

BKC-TL5M
The centrifuge
Operating instruction

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preface

Dear users:

Welcome to buy BIOBASE centrifuge, thank you!

Sincerely hope that our products can bring the greatest help to your work.

In order to make you have more understanding of the centrifuge, this manual mainly introduces the centrifuge product technical parameters, installation environment, operation methods, maintenance methods and simple troubleshooting. Please be sure to read the instruction carefully before use. The content of this instruction is very important for your safe and correct use of this machine.

After reading the instruction, please keep it in a place where it is easy to use for easy reference.

Information is subject to change without prior notice.

We reserve the right to improve the machine performance without prior notice.

1. Product overview

1.1 Introduction to the centrifuge

In medical examination, the centrifuge is often used as an instrument to separate serum, plasma, precipitate protein or make urine sediment examination. The centrifuge can make the suspended particles in the mixed liquid precipitate quickly, so as to separate various material components with different specific gravity, which can be widely used in radioimmunity, biochemistry, pharmaceutical and other industries.

BKC-TL5M type low speed centrifuge adopts brushless DC motor, microcomputer control, convenient and fast, with a variety of protection functions, make your operation safer, simpler, more reliable.

1.2 Operating principle of centrifuge

Centrifuge is the use of centrifugal filtration and centrifugal sedimentation of two principles, under the action of centrifugal force so that the density of different cells (particles) in the solution under the action of centrifugal force to achieve separation, concentration or purification.

Will be equipped with the same test solution centrifuge tube placed symmetrically in the rotor tube hole, after start the instrument, motor drives the rotor relative centrifugal force generated by high speed rotation (RCF) test solution density of different cells (particles) separation, depends on the size of the sample position relative centrifugal force to the axis of the horizontal distance of the rotating radius r and rotational speed n , its computation formula is as follows:

$$RCF = 1.118 \times 10^{-5} n^2 r \times g$$

N ----- Speed (revolution/min)

R ----- Rotation radius (cm)

The time T_S required for particle separation and precipitation in the mixed liquid is calculated by the following formula:

$$T_S = \frac{27.4 \times (\log_e R_{\max} - \log_e R_{\min}) \mu}{n^2 r^2 (\sigma - \rho)}$$

Fraction of:

R_{max} ----- Rotation radius of the farthest test solution from the axis (cm)

R_{min} ----- Rotation radius of the test solution nearest to the axis (cm)

ρ ----- Mixed liquid density (g/cc)

μ ----- Mixture viscosity (mooring)

N ----- Speed (revolution/min)

R ----- Particle radius (cm)

σ ----- Particle Density (g/cc)

II. Scope of application

For the separation of human samples before pathological analysis.

Three, product performance

This product belongs to the first category of medical devices. Its basic performance parameters are as follows:

model Technical parameters	BKC-TL5M centrifuge
Record number of medical devices	No. 20200420, Luji Machine
The power supply parameters	AC220V 50HZ
The engine power	500W
The highest speed	5000r/min
Maximum preparation capacity	4 x 500 ml
Maximum relative centrifugal force	4390 x g
Speed stability accuracy	($\pm 2.5\%$ or 20 RPM) take the highest value
Timing around	(1 ~ 999 min)

The noise	65 db or less
Size of the host Mm (L×W×H)	620×450×355
Packing size (LxWxH)mm	700×530×480
Net weight/gross weight	45kg

3.1 Basic parameters of centrifuge:

3.2 Adapting rotor parameters

Rotors Type	NO.	Volume (ml)	Max Speed (r/min)	Max RCF (×g)	Tube Size
Swing Rotor	No. 1	4×50ml	5000	4390×g	Φ28×104
	No. 2	4×4/2×50ml	4000	3580×g	Φ28×104
	No. 3	4×500ml		3580×g	Φ13-72×75-140
		(12×50ml/8×100/48×15)			
	No. 4	80/96/120×5/7ml		3580×g	Φ13×75
	No. 5	4×250ml		3500×g	Φ13-70×70-110
		(8×50ml/36×10ml)			
	No. 6	40/48/72×5/7ml		3500×g	Φ13×75
	NO. 7	4×300ml		3900×g	Φ60×130
No. 8	36/64×10ml	2810×g		Φ16×87-108	
Enzyme-labeled rotor	No. 9	2×2×96Holes		2300×g	Enzyme-labeled
Fixed Rotor	No. 10	12×15ml	5000	2200×g	Φ16-19×120
	NO. 11	18/24x10ml		2200×g	Φ16×87-108
	NO. 12	8x50ml		3400×g	Φ28×104
	NO. 13	4x100ml		2800×g	Φ38×107



Note: 1. It is strictly prohibited to exceed the rotor speed and capacity specified in the attached table!

2. The rotor listed in the attached table is suitable for this type of centrifuge, which does not mean that our company randomly provides it. Please refer to the actual order.

IV. Product reception and installation

4.1. Product reception

- When you receive the centrifuge, please confirm whether the specifications and models of the centrifuge are the same as those you ordered.

- Please check whether the packing box of the centrifuge is damaged. If so, please do not unpack at will and contact our company in time.

- Please check the product packing information according to the packing list, and check whether the corresponding random items and supporting documents are complete.

4.2. Product Installation

4.2.1 Equipment installation

A. Installation environment requirements:


- (1) Only applicable to indoor;
- (2) Ambient temperature: 5°C ~ 40°C;
- (3) Relative humidity: ≤80%;
- (4) atmospheric pressure range: 860 hPa ~ 1060 hPa;

B. Before connecting the AC power supply, ensure that the voltage of the power supply is consistent and stable with the input voltage of the centrifuge, and ensure that the rated load of the power socket is not less than this requirement, and that the power supply must be reliably grounded.

