January 2011, Printed in Japan

4000 4200

TABLE－TOP CENTRIFUGE

INSTRUCTION
AND
SERVICE MANUAL

To ensure proper operation of the centrifuge, be sure to read this manual carefully before operating it.
Also, keep this manual handy so that you can refer to it at any time.

NOTE

■The products being indicated in this Instruction Manual are designed for operators with expert knowledge and are intended only to be used by such qualified operators observing the indicated precautions for respective purposes. For persons lacking necessary expert knowledge, these products may be difficult to use properly and may even pose a danger to use. When the aforesaid persons lacking the necessary expert knowledge are using these products, do so under appropriate supervision and guidance of a qualified operator possessing the necessary expert knowledge.

■Do not distribute this manual within the U.S.A., Mexico, Canada and Australia as the products advertised in the manual shall not be distributed in these countries.

For information added or modified after February 2011, please contact your local dealer.

KUBOTA CORPORATION

29-9 HONGO 3-CHOME, BUNKYO-KU, TOKYO 113-0033, JAPAN

[**86 Pages**]
M10420108

WARRANTY

Kubota Corporation ("Kubota") warrants that the instrument covered by this warranty shall be free from defects in material and workmanship under normal use. Kubota will repair or replace, free of all charges, the instrument which, within one (1) year after delivery or fifteen (15) months after shipping, whichever comes earlier is proved to the satisfaction of Kubota to have been defective at the time of delivery, provided that it does not fall under the exceptions and conditions specified in this warranty. Such exception and conditions include, but are not limited to, failure due to natural wear and tear, accident, negligence, alteration, repair, or operation in a manner not prescribed in the Instruction Manual supplied with the instrument. The foregoing expresses Kubotas sole warranty with respect to the instrument.

THIS WARRANTY IS MADE IN LIEU OF ANY AND ALL OTHER WARRANTIES AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED AND EXCLUDED.

Kubota and its authorized dealers will not be liable for any consequential damages, loss or expense arising from the improper use of the instrument. Kubota will not honor any other warranty, which may be given, by its representative or dealer or otherwise which is different from the warranty given hereunder. This warranty is not assignable and is operative only in favor of the original customer to whom this warranty is originally delivered.

Use of Model 4000 / 4200

Model 4000 and 4200 can be used for preprocessing in in-vitro analysis, which breaks down blood or urine samples containing plasmas or cells. Accordingly, it is not designed to connect directly to a patient's body.

Do not use the centrifuge for separation of any hazardous material (explosive, chemically active, organic, or radiation containing material, or material contaminated by pathogenic microorganisms) or oil.

Safety Instructions

The centrifuge and the manual indicate important information in order to ensure safe operation of the centrifuge and to prevent physical injuries and property damages. Be sure to understand the meanings of the following indications and follow the instructions.

1. Explanation of indication marks

Indication	Meaning
⚠ **WARNING**	It is a possibility of serious accident resulting in death or serious injury.
⚠ **CAUTION**	It is a possibility of accident resulting in slight or non-fatal injury or property damage.

■ "Serious injury" is defined as injuries such as loss of eyesight, burn (high/low temperature), electric shock, bone fracture, poisoning causing aftereffects, or any other injuries requiring long-term medical treatment at hospital.

■ "Non-fatal injury" is defined as burns, electric shock, or any other injuries which do not require long-term medical treatment at hospital. "Property damage" is defined as expansion damage related to damage to equipment or other property.

2. Explanation of pictorial marks

Pictorial marks	Meaning
	Indicates prohibition (things you must not do). Details are shown near the mark, using illustration or sentences.
	Indicates requirements (things you have to do). Details are shown near the mark, using illustration or sentences.
	Indicates caution, warning and danger. Details are shown near the mark, using illustration or sentences.
	This label indicates the risk of electric shock. Touching this attached part will cause an electric shock.
	This label indicates a hot section. Touching this attached part will cause an burn.
I	Indicates that the power is on. It is indicated on the power switch and the circuit breaker.
O	Indicates that the power is off. It is indicated on the power switch and the circuit breaker.

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Section 4. Service

Section 5. Troubleshooting

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Dispose of the centrifuge unit, rotor, and accessories

Section 8. Parts List

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General Notes Be sure to follow them.

Since large electrical and mechanical energies are present on the centrifuge and rotor, reasonable care is required for their handling.
Otherwise failure may occur resulting in property damages or fatal physical injuries.
In order to prevent them from happening,be sure to follow the instruction given below.

⚠WARNING

（1）Maximum load

Do not exceed the maximum load of rotor and bucket.
The rotor or bucket used beyond the allowable load level can be damaged, thereby causing an accident.

（2）Maximum speed

Keep the rotor and bucket speed below the maximum speed.
An excessive speed may cause a damage to the rotor,bucket and the centrifuge. The maximum speed depends on the rotor and bucket strength.

（3）Modification and unspecified parts

Do not modify, nor use unspecified parts.
Unauthorized retrofit of the centrifuge, rotor or bucket, or use of unauthorized parts for them can result in accidents.

（4）Hazardous material

Do not put any hazardous material (explosive, chemically active, organic, or radiation containing material, or material polluted by pathogenic microorganisms) as a sample of the centrifuge and do not place it closer than 30 cm to avoid a secondary accident should the centrifuge accidentally rotate and contact the material.

（5）While the centrifuge is in operation

While the centrifuge is in operation, do not stand closer than 30 cm to avoid a secondary accident.

（6）Lid

Do not open the lid when the rotor is spinning.
Physical contact with the spinning rotor or bucket may cause serious injury.

（7）Sterilization

Do not perform dry-heat or autoclave sterilization with temperatures higher than those specified. Otherwise, the rotor may deteriorate and cause an accident.

（8）Rotor and drive shaft during rotation.

Do not touch rotor and drive shaft during the rotation.
Physical contact with the spinning rotor or drive shaft may cause serious injury.

（9）Damaged, corroded, rusted or deformed

Discontinue use of the equipment when its rotor or the bucket are found to have been damaged, corroded, rusted or deformed.
Otherwise failure may occur.

Cont'd. on next page.

⚠WARNING

（１０） Lifetime and usable number of cycles of rotors

Use of rotors beyond the lifetime and usable number of cycles may lead to breakage of the rotor.
If the rotor is used continuously even after the lifetime and usable number of cycles of the rotor has expired, should the rotor get damaged an accident may occur.

（１１） Grounding

Do not connect the ground cable to the following places:
1. Gas piping
   Explosion or fire may occur.
2. Ground cable of the lightning conductor, or telephone cable.
   Electric shock may occur in case of thunderbolt.
3. Water pipes
   City water piping may not work properly as a ground as it may consist of chloroethylene pipings.

Make sure that the ground cable is connected to the grounding terminal.
This precaution must be strictly observed to avoid accidents due to electric shocks or leakage.

（１２） Installation

A clearance of 30 cm minimum must be provided around the centrifuge.
If the centrifuge is driven into uncontrolled rotations due to its failure, secondary disasters can result from energy absorbed by the rotation.

⚠ CAUTION

（１） Installation

Do not not install the centrifuge on a inclined place, loosely place, slippery place, shaky place.

Violent vibration may occur.

Do not install the centrifuge in a place where the temperature is below 10 ℃ or over 40 ℃.
A place with the ambient temperature beyond 40 ℃ can introduce undesirable build
up of heat inside the centrifuge and a place under 10 ℃ can cause the centrifuge malfunction and, as the result, accidents.

Do not install the centrifuge in a dusty place.
When the air intake port for the refrigerator located behind the centrifuge becomes clogged with dust, cooling efficiency will drop and the internal components of the centrifuge will become heated, leading to failure.

Do not install the centrifuge in a place with poor ventilation.
Otherwise inside temperature of the centrifuge may rise resulting in accidents.

Do not install the centrifuge in a place with high humidity (relative humidity 85 % or above).
Leak or accident may occur.

⚠ CAUTION

（２）Toxic or radioactive substances etc.

When centrifuging of substances contaminated with pathogenic bacteria, or toxic or radioactive substances, always use containers that are pathogenic bacteria, toxic substance or radiation proof.
Otherwise, infections, intoxication or radioactive exposure accidents may occur.

（３）Fasten a rotor

Ensure that the rotor is firmly fastened to the drive shaft.
If not positively held in place, the rotor or centrifuge can be damaged, thereby causing accidents.

（４）Bucket

The same type buckets must be provided to every rotor yoke.
If not positively held in place, the rotor or centrifuge can be damaged, thereby causing accidents.

（５） Tube

Use the same type of tubes.
The wrong arrangement will cause imbalance and resulting in damage to rotor, bucket or the centrifuge.

（６）Glass tube

Glass tube strength varies by manufacturer. Use the glass tubes within the guaranteed range (centrifugal force resistance) specified by the manufacturers.
A glass tube damaged during centrifugation may cause serious accidents including physical injury.

（７）Balance of sample

Keep the load (of the sample, bucket, etc.) balanced.
If an appropriate balance is not provided, unexpected accidents can result from a damaged rotor or centrifuge.

（８）Cushion

Replace the cushion when the glass or plastic tube is cracked.
If the cushion with glass fragment cut to it is used, the tube is easily cracked.

（９）Cleaning

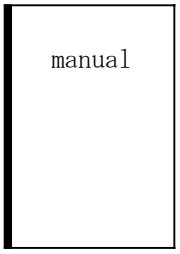
Do not use detergents exceeding the range of pH 5-8 or chlorine detergents for washing purposes.
Corrosion may damage the rotor and bucket resulting in damage to the centrifuge.

（１０）Caution plate

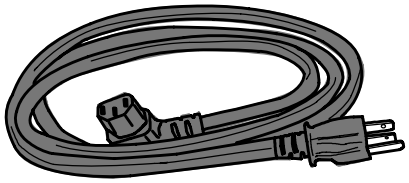
Do not remove the caution plates.
When a caution plate becomes dirty, blurred or peeled off, replace it with a new one (caution plates are available at charge).

Standard Accessories

1. Instruction manual ·····1 Copy

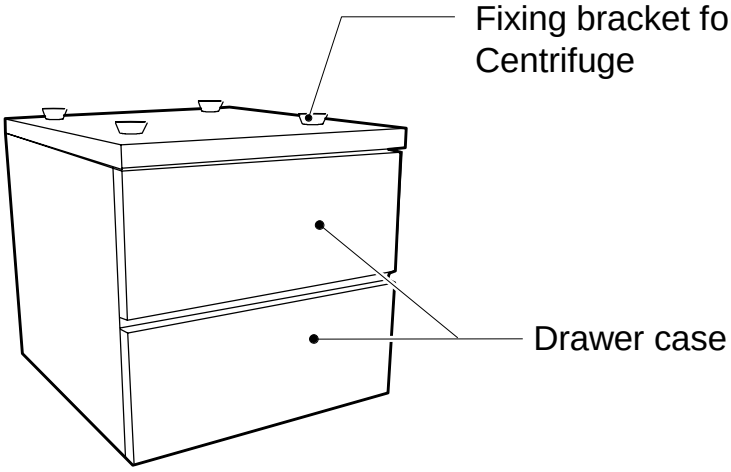


2. Power cable ·····1 Pc.



Option

Table for Centrifuge



Usable Rotor

⚠WARNING

（1）Do not use any rotors other than those specified in (2) and (3) below.
If rotors other than those specified are used, the rotors may be broken, resulting in a serious accident.

（2）The rotors that can mount as of January 2011 are as follows:
This information is subject to addition or change.
For information after February 2011, please contact your local dealer.

Model	Fixed Angle Rotor	Swinging Bucket Rotor	Plate Rotor
4000	AT-508C	ST-480M ST-504M ST-722M ST-2504MS	PT-89M PT-21M
4200	RA-2724M AT-2730M AT-508C		

（3）Rotors that can mount, though their production was discontinued are as follows:

Model	Swinging Bucket Rotor	Plate Rotor
4000	RS-410M ST-410M RS-480M RS-720M ST-720M	RMP-21M RMP-89M
4200		

When installing a rotor, always read the Instruction Manual for that rotor.

Lifetime and usable number of cycles of rotors

⚠WARNING

Use of rotors beyond the lifetime and usable number of cycles may lead to breakage of the rotor.
If the rotor is used continuously even after the lifetime and usable number of cycles of rotors has expired, should the rotor get damaged, the main unit of the centrifuge suddenly may start to rotate; this could result in an accident causing injury or death.

Lifetime and usable number of cycles of rotors should be deemed as follows.
When either one of the following conditions has been met, discontinue operation of the centrifuge to change the rotor with a new one.
Earlier replacement, however, is required if any corrosion, lowered strength, flaw or deform due to wrong operation is detected on the rotor.
In such case, contact your local dealer and be sure to have the rotor checked before reusing it.

［1］ Lifetime of rotors is 7 years after the delivery.

［2］ When the rotor exceeded the usable number of cycles, defined in the following table after it was delivered.

Contact your nearest dealer for inspection of the rotor and bucket.

Usable number of cycles of rotors

Rotor	Usable number of cycles
AT-508C ST-2504MS	When reached 50,000 cycles.

Number of cycles allowed for autoclaving of rotor

⚠WARNING

Stop the use of the rotor immediately when it is used beyond the number of cycles allowed for autoclaving. Otherwise, the rotor may deteriorate by the heat generated by autoclaving, resulting in deformation or destruction.
Should the rotor get damaged, the main unit of the centrifuge suddenly may start to rotate; this could result in an accident causing injury or death.

The number of cycles allowed for autoclaving of each rotor should be deemed as follows. When the following conditions have been met, discontinue operation of the centrifuge to replace the rotor with a new part.
Earlier replacement, however, is required if any corrosion, lowered strength, flaw or deform due to wrong operation is detected on the rotor. In such case, contact your local dealer and be sure to have the rotor checked before reusing it.

[1] Number of cycles allowed for autoclaving and temperature of rotor

Rotor		Temperature and minutes of autoclave	Usable number of cycles
PT-21M		126℃, 10 - 15 minutes	50 cycles
AT-2724M AT-2730M		121℃, 20 minutes	100 cycles
		134℃, 60 minutes	50 cycles
		Mixed use of 121℃, 20 minutes and 134℃, 60 minutes	
ST-480M (RS-480M) ST-504M	Rotor york	121℃, 20 minutes	50 cycles
	Stainless bucket ∗Aluminum bucket cannot be autoclaved. Refer to rotor instruction manual for details.		
ST-722M (ST-720M) (RS-720M)	Rotor york	121℃, 20 minutes	50 cycles
	Tube rack ∗There are some tube racks that cannot be autoclaved. Refer to rotor instruction manual for details.		
	Bucket (Code No. 053-0020)		

( ) of rotor is discontinued.

