INSTRUCTION MANUAL

HITACHI

HITACHI
HIGH-SPEED REFRIGERATED CENTRIFUGES

CR22G/CR21G

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

S99944006

⚠ SAFETY NOTICES

⚠ Safety reminders

Carefully read and fully understand the following safety instructions.

- Operate your instrument according to the instructions and procedures described in this manual.
- Be sure to observe the all safety precautions in this manual and safety instructions on your instrument. If neglected, personal injury and/or instrument damage can be caused.
- 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 this manual. If any problem is found on your instrument, contact your local dealer or Hitachi Koki service representative.
- Although the safety precautions in this manual and safety instructions on your instrument have been fully considered, an unexpected situation may arise. Observe the instructions in this 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 in the clearance envelope.
- 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 buckets).
  Using such a sample could corrode the rotor (including 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 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 them.
- Do not exceed the allowable imbalance.
- Maximum rotor speed depends on the buckets, assemblies, tubes or adapters to be used. Follow the instructions on the rotor instruction manual.
- 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 (crown) gently and properly. Do not drop the rotor or apply excessive force to the drive shaft (crown).
- 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.
- Storing the rotor on the shelf is permitted if the shelf is taken necessary countermeasures against earthquakes not to drop the rotor.

⚠ SAFETY NOTICES

○ Mechanical Safety

⚠ **CAUTION**:
- If dew drops 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.
- Do not pour any solution such as water, detergent and disinfectant directly into the rotor chamber.
  Otherwise, the bearings of the drive unit may be corroded or deteriorated.
- 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.
- Installation or relocation of your centrifuge must be done by the authorized Hitachi Koki service representative. Contact Hitachi Koki authorized sales/service representative.
- Unauthorized repairs, disassembly, and other services to the centrifuge except by Hitachi Koki authorized sales/services representative are strictly prohibited.

⚠ **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 instrument is not designed for use with materials capable of developing flammable or explosive vapors. Do not centrifuge such materials in this instrument nor handle or store them near the instrument.

○ Chemical and Biological Safety

⚠ **WARNING**:• Make sure to prepare necessary safety measures before using samples that are toxic or radioactive samples or pathogenic or infectious blood samples at your own responsibility.

- If the centrifuge, rotor or the accessory is contaminated by toxic or radioactive samples or pathogenic or infectious blood samples, be sure to decontaminate it according to good laboratory procedures and methods.
- If there is a fear that the centrifuge, rotor or the accessory is contaminated by toxic or radioactive samples or pathogenic or infectious blood samples that impair human health,it is your responsibility to sterilize or decontaminate the centrifuge, rotor or the accessory properly before requesting repairs to Hitachi Koki authorized sales/service representative.

⚠ SAFETY NOTICES

○ Chemical and Biological Safety

⚠ **WARNING**:• It is your responsibility to sterilize or decontaminate the centrifuge, rotor or the accessory properly before returning to Hitachi Koki authorized sales/service representative.

Notice for an Earthquake

An abnormality may be found on the centrifuge depending on the magnitude of an earthquake. If any abnormality is found, stop using the centrifuge immediately and ask for inspection by the Hitachi Koki service representative.

Table of contents

1. Specifications

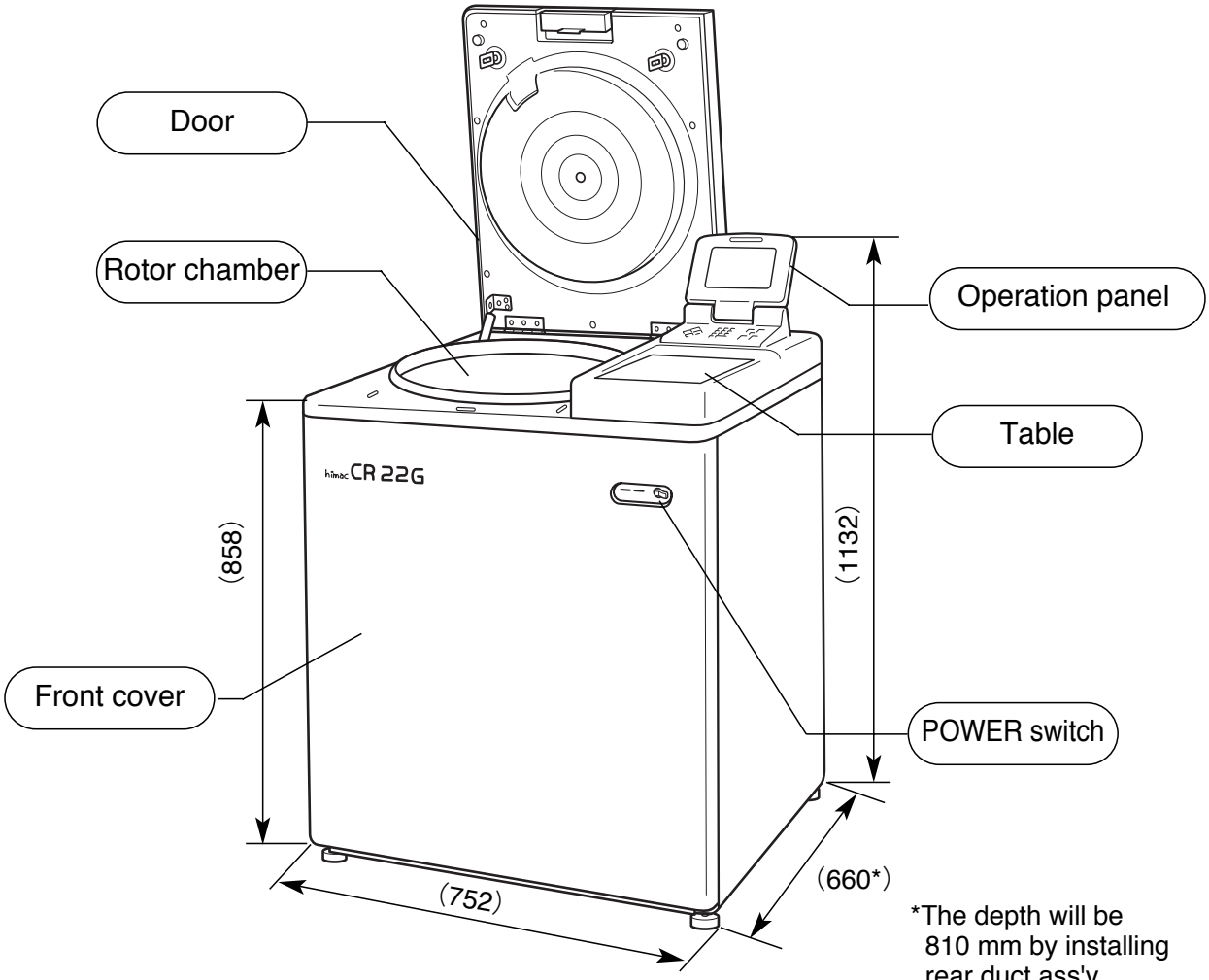
	CR22G	CR21G
Maximum speed	22,000 rpm	21,000 rpm
Maximum RCF	51,200×g（R22A2 rotor）	48,000×g（R20A2 rotor）
Maximum capacity	4,000 mℓ（R9AF rotor）	
Driving system	Brushless high-frequency motor	
Set speed	300 to 22,000 rpm	300 to 21,000 rpm
Set temperature	−20℃ to +40℃	
Set time	1 second to 99 minutes, 59 seconds; HOLD for continuous operation (Option: 1 minute to 99 hours, 59 minutes)	
Program function	Capable of saving 30 kinds of run conditions and displaying/setting the RCF(g) and g.sec	
Dimensions	752（W）×810*（D）×1132（H）mm from bottom to the chamber inlet: 858 mm	
Power requirements	Single phase: 220, 230 or 240 Vac ± 10 %; 50/60 Hz; 30 A	
Weight	220 kg	

＊Measurement including rear duct ass'y (660 mm without rear duct ass'y)

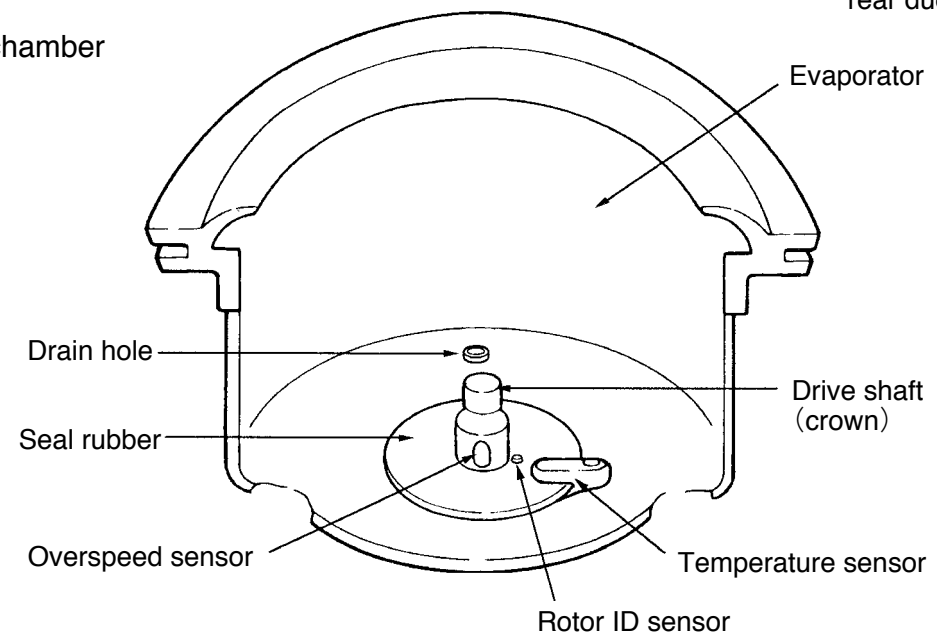
2. Structure

This section explains the appearance and the structure of the main components of the CR22G/CR21G refrigerated centrifuge.

2-1 Appearance



Rotor chamber



2-2 Structure

2-2-1. Operation Panel

The operation panel of the CR-G 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).

