Refrigerated Centrifuge

1848R

User Manual

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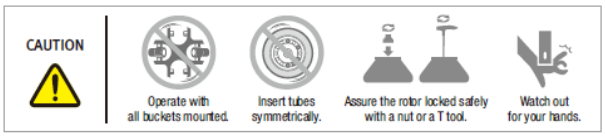
1. Warning Signs & Safety Precautions

1-1. Warning Signs

1-1-1. Warning Signs and Hazard Icons on the device

Symbol	Meaning	Symbol	Meaning
	General Danger		Danger of Electric shock
	Attention and warning for correct way of sample balancing in the rotor. Attention and warning for rotor coupling. Attention and warning for lid opening and closing		

1-1-2. Warning Signs on the manual

Symbol	Meaning	Symbol	Meaning
	This symbol refers to safety relevant warnings and indicates possible dangerous outcomes.		Note. This symbol refers to an important reminder.

1-2. Safety Precautions

Before using the instrument, please read the operation manual to ensure correct usage. Incorrect handling of the instrument could possibly result in personal injury or physical damage on the instrument or its accessories.

1. ALWAYS locate the instrument on a flat, rigid and stable table capable of withstanding the weight of the instrument and its spinning operation.

2. ALWAYS leave a safety zone of 30 cm around the centrifuge to indicate that neither hazardous materials nor persons should be permitted within the area during operation.

    ✓ ALWAYS position the instrument with enough space on each side of instrument to ensure proper air circulation.

3. ALWAYS install the instrument within a temperature and humidity controlled environment. (Permissible ambient temperature: +5°C ~ +35 °C, Relative humidity: ≤ 85%)

4. Before connecting the power, check the rated voltage.

5. DO NOT use unapproved rotors and accessories.

    ✓ ONLY USE rotors from GYROZEN Co., Ltd. with appropriate centrifugal tubes and suitable adaptors to embrace sample containers tightly enough inside rotor tubes.

6. Before operating the instrument, check if the rotor and the rotor lid are securely fastened.

    ✓ The instrument should be operated with the rotor properly installed and securely fastened to the motor shaft.

7. Perform manual spinning to ensure that the rotor is properly mounted to the motor shaft.

8. DO NOT attempt to stop the rotor with hand when spinning.

9. Perform Emergency Lid-Lock Release ONLY when spinning has completely stopped

10. DO NOT exceed the maximum allowed speed or specific gravity. To avoid rotor failure, reduce the maximum rotational speed for samples with a density greater than 1.2g/ml.

11. Fill the tube with the sample fluid within 80% of its total capacity to avoid sample fluid leak and tube damage.

12. ALWAYS load the tubes symmetrically with evenly weighted samples to avoid rotor imbalance. If necessary, use the water blank to counterbalance the unpaired sample.

13. The operation speed should not exceed individually guaranteed g-force of each centrifuge, rotor, bucket or adaptor and sample container. Especially DO NOT neglect the guaranteed g-force of the sample container.

14. For longer usage life and safety, clean and dry the rotors after each use.

15. ALWAYS disconnect the power supply prior to maintenance and service to avoid electrical shock.

16. ALWAYS use proven disinfection procedures after centrifuging biohazardous materials.

17. DO NOT centrifuge flammable, toxic, radioactive, explosive, or corrosive materials.

18. In case of a need to centrifuge toxic, radioactive materials or pathogenic micro-organism under Risk Group II of WHO, follow carefully the instructions from the “Laboratory Bio-Safety Manual”.

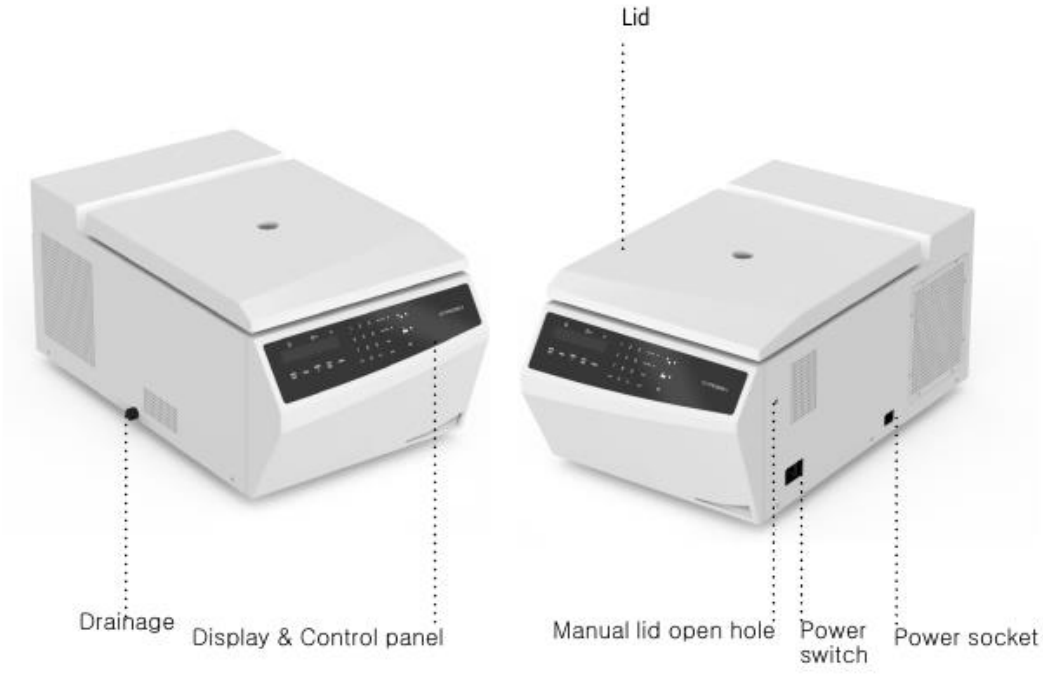
19. After using the centrifuge, turn the power switch off.