Cont'd. on next page.

Rotor		Temperature and minutes of autoclave	Usable number of cycles
ST-2504MS	Rotor york	121℃, 20 minutes	50 cycles
	Bucket		
	Sealing cap		
	Packing of sealing cap		
	Tube rack		
(ST-410M)	Rotor york	126℃, 10 - 15 minutes	100 cycles
	Bucket		
	Sealing cap	115 - 118℃, 30 - 40 minutes	50 cycles
	Tube rack	※ Cannot be autoclaved.	

(　) of rotor is discontinued.

［2］Recording autoclave

After each autoclave process, be sure to record the following （1）to （3）to control how many times the autoclave is executed.

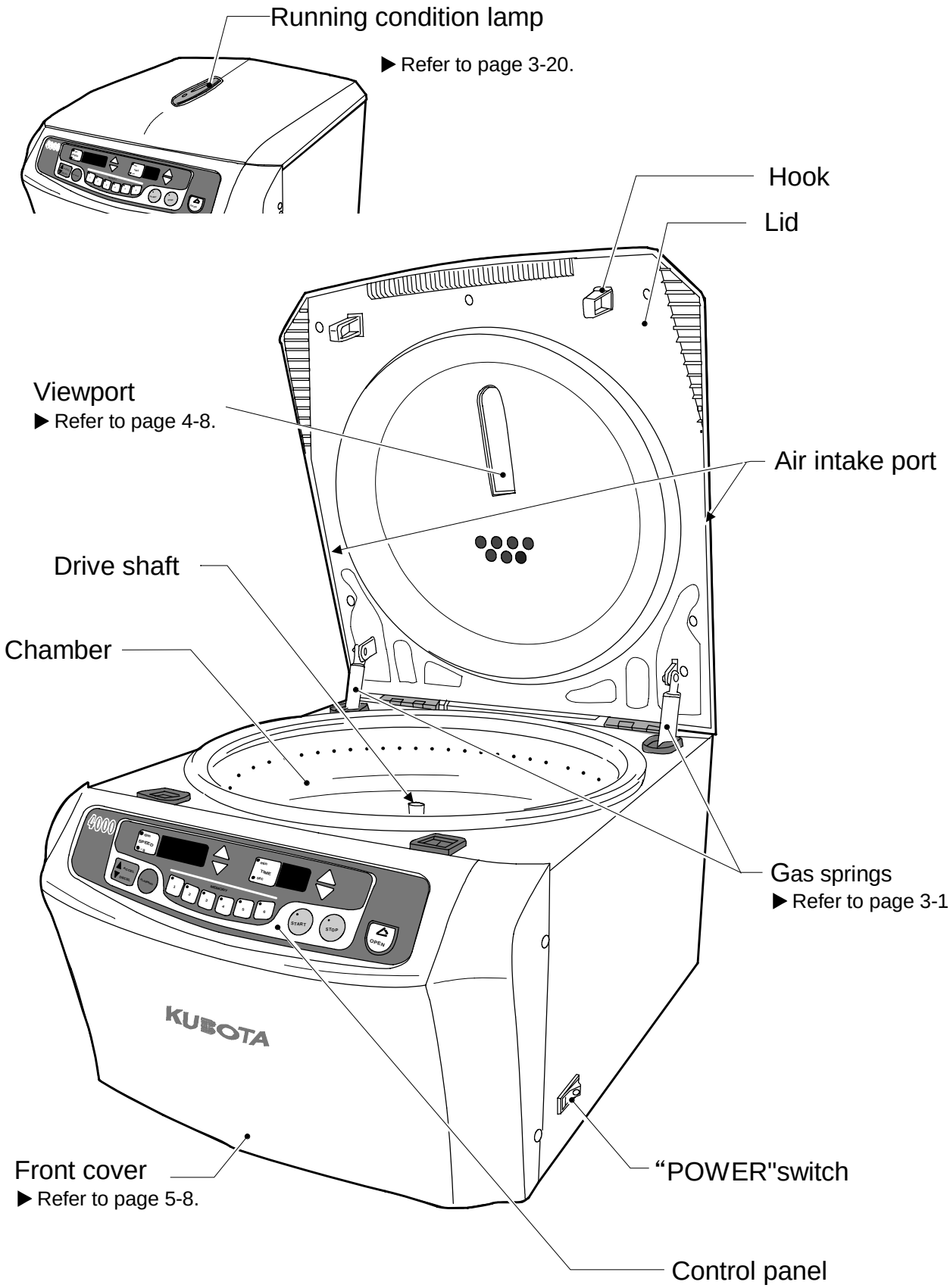
（1）Date
（2）Temperature of autoclave
（3）Time of autoclave

▶ You can take advantage of using the "Autoclave record table" attached to the rotor instruction manual.

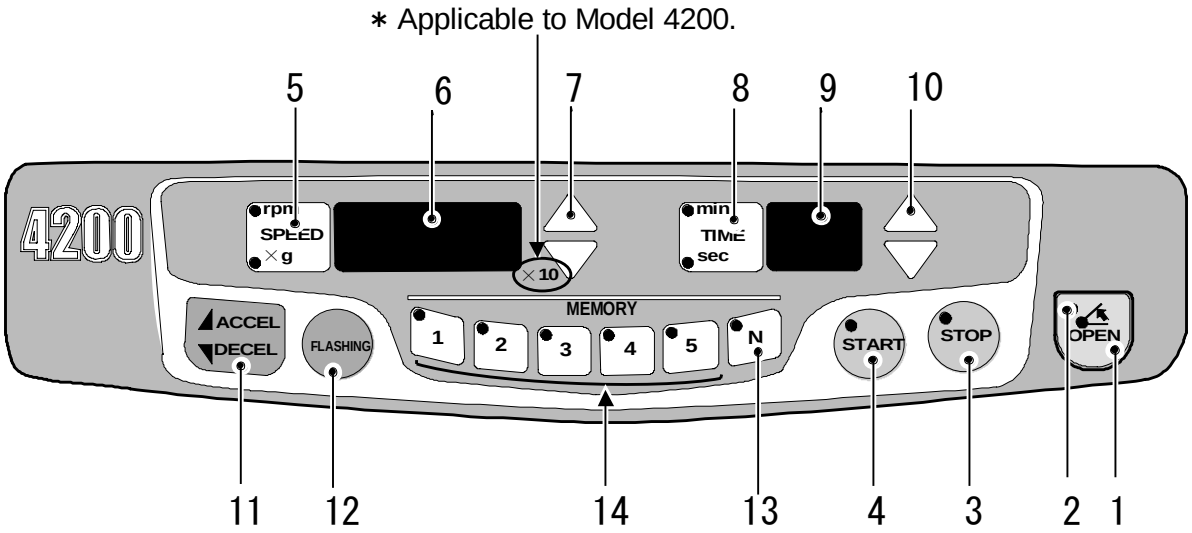
Stop the use of the rotor immediately when it is used beyond the number of times allowed for autoclaving. ▶ Refer to ［1］.

Section 1 Component Name and Explanation

1 – 1. Appearance



1－2. Control Panel



No.	Name and Function	Page
1	"OPEN" key (Lid open) When the STOP lamp light or flash, press this key, and the lid can be opened.	3-1
2	"OPEN" lamp When lid is opened, this lamp remains lit. When open the lid during the rotor is spinning, the rotor stop spinning and the lamp is flashing.	3-1
3	"STOP" key Pressing this key during operation will light the lamp and discontinue the operation.	3-3
4	"START" key The lamp lights during operation.	3-2
5	"SPEED" key This key allows setting the speed or centrifugal force.	3-4
6	"SPEED" display (Speed / RCF) Model 4200 : × 10 Model 4000 : × 1	3-4
7	"SPEED" setting（△▽）key	3-4

No.	Name and Function	Page
8	"TIME" key	3-8
9	"TIME" display	3-8
10	"TIME" setting（△▽）key	3-8
11	"ACCEL/DECEL" key	3-10
12	"FLASHING" key While pushing the key, the rotor rotates at the rapid acceleration and the rapid deceleration characteristics.	3-12
13	"NORMAL" key Press this key when the programmed operation is not required. Parameters can be set with each knob and key. Pressing this key during operation will indicate the current parameter status on each display for 5 seconds.	3-4
14	MEMORY selection keys These keys allow the selection of saved programs. Pressing the key will light the lamp.	3-11

Section 2 Installation and Power Supply

2－1. Unpacking

When the centrifuge is taken out of a corrugated carton box, check the followings.

（1）Upon receiving the centrifuge, examine it for any visible damage caused during transportation.
If any is found, contact the dealer immediately.

（2）Confirm that all the accessories listed in [Standard Accessories] are included with the delivery. ▶ Refer to page Ⅳ.

2－2. Place of installation

⚠WARNING

A clearance of 30 cm minimum must be provided around the centrifuge.
If the centrifuge is driven into uncontrolled rotations due to a failure, secondary damage can result from energy absorbed by the rotation.

⚠CAUTION

Do not install the centrifuge on an inclined, slippery, or unstable surface.
Violent vibration may occur.

2－3. Movement of centrifuge

⚠WARNING

- Never move the centrifuge while the rotor is rotating or while the rotor is attached to the centrifuge. Otherwise, the drive shaft may become bent or the rotor and the bucket may come off, resulting in an accident or damage to the centrifuge.
- Ensure that rotor and bucket are removed from the centrifuge and that the power cord is disconnected from the wall socket.
- Moving the position of the centrifuge while the power is turned on may cause electrification accident or functional failure of the centrifuge.

⚠CAUTION

- When moving the centrifuge, lift up the bottom of the centrifuge body by two or more persons using equal forces to move the centrifuge to the desired place.
- Do not drop the centrifuge, otherwise damage or injury may occur.

2 – 4. Power Requirement

⚠WARNING

Prepare a power supply that meets the following conditions.

1. The power supply voltage must be the same as that indicated on the nameplate of the centrifuge and the voltage variation must be within the range given in Table 2-1.
2. The current capacity must be more than given in Table 2-1.
3. In connecting the cord, install a knife switch or circuit breaker of given value in Table 2-1.
   When the centrifuge is connected to an outlet by means of a plug, use a 3-pin plug with a ground terminal.
4. Use single-phase power.
5. The outlet must have a ground terminal and its ground resistance must be less than 100 ohm.

Rated Voltage	110V	115V	120V	200V	220V	230V	240V
Acceptable Voltage Range	99V to 121V	103V to 126V	108V to 132V	180V to 220V	198V to 242V	207V to 253V	216V to 264V
Current requirement	15 A	15 A	15 A	8 A	8 A	8 A	8 A

Table 2-1 Rated Voltage, Current and Acceptable Voltage Range and Current Requirement

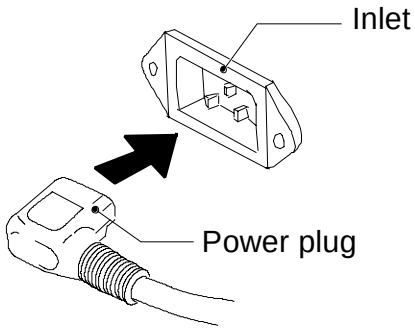
⚠WARNING

- The power cable alone should be connected to the plug socket.
- Do not use a branched plug socket, which may cause overheating or fire.

2－5. Grounding

NOTE

When using the centrifuge for the first time, plug the power cable on the centrifuge into the inlet on the back of the centrifuge.



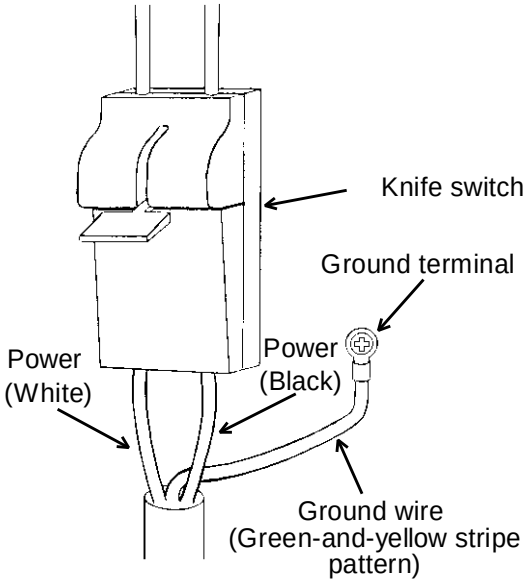
⚠WARNING

Ensure that the ground wire is connected to the grounding terminal.

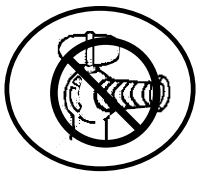
⚠WARNING

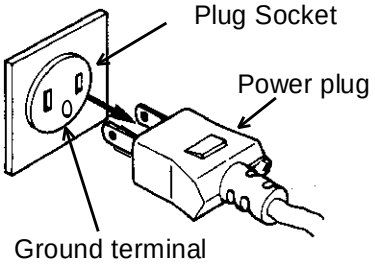
Do not connect the ground cable to the following places:

1. Gas piping
   Explosion or fire may occur.
2. Ground cable of the lightning conductor, or telephone cable. Electric shock may occur in case of thunderbolt.
3. Water pipes
   City water pipes may not be adequate as a ground since it may be connected to plastic pipework.




water pipes


Gas piping



Section 3 Operation

3－1. Cautions of Operation

When using this centrifuge, observe the contents of the Section "General Notes" being described in the front part of this document and the precautions given in respective sections.

3－2. Operation

Operation 1. Turn on the "POWER" switch.

Operation 2. After the "STOP" lamp on the control panel lights, press the "OPEN" key.

