INSTRUCTION MANUAL

HITACHI

HITACHI
HIGH-SPEED REFRIGERATED CENTRIFUGES

CR22GⅢ/CR21GⅢ

Thank you for purchasing the Hitachi
high-speed refrigerated centrifuge.
Before using this centrifuge,
carefully read through
this instruction manual to ensure
efficient and safe operation.
Keep this instruction manual handy.

・The appearance or specification of the products covered in this manual is subject to partial change for improvement.

Hitachi Koki

July 2009
S99807002

⚠ SAFETY NOTICES

⚠ Safety reminders

The centrifuge is designed to separate liquid-suspended materials having different densities and particle size.
Carefully read and fully understand the following safety instructions.

- Operate your instrument according to the instruction manual.
- Be sure to observe the all safety precautions in the instruction manual and safety instructions on your instrument. If neglected, personal injury and/or instrument damage can be caused.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- The safety reminders are indicated as shown below. The signal words "DANGER", "WARNING" and "CAUTION" are indicated together with the hazard alert symbols in this manual.

⚠ **DANGER :** This note indicates an imminently hazardous situation, which if not strictly observed, could result in personal severe injury or possible death.

⚠ **WARNING :** This note indicates a potentially hazardous situation, which if not strictly observed, could result in personal severe injury or possible death.

⚠ **CAUTION :** This note indicates a potentially hazardous situation, which if not strictly observed, could result in personal injury or severe damage to the instrument.

This hazard alert symbol indicated together with a signal word is a reminder to emphasize important safety instructions.

"NOTE" indicates a note which has no direct bearing on personal safety.

- Do not perform any operation not specified in the instruction manual. If any problem is found on your instrument, contact a Hitachi Koki authorized sales/service representative.
- Although the safety precautions in the instruction manual and safety instructions on your instrument have been fully considered, an unexpected situation may arise. Observe the instructions in the instruction manual and always be careful yourself when operating this instrument.

⚠ SAFETY NOTICES

○Mechanical Safety

⚠ **WARNING**:

- For operator safety, maintain a 30-cm "clearance envelope" around the instrument while the rotor is spinning. Do not store dangerous substances capable of developing flammable or explosive vapors on nor near the centrifuge.
- Do not attempt to unlock the door forcefully while the rotor is spinning.
- Do not attempt to slow or stop the spinning rotor by hand.
- Check the chemical resistance chart attached to the rotor, and do not use any sample inapplicable to the rotor (including the buckets). Using such a sample could corrode the rotor (including the buckets).
- Do not incline or move the instrument while the rotor is spinning. Do not lean on the instrument.
- Do not exceed the maximum rated speed of the rotor or buckets in use.
- Do not use corroded, scratched or cracked rotor, buckets and assemblies. Check that the rotor, buckets and assemblies are free of such abnormalities before operation.
- When using a swing rotor, check that the buckets are properly engaged with the rotor pins before operation. Wrong setting can cause severe damage to the instrument. Be sure to set all the buckets of the same serial number.
- If abnormal sound or vibration occurs, stop the operation immediately and contact a Hitachi Koki authorized sales/service representative.

⚠ **CAUTION**:

- Before using a rotor, be sure to read through the rotor instruction manual.
- Check the chemical resistance chart attached to the rotor, and do not use any sample inapplicable to the tubes, the bottles, the tuberacks, the microplates or tube / bottle caps, etc. Using such a sample could deteriorate such parts.
- Maximum rotor speed depends on the buckets, assemblies, tubes or adapters to be used. Follow the instructions on the rotor instruction manual.
- Do not exceed the allowable imbalance.
- Use the rotor tubes and bottles within their actual capacities.
- Be sure to mount the rotor cover if provided. Check that the rotor cover is completely secured with a screw if provided.
- Mount the rotor onto the drive shaft gently and properly. Do not drop the rotor or apply excessive force to the drive shaft to avoid damage to the drive shaft.
- Clean the inside of the drive hole (crown hole) of the rotor and the surface of the drive shaft (crown) of the centrifuge once a month.
- When storing the rotor on a shelf, make sure that the shelf is secured (for example, to avoid the rotor from dropping during an earthquake).
- If dewdrops are in the rotor chamber, drain the chamber through the drain hose to prevent the sample to get mixed up with them or prevent them from leaking into the drive unit. Be sure to recap the drain hose after drainage.
- Do not pour any liquid such as water, detergent and disinfectant directly into the rotor chamber.
  If you do so, the bearings of the drive unit might corrode or deteriorate.
- Before relocating the centrifuge, remove the rotor from the rotor chamber to avoid damaging to the drive shaft.
- Always keep the liquid crystal panel in a visible position while the POWER switch is turned on so that you can check the current operating state (running or stopping).

⚠ SAFETY NOTICES

○ Safety During Installation and/or Maintenance

⚠**WARNING**:
- Level the centrifuge by using the four level adjusters and secure them completely.
  Improper securing can cause significant movement of the centrifuge in the event of a rotor disengagement.
- When servicing the centrifuge, be sure to turn off the POWER switch, turn off the distribution board of your centrifuge room, and then wait for at least three minutes before removing covers or tables from the centrifuge to avoid electrical shock hazards.
- Do not remove the adapter of the inner of the door, the cover of the left side of the centrifuge and the caps of the inside of rotor chamber except using a continuous flow rotor in the CR22GⅢ/CR21GⅢ refrigerated centrifuge. The CR22GⅢ/CR21GⅢ refrigerated centrifuge do not conform to the CE marking requirements when using a continuous flow rotor due to the construction of the rotor.
- Installation or relocation of your centrifuge must be done by the authorized Hitachi Koki service representative. Contact a Hitachi Koki authorized sales/service representative.
- Repairs, disassembly, and other modifications to the centrifuge are strictly prohibited unless performed by a Hitachi Koki authorized sales/service representative.

⚠**CAUTION**:
- Avoid a place exposed to ultraviolet rays for operation or storage of the centrifuge. Otherwise, the covers can be discolored and the coating can be peeled off easily. If installation in such place is unavoidable, cover the centrifuge with a cloth after operation to protect from ultraviolet rays.

○Electrical Safety

⚠**WARNING**:
- Your centrifuge must be grounded properly to avoid electrical shock hazards.

⚠**CAUTION**:
- Do not place containers holding liquid in the rotor chamber or on or near the instrument. If they spill, liquid may get into the instrument and damage electrical components.

○Safety against Risk of Fire

⚠**WARNING**:
- This centrifuge is not explosion-proof. Never use explosive or flammable samples, or materials that chemically react vigorously. Do not centrifuge such materials in this instrument nor handle or store them near the instrument.

○Chemical and Biological Safety

⚠**WARNING**:
- Take all necessary safety measures before using samples that are toxic or radioactive, or blood samples that are pathogenic or infectious. You use such samples at your own responsibility.
- If the centrifuge, rotor, or an accessory is contaminated by samples that toxic or radioactive, or blood samples that pathogenic or infectious, be sure to decontaminate the item according to good laboratory procedures and methods.
- If there is a possibility that the centrifuge, rotor, or an accessory is contaminated by samples that might impair human health (for example, samples that are toxic or radioactive, or blood samples that are pathogenic or infectious), it is your responsibility to sterilize or decontaminate the centrifuge, rotor, or the accessory properly before requesting repairs from a Hitachi Koki authorized sales/service representative.
- It is your responsibility to sterilize and/or decontaminate the centrifuge, rotor, or parts properly before returning them to a Hitachi Koki authorized sales/service representative.

Notice for an Earthquake

Depending on the magnitude, an earthquake might damage the centrifuge. If you observe some abnormality, stop using the centrifuge immediately and ask for inspection by the Hitachi Koki service representative.

Table of Contents

Table of Contents

1. Specifications

	CR22GⅢ	CR21GⅢ
Maximum speed	22,000 rpm	21,000 rpm
Maximum RCF	55,200×g （R22A4 rotor）	50,300×g （R22A4 rotor）
Maximum capacity	4,000ml（R9A rotor）	
Set speed	300 to 22,000rpm	300 to 21,000rpm
Set temperature	-20º C to +40º C	
Set time	1 second to 99 minutes and 59 seconds; HOLD for continuous operation (Option: 1 minute to 99 hours and 59 minutes)	
Acceleration/deceleration control	9-stage variable acceleration control, 9-stage braked deceleration, plus coasting deceleration control	
Program function	Capable of saving 30 programmed run conditions and displaying/setting the RCF(g) and g·sec	
Lockout function	available	
Machine log management function	available	
Variable deceleration slope function	available	unavailable
Driving motor	Induction motor (inverter-controlled)	
Refrigerator	1,500 W, fully enclosed (refrigerant: R404A)	
Safety devices	Door interlock, dual-overspeed detector, imbalance detector and over-temperature detector	
Applicable standard	CE marking(*1)	
Dimensions	752 (W) x 810* (D) x 1,144 (H) mm from bottom to the chamber inlet: 858mm *Measurement including rear duct ass'y	
Power requirements	Single phase: AC200/220/230/240 V+/-10 %; 50/60 Hz;30 A	
Environment requirements	Altitude 2000M max.; Humidity of 80% max. for temperatures up to 31℃, decreasing to 50% relative humidity at 40℃. Installation category: Ⅱ Pollution degree:2	
Ambient temperature	Ambient temperature for operation : 2°C to 40°C Ambient Temperature for performance guarantee : 15°C to 25°C	
Weight	300 kg	

CE

The CR22GⅢ/CR21GⅢcentrifuges satisfy CE marking requirements. The CE marking is an international symbol, which shows that the product conforms to EC directives.
Standards concerning these directives are as follows:
• Product Safety (EN61010-1 and EN61010-2-020)
• Electromagnetic compatibility (EN61326, EN61000-6-2)

*1 The following are required to satisfy the CE Marking requirements for the use of the CR22GⅢ/CR21GⅢ centrifuges.

(1) Only the rotors with overspeed adapters (magnets) must be used.
The CR22GⅢ / CR21GⅢ refrigerated centrifuge do not conform to the CE marking requirements when using a continuous flow rotor due to the construction of the rotor.

2-2 Structure

2-2-1 Operation Panel

When power switch is turned on, the initial screen is displayed as shown in Fig.2-2-1.
When the lockout system is used in the CR22GⅢ or the CR21Ⅲ centrifuge, the initial screen is displayed first and then the initial screen of the lockout system is displayed.
For the lockout system, refer to Section 3-3-6.
The lockout system has not been set before setting.

Fig.2-2-1 The initial screen

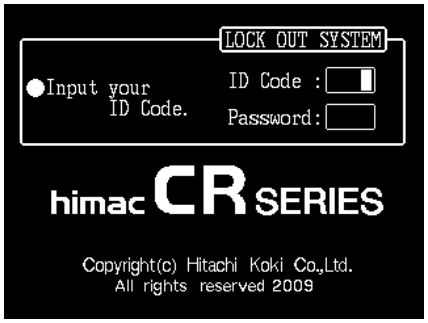


Fig.2-2-2 The initial screen of the lockout screen

The operation panel of the CR-GⅢ series refrigerated centrifuges is composed of a display panel and function keys. The liquid crystal display can be tilted back and forth for easy operation. The display panel shows various screens displays such as programmed operation, rotor list and user customization in addition to the basic screen (RUN SCREEN). Fig. 2-2-1 shows the display panel (RUN SCREEN).

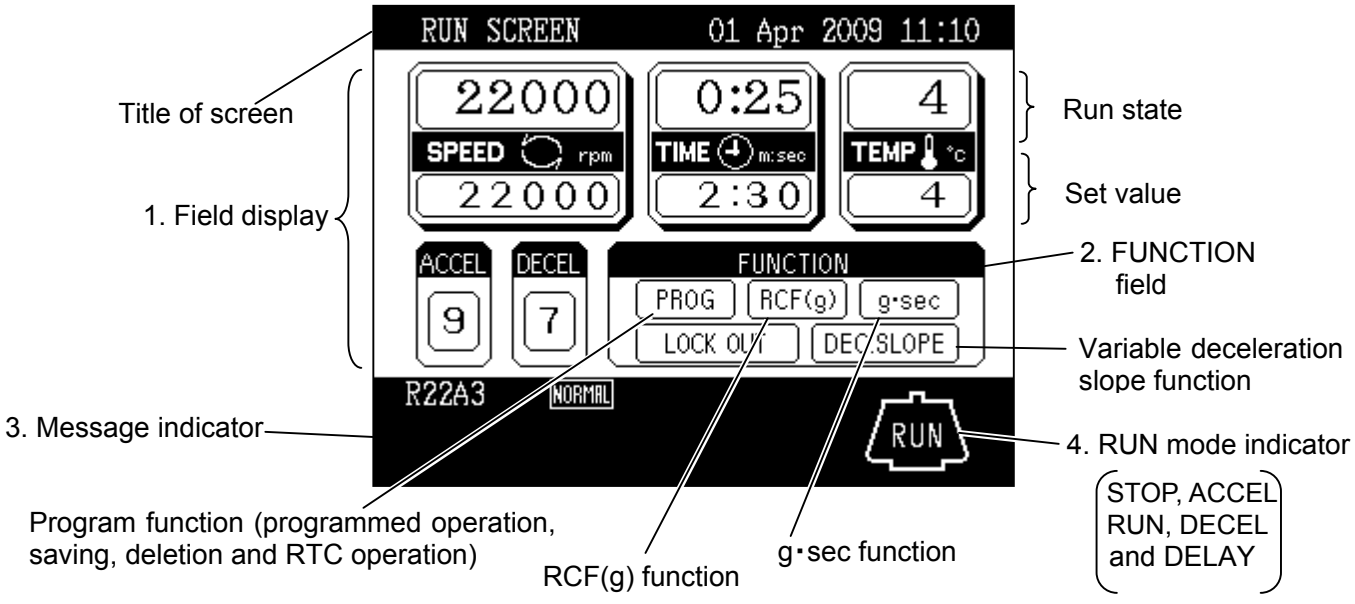


Fig.2-2-3 Display panel of CR22 GⅢ(When the lockout system has been set)

(2) Display panel of CR22GⅢ(When the lockout system has not been set)

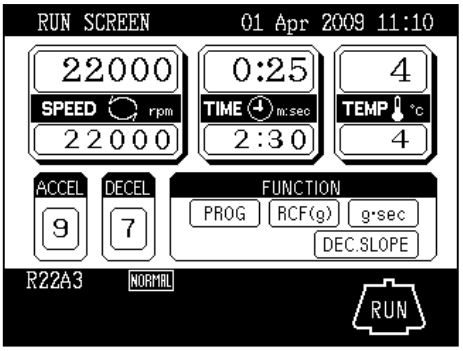


Fig. 2-2-4 Display panel of CR22GⅢ(When the lockout system has not been set)