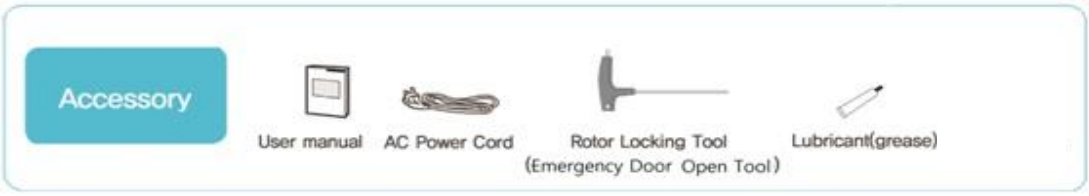
20. Unplug the power cord before cleaning or whenever the centrifuge is to remain unused for a long period of time.

- ✓ Do not place hazardous materials within the safety zone of 30 cm around the centrifuge, recommended by IEC 61010-2-020
- ✓ Use the Emergency Lid-Lock Release function only when the lid button on the control panel is compromised and under the condition of complete stop of rotor running.
- ✓ DO NOT attempt to open or move the instrument if it has not completely stopped.
- ✓ DO NOT use the instrument if the power input is more than +/- 10% of the recommended voltage or fluctuates frequently to avoid malfunction and serious damage.
- ✓ Install the instrument away from any kind of corrosive substances.

2. Product Description & Technical Specifications

2-1. Product Description





*Lubricant will added when order swing-out rotor

2-2. Technical Specifications

Max. RPM/RCF	Fixed angle	18,000 rpm / 30,356 xg
	Swing out	13,000 rpm / 16,438 xg , 5,750 rpm / 3,050 xg
Max. capacity	Fixed angle	8 x 50 mL Conical, 48 x 1.5/2.0 mL
	Swing out	24 x 2.0ml , 4 MTPs
Temp. range (℃)		-12 ~ +40
FAST cool button		Yes
Time control		Timed < 10 hr or continuous
Time counting modes		Selectable, at set speed or from starting
RPM/RCF conversion		Yes
Noise level (dB)		<60dB
ACC/DEC		9/10 steps

Program memory	100
Parameters on display window	RPM (RCF), Time, Temp, ACC, DEC
Display	White FND
Automatic rotor Identification	Yes
Imbalance cut-off	Yes
Safety lid lock	Yes
Lid drop protection	Yes
Motorized lid open & close	Yes
Power supply(V/Hz)	220V, 60Hz(AC 220-230V, 50/60Hz: 110V optional)
Power requirement	2.0 kVA
Dimension(W x D x H, mm)	380x654x312
Weight without rotor (kg)	53.5kg

☞ This instrument has the following safety functions.

1. Automatic rotor identification.
2. Automatic imbalance, excess speed and heating detection and alarms.
3. Lid lock safety and drop protection.

3. Installation

3-1. Unpacking

1. After purchasing the centrifuge, open the package and check the components. (Centrifuge/ Manual/ AC power cord/ Rotor locking tool / Grease(Lubricant))

3-2. Power On/Off

1. Connect the AC Power cord to the power socket on the right side of the instrument. Then, plug the cable into the outlet.
   - Only connect the instrument to power sources that match the electrical specifications on this instrument.

2. Turn on the power switch from [I / O] to ON [I] on the right side of the instrument.
   - The set value is displayed with a beep sound.
   - The default values of the instrument are Max. RPM, 10 min for each rotor.

3-3. Lid Release

1. Touch the button to open the lid.

- Touch the button again when the lid is closed (Lid LED shows off)
- Close the lid until hearing clank shut.
- When the lid is opened, the lid LED turns on.

☞ ✓ Motorized Lid Closure system
Do not press the lid with excessive pressure to close.
A soft touch assisted by the lid locking system will close the lid.

3-4. Rotor insert and removal

1. Clean the motor shaft and chamber with a soft, dry towel before coupling the rotor.

Swing-Out Rotor

1. Mount the proper rotor into the motor shaft.
2. Hold the rotor with one hand, and place Rotor Key at rotor thread.
   - Rotor insert to Shaft: Rotate the Rotor Key clockwise until tightly mounted.
   - Rotor removal from Shaft: Rotate the Rotor Key counterclockwise.

3. Hang the appropriate buckets into the rotor.
   - Load identical bucket at each wing for safety. (Do not leave any wing without bucket. All wings should hold identical bucket.)
   - Remove dirt and dust around hooks at the rotor and bucket hinges.
   - Spin the rotor manually to check if the buckets swing freely enough. If they do not swing freely, apply the provided Lubricant (grease) to the linking area.