（1）CR22G/21G

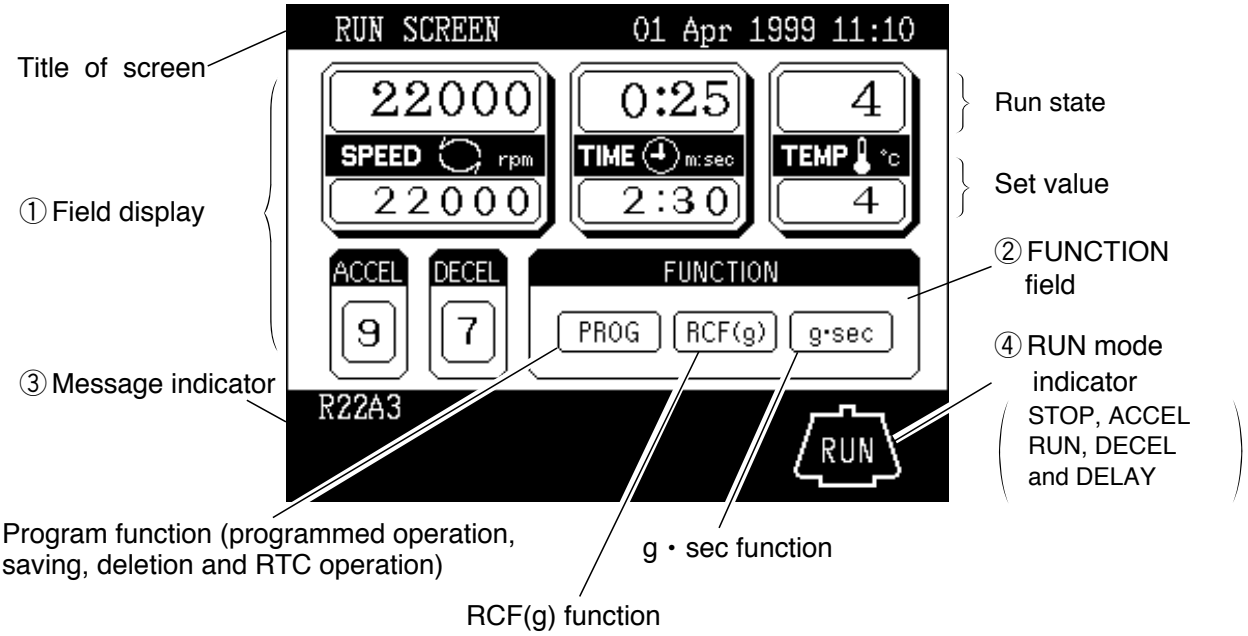


Fig. 2-2-1 Display panel

〔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. Set speed range is from 300 rpm to the maximum speed. Maximum speed CR22G：22,000 rpm CR21G：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℃. （Lower line）Temperature range is from - 20 ℃ to 40 ℃ in increments of 1 ℃. ● 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.
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 during rotor is rotating at set speed) DECEL DELAY (Displayed up to RTC operation is started)

〔Function keys〕

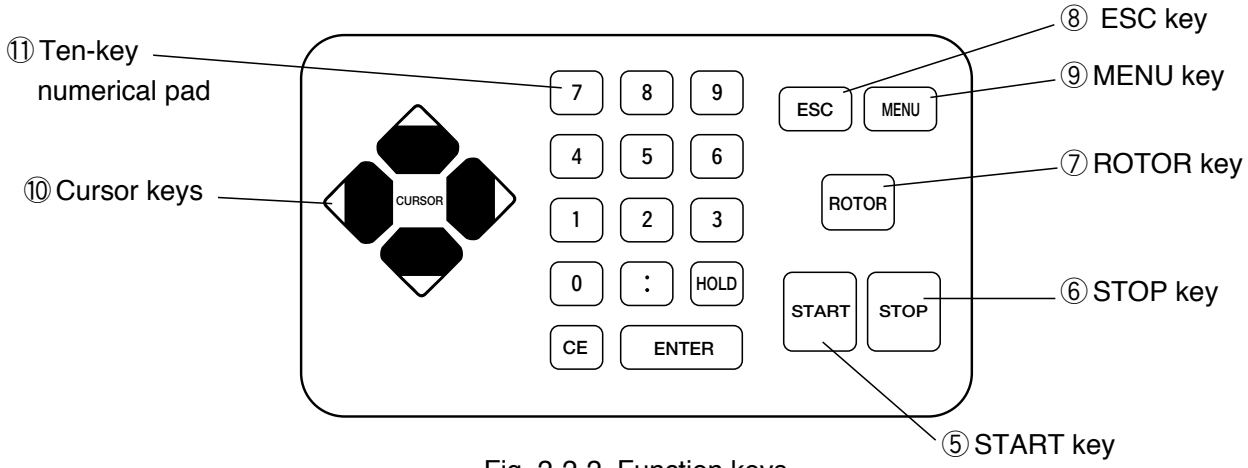


Fig. 2-2-2 Function keys

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, entry of new rotor or alarm information in MENU screen.
⑩	Cursor keys ① ② CURSOR ③ ④	(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 7 8 9 4 5 6 1 2 3 0 :/– HOLD CE ENTER	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 page 5-3 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

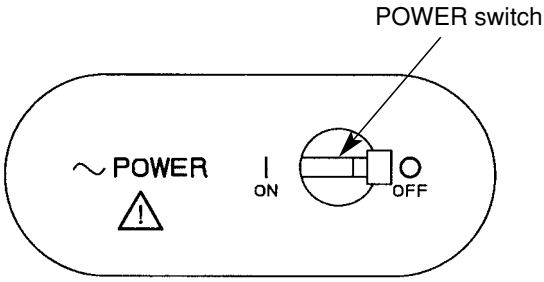


Fig. 2-2-3 POWER switch

⚠ **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) Overspeed detector

This centrifuge is equipped with a sensor that does not allow the rotor to rotate over the allowable maximum speed. If improper speed over the allowable maximum speed is set, the overspeed detector detects it when the rotor is running at low speed (1,000 rpm) and displays an alarm message "SPEED", then stops the rotor.

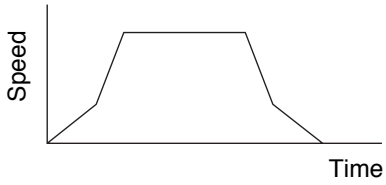
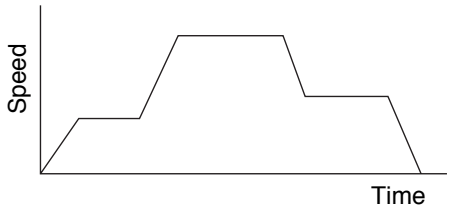
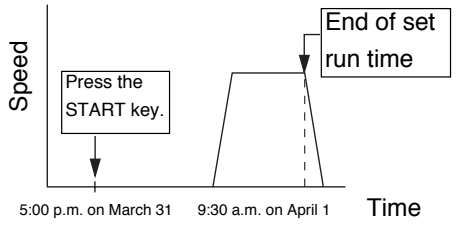
(5) Rotor cover detector

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"

3-1 Preparation for Operation

⚠ **WARNING**：1.This centrifuge is not designed for use with materials capable of developing flammable or explosive vapors. Do not use such materials in this instrument nor handle or store them near the instrument.

2. Make sure to prepare necessary safety measures before using samples that are toxic or radioactive samples or pathogenic or infectious blood 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, asemmbly,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.

The specifications of applicable rotors are listed below.

Spec. / Rotor	Rotor No.	Max.speed (rpm)	Max.RCF (g)	Speed for refrigerating at 4℃ (rpm)	RCF at speed for refrigerating at 4℃ (g)	Allowable imbalance (g)	Max RADIUS (mm)
R26A	15	19,000	42,780	17,000	34,250	1	106
R26A2	6	19,000	43,200	18,000	38,800	1	107
R24A	23	19,000	43,190	18,000	38,760	1	107
R22A	27	20,000	45,170	19,000	40,760	0.5	101
R22A2	24	✶22,000	51,200	✶21,000	46,600	1	94.6
R22A3	70	✶22,000	50,300	✶22,000	50,300	0.2	93
R22A4	75	19,000	41,200	17,000	33,000	0.2	102
R21A	26	19,000	43,600	18,000	39,120	0.5	108
R20A	33	16,000	33,200	16,000	33,200	1	116(inner100)**
R20A2	46	20,000	48,000	18,000	38,900	2	107
R19A	28	18,000	40,940	16,000	32,340	2	113
R18A	42	18,000	42,200	16,000	33,300	2	116.5
R17A	34	15,000	31,800	14,000	27,700	2	126.5
R16AF	32	13,000	26,320	12,000	22,400	2	139.3
R15A	47	15,000	32,300	13,500	26,200	2	128.4
R14A	29	14,000	30,240	12,000	22,220	4	138
R14A2	43	13,000	26,100	12,000	22,220	4	138
R14A3	44	14,000	29,100	13,000	25,100	2	133
R14AF	1	13,000	26,320	12,000	22,400	4	139.3
R13AF	74	12,800	25,100	11,500	20,270	4	137
R12A	31	12,000	24,310	11,000	20,430	4	151
R12A2	25	12,000	18,800	12,000	18,800	2	117
R12A3	41	12,000	23,800	11,000	20,000	4	148
R12A4	48	12,000	23,800	12,000	23,800	0.2	148
R12A5	16	12,000	18,800	12,000	22,500	2	117
R12A6	49	12,000	22,500	12,000	22,500	6	140
R12AF	2	12,000	22,500	11,000	18,900	4	139.7
R10A	30	10,000	18,780	9,500	16,950	6	168
R10A2	3	10,000	16,200	10,000	16,200	2	145
R10A3	45	10,000	18,800	9,500	17,000	6	168
R9AF	5	9,000	14,900	9,000	14,900	6	165
R9AF2	73	9,000	15,200	9,000	15,200	6	168

(Note)✶When using R22A2 rotor or R22A3 rotor in the CR21G centrifuge, the maximum speed and the speed for refrigerating at 4℃ are 21,000rpm.

