LABDEX

Low Speed Refrigerated Centrifuge LX108LSR

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Index

1. Safety Measures

1.1 Attention to safety

Attention to safety clarifies the requirements of safe operation in the instruction manual. Kindly carefully read it before installation, operation, maintenance, and repair. Understanding the warning and correct operation can avoid personal injury and damage to the centrifuge.

1.2 Attention for installation and maintenance ·

The rotor accessory and package may be placed in the centrifugal chamber. When installing, you should open the door lid to check. In machine maintenance, the parts that need to be covered may cause electrical shock or personal injury. Ensure that the power has been cut off, the power line has been removed from the socket, and qualified staff has manipulated it. The replaced part must be consistent with the requirements of this centrifuge.

1.3 Attention to electric system ·

To reduce the risk of electric shock, the centrifuge adopts the plug with three points which must connect with the socket with ground lead. Make sure the wall socket is connected to the ground wire. The voltage of the power supply must accord with the voltage of the centrifuge. Don't use the power adapter from three holes to two holes. It is forbidden to use the expanding socket with two lines or an all-purpose power adaptor without ground wire. Don't put the container with liquid on the centrifuge or around the centrifuge. If the container is knocked over, the liquid will infiltrate into the centrifuge and damage the electrical or mechanical parts.

1.4 Attention for fireproofing

Kindly use the overload fuse with the same model and specification. The centrifuge is not designed for flammable and explosive matter. You cannot make centrifugation for the matter (chloroform, acetaldehyde), and cannot put the matter in the centrifuge or store them around the centrifuge within 30cm.

1.5 Attention to safe operation

- Kindly use the rotor and accessories that are designed for this centrifuge.
- Make sure the centrifugal chamber is cleaned before operation.
- Make sure the screw (nut) of the rotor in the centrifugal chamber has been screwed down.
- Not exceed the max speed of the rotor during operation.
- Don't decelerate rotor speed or stop by hand.
- Don't hold or move the centrifuge when the rotor is rotating.
- If the glass test tube is cracked in the centrifuge chamber, kindly carefully check and clean the gasket and centrifugal chamber because the glass fragment may have been inserted into their surface.
- Don't open the door lid of the centrifuge in the running status.

- The distance between the centrifuge and other objects must be kept at 30cm during operation. You should not stand around the centrifuge within 30cm unless adjusting it. Anything is not allowed to enter the centrifuge during the operation.

1.6 Attention to safety in chemistry and biology ·

- The routine manipulation may include all kinds of liquid and test samples which may be the disease-causing and poisonous matters. The centrifuge cannot be manipulated with the matters unless you have taken the protection measures. Kindly pay attention to the liquid explanation in the container before operation.
- Be careful of the infectious liquid. If not understanding the provided sample, kindly at least make sure that they aren't microbes. You must make further aerosol to protect the suspended specks in the air, such as smoke and fog.） for the easier disease-causing hepatitis virus(B or C), HIV, atypical mycobacteria, and the fungus of physical structure.
- The infectious samples must be manipulated according to the program and method in the lab to avoid expanding disease.
- The spilled matter may produce an aerosol (the suspended speck in the air, such as smoke and fog), so Kindly pay attention to the warning about aerosol (the suspended speck in the air, such as smoke and fog.
- Only use the suitable rotor and adaptor. The centrifuge cannot be manipulated with disease-causing, poisonous, or radioactive matters unless you have taken the protection measures. When the second type of hazardous substances (according to the "Laboratory Biosafety Manual" of the World Health Organization.) is manipulated, the air safety level must be monitored. The superior substances require a higher level of safe protection measurements.
- You should follow the environmental security and protection requirements when destroying the discarded liquid.

1.7 Symbols and Warnings

No	Symbol	GB No	Meanings
1	~	4706.1	Alternating current
2		4728.2	Protective earthing(ground)
3		4793	Warning!

2. Introduction

Low speed refrigerated centrifuge LX108LSR is a microprocessor controlled unit with a speed of 5350 rpm. LCD screen display various parameters like speed, time and RCF for viewing and monitoring parameters. When it reaches the highest speed, it can keep the temperature below - 4℃. With the built-in special wind deflector, after centrifugation for 15 minutes, the chamber temperature won't exceed 10 ℃, the sample temperature won't exceed 4℃, keeping the sample in a good state. Operation data and error code can be copied by USB for easy record.

