Quick guide of PI9000 operation

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1.The introduction of new generation of PI9000
2. The new generation of PI9000 has following feature .
3. Installation of PI9000 procedure :
4.Examples of connections between the Inverter typical peripheral devices are shown.
5.Keyboard operating instruction.
6.Trial operation follow chart
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8.How to perform motor auto-turning
9. Apply the braking unit and braking resistor
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14. Multi-speed applying with I/O interface terminal
15.Frequency UP and Down controlled by I/O interface terminal board
16.1.Application of multi-function output .(1) alarm output
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17. PID control for constant pressure water supply-electrical diagram (0-10V signal feedback)
18. PI9000 apply in air compressor retrofitting with PID control function.
19.Application of PI9000 series inverters in crane
20. Fault Diagnosis

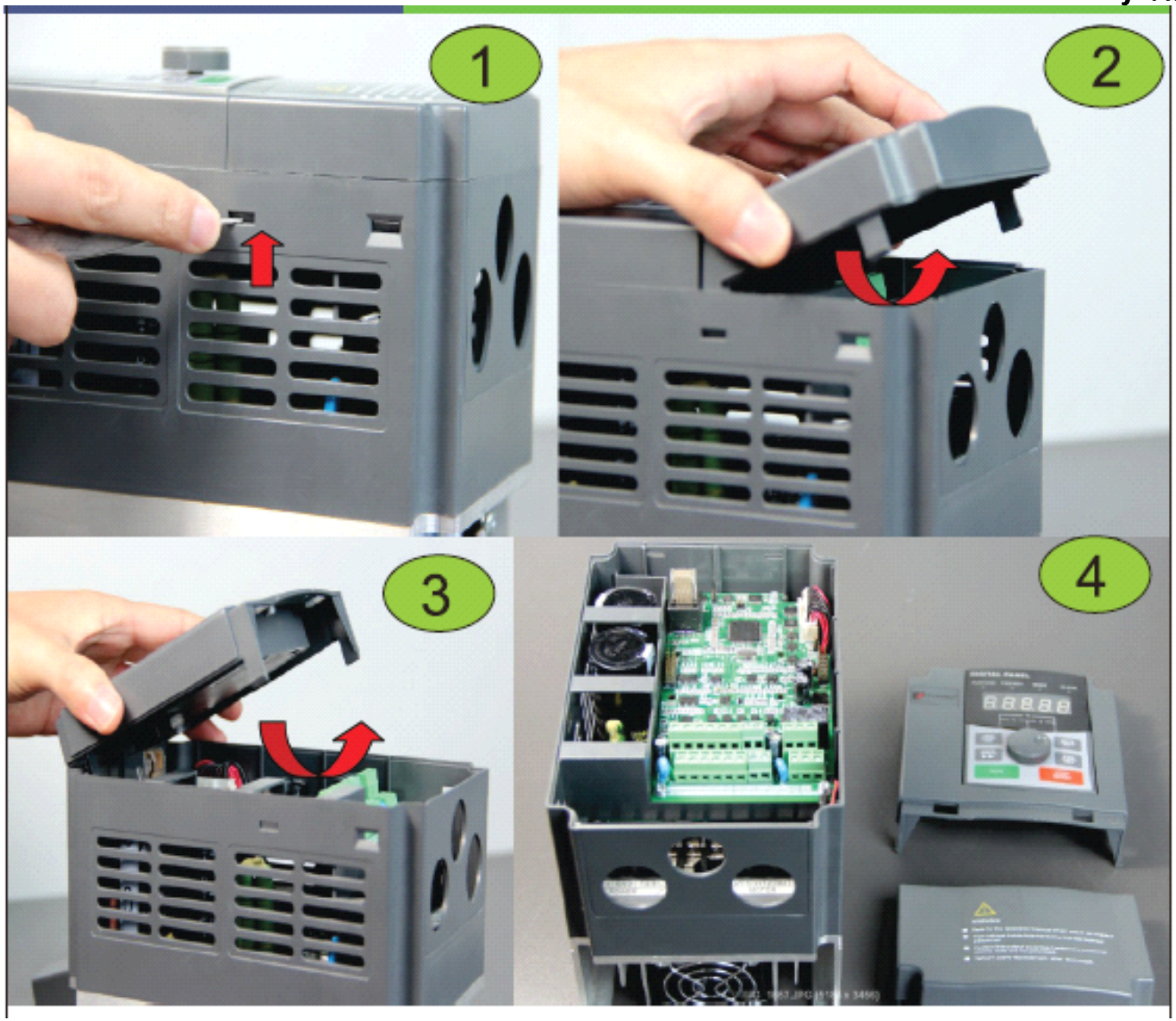
1.The introduction of new generation of PI9000 of POWTRAN Technology.

The PI9000 series inverter is high-performance motor control module and consists of V/F, sensorless vector control (SVC) and torqure control. It is mainly responsible for high performance control and overall protection of the motor, controlling the motor through sending running commands to multiple channels or performing close loop vector control through encoder interface.
which mainly ,includes most of functions of the inverter, such as PID control, MS speed, and swing frequency and so on .

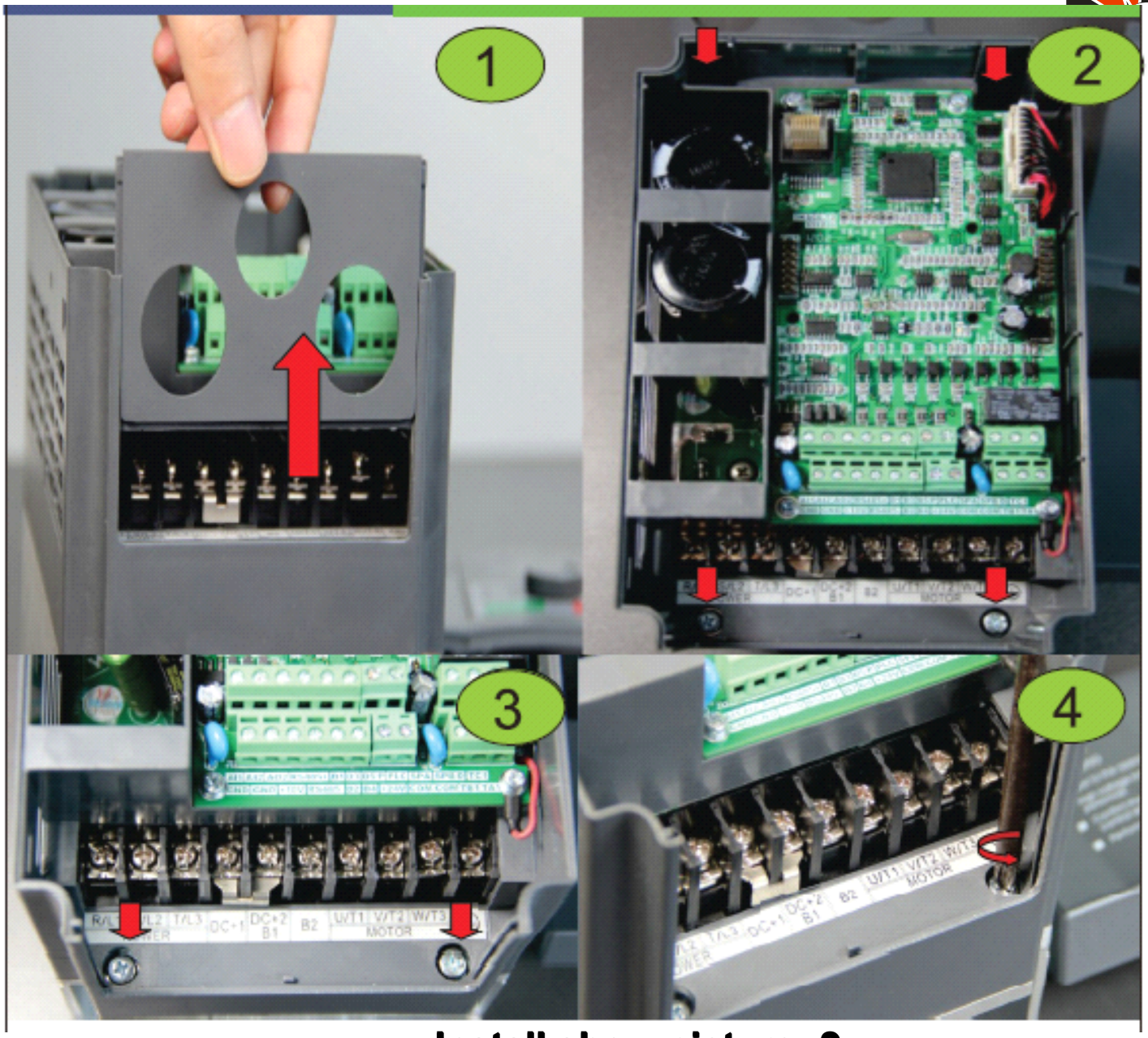
2. The new generation of PI9000 has following feature .

Input/output terminal	Five digital two analog input signal, two analog output ,two high speed port and one relay
Control mode	0:V/F 1:open loop flux vector control 2:torque control (open loop flux vector control) 3:closed loop with sensor flux vector control
MS speed	Be able to realize 16S speed
PLC Simple PLC	Be able to realize 16S timing operation
Swing frequency and fixed-length control	Available
Swing frequency and	Available
Main/auxiliary setup	Available
Communication function	standard RS485 ,Modbus
PID control	Available
Protection function	It can implement power-on motor short-circuit detection, input/output phase loss protection, over current protection, over voltage protection, under voltage protection, over heat protection and overload protection. Over voltage stall protection ,current limit ….
Parameter copy	It enables the parameter copy unit to copy the parameters quickly.
Optional parts	LCD operation panel, braking components, communication card,, PG card, water supply card, etc

3. Installation of PI9000 procedure :



Install show picture -1



Install show picture -2

Power on inverter

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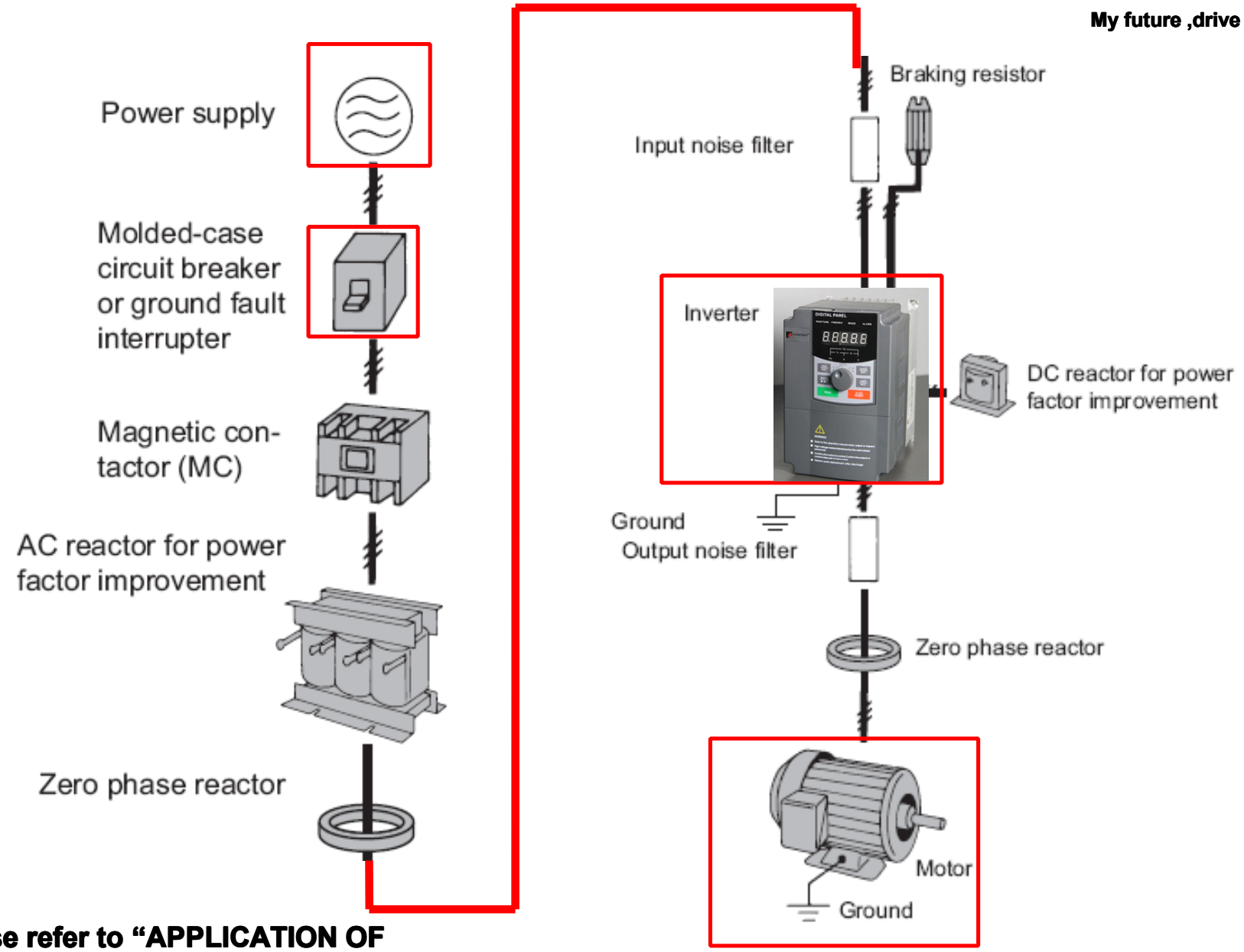
keyboard

I/O control terminal

Main Terminal cover

Front cover

4.Examples of connections between the Inverter typical peripheral devices are shown.



Please refer to "APPLICATION OF OPTIONAL EQUIPMENT ".

5.Keyboard operating instruction._1

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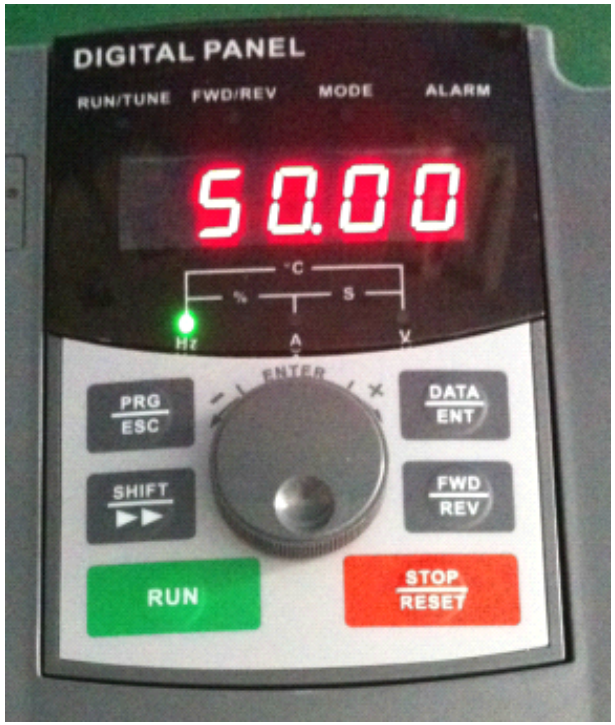
The operator interface provides a means for an operator to start and stop the motor and adjust the operating speed.



PRG / ESC — Parameters setting / Escape key :enter into function parameters list or escape it **.**

SHIFT / ▶▶ — 1.Shift the data bit when do a modification .
2:shift the monitor parameters in the stop mode

FWD / REV — 1:JOG running
2:switch forward and reverse direction

DATA / ENT — Enters menus and parameters, and set validates parameter changes.

RUN — Starts the Inverter operation

STOP / RESET — 1.Stop inverter operation
2.Also acts as the Reset key when a fault has occurred.

1.Change the F00-F14 in the first Menu
2.Change the function code in the second menu
3.Change the value of function code in the third menu
4.Frequency setting in the run or stop mode.

