

USER MANUAL

High Speed Mini Centrifuge



Before using centrifuge, please carefully read this user manual for its efficient operation and safety.

Ver.20180830


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Safety Reminder


Common safety precautions

Carefully read the following safety precautions for a thorough understanding.

- Follow the instructions and procedures described in this manual to operate this centrifuge safely.
- Carefully read all safety messages in this manual and the safety instructions on the instrument.
- Safety messages are labeled as indicated below. They are in combination with signal words of “WARNING” and “CAUTION” with the safety alert symbol  to call your attention to items or operations that could be dangerous to you or other persons using this instrument. The definitions of signal words are as follows:

 **WARNING:** Personal Danger

Warning notes indicate any condition or practice, which if not strictly observed, could result in personal injury or possible death.

 **CAUTION:** Possible damage to instrument

Caution notes indicate any condition or practice, which if not strictly observed or remedied, could result in damage or destruction of the instrument.

NOTE: Notes indicate an area or subject of special merit, emphasizing either the product’s capability or common errors in operation or maintenance.

- Do not operate this centrifuge in any manner not described in this User manual. When in doubt or have any troubles with this centrifuge, ASK FOR HELP.
- The precautions described in this User manual are carefully developed in an attempt to cover all the possible risks. However, it is also important that you are alert for unexpected incidents. Be carefully operating this centrifuge.

 **WARNING:**

- This centrifuge is not explosion-proof. Never use explosive or flammable samples.
- Do not install the centrifuge in or near places where inflammable gases are generated or chemicals are stored.

- Do not place dangerous material within 30cm around the centrifuge.
- Make sure to prepare necessary safety measures before using samples that are toxic, radioactive or contaminated with pathogenic micro-organisms at your own responsibility.
- If the instrument, rotor and/or accessories that has been contaminated by solutions with toxic, radioactive or pathogenic materials, clean it according to the decontamination procedure that you are specified.
- If you require services at site, please sterilize and decontaminate it in advance, and then notice the service center involved in the details of the particular materials.
- Do not handle the power cord or turn on or off the POWER switch with wet hands to void electrical shocks.
- For safety purposes, do not enter within 30cm around this centrifuge while it is in operation.
- While the rotor is rotating, never forcedly release the door lock.
- Unauthorized repairs, disassembly, and other services to the centrifuge except by our service center are strictly prohibited.



CAUTION

- This centrifuge must be located on one firm and level table.
- Make sure the centrifuge is horizontal before running.
- Make sure the angle between the door and cover is greater than 70 degrees when open the door.
- Be careful not put your fingers or hands between the door and cover when the door off.
- Do not move or relocate this centrifuge while it is running.
- If fluid spills in the rotor chamber, please promptly clean and dry with a dry cloth to avoid sample contamination.
- Ensure to remove any objects and fragments of the tubes dropped inside the rotor chamber before running this centrifuge.
- Cautions on rotors
 - (1) Always check for corrosion and damages on the rotor surface before using it. Do not use the rotor if an abnormality is found.
 - (2) Do not set the centrifuge speed beyond the allowable minimum speed of the rotor kits (rotor or adapters). Make sure to run it below the allowable minimum speed.
 - (3) Do not exceed the allowable imbalance.
 - (4) Use the rotor and tubes within their actual capacities.
 - (5) If the rotor is attached with a lid, ensure it is tightened before operation.
- If any abnormal condition occurs during operation, please stop it immediately and contact our service center. Notify the service center is a warning code if displayed.

- Vibrations are likely to damage the centrifuge, contact our service center if abnormality observed.

1. Specifications

Maximum speed	15000rpm, increment: 100rpm
Maximum RCF	15100×g, increment: 100×g
Maximum capacity	2ml×12
Timer	30 seconds -99 minutes-HOLD, continuous operation
Driving Motor	Brushless DC motor
Safety devices	Door interlock, over-speed detector, over-temperature detector, Error code runtime display
Power requirements	Single-phase, 110V-240V, 50Hz/60Hz, 3A
Dimensions (mm)	(L) 255× (W) 245× (H) 140
Weight	6kgs
Additional features	Speed/RCF switch, Pulse operation, LCD display of runtime status, buzzer notification & alert

2. Declaration of Conformity

High Speed Mini Centrifuge:

Construction in accordance with the following safety standards:

EN 61010-1

Construction in accordance with the following EMC standards:

EN 61326-1/ FCC Part 15 Subpart B/ ICES 001

Associated EU guidelines:

EMC-guidelines: 2004/108/EC

Instrument guidelines: 2006/95/EC

This ISM device complies with Canadian ICES-001.

Cet appareil ISM est conforme à la norme NMB-001 du Canada.

The centrifuge:

Construction in accordance with the following safety standards:

EN 61010-1

EN 61010-2-10

Construction in accordance with the following EMC standards:

EN 61326-1/ FCC Part 15 Subpart B/ IECS 001

Associated EU guidelines:

EMC-guidelines: 2004/108/EC

Instrument guidelines: 2006/95/EC

This ISM device complies with Canadian ICES-001.

Cet appareil ISM est conforme à la norme NMB-001 du Canada.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This centrifuge has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the centrifuge is operated in a commercial environment. The centrifuge generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the user manual, may cause harmful interference to radio communications. Operation of centrifuge in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference.

3. Required Operational Condition

3.1 Basic operational Conditions

- (1) Power: 110V-240V, 50Hz/60Hz, 3A.
- (2) Ambient temperature: 2°C-40°C.
- (3) Relative humidity: $\leq 80\%$.
- (4) No vibration and airflow around.
- (5) No electric dust, explosive and corrosive gases around.

3.2 Transport and storage condition

- (1) Storage temperature: -40°C-55°C.
- (2) Relative humidity: $\leq 93\%$.

4. Installation

This section describes the instructions that you should abide when install the centrifuge to ensure your safety and the optimum performance. Before moving the centrifuge, the rotor must be removed.

 **WARNING:**

- Improper power supply may damage centrifuge.
- Make sure the power source conforms to the required power supply before connecting.

4.1 Location

(1) Place the centrifuge on a firm, flat and level table, ensure the four feet of this centrifuge stand on the table firmly. Avoid installing on the slippery surface or surface prone to vibration.

(2) Ideal ambient temperature is $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$, avoid placing the centrifuge in direct sunlight if temperature exceeds 30°C .

(3) Keep clear of the centrifuge at least 10cm on both sides and at least 30cm behind it to guarantee the cooling efficiency.

(4) Keep away from heat or water to avoid sample temperature issues or centrifuge failures.

4.2 Connection of the power cord and grounding

 **WARNING:**

- To avoid electrical shocks, ensure your hands are dry when touching the power cord.
- This centrifuge must be grounded properly.

A minimum 10A outlet providing a sufficient ground is required, and this must meet with local safety requirements.

