KPM60 Low voltage motor protection controller Instructions V1.7

compere

Danger and Warning

The device may only be installed by professionals.
Caused any malfunction due to not follow the instructions in this manual, Manufacturers will not bear any responsibility.

Electric shock, burning and explosion

- Devices can only be qualified by the staff to install and maintain.
- Before any operation on the Devices, should be isolated from the voltage input and power supply, and the secondary windings of all current transformers are Short circuit.
- Verify that the device is live before operation.
- All mechanical parts and covers should be restored in place before the device is energized.
- Device in use should provide the correct voltage.

Do not pay attention to these precautions may cause serious injury.

1. Summary

KPM60 series low voltage motor protection controller is suitable for the application of three-phase asynchronous motor with rated voltage of 380V to 660V. and rated current of 800A. It can realize the functions of protection, control, measurement and fault management of the motor, greatly simplifying the secondary control protection circuit of the motor, providing perfect protection and control measures, and implementing the network camp of the motor based on various presidential communication methods. In this case, the application of the controller greatly improves the design and production efficiency, and reduces the workload of on-site commissioning and maintenance.
This product adopts modular structure design, small size, compact structure and convenient installation. It can be directly installed and used in low-voltage control terminal cabinet and 1/2 module and above drawers. It is suitable for coal mine, petrochemical, smelting, electric power, etc.

2.Features

♦ KPM65's auxiliary power supply supports 85~264VAC, 100~370VDC
♦ 8-channel programmable input DI with optical isolation, passive dry node access
♦ 4 -way relay isolation outputs are used to control the protection motor and output warning signs
♦ A variety of detection features. Measuring three-phase current, three-phase voltage, frequency, power factor, and electrical energy, can be viewed through the KPM60's own LCD screen or remotely via the communication interface
♦ Complete motor protection: Basic protection includes protection from start-up, overload, stall, phase failure, current balance, grounding, underload, blocking, etc. Protection functions can also be selected as needed (leakage protection, temperature protection, overvoltage protection, undervoltage protection, underpower protection, power factor protection, phase sequence protection, etc.)
♦ Supports a variety of motor control modes: protection mode, direct start, two-way reversible start, star / triangle start, self-turning transformer start, resistance barrier start
♦ The protection setting parameters can be set by the professional according to the actual parameters of the field motor, and the power failure is not lost
♦ Record 10 recent fault information, time information, fault site electrical parameters
♦ Friendly human-machine interface, Chinese / English LCD display

3.Technical Parameters

3.1 Symbol comparison table

Symbol	Implication	Symbol	Implication
Ie	Motor rated current	Uab, Ubc, Uca	Three phase line voltage
Ue	Rated line voltage of the motor	P	Active power
Pe	Rated power	Q	Reactive power
Ise	Rated leakage current	F	Frequency
Ia, Ib, Ic	A、B,C Phase current	PF	Power factor
Ig	Ground current	Ep	Active energy
Is	Leakage current	Eq	Rective energy
I1	Positive sequence current	I2	Negative sequence current
S	Apparent power		

3.2 Technical indicators

Parameter	Indicator
Rated input voltage	380V, 660V
Rated input current	5A, 32A, 100A, 250A, 400A
Overload coefficient	Voltage: 1.5 times, current 10 times
Temperature measurement	0° C~ 200 ° C(Optional)
measurement accuracy	Voltage/Current: 1%, electrical energy: 2%
Relay output	4-way relay isolated output, contact capacity 5A/ 250VAC, 5A/30VDC
Auxiliary power	85-264VAC, 100- 370V DC
Communication port	Rective energy
Analog transmission	Negative sequence current
Working environment	Operating temperature:-25 ° C~ 70 ° C, Storage temperature: -30 ° C ~75 ° C
Safety	Withstand voltage: power frequency withstand voltage 2kV, insulation: greater than 100 MΩ
Electromagnetic Compatibility	Surge (impact) immunity test (IEC61000-4-2), level 3 Electrical fast transient burst immunity test (IEC61000-4-5), level 3 Electrostatic discharge immunity test (IEC61000-4-4), level 3 Oscillatory wave anti-interference test (IEC61000-4-8)level 3
Reference Standard	General technical conditions for digital motor integrated protection devices JB/T10613-2006 AC motor protector JB/T10736-2007 General rules for low-voltage switchgear and control equipment GB14048.1 Low voltage electromechanical contactors and motor starters GB14048.4 Control circuit electrical and switching components electromechanical control circuit electrical appliances GB14048.5 Basic test method for relay protection and safety automatic devices GB/T7261-

4.Product model

KPM60 -□-□-□-□

- Auxiliary function: A- Analog output
  R- Undervoltage restart function (requires optional anti-shake module and voltage protection function)
- Additional function: V- Voltage protection
  T-Temperature protection
  L-leakage protection (requires optional leakage transformer)
  TE- TE protection
- Communication protocol: C-Modbus-RTU
  P- Profibus-DP
- Rated Current:5A, 32A, 100A, 250A, 500A
- Design Number
- Compere's meter

Selection instructions:

♦Each KPM60 requires at least one host and one current transformer. The host has its own LCD screen and 5 buttons, which can display the on-site power grid parameters, modify the protection settings, modify the system parameters, and query the fault records. It is also possible to control the starting, stopping and resetting of the motor as needed.
♦Use the appropriate range of transformers to match the host: CT-primary rated current 5A (for motor rated current 1A~5A), 32A (5A~32A), 100A (32A~100A), 250A (100A~250A), 500A (250A~500A).
♦When the user doesn't use the leakage transformer, the product does not have leakage protection function. Product is configured with ground protection at this time.
♦If the user needs to use the power failure restart function, the voltage function needs to be selected.
♦For example, KPM60-32A-C-VL-A indicates that the product has 1-road Modbus-RTU port,current range of 32A, It has voltage protection, leakage protection and analog transmission. When the leakage function is selected, it is necessary to add a leakage transformer (1A/0.5m A, which can be purchased at our company).