✶✶Type ' 41 ' for sample height to indicate G values of inner tubes .

Rotor \ Spec.		Rotor No.	Max. speed (rpm)	Max. RCF (G)	Speed for refrigerating at 4℃ (rpm)	RCF at speed for refrigerating at 4℃ (G)	Allowable imbalance (g)	Max. radius (mm)
Swing rotor	R15S2/R15S3	71/4	15,000	28,680	14,000	24,980	1	114
	R10S	36	10,000	16,470	10,000	16,470	2	147
	R7S	37	7,000	9,430	7,000	9,430	2	172
	R6S	68	5,700	5,010	5,700	5,010	4	138
	R4S* (15X8 assembly)	39	3,600	2,350	3,600	2,350	4	162 (Note that max. radius of the 10x10 assembly is 151. When using RCF function, add 11 to sample height value.)
	(15X6 assembly)		3,600	2,350	3,600	2,350	4	
	(10X10 assembly)		3,600	2,190	3,600	2,190	4	
	(50X2 assembly)		3,600	2,350	3,600	2,350	4	
	(15X10 assembly)		3,000	1,630	3,000	1,630	4	
	(50X1 assembly)		5,000	4,530	5,000	4,530	4	
	R3S (Tube rack BL)	40	3,000	1,870	3,000	1,870	6	193 (Note that max. radius of tube racks is 186. When using RCF function, add 7 to sample height value.)
	(Tube rack GR)		3,000	1,870	3,000	1,870	6	
	(Tube rack YE)		3,000	1,870	3,000	1,870	6	
	(Tube rack OR)		3,000	1,870	3,000	1,870	6	
	(500PP tube)		3,000	1,940	3,000	1,940	6	
Horizontal rotor	R10H	53	10,000	13,000	10,000	13,000	4	116
Vertical rotor	R20V	51	20,000	38,300	20,000	38,300	1	85.6
Continuous flow rotor	R18C	54	18,000	34,960	16,000	27,620	—	96.5
	R13C	55	13,000	21,260	13,000	21,260	—	112.5
	R10C	56	10,000	14,590	10,000	14,590	—	130.5
Soil dehydrate rotor	R11D	60	11,000	15,830 (PF4.2)	11,000	15,830 (PF4.2)	4	117
Elutriator rotor	R5E	67	5,000	4,700	5,000	4,700	—	**168

(NOTE) * Conventional rotors without overspeed adapter (magnet) cannot be used in this centrifuge.

** Washing radius

The rotors other than listed above cannot be used in principle. (Contact Hitachi koki authorized sales/service representative for more information.)

⚠ **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 tubes/bottles and load them in the buckets that are placed symmetrically with respect to the drive shaft in the rotor.

- If sample that are equal in volume but different in composition are used, the precipitation levels may be different by centritugation and such operation may increase the level of imbalance.
- If sample that are equal in weight but different in volume (density) are used or if the tubes / bottles are different in inside diameter or shape, there may be variations in position of center of gravity and such operation may cause imbalance.

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 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.

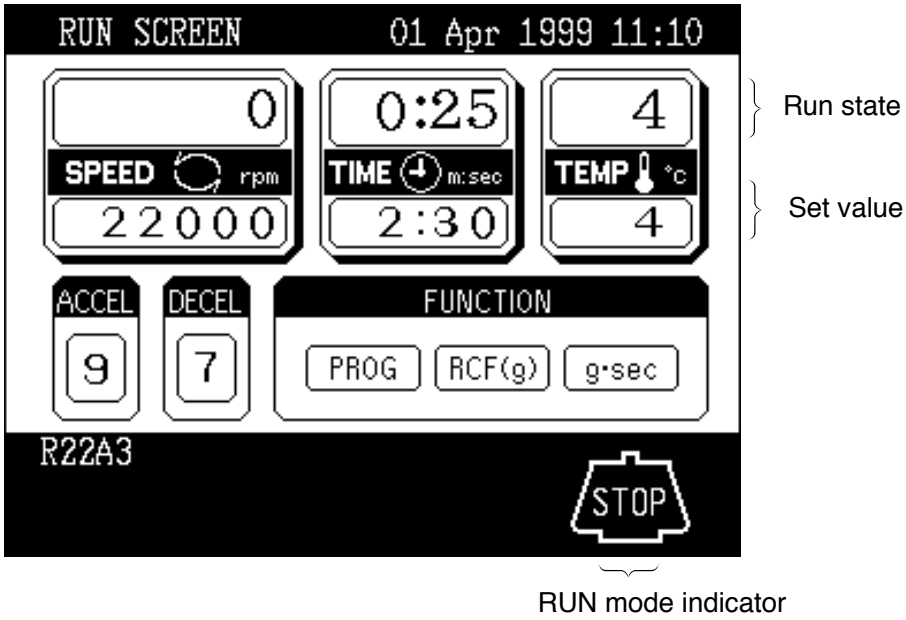


Fig. 3-2-1 RUN SCREEN

[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).

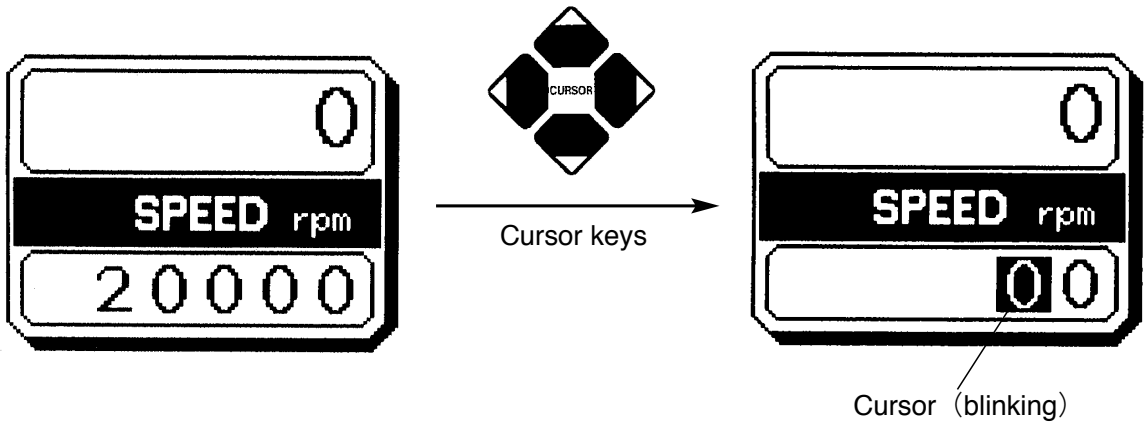
The entry line state varies depending on the presence of cursor as shown below.

（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.



Accepts no entry of numeric values.

Accepts entry of numeric values. The cursor can be moved to another item by pressing the cursor keys.

（1）Fixed-entry state

（2）Ready-to-enter state

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.

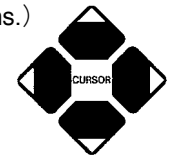
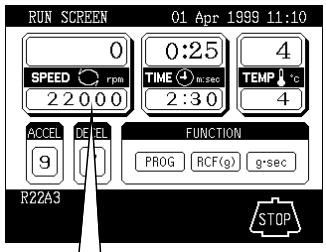
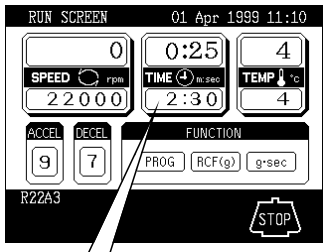
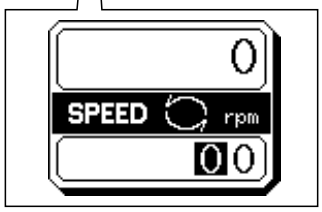
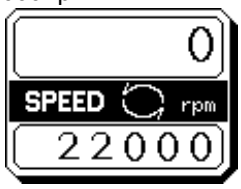
(2) When setting two or more run conditions, there is no need to press the ENTER key after each setting. The set value is entered by pressing a cursor key and the cursor moves to the new item in ready-to-enter state.

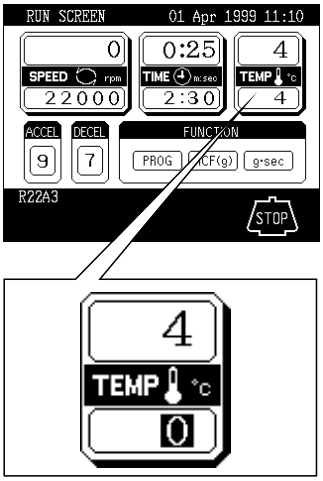
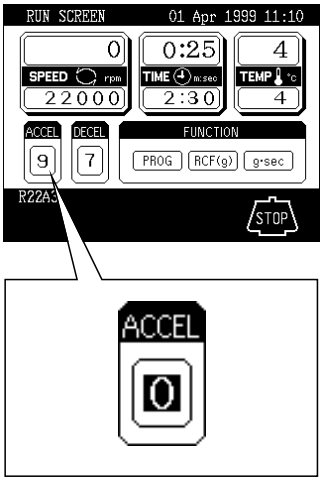
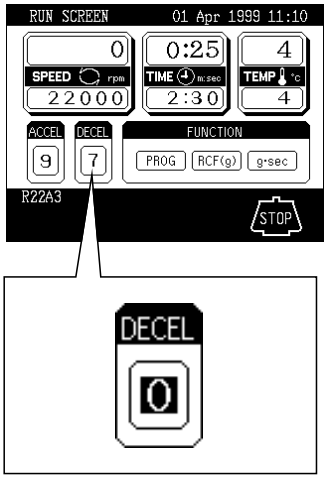
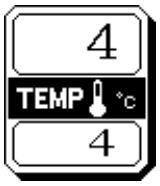
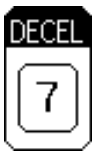
(3) When rekeying the TIME setting during continuous operation (HOLD), enter a value added the desired remaining time to the elapsed time. For example, to stop the operation after 1 minute and 30 seconds when 5 minutes have elapsed in continuous operation, turn the TIME display to ready-to-enter state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

6 : 3 0 ENTER

◆ Setting run conditions

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

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

Temperature (TEMP)	Acceleration rate (ACCEL)	Deceleration rate (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℃	1 to 9	1 to 9 and 0 for free coast

3-2-2 Operating Procedure

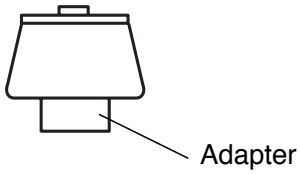
This section describes the procedure for normal operation.