5. Structure

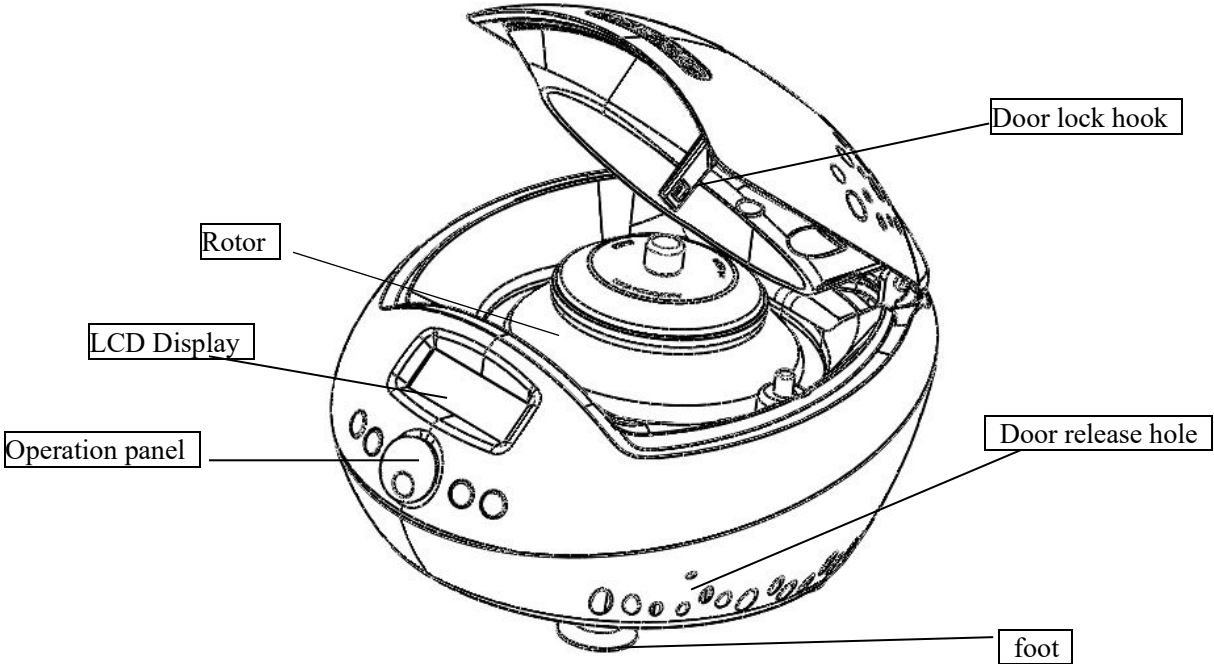


Figure 5.1 Front view of centrifuge

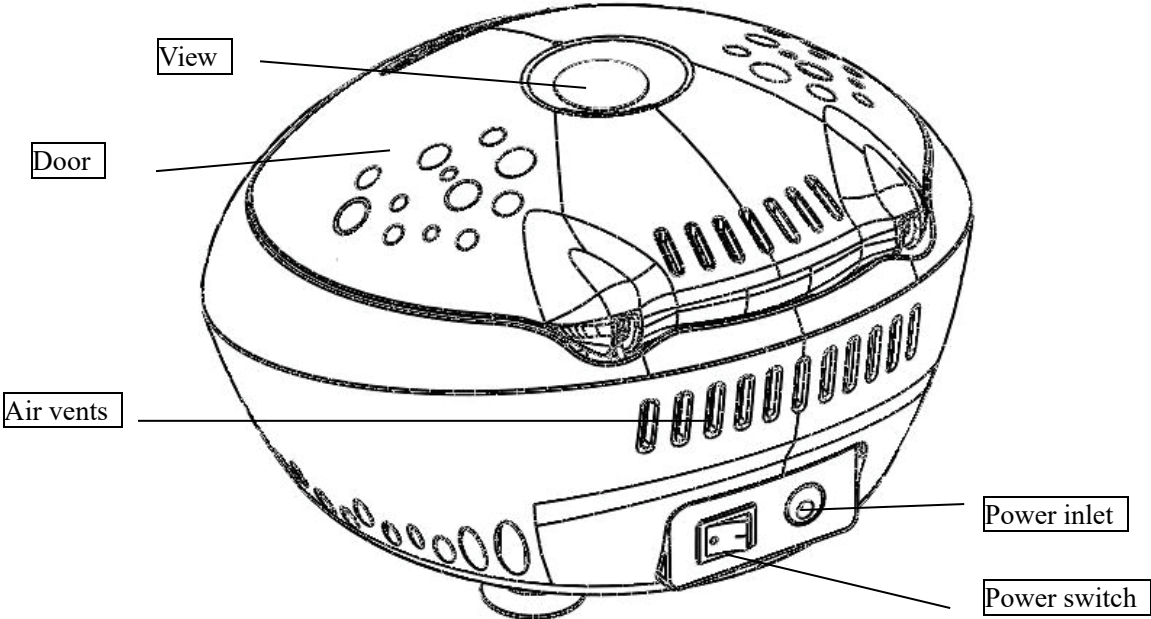


Figure 5.2 Rear view of centrifuge

6. Operation panel

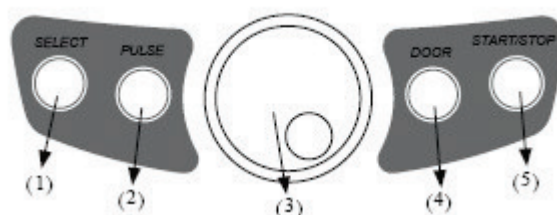







Figure 6-1 Operation Panel

Item	Symbol	Name	Function
1		Select button	Press the button to choose the program which you want to modify.
2		Pulse button	The speed can be accelerated and held at the speed when pressing Pulse on.
3		Parameter button	Clockwise rotate to increase program values. Rotate anti-clockwise to decrease parameter values. Press the button, shift between speed and RCF display.
4		Open/ lock button	Press the button to open the door The button is not available when the centrifuge is running.
5		Start/ Stop button	Press the button to start running. The centrifuge will brake to stop running if pressed during centrifugation.

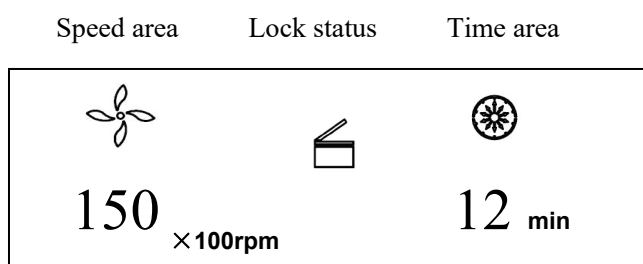




Figure 6-2 the main interface

Main interface is as figure 6-2. The speed is set to be 15000 rpm, running time is 12 minutes. When speed symbol  is rotating, indicating the centrifuge is running. Time display symbol  display the ratio of working to time setting. The total time setting is divided into 10 sections.

7. Rotor Preparation

7.1 Prepare the samples

7.2 Inject the samples into tubes.

 CAUTION:

- Do not overload samples into the centrifuge which will cause leaking.

- Do not exceed the actual capacity allowed in the user manual.

7.3 Keep the tubes balance

- Although the centrifuge can accept sample balancing by eye, we recommend that you keep this centrifuge in a well-balanced condition to extend its life expectancy.
- Never intentionally run the centrifuge under unbalanced condition even though the allowable imbalance is not exceeded.

7.4 Inspect the rotor

Check the rotor for corrosion or scratches before using.

 CAUTION:

- Any abnormality such as corrosions or scratches are found, stop using the rotor and contact our service center.
- Only manufacturer's rotors must be used with the unit.

7.5 Symmetrically load centrifuge tubes in rotor

 CAUTION:

- Make sure the rotor lid is securely fixed on the rotor, as well as the rotor and shaft are tightened. Otherwise, the rotor may be moved off while rotating and cause damage of the centrifuge and rotor.

8. Operation

⚠ CAUTION:

- Do not push or lean against the centrifuge while it is running.
- Do not run the centrifuge when fragments or sample solutions are left in the centrifuge chamber. Always keep the centrifugal chamber clean.
- If the centrifuge makes strange noise during operation, stop it immediately and contact our service center. Notify them of the warning code if displayed.

8.1 Normal Operation

Turn on the power switch, centrifuge will display the running interface last time after passing the self-diagnostic checks, see figure 8-1 below:

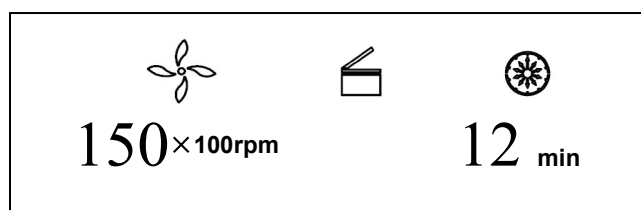


Figure 8-1 the last running interface

- Speed: 15000rpm. Running time: 12 minutes.
- The door lock is released.

8.1.1 Rotor loading and removal

⚠ CAUTION

- Attach the rotor to the rotor shaft. Ensure the rotor is in position and connected with the shaft, tightening the locking nut to secure the rotor with shaft, to prevent the rotor damaging the centrifuge.
- Ensure the rotor lid is firmly tightened to the rotor.