(3) Display panel of CR21GⅢ(When the lockout system has been set)

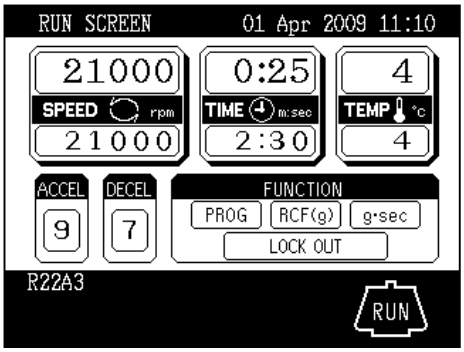


Fig. 2-2-5 Display panel of CR21GⅢ(When the lockout system has been set)

(4) Display panel of CR21GⅢ(When the lockout system has not been set)

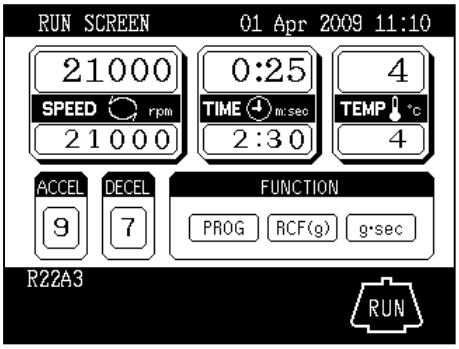


Fig. 2-2-6 Display panel of CR21GⅢ(When the lockout system has not been set)

[Functions of display panel]

No.	Name	Function
1	Field display	Displays the following run conditions. For SPEED, TIME and TEMP displays, the upper line shows the run state and the lower line shows the set value. Refer to "3-2-1 Setting Run Conditions" for details. • SPEED (Speed display) (Upper line) Displays rotor speed in increments of 10 rpm under 10,000 rpm and increments of 100 rpm from 10,000 rpm. (Lower line) Displays rotor speed in increments of 10 rpm under 10,000 rpm and increments of 100 rpm from 10,000 rpm. Maximum speed CR22GⅢ: 22,000 rpm CR21GⅢ: 21,000 rpm • TIME (Run time display) (Upper line) Displays remaining run time during operation. If HOLD is selected, displays elapsed run time. (Lower line) Run time range is from 1 second to 99 minutes, 59 seconds in increments of 1 second or 1 minute. • TEMP (Temperature display) (Upper line) Displays rotor temperature in increments of 1 ºC. (Lower line) Temperature range is from - 20 ºC to 40 ºC in increments of 1ºC. • ACCEL (Acceleration rate display) Displays 1 to 9 acceleration rates. • DECEL (Deceleration rate display) Displays 1 to 9 deceleration rates and free coast (0).
2	FUNCTION field	• PROG Used to save run conditions for programmed operation. • RCF(g) Used to display and set RCF(g) value. • g･sec Used to display and set for integrator operation. • LOCK OUT Used to limit the users of the centrifuge • DEC.SLOPE Used to separate samples that are apt to be disturbed during deceleration (CR22GⅢonly)
3	Message indicator	Displays alarm message, prompt and rotor model.
4	RUN mode indicator	Displays operating mode with illustration of a rotor. Operating modes are as follows: STOP, ACCEL, RUN (Displayed while rotor is rotating at set speed) DECEL DELAY (Displayed up to RTC operation is started)

[Function keys]

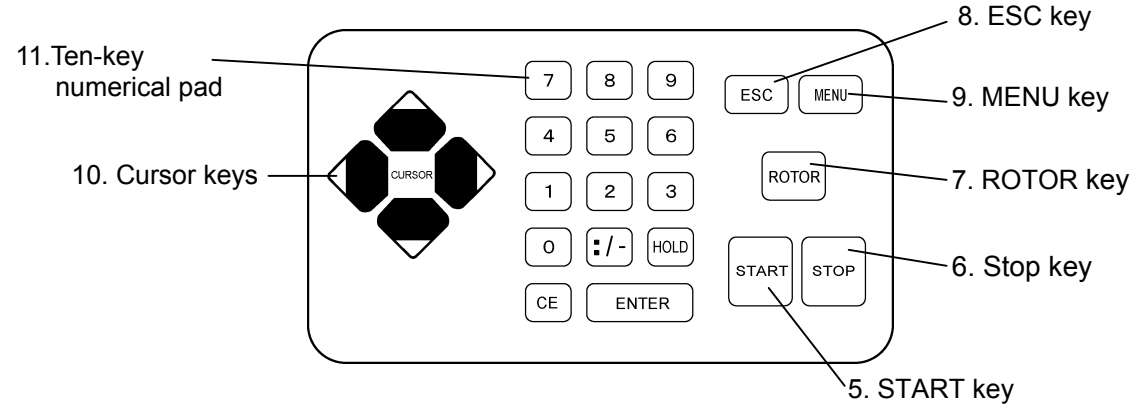
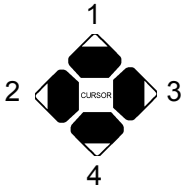
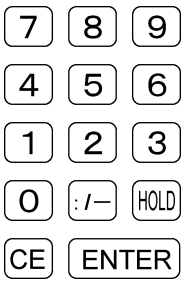


Fig. 2-2-7 Function keys

No.	Name	Function
5	START key	Starts the centrifuge run.
6	STOP key	Stops the centrifuge run.
7	ROTOR key	Used to display rotor list or to enter desired rotor number.
8	ESC key	Used to return to the previous screen. (e.g., from MENU screen to RUN SCREEN)
9	MENU key	Displays MENU screen. You can select user customization or alarm information in MENU screen.
10	Cursor keys  	(1) Makes the RUN SCREEN ready-to-enter state. (2) Moves the cursor on the screen. 1. Moves the cursor upward (↑). 2. Moves the cursor left (←). 3. Moves the cursor right (→). 4. Moves the cursor downward (↓).
11	Ten-key numerical pad  	Used to set run conditions with numeric values. :/– At time setting : Switches between minutes and seconds. At temperature setting : Used to enter a minus sign. HOLD At run time setting : Used to set continuous operation. CE Used to clear typing errors and alarm messages. (1) By pressing the CE key, the entered value on the line where the cursor stays is cleared and the cursor returns to the previous position. (2) By pressing the CE key, displayed alarm message is cleared. If two or more alarm messages are displayed at a time, clear them one by one. (Refer to "Corrective actions" on section 5.1 for details.) ENTER Used to fix the entered value.

2-2-2 **POWER Switch**

The POWER switch applies electric power to the centrifuge.

「｜」 : ON

「○」 : OFF

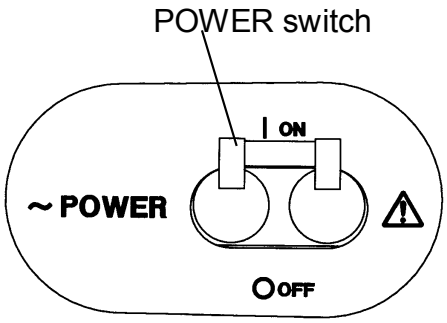


Fig. 2-2-8 POWER switch

⚠ **CAUTION:** Always keep the liquid crystal panel in a visible position while the POWER switch is turned on so that you can check the current operating state (running or stopping).

2-2-3 **Safety Device**

(1) Protector of rotor chamber

The rotor chamber allows the rotor to rotate at high speed. To prevent any rotor mishap during centrifugation, a steel protector is provided around the chamber for operator safety.

(2) Imbalance detector

This centrifuge is equipped with a sensor that detects severe vibration of the rotor due to improper bucket setting or excessive imbalance, and decelerates the rotor when detecting it.

(3) Door lock

For the sake of safety, the door is automatically locked while the rotor is rotating. The locked state is held even if the instrument power is turned off. The door can be opened/closed only when the rotor stops.

(4) Dual-overspeed detector

This centrifuge is equipped with a sensor that does not allow the rotor to rotate over the allowable maximum speed.

1. If improper speed over the allowable maximum speed is set, the overspeed detector detects it when the rotor is running at low speed (300 rpm) and displays an alarm message "SPEED".
2. Even if the improper operation exceeding over the allowable maximum speed is occurred, the centrifuge is equipped with the CPU that detects over-speed . Then it stops the rotor for operator safety.

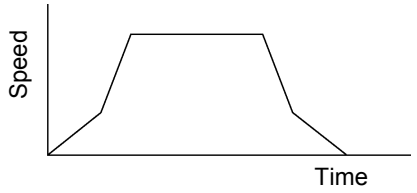
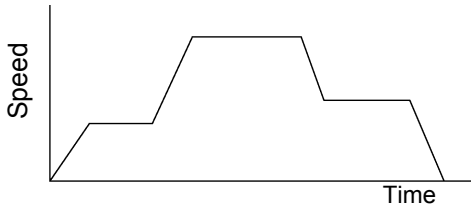
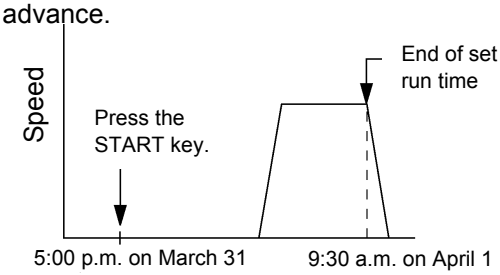
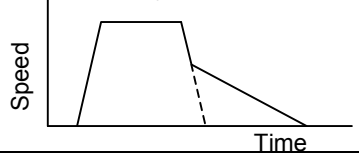
(5) Rotor cover detector

Operation without the rotor cover can cause disengagement of rotor due to buoyant force.

This centrifuge is equipped with a sensor that detects absence of the rotor cover and decelerates the rotor for operator safety.

3. Operation

The centrifuge operates in a variety of ways so that it may be applied for a wide range of use.
A brief description of each mode of operation is given below.

		Brief description	Reference
Normal operation			☞ Section 3-2 "Basic Operation"
Add-on features	Programmed operation	You can save set run conditions in memory for later use in repeated operation.	☞ Section 3-3-1 "Programmed Operation"
	Step-mode operation	Three normal operations can be combined in a sequence of operations. 	☞ Section 3-3-2 "Step-mode Operation"
	RTC operation (Real Time Control)	Automatic centrifugation can be performed by setting the desired date and time in advance. 	☞ Section 3-3-3 "RTC (Real Time Control) Operation"
	Displaying and setting RCF (Relative Centrifugal Force)	The centrifuge automatically computes RCF values from set speed, or speed from set RCF values, and then displays the result of computation on the control panel	☞ Section 3-3-4 "Displaying and Setting RCF(g)"
	Displaying and setting g・sec	This centrifuge automatically computes and displays integrator (g・sec) values from RCF and run time. The centrifuge can also be operated by entering integrator (g・sec) values.	☞ Section 3-3-5 "Displaying and Setting g・sec"
	Lockout system function	This function is used to limit the users of the centrifuge.	☞ Section 3-3-6 "Lockout system function"
	Variable deceleration slope function	This function is used to separate samples that are apt to be disturbed during deceleration (CR22GⅢonly) 	☞ Section 3-3-7 " Variable deceleration slope function "

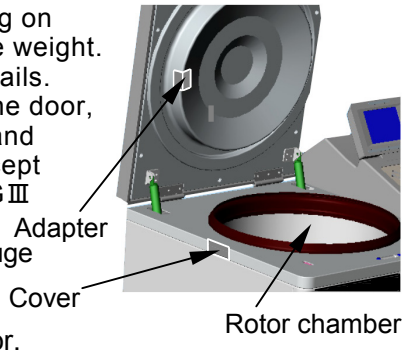
3-1 Preparation for Operation

⚠ **WARNING :** 1.This centrifuge is not explosion-proof. Never use explosive or flammable samples, or materials that chemically react vigorously. Do not centrifuge such materials in this instrument nor handle or store them near the instrument.
2.Take all necessary safety measures before using samples that are toxic or radioactive, or blood samples that are pathogenic or infectious. You use such samples at your own responsibility.

⚠ **CAUTION :** Do not place containers holding liquid near the rotor chamber, table or the centrifuge. If spilt, liquid may get into the instrument and damage electrical and mechanical components.

3-1-1 ROTOR

⚠ **WARNING :** 1.Never use any rotor, bucket, assembly, etc. that is not designated for the centrifuge by Hitachi Koki.
2.Do not use corroded, scratched or cracked rotor, buckets and assemblies. Check that the rotor, buckets and assemblies are free of such abnormalities before operation.
3.Do not exceed the maximum rated speed of the rotor or buckets in use.
4.Be sure to set all the buckets of the same serial number.
5.The rotor speed should be limited depending on the mean density of sample and the sample weight. Refer to the rotor instruction manual for details.
6.Do not remove the adapter of the inner of the door, the cover of the left side of the centrifuge and the caps of the inside of rotor chamber except using a continuous flow rotor in the CR22GⅢ /CR21GⅢ refrigerated centrifuge. The CR22GⅢ/CR21GⅢ refrigerated centrifuge do not conform to the CE marking requirements when using a continuous flow rotor due to the construction of the rotor.



⚠ **CAUTION :** 1.Read the rotor instruction manual thoroughly before use.
2.Never use any adapter, tube or bottle that is not designated for the centrifuge by Hitachi Koki.
3.Mount the rotor cover securely.
4.Do not exceed the allowable imbalance.
5.Be careful that imbalance operation may occur in the following cases. Fill the same sample in the same tubes/bottles and load them in the buckets that are placed symmetrically with respect to the drive shaft in the rotor.
- If samples that are equal in volume but different in composition are used, the precipitation levels may be different by centrifugation and such operation may increase the level of imbalance.
- If samples that are equal in weight but different in volume (density) are used or if the tubes/bottles are different in inside diameter, material, or shape, there may be variations in position of center of gravity and such operation may cause imbalance.

6.Be sure to set all the plates and all the plate adapters when using the horizontal rotor.
7.Do not run this centrifuge over the allowable maximum speed of the rotor, buckets, tube , bottle, tube,/bottle cap, and adapters. If their maximum speeds vary, run it at the lowest maximum speed among them. The allowable maximum speed may be limited depend on the combination of the tube/bottle, the tube/bottle cap, and the adapter. For the allowable maximum speed, refer to the rotor instruction manual provided with the rotor. When using tubes on the market, perform operation under the allowable speed or the allowable RCF specified by the manufacturer. Otherwise the tubes may be broken during operation.
8.Although the tubes/bottles are balanced within the allowable range, imbalance alarm may occur when setting the acceleration rate 8 or less depending on the combination of the tubes/ bottles and the rotor. Balance them more accurately.