C. Centrifuge should be placed in a ventilated place, avoid heat source and direct sunlight, and the indoor environment should be dry and clean.

D. The gap between the main machine and the wall of the centrifuge should be greater than 50cm. The working table must be placed horizontally and can safely support the operation

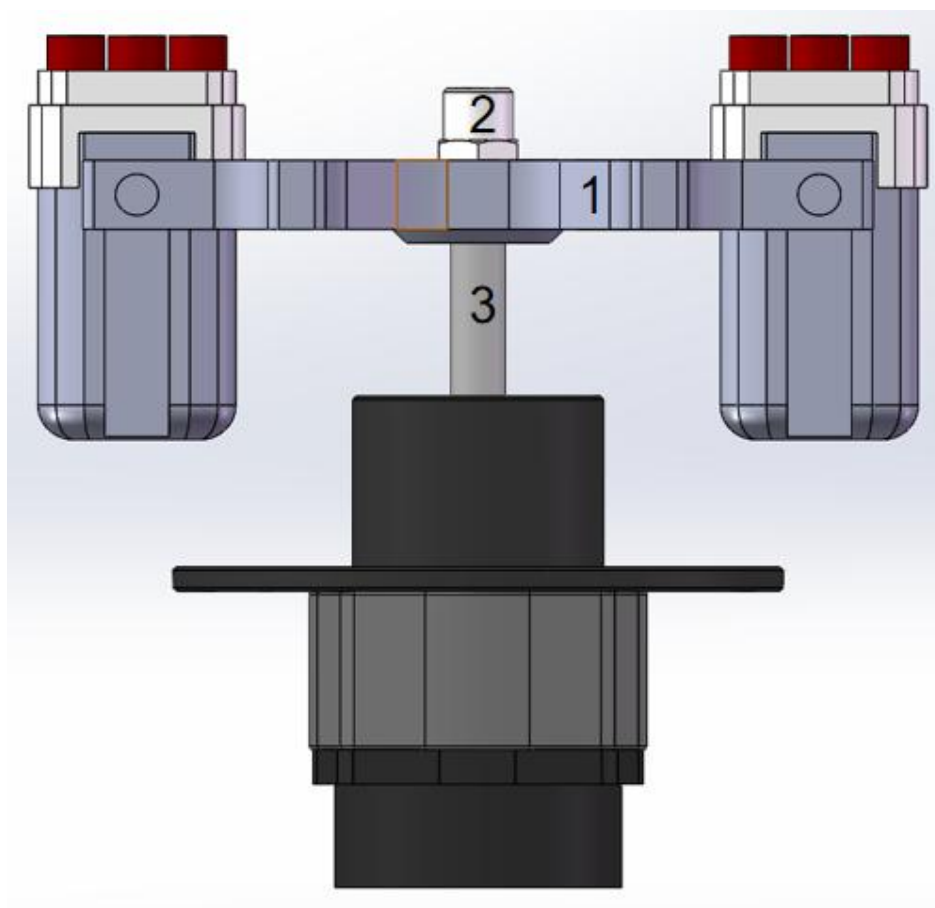
of the centrifuge to ensure that all the four legs of the centrifuge are in contact with the working table without shaking and vibration.

Note: 1. The four rubber feet have uneven forces, which will produce vibration and loud noise, which will affect the separation effect, and even cause the explosion from the ventricle, resulting in safety risks.

2. There is no strong vibration source near the centrifuge.

3. To ensure safety, the centrifuge should be connected to a remote emergency switch (preferably outside the room where the centrifuge is located or near the exit), so that the connection between the centrifuge and the main power supply can be cut off in case of failure.

4.2.2 Installation of Rotor




1. Horizontal rotor 2. Tighten the nut 3

Fig. 1 Rotor installation diagram

As shown in Fig. 1, the specific rotor installation process is as follows:

A. Wipe the rotor seat, the rotor body hole and the DC motor shaft in the centrifugal chamber with a clean, soft cloth to ensure that they are clean and free of impurities. A thin layer of grease is coated on the mounting hole of the rotor body;

 **Note: grease should not be overcoated, too much may lead to the tightening of the nut can not tighten.**

B. Put the supporting rotor into the motor shaft and pay attention to the position of the center hole;

C. Screw the lock nut from the top of the motor shaft and tighten it with a wrench to prevent the equipment from falling off during operation;

D. After the rotor is installed, put the lifting cup or the adapter with a test tube on the rotor, and rotate the rotor gently. The rotor should rotate flexibly, and the lifting cup (adapter) should tilt freely on the rotor without blocking or rubbing.

V. Structure composition

BKC-TL5M centrifuge is mainly composed of a control system, a centrifugal chamber, a driving system, a rotor and a safety protection device. The specific structure is as follows:

5.1 Display control system

The control system is mainly composed of speed setting, centrifugal time setting, speed/centrifugal force setting, rotor number setting, program calling and safety control system. See the schematic diagram of its specific composition in the control panel below.

5.1.1 Instructions for the button of centrifuge operation panel:

The appearance of centrifuge operation panel is shown in Figure 2, which is mainly composed of display panel and peripheral keys.