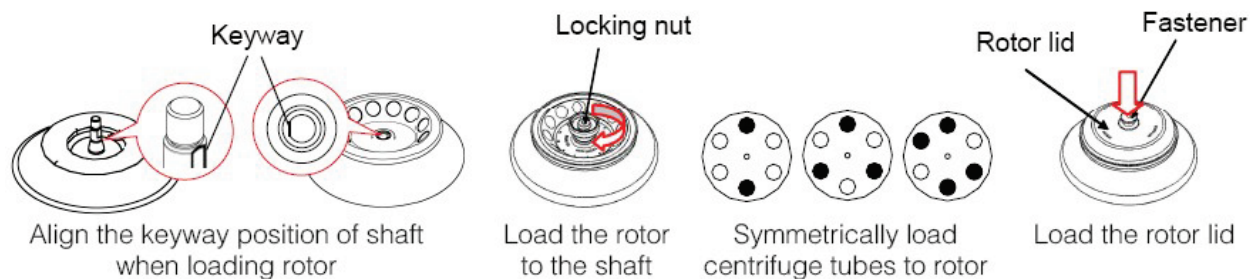






Figure 8-2 the rotor installation

- Load the rotor to the shaft to ensure rotor is in position until it connected well with the shaft.
- Rotate the rotor slightly by your fingers to check, if the rotor vibrates, if so attach the rotor again.
- Hold on the rotor with one hand, tighten clockwise the nut with the other hand, and make sure tighten firmly.
- Put the rotor lid to the rotor, press the fastener down and make the fastener attach to the nut tightly.
- Close the door and start running.
- To release the rotor, firstly pull the fastener up to remove the lid, and then turn the locking nut anti-clockwise.





⚠ CAUTION



- Check the rotor is firmly tightened before running.

8.1.2 Set the operation parameters



Press the  button to select required parameters. The parameter can be modified when the parameter is flashing. Clockwise rotate the parameter button  to increase parameter value; counter-clockwise rotate the parameter button  to decrease parameter value. Parameter button  rotate faster, parameter value increase faster. The minimum speed increment is 100 rpm, the minimum time increment is 1 second.

(1) Set the speed

- Press the select button  until the speed rpm is displayed.
- When the speed button is selected, the speed symbol will flash the speed value.
- The minimum speed value you can set 500rpm, the minimum increment is 100rpm.
- Rotate program button clockwise  to increase speed value, rotate the program button anti-clockwise  to decrease speed value.
- You can speed-up set the speed value by rotating program button  quickly.
- There is a circulating function to increase/decrease the speed values. Rotate the program button

clockwise  to change settings from small → large → maximum → minimum. Rotate the program button anti-clockwise  to change settings from large → small → minimum → maximum.

(2) Set the time




- Press button , time value flashes in the time setting mode.
- Rotate the program button  to set running time from 30 seconds to 99 minutes.
- When time displays HD, this is a continuous running mode.

8.1.3 Start the operation

(1) Press running button  to start running

- Timer will operate once the speed setting value is reached, the screen displays the remaining run time.


(2) View and modify the operation programs

- Pressing button , returns the display to the program interface and displays settings programs. Press the select button  to the desired program. When flashing, rotate parameter button  to modify values. Release the button after 5 seconds, and the centrifuge will return to normal operation mode and run according to the new value.
- If the set time value has been modified, the operation time is not affected and will continue.

(3) Warning display


- If an error occurs during the operation, the centrifuge will brake to stop automatically, and display the error code on the time/display area. The error code can be checked in the table 10-1, and corrective actions can be applied accordingly.

8.1.4 End the operation

(1) The centrifuge will brake when it reaches the setting time or  button is pressed.



- When the rotor stops rotating, centrifuge will start beeping to alert the operation has finished.

(2) Open the door

- The door can be released automatically when the operation has stopped.
- With the door closed, you are able to press the  button to open it.
- After ending the operation, the program will store the setting parameters of this operation, and will recall these parameters when restart the program.

(3) Open the door and take out the rotor and samples.



8.2 RCF Operation

- (1) Turn on the power switch.
- (2) Set a RCF (Relative Centrifugal Force) value.
 - Press the select button  and choose speed unit $\times g$, the speed symbol will flash into RCF value input status.
 - If no button is pressed after the speed value has flashed for 5 seconds, the input mode will be shut down.
 - Rotate program button  to input a RCF value, RCF increment is $100\times g$.
- (3) Set operating conditions
 - The other operation, please refer to the section 8.1.

8.3 Pulse Operation

This function is used to remove the residual samples adhered on the interior of the tubes.

Note: The button works only when the rotor stopped and the door is locked.

- (1) Turn on the power switch and load the rotor to the shaft, tighten the rotor lid and make sure it is in secured position, and then close the door.
- (2) The centrifuge gets into preparation mode and displays last running values. The values can be reset.
- (3) Press  knob and hold, the centrifuge will speed up to the setting speed. While releasing  knob during acceleration, the centrifuge will start to decelerate and stop.

9. Maintenance

CAUTION

- If do not follow the recommended instructions for cleaning or disinfecting may damage the centrifuge.

(1) Centrifuge

- If the centrifuge is exposed to ultraviolet rays for a long time, the color of the doors may be changed or the label may be came off. After using, cover the centrifuge with a piece of cloth to protect it from direct exposure.
- If the centrifuge needs cleaning, clean it with a cloth or sponge moistened with a neutral detergent

solution.

- Sterilize the centrifuge by wiping with a cloth moistened with 70% ethanol solution.
- (2) Rotor chamber

 CAUTION

- Do not directly pour water, neutral detergent or disinfectant solution into the rotor chamber. Otherwise fluids may leak into the drive units and cause corrosion or deterioration to the bearings.

- If the rotor chamber needs cleaning, clean with cloth or sponge moistened with a neutral detergent solution. Sterilize the centrifuge by wiping with a cloth moistened with 70% ethanol solution.

(3) Drive shaft

- We recommend regular maintenance for drive shaft. You can wipe the drive shaft with soft cloth, and then apply a thin coat of silicon grease.

(4) Door

- Clean and sterilize the door using the same method as the step (1) above.

(5) Rotor

- To prevent corrosion, remove the rotor from rotor chamber. If not in use for a lone term, then detach the rotor lid and turn upside down to dry the tube holes and keep clean.
- For sample leaks in the rotor, rinse the rotor with water. Apply a thin coat of silicon grease to the rotor when it is completely dry.
- The rotor should be regular maintenance, recommend to cleaning it each 3 months to ensure tube and rotor holes keep clean, and then apply a thin coat of silicon grease.

10. Troubleshooting

10.1 Frequent problems list

This centrifuge has a self-diagnostic function. If a problem occurs, an error/warning code will be displayed on the time display screen and the operator can determine the malfunction with the warning code below.

Symptom	Causes	Solutions
Nothing appears on the screen when the POWER is turned on.	<ul style="list-style-type: none"> • Building power circuit breaker trips. • the fuse was blown out. 	<ul style="list-style-type: none"> • Remove the trouble and turn on the POWER. • Replace the fuse.
Abnormal vibration	<ul style="list-style-type: none"> • Rotor do not match with spindle • Samples are imbalance 	<ul style="list-style-type: none"> • Install again the rotor • Weighting scales, install symmetrically


		• Rotor lid loosed	• Tighten the rotor lid firmly
Alarm code appeared on the time display screen	E-02 Door fault	• The door opened in running. • The  button is pressed while the door opening.	• Close the door immediately. • Close the door, and then start to operate.
	E-06 Set wrong speed	• The setting speed exceed the allowable range.	• Modify the speed value.
	E-10~86	• Read the service manual	• Contact with service center

Table 10-1 Frequent problems and solutions


- Warning code E-1~9 are related to wrong operating. You can continue running the centrifuge after the cause removed.

10.2 How to open the door

10.2.1 In the case of power on

CAUTION

- The door just can be opened while the power on and rotor stops rotating.