NOTE

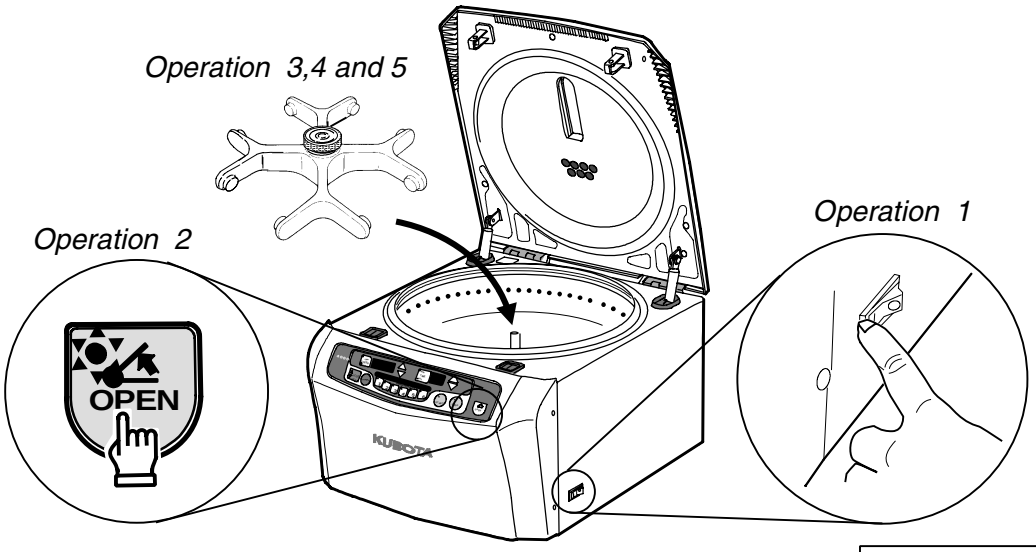
The lid is locked in following cases and will not open even if the "OPEN" key is pressed.
- When the rotor is spinning.
- When there is a power failure or the power is turned off.

Do not push up the lid forcibly. It causes the gas spring to break.
▶ Refer to page 1-1, 4-9.

Operation 3. Mount the rotor on the drive shaft.
Make sure that the rotor is firmly fastened to the drive shaft with the rotor knob.
▶ Refer to "mounting the Rotor" in the rotor instruction manual.

Operation 4. For swinging bucket rotor, mount buckets and tube racks on the rotor.
The same type buckets must be provided to every rotor yoke.
▶ Refer to "mounting the Rotor" in the rotor instruction manual.

Operation 5. Place the sample in the rotor or buckets. ▶ Refer to rotor instruction manual.



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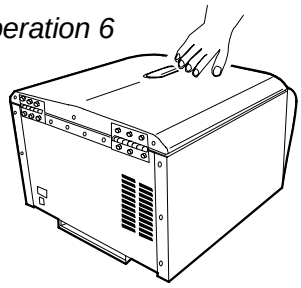
Operation 6. Push lightly the center of the front of the lid, and close the lid.
Close the lid firmly locked, "Running condition lamp" and "OPEN" lamp care turned off.

Operation 6



NOTE

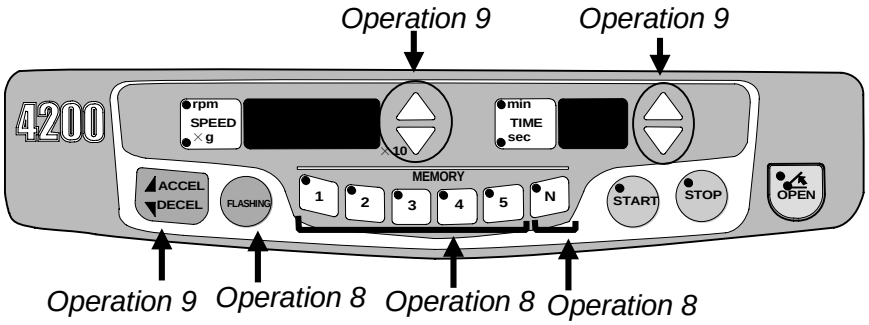
If the lid is not closed properly the centrifuge is not able to start.
Make sure the lid is closed firmly.

Operation 7. Proceed to *operation 10* when operating with the same setting values as before.

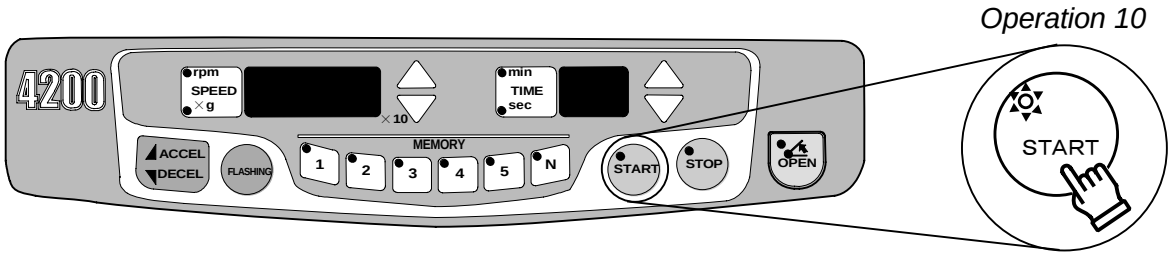
Operation 8. Press "NORMAL" key on the control panel.

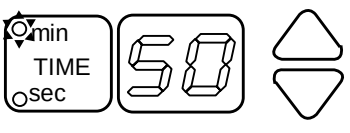
- When the memory has been saved, after pressing the "MEMORY" selection key, proceed to *Operation 10.* ▶ Refer to page 3-11.
- Refer to page 3-12 to carry out Flashing operation.

Operation 9. Set the operating parameters.
Press the "SPEED" setting（△▽）key to set to required speed. ▶ Refer to page 3-4.
Press the "TIME" setting（△▽）key to set to required time. ▶ Refer to page 3-8.
Set braking force during deceleration and acceleration speed with the "ACCEL/DECEL" key . ▶ Refer to page 3-10.

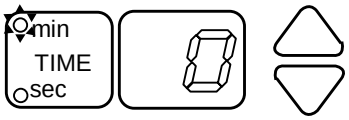


Operation 10. Press the "START" key.
"Pip" sounds and lamp on the "START" key lights.



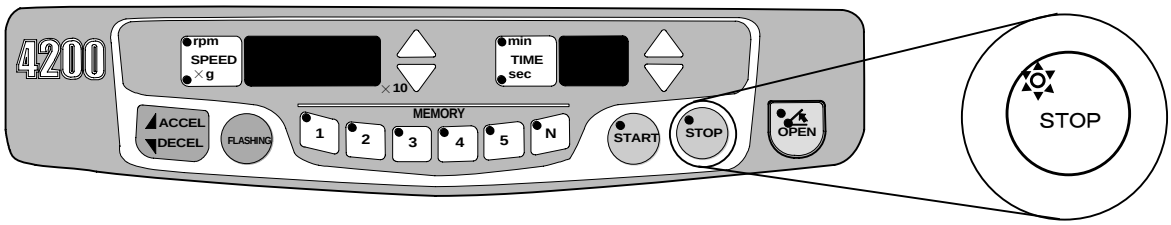


Value on the "TIME" display starts decreasing.



When the value becomes 0, the centrifuge automatically decelerates and stops.

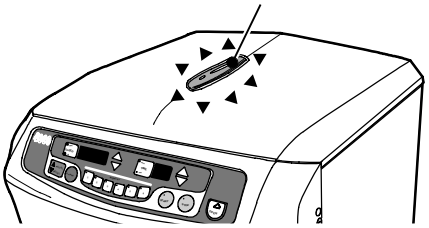
Operation 11. When the rotor stops, "STOP" lamp remains lit, sound that notify the end of the operation, the Running condition lamp flashes, and the lid automatically opens.



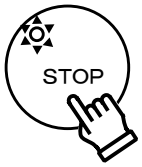
NOTE

When an alarm sounds and the centrifuge is deactivated, the lid does not open automatically.
Check that the rotor is stopped, turn the power ON and press the "OPEN" key to open the lid.

Running condition lamp



***** In the following case *****



∗ **When you want to halt operation, press the "STOP" key.**

"Sound that informs the end of the operation" sound and the "STOP" key lamp will light and the rotor will come to a halt.

● In case that the operation is stopped before the end of the period set by the timer and is resumed, the operation period after resumption is the remained period of the operation. ▶ Refer to Page 3-29.

Operation 12. Remove the sample.

Operation 13. If the centrifuge is to be used again, return to *Operation 4.*

Operation 14. After finishing use of the centrifuge, turn "OFF" the "POWER" switch to turn off the power supply.

NOTE

● If the power is turned off while a memory is recalled and is then turned on again, the same memory as displayed before the power off will be recalled and displayed.
<Example> Turn off the power while "MEMORY 2" is recalled. Turn on the power, and the "MEMORY 2" key lamp will light and the parameter stored under "MEMORY 2" key will be displayed.

● The following function is able to change it.
The Sound that notify the end of the operation, The key buzzer sound [ON/OFF], The Reminder alarm [ON/OFF], Automatic unlocking and opening of lid after operation [ON/OFF] ▶ Refer to Page 3-18, 3-28 and 3-29.

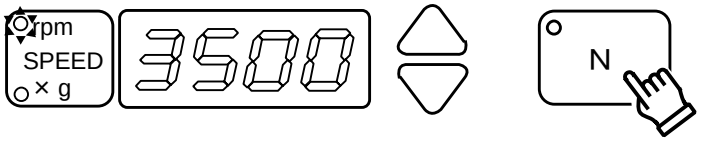
3－3. Setting the Speed

［1］Setting the speed by the rpm

［Ex.］The process mentioned below shows the case that ST-722M rotor is mounted. (Model 4000)

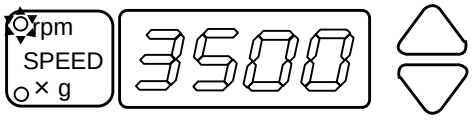
（1）Mount the rotor on the drive shaft.

（2）Press the "NORMAL" key.
The "SPEED" display indicates the current setting.

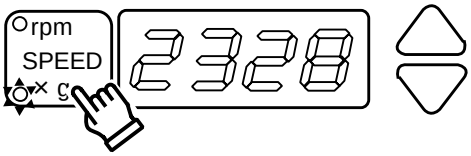


（3）Check if the 〈 rpm〉 lamp turned on.

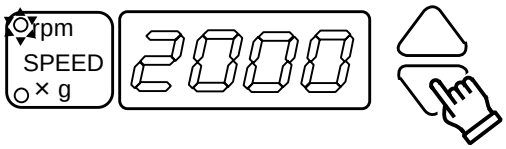
① When the 〈 rpm〉 lamp is on・・・・・・・・・・・・・・・・・ Proceed to the Procedure(4).



② When the 〈× g〉 lamp is on・・・・・・・・・・・・・・・・・・ Push the "SPEED" key and the 〈× g〉 lamp turns off.
The indicated figure turns to 3,500.
Proceed to the Procedure (4).



（4）Press the "SPEED" setting （△▽）key to set to required speed.
Indication on the "SPEED" display is at 100 rpm intervals, and the speed can be set 100 rpm intervals.

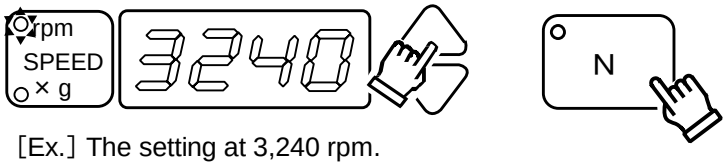


（5）When you desire to make the settings at 10 rpm intervals.
Press the "SPEED" setting （△▽）key while depressing the "NORMAL" key, the minimum unit will become 10 rpm.

［Ex.］When you desire to make the settings at 3,240 rpm by ST-722M.

① Set at 3,200 rpm.

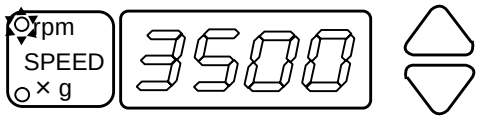
② Press the "SPEED" setting （△）key while depressing the "NORMAL" key, the speed settings can be made 3,210・・・・・・・3,240 rpm.



［Ex.］The setting at 3,240 rpm.

Model 4000 and 4200 indication on the "SPEED" display

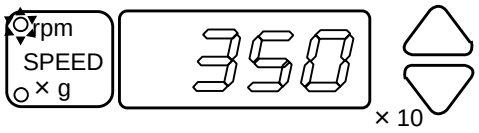
① Model 4000



1 rpm intervals.

［Ex.］3,500 rpm

② Model 4200



10 rpm intervals.

［Ex.］3,500 rpm

［－－－］is indicated.

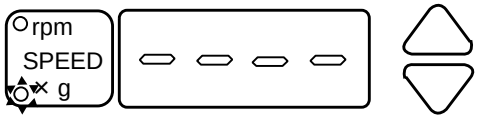
NOTE

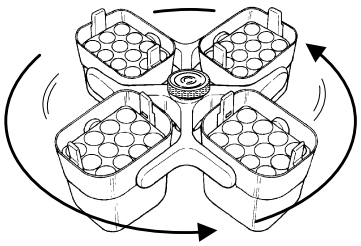
Before operation or while the lid is open, the centrifugal force will not be displayed even when the display mode is switched from speed to centrifugal force.

Once the rotor is operated or rotate the rotor counterclockwise more than twice by hand, the centrifugal force can be displayed.

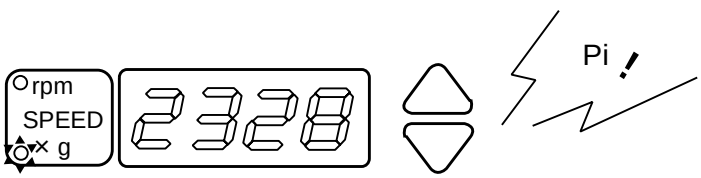
【Manually rotate the rotor counterclockwise, the centrifugal force can be displayed.】

（1）Manually rotate the rotor counterclockwise two to three turns or more.



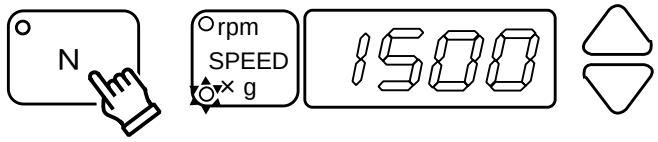


（2）A buzzer sounds and the display shows the centrifugal force with et speed.