5.Keyboard operating instruction. _2

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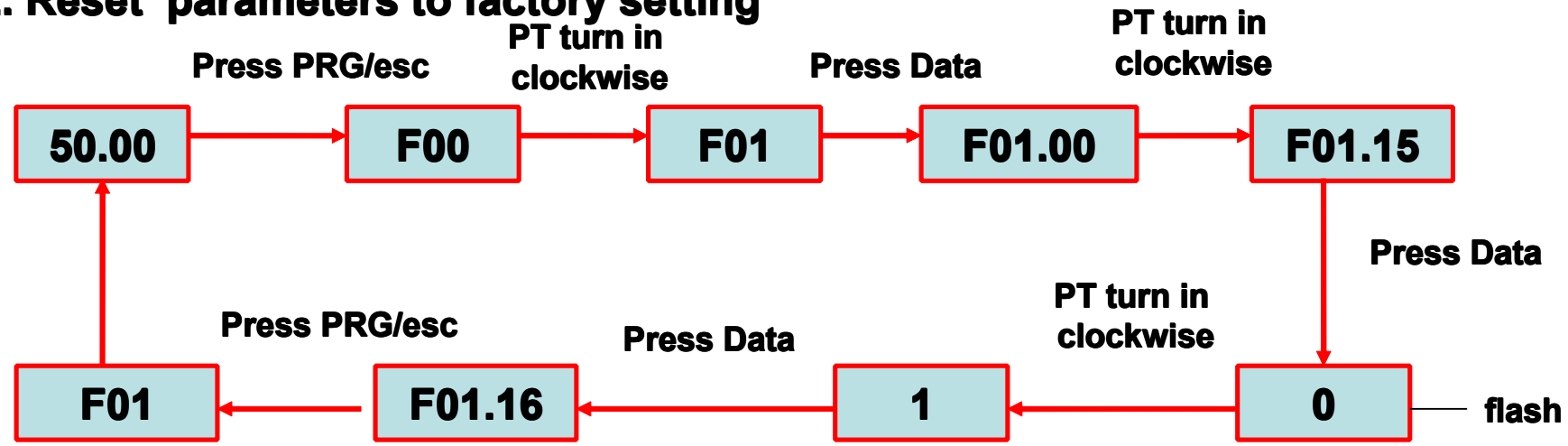
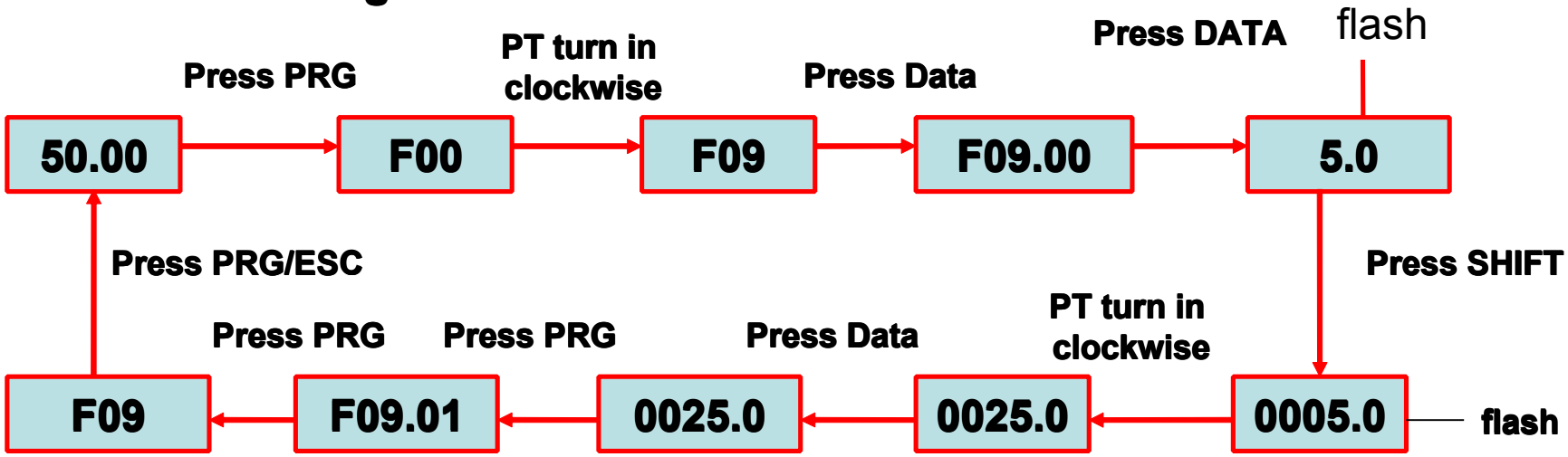
1.The first menu:F00 2.The second menu:F00.00 3.The third menu:50.0(

2. Reset parameters to factory setting



3. Parameters setting



6.Trial operation follow chart

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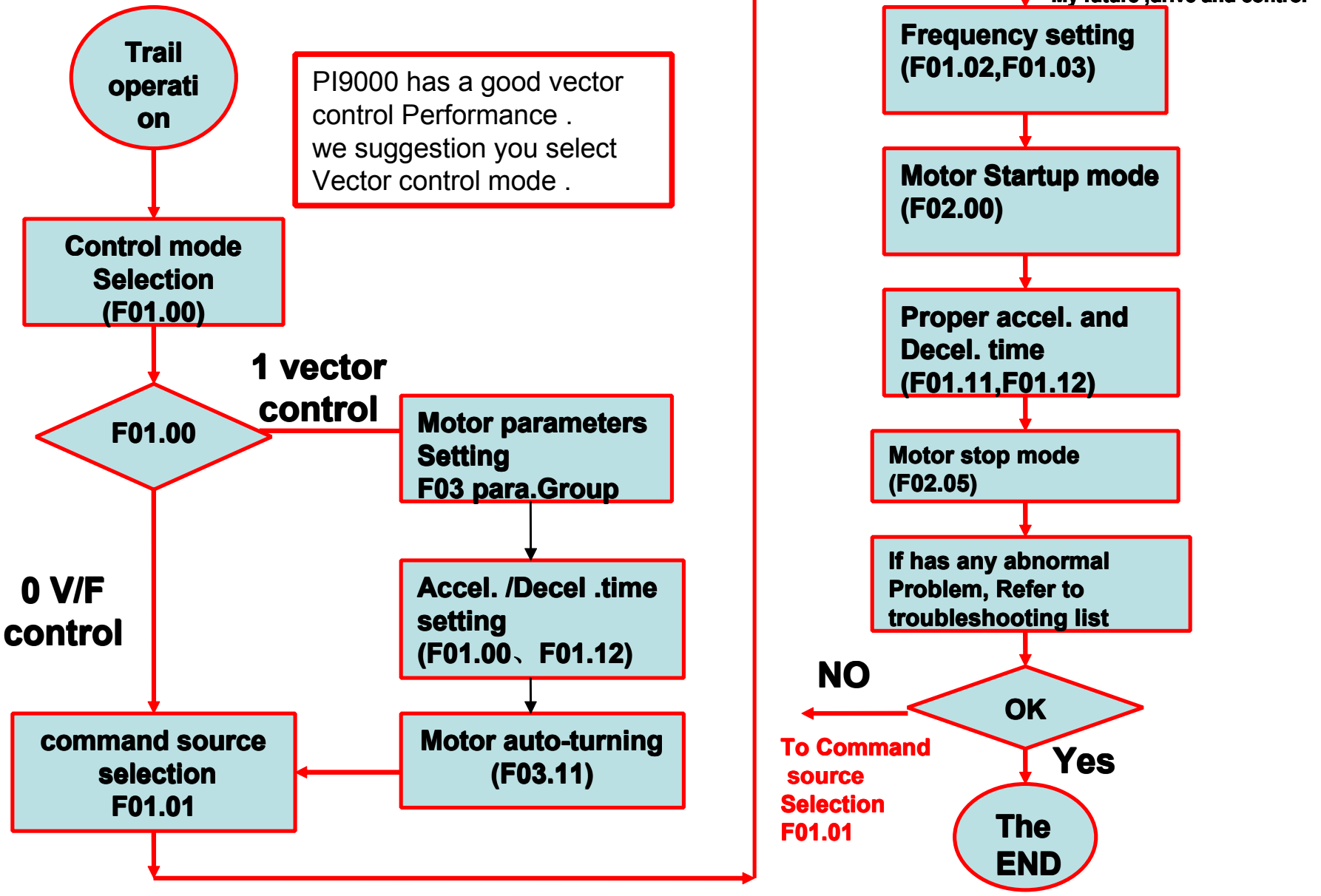
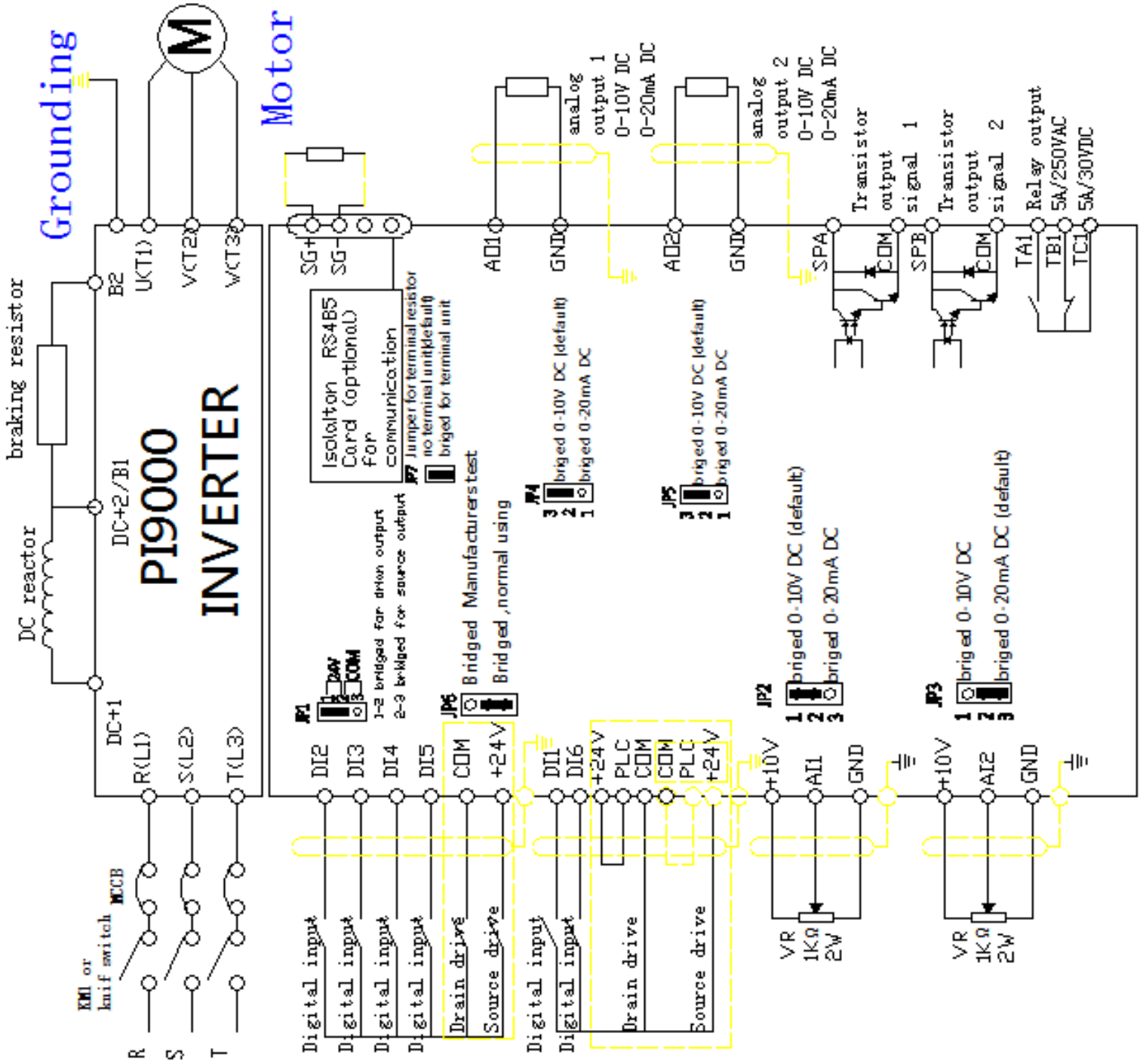
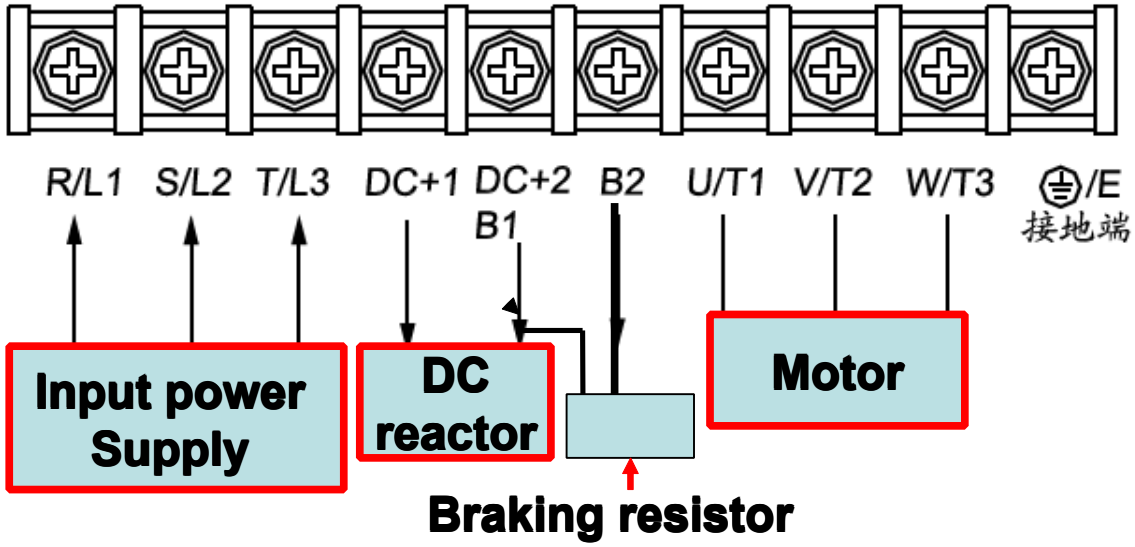


7.Wiring Of PI900 inverter

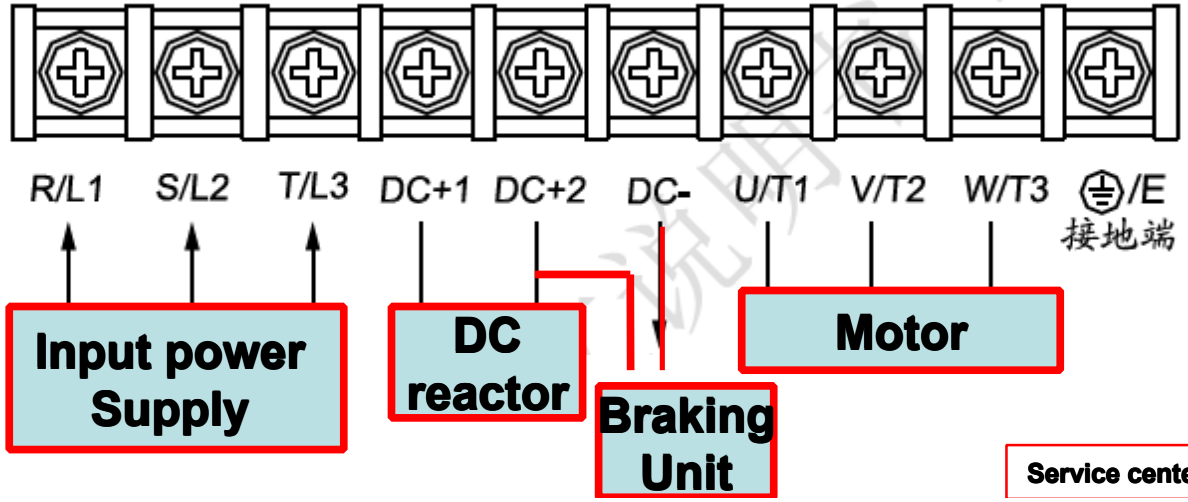


. Main terminal

0.4KW to 18.5 KW inverter:



