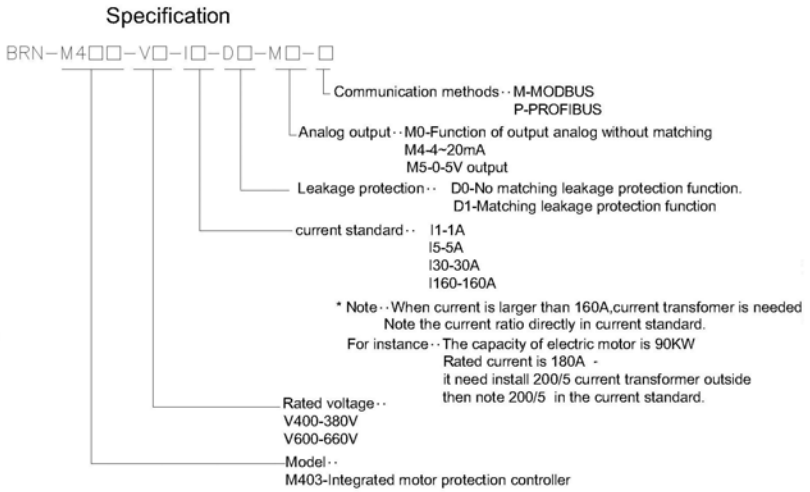
BRN-M403 Integrated Electromotor Protection Controller
Operation Manual

Shanghai Brilliant Automation Technology Co. Ltd

In August 2011

Catalog

1.Product Type Selection and Current Standard



CURRENT STANDARD OPTIONS

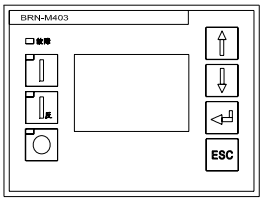
STANDARD	CURRENT RANGE	MOTOR POWER (380V)
1A	0.5～1A	0.18～0.37kW
5A	1～5A	0.37～2.5kW
30A	5～30A	2.5～11kW
160	30～160A	11～75kW
200/5A	160～200A	75～90kW
300/5A	200～300A	90～160kW
400/5A	300～400A	160～200kW
500/5A	400～500A	200～250kW
600/5A	500～600A	250～315kW
800/5A	600～800A	＞315kW

Note:: according to the type selection above, generally , if the motor power in within 75kW(including 75kW), it is available to use current transformer which in included innerly in motor protection instead of the one which is equipped outside.

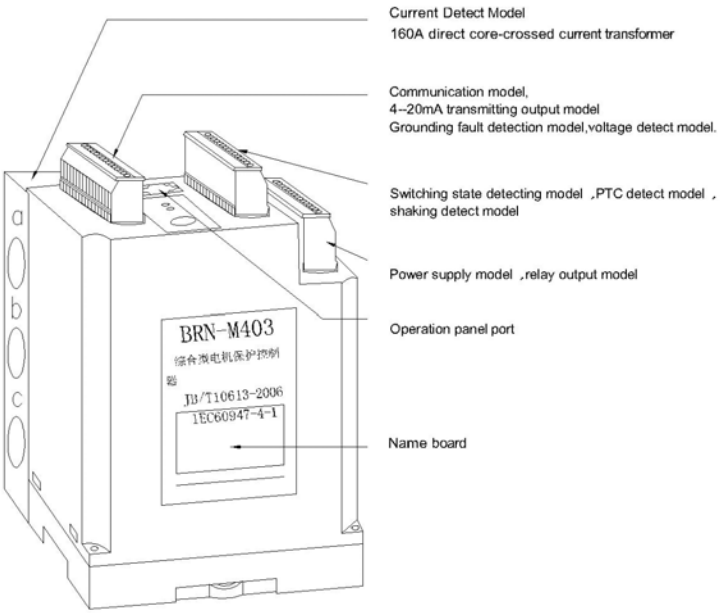
2.Product Confirmation and the Components

Take out the devices from the package and check the rated nameplate in the side of the device then confirm the type whether it satisfy the indent and whether the machine need repair.

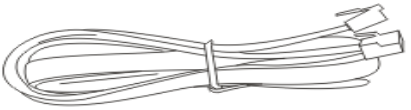
2.1 The operation panel(BRN-M403A, Panel is called for short.)



2.2 Basic unit(BRN-M403B, Body is short for it)



2.3 Connection Cable

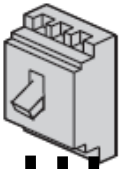


Used for connecting basic units and operation panel .Flat banded cable, optional length: 1.0 meter、1.5meter、2.0meter、3.0meter，If there is no special note when ordering the goods ,we configure the 1meter cable by default.

3.Installation and Connection

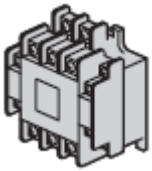
3.1 Introduction of Peripheral Equipment

3-phase Alternating Current Power Supply



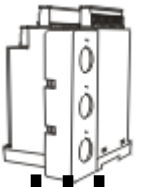
Plastic Shell Breaker（MCCB）or leakage breaker（ELB)、Fuse（FU）

Starting electric motor which can cause huge current. Therefore, much attention should be paid to the selection of breaker.



Electromagnetic Contactor（MC）

Selecting according to the motor’s capacity

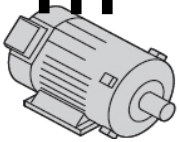


BRN-M403

Via switching value input or output terminal port.

Or RS485 Communication method;

To realize start or stop the motor by remote controlling PLC、DCS system. In the same time, monitoring the functioning of motor.



Electric Motor

the motor capacity purcha

peripheral equipment must be selected according to the capacity.

Attention: The lifetime of the device is influenced by the environment surrounding, thus pay attention to the temperature surrounding. When installing the device, much attention should be paid to the control signal line and make sure it is away from main loop as far as possible and avoid disturbing from the outside.

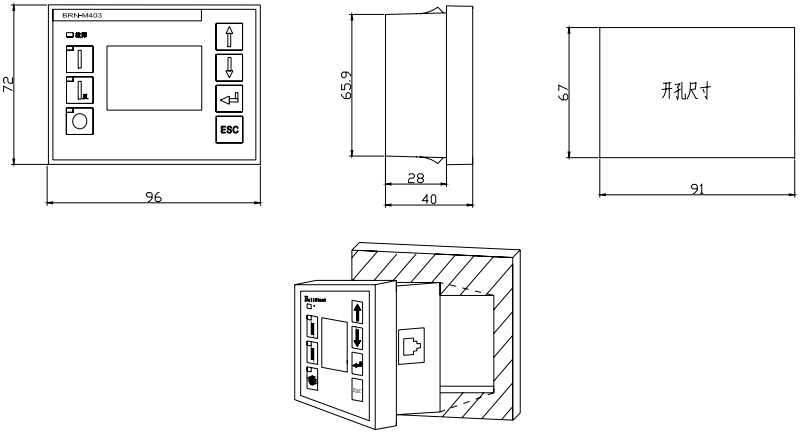
- The details of periphery equipment and selection refers to the user manual of periphery.

3.2 Installation

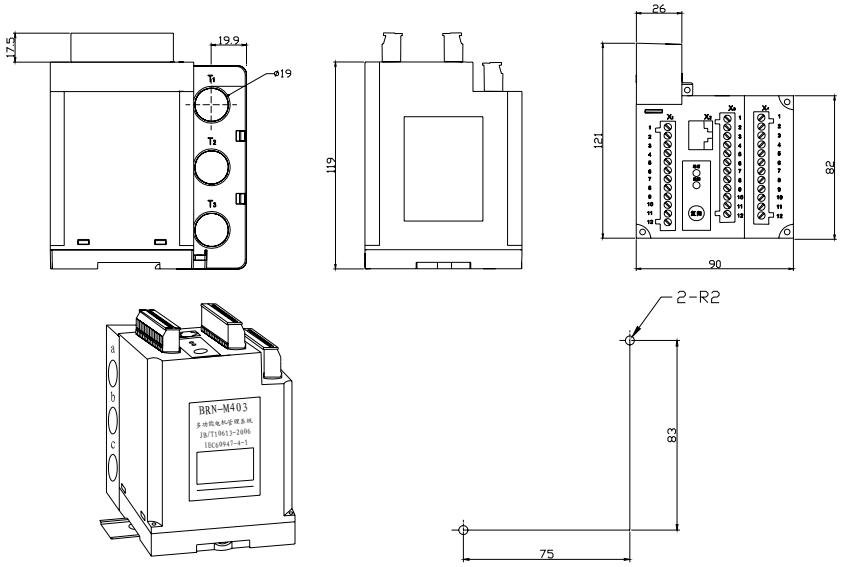
The first concern in installation is easy access for all the component of device. Wires, fuse and other parts and accessories must have additional space for sure. Then the devices must be installed in the proper environment. and keep the temperature between -20℃～+65℃.

3.2.1 Installation of The Panel

BRN-M403 panel need a 91*67mm notch to embed the operation panel.

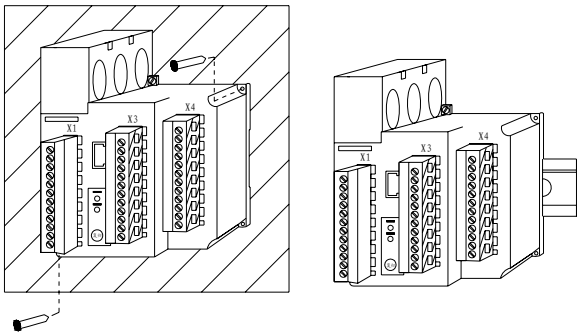


3.2.2 Subject Installation (The subject can be installed on the standard track, or fixed by screw.)



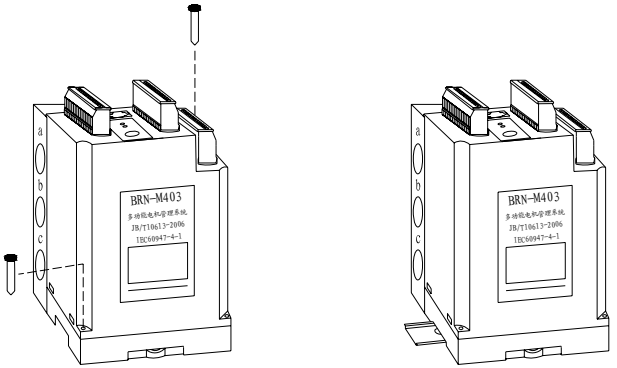
Use the vertical setup method for subject

Fixed screw install track (35mm DIN standards-track)

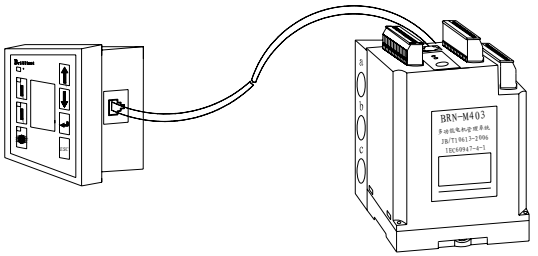


Use vertical installation for subject.