3. Features

- Speed - 5350 rpm
- Microprocessor controlled system
- LCD display that indicates speed, time and RCF in operation
- Three tier protective steel covering
- Nine acceleration and ten deceleration profiles
- Automatic electric lid lock that provides protection against over speed and temperature and imbalance
- Environmental refrigerant, keeps the temperature below −4℃ at maximum speed
- Operation data and error code can be copied by USB for easy record
- Enables easy and quick loading of samples
- Optional rotors available

4. Specifications

Model No.	LX108LSR
Maximum speed	5350 rpm
Maximum RCF	5030 x g
Maximum capacity	4 x 750 ml
Timer range	1 min to 99 min
Speed accuracy	± 10 rpm
Temperature setting range	-20 °C to 40 °C
Temperature accuracy	± 1 °C
Compressor unit	Non-CFC (R404a)
Noise	≤ 65 dB
Power	1700 W
Dimension	565 x 660 x 860 mm
Weight	125 kg
Packing dimension	900 x700 x1320 mm
Gross weight	160 kg

5. Applications

Used in biochemical and clinical labs for precipitate separation and serum analysis, in pharmaceutical industry etc. and is perfect for DNA, RNA, PCR or antibody analysis.

6. Instrument Introduction

6.1 Structure for the whole machine

This centrifuge is composed of the main machine, rotor, and other accessories (by user's option). And main machine is composed of a machine frame, door lid, control panel, drive system, refrigerating system, and electric control system.

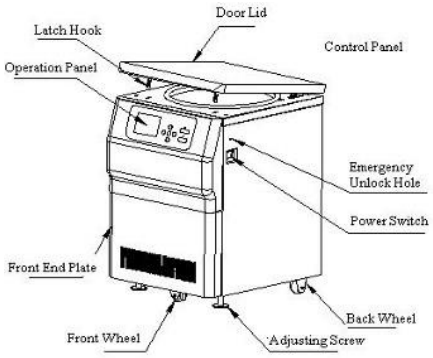


Figure-1

Working Theory

Centrifuge makes use of the strong RCF that centrifuge rotates with high speed to accelerate the settling speed of the granule in the liquid, and separate, condense, and purify the matters with different settling coefficients and density.

6.2 Refrigeration system

This centrifuge is equipped with imported compressor with two circuit controls for good efficiency in heating and refrigerating.

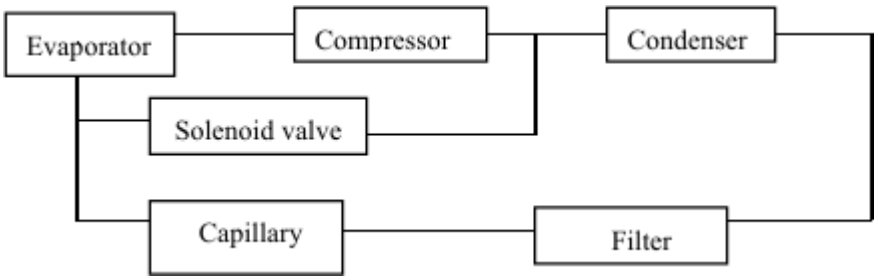


Figure-2 Refrigeration theory

6.3 Drive system

Direct drive system. A frequency conversion motor with high torque is equipped with a special shocking absorber for reducing vibration and noise

6.4 Electrical Control

System control is adopted 8-digit CPU, and motor drive is adopted by vector control technology for stable speed and energy saving, with over-speed and over-temperature protection functions.

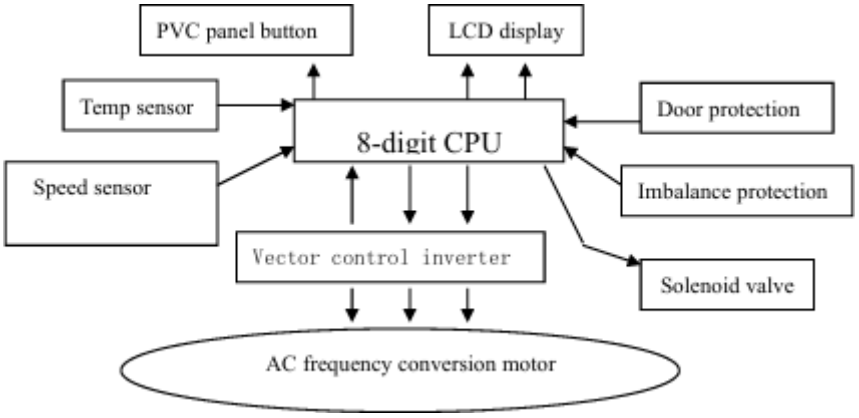


Figure-3 Electric Control theory

7. Installation

7.1 Unpacking of Package (by user)

Firstly, remove the nails on the top plank surrounding and take off the plank. Remove 8 PCs of M8 wooden screws connecting four side planks to the baseboard and discharge four whole side planks together. Take off the plastic cover and remove the front endplate after screwing off 2 wooden screws. Then twist off 3 bindings bolts that connect the baseboard and packing baseboard (2 bolts in the front of the baseboard and one in the back), at last offload the main machine from the packing baseboard. Then push the centrifuge to the installing place.

