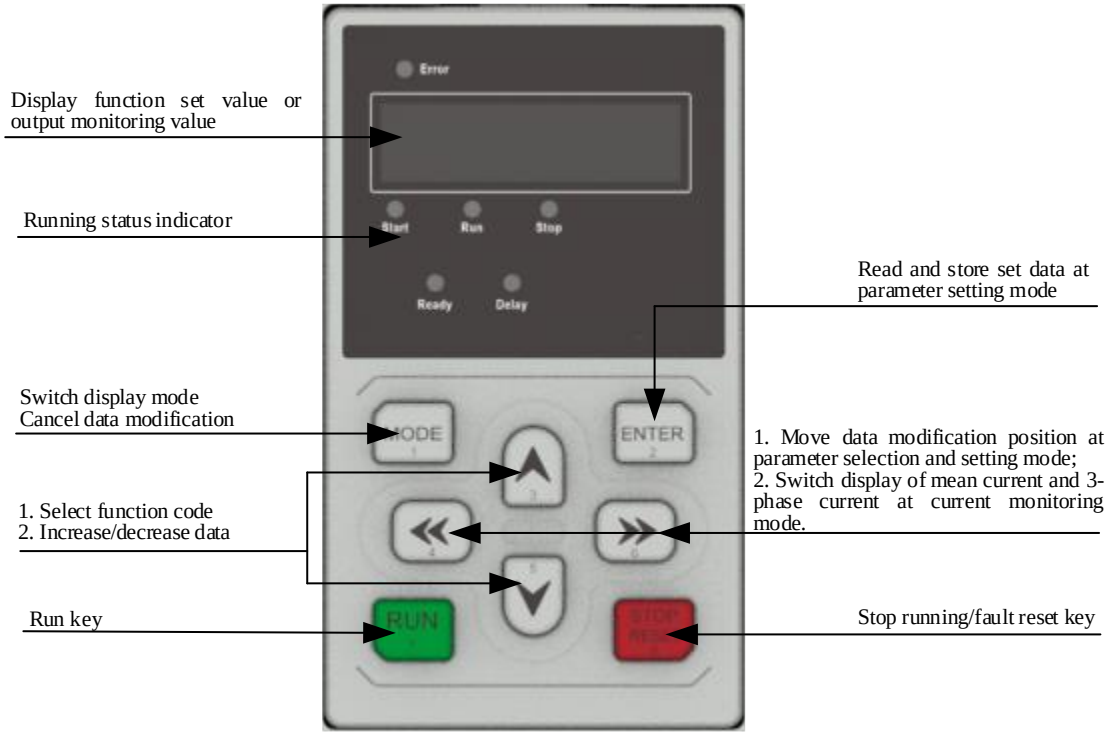
(10) RS485 communication terminal A, B

A: 485 positive signal; B: 485 negative signal

Chapter 4 Keyboard Operation and Running

4.1 Keyboard Operation

4.1.1 Keyboard Display, Button and Function Introduction



Functional introduction to indicator lamps:

No.	Name (English)	Name (Chinese)	Function Description
1	Error	故障	The lamp is on when the Product becomes faulty
2	Ready	准备	The Lamp is on when the Product is ready for start
3	Delay	延时	The lamp is on when the Product is under delay mode
4	Start	起动	The lamp is on when the Product is under startup status
5	Run	运行	The lamp is on when the Product is running
6	Stop	停止	The lamp is on when the Product is shut down

4.1.2 Display Method and Operation Method

1. Display contents

The Product's keyboard display has two modes: Monitoring mode and function code mode.

a) Display contents at monitoring mode:

“READY”: Ready for start;

“DELAY”: Delayed start;

“START”: In start process;

“RUN”: In bypass running;

“STOP”: In stop process;

“RESTA”:Terminal starting is ineffective (Terminal starting is shut down by the keyboard or communication, or when P035=1, the terminal starting is effective and then the soft starter is powered on, requiring a restart);

“ERR-X”: Fault display;

"Display mean current";

"Display Phase-A current"

"Display Phase-B current";

"Display Phase-C current"

b) Function code mode

“P0XX”: Function code No.;

“XXXX”: Parameter value of function code;

Monitoring mode and function code mode can be switched via "MODE" key.

2. Operation method at monitoring mode

a) Power on the Product normally, pass power-on self-test and nixie tube will show "READY" and indicator "Ready" is on, which means the Product is ready for start;

b) If wiring and phase sequence are correct and delay function is enabled, press "RUN" key and it will show "DELAY" and indicator "Delay" is on; if delay function is disabled or delay period is finished, it will show "START" and indicator "Start" is on; "START" will be displayed for about 1 s in startup process of the Product before it is automatically switched to display of mean current.

c) Once started, the Product will show "RUN" and indicator "Run" is on, which mean bypass is running. “RUN” will be displayed for about 1 s before it is automatically switched to display of mean current.

d) Press ">>" key to display the "Phase A current", "Phase B current" and "Phase C current" in turns.

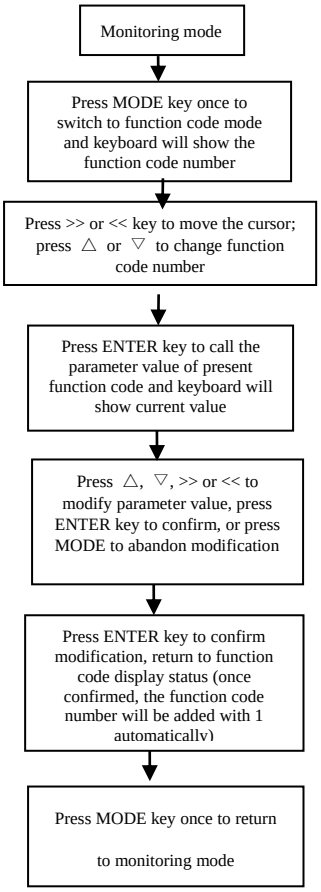
e) Press "STOP" key to display "STOP", indicator "Stop" is on and the Product will be stopped.

f) "Ready" will be displayed at the completion of stop process.

g) For any fault or alarm in execution process of the Product, it will show flickering “ERR-X”; X means fault code and indicator "Error" is on. Press "STOP" key or close "RET" terminal to reset the Product.

3. Operation method at function code mode

Press "MODE" key at monitoring mode to enter the function code mode. Firstly, it shows the function code No. "P0XX", press "ENTER" key to call the parameter value of present function code, press “>>” or “<<” key to move to the to-be-modified digit; press “△” or “▽” key to increase or decrease the value at the current digit. Once setting is done, save the parameters, press "ENTER" key; or press "MODE" key to abandon the setting.



For example: Modify stop time parameter P002 from 2s to 5s

1	READY	Display ready status, press MODE key to enter function code mode
2	P000	Display function code number P000 and press △ key twice
3	P002	Press ENTER key to call the parameter value of function code
4	02	Check if current parameter value is 02 and the point stays at the final data bit 2
5	05	Press △ key for third times, modify display value as 05 and then press ENTER key
6	P003	Save Data 05 and write it into P002, return to display of function code number, add 1 and display P003
7	P002	If MODE, instead of ENTER, is pressed in the 5th step, the keyword will return to function code display P002, data will be kept as 02 and data are not modified
8	READY	Press MODE key to return to monitoring mode

Note: Do not modify the parameters once parameter protection function is enabled in P029 (parameter protection).