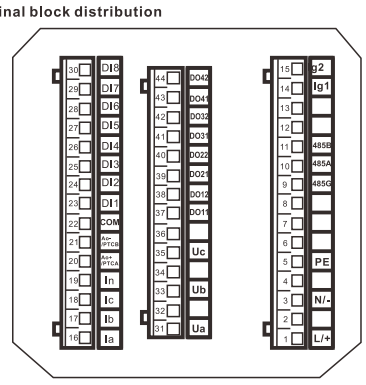
5.Function setting

Function	Content	Standard Configuration	Optional Configuration	Description
Measurement	Three-phase current	•		
	Three-phase Voltage		•	Need to increase voltage function
	Active power		•	
	Reactive power		•	
	Power factor		•	
	Frequency		•	
	Active energy		•	
	Reactive energy		•	
	Ground current	•		
	Leakage current		•	Need to increase the leakage function
	Heat capacity	•		
	Temperature			Need to increase the temperature function
Protection	Overload protection	•		
	locked rotor protection	•		
	Blocking protection	•		
	External fault protection	•		
	Current imbalance protection	•		
	Start timeout protection	•		
	Ground protection	•		
	Phase failure protection	•		
	Contactor breaking current protection	•		
	Underload protection	•		
	Leakage protection		•	Need to increase the leakage function
	TE protection		•	Suitable for increased- safety motors
	Temperature protection		•	Need to increase temperature protection
	Overvoltage protection		•	Need to increase voltage function
	Undervoltage protection		•	
	Underpower protection		•	
	Undervoltage restart		•	
	Phase sequence protection		•	
	Power factor protection		•	
Communication	Modbus-RTU	•	•	
	Profibus-DP		•	
Analog output	1 channel 4-20mA transmission output, programmable project		•	Need to increase analog output
Switch input	8-channel passive dry node optically isolated input	•		
Relay output	4-way relay output	•		

6.Protection parameter list

Item	Content	Range
Motor	Rated current Ie	5A,(1A~5A), 32A(5A~32A), 100A(32A~100A) 250A(100A~250A) 500A(250A~500A)
	Rated voltage Ue	380V~660V
	Rated power Pn	0.5~280.0kW
Start timeout protection	Protection method	Alarm, Trip, Exit
	Time setting	1~100s
Overload protection	Protection method	Alarm, Trip, Exit
	Heating time constant	30~600s
	Heat dissipation coefficient	0.01~10
	Negative sequence heating coefficient	3.0~10.0
locked rotor protection	Protection method	Alarm, Trip, Exit
	Action setting	400%Ie~800%Ie
	Time setting	0.1~60.00s
Blocking protection	Protection method	Alarm, Trip, Exit
	Action setting	50%Ie~800%Ie
	Time setting	0.1~5s
Phase failure protection	Protection method	Alarm, Trip, Exit
	Time setting	0.1~20s
Current imbalance protection	Protection method	Alarm, Trip, Exit
	Action setting	10%Ie~60%Ie
	Time setting	0.1~60s
Ground/Leakage protection	Protection method	Alarm, Trip, Exit
	Action setting	Ground: 20%Ie~100%Ie Leakage: 20%Ise~100%Ise
	Time setting	0.1~60.0s
Underload protection	Protection method	Alarm, Trip, Exit
	Action setting	20%Ie~95%Ie
	Time setting	0.1~99.99s
Overvoltage protection	Protection method	Alarm, Trip, Exit
	Action setting	105%Ue~150%Ue
	Time setting	0.1~60.0s
Undervoltage protection	Protection method	Alarm, Trip, Exit
	Action setting	50%Ue~95%Ue
	Time setting	0.1~60.0s
Underpower protection	Protection method	Alarm, Trip, Exit
	Action setting	20%Ie~95%Ie
	Time setting	0.1~99.99s
TE protection	Protection method	Alarm, Trip, Exit
	Time setting	1.0~15.0s
Contactor breaking current protection	Protection method	Put in, Exit
	Action setting	600%Ie~1000%Ie
Undervoltage restart	Protection method	Put in, Exit
	Recovery voltage	70%Ue~100%Ue
	Power loss time	0.5~60.0s
	Delayed start time	0.1~300.0s
Phase sequence protection	Protection method	Alarm, Trip, Exit
	Time setting	0.1~5s
Power factor protection	Protection method	Alarm, Trip, Exit
	Time setting	0.1~60.0s
	Power factor setting	0.1~1s
External fault protection	Protection method	Alarm, Trip, Exit
	Time setting	0.1~25s
Temperature protection	Protection method	Put in, Exit
	Time setting	20~200℃

7.Terminal block distribution



The KPM60 has an 8-channel digital input terminal with a 24V DC power supply. It can only be connected to the dry node switching signal. These 8-channel digital inputs have different definitions in different control modes. Provide 4 relay output signals, all of which are normally open contacts.
There is 1 channel leakage transformer input, 1 channel 485 input, transmission function and temperature function can only choose one.
KPM60 has 160*160 LCD screen and 5 buttons for motor control operation and viewing setting parameters.

Meaning of the terminal

No.	Name	Function	Remark
1	L/+	Auxiliary power input L or DC power input (+)	
3	N/-	Auxiliary power input N or DC power input (-)	
5	PE	Protective ground for auxiliary power input	
9	485G	Rs485 communication shield ground	
10	485A	RS485 communication terminal	
11	485B		
14	Ig1	Leakage transformer input terminal	Lg1, Ig2 have no wiring direction
15	Ig2		
16	Ia	CT secondary side A phase access	
17	Ib	CT secondary side B phase access	
18	Ic	CT secondary side C phase access	
19	In	CT secondary side common access	
20	Ao+/PTCA	Transmitter output + or PT100 input	Only one of the transmission function and PT100 function can be selected.
21	Ao-/PTCB	Transmitter output - or PT100 input	
22	COM	Programmable DI common terminal	
23	DI1	DI input	
24	DI2	DI input	
25	DI3	DI input	
26	DI4	DI input	Reset signal input
27	DI5	DI input	Local/remote switching
28	DI6	Programmable DI input	
29	DI7	Programmable DI input	
30	DI8	Programmable DI input	
31	Ua	Ua voltage input terminal	
33	Ub	Ub voltage input termina	
35	Uc	Uc voltage input termina	
37	DO11	Relay1 output terminal	Control relay A output
38	DO12		
39	DO21	IRelay2 output terminal	Control relay B output
40	DO22		
41	DO31	Relay3 output terminal	Fault information output
42	DO32		
43	DO41	Relay5 output terminal	Self-diagnostic output
44	DO42		

8.Motor control and other functions

8.1 Division of motor operating conditions

This product divides motor operation into five states: ready state, starting state, operating state, parking cooling state, and parking state.
Ready state: The motor can be immediately started when it is in a cold state.
Starting state: The motor runs after receiving the start command until it reaches the state before steady state operation.
Operating status: normal motor operation.
Parking cooling state: After the motor receives the parking command, it stops running, the temperature drops, and the heat capacity drops to 15%.
Parking status: The motor heat capacity drops to less than 15%. At this time, if there is fault information, the motor is in the group lock state and does not accept the start command. In case of emergency, it can be reset to clear the fault information, then the motor switches to the ready state.