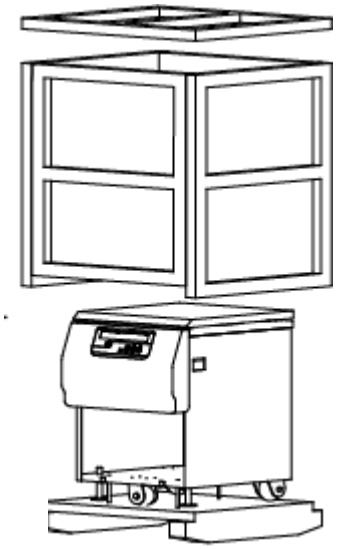


Figure-4 LX108LSR Unpacking

Attention:

The idler wheels of this centrifuge can be only moved a short distance on the smooth ground to avoid damage. Be sure to check the accessories and packing list after unpacking the case.

7.2 Installing the requirements (by user)

1) **Environment requirements:**
   This centrifuge should be installed indoors with steady ground, no conducting dust, no corrosive gas, no strong shock source, and no direct sunlight.
2) **Space requirement:**
   The distance between the centrifuge and wall should be kept at 30cm at least for air circulation. The room temperature should not exceed 35°C for best efficiency.
3) **Power requirements:**
   This centrifuge is adopted AC with single phase, 220V/50Hz and 16A. Power must be equipped with a protecting ground wire, and it is forbidden to use the null line for substitution. If users have any questions about power type, kindly consult your distributor or local power station.

Note: The ground wire should be connected properly in case of electric shock. As a safety measure, this centrifuge is adopted with a single phase and three wires plug to make sure of grounding. If your plug can not plug in the main jack, kindly contact the electrician to replace your main jack. Make sure that the centrifuge is grounded properly.

4) Place the centrifuge on a steady platform or table. Make four rubber cushions stand in balance to prevent vibration. Otherwise, add some pads to readjust the height up to the requirements (by the user).

7.3 Centrifuge adjustment

1) **Checking the goods:**
   Check the packing list and make sure that damage occurred during delivery.
2) **Door lid opening:**
   Check the connection of all connectors and fuses first and turn on the main switch. The door lid will be opened automatically by pressing the "**STOP**" button after the last centrifugation parameters are displayed on the LCD screen.
3) **Rotor installation**:
   The rotor should be checked carefully before use. It is forbidden to use the rotor and buckets with cracks and corrosion spots (especially the bucket bottom of the swing rotor). All accessories should not be used if they exceed their service life. The conical surface of the driving shaft should be smeared with some lubricating grease if the main spindle is left unused.

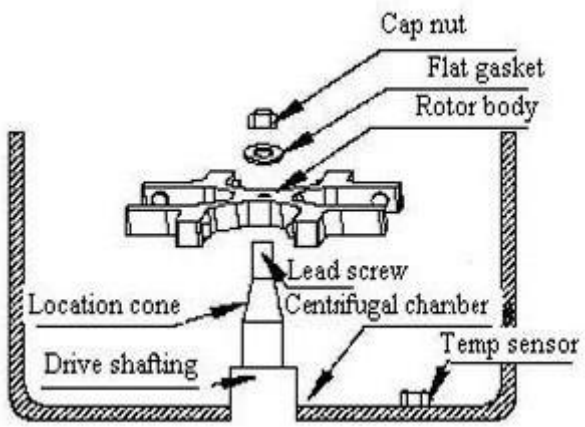


Figure-5 Rotor installation steps

Note: The conical surface of the rotor and driving shaft must be connected closely. As shown in the above figure: Firstly, clasp the symmetric spoke of the rotor, and put it on the rotor base vertically and placidly while the rotor bottom's location cone aims at the location cone of the drive shaft; then put the flat gasket on the lead screw and screw down the cap nut. At last, hold up the rotor steadily (not shacking) by one hand, and put the 19 solid wrench on the cap nut by another hand. In the meantime, turn the wrench for 3 to 6 rounds in a clockwise direction until the rotor connects the drive shaft closely.

Rotor Disassembly (after finishing adjusting the centrifuge)

First, clasp the spoke of the rotor with one hand, and put the 19 solid wrench on the cap nut by another hand. In the meantime, turn the wrench in a counterclockwise direction to loosen the cap nut. Then clasp the symmetric spoke of the rotor and lift the rotor vertically until the rotor separates from the driving shaft. If the rotor is not taken out from the drive shaft for a long time and blocked, you can beat the surrounding spoke of the rotor several times slightly with a wooden or rubber hammer. Then clasp the symmetric spoke of the rotor lift slightly by both hands and put the rotor on the flat table and ground covered with a soft pad.