4.2 Running

4.2.1 Trial Run

Do trial run to see if revolving direction and transmission of motor are normal

(1) Make sure all wires are connected reliably and phase of main electric wiring is correct;

(2) Power on and keyboard displays "READY";

(3) Adjust the Product's function parameters reasonably according to motor load at site, in order to reach the optimal starting torque of motor;

(4) Press RUN to start the Product, check if motor revolving direction is correct and if not, press STOP to stop it. For any rotation failure of motor, increase the starting voltage and torque.

4.2.2 Operation

(1) Adjust the Product's function parameters reasonably according to motor load at site, in order to reach the optimal starting torque of motor;

(2) Press RUN key on panel to start the Product. If motor is running stably and free from acceleration or sudden current change, the parameters are proper and press STOP key to stop it;

(3) For any fault in running, find out the fault as per Chapter 6;

(4) Stop time must be set as 0 if the Product is used for driving two motors.

(5) Once the Product is started, press “>>” to switch the display of "Mean current", "Phase A current", "Phase B current" and "Phase C current";

Chapter 5 Function Code Parameter

5.1 List of Function Codes

Function code number	Name	Setting range	Factory default	Description	Communication address
P000	Initial voltage	30%～80%	30	Valid for all modes	0000H
P001	Starting time	2～100S	12	Valid for all modes	0001H
P002	Parking time	0～50S	0	0: Free parking	0002H
P003	Starting mode	0: Voltage 1: Current limiting 2: Kickstart with current limiting (heavy load) 3: Torque ramp 4: Torque current limiting 5: Kickstart with torque current limiting	0	Select based on the motor load conditions	0003H
P004	Load type	0: No specified load 1: Centrifugal pump 2: Fan 3: Compressor (piston-type) 4: Compressor (centrifugal-type) 5: Conveyor 6: Mixer 7: Ball mill 8: Crusher 9: Water pump	0	Set this parameter based on the load conditions. Setting to 1-9 will batch configure other parameters. Refer to Appendix 1 for details.	0004H
P005	Control mode	0: Keyboard control 1: Terminal control 2: Keyboard control + Terminal control 3: Communication control 4: Keyboard control + Communication control 5: Terminal control + Communication control 6:All of three control modes are enabled 7:Locked running	4	Please select according to actual operating conditions. The validity of terminal start signal depends on P035 setting during power-up. For other cases, it is effective at rising edge (disconnected from COM -> connected to COM).	0005H
P006	Start and maintaining period	0～20.0S	0.0	Valid in all modes. In Heavy-duty mode, represents impulse voltage duration	0006H
P007	Intermediate voltage	P000～70%	50	Valid for all modes	0007H
P008	Intermediate time	0～P001-2	0	Valid for all modes	0008H
P009	Impulse voltage	50%～90%	50	Effective during kickstart phase in Heavy-duty mode	0009H
P010	Start delay	0～999.9S	0	Delay time between Run Signal activation and startup initiation	000AH
P011	Emergency stop control	0:Emergency stop control is invalid 1:Emergency stop control is valid	0	Set the validity of EMS terminal	000BH
P012	Fault relay control	0:Normally open 1:Normally closed	0	Set contact state	000CH
P013	Closing moment of multi-function relay	0:Running signal is effective 1:Start process 2:Bypass running 3:Stop process 4:Stop completes 5:Fault 6:Heavy-load start completes	2	Please configure this group of parameters appropriately in conjunction with external usage; When P013=5 or P014=5, the 5 status (Fault) takes priority during fault conditions; When P005 includes external control and P025 is greater than 0, the soft starter enables the heavy-load restart function, which resets the fault after a 6s delay. If the external start signal remains valid, the starter will respond to the start command and trigger 'Heavy-load start completes' after fault reset.	000DH
P014	Opening moment of multi-function relay		4		000EH

Function code number	Name	Setting range	Factory default	Description	Communication address
P015	Closing delay of multi-function relay	0.0～999.9S	0	0: No delay;	000FH
P016	Opening delay of multi-function relay	0.0～999.9S	0	0: No delay;	0010H
P017	Limiting current	150%～500%	300	P003=0 or P003=3, invalid	0011H
P018	Overload protection coefficient of soft starter	50%～200%	100	Overload coefficient adjustment	0012H
P019	Degree of unbalance	0～100%	50	0: Off,unbalance detection activates after three-phase current reaches at least 5 A.	0013H
P020	Analog output of full-scale value	20～5000A	Model type	Set the current value corresponding to the maximum analog output (20mA)	0014H
P021	Select analog quantity output	0：4～20mA 1：0～20mA	0	Current range selection for analog output	0015H
P022	Light-load control	0: Off 1: Alarm 2: Shutdown	0	Action mode of soft starter after light-load detection	0016H
P023	Light-load rate	10～100%	100	Light-load detection level	0017H
P024	Light-load detection delay	0.0～99.9S	0	Action delay after light-load detection	0018H
P025	Restart times supported	0～3	0	Number of restart times supported after fault shutdown	0019H
P026	Select baud rate	0：2400bps 1：4800bps 2：9600bps 3：19200bps 4：38400bps 5：57600bps	2	Set communication parameters	001AH
P027	Data format	0: ASCII N-8-1 (No parity) 1: ASCII E-8-1 (Even parity) 2: ASCII O-8-1 (Odd parity) 3: RTU N-8-1 (No parity) 4: RTU E-8-1 (Even parity) 5: RTU O-8-1 (Odd parity)	3	Set communication data format	001BH
P028	Machine No.	0～31	1	Set communication parameters	001CH
P029	Parameter writing protection	0: No protection 1: Protection enabled 2: Enable special write	0	Protects parameters from being modified	001DH
P030	Parameter initialization	0: No action 1: Restore factory settings 2: Clear fault records (P031-P034)	0	When P042 User Password is enabled, communication settings are restricted; the correct password must be entered first.	001EH
P031	Fault record 1			Most recent fault record	001FH
P032	Fault record 2				0020H
P033	Fault record 3				0021H
P034	Fault record 4				0022H
P035	Select power-on running	0: Respond to operation 1: No response during operation	1	P035=1: When powered on, it does not respond to the already valid terminal start command (displaying "RESTA"). After the current terminal start command is cancelled, it responds to the next terminal start command.	0023H
P036	Rated motor current	1～1100A	Model type	Default value corresponds to the soft starter's rated current	0024H
P037	Motor overload protection class	0: Off 1: Class 2 2: Class 10A 3: Class 10 4: Class 20 5: Class 30	3	A higher overload class value increases the triggering time for Err10 and Err14.	0025H
P038	Overload recovery time	0～65535s	300	Minimum recovery time after Err-2/Err10/Err14 activation. Faults cannot be reset during this period.	0026H
P039	Real-time temperature	-100℃～200℃		Real-time temperature of the heatsink	0027H