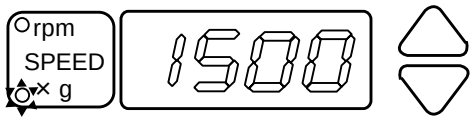


［2］ Setting the speed by the centrifugal force (× g)

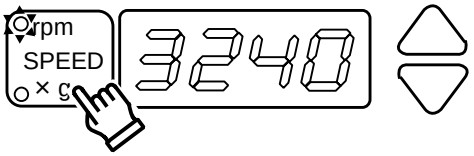
（1） Mount the rotor on the drive shaft.
（2） Press the "NORMAL" key.
The "SPEED" display indicates the current setting.



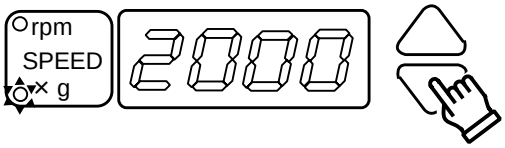
（3） Check if the 〈× g〉 lamp turned on.
① When the 〈× g〉 lamp is on ····· Proceed to the Procedure (4).



② When the 〈× g〉 lamp is off ····· Press the "SPEED" key and the 〈× g〉 lamp turns on.
The indicated figure turns to 15,000.
Proceed to the Procedure (4).

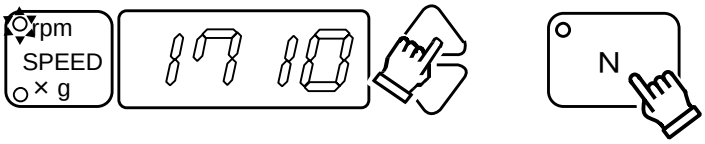


（4） Press the "SPEED" setting (△▽) key to set to required centrifugal force reading.
Indication on the "SPEED" display is at × g intervals.



（5） When you desire to make the settings at 10 × g intervals.
Press the "SPEED" setting (△▽) key while depressing the "NORMAL" key, the setting unit will become 10 × g.

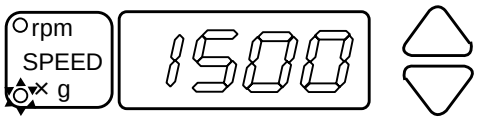
［Ex.］ When you desire to make the settings at 1,710 × g by ST-722M.
① Set at 1,700 × g .
② Press the "SPEED" setting (△) key while depressing the "NORMAL" key, the speed settings can be made 1,710 × g .



［Ex.］ The setting at 1,710 × g.

Model 4000 and 4200 indication on the "SPEED" display

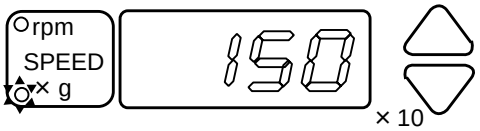
① Model 4000



1 × g intervals.

［Ex.］1,500 × g

② Model 4200



10 × g intervals.

［Ex.］1,500 × g

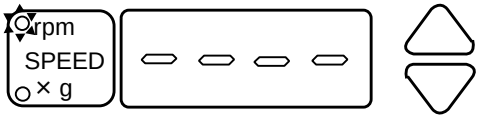
［－－－］is indicated.

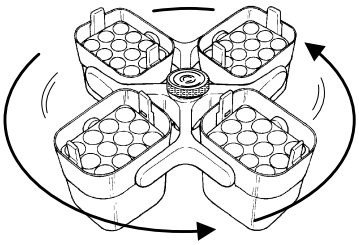
NOTE

Before operation or while the lid is open, the speed will not be displayed even when the display mode is switched from centrifugal force to speed. Once the rotor is operated or rotate the rotor counterclockwise more than twice by hand, the speed can be displayed.

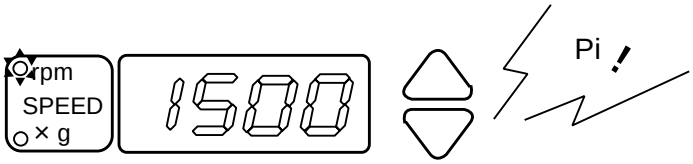
【Manually rotate the rotor counterclockwise, the speed can be displayed.】

（1）Manually rotate the rotor counterclockwise two to three turns or more.





（2）A buzzer sounds and the display shows the speed with the set centrifugal force.

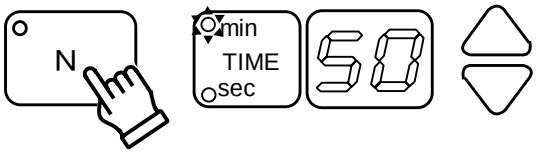


3－4. Setting the Timer

- As for the setting method of the timer, there are the following 2 kinds.
  ［1］ Set the timer to minutes or seconds.
  ［2］ Set the timer to the desired combination of minutes and seconds.
- Refer to page 3-30 and change the setting.
- Factory default : ［1］ Set the timer to minutes or seconds.

［1］ Set the timer to minutes or seconds

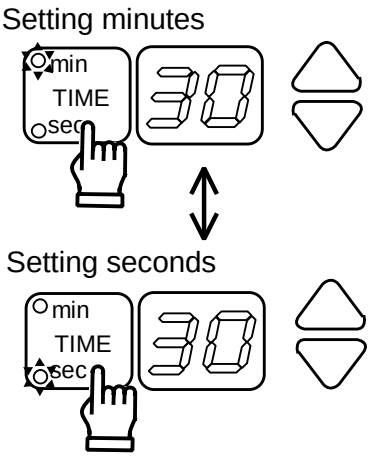
（1） Press the "NORMAL" key and show the current parameter on "TIME" display.



（2） Set to the mode as required. And, set to required time.

① Setting minutes or seconds.
Pressing "TIME" key changes the estate range of centrifuging time as described below.

	Settable range	Setting unit
Setting minutes	1-99 minutes	1 minute
Setting seconds	1-99 seconds	1 second

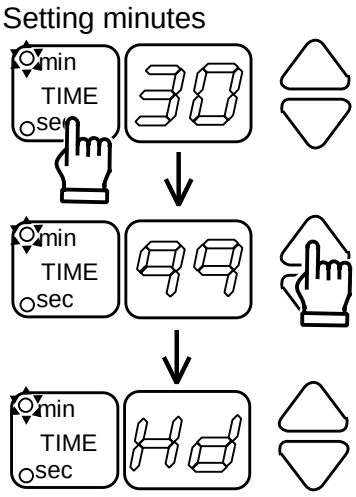


② HOLD
It will continuously operate regardless of the timer.

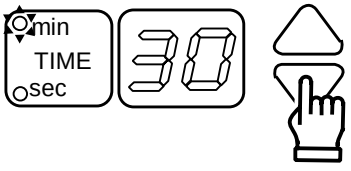
a) Pressing "TIME" key changes the estate range of minutes.

b) Pressing the "TIME" setting (△) key several times and let indicate "Hd" on the "TIME" display.

The "TIME" display of the display "Hd" displays it next to 99.
(1,2,3,・・・・・・・・・・・・・・98, 99, Hd)



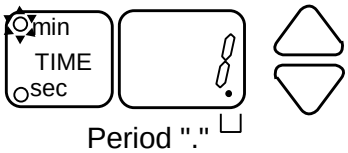
（3） Pressing the "TIME" setting (△▽) key changes the indication on the display.
Set to the time required.
When started, the display will diminish and stop at point 0.



[2] Set the timer to the desired combination of minutes and seconds.

(1) Check that a period "." is displayed to the right of the "TIME" display.

If a period is not displayed, refer to page 3-30 [d.5:Setting the timer] and change the setting.



Period "."

(2) Set to the mode as required. And, set to required time.

① Setting minutes.

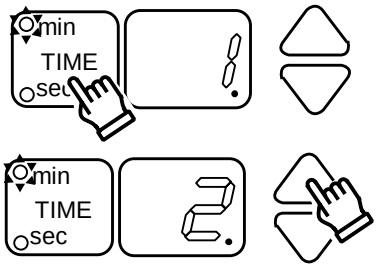
a) Press the "TIME" key and the 〈min〉 lamp turns on.

b) Press the "TIME" setting (△▽) key and set to the minutes required.

② Setting seconds.

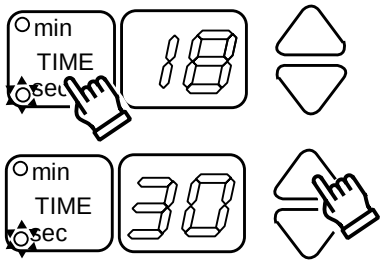
a) Press the "TIME" key and the 〈sec〉 lamp turns on.

b) Press the "TIME" setting (△▽) key and set to the seconds required.



[Ex.] 2 minutes

(3) When started, the display will diminish and stop at point 0.

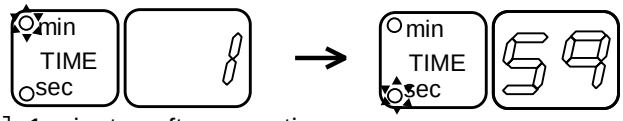


[Ex.] 30 seconds

NOTE

(1) Setting minutes

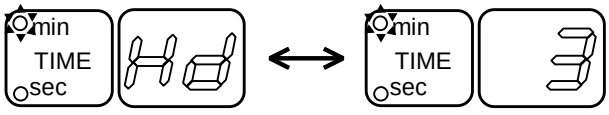
When the operation time becomes less than one minute, the display automatically switches to show time in seconds.



[Ex.] 1 minutes after operation

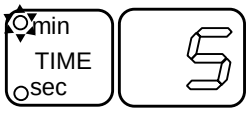
(2) Setting minutes

① "Hd" and the elapsed time of operation are indicated alternately on the "TIME" display.



[Ex.] 3 minutes after operation

② After it reaches 99 minutes, the time display will return to 0 and repeat the timing [process].

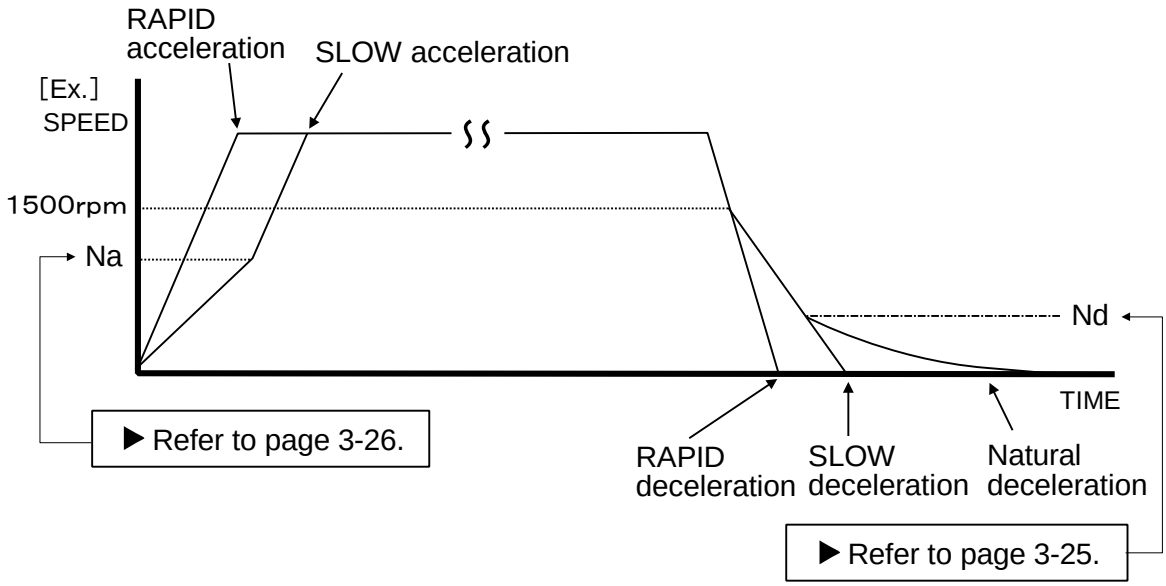


This indication will be stored until the next operation is started or until the next setting change is made.

[Ex.] 5minutes after operation

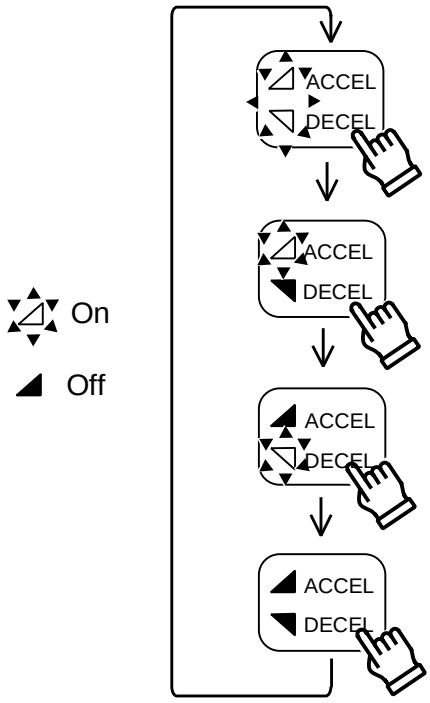
3－5. Setting the acceleration･deceleration

When blowing-up of samples is concerned, adjust the acceleration and the deceleration setting by pressing the "ACCEL/DECEL" key.



NOTE

- The speed (Na) that you want to accelerate at the "SUPER SLOW" can be set. ▶ Refer to page 3-26.
- The speed (Nd) that starts "SUPER SLOW" decelerating (Natural deceleration) can be set. ▶ Refer to page 3-25.



ACCEL：RAPID（**“RAPID”** acceleration）
DECEL：RAPID（**“RAPID”** deceleration）

ACCEL：RAPID（**“RAPID”** acceleration）
DECEL：SLOW（**“SLOW”** deceleration）

ACCEL：SLOW（**“SLOW”** acceleration）
DECEL：RAPID（**“RAPID”** deceleration）

ACCEL：SLOW（**“SLOW”** acceleration）
DECEL：SLOW（**“SLOW”** deceleration）

3－6. Saving the Memory

Saving the setting value enables operation with the same setting value repeatedly.

［1］ Saving the Memory

（1）Set the respective parameters.
Refer to the following page for the setting method.

［3－3. Setting the speed］ ▶ Refer to page 3-4.
［3－4. Setting the timer］ ▶ Refer to page 3-8.
［3－5. Setting the acceleration･deceleration］ ▶ Refer to page 3-10.