Fig. 2 centrifuge operation panel

It mainly includes centrifuge status display, time plus/minus button, speed plus/minus button, rotor selection button, program selection button, start/stop, door opening button, green operation status light, red failure light and other parts

Time plus/minus buttons: "Time +" and "Time -" buttons on the panel adjust the working TIME of the centrifuge. Short press the \pm adjustment button, the corresponding centrifugation

time is ± 1 minute; long press the button for more than 5 seconds, the corresponding centrifugation time is ± 10 minutes; long press the button for more than 10 seconds, the corresponding centrifugation time is ± 50 minutes. The maximum centrifugation time can be set as 999 minutes, and the minimum centrifugation time is 1 minute.

Speed plus/minus button: Short press SPEED \pm adjust button, corresponding centrifugal duration is ± 50 rpm, long press this button for more than 5 seconds, corresponding centrifugal duration is ± 200 rpm, maximum SPEED is 5000rpm, minimum SPEED is 50rpm.

Rotor selection: press the button to select the rotor number according to the actual rotor installed. Different rotor radius is not the same, the same speed of centrifugal force is different, can achieve the highest speed is also different, the actual use of the rotor according to the actual installation of the rotor set rotor number, number 1, 2, 3.

Long press to switch the acceleration rate, which can be set within the range of 0-10. The value 10 is displayed with the letter A.

Program selection: press the button to quickly switch rotor, centrifugal time, speed and other parameters, which can be set in detail on the setting interface.

Long press the switch stop brake coefficient can be set within the range of 0-10, the value 10 is shown by the letter A.

Start: Control centrifuge startup.

Stop: The centrifuge stops.

Open the door: open the cover after the centrifuge stops working.

Status indicator light: the green operation indicator light will light up when there is no fault after the system is started up, and the red indicator light will light up when there is a fault, and the text fault information will be displayed in the corresponding area of the display panel.

5.1.2 Detailed description of display panel

The specific display effect of the display panel is shown in Figure 2.

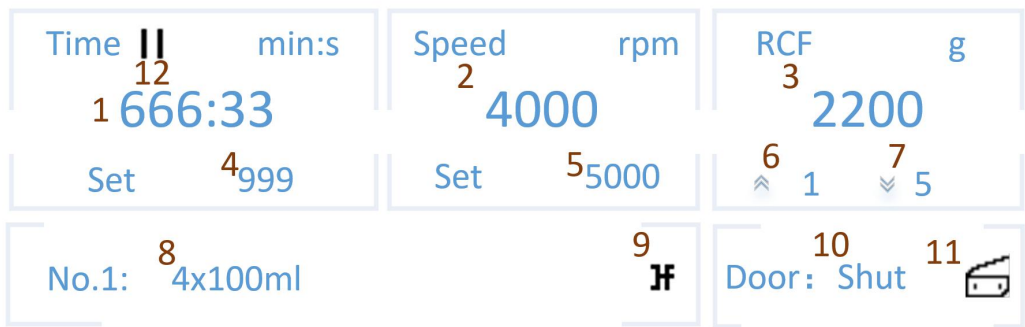


Figure 3 shows the working screen of the panel

1. System boot time and centrifugal time display area, time unit "minutes:seconds".The middle shows the remaining duration, and the bottom shows the set duration.The "Time +" and "Time -" buttons on the panel adjust the working TIME of the centrifuge.

2. Motor speed real-time display area, time unit "RPM".The middle is the real-time speed display, and the bottom is the set speed display.It can be adjusted by the "Speed +" and "Speed -" buttons on the panel.

3. Centrifugal force and rotor display area, the unit of centrifugal force is "g", motor stop state display is set speed calculation centrifugal force.The running status of the motor is displayed as real-time centrifugal force.Select the corresponding rotor number according to the actual rotor number installed.Due to motor power limitations, the maximum speed of some rotors is limited to 4000rpm.

4. Centrifuge status display area.This area displays the centrifuge's acceleration, centrifugation, deceleration, controller communication fault, unbalanced state fault, motor overload fault, door lock fault and other information. Users can conduct centrifuge operation or shutdown troubleshooting according to the prompt information.

5. Lock status display area, real-time display of lock status information.

6. Use the icon to display the status information of the door lock.

7. The motor acceleration coefficient value set value shows that the optional range is 1-10, the value 10 is represented by the letter A, the value 1 has the smallest acceleration, and the value 10 has the largest acceleration.

8. The setting value of the stopping brake coefficient shows that the optional range is 1-10, the value 10 is represented by the letter A, the value 1 is slow braking, and the value 10 is fast braking.

Note: The centrifuge adopts EABS electronic brake system. In case of sudden power failure during shutdown, the electronic brake system will not work. It is necessary to wait about 5-10 minutes for the motor to stop completely before opening the cover manually.

9. Centrifugal time value set value display, optional range of 1-999 minutes.If you need to work for a long time, please make sure the power supply is well grounded and someone is on duty to ensure safety.

10. The SPEED setting value is displayed. The SPEED value can be adjusted by short/long

press the SPEED button. Different rotors have different maximum speeds.

Note: There is a risk of damage to the motor and mechanical injury by setting the horizontal rotor speed in excess of 4000RPM.

11. Speed icon display, divided into horizontal rotor and Angle rotor two ICONS, corresponding to different maximum speed. Rotor number display, the value is 1-14.

12. Rotor number numerical display. Numbers from 1 to 14 correspond to different rotors.

13. Centrifuge operating status mark: according to different status display stop, acceleration, deceleration, normal operation of four states.

14. Enabling sign of self-recovery function: the system is in a centrifugal state. In case of accidental power loss, the system will automatically restore the remaining time of the last centrifugal state after power on. This function is off by default, and the system records the remaining time of the centrifuge once every 3 minutes by default. Enable/disable this feature by holding down the "Stop" button. You can press any button to cancel and restore the previous centrifuge procedure when the power is off and restart.