Function code number	Name	Setting range	Factory default	Description	Communication address
P040	Power-up duration	0～65535h		0: Disabled; Modifiable when P029=2. If P042 (User Password) is valid, read/write operations require entering the set password.	0028H
P041	Run time	0～65535h			0029H
P042	User Password	0～65535	0		002AH
P043	Power-on allowed time	0～65535h			002BH
P044	Operation allowed time	0～65535h			002CH
P045	FM target current 1	0～11.999mA	4.000	FM analog output calibration	002DH
P046	FM measured current 1	0～11.999mA	4.000	FM analog output calibration	002EH
P047	FM Target Current 2	12.000mA～24.000mA	16.000	FM analog output calibration	002FH
P048	FM measured current 2	12.000mA～24.000mA	16.000	FM analog output calibration	0030H
P049	Analog output bias	-100.0%～100.0%		FM analog output calibration	0031H
P050	Motor overload status	0～100.0%		Read-only motor overload status	0032H
P051	Soft starter overload status	0～100.0%		Read-only soft starter overload status	0033H
P052	Imbalance time	0.01～20.00s	0.50	If the current in each phase exceeds 10% of the P036 current value (minimum 5A),if the continuous 3-phase imbalance state persists for this duration, Err4 (3-phase imbalance) will be triggered.	0034H
P053	Bypass current	0～65535A	Model type	Default value: P036*200%. After starting is completed, bypass is switched when output current is ≤ this set value.	0035H
P054	Locked rotor current	100～750%	500	When the motor current > soft starter rated current, it is based on the soft starter rated current; otherwise, it is based on P036 the rated motor current.	0036H
P055	Locked rotor time	0.01～5.00s	0.10		0037H
P056	Real-time power supply frequency	0.1Hz		Read-only function code	0038H
P057	Soft starter rated voltage	220～690V	Model type		0039H
P058	Main circuit RS voltage	0～1100V		Read-only function code	003AH
P059	Main circuit TS voltage	0～1100V		Read-only function code	003BH
P060	Main circuit overvoltage coefficient	100～130%	120	Overvoltage value calculation based on P057	003CH
P061	Main circuit overvoltage time	0～10.00s	0	0: Off;	003DH
P062	Main circuit undervoltage coefficient	70～99%	80	Undervoltage value calculation based on P057	003EH
P063	Main circuit undervoltage time	0～10.00s	0	0: Off;	003FH
P064	Fan operation time after shutdown	0～600s	60	0: Fan runs continuously;	0040H
P065	Power supply phase sequence detection	0～2	0	0: No detection; 1: Forward sequence input; 2: Reverse sequence input; Triggers Err18 power phase sequence error when detected RST phase sequence conflicts with setting.	0041H
P066	Communication timeout duration	0～60.0s	0	0: Disabled; 0.1-60.0s: Triggers Err19 communication timeout when no data is received within this duration.	0042H
P067	Motorless test enable	0～1	0	0: Not active ; 1: Enable test (allowed when P029=2); For debugging only. UVW output operates as normal startup. Electrical safety precautions still apply. Invalid after re-powering.	0043H
P068	DI filter time	0～3.000s	0.010	Set DI terminal filter time	0044H
P069	DI status		0	Read-only function code, bit3: RUN, bit2: STOP, bit1: EMS, bit0: RET	0045H

Function code number	Name	Setting range	Factory default	Description	Communication address
P070	DO Status		0	Read-only function code, bit5: Fault relay, bit4: Multi-function relay, bit3: Pulse break, bit2: Pulse engage, bit1: Bypass, bit0: Fan	0046H
P071	Input Phase Difference Detection Configuration	0x0000～0xF011	0x5011	Err0 fault is reported upon abnormal phase difference; the following are configuration items: Units Digit: Start/Stop Detection Enable Tens Digit: Bypass Detection Enable 0: Disabled; 1: Enabled; Thousands Digit: Detection Sensitivity 0x0～0xF: Higher values indicate increased sensitivity.	0047H
P072	Input Phase Loss Detection Time	0.040 to 10.000 seconds	1.000	Associated with Err0 and Err16 detection.	0048H
P073	Output phase loss detection time	0.040 to 10.000 seconds	1.100	Associated with Err17 detection.	0049H
P074	Overheat protection temperature	65℃～85℃	85	When P039 is greater than or equal to the set value, Err1 overheat fault is triggered.	004AH
P075	Fan control mode	0: Follow the output operation 1: Temperature control	0	0: Operates synchronously with the output; runtime after shutdown is determined by P064. 1: Temperature-controlled operation; minimum operating temperature determined by P076.	004BH
P076	Fan start temperature	10℃～50℃	35	Valid when P075 equals 1; the fan starts when P039 is greater than or equal to P076 and stops when P039 is less than or equal to (P076 minus 5 ℃). Excessively high settings may result in Err1 overheat fault.	004CH

5.2 Introduction to Function Code

5.2.1 P000: Initial Voltage

P001: Starting time

As the start control parameters under voltage mode, the initial voltage can be increase to overcome the static friction force at startup; the start time will be longer if load inertia is increased.

When started, the Product will increase its output voltage gradually from the initial voltage by start time; when rated voltage is reached, the bypass contact will be closed to finish the start process. In which, the start time is the time parameter baseline for the Product's output voltage rise, in order to control the output voltage, accelerate the motor stably to finish the start process. So, the start time is lower than the set value in case of light load and it is normal phenomenon only if the Product can be started normally.

5.2.2 P002: Stop Time

The Product can stop freely if soft stop time and stop time is 0.

Under mode of soft stop, the motor's power supply will be switched by bypass contactor to the thyristor output of the Product; the Product's output voltage will be reduced slowly from full voltage, in order to reduce the motor's revolving speed stably, avoid mechanical vibration; however, the system may become unstable if stop time is too long.

Upon receiving the stop command under free stop mode, the Product will cut off the bypass contactor immediately and prohibit the voltage output of the Product's thyristor and the motor will be stopped gradually due to the load inertia. Set free stop mode if n wirings are driven by the Product, in order to avoid open phase during output switching.

5.2.3 P003: Start Mode

0: Voltage mode

1: Current limiting mode

2: Jump and current limiting (heavy load) mode

3: Torque slope mode

4: Torque current limiting mode

5: Jump and current limiting mode

Jump: A high impact torque is applied at startup and lasts for a certain period before start. It mainly applies to the loads with high inertia.

Torque mode: The output voltage is controlled according to the law of linear increase of motor start torque. Merit: Smooth and flexible start; favorable for driving system; reduce the impacts on power grid. Demerit: Long startup period. In theory, the starting current at torque mode is relatively lower.

Voltage start mode: Please refer to the introduction to start parameters at voltage mode in 5.2.1. Voltage mode applies to the scenarios with low requirements for starting current but high requirements for start stability

Current-limiting start mode: Please refer to the introduction to current-limiting parameters of 5.2.13. Current-limiting mode applies to the scenarios with limitation on starting current.

Jump and current limiting (heavy load) mode: Current is limited not during sudden tripping but after sudden tripping.

Torque slope mode: Current is not limited when started at torque mode.

Torque current limiting mode: Current is limited when started at torque mode.

Jump torque current limiting mode: Current is limited not during sudden tripping but after sudden tripping.

5.2.4 P004: Load Type

Set this parameter properly depending on the load. Adjust the startup parameters properly if startup effects are not ideal.

