



**KGL Series Synchronous Motor Excitation
Cabinet**

KGL 系列同步电机励磁柜

Installation and Operation Instructions

安装使用说明书

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1 Performance Features

1 性能特点

1. It is applied in 380~10000V synchronous motor and three phase four wire system, and it can meet the demands on light load or overloading starting;

1. 适用于 380V—10KV 电压等级的同步电动机，装置供电为三相四线制，可满足轻载或重载启动要求；

2. Full digital control mode, abandon traditional potentiometer setting and adjustment method;

2. 全数字控制模式，摒弃常规电位器整定及调节方法；

3. Starting without pulse. Motor's asynchronous starting is smooth and convenient. It can meet the need of reduce-voltage and full-voltage starting;

3. 启动无脉振。电机异步启动过程平稳、快捷。可满足电机降压或全压启动；

4. Excitation input of motor uses slip frequency to check prepared angle (reversed polarity end) excitation input. Angle of excitation input adopts internationally recognized the smallest position of electrical separation angle; backup excitation input setting keep successful excitation input once motor started;

4. 电机的投励采用滑差检测准角（反极性末尾）投励，投励的角度选择国际公认的电器分离角最小的位置；还设有定时后备投励环节，保证电机启动一次投励成功；

5. Constant excitation current keeps power factor stable: excitation device can be operated in the way of constant current and keep power factor constant (optional). It can effectively overcome voltage fluctuation of grid and current change caused by rotor temperature rise of motor. Excitation can be adjusted in different load requirements.

5. 恒定励磁电流稳定功率因数：励磁装置能以恒流、恒功率因数方式运行（选配），



能有效克服电网电压的波动，及由于电机转子温升带来的电流变化。适应不同负荷要求自动调节励磁；

6. Adopt proprietary technology setting field suppression to eliminate pulse taking in the starting process of motor, increase pull-in torque to start motor smoothly;

6. 采用自有专利技术——整定灭磁，消除电机启动过程的脉振，增大牵入转矩，使电机启动平稳快捷；

7. Protect and make motor synchronized when step out;

7. 电机失步时具有保护功能，并能动作于失步再整步；

8. Invert-loop control effectively taps energy storage of motor rotor, protect motor and excitation device;

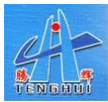
8. 设有逆变环节，有效泻放电机转子的储能，保护电机和励磁装置免受损害；

9. Automatic reclosure signal measurement can avoid critical damage of asynchronous impulsion to motor;

9. 测量自动重合闸信号，能够避免非同期冲击对电机造成的致命伤害；

10. With communication function with host computer, through the interface of RS485 to implement MODBUS protocol. Power factor $\text{COS}\phi$, stator current, excitation current and current upload can be achieved to remote adjust excitation;

10. 具有和上位计算机通讯功能, 通讯接口为 RS232 或者 RS485。通讯协议为 MODEL BUS。可以实现励磁柜功率因数 $\text{COS}\phi$ ，定子电流，励磁电压，电流的上传，实现远程调节励磁；



2 Installation and Operating Instructions

2 安装调试及操作说明

1. Close control power supply and adjust switch to “zero”;

1. 关闭控制电源开关，转换开关打至“零”位；

2. Close air switch power supply in the excitation cabinet, and then AC power indicator light will be on, it means the main transformer of excitation cabinet is powered on; “Operation” light on microcomputer controller flickers regularly refers to self-inspection of microcomputer internal program is normal. Microcomputer has self-inspection function and it will stop flickering if problems occur;

2. 合励磁柜内总电源空气开关，此时盘面“交流电源指示”灯亮，表示励磁柜主变压器已带电；微机控制器上“运行”灯会有规律的闪烁，半秒亮、半秒灭，表示微机内部程序自检正常，微机具有自诊断功能，如果内部有问题就会停止闪烁；

3. Close control power switch, light “control power indicator” on the panel will be on. It refers to secondary circuit electrification in excitation cabinet is ready;