Screw installation Track installation(35mm DIN standards- track)

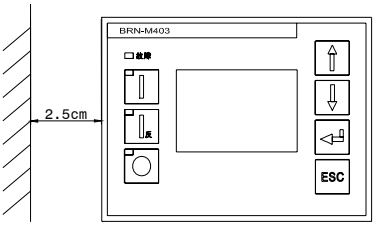


3.2.3 The connection between panel and subject. (adopt flat data cable of RJ45 port)

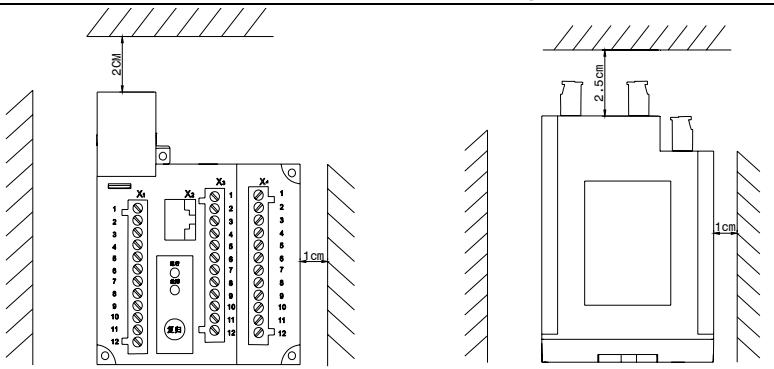


3.2.4 The Reserve Zone of Installation

Front Panel

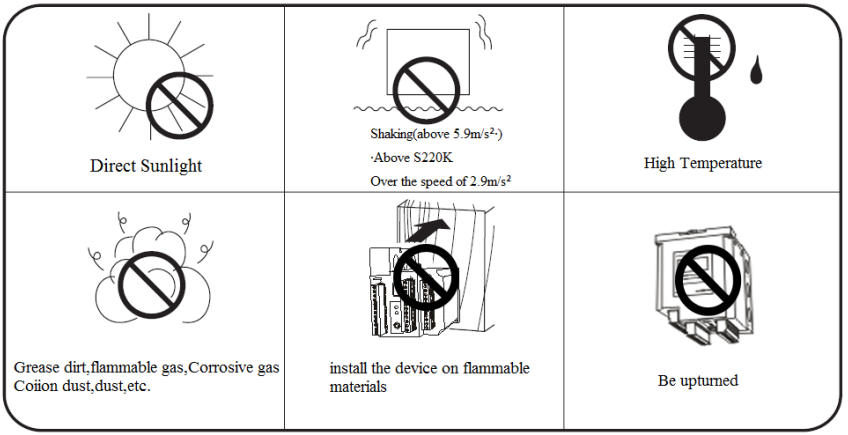


Basic Unit



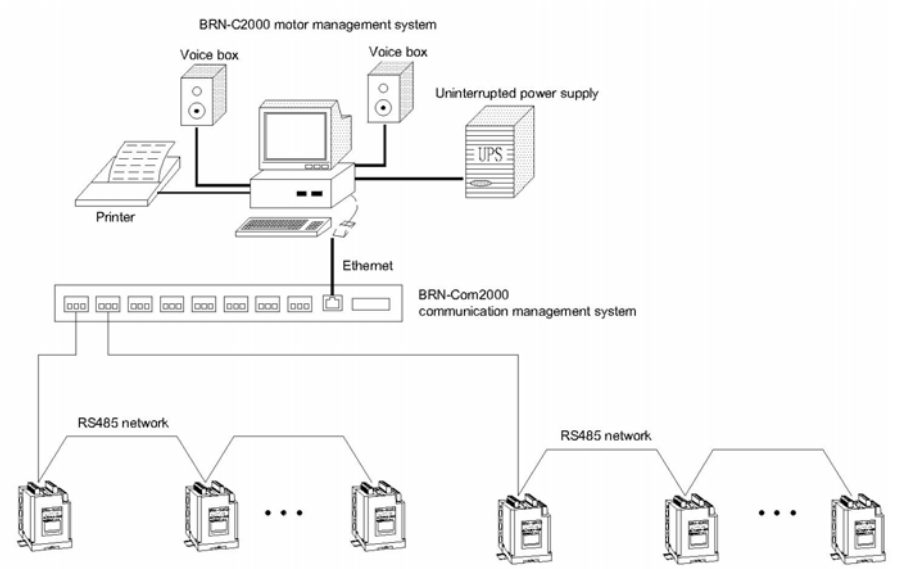
3.2.5 The Surrounding Environment when Installing.

BRN-M403 consists of precise mechanical and electric parts. If used or installed in the premises below, which can cause abnormal action or fault. Avoiding use them in the cases below.

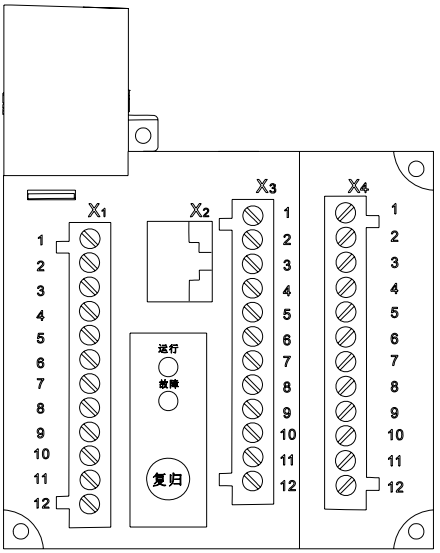


3.3 Communication Connection

Please choose the twisted-pair with shielding layer（for instance RVSP2*0.5）as communication cable, one single bus can connect 32 models at most. The diagram below is the management system connecting BRN-M403 and BRNC2000 via BRN-COM2000 .

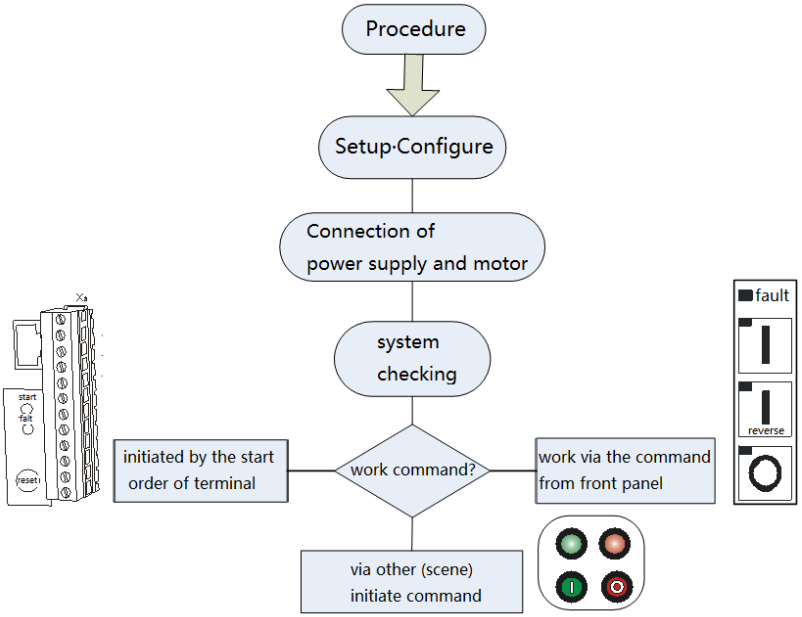


3.4 Terminal Port Diagram

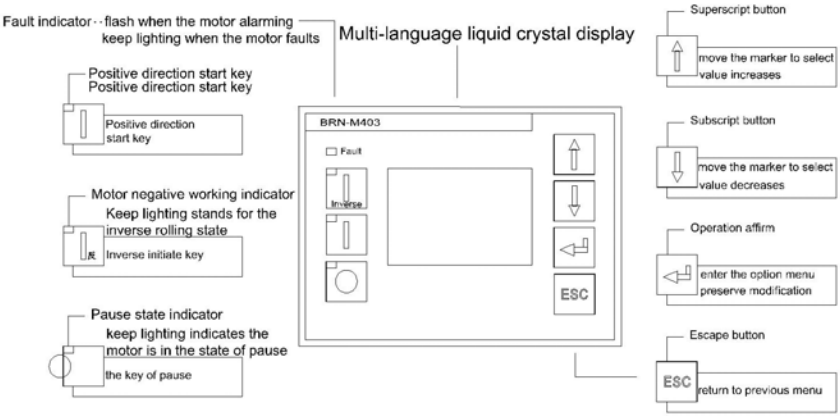


4.Electric Motor Working Control

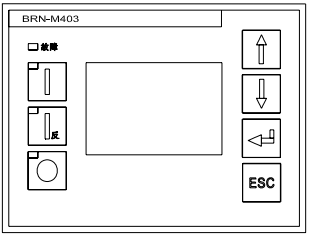
4.1 Working Procedure



4.2 BRN-M403fint Front Panel



4.3 Functions by Sending Out Start Order from Panel



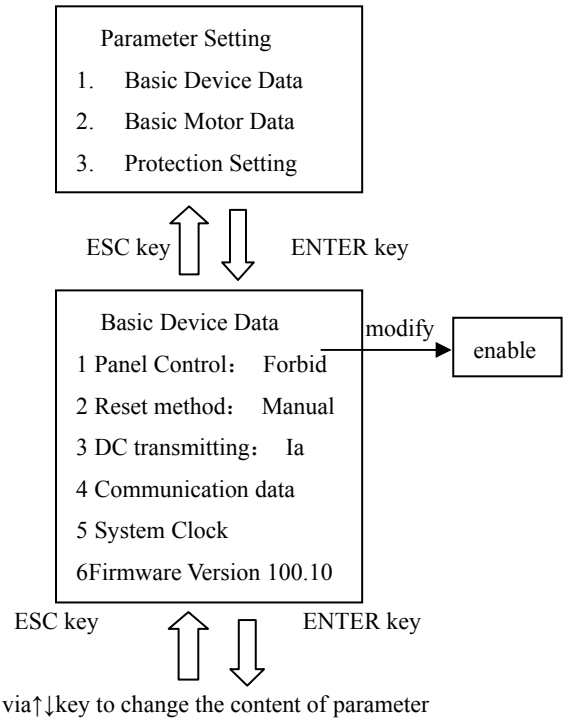
Start（positive）

Start（negative）

Pause

Remove Forbidding Operation

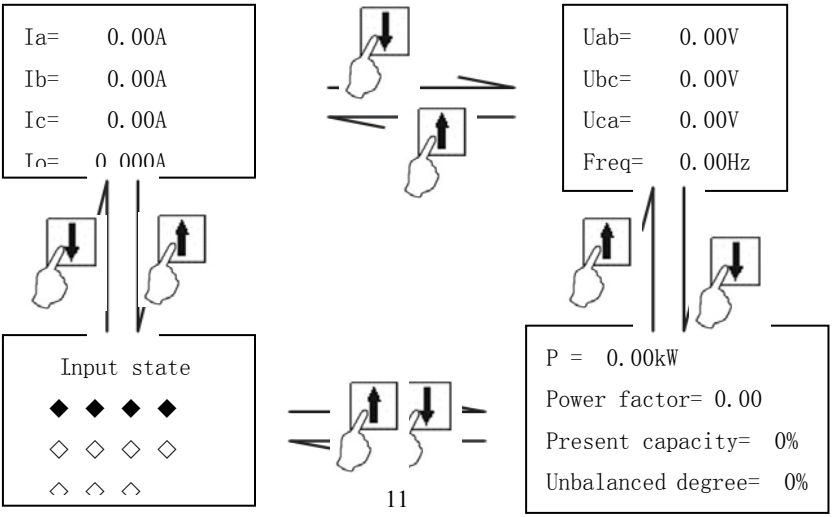
The three control button of BRN-M403A can be locked as “Forbidden” state .When under the condition of “enable” for “panel control” option, then BRN-M403A control button is available for controlling start and pause.