5.2 Safety protection device

The centrifuge adopts multiple safe operation protection devices to ensure the safe and effective operation of the centrifuge.

- **Main current protection setting.** When the power supply current exceeds the rated value, the Mini-breaker protects the mainframe and power off.

- **Overspeed protection device.** When the speed is out of control or exceeds the preselected speed $\pm 300\text{r/min}$ (the overspeed treatment will be carried out after the control system confirms the speed is stable), "Centrifuge status display area" in the lower left corner of the display screen shows "motor overspeed". At this time, the buzzer alarm, the control system will automatically enter the stop step, so that the motor stops running, to prevent the machine from overspeed work, to protect the machine and personal safety.


- **Unbalance protection device.** When the vibration caused by unbalanced operation of the machine is too large, the unbalance protection switch installed at the bottom of the centrifuge will work, the buzzer will alarm, and the "centrifuge state display area" in the lower left corner of the screen will display "unbalance". At this time, the buzzer alarm, the control system will automatically enter the stop step, so that the motor stops running,


to prevent the machine imbalance caused by mechanical vibration, to protect the machine and personal safety.

· **Door opening protection.** If the door cover is not closed or closed properly, and the lock sensor fails, the "lock status display area" in the lower right corner will use the icon and text to mark the lock status. When the system is started, it cannot run if the door protection detection does not detect the signal, and the operating instrument cannot be started at this time. The system will automatically stop when the door lock is opened unexpectedly during centrifuge operation, and the "door lock open" buzzer will be displayed in the lower left "centrifuge state display area" to give an alarm.

Emergency door lock in case of shutdown and power failure

At this time, in order to protect the test solution, we have an emergency door lock hole at the side of the instrument. Please use a special tool to push the door lock tongue and manually open the door cover. The test tube can be taken out from the ventricle.

 **Warning:** The rotor is not reduced to the safety speed ($\leq 100\text{r/min}$), do not allow to manually open the door, do not force the rotor to stop running by hand!

 **Note:** When the safety protection device is started, such as unbalance, overcurrent protection, motor blocking, motor controller IPM module failure, etc., the power should be cut off immediately to check and confirm that there is no potential safety hazard before starting it again. When the system is powered on and started, the default fault indicator light will light up and the door lock status is "on". After the communication between the host and the motor control board is normal, the fault indicator light will go off and the door lock status display is normal.

VI、 Operation Instructions

6.1. Sample placement

1). Power on the equipment, press the "Open the door" to open the cover door of the centrifuge and check whether there is any foreign body in the centrifugal chamber. If there is any foreign body, be sure to clean it up before running.

2). Install the centrifuge rotor according to the requirements in 4.2.2.

3). Put the weighed separated sample into the horizontal rotor or Angle rotor symmetrically, and the weighing error is less than 2g.

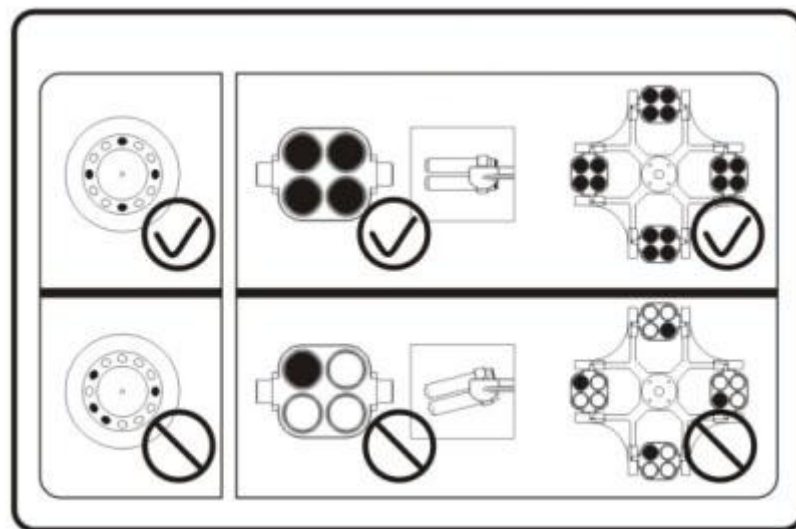



Fig. 4 Diagram of rotor balance

 **Note:** All cylinders must be operated at the same time in each operation. Asymmetric placement of separated samples for operation is absolutely not allowed. The wrong use of centrifugal bottles will produce great vibration, and even damage the machine and endanger personal safety.

4). Close the centrifugal chamber cover door to complete the sample placement.

6.2. Setting of sample centrifugation program

1). When setting parameters such as rotor number, speed up, speed down, speed/centrifugal force, time, etc., directly press the corresponding button under the display window to set them.

A. Setting Rotor number: Hold the "Rotor" button short and the Rotor number display area on the right side will display the Rotor number with the numbers 1-14 and the icon. Different Rotor numbers installed correspond to different maximum speed and centrifugal force.

Note: The set rotor number must be consistent with the actual rotor used. See "1.2 Rotor Adaptation Parameters" for the corresponding relationship between rotor number and rotor.

B. Setting speed rise: Long press the "Rotor" button to set the speed rise range of the Rotor with this operation. There are 1 to 10 grades, 10 of which are indicated by the letter "A" at the fastest. See Figure 3 for details.

C. Setting speed down: Long press the "PROG" button to set the speed down range of the rotor in this operation. There are 1 to 10 grades, 10 of which are indicated by the letter "A" at the fastest. See Figure 3 for details.