3. 打开控制电源开关，盘面“控制电源指示灯”亮，表示励磁柜内部二次回路带电准备就绪；

4. Turn the switch to “debug”, AC contactor KC will be closed (see schematic diagram), the fan starts and “start indicator” light on it will be on. Several seconds delay, regular excitation input begins (time can be set freely in 25 seconds). “Excitation input” light on microcomputer controller means to begin input excitation if the light is on; “+A”, “+B”, “+C”, “-A”, “-B” and “-C” light means 6 impulses;

4. 将转换开关打至“调试”，交流接触器 KM（见原理图）吸合，风机起动，盘面“风机起动指示”灯亮，延时若干秒后定时投励（时间在 25 秒内可任意设定），微机控制器上“投励”灯亮表示已投励；“+A”、“+B”、“+C”、“-A”、“-B”、“-C”灯亮，表示输出六个脉冲；

5. After excitation input, according to motor parameters, push “up” and “down” to adjust “excitation voltage” (or excitation current); if push “fast” button which means “fast up” or “fast down”. When excitation voltage is up, if field suppression occurs, maybe field suppression setting is low;

5. 投励后，可根据电机的参数按“上升”或“下降”键调节“励磁电压”（或“励磁



电流”)值;若同时按“快速”键即是快速上升或快速下降。在升高励磁电压时,若出现灭磁,应考虑灭磁整定是否太低;

6. Adjust switch to “zero”, microcomputer stops excitation input. Contravariant can be set as required, microcomputer can memorize conduction angle of whole bridge circuit so as to output constant excitation voltage and current value when motor starts;

6. 将转换开关打至“零”位,微机停止投励,根据需要可设定逆变,微机可自动记忆整个桥路的导通角,以保证开车时可以输出恒定的励磁电压和电流值;

7. Field suppression test: in the condition of normal output, push “field suppression test” button, and then pointer of excitation voltage meter turns to zero, it means field suppression is normal; If point doesn't turn to zero, it refers to fault in field suppression system. The fault must be debugged until field suppression becomes normal, and then turn switch to “allow” position;

7. 灭磁实验:在正常输出状态下,按下“灭磁检测”按钮,此时励磁电压表指针回零,说明灭磁系统正常;若电压表指针不回零,说明灭磁系统有故障,必须检查排除故障,直至灭磁系统正常,方可将转换开关打至“允许”位置;

8. Turn switch to “remote change-over” and wait for host machine operates. When high-voltage switchgear send start signal, “host machine operation indicator” light on panel will be on, and then the fan starts; when rotor turning slip of motor reaches 5%, input excitation in sequence polar. If slip excitation-input fails, regular excitation-input will be backup to keep excitation device run in normal excitation voltage;

8. 将转换开关打至“远方选择”位置,等待主机运行。当高压开关柜送来开车信号时,盘面上“主机运行指示”灯亮,风机起动,当电动机转子转动的转差达到5%时,顺极性投入励磁,若滑差投励失败,定时投励作为后备,依然可以控制励磁装置转入正常励磁电压。

9. Before excitation-input, asynchronous machine is in no-voltage field suppression state; after excitation-input, it is in over-voltage state;

9. 电机投励前异步起动阶段为零电压灭磁状态;投励后为过压灭磁状态;

10. When motor stops, microcomputer begins to automatically remember data before stop and save power-off.

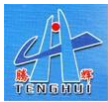
10. 当现场停车时,微机将按照停车前所使用的数据自动记忆,并可掉电保存。



3 User Wiring Schedule

3 用户配线表

NO.	Excitation cabinet	High voltage switchgear	NO.	Excitation cabinet	High voltage switchgear
1	A412	CT in	13	121	Communication signal on spot (out)
2	N411		14	123	
3	B601	PT in	15	409	Start allowed
4	C601		16	411	
5	139	Putting into full voltage	17		
6	141		18		
7	90	Force excitation	19	24+	Start signal in
8	91		20	300	
9	401	To tripping circuit	21		
10	403		22		
11	121	Communication signal on spot (in)	23		
12	123		24		



4 Parameter Specification of Microcomputer Controller

4 微机控制器参数说明

Display functions

显示功能

Running light: after microcomputer power on, internal program will begin self diagnosis. If there are no problems in peripheral circuit and microcomputer, running light will flicker regularly; if problems occur, the light will flicker chaotically.