8.2 Start and stop operation

Motor start and stop have three modes of operation: local operation (motor protector host key operation, hereinafter referred to as host key), remote terminal operation (via terminal operation), remote communication control operation.

8.3 Local/Remote selection

The operating authority of the controller can be set via the terminal DI5 input of the motor. There are three modes of operation: "Local Operation", "Remote Terminal" and "Remote Communication".
When DI5 is normally open, the operation mode of the controller is "local operation" or "remote communication". The operation limit can be modified by remote communication or host button. When set to local operation, the motor start/stop can only be controlled by the host button.
When the protection action occurs, the reset operation can be performed by the host key and the DI terminal. When the remote communication limit is set, the motor start/stop control can only be performed by communication. When the protection action occurs, the remote communication and the DI terminal can be used. Reset operation.
When DI5 is switched to closed, the default operation authority is switched to the remote terminal; at this time, the motor start/stop control and reset operation can only be performed through the remote terminal. At this time, the host and remote communication can be viewed, but the operation authority cannot be changed.

8.4 Protection/Control

Protection (control)relay output has the double function of starting and stopping control of AC contact and protecting tripping. When the motor is in normal operation, the operation key can make the corresponding ready to carry out normal parking to the motor. When the fault occurs, if the protective action is set to trip, the trip signal is automatically associated to the corresponding relay to stop the motor running.
Note：Circuit breakers can only be jumped in protection mode and direct start mode.

8.5 Fault information output

The motor has the motor fault information output relay, the contact is normally open. After the controller sends out the alarm or trip the fault information, the fault ready contact point is closed; if the fault information is clear, then the relay contact are opened.

8.6 Reset

After the controller protects the trip and enters the parking lot, if need to operate again, it is necessary to reset the fault information firstly. Reset in a variety of ways: The host has a reset button , the controller has a reset terminal, and through the communication port to achieve remote reset.

9.Switch input and relay output setting

The KPM60 provides three programmable input points DI6, DI7, DI8, programmable inputs can be defined as the following functions:
1.General DI input, 2. External fault input, 3. Delay start A (forward rotation), 4. Delay start B (reverse).When the wiring check function is turned off, DI6, DI7, DI8 are programmable input points. When the check function is turned on, DI6, DI7, DI8 will be as shown in the table below.

Function	Parameter name	Setting range	Default value	Define
Overload protection	Protection execution method	Alarm,trip,disable	Trip	
	Heating time constant	30-600	300	
	Negative sequence current coefficient	3-10	6	
	Heat dissipation coefficient	0.01-10	4	
Overload protection	Protection execution method	Alarm,trip,disable	disable	
	Action setting value	50%Ie-600%Ie	120%Ie	
	Time setting value	0.1s-99.99s	10s	

The following table shows several sets of operating time when the motor is overloaded

Ieq/Ie \ action time	Heat time constant unit：S					
	100	200	300	400	500	600
1.1	930.2	1860.5	2790.7	3720.9	4651.2	5581.4
1.2	296.3	592.6	888.9	1185.2	1481.5	1777.8
1.5	87.1	174.3	261.4	348.6	435.7	522.9
2	34.5	69.0	103.5	138.1	172.6	207.1
3	12.7	25.3	38.0	50.6	63.3	76.0
4	6.7	13.4	20.1	26.9	33.6	40.3
5	4.2	8.4	12.6	16.7	20.9	25.1
6	2.9	5.7	8.6	11.5	14.3	17.2
7.2	2.0	3.9	5.9	7.9	9.9	11.8
8	1.6	3.2	4.8	6.4	7.9	9.5

12.3 Locked-rotor protection

Locked-rotor protection is to prevent the motor during the start, due to the rotor stuck to stop the rotation, causing the current rise, resulting in motor damage. Locked rotor protection is input during the motor starting process. According to the ratio of the maximum phase current and the rated current as the judgment basis, when the current ratio is greater than the setting value, the stall protection is started and executed according to the time limit.
Related parameters

Function	Parameter name	Setting range	Default value	Define
Locked-rotor protection	Protection action	Alarm, trip, disable	Disable	
	Action setting value	50%Ie~800%Ie	600%Ie	
	Time setting value	0.1~60s	5.0s	

12.4 Blocking protection

Blocking protection is to prevent serious overload of the motor during operation, the motor rotor stops turning, damaging the motor due to increasing current. The blocking protection is put into operation after the motor is running, according to the maximum phase current and rated current ratio as the basis for judging, when the current ratio is greater than the set value, the protection starts, and according to the time-limit.