5.2.5 P005: Control Mode

0: Keyboard: Start/stop is solely controlled by RUN and STOP key on panel

1: External control: Startup is solely supported by RUN/STOP/COM two-wire or three-wire startup mode of terminal

2: Keyboard + external control (applicable to 3-wire control mode)

Both of keyboard and external control are available for operation. However, the external control terminal STOP-COM must be connected when started via keyboard

3: PC: Operation is controlled and monitored via busbar

4: Jointly controlled by keyboard + PC keyboard and busbar

5: Jointly controlled by external control + PC terminal RUN, STOP and busbar terminal

6: Jointly controlled by keyboard + external control + PC keyboard, external control terminal and busbar

7: Locked running: Neither of keyboard, external control and PC is enabled

Remark: If external control is included in combined control mode, the 3-wire control mode should be adopted as external control

5.2.6 P006: Start Maintaining Period

This parameter is regarded as maintaining period of original voltage under current and current limiting mode, or regarded as lasting period of impulse voltage under heavy-load mode.

5.2.7 P007: Intermediate Voltage

P008: Intermediate time

Valid in all modes;

Intermediate voltage: The proportion of a motor's rated voltage;

Intermediate time: The period from initial voltage to the intermediate voltage.

5.2.8 P009: Impulse Voltage

Valid under heavy-load mode: To overcome the static friction force at startup under heavy load and be used together with P006.

5.2.9 P010: Start Delay

Set the delay time from enabling of start signal to the start of the Product.

5.2.10 P011: Emergency Stop Control

Enable or disable the emergency stop function of external control to enter EMS function

0: Emergency stop control is disabled;

1: Emergency stop control is enabled.

5.2.11 P012: Control over Faulty Relay

User may set output of faulty relay as normally open (0) or normally closed (1) as required.

5.2.12 P013: Closing moment of multi-function relay

P014: Disconnection moment of multi-function relay

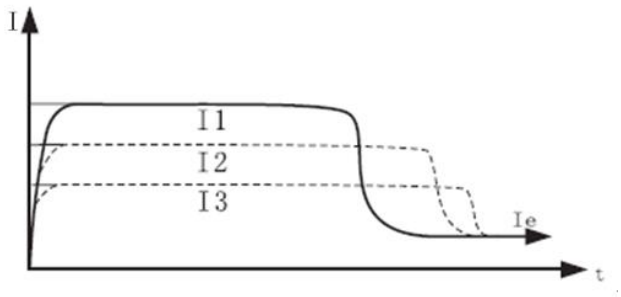
P015: Closing delay of multi-function relay

P016: Disconnection delay of multi-function relay

Disconnection/closing moment and action delay of multi-function relay can be set flexibly by user as required.

5.2.13 P017: Current Limiting Current

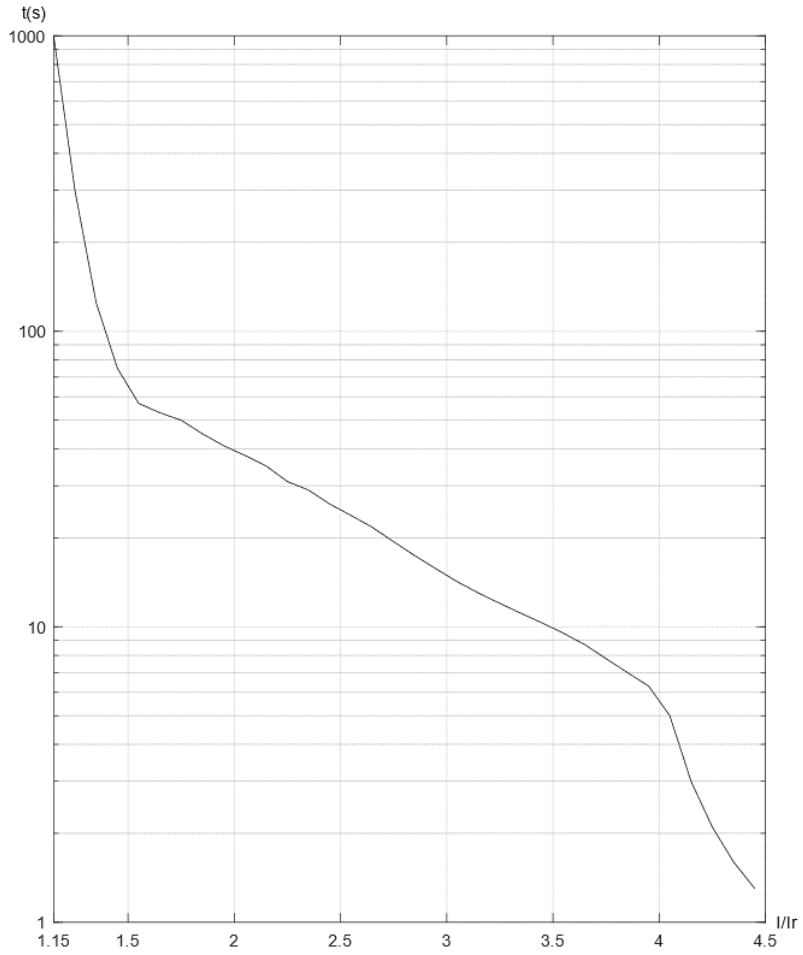
Set the current limit under current-limiting start mode; increase output voltage at the start of motor until motor current reaches the set value, and keep the starting current value not higher than the this value. Once bypass contactor is connected, the output current will be reduced to be lower than the rated current. The start period will be shortened along with the increase of this set value.



5.2.14 P018: Overload protection coefficient of soft starter

In the bypass operation stage, soft starter overload protection works, and corresponds to Err-2. The curve map of soft starter overload is shown below (P018=100%). Ir is the rated current of soft starter. Overload calculation: current I = three-phase average current Id×100%/P018. When I >= 450%×Ir, the overload time reaches minimum, 1.3s.

When the motor power is < the soft starter power, P018 should be set to motor rated current / soft starter rated current ×100%, to provide effective overload protection.



Characteristic curve of overload protection inverse time

5.2.15 P019: Degree of Unbalance

0: Unbalance protection is disabled;

1%~100%: Threshold for unbalance protection;

When all three-phase currents reach P036 rated motor current* 1 0% (if less than 5A, it is considered as 5A), degree of unbalance detection begins. If the actual detected current degree of unbalance exceeds this set value and persists for the duration of P052 unbalance time, the soft starter protection is activated.

Definition of unbalance K: K=Is / Id *100%

Is: The maximum value of | Ia-Ib |, | Ia-Ic | and | Ib-Ic |; Id: The mean value of 3-phase current Ia, Ib and Ic.

5.2.16 P020: Full-scale Value of Analog Output

P021: Select analog output

Port FM-GND means output of analog quantity with output range of P021=0: 4~20mA, P021=1: 0~20mA. The analog output current is in linear relationship with the actual output current of the Product. The Product's output current corresponding to analog output 20mA is determined by P020.

5.2.17 P022: Light Load Control

P023: Light load rate

Light load control applies to detection of belt tripping accidents.

P022=0: Disable light load detection function;

1: When it is lower than the set light load rate (P023), give out alarm through fault relay only;

2: When it is lower than the set value, stop the starter; meanwhile, the fault relay will act.

Definition of P023 light-load rate Ks: Ks=Is / Ie *100% (Ie is the rated current of motor; Is: Mean value of 3-phase current)

5.2.18 P024: Light Load Detection Delay

Once light-load fault is detected, the Product will give out alarm or be stopped according to set method of P022 after a delay period of P024.

5.2.19 P025: Restart Times

This function code is valid under external control mode only.

