CENTRÍFUGA REFRIGERADA DE ALTA VELOCIDAD
HIGH SPEED REFRIGERATED CENTRIFUGE
CENTRIFUGEUSE RÉFRIGÉRÉE À GRANDE VITESSE

Modelo, Model, Modèle 2811R

Este manual es parte inseparable del aparato por lo que debe estar disponible a todos los usuarios del equipo. Le recomendamos leer atentamente el presente manual y seguir rigurosamente los procedimientos de uso para obtener las máximas prestaciones y una mayor duración del mismo.

This manual should be available for all users of these equipments. To get the best results and a higher duration of this equipment it is advisable to read carefully this manual and follow the processes of use.

Ce manuel est une partie indissociable de l'appareil et doit être mis à la disposition de tous les utilisateurs de l'équipement. Nous vous recommandons de lire attentivement ce manuel et de suivre scrupuleusement les procédures d'utilisation afin d'obtenir des performances maximales et une plus longue durée de vie de l'appareil.

LANGUAGE INDEX

Spanish 2-25
English 26-49
French 50-73

SAFETY INSTRUCTIONS

In order to avoid damage to people, the surrounding objects and the environment, please follow all the safety instructions in this User Manual.

In addition, local laws and regulations for the installation of the centrifuge, accident prevention, environmental protection and recognized professional standards for occupational safety and health must be carefully observed.

- Please read this manual carefully when using this device for the first time.
- Centrifuges can only be operated by trained and authorized personnel.
- Equipment maintenance can only be done by qualified technicians.
- Do not introduce the following materials in the centrifuge:
  - Flammable or explosive substances
  - Aggressive chemicals
  - Toxic or radioactive substances
  - Pathogenic microorganisms
- If the operator encounters a situation not mentioned in this manual, please contact your distributor to request technical assistance.
- Use accessories provided by the manufacturer. If the user uses other accessories, Auxilab S.L. will not be responsible for the adverse consequences.
- This centrifuge must be inspected and maintained at regular intervals.
- Do not plug or unplug the power plug and toggle the power button when the hands are in possession of liquid.
- Do not unplug the power plug when the device is powered.
- It is strictly forbidden to maintain and clean the centrifuge under power-on state.
- It is strictly forbidden to install the device on the work surface with unevenness and vibration.

ENVIRONMENTAL CONDITIONS FOR USE

The following factors may damage the centrifuge; take them into account to assure a safe operation:

- Chemical effects
- Environmental impacts, including natural UV radiation
- Corrosion and wear of safety parts

- Indoor use only
- Altitude: ≤ 2000m
- The permissible ambient temperature range is +5℃ ~ +40℃
- The permissible relative humidity is ≤80%
- There must be sufficient ventilation in the working room
- There are no vibrations and air flows around the centrifuge
- There is no conductive dust in the surrounding air, explosive gas and corrosive gas

TABLE OF CONTENTS

1. Terms of safe use....28
1.1 Operation precautions....28
1.2 Reference standards....29
2. Introduction....29
2.1 Appearance 29
2.2 Summary 30
2.3 Introduction to equipment structure....30
2.4 Safety protection....31
2.5 Machine placement requirements....31
3. Optional accessories....32
Rotor types and technical parameters....32
4. Preparation before use....32
4.1 Transportation and installation....32
4.2 Location requirements....33
4.3 Securely place the centrifuge....33
4.4 Connect the power supply correctly....33
5. Operating instructions....33
5.1 Introduction to control panel and display interface....33
5.2 Start up....34
5.3 Opening the door....34
5.4 Closing the door.....35
5.5 Rotor installation....35
5.6 Calculation of rotor load....36
5.7 Filling of sample in container....37
5.8 Safe use of rotor....37
5.9 Example of parameter setting....37
5.10 Other parameters setting....38
5.11 Calculation of centrifugal force....40
5.12 Running curve interface Speed Temperature....40
5.13 Main parameters setting interface....41
6. Maintenance....43
6.1 Cleaning / Decontamination....43
6.2 Maintenance....43
7. Troubleshooting....44
7.1 Emergency door opening....44
7.2 Fault alarm information....44
8. Technical data....48
9. Packing list....49

1. TERMS OF SAFE USE

Note: Any personnel involved in the use or maintenance of this centrifuge must read and understand the use methods and safe use rules given in this manual.

If the following incorrect or inappropriate use methods are used, equipment damage or personal injury will be caused when using this centrifuge:

- It is not used according to the design requirements
- Operators and maintenance personnel are not trained
- The user makes inappropriate changes to the device design without authorization
- Failing to pay attention to or understand the rules for safe use

In addition, in order to prevent accidents, the following rules must be strictly implemented:
This manual is one of the components of the device, which must be placed together with the centrifuge for the convenience of operators.
The 2811R model centrifuge is designed for clinical medicine, biology, chemistry, genetic engineering, immunology, etc. The density of the sample that can be separated at the maximum speed shall not exceed 1.2g/cm3. When the density of the sample is greater than 1.2g/cm3, the maximum speed of the rotor must be reduced accordingly.
During the operation of the high-speed centrifuge (during rotor rotation), within 30cm around the centrifuge, ensure that there are no operators or hazardous substances standing, and no objects blocking the centrifuge vent.
If the following safety measures are not observed when using the device, it will cause injury to the operator or other personnel or damage to the centrifuge and samples:

- The design of the centrifuge is neither anti-corrosion nor explosion-proof, so the centrifuge cannot be used in the corrosive environment and the environment that may cause explosion.
- It is forbidden to introduce the following materials in the centrifuge:
  - Flammable or explosive substances
  - Aggressive chemicals
  - Toxic or radioactive substances, pathogenic microorganisms, etc.
- The separation of corrosive substances will cause damage and destruction of materials inside the centrifuge or weaken the mechanical strength of the rotor. Therefore, when separating corrosive substances, they must be placed in leak proof containers.

1.1 Operation precautions

- Before the centrifuge runs, it must be confirmed that a suitable rotor is installed and firmly installed.
- Never open the door and move the centrifuge manually when the centrifuge is running or when it is stopped (but the rotor is still rotating).
- The parts used in 2811R model centrifuge must be provided by the manufacturer. For some common parts, such as plastic containers for separation, products that have been confirmed to meet the requirements can also be used, which should meet the requirements of the maximum speed and maximum centrifugal force of the corresponding rotor.
- Never use the centrifuge with the door open.
- When disassembling the centrifuge, do not turn on the power switch of the equipment (unplug the power cord).
- The mechanical parts and electronic components of the centrifuge must be replaced by authorized Technical Service personnel.
- When using the centrifuge, the operator must select the rotor with appropriate load, and shall not overload the rotor.