For the specifications of applicable rotors to this centrifuge, refer to the “Applicable rotors to the CR22GⅢ/ CR21GⅢ and CR22GⅡ centrifuges” (Part No. S998077).

3-2 Basic Operation

⚠ **WARNING:** Do not incline or move the instrument while the rotor is spinning.
Do not place any object on the instrument or lean on the instrument.

⚠**CAUTION:** 1. Do not tilt the display panel forcedly, otherwise mechanical components can be damaged.
2. Do not press the function keys with a sharp-pointed object such as a ball-point pen.
3. If abnormal sound is heard during the operation, stop the operation immediately and contact a Hitachi Koki authorized sales/service representative.

3-2-1 Setting Run Conditions

This section explains how to set run conditions on the RUN SCREEN and how to use the cursor keys.

[RUN SCREEN]

The RUN SCREEN shows the set run conditions and the current run state .
The speed (SPEED), time (TIME) and temperature (TEMP) displays have two-line display.
The upper line shows the actual run state and the lower line shows the set value.
The acceleration (ACCEL) and deceleration (DECEL) displays show the set value.

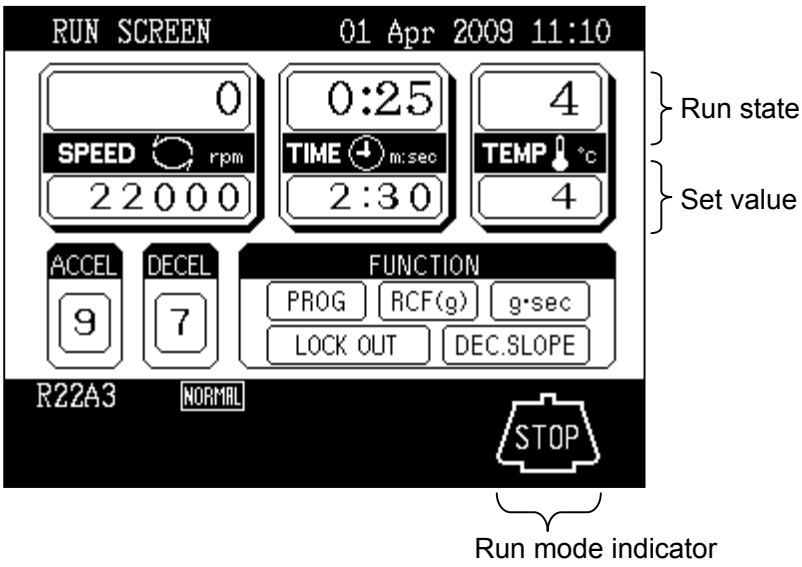


Fig.3-2-1 RUN SCREEN

[Cursor key]

A cursor appears and blinks on the entry line of a run condition display by pressing a cursor key as shown in Fig. 3-2-2 (2).
The entry line state varies depending on the presence of cursor as shown below.

(1) Fixed-entry state: No cursor appears in normal state.

(2) Ready-to-enter state: By pressing any of the four cursor keys in fixed-entry state, a cursor appears blinking "0" (or other numeric value) on the entry line. Desired numeric value can be entered in this state. The cursor can be moved by pressing the cursor keys.

To set desired run conditions, make the RUN SCREEN to ready-to-enter state. Move the cursor to the desired item and enter a numeric value. If no numeric value is entered in ready-to-enter state for 30 seconds or more, the display automatically turns to fixed-entry state.

NOTE To enter desired value when the entry line is fixed-entry state (e.g., the state of RUN SCREEN after turning on the POWER switch), press any of the four cursor keys to show a blinking cursor and move the cursor to the desired item with cursor keys. The cursor keys have two functions. One is to show a cursor on the screen and the other is to move the cursor. The cursor on the screen can be moved up, down, left and right according to the arrow marks on the cursor keys.

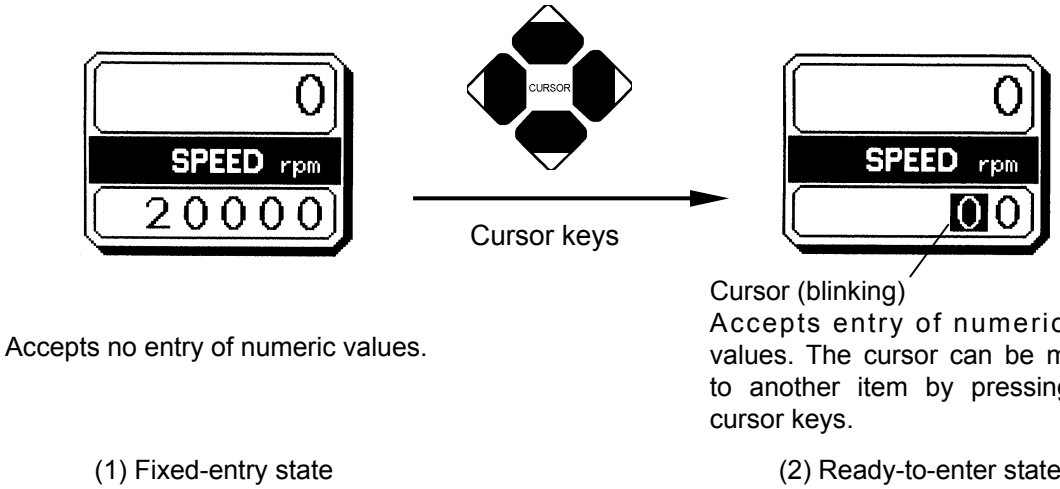


Fig. 3-2-2 Entry line state

Refer to the next page for setting run conditions (example).

NOTE (1) If incorrect value is entered, press the CE key to return to ready-to-enter state. If the incorrect value is already fixed by pressing the ENTER key, press a cursor key to turn to ready-to-enter state and then enter the correct value.

(2) When setting two or more run conditions, there is no need to press the ENTER key after each setting. The set value is entered by pressing a cursor key and the cursor moves to the new item in ready-to-enter state.

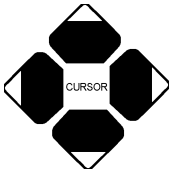
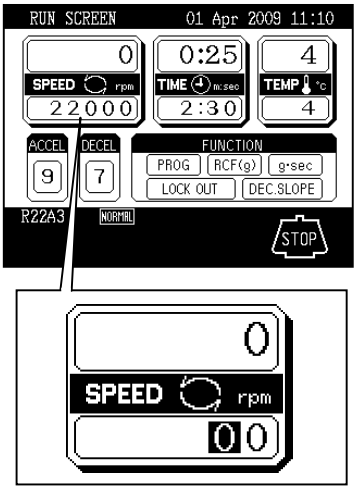
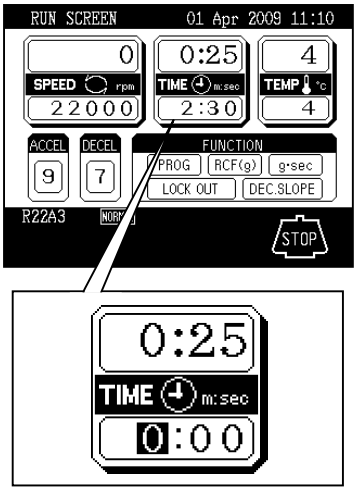
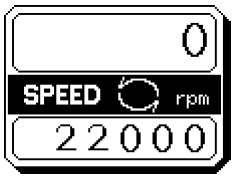
(3) When re-keying the TIME setting during continuous operation (HOLD), enter a value added the desired remaining time to the elapsed time. For example, to stop the operation after 1 minute and 30 seconds when 5 minutes have elapsed in continuous operation, turn the TIME display to ready-to-enter state by pressing a cursor key and enter as follows.

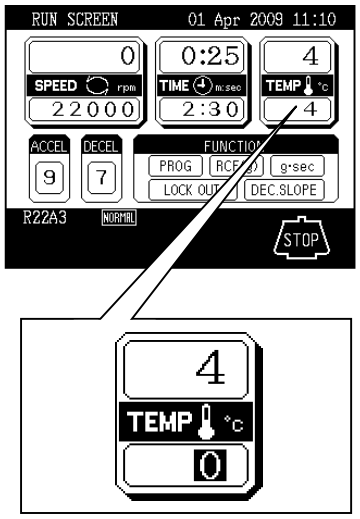
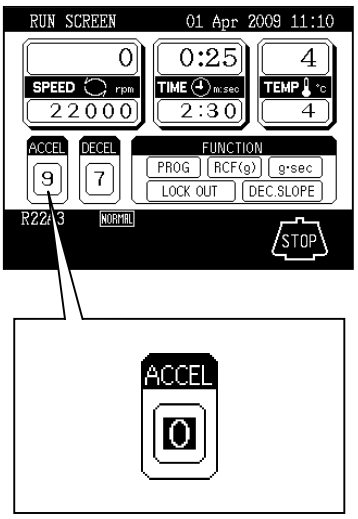
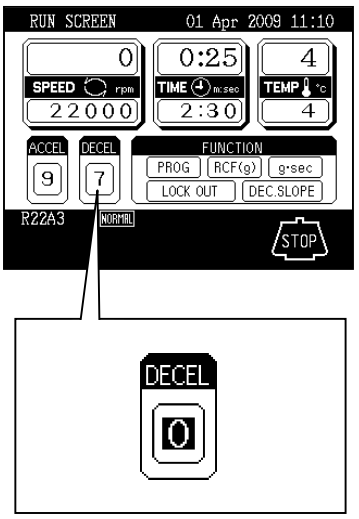
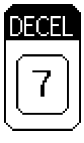
6 **:** **3** **0** **ENTER**

⚠ **CAUTION:** Do not run this centrifuge over the allowable maximum speed of the rotor, buckets, adapters, tubes, bottles, etc. If their maximum speeds vary, run it at the lowest maximum speed among them.

* Setting run conditions

The table below exemplifies how to set run conditions such as rotor speed, run time and rotor temperature.

<table>
<tr><td colspan="3">Item</td><td>Speed（SPEED）</td><td>Run time（TIME）</td></tr>
<tr><td colspan="3">Example set value</td><td>22,000rpm</td><td>2 minutes, 30seconds</td></tr>
<tr><td rowspan="5">Procedure</td><td>1</td><td>Press a cursor to turn the display to ready-to-enter state.</td><td>The display turns to ready-to-enter state.</td><td>The display turns to ready-to-enter state.</td></tr>
<tr><td>2</td><td>Move the cursor to the desired item by pressing the cursor keys.
(The arrow marks on the cursor keys indicate cursor moving directions.)
 
</td><td rowspan="2"> 
</td><td>The cursor blinks on the minutes setting position.
 
</td></tr>
<tr><td>3</td><td>The cursor blinks on the entry line for 30 seconds.
<u>The display is now ready-to-enter state.</u></td></tr>
<tr><td>4</td><td>Enter the desired value with the ten-key numerical pad.
7 8 9
4 5 6
1 2 3
0 :/– HOLD
CE ENTER
<u>Entered numerals are shifted to the left in order.</u></td><td>2 2 0 0
The last zero (0) need not be entered.</td><td>2 :/– 3 0
The cursor can be moved to the seconds setting position by pressing the " : /-" key.
For continuous run, press the HOLD key.</td></tr>
<tr><td>5</td><td>Check the setting and fix it by pressing the ENTER key. <u>Setting can also be fixed by pressing a cursor key.</u>
The CE key is used to cancel the setting.</td><td>The speed setting is "22,000 rpm".
 
</td><td>The run time setting is "2:30 (2 minutes 30 seconds)".
 
</td></tr>
<tr><td colspan="3">Setting range</td><td>300 rpm to the maximum speed: in increments of 10 rpm under 10,000 rpm, and in increments of 100 rpm from 10,000 rpm</td><td>1 second to 99 minutes 59 seconds: in increments of 1 second</td></tr>
</table>

Temperature (TEMP)	Acceleration rate (ACCEL)	Deceleration (DECEL)
4℃	9	7
The display turns to ready-to-enter state.	The display turns to ready-to-enter state.	The display turns to ready-to-enter state.
The cursor is blinking at the one place. 		
4	9	7 Enter "0" for selecting free coast.
The temperature setting is "4℃". 	The acceleration rate setting is "9". 	The deceleration rate setting is "7". 
-20℃to 40℃: in increments of 1℃ Press the " : /-" key to enter the minus.	1 to 9	1 to 9 and 0 for free coast

3-2-2 **Operating Procedure**

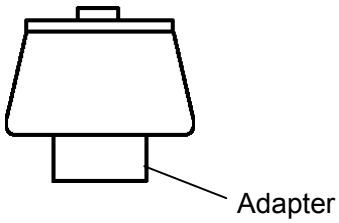
This section describes the procedure for normal operation.

NOTE Before following the procedure, read the rotor instruction manual carefully and make sure that you have selected the appropriate type of tube for the sample, and that the amount of sample in the tubes is correct.

Step	Procedure	State of centrifuge and notices
1	Turn ON the POWER switch of the centrifuge.	• The panel indicators turn on. • The door lock is released.
2	Mount the rotor.	• Mount the rotor properly onto the drive spindle. • When using a rotor without rotor ID*, press the ROTOR key and enter the correct rotor number. • When using a rotor with rotor ID*, the rotor model appears on the message display during operation. There is no need to enter the rotor number.
3	Set run conditions.	• Set run conditions referring to "3-2-1 Setting Run Conditions".
4	Press the START key.	• The rotor starts rotating. • When the rotor reaches the set speed, the timer starts counting.
5	The set run time has elapsed or the STOP key is pressed.	• The rotor starts decelerating.
6	The rotor stops.	• The centrifuge makes a beep to notify that the rotor stops.
7	Remove the rotor.	• Wait until the rotor stops completely and then remove the rotor.