Supports A total of 10 levels from 1 to 10, 10 is represented by the letter A, 1 is the slowest, 10 is the fastest, when the use of A large volume of angular rotor or horizontal rotor, you can choose A slower gear, the other can choose A faster gear. It is generally recommended to choose 5 grades.

D. Speed setting: press the Speed+ and Speed- buttons to set the corresponding Speed. At the same time, the centrifugal force display area on the right side displays the specific value of the centrifugal force corresponding to the rotor. Short press ± 50 rpm each time, long press ± 300 rpm each time.

Special reminder: the instrument with the rotor and different adapters composed of several configuration specifications have their own rotor number and maximum speed limit, the user must strictly abide by the speed limit of the rotor when setting speed parameters, strictly prohibit overspeed operation, in order to ensure the safety of operation.

E. Set the centrifugal force: adjust the speed and rotor number, and set the corresponding centrifugal force.

Tips: The speed and centrifugal time can be set quickly through the "Prog" button, which is convenient for experimental operation. The centrifuge can store up to 20 parameter combinations. Specific program parameter combination can be set in detail through the setting interface.

F. Setting Time: Press "Time+, Time-" to set the corresponding centrifugation Time in minutes. Meanwhile, the time display area on the left will display the corresponding setting time. Short press time is ± 1 minute, long press time is $\pm 5-50$ minutes

Special reminder: the instrument time is set to 1min-999min.

Tips: The timing method is to start the timing when 97.5% of the set speed is reached, which is the countdown.

G. When each step above is completed, click the start button to start the centrifuge and record the data at the same time. The data will be automatically called when the machine is switched on next time.

Warm prompt: there is a short buzzer to remind the operator when the button is pressed once.

3) Finally, after the above Settings are carefully checked and confirmed, press the "Start" button to start the instrument into operation.

The above setting is for manual operation of the rotor number. The rotor technical

parameter table is set according to the rotor number used by the user. For example: in the operation, the rotor number is selected first, and then selected its speed and other parameters, such as No.2 4000r/min, in the case of the correct installation of No.2 rotor, press the "start" key instrument operation; If other rotors are installed, such as No.4 rotor, the centrifugal force displayed is inconsistent with the actual centrifugal force due to different rotor diameters and weights.

When the running time countdown to "0", the motor will automatically stop working, centrifugal force is "0", the buzzer sound long ring, automatic door. Or the operator press the "open the door" button, you can open the door cover, take out the sample separation, complete the whole centrifugation process.

In case of emergency, press "STOP" button during operation. The centrifuge will Stop running. When the rotating speed is 0, the buzzer will sound long and short.

Note: Do not manually open the centrifuge door cover before "0" is not displayed in the rotating speed/centrifugal force window; When there is a rotating speed, the electric door can not be opened to prevent safety accidents. The instrument stops running. When the speed is not displayed as "0", it can not start running again. In other words, it can only start again after completely stopping.

4) "Centrifugal time and speed" can be modified during operation. Other information cannot be modified. You can modify it by pressing the corresponding key directly on the operation panel. It is not allowed to modify parameters such as rotor number and speed range during operation.

5) When there are different centrifugal needs, it is recommended to save your different parameters through different program groups.

Program group storage and call: support 1 ~ 20 groups of program group number.

The centrifuge was shut down and the "Rotor+Prog" button was pressed to start the machine. After the system displays the following interface, release the button:

[TD5M Centrifuge SN page.](#)

Software version: MBTD5K Version1.0
Serial number: LW-2103-294967295

Biobase Technology

Fig. 5 Serial number of centrifuge

"Serial Number" in the figure is the unique number of the machine. After waiting for about 5 seconds, the system will automatically enter the setting interface, as shown in the figure below:

Num	Rotor	U	D	Time	Speed	RCF
1	*	1	2	20	1000	175
2	*	2	3	20	1050	295
3	*	3	4	20	1100	369
4	*	4	4	20	1150	470
5	*	5	5	20	1200	572
Pro:Select		Start: *		Stop:Save		Door:EN/CH

Figure 6 Setup interface

Press the program button to move the cursor up and down. Press the "Start" button to set whether the parameters of the cursor line are enabled. Combination parameters marked with * are enabled, and parameters without * are not enabled. Press the "open door" button to switch languages between Chinese and ENG. Press "Stop" to save the current set parameters, and the red "fault indicator" of the data saving device will light up. After the failure indicator light goes out, the centrifuge can be switched off and restarted.

Tips: Do not power off or carry out other operations during data storage.

6) If there is a fault, corresponding faults will be displayed in the centrifuge status display area. The main faults include: communication error with the motor controller, door lock fault, imbalance fault, IPM module fault, motor overload, motor blocked rotation, and motor hall gap. The centrifugal machine manually rotates the induced electromotive force (EMF), and the reverse rotates the electromotive force (EMF) to send out the wrong Hall signal. If the induced electromotive force is too high, the motor controller may be burned down, or the "Hall phase loss" fault is reported.

See "Part7. Troubleshooting" for the meaning of the trouble code.

8) After the operation, please turn off the power switch and unplug the instrument when it is not in use.

6.3. Precautions

1) In order to ensure safety and centrifugal effect, the instrument must be placed on a firm, shockproof, horizontal platform, and ensure that the four legs of the balanced force.

2), before use, carefully check the rotor, test cup, test tube, centrifugal bottle to

see if there are cracks, corrosion traces and aging phenomenon, if there must be replaced immediately, the use of cracked or corroded rotor is strictly prohibited.