（2）Keep pressing until you hear the buzzer (for about 3 seconds) the memory selection key to which you want to assign the settings. As to the location of MEMORY selection key, refer to [1-2. Control Panel] on page 1-2.

About 3 seconds

NOTE

The parameters necessary for operation (speed, RCF, time, acceleration / deceleration, etc.) can be stored as memories with either MEMORY 1-5 keys.

［2］ Recall the Memory

Pressing "MEMORY" key, the lamp is lit, and choose the lamp number you want to recall.

NOTE

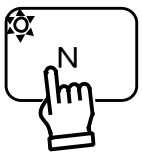
Even if the power is turned off, the parameters set at the time of power off remain stored.

The last setting is displayed and can be operated.

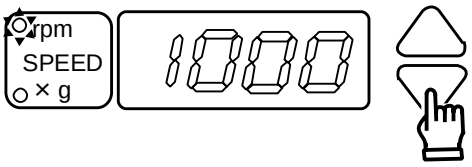
［3］ Memory operation cancellation

The memory is cancelled with the following method.

● Press the "NORMAL" key when the stored memory is recalled.
The "NORMAL" key lamp is turned on and the normal setting mode will be selected.



● Press the setting （△▽）key .
The normal setting mode will be selected.



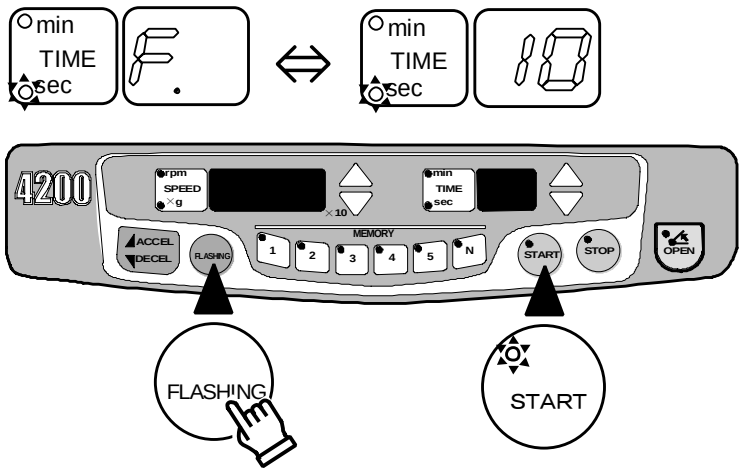
3－7. Flashing operation

The flashing operation continues as long as the "FLASHING" key is kept depressed.
The flashing operation decelerates and stops when the "FLASHING" key is released.

Operation 1. At first, execute ordinary *Operation 1 - 6* in the［3-2.Operation］.
▶ Refer to page 3-1.

Operation 2. Keep the "FLASHING" key depressed.
Lamp on the "START" key lights on.
"F(FLASHING)" and time of operation are indicated alternately on the "TIME" display.
Settable range：1 - 99 second

［Ex.］10 seconds



As for the speed, the rotor can be rotated at its maximum speed. If the set value does not reach the maximum speed, the rotor rotates only up to the set value.

Operation 3. The operation will stop when you release the "FLASHING" key.
"FLASHING" and "START" lamp lights off.
The indication on the "TIME" display will show the value at the time when the "FLASHING" key was released, until the lid will be opened.

Operation 4. When the rotor stops, a beep sound that notify the end of the operation, the Running condition lamp flashes, and the lid automatically opens.
The set time returns to the prior setting.

Operation 5. Remove the sample.

Operation 6. If the centrifuge is to be used again, return to *Operation 5* in the［3-2.Operation］.
▶ Refer to page 3-1.

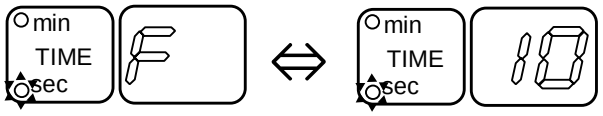
Operation 7. After finishing use of the centrifuge, turn "OFF" the "POWER" switch to turn off the power supply.

3－8. Memory Flashing operation

The last ordinary flashing operation is memorized automatically. When the "FLASHING" key is pressed shortly (within a second), the memory is called out and the equipment will make spinning down for the same time as the last operation.
It is not necessary to keep depressing of the flashing key.
This function is convenient when it is desired to maintain the spinning down condition.

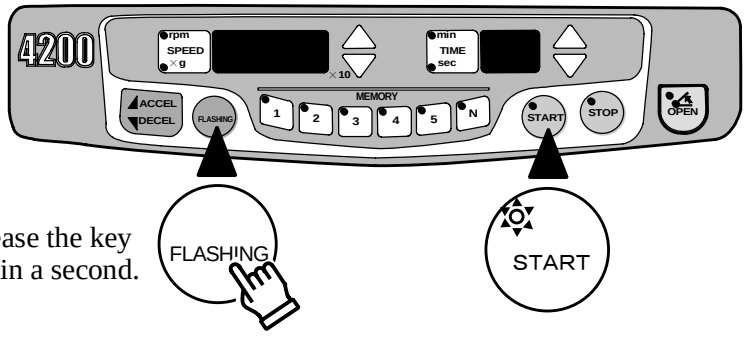
Operation 1. At first, execute ordinary flashing operation.
▶ Refer to page 3-12.

Operation 2. When making the 2nd flashing operation, press the "FLASHING" key shortly (within a second). (If you keep it depressed for more than a second, the equipment will make ordinary flashing operation.)
Lamp on the "FLASHING" key and "START" key light turn on.
"F(FLASHING)" and time of operation are indicated alternately on the "TIME" display.
Settable range：1 - 99 second



［Ex.］10 seconds

* As for the acceleration rate, the rapid acceleration characteristics will be selected.
* As for the deceleration strength, the rapid deceleration characteristics will be selected.



NOTE

- Press the "FLASHING" key once again, in case that you want to check the operation time during the flashing operation.
- When you want to halt operation, Press the "STOP" key.

Operation 3. When the equipment reaches the flashing time which was last memorized, the operation will be decelerated to come to a complete stop.
Then, the "START" key lamp will turn off and the "STOP" key lamp will flashing.

Operation 4. When the rotor stops, a beep sound that notify the end of the operation, the Running condition lamp flashes, and the lid automatically opens.
The set time returns to the prior setting.

Operation 5. Remove the sample.

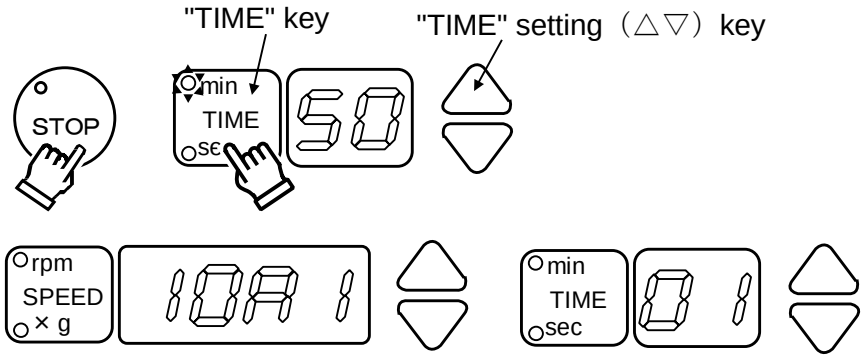
Operation 6. If the centrifuge is to be used again, return to *Operation 5* in the ［3-2.Operation］.
▶ Refer to page 3-1.

Operation 7. After finishing use of the centrifuge, turn "OFF" the "POWER" switch to turn off the power supply.

3－9. Setting the optional function

This product allows setting the following displays and buzzer sounds for check.

（1）Pressing the "TIME" key while holding down the "STOP" key indicates the version number of control software.



[Ex.] Version Number of 10A1.

（2）Choose the item you want to set up from the list shown below, and press the "TIME" key.

Choose the item you want to set up, and press the "TIME" key.

Return to 1.

Turn	"SPEED" display	"TIME" display	Function	Outline	Page
1	10A1	[Ex.] 01	Control of Software Version	You can check the version number of the control software contained in the centrifuge.	3-16
2	r. u.t	[Ex.] ST-722M ID 22.	Used number of cycles and times of the rotor	Check the used number of cycles and times of each rotor.	3-16
3	[Ex.] 1	b.n.	Sound that notify the end of the operation	Select the Sound that informs the end of the operation and the operation sound of the key.	3-18
4	[Ex.] High 2	b.v.	Sound volume	Three volume levels (mute, low and high) can be selected the "Sound that notify the end of the operation" and "key entry buzzer."	3-19
5	[Ex.] Green 2	P.1	Setting the Running condition Lighting lamp [Operation]	The "seven colors shown below, as well as no color," are selectable for the running condition lamp	3-20
	[Ex.] Blue 3	P.2	Setting the Running condition Flashing lamp [Stopped condition]		
6	[Ex.] 0 sec. 0	d.t	Delayed operation start-time	Setting the time to elapse before the automatic operation is started.	3-22

Return to 1.

Turn	"SPEED" display	"TIME" display	Function	Outline	Page
7	r.rAd	[Ex.] ST-722M ID 22	Rotation Radius	Setting the desired rotation radius.	3-24
8	[Ex.] 0 rpm 0	S.d	"Natural" deceleration	Setting the natural deceleration starting speed.	3-25
9	[Ex.] 1,000 rpm 1000	S.A	"SUPER SLOW" acceleration	Setting the speed of Na up to which the "SUPER SLOW" acceleration is applied.	3-26
10	[Ex.] ON	d.0	Other functions The "TIME" setting （△▽） key	Buzzer sound of the "START" key Setting the buzzer sound. [ON/OFF]	3-28
	[Ex.] ON	d.1		Buzzer sound of the "STOP" key Setting the buzzer sound. [ON/OFF]	3-28
	[Ex.] OFF	d.2		Operation time after resumption Setting the [preset time/remaining time].	3-29
	[Ex.] OFF	d.3		Reminder alarm Setting the reminder alarm. [ON/OFF]	3-29
	[Ex.] ON	d.4		Automatic unlocking and opening of lid after operation Setting the lid to automatic opening after operation. [ON/OFF]	3-29
	[Ex.] OFF	d.5		Setting the Timer Select [Set the timer to minutes or seconds.(OFF)] or [Set the timer to the desired combination of minutes and seconds.(ON)].	3-30
	[Ex.] ON	d.6		Grease application message Setting the grease application message. [ON/OFF]	3-30
	OFF	d.7		–	–

（3） After setting any one of the above, please return the display to the previous indication of Speed, Time.
To do above, press the "TIME" key while holding down the "STOP" key.

NOTE

The setting in the above table is saved even if the display is not returned to the previous indication.

［1］Control of Software Version

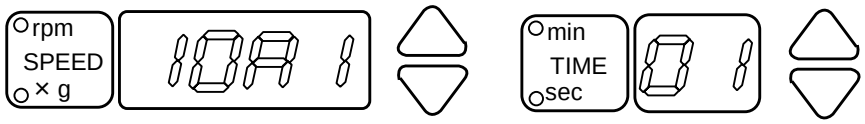
To check the software version number for maintenance purposes, follow the method below:

Software version number shall be informed when you have any inquiry.

（1）Pressing the "TIME" key while holding down the "STOP" key.

（2）The "SPEED" display and the "TIME" display indicate the software version number.
▶ Refer to page 3-14.

[Ex.] Version Number of 10A1.



[Ex.] Sub Version Number of 01.

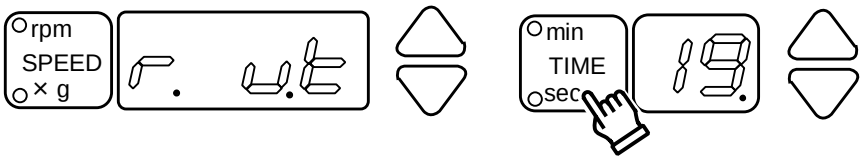
（3）After checking the software version, please return the display to the previous indication of Speed and Time.
To do above, press the "TIME" key while holding down the "STOP" key.

［2］Used number of cycles and times of the rotor

You can check the used number of cycles and times of each rotor.

（1）Pressing the "TIME" key while holding down the "STOP" key .
The software version number is displayed.

（2）Pressing the "TIME" key several times and let indicate "r.u.t" on the "SPEED" display.
▶ Refer to page 3-14.
The "TIME" display indicates ［the rotor ID number］ or ［－－］.

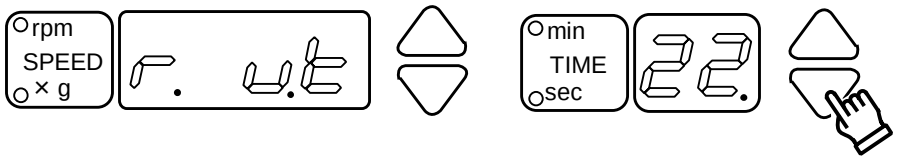


［Ex.］ST-480M rotor ID No.19

NOTE

Before operation or while the lid is open, the centrifugal force will not be displayed even when the display mode is switched from speed to centrifugal force.
Once the rotor is operated or rotate the rotor counterclockwise more than twice by hand, the centrifugal force can be displayed.

（3）Press the "TIME" setting （△▽）key to display the ID number of the rotor on the "TIME" display.



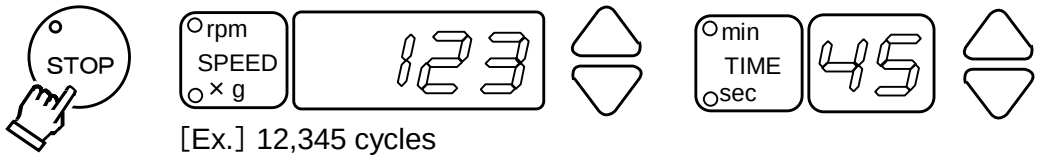
［Ex.］ST-722M rotor ID No.22

Rotor number table

Rotor	ID number	Rotor	ID number	Rotor	ID number
（ST-410M）	28	ST-2504MS	45	AT-2730M	35
ST-480M	19	PT-21M	29	AT-508C	43
ST-504M	44	PT-89M	34		
ST-722M （ST-720M）	22	RA-2724M	42		

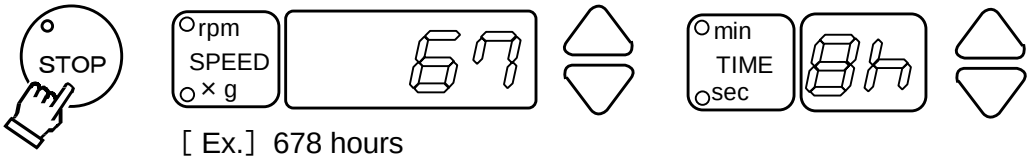
(　) of rotor is discontinued.