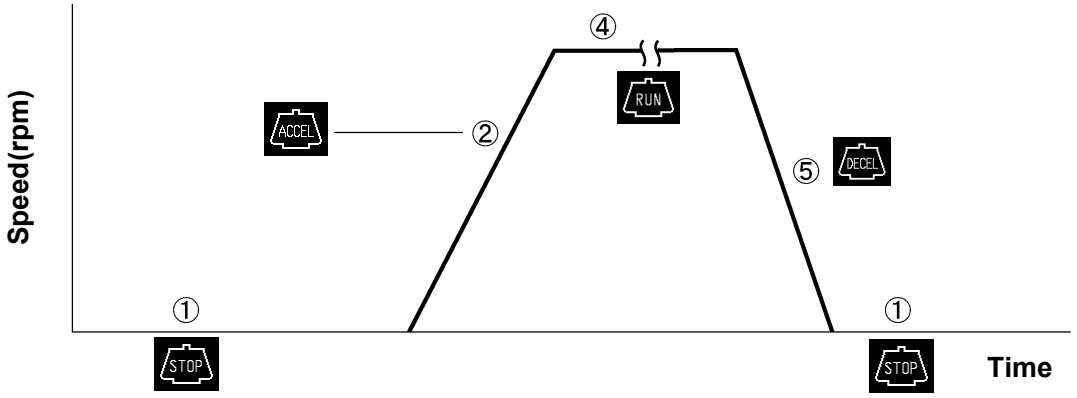
*Rotor ID (automatic discrimination function)

Rotors with rotor ID (i.e., automatic discrimination-type rotors) have blue adapters at the bottom and other rotors without rotor ID have black adapters. Note that the rotors without rotor ID will stand by at 50 rpm for 10 seconds during acceleration and then go up to the set speed.



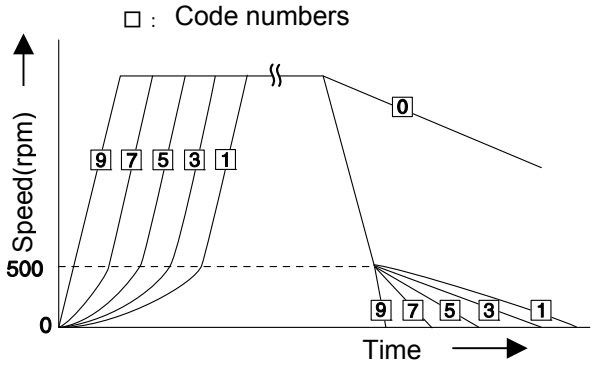
NOTE The rotors without the adapters are not available for this centrifuge.

The RUN mode indicator is displayed on the panel as follows:



3-2-3 **Acceleration Rate and Deceleration Rate**

The acceleration and deceleration rates can be adjusted for a wide range of use. The figure below shows how a rotor accelerates and decelerates in compliance with a code number selected from among 1 through 9.



Code no.	Time for acceleration from 0 to 500 rpm	Time for deceleration from 500 to 0 rpm
9	Minimum*	Minimum*
8	30 sec.	1 min.
7	45 sec.	2 min.
6	1 min.	3 min.
5	2 min.	4 min.
4	3 min.	6 min.
3	4 min.	9 min.
2	6 min.	12 min.
1	10 min.	15 min.
0	—	Coasting deceleration from set speed

NOTE These time values vary with the type of rotor in use.

* The minimum time is the one that occurs when the rotor is being accelerated or decelerated with the maximum torque of the driving motor. This time varies with the type of rotor in use.

The variable deceleration slope function is specifically designed for the CR22GⅢ centrifuge (see section 3-3-7).

3-3 FUNCTION Field

The CR22GⅢ/ CR21GⅢrefrigerated centrifuge has many add-on features such as programmed operation and centrifugal force values displaying and setting. These features are displayed and selected on the FUNCTION field.

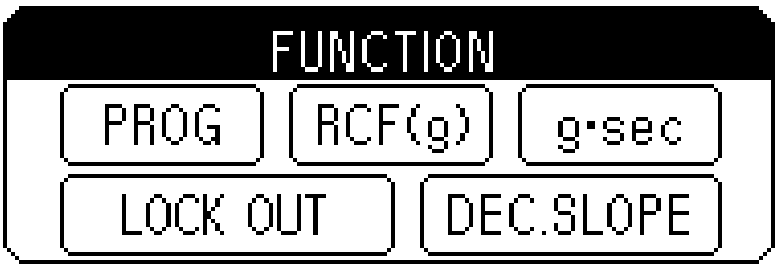


Fig. 3-3-1 FUNCTION field

PROG : You can save run conditions in memory for later use in repeated operation. This feature also allows step-mode operation (three normal operations can be combined in a sequence of operations).

RCF(g) : The centrifuge automatically computes and displays RCF values from set speed, or speed from set RCF values.

g·sec :The centrifuge automatically computes and displays integrator (g·sec) values from RCF and run time. The centrifuge can also be operated by entering integrator values.

LOCK OUT : when logging off the lockout system or when the user name is displayed, LOCK OUT is used.

DEC.SLOPE : This function is used for separation of samples that are apt to be disturbed. （CR22GⅢonly ）

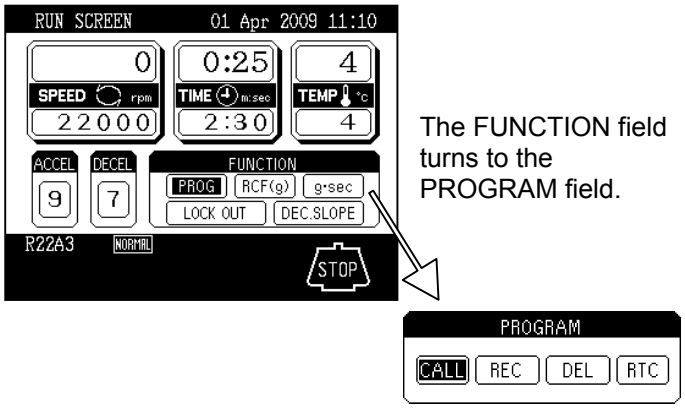
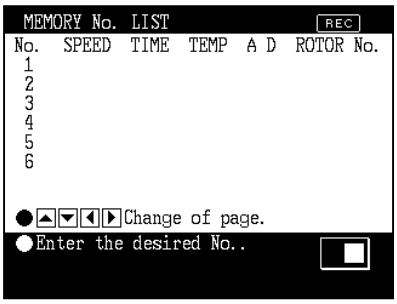
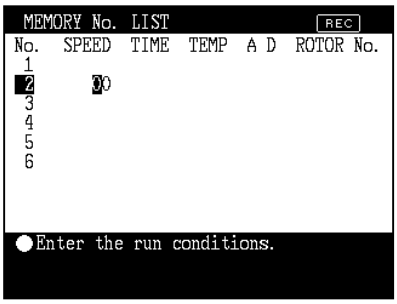
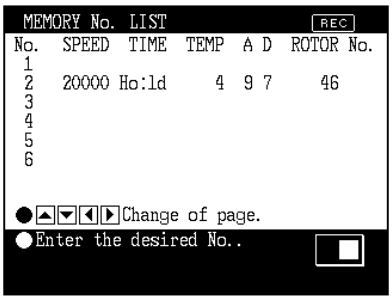
3-3-1 **Programmed Operation**

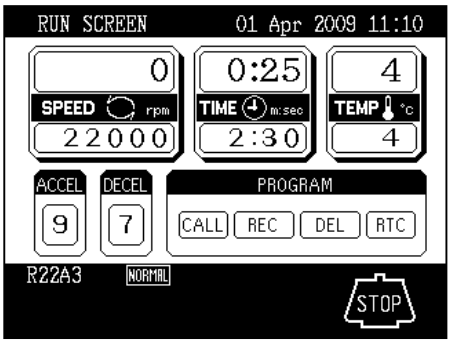
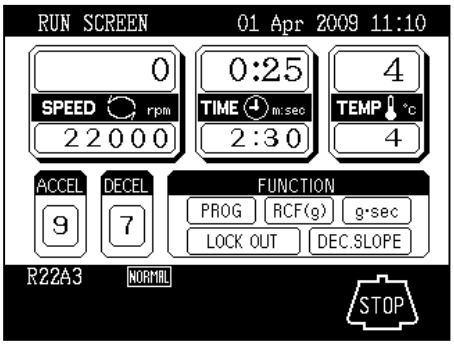
Programmed operation capability is an add-on feature that saves set run conditions in memory for later use. This feature allows you to save frequently used run conditions in memory and then recall the saved run conditions whenever you need them, thus making the operation procedure simple. (Even when the POWER switch is turned off, the saved run conditions remain in effect in memory.)

The memory in the centrifuge can contain 30 sets of run parameters and 3 sets of run parameters for three-step (step-mode) operations. After recording run parameters (speed, run time, temperature, etc.) for three-step operation, you can recall and perform those steps successively with the saved run conditions (i.e., step-mode operation).

(1) Saving and changing run conditions

To save or change run conditions in memory, use the following procedure.

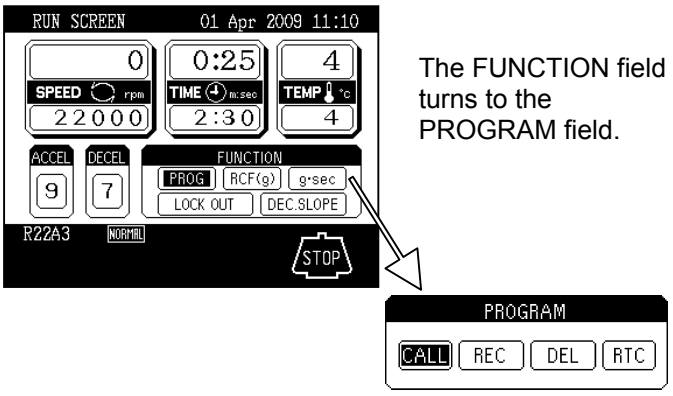
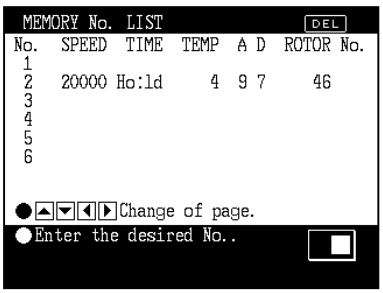
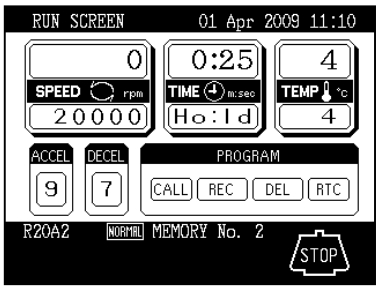
Step	Key operation	Screen display and notices
1	Move the cursor to **PROG** and press the ENTER key.	 The FUNCTION field turns to the PROGRAM field.
2	Press the cursor key ◆ to move the cursor to **REC** and press the ENTER key.	 The screen turns to the MEMORY No. LIST screen.
3	Enter the desired MEMORY No. to be saved or changed with the ten-key numerical pad and press the ENTER key. (e.g.: saving run conditions at MEMORY No.2) 2 ENTER	 The cursor moves to the desired MEMORY No.
4	Enter run conditions as follows. e.g.: SPEED: 20,000 rpm TIME: HOLD TEMP: 4 ℃ ACCEL: 9 DECEL: 7 ROTOR No.: 46 (R20A2) 2 0 0 0 ◆ HOLD ◆ 4 ◆ 9 ◆ 7 ◆ 4 6 ENTER	 The run conditions are saved a MEMORY No.2. • The screen turns to RCF(g) and g·sec values entry screen by pressing the cursor key ◆ .

Step	Key operation	Screen display and notices
5	After saving run conditions, press the ESC key twice.	• The PROGRAM field appears by the first press of the ESC key.  • The FUNCTION field appears by the second press of the ESC key. 

NOTE (1) When the saved run conditions are changed, the previous run conditions are cleared and the newly saved run conditions are in effect.
(2) Run conditions cannot be saved while the rotor is rotating. Check that the rotor stops completely before saving run conditions.

(2) Using programmed operation

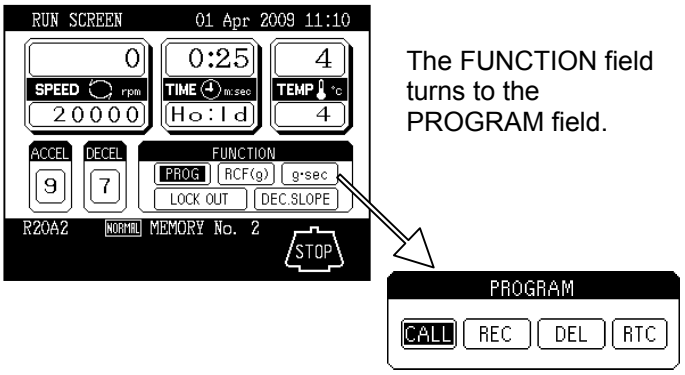
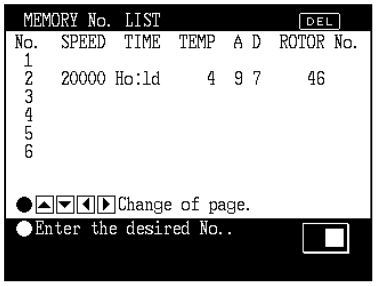
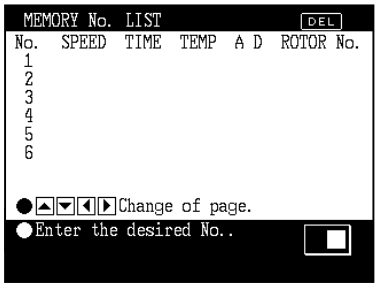
To recall the saved run conditions and use programmed operation with the recalled run conditions, take the following procedure.

Step	Key operation	Screen display and notices
1	Move the cursor to **PROG** and press the ENTER key.	 The FUNCTION field turns to the PROGRAM field.
2	Press the ENTER key when the cursor stays on **CALL** .	 The screen turns to the MEMORY No. LIST screen.
3	Enter the desired MEMORY No. with the ten-key numerical pad and press the ENTER key. (e.g.: recalling run conditions saved at MEMORY No. 2) 2 ENTER	 The recalled run conditions are displayed. The MEMORY No. appears on the message display. • Only the saved MEMORY No. can be recalled.
4	Mount the rotor and press the START key.	• The rotor starts rotating. • When reentering (changing) a run condition of the recalled MEMORY No. (e.g., SPEED), the MEMORY No. is canceled. Recall the MEMORY No. again if necessary. • The MEMORY No. cannot be changed (or recalled) while the rotor is rotating. • When using an automatic discrimination-type rotor, the alarm message "ROTOR NO." is indicated if the rotor type appearing on the message indicator is different from the rotor in use.

(3) Procedure for deleting run conditions

To delete run conditions saved in memory, take the following procedure.

NOTE Check that the rotor stops completely before deleting saved run conditions.