■Check the rotor frequently. If there is obvious corrosion trace or obvious damage on the rotor, stop using it.
■After being used for a period of time, the maintenance shall be carried out in strict accordance with the provisions of “cleaning and disinfection”.

1.2 Reference standards

This high-speed centrifuge is based on the current technical and safety standards:
■**IEC61010-1:2001** Safety Requirements for Electrical Equipment for Measurement and Control Laboratories - Part 1: General Safety Requirements.
■**IEC61010-2-020:2006** Safety Requirements for Electrical Equipment Used in Measurement and Control Laboratories. Special Requirements for Centrifuges Used in Laboratories.
■ISO780-1997 Pictorial Marks for Packaging, Storage and Transportation.
■**ICS19.040** Transportation Test of Electronic Measuring Instruments.
■**IEC60601** Environmental Requirements and Test Methods for Medical Electrical Equipment.

2. INTRODUCTION

2.1 Appearance

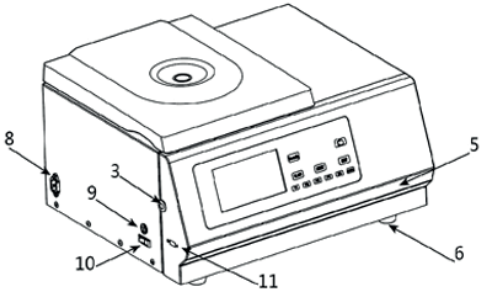


Figure 1: Left side view

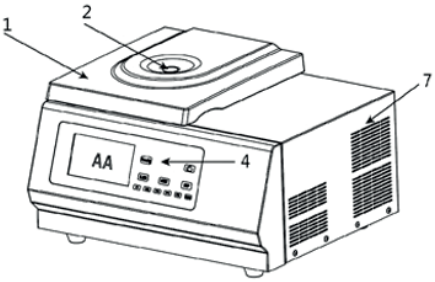


Figure 2: Right side view

Figures 1 and 2 illustrate:
1. Door
2. Observation window
3. Emergency door opening (be sure to operate when the machine power is off)
4. Control panel and display window
5. Front cover
6. Machine feet
7. Heat dissipation hole
8. Power socket
9. Electronic overload/short circuit protector
10. Power switch
11. USB port

2.2 Summary

This device is a refrigerated high-speed desktop centrifuge for routine analysis in medical laboratories, biochemical and molecular biology research and industrial laboratories. It can be widely used in clinical medicine, biology, chemistry, genetic engineering, immunology and other fields. It can be used with nine types of angular rotors (see “Table 1: Rotor types and technical parameters” for details).

2.3 Introduction to equipment structure

This equipment consists of refrigeration system, door cover system, chamber system, drive system, rotor system, base system, power supply system, control system, display system, and alarm system.

■The refrigeration system includes compressor, condenser, fan, etc. Adopting a powerful fluorine-free high-efficiency refrigerant R134a, the temperature control range is between -20 ºC and+40 ºC, and it can also quickly precool the rotor in a stationary state. When the centrifuge door cover is opened, the refrigeration system will still ensure constant temperature operation at the set temperature to avoid icing in the rotor chamber.

■The door cover system includes door cover, door hinge and damping gas spring, door lock, door alarm, emergency door lock mechanism, etc. The door hinge is located inside the rear of the rack, and the door lock is in front of the rack. Only when the door lock is locked can the centrifuge be started, otherwise the door alarm system will work (the buzzer will sound) and the machine will not start.

To open the door cover, simply press the open button on the machine control panel. When the door cover is opened to a certain height, the door hinge and damping gas spring can support the door cover. If there is a power outage or failure of the door opening key, and the samples must be taken out in a timely manner, it is necessary to use the accompanying tool to insert it into the emergency door opening hole and rotate it clockwise for one and a half turns until the door cover is opened.

When the rotor is rotating and the power is turned on, it is strictly prohibited to use emergency tools to open the door cover!

■Chamber system includes a stainless steel inner liner and a rubber sealing ring. It can provide a stable working environment.

■This equipment uses a variable frequency motor to directly drive the rotor of the load sample to rotate together. The drive system adopts a direct drive method, which ensures high precision in matching the rotor with the shaft and smooth operation.

■The rotor system is composed of various rotors (see Table 1: Rotor Types and Technical Parameters for details), centrifugal tubes and other related accessories. The function of the rotor is to rotate the load sample at a certain speed, creating a relative centrifugal force field, thereby achieving the purpose of separating the sample. Since the centrifugal force reached when the rotor rotates at low speed is thousands of times more than the gravitational acceleration g value of the Earth, it is very important for the safe use and careful maintenance of the rotor!

■The base system consists of a rack, a base plate, a body shell, and rubber support feet.

■The power supply system includes power sockets and switches, which are responsible for the mains power supply required for the normal operation of the machine.

■The control system includes settings for rotational speed and centrifugal force, operating time, selection of acceleration and deceleration rates, control of the entire machine display system, and alarm system. To ensure the normal operation of the machine and the personal safety of the operator, please do not disassemble the machine casually!

■The display system consists of a 7-inch color LCD touch screen and a PET touch keyboard panel (control panel). It is a medium for human-machine dialogue. It can synchronously display various parameters set and track the actual changes of various parameters. In addition, it can also display and alarm various faults.

■The alarm system is equipped with alarms for door cover failure, overspeed, imbalance, overvoltage, etc. In case of overspeed, door cover opening, imbalance and other faults of the machine, the system will give an alarm. At this time, the buzzer will give an alarm sound, and an error code will appear in the middle of the screen. The machine cannot be started (it is not allowed to start). The running machine will automatically stop until the fault is eliminated, and the machine can be restarted. Note: To eliminate the alarm sound emitted by the buzzer, press the stop button on the control panel.

2.4 Safety protection

This centrifuge has a series of safety protection mechanisms:
The frame and protective steel ring are made of steel plates, and the chamber is made of stainless steel. The door cover adopts an explosion-proof structure, and there is a locking mechanism at the front of the door cover. Only when the centrifuge is powered on and the rotor is stopped you can press the open button on the control panel to open the door cover of the centrifuge. The centrifuge can only be started when the door cover is locked!