Function	Parameter name	Setting range	Default value	Define
Blocking protection	Protection executi on method	Alarm, trip, disable	Trip	
	Action setting value	400%Ie~800%Ie	300%Ie	
	Time setting value	0.1~60s	5.0s	

12.5 Phase Failure Protection

Function	Parameter name	Setting range	Default value	Define
Phase failure protection	Protection action	Alarm, trip, disable	Disable	put into operation at startup and operation
	Action setting value	0.1~20s	4.0s	

12.6. Current Unbalance Protection

Current unbalance protection prevents overheating of the motor due to unbalanced three-phase current. Unbalanced protection can be closed, if the user is protected at this time to open, in the start of the process is put into.
Because the motor's data is relatively small, so set the standard is based on the experience of th e imbalance. For a known equilibrium condition, the starting value of 50% is recommended as a starting point. The starting value can be lowered to a level higher than the frequent trip. For a mild load motor, a lot of unbalance current will not cause damage to the motor, such cases can be raise d, can also set a longer delay time.
PUN: current unbalance rate. The calculation formula is:

$$Pun=|Imax(Imin)-Iav|/|Iav|\times 100\%$$

Where Pun is the current unbalance rate, Imax is the maximum value, Imin is the minimum value. Iav is average current, Pun takes Imax and Imin into the maximum calculated above.
During the start and run of the motor, the controller calculates the three-phase current unbalance of the motor. When the current imbalance is detected greater than the set value, the current unba lance protection is activated and executed in a definite time.
Related parameters

Function	Parameter name	Setting range	Default value	Define
Blocking protection	Protection action	Alarm, trip, disable	Disable	
	Action setting value	10%~60%Ie	50%Ie	
	Time setting value	0.1~60s	5.0s	

12.7 Ground Fault/Leakage Protection

The ground protection current signal is calculated by the three-phase current vector and the current signal of the leakage protection is taken from the external current transformer. Earth leakage protection and ground protection can only take one of the two. The magnitude of the ground fault current depends on the position of the fault on the coil of the motor, and it is desirable to set a low ground fault action value to protect as many stator coils as possible and to prevent the motor housing from becoming dangerous due to charging. Protection action characteristics: If the ground current ≥ set the value to the end of the delay time, ground protection and reliable action.
Protection action characteristics: If the leakage current ≥ set the value of the delay time is over, the ground protection reliable action.

Function	Parameter name	Setting range	Default value	Define
Ground Fault/Leakage Protection	Protection execution method	Alarm, trip, disable	Disable	
	Action setting value	Ground 20%~100%Ie Leakage 20%~100Ie	50%Ie	General ground protection settings of not less than 50% Ie, leakage protection according to the need to
	Protection function selection	Ground Fault/Leakage	Ground	This protection is preferred for this setting
	Time setting value	0.1~60s	5.0s	

9.1 Protect mode

Input signal	Application Annotation	Relay output	Application annotation
DI1	Universal input DI	DO1	Motor protection Relay 1 output
DI2	Universal input DI		
DI3	Universal input DI	DO2	Trip breaker
DI4	Reset signal input		
DI5	Universal input DI	DO3	Motor fault information output
D16	Universal input DI		
DI17	Universal input DI	DO4	Power-lossing self diagnostic output(normally-closed contact)
DI18	Universal input DI		

9.2 Direct Startup Mode

Input signal	Application Annotation	Relay output	Application annotation
DI1	Starting signal input	DO1	Motor protection A Relay output
DI2	Universal DI input		
DI3	Stop signal input	DO2	Trip breaker
DI4	Reset signal input		
DI5	Local/Remote terminal	DO3	Fault message output of motor
D16	Contact CI status input		
DI17	Universal DI input	DO4	Power-lossing self diagnostic output(normally-closed contact)
DI18	Break status input		

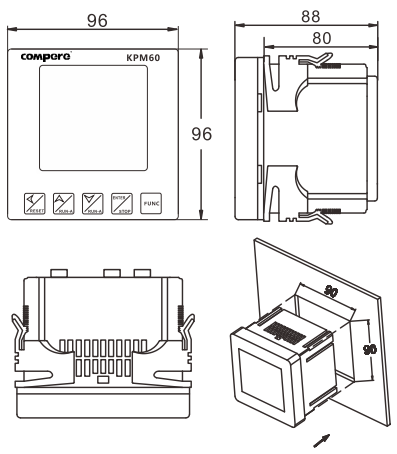
9.3 Bi-directional Start Mode

Input signal	Application Annotation	Relay output	Application 1nnotation
DI1	Starting A signal input （forward）	DO1	Motor protection Relay1output
DI2	Starting B signal input （reversal）		
DI3	Stop signal input	DO2	Motor protection Relay2 output
DI4	Reset signal input		
DI5	Local place/long-distance terminal	DO3	Fault message output of motor
D16	Contactor C1 status input		
DI17	Contactor C2 status input	DO4	Power-lossing self diagnostic output(normally-closed contact)
DI18	Breaker status input		

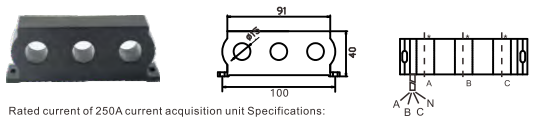
9.4 Star/Triangle and Autotransformer starting mode

Input signal	Application Annotation	Relay output	Application Annotation
DI1	Starting signal input	DO1	Motor protection Relay 1 output
DI2	General DI input		
DI3	Stop signal input	DO2	Motor protection Relay 2 output
DI4	Reset signal input		
DI5	Local/Remote terminal	DO3	Fault message output of motor
D16	Contactor C1 status input		
DI17	Contactor C2 status input	DO4	Power-lossing self diagnostic output(normally-closed contact)
DI18	Breaker status input		

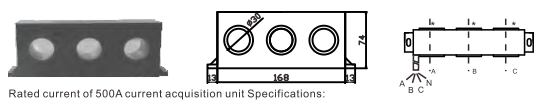
10.Installation Dimensions



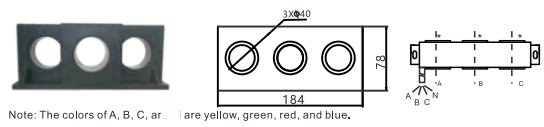
Rated current of 5A, 32A and 100A current acquisition unit specifications：



Rated current of 250A current acquisition unit Specifications:



Rated current of 500A current acquisition unit Specifications:



Note: The colors of A, B, C, ar are yellow, green, red, and blue.

11. Operating Description

11.1 Brief

KPM60 man-machine interface can provide local data query, fault information display and set tuning parameters. There are five button on the panel, used for parameter tuning and interface switching; the display screen uses a 160*160 standard power LCD screen, friendly and convenient display interface.