Step	Key operation	Screen display and notices
1	Move the cursor to **PROG** and press the ENTER key.	 The FUNCTION field turns to the PROGRAM field.
2	Press the cursor key twice to move the cursor to **DEL** and press the ENTER key.	 The screen turns to the MEMORY No. LIST screen.
3	Enter the desired MEMORY No. to be deleted and press the ENTER key. (e.g.: deleting run conditions saved at MEMORY No. 2) 2 ENTER	 The cursor moves to the MEMORY No. 2.
4	Select "1 : Yes" to delete the run conditions. 1 ENTER	 Run conditions saved at the MEMORY No. 2 are deleted. • When "2. : No" is selected, the display goes back to the screen of step 2
5	Press the ESC key several times to return to the RUN SCREEN.	• Note that the centrifuge cannot operate with the memory number if deleted.

3-3-2 **Step-mode Operation**

This centrifuge has the step-mode operation capability that allows you to save three different sets of values for a run parameter set in a single memory location (MEMORY Nos. 31 - 33, 41 - 43, and 51 - 53) and then change some or all of the run conditions (e.g., speed, run time, rotor temperature, etc.) for each step during a step-mode run. Save step-mode run conditions at the MEMORY Nos. 31 - 33 (41 - 43 or 51- 53) in accordance with "3-3-1 Programmed Operation (1)".
When the MEMORY No. 31 is recalled, the centrifuge automatically performs step-mode operation in order of MEMORY Nos. 31, 32 and 33.

(1) Procedure for step-mode operation
[Example]
The table below shows the run parameters and their values required for an example 3-step run (MEMORY Nos. 31 to 33). Fig. 3-3-2 depicts how the example run will proceed.

	1st step (Memory No. 31)	2nd step (Memory No. 32)	3rd step (Memory No. 33)
Speed	1000rpm	20000rpm	5000rpm
Run time	30min	60min	10min
Temperature	4℃	4℃	4℃
Accel rate	9	9	9
Decel rate	9	9	7
Rotor No.	46	46	46

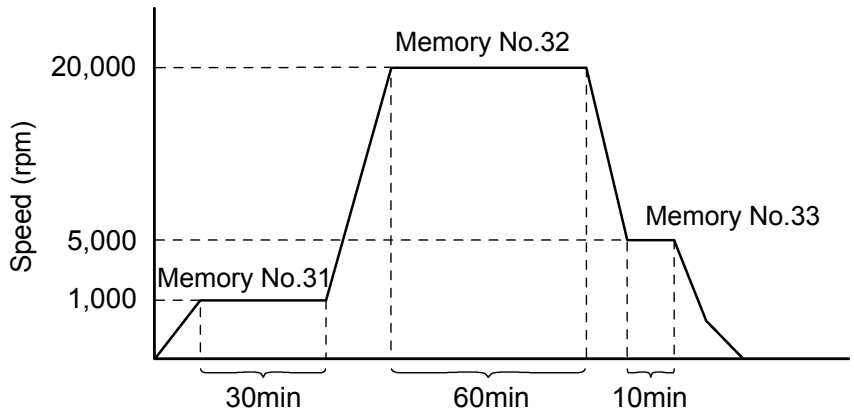


Fig. 3-3-2 Details of an example step-mode operation

NOTE (1) Select the same rotor number for each step. Otherwise, alarm message "ROTOR NO." is indicated and the centrifuge stops operation. (Contents of the memory cannot be called up.)
(2) Use the MEMORY Nos. 32 and 33 (42 and 43 or 52 and 53) for the step-mode operation with two steps

3-3-3 **RTC (Real Time Control) Operation**

The CR22GⅢ/ CR21GⅢ refrigerated centrifuge can be programmed to perform automatic centrifugation by setting the incorporated time clock to start and end centrifugation at the desired time in advance. This is the RTC (Real Time Control) operation. Fig. 3-3-3 illustrates an example of procedure for RTC operation.

Example : The rotor is loaded in the centrifuge and the run conditions listed below are set in the evening on April 1, to end the operation about 9:30 a.m. next morning.

1. Rotor : R22A3
2. Speed : 22,000rpm
3. Run time : 60分
4. Temperature : 4℃
5. Acceleration rate : 9
6. Deceleration rate : 7

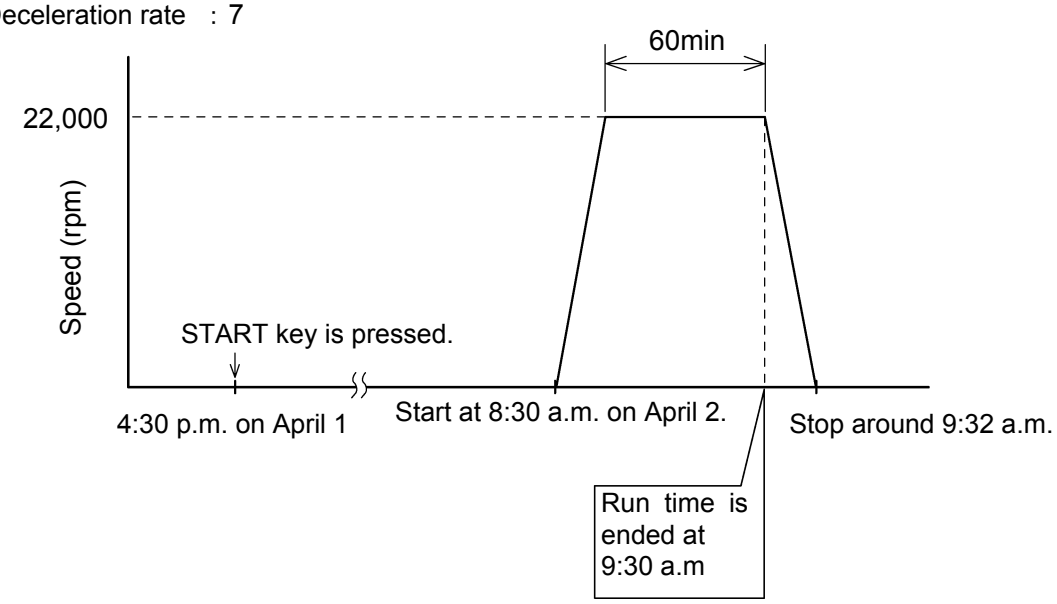
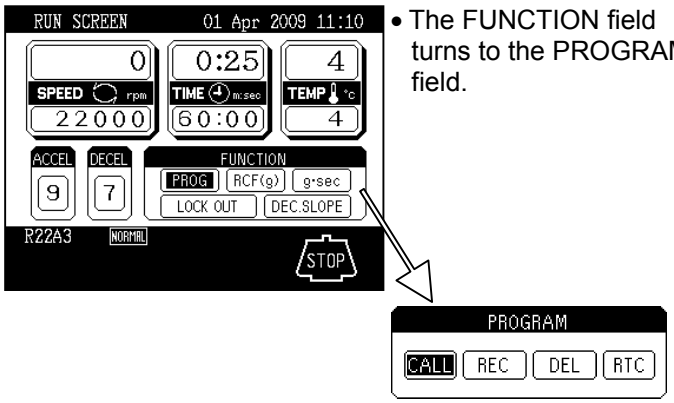
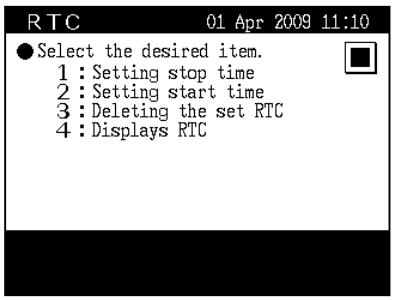
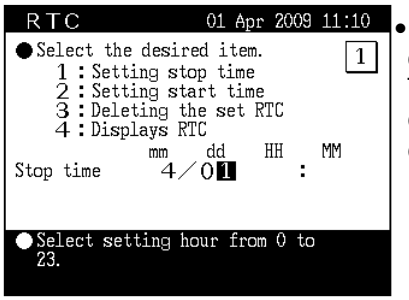
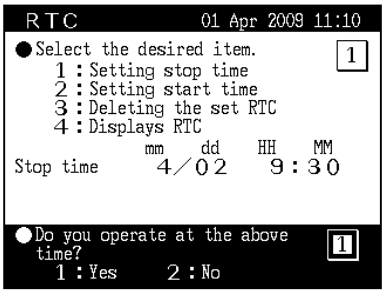
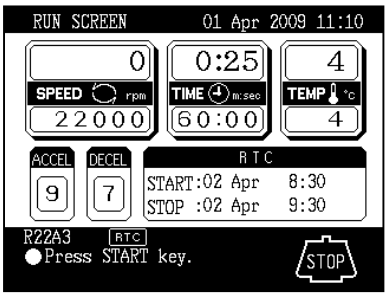


Fig. 3-3-3 Example of RTC operation

In this example, the above run conditions from (2) to (6) are set first and then the designated time to complete the RTC operation, 9:30 a.m. on April 2. Then START key is pressed.
(Otherwise, the same RTC operation can be achieved by setting the designated time to start centrifugation, 8:30 a.m. on April 2.)

(1) Procedure for RTC operation

Step	Key operation	Screen display and notices
1	Set the run conditions.	• Set the run conditions referring to "3-2-1 Setting Run Conditions". • For time setting, do not select HOLD but enter a numeric value.
2	Move the cursor to [PROG] and press the ENTER key.	 • The FUNCTION field turns to the PROGRAM field.
3	Press the cursor key three times to move the cursor to [RTC] and press the ENTER key.	 • The screen turns to the RTC operation setting screen.
4	Select the desired item. When selecting "1: Setting stop time", press the following keys. [1] [ENTER]	 • The cursor is blinking on "day" column. The date (month and day) is automatically displayed.

Step	Key operation	Screen display and notices
5	Enter the desired date and time (month, day, hour and minutes) using the cursor keys and the ten-key numerical pad. Press the ENTER key.	 • The range for "hour" setting is from 0 to 23 (24-hour display). • Do not enter any date and time that passed the current time. Set a proper stop time considering the centrifugation time so that the start time will be later than the current time. • It is impossible to set an operation that will start 20 days or more ahead from the current time.
6	Select Yes or No in response to the prompt. "Yes": [1] [ENTER] "No": [2] [ENTER]	• When selecting "Yes":  • The screen turns to the RUN SCREEN and the RTC time is displayed. • [RTC] appears on the message indicator. • When selecting "No", the display turns to the screen of Step 2. Enter the desired setting again. • Although a "sec" value on the TIME display is rounded up to a value in minutes and displayed on the RTC display, actual run time is the value indicated on the TIME display. • Note that the run time setting cannot be changed after setting the RTC operation. Clear the RTC setting and then reset the run time if necessary.When clearing the RTC setting, select "3.Deleting the set RTC "on the RTC operation setting screen.
7	Check the RTC setting on the RUN SCREEN and press the START key. [START] RTC operation will not start unless the START key is pressed.	• Perform operation according to "3-2-2 Operating Procedure". • The centrifuge turns to "DELAY" mode by pressing the START key and wait until the set time. The centrifuge automatically starts operation at the set time and keeps operation during the designated time.  • The RUN mode indicator on the message display turns to "DELAY".

NOTE (1) The RUN mode indicator on the panel turns as follows in RTC operation.

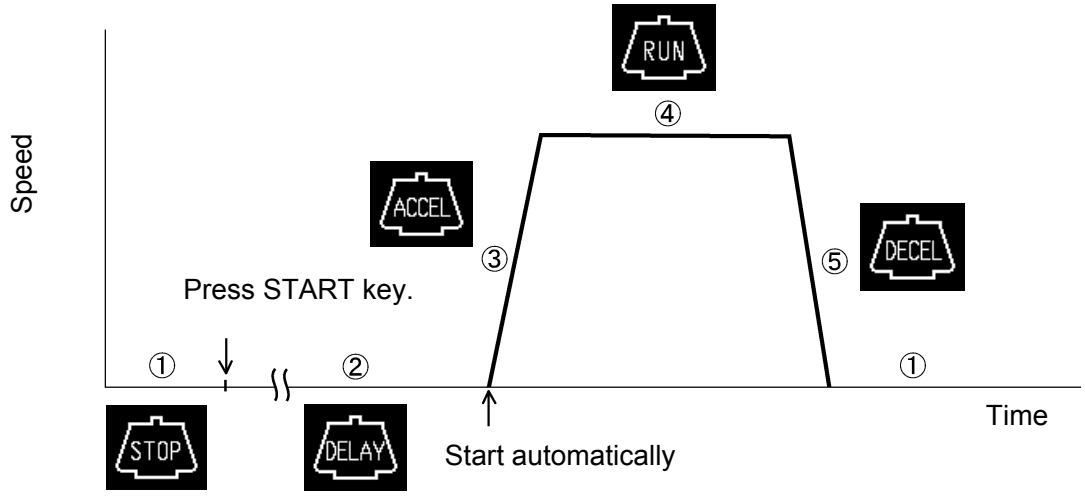


Fig. 3-3-4 Operating mode (RTC)

(2) Note that the RTC setting is not available in the following cases:
1. The time setting on the RUN SCREEN is "HOLD" (continuous run).
☞ Change the run time setting from "HOLD" to a desired numeric value.
2. The start time has already passed.
☞ Change the setting so that the start time will be later than the current time.
3. The start time is 20 days or more ahead from the current time.
☞ Change the setting so that the start time will be within 20 days.

(3) Clear the RTC setting and then reset the run time if it is necessary to change the run time setting after setting the RTC operation.

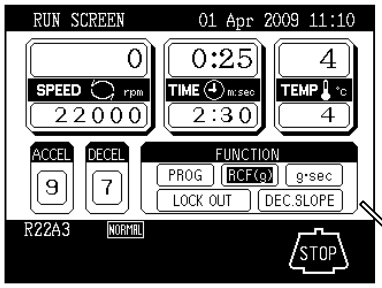
(4) Recall the saved run conditions and enter the RTC setting when performing the programmed operation (including the step-mode operation) and the RTC operation in combination. The centrifuge automatically computes the total run time of all steps in the programmed operation and also the start time for RTC operation. Note that the saved run conditions cannot be recalled after setting the RTC operation.

(5) Press the STOP key to stop the operation. The RTC operation is stopped and the rotor stops.

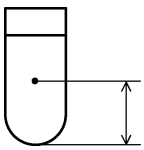
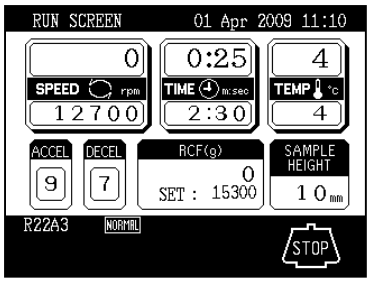
3-3-4 **Displaying and Setting RCF**

The CR22GⅢ/ CR21GⅢ refrigerated centrifuge retains, in its internal memory, data representing the maximum radii of all available rotors. Based on this data, the centrifuge automatically computes relative centrifugal force (RCF) values from set speed, or speed from set RCF values, and then display the result of computation on the control panel. This section explains how to use this RCF displaying and setting capability of the centrifuge.