18.5 to 250 KW and above inverter :



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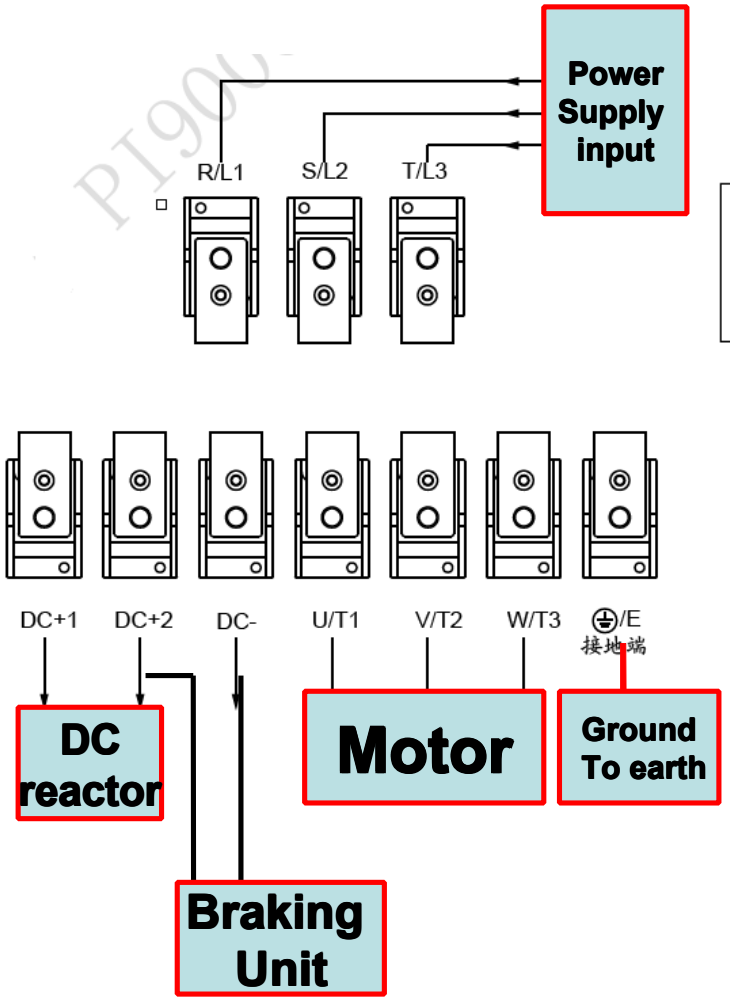
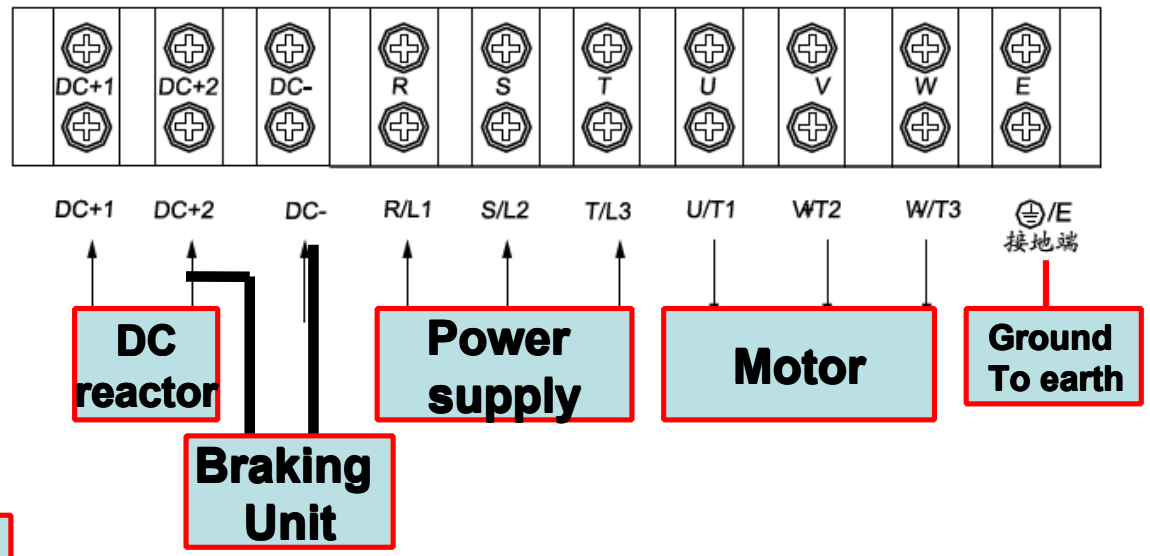
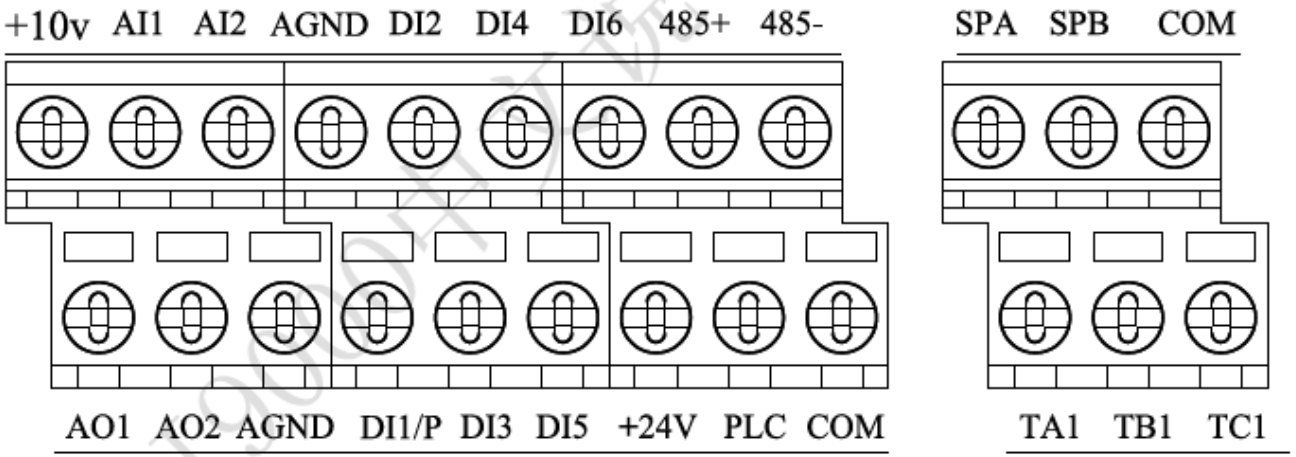
The main terminal of 45~250kW（380V）inverter



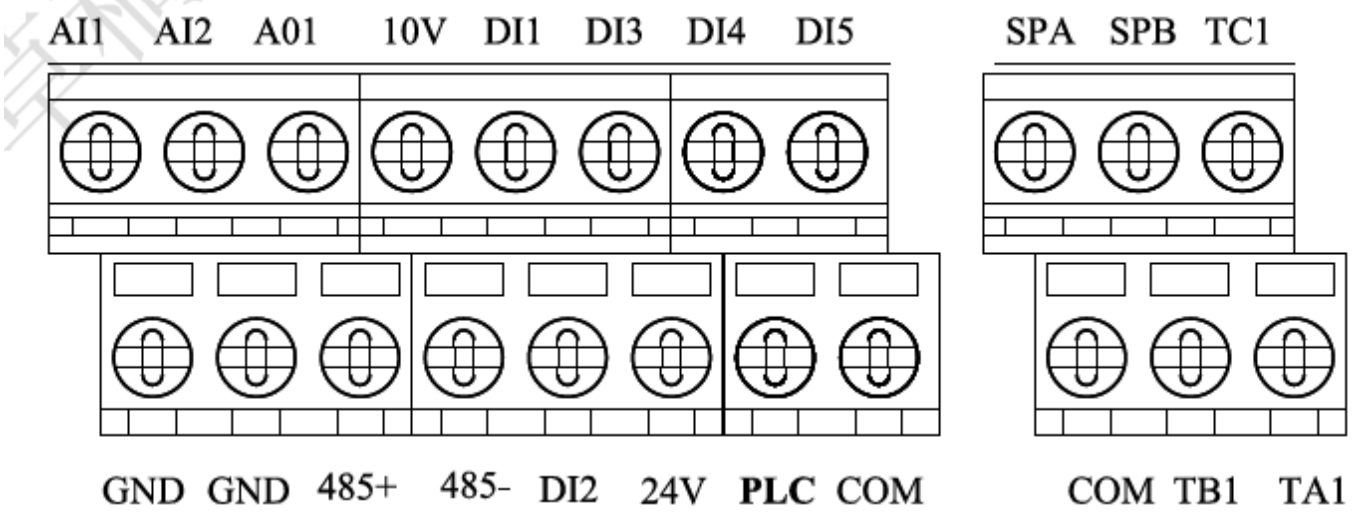
The main terminal of 280~355kW（380V）inverter



I/O control terminal of PI9000.
There are two type of controller board of PI9000.



The I/O terminal of 9KLCB controller board



The I/O terminal of 9KSCB controller board

8.How to perform motor auto-turning ?

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Performing motor auto-turning to get the motor parameters Automatically for vector control application .

1. Set the B motor parameters according you motor .(F03.00-F03.05)
2. Disconnect load from motor for performing complete Rotational auto-turning
3. Program F03.11=1 and press DATA/ENT key ,the auto-turning is going to start.

F03.00	inverter type	0:General type 1:Fan and pump type inverter
F03.01	rated power	0.4～900.0KW
F03.02	rated frequency	0.01～F01.07 (maximum frequency)
F03.03	rated rotation speed	0～36000RPM
F03.04	rated voltage	0～460V
F03.05	rated current	0.1～2000.0A
F03.06	stator resistance	0.001～65.535Ω
F03.07	rotor resistance	0.001～65.535Ω
F03.08	leakage inductive reactance	0.001～6553.5mH
F03.09	mutual inductive reactance	0.001～6553.5mH
F03.10	no-load current	0.01～655.35A
F03.11	motor auto-turning selection	0:no operation 1:complete Rotational auto-tuning 2:Stationary auto-tuning

8.Motor auto turning _1

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4. The time of auto-turning also depend on the(F01.11,F01.12) acceleration and deceleration time

5.If the load can't take from the motor ,please set F03.11 to 2 to perform stationary auto-turning .

Motor basic Parameter setting

Going to Auto-turning

Auto-turning

Finish auto-turning

9. Apply the braking unit and braking resistor .

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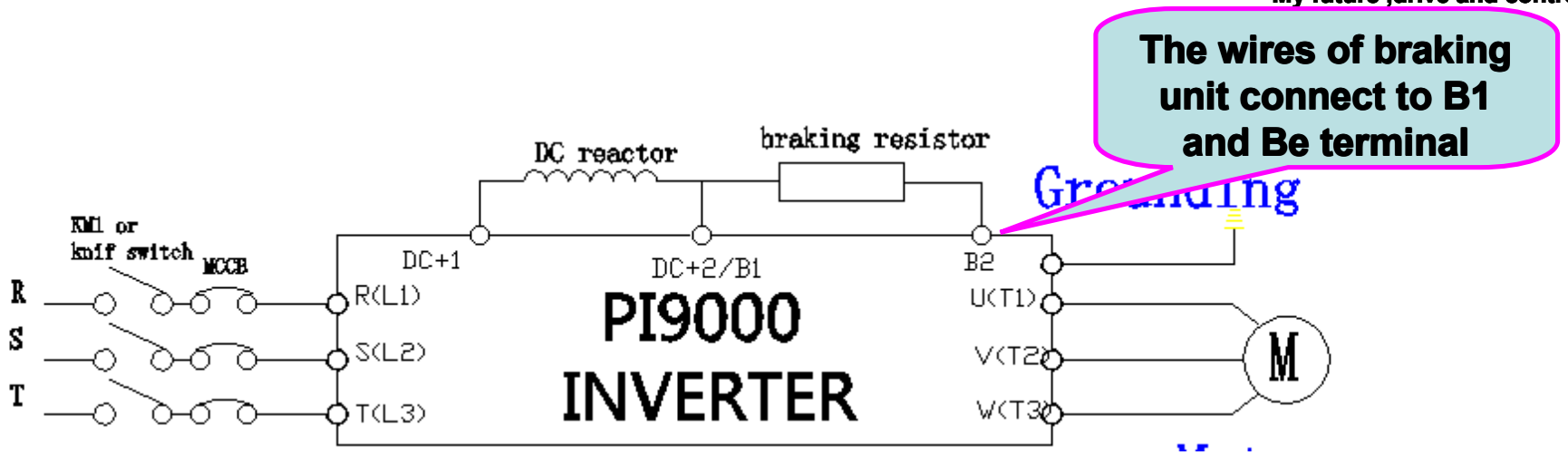

The HP of 22kW of 220V and below and HP of 15 and it is below has built In braking unit inside of inverter ,it can provide maximum of 50% of braking Torque ,if connect to braking unit ,it can provide maximum of 150% torque .

It is no need to set any parameters for connecting the braking unit .

The braking function is activated in default ! The activated of DC braking Voltage is 130% U_{DC}

10.1. Operating the VFD with keyboard

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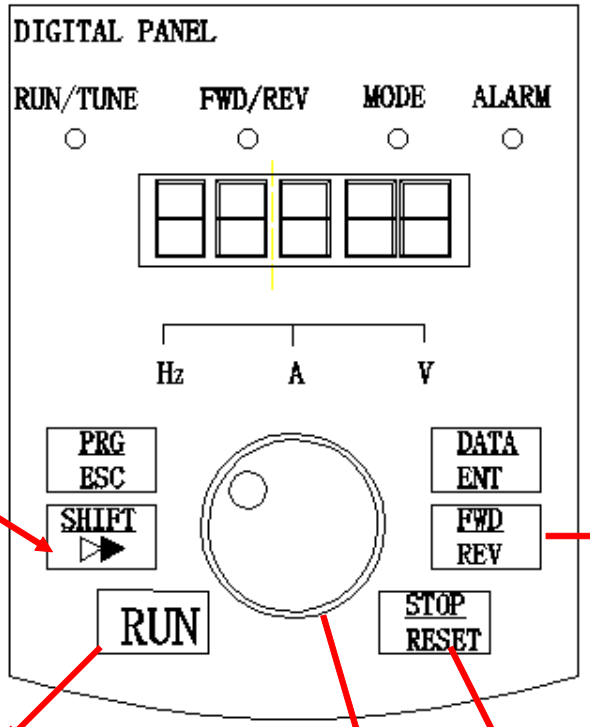
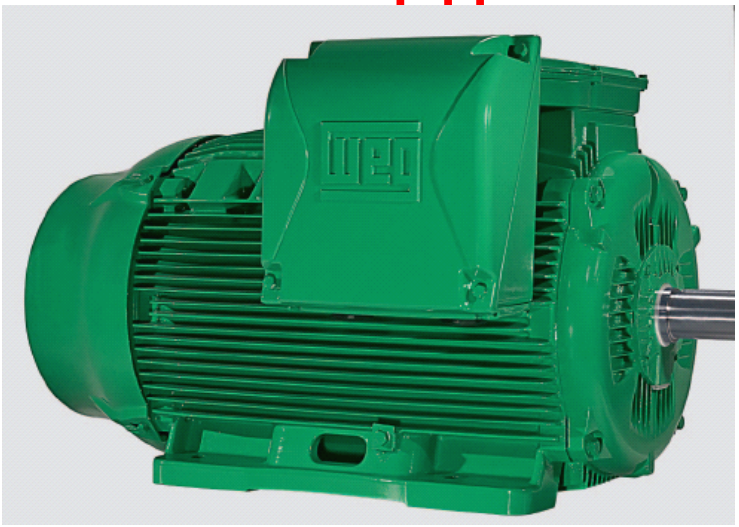