（4）Press the "STOP" key.
The "SPEED" display and the "TIME" display show the used number of cycles of the (3) rotor.



［Ex.］12,345 cycles

（5）Press the "STOP" key.
The "SPEED" display and the "TIME" display show used hours of the (3) rotor.



［Ex.］678 hours

（6）Press the "STOP" key. Return to(3)

（7）Press the "TIME" key while holding down the "STOP" key.
The display returns to the previous Speed and Time indication.

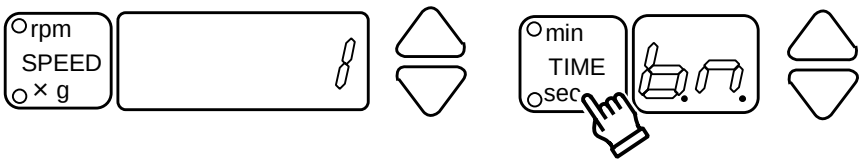
［3］Setting the Sound that notify the end of the operation

The "Sound that notify the end of the operation" can be selected from the 5 kinds ＋ Sound none.
Use this function to identify each "Sound that informs the end of the operation" when you use more than one centrifuges.
Factory default : ［1］

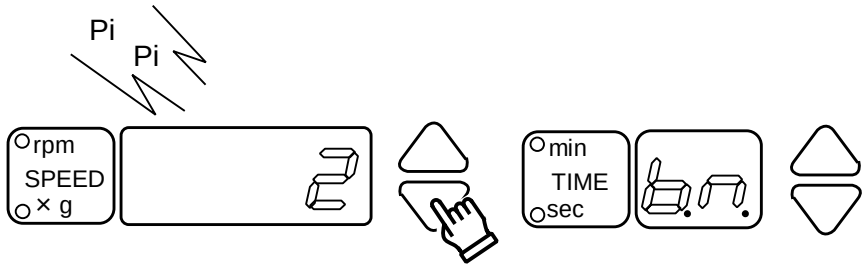
（1）Pressing the "TIME" key while holding down the "STOP" key .
The software version number is displayed.

（2）Pressing the "TIME" key several times and let indicate "b.n." on the "TIME" display.
The number of the currently set the sound that notify the end of the operation appears on the "SPEED" display and a beep sounds once. ▶ Refer to page 3-14.

［Ex.］ The "Sound that notify the end of the operation" 1.



（3）Press the "TIME" setting （△▽） key to change the "Sound that notify the end of the operation".
The "Sound that notify the end of the operation" can be selected from 1, 2, 3, 4 ,5 of 5 kinds ＋ 0 (Sound none).



［Ex.］ The "Sound that notify the end of the operation" 2.

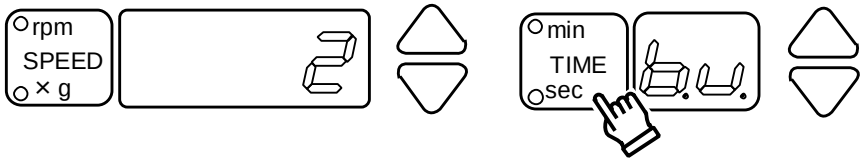
（4）Press the "TIME" key while holding down the "STOP" key.
The display returns to the previous Speed and Time indication.

［4］Setting the Volume for the buzzer

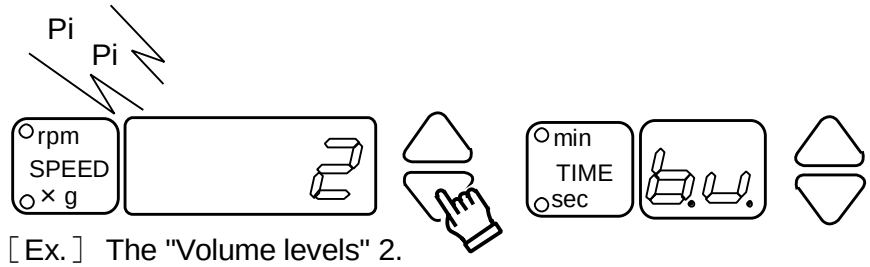
Three volume levels (mute, low and high) can be selected the "Sound that notify the end of the operation" and "key entry buzzer."
Factory default : ［High(2)］

（1）Pressing the "TIME" key while holding down the "STOP" key .
The software version number is displayed.

（2）Pressing the "TIME" key several times and let indicate "b.v." on the "TIME" display.
The number of the currently set the volume levels appears on the "SPEED" display and a beep sounds once. ▶ Refer to page 3-14.



（3）Press the "TIME" setting （△▽） key to change the "Volume levels".
▶ Refer to the following table.



［Ex.］ The "Volume levels" 2.

Volume levels	No.
Mute	0
Low	1
High	2

（4）Press the "TIME" key while holding down the "STOP" key.
The display returns to the previous Speed and Time indication.

［5］Setting the Running condition lamp

● The lamp color of "Running condition lamp" of the lid can be selected from "Seven colors shown as follows" by "MEMORY"1～5Key and "NORMAL" Key.

＊ Caution is indicated by the lamp rapidly flashing "yellow."
Alarm is indicated by the lamp rapidly flashing "red."
(The colors for caution or alarm conditions are not selectable.)

Running condition lamp color	Off	Red	Green	Blue	Light blue	Yellow	Purple	White
No.	0	1	2	3	4	5	6	7

● Setting table of Running condition lamp

"TIME" display	Running condition	Lamp Pattern	Lamp color・No. ＊ Factory default
P.1	Operation	Lighting	Green・2
P.2	Stopped condition	Flashing	Blue・3

＊ The colors for Running condition lamp are selectable.

（1）Pressing the "TIME" key while holding down the "STOP" key .
The software version number is displayed.

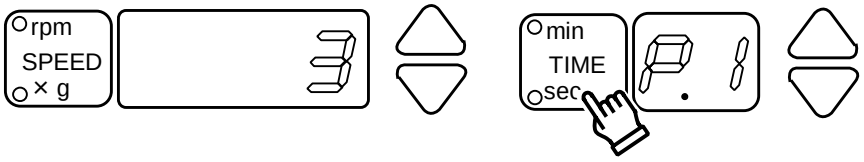
NOTE

The lamp color of "Running condition lamp" of the lid can be selected from "seven colors" by "MEMORY" 1～5key and "NORMAL" key.

（2）Pressing the "TIME" key several times and let indicate "P.1" or "P.2" on the "TIME" display. ▶ Refer to page 3-14.

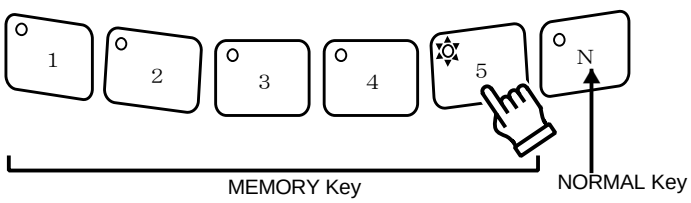
The "SPEED" display indicates the current setting of the lamp color No.
The lamp flashes or lighted.

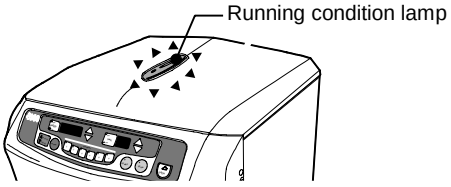
［Ex.］ Color of the lamp in operation - Blue [3]



（3）Press the "MEMORY" or "NORMAL" key, which you want to choose the color of the lamp. The lamp of "MEMORY" or "NORMAL" key indicates the current setting of the lamp color number The lamp flashes or lights.

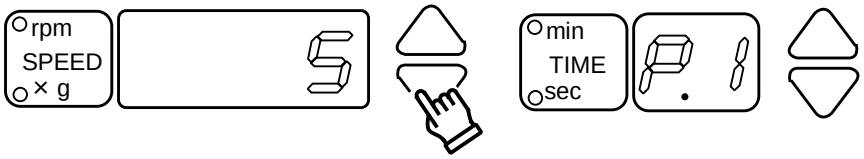
［Ex.］It lights by the color to which selected Key and Running condition lamp are memorized.





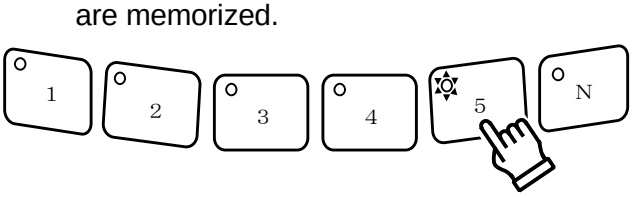
（4）Press the "SPEED" setting （△▽）key to change the "Running condition lamp".

［Ex.］It lights by the color to which selected Key and Running condition lamp are memorized.

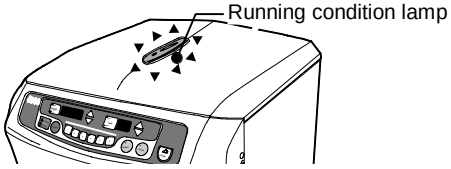


（5）When it keeps pressing Key that has blinked until sounding for about 3seconds, the LED lamp color is preserved in the memory.

［Ex.］It lights by the color to which selected key and Running condition lamp are memorized.

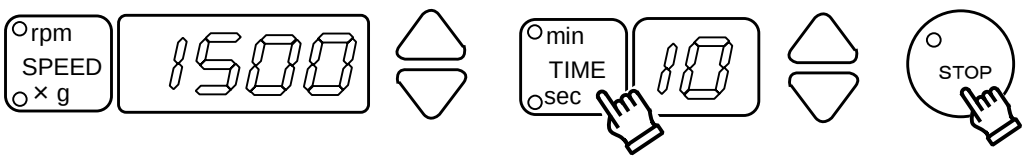


Keep pressing about 3 seconds.



（6）It returns to the normal screen when "TIME" Key is pushed with "STOP" Key pushed after the operation ends.

［Ex.］Press the "TIME" key while holding down the "STOP" key. The display returns to the previous Speed and Time indication.



［6］Setting the Delayed operation start-time

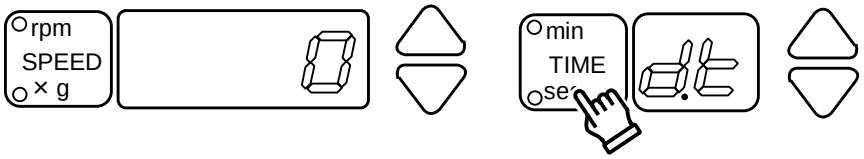
This function is helpful for biochemical tests and serological tests when the start of operation is required to be delayed for the previously specified time.
When centrifugal separation is conducted for the fresh blood taken out, processing will wait until that the erythrocytes coagulate and then will start automatically.
Press "START" key and then set the time to elapse before the automatic operation starts.
Settable range：0 - 999 second

> NOTE
> Store the delayed operation start-time to the memory (1- 5) for later use.

（1）Pressing the "TIME" key while holding down the "STOP" key .
The software version number is displayed.

（2）Pressing the "TIME" key several times and let indicate "d.t" on the "TIME" display.
The "SPEED" display indicates the current setting of delayed time for start of operation.
▶ Refer to page 3-14.

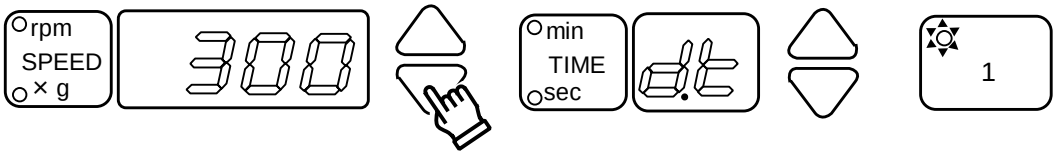
［Ex.］ 0 second



（3）Press the "MEMORY" selection key to which you want to assign the settings.
Lamp of "MEMORY" selection key is 1it on.

（4）Press the "SPEED" setting （△▽） key to change the delayed time.
Lamp of "MEMORY" selection key is flashing.

［Ex.］ 300 seconds



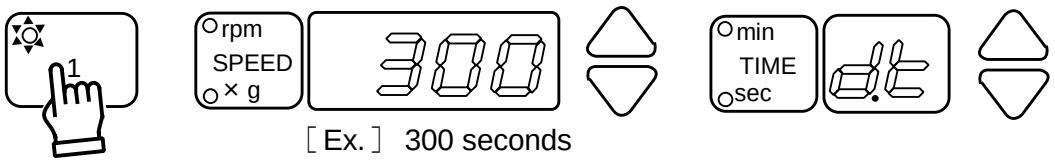
（5）Keep pressing until you hear the buzzer (for about 3 seconds) the memory selection key to which you want to assign the settings.

About 3 seconds

（6）Press the "TIME" key while holding down the "STOP" key.
The display returns to the previous Speed and Time indication.

How to check the delayed operation start-time that has been saved

① Implement the operations（1）and（2）given in page 3-22.
② Pressing "MEMORY" key where the delayed operation start time is set, and choose the lamp number you want to recall.
The "SPEED" display indicates the stored delayed operation start time.