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.



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

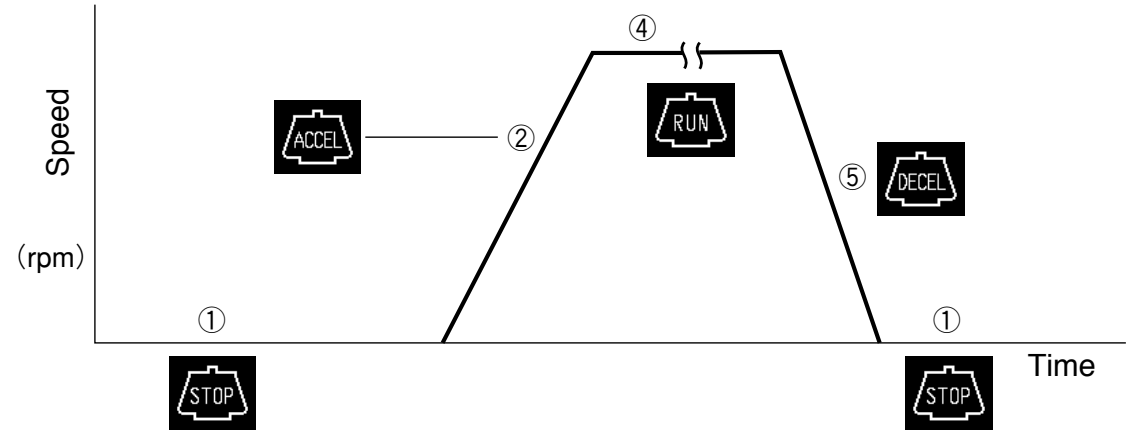
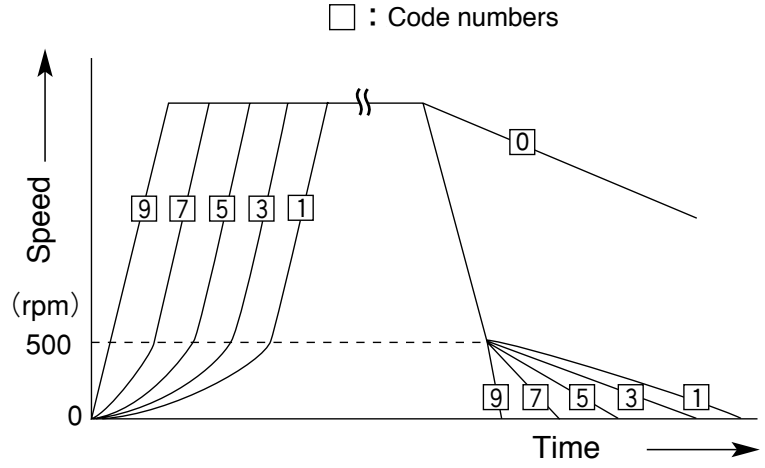


Fig. 3-2-3 RUN mode indicator

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.	8 min.
2	6 min.	10 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.

3-3 FUNCTION Field

The CR22G/CR21G refrigerated 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.

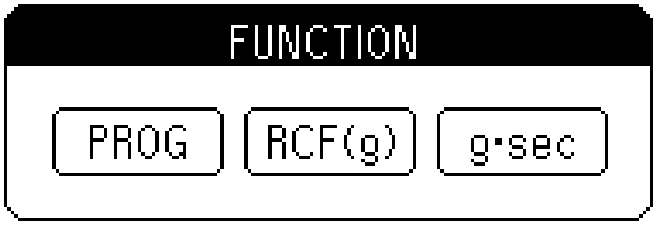


Fig. 3-3-1 FUNCTION field

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.

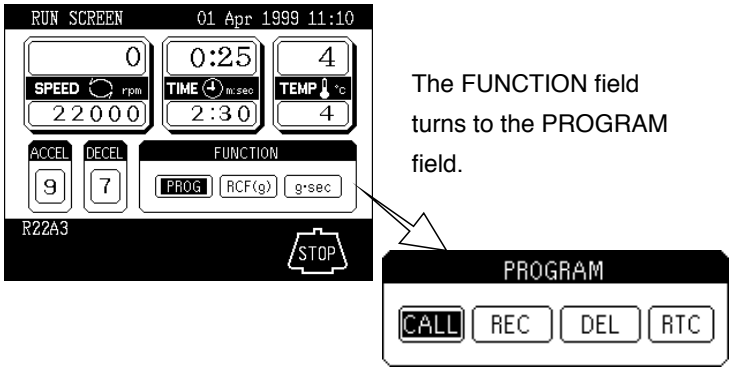
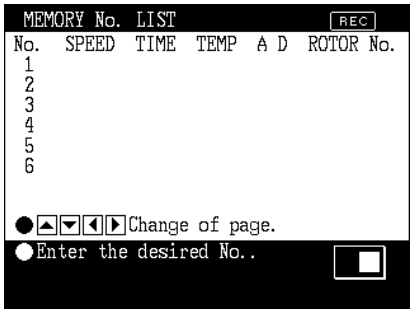
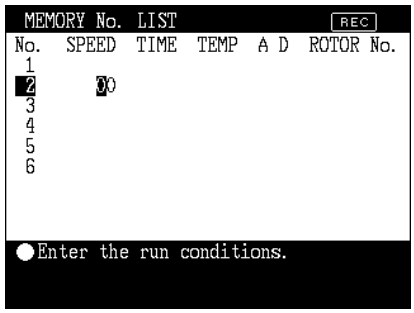
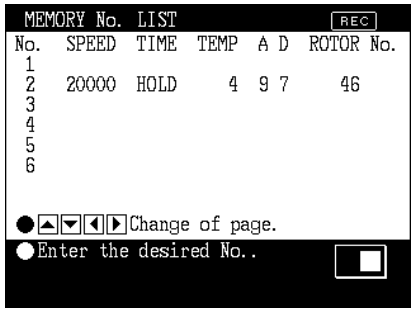
g.sec ： The centrifuge automatically computes and displays integrator (g.sec) values from RCF and run time. The centrifuge can also be operated by entering integrator values.

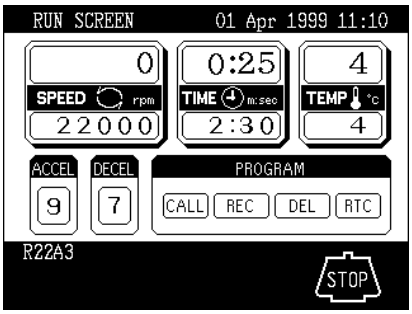
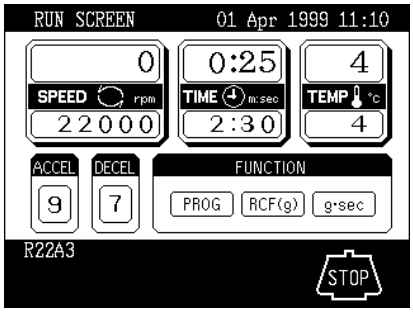
3-3-1 Programmed Operation

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 at 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. 

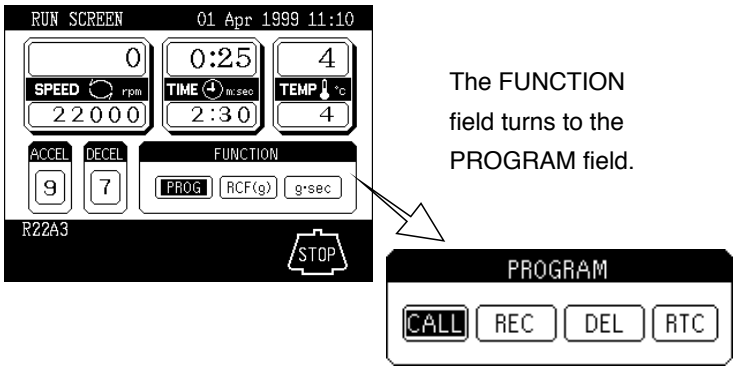
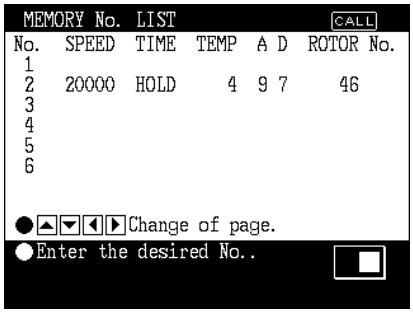
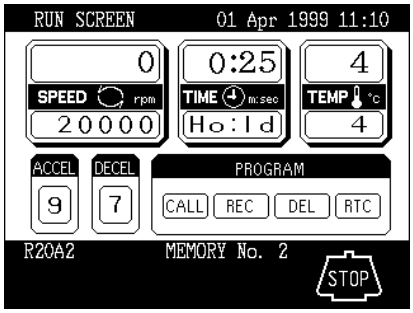
NOTE

（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.