Attention: All actions on the rotor must be soft to avoid damage to the driving shafting.

4) **Adjusting the level of the main machine:**

Take out the gradient after rotor installation, open the lid of the centrifugal chamber, and then put it on the rotor bracket. Adjust 2 leveling screws (on the front of the baseboard) until the bubbles of any direction are all located in the center.

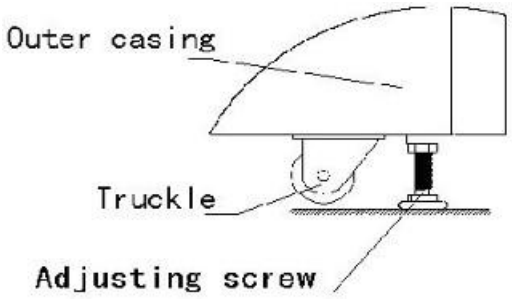


Figure-6 LX108LSR

Warning: Adjust the screws for instrument leveling; reliable installation can reduce rotor damage

Attention: Make sure that 2 back when and 2 adjusting screws are all stressed, it is forbidden for hanging. Installation, adjustment, and maintenance must be done by a professional technician

5) **Material adding and counterweight**

 It is not allowed to exceed the max imbalance volume: Any buckets should not be taken off before operating.

 Before moving the instrument, the rotor must be taken out of the main shaft against the damage.

Weighing the buckets while holding blood bags by balance, the weight difference should be kept ≤2g. By using centrifugal bottles, only the bottles first, and then insert them into buckets with a weight difference of ≤2g. The buckets should be inserted according to the rotor with the whole amount to prevent rotor imbalance. (Substitute sample with the same density should be added in if only a little original sample).

6) **Close the door lid**
The door lid can be closed properly after two latches are inserted into the lock hole at the right and left sides according to sound production**.**

7.4 Storage Conditions

- Users should use the wooden case and carton during long-distance transportation. Put a centrifuge with a dust cap into the case and fill it with foam or plastic shock absorption materials. It is forbidden to be hit, inverted, rolled, and soaked by rain and snow.
- Users can directly move the centrifuge in the room, but avoid big vibrations, hitting, and inversion.
- If it is left unused for a long time, you should open the door lid and store it in a ventilated, dry, and clean room where there is no corrosive, flammable explosive matter.
- As the technology continuously renews, kindly consult us if there is something unconformable with this instruction manual.

8. Operations

8.1 Instrument Panel button illustration

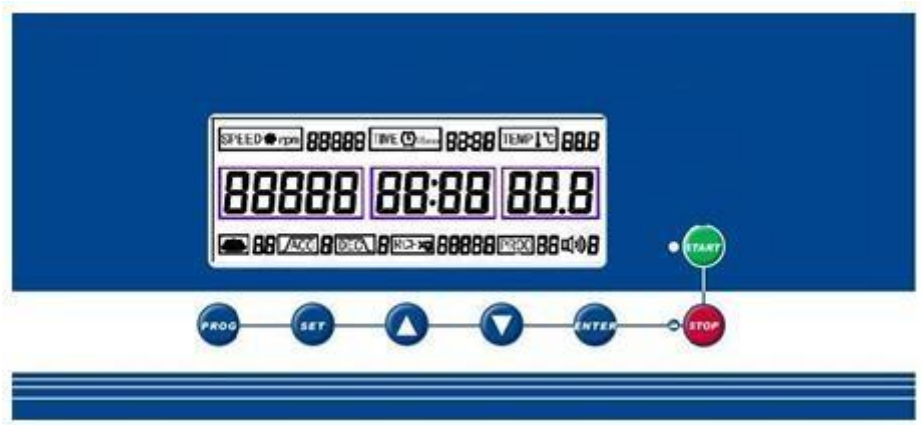


Figure-7 Instrument Panel

8.1.1 LCD Display Window

	Rotor: Display set up or current running rotor No.
PROG	**Program:** Display running program No.
SPEED rpm	**Speed:** The speed display window shows the setup speed and the actual running speed (unit: Rpm).
TIME H:mm	**Time**: The time display window shows the setup time and the running time (unit: minute and second).
TEMP °C	**Temp:** Temperature display window, show the setup temp and the running temp (unit: °C)
RCF	**RCF:** RCF displays the window in real-time.
ACC	**Acceleration:** Display setup acceleration profile.
DEC	**Deceleration:** Display setup deceleration profile.