Fixed Angle Rotor

1. Mount the proper rotor into the motor shaft.
   Hold the rotor with one hand, and place the Rotor Key at the rotor thread.
   - ➢ Rotor insert to Shaft: Rotate the Rotor Key clockwise until tightly mounted.
   - ➢ Rotor removal Shaft: Rotate the Rotor Key counterclockwise.

2. Insert the correct sample tube into the rotor tubes, close the rotor lid, and secure the lid knob clockwise.
   - ➢ To open the lid: rotate the rotor lid nut counterclockwise.
   - ➢ To close lid: rotate the rotor lid nut clockwise

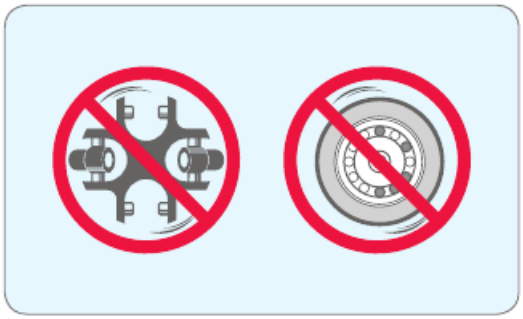
When you run a fixed angle rotor, make sure that the rotor lid is tightly closed. The lid can be crushed if not completely locked.

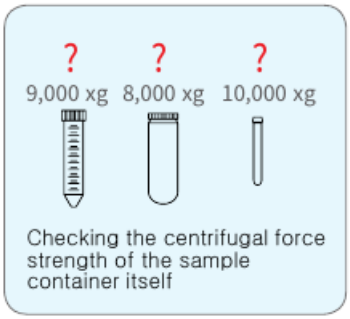
☞ For operational safety, this instrument has the automatic rotor recognition function.

3-5. Loading Sample Tubes

1. Before loading sample tubes, check for water drops or dirt in the rotor hole or inner adaptor.
   - ➢ If there are water drops or dirt in the rotor hole or inner adaptor, remove with soft dry cloth.

2. Place the tubes in the rotor with same amount of samples at symmetrical positions.
   - ➢ Use the sample tube after checking the proper sample capacity for centrifugal force strength (Max RCF) and material of tubes.
   - ➢ Fill the tubes with identical weight and density. Arrange the tube with equal space, in symmetry.

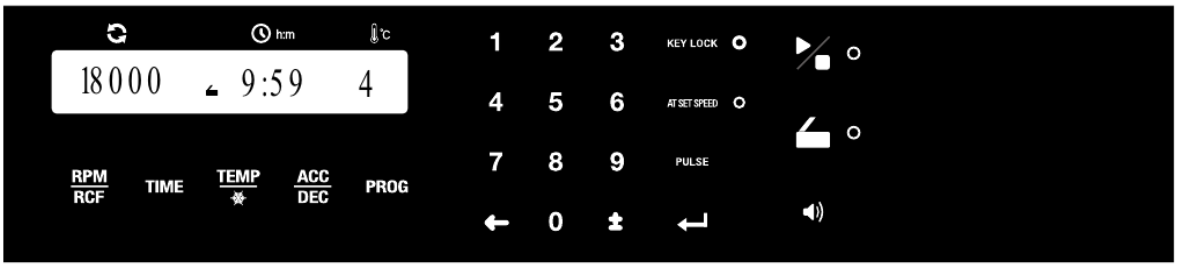




! [Sample weight asymmetric detection] system
If the sample weight differs from certain amount, it has the ability to detect asymmetry and force it to stop for the safety of the device as well as the user.

4. Operation

4-1. Control Panel Key Functions



- □ RPM / RCF — To enable automatic RPM/RCF conversion and to set speed
- □ TIME — To set timer, range available up to 9 hours 59 min (00:00: continuous)
- □ TEMP — To set temperature (-12°C ~ 40°C)
  To reach rapid refrigeration up to the setting temperature. (touch for more than 2 seconds.)
- □ ACC / DEC — To set the acceleration & deceleration level from 1 to 9 steps. '0' in deceleration step means natural deceleration. Larger number means faster acceleration or deceleration.
- □ PROG — To save a set values or recall the saved program number
- □ KEY LOCK — To use key lock mode
- □ AT SET SPEED — To count the run time once the actual run speed reaches to the set speed value
- □ PULSE — To use pulse mode
- □ ↵ — To complete data setting
- □ ▶/■ — To start and stop operation
- □ — To open instrument lid
- □ — To adjust number of beeps and speaker volume

4-2. Setting RPM/RCF Value

Speed is shown in RPM or RCF, and rpm can be set to 18,000 and RCF to 30,356 xg. The speed set values are also interlinked and automatically calculated

1. Touch [RPM/RCF]

   - RPM MODE is set by touching a [RPM/ RCF] button once.
   - RCF MODE is set by touching the [RPM/ RCF] button twice.
   - Display will show RPM or RCF at the set mode.

2. Touch [Enter] after set value.

   - To save set speed, push [Enter]
   - The RPM/RCF value changes every 1 rpm/ 1xg
   - Not touching the numbers within 15 seconds will clear settings.
   - If the setting is incorrect, press [←] and re-enter the set value.

3. Touch the [ENTER] button to complete the setting.
   - Touch [ENTER] to save the set value.
   - To make correction, touch [←] button and re-input the values.