■**Overspeed**

When the operating speed of the centrifuge rotor exceeds the set speed by 600rpm, the machine will sound an alarm. When the operating speed exceeds the maximum rated speed of the rotor by 600rpm, the rotor will automatically stop running. The door can only be opened after the rotor has completely stopped. After troubleshooting, the machine will restart.

■**Unbalance**

If the rotor rotates unevenly during operation, causing the shaft to shake beyond the specified range, the machine will stop running in a timely manner and issue an alarm prompt; Generally, the rotor load is unbalanced. After the operation is terminated, open the door cover, and after troubleshooting, the operation can be restarted.

■**Overtemperature**

When the temperature in the centrifugal chamber exceeds the set temperature by 10 ºC, the machine will stop running in a timely manner and issue an alarm prompt. It can only be restarted after cooling down the centrifugal chamber.

■**Emergency door opening**

During the operation of the rotor, if there is a sudden power outage or machine malfunction that makes it impossible to open the door with a button, manual door opening can be used (see 2.3.2).

2.5 Machine placement requirements

■The machine should be placed on a level table with sufficient rigidity and away from vibration and impact equipment, avoiding direct exposure to heat sources and sunlight.

■There should be a space of 20 cm to 25 cm on all sides of this machine for ventilation and heat dissipation.

■After placement, the level should be adjusted and the four supporting feet at the bottom of the equipment should be evenly supported on the table.

■The applicable working power supply is 220VAC±10%, 50/60Hz, 15A.

This machine must be strictly and reliably grounded, and the machine power grounding wire must be reliably connected to the power grid grounding wire! During the operation of the rotor, it is strictly prohibited to manually power off, otherwise it may cause damage to the control circuit!

3. OPTIONAL ACCESSORIES

Various rotors for 2811R model centrifuge are available for users. You can purchase the centrifuge according to your actual use requirements (see "Table 1: Rotor types and technical parameters" for details).

Table 1: Rotor types and technical parameters

Code	Capacity	Maximum speed (rpm)	Maximum relative centrifugal force (×g)	Tube type, PP
GLK016	1,5/2 mL×24	16000	23470	Round/conical bottom with cover
GLK042	1,5/2 mL×36	14000	17970	Round/conical bottom with cover
GLK020	0,5 mL×36	15000	16350	Conical bottom with cover
GLK022	5 mL×12	16000	18890	Round bottom with cover
GLK019	0,2 mL×8×4	14800	16200	Conical bottom PCR tube with cover
GLK024	15 mL×8	13000	17570	Conical bottom with cover
GLK025	50 mL×6	12000	14750	Conical bottom with cover
GLK026	100 mL×4	12000	15940	Round bottom with cover
GLK023	10 mL×12	13000	15315	Round bottom with cover

Other accessories:

- Code GDF001: Adapter for 0.2 mL microtube (to be used with rotors GLK016, GLK021 and GLK042).
- Code GDF002: Adapter for 0.5 mL microtube (to be used with rotors GLK016, GLK021 and GLK042).
- Code GDF014: Adapter for 15 mL tube (to be used with rotor GLK025).
- Code GDF015: Cushion for 50 mL round bottom tube (to be used with rotor GLK025).

4. PREPARATION BEFORE USE

4.1 Transport and installation

The high-speed refrigerated centrifuge is transported in wooden packaging boxes, which are filled with buffering and protective materials. After opening the packaging box, the buffering and protective materials inside are taken out.

Note: The net weight of the machine is about 60kg. When carrying, lift the equipment from the left and right sides of the machine and balance the force. Please carry it vertically and do not shake the machine. During transportation or long-distance transportation, please use special packing boxes, properly fix them firmly and keep them vertical, and handle them with care.

4.2 Location requirements

This centrifuge can only be used indoors, and the location should meet the following requirements:

- When the centrifuge is running, a safe distance of 30cm must be kept around. No hazardous substances shall be placed within this safe distance, and personnel shall not stay.
- The platform or table on which the centrifuge is placed shall be firm without shaking and vibration. If movable supports or trolleys are used, those with locking devices shall be used, to ensure the safe operation of the centrifuge.
- If the centrifuge is placed at the wall edge or corner, in order to ensure smooth air circulation and good heat dissipation, please ensure that the distance between the back side of the centrifuge and the left and right sides of the centrifuge from the wall is not less than 15cm and 20cm respectively.
- Centrifuge shall be placed away from windows to avoid direct heat and sunlight.
- After the centrifuge is placed, the four support feet shall be evenly supported on the table and adjusted horizontally.
- The room where the centrifuge is placed must be a constant temperature room with the ambient temperature between +5ºC and 40ºC and the ambient humidity ≤ 80%, and the environment must be kept clean.

4.3 Securely place the centrifuge

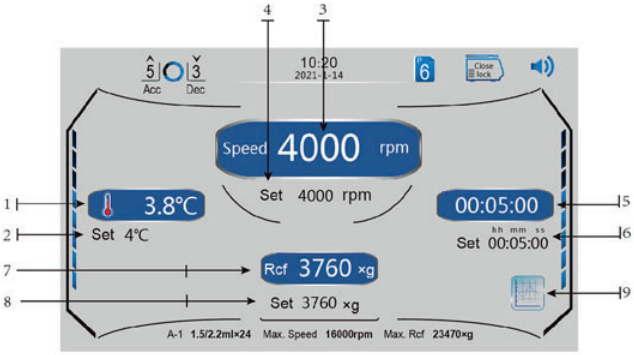
Once the centrifuge is placed, do not move it at will. If it is moved, reconfirm or adjust the level, and make the four support feet at the bottom of the machine evenly support on the table. Make sure that the platform or table on which the machine is placed is firm and cannot shake or vibrate.

4.4 Connect the power supply correctly

The centrifuge power cord shall use a separate power socket, which must be well grounded. Confirm that the power cord used complies with the safety specifications of the country and region where it is located. The power voltage and power frequency applied to the centrifuge shall comply with the requirements specified in this instruction or the specifications marked on the device nameplate. Please use the power cord supplied with the machine, correctly connect it to the machine power socket, and firmly connect it to the network power supply. When the power switch is closed, it is "|", and when disconnected, it is "O".