(1) Displaying and setting RCF values

Step	Key operation	Screen display and notices
1	Move the cursor to **RCF(g)** and press the ENTER key.	 The FUNCTION indicator turns to the RCF(g) display.  RCF(g) : (Upper line) Displaying RCF(g) RCF(g) computed from the motor speed and the sample height is displayed. (Lower line) Setting RCF(g) RCF(g) computed from the set speed and the sample height is displayed.

NOTE Press ESC key to clear the RCF screen.

Step	Key operation	Screen display and notices
2	Move the cursor to RCF(g) and set the desired RCF and sample height values. (Example) RCF(g) ＝15300 g Sample height ＝10 mm [1] [5] [3] [0] ◆ [1] [0] [ENTER]  	 • Entered values are displayed on the RCF(g) SET column and the SAMPLE HEIGHT column respectively. • Speed is computed from the rotor model and the RCF value. •"－－" is indicated on the SPEED display when no rotor model is displayed on the message display. The speed is computed and displayed after automatic discrimination of the rotor model. • RCF(g) values can be set in increments of 10×g. • Sample height values can be set in increments of 1mm.

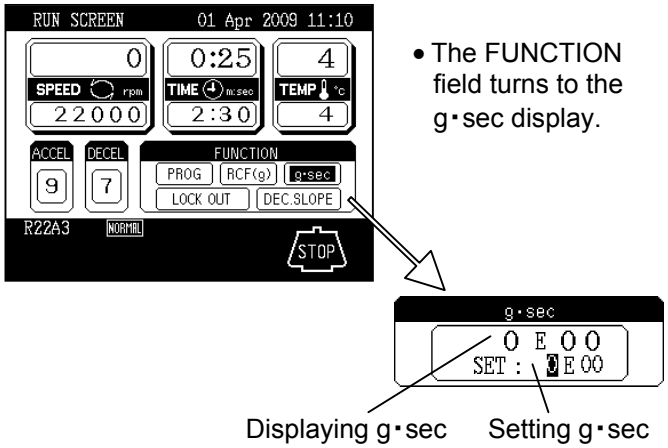
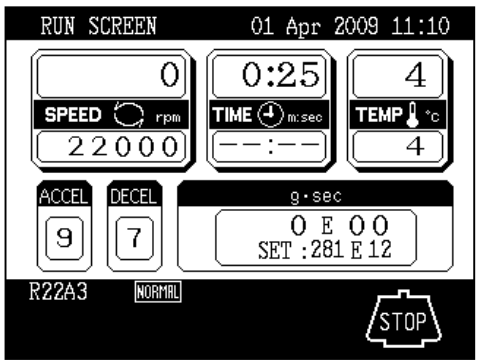
NOTE (1)Press ESC key to clear the RCF screen.

(2)There may be a slight difference between the set RCF and the actual RCF values because the speed setting is done in increments of 100 rpm when computing the speed from the RCF value.

(3)Set the speed to clear the operation of the RCF setting.

3-3-5 **Displaying and Setting g･sec**

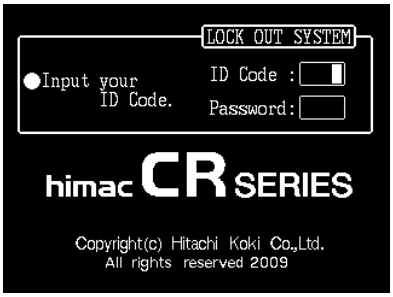
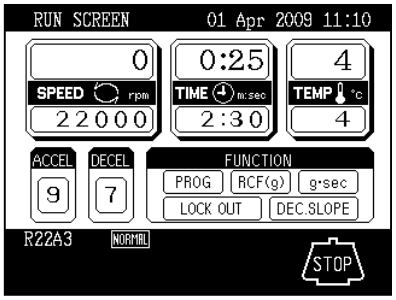
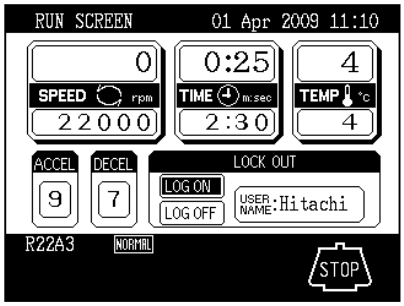
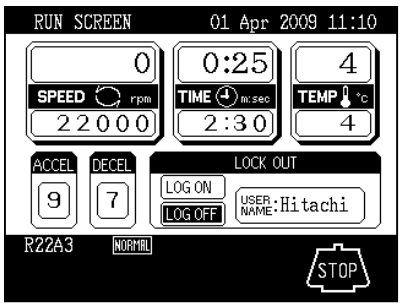
This section explains how to use the g･sec displaying and setting capability of the centrifuge.
(1) Procedure for displaying and setting g･sec values

Step	Key operation	Screen display and notices
1	Move the cursor to **g･sec** and press the ENTER key.	 • The FUNCTION field turns to the g･sec display. • Displaying g･sec ; g･sec value computed from the actual speed and the run time is displayed. • Setting g･sec ; "－E－－" is displayed when no g･sec value is set.
2	Set the desired g･sec value. (e.g.: setting "281exp12") 2 8 1 1 2 "ENTER"	 • The TIME display shows "－－：－－" by pressing the ENTER key.(TIME display shows the elapsed time.) • The centrifuge starts deceleration when the set g･sec value matches the displayed g･sec value, and the displayed g･sec shows the total value until the rotor stops. • Set the run time to clear the operation of the g･sec setting.

3-3-6 **Lockout system function**

The lockout system function is specifically designed for the CR22GⅢ/ CR21GⅢcentrifuge. This lockout system is used to limit the users of the centrifuge. The registered users can use this system after the system administrators have registered the users.

It is necessary for the system administrators to read the separated manual "CR22GⅢ/ CR21GⅢ LOCKOUT SYSTEM INSTRUCTION MANUAL". The users are required to log on to the centrifuge by inputting the ID code and the password on the initial screen of the lock out system to operate the centrifuge. After using the centrifuge, be sure to log off the lock out system or turn off the main power switch. This section describes the procedure for the lock out system operation.

Step	Key operation	Screen display
1	When using the lockout system, turn on the main power switch. Then the initial screen of the lockout system is displayed. Input your (registered user) own ID code (4digits) and press the ENTER key. Then input the password (4digits) and press the ENTER key.	
2	The screen shown in the right figure is displayed. (This screen is displayed when using the CR22GⅢ centrifuge.) The centrifuge is now operable.	
3	Logged on user name can be displayed. Press the cursor key to move the cursor to "LOCK OUT" in the FUNCTION box and press the ENTER key.	
4	After using the centrifuge, log off the lockout system according to the following procedure. (The lockout system can also be logged off by turning off the main power switch.) The lockout system is not available next time if this procedure is not performed. Press the cursor key to move the cursor to "LOCK OUT" in the FUNCTION box and press the ENTER key. Press the cursor key ◆ to move the cursor to "LOG OFF" and press the ENTER key. Then the initial screen of the lockout system is displayed(same as the above step1)	

3-3-7 **Variable deceleration slope function (CR22GⅢ only)**

The variable deceleration slope function is specifically designed for the CR22GⅢ centrifuge. Two slower deceleration slopes are selectable in addition to the same slope as the well-reputed slope of the conventional centrifuges. This function is effective for separation of samples that are apt to be disturbed. The deceleration mode is selectable from three SLOPEs, normal deceleration slope (NORMAL), slow deceleration slope (SLOW) and free coasting slope (FREE), and it is changeable from NORMAL to SLOW or FREE when the rotating speed is 10,000 rpm or lower as shown in the following example. The rotating speed is changeable to a desired speed between 1,000 rpm and 10,000 rpm in increments of 1,000 rpm. If the desired speed is higher than the set speed, it decelerates from the set speed to SLOW or FREE.

Example) Following is an example of operation using the variable deceleration slope function with the R22A3 rotor.

① Selection of the variable deceleration slope function
Deceleration slope (SLOPE): SLOW
Deceleration mode change speed (MODE CHANGE SPEED): 7,000 rpm

② Other setting
Rotor: R22A3
Speed: 22,000 rpm
Time: 2 mintues and 30 seconds
Temperature: 4℃
Acceleration mode: 9
Deceleration mode: 7 (Note that the indication on “DECEL” is “－” even after setting “7” and the deceleration from 500 rpm to 0 rpm is different from the selected deceleration mode.)

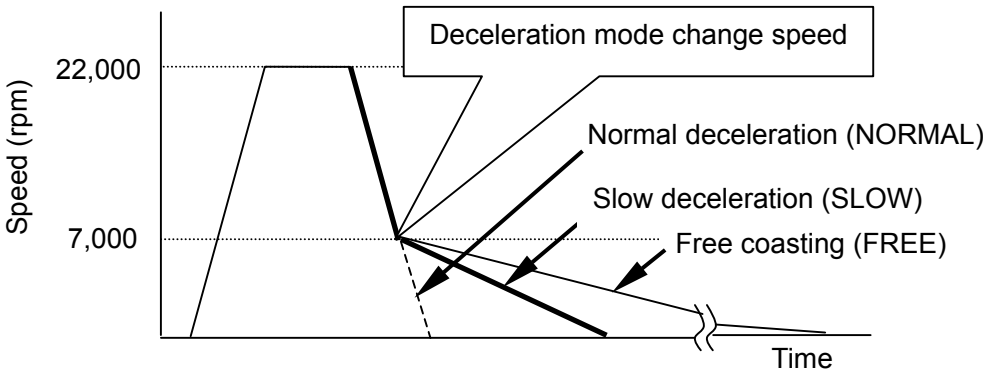
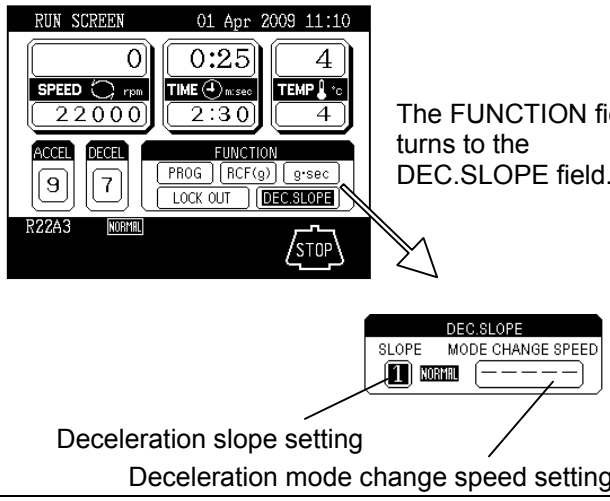
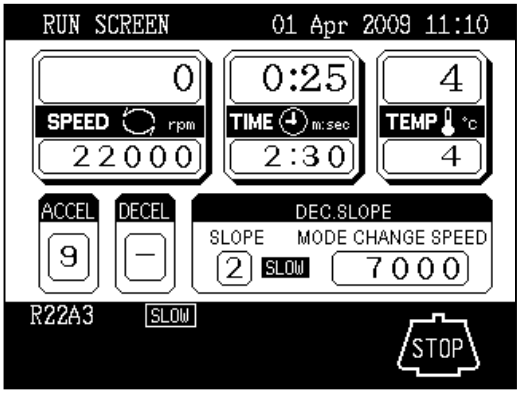


Fig. 3-3-5 Example of operation using the variable deceleration slope function

(1) Procedure for calling up the variable deceleration slope function

Step	Key entry	Display on the screen and remarks
1	Move the cursor to DEC.SLOPE with the cursor key and press the "ENTER" key. The current setting is displayed.	 The FUNCTION field turns to the DEC.SLOPE field.
2	Select the deceleration slope (SLOPE) from the following three. 1: Normal deceleration slope (NORMAL) 2: Slow deceleration slope (SLOW) 3: Free coasting slope (FREE) (Example) Slow deceleration 2 or ENTER Set the deceleration mode change speed (MODE CHANGE SPEED) within the range from 1,000 rpm to 10,000 rpm in increments of 1,000 rpm. (Example) When the deceleration mode change speed is 7,000 rpm: 7 0 0 0 ENTER	 The display shows the deceleration slope (NORMAL, SLOW or FREE) corresponding to the entered value from 1 to 3. When selecting SLOW or FREE, "–" is indicated on the DECEL column. To cancel the variable deceleration slope function, set the deceleration slope (SLOPE) to NORMAL. Then the indication on the MODE CHANGE SPEED becomes"– – – – –". The current setting of the variable deceleration slope function is shown on the message column such as SLOW. When RTC operation is selected, RTC is indicated prior to the setting. NOTE The slope is changed upon changing the deceleration slope (SLOPE) while the rotor is decelerating at the deceleration mode change speed (MODE CHANGE SPEED) or lower. When the deceleration mode change speed (MODE CHANGE SPEED) indicates "– – – – –", the slope is not changed to the slow deceleration slope (SLOW) or the free coasting slope(FREE) , even if the deceleration slope is selected to (SLOW) or to (FREE).

3-4 Emergency Recovery from Power Failure

⚠ **WARNING:** When servicing the centrifuge, be sure to turn off the POWER switch, turn off the distribution board of your centrifuge room, and then wait for at least three minutes before removing covers or tables from the centrifuge to avoid electrical shock hazards.

⚠**WARNING:** 1. Never attempt to open the door while the rotor is rotating.
2. Never attempt to slow or stop the rotor by hand.

⚠**CAUTION:** Do not perform any operation not specified in this manual. If any problem is found on your centrifuge, contact a Hitachi Koki authorized sales/service representative.

(1) Rotation of rotor
The rotating rotor coasts free and finally stops if a power failure occurs during operation. When the power is restored, the centrifuge automatically re-accelerates the rotor if the rotor is still rotating at 250 rpm or higher, or decelerates the rotor if the rotor is rotating under 250 rpm.

(2) Operation panel
During the power failure, all the displays on the control panel are off. When the power is restored, the centrifuge will restart the control of the run with the set parameters that were in effect before the power failure (battery-backed), and will report the occurrence of the power failure by lighting up the alarm message.

(3) Taking out the rotor during power failure
If the power failure is continuing for a long time, and you have decided to remove the rotor from the rotor chamber during the power failure, then take the following procedure.