4.4 Monitoring Motor Current and Voltage Working Information.

BRN-M403 keep monitoring the real time data of three phase current, three phase voltage, power, power factor, input state, fault, warning, maintain information, electric parameter. A variety of protection information is generated automatically. These information circulates displaying directly on the LCD of operating panel. Via ↑ ↓ key to roll the screen ,and check the data rapidly.

Measure and Display in real time	BRN-M403
Three phase current	■
Three phase voltage	■
Frequency	■
Active power	■
Power factor	■
Working time for this time	■
Accumulated working time	■
On-off times of the motor	■
Input state	■
Time and reason of recent 8 times of warn/fault	■
Time and reason of recent 8 times of trip	■
Zero sequence current	□
Active energy	□
Leakage current	□



Note：various type of BRN-M403 will illustrate different real time data.

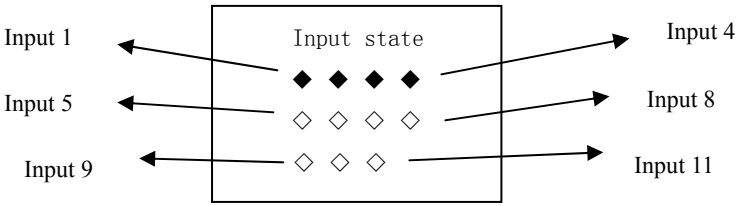
- Ia, Ib, Ic refers to the three phase current of motor, their values equals to the product of measured current and CT ratio. If the motor cross the core after via circumscribed CT. the CT ratio must be setted correctly. Then it can reflect the practical current correctly. If the device across the core directly rather than circumscribed CT, CT ratio must be setted as 1.
- I0 refers to the leakage of motor.
- Uab,Ubc,Uca stands for the line voltage of the three phase respectively.
- P refers to the active power ， Freq represent the frequency.
- Input state refers to the input real time state by switching quantity

Mainly for checking the states of contactor, breaker, supplementary connection.

The device has 11 switching quantities in total, which are showed in 3 lines, the first line are input 1,2,3,4,respectively,the second line are 5,6,7,8.and the third is opening 9,10,11.

◆ Stands for the opening connection state，set as 1；

◇ Represent for the break state in the input port, set as 0；



Attention：when connecting lines , much attention should be paid to the correct direction of current and voltage. If you do not follow the sketch in the instruction, the measured value of current and voltage will be incorrect. Therefore, if there happens to illustrate incorrect current and voltage, the connection should be checked first and make sure every single line are matched. The right connection is :the current of phase A should enter the L1 port and exit at the T1 port. The current of phase B gets in and out from port L2 and T2, respectively. As for the current of phase C, it gets in and out from

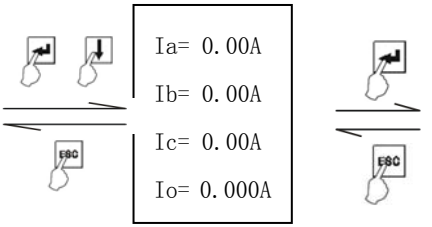
port L3 and T3 respectively. The matched terminal number of phase A is X1:1, and for phase B the matched number is X1:3, and X1:5 is matched for the voltage of phase C.

4.5 Check and Clear up the Records.

The history recording item provides the electric motor with the records of recent 8 times' tripping.(Time &Reason)、warning record(Time &Reason)、and other Incidents information. Via the communication port we can access to the content in detail.(The action value of tripping and warning).

History Record	Main menu
1. Trip record	1. Parameter setting
2. Warning Record	2. Parameter viewing
3. Clear up records	3. History recording
	4. Resetting by force

In the interface of real time monitoring, press ENTER to access to the system menu option. Via ↑ ↓key to select, the menu with black background which means it is now available. then press ENTER to access the matched submenu.



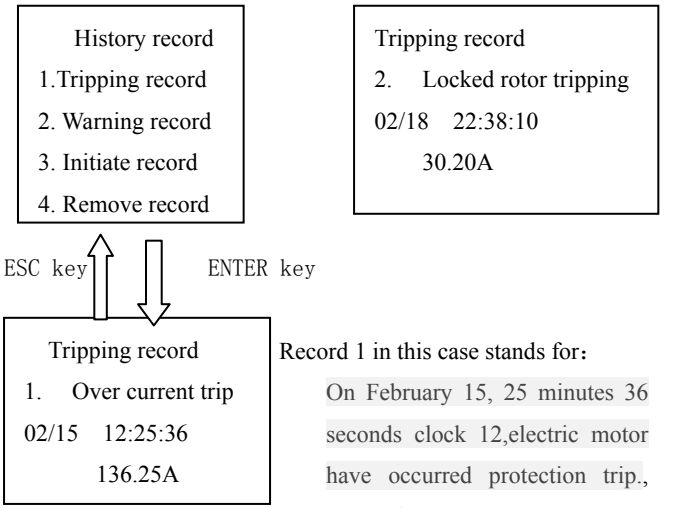
Trip record: recording the recent 8 times of tripping and put down the reason , date, and tripping time.

Warning record: recording the recent 8 times of warning reason , date, and time.

Clean up record: clean up all records of tripping, warning.

Viewing Tripping Record

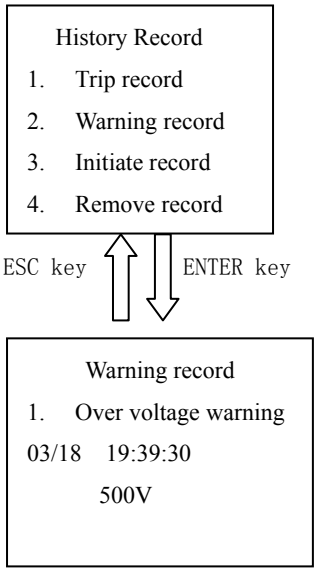
Press ENTER to access the submenu of tripping record, press ↑ ↓ key to view it.



Record 1 in this case stands for：

On February 15, 25 minutes 36 seconds clock 12,electric motor have occurred protection trip., and the trip current is 136.25A.

Warning Record Checking



In this case the record 1 represent:

On March 18, 19 when 39 minutes and 30 seconds，the motor have occurred protection warning.

Warning record

2. Under voltage warning
03/21 20:16:19
190V

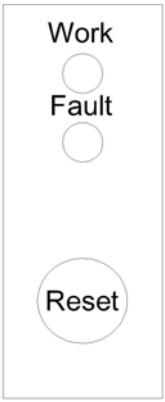
.....

Warning record

8. Over current warning
04/15 06:16:55
120A

4.6 Motor Working Fault Indication.

BRN-M403 basic unit has 2 working LED indicators and a reset button.



"Work" indicator:

• Flashing represents BRN-M403 is working under normal condition.

• Keep lighting represents BRN-M403 crashed，recommending reset the power.

• Light off，checking the power supply 。

"Fault" indicator:

• The light is off when the motor working normally.

• When motor works, the warning light flashes.

•The light is keep on When the motor faults .

4.7 The Reset Operation After The Fault Action.

For there is a fault occurs in motor, which is caused by protection action. The fault indicator keep lighting ,the halt exit relay and fault action signal maintain action state. The motor initiating closing control loop power supply is cut off by halt exit relay ， and keeps the state of power failure. Any initiating operation will close during this period until the confirmation of fault clearing then return.

There are two reset methods of halting exit relay and faulting action signal they are reset automatically and reset manually by force.

Automatic Reset

Basic Parameter of Facility
1. Panel control :enable
2. Reset manner：Automatically
3. DC transmit： Ia

After halting, the motor get cooling naturally, when the present heat capacity is lower than15%,and it is time to reset timer delay time.BRN-M403,meanwhile give off the halt exit relay and fault action signal relay. And the fault signal is out.

Manually reset the signal by force

Manually reset operation remove the record data of the present heat capacity of motor at the same time, and reset it to zero.

Main menu
1. Parameter setting
2. Parameter cheking
3. History record
4. Resetting by force

5.Parameter selection and setting.

5.1 Parameter Viewing

Ordinary—Parameter Sketch

CONSTANT VALUE	DEFAULT SETTING	SET RANGE	SET STEP SIZE	NOTE
BASIC DEVICE PARAMETER				
Panel ctrll	Enable	EnableDisable		
Reset pattern	Manual	Automatic/Manual		
DC transmmit	Ib	Ia/Ib/Ic		
Modbus setting	9600	4800-19200		Communication rate
	1	1~250		Communication address
System time	Date	2010/10/1		
	Date	00:00:00		
Hardware	4.10	15.10		Version number
Basic motor parameters				
Rated cur		0.1~999.9A	0.1	Rated current
Restart delay		1~999(S)	1	
Change delay	OFF	OFF/0.1~999.9	0.1	OFF stands for deselect this option Open represents the delay from high speed to low speed.
CT ratio	1	1~1200	1	Higher than 75KW,connect CT externally
Cool T constant	1	1~80min	1	
Rated cap	15	15%~100%	1	
Protection Para				
Short circuit		input/close		
Trip current		6.0~8.0(FLC)	0.1	6~8 times of rated current
Trip delay		0.1~25.0(S)	0.1	
Start time out				
Initiate Trip DLY		1.0~99.9S	0.1	
Blocking protection		Input/Escape		
Trip current		150%~600(% FLC)	1	1.5~6 times rated current
Trip DLY		1.0~99.9(S)	0.1	
Overload		trip/alarm---input/escape		
Overload constant		100%~125%	1	
Curve num		1~15	1	
Trip cap		51~100(%TC)	1	
ALM cap		51~99(%TC)	1	
Under voltage		trip/alarm---input/escape		
Trip current		20~95(%FLC)	1	
Trip DLY		1.0~99.9(S)	0.1	

Alarm current		20~95(%FLC)	1	
Alarm DLY		1.0~99.9(S)	0.1	
Fault earthing		trip/alarm---input/escape		
		0.03-5.00(A)	0.01	Select function
Trip DLY		0.1~99.9(S)	0.1	
Alarm current		0.03-5.00(A)	0.01	
Alarm delay		0.1~99.9(S)	0.1	
Over voltage		trip/alarm---input/escape		
Trip voltage		300~800(V)	1	
Trip delay		0.1~99.9(S)	0.1	
Warning voltage		300~800(V)	1	
Alarm DLY		0.1~99.9 (S)	0.1	
Under voltage		trip/alarm---input/escape		
Trip voltage		180~690(V)	1	
Trip DLY		0.1~99.9(S)	0.1	
Alarm voltage		180~690(V)	1	
Alarm DLY		0.1~99.9(S)	0.1	
imbalance		trip/alarm---input/escape		
alarm unbalance		10~80%	1	
Alarm Delay		1.0~99.9(S)	0.1	
Trip unbalance		10~80%	1	
Trip DLY		1.0~99.9(S)	0.1	
Rotor jamed		trip/alarm---input/escape		
Trip current		101%~600(%FLC)	1	
Trip DLY		1.0 ~99.9(S)	0.1	
Alarm current		101%~600(%FLC)	1	