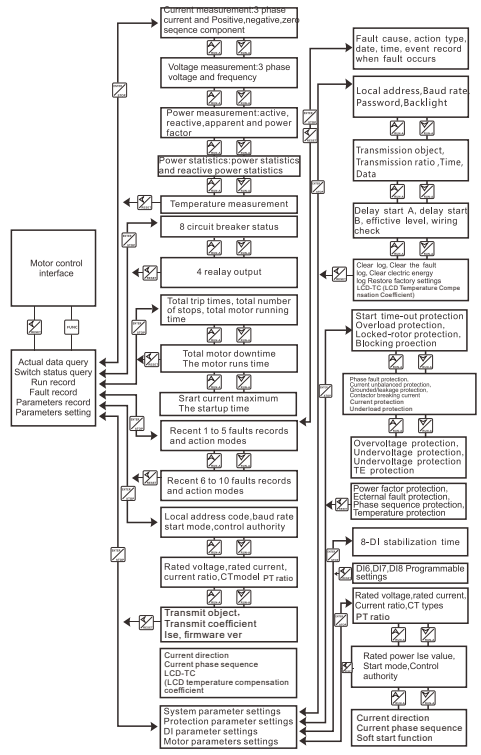
11.2 Functional Description

♦ Display list: Control interface, Query interface, Set interface.
♦ After power up, the default interface is control interface, under this interface , user can control start-up and shutdown the motor through keys if the operation authority of the controller is local display; The ab ove operations will not be implemented if the operation authority of the controller is remote terminal or remote communication.
♦ By operating the buttons, the display interface can be switched from the control interface to the query / setup root interface, under the interface, user operation buttons can query all measurement parameters of the host.
♦ By operating the buttons, the display interface can be switched from the control interface to the query / setup root interface, the user operates the button under this interface can set the host's protection settin gs and system parameters.

11.3 Button

♦ KPM60 front panel has 5 buttons, from left to right.
♦ After the device is turned on, the default is the control interface., press "FUNC" button to enter query/s etup interface, in the root interface "parameter setting" option "ENTER/STOP" enter the protection pass word input interface, enter the four-digit password and press the "ENTER/STOP" button, the fault passw ord is 1111, if the password is correct, enter the parameter setting interface, if the password is incorrect, prompt password
♦ The meaning of the keys in different interfaces.

Button name	Query interface	Setting interface	Control interface
	Flip view parameters	Increase the value of the modified bit or switch to the next parameters	Positive start motor
	Flip view parameters	Move to modify the bit or switch to the next parameter	Reverse start motor（Valid in bidirectional reversible start mode only）
ENTER/STOP	Invalid or enter subordinate menu page	Confirm the parameter or go to the submenu page	Stop motor
	Back to previous, if it is in ontology and the operating modes is not protected, back to control interface	Cancel parameter or back to the previous page	Under this interface, When the motor is in the parked state, press this key clears the fault message,controller exits the alarm/trip status
FUNC	Enter query/setting root interface	Enter query/setting root interface	Under this interface, press this key the display screen switch from the controller interface to query/setting interface



12. Protection Function Description

12.1 Start time-out protection

The motor starting current is relatively large, if the start time is too long, easy to make the motor heat damage, to this end, the device provides start-up timeout protection.Protective action chara cteristics
In the process of starting the motor, if the set start time to the rear, the current of any phase curren t≥1.1 times the rated current, Start time-out protection immediate action.Related parameters

Function	Parameter name	Setting range	Default value	Define
Start time-out protection	Protection action	Alarm,trip,disable	Trip	
	Setting time	1-100S	10.0S	

12.2 Overload protection

A motor overheating protection is a common protection function, used to protect the motor ove rload for a long time lead to winding heat, resulting in damage to the motor winding insulation dam age to the motor. Overload protection prevents the motor from being damaged by heat due to over load operation. This protection is started after the start, the protection is based on the ratio of the equivalent current to the rated current, according to the following characteristic equation, when th e time is met, the overload protection action. When Ieq > 1.05 * Ie, the heat accumulation, thermal protection equation is:

$$t=\frac{Tfr}{\left(\frac{Ieq}{Ie}\right)^2-1.05^2} \qquad Ieq=\sqrt{K1\times I1^2+K2\times I2^2}$$

When Ieq <1.05 * Ie, the heat dissipation protection equation is:

$$t=\frac{Tsr}{-\left(\left(\frac{Ieq}{Ie}\right)^2-1.05^2\right)}$$

K1, K2 is positive sequence current heating time constant, in the start time K1 take 0.5, after runn ing, take "1", K2 is negative sequence current heating time constant, k2 take 3~10, generally set to 6; I1 is positive sequence current, I2 is negative sequence current
Tsr = Tfr * Ksr.
Tfr：Overheating time constant;
ksr: Cooling coefficient, generally take 4;
When the heat accumulation value reaches a certain level, the relay output adjusts, after tripping, the heat capacity does not fall below 15%, does not allow the starting motor, emergency press the parking and reset button at the same time, then achieve manually remove the thermal memory va lue.
Related parameters

12.8 Underload protection

Motor underload is generally not need to be protected, but, the occasion requires underload protection such as load may appear abnormal mutation, for sudden rupture of assembly line conveyor belt and so on. This situation needs to be put into underload protection.
Protection operation characteristic: if average of three current≥ overload setting value until the time is out, underload protection acts reliably.
Operation time characteristic: definite time limit protection.

Function	Parameter name	Setting range	Default value	Define
Underrun protection	**Protection execution method**	Alarm, trip, disable	Disable	
	Action setting value	Ground 20%~95%Ie	40%Ie	
	Time setting value	0.1~99.99s	10.0s	

12.9 Overvoltage protection

Motor underload is generally not need to be protected, but, the occasion requires underload protection such as load may appear abnormal mutation, for sudden rupture of assembly line conveyor belt and so on. This situation needs to be put into underload protection.
Protection operation characteristic: if average of three current≥ overload setting value until the time is out, underload protection acts reliably.
Operation time characteristic: definite time limit protection.