Change the Display content With SHIFT key

F07.3=0 For JOG
F07.3=1 For switchover FWD and REV Running direction

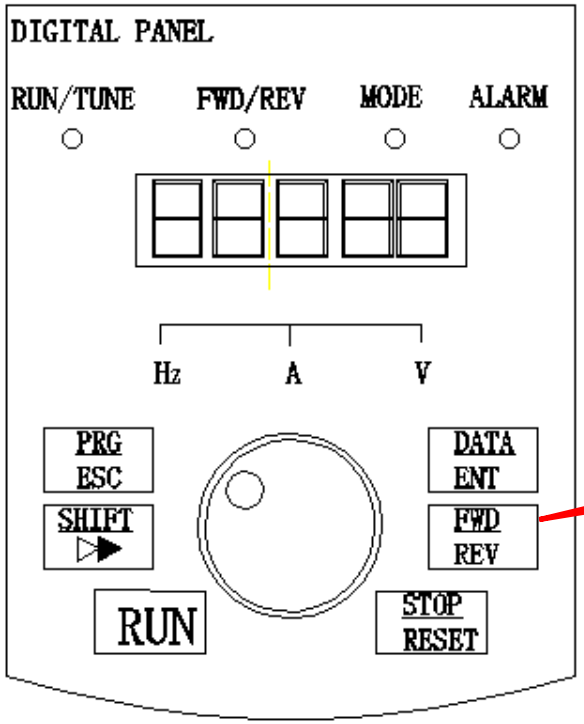


Run command by key board F01.01=0 ,

Stop motor F01.01=0

Frequency setting F01.3=7 (keyboard in default)

10.2 Operating Forward and reverse key of keyboard for JOG running



press the FWD/REV key for JOG Running

F07.03	FWD/REV function key selection	0:JOG	0
F09.06	Jog running frequency	0.00～F01.07(Maximum frequency)	5.00Hz
F09.07	Jog acceleration time	0.1～3600.0S	inverter type
F09.08	Jog deceleration time	0.1～3600.0S	inverter type

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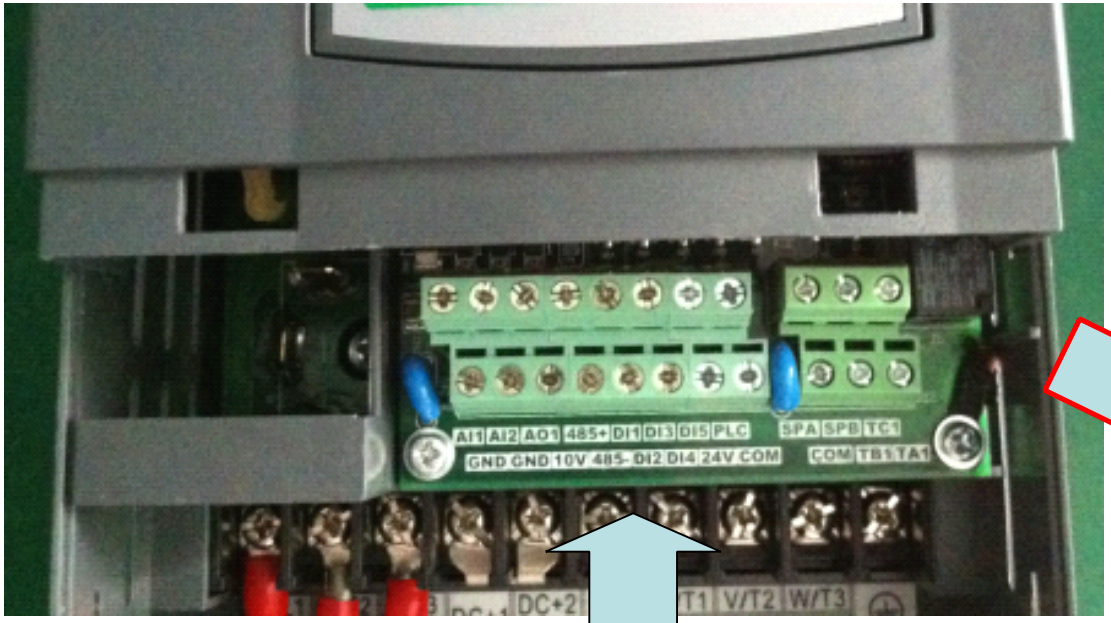
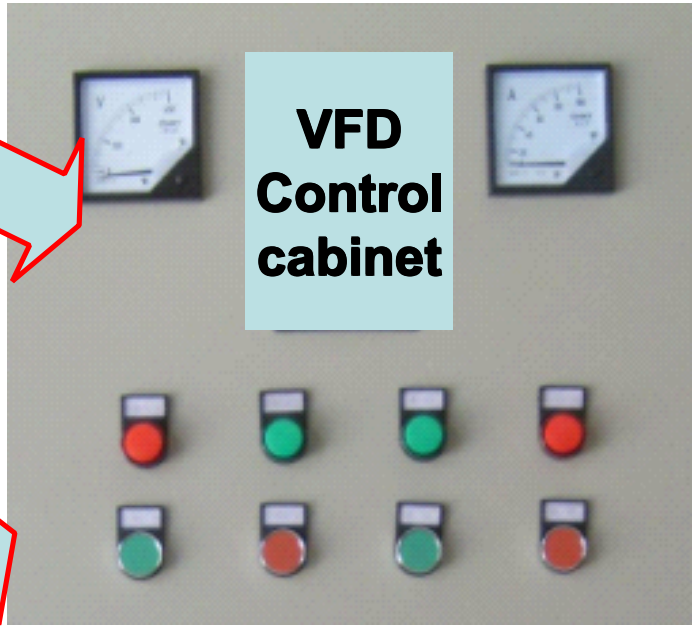
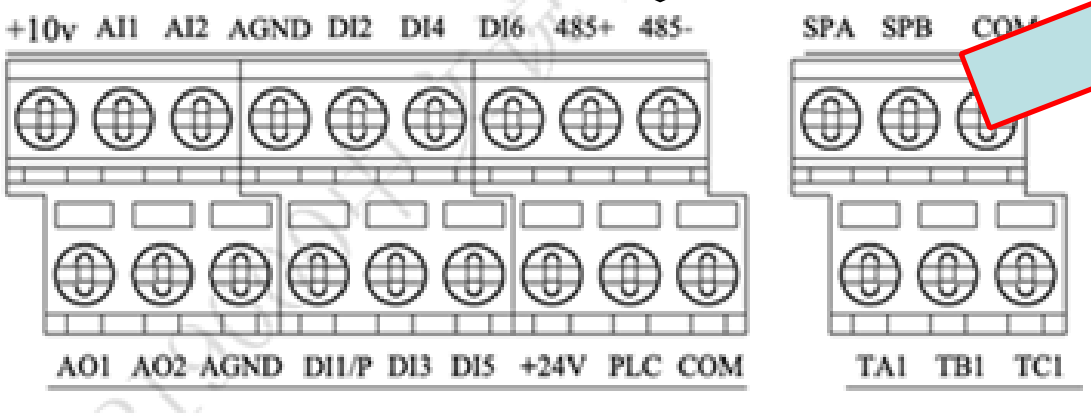
10.3.1.Operating VFD by I/O terminals board.

(I/O) terminals for connecting pushbuttons, switches and other operator interface devices or control signals.



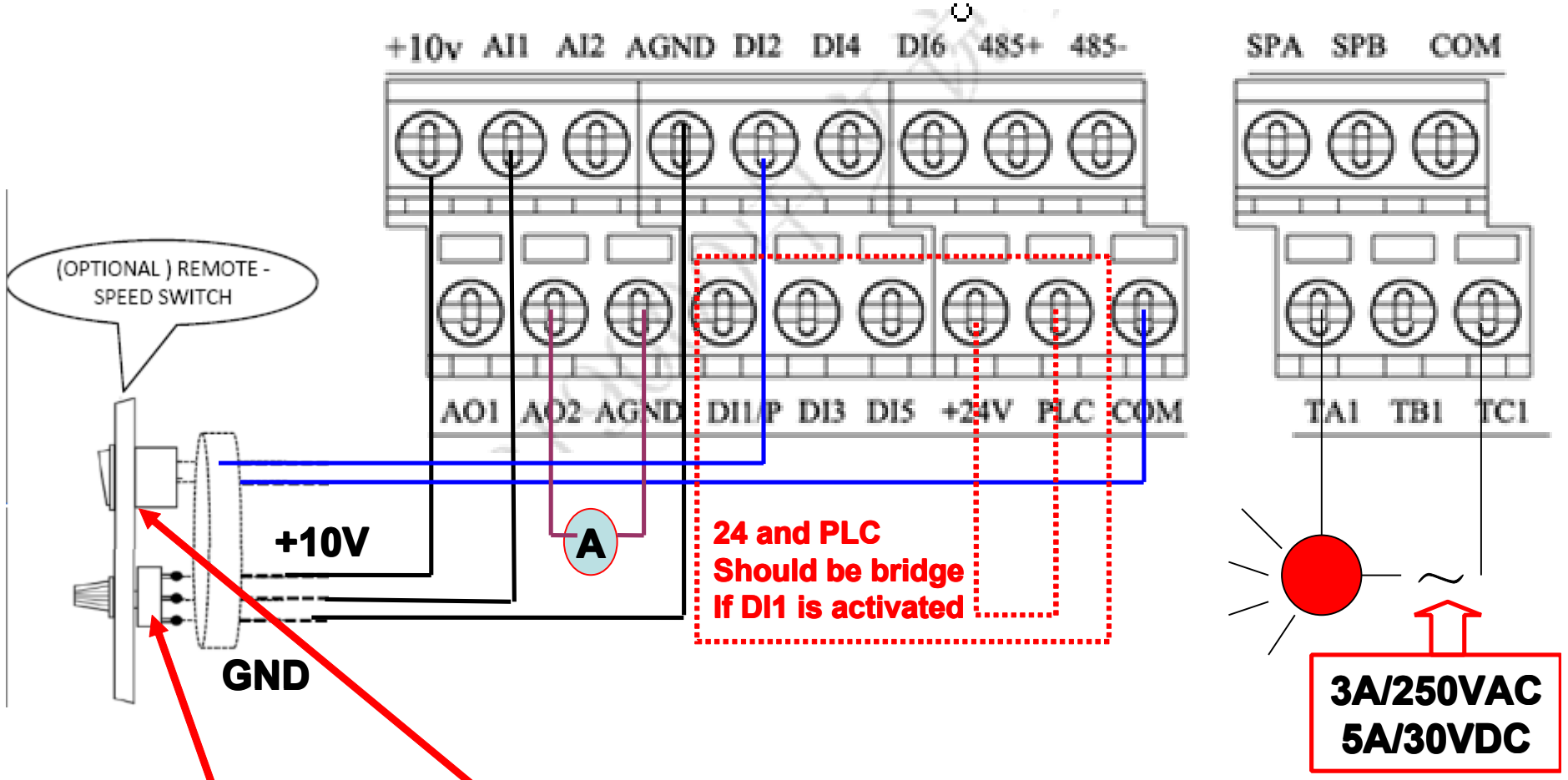
For example: Operating this Button connecting to I/O interface for controlling the Inverter .





Operate VFD by operating panel

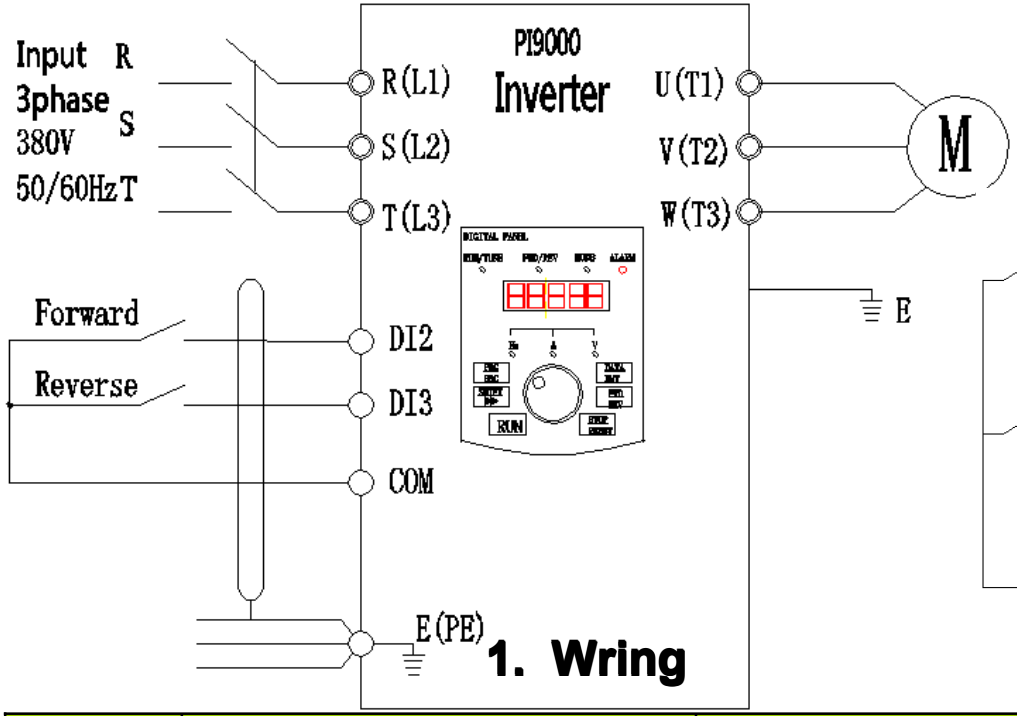
10.3.2. wiring of I/O interface terminal .



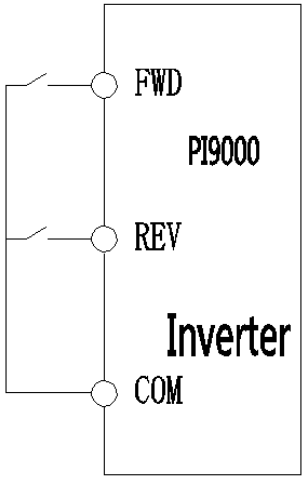
Push button

external potentiometer
for giving 0-10V input signal

10.3.3. FWD and REV running controlled by I/O terminal .



1. Wring



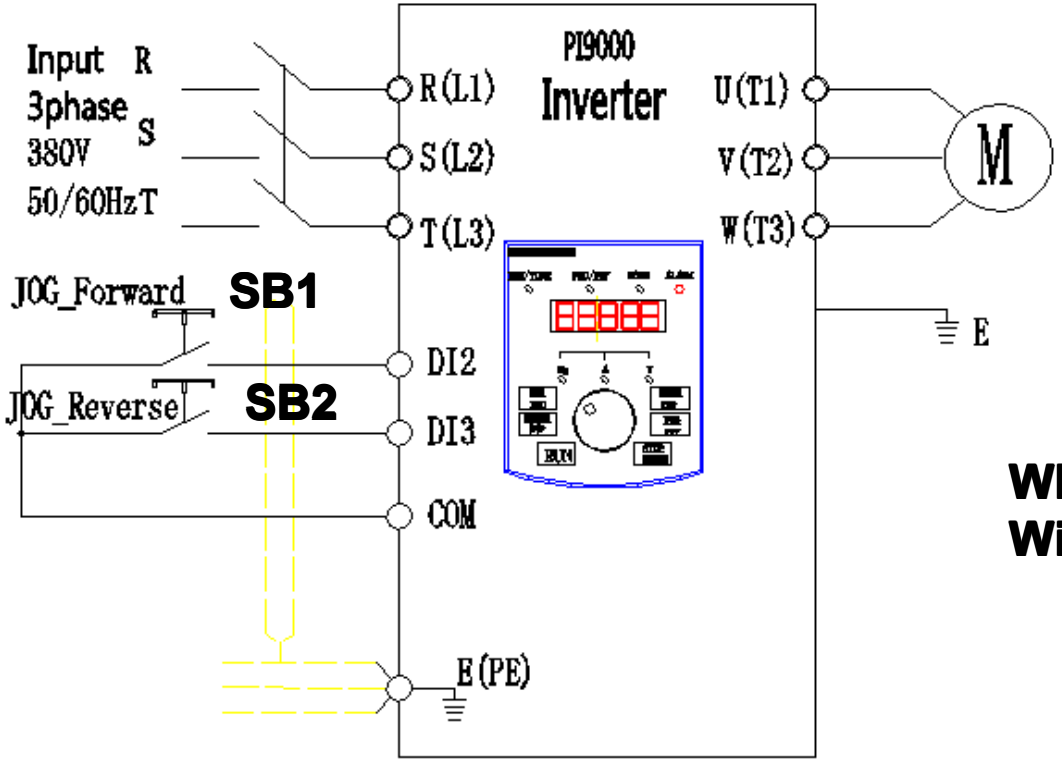
The two line control mode 1

K1	K2	running command
OFF	OFF	stop
ON	OFF	forward
OFF	ON	Reverse
ON	ON	Stop

F01.1	command source selection	1:Terminal command channel (LED ON)	0
F01.13	running direction	0: Consistent direction	0
F06.01	DI2 function selection	1.Forward running direction	1
F06.02	DI3 function selection	2.Reverse running direction	2
F06.07	Terminal command mode	0.two line control mode 1	0