3-3-2 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	1000 rpm	20000 rpm	5000 rpm
Run time	30 min.	60 min.	10 min.
Temperature	4℃	4℃	4℃
Accel rate	9	9	9
Decel rate	9	9	7
Rotor No.	46	46	46

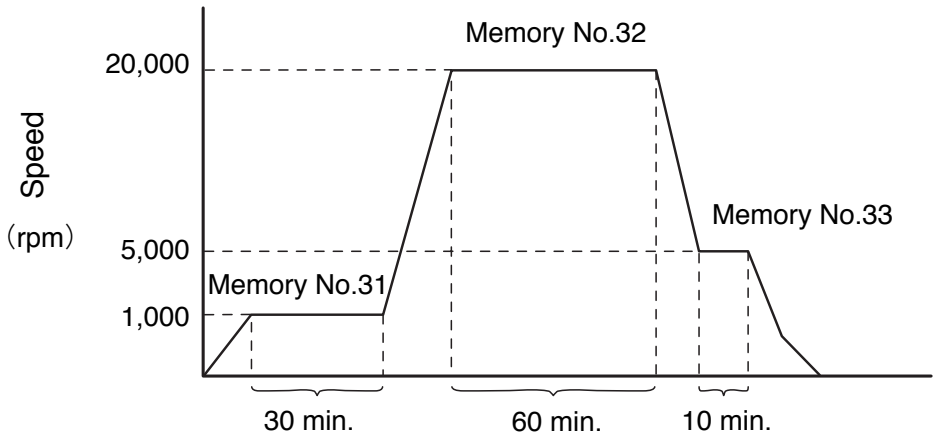


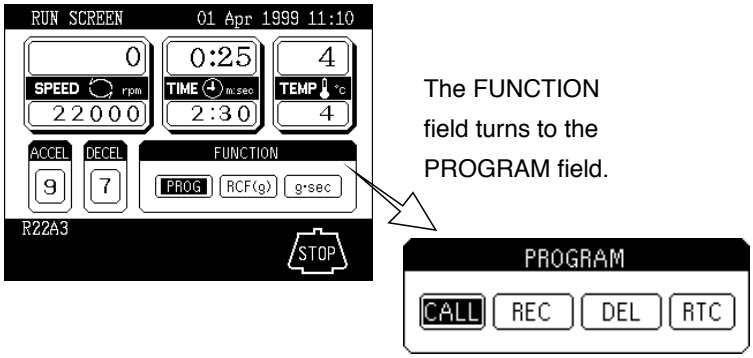
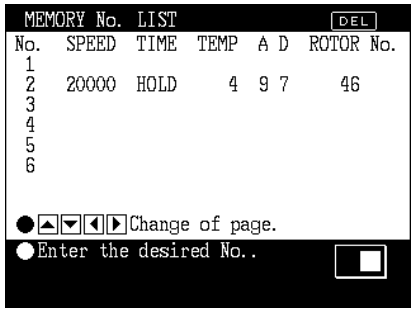
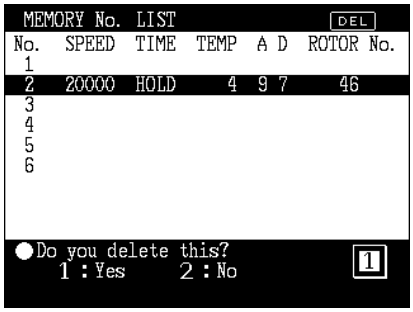
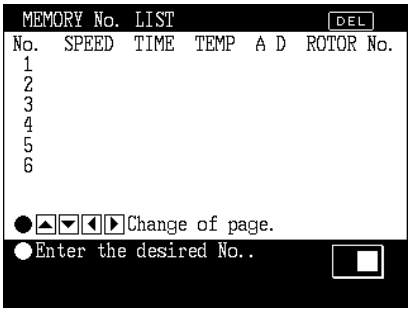
Fig. 3-3-2 Details of an example step-mode operation

NOTE Select the same rotor number for each step. Otherwise, alarm message "ROTOR NO." is indicated and the centrifuge stops operation.

(2) 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.

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

The CR22G/CR21G 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. 3-3-5 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 ：R20A2
② Speed ：18,000 rpm
③ Run time ：60 minutes
④ Temperature ：4℃
⑤ Acceleration rate ：9
⑥ Deceleration rate ：7

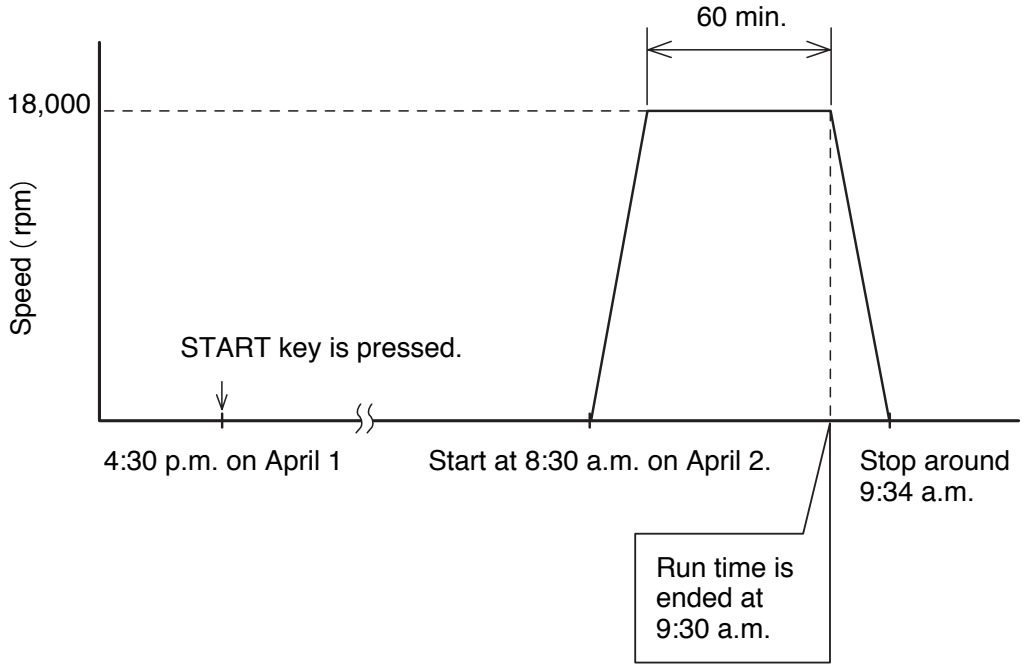
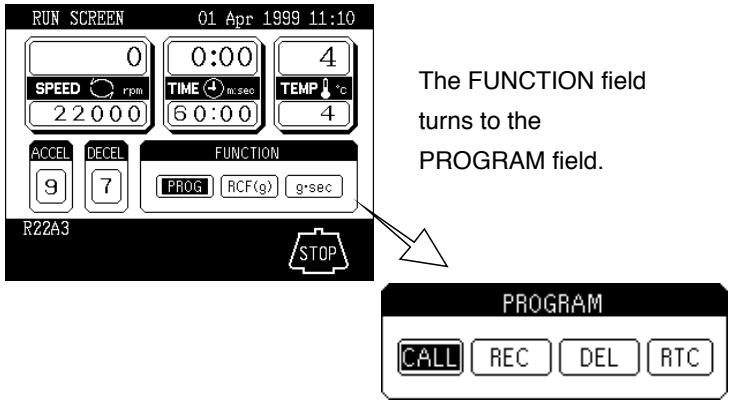
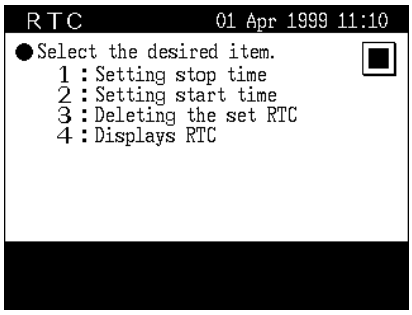
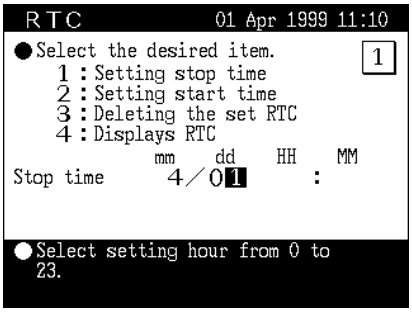
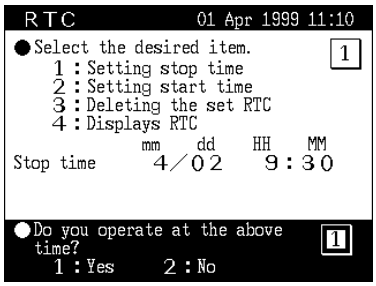
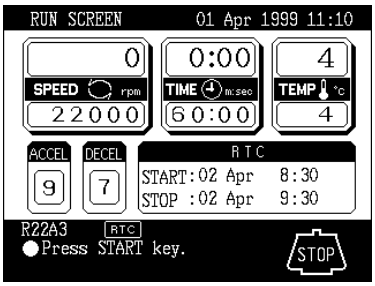


Fig. 3-3-5 Example of RTC operation

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.
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". ○ 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. ○ 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.

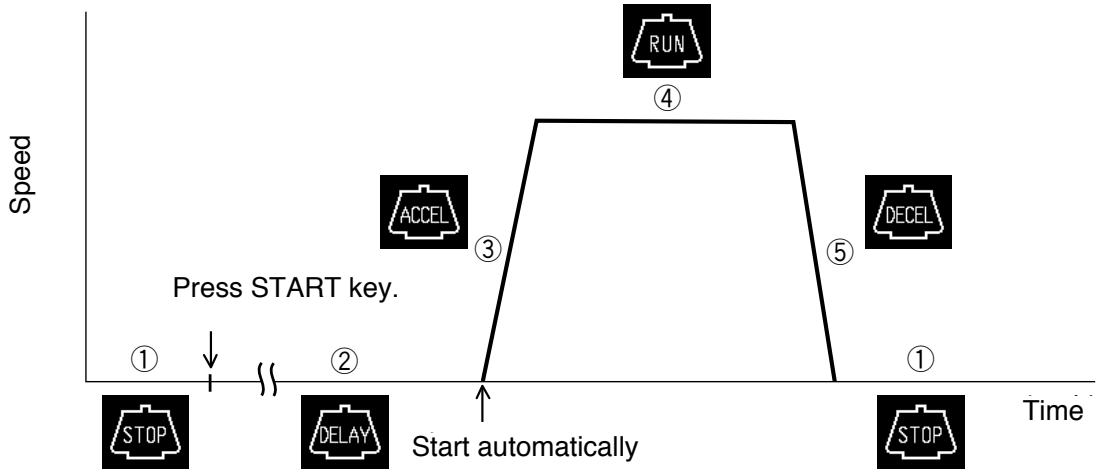


Fig. 3-3-6　Operating mode (RTC)

（2）Note that the RTC setting is not available in the following cases:

①The time setting on the RUN SCREEN is "HOLD" (continuous run).