4-3. Setting Timer

- Time can be set to hours and minutes up to 09:59 or continuous operation (set 00 minutes and 00 seconds)

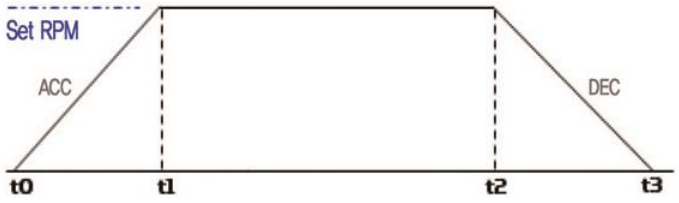
4.3.1. Setting the AT SET SPEED mode

1. Touch the [AT SET SPEED] button once.

   AT SET SPEED MODE → lamp light turns on (Counting the time after reaching the set speed)

AT SET SPEED Mode

For precise time control, this instrument can be set with AT SET SPEED mode which counts the run time once the actual run speed reaches to the set speed value and stops when the deceleration begins.



*[AT SET SPEED] lamp turns on: counts the run time from t1 to t2
*[AT SET SPEED] lamp turns off: counts the run time from t0 to t2

4.3.2. Setting the 'HOUR / MIN' Value

✓ Time counts down after starting centrifugation.

1. Touch the [TIME] button once.
   - ➢ Switching to Min input Mode.

2. Touch the numbers to change the minute value and touch [ENTER].

   - ➢ Touch the [ENTER] button → switch to HOUR
   - ➢ Input mode Time setting unit: 1 min.
   - ➢ Not touching the number button for more than 15 seconds will clear settings.
   - ➢ To make correction, touch [←] button and re-input the values.

3. Touch the number buttons to change the hour value and touch [ENTER].

   - ➢ Touch [ENTER] → final save of time
   - ➢ Input mode Time setting unit: 1 hour.
   - ➢ Not touching the number button for more than 15 seconds will clear settings.

     To make correction, touch [←] button and re-input the values.

4-4. Setting Temperature and Fast Cool

The temperature setting range can be set from -12°C to 40°C.

For temperature sensitive samples, fast cooling is supported, reaching room temperature or below in a short period of time.

1. Touch [TEMP] button
   - ➢ The temperature set value flashes in the display.

2. Touch [ENTER] button after input set value to input temperature.
   - ➢ Set the temp value to number keys
   - ➢ Touch [ENTER] button to save the last set temperature

   - ➢ Not touching the numbers within 15 seconds will clear settings.
   - ➢ Enter "+/-" once and the - sign will appear before the temp set value. On 2 inputs - the sign will disappear.
   - ➢ To make correction, touch [←] button and re-input the values.

4.4.2. Fast Cool

1. Install the rotor. Refer to [3.4 Rotor mounting and dismounting]
2. Enter the set temperature according to normal temperature setting procedure.
3. Close the lid and press [TEMP] for 2 seconds.
   - ➢ Press [TEMP] 2 seconds → Fast Cool activated (1,000 RPM)
   - ➢ Operation time flashes on the display screen when fast cool starts.

☞	Fast Cool enables speed cooling by accelerating air circulation in the chamber through low speed rotation.

4. After installation of the rotor and closing the lid of instrument, touch the [TEMP] button for more than 2 seconds.
   - ➢ For fast cooling, the instrument is refrigerated down to the set temperature in a short time. During the fast cooling, the rotor runs at low speed (1,000 rpm).
   - ➢ The passed time flashes in the display.

4-5. Acceleration / Deceleration

Set the acceleration rate to 9 steps and the deceleration rate to 10 steps (Natural Depreciation: 0) to protect sensitive samples and clean separation.

1. Touch [ACC/DEC] button.

2. Touch [ENTER] button after inputting set value to input ACC
   - The ACC is flashing on the display.
   - ACC can be set from 1 to 9.
   - If you do not touch the number button for 15 seconds, the setting mode is cleared.

3. Touch [ENTER] button after inputting set value to input DEC
   - The DEC is flashing on the display.
   - DEC can be set from 0 to 9. (Natural Depreciation: 0)
   - To make correction, touch [←] button and re-input the values.

4-6. Start/Stop

This button is used to start or stop centrifugation. The Start/Stop button lamp illuminates during operation.

4.6.1 Start

1. Touch the [Start/Stop] button after completing the settings such as speed and time.
   - During operation, the lamp to the right of the [Start/Stop] button is illuminated.
   - Operation only starts when the lid is closed.
   - Touching [Enter] indicates the set value immediately before entering the start button.

4.6.2 Stop

1. Touch the [Start/Stop] button to exit.
   - Press the [Start/Stop] button during operation, to slow down immediately.
   - Touch the [Start/Stop] button during slow down to decelerate the instrument rapidly to DEC 9 step regardless of the setup step.

4.6.3 Emergency stop

1. Press the [Start/Stop] button twice to exit.
   - Touch the [Start/Stop] button during slow down to decelerate the instrument rapidly to

DEC 9 step regardless of the setup step.

4-7 Pulse mode

Rotates only while [Pulse] is pressed. When [Pulse] is released, the instrument slows down immediately.

1. Touch[Pulse]
   - ➢ While [pulse] is pressed, the speed accelerates to the set speed.

4-8 Program Saving & Recalling

Program Saving

Save the set values, such as speed and time, in advance and call them up as needed for immediate use, in case to operate the device under various conditions.