运行灯：微机上电后，内部程序会进行自诊断，如果外围电路和微机自身没有问题，运行灯会有规律的闪烁，半秒亮、半秒灭，如果内部有问题会显示一种混乱状态。

Excitation-input indicator light: excitation-input indicator light refers to excitation-input state, and the light will be on if there is trigger pulse. Inverter mode keeps indicating for 5 seconds.

投励指示灯：投励指示灯指示投励状态，只要有触发脉冲，它就一直亮，逆变状态维持 5 秒，依然指示。

Protection: this indicator light indicates tripping protection, it is on in the output and stop state. It can only be reset through parameter setting clear.

保护：此指示灯指示跳闸保护动作，输出保护状态时亮，停车不关，只有通过参数设定清除才能被复位，以方便事故分析，追忆事故状态。

The pulse light: +A, +B, +C, -A, -B and -C indicate output state of pulse respectively. Pulse indicator light should be steady and flicker free, for the convenience of relevant personnel monitor operation effect of controller.

脉冲指示灯：+A、+B、+C、-A、-B、-C 分别指示脉冲的输出状态，脉冲指示应稳定不闪烁，方便有关人员观察，监视控制机运行效果。

Display Chinese characters window: display window is composed by 4 lines Chinese characters, a maximum of 8 characters per line. It is divided as 4 states and 12 pages. Display window has 2 color, yellow green and blue white.

汉字显示窗口：显示窗口由四行汉字组成，每行最多显示 8 个汉字，共分为 4 个状态，12 个页面。颜色有 2 种，黄绿屏或蓝白屏。

Power on display: after microcomputer power on, this page in the window will last 3



seconds and then switch to operation page.

上电显示页面：微机上电后进入上电页面，页面维持 3 秒钟后，自动切换到运行页面。

Power on page:

上电页面:

欢迎使用
励磁微机

Operation page:

运行页面:

TK-1 励磁微机
励磁 I: ** Φ : ***
移相: *** S: *. **

Parameter specification of operation page display:

运行页面显示参数说明:

Excitation I refers to excitation current, controller constantly collect excitation current in the operation. Excitation current on the display page will be refreshed per 20 milliseconds.

励磁 I，代表励磁电流，控制器运行中在不停的采集励磁电流，每 20 毫秒，页面上显示的励磁电流刷新一次。

Φ refers to power factor, and it is collected by controller automatically. Power factor will be refreshed per 20 milliseconds, it can indicate inductive, capacitive and resistive operation state.

Φ ：代表功率因数，控制器自动采集功率因数。每 20 毫秒刷新一次,并且可以指示出感性,容性或阻性运行状态.

When operation state of motor is inductive, it shows L, and ** ,** is measured value of actual power factor.

当电动机运行状态为感性时显示:L.** ,**为实际功率因数测量值

When operation state of motor is resistive, it shows 1.00.

当电动机运行状态为阻性时显示:1.00

When operation state of motor is capacitive, it shows C, and ** ,** is measured value of actual power factor.



当电动机运行状态为容性时显示:C.** , **为实际功率因数测量值

Phase shift indicates phase-shift angle of trigger pulse. In the state of inverter and adjustment, use constant excitation current or power factor to adjust automatically, controller will show change of phase-shift angle automatically, it is refreshed 20 per milliseconds.

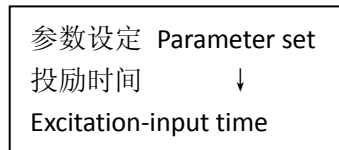
移相：显示的是触发脉冲的移相角度，在逆变状态，调节状态，使用恒励磁电流或恒功率因数自动调节时，控制器会自动显示移相的角度。并且反映移相角度的变化，每 20 毫秒显示刷新一次。

S: Excitation-input time when motor starts

S: 本次开车投励时间。

Parameter modification page

参数修改页面：



Parameter can be modified in parameter modifier page, and page display format is seen as above. Specific parameters can be modified as follows:

在参数修改页面下可以修改参数，页面显示格式如上图，具体可以修改的参数如下：

1. Proportion parameter: controller to excitation current or power factor as P parameter when PID closed-loop regulation.