5. OPERATING INSTRUCTIONS

5.1 Introduction to control panel and display interface



1. Real time temperature
2. Set temperature
3. Real time speed
4. Set speed
5. Real time
6. Set time
7. Real time relative centrifugal force
8. Set relative centrifugal force
9. Switch to the graph interface icon

Figure 4: Screen of running parameters

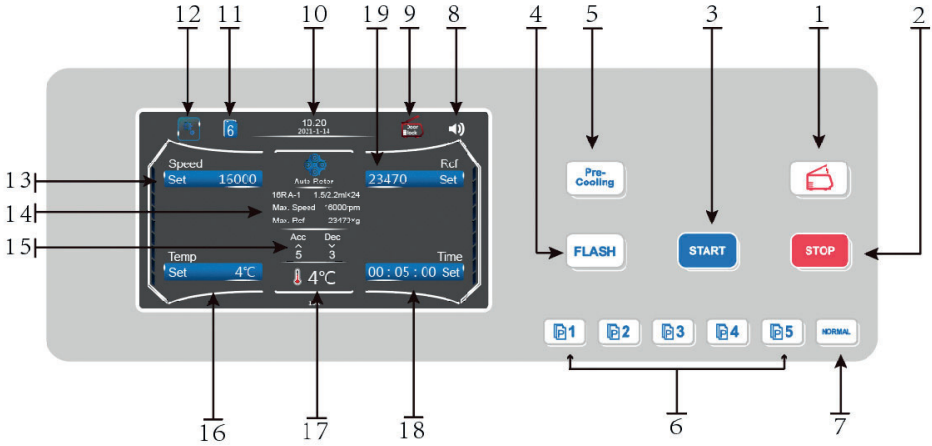


Figure 3: Schematic diagram of control panel/display interface

1. Door opening key
2. Stop key
3. Start key
4. Short centrifugation key
5. Pre-cooling/fast cooling setting key
6. Stored programs shortcut call keys
7. Press this key during non-program operations to instantly set various centrifugation parameters (NORMAL)
8. Prompt tone status display
9. Door cover status display
10. Date and time display
11. Storage page settings display status
12. Secondary menu buttons
13. Set speed display
14. Rotor parameters display
15. Display area for acceleration and deceleration rates
16. Set temperature display
17. Real time temperature display
18. Set time display
19. Set relative centrifugal force display

5.2 Start up

Connect one end of the power cord to the power socket, and the other end to the mains power supply. The mains power supply should use a separate socket. The power supply range used in this machine is 220VAC±10%, 50/60Hz. After connection, turn on the power switch. The LCD color display on the control panel lights up. After the self-inspection is completed, enter the Home screen, and now you can proceed to the next step.

5.3 Opening the door

Press the door open key on the control panel, the buzzer will give a prompt sound.
The door status display area shows the door cover opening symbol, and then the door cover needs to be lifted up by hands to fully open the door cover, and the inner chamber will be displayed in front of the user.
Note: If a malfunction occurs and the door cover cannot be automatically opened, if it is necessary to remove the samples inside the chamber, manual door opening can be used, as detailed in "2.3.2".

5.4 Closing the door

Please hold both sides of the door cover with both hands at the same time and close the door cover gently. After the door cover is locked, the machine will give a prompt tone and the door cover status display area shows the closed door symbol.

Notes: When the door cover is not closed properly, the centrifuge does not operate. Please confirm that the door cover is closed properly.

When closing the door, please close it slowly with both hands, and do not use too much force to prevent the door cover from hurting the palm or damaging the lock hook.

5.5 Rotor installation

The rotor used must be supplied by the centrifuge manufacturer. The specifications of various available rotors from manufacturer are included in this manual (see "Table 1: Rotor types and technical parameters" for details).

Note: The use of inappropriate rotors and centrifuge tubes will lead to a poor centrifuge performance, or even damage the centrifuge.

The steps for installing the rotor are as follows (as shown in Fig. 5 and Fig. 6):

- Turn on the power switch and wait until the self-inspection is completed.
- Press the door open key, open the centrifuge door cover, and confirm that the chamber is clean and free of foreign matters.
- Clean the surface of motor shaft.
- Install the tension sleeve on the motor shaft as shown in Fig. 5, and turn it clockwise for 5 turns with the Allen wrench (Note: it must only be turned for 5 turns, otherwise the rotor will not be installed on the tension sleeve).
- Prepare the rotor you want to use at the position shown in Figure 6. Hold the rotor with both hands, align the central hole of the rotor with the motor spindle, put it down vertically, place it at the bottom of the shaft, release both hands, and then press the rotor down with your hands.
- Use the special hexagonal wrench to tighten the lock nut clockwise.

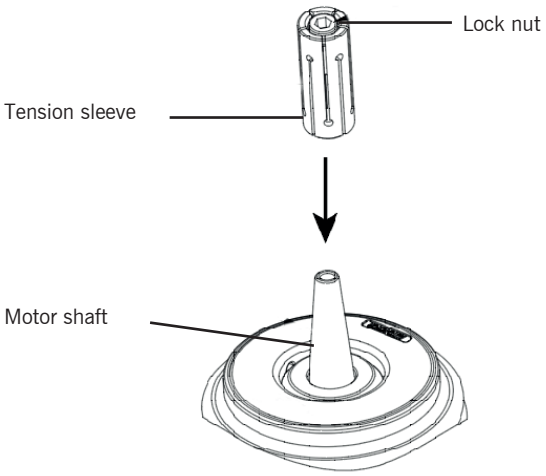


Figure 5: Schematic diagram of installing angle rotor

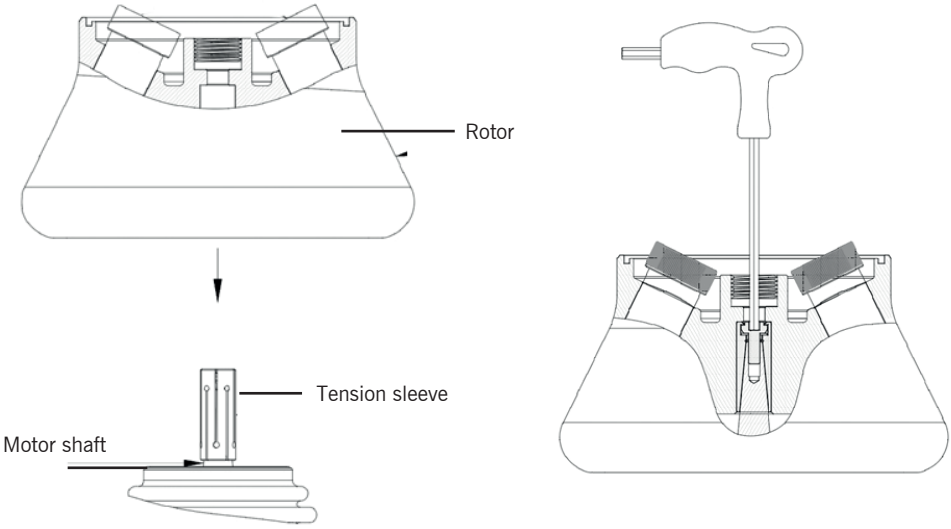


Figure 6: Schematic diagram of installing angle rotor

Note: After installing the rotor, check whether the position of the rotor changes before or after each use. If necessary, screw the lock nut again to ensure that the rotor is firmly installed.