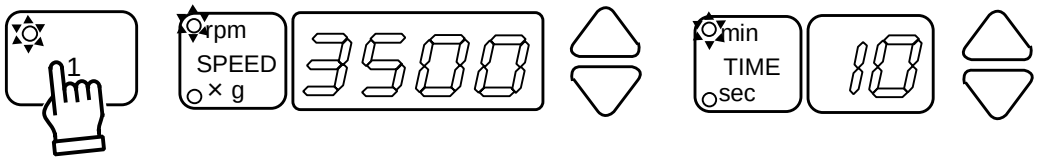
［Ex.］ 300 seconds

Delayed start-time operation

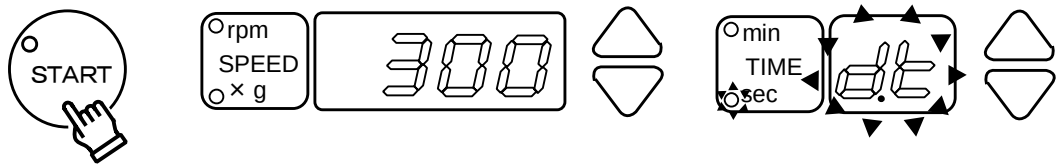
NOTE

- The delayed operation start time can not be used. if it is not preserved to the memory beforehand.
  Refer to 3-22 page and preserve the delay time to the memory.
- Be sure to turn on the delayed operation after making sure that the rotor is appropriately balanced.
- The operation can not start at the time when the display indicates any setting condition of the function. Return the display to the previous indication of "Speed", and "Time".
- Under a delayed operation, the lid cannot be opened even when the rotor is stopped.
  If you want to open the lid at such a time, press the "STOP" key once to interrupt the delayed operation. Pressing the "START" key again will resume the delayed operation counter from the point of interruption.
- To delete a delayed operation before it finishes, press the "STOP" key twice.

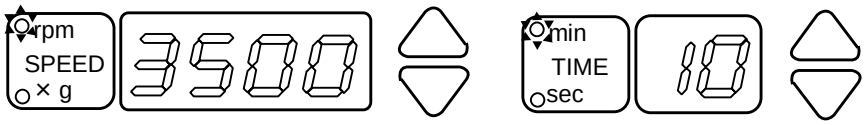
① Pressing "MEMORY" key where the delayed operation start time is set, and choose the lamp number you want to recall.
The "SPEED" display indicates the stored delayed operation start time.



② Press the "START" key.
The "TIME" display indicates the current setting of delayed operation start time.
The value of the "TIME" display starts the countdown.



③ The operation is started automatically, when the saved delayed time has passed.



［7］Setting the Rotation Radius

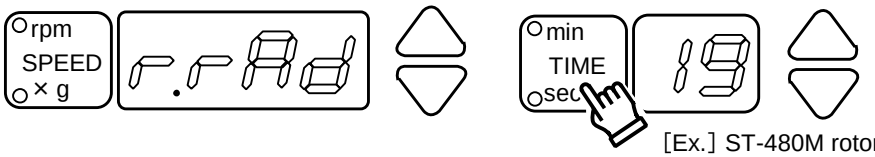
To obtain more accurate centrifugal force, adjust the rotation radius to that of the rotor buckets.

Factory default : Initial value of each rotor

Since the radius of gyration is different depending upon each of the rotor and each of the bucket, a deviation will occur in the indications of the centrifugal force.

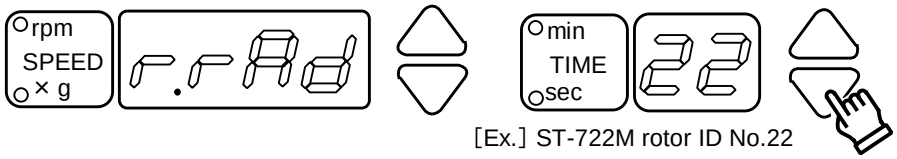
（1）Pressing the "TIME" key while holding down the "STOP" key .
The software version number is displayed.

（2）Pressing the "TIME" key several times and let indicate "r.rAd" on the "TIME" display.
The "SPEED" display indicates the rotor ID number. ▶ Refer to page 3-15.
Refer to [Rotor number table] on page 3-17.



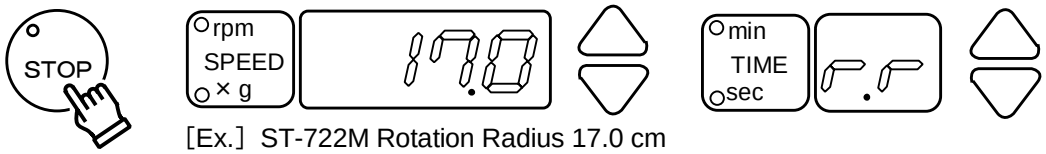
［Ex.］ST-480M rotor ID No.19

（3）Press the "TIME" setting （△▽） key to display the ID number of the rotor on the "TIME" display.
Refer to [Rotor number table] on page 3-17.



［Ex.］ST-722M rotor ID No.22

（4）Pressing the stop key the selection of the rotor number is completed.
The "SPEED" display indicates the current setting and let indicate "r.r" on the "TIME" display.



［Ex.］ST-722M Rotation Radius 17.0 cm

（5）Press the "SPEED" setting （△▽）key to set to the rotation radius of the rotor bucket to be used for operation.

［Ex.］ST-722M Rotation Radius 15.6 cm

（6）Press the "TIME" key while holding down the "STOP" key.
The display returns to the previous Speed and Time indication.

NOTE

Pressing the "SPEED" key, the indication will return to the initial indication.

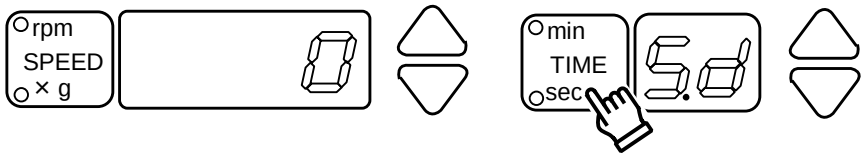
[8] Setting the "Natural" deceleration

You can set the natural deceleration starting speed Nd by the following method.
Factory default, it is set as 0 rpm.
The Nd value can be set up to the maximum speed of the rotor that is being used.

(1) Pressing the "TIME" key while holding down the "STOP" key .
The software version number is displayed.

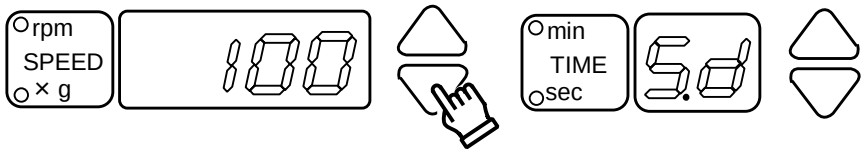
(2) Pressing the "TIME" key several times and let indicate "S.d" on the "TIME" display.
The "SPEED" display indicates the current setting of the natural deceleration speed.
▶ Refer to page 3-15.

[Ex.] 0 rpm



(3) Press the "SPEED" setting (△▽) key to set the natural deceleration speed (Nd).

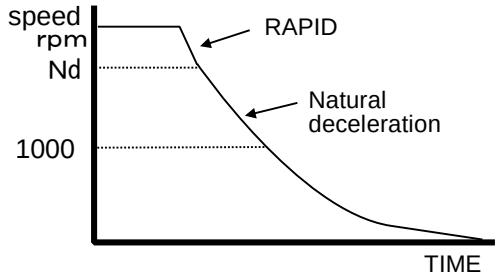
[Ex.] 100 rpm



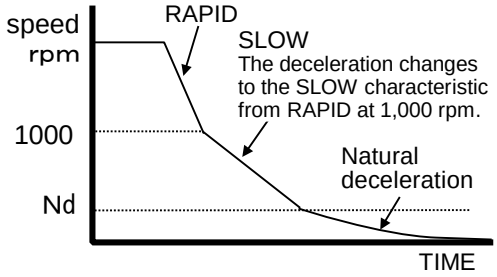
(4) Press the "TIME" key while holding down the "STOP" key.
The display returns to the previous Speed and Time indication.

"SUPER SLOW" decelerating

(A) Nd = 1,000 rpm or more



(B) N = 1,000 rpm or less



NOTE

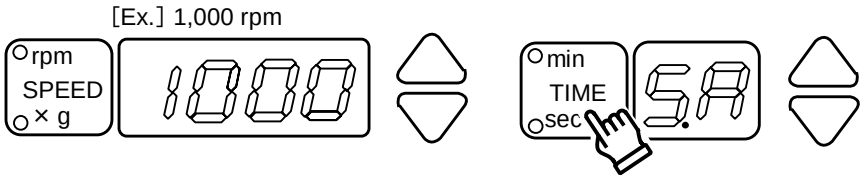
When deceleration characteristic is set as SLOW deceleration only, it becomes natural deceleration.

[9] Setting the "SUPER SLOW" acceleration

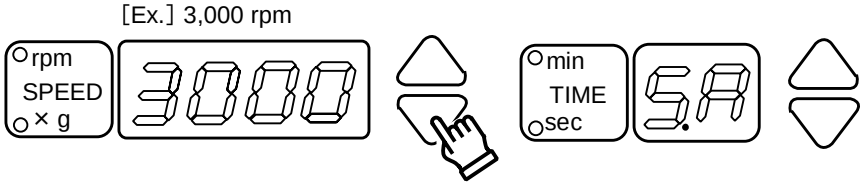
You can set the speed of Na up to which the "SUPER SLOW" acceleration is applied by the following method.
Factory default, it is set as 1,000 rpm.
The Na value can be set up to the maximum speed of the rotor that is being used.

(1) Pressing the "TIME" key while holding down the "STOP" key .
The software version number is displayed.

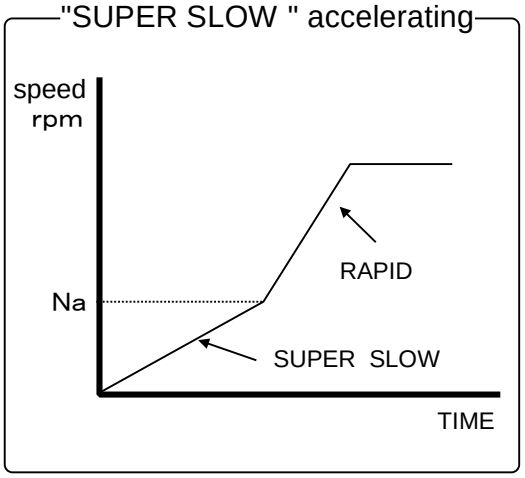
(2) Pressing the "TIME" key several times and let indicate "S.A" on the "TIME" display.
The "SPEED" display indicates the current setting of the "SUPER SLOW" acceleration speed. ▶ Refer to page 3-15.



(3) Press the "SPEED" setting (△▽) key to set the speed of Na up to which the "SUPER SLOW" acceleration is applied. (Na)
The speed over the Na becomes "RAPID" acceleration.



(4) Press the "TIME" key while holding down the "STOP" key.
The display returns to the previous Speed and Time indication.



［10］Setting the other Function

The following 7 items are possible setting with ON/OFF.

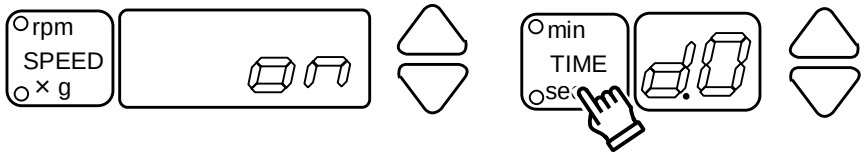
Other function lists

"TIME" display	Function	Default	Page
d.0	Buzzer sound of the "START" key.	on	3-28
d.1	Buzzer sound of the "STOP" key	on	3-28
d.2	Operation time after resumption	off	3-29
d.3	Reminder alarm	on	3-29
d.4	Automatic unlocking and opening of lid after operation	on	3-29
d.5	Setting the Timer	off	3-30
d.6	Grease application message	on	3-30
d.7	－	off	－

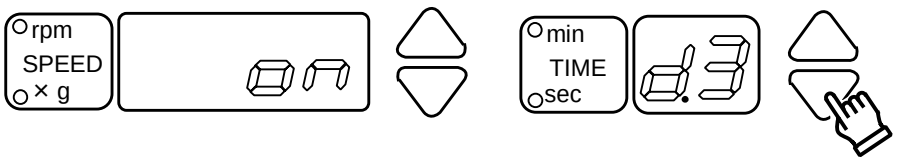
（1）Setting of other functions

① Pressing the "TIME" key while holding down the "STOP" key .
The software version number is displayed.

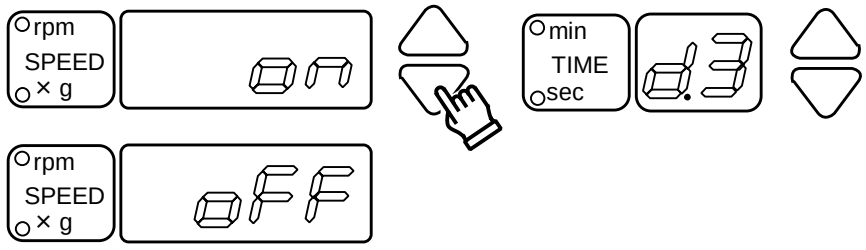
② Pressing the "TIME" key several times and let indicate "d.0" on the "TIME" display.
The "SPEED" display indicates the current setting of the "START" buzzer sound "ON/OFF". ▶ Refer to page 3-15.



③ Choose the item (d.0 - d.6) you want to set up from the list shown below and press the "SPEED" setting （△▽） key.



④ Pressing the "SPEED" setting （△▽） key to change ON or OFF.

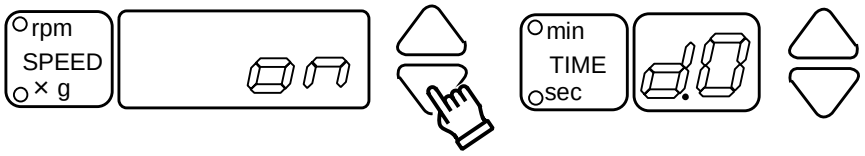


⑤ After setting any one of the above, please return the display to the previous indication of Speed and Time.
To do above, press the "TIME" key while holding down the "STOP" key.

（2）Setting of other functions

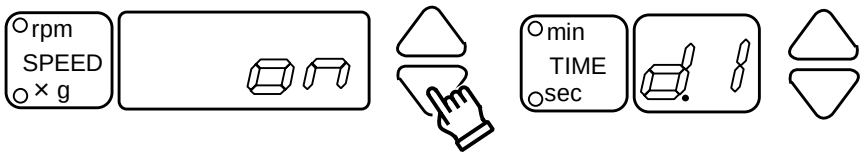
①d.0 : Setting the "START" buzzer sound

Buzzer sound of "START" key can be ON/OFF.
Its default setting is ON.
Pressing the "SPEED" setting （△▽） key to change ON or OFF.