1、比例参数：控制器对励磁电流或功率因数。做 PID 闭环调节时的 P 参数。

2. Invert mode: it shows if there is invert or not in controller and size of invert angle. For hybrid converter, because of no-invert, so there is no invert mode when stop motor. When fully-bridge controlled, the relevant invert angle will be showed.

2、逆变状态：逆变状态显示的是，控制器有无逆变，逆变角度的大小。对于半控桥，由于没有逆变，停车时不显示逆变状态，全控桥停车时显示对应的逆变角度。

3. Slip frequency setting of motor

3、电机滑差设定。

4. Trip reset: I parameter setting: If controller detects step out or field loss signal in the



operation of motor, it will send trip signal and protect motor. In the convenience of post disturbance review after tripping, trip state can be cleared only by setting before, or the trip state will be remained. I parameter is automatic adjustment integral parameter of excitation current and power factor.

4、跳闸复位，I 参数设定：控制器在电机运行中如果检测到失步或失磁信号，控制器就会发出跳闸信号，产生保护动作，为了方便跳闸后事故追忆，必须由人为设定才能清除跳闸状态，否则跳闸状态一直保持。I 参数是励磁电流或功率因数自动调节过程中的积分参数。

5. Regular excitation-input: it is effective complementation of slip frequency excitation-input.

5、定时投励：定时投励是滑差投励的有效补充。

6. Force excitation setting: COS Φ target value setting

6、强励设定：COS Φ 目标值设定。

7. Putting into full-voltage: use this parameter if there is soft starter for motor. Like excitation-input, slip frequency in advance before putting into full-voltage.

7、投全压时间：有降压启动的电机，使用此项参数，和投励一样，投全压也是滑差优先。

8. Close loop setting: in order to overcome excitation wave caused by grid voltage wave, rotor temperature rise and rapid melt SCR damage, this parameter is to keep excitation current constant and make motor operate stably. 0 means open loop application; 1 means constant excitation current; 2 means constant power factor.

When constant excitation current adjustment, regulation precision is $\pm 0.5A$.

When constant power factor adjustment, regulation precision is ± 0.005 .

8、闭环设定：为了克服电网电压波动、转子温升、快熔可控硅损坏引起的励磁电流波动，使用此项参数，恒定励磁电流，使电机稳定运行。0，开环应用 1，代表恒励磁电流。2，代表恒功率因数。

恒励磁电流调节时，调节精度 $\pm 0.5A$

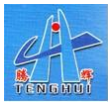
恒功率因数调节时，调节精度 ± 0.005

9. When two-channel excitation adjustment, controller will detect switch state automatically. Parameter is transformed by communication between controllers, controller



has automatic tracking function.

9、双通道励磁调节时，控制器自动检测切换状态，控制器之间通过通讯传递参数。自动跟踪。



5 Microcomputer Operation

5 微机操作

1. Buttons define: up/down button are cooperated with fast/slow buttons, it can achieve setting of excitation current. Press “up” button, excitation current will rise slowly, and the adjusted phase-shift angle will be shown on operating page. After adjustment, microcomputer will keep adjustment in memory for the sake of error-free in next time motor start. Press up and fast/slow buttons simultaneously can quickly adjust current, and operation page will also show relevantly changed phase-shift angle.

As well, press “down” button to reduce current, it can be seen that current is reduced slowly and the changed phase-shift angle will be shown on operation page; press down and fast/slow buttons simultaneously can quickly adjust current, and operation page will also show relevantly phase-shift angle.

For the convenience of introducing, ▼ is called up/down button, ► is called left/right button and number-setting button. These three buttons are all for modifying parameters, and all modified parameters will be shown and kept in memory on the relevant modifier page.