Function	Parameter name	Setting range	Default value	Define
Overvoltage	**Protection execution method**	Alarm, trip, disable	Disable	
	Action setting value	Ground 105%Ie~150%Ie	120%Ie	
	Time setting value	0.1~25.5s	5.0s	

12 10 Undervoltage Protection

When the system voltage is too low, the motor torque is insufficient, long-term operation will lead to the motor burn, the undervoltage protection function can avoid the motor in the low voltage conditions are not allowed to run.
The undervoltage protection is energized during the start-up of the motor. When any line voltage is monitored below the voltage setting, the undervoltage protection is initiated and executed in a limit time.

Function	Parameter name	Setting range	Default value	Define
Undervoltage	**Protection execution method**	Alarm, trip, disable	Disable	
	Action setting value	Ground 50%Ie~95%Ie	70%Ie	
	Time setting value	0.1~25.5s	2.0s	

12.11 Underpower protection

When the motor is running at low load, the current of the motor is not necessarily small due to the low power factor. The undercurrent protection function protects the motor by monitoring the active power.
Under power protection is applied after the motor has entered the operating state.
When the active power is lower than the set setting value, the under-power protection is activated and executed in a limit time.
Related parameters

Function	Parameter name	Setting range	Default value	Define
Underpower protection	**Protection execution method**	Alarm, trip, disable	Disable	
	Action setting value	Ground 20%Ie~95%Ie	40%Ie	
	Time setting value	0.1~99.99s	10.0s	

12.12TE Protection(Adapt to increased safety type motor)

TE time protection is suitable for continuous operation, including easy start and infrequent start-up will not produce significant additional temperature rise, allows the use of anti-time overload protection device of the increased safety explosion-proof motor(example: YA, YA2 series .etc), it is not suitable for motors that are difficult to start or start frequently.
Increased the safety and explosion-proof motor nameplate data "tE" time for the AC winding at the maximum ambient temperature to reach the rated operating stability after the temperature, from the time it takes to block the current to the time required to rise to the limit temperature.
When the TE time protection function is turned on, the overload protection function will be automatically turned off. TE time protection function in line with GB3836.3-2010 standard requirements, TE time protection failure must be manually reset.

Function	Parameter name	Setting range	Default value	Define
TE protection	**Protection execution method**	Alarm, trip, disable	Disable	
	Action setting value	1.0s~15.0s	4.8s	Allowed to run at 7 times the rated current

TE time protection property list, the curve up to the standard of IEC79-7, GB3836.3-2000.

Ie/Ie / Top	1s	4.0s	4.3s	5.0s	5.5s	6.0s	15.0s
3.0	4.00	16.00	17.20	20.00	22.00	24.00	60.00
3.2	3.48	13.91	14.96	17.39	19.13	20.87	52.17
3.40	3.08	12.31	13.23	15.38	16.92	18.46	46.15
3.60	2.76	11.03	11.86	13.79	15.17	16.55	41.83
3.80	2.50	10.00	10.75	12.50	13.75	15.00	37.5
4.00	2.29	9.14	9.83	11.43	12.57	13.71	34.29
4.20	2.11	8.42	9.05	10.53	11.58	12.63	31.58
4.40	1.95	7.80	8.39	9.76	10.73	11.71	29.27
4.60	1.82	7.27	7.82	9.09	10.00	10.91	27.27
4.80	1.70	6.81	7.32	8.51	9.36	10.21	25.53
5.00	1.60	6.40	6.88	8.00	8.80	9.60	24.00
5.20	1.51	6.04	6.49	7.55	8.30	9.06	22.64
5.40	1.43	5.71	6.14	7.14	7.86	8.57	21.43
5.60	1.36	5.42	5.83	6.78	7.46	8.14	20.34
5.80	1.29	5.16	5.55	6.45	7.10	7.74	19.35
6.00	1.23	4.92	5.29	6.00	6.77	7.38	18.46
6.20	1.18	4.71	5.06	5.88	6.47	7.06	17.65
6.40	1.13	4.51	4.85	5.63	6.20	6.76	16.90
6.60	1.08	4.32	4.65	5.41	5.95	6.49	16.22
6.80	1.04	4.16	4.47	5.19	5.75	6.23	15.58
7.00	1.00	4.00	4.30	5.00	5.5	6.00	15.00
8.00	1.00	4.00	4.30	5.00	5.5	6.00	15.00

12.13 Contactor Breaking Current Protection

When a short-circuit current fault occurs in the motor circuit and the current is large, such as a metallic single-phase ground fault, if the contactor is forcibly opened, the contactor may be damaged. At this time, the contactor should be directly controlled to trip to achieve safe removal of the fault current. the goal of. If the contactor breaking current protection is turned on, the protection is always on. When the maximum phase current is monitored to be greater than the set contactor's allowable breaking current, the circuit breaker will be directly opened.
Related parameters

Function	Parameter name	Setting range	Default value	Define
Contact breaker protection	**Protection execution method**	Alarm, trip, disable	Disable	
	Action setting value	600%~1000%Ie	800%Ie	

12.14 Undervoltage Auto-restart

Low voltage motor control power often direct quote from 380V power system when the system voltage appears short fault (commonly known as "shake of voltage"), easily lead to shutdown of the motor. The device provides the motor with the loss of voltage restarting function, so that the motor in the power supply and the system is restored to normal condition, can automatically restart to the normal operation.
Immediately restart: when the motor undervoltage protection parking or lost voltage sags interval in 0.5 seconds, due to inertia that motor rpm drop is very small, can be directly to restart the motor. This function in the power grid, "shaking", can ensure the continuous normal operation of equipment.
Time delay reset: when the motor undervoltage protection parking or lost voltage due to voltage sags time interval in the 0.5s-60s (time can be set). At this time the current change greatly, at the same time to start multiple motor will lead to excessive starting current. Therefore, the device will be in accordance with the restart delay to restart the motor (delay time can be set).