5.6 Calculation of rotor load

■Calculation of maximum load

When the high-speed centrifuge operates at low speed, there is a huge centrifugal force; when each rotor is designed, it is required to have sufficient mechanical strength when working at the maximum rated speed - namely, “safety factor”; however, this “safety factor” regulation requires that the rotor load shall not exceed its maximum rated load.

If you put the samples together into the rotor, and the total exceeds the maximum rated load of the rotor, you must reduce the weight of the samples or calculate the allowable running speed (NPERM) of the rotor to ensure that the rotor load does not exceed its maximum rated load.

The allowable running speed (NPERM) of the rotor is calculated as follows:

NPERM = Nmax × (maximum permissible load÷actual load) 0.5

Nmax: maximum rated speed

Note: Do not overload the rotor, or the rotor will explode, and the debris generated by the explosion will damage the centrifuge.

5.7 Filling of sample in container

When the centrifuge is running, the better the rotor balance performance is, so the better the centrifugation effect achieved. Therefore, the samples shall be filled into the centrifuge containers as evenly as possible, to achieve a better balance effect during operation. All samples must be placed in suitable containers.

Carefully check whether the container (centrifuge tube) used complies with its maximum allowable rated acceleration (centrifugal force); if the requirements are met, please reduce the running speed for use.

Note: Please pay attention to the service life of the centrifugal containers used, especially when running under the maximum allowable load and speed; check whether the containers used are damaged, and replace them if needed.

5.8 Safe use of rotor

■Samples shall be loaded accurately and symmetrically, and the tubes shall be placed before rotor operation.

■If the centrifuge needs to be operated repeatedly, check whether the lock nut is loose after several times of use. If it is loose, it must be tightened before starting the centrifuge.

■Centrifuge tubes must be loaded symmetrically (allowable weight error ≤ 1.5g). If samples are loaded asymmetrically, it is not allowed to start the machine.

5.9 Example of parameter setting

■When the centrifuge is configured with the 16R A-1 rotor (1.5/2 mL × 24). The specific operation is as follows: turn on the power - turn on the power switch of the device - the color LCD display will light up. For example, the following parameters need to be set:

Rotor	Speed (rpm)	Time (min)	Temp ºC	ACC	DEC
16R A-1	16000	30	4	5	3

■**Set up:** 

Press this key to cancel the memory operation and set various centrifugation parameters immediately. At this time, the stored program icon “P+number” on the display 

will be hidden.

■**Rotor number setting:** The device automatically recognizes the rotor model without setting, and the rotor number display area shows a numerical value during automatic recognition 

;when a fault occurs in automatic recognition, please refer to Section 5.10.7 for manual setting.

■**Temperature setting:** Click on the Temperature module on the screen - make the numbers in the Temperature display area flash - input parameter to set the temperature value to 4.0.

■**Speed setting:** Click on the Speed module on the screen - make the numbers in the Speed display area flash - input parameter to set the speed to 16000. Note: The Rfc value is automatically converted with the speed value.

■**Time setting:** Click on the Time module on the screen (time is divided into three touchable areas: hours, minutes, and seconds) - the numbers in the time display area flash - enter the required time.

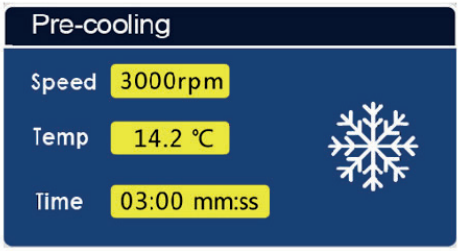
■**ACC/DEC setting** (the acceleration and deceleration settings for starting the machine to the set speed and stopping the machine from running, with values ranging from 0 to 9. The higher the value, the shorter the time it takes): Enter the second level menu interface. Note: When DEC is set to 0, the shutdown is free, and the system has no brake intervention!

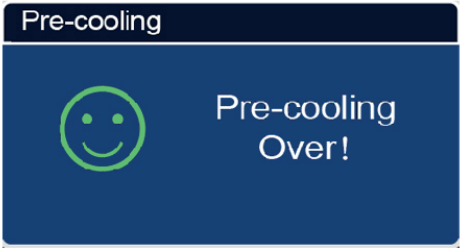
5.10 Other parameters setting

■During the process of setting parameters, if an alarm occurs due to machine malfunction or incorrect parameter settings. Press the **STOP** key to cancel the alarm and reset it according to the rotor number.
■Press the **START** key and the machine will start running (if you need to stop midway, please press the **STOP** key). The time will gradually decrease from the set value to zero. When the time value is displayed as zero, the centrifuge will automatically stop. At this time, the speed will gradually decrease from the set value to zero (the time taken for the speed to decrease from the set value to zero is related to the deceleration setting). When the speed becomes zero, the machine will emit shutdown sound. Press the **STOP** key to stop the sound. Centrifugation completed.
■**If short time centrifugation is required:** Please press and hold the **FLASH** key on the control panel, and the speed will continue to increase. Release the key to stop.The maximum speed during this time will be the set speed corresponding to the rotor number and time increase in sec.
■**Reminder tone setting:** Enter the menu interface for settings.
■**Storage Memory Setting:** The device provides 10 sets of custom memory programs for different experimental parameters. P1-P5 is a commonly used shortcut key on the control panel. For P6-P10, please press the storage icon in the screen to enter. To cancel storage and switch to normal operation mode, press the NORMAL key.

■**Pre-cooling setting:** To use this function, install a rotor and close the door cover, otherwise the expected effect cannot be achieved! Press the **PRE-COOLING** key on the control panel.

The pre-cooling confirmation interface appears on the screen. Click Yes to activate the pre-cooling function. The pre-cooling process and the pre-cooling finish displays are as follows:





The fixed temperature is 0.0 ºC. When the temperature drops from room temperature to 0.0 ºC, the countdown runs for 3 minutes (keeping the temperature inside the centrifugal chamber in depth) and the status bar appears. Press the **START** key to end this function.