1、按键定义：上升键、下降键分别与快/慢键相配合，可以实现励磁电流的设定。按住上升键，励磁电流就会缓慢上升，运行页面会显示调节后的移相角，停止调节，微机内部会对调节进行记忆，下次开车，保证无误。同时按下上升和快慢按键可实现电流的快速调节，运行页面也会显示相应变化后的移相角。

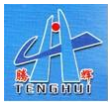
同样，电流下降调节时，按住下降按键，可以看到电流缓慢下降，运行页面会显示改变后的移相角；同时按住下降键和快慢键可实现电流的快速下降调节，运行页面显示相应的移相角。

▼为了介绍方便把它叫做上下键，►此键叫左右键，还有置数键，这三个键配合用来修改参数，所有被修改的参数，都会在相应的修改页面显示，同时会得到记忆。

2. Parameter browsing: it can be carried out under any conditions. Press number-setting button, display page will be shifted to parameter setting page.

First line on the page display (parameter setting)

Second line shows parameters. At the end of second line parameters show a “↓”



icon.

Third line shows content of second line parameters

Press up/down button can set recycling shows from excitation-input time to force excitation, scan setting values in different parameters. After scanning, press number-setting button, page will be shifted to operation page and finished.

2、参数的浏览：参数浏览在任何状态下都可以进行，按下置数键，显示页面从运行页面切换到参数设定页面。

页面第 1 行显示（参数设定）。

第 2 行显示代表的参数，同时第 2 行参数的末尾显示一个向下的 ↓ 图标。

第 3 行显示的是第 2 行参数的内容。

此时按上下键可以从投励时间到强励设定循环显示显示、浏览不同参数内的设置值。浏览完毕按下置数键，页面自动切换到运行页面，操作完毕。

3. Parameters modification: parameter only can be modified in the condition of no-excitation input. No modifying parameter in the operation of motor, but scanning is allowed. Press number setting button when parameters modification, display window will be shifted to parameter setting page. Use up/down button to choose option to modify. Press left/right button, cursor ↓ will be moved from second line to the third line, at the same time, cursor ↓ will change to ↑, and the press up/down button can change content to modify. After modification, press number setting button to finish.

3、参数的修改：修改参数只能在没有投励的状态下进行，电机运行中不许修改参数，只能浏览！参数修改时按下置数键，显示窗切换到参数设定页面。用上下键选择要修改的选项，按左右键，显示光标的↓会从第 2 行移动到第 3 行。同时符号↓会变成↑。此时按上下键，可以改变要设置的内容，修改完毕，按置数键结束修改。

Parameter modification page

参数修改页面：

参数设定	Parameter set
投励时间	↓
Excitation-input time	

4. Here are contents can be modified by parameters as follows:

4、下面是各参数可以设置的内容：



P parameter setting: it can be adjusted between 0~80 as closed loop controlling. Users can modify P according to output situation.

P 参数设定: 可以在 0—80 之间调节, 做闭环控制时。用户根据输出情况修改。

Inverter mode: it is changed between 0, 1 and 3. 0 refers to hybrid converter or cominer circuit voltage regulator; 1 refers to Y/ Δ or Δ /Y connection of excitation transformer; 3 refers to Δ / Δ or Y/Y connection of transformer.

逆变状态: 在 0、1、3 之间变化, 0 代表半控桥或合成电路调压器——不逆变, 1 代表励磁变压器接法为 Y/ Δ 或 Δ /Y, 3 代表变压器接法为 Δ / Δ 或 Y/Y。

Slip frequency reset: this parameter is set from 0 to 10. Generally choose to use 10 or 9. It has been finished setting before leaving factory, so users do not arbitrarily set without special circumstances.

滑差: 此项参数在 0—10 之间设定。一般使用 10 或者 9。出厂已经设定完毕, 没有特殊情况用户不要随意设定。

Trip reset: it can be chosen between 0 and 20, 1~10 means no reset. Parameter I is 1~10, 11~20 refers to reset.

跳闸复位: 在 0、20 之间选择, 1-10 表示不复位, 同时 I 参数为 1-10。11-20 代表复位。

Regular excitation-input time: it can be adjusted from 1 to 50, every time one numbers changed, excitation-input time will be changed 0.5 second. 1 refers to 0.5 second, 50 refers to 25 seconds. If the longest excitation-input time required, please inform us in advance.