2.Parameters setting

10.3.4. FWD and REV JOG running controlled by I/O terminal :



When the SB1 is on ,the motor Will run ,it off ,the motor will stop

CODE	Description	Range of setting	Refer. value
F01.01	command source selection	1:Terminal command channel (LED ON)	1
F06.01	DI2 function selection	Forward rotation JOG	4
F06.02	DI3 function selection	5:Reverse rotation (RJOG)	5
F09.06	Jog running frequency	0.00～F01.07(Maximum frequency)	6
F09.07	Jog acceleration time	0.1～3600.0S	10s
F09.08	Jog deceleration time	0.1～3600.0s	10s

10.3.5. three line control mode

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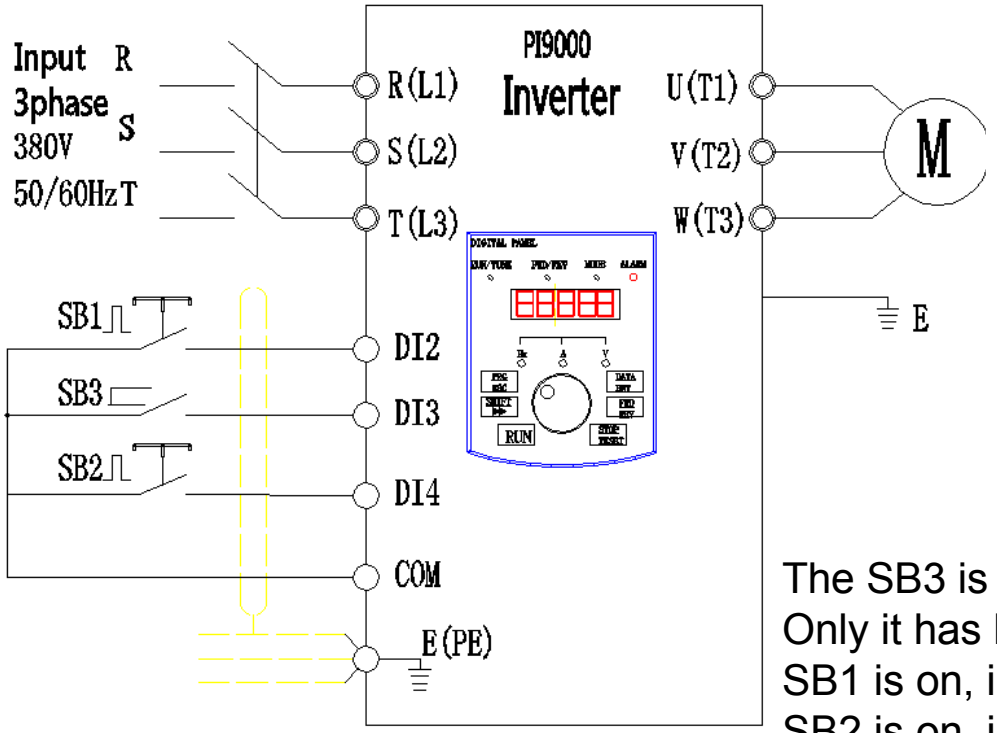

SB2	SB1	SB3	running command
ON	↑		forward
ON		↑	Reverse
OFF	X	X	Stop

3 line control mode

The SB3 is emergency stop button,
Only it has been on ,the inverter is active .otherwise.
SB1 is on, inverter will run in forward direction;
SB2 is on ,inverter will run in Reverse direction .

F01.1	command source selection	1:Terminal command channel (LED ON)	0
F01.13	running direction	0: Consistent direction	0
F06.01	DI2 function selection	1.Forward running direction	1
F06.02	DI3 function selection	3:Three line mode running control	3
F06.03	DI4 function selection	2.Reverse running direction/3:Three	2
F06.07	Terminal command mode	0. three line control mode 2	3

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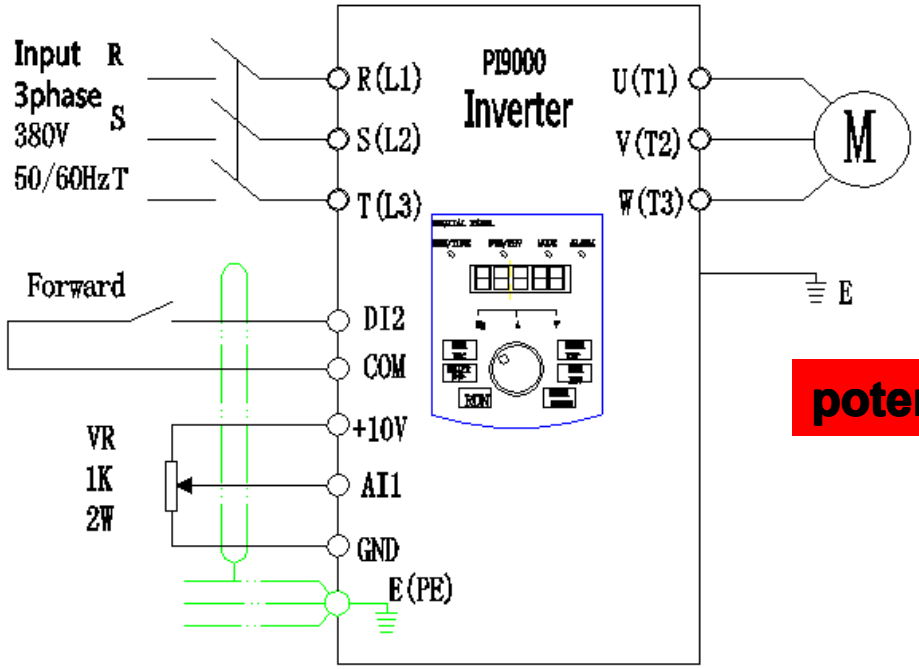
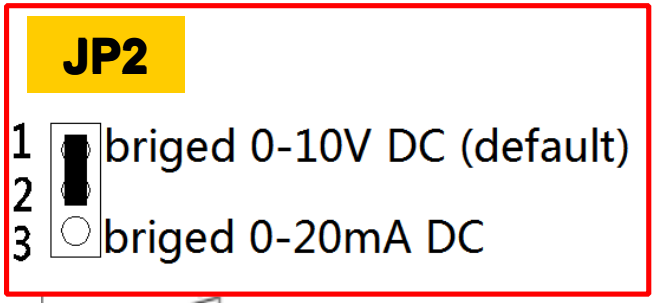
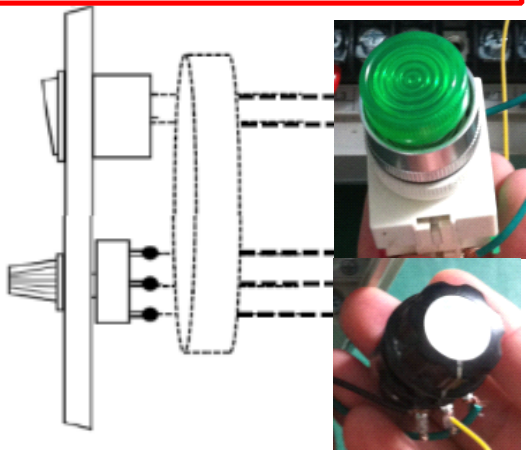
11. Frequency setting with external potentiometer (Variable resistor)





potentiometer

button



Parameters setting

F01.1	command source selection	1:Terminal command channel (LED ON)	0
F01.03	frequency setting source selection	1:AI1 analog signal input	1
F01.13	running direction	2: reverse direction is forbidden	2
F06.01	DI2 function selection	1.Forward running direction	1
F06.07	Terminal command mode	0.two line control mode 1	0

12. Frequency setting by analog current (AI2)

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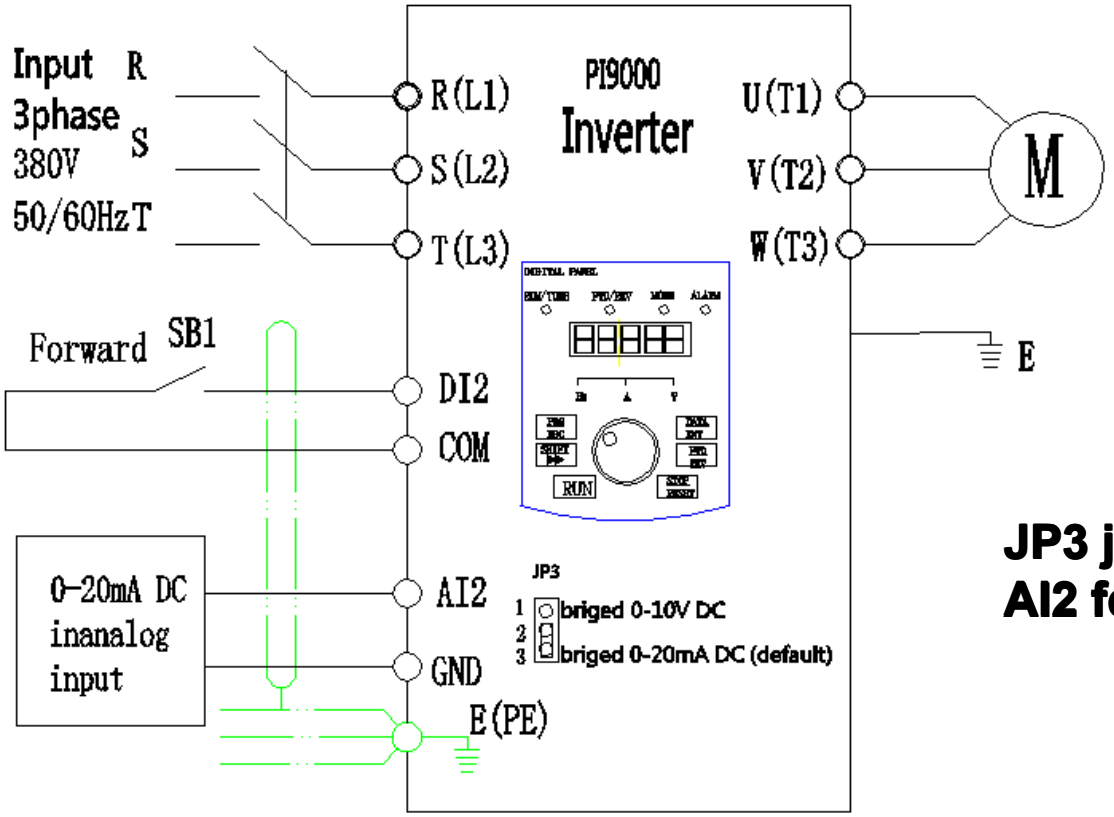

JP3 jumper setting for
AI2 for receiving input analog signal

F01.1	command source selection	1:Terminal command channel (LED ON)	0
F01.03	frequency setting source selection	1:AI2 analog signal input	2
F01.13	running direction	2: reverse direction is forbidden	2
F06.01	DI2 function selection	1.Forward running direction	1
F06.07	Terminal command mode	0.two line control mode 1	0

Parameters setting

13.Employ output analog signal for monitoring current ,frequency ,speed etc.

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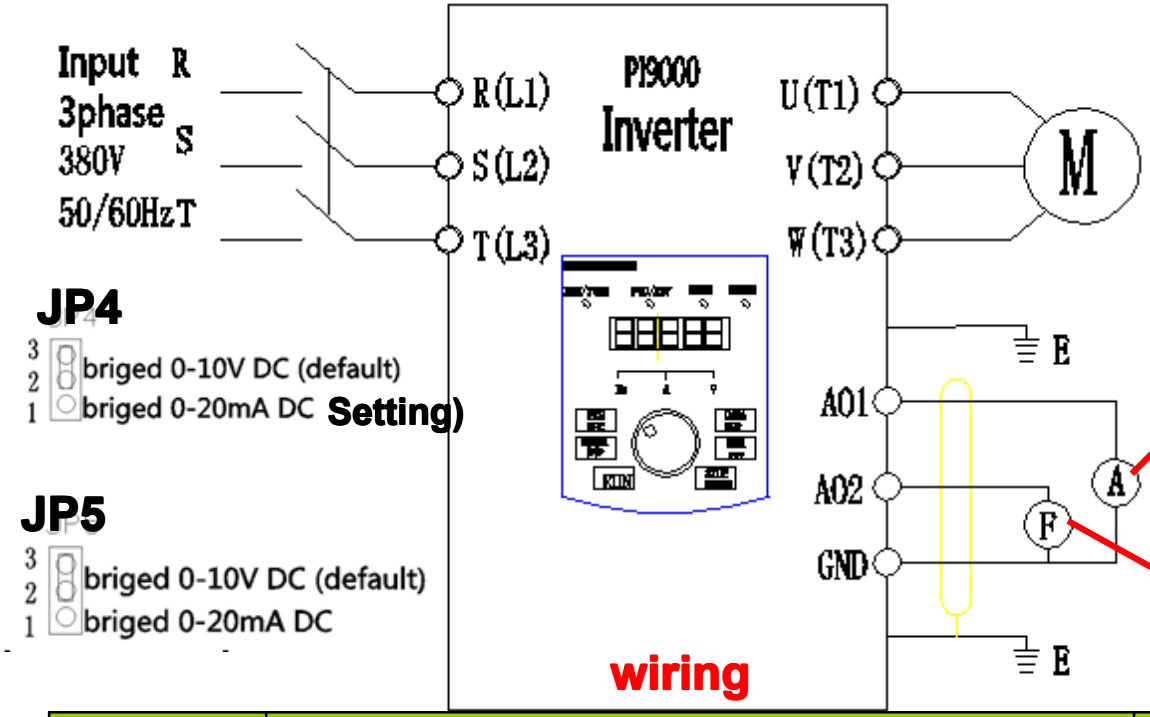

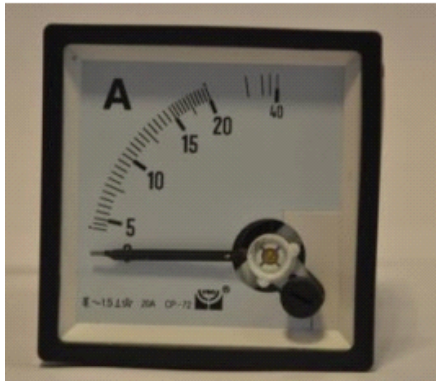

Ampere meter

frequency meter

F08.03	AO1 analog output	3.Output current	3
F08.04	AO1 minimum output	0.0%～100.0%	0.00%
F08.05	AO1 minimum output corresponding setup	0.00V～10.0V	0.00V
F08.06	AO1 maximum output	0.0%～100.0%	100%
F08.07	AO1 maximum output correspond setup	0.00V～10.0V	10V
F08.08	AO2 analog output	0:running frequency	0
F08.09	AO2 minimum output	0.0%～100.0%	0
F08.10	AO2 minimum output corresponding setup	0.0A ～20mA	4mA
F08.11	AO2 maximum output	0.0%～100.0%	100%
F08.12	AO2 maximum output correspond setup	0.0A ～20mA	20mA