Alarm DLY		1.0 ~99.9(S)	0.1	
Phase loss		input/close		
trip DLY		0.1~99.9(S)	0.1	

Double speed—parameter—viewing

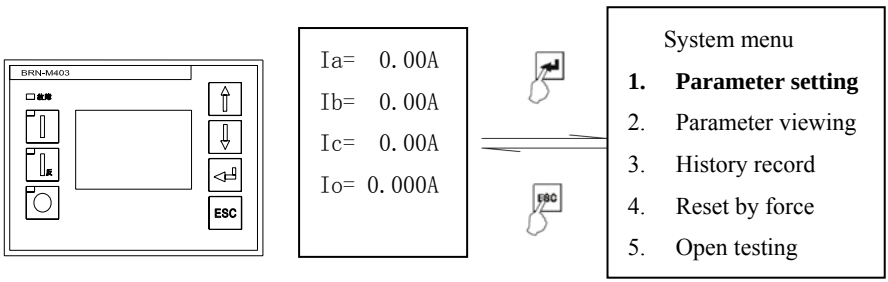
CONSTANT NAME	DEFUL T	SETTING RANGE	SETTING STEP SIZE	NOTE
DEVICE BASIC PARAMETER				
PANEL CONTROL	ENABL E	ENABLE/ DISABLE		
RESET METHOD	MANU AL	ANT/MAN		
DC transmit	Ib	Ia/Ib/Ic		
Modbus setting	9600	4800-19200		Communication speed
	1	1~250		Communication address
System time	date	2010/10/1		
	time	00:00:00		
Hardware	4.10	4.10		Version number
MOTER RATED CURRENT				
High speed current	60A	0.1~999.9A	0.1	High speed rated current
Low speed current	30A	0.1~999.9A	0.1	Low speed rated current
Transform DLY	OFF	OFF/0.1~999. 9	0.1	OFF stands for deselect this option Open represents the delay from high speed to low speed.
CT ratio	1	1~1200	1	Larger than75KW External CT
Cool.T.const	1	1~80min	1	
Rated cap	15	15%~100%	1	
PROTECTION PARA				
START				
Start overlong delay		0.1~99.9S	0.1	
Short circuit		input/close		
Trip current		6.0~8.0(FLC)	0.1	6~8times rated current
trip delay		0.1~25.0(S)	0.1	
Block rotor		input/close		
Trip current		150%~600(% FLC)	1	1.5~6times rated current

Trip delay		0.1~99.9(S)	0.1	
overload		trip/alarm---input/escape		
Overload constant		100%~125%	1	
Curve number		1~15	1	
Trip cap		51~99(%TC)	1	
Alarm cap		51~99(%TC)	1	
Under load		trip/alarm---input/escape		
Trip current		1~99(%FLC)	1	
Trip delay		0.1~99.9(S)	0.1	
Alarm current		1~99(%FLC)	1	
Alarm delay		0.1~99.9(S)	0.1	
Fault earthing		trip/alarm---input/escape		
Trip current		0.01-10.00(A)	0.01	Selection function
Trip DLY		0.1~99.9(S)	0.1	
Alarm current		0.01-10.00(A)	0.01	
Alarm DLY		0.1~99.9(S)	0.1	
Overload		trip/alarm---input/escape		
Trip voltage		300~800(V)	1	
Trip DLY		0.1~99.9(S)	0.1	
Alarm current		300~700(V)	1	
Alarm DLY		0.1~99.9 (S)	0.1	
Under voltage		trip/alarm---input/escape		
Trip current		180~690(V)	1	
Trip DLY		0.1~99.9(S)	0.1	
Alarm current		180~690(V)	1	
Alarm DLY		0.1~99.9(S)	0.1	
IMBALANCE		trip/alarm---input/escape		
Alarm unbalance		10~80%	1	
Alarm DLY		0.1~99.9(S)	0.1	
trip unbalance		10~80%	1	
Trip delay		0.1~99.9(S)	0.1	
Rotor block		trip/alarm---input/escape		
Trip current		101%~600(% FLC)	1	
Trip delay		0.1 ~99.9(S)	0.1	

Alarm current		101%~600(% FLC)	1	
Alarm DLY		0.1 ~99.9(S)	0.1	
Phase loss		input/close		
Trip DLY		0.1~99.9(S)	0.1	

5.2 How to Enter and Exit the Menu

BRN-M403 consists of 4 options. They are parameter setting， viewing,history record,reset by force.display state in the real time data,press enter to access the main menu,via ↑ ↓ key to select options.



Parameter setting: to set the basic parameters of motor and protection

Parameter viewing: check the basic parameter of motor and protection

History record: the recent 8 times of trip records and warning.

Reset by force: when it needs initiation in the emergency situation, reset delay will set the exit and capacity to zero.

Open test: test the 5 output relay of device. (pass word is ↑ ↓ ↑ ↓ ↑ ↓)

Attention ：

- to enter the parameter setting from main menu , password is necessary,and the correct password is required to enter the submenu.

Enter the parameter submenu

ESC key ↑ ↓ ENTER key

Password correct

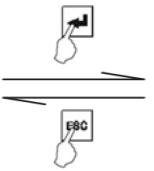
Parameter setting
1. Device parameter
2. Motor parameter
3. Protection setting

Main menu
1. Parameter setting
2. Parameter viewing
3. History record
4. Reset by force

password incorrect

Basic parameter setting

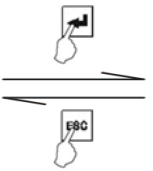
Parameter setting
1. Device parameter
2. Motor parameter
3. Protection setting



Device basic parameter
1. Panel control: forbid
2. Control method: manul
3. DC transmit: Ia
4. Communication parameter
5. System clock
6. Firmware 15.10

Via ↑ ↓ key to select and change the content of parameter
Press ENTER to save, press ESC to cancel modification.

Parameter setting
1. Device parameter
2. Motor parameter
3. Protection setting



Motor parameter
1. Rated current 999.9
2. Restart delay OFF
3. CT ratio 1
4. Dissipation constant 1
5. Rated capacity 15%

Motor basic parameter

Parameter	range	
Rated current	0.1~999.9A	step size 0.1
Restart delay	OFF, 1~999s OFF 闭锁,	step size 1
CT ratio	1~1200	step size 1

Dissipation constant	1~80	step size 1
Rated capacity	15%~99%	step size 1

5.4 Rated current setting

Ia= 0.00A Ib= 0.00A Ic= 0.00A Io= 0.000A	Main menu **1 Parameter setting** 2 parameter viewing 3 history record 4 restart by force	Please enter the password: XXXXXX	Parameter Setting 1 device basic parameter **2 motor basic parameter** 3 protection setting

Within 160A, CT ratio → Must be set to 1

Motor basic parameter 1 initiation direct 2 transform time OFF 3 rated current **107.0** 4 CT ratio 1 5 thermal dissipation 1 6 rated heat capacity 15%	Motor basic parameter 1 initiation direct 2 transform OFF 3 rated current **999.9** 4 CT ratio 1 5 heat dissipation time 1 6 rated capacity 15%

Note: rated current, configure the rated current according to the nameplate!

5.5 Cooling Time Constant and The Selection of Rated Heat Capacity

Heat Dissipation Constant: It relates to the structure and material

of motor, generally ,through the time of 5 times of time constant then it is confirmed that the motor is cooling completely, namely, the temperature is same as that of surrounding environment.

Rated Heat Capacity：the motor runs under the rated current for long time, its capacity and the radio of the maximum capacity which is permitted by motor, can get from the equation above:

Rated Capacity＝(1－thermal rotor locked time/cool rotor locked time)×100%

The thermal rotor locked time stands for the motor which is under the function of rated current and the time of getting to the stable value.

Cool Rotor Locked Time represents for locked time of the motor temperature equals to the environment .

Thermal rotor locked time and cool rotor locked time which can be found in the specification .The general ratio of them is 85%,following this ,the typical thermal value is 15%.

When the function current of the motor is lower than or equals to the setting motor rated current,BRN-M403 use rated heat capacity to imitate the model of thermal .When the motor is under the condition of cooling (the temperature of motor is equals to the surrounding temperature), the thermal capacity is 0%,and the motor is hot (running under the rated current and get to a constant temperature),the motor's thermal capacity is rated capacity. As the example above ,which is equals to 15%.In the extreme value is Linearity, the thermal model includes all the range of temperature :Cooling -Warming-Radiation-Overheated .

When the practical running current of motor is under the overload constant value, the motor capacity can be calculated by the equations below:

The Present＝(Practical Current)/(Rated current)×Rated thermal capacity

Example 1: The locking time of thermal rotor is 6s. The locked time of cool rotor is 9s, the rated current of motor is 50A, the overload current value is set to 118% FLC(namely, 59A), the practical running current is 56A, then the present heat capacity of motor is:

The present heat capacity＝(practical capacity)/(rated current)×rated heat capacity

＝(practical)/(rated current)×)100%－the locked time of thermal rotor/cool rotor locked time)

＝56/50×(100%－6/9×100%)　＝37.3%

When the heat capacity of the rotor exceeds the protection, BRN-M403 sends out warning signal, and the fault indicator flashes, based on the signal the operation stuff can reduce the load of the motor or the motor will continue overloading, its heat capacity will continue raising until reach the thermal capacity of the protection, and then take place the overload protection. After tripping, BRN-M403 indicator stop flashing and keep lighting.

After protection trip, in order to avoid for the operator restarting a overheated motor which will lead to destruction. BRN-M403 waits for the thermal capacity down to 15%, then reset is permitted. When meet with the emergency situation, which requires an overheated motor, then allows the emergency reset. According to the equation below, the reset time can be estimated automatically:

Reset Time $t = -T \ln(15/TC)$

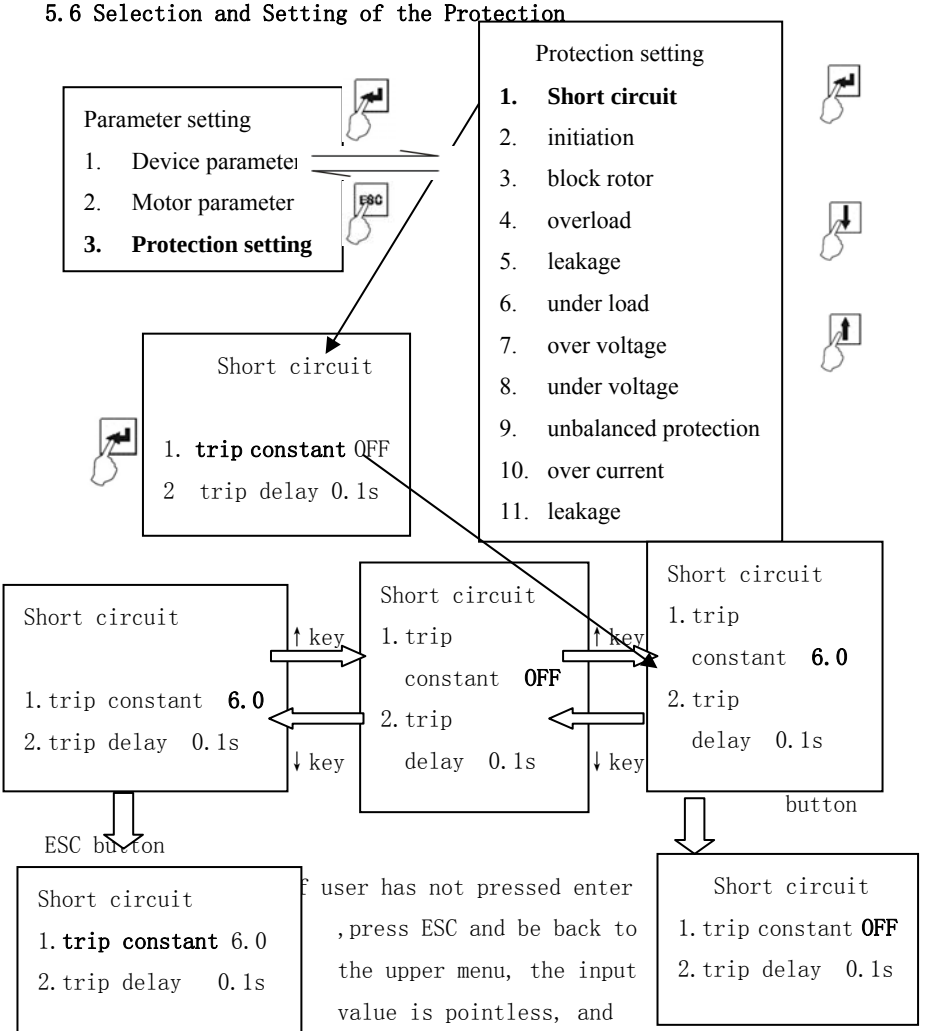
In the equation: T : motor thermal dissipation time constant. TC : pre-set motor trip thermal capacity.