1. Touch the [PROG] button twice.
   - ➢ 'SAVE' is turned on the display window.

2. Set the program number to indicate where you want to save it, then touch [ENTER].
   - ➢ Touch [ENTER]→The program you set with the saved phrase display on the display is saved for the last time.
   - ➢ Save up to 100 programs.
   - ➢ Not touching the number button for 15 seconds will clear the setting.

3. Touch the [ENTER] button to complete the saving.

Program Recalling

Program recalls are designed to call programs stored between 00 and 99.

1. Touch [PROG] button once.
   - ➢ 'CALL' is shown in the display window.

2. Touch [ENTER] and enter the program number to be called.
   - ➢ Touch [ENTER] → program recall
   - ➢ The display shows the set values (speed, time, temperature, value/decrease, etc.) of the called program.
   - ➢ Not touching the number button for 15 seconds will clear the setting.

3. To make correction, touch [←] button and re-input the values.

4-9. Set Key Lock/Unlock

During operation, the speed/time/temperature/acc/dec set value can be adjusted. There also is a lockdown mode to prevent such adjustments.

Key Unlock (Change the set value during operation)

1. To change the set value during operation, press the appropriate mode button and enter the desired set value.
    - Speed / time / temperature / acc / dec setting can be adjusted during operation.
    - The changed time set does not reflect the initial time set value.

Key Lock (Lockdown mode)

1. Press the [KEY LOCK] button to prevent set value changes during operation.
    - Touch [KEY LOCK] → set Lockdown mode.
    - Touch [KEY LOCK] at lock mode to clear lock mode with the unlock statement shown on the display.

4-10 Setting Speaker Volume

Adjust the sound with the end of the action from 0 to 10 steps (0: mute).

1. Touch [Sound]
    - Touch [Sound] → Display shows sound LEVEL

2. Touch [Enter] input set value to adjust volume of sound
    - Touch [Enter] → save sound volume
    - Sound volume → 0 ~ 10(0: mute)

4-11 Setting the End Alarm Repeat Count

Adjust the number of end alarms up to 99 times (0-99, 0: no alarm).

Only adjustable before centrifugation starts.

1. Touch [AT SET SPEED] button for more than 2 seconds.
    - 'SOUND RPT' appears on the display window. '

2. To adjust the number of end alarms, enter the set value using the number plate and touch [Enter].
    - Touch [Enter] → Save number of end alarm.
    - Number of end alarm → 0 ~ 99 (0: no alarm, 99: 99 times)

4-12 Emergency Lid-Lock Release

The following is the procedure to remove samples when the lid cannot be opened automatically due to no power to the main body

1. Make sure the inner rotor is completely stationary.
2. Hold the manual lid opening cap on the bottom right side of the 'Manual Door Open' label, remove it, and check the hole
3. Insert the supplied rotor key vertically and turn it counterclockwise.
   - ➢ Counterclockwise → Lid opens
   - ➢ Clockwise → Lid close
   - ➢ The lid opens manually with the sound of the gear motor.

Perform manual opening only when spinning completely stops to prevent harmful damage to the samples and operators.

After manually opening the lid, it is recommended to not close it until normal electricity is restored.

5. Maintenance

5-1. Outer part of Instrument

1. Clean the outside of the instrument with dry soft cloth. If necessary, dip the cloth in neutral detergent and clean contaminated area. Keep completely dry after cleaning.
2. Do not use any volatile chemicals such as alcohol and benzene, etc.
3. Be careful not to make scratches on the surface of the instrument.

✓ The scratches can cause corrosion on the surface of the instrument.

✓ If any rust appears, clean it with neutral detergents and keep dry.

5-2. Chamber

1. Keep dry inside the chamber after every use.
2. If the chamber is contaminated, dip the cloth in neutral detergent and clean contaminated area.

5-3. Shaft

1. Always make special attention to clean the motor shaft to avoid any imbalance problem due to the contaminants.
2. After using the instrument, take out the rotor from the shaft, and clean the shaft with dry soft cloth to keep dry.
3. Do not remove the rotor by force unless it is removed from the axis of rotation and contact service center

5-4. Rotor

1. If any parts are contaminated with samples, clean the rotor with soft wet cloth and keep the rotor dry.
2. Be careful not to make scratches inside or on the surface of rotors. Any small scratches can cause corrosion of the rotor and big damage to the instrument.
3. If you do not use the instrument, keep the rotor separately from the motor shaft and place it upside down.

6. Trouble Shooting

6-1. Check List

If there is something wrong with the centrifuge, check the following before referring it to the service center.

Symptom	Check List
Power failure	Connect the AC Power cord and make sure that the line is completely connected between the instrument and power outlet. Check if the power switch is turned on. (Refer to 3-2. Power On/Off and Lid Release)
Cannot start the instrument	If the lid is not closed completely, the instrument can't run. Check the Lid LED on the display window and close the lid completely.
Cannot open the lid	If the power is out, check the main fuse for the laboratory power supply. If it is not solved shortly, open the lid with emergency lid-lock release tool manually for safety of samples. (Refer to 4-12. Emergency Lid-Lock Release)
Cannot close the lid	Remove the dirt at the lid latch and then close the lid completely again. If the lid seems not closing by mechanical reason, please contact our service team.
Noise and vibration during running	Check that both the table and the instrument are balanced.
	Re-check the coupling status of the following to minimize noise 1. the rotor coupled into the motor shaft, well-balanced 2. the Rotor Locking Nut fixed completely 3. the Rotor Lid matched with the rotor correctly (Refer to 3-4. Rotor insert and removal)
	Check balances of samples in the rotor. (Refer to 3-5. Loading Sample Tubes) and load samples with identical weight and symmetry.