■Manual setting of rotor number: When the automatic recognition of the centrifuge fails or the fault code Error12 appears.
When an Error17/Error18/Error19/Error20 alarm occurs, simply enter the secondary menu interface and turn off the rotor recognition function. To turn off the password, ask for it to your dealer.
■After the machine speed stabilizes, if necessary, the parameters such as speed/centrifugal force, time, acceleration/deceleration can be modified again.
■**End prompt tone/tone key:** This device comes with four end and mute states for selection, and the

sound key can also be manually turned on and off.

■ **Language selection:** This machine comes with Chinese and English interfaces for selection.

■ **Screen brightness setting:** The screen brightness can be adjusted on the second page of the menu interface; 0-100 adjustable.

■ **Timer Mode:** There are two timing modes, namely start timing and stable speed timing.

Menu function is shown in the following figure:

Figure 8: Menu function

- **Before setting parameters, the rotor must be correctly installed on the shaft.**
- **If an error is found during the parameter setting process, the parameters can be reset.**

5.11 Calculation of centrifugal force

The relative centrifugal force is generally thousands of times the gravity of Earth (g). It is a unit used to measure the efficiency of centrifuges in separating objects. The calculation of centrifugal force is related to centrifugal speed and centrifugal radius, and is calculated according to the following equation:

$$RCF = 11.18 \times (n/1000)^2 \times r$$

r: Centrifuge radius, in cm
n: Centrifugal speed in rpm (revolutions per minute)

Note: “The maximum centrifugal force value is related to the maximum centrifugal radius”.
The “centrifugal force value” set should take into account the radius of the rotor and the shape of the centrifugal container.

5.12 Running curve interface

Speed Temperature

When the instrument is running, it can be observed in real-time through a digital interface or curve interface. The curve interface can display real-time curves through the Speed and Temperature icons, and the speed, timing, and temperature can be adjusted in real-time.

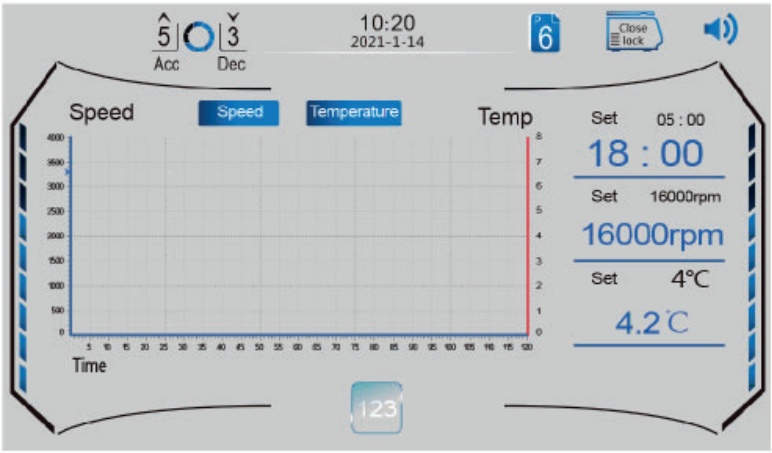
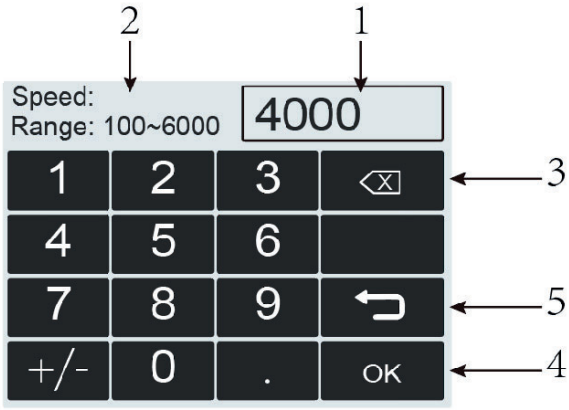


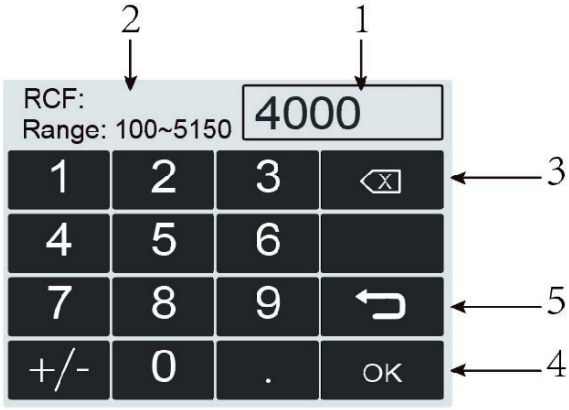
Figure 9: Schematic diagram of the operation curve interface

5.13 Main parameters setting interface



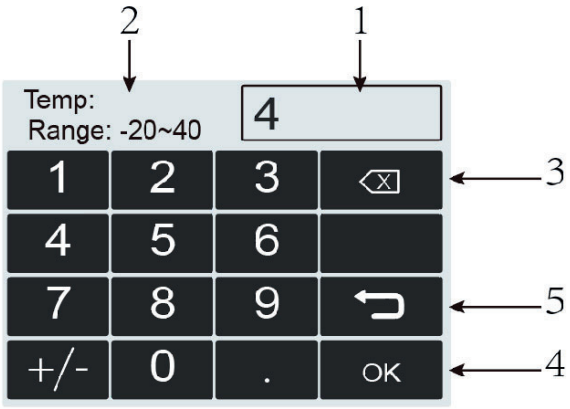
Speed setting interface

1: Set speed display
2: Speed setting range display
3: Delete key
4: OK/Confirm key
5: Return key



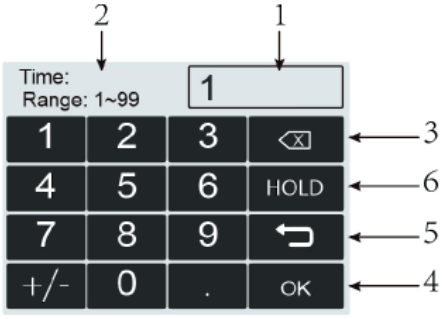
Relative centrifugal force setting interface

1: Set centrifugal force display
2: RCF setting range display
3: Delete key
4: OK/Confirm key
5: Return key