②d.1 : Setting the "STOP" buzzer sound

Buzzer sound of "STOP" key can be ON/OFF.
Its default setting is ON.
Implement the operations ①and ② given in page 3-27 (1) the [d.0] is displayed.
Press the "TIME" setting （△▽） key to select a [d.1].
Pressing the "SPEED" setting （△▽） key to change ON or OFF.



③ d.2 ［Operation time after resumption］

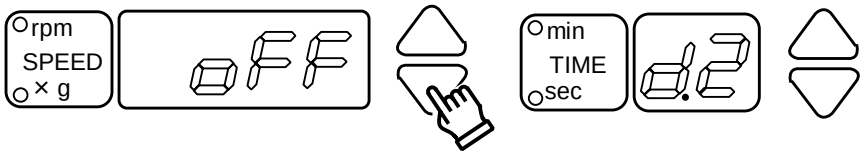
When stopping the operation midway and when resuming the operation after that, it is possible to make the setting for resuming the operation from the beginning of the preset time (ON) or to make the setting for resuming the operation for the remaining time (OFF).

Its default setting is OFF.

Implement the operations ①and ② given in page 3-27 (1) the [d.0] is displayed.

Press the "TIME" setting （△▽） key to select a [d.2].

Pressing the "SPEED" setting （△▽） key to change ON or OFF.



④ d.3 ［Setting the Reminder alarm］

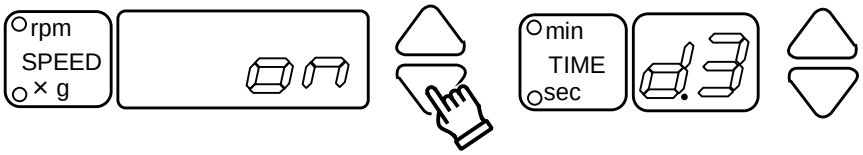
The alarm reminds the user every minute when samples are left inside the centrifuge after completion of the operation.

Its default setting is ON.

Implement the operations ①and ② given in page 3-27 (1) the [d.0] is displayed.

Press the "TIME" setting （△▽） key to select a [d.3].

Pressing the "SPEED" setting （△▽） key to change ON or OFF.



NOTE

Press any key or manually rotate the rotor for a quarter turn or more to turn reminder alarm off.

⑤ d.4 ［Automatic unlocking and opening of lid after operation］

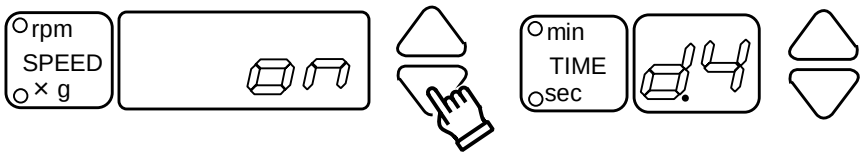
The lid can automatically open after an operation.

Its default setting is ON.

Implement the operations ①and ② given in page 3-27 (1) the [d.0] is displayed.

Press the "TIME" setting （△▽） key to select a [d.4].

Pressing the "SPEED" setting （△▽） key to change ON or OFF.



⑥ d.5 ［Setting the timer］

The setting method of the timer is able to select ［Set the timer to minutes or seconds.(OFF)] or [Set the timer to the desired combination of minutes and seconds.(ON)].

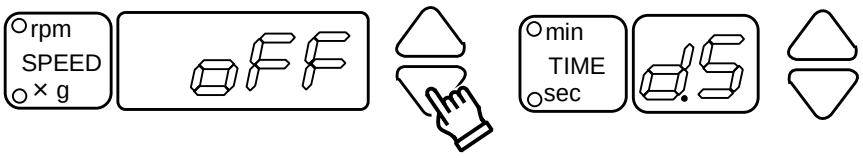
▶ Refer to page 3-8 [3-4.Setting the timer]

Its default setting is OFF.

Implement the operations ①and ② given in page 3-27 (1) the [d.0] is displayed.

Press the "TIME" setting （△▽） key to select a [d.5].

Pressing the "SPEED" setting （△▽） key to change ON or OFF.



NOTE

If the "ON/OFF" setting is changed by a timer setting, the memorized "TIME" setting may change accordingly.

Set the "TIME" setting again.

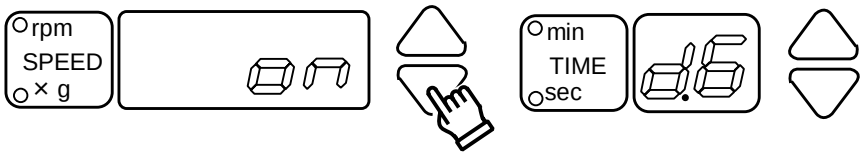
⑦ d.6 ［Grease application message］

You can set a message indication to appear after the operation when the greasing to the rotor is required. Its default setting is ON.

Implement the operations ①and ② given in page 3-27 (1) the [d.0] is displayed.

Press the "TIME" setting （△▽） key to select a [d.6].

Pressing the "SPEED" setting （△▽） key to change ON or OFF.

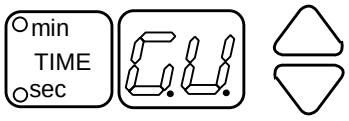


Grease application message

You can set a message display to appear after the operation when the greasing to the rotor is required.

The alarm will be indicated three times for every 300 operations.

［Ex.］ The message indicated at 300, 301 and 302 times.



When any one key is pressed, the indication will return to the normal indication.

⑧ d.7 ［－］

3－10. Calculating Centrifugal Force

You can readily calculate the centrifugal force by assigning the Rotation Radius and speed in the following equation:
Please refer to the Nomograph for Centrifugal Force Calculation at the last page of this manual.

[formula 3-1]

$$\text{Centrifugal force RCF}(\times g) = 11.18 \times \left(\frac{\text{Speed N (rpm)}}{1000}\right)^2 \times \text{Rotation Radius R(cm)}$$

NOTE

Refer to the each instruction manual for the rotor as to the rotation radius.
The maximum centrifugal force being indicated in the separately issued instruction manual for the rotor is calculated by substituting the maximum radius of gyration of the rotor for the radius of gyration of each rotor (cm) and by rounding the first digit above the decimal point of the calculation result.

3－11. Allowable load and Reduced maximum speed

⚠WARNING

Do not exceed the maximum speed and the allowable load of rotor and bucket.
An excessive speed or overload may cause damage to the rotor, bucket and the centrifuge.
If the load exceeds the limit, reduce the maximum speed as shown in the formula 3-2 and set the actual speed below the reduced maximum speed.

[formula 3-2]

$$\text{Reduced maximum speed (rpm)} = \text{Maximum speed (rpm)} \times \sqrt{\frac{\text{Allowable load (g)}}{\text{Actual load (g)}}}$$

（1）When the gravity of sample is 1.2 or higher or when a special tube is used, check the allowable load of the rotor and bucket.
（2）Regarding allowable load on rotors and buckets at the maximum speed refer to the appropriate Specification Table for rotor in use.
（3）The allowable load includes the weight of sample, cushions, adaptors, tubes, caps, and racks. (The weight of bucket is not included in the allowable load.)

Section 4 Service

4－1. Daily Inspection

⚠WARNING

If any abnormality is found during routine daily inspections, discontinue centrifuge operation, use the "POWER" switch to turn the machine OFF, disconnect the power cable, attach "DO NOT USE" labels to the rotor and the outside of the centrifuge, and contact your nearest dealer to request a centrifuge inspection before resuming operation of the equipment.
If the centrifuge is used after discovering any abnormality, an accident could occur, possibly leading to serious damage or accidents involving physical injury.

Checkpoint	Action taken
Check whether the rotor knob and rotor locking bolt are properly tight.	Retighten, if either of these is loose. ▶ Refer to "Mounting the Rotor" in the rotor instruction manual.
To inspect, mount buckets on the swinging bucket rotor when it is stopped, and lift up the buckets manually.	If the buckets do not move smoothly and freely, clean the bucket grooves and trunnion pins of the rotor yoke using alcohol. Contact your local dealer and make an appointment for an authorized inspection if these parts fail to operate smoothly even after lubricant has been applied. ▶ Refer to Page 4-6.
Check carefully for any cracks, evidence of corrosion, rust or deformation on the rotor and buckets.	Do not use the rotor or buckets if any cracks, corrosion, rust or deformations are found. Contact your local dealer for an inspection.
Check that no foreign material or water is present in the chamber.	Remove any foreign material or water before operating the centrifuge.
Check that the lid is auto-locked.	If the lid lock does not work, discontinue operation of the centrifuge. Contact your nearest dealer for a centrifuge inspection.
Check that the screws securing the lids gas springs are not loose.	If any of these securing screws are loose or have been removed, stop centrifuge operation immediately and contact your local dealer for an inspection. ▶ Refer to Page 1-1.
Check that the grounding wire is correctly connected.	▶ Refer to Page 2-3.
Check that all keys, displays, lamps and switches operate correctly.	If any do not operate correctly, contact your local dealer for an inspection. ▶ Refer to Page 1-1 and 1-2.
Check that the centrifuge is properly leveled.	If it is not properly leveled, carry out appropriate adjustments. ▶ Refer to Page 2-1.

4－2. Monthly Inspections

［1］Inspect the rotor

⚠WARNING

Perform a monthly careful inspection of the rotor appearance. Check for any deformation or damage, including the interior and bottom of the holes. If any abnormality whatsoever is found, there may be significant damage or corrosion of the rotor that could lead to serious damage or accidents involving physical injury. Stop operation at once, put "DO NOT USE" labels on the rotor and centrifuge lid, and contact your local dealer.

［2］Clean the rotor and buckets

Remove the rotor from the shaft, and clean it.

▶ Refer to Page 4-3.

［3］Clean the chamber interior

▶ Refer to Page 4-3.

4－3. Annual Inspection

Annual Inspection (fee required)

For the following inspection items, please call your local dealer and set up an appointment for a periodical inspection.

Motor	Timer
Rotor and Bucket	Speed Control
Auto lid lock	Imbalance
Chamber	Power Supply
Speed Sensor	Insulation
Installation	

4－4. Cleaning and Sterilization

⚠WARNING

Consult with your nearest dealer prior to attempting any cleaning procedure for the rotor, buckets, or tube rack that is not specifically recommended in this manual. Certain cleaning methods or cleaning agents may cause corrosion and then breakage leading to serious damage or accidents involving physical injury.

［1］Cleaning the chamber interior

The chamber is made of stainless steel (SUS304) but may rust if sample spillage containing salt (NaCl) or chlorinated chemicals (Cl) is allowed to remain.
After using the centrifuge, follow the method below (1) when wiping the inside of the chamber and cleaning the surfaces.

（1）Cleaning and rust prevention

Cleaning the chamber interior according to the following procedure will help prevent rust.

1) Wipe off any dirt or residue using a cloth moistened with a small quantity of a neutral detergent.
2) Wipe away any detergent residue using a cloth dampened with water, and then dry the inside of the chamber.
3) To prevent rust, we recommend the use of common anti-rust agents (such as CRC-556) only if such will not affect the samples being centrifuged.

（2）If rust is present

Superficial rust can be removed by using a mild solution of sodium bicarbonate (NaHCO3, bicarbonate of soda, baking soda).

1) Moisten a paper towel with a little water, apply some bicarbonate of soda, and then rub the area where rusting has occurred.
2) After removing the rust with the bicarbonate of soda, follow the above procedure (1) and clean the chamber interior using a neutral detergent followed by a thorough wiping with plain water. Make sure that such cleaning is especially thorough, so that all traces of the bicarbonate of soda are removed.

［NOTE］

Under no circumstances should any rust inside the chamber be removed by using sandpaper or abrasive agents, since if the interior surfaces are scratched, this will only increase the likelihood of additional rust developing.

Cont’d. on next page.

[2] Cleaning the rotor, buckets and tube rack

⚠CAUTION

Do not use detergents exceeding a pH range of 5 - 8, or chlorinated detergents normally used for washing.
Corrosion may damage the rotor, bucket, or tube rack, resulting in damage to the centrifuge that may lead to serious additional damage or accidents involving physical injury.

NOTE

Do not allow any spilt samples to remain on any surfaces, otherwise rust or corrosion may occur. Also, if sample spillage is left between the rotor and shaft, later detachment of the rotor may become problematic.

1) If sample spillage has occurred, remove the rotor, buckets, and tube rack from the centrifuge, and wash the affected items with a neutral detergent and warm water.
Then rinse the items with the distilled water and thoroughly dry them before use.

2) If water has accumulated inside the rotor, place the rotor with its bottom side up and allow it to dry completely.

3) If a sample has spilled onto the drive shaft, wipe it off using a cloth moistened with a small amount of a neutral detergent and then clean away all detergent traces using a cloth moistened with water. Then, dry the surfaces completely before using the machine.

[3] Sterilization of rotor, buckets and tube rack

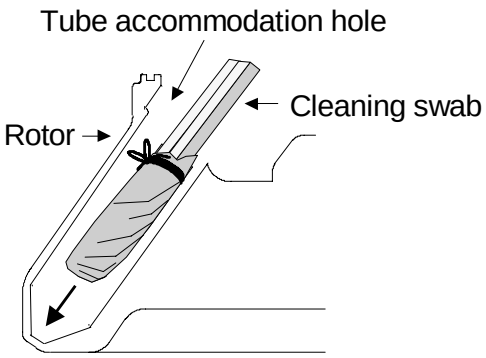
⚠WARNING

Do not heat the rotor, the bucket or the tube rack above 100 ℃ for sterilization or disinfection purposes.
Also, do not use an autoclave for dry heat sterilization. Otherwise, the strength of the rotor, the bucket or the tube rack may deteriorate, resulting in breakage of the rotor, the bucket or the tube rack and cause serious damage or accidents involving physical injuries.
Regarding the specified rotor, however, you can conduct an autoclave sterilization at 121 ℃ or 134 ℃. ▶ Refer to page Ⅶ.

To disinfect the rotor, buckets, or tube rack, a 70 % ethanol solution, or ultraviolet radiation, is recommended.

[4] Clean and disinfect the bottom of the tube accommodation hole

Wet a cleaning swab (preparation of which is described below) with warm water and remove any stains or residue adhering to the bottom of the hole.
If the part must be disinfected, use rubbing alcohol, either by applying the liquid