☞ Change the run time setting from "HOLD" to a desired numeric value.

②The start time has already passed.

☞ Change the setting so that the start time will be later than the current time.

③The 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.

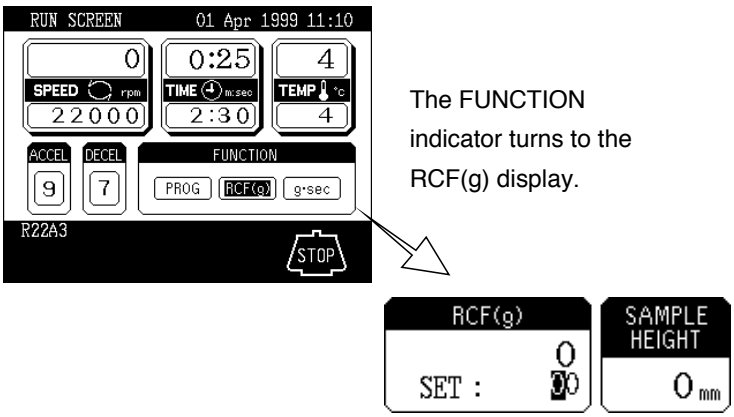
（4）Recall the saved run conditions and enter the RTC setting when performing the programmed operation (including the step-mode operation) and the RTC operation in combination. The centrifuge automatically computes the total run time of all steps in the programmed operation and also the start time for 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.

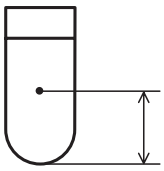
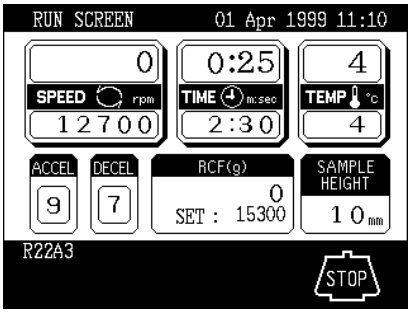
3-3-4 Displaying and Setting RCF

The CR22G/CR21G 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]  Sample height 10 mm	 ● 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.

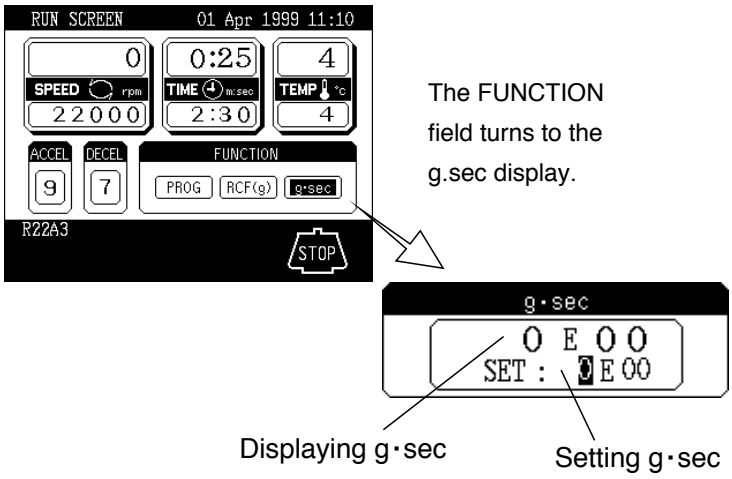
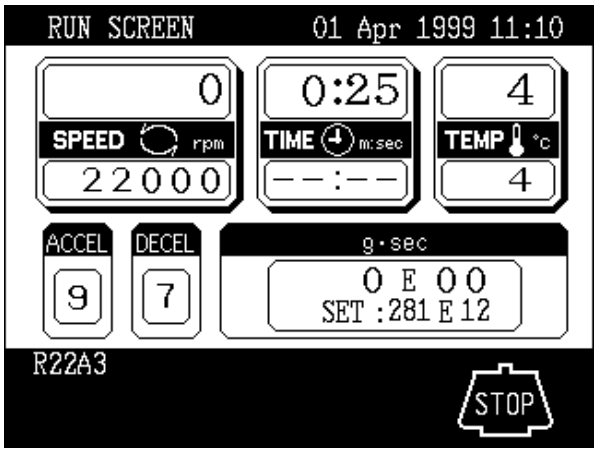
NOTE (1) Press ESC key to clear the RCF screen.

(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.

3-3-5 Displaying and Setting g.sec

This section explains how to use the g.sec displaying and setting capability of the centrifuge.

（1）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 screen.  ● 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.

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：** ①Never attempt to open the door while the rotor is rotating.
②Never 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 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.

The rotor needs more than 60 minutes to coast to a complete stop if the rotor has been rotating at high speed.

①Check that the rotor stops completely.

②Turn off the POWER switch of the centrifuge and the distribution board of your centrifuge room.

③Remove 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.

④Lower the two door lock solenoids and secure them with adhesive tape.

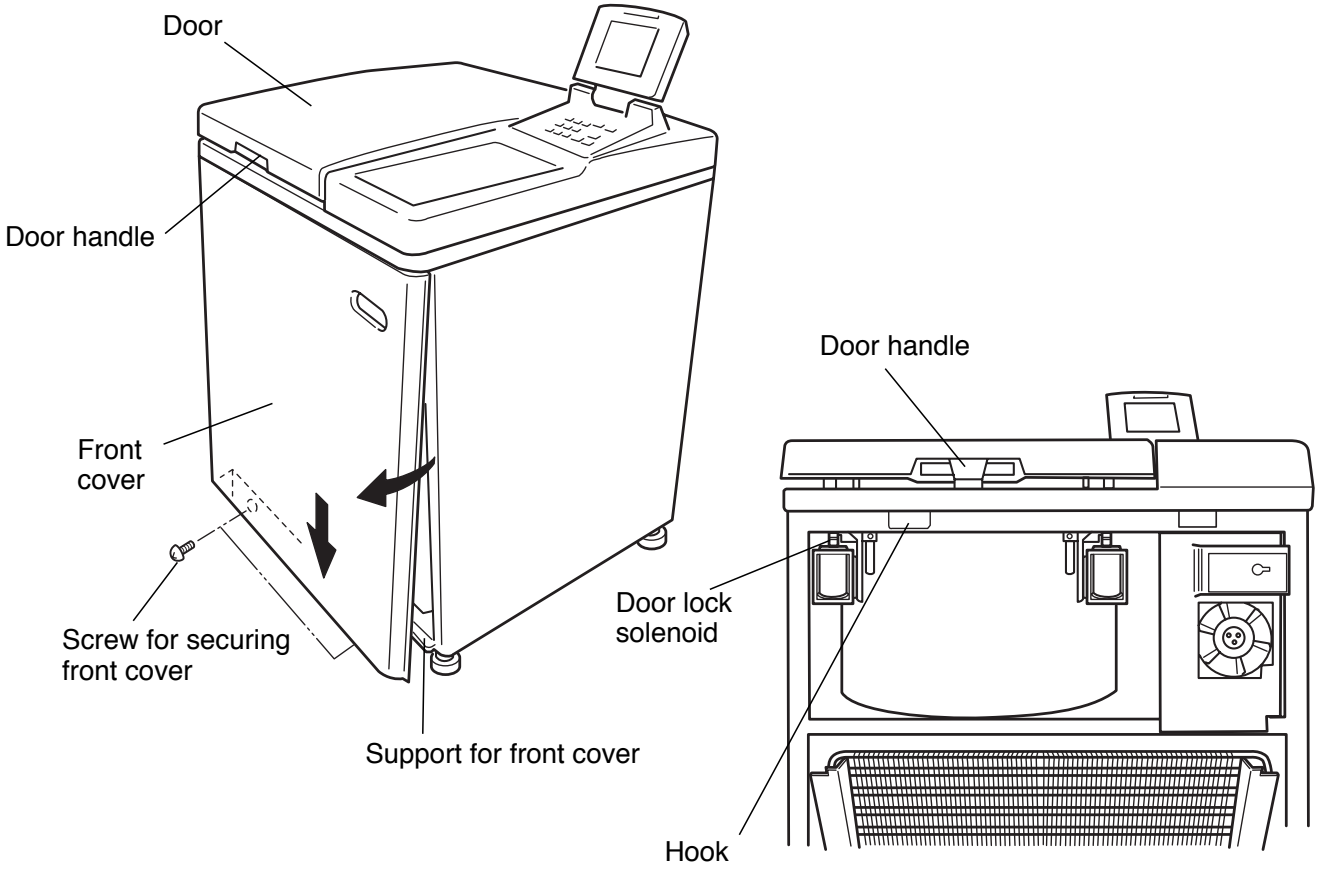


Fig. 3-4-1 Opening the door

⑤Release 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.

⑥Take out the rotor and remove the adhesive tape from the door lock solenoids.

Insert the hooks into the square holes and put the front cover on the support, then secure the front cover with the screws in the reverse order of removal.

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

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.

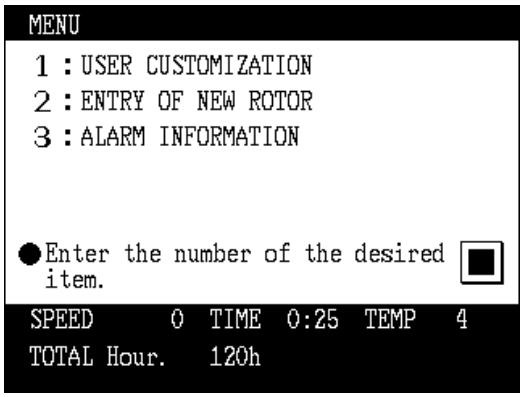


Fig. 3-5-1 MENU screen

3-5-1 User Customization

The user customizations include the following items.