Once P025 is set as other parameters other than 0, the Product, if stops due to a fault, will be reset and enter running after a delay of 6 s and times of available restart is reduced by 1. If the times of available start are reduced to 0, the Product can be reset manually only.

If this parameter is set as 0, the Product needs to be reset manually before restart.

5.2.20 P026: Select Baud Rate

P027: Data format

P028: Machine No.

Set communication parameters.

See Appendix 1 for communication protocol.

5.2.21 P029: Parameter Protection

Once function code P029 is set as 1, the remaining parameters are unmodifiable to prevent the Product's parameters from being changed by other personnel other than debugging staffs. This value should be set as 0 before user is allowed to modify the parameter.

5.2.22 P030: Parameter Initialization

0: No action

The Product is under normal parameter reading/writing status.

1: Recover default setting

After setting to 1 and confirming, the Soft Starter will restore all parameter values of the functional codes in group P to their factory default settings. In this process, the keyboard displays "——————".

5.2.23 Select P035 Power-on and Running

0: Make response and run.

1: Make no response to running. The running command must be removed and enabled again before running.

5.2.24 Rated current of P036 motor

The default setting is the rated current of soft starter. User can make change from the default to the rated current of actual motor.

5.2.25. P037:Motor overload protection class

When P037=0, the soft starter does not have overload protection for the motor, and user is advised to heat the relay between the soft starter and the motor. When P037=1-5, overload protection works. The higher the overload protection class, the longer the time of reporting Err10 and Err14. For Err10 or Err14, the current multiple is calculated through three-phase average current divided by motor rated current.

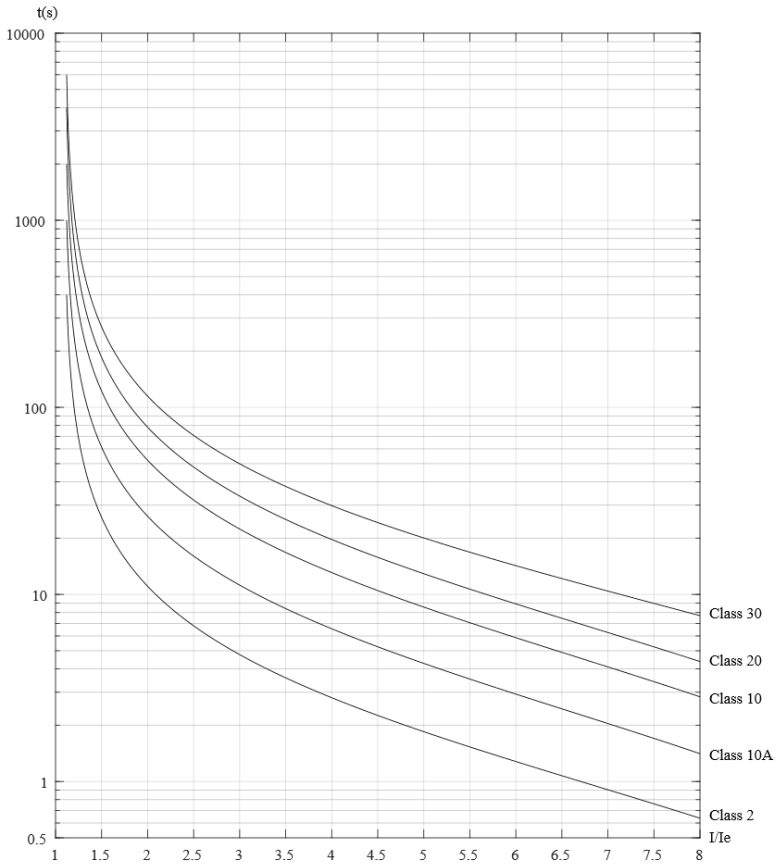
For Err14, overload protection works during start and during stop. Below are some typical values of protection time at all overload classes (in seconds):

Actual current	150%	200%	250%	300%	350%	400%	450%	500%
1: Class 2	282	157	100	69	51	39	31	25
2: Class 10A	282	157	100	69	51	39	31	25
3: Class 10	282	157	100	69	51	39	31	25
4: Class 20	341	189	120	83	61	47	37	30
5: Class 30	452	252	160	111	81	62	49	40

For Err10, the motor is overloaded. Protection works at bypass running. Below are some typical values of protection time at all overload classes (in seconds):

Actual current	150%	200%	250%	300%	350%	400%	450%	500%
1: Class 2	26	11	7	5	4	3	2	2
2: Class 10A	61	26	16	11	8	7	5	4
3: Class 10	122	52	32	22	17	13	10	9
4: Class 20	185	78	48	34	25	20	16	13
5: Class 30	269	115	71	50	38	30	24	20

For Err10, the motor is overloaded. Below is the protection curve at all classes (in seconds):



5.2.26. P038: Overload recovery time

Within the minimum recovery time after Err-2, Err10, and Err14 are triggered, the fault cannot be reset. When P038=0, the function is off.

5.2.27. P039: Real-time temperature

Display the real-time temperature and read-only function code of the cooler.

5.2.28. P045: FM target current 1

P046: FM measured current 1

P047: FM target current 2

P048: FM measured current 2

P049: Analog output bias

These are used for FM analog output calibration, which is demonstrated as follows:

(1) Set P045 and P046 to 4.000 mA as well as P047 and P048 to 16.000 mA.

(2) Under a setting P049 = 80.0%, test the FM output and record the current value 1.

(3) Under a setting P049 = 20.0%, test the FM output and record the current value 2.

(4) Set P048 to the current value 1 (accurate to 0.001 mA).

(5) Set P046 to the current value 2 (accurate to 0.001 mA).

(6) Power on the soft starter again. At this point, calibration is finished.

5.2.29. P050: Motor overload status

P051: Soft starter overload status

Display the real-time overload status of motor and the overload status of soft starter, as well as read-only function codes.

5.2.30. P054: Stall current

P055: Stall time

When P036 rated motor current exceeds the Soft Starter Rated Current, the stall current is based on the Soft Starter Rated Current; otherwise, it is based on the P036 rated motor current. If the current in any phase reaches the stall current value and persists for the duration set by P0 55, Err6 overcurrent (stall) will be triggered. If the instantaneous current of any phase reaches 10 times the Soft Starter Rated Current, Err6 overcurrent (stall) will be triggered immediately, and the fault will be maintained for 20 seconds.

5.2.31. P057: Soft Starter Rated Voltage

P058: Main Circuit RS Voltage

P059: Main Circuit TS Voltage

P060: Main Circuit Overvoltage Coefficient

P061: Main Circuit Overvoltage Duration

P062: Main Circuit Undervoltage Coefficient

P063: Main Circuit Undervoltage Duration

When P061 is not zero, overvoltage detection is enabled. The overvoltage threshold is calculated as P057 multiplied by P060. If the voltage value of P058 or P059 exceeds this threshold continuously for the duration set by P061, Err15 power supply overvoltage will be triggered.

When P06 3 is not zero, undervoltage detection is activated. The undervoltage threshold is equal to P057 multiplied by P06 2. If the voltage value of P058 or P059 remains below the undervoltage threshold for the duration set by P06 3, Err1 3 power undervoltage fault will be triggered.

When P030=1 to restore factory default settings, P057 will be reset to the rated voltage of the device model.