⚠**WARNING:** Make sure that the rotor has coasted to a complete stop. When the rotor is at rest, it make no sound. So listen carefully for any sound coming from the rotor chamber. Never attempt to override the door interlock system while the rotor is rotating.

It takes more than 90 minutes for the rotor to come to a complete stop when the rotor is rotating at high speed. Before opening the door, wait until the rotor comes to a stop.

1. Check that the rotor stops completely.
2. Turn off the POWER switch of the centrifuge and the distribution board of your centrifuge room.
3. Remove the two screws from the lower portion of the front cover. Remove the front cover by pulling the lower portion of the front cover forward and downward. The upper portion of the front cover is hooked, not secured with screws.
4. Move the two link bars toward the arrows and secure them with adhesive tape.

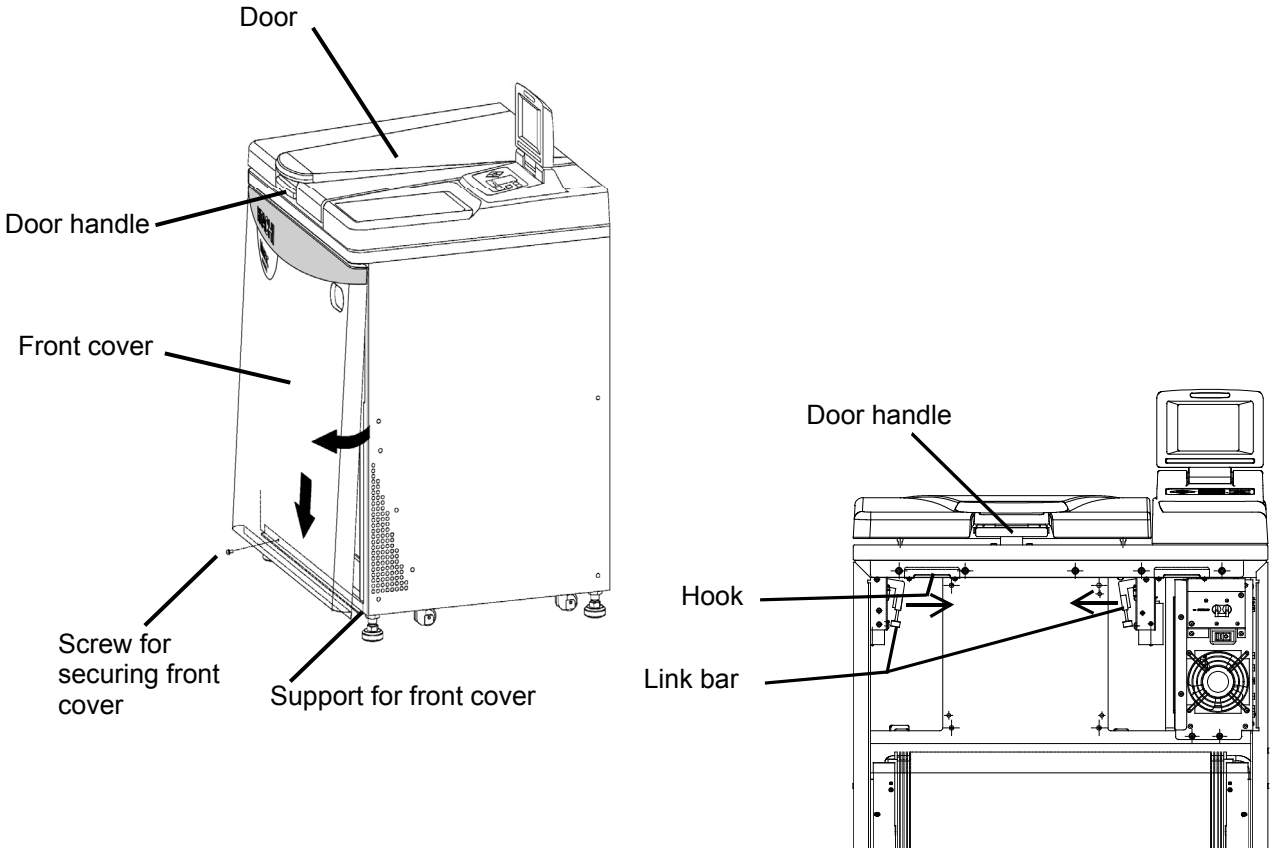


Fig. 3-4-1 Opening the door

5. Release the door handle and open the door slowly.
   Check that the rotor stops completely. If the rotor is rotating, close the door immediately.

⚠ **WARNING:** In the event where the door is opened while the rotor is still rotating, close the door immediately.

⚠ **WARNING:** Never attempt to slow or stop the rotor by hand.

6. Take out the rotor and remove the adhesive tape from the link bars. Insert the hooks into the slots on the front cover and place the front cover on the support. Secure the front cover with the screws.

3-5 Features on Menu Screen

Press the MENU key and a menu appears as follows.

(1) User customization
(2) Entry of new rotor
(3) Alarm information
(4)Lock out system

Select the desired item with the numeric key and press the ENTER key to show the corresponding screen.

The message display at the lower portion of the MENU screen shows the total hours of the drive unit operation. Inform it when making a service call.

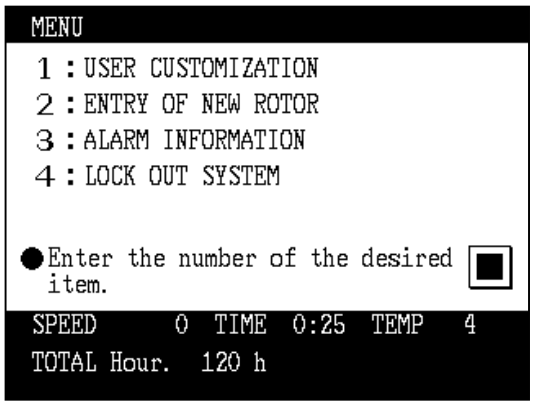


Fig. 3-5-1 MENU screen

3-5-1 User Customization

The user customizations include the following items.

(1) SCREEN UTILITIES
(2) FINISH SCREEN
(3) Pre-cool
(4) MELODY

Select the desired item with the numeric key and press the ENTER key to show the corresponding screen.

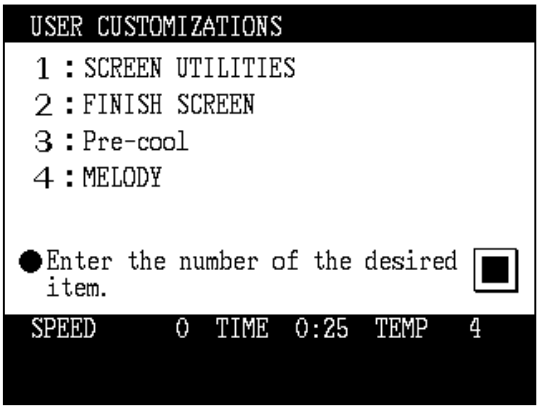


Fig. 3-5-2 USER CUSTOMIZATION screen

(1) SCREEN UTILITIES

You can customize the centrifuge in display language, current time setting, screen contrast level, etc.

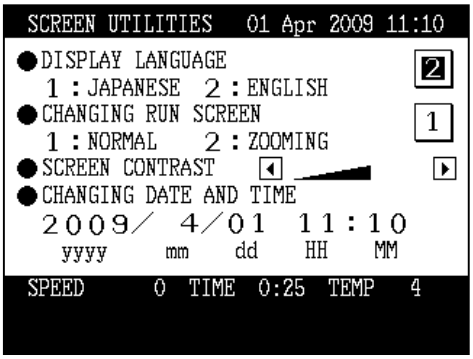


Fig. 3-5-3 USER CUSTOMIZATION screen

1) Display language (Japanese or English)
Select the desired display language either Japanese or English with the numeric key and press the ENTER key.

2) Changing RUN SCREEN
1. NORMAL: RUN SCREEN is displayed.
2. ZOOM: The display automatically turns to ZOOM screen shown in Fig. 3-5-4 when 20 seconds have passed after reaching the set speed. The ZOOM screen returns to the RUN SCREEN by pressing any key on the panel or when the rotor starts deceleration.

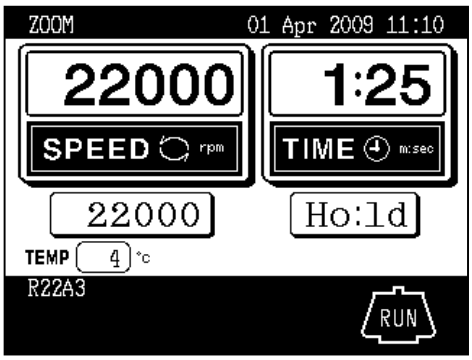
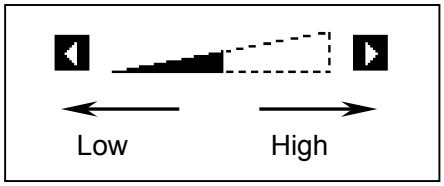


Fig. 3-5-4 ZOOM screen

3) Screen contrast
Use cursor keys ◀ and ▶ to adjust the contrast.



4) Changing date and time
This feature is used when adjusting the incorporated time clock to the current date and time correctly.
Set the correct date and time for RTC operation.
Enter the desired date and time using the cursor keys and the ten-key numerical pad, then press the ENTER key.

NOTE (1) Press the ESC key several times to return to the RUN SCREEN.
(2) Press a cursor key to show the cursor on the screen in this case.

(2) FINISH SCREEN

If you choose the “2.FINISH SCREEN”, the “FINISH” (see Fig 3-5-6) appears when the rotor stops, and then “FINISH” blinks.
If you select “1.NORMAL” , the “FINISH” does not appear when the rotor stops.
If you press any function key or open the door while “FINISH” blinks, the RUN SCREEN reappears.

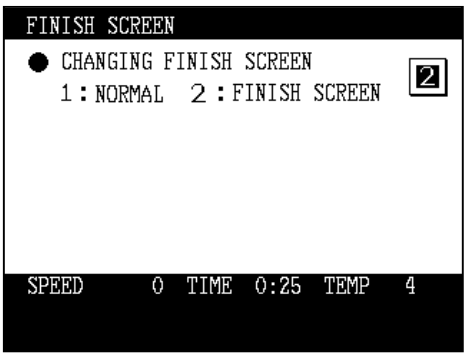


Fig. 3-5-5 Screen for choosing the FINISH SCREEN

Fig. 3-5-6 FINISH SCREEN

(3) Pre-cool

The temperature in the chamber is controlled at about 15℃ when closing the door by selecting “Pre-cool”.
Presence of a rotor is automatically detected when closing the door and the temperature in the chamber is controlled
at 15℃ if no rotor is loaded.(controlled at the set temperature when a rotor is mounted.)
The temperature in the chamber may not be controlled if the ambient temperature or the temperature of the evaporator is 15℃ or less.

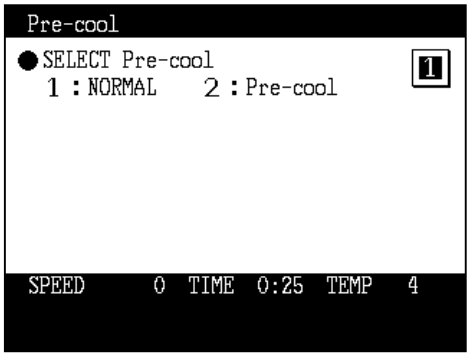


Fig. 3-5-7 Pre-cool screen

(4) MELODY

You can select a desired melody from five different sounds and a beep, or silence with the numeric key. Press the ENTER key after selection.

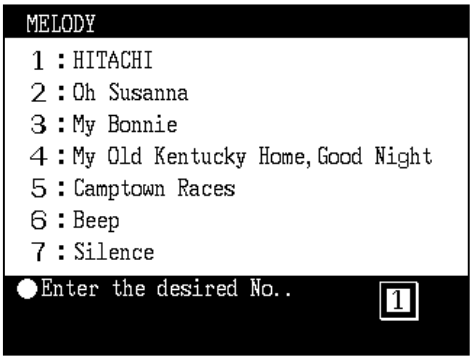


Fig. 3-5-8 MELODY screen

This centrifuge does not require complicated maintenance and inspection. To ensure safe and trouble-free use for a long time, follow the instructions below.

⚠ **CAUTION：** Using a cleaning or sterilization method other than the ones recommended in this instruction manual might cause corrosion or deterioration of the centrifuge. Refer to the chemical resistance chart provided with the rotor, or contact Hitachi Koki.

⚠ **CAUTION：** Be sure to turn off the POWER switch before cleaning or sterilizing the centrifuge.

For information on the maintenance of rotors and tubes, see the rotor instruction manual provided with the rotor.

4-1 Rotor Chamber

⚠ **CAUTION:** Do not pour any liquid (such as water, detergent, or disinfectant) directly into the rotor chamber. If you do so, the bearings of the drive unit might corrode or deteriorate.

(1) If the rotor chamber is found not dry, wipe moisture from the chamber with a cloth or sponge to cool the rotor efficiently. Drain condensed water from the chamber by using the drain hose.
(2) If the rotor chamber is found dirty, wipe the chamber with a cloth or sponge dampened with a diluted solution of neutral detergent.
(3) Turn off the centrifuge power and keep the door opened to dry the chamber after operation.

4-2 Drive Shaft (Crown)

⚠ **CAUTION:** Once a month, clean the inside of the drive hole (crown hole) of the rotor and the surface of the drive shaft (crown) of the centrifuge. If the drive hole or the drive shaft is stained or any foreign matter adheres to it, the rotor may be improperly installed and come off during operation.

This part is very important because the rotor is mounted on it and the crown transmits the driving force to the rotor. Before mounting a rotor, wipe the outer surface of the crown with a soft cloth sufficiently dampened with water.

4-3 Cabinet

Always keep the table and the cabinet of the centrifuge clean to prevent dust and other materials from falling into the rotor chamber. Wipe the table and the cabinet with a cloth or sponge dampened with a diluted solution of neutral detergent. If any solution that is toxic, radioactive, or pathogenic is spilt inside or outside the centrifuge, take necessary action according to your proper laboratory procedures and methods.

4-4 Rotor

(1) To prevent corrosion, take out the rotor from the rotor chamber after operation and remove the rotor cover to dry the tube holes.
(2) If any sample is spilt inside the rotor, wash and dry the rotor well, then apply silicone grease lightly to the rotor.
(3) Regularly apply lubricant grease to the thread portion of the rotor cover knob.

4-5 Radiator

To maintain the efficiency of the refrigeration system, remove the front cover and clean the radiator with a vacuum cleaner at six-month intervals.