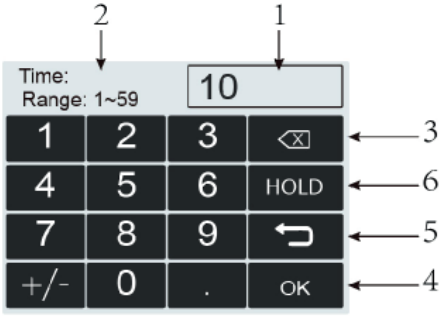


Temperature setting interface

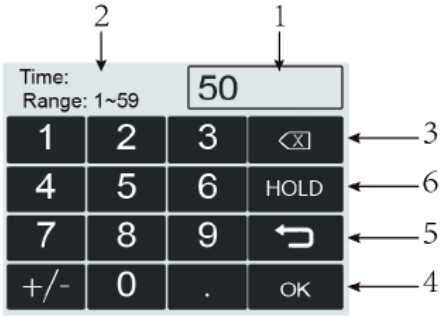
1: Set temperature display
2: Temperature setting range display
3: Delete key
4: OK/Confirm key
5: Return key



Hour setting interface



Minute setting interface



Second setting interface

Time setting interface

1: Set time display
2: Time setting range display
3: Delete key
4: OK/Confirm key
5: Return key
6: HOLD continuous mode

6. MAINTENANCE

6.1 Cleaning / Decontamination

Do not attempt to clean the centrifuge when the power cord is plugged in or the power switch is turned on. If the equipment or accessories are contaminated by pathogenic, toxic or radioactive materials, it is the responsibility of the user to perform proper cleaning/decontamination. The selected cleaning/ decontamination method could damage the equipment; consult with your supplier first. If you plan to send equipment or accessories to the Technical Service for repair, you must ensure that are clean and harmless to the human body.

Do not use organic solvents because it can decompose the grease in the motor bearings; during the cleaning process, liquids, especially organic solvents, cannot be contacted to the motor shaft and the bearings.

Regular cleaning and maintenance work should include centrifuge shell, inner chamber and rotor. This is to prevent pollutants from being left on the surfaces, causing corrosion and environmental pollution.

6.2 Maintenance

- Do not use sharp objects to collide with the rotor. Prevent bumps during handling and disassembly. Prevent cracks in the rotor during use due to scratches or trauma.
- Regularly check the rotor assembly for corrosion spots, grooves, and small cracks. If any of the above conditions are found, stop using the rotor and contact the Technical Service.

Note: When disassembling the rotor, hold the rotor with both hands and lift it up vertically without shaking it from side to side.

- Normally, the rotor should be cleaned once a week. If it is used for salt solutions or other corrosive samples, please wash it immediately after use. If the sample is found to be spilled on the rotor, it should be immediately drained and partially cleaned.
- When cleaning the rotor, clean it with a mild detergent dampened with a sponge or cotton cloth, then wash off the detergent with distilled water. Do not sprinkle or spray the rotor with water as the liquid may be left somewhere and cause corrosion. Allow to invert and dry after washing.
- Use rags or tweezers to remove the dirty debris in the centrifuge chamber.
- The connecting parts of motor shaft and rotor shaft hole shall be coated with lubricating oil.
- Steps for motor shaft maintenance:

  - Turn on the power switch and wait until the self-inspection is completed; press the key to open the centrifuge door cover.

  - Use the supplied special tool for disassembling and assembling the rotor, unscrew the locking nut, take out the rotor, and clean the tension sleeve. Note: the clockwise direction is to tighten the locking nut, and the counterclockwise direction is to loosen the locking nut.

  - Clean the taper surface of the motor shaft, and do not leave dirt. Add proper amount of lubricating oil or use lubricating paper to coat it.
- When disassembling and assembling the machine, the power must be cut off first, and the power cord connected to the back wall of the machine must be unplugged. Live operation is not allowed to prevent the personnel from getting electric shock or damaging the machine. Note: This operation can only be carried out by specially trained maintenance personnel.
- Only use spare parts supplied by the manufacturer.
- The power supply shall be cut off when the centrifuge is not in use.
- Transportation and storage

■This machine is a precision device. During transportation and storage, please pay attention to moisture-proof and shockproof. Do not place it horizontally or upside down.

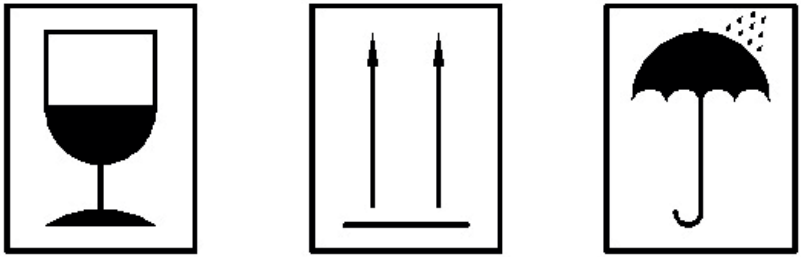


Figure 10: Precautions for transportation and storage

7. TROUBLESHOOTING

7.1 Emergency door opening

During normal use, due to accidental power failure or door opening failure, you cannot use the automatic door opening function. In this case, you can use the centrifuge's manual door opening method to open the door cover and take out the samples. Note: This method is only allowed to be used in an emergency and must not be used casually.

Note: In case of power failure, the rotor stops running without braking function. It takes a long time to stop completely. Please wait patiently.

Emergency door opening steps are as follows:

■Confirm that the rotor stops completely.

■Turn off the power switch.

■Use the supplied tool, insert it into the emergency door opening and turn it clockwise until the door cover is opened; then you can take out the samples.

7.2 Fault alarm information

The following list shows the alarm information indicated by the centrifuge, the causes of related faults and solution methods, so you can eliminate the faults according to the prompts. If the user is still unable to eliminate the fault after trying or the indicated alarm information is not in the following list, the user should immediately contact the Technical Service.

Note: In case of any abnormality, turn off the power supply first, and then identify the failure according to the error message and act accordingly.