Function	Parameter name	Setting range	Default value	Define
Undervoltage Auto-restart	Protection execution method	Enable/Disable	Disable	
	Restore voltage	70%~100%Ue	85%Ue	
	Power loss time(s)	0.5~60.0s	10.0s	Maximum delayed restart power loss time
	Delay start time(s)	0.1~300.0s	5.0s	Delay start time

12.15 Power Factor Protection

For low-side motors, the power factor changes more frequently than motor current or active power. Therefore, power factor protection is particularly suited to the distinction between no-load operation and failure (such as tearing of the conveyor belt or transmission shaft breakage)
Related parameters

Function	Parameter name	Setting range	Default value	Define
Power factor Protection	**Protection execution method**	Alarm, trip, disable	Disable	
	Action setting	0.1~1	0.1	
	Time setting	0.1~60.0s	0.5s	

12.16 External Fault Protection

External fault protection is provided to users by external access. the switch quantity is used as the input point of the external fault signal, access process closing and tripping integrated chain contact, can be used for process chain function; the user can control according to the needs of the motor, using external fault protection to obtain trip or alarm function. External fault protection Access switch input can be selected "normally open" or "normally closed" mode. After the controller is powered on, the switch input status is continuously detected and the limit time protection is provided according to the input state.
Related parameters

Function	Parameter name	Setting range	Default value	Define
External fault protection	**Protection execution method**	Alarm, trip, disable	Disable	
	Time setting	0.1~25.0s	0.1s	

12.17 Phase sequence protection

Phase sequence protection can identify phase sequence errors in the three-phase voltage of the motor and avoid motor reversal. In order to avoid the overload protection malfunction, if the phase sequence rotection occurs, the corresponding limit should be corrected immediately to ensure the reliable operation of the motor. Phase sequence protection is applied when the motor is ready, starting and running.
hen the phase sequence of the three-phase voltage is detected, it is time-limited.
Related parameters

Function	Parameter name	Setting range	Default value	Define
Phase sequence protection	**Protection execution method**	Alarm, trip, disable	Disable	
	Action setting	0.1~5.0s	0.2s	

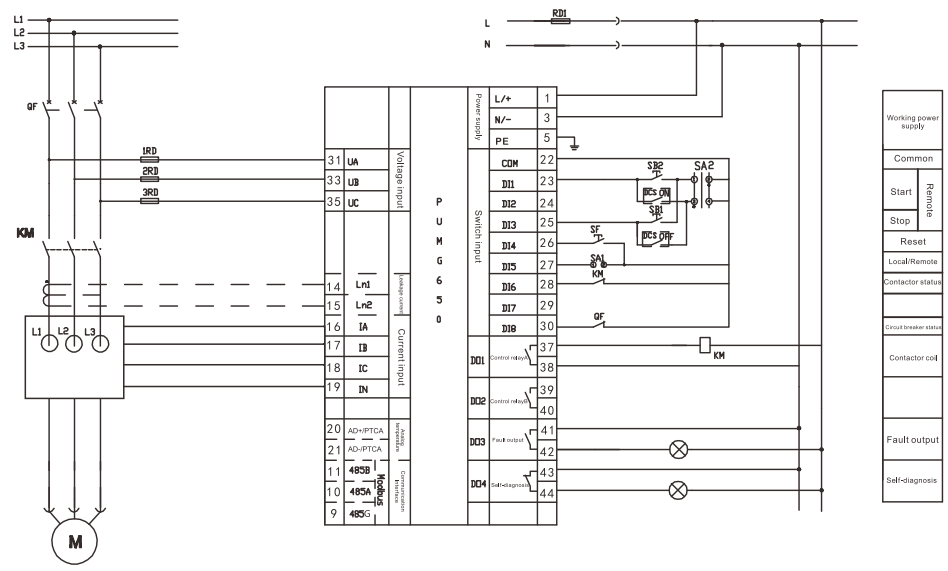
12.18 Temperature Protection

Temperature protection is the most direct protection of the motor. Insert the PT100 into the motor windings, the resistance of PT100 varies linearly with temperature. Protector according to PT100 features, the motor winding temperature is detected, for motor protection, the protection logic is: When the detected temperature value is greater than the set value, perform a protection action.

Function	Parameter name	Setting range	Default value	Define
Temperature protection	**Protection execution method**	Alarm, trip, disable	Disable	
	Temperature setting	20~200°C	100°C	

13.Common Field Wiring Diagram

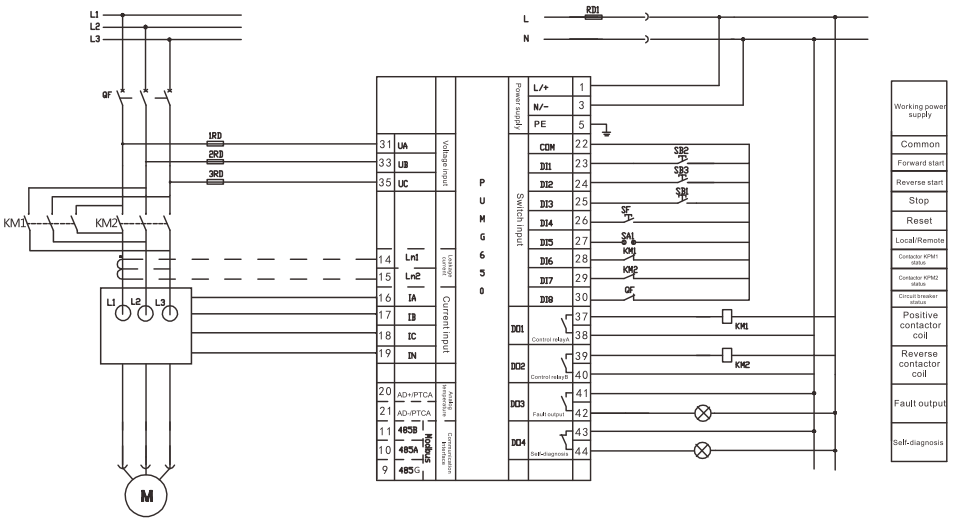
KPM60 series supports a variety of start control mode, due to limited space, this manual only provides typical wiring diagrams for KPM60 in protected mode, direct start mode and bidirectional start mode, For more typical wiring diagrams, please contact the relevant personnel. If you encounter problems with the use of the product, please contact the company's technical staff.