3) Before centrifuge use, remove the foreign body from the ventricular cavity; Check that the rotor is installed and fastened properly and that the centrifugal cup is free of jamming.

4) The rotor is strictly prohibited from running beyond the maximum speed specified in its design.

5), it is strictly prohibited that the rotor is unbalanced (the weight error of the separation sample is too large, and the separation sample is placed asymmetrically).

6) When the centrifuge is running, it is forbidden to move the centrifuge or open the door cover of the ventricle; Do not touch the running rotor with your hands.

7), no rotor high-speed operation is strictly prohibited.

8), other units of the rotor do not mix, in order to prevent damage to the instrument and personal safety.

9) Check whether the external power supply meets the requirements and whether the instrument is reliably grounded.

10) After the instrument or rotor has been out of service for three months, it must run at a low speed for 10min before it is allowed to run at the highest speed of the rotor.

11) Do not place a container containing liquid on the instrument. If the container is overturned, the liquid may enter the centrifuge and rust and damage its mechanical parts or electrical parts.

12) Do not use the centrifuge to handle flammable and explosive materials (such as chloroform or ethanol). Do not use or store such materials within 30cm of the centrifuge.

13) When taking out the rotor, the special handle provided by the machine must be used. After loosening the screw, it is forbidden to directly pull or knock up by hand, so as not to damage the flexible support of the motor.

14) After the separation, the instrument should be wiped clean in time, and the power switch of the instrument should be turned off and the power plug should be unplugged.

15) For models driven by DC device, it is strictly prohibited to change the set value of the function parameters of DC device without authorization.

It is forbidden to use rotors that exceed the service life of the rotor. The service life of the aluminum rotor is 5 years. The accumulative use times is 3000 times, the accumulative use time is 2000 hours. If any one of the three items has been met, the service period has

been reached

When the instrument due to power failure or other reasons, press the door key can not open the door cover, there is an emergency guide hole on the left side of the instrument, with the delivery of the cross screwdriver can be opened. Attention! Before the rotor stops rotating, it is not allowed to open the lock manually, and it is forbidden to force the rotor to stop running by hand, otherwise it is easy to cause injury accidents.

7. Maintenance

In order to make the centrifuge work safely and effectively for a long time and extend its trouble-free working time, regular maintenance and inspection should be carried out. If you have any questions or problems, please inform the management and our maintenance department immediately.

The serial number	Maintenance content	Maintenance cycle
1	Check for cleanliness	Once a week
2	Clean and scrub the centrifugal chamber	Every use or sample leakage occurs
3	Clean drive shaft and apply anti-rust oil grease	After the turnhead is removed from the centrifugal chamber
4	Clean and scrub the outside of the machine	Once a month or after sample leakage
5	Check door cover, pneumatic support rod mounting screws	Once a month
6	Check control of speed, time and temperature	Half a year or when a problem is suspected
7	Make a complete inspection and calibration of the machine	It's done once a year by a professional

7.1 Centrifuge maintenance

A) Centrifuge should use AC220V 50HZ AC circuit, and ensure voltage stability; If the user

voltage is not stable, it is recommended to equip the machine with automatic electronic AC voltage regulator purifier to avoid damage to the centrifuge. The centrifuge should be installed on a firm, stable and horizontal ground with a certain space around the cabinet and good ventilation.

B) After each shutdown (power outage), the time interval for starting up shall not be less than 5 minutes.

C) The centrifuge shell should be kept clean and dry, and can be swabbed with a dry/wet cloth. Neutral detergent can be used, but acid/alkaline detergent cannot be used.

D) The centrifuge room should be kept clean and dry. When there is a foreign body in the centrifuge room, please use a rag or tweezers to remove the object debris from the centrifuge room. Scrub with dry/wet rag, use neutral detergent if necessary, then rinse with clean water and dry. But can't use acid/alkaline, the solvent that has corrosion to the material and contain chlorine to wash disinfectant. Disinfect with 70% alcohol. For radioactive contamination, clean with an equal amount of a mixture of 75% alcohol, 10% SDS and water, then clean with alcohol and deionized water, and dry with a soft dry cloth. During normal operation, condensation occurs due to the contact between the air and the wall of the low-temperature centrifugal chamber. It should be dried in time to prevent frosting.

E) After each use of the centrifuge, open the door cover, wipe away the condensed water, and then dry it naturally; Before and after centrifugation, the rotating head must be gently vertically lowered or lifted to avoid collision with the rotating shaft and the rotating head itself.

F) Rubber sealing rings are installed at the contact place between the upper part of the centrifuge chamber and the door cover, the rotor seat and the bottom of the ventricle. With the extension of the use time, deformation should be observed frequently to prevent the infiltration of external heat, so that the temperature control effect will be poor and the centrifugal results will be affected. If found deformation or aging should be replaced in time.

G) When the centrifuge is not in use for a long time, the rotor should be taken out and antirust oil should be coated on the rotor seat (or driving shaft) to prevent the rotor seat from rusting and the poor coordination with the rotor body, which will affect the balance effect of the operation of the instrument. If necessary, desiccant can be placed in the centrifugal chamber to absorb moisture and prevent the rotor seat (or drive shaft) from

rusting.

H) The pneumatic support rod of the door cover should be regularly checked whether it can work normally and whether the connection is intact. If there are cracks and other problems, please replace them immediately.

I) Special safety measures must be taken when centrifuging toxic, radioactive or contaminated samples.

J) The operator should pay attention to safety matters: the turnhead should be fixed in an accurate position, the fixed screw should be tightened, and the turnhead and other accessories should be checked for cracks and corrosion, as well as ground wire contact.