8.1.2 Key function:

- **SET:** Setting key. Set program No., rotor No., speed, time, acceleration, and deceleration profiles by pressing this key once or several times until the selected item flashes.
- **PROG:** Program key. Select program preferences; revise and save program preferences.
  - ▲Increase key. When you set rotor number, speed, Acc/Dec, and time, press "▲" to increase the setting parameter value.
  - ▼Decrease key. When you set rotor number, speed, Acc/Dec, and time, press "▼" to decrease the setting parameter value.
- **ENTER:** Press [ENTER] to confirm and store the setup values of rotor No., Acc/Dec. profiles, speed, and time.
- **START:** Press [START] to begin centrifugation after setting and confirming the parameters or repeating the setup parameters last time, and the start indicator light on.
- **STOP:** The key to stop centrifugation and open the door lid. When the centrifuge is working (time isn't counted down to "0"), you can stop it by manually and the stop indicator light on. When the centrifuge is in the state of standby, press it to open the door lid.

8.1.3 The functions of indicator light

- [**START**] indicator light: The [**START**] indicator light is on, which means that the centrifuge has started and is in the running status.
- [**STOP**] indicator light: The [**STOP**] indicator light is on which means [STOP] is pressed or the work time is counted down to "0". The centrifuge is slowing down for stopping or has stopped.

8.2 Instrumental Panel and Parameter setting:

After powering the machine, the system displays the setup value in the last operation which was stored before it stopped. Then press [START] to run. If the user require modifying the setup value, kindly operate according to the following steps:

1) **Select, store, and modify the preset program.**
   - **Program storing:** "In the stopping status, press "PROG" once, and the" PROG 88 value flashes (PROG character will not flash), then press [▲]/ [▼] to select the preset program (preset programs are 1 to 25, a total of 25 programs). At last, must press "ENTER" to confirm the current settings. Otherwise, it will automatically cancel the setup after 3 seconds.
   - **Program using:** In the stopping status, press "PROG" twice, and the " PROG 88 " value and character flash simultaneously, then press [▲]/ [▼] to select the stored program (preset programs are 1 to 25, a total of 25 programs). At last, must press "ENTER" to confirm the program selection. Otherwise, it will automatically cancel the setup after 3 seconds.

- **Program modifying:** Operate according to the following 2 ～ 7 steps: press
- "**ENTER**" to confirm and the current program will automatically be stored as 

0. If press "PROG" in the status of parameters not being modified 

, the digital value will flash (but 

character will not flash), and press "ENTER" to confirm. The current program will automatically be stored to " 

XX" (XX is 1 to 25, no more than 25 programs).

2) **Rotor number:** Press the "SET" key until the last number of " 

" display window flashes, and then you can set the rotor number; press "▲" or "▼" to select the installed rotor number. Press "**ENTER**" to keep the current setting at last, otherwise it will automatically cancel the setup after 3 seconds. It is prohibited to modify the rotor number during a run.
Attention: The rotor type should be set according to the installed one. The wrong setting will make the rotor overspeed and lead to an accident.

3) **Speed:** Press the "**SET**" key until the last number of " 

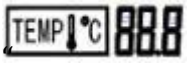
" display window flashing, then you can set the speed value; then press "▲" or "▼"to set the speed for this centrifugation. Press "ENTER" to keep the current setting at last, otherwise, it will automatically cancel the setup after 3 seconds.

4) **Time**: Press the "**SET**" key until the last number of " 

" display window flashing, then you can set time (Time range: 1min00s～99min59s or continuous centrifugation 

Hold); and then press "▲" or "▼" to set time for this centrifugation(set minutes while the second figure of /"min" flashes; set seconds while the fourth figure of 

/"s" flashes). Press "**ENTER**" to keep the current setting at last, otherwise, it will automatically cancel the setup after 3 seconds.

5) **Temp:** Press the "**SET**" key until the last number of " 

" display window flashing, then you can set temperature (Temp range: -20～40℃); and then press "▲" or "▼" to set a desired temp for this centrifugation. Press "**ENTER**" to keep the current setting at last, otherwise, it will automatically cancel the setup after 3 seconds.

6) **Acc profiles**: Press the "SET" key until the last number of " 

" display window flashes, then you can set Acc profiles; and then press "▲" or "▼" to set Acc profiles for this centrifugation. There are 1~9 Acc profiles, and the acc time would be shorter while the setting figure is bigger. We choose 5 usually. Press "**ENTER**" to keep the current setting at last, otherwise it will automatically cancel the setup after 3 seconds.
Warning: Choose an Acc curve according to rotor load. You should choose the moderate value of the Acc curve if there is no special requirement.