- (1) Turn on the POWER switch, the door lock will release automatically.
- (2) The door lock will release automatically once the operation finished.
- (3) It is available to release the door by pressing button  once the rotor stops.

10.2.2 In the case of power outage

The door cannot be opened automatically if there is a power outage. It is available to be opened manually.

- (1) Ensure if the rotor has stopped rotating.
- Listen carefully to ensure no rotating sound can be heard.
- (2) Insert a screw driver into the hole to open the door.
- Hole is located on the top right side of the unit.
 - Insert a screw driver into the hole and push forward to release the door.

11. Instructions of rotor and tube

⚠ CAUTION:

- Read the instructions thoroughly, correct use rotor.
- Do not exceed the allowable maximum speed of rotor, tube and adapters etc., be care that the allowable maximum speed of some adapters are lower than the rotor's maximum speed.

11.1 The rotor instructions

11.1.1 Rotor structure

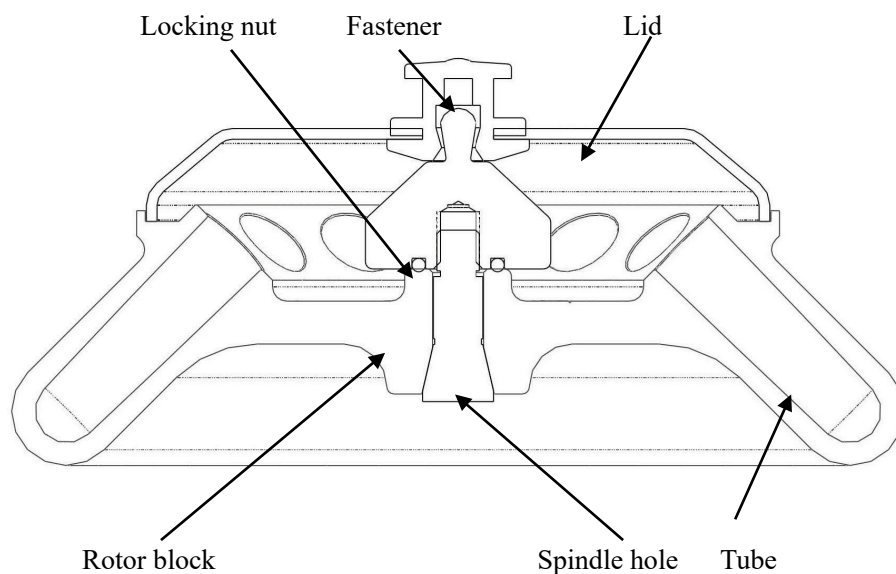


Figure11-1 the rotor profile

11.1.2 Available rotors and adapters

Table 11.1 Rotors and adapters

Model	Rotor type	ID code	Tubes	Adapters	Maximum speed (rpm)	Maximum RCF ($\times g$)	Allowable imbalance (*)	
							imbalance	Volume imbalance (**)
High Speed Mini Centrifuge plus	A12-2P	02	1.5/2.0ml tube		15000	15100	2.0g/ tube	5mm/ tube
			0.2ml PCR	A05P2	15000	11700		

			tube					
			0.5ml micro tube	A02P2	15000	12780		

11.1.3 Notice

- The centrifuge rotor can separate sample which density lower than 2.0g/ml. if the separated samples density is over 2.0g/ml, please calculate allowable speed depending on the following formula.
Allow Speed (rpm)= Maximum speed $\times(2.0(\text{g/ml})/\text{Sample density (g/ml)})^{1/2}$

11.1.4 Autoclaving

A12-2P rotor is made of plastic, cannot be high-pressure sterilization and UV irradiation, only ordinary sterilization can be used.

⚠ CAUTION:

- The lid of the rotor is made of plastics, can not be high-pressure sterilization, only ordinary sterilization can be used.

11.2 Tubes

11.2.1 Cleaning and sterilizing tubes

Table 11.2 Cleaning and sterilizing conditions for tubes

O: Applicable X: Inapplicable

Condition		Material	PA	PC	PP
Cleaning	Cleaning fluids	Acidic (pH5 or lower)	X	X	X
		Acidic (higher than pH5)	O	O	O
		Alkaline (higher than pH9)	O	X	O
		Alkaline (pH9 or lower)	O	O	O
		Neutral (pH7)	O	O	O
		Warm water(up to 70°C)	O	O	O
Ultrasonic cleaning	Neutral detergent (pH7)	O	O	O	
Sterilization	Autoclaving	115°C (0.7kg/cm ²) 30minutes	O	O	O
		121°C (1.0kg/cm ²) 20 minutes	X	O	O
		126°C (1.4kg/cm ²) 15 minutes	X	X	X
	Boiling	15 to 30 minutes	O	O	O
	Ultraviolet sterilization	200-300nm	X	X	X
	Gas sterilization	Ethylene oxide	O	X	O

		Formaldehyde	O	O	O
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PA: Polyallomer; PC: Polycarbonate; PP: Polypropylene

11.2.2 Cleaning PC tubes

PC materials are low in chemical resistance against alkaline solutions. Avoid using neutral detergents with pH higher than 9. Note that pH of some neutral detergents are still higher than 9 even if diluted according to the instruction in the maker's catalog. Use detergent with its pH between 7 and 9.

11.2.3 Autoclaving PA, PC and PP tubes

PA begins softening at about 120°C, PC and PP at about 130°C. Autoclave PA tubes at 115°C (0.7kg/cm²) for 30 minutes and PC and PP tubes at 121°C (0.1kg/cm²) for 20 minutes. If a certain temperature is exceeded, the tubes may be deformed.

When using a sterilizing chamber, please operate as follows:

- (1) Place tubes in vertical position, mouths upward. If tubes are placed sideways, they may deform into an oval shape due to gravity.
- (2) Remove screw nuts and inner covers to prevent from deformation or rupture.
- (3) Wait until the sterilizing chamber cools down to the room temperature before the tubes are removed.

11.2.4 Condition and life expectancy of tubes

The life expectancy of plastic tubes depends on the characteristics of samples, speed of the rotor used, and temperature applied, and so on. When the plastic tubes are used for centrifuge of ordinary aqueous samples (pH between 5 and 9), their life expectancies are defined as follows.

Be operated at the maximum speed:

High quality tubes (PA, PC, PP): 30-50 operations

Ordinary tubes (PA, PC, PP): around 10 operations (Using in low speed can extend the tube life) .

Life expectancy of tubes also depends on the pretreatment conditions such as cleaning and sterilization, lifetime can be cut down.

Notice: Do not use damaged or cracked tubes.

12. Calculation Relative Centrifuge Force (RCF)

Relative Centrifuge Force (RCF) can be determined with the following calculation formula.

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

R—rotating radius, unit: cm; n—rotating speed, unit: rpm

13. Warranty

14.1 Warranty of the centrifuge

This centrifuge is guaranteed for two years from the date of delivery provided that it has been operated and maintained properly.

14.2 Warranty of the rotor

The rotor is guaranteed for 5 years from the date of delivery upon manufacture. Please pay attention, do not use the rotor once it has been corrosion or fatigue damage. We do not guarantee this centrifuge and the rotor under the following conditions even if within the guarantee period expires:

- (1) Failures caused by incorrect installation.
- (2) Failures caused by rough or improper handling.
- (3) Failures caused by conveyance or relocation after installation.
- (4) Failures caused by unauthorized disassembly or modification.
- (5) Failures caused by using parts of the other companies, such as rotors and adapters.
- (6) Failures caused by natural disasters including fire, earthquakes and so on.
- (7) Consumables and parts have a limited guarantee period

14. After-sales Service

In order to ensure to operate centrifuge safely and efficiently, it is necessary for regular maintenance. If centrifuge has problems, do not attempt to repair it by yourself. Contact our sales or service center.