K) Functional inspection of centrifuge

The operator should ensure that the important parts of the centrifuge are in good condition, which mainly refers to:

Motor installation is stable;

No deviation of rotor seat (rotating shaft);

Rotor and accessories are free from corrosion;

Screw connection fastening;

Reliable ground connection.

7.2 Maintenance of rotors

A) After the centrifugal work every day, wipe the residual liquid or water on the inner and outer surfaces of the rotor and the centrifugal cup with a clean soft cloth, and dry it for use. The rotor and centrifugal cup that are not used for the time being should be removed from the ventricle and stored in a clean and dry place respectively. Rotor for a long time should not be coated with a layer of paraffin protection.

B) The quality of the centrifugal tubes and cups must be guaranteed, and attention should be paid to their cleaning, disinfection and maintenance at ordinary times. Check the oxidation layer on the inner surface of the rotor and centrifugal cup regularly, and stop using it if there is peeling, corrosion, serious scratch, deformation or small crack.

C) When used in harmful gas or in humid environment, it will accelerate the occurrence and expansion of corrosion phenomenon of centrifuge rotor, and affect the service life of rotor.

D) The rotor may leak during use due to damage to the centrifugal tube, overfilling or lax sealing. The rotor should be removed from the shaft after the use of the rotor, timely

cleaning, coating protective agent (if placed on the shaft for a long time, the rotor and the rotating shaft contact under the action of compressive stress, resulting in increased corrosion effect, this may occur "bite" phenomenon). In order to prevent corrosion and hidden danger, attention should be paid to the sample filling amount of the centrifugal tube and the tightness of the seal during the use of the rotor, and the sealing ring should be regularly checked to see if it is in good condition. If aging, damage should be replaced in time to avoid leakage.

E) Place corrosive solvents in direct contact with the rotor. After the rotor is used, rinse, wipe, spray protective agent and smear protective grease in time.

F) During the use and preservation of the rotor, the rotor should be prevented from being bruised, scratched or scratched as far as possible to prevent mechanical damage.

G) When the average density of the separated sample is greater than 1.2g/mL, the rotor should be used to slow down the speed, as calculated by the following formula. $N = N_{\max} \times \sqrt{1.2/\rho}$

H) When using stainless steel centrifugal tubes, it is necessary to slow down the speed of the rotor. $N = N_{\max} \times (1 - 25\%)$

Note: in terms of safety, the allowable service life of the metal rotor of the centrifuge is three years, and the allowable service life of the non-metal rotor is one year. Rotor beyond the allowable life, not to continue to use!

Warning: The rotor equipped with this machine is strictly prohibited to exceed the speed specified in the manual. The consequences of damage caused by excessive speed should be borne by you. It is strictly prohibited to use cracked and corroded rotors.

7.3 Pollution prevention measures

If the centrifuge or rotor has been used to handle radioactive or pathological samples, the following procedures should be followed to prevent contamination.

Clean centrifuge and rotor surfaces as described above

- Take out the whole rotor
- Remove motor seal ring and gasket, clean
- Clean the centrifuge door cover, centrifugal ventricle and rotating shaft
- Clean all motor and rotor seat near the foreign body fouling
- Clean the rotor body and rotor hood

7.4 Sterilization and disinfection of rotor cavity and accessories

All conventional disinfectants can be used. Since the centrifuge and accessories are made of different materials, the compatibility of disinfectant must be taken into account.

The life of the accessory is related to the number of times of sterilization and use. If the construction or color of the fitting changes or leaks, the fitting should be replaced.

Detailed sterilization parameters are shown in the table:

The attachment	Maximum temperature (°C)	time (min)	Most times
Glass tube	134-138.	3-5	-
The PC tube	115-118.	30 to 40	20
PP pipe	115-118.	30 to 40	30
Aluminum alloy rotor/centrifugal cup	126-129.	10-15	-
Rubber sleeve/rubber pad	115-118.	30 to 40	-

VIII. Troubleshooting

Any opening of any cover during any maintenance of this equipment may expose parts with a risk of electric shock or personal injury. Make sure the power switch is disconnected, the centrifuge is disconnected from the main power supply, and that such repairs can only be performed by a professional.

The machine is provided with a fault display window. When the machine fails, the "time" window will display the fault code. The meaning of the code is as follows:

OLED fault display	instructions
unbalanced	An unbalance detection switch is installed at the bottom of the centrifuge, which will alarm if unbalance is detected.

Motor overload	When the motor current is too large, the alarm is generally overweight.
Door lock fault	The door cover is open and cannot be activated. The centrifuge accidentally opened the cover during operation and reported the failure.
IPM fault	Motor controller overheating, issued IPM fault instruction, automatic shutdown.
Motor blocked	If the motor is stuck and the motor cannot start within 3 seconds after starting, it will be judged to be stuck.
The motor speed	In the normal centrifugal process, the motor speed exceeds the set speed by 300rpm to report failure.
The hall lacks	DC brushless motor Hall components are damaged, continued use will burn the risk of control panel.

Unbalance: please check whether the weight of the test sample in the instrument is within the range, please check whether the imbalance socket of the control board is loose, etc. In the case of power failure, manually rotate the rotor to observe whether there is obvious imbalance.

Motor overload: observe whether the set rotor number is consistent with the rotor actually installed to reduce the load.

Door lock failure: Door not closed/Door opened in operation: Please make sure the door is closed. Please check whether the door state socket of the control panel is loose or whether the door detection switch is damaged.

IPM fault: the motor controller adopts the IPM intelligent motor control module. When the current is too high or the temperature is too high, the module will automatically report the fault. Reduce load testing.