Example 2: If the cooling time constant of motor is 12min, the pre-set trip capacity is 95%, then the time after trip is: t=-12ln(15/95)≈22.1min

Example 3: we assume that the constant value of motor cooling time is 10 min, according to the equation above, after 10 minutes the thermal will reduce to 36.8%(1T) of the original percent. After around 19 minutes

the thermal capacity will reduce to 15% of the original percent. and the facility is permitted to reset, after 30 minutes it downs to 5%(3T),and after around 40 minutes, it reduces to 2%(4T),then after 50 minutes, it can be confirmed as complete cooling(5T),namely it equals to the surrounding temperature.

5.6 Selection and Setting of the Protection



f user has not pressed enter ,press ESC and be back to the upper menu, the input value is pointless, and parameter will maintain the original value.

Motor protection selection

Signal specification:

Signal specification:

FLC	motor rated current
Imax=max(Ia,Ib,Ic)	largest phase current
Imin=min(Ia,Ib,Ic)	smallest phase current
Iav=(Ia+Ib+Ic)/3	average current
Iub%=max((Imax-Iav),(Iav-Imin))-100%/Iav	unbalanced degree(Ia>FLC)
Iub%=max((Imax-Iav),(Iav-Imin))-100%/FLC	unbalanced degree (IaV≤FLC)
Umax=max(Uab,Ubc,Uca)	largest line voltage
Umin=min(Uab,Ubc,Uca)	smallest line voltage

Input over length, over voltage, leakage , short of phase protection when initiating motor, other function will input after finish initiation.

Short circuit will be input at any time.

Special Attention:

Short circuit maybe overextend of the cutting of ability of contactor. When the protection trip conditions establish , **BRN-M403 will start trip exit(R1) when the phase current is larger than the pre-set maximum breaking current,** meanwhile, BRN-M403 acts on exit transformer (R4) and fault signal transformer (R5) to pretend it from being damaged. Therefore, fuse protector and breaker must be put into using in the system(at least match the one of them).

BRN-M403 default the maximum open-close current is 8 times of rated motor current. When designing , R4 can connect the shunt trip loop, and serves as the reserve fault protection. In the logics below we do not illustrate respectively.

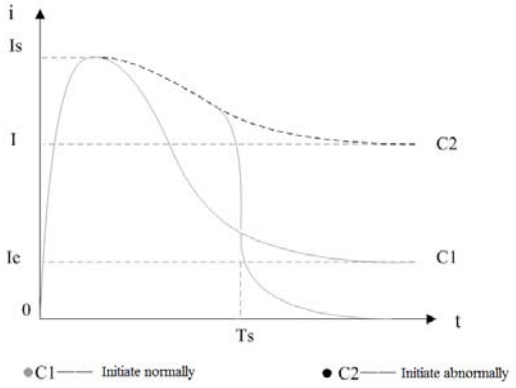
Start Protection

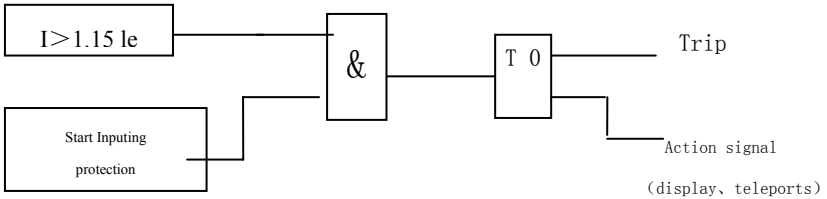
In the direct or invertible starting, if the closing start overlong protection, then checking if there exists a current of 300ms then the motor comes into working condition. If it initiates overlong protection, when detected a current within 300ms, the maximum current is under 115%FLC, then it is considered to be in the state of working or in the state of initiating state.

In the process of starting star-delta, if the starts overlong protection, after start star connection, through the pre-set transform time, the motor will change to the triple star working pattern. If the overlong protection is put into function. After starting for a while, the current will be smaller than 115% of the rated current of star connection. And the time exceed the 25% of transform delay. It is allowed to transform to triple star model. After initiating star connection through the transform time ,and the current of the motor is always larger than 115% of the rated current star connection, then it will not change to the triple working model, waiting overlong trip.

Star-delta initiates ,its delay overlong should be set longer than that of star-delta transform or it will fail in starting motor. When access to the working condition, it will exit model of starting overlong protection.

The normal initiating process is shown below:



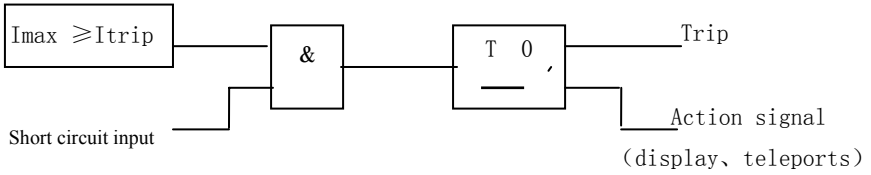


The setting range of initiating protection constant：

Start protection	Initiate overlong trip delay	1.0~99.9 (s)step size is 0.1 OFF represents the closing function

Short circuit protection

When it happens short circuit fault, the circuit should be cut off immediately, avoiding doing damages to motor like burning down, trip at the enter-wire. MCC control center power failure and other accidents.



The short circuit protection constant setting range is shown below:

Short circuit Protection	Trip circuit	6.0～8.0（FLC） 步长为 0.1 OFF stands for the closing function
	Trip delay time	0.1～25.0（s） Step size is 0.1

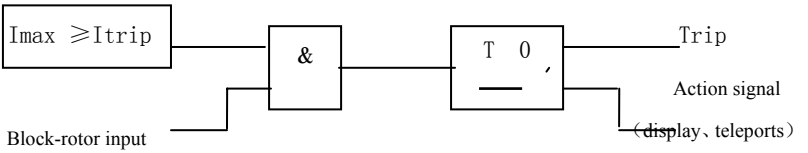
Short circuit within 8 times of FLC, contactor trips at the exit.

When it exceeds 8 times of FLC, in order to protect contactor(the break ability is limited), breaker trip at the exit of the device, and will not trip contactor any more.

Lock-rotor protection

In the process of motor working, for the overload or mechanical reasons, the motor is blocked, if we do not remove fault, it will burn

and destroy the winding of motor. When 3 phase current has a overload which is 1.5～6times of rated current. Namely we can press the protection constant and time limited quick trip, to avoid damaging the rotor.



Block-rotor constant setting range is shown below:

Block protection	Trip current	150%～600%（FLC） step size is 0.1 OFF represents closing this function
	Trip delay time	1.0～99.9（s） step size is 0.1

Overload protection

BRN-M403 relates to IEC 60947-4-1 and requires providing 3 phase or AC motor with protection. It equips the inner tripping curve from TC2.5 to. Then, the cut-off time will be accurately adapt to load torque, and make full use of motor more efficiently than before.

The heat capacity of the motor is of a certain amount. When the used thermal capacity accumulates and gets to the full percentage of maximum capacity. Under the present circumstance, if continue working overload, then the heat generated will raise the temperature of motor constantly. which will finally damage the insulation and burn down the motor.

When overload tripping occurs ,the thermal capacity of motor will decrease at a speed of index until the thermal capacity is lower than 15% then it will reset. When the emergency initiation is needed, reset by force is available by pressing the button of panel.

The thermal model of motor:

1) When the motor stops: its thermal decrease at a speed of index:

Present thermal capacity＝Before halt thermal capacity×$e^{t/T}$

In the equation: *T is the heat dissipation constant value*

2) When functioning under normal conditions, (including overload in a certain period, the thermal capacity increase, but still within the range of trip, then the motor will be back to the normal working condition.) :

Steady state thermal capacity =(practical current)/(rated current) × rated thermal capacity

The present thermal capacity= steady thermal capacity + the value which is over the value of steady stable thermal capacity and decrease exponentially.

When working, the time of heat dissipation is half of the time of halting.

3) When the motor working current exceeds the current of overload protection constant: Its thermal capacity increase at a speed of squared relationship. In the meanwhile, we calculate the heat dissipation only, namely the heat capacity increases without decreasing.

4) When it occurs trip: its thermal capacity decrease exponentially: the present thermal capacity = trip thermal capacity$\times e^{t/T}$

Overload Protection constant value setting range is shown as follows:

Time inverse Thermal overload protection	Overload constant	100~125 (%FLC) step size is 1
	Curve number	1~15 step size is 1
	Trip thermal capacity	51~100(%TC) step size is 1 OFF stands for the close overload trip function
	Warning thermal capacity	51~99(%TC) step size is 1 OFF represents for close overload warning function

Overload constant: The initiate current of overload. When the rated current reaches over limits, the protection initiates. Overload constant range is 100～125%FLC, users can set a more reasonable value according to the thermal heat characteristic.

Curve Number：this value is relevant to the thermal property. BRN-M403 provides user with 15 curves to choose from so that we can be better in matching the thermal property. If the motor manufacturer provides the motor thermal curve , then we can choose 1 from the 15 over current curve and make it exactly lower than the motor damage curve. If there is no thermal curve , this constant can be confirmed according to the block rotor current and the maximum block time permitted . Find the line in which lies the block rotor current. Find the value which approaches to the largest block rotor time , but the smaller one is the curve number which need setting. For instance , if the block rotor is 6FCL, the permitted time is 16s, then select the 6 times of over current from this line, and the selected value is most extreme to 16s, and 14.99 is smaller, so the line which it lies is the required curve number. When the current is larger than 6 times of FLC, BRN-M403 still calculates trip time according to 6 times of FLC.

Trip thermal capacity：the present used thermal capacity can be read at RS485 port and LCD of operating panel, upper computer reacts to this signal, controlling load or other devices, to decrease the load of motor, guarantee the normal functioning or motor. Otherwise, the temperature of motor will go on rising. when the used thermal capacity gets to rated trip thermal capacity or over it. which will active the overload trip. In order to keep motor running normally, thermal capacity should not be set to a large number, 95 is recommended , in normal condition , this can not be exceeded.