Output analog signal selection parameters list

F08.03	AO1 analog output	0:running frequency 1:setup frequency2:runing speed3:output current 4:output voltage5:output power6:output torque7:AI1 input analog signal8:AI2 input analog signal	0
F08.04	AO1 minimum output	0.0%～100.0%	0.00%
F08.05	AO1 minimum output corresponding setup	0.00V～10.0V	0.00V
F08.06	AO1 maximum output	0.0%～100.0%	100%
F08.07	AO1 maximum output correspond setup	0.00V～10.0V	10V
F08.08	AO2 analog output	0:running frequency 1:setup frequency2:runing speed3:output current 4:output voltage5:output power6:output torque7:AI1 input analog signal8:AI2 input analog signal	0
F08.09	AO2 minimum output	0.0%～100.0%	0.00%
F08.10	AO2 minimum output corresponding setup	0.00V～10.0V	0.00V
F08.11	AO2 maximum output	0.0%～100.0%	100%
F08.12	AO2 maximum output correspond setup	0.00V～10.0V	10V

14. Multi-speed applying with I/O interface terminal

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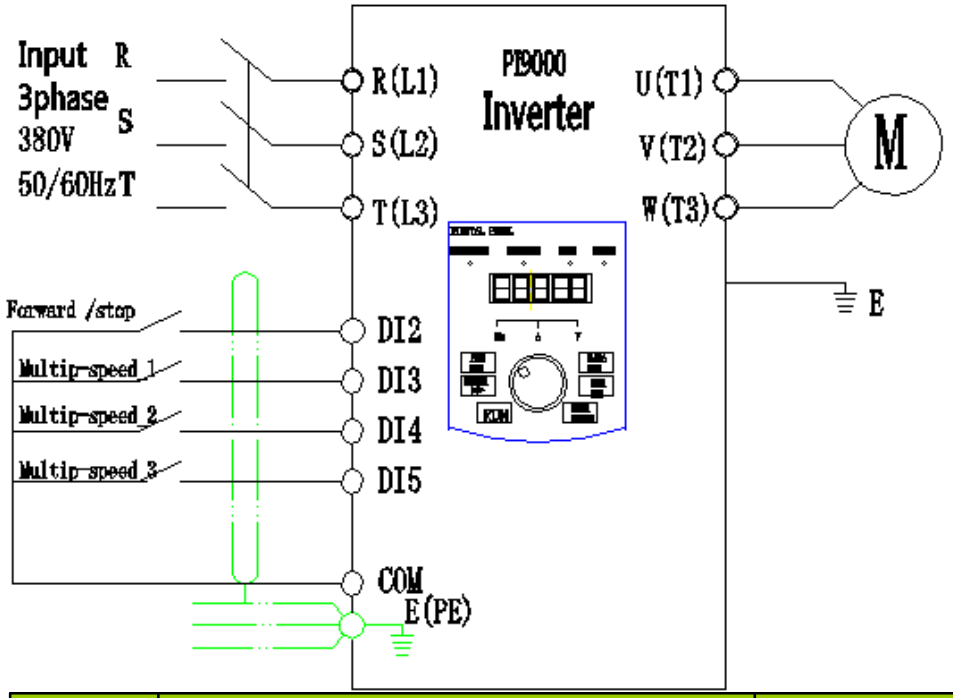

MS terminal relative to Ms speed table.

MS1	MS2	MS3	MS4	
OFF	OFF	OFF	OFF	F11.00
OFF	OFF	OFF	ON	F11.01
OFF	OFF	ON	OFF	F11.02
OFF	OFF	ON	ON	F11.03
OFF	ON	OFF	OFF	F11.04
OFF	ON	OFF	ON	F11.05
OFF	ON	ON	OFF	F11.06
OFF	ON	ON	ON	F11.07
ON	OFF	OFF	OFF	F11.08
ON	OFF	OFF	ON	F11.09
ON	OFF	ON	OFF	F11.10
ON	OFF	ON	ON	F11.11
ON	ON	OFF	OFF	F11.12
ON	ON	OFF	ON	F11.13
ON	ON	ON	OFF	F11.14
ON	ON	ON	ON	F11.15

Parameters setting

CODE	Description	Range of setting	Refer. value
F01.01	command source selection	1:Terminal command channel (LED ON)	1
F01.03	frequency setting source selection	4.multiple-speed frequency setting	4
F06.01	DI2 function selection	Forward rotation	1
F06.02	DI3 function selection	MS speed terminal 1	12
F06.03	DI4 function selection	Ms speed terminal 2	13
F06.04	DI5 function selection	Ms speed terminal 3	14
F11.01	MS speed 1	-100.0～100.0%	20
F11.02	MS speed 2	100.0～100.0%	50
F11.04	MS speed 3	100.0～100.0%	100

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15.Frequency UP and Down controlled by I/O interface terminal board

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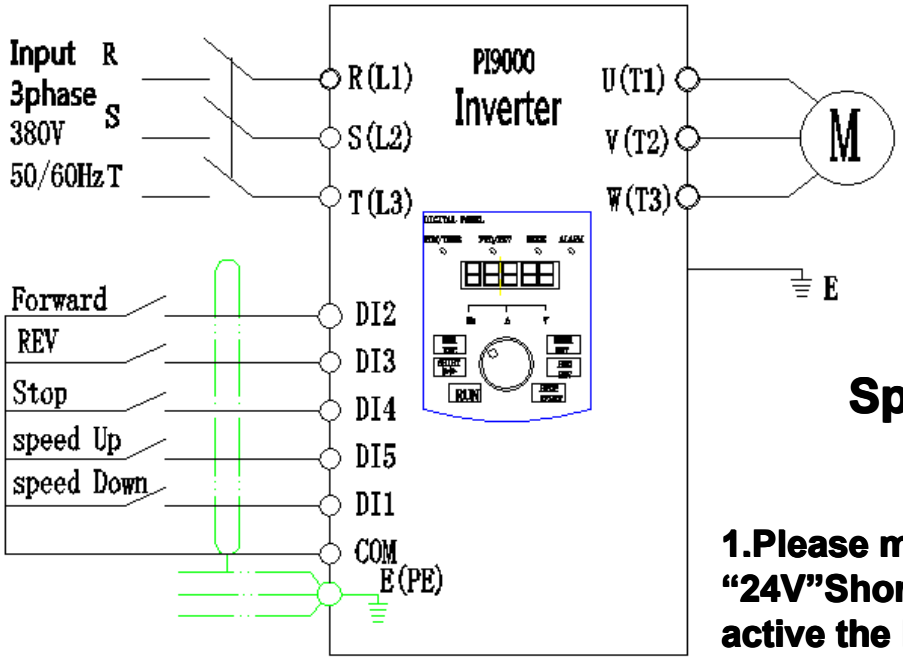

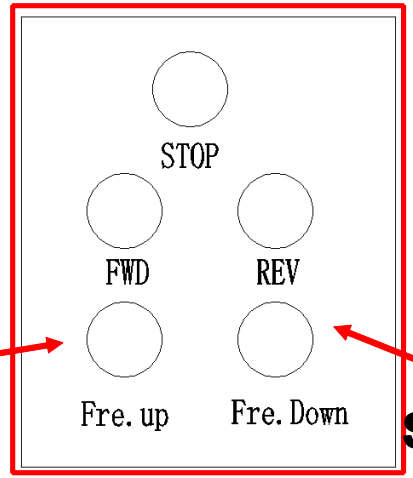

Speed up

Speed up

1.Please make "PLC" and "24V"Short-circuit first to active the DI1 terminal

Control panel

Parameters setting

CODE	Description	Range of setting	Refer. value
F01.01	command source selection	1:Terminal command channel (LED ON)	1
F06.01	DI2 function selection	Forward rotation	1
F06.02	DI3 function selection	Reverse rotation	2
F06.03	DI4 function selection	Three line mode control mode (stop)	3
F06.04	DI5 function selection	9:frequency UP by terminal (UF)	9
F06.00	DI1 function selection	10:frequency Down by terminal (DN)	10
F06.08	change rate of terminal up and down	0.01～100.00Hz/s	0.5Hz

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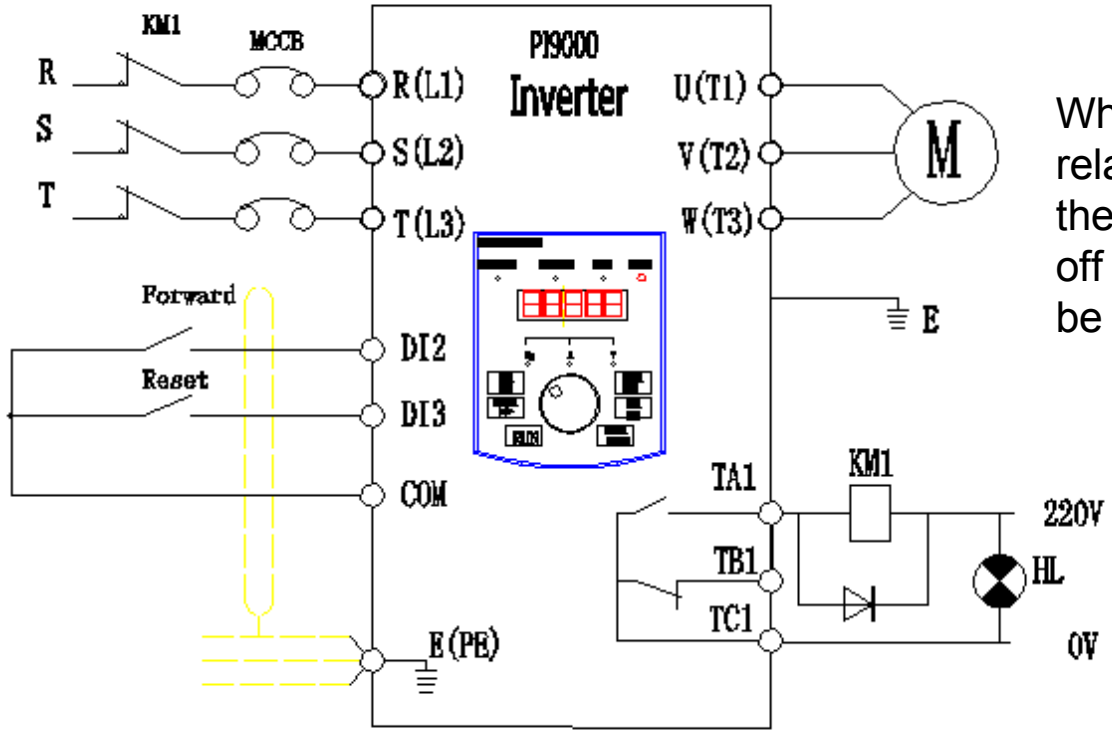
16.1.Application of multi-function output .(1) alarm output



When alarm happen ,the normal open relay will close ,the KM1 will be on, the main switch will be open and cut off the main circuit .The alarm light will be on as well to show there is alarm .

5A/250VAC
5A/30VDC

Parameters setting

CODE	Description	Range of setting	Refer. value
F01.01	command source selection	1:Terminal command channel (LED ON)	1
F06.01	DI2 function selection	Forward rotation	1
F06.02	DI3 function selection	Fault reset	7
F08.2	Relay output selection	0: No output 1:motorforward running 2:motor reverse running 3:Fault output 4:Frequency level detection FDT output 5:Frequency arrival 6:in Zero speed operation 7:Frequency upper limit arrival 8:Frequency lower limit arrival 9～10:Reserved	3

16.2.Application of multi-function output 2. (frequency arrival and frequency detecting)

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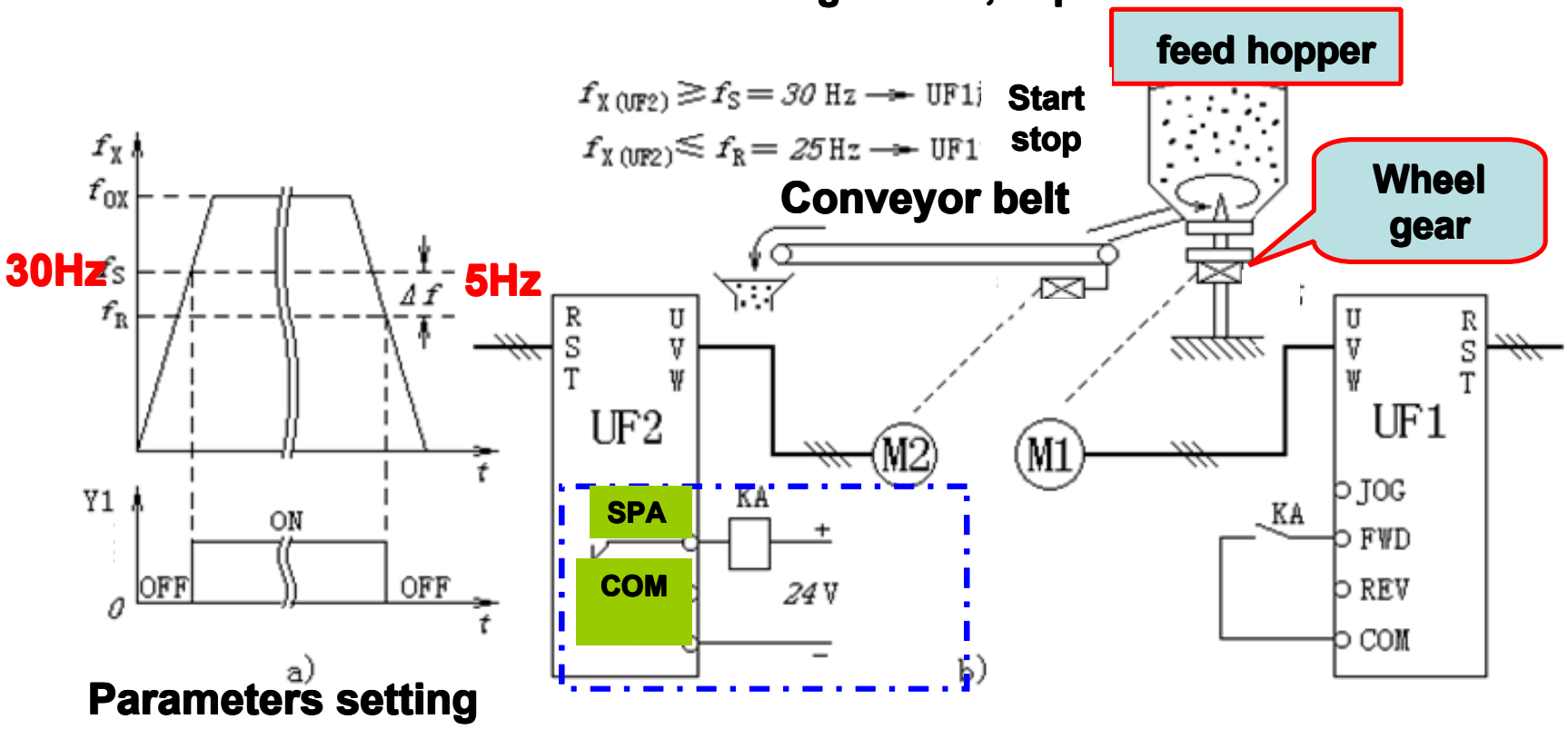
VFD 1 will start once the fre. of VF2 arriving at 30Hz,stop when fre. of VF2 limit 25Hz.