□

USER MANUAL

台式高速小型离心机 使用说明书





在操作使用离心机之前，请认真阅读本使用说明书，充分理解与安全有关的注意事项。

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安全警示

符号  是国际通用的安全标志，请仔细阅读并充分理解下面的安全细则：

- 遵守说明书的操作要求，确保正确、安全地使用该离心机。
- 仔细阅读所有安全信息和安全提示。
- 安全信息作以下标记，安全符号  分别同警告和告诫组合，提示用户潜在的危险。这两种组合以及提示符号的具体定义如下：



警告： 人身危险。

警告潜在的危险，如不严格遵守说明书的要求，可能会导致人身伤亡。



告诫： 离心机损坏危险。

警告潜在的离心机损坏危险，如不严格遵守说明书的要求，可能会导致离心机损坏。

提示： 通常需要注意的事项。

- 不要以本说明书没有提及的方式使用该离心机，若遇到任何问题请与制造商/供应商联系。
- 本说明书对潜在的危险已经作了比较完整的提示，然而，用户对不可预测的事情还须有必要警惕，小心使用该离心机。



警告

- 该离心机是非防爆型，不要用于易燃、易爆样品的分离。
- 不要将该离心机安装在易燃气体、易燃化学物质附近。
- 该离心机 30cm 范围内不要放置危险品。
- 在对具有毒性、辐射性、致病有机体进行分离时，必须采取必要的安全措施，并自行承担不良后果。
- 如果离心机、转子及其它附件受到污染，请严格按照去污程序清洗消毒。

- 如果需要我们的现场帮助，需事先对该离心机进行消毒、去污，并告知服务中心所涉及的特殊物质详情。
- 不要用湿手接触电源线和电源开关，以防电击。
- 为安全起见，当离心机运行时，人员与离心机保持 30 厘米距离。
- 当转子运行时不要打开上盖。
- 除本公司的维修人员外，禁止非授权单位或个人维修、拆卸该离心机。



告诫

- 确保该离心机置于坚实而平整的水平桌面上。
- 离心机运行前要确保离心机水平。
- 打开上盖时要确保上盖与机壳角度大于 70 度。
- 当关上盖时，不要将手放在上盖和机壳之间。
- 当离心机运行时不要移动离心机，也不要依靠离心机。
- 当离心腔内有液体时，请及时用干布擦干，以避免污染样品。
- 在运行离心机前要保证离心腔清洁，务必取走离心腔中的异物，如离心管碎片等。
- 对于转子的提示：
 - (1) 在使用转子前检查转子表面是否有腐蚀或损坏，若有此类问题，则停止使用。
 - (2) 离心机设定转速不能超过转子组件及适配器中所允许的最小转速，务必使离心机运行在最小允许转速以下。
 - (3) 不要超出所允许的不平衡量。
 - (4) 所使用的离心管应在它们的允许容量以内。
 - (5) 如果转子有盖子，运行前确保将盖子旋紧。
- 在运行过程中出现奇怪噪音等异常现象，请马上停机，与我服务中心联系，并告知所显示的故障代码。
- 地震有可能对离心机造成损坏，如果出现不正常情况，请与服务中心联系。

1. 性能指标

最高转速	15000rpm (500-15000rpm), 步长: 100rpm
最大相对离心加速度	15100×g, 步长: 100×g
最大容量	2ml×12
定时	30 秒-99 分-连续运行
驱动电机	无碳刷电机
安全性能	门锁、超速、过温、状态诊断系统
电源	单相, 110V-240V, 50Hz/60Hz, 额定电流 3A
尺寸 (毫米)	(长) 255× (深) 245× (高) 140
重量	6kg
其它功能	转速/加速度转换功能、短时运行功能、运行进程显示、声音提示功能

2. 符合标准

离心机结构符合以下安全标准:

EN 61010-1

EN 61010-2-10

UL 3101-1

CAN/CSA C22.2 (1010-1)

离心机结构符合以下电磁兼容标准:

EN 61326-1

符合以下欧盟标准:

EMC 标准: 89/336/EWG

机械设计标准: 73/023/EWG

3. 环境条件

3.1 基本运行条件

- (1) 电源：单相，110V-240V，50Hz/60Hz，额定电流 3A，标准正弦波。
- (2) 环境温度：2°C~40°C。
- (3) 相对湿度：≤80%。
- (4) 周围无影响性能的振动和气流存在。
- (5) 周围空气中无导电尘埃、爆炸性气体和腐蚀性气体存在。

3.2 运输和贮存条件

- (1) 环境温度范围：-40°C~55°C。
- (2) 相对湿度范围：≤93%。

4. 安装

用户必须遵守本章的安装说明，切记！移动离心机前必须取下转子。

 警告

- 不正确的电源连接会损坏离心机。
- 在连接电源前请检查供电电源是否满足要求。

4.1 安装位置

- (1) 该离心机必须安装在坚实、平整和水平的台面上，且保证离心机四个脚与台面接触。不要将离心机安装在滑动台面上，否则容易引起较大振动。
- (2) 理想环境温度为 20°C±5°C，环境温度不宜超过 30°C。避免阳光直接照射该离心机。
- (3) 确保离心机两侧 10cm 间隙，离心机后侧 30cm 间隙，这样可以保证离心机的风冷效果。
- (4) 离心机附近不能有热源或水源泄漏。否则，容易导致样品温度升高或离心机故障。