定时投励时间: 在 1—50 之间可以调节, 每变化一个数, 投励时间变化 0.5 秒。1 代表 0.5 秒, 50 代表 25 秒, 如果时间要求超长, 请在定货时提前声明。

Force excitation value setting: it can be set between 0, 1 and 2. 0 refers to normal excitation, when setting is 1, it means the setting excitation current value is output value of force excitation. If set force excitation value, firstly set it to 1 and then input excitation, excitation current value will be output value of force excitation, finally stop excitation-input. If parameter is set to 0, excitation-input begins and adjust excitation to normal excitation. Finish force excitation setting, low voltage signal in and observe force excitation output.



强励值设定：在 0、1、2 之间设定，0 代表正常励磁。设定为 1 时，说明现在正在设定调节的励磁电流值是强励时的输出值。要设定强励值，首先将此项参数置成 1，投励，调节励磁电流为强励时的输出值，停止投励，设本项参数为 0，投励，调节励磁为正常励磁。强励设定完成，给低电压信号，观察强励输出。

When the setting is 2, set power factor to self-adjusted power factor. Specific setting method is as follows: set this parameter to 2, press up/down button to adjust excitation current, observe power factor value is proper or not. Change this parameter to 0 and finish power factor setting. Set closed loop parameter to 2, controller will be operated in automatic adjustment state.

设定为 2 时：设定功率因数自调用的功率因数，具体设定方法如下：把此参数设定为 2，上升或下降调节励磁电流，观察功率因数为合适的值。然后把此参数改回 0。功率因数设定完成。把闭环参数设定为 2，控制器就运行在功率因数自动调节状态。

Fully input voltage time: it can be set freely from 0 to 50, every number represents 0.5 second. Fully input voltage can be set according to grid capacity, transformer capacity, motor size and load situation. Remember that fully input voltage time setting should be shorter than regular excitation-input time.

投全压时间，在 0—50 之间可以随意设定，每个数代表 0.5 秒，全压时间的设定可根据电网容量，变压器容量，电机大小，拖动负荷状况，灵活设定，切记它应该小于定时投励时间。

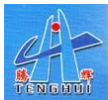
Closed loop setting: it can be set between 0, 1 and 2. 0 refers to open loop operation; 1 refers to closed loop operation of constant excitation current; 2 refers to operation of constant power factor.

闭环设定：在 0、1、2 之间调节，0 代表开环运行，1 代表恒励磁电流闭环运行，2 代表恒功率因数运行。

Controller can be finished operation after mastering modification and scanning above.

掌握了以上参数的修正、浏览，就完成了对控制机的操作。

Trip protection page:



跳闸保护画面:

保护动作 Protection 失磁 Excitation-loss

保护动作 Protection 失步 Step-out

Excitation-loss protection and step-out protection are set in the controller. When protection occurs, controller will be automatically switched to the relevant page. For the convenience of post disturbance review, after protection tripping, output relay of microcomputer cannot reset automatically, so trip page will be kept. The way to remove is parameter modification and reset state protection. Set parameter from 0 to 1, protect relay reset and the display page will be reset to operation page.

在控制器内部设置了失磁保护和失步保护，当发生保护时，控制器会自动切换到相应的页面。为方便事故追忆，保护跳闸后，微机的输出继电器不能自动复位，跳闸画面也会保留。解除的办法是进入参数修改，保护复归状态，把参数从 0 设置为 1，保护继电器复位，同时显示画面自动恢复到运行画面。