Warning Heat Capacity：when the used heat capacity is over the given warning heat capacity, then the warning signal is sent out, and light the yellow indicator on the panel. The warning heat capacity value can be set to 70～80% of trip heat capacity. For the load of frequency changing, for instance, hoist、elevator, etc, in order to avoid warning too often, the overload warning heat capacity can be set higher than

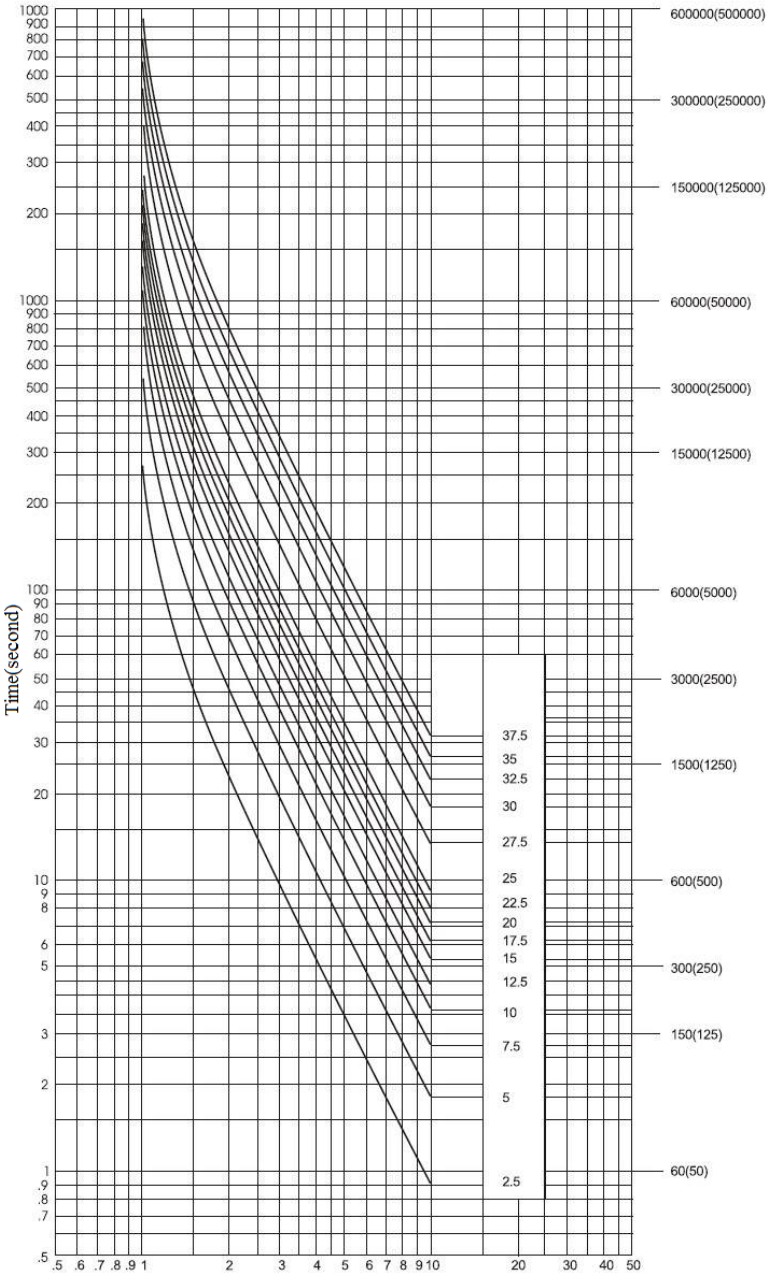
rated value.

Time Inverse Overload Property Curve Diagram(Cold State)

Multiple of OC	Curve number of overload delay time(s)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.01	4353	8706	13060	17413	21766	26119	30473	34826	39179	43532	47886	52239	56592	60945	65299
1.05	854	1707	2561	3415	4268	5122	5976	6829	7683	8537	9390	10244	11098	11951	12805
1.10	417	833	1250	1667	2083	2500	2917	3333	3750	4167	4583	5000	5417	5833	6250
1.20	199	398	597	795	994	1193	1392	1591	1790	1989	2188	2386	2585	2784	2983
1.30	127	254	380	507	634	761	888	1014	1141	1268	1395	1522	1649	1775	1902
1.40	91.15	182	273	365	456	547	638	729	820	911	1003	1094	1185	1276	1367
1.50	70.00	140	210	280	350	420	490	560	630	700	770	840	910	980	1050
1.75	42.42	84.85	127	170	212	255	297	339	382	424	467	509	552	594	636
2.00	29.17	58.33	87.50	117	146	175	204	233	263	292	321	350	379	408	438
2.25	21.54	43.08	64.62	86.15	108	129	151	172	194	215	237	258	280	302	323
2.50	16.67	33.33	50.00	66.67	83.33	100	117	133	150	167	183	200	217	233	250
2.75	13.33	26.67	40.00	53.33	66.67	80.00	93.33	107	120	133	147	160	173	187	200
3.00	10.94	21.88	32.81	43.75	54.69	65.63	76.56	87.50	98.44	109	120	131	142	153	164

3.00	10.94	21.88	32.81	43.75	54.69	65.63	76.56	87.50	98.44	109	120	131	142	153	164
3.25	9.15	18.30	27.45	36.60	45.75	54.90	64.05	73.20	82.35	91.50	101	110	119	128	137
3.50	7.78	15.56	23.33	31.11	38.89	46.67	54.44	62.22	70.00	77.78	85.56	93.33	101	109	117
3.75	6.70	13.40	20.10	26.79	33.49	40.19	46.89	53.59	60.29	66.99	73.68	80.38	87.08	93.78	100
4.00	5.83	11.67	17.50	23.33	29.17	35.00	40.83	46.67	52.50	58.33	64.17	70.00	75.83	81.67	87.50
4.25	5.13	10.26	15.38	20.51	25.64	30.77	35.90	41.03	46.15	51.28	56.41	61.54	66.67	71.79	76.92
4.50	4.55	9.09	13.64	18.18	22.73	27.27	31.82	36.36	40.91	45.45	50.00	54.55	59.09	63.64	68.18
4.75	4.06	8.12	12.17	16.23	20.29	24.35	28.41	32.46	36.52	40.58	44.64	48.70	52.75	56.81	60.87
5.00	3.65	7.29	10.94	14.58	18.23	21.88	25.52	29.17	32.81	36.46	40.10	43.75	47.40	51.04	54.69
5.50	2.99	5.98	8.97	11.97	14.96	17.95	20.94	23.93	26.92	29.91	32.91	35.90	38.89	41.88	44.87
6.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00	27.50	30.00	32.50	35.00	37.50
6.50	2.12	4.24	6.36	8.48	10.61	12.73	14.85	16.97	19.09	21.21	23.33	25.45	27.58	29.70	31.82
7.00	1.82	3.65	5.47	7.29	9.11	10.94	12.76	14.58	16.41	18.23	20.05	21.88	23.70	25.52	27.34
7.50	1.58	3.17	4.75	6.33	7.92	9.50	11.09	12.67	14.25	15.84	17.42	19.00	20.59	22.17	23.76
8.00	1.39	2.78	4.17	5.56	6.94	8.33	9.72	11.11	12.50	13.89	15.28	16.67	18.06	19.44	20.83

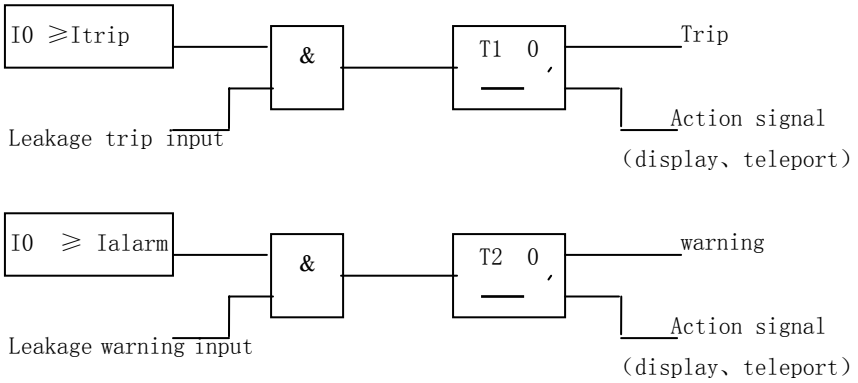
$$t=\frac{87.5c}{(I/In)^{2}-1}$$ In the equation：C is curve number，In is rated current.



Heat Overload time limited curve(cold state)

Leakage Protection

BRN-M403 requires external zero sequence current transformer to achieve external grounding fault monitor function. External grounding fault checking function is used for high impedance grounding system. By using zero sequence transformer, it can detected extreme low grounding current. Zero sequence mainly reacts the grounding system. Under the normal condition , the sum of 3 phase current is 0. due to the low voltage system neutral point is grounding. If a certain phase is grounding there will generate a substantial zero sequence current, then it will damage the stator groove of motor , leakage even will do harm to the human body.

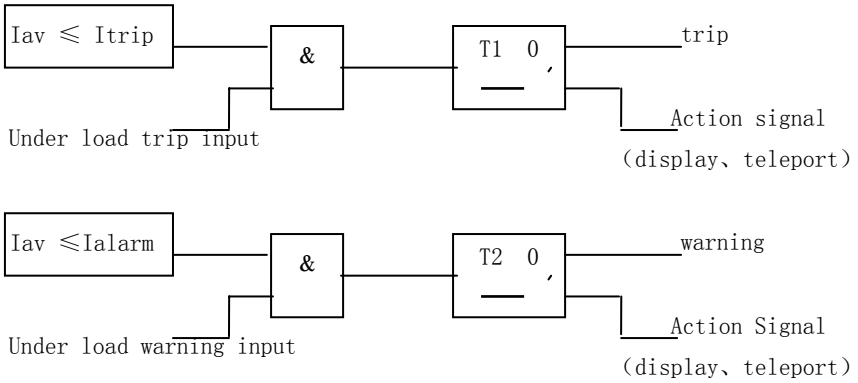


Leakage protection setting range is shown as follows:

Leakage protection	Trip current	0.03～5.0（A） step size is 0.1 OFF is to close the function
	Trip delay time	0.1～99.9（s） step size is0.1
	Warning current	0.03～5.0（A） step size is 0.1 OFF stands for close the function
	Warning delay time	0.1～99.9（s） step size is 0.1

Under load

It is needless for motor to equip under load, for it will not burn down the motor, but we must take the reasons seriously. For instance roller break, band carrier disconnect, water pump empty suck. these will cause serious accident .Meanwhile, the power factor is rather low when functioning under load, and consume large quantity of idle work, which is a waste of energy. when the motor is under the setting value, then it will warn or trip as the setting requirement.



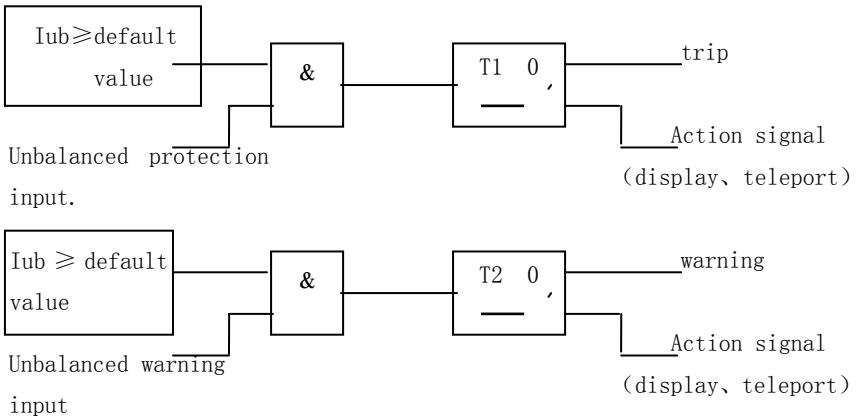
Under load setting range is illustrated as follows:：

Under load protection	Trip current constant	20~95 (%FLC) step size is 1 OFF is to close the function
	Trip delay time	1.0~99.9 (s) step size is 0.1
	Warning current constant	20~95 (%FLC) step size is 1 OFF stands for close the function
	Warning delay time	1.0~99.9 (s) step size is 0.1

Three Phase Current Unbalanced Protection

In normal condition, the current of every single phase is equality, stator current is right to provide the rotation torque .when the stator. When the stator current is unstable ,there will be a large negative sequence current in it. The working frequency of the current is twice of normal power supplying, and have a rotation torque which is opposite to the original working direction. In normal condition, the

increment of stator current is quite small(125%～200%), thus after a long while the current protection trips. Moreover large quantity of stator current will damage large area of stator. The tolerance capacity is decided by design of rotor and thermal dissipation property. Because of the shortage of data providing by motor, the standard of unbalanced setting is decided by experience. As for the balanced state, we suggest considering 10% and 5 seconds of delay as a start location. The initiating value can be down regulated to the level in which there will occur trip quite often, In the same time, if necessary, the delay time can increase too. To a slight load motor, an larger unbalanced current will not be harmful to motor, in case of tripping/warning, when average current is lower than 30%FLC,BRN-M403 close the unbalanced protection function.