6-2. Error Code

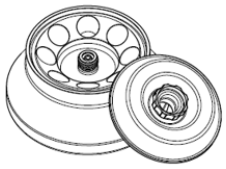
If the problem persists even after the remedy, contact the service center.

Error	Cause	Remedy
Error 1	Motor Maneuver:	-Shown when 200 rpm is not reached within 2 seconds of the operation. -Check the center window on the lid for rotor rotation.
Error 2	Lid Open	- Check that the lid is closed. - Check the lid lamp status.
Error 3	Motor Overheating	- Shown when the motor is overheated. -Check if the centrifuge vent is blocked with foreign substances, and separate them by 30cm to disperse heat from the centrifuge evenly. -Shut off power supply for an hour with the lid opened. Then turn on the power switch to check the instrument.
Error 4	Low Voltage	- Shown when the power supply (V/Hz) input is 10% less than required.

		- Shut off the power supply and check its voltage (V/Hz). - Use AVR to provide proper power.
Error 5	High Voltage	- Shown when the power supply (V/Hz) input is 10% more than required. - Shut off the power supply and check its voltage (V/Hz). - Use AVR to provide proper power.
Error 6	Over Speed	- Over-speeding the instrument can cause problems in motor overload output. -Shut off power supply. Then turn on the power switch to check the instrument.
Error 7	Firmware program	- Shown when the installed software has bugs. - Update firmware (Download)*
Error 8	Imbalance	- Check weight-balances of samples (Refer to 4-3. Installing Sample Tubes) and then turn off and on the instrument to check.
Error 9	Rotor ID or RPM Sensor	- Shown when rotor recognition function fails. - This message will be cleared by coupling an appropriate rotor (Refer to 3-4. Rotor Insert and Removal.) - If the error code persists, please call GYROZEN Field Service Engineer.
Error 11	Chamber Temp. Error	- Shown when the instrument does not reach the setting temperature within an hour. - No user action. Please contact our service team.
Error 12	Temp. Sensor Error	- Shown when there is a fault in chamber temperature sensor or over-heating. - No user action. Please contact our service team.
Error 15	Motor Temp. Sensor	- Shown when the there is a fault in motor temperature sensor. - No user action. Please contact our service team.
Error 16	Comp. Temp. Sensor	- Shown when compressor is over heated. - No user action. Please contact our service team.
Error 17	Communications Error	- Shown when insecure communication arises among Main-Display-I/O. - No user action. Please contact our service team.
Error 20-27	Lid Lock	- Shown when the sensors or cables of the lid lock system do not work normally. - No user action. Please contact our service team.

7. Rotor and accessories

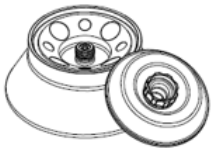
Fixed Angle Rotor, **GRF-M-c50-8**



Capacity : 8 x 50 mL Conical
Max. RPM / RCF : 8,500 / 8,893
Hole angle from axis during rotation : ∠ 30°
Hole dimension (Ø x L,mm) : 29.8 x 94
Hole bottom type : Conical
Max. height for tube fit (mm) : 123
Supplied with a lid and an O-ring inserted

Tube						
Tube capacity (mL)	15 mL conical	25mL conical		30	50	50 mL conical
Tube Dimension (Φ x L,mm)	17 x 120	28.8 x 83	28.8 x 78.5	25.7 x 101.4	29 x 108	29.5 x 118
Adapter						None
Cat No.	GAS-c15(c50)	GAS-c25(c50)		GAS-30(c50)	GAS-50(c50)	-
Adaptor hole dimension (Φ x L,mm)	17 x 105	27.1 x 14.1		26 x 83.8	27.9 x 11	-
Adaptor hole bottom type	Conical	Conical		Round	Round	-
Adaptor dimension / weight (Φ x L,mm / g)	29.2 x 105 / 34	29.4 x 51.7 / 32		29.4 x 94 / 230	29.4 x 21.4 / 6	-
Max. radius (mm)*	106.9	93.4		106.4	107.1	110.1
Max. RCF (g-force)*	8,635	7,544		8,595	8,651	8,893

Fixed Angle Rotor, **GRF-M-50/c15-4/4**

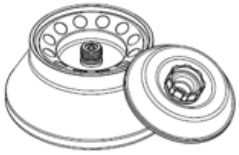


Capacity : 4 x 50 mL plus 4 x 15 mL Conical
Max. RPM / RCF : 8,500 / 9,144 / 8,293
Hole angle from axis during rotation : ∠ 30°
Hole dimension (Ø x L,mm) : 29.8 x 93.5 / 17.2 x 93.5
Hole bottom type : Flat for 50 mL / Conical for 15 mL
Max. height for tube fit (mm) : 123
Supplied with a lid and an O-ring inserted