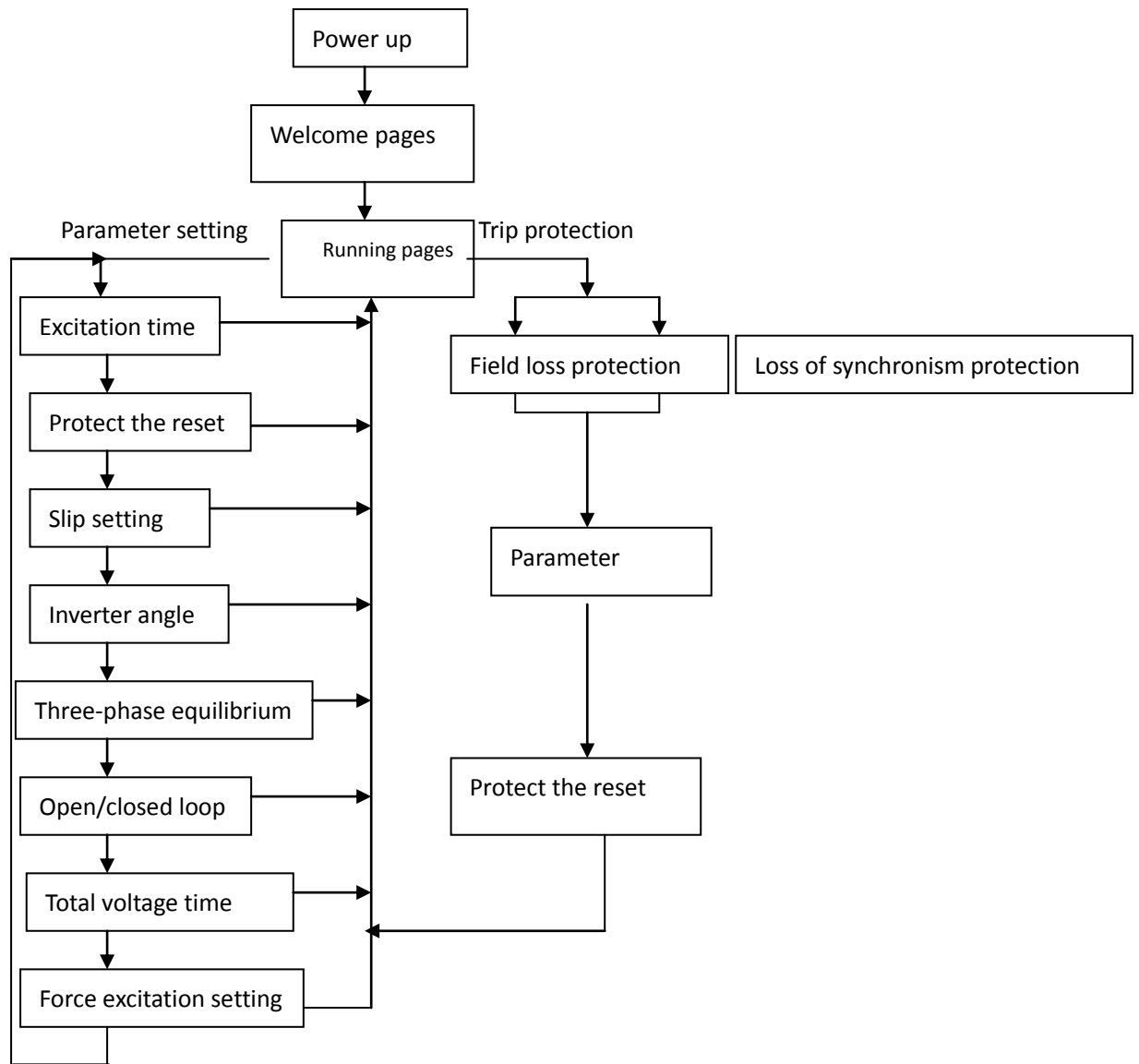
Due to protection reset is 1, so excitation-loss protection and step-out protection will be shielded. In order to make protection continue to play a role, please use parameter modification method to set protection reset to 0.

由于保护复归被设定为 1，所以失磁保护和失步保护功能被屏蔽。为了让保护继续发挥作用，请使用参数修改的办法，把保护复归设定为 0。让保护发挥作用。



The picture below refers to parameter show and pages switch process.

下图表示了参数显示和各画面互相切换的过程。





6 Device Working Environment

6 设备使用环境

1. 海拔高度小于 1000 米；
1. The altitude should be no more than 1000 meters
2. 环境温度 -10~50℃；
2. Environment temperature :-10~50℃。
3. 相对湿度小于 85%RH，无凝结；
3. Relative humidity should be less than 85%RH, no condensation。
4. 无导电尘埃，无腐蚀性气体，非易爆场所；
4. No conducting dust, No corrosive gas, No explosive area。
5. 无剧烈震动和冲击；
5. No violent vibration and impact。
6. 室内使用。
6. For indoor use。