（1）Screen utilities

（2）Pre-cool

（3）Melody

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

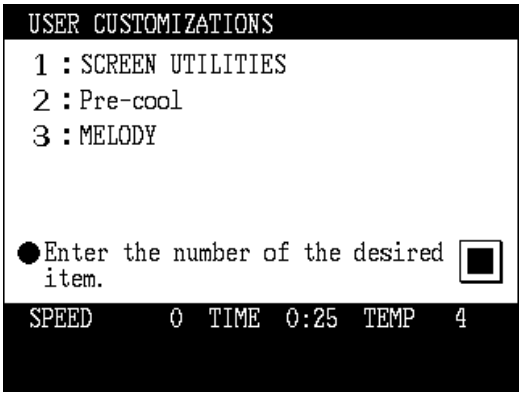


Fig. 3-5-2

3-5-2 Screen Utilities

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

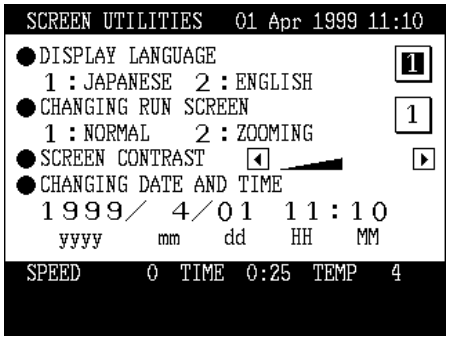


Fig. 3-5-3 User customization screen

(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

①NORMAL：RUN SCREEN is displayed.

②ZOOM：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.

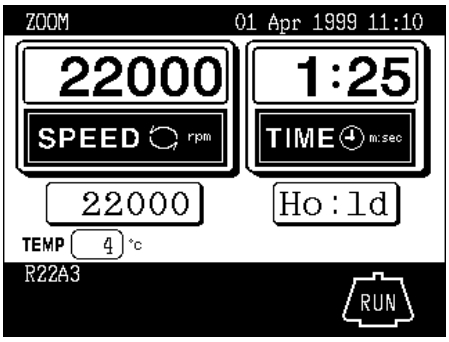


Fig. 3-5-4 ZOOM screen

(3) Changing date and time

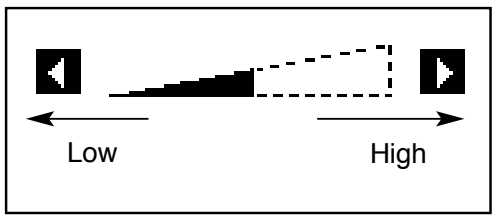
This feature is used when adjusting the incorporated time clock to the current date and time correctly.

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.

(4) Screen contrast

Use cursor keys ◀ and ▶ to adjust the contrast.



NOTE

(1) Press the ESC key several times to return to the RUN SCREEN.

(2) The cursor disappears from the screen after the keyboard is idle for more than 30 seconds. Press a cursor key to show the cursor on the screen in this case.

3-5-3 Pre-cool

The temperature in the chamber is controlled at 15℃ when closing 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).

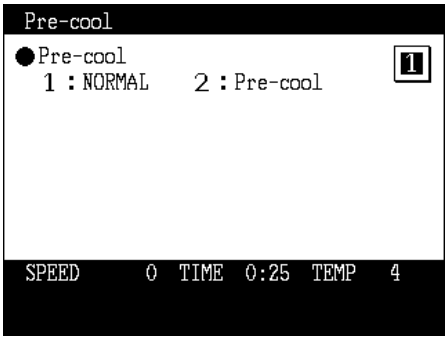


Fig. 3-5-5 Pre-cool screen

3-5-4 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.

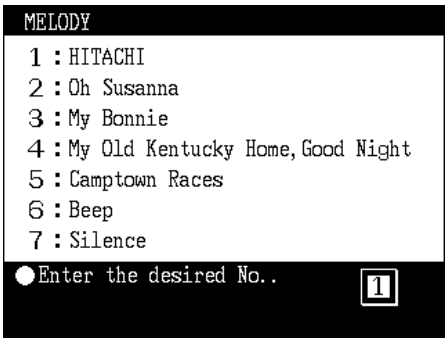
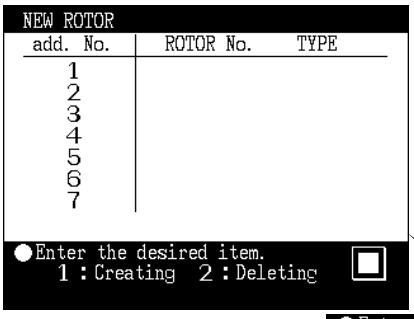
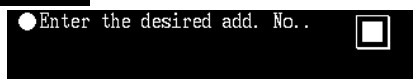
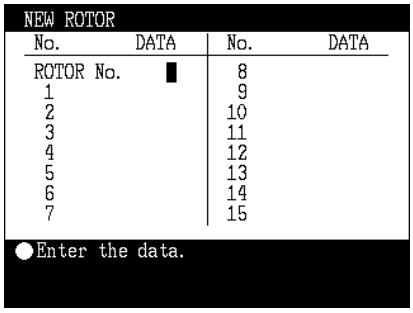
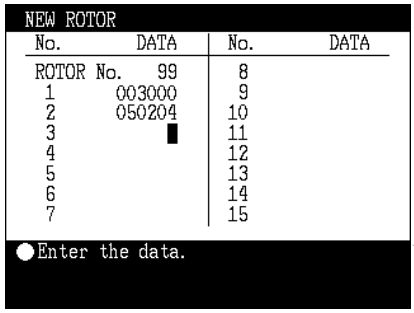
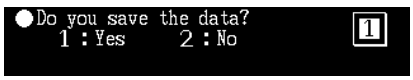
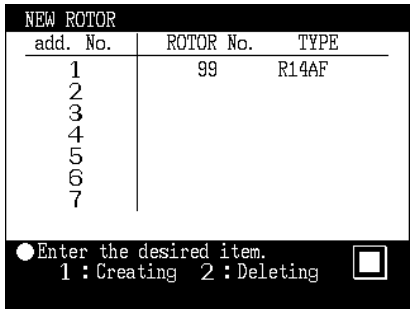


Fig. 3-5-6 MELODY screen

3-5-5 Entry of New Rotor

- You can enter information about the desired rotor which is not entered in this centrifuge by using the key switches.
- Up to seven types of rotors can be entered in this centrifuge.

(1) Procedure for entry of new rotor

Step	Key operation	Screen display and notices
1	The NEW ROTOR screen is displayed by selecting "ENTRY OF NEW ROTOR" on the MENU screen. Press the following keys to enter new rotor. [1] [ENTER]	 The prompt changes as follows. 
2	Enter the desired address number and press ENTER key. (e.g., entering add. No.1) [1] [ENTER]	 The display turns to the screen to enter data of new rotor.
3	Enter the rotor numbers and data from No.1 to 23 according to the rotor entry data. A prompt appears when the ENTER key is pressed after entering the No.23 data. Press the following keys if "Yes". [1] [ENTER] NOTE Contact Hitachi Koki service representative for the rotor entry data.	 ○Note that incorrect data cannot be entered. ○Mistakes can be corrected by backing up and retyping. 
4	The screen turns to the NEW ROTOR screen. Entered rotor number and type are displayed. Press the [ESC] key several times to return to the RUN SCREEN.	

3-5-6 Alarm Information

Necessary alarm information and remedies are displayed on the ALARM INFORMATION screen. This feature allows you to cope with troubles occurred during operation. Refer to "5. Troubleshooting" for details.

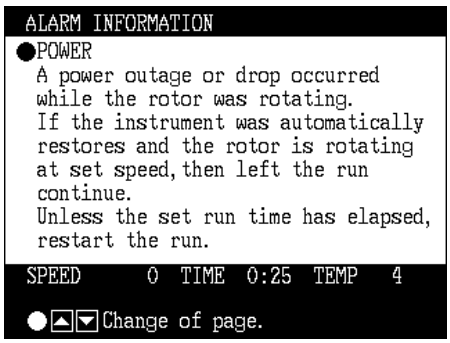


Fig. 3-5-7 ALARM INFORMATION screen

4. Maintenance

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

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

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

③It is your responsibility to sterilize or decontaminate the centrifuge, rotor or the accessory properly before returning to 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 Hitachi Koki authorized sales/service representative.

This centrifuge does not require complicated maintenance and inspection. For longer and safe use of this centrifuge without trouble, observe the following instructions.
For information on the maintenance of rotors and tubes, see rotor instruction manual.

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

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

4 — 1 Rotor Chamber

⚠ **CAUTION :** Do not pour any solution such as water, detergent and disinfectant directly into the rotor chamber. Otherwise, the bearings of the drive unit may be corroded or deteriorated.

(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 :** 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. If the drive hole or the drive shaft is stained or any foreign matter is adhered, 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 driving force to the rotor. Before mounting a rotor, wipe the outer surface of the crown with a soft cloth dampened with water sufficiently.

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　Others

（1）Maintenance contract

For longer and safe use of your centrifuge, it is recommended that you sign the maintenance contract with Hitachi Koki.

Principal conditions of the maintenance contract are:

①Periodical inspections will be carried out twice a year.
②The result of inspection will be recorded in charts for preventive maintenance.
③The parts having trouble will be repaired or replaced with new ones after inspection.
④Sudden trouble will be quickly and economically responded by Hitachi Koki service representative.

Contact Hitachi Koki authorized sales/service representative for more information.

（2）Retention period of service parts

The retention period of the service parts is seven years from the date of the production discontinuance. The service parts mean the parts required to maintain the specified performance of the centrifuge.

5. Troubleshooting

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

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

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

③It is your responsibility to sterilize or decontaminate the centrifuge, rotor or the accessory properly before returning to 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 Hitachi Koki authorized sales/service representative.