5.2.32. P065: Power Phase Sequence Detection

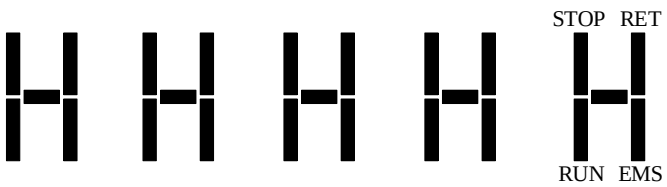
When P065 is not zero, power phase sequence detection is enabled. After startup, if the detected input RST phase sequence does not match the configured setting, Err18 power phase sequence error will be triggered. Positive sequence input refers to the RST phase sequence relationship where R leads S, S leads T, with a phase difference of 120°. Reverse sequence input indicates the RST phase sequence as R leading T, T leading S, with a phase difference of 120°.

5.2.33. P067: Motor test disabled

When motor test is disabled, detection of Err0 Open phase input, Err16 abnormal power frequency, and Err17 Open phase output is invalid. This mode is for debugging purposes only. UVW output operates as in normal start mode. Electrical safety precautions must still be observed. The function is disabled after power cycling.

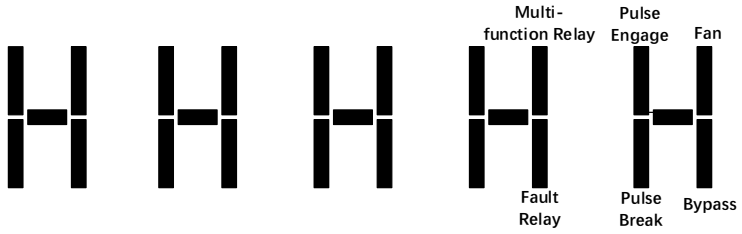
5.2.34. P069: DI status

The DI status relationship is shown in the following diagram:



5.2.35. P070: DO status

The DO status relationship is shown in the following diagram:



5.2.36. PASS: Manufacturer password

Display the special function code for manufacturer when the manufacturer password is entered.

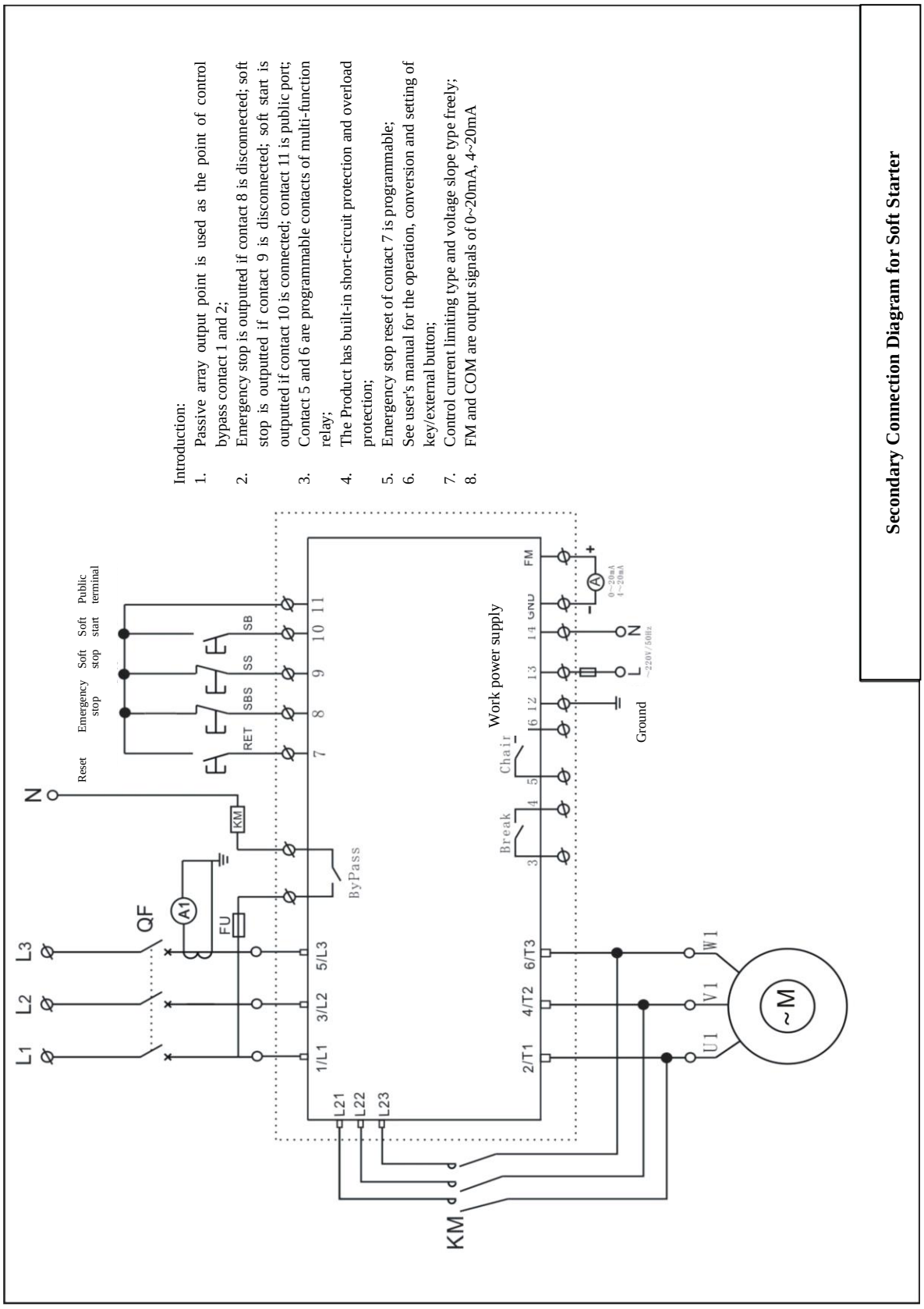
Chapter 6 Troubleshooting

With complete protection functions, the Product will shut down and display the fault codes if meeting any fault, and it will not be restarted (auto start is supported if restart function is enabled) unless the fault status is relieved via STOP key or external control RET.