4.2 电源线与地线的连接

⚠ 警告

- 不要用湿手接触电源线，以防止电击。
- 该离心机必须良好地接地。

(1) 该离心机使用三芯电源线，插头为三芯扁平插头，可将插头直接连接到电源插板上。

(2) 电源插板额定电流应为 10A 以上，并且要满足地方电气安全要求，保证具有良好的保护地端。

5. 结构

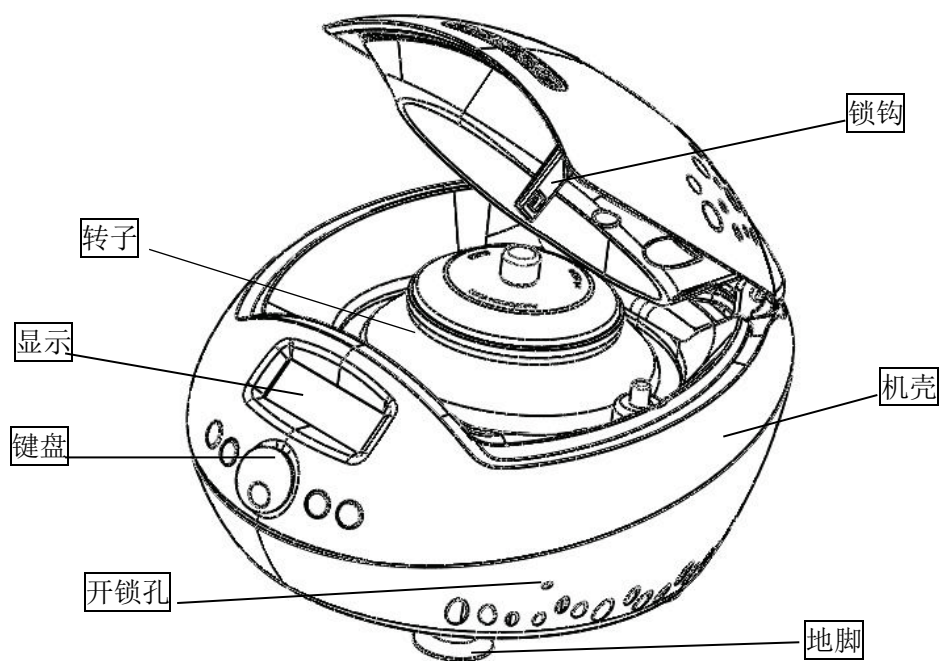


图 5.1 台式高速微型离心机离心机正面图

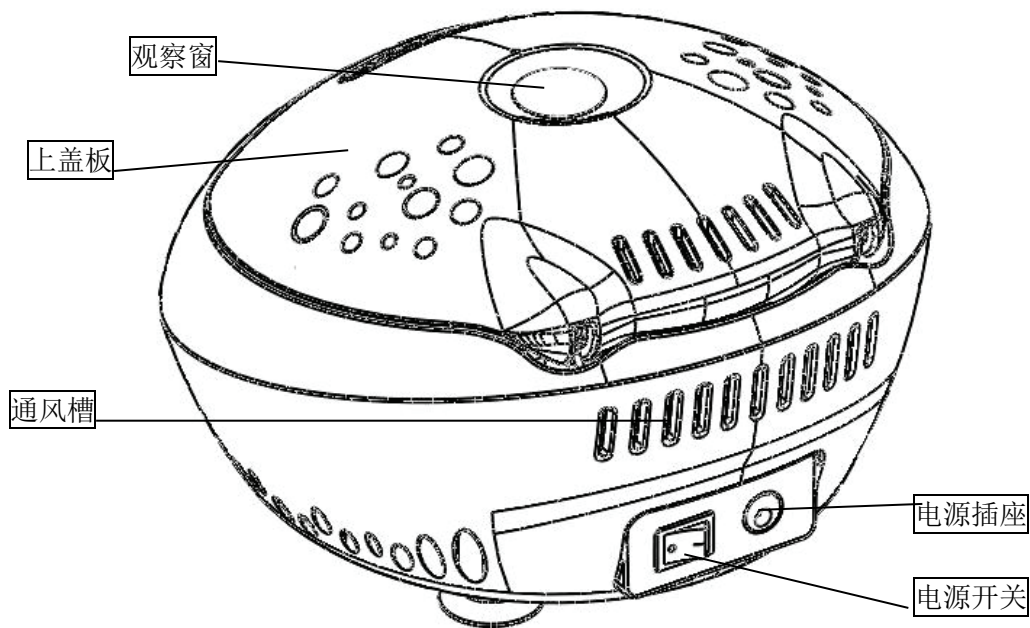


图 5.2 台式高速微型离心机离心机背面图

6. 操作面板

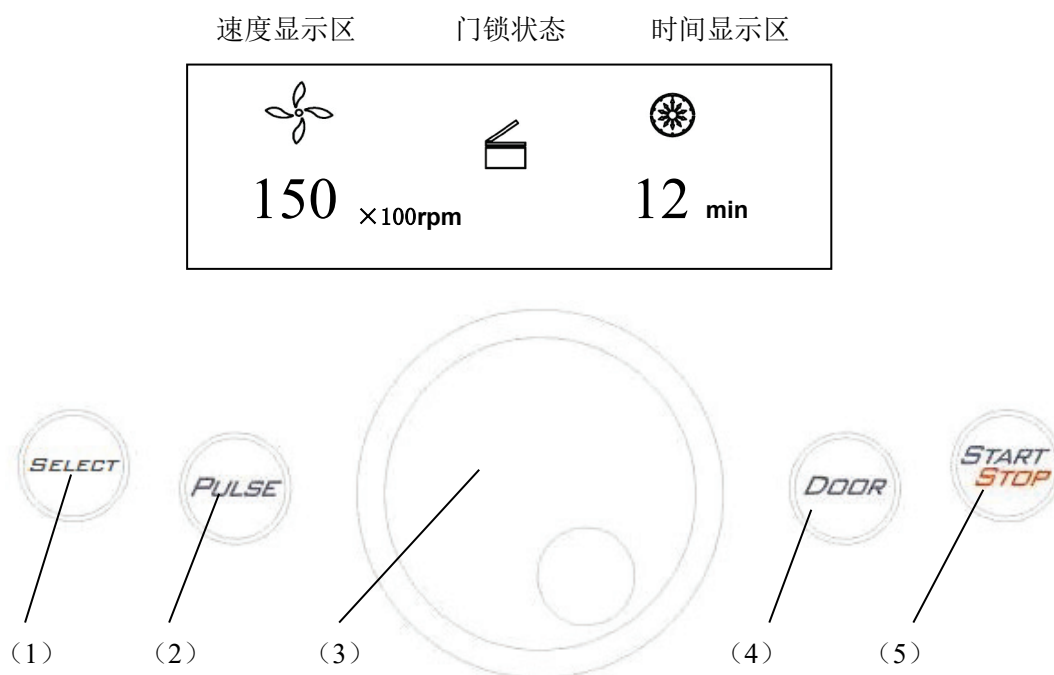




图 6-1 操作面板示意图

序号	图示	名称	功能
1		位选键	按下该键，选择需要修改的参数
2		点动键	按下此键并保持住，则离心机升速运行，抬起该键，则离心机停车
3		参数输入键	按下该键，可以选中要修改的参数。 顺时针旋转，参数增加，逆时针旋转，参数减小
4		门锁开关键	当转速为零时，按下该键，门锁打开。转速不为零时，按下该键无效
5		运行键	当转速为零时，按下该键，离心机开始运行。 离心机运行过程中，按下该键，离心机开始停车