Parameters setting

CODE	Description	Range of setting	Refer. value
F01.01	command source selection	1:Terminal command channel (LED ON)	1
F06.01	DI2 function selection	Forward rotation	1
F08.2	Relay output selection	4:Frequency level detection FDT output	4
F09.17	(FDT) frequency detection value	0.00～F01.07(Maximum frequency)	35Hz
F09.18	FDT detection hysteresis	0.0%～100.0%(FDT level)	5Hz

17. 1.PID control for constant pressure water supply -electrical diagram (0-10V signal feedback)

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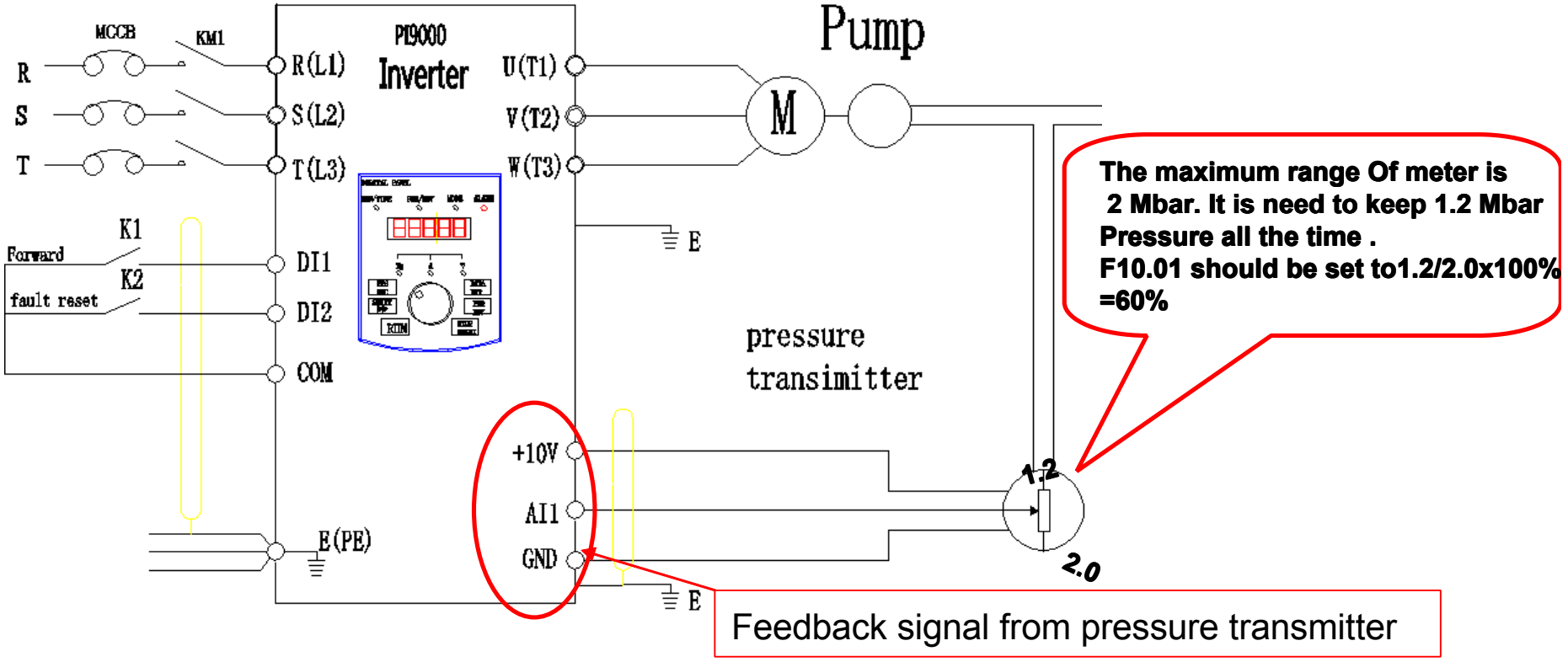
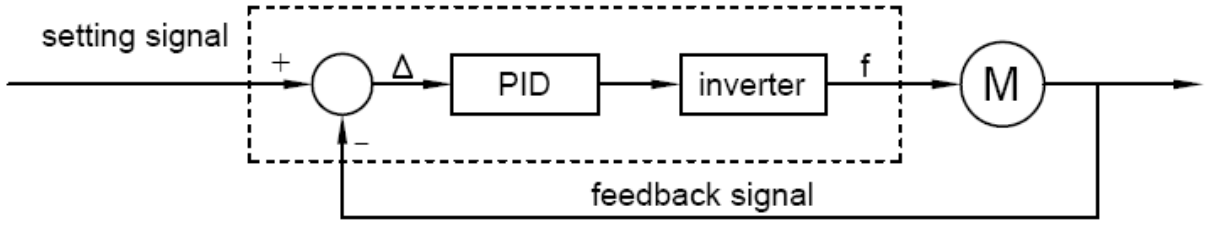


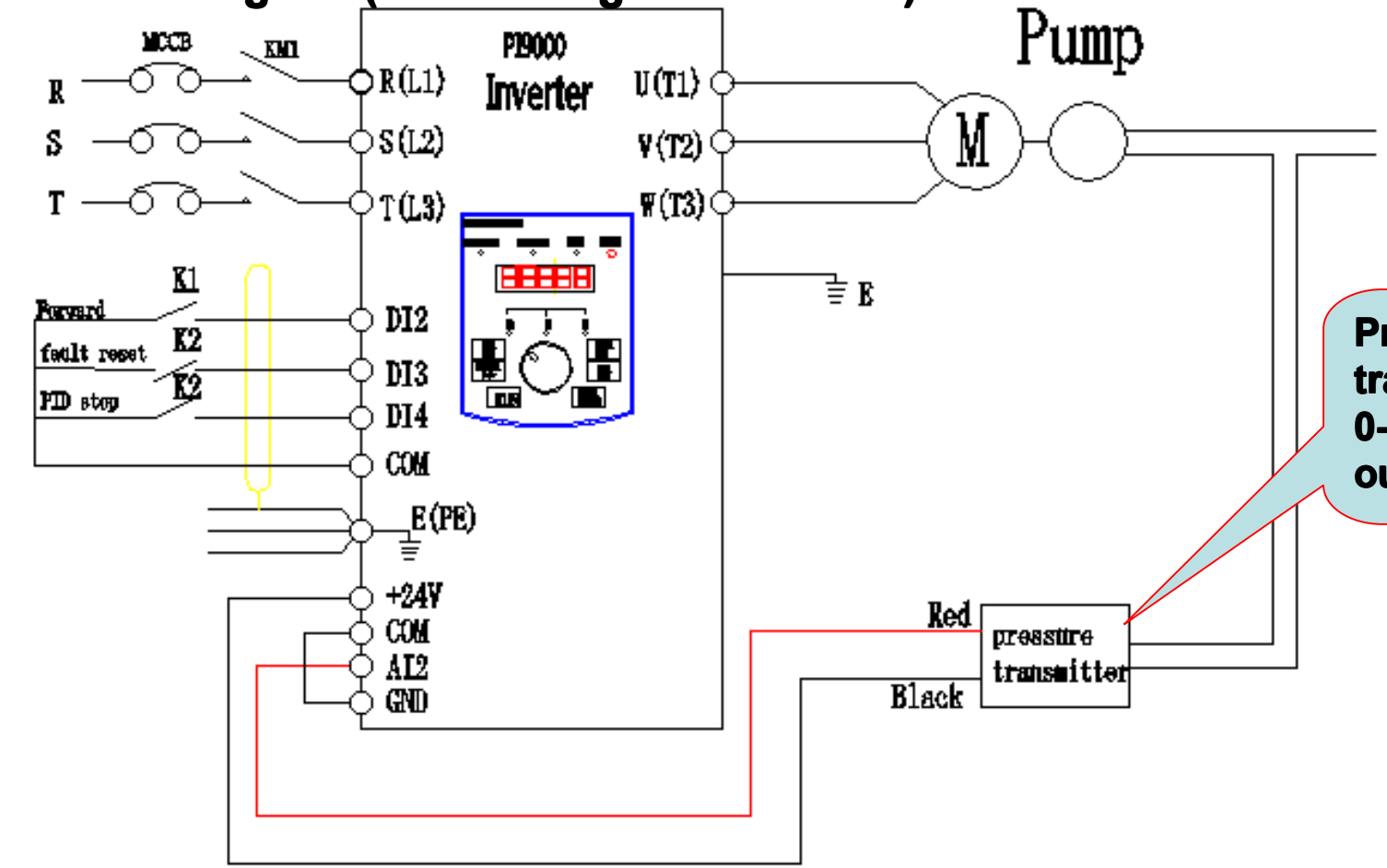


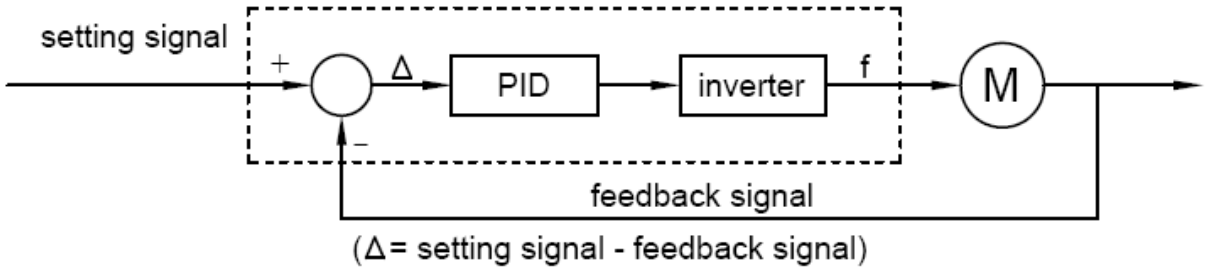
(Δ= setting signal - feedback signal)

PI8000/PI8100 PID regulation

negative action, when Δ＞0 is positive, frequency rises and when Δ＜0 is negative, frequency falls. For constant Pressure water supply.

17.2.PID control for constant pressure water supply -electrical diagram (0-20mA signal feedback)





PI8000/PI8100 PID regulation

negative action, when Δ＞0 is positive, frequency rises and when Δ＜0 is negative, frequency falls. For constant Pressure water supply.

PID control for constant pressure water supply
Parameters setting

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F01.0	Control mode	0:V/F	0
F01.1	command source selection	1:Terminal command channel (LED ON)	1
F01.03	frequency setting source selection	5:PID control setting	5
F01.11	acceleration time	0.1～3600.0s	25
F01.12	deceleration time	0.1～3600.0s	25
F10.00	PID setup source	key board (F10.01)	0
F10.01	PID value set by keyboard	0.0%～100.0%	50
F10.02	PID feedback source	0:analog input feedback signal AI1 /AI2	0/1
F10.03	PID action direction	1:negative action	1
F10.04	proportional gain (Kp)	0.00～100.00	1.0
F10.05	integration time (Ti)	0.00～100.00	0.10s
F10.06	Differential time (Td)	0.00～100.00	0.10s
F10.08	PID control Deviation limit	0.0～100.0%	0
F01.08	upper limit frequency	F01.09～F01.07(maximun frequency)	50Hz
F01.09	lower limit frequency	0.00Hz～F01.08(upper limit frequency)	30Hz
F06.01	DI2 function selection	1.Forward running direction	1
F06.02	DI3 function selection	7:fault reset	7
F06.02	DI4 function selection	16.PID stop	16
F06.07	Terminal command mode	0.three line control mode 2	3

Suggestion :

1.Check the direction of running . Press “FWD” for 1 sec ,if the direction of motor running is wrong, ,please cut off the input power supply ,and change the order of input power phase .

2. F10.01 (PID value set by keyboard),the value should be sett according the law ,
Target of pressure want to keep up (P)/ maximum pressure range of meter *100%.

3 .proportional gain (Kp) and integration time (Ti) setting method :

A, program a little value for proportional gain (Kp), and pre-set integration time (Ti) to 20～30s about .

B, Increase the Kp value gradually until oscillation happen in system ,and then make the value pre-set of Kp to it’s half .

C, Decrease Ti value gradually until oscillation happen in system ,and then set 150% or pre-set instead .

In common ,everything will ok according above mentioned setting . if a little oscillation happen ,please set Kp a little small ,or set Ti a little big ,if the system need to air restore soon after air leaking ,please set Kp a little big ,or set the Ti a little small .

18. PI9000 apply in air compressor retrofitting with PID control function.

The air compressor variable frequency control system is mainly composed of a frequency converter, a pressure sensor (pressure transmitter).
A pressure sensor component is first used to test the pressure in the reservoir . Next, the detection display instrument sends the output pressure analog signal to the frequency converter, which then compares to the feedback signal and the given objective signal, using the internal PID of the frequency converter to carry out automatic output frequency regulation, allowing for automatic adjustment of compressor motor speed and output power. This creates a closed-loop feedback system that maintains constant pressure and automatic control in the pipe network.

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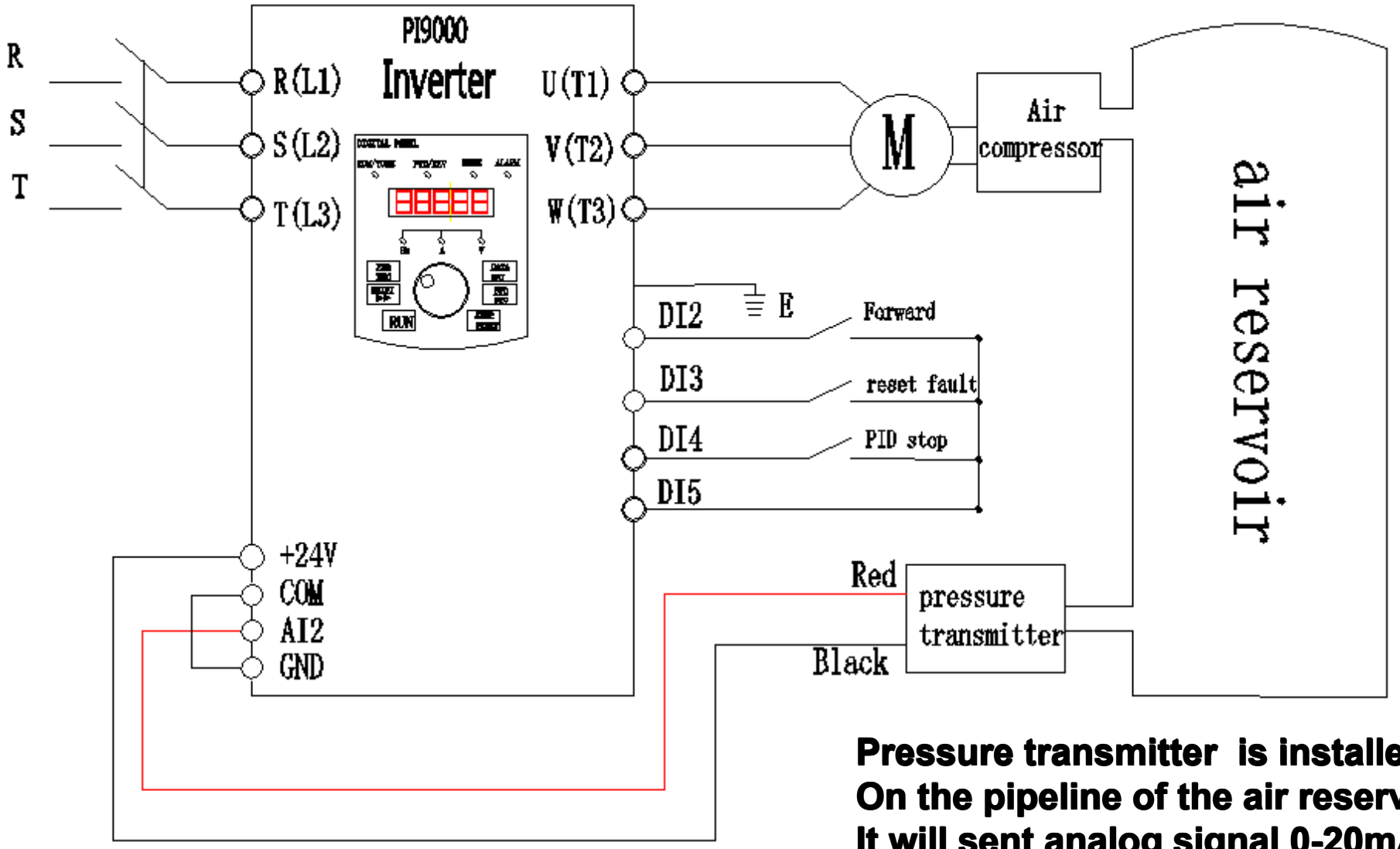
Wirings of electrical diagram with 0-20mA type of pressure transmitter



Pressure transmitter is installed On the pipeline of the air reservoir It will sent analog signal 0-20mA to inverter .