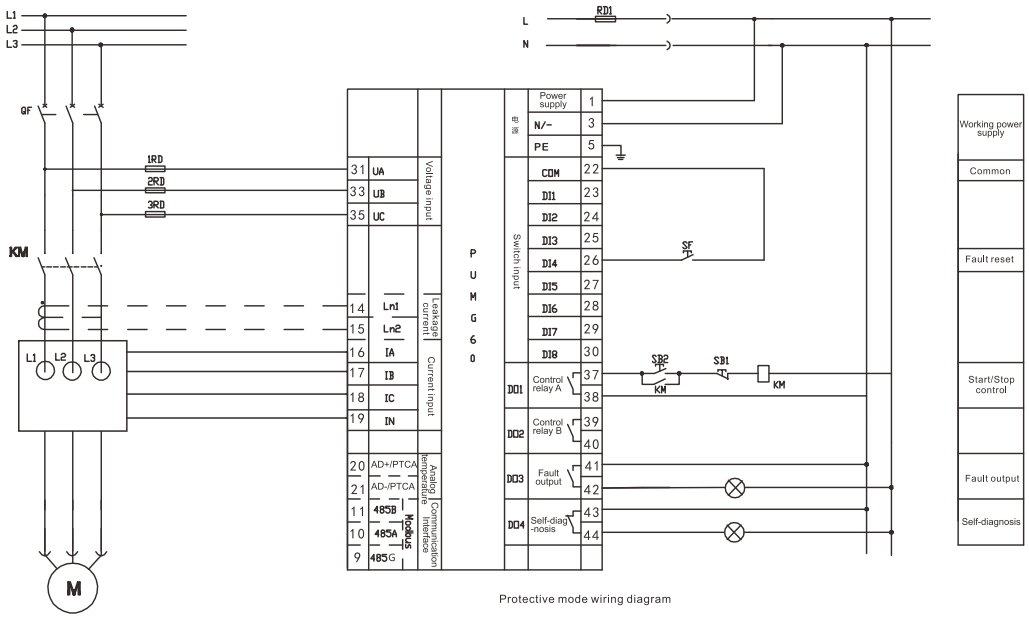
Selectable switch

Handle position \ Contact	1-2	3-4
Manual	—	
DCS		—

1.In the direct start mode, after the controller receives the start command in the ready state, the internal relay DO1 is closed, the contactor KM coil is electrically closed, and the motor is started. When the controller receives the opening command or a protection trip occurs, the relay DO1 is disconnected, the KM coil is de-energized, and the motor is stopped.
2.When the motor has a protection alarm or protection trip, press the reset button to clear the fault indication. When the parking process is over, it can receive a restart command when it enters the ready state.
3.Dotted lines indicate optional features



1.In the bidirectional start mode, in the ready state, when the protector receives the "start A" command, the internal relay DO1 is closed, the contactor KM1 was forced to pull; when the controller received a stop command or protection trip, DO1 relay is disconnected, contactor KM1 is de-energized, motor stops. In the ready state, when the protector receives the "start B" command, the internal relay DO2 is closed and the contactor KM2 is energized; when the controller receives the stop command or the protection trip occurs, the DO2 relay is disconnected and the contactor KM2 Power loss freed, motor stop.
2.When the motor has a protection alarm or protection trip, press the reset button to clear the fault indication. When the parking process is over, it can receive a restart command when it enters the ready state.
3.Dotted line marked as optional function.



Protective mode wiring diagram

1.Under protected mode, the normally open contact string of the control relay DO1 is in the coil loop of the contactor KM, when the controller is powered up, DO1contacts are closed immediately, operation start button SB2 then motor start, the protection trip occurs, relay DO1 is disconnected, the contactor KM's coil is de-energized, the contactor KM is released, the motor stops.
2. When the motor has a protection alarm or protection trip, press the reset button to clear the fault indication. The relay DO1 will automatically close and enter the ready state, allowing the motor to start again.
3. Dotted lines indicate optional features

14. Precautions

14.1 Basic settings

Before operating properly, make sure to set the following system parameters:
◆ Rated current of the motor;
◆ Enter the correct CT rated current value;
◆ CT ratio is a backup item, is also used by the manufactures to provide 5A CT, external use of other transformers, default value 1;
◆ Set the appropriate contactor breaking current, the default setting is 8 times the Ie;
◆ Confirm the operating mode;
◆ Confirm the operating authority;
◆ Confirm the device address and communication baud rate are consistent with the host computer;
◆ Before the normal operation, you also need to set the protection function to be used for parameter setting;
◆ In the protection of the stall, unbalanced protection, grounding / leakage protection, short circuit protection, underload protection, overvoltage protection, undervoltage protection, under power protection, if the protection mode is exited, the protection is disabled; if you need to turn on these protection, set the range of the action values and delay times for each protection in the protection function description.

14.2.Common Problem

Fault phenomenon	Possible reason	Possible solution
◆ The device does not start working properly after power-up	The power supply failed to join the device	Check that the correct operating voltage is added to the device L / + and N / - terminals
The measured value is incorrect or does	Voltage measurement is incorrect	Check whether the measured voltage matches the device rating
	current measurement is incorrect	Check that the measured current matches the device rating parameters Check that the CT ratio setting is correct
	Sensor or signal processing circuit board failure	Check the sensor wiring or repair
◆ Relay does not operate	No control commands have been received	Check that the communication link is correct
◆Relay error action	The relay operating mode is not correct	Check that the current relay is in the correct mode
◆PC cannot communicate with the device	Device address is incorrect	Check if the device address is consistent with the definition
	Device communication baud rate is incorrect	Check whether the device communication baud is consistent with the definition
	The communication link is disturbed	Check that the communication shield is well grounded
◆The PC cannot start / stop the motor	Permission is wrong	Check that the control permissions are set correctly
◆ The set protection function does not operate	function switch is not open	Open the protective function switch
	Bad contact cable	Check the senor cable
Unable to enter parameter setting	Incorrect password	Contact the dealer or the company after sales service department
Ground fault does not work	Ground protection is not turned on	Turn on the ground protection switch
	Poor cable contact	Check sensor cable

15 Contact details

Henan Compere Smart Technology CO., LTD.
Telephone:+86-371-86181681
Fax:+86-371-67890037
Web:www.comperepower.com
Address:Unit 1, Building 38, Liandong U Valley, No. 352 Lianhua Street, High-tech Zone, Zhengzhou, China

The final interpretation of this manual is owned by Henan Compere Smart Technology Co.,Ltd.