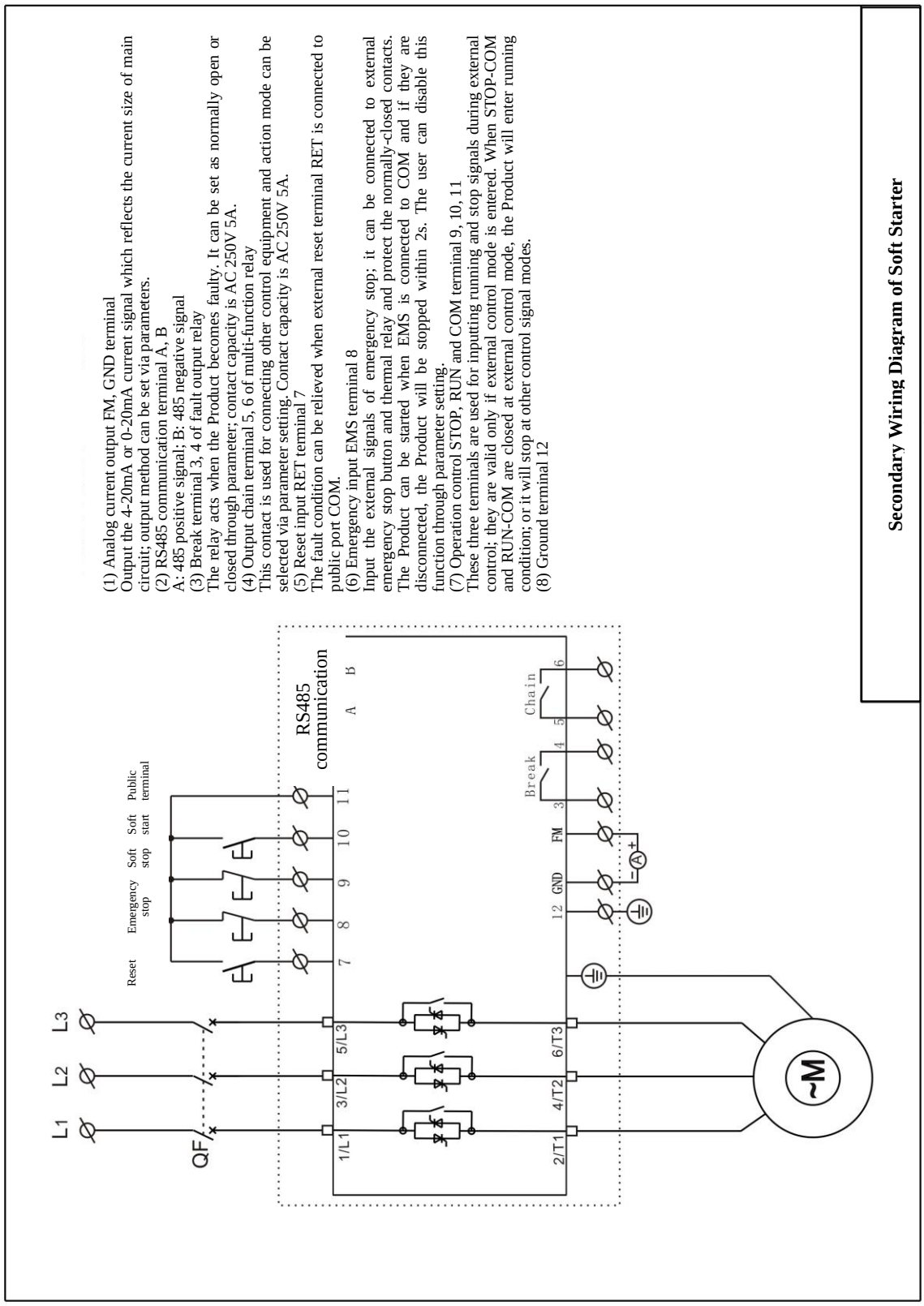
Fault Display	Fault Introduction	Cause and Troubleshooting
Err-0	Phase loss of input	Check if incoming wire power supply and SCR are damaged
Err-1	Overheat	Start is frequent or start period is too long
Err-2	Soft starter overload	Change the overload protection coefficient or reduce the load
Err-3	Light load	Load is light, set P022 as 0 Accidents occur, such as belt tripping; please check the device.
Err-4	3-phase imbalance	Check the load and whether wiring is loose
Err-5	Emergency stop	Emergency stop terminal EMS has open circuit to COM; please check the test device If this terminal is unused, please set P011 as 0
Err-6	Overcurrent (blockage)	Overcurrent occurs at startup, reduce the initial voltage or change it as current-limiting mode Overcurrent occurs in running; reduce the load
Err-7	Control board is faulty	Current sampling circuit is faulty
Err-8	Start period is too long	Parameter is improper or load is too heavy
Err-9	Parameter reading and writing errors	Repeat operations. Start the motor again or recover settings to the default.
Err10	Motor overload running	Overload protection parameters are not reasonable, or the duty is too heavy. Before the recovery time under P038 comes to an end, the fault cannot be reset.
Err11	Power-on time has been reached	The set time in P043 has been reached; reconfigure appropriate parameters;
Err12	Running time has been reached	The set time in P044 has been reached; reconfigure appropriate parameters;
Err13	Undervoltage power supply	Check the input RST power supply; verify if P057, P062, and P063 are set correctly;
Err14	Overload during start and during stop	Starter parameters are not reasonable, or the duty is too heavy. Before the recovery time under P038 comes to an end, the fault cannot be reset.
Err15	Power overvoltage	Check RST input power supply; Verify the settings of P057, P060, and P061;

Fault Display	Fault Introduction	Cause and Troubleshooting
Err16	Abnormal power frequency	Check RST input power supply;
Err17	Output phase loss	Verify motor connection reliability;
Err18	Power phase sequence error	Check P065 configuration; Inspect RST input power phase sequence;
Err19	Communicatio n timeout	Verify P066 settings; Check communication line connections; Ensure main station operates normally;
Err20	Deceleration Abnormality	Improper parameter settings; please consult technical support;
d.Err	Parameter error	Set P029 as 0, restart or recover to the default value

Secondary Connection Diagram for CDRA Series Soft Starter



Secondary Wiring Diagram for CDRAK3 Series Soft Starter



Attached Table 1

Application scenarios

P004 Load type	P000 Initial voltage	P001 Starting time	P002 Parking time	P003 Starting mode	P006 Start and maintaining period	P007 Intermediate voltage	P008 Intermediate time	P009 Impulse voltage	P017 Limiting current
1: Centrifugal pump	30	5	0	1	0	30	0	50	250
2: Fan	30	30	0	2	2	30	0	50	400
3: Compressor (Piston type)	30	10	0	1	0	30	0	50	300
4: Compressor (Centrifugal type)	30	20	0	0	0	30	0	50	250
5: Conveyor	30	10	0	1	0	30	0	50	250
6: Mixer	30	5	0	2	2	30	0	50	350
7: Ball mill	30	12	0	2	2	30	0	70	400
8: Crusher	50	25	0	0	0	50	0	50	350
9: Water pump	30	18	5	1	0	30	0	50	350

Appendix 1: MODBUS Communication Protocol

The CDRA series soft starter is equipped with RS-485 communication interfaces

1. Definition of MODBUS communication code:

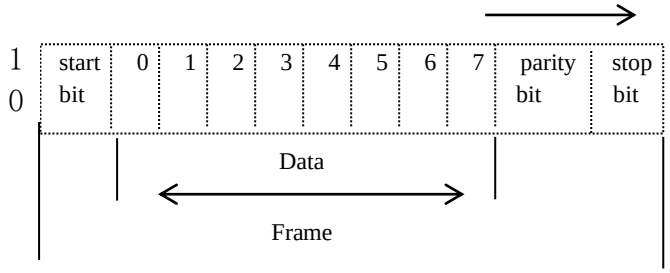
ASCII mode: 8-Bit data consist of two ASCII character sets; for example, one 1-Bit data 64H (hexadecimal) are expressed by ASCII“64”, including 6 (36H) and 4 “34H”.

Character Symbol	0	1	2	3	4	5	6	7
ASCII Code	30H	31H	32H	33H	34H	35H	36H	37H
Character Symbol	8	9	A	B	C	D	E	F
ASCII Code	38H	39H	41H	42H	43H	44H	45H	46H

2. On basis of asynchronous transmission, the data can be sent by one host and received by multiple slaves (soft starter). Information cannot be sent by slave unless otherwise a request from host is received.