Wirings of electrical diagram with 0-10V type pressure transmitter

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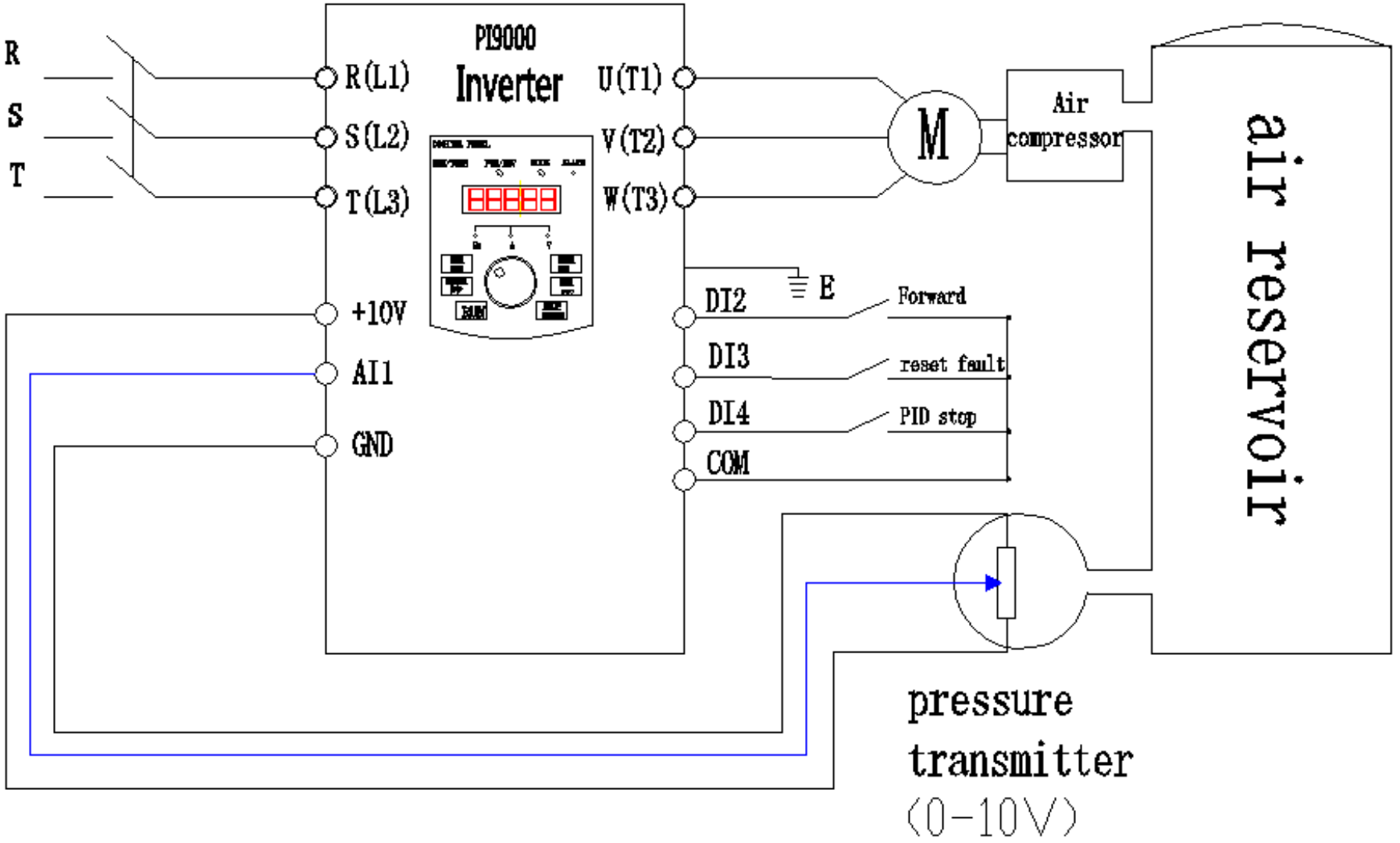

Parameters setting table

CODE	Description of Code	Range of setting	Refer. value
F01.0	Control mode	0:V/F	0
F01.1	command source selection	1:Terminal command channel (LED ON)	1
F01.03	frequency setting source selection	5:PID control setting	5
F01.08	upper limit frequency	F01.09～F01.07(maximum frequency)	50Hz
F01.09	lower limit frequency	0.00Hz～F01.08(upper limit frequency)	30Hz
F01.11	acceleration time	0.1～3600.0s	25
F01.12	deceleration time	0.1～3600.0s	25
F10.00	PID setup source	key board (F10.01)	0
F10.01	PID value set by keyboard	0.0%～100.0%	60
F10.02	PID feedback source	0:analog input feedback signal AI1	0
F10.03	PID action direction	1:negative action	1
F10.04	proportional gain (Kp)	0.00～100.00	1.0
F10.05	integration time (Ti)	0.00～100.00	0.10s
F10.06	Differential time (Td)	0.00～100.00	0.10s
F10.08	PID control Deviation limit	0.0～100.0%	0
F06.00	DI1 function selection	1.Forward running direction	1
F06.01	DI2 function selection	7:fault reset	7
F06.02	DI3 function selection	16:PID control stop	16
F 03.00	inverter type	1:F type inverter (fan ,pump 's load type inverter)	1

19.Application of PI9000 series inverters in crane

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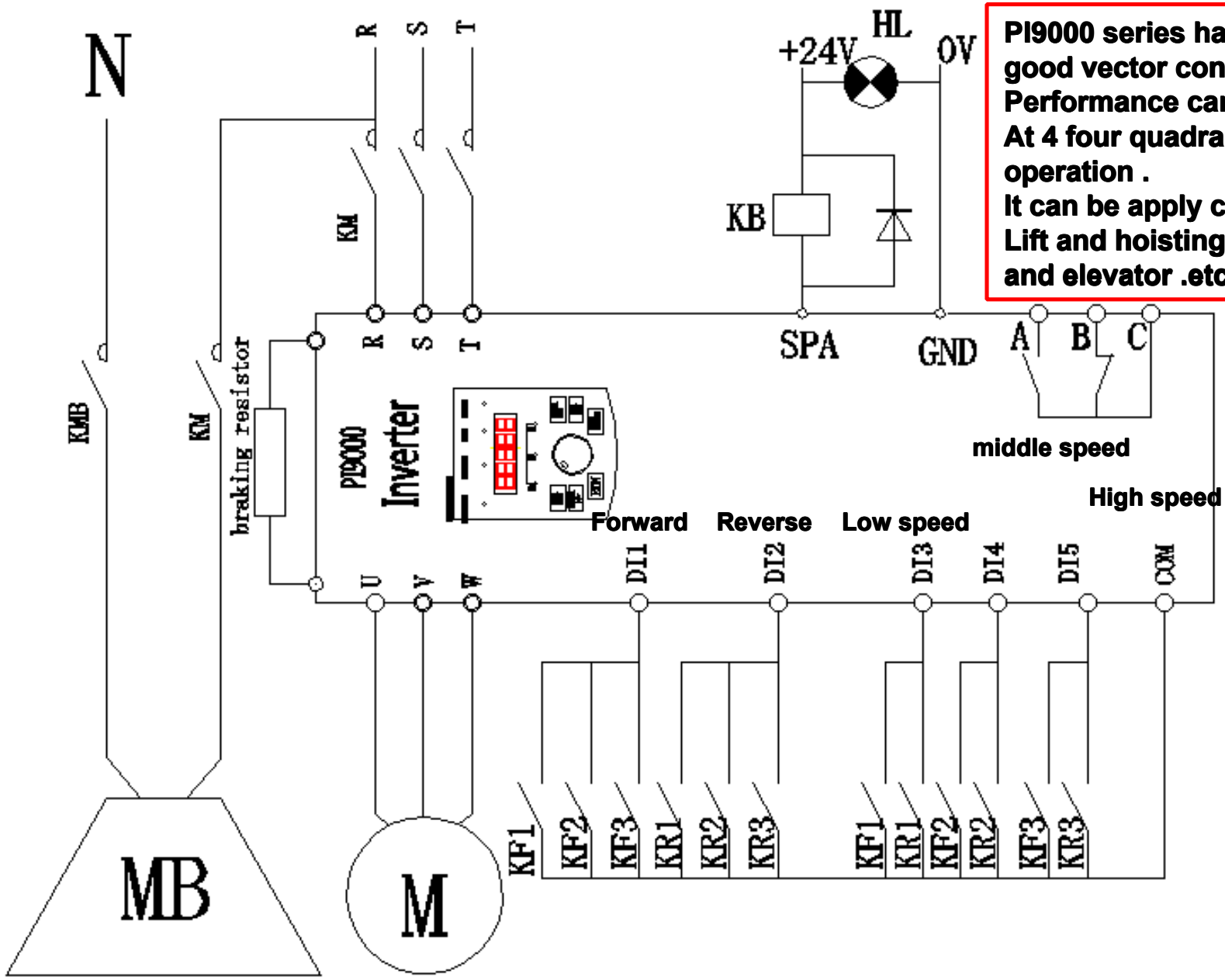
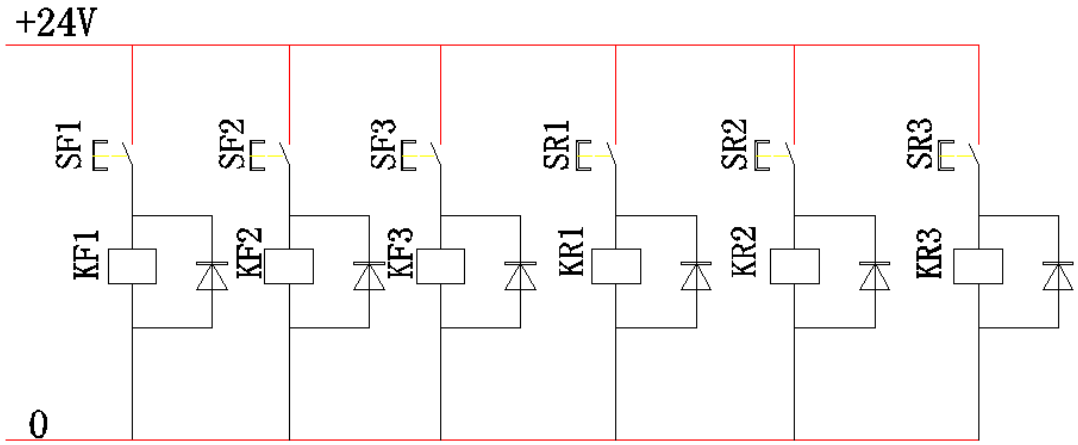
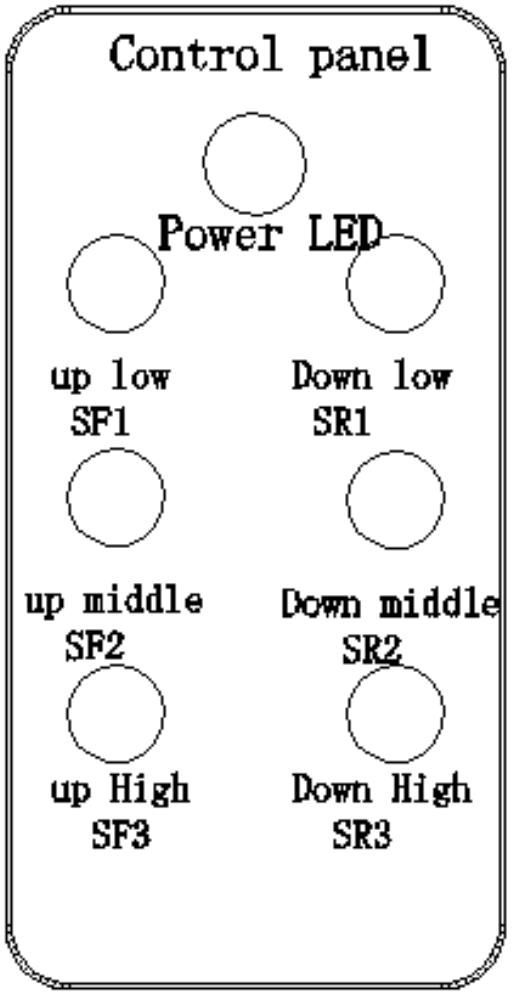
PI9000 series has good vector control Performance can run At 4 four quadrant operation . It can be apply crane Lift and hoisting machine and elevator .etc







DI1 – lift up the load
DI2 – Down the load
DI3- MSS1 for low speed running
DI4-MSS 2 for middle speed running
DI5-MSS 3 for high speed running .

We can select the DC brake function before running to hold the Motor for prolong the working life of mechanical of brake .
Also can using the DC braking function before stop to protecting From load loss suddenly . F02 parameter group

1. Must perform motor auto-turning first when apply the vector control mode

1.Disconnect the load from motor .(This is important ,otherwise can't get the Motor parameters precision ,the perform of vector can't work well)
2. put the F03.01 ,F03.02,F03.03,F03.04,F03.05 according nameplate of motor.
3.Put the F03.11 to 1, the light of TUN will on in the keyboard ,and then press The RUN key ,motor will start auto-turning automatic .
4. It will display 'END" in the menu at the end of auto-turning .it means the auto Turning has performed successfully .

CODE	Description of Code	Range of setting
F03.01	rated power	15.000
F03.02	rated frequency	50Hz
F03.03	rated rotation speed	1450
F03.04	rated voltage	380V
F03.05	rated current	32A
F03.11	motor auto-turning selection	1:complete Rotational auto-tuning

Parameters setting table :

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CODE	Description of Code	Range of setting	Refer. value
F01.0	Control mode	0:Vector control mode	1
F01.1	command source selection	1:Terminal command channel (LED ON)	1
F01.03	frequency setting source selection	4:Multiple speed setting	4
F01.11	acceleration time	0.1～3600.0s	10
F01.12	deceleration time	0.1～3600.0s	10
F06.00	DI1 function selection	1.Forward running direction	1
F06.01	DI2 function selection	2:Reverse rotation (REV)	2
F06.02	DI3 function selection	12:MS speed terminal 1	12
F06.03	DI4 function selection	13:MS speed terminal 2	13
F06.04	DI5 function selection	14:MS speed terminal 3	14
F08.02	SPA collector output selection	4:Frequency level detection FDT output	4
F02.00	Startup mode	1:star up before apply DC braking	1
F02.03	DC brake current at start	0.0～150%	130%
F02.04	DC brake time at start	0.0～50.s	1.0s
F02.06	DC brake beginning frequency at stop	0.00～F01.07	4Hz
F02.09	Dc brake time at stop	0.0～50.s	1s
F11.01	MS speed 1	-100.0～100.0%	10
F11.02	MS speed 2	-100.0～100.0%	50
F11.04	MS speed 4	-100.0～100.0%	100

gy company

20. Fault Diagnosis

PI9000 inverter has a number of warning information and protection function. In case of abnormal fault, the protection function will be invoked, the inverter will stop output, and the faulty relay contact of the inverter will start, and the fault code will be displayed on the display panel of the inverter.

1:inverter unit U protection (E.OUP)
2:inverter unit V protection (E.OUP)
3:inverter unit W protection (E.OUP)
4:over current during acceleration (E.oC1)
5:over current during deceleration (E.oC2)
6:over current when constant speed (E.oC3)
7:over voltage during acceleration (E.oU1)
8:over voltage during deceleration (E.oU2)
9:over Voltage when constant speed (E.oU3)
10:lower voltage in DC bus (E.LU)
11.motor over load (E.oL1)
12:inverter over load((E.oL2)
13:input phase of power failure (E.PHI)
14:output phase of power failure (E.PHo)
15:over heat of rectifier (E.oH1)
16:over heat of IGBT(E.oH2)
17:external device fault (E.SET)
18:communication fault (E.CE)
19:current detection fault (E.ItE)
20:Motor auto-turning fault(E.tE)
21:EEPROM read and write fault (E.EEP)
22:PID feedback has fault(E.PId)
23:braking unit has fault(E.bCE)