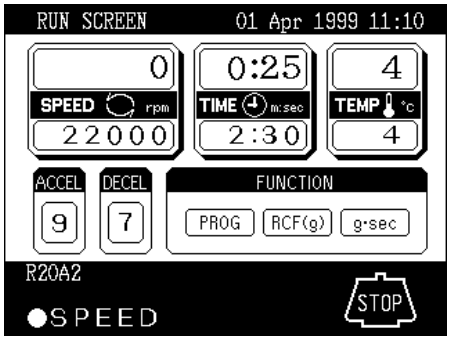
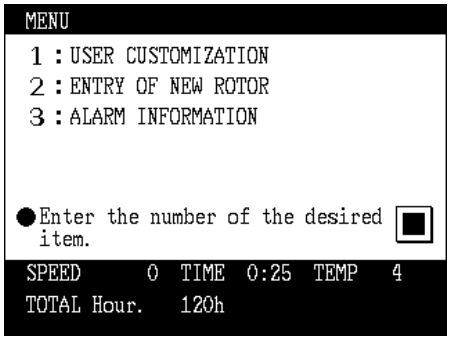
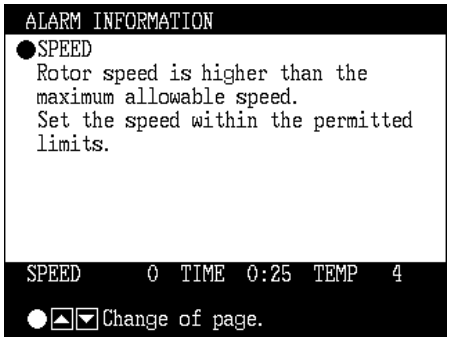
The CR22G/CR21G refrigerated centrifuge has a self-diagnosis capability that identifies and reports a problem that occurs when the instrument is starting up or in operation, and that affects the operation of the instrument.

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 CR22G/CR21G 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

No.	Key operation	Screen display and notices
1	The alarm message "SPEED" 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 INFORMATION" by pressing the following keys. 3 ENTER	 ● ALARM INFORMATION screen appears. ○ Corresponding alarm information is displayed. ○ Press the ESC key two times to return to the RUN SCREEN.

(2) Corrective actions

In response to the displayed alarm message, take the appropriate actions as described below to remove the cause of the problem, then press the CE key to restart the centrifugation.

⚠ **WARNING :** Unspecified repairs,remodeling or disassembly of the centrifuge that is not listed below is strictly prohibited by any person other than Hitachi Koki authorized services representative.

After taking the actions, if the problem still persists, contact Hitachi Koki authorized sales/service representative to ask for repair.

Alarm message	Cause	Corrective action
POWER	A power failure occurred while the rotor was spinning and the speed decreased by 300 rpm from the set speed. If the rotor is rotating at 250 rpm or more when the power is restored, the centrifuge will accelerate again or decelerate if the speed is less than 250 rpm.	Check the run time if the rotor has stopped and restart operation if necessary.
ROTOR COVER	Operation is started without mounting the rotor cover.	Mount the rotor cover properly.
	The sensor on the back of the door becomes wet.	Wipe the sensor with a soft cloth.
ROTOR	Rotor is not properly secured to the drive spindle.	Make sure the rotor is secured to the drive spindle.
	The rotor in use is not entered to the centrifuge.	Enter the data of the rotor (refer to page 3-29 for details).
	The sensor on the back of the door becomes wet.	Wipe the sensor with a soft cloth.
TEMP	TEMP display shows a temperature over 50℃, or a temperature lower or higher than the set temperature more than 20℃.	Lower the room temperature if it is over 35℃. Clean the radiator if clogged.
DOOR	START key is pressed with the door opened, or the door handle is released	Close the door and start operation. If the door handle is released, lock it again
	while the rotor is rotating.	immediately to clear the alarm and reaccelerate the rotor.
SPEED	Rotor speed is set higher than the maximum allowable speed.	Set the speed within the permitted limits.
ROTOR NO.	Incorrect rotor number is entered. A rotor other than those saved in the memory is used.	Check the rotor number and enter the correct number.
IMBALANCE	Rotor is not properly balanced.	Check if the sample tubes exceed allowable imbalance level.
	Rotor cover is not properly secured with the screw.	Secure the rotor cover properly.
E11 to E63	The centrifuge has a problem requiring maintenance by service personnel.	Contact Hitachi Koki service representative.

If any of the alarm messages E11 to E63 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 60 minutes, in order to allow the rotor to come to a complete stop. Wait without turning off the power to the centrifuge. After 60 minutes or more, 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℃.	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 page 4-2.

6. Installation and Relocation

Installation or relocation of your centrifuge must be done by the authorized Hitachi Koki service representative. Contact your local dealer or Hitachi Koki service representative.
Observe the following instructions for installation or relocation of your centrifuge.

⚠ **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.

(1) Electric Power Requirements

Your centrifuge can operate on the following power source: Single phase, 220, 230 or 240 Vac; 50/60 Hz; 30A. Provide an emergency switch (circuit breaker) intended for the centrifuge only to turn off the centrifuge power in the event of failure. It is recommended to provide that switch at the outside of the centrifuge room or near the exit of the centrifuge room.

(2) Location

⚠ **WARNING :** For operator safety, maintain a 30-cm "clearance envelope" around the instrument and keep out that area while the rotor is spinning. Do not store dangerous substances capable of developing flammable or explosive vapors in the clearance envelope.

①Install the centrifuge on a flat, vibration-free concrete floor. Avoid installing on a carpeted floor.

②Ambient temperature range is 5℃ to 25℃. The rotor temperature will be high if the ambient temperature becomes higher than 25℃. Avoid a place exposed to direct sunlight.

③Maintain a 30-cm "clearance envelope" around the centrifuge. Do not store any substances in the clearance envelope.

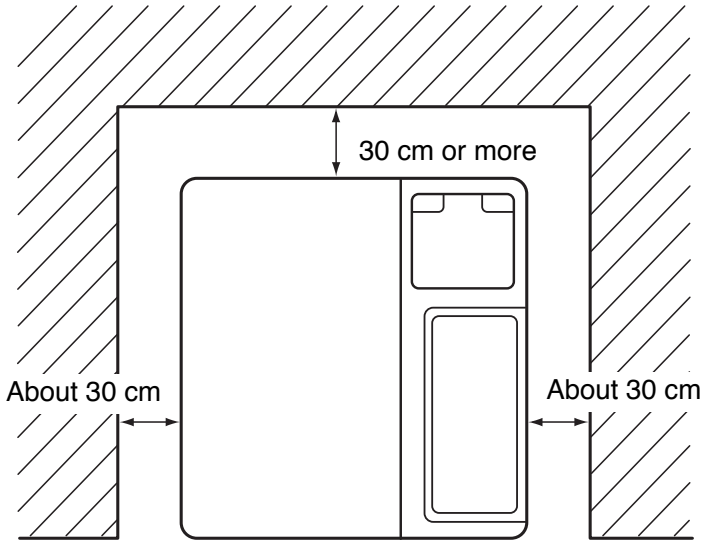


Fig. 6-1 Clearances for centrifuge

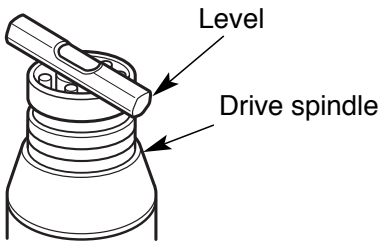
(3) Power cord

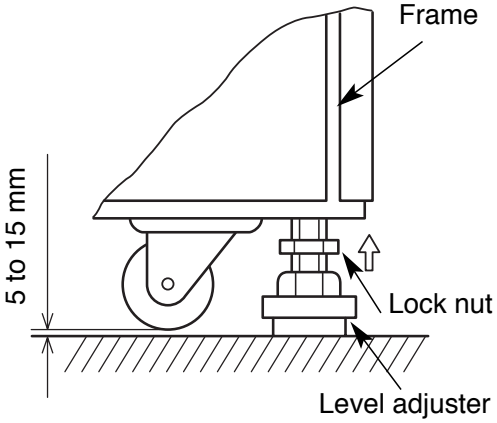
Plug the power cord coming from the rear of the centrifuge in the terminal of the distribution board. The green/yellow wire is a grounding wire. Your centrifuge must be grounded properly.

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

(4) Leveling

- Turn on the centrifuge power and open the door. (If power supply is not yet available, perform the emergency recovery procedure discussed on page 3-24.)
- Place the level across the top of the drive spindle.





- Using a wrench, turn each of the four level adjusters until the casters are 5 to 15 mm off the floor.
- When the centrifuge is level, remove the level and make sure each of the four level adjusters is secure and rattle-free.
- Secure each of the four level adjusters with the lock nuts.

⚠ **CAUTION :** Level the centrifuge by using the four level adjusters and secure them with the lock nuts. Improper securing can cause significant movement of the centrifuge in the event of a rotor disengagement.

(5) Relocation

Before relocating the centrifuge, unplug the centrifuge and lower the casters on the floor by turning the leveling bolts with a wrench. Raise the leveling bolts enough and relocate the centrifuge. After relocation, the centrifuge must be installed and leveled again.

⚠ **CAUTION :** Remove the rotor from the rotor chamber before relocating the centrifuge.
Be careful when carrying on uneven or slanted floors not to turn over the centrifuge.

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

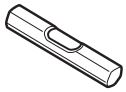
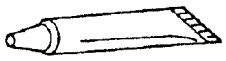
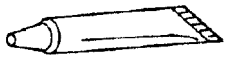
〔Incidental conditions〕

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.

8. List of Standard Accessories

Accessory	Q'ty	Figure	Remarks
Instruction manual	1		S999440
Summarized sheet of instruction manual	1		S999587
Rotor and tube catalog	1		999484
Level	1		403584
Rear duct ass'y	1		S203536A (To be mounted to the rear cover at installation)
Silicon grease	1		660557
Lubricant grease	1		84810201
Rotor cleaning bar	1		S301333

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 method (conditions): _____

_____

_____

Date of decontamination: _____ Signature _____

After-sales Service

For safe and efficient use of your centrifuge, it is recommended that the centrifuge be inspected periodically by Hitachi Koki service representative. Contact Hitachi Koki authorized sales/service representative if the centrifuge does not operate normally or for ordering parts. Never attempt to repair the centrifuge by yourself.

Export office

Hitachi High-Technologies Co., Ltd.
Head Office:
1-24-14, Nishishinbashi, Minato-ku,
Tokyo, 105-8717 Japan
Tel: (81) 3-3504-7211
Fax:(81) 3-3504-7123

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/