Table 3: Fault alarm information

Fault code	Meaning	Troubleshooting
Error 01	Imbalance	1- Place the samples in balance, with an allowable imbalance of ≤ 1.5g. 2- Check whether the two ends of the output line of the imbalance protection switch are short circuited and closed (under normal circumstances, it should be in an open circuit state). 3- Contact the dealer to replace accessories.
Error 02	Speeding	When it is detected during operation that the speed exceeds the maximum rotor speed by 600rpm; it usually occurs in the rising stage and the speed up gear should be reduced.
Error 03	Door cover not closed	1- Check if the door cover signal wiring is properly plugged in. 2- Check if there is an open circuit at both ends of the lead wire of the door cover detection switch (it should be in a short circuit closed state under normal door cover closure).
Error 04	Hall sensor fault	Motor Hall sensor fault, check if the motor Hall sensor wire is properly connected or if the Hall sensor is damaged.
Error 05	Brake overpressure	1- Check if the brake resistor is properly connected or if the brake resistor is burnt out. 2- Reduce the DEC value.
Error 06	Overcurrent	1- Accelerate too quickly under heavy load, reduce the ACC value. 2- Drive board failure or high external power supply voltage. 3- Motor failure.
Error 07	No speed measurement	1- Check the speed measuring cable to ensure that it is connected properly. 2- The motor speed measuring Hall sensor is faulty, and the speed measuring plate at the end of the motor needs to be replaced.
Error 08	Communication error	1- Check if the communication cable (10 pins grey flat cable) is connected properly. 2- The drive board is faulty and needs to be replaced.
Error 09	Overvoltage	Ensure that the voltage supply of the external power grid meets the rated voltage of the machine.

Fault code	Meaning	Troubleshooting
Error 10	Temperature measurement fault	1- Check if the sensor plug is connected properly. 2- Sensor open circuit, contact the dealer.
Error 11	Speed not reached	Contact the dealer.
Error 12	Rotor identification fault	The rotor is not installed in place.
Error 13	Missing rotor identification signal	1- The rotor is not installed in place. 2- The magnetic steel at the bottom of the rotor falls off.
Error 14	Rotor mismatch	Check if the set rotor is consistent with the actual rotor.
Error 15	The rotor cannot be identified	1- Check if the sensor plug is connected properly. 2- Sensor open circuit, contact the dealer.
Error 16	Wrong rotor setting	Check if the set rotor is consistent with the actual rotor.
Error 17	Drive overtemperature protection	Drive board module temperature too high.
Error 18	Low voltage	The input voltage of the mains power supply is too low.
Error 19	Record export failed	USB drive export history failed 1- USB drive not connected or not inserted properly 2- USB drive not formatted as required 3- Loose USB drive connection cable
Error 20	Unlock timeout	When the unlocking action exceeds the set time, the fully opened position is still not detected.
Error 21	Lock timeout	The locking action exceeded the set time and still did not detect the fully closed position.
Error 22	Switch limit error	Simultaneously detecting switch limit.

Table 4: Failures, causes and troubleshooting

Failure	Faiulure causes and troubleshooting
Display off or suddenly the display turns off	1. Check whether the power socket and the connection are good, and whether the power socket is charged. 2. Check whether the power switch has no good contact. 3. Check the fuse. If it is blown, please replace the fuse. 4. If the cause cannot be found, please contact the Technical Service.
The machine is suddenly stopped in operation	1. The speed is over the maximum rated speed of the rotor. 2. Once the rotor exceeds the max. rated speed of the rotor by more than 600 rpm, the overspeed alarm will work immediately. At this time, the speed must be reset after the shutdown. 3. The speed is over the set speed. 4. When the motor is overheated, the power is cut off inside the machine and the machine stops running. 5. If the keyboard panel does not work, please check the power supply system of the machine. 6. The voltage may be too low; check whether the power supply voltage meets the requirements.
The door can't be opened	1. Rotor has not stopped completely; the door should not be opened. 2. Check the door lock components. 3. Check the electrical wiring of the door lock. 4. Open the door by manual method. 5. If the cause cannot be found, please contact the Technical Service.
The machine vibrates greatly	1. The rotor over the critical speed, some machine vibration is normal. 2. Check whether the rotor is locked. 3. Check the symmetry of the rotor load and check the level of the machine. 4. Check whether the rotor is properly installed. 5. Check the drive shaft and rotate by hand. If it cannot rotate smoothly, there may be a problem with the drive shaft or motor.
The display shows an exception	May be caused by the power grid interference, please shut down, to stop for one minute before the boot; the display can be normal again.
The motor does not rotate after pressing the start button	The electrical control circuit is broken, replace the electrical control board.
The machine smells burnt	1. Cut off the power supply. 2. Check whether the motor is burned down. 3. Check whether the electrical components are burned down.

8. TECHNICAL DATA

Function / Parameter	Technical data
Operating environment	Indoor use only There is no vibration and airflow affecting the centrifuge performance. There is no conductive dust, explosive gas and corrosive gas in the surrounding air. Altitude: ≤ 2000m Relative humidity: ≤80% Ambient temperature: +5ºC-40ºC
Power supply	220VAC±10%, 50/60Hz, 15A
Power	750W
Protection system	Electronic short-circuit overload protector
Set time range	1-99 hours/1-59 minutes/1-59 seconds. Three modes are available for selection. Accuracy ± 1 second.
Max. speed	16000 rpm±20 rpm The rated maximum speed of different rotors is different. Below the rated maximum speed, the speed can be set arbitrarily.
Max. RCF	23470×g
Max. capacity	400 mL (100 mL×4)
Acceleration	Speed up time from zero to maximum speed ≤ 18 seconds
Deceleration	Time to decelerate from maximum speed to zero ≤ 20 seconds
Temperature range	-20 ºC~+40 ºC / step increase of 0.1 ºC / display accuracy of 0.1 ºC / control accuracy of ±2 ºC
Display screen	Touch screen, 7-inch IPS color LCD display, resolution 1024 × 600dpi
Cooling effect and temperature stability accuracy	When the temperature of the centrifugal chamber is consistent with the ambient temperature, the cooling time of the centrifugal chamber to reach 0 ºC shall not exceed 15 minutes. At the highest speed and corresponding load of the centrifuge, the lowest temperature of the centrifugal chamber can be cooled to -12 ºC. The accuracy of the temperature inside the centrifugal chamber shall not exceed ± 1 ºC.
Motor	Maintenance-free brushless variable frequency induction motor
Noise (at max.speed)	≤60dB(A)
Protection class	IP20
Size	493 mm (L)×584 mm (A)×345 mm (H)
Weight (without rotor)	60 Kg
Interference suppression standards	EN 61010-1, EN 61010-2-020, EN 61326-1, EN 61010-3-2/A2

9. PACKING LIST

Nº.	Name	Quantity	Notes
1	2811R model centrifuge	1	
2	Power cord	1	
3	Rotor	1	According to the order
4	Special hexagon key	1	
5	Lubricating oil	1	20 mL
6	User Manual	1	