	Conical 15 mL Hole			
Tube				
Tube capacity (mL)	5		14 mL	15 mL conical
Tube Dimension (Φ x L,mm)	16 x 59	16 x 67	15.7 x 96	17 x 120
Adapter				None
Cat No.	GAS-c5(c15)		GAS-14(c15)	-
Adaptor hole dimension (Φ x L,mm)	14.8 x 20		16 x 7.8	-
Adaptor hole bottom type	Conical		Round	-
Adaptor dimension / weight (Φ x L,mm / g)	16.6 x 77.5 / 13		16.8 x 31.4 / 4	-
Max. radius (mm)	80.1		92.5	102
Max. RCF (g-force)	6,470		7,472	8,239

	Flat 50 mL Hole					
Tube						
Tube capacity (mL)	25mL conical		30	50	50 mL conical	0 mL conical(skirted)
Tube Dimension (Φ x L,mm)	28.8x83	28.8x78.5	25.7 x 101.4	29 x 108	29.5 x 118	29.5 x 118
Adapter						None
Cat No.	GAS-c25(f50)		GAS-30(f50)	GAS-50(f50)	GAS-c50(f50)	-
Adaptor hole dimension (Φ x L,mm)	27.1 x 14.1		26 x 86.5	29.5 x 14	29.5 x 17.5	-
Adaptor hole bottom type	Conical		Round		Conical	-
Adaptor dimension / weight (Φ x L,mm / g)	29.4 x 51.7 / 39		29.4 x 93.5 / 25	29.4 x 21 / 11	29.5 x 15.6 / 8	-
Max. radius (mm)	88.9		103.3	104		113.2
Max. RCF (g-force)	7,181		8,344	8,401		9,144

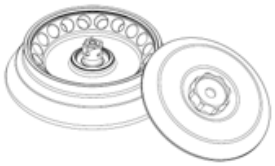
Fixed Angle Rotor, **GRF-M-c15-12**



Capacity : 12 x 15 mL Conical
Max. RPM / RCF : 8,500 / 8,611
Hole angle from axis during rotation : ∠ 30°
Hole dimension (Ø x L,mm) : 17.2 x 96.5
Hole bottom type : Conical
Max. height for tube fit (mm) : 125
Supplied with a lid and an O-ring inserted

Tube				
Tube capacity (mL)	5		14 mL	15 mL conical
Tube Dimension (Φ x L,mm)	16 x 59	16 x 67	15.7 x 96	17 x 120
Adapter				None
Cat No.	GAS-c5(c15)		GAS-14(c15)	-
Adaptor hole dimension (Φ x L,mm)	14.8 x 20		16 x 7.8	-
Adaptor hole bottom type	Conical		Round	-
Adaptor dimension / weight (Φ x L,mm / g)	16.6 x 77.5 / 13		16.8 x 31.4 / 4	-
Max. radius (mm)*	84.7		97.1	106.6
Max. RCF (g-force)*	6,842		7,843	8,611

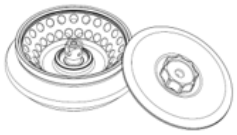
Fixed Angle Rotor, **GRE-M-m5.0-20**



Capacity : 20 x 5.0 mL
Max. RPM / RCF : 13,000 / 20,595
Hole angle from axis during rotation : ∠ 45°
Hole dimension (Ø x L,mm) : 17 x 53
Hole bottom type : Conical
Max. height for tube fit (mm) : 68
Supplied with a lid and two V-rings inserted

Tube		
Tube capacity (mL)	5.0	
Tube Dimension (Φ x L,mm)	16 x 59	16 x 67
Max. radius (mm)*	109	
Max. RCF (g-force)*	20,595	

Fixed Angle Rotor, **GRE-M-m2.0-48**



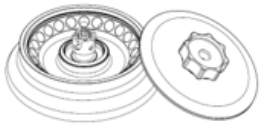
Capacity : 48 x 1.5/2.0 mL (24 outer, 24 inner)
Max. RPM / RCF : 13,000 / 18,479
Hole angle from axis during rotation : ∠ 45°
Hole dimension (Ø x L,mm) : 11.1 x 39
Hole bottom type : Round
Max. height for tube fit (mm) : 52
Supplied with a lid and two V-rings inserted

	Inner 2.0 mL				
Tube					
Tube capacity (mL)	0.2	0.5	1.5/2.0	2ml filter tube	2.0mL with screw cap *
Tube Dimension (Φ x L,mm)	6 x 8	8 x 30	11 x 38	11 x 38	10.1 x 46
Adapter			None	None	None
Cat No.	GAS-m0.2(2)	GAS-m0.5(2)	-	-	-
Adaptor hole dimension (Φ x L,mm)	6.5 x 23	8 x 31	-	-	-
Adaptor hole bottom type	Open	Open	-	-	-
Adaptor dimension / weight (Φ x L,mm / g)	13.5 x 23 / 2	14 x 31 / 2.5	-	-	-
Max. radius (mm)	67	73	84.3		
Max. RCF (g-force)	12,659	13,793	15,928		

*Depending on the size of cap, lesser tubes than maximum can be applied.