3. Baud rate: Be set via function code P026; the default baud rate is 9600bps.

4. Format of digital element



1-bit start bit

8-bit data bit

Odd-even check: Determined by function code

1-bit stop bit

Format of standard MODBUS ASCII communication:

STX “:” (3AH)	A	K	DATA $_{(n-1)}$ …DATA$_0$	LRC	END CR (0DH) LF (0AH)

1) STX: Start unit ":" 3ah

2) A: Address of slave (soft starter).

3) K: Function of data packet.

03H: Read the contents from one or more registers.

06H: Write data to one register.

4) DATA $_{(n-1)}$…DATA$_0$: Data contents

5) LRC: LRC detection error value: Calculate the contents from A to the final data, divide the results with 256, remove the excessive parts (for example: Take 5AH if result is 15AH) and then calculate the results after secondary supplementation as the LRC detection error value.

6) END: END character is “CR”0DH, “LF”0AH

Format of standard MODBUS RTU communication:

STX	A	K	DATA $_{(n-1)}$ …DATA$_0$	CRC	END

1) STX: Start unit, the static period over 10MS.

2) A: Address of slave (soft starter).

3) K: Function of data packet.

03H: Read the contents from one or more registers.

06H: Write data to one register.

4) $DATA_{(n-1)}…DATA_0$: Data contents

5) CRC: CRC detection error value:

16-bit detection error value consists of 2 8-bit characters

6) END: Static period over 10ms

5. Correction Method:

ASCII mode:

LRC (Longitudinal Redundancy Check) detection error value is adopted in ASCII mode. LRC: LRC detection error value: Calculate the contents from A to the final data, divide the results with 256, remove the excessive parts and then calculate the results after secondary supplementation as the LRC detection error value.

Calculation method of LRC calibration:

Start Bit	3AH
Address of Soft Starter	30H
	31H
CMD	30H
	36H
Data Address	30H
	30H
	31H
	32H
Data Content	30H
	30H
	36H
	45H
LRC Calibration	37H
	39H
End Character	0DH
	0AH

LRC calibration of this case:

Secondary supplementation of 01H+06H+00H+12H+00H+6EH=82H is **79H**

RTU mode:

CRC calculation method

1. Preset one 16-bit register as hexadecimal FFFF (all of them is 1); this register is called CRC register;
2. Apply exclusive OR to the lower 8 bits of one 8-bit binary data (the first byte of communication frame) and 16-bit CRC register and put the result into CRC register;
3. Move the contents of CRC register to the right for 1 bit (lower bit) and fill the highest bit with 0; inspect the shift-out bit after rightward movement;
4. If shift-out bit is 0: Repeat the Step 3 (move it to the right bit again);

If shift-out bit is 1: Apply exclusive OR to the CRC register and polynomial A001 (1010 0000 0000 0001);

5. Repeat Step 3 and 4 until it is shifted to the right for 8 times; so, all of 8-bit data are handled;
6. Repeat Step 2 to 5 and handle the next byte of communication information frame;

7. Calculate all bytes of communication information frame according to steps above and exchange the high and low bytes of 16-bit CRC register;

Definition of parameter address of standard MODBUS communication protocol:

Definition	Parameter Address	Functional Description	
Pxxx Function Code	00nnH	Nn represents hexadecimal function code numbering, e.g., P020 is represented by 14H	
Drive Commands (Read invalid)	2000H	Bit0～Bit1	01B: Stop
			10B: Start
		Bit2～Bit15	Reserved
	2001H	Bit0～Bit15	Reserved
	2002H	Bit0	Reserved
		Bit1	1B：Reset
		Bit2～Bit15	Reserved
Drive Status Monitoring	2100H	Bit0～Bit1	01B: Ready State 10B: Normal Operation State
		Bit2	Err0 Input open phase
		Bit3	Err1 Heatsink overheat
		Bit4	Err2 Driver overload
		Bit5	Err3 Load loss
		Bit6	Err4 3-phase imbalance
		Bit7	Err5 Emergency stop EMS
		Bit8	Err6 Overcurrent (locked rotor)
		Bit9	Err7 Current detection failure
		Bit10	Err8 Start timeout
		Bit11	Err9 EEPROM read/write fault
		Bit12	Err10 Motor running overload
		Bit13	Err11 Power-on time reached
		Bit14	Err12 Operation time reached
		Bit15	Err13 Undervoltage
	2101H	Bit0～Bit15	Average current display (1A)
	2102H	Bit0	Err14 Overload during start and stop processes
		Bit1	Err15 Power Overvoltage
		Bit2	Err16 Power Frequency Abnormal
		Bit3	Err17 Output Phase Loss
		Bit4	Err18 Power Phase Sequence Error
		Bit5	Err19 Communication Timeout
		Bit6	Err20 Deceleration Fault
		Bit7～Bit15	Reserved
	2103H	Bit0～Bit15	Operation Status 1: Standby 2: Self-Test 3: Start Delay 4: Starting Process 5: Bypass 6: Decelerating 7: Fault
	2104H	Bit0～Bit15	Phase A Current Display (1A)
	2105H	Bit0～Bit15	Phase B Current Display (1A)
	2106H	Bit0～Bit15	Phase C Current Display (1A)
	2107H	Bit0 ~ Bit15	Real-Time Fault Code 0: No Fault 1: Err0 Input Phase Loss ...and so on

Introduction to parameter function:

CMD: Function command

03H: Read the contents of one register

For example: Read current-limiting current P017

Command information:

RTU mode:

Address of Soft Starter	01H
CMD	03H
Data Address	00H
	11H

Data Number	00H
	01H
CRC Calibration	D4H
	0FH

Response:

Address of Soft Starter	01H
CMD	03H
Data Number	02H
Data Contents	00H
	FAH
CRC Calibration	38H
	07H

ASCII mode:

Start Bit	3AH
Address of Soft Starter	30H
	31H
CMD	30H
	33H
Data Address	30H
	30H
	31H
	31H
Data Number	30H
	30H
	30H
	31H
LRC Calibration	45H
	41H
Ending Character	0DH
	0AH

Response:

Start Bit	3AH
Address of Soft Starter	30H
	31H
CMD	30H
	33H
Data Number	30H
	32H

Data Contents	30H
	30H
	46H
	41H
LRC Calibration	30H
	30H
Ending Character	0DH
	0AH

06H: Write one character

For example: Write motor overload protection parameter P018

Command information:

RTU mode:

Address of Soft Starter	01H
CMD	06H
Data Address	00H
	12H
Data Contents	00H
	6EH
CRC Calibration	A8H
	23H

Response:

Address of Soft Starter	01H
CMD	06H
Data Address	00H
	12H
Data Contents	00H
	6EH
CRC Calibration	A8H
	23H

ASCII mode:

Start Bit	3AH
Address of Soft Starter	30H
	31H
CMD	30H
	36H
Data Address	30H
	30H
	31H
	32H
Data Contents	30H
	30H
	36H
	45H
LRC Calibration	37H
	39H
Ending Character	0DH

	0AH

Response:

Start Bit	3AH
Address of Soft Starter	30H
	31H
CMD	30H
	36H
Data Address	30H
	30H
	31H
	32H
Data Contents	30H
	30H
	36H
	45H
LRC Calibration	37H
	39H
Ending Character	0DH
	0AH