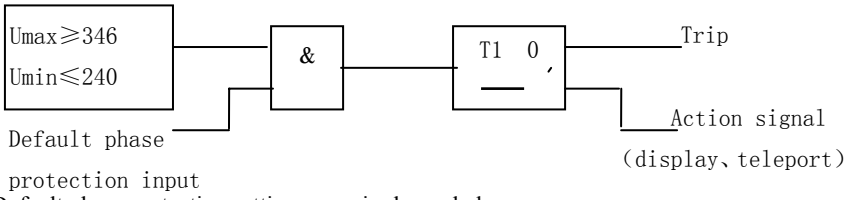
Unbalanced protection setting range is shown as follows:

Unbalanced protection	Trip constant	10~80 (%FLC) step size is 1 OFF stands for close the function
	Trip delay time	1.0~99.9 (s) step size is 0.1
	Warning constant	10~80 (%FLC) step size is 1 OFF represents for close the function
	Warning delay time	1.0~99.9 (s) step size is 0.1

Default Phase Protection

The three phase unbalanced voltage is one of the main reason for damaging

motor, and this unbalanced situation is caused by various of factors, which are common in industrial environment and one of the reasons is that it has a resistance given by the current contactor with fault, inattention connection, various voltage configuration of transformer, or total different three phase distribution, etc. The electric supply from power plant is balanced, but there is a varity of single phase which will generate unbalanced voltage at the terminal, the most serious of unbalanced situation is that it is completely lost of voltage for a single phase. This situation is properly caused by fusing of a certain phase. which will damage the three phase seriously.

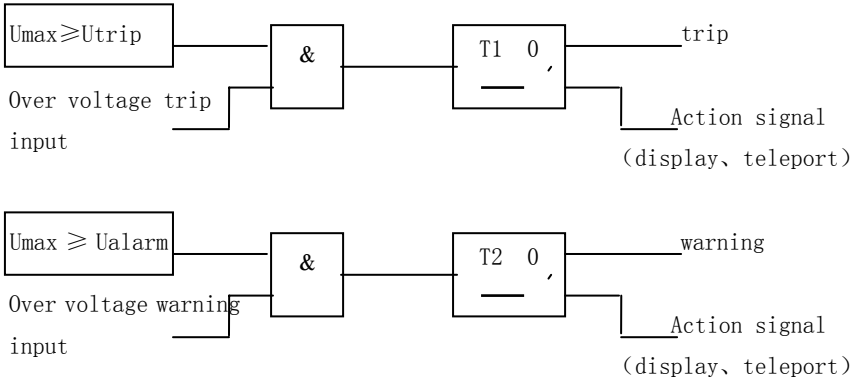


Default phase protection setting range is shown below：

Default protection	Trip delay	0.1～99.9（s） step side is 0.1 OFF stand for closing the function

Overvoltage Protection

Over voltage of the system will cause increasing excitation current dramatically, and generate large quantity of third harmonic, the over large voltage will also cause damage to insulation.



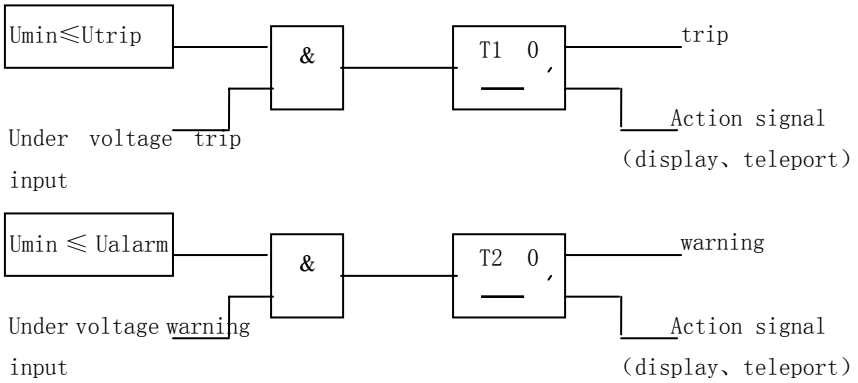
Over voltage protection setting range is shown as follows:

Over Voltage Protection	Trip voltage constant	300～800（V）step size is 1
	Trip delay time	OFF stands for close the function 0.1～99.9（s）step size is 0.1
	Warning voltage constant	300～800（V）step size is 1
	Warning delay time	OFF is to close the unction 0.1～99.9(s) step size is 0.1

Under Voltage Protection

When the low voltage distribution loop decrease dramatically due to the fault of system, the normal functioning motor will decelerate, over current, block rotor, etc, and large quantity of motor will be over current or short circuit.

From the basic theory(ideal situation),no matter it is squirrel-cage motor or wound motor, its under voltage action value is (70%～35%)Ue, users can set it according to the practical situation.



Under voltage protection setting range is illustrated below：

Undue Voltage protection	Trip voltage constant	180～690（V）step size is 1
	Trip delay time	OFF stands for close the function 0.1～99.9(s)step size is 0.1
	Warning voltage constant	180～690（V） step size is 1

	Warning delay time	OFF represents closing the function 0.1～99.9(s)step size is 0.1

Interference Electricity Protection（Restart Automatically）

“Interference Electricity” refers to lighting stroke, short circuit, or other reasons which lead to voltage fluctuation temporarily or power failure of power grid. When the motor in the scene pauses due to the interference electricity, if it is permitted to recover to normal condition(back to the default configuration or even higher),protector restart the interference motor, if not, protector will close and do not start any more. To avoid multiple motor lost voltage initiation which will cause large impact to grid, every lost voltage restart motor has a interval, the specific time interval according to the practical requirements.

parameter	Range
Restart delay	OFF is to close the function delay time is 1-999S step size is 1
Trip voltage	Device default 30% rated voltage
Recover voltage	Device default 70% rated voltage

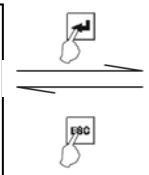
Trip voltage：when the grid voltage is under 30% of rated voltage，contactor trip，protector start interference.

Recover voltage：when the power grid is higher than 70% of rated voltage, it will stop interference time.

Interference electricity delay：It refers to the time of grid voltage recover from trip to recover voltage time. If this period of time is larger than the defaulted interference delay, then it will close.

5.7 Communication Port Configuration

Parameter setting
1 basic device parameter
2 basic motor parameter
3 protection setting



Device basic parameter
1. Panel control： forbid
2. Control method： manual
3. DC transmit： Ia
4. Communication parameter
5. System clock
6. Firmware version = 100.10

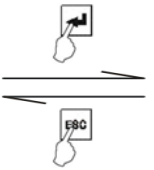
Communication parameter
1 Baud rate 9600
2 address 1

Via ↑ ↓key to select and change the content of parameter
press ENTER to save, press ESC to give up modification

communication address setting range is set to 1～250;
Baut rate equip standard is 4800、9600 two grade, if necessary
19200、38400, it need specification when ordering goods.

5.8 Clock Calibration

Parameter setting
1 Basic device parameter
2 Basic motor parameter
3 protection setting



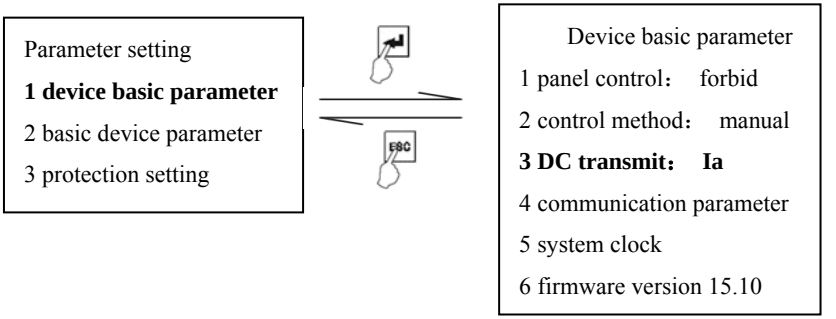
Facility basic parameter
7. Panel control： forbid
8. Control method：manual
9. DC ： Ia
10. Communication parameter
11. **System clock**
12. Firmware version 100.10

Via ↑ ↓key to select and change parameter content.
Press ENTER to save, press ESC to give up modification

Clock format：date：year/month/day
time：hour/minute/second

System clock
Date：2010/11/17
time：13/57/48

5.9 4～20mA imitation quantity transmit output setting



By pressing ↑ ↓ to select and change content of parameter

Press ENTER to save, press ESC to cancel modification.

BRN-M403 default 20mA matched value is 1.2 times of rated current. If there is special demand, please specify when ordering.

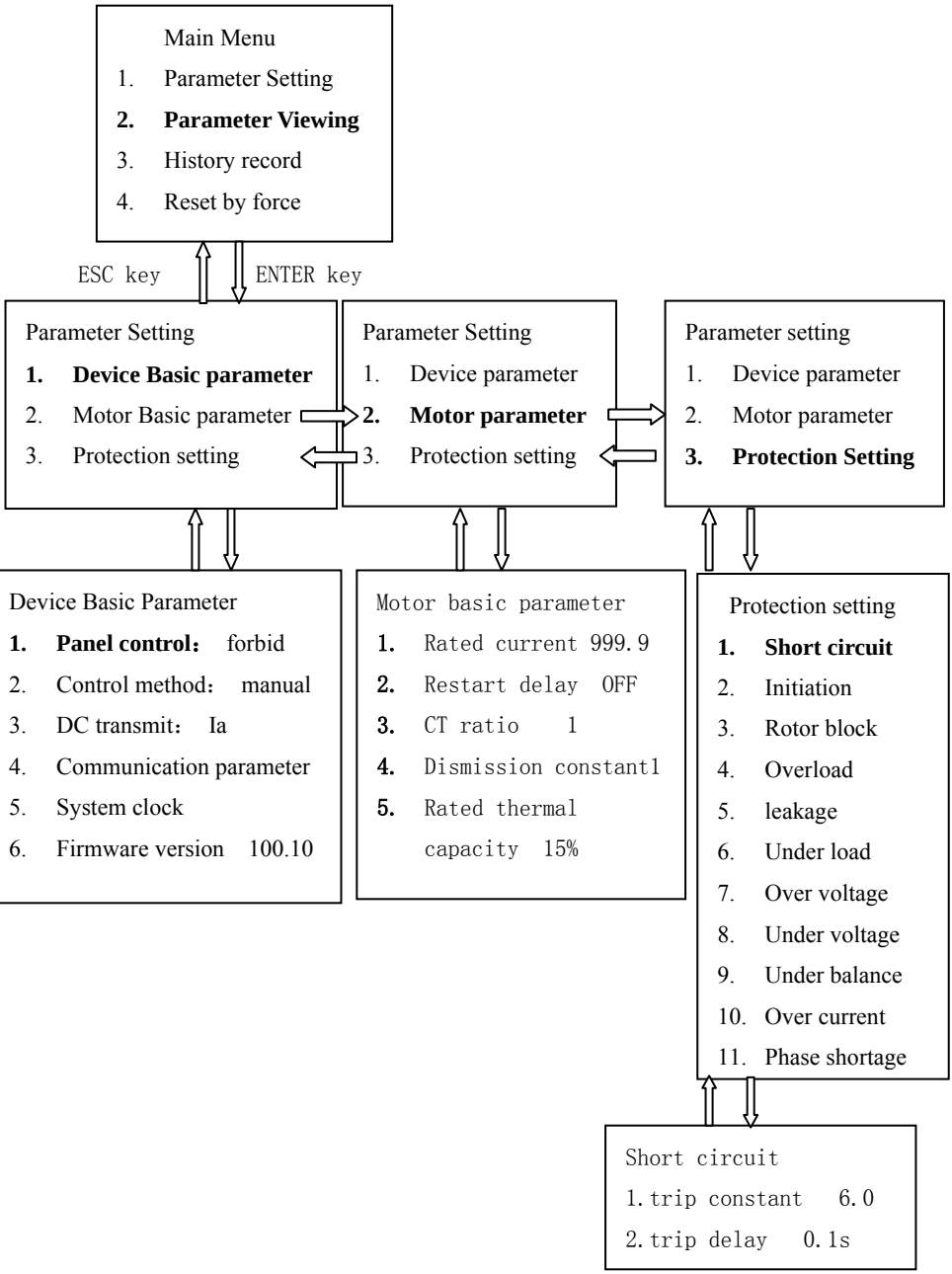
For instance, the rated current of motor is set to 117A, then the transmit output is 20mA and the matched current is 140.4A.