⚠ **CAUTION:** Avoid contacting the radiator fins that can cause injury to fingers.

4-6 Replacement Parts

The table below lists the consumable parts of this centrifuge. It is recommended to replace parts earlier referring to the suggested guidelines for replacement timing in the table below. The timing of replacement varies depending on operation environment and condition.

No.	Description (Part No.)	Guideline for replacement timing
1	Gas spring(2pc.)（S307689E）	It is recommended to replace the gas spring every three years (about 15,000 times of opening and closing). If the opened door closes naturally or the door feels heavy to open within three years, replace the gas spring with new one.

4-7 Others

(1) Storage period of service parts
Service parts are kept in stock for seven years after the discontinuation of production.
The term “service parts” means the parts that are necessary to ensure the correct functioning of the centrifuge.

5. Troubleshooting

Be sure to read and keep in mind the following cautionary information before troubleshooting.

⚠ **WARNING：** 1.When servicing the centrifuge, be sure to turn off the POWER switch, turn off the distribution board of your centrifuge room, and then wait for at least three minutes before removing covers or tables from the centrifuge to avoid electrical shock hazards.

⚠ **WARNING：：** 1.If the centrifuge, rotor, or an accessory is contaminated by samples that are toxic or radioactive, or blood samples that are pathogenic or infectious, be sure to decontaminate the item according to good laboratory procedures and methods.

2.If there is a possibility that the centrifuge, rotor, or an accessory is contaminated by samples that might impair human health (for example, samples that are toxic or radioactive, or blood samples that are pathogenic or infectious), it is your responsibility to sterilize or decontaminate the centrifuge, rotor, or the accessory properly before requesting repairs from a Hitachi Koki authorized sales/service representative. Note that Hitachi Koki cannot repair the centrifuge, rotor, or the accessory unless sterilization or decontamination is completed.

3.It is your responsibility to sterilize and/or decontaminate the centrifuge, rotor, or parts properly before returning them to a Hitachi Koki authorized sales/service representative. In such cases, copy the decontamination sheet at the end of this manual and fill out the copied sheet, then attach it to the item to be returned.
Hitachi Koki may ask you about the treatment for the centrifuge, rotor or the part if the decontamination is checked and judged as insufficient by Hitachi Koki. It is your responsibility to bear the cost of sterilization or decontamination.
If you have any question, please send e-mail to **“** himac@hitachi-koki.co.jp **”** .
Note that Hitachi Koki cannot repair or inspect the centrifuge, the rotor or the accessory unless sterilization or decontamination is completed.

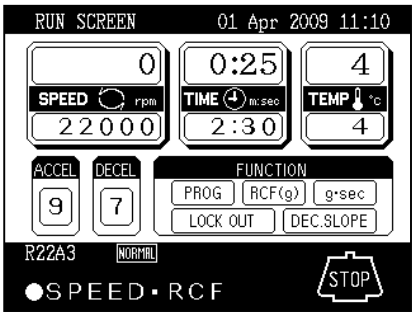
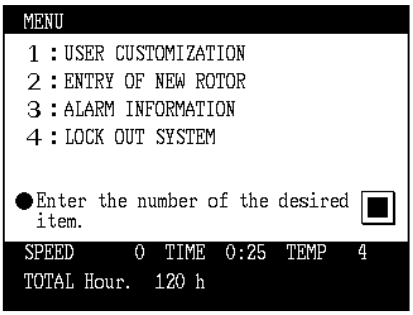
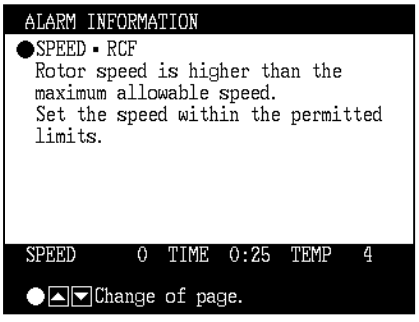
⚠ **CAUTION：** Do not perform any operation not specified in this manual. If any problem is found on your centrifuge, contact a Hitachi Koki authorized sales/service representative.

The CR22GⅢ/ CR21GⅢ refrigerated centrifuge has a self-diagnosis capability that identifies and reports a problem that occurs when the instrument is starting up or in operation, and that affects the operation of the instrument.

5-1 Alarm Messages

When a problem occurs that affects instrument operation, the centrifuge beeps and displays corresponding alarm message, in order to report the occurrence of the problem.
The CR22GⅢ/ CR21GⅢ refrigerated centrifuge has a capability that shows an alarm information screen to help the user to cope with the problem immediately. You can call up the alarm information screen according to the following procedure (example).

(1) Displaying for alarm information

Step	Key operation	Screen display and notices
1	The alarm message "SPEED・RCF" is displayed.	 • The alarm message appears on the message indicator of the RUN SCREEN.
2	Press the MENU key.	 • The screen turns to the MENU screen.
3	Select "ALARM INFORMA-TION" by pressing the following keys. 3 ENTER	 • ALARM INFORMA-TION screen appears. * Corresponding alarm information is displayed. * Press the ESC key two times to return to the RUN SCREEN.

If any of the alarm messages E10 to E95 lights up, it is indicating that the centrifuge has a problem and requires maintenance by Hitachi Koki service representative. When you call the service personnel, tell them the displayed alarm code.

NOTE The E13 alarm code indicates that the speed sensor is malfunctioning. When this alarm code appears, the centrifuge will not accept an input from the CE key for 90 minutes, in order to allow the rotor to come to a complete stop. Wait without turning off the power to the centrifuge.

After the RUN mode indicator on the panel turns 

, press the CE key.

5-2 User-corrected Problems

Some problems are not identified and reported by the self-diagnostic capability of the centrifuge. To correct these problems, take the actions described in the table below.

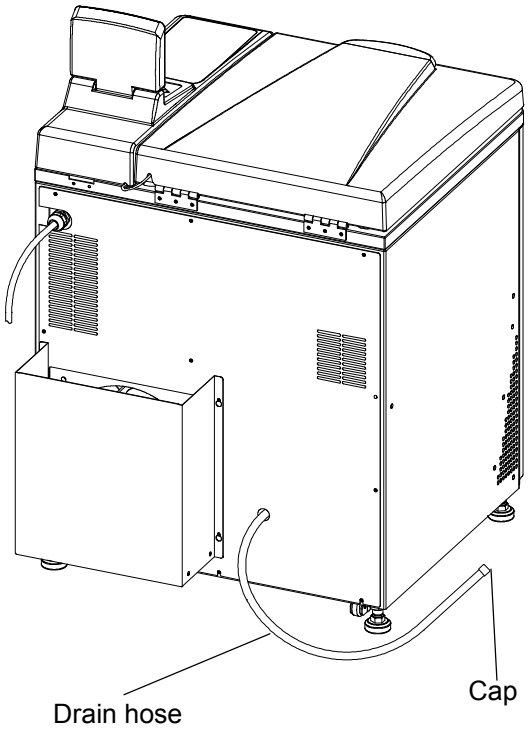
Symptom	Cause	Corrective action
Centrifuge does not accept entries of run conditions.	ENTER key is not pressed after entering the numeric values.	Press the ENTER key after entering run conditions.
Rotor does not start accelerating when START key is pressed.	The beeper sounds three short beeps when the START key is pressed.	Check the run conditions again.
Run conditions cannot be set or recalled.	The rotor is still rotating.	Set or recall the run conditions when the rotor stops completely.
Recalled run conditions are changed.	The battery to back up the programmed memory is dead.	Set the run conditions again and keep the centrifuge turned on for 10 hours by pressing the POWER key to recharge the battery.
Rotor is not cooled.	The room temperature is over 30 ºC.	Lower the room temperature using an air conditioner or lower the speed in non-air-conditioned environments.
	A heat-producing device such as a refrigerator or a generator is near the centrifuge.	Relocate the heat-producing device to another place or contact your local dealer to ask for relocation of the centrifuge.
	The radiator is clogged with dust.	Clean the radiator according to the procedure specified in section 4-5.

(6) Handling the drain hose

⚠ **CAUTION:**
- Be careful not to hurt your hands or fingers when cutting the band fixing the drain hose.
- Cooling ability degrades if this centrifuge is operated with its drain hose inserted in an effluent container without the cap on.

1. The drain hose is fastened to the back of the centrifuge by a band during transport.
   Cut this band to facilitate drainage.

2. Remove the cap at the tip of the drain hose only while draining the centrifuge. Keep the cap on.
   Be careful not to lose it.



Installation or relocation of your centrifuge must be done by the authorized Hitachi Koki service representative.
Contact a Hitachi Koki authorized sales/service representative.

7. Warranty

7-1 Warranty on Centrifuge

The centrifuge main body is warranted for one year from the delivery date on condition that it is properly operated and maintained.

7-2 Warranty on Rotor

For information on the warranty on rotors, refer to the instruction manuals of each rotor for Hitachi high-speed refrigerated centrifuge.

〔Incidental conditions〕

We do not warrant this centrifuge under the following conditions even before the warranty period expires:

(1) Failures caused by incorrect installation
(2) Failures caused by rough and/or improper handling
(3) Failures caused by operation or maintenance in any manner not described in the rotor instruction manual and the centrifuge instruction manual
(4) Failures caused by conveyance or relocation after installation
(5) Failures caused by modification or disassembly without Hitachi Koki's permission
(6) Failures caused by use of rotors, buckets, adapters, tubes and bottles that are not designated for the centrifuge by Hitachi Koki.
(7) Failures caused by fire, earthquakes, or other natural disaster
(8) Consumable parts and parts having a limited warranty period
(9) Failures caused by use of a rotor that is out of warranty

This warranty does not apply to samples or other damage caused by a failure of this centrifuge or the rotor.

9.Tubes and Bottles

Cleaning and sterilizing tubes and bottles

Use the best method for cleaning and sterilizing tubes and bottles, referring to the table below.

Cleaning and sterilizing conditions for tubes and bottles

✓: Applicable ×: Inapplicable

Condition		Material	PA	PC	PP
Cleaning	Cleaning fluids	Acidic (pH5 or lower)	×	×	×
		Acidic (higher than pH5)	✓	✓	✓
		Alkaline (higher than pH9)	✓	×	✓
		Alkaline (pH9 or lower)	✓	✓	✓
		Neutral (PH7)	✓	✓	✓
		Warm water (up to 70°C)	✓	✓	✓
	Ultrasonic cleaning	Neutral detergent (pH7)	✓	✓	✓
Sterilization	Autoclaving	115°C（0.7kg / cm^2）30 minutes	✓	✓	✓
		121°C（1.0kg / cm^2）20 minutes	×	✓	✓
		126°C（1.4kg / cm^2）15 minutes	×	×	×
	Boiling	15 to 30 minutes	✓	✓	✓
	Ultraviolet sterilization	200 to 300 nm	×	×	×
	Gas sterilization	Ethylene oxide	✓	×	✓
		Formaldehyde	✓	✓	✓

PA: Polyallomer PC: Polycarbonate PP: Polypropylene

Cleaning PC tubes and bottles

PC materials have low chemical resistance to alkaline solutions. Avoid using neutral detergents higher than pH9. Note that some neutral detergents are still higher than pH9 even if diluted according to the instruction in the maker's catalog. Use detergents between pH7 and pH9 (The Hitachi cleaning set with a brush (Part No. S305166A) is recommended for cleaning rotors.).

Autoclaving PA, PC and PP tubes and bottles

PA begins softening at about 120°C, and PC and PP at about 130°C. Autoclave PA tubes/bottles at 115°C (0.7 kg/cm^2) for 30 minutes and PC and PP tubes/bottles at 121°C (1.0 kg/cm^2) for 20 minutes. If a certain temperature is exceeded, the tubes/bottles may be deformed.

Observe the following instructions when using a sterilizing chamber:

(1) Place bottles in a vertical position, mouths facing up. If bottles are placed sideways, they may deform into an oval shape due to their own weight.

(2) Remove screw caps and inner covers to prevent deformation or rupture.

(3) Wait until the sterilizing chamber cools down to room temperature before removing the bottles.

Conditions and life expectancy of tubes and bottles

The life expectancies of plastic tubes and bottles depend on factors such as the characteristics of samples, speed of the rotor used, and temperature.

When plastic tubes/bottles are used for centrifugation of ordinary aqueous samples (between pH5 and pH9), their life expectancies are defined as follows.

When operated for 1 hour at the maximum speed:

Tubes (PA, PC, PP)・・・・・・・・・・・・・・・・・・・・・・・・・ 5 operations

Thick-walled tubes and bottles (PA, PC, PP) ・・・・ 50 operations

himac 50 TC tubes and tubes on the market・・・・・ 1 operation

The life expectancies of the PC bottles are specifically defined as follows according to the pretreatment conditions such as cleaning and sterilization.

Cleaning and sterilization / Sample	Gas sterilization and cleaning with warm water	Autoclaving at 121°C for 20 min.
Neutral (PH7)	50 operations	10 operations
Alkalescent (PH7 to 9)	30 operations	5 operations

Do not use crazed (cracked) tubes or bottles.

It is requested that you return the faulty product with this Decontamination Sheet in order to repair it safely in our plant.
Be sure to decontaminate the product according to good laboratory procedures and methods, and fill out this Decontamination Sheet and attach it to the product to be returned to Hitachi Koki for repair.

Attention: Hitachi Koki Co., Ltd.

Decontamination Sheet

Date:

Name:
Name of company(organization) or school:
Division or faculty/Subject of study:
Telephone number:
Address:

I performed decontamination to remove biological or chemical contaminants(including radioactive isotope) from this product as follows.

Model of centrifuge: Serial number
Model of rotor: Serial number
Accessory: Serial number
Contaminants used:
Decontamination methods(conditions):

Date of decontamination Signature

MEMO

After-sales Service

Periodic inspection of the centrifuge is recommended to assure safe and efficient operation.
If the centrifuge fails to function normally, do not attempt to repair it yourself. Contact a Hitachi Koki authorized sales/service representative.

Export office

Hitachi Koki Co., Ltd.

Head Office:
Shinagawa Intercity Tower A,
15-1, Konan 2-chome, Minatoku,
Tokyo, 108-6020 Japan
Tel: (81)3-5783-0665(Dial in)
Fax: (81)3-5783-0771

Manufacturer

Hitachi Koki Co., Ltd.

1060, Takeda, Hitachinaka City
Ibaraki Pref., 312-8502 Japan
Tel: (81)29-276-7384 (Dial in)
Fax: (81)29-276-7475

URL: http://www.hitachi-koki.com/himac/