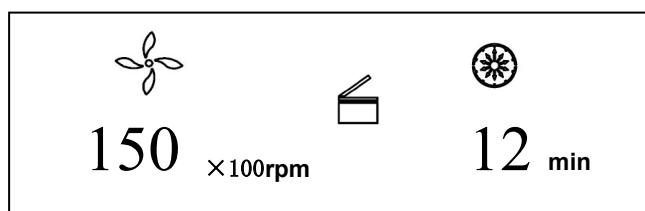



图 6-2 主画面示意图

主画面如图 6-2 所示，此时转速设定为 15000rpm，设定运行时间为 12 分钟。

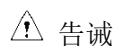
速度图标  旋转时，表示离心机正在运行，其转动越快，表示当时的转速越高。

时间显示图标  将整个运行时间分成 10 等分，显示已运行时间占总时间的比例。

7. 转子准备

7.1 准备要分离的样品

7.2 将样品放入离心管中



告诫

- 在离心管中加入过量样品会引起泄露，因此不要加入过量样品。

- 样品量不超过说明书中所允许的最大限量。

7.3 确保离心管平衡

- 尽管该离心机允许目测平衡方法使用，但是为了延长离心机使用寿命，建议样品使用天平称量，确保平衡。

- 尽管不平衡量是允许的，也不要再在不好的平衡条件下运行该离心机。

7.4 检查转子

告诫

- 如果发现转子上存在腐蚀或划痕等，请停止使用。
- 禁止在本机上使用其它牌号或规格的转子。

- 使用前需要检查转子是否有腐蚀或划痕。

7.5 确保将平衡好的离心管对称地放入转子孔内

告诫

- 确保将转子与主轴旋紧，盖子安全固定在转子上。否则，在离心机运行时转子可能脱落，造成离心机或转子损坏。
- 转子盖与转子旋紧牢固。

8. 操作

8.1 正常运行操作

打开电源开关显示亮，离心机进行自检后显示上次运行界面。图例见图 8-1 所示。

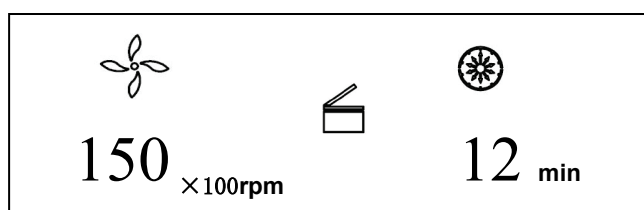


图 8-1 上次运行画面

- 速度设定 15000rpm，时间设定为 12 分。

- 上盖门锁释放。

8.1.1 转子安装和更换

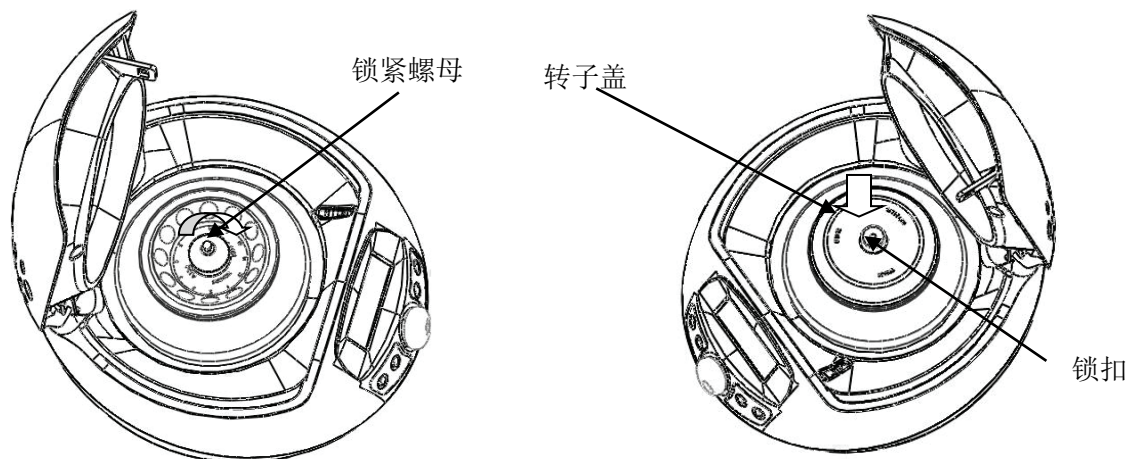







图 8-2 转子安装示意图

- 放置转子时要保证转子与主轴完全接触。
- 转子正确放在主轴上会发出清脆响声，如果没有，可能主轴与转子之间有异物，需要检查，并清除异物。
- 放置完转子后，可以用手轻转检查转子，观察是否正常，如果转子有明显晃动，则需要重新放置转子。
- 一手按住转子体，另一只手顺时针旋转旋紧螺母，保证转子与主轴旋紧牢固。
- 盖上转子盖，保证上盖与主轴夹紧牢固。
- 关好上盖门，运行离心机。
- 转子的拆卸与上述方法相同，只是旋紧方向为逆时针。


⚠ 告诫

- 每次运行前必须确保转子安装牢固。









8.1.2 设置运行参数

通过参数键  可以输入、修改运行参数。向下轻按位选键  可以选择需要输入的参数对象，使该参数图标闪烁，进入参数修改状态。这时右旋参数键 ，可以增加参数，左旋，则减小参数。参数键  转动越快，输入参数的值变化越快。反之，参数键  转动越慢，输入参数的值变化越慢。



转速、加速度的最小步长为 100rpm，时间的最小步长为 1 秒钟。

 告诫：当转子组件中的离心管及适配器所允许的最高转速低于转子的最高转速时，设定转速不能超过转子组件中最小的允许转速。

(1) 设定转速

- 按位选键 ，选择转速单位为 rpm，速度值闪烁，进入速度参数输入状态。
- 转动参数键 ，输入速度参数。
- 最小转速设定值为 500rpm，最小步长为 100rpm。
- 顺时针旋转参数键 ，参数增加。反之，逆时针旋转参数键 ，参数减小。
- 参数键  具有快速输入功能，快速旋转参数键 ，可以加快参数的变化。
- 增加、减少参数具有循环功能。顺时针旋转参数键 ，数值从小→大→最大→最小，如此循环。逆时针旋转参数键 ，数值从大→小→最小→最大，如此循环。

(2) 设定运行时间




- 轻按位选键 ，使时间值闪烁，进入时间设定模式。
- 旋转参数键 ，输入时间设定值，设定范围 30 秒-99 分钟或 HD，连续运行。

8.1.3 开始运行

(1) 按运行键 ，启动运行

- 上盖门锁上，转子开始旋转。
- 当转速达到设定转速后开始计时，时间显示剩余运行时间。



(2) 运行参数的查询和修改

- 离心机稳速运行后可对其运行参数进行修改：
- 轻按位选键 ，显示返回预备模式界面，显示设定的运行参数。这时，再轻按位选键 ，使所需要修改的参数闪烁，再旋转参数键 ，修改其参数。无键操作 7 秒后离心机回到正常运行状态，并按新参数继续运行。
- 时间设定参数修改后，已运行时间不清零而将继续累加。

(3) 错误显示

- 离心机运行过程中出现故障，程序将自动停车，并在时间显示窗显示出故障代码，通过查询表 10-1，即可知道故障原因并可进行相应处理。

8.1.4 结束运行



- (1) 当运行时间到或按  键时，离心机开始停车
 - 当转子停止旋转后，离心机鸣叫，告诉用户运行结束。
- (2) 上盖门锁打开
 - 运行结束，离心机自动打开上盖门锁。
 - 上盖门锁关闭后，可以通过  按键打开上盖门锁。
 - 运行结束后，程序将自动储存本次运行的设定参数。再次开机时程序将自动调出最后一次运行的设定参数。
- (3) 打开上盖门，取出样品和转子

8.2 RCF 运行操作

- (1) 接通电源开关
- (2) 设定 RCF(相对离心加速度)

告诫

- 所设定的相对离心加速度不要超过离心管及其适配器所允许的最大相对离心加速度。
- 相对离心加速度是根据转子最大离心半径和运行转速计算的。

- 按下位选键 ，选择转速单位为 100g，这时，表示加速度参数输入模式。
- 加速度参数闪烁 7 秒后若无按键操作，输入模式将被关闭。
- 旋转参数键 ，输入相对离心加速度，相对离心加速度以 100×g 步长变。



- (3) 设定运行条件

其它部分操作，请参照 8.1 部分。


8.3 短时运行操作

该功能通常用于去掉附着在离心管内壁上的样品。

提示：只有当转子没有转动并且上盖门关上时该按键才有效。

- (1) 打开电源开关，将转子固定在主轴上，旋紧转子盖，并保证旋紧牢固。
- (2) 离心机进入预备模式，并显示上次运行的参数值。
- (3) 按下  键并保持住，转速不断上升，直到达到最高转速。当抬起  键时开始减速停车。

9. 维护

 告诫

- 不按说明书的建议对离心机进行清洁或消毒有可能损坏离心机。

(1) 离心机

- 离心机长期暴露在紫外光线下，机壳的颜色会有变化，上面的标签可能脱落，用完后请用布盖住离心机，避免光线照射。
- 离心机脏了后，请用布或海绵配以中性清洁剂清洗。
- 可以用布配以 70% 的酒精溶剂对离心机消毒。

(2) 离心腔

 告诫

- 不要将水及其它溶剂直接倒入离心腔，否则这些溶剂可能进入驱动单元而引起轴承腐蚀或损坏。

- 如果离心腔脏了，可以用布或海绵配以中性清洁剂擦干净，用布配以 70% 酒精可以对离心机消毒。

(3) 驱动轴

- 建议对驱动轴做定期维护，可以用软布擦净驱动轴，然后在轴上涂一薄层硅胶。

(4) 上盖门

- 清洗或消毒上盖门方法同(1)离心机部分。

(5) 转子

- 为了防止腐蚀，如果转子长期不用，请将转子从离心腔中取出，并取下转子上盖，将转子倒置，晾干转子孔。
- 如果有样品泄露在转子孔内，则用清水冲洗转子孔，晾干后在转子表面涂一薄层硅油。
- 转子需要定期维护，建议每三个月作一次清洗，保证试管孔与主轴孔清洁，并涂一薄层硅脂。

10. 常见故障及解决办法

10.1 常见故障列表

该离心机具有自我诊断功能，当离心机出现故障不能运行时，在时间显示窗上会显示故障代码，根据故障代码即可知道故障原因。


现象	可能原因	解决办法
通电，没有显示	·电源座断电 ·保险烧断	·排除故障，重新通电 ·更换保险
离心机振动异常	·转子与主轴配合不好 ·样品安装不对称 ·转子盖松动	·重新安装转子 ·天平称量，对称安装 ·重新安装转子盖
报警码显示在时间显示窗上	E-02 上盖门故障	·运行中门打开 ·门开着时按下  键
	E-06 转速设定异常	·设定转速超出转子所允许的最高转速
	E-10~86	·见服务手册
		·马上关闭盖门 ·关闭盖门，然后运行
		·修改转速设定值
		·与服务中心联系


表 10-1 常见故障及解决办法

- 故障码 E-1~E-9 与操作错误有关，故障清除后可以继续运行离心机。

10.2 如何打开上盖门

10.2.1 通电情况下

提示：只有当离心机通电并且转子不转动时才能打开上盖门。

- (1) 离心机通电，上盖门锁自动打开。
- (2) 离心机运行结束后，上盖门锁自动打开。
- (3) 当转子停止运行，按  键，可以打开上盖门锁，这时可以翻开上盖门。