	Outer 2.0 mL			
Tube				
Tube capacity (mL)	0.2	0.5	1.5/2.0	2.0mL with screw cap
Tube Dimension (Φ x L,mm)	6 x 8	8 x 30	11 x 38	10.1 x 46
Adapter			None	None
Cat No.	GAS-m0.2(2)	GAS-m0.5(2)	-	-
Adaptor hole dimension (Φ x L,mm)	6.5 x 23	8 x 31	-	-
Adaptor hole bottom type	Open	Open	-	-
Adaptor dimension / weight (Φ x L,mm / g)	13.5 x 23 / 2	14 x 31 / 2.5	-	-
Max. radius (mm)	80.5	87.5	97.8	
Max. RCF (g-force)	15,210	16,532	18,479	

Fixed Angle Rotor, **GRE-M-m2.0-24**

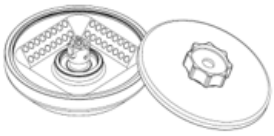


Capacity : 24 x 1.5/2.0 mL
Max. RPM / RCF : 18,000 / 30,536
Hole angle from axis during rotation : ∠ 45°
Hole dimension (Ø x L,mm) : 11.1 x 39
Hole bottom type : Round
Max. height for tube fit (mm) : 52
Supplied with a lid and two V-rings inserted

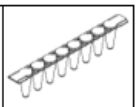
Tube				
Tube capacity (mL)	0.2	0.5	1.5/2.0	2.0mL with screw cap *
Tube Dimension (Φ x L,mm)	6 x 8	8 x 30	11 x 38	10.1 x 46
Adapter			None	None
Cat No.	GAS-m0.2(2)	GAS-m0.5(2)	-	-
Adaptor hole dimension (Φ x L,mm)	6.5x23	8x31	-	-
Adaptor hole bottom type	Open	Open	-	-
Adaptor dimension / weight (Φ x L,mm / g)	13.5 x 23 / 2	14 x 31 / 2.5	-	-
Max. radius (mm)*	67	73	84.3	
Max. RCF (g-force)*	24,270	26,443	30,536	

*Depending on the size of cap, lesser tubes than maximum can be applied.

Fixed Angle Rotor, **GRE-M-s0.2-64**



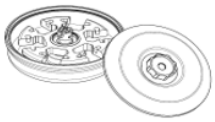
Capacity : 8 x8-Tube PCR strips, 64 x 0.2 mL
Max. RPM / RCF : 12,500 / 11,722
Hole angle from axis during rotation : ∠ 45°
Hole dimension (Ø x L,mm) : 6.5 x 16
Hole bottom type : Round
Max. height for tube fit (mm) : 25
Supplied with a lid and two V-rings inserted

Tube		
Tube capacity (mL)	0.2	8-Strip tube
Tube Dimension (Φ x L,mm)	6 x 8	6 x 8
Max. radius (mm)*	Inner: 58.6 / Outer: 67.1	
Max. RCF (g-force)*	Inner: 10,237 / Outer: 11,722	

Windshield Swing-out Rotor, **GRD-M-m2.0-24**

6 loadings
Max. Capacity : 6 x 4 x 1.5/2.0 mL
Max. RPM / RCF : 13,000 / 16,438
Hole angle from axis during rotation : ∠ 90°
Supplied with two V-rings inserted incl. sixr buckets and a lid

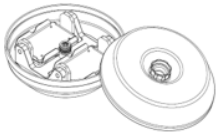
Microtube 1.5/2.0 mL Quaduple Bucket, GLB-m2.0-4(16)
Max. Capacity : 4 x 1.5/2.0 mL
Max. RPM / RCF : 13,000 / 16,438
Hole dimension (Ø x L,mm) : 11.1 x 19
Hole bottom type : Open
Max. height for tube fit (mm) : 43
Bucket dimension / weight (net, w x d x h, mm / g) : 46 x 30 x 39 / 33



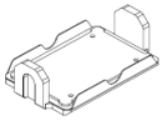
Picture with all buckets unloaded

Tube				
Tube capacity (mL)	0.2	0.5	1.5/2.0	2.0mL with screw cap *
Tube Dimension (Φ x L,mm)	6x8	8x30	11x38	10.1 x 46
Adapter			None	None
Cat No.	GAS-m0.2(2)	GAS-m0.5(2)	-	-
Adaptor hole dimension (Φ x L,mm)	6.5 x 23	8 x 31	-	-
Adaptor hole bottom type	Open	Open	-	-
Adaptor dimension / weight (Φ x L,mm / g)	13.5 x 23 / 2	14 x 31 / 2.5	-	-
Max. radius (mm)*	70	78	87	
Max. RCF (g-force)*	13,226	14,737	16,438	

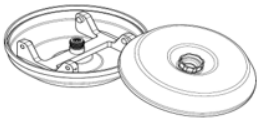
Windshield Swing-out Rotor, **GRD-M-mw-2**



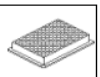
2 loadings
Capacity : 2 MTP
Max. RPM / RCF : 5,750 / 3,050
Angle from axis during rotation: ∠ 90°
Supplied with two V-rings inserted incl. two plate holders and a lid



Microplate Holder Bucket, GLP-mw(mw-2)
Max. RPM / RCF with GRD-M-mw-2 : 5,000 / 2,306
Max. Radius (mm) with GRS-G-r750-4 : 82.5
Hole dimension (w x d x h,mm) : 88 x 130.3 x 36
Max. height for tube fit (mm) : 36
Bucket dimension / weight (net, w x d x h, mm / g) : 90 x 146.3 x 45 / 379



Picture with all buckets unloaded

Tube	
Tube capacity (mL)	MTP
Tube Dimension (Φ x L,mm)	87 x 128 x 15
Bucket capacity(ea / 2)	2 / 4
Max. radius (mm)	82.5
Max. RCF (g-force)	3,050