7) **Dec profiles**: Press the "**SET**" key until the last number of "  " display window flashes, then you can set Dec profiles; and then press "▲" or "▼" to set Dec profiles for this centrifugation. There are 1~9 Dec profiles, and the stopping time would be shorter while the setting figure is bigger. We choose 5 usually. Press "**ENTER**" to keep the current setting at last, otherwise, it will automatically cancel the setup after 3 seconds.
   Note: Choose Dec Curve according to rotor load. You should choose the moderate value of the dec curve if there is no special requirements.
8) The above steps can be set continuously, and press **[ENTER]** to confirm at last. After confirming the setting value of the rotor number, speed time, etc., press [**START**] to run the centrifuge. If [] error code shows which means maloperation, you should reset rotor No. or speed parameters.

8.3 Centrifugal Operation

1) **Timing centrifugation operation**: Press [SET] and set  as any value of 01:00 ～ 99:59(Regular operation mode). Press [**START**] to start the centrifuge and the [**START**] indicator light is on. The value of the running time window is the countdown centrifugation time (XX: XX～00:00), and the unit of time is the minute: second. When time is counted down to "0", the centrifuge automatically slows down and stops running. When the speed is 0 r/min, the buzzer will tweet, and the **[STOP**] indicator light is on.
2) **Pulse centrifugation(short-time) operation:** Press [**SET**] and set  as any value of 01:00～99:59(Pulse/short-time operation mode). Press [**PULSE**] to start the centrifuge and the [**START**] indicator light is on. The  "PUSE" shows and the cumulated centrifugation time (an increase from 00:00) is displayed in the running time window (the unit of time is minute: second). When the [**PULSE**] button, the centrifuge automatically slows down and stops running. When the speed is 0 r/min, the buzzer will tweet, and the [**STOP**] indicator light is on.
3) **Continuous centrifugation operation (HOLD mode)**: Press [**SET**] and set  as "A0: XX" (continuous centrifugation mode). Press [**START**] to start the centrifuge and the [**START**] indicator light is on. the cumulated centrifugation time (an increase from 00:00) is displayed in the running time window  "**Hold**" (the unit of time is minute: second). When pressing the [STOP] button, the centrifuge automatically slows down and stops running. When the speed is 0 r/min, the buzzer will tweet, and the [**STOP**] indicator light is on.
4) **Stop by manual**: In the running status (the working time isn't counted down to "0"), press [**STOP**] to slow down and stop running. The buzzer will not tweet, and the [**STOP**] indicator light is on.
5) **Abnormal stop**: The centrifuge automatically slows down and stops running when the instrument appears some error, such as, the door lid not closed well, imbalance, overspeed, inverter error, and so on during running (the time is not counted down to 0, and the [**STOP**] light on. At the same time, the error

displaying window displays an "X" error code. It can be saluted by pressing the [**STOP**]. And do related shooting when stopped.

6) **Open the door:** The centrifuge will stop automatically when the running time to "0 r/min" or the centrifuge has a problem, press [**STOP**] to open the door lid (if the door lid cannot open when the electric power cut, open it by insert the special tool (screwdriver) into the hole for emergency door opening on right side of the machine), buzzer will tweet several times. The centrifuge will stop running when press [**STOP**] key during running, and the buzzer will not tweet.

8.4 Rotor preparing and installing

- Choose corresponding rotor and centrifugal buckets by sample requirements.
- Weighing the tubes or bottles with holding sample by electric balance, the weight difference is not allowed to exceed the max imbalance volume. The equivalent tubes or bottles must be placed in the rotor symmetrically. Then screw down the rotor lid and close the door lid.

8.5 Operational Procedures

8.5.1 Attention Before Operation

A subtle fault in operation will cause the centrifuge damaged because the centrifuge runs at high speed. Therefore, the operator should read the instruction manual carefully for safe operation, and notice the following items:

1) The rotor running must not exceed its maximum speed.
2) It is forbidden to run an imbalance rotor. (Big imbalance of blood bags, test bottles, and tubes, or the sample is not set in balance).
3) The rotor should be installed on the motor shaft correctly and locked by a special tool.
4) Check rotors and buckets before using them to avoid cracks and corrosion. forbidden to use those rotors.
5) The door lid must not be opened during operation.
6) It is forbidden to use the centrifuge which has not been adjusted level.
7) Check whether the external power source accords with the standard.

8.5.2 Rotor preparing and installing

1) Choose corresponding rotor and centrifugal buckets by sample requirement.
2) Weighing the tubes or bottles with holding sample by electric balance, the weight difference is not allowed to exceed 2g. The equivalent tubes or bottles must be placed in the rotor symmetrically. Then close the door lid.

8.5.3 Simple operation procedures

1) Plug in power, and then turn on the main switch. The LCD window would show the last using parameters.
2) Press the [**STOP**] key to open the door lid. Place the rotor on the motor's main shaft and screw down the cap nut (lift the rotor by hand to make sure there is no space). Put test tubes (in even numbers and test samples should be equal) into rotors or buckets and set them symmetrically.
3) Close the door lid to make it locked and conduct a manual check if it is locked properly.