Motor blocking: whether the communication line between the motor and the control panel is well connected or the motor is damaged. After power off, manually rotate the rotor to check whether there is stuck phenomenon.

Motor overspeed: check the 5-pin Hall sensor socket on the control panel for loosening or speed sensor failure.

Hall phase loss: the manual inverter will indicate the Hall phase loss fault. In addition, if the Hall components of the motor are damaged, the fault will also be reported. At this

time, you should contact our technical personnel for maintenance in time. Continuing to run the centrifugal machine when Hall is out of phase will cause the motor to jump, tremor, burn the motor controller, etc.

Emergency door cover:

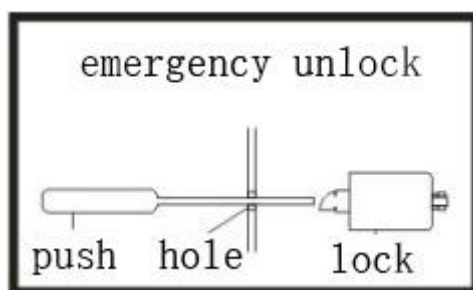
In normal use, due to accidental power failure or failure of door opening operation, you can not use the automatic door opening function, but you must take out the items in the centrifugal chamber, in this case, you can use the centrifuge manual door opening method to open the door cover, take out the separated samples.

Note: this method is only used in an emergency, do not use at will!

Warning: Because there is no brake function when the rotor stops running during power failure, it will take a long time to stop running completely. Please wait patiently!

Emergency door opening steps:

1. Turn off the power switch;
2. Emergency lever emergency door structure: there is a small hole on the side of the door lock of the box door cover. The door cover can be opened by inserting the emergency lever into the hole with a special tool, pressing the door cover with one hand and gently opening the lock pin with the emergency lever with the other hand.



Common faults and troubleshooting methods

Common faults	why		Elimination method
The screen doesn't light up after you plug it in	Whether there is external power supply	no	Check external power supply
		is	Check the circuit breaker (main power switch) or fuse

Display screen has display, press the start button does not operate, no speed display	The indicator light does not light when pressing the keyboard	The key board is damaged, please replace it
	Check the loosening of the input port of the speed signal	To put tight
	Gently rotate the rotor by hand, there is abnormal sound	Motor failure, sent to the manufacturer for repair
It works but not at a high speed. The machine has a strange sound or smell	Control system or motor failure	Send to the manufacturer for maintenance
Actual speed is different from the set or displayed speed, out of control or unstable	Control system failure	Send to the manufacturer for maintenance
The centrifuge vibrates greatly	The ground is not smooth or the instrument feet are not uniformly stressed	Place on a firm, flat ground and adjust the instrument leg for even force
	The centrifugal tubes in the rotor are not placed symmetrically	Check the adjustment
	Centrifugal tube rupture	Inspection and replacement
	The rotor is not tightened	Check the adjustment

	Damaging part of shock absorption	Check the replacement
	Motor or drive bearing damaged	Send to the manufacturer for maintenance

IX. Warranty Regulations

1, centrifuge main machine, accessories are provided with a one-year quality guarantee period. In case of non-man-made damage to the product, the company will provide free repair service within one year from the date of purchase. In case of man-made damage within one year or failure over one year warranty period, the company will charge a certain cost for maintenance.

2. The company shall not be held responsible for any of the following situations:

A. Use exceeding the maximum rotor speed;

B. The rotor is scratched or bruised by someone;

C. The rotor is seriously corroded by acid and alkali;

D. Safety accidents caused by unbalanced separation samples placed in the rotor during operation;

E. Maintenance by unauthorized professional personnel;

F. Failure to follow instructions and improper use.

3. Unauthorized professionals shall not open the machine without the permission of the company; All repairs and adjustments must be carried out by a professional in accordance with the maintenance manual.

4, the company will not be responsible for any consequences caused by unauthorized personnel maintenance and adjustment of the machine!

5. After-sales service telephone: 0531-7560 6996

Centrifuge maintenance management

If the centrifuge is damaged and needs to be returned to the manufacturer for repair, disinfection and decontamination must be done first to protect human health, the environment and the safety of materials. If not handled clean, no maintenance.

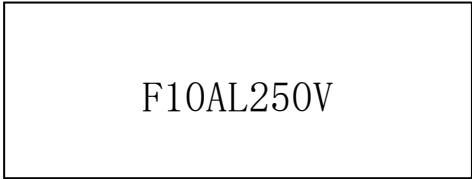
We reserve the right to accept only sterilized centrifuges. The costs related to centrifuge disinfection and decontamination shall be borne by the user.

X. Label description

1. Company logo



2, fuse (fuse) label



3. Ground label



XI. Packing list

Packing list

The serial number	The name of the	Specifications and codes	The number of	note
1	The centrifuge	BKC-TL5M	1	
2	The power cord		1 the root	
3	Cross screwdriver		1 the	
4	The instructions		1	

5	Warranty card		1	
6	Certificate of approval		1	
7	Rotor and fittings		1 set of	optional
8	Insurance tube	250V 10A	1	

Manufacturer: Jinan Xinchí Medical Technology Co., Ltd

Production address: Room 105, No.019, Qishan Road, Laiwu High-tech Zone, Jinan City, Shandong Province

Registered address: No. 019, Qishan Road, Laiwu High-tech Zone, Jinan City, Shandong Province

Production record certificate number: Luji Food and Drug Administration Equipment Production No. 20200094

Telephone: 0531-7560 6996