10.2.2 断电情况下

突然断电不能打开上盖门时，可按以下步骤打开上盖门：

- (1) 检查转子是否运转
 - 仔细听，确保没有转动声音。
- (2) 用小起子插入机壳小孔打开上盖门锁
 - 小孔在右侧面板前端上方。
 - 用小起子通过小孔向前推，即可打开上盖门锁，这时可以翻开上盖门。

11. 转子及离心管介绍

告诫

- 仔细阅读说明书，正确地安装和使用转子。
- 不要超过转子、试管及适配器等组件所允许的最高转速，有些适配器所允许的最高转速低于转子的最高转速。

11.1 转子介绍

11.1.1 转子结构

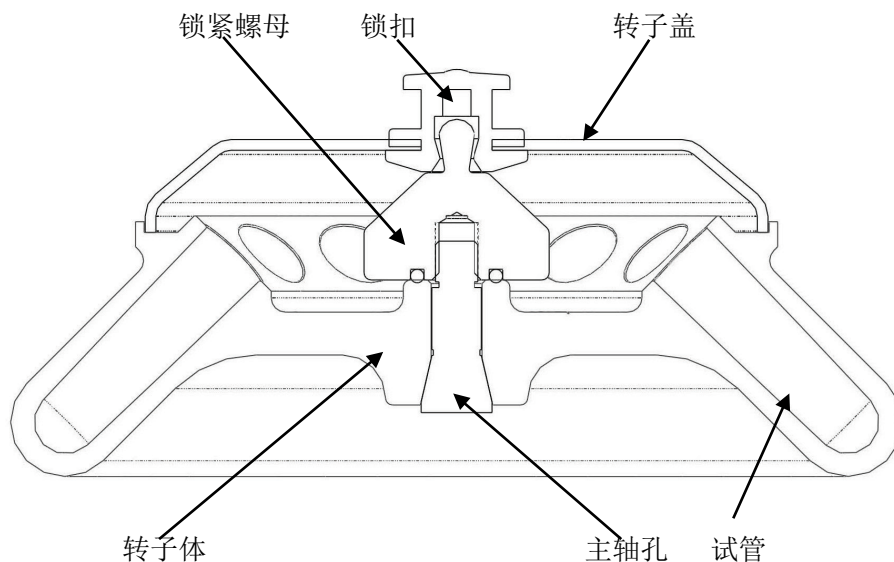


图 11-1 转子结构

11.1.2 转子和适配器

该离心机可使用的转子和适配器列表如下：

表 11.1 转子和适配器列表

转子类型	转头号	离心管	适配器	最高转速 (rpm)	最大相对离心加速度 (×g)	允许不平衡(*)	
						质量不平衡	容量不平衡(**)
A12-2P	01	1.5/2.0ml 管		15000	15100	2.0g/管	5mm/管
		0.2mlPCR 管	A02P2	15000	11700		
		0.5ml 微量管	A05P2	15000	12780		

*：表中给出的不平衡是指对称放置的离心管中样品所允许的质量不平衡或容量不平衡。

**：容量不平衡只是一个粗略不平衡测量，因此，没有必要与质量不平衡严格匹配。

11.1.3 注意事项

(1) 该离心机转子可分离样品的密度在 2.0g/ml 以下，如果被分离的样品密度超过 2.0g/ml，请根据下面的公式计算允许的转速：

$$\text{允许转速(rpm)} = \text{最大转速} \times (2.0(\text{g/ml}) / \text{样品密度}(\text{g/ml}))^{1/2}$$


(2) 为了防止腐蚀，如果转子长期不用，请将转子从离心腔中取出，并取下转子上盖，将转子倒置，晾干转子孔。

(3) 如果有样品泄露在转子孔内，则用清水冲洗转子孔，晾干后在转子表面涂一薄层硅脂。

(4) 转子需要定期维护，建议每三个月作一次清洗，保证试管孔与主轴孔清洁，并涂一薄层硅脂。

11.1.4 高压灭菌

该转子体使用高强度塑料材质制造，不可以进行高压灭菌。

 告诫

- 转子盖采用高强度透明塑料制作，不可以高压灭菌。

11.2 离心管

11.2.1 请参照下表对离心管进行清洗和消毒

表 11.2 离心管清洗和消毒条件

O: 可用 X: 不可用

条件		材料	PA	PC	PP
清洗	流动清洗	酸性清洗剂 (pH5 或更低)	X	X	X
		酸性清洗剂 (高于 pH5)	O	O	O
		碱性清洗剂 (高于 pH9)	O	X	O
		碱性清洗剂 (pH9 或更低)	O	O	O
		中性清洗剂 (pH7)	O	O	O
		70°C热水	O	O	O
	超声清洗	中性清洗剂 (pH7)	O	O	O
消毒	高压灭菌	115°C (0.7kg/cm ²) 30 分钟	O	O	O
		121°C (1.0kg/cm ²) 20 分钟	X	O	O
		126°C (1.4kg/cm ²) 15 分钟	X	X	X
	煮沸灭菌	15-30 分钟	O	O	O
	紫外线灭菌	200-300nm	X	X	X
	气体灭菌	乙烯氧化物	O	X	O
		甲醛	O	O	O

PA: 同质异晶聚合物 PC: 聚碳酸脂 PP: 聚丙烯

11.2.2 PC 离心管清洗

PC 材料对碱性溶剂具有较低的化学稳定性，应避免使用 pH 值大于 9 的清洗剂。一些中性清洗剂按厂家的说明冲淡使用其 pH 值仍大于 9，因此，建议使用 pH 值在 7-9 之间的清洁剂。

11.2.3 PA、PC 和 PP 离心管的高压灭菌

PA 在 120°C 开始变软，而 PC 和 PP 是 130°C。通常，PA 可以在 115°C (0.7kg/cm²) 经 30 分钟灭菌，而 PC 和 PP 可以在 121°C (1.0kg/cm²) 经 20 分钟灭菌。如果温度过高，离心管就会变形。

当使用灭菌皿时按如下操作：

- (4) 将离心管口向上，竖直放置。如果将离心管倾斜或侧向放置，由于重力作用将会变形。
- (5) 取下螺纹盖子和内部盖子以防止离心管变形或裂口。
- (6) 当灭菌皿降到室温之后才能将离心管取出。

11.2.4 离心管的寿命

塑料离心管的寿命取决于样品特性、转子转速、离心温度等。当塑料离心管用于离心常规中性样品 (pH5-pH9) 时，其寿命估计如下：

在最高转速下使用：

优质离心管 (PA、PC、PP)：30-50 次。

常规离心管：10 次左右 (低速使用可以增加使用次数)。

离心管寿命还与清洗和消毒的条件有关，使用寿命会有所降低。

注：不要使用有裂纹的离心管。

12. 相对离心加速度 (RCF) 的计算

相对离心加速度 (RCF) 可以通过计算公式计算。

$$\text{计算公式：RCF} = 1.118 \times r \times n^2 \times 10^{-5}$$

其中，r—旋转半径，单位：cm；n—旋转转速，单位：rpm。

13. 质保

14.1 整机质保

整机从交货之日起在正常维护的情况下保修两年。

14.2 转子质保

转子自交货之日起，担保 5 年。特别注意，当转子已经被腐蚀或疲劳损坏，请不要再使用。因以

下原因引起的主机或转子的损坏不属于担保范围。

- (8) 由于不正确的安装引起的损坏。
- (9) 野蛮或不正确操作引起的损坏。
- (10) 安装完毕后重新移位或运输引起的损坏。
- (11) 由于无授权单位的拆卸或修改而引起的损坏。
- (12) 使用非我公司的部件，如转子、适配器等造成的损坏。
- (13) 由于自然灾害，包括火灾、地震等造成的损坏。
- (14) 易损件和具有保修期的部件。

售后服务

为了确保离心机安全高效地运行，需要定期维护。如果离心机出现问题，不要试图自己修复，请与服务中心联系。