4) Press the [**SET**] key to choose the parameter and then press [▲/▼]to modify the parameter. Press [**ENTER**] to keep the current setting at last. Press [**START**] to operate the instrument， the working parameters will be displayed in the window. Press **[STOP**] to brake at any time during a run. If there is any Error code shown during a run or setting process, just press [**STOP**] to clear the code and deal with it accordingly.
5) When the time is counted down to "0" the instrument will stop timing and slow down to stoppage. Then the door lid can be opened and the sample.
6) Open the door lid and take out centrifugal tubes or bags when the rotor is completely stopped. It is forbidden to reduce the speed of rotating rotors and accessories by hand.
7) Power off and unplug the power cable.

8.6 Safety and Protection

This centrifuge has 6 protection functions and will stop automatically when trouble occurs. The error code will be displayed in the "error display" window, then press "**STOP**" for display clearance.

- **Error code 2**：Over-temperature protection
  The system will be stopped automatically for damage to the temperature measurement element, and poor refrigerating effect. It will display "E2".
- **Error code 5**：Door lid protection
  Since the centrifuge runs at high speed, it will not run for the door lid opening. If forcing the door lid open during a run, the system will be stopped automatically, and "E5" will be then displayed.
- **Error code 6**：Over-speed protection the system will be stopped Automatically if the actual speed is over the rotor max speed or the setup speed by 500r/min. "E6" will be then displayed.
- **Error code 7**：Velocity-measuring protection
  The centrifuge will not stop when the velocity-measuring system is broken, the error "7" will display.
- **Error code 8**：Error manipulation
- Before a run error occurs, the system cannot work; during a run set wrongly, the setup would be invalid. In standby mode press the [START] key, and the error "8" will be then displayed while it cannot start.
- **Error code 9**：Communication(inverter) trouble While the motor driver or Inverter has trouble, the system cannot work and the error "9" will be then displayed.

8.7 RCF value and allowable Max. Speed

8.7.1 Calculating RCF Value

The setting rotor number of this centrifuge can calculate the RCF value automatically.
We can draw RCF value from the following formula:
RCF=1.118×10-5×r× N2 (g)
N: Speed (r/min)
r: Centrifuging radius (cm)
g: Gravity acceleration (9.8 M / S2)

8.7.2 The Explanation of Rotor's Allowable Max. Speed

- Every centrifugal head mark Max. speed value in an obvious position (Or the Max. speed value is emphasized in the introduction manual.). The value is the allowable Max. speed on the conditions that the centrifugal head uses with plastic tube and aluminum tube cover and the density of samples is no more than 1.2 g/ml.
- If the density of centrifugation samples is more than the required 1.2g/ml, the Max. speed of the centrifugal head should accordingly decelerate. It can be calculated by the following formula:

$$\mathbf{N}\text{allowable}_{\text{max.speed}} = \mathbf{N}_{\text{Max.speed}} \times (1.2/\text{new density value})\text{-}0.5$$

9. Maintenance

We try to reduce the complex work of maintenance and checking in the centrifuge's design. But the operator should also maintain daily according to the requirements of the "**Instruction Manual**" for long-term, safe, and efficient work.

9.1 Centrifugal Chamber Maintenance

Clean the centrifugal chamber time, take out the rotor, and then scrubbed by a clean cloth. Put the silica gel bag into a chamber if the centrifuge will not be used for a long time to absorb humidity and avoid rust.

9.2 Drive Shaft Maintenance

The drive shaft must not be hit for conical surface/cone protection. Use a soft cloth to clean the drive shaft and taper hole before rotor installation, and then smear some Vaseline or other lubricating grease.

9.3 Control Case and Workbench Maintenance

Keep the control case and workbench clean, the rotor, centrifuge tube, and test glass are not allowed to be put on the centrifuge panel. The control case and workbench should be cleaned with a soft cloth and neuter cleanser. It is forbidden to use a corrosive cleanser (for 84thimerosal) to sterilize the centrifuge**.** The rotor must be taken out after finished centrifugation every day.

10. Troubleshooting

Error Code	Description	Reasons	Solution
2	Temperature sensor broken	The digital temperature the sensor circuit is broken.	Welding or replace.
	Centrifugal chamber temperature is too high	The refrigeration system is broken.	Refrigeration system maintenance.
5	Door lid protection	The door lid isn't closed when pressing [START].	Close the door lid Properly.
	The door opens during the run	The sensitive switch of the door lid detecting triggers the protection function during centrifugation.	Close the door lid properly.
6	Overspeed	Check and reset speed, rotor number, Acc, and Dec value.	Reset parameters.
7	The motor does not run or runs without speed	The motor runs without speed; The speed-detecting signal is unreliable, or the speed sensor is damaged.	Check and replace.
		The motor does not run, and the shaft is blocked.	Replace motor.
9	Motor driver trouble	Overcurrent, overvoltage, overheating, and damage in the process of Acc and Dec.	Replace the board.
	Inverter trouble	Overcurrent, overvoltage, overheating, and damage in the process of Acc, and Dec.	Power off and restart.
		The connecting wire to the inverter is broken and the inverter is damaged.	Check the connecting wire.