20mA→1.2×rated current rated current is rated current of motor practical setting current.

4 ～ 20mA imitation quantity output matched detected current theoretical value is $i=1.2I_n(A_O-4)/16$。

In the equation: In is the rated current, AO is the imitating 为 transmit output。

6. Parameter Viewing



7.Fault Strategy

If something is wrong with the facility,please refer to the table below:If it can not be solved,please have a contact with our organization.

Unusual State Viewing

Display	Reasons and strategies
Basic working unit indicator light off	Detected the facility if it is supplying power normally.and assure the correct connection,and check out the fuse
Basic unit indicator keep lighting on	Off the power supply,then turn it on
Basic unit fault indicator keep lighting on	It indicates that there is a fault with a protection action with the motor. After deal with the caused reasons,and go on with operation.
Panel fault indicator flashing	Check the basic connection between basic unit and the panel
Panel fault indicator keep lighting on	It indicates that there is a fault with a protection action with the motor. After deal with the caused reasons,and go on with operation.。
Panel LCD abnormal display	Check the connection between basic unit and panel.
Motor acts disorderly	1) check the motor control loop. 2) check the signal connection. 3) check the configuration of control mode.
Can not wright in parameter	Whether the motor is under working condition

8. Technology Specification

Permitted Temperature • working period • storage and transport	 °C °C	 -25 ... +60 -40 ... +80
Installation Height(with out secure isolation) • permitted highest environment temperature +50 ° C • permitted highest environment temperature +40 ° C	m m m	≤2000 ≤3000 ≤ 4000
Defend level(correspond to IEC60529) • all of the parts • current measure model • operation panel		 IP20 IP40 IP54
Anti-seismic（sine pulse）	g/ms	15/11

Electromagnetism compatibility fits IEC 60947-1

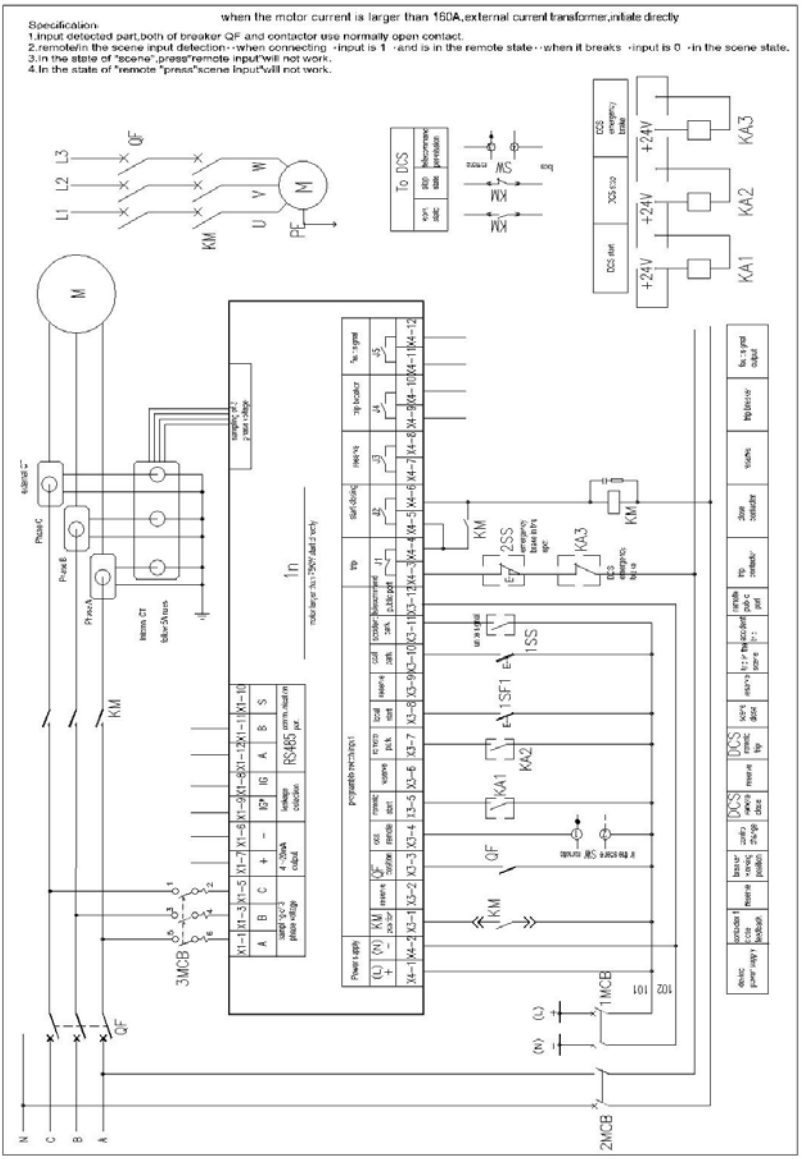
- Line conduction disturbing,impact satisfy IEC 61000-4-4
- conduction interference，high frequency fits IEC 61000-4-6
- line induction interference，surging fit IEC 61000-4-5
- electrostatic discharge， ESD fit IEC 61000-4-2

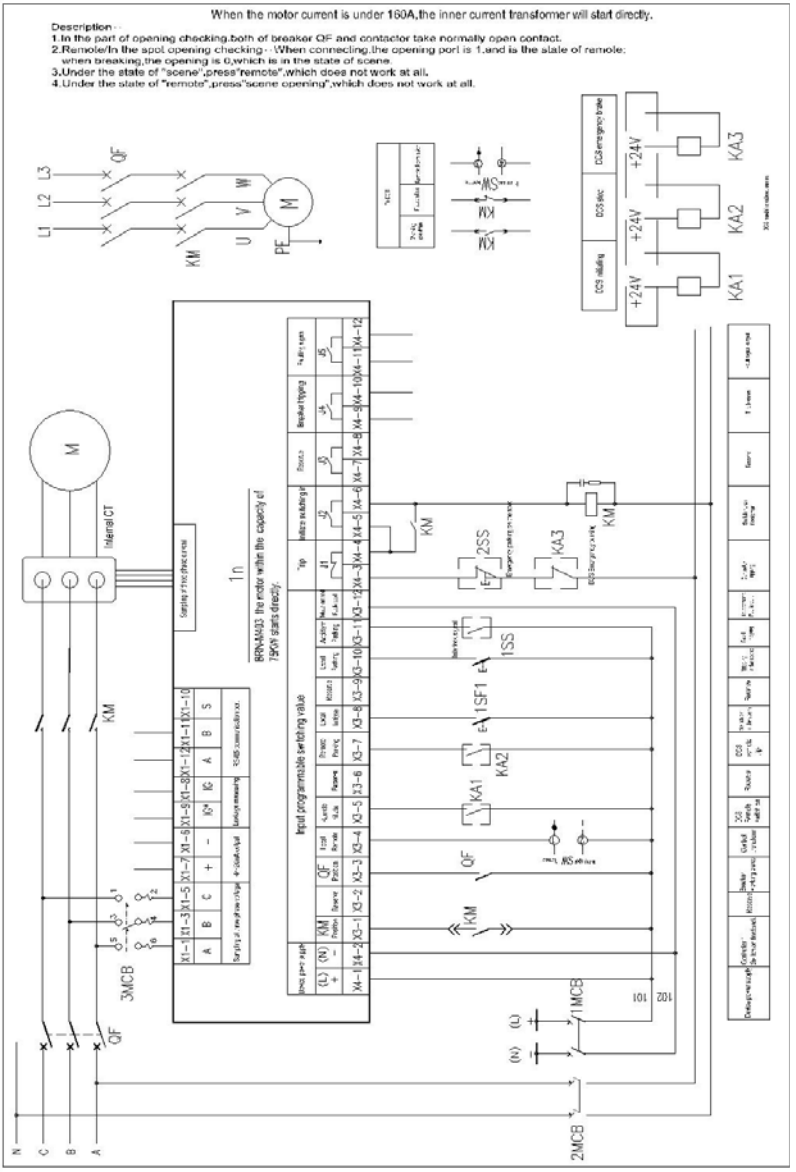
Rated control voltage Us	220 V AC；50/60 Hz		85~265V DC
Suitable voltage range	0.85 ... 1.1 x Us		0.85 ... 1.2 × Us
Rated insulation voltage Ui	V	300 (污染等级 3)	
Rated tolerance voltage Uimp	kV	4	
Power supply consumption		AC/DC85~265V <5W	
Protection component accuracy		≤±3.0%	

current、voltage time		≤±20ms
Relay output Largest open-break current/voltage Normal open-break capacity Electrical lifespan	 A A	 cosΦ=1.0，10A /227VAC cosΦ=1.0, 5A /220VAC; Larger than 10^5 times
Switch input	External power supply(220VAC/DC),resolution ratio 10ms	
4~20mA transmit output	The largest load 700 ohm，accuracy0.5%	
RS485 communication port	Modbus RTU agreement，baud rate 4800bps~38400bps	
Average normal time	Larger than 50,000h	

9. Connection Principle

Sketch




When the motor current is under 160A,the inner current transformer will start directly.
Description:
1.In the part of opening checking,both of breaker QF and contactor take normally open contact.
2.Remote/In the spot opening checking:When connecting,the opening port is 1,and is the state of remote;
when breaking,the opening is 0,which is in the state of scene.
3.Under the state of "scene",press"remote",which does not work at all.
4.Under the state of "remote",press"scene opening",which does not work at all.
L1 L2 L3
QF
KM
U V W
M
PE
KA1 KA2 KA3
+24V
DCS alarming
DCS elec
DCS emergency brake
Internal CT
3MCB
2MCB
1MCB
1n
BRN-M403 the motor within the capacity of 75KW starts directly.
Input programmable switching value
1SS
1SF1
2SS
KA1
KA2
KA3
N
C
B
A