Note:

- Kindly check carefully again when trouble appears, users can start the centrifuge just after or code has been cleared by pressing the [STOP]key.
- Some trouble needs to turn off the power and start again to clear the error code, such as 9.

Trouble	Cause	Removal
Rotor work can't	The power supply connection is not proper.	Check power supply
Poor refrigerating effect	The temperature of the environment and the centrifugal chamber is too high;	Turn on the air-conditioner to cool the room temperature
	The centrifuge is installed too near the wall	Place and install the centrifuge properly.
	The heat sink in the condenser is blocked by dust or the condensing fan is broken;	Check the condenser connection and clean
	The refrigerant in the refrigerating system is leaked and interfaced with air, or the refrigerating pipeline is blocked and broken.	Check pipelines of the refrigeration system
	After reparation the quantity of refrigerant pumped in is improper.	Add or replace the refrigerant.
Loud noise or abnormal sound	Whether the ground is stable and there is a strong shock around。	Place and install the centrifuge properly.
	The dynamic balance of the rotor is damaged.	Repair or replace the rotor
	The tube/bottle balance does not meet the requirement or is not placed symmetrically.	Weight the equivalent (or between the tolerance range) sample symmetrically.
	The level is not adjusted properly, and the stress is not even	Install the rotor properly and readjust the level
The temperature rises too high to get the desired centrifugation effect	The temperature measurement elements are damaged.	Replace
	The compressor cannot work	Check the compressor
	The ambient temperature is too high which makes over-temperature protection invalid	Lower the ambient temperature
Power trouble	Unstable voltage	Adopt a stable power supply
	Unstable speed	Chose the normal voltage
The door lid cannot be closed	The door interlock does not reset	Insert the special tool into the emergency door-opening hole to make the interlock reset.
Over-speed	The velocity-measuring element is damaged	Replace the velocity-measuring element
	Over-speed setting	Reset the speed

Error manipulation	Centrifuge cannot work normally	Reset correct parameters till the speed is descended to 0.
Inverter trouble		Check if the temperature of the inverter is over 45℃, unpack the front shroud, and turn off power for 5 minutes to retry

11. Rotor Selection

Rotor name	Maximum speed (rpm)	Maximum capacity (ml)	Maximum RCF (×g)
Angel rotor R1	5350	6 x 50	5030
Swing rotor R2	4000	4 x 500	3040
Microplate rotor R3	4000	2 x 2 x 96 Wells	2200
Swing rotor R4	4000	4 x 750	3500
Swing rotor R5	4200	6 x 250	3500
Swing rotor R6	4200	4 x 250	3500

12. Adapter Selection

Name of Adapter		Maximum capacity (ml)
A1 for rotor R1		30
		25
		20
		10
		5
		1.5
A2 for R2	Microplate bucket	4 x 2 x 96 wells
	Rectangular bucket	4 x 250
		4 x 4 x 50 (conical)
		4 x 4 x 50
		4 x 25 x 1.5
		4 x 10 x 15 (conical)
		4 x 10 x 15
		4 x 20 x 10
		4 x 28 x 5
A3 for R3		2 x 2 x 96 wells
A4 for R4 (4 x 750 ml)		4 x 500 (conical)
		4 x 300
		4 x 500
		4 x 2 x 100
		4 x 10 x 20
		4 x 4 x 50 (conical)
		4 x 4 x 50
		4 x 14 x 15 (conical)
		4 x 19 x 15
		4 x 24 x 7
		4 x 37 x 7
A5 for R5	6 x 250 ml	6 x 7 x 10
		6 x 10 x 5
	and	6 x 4 x 20
		6 x 100
	6 x 250 ml with sealing cover	6 x 6 x 15
		6 x 4 x 15
		6 x 50
		6 x 50 (conical)
		6 x 8 x 1.5 (cap)
A6 for R6	4 x 250 ml	4 x 7 x 10
		4 x 4 x 15
	and	4 x 10 x 5
		4 x 50
	4 x 250 ml with sealing cover	4 x 4 x 20

		4 x 50 (conical)
		4 x 100
		4 x 8 x 1.5
		4 x 6 x 15
	4 x 250 ml	4 x 250
		4 x 7 x 15
		4 x 4 x 50 (falcon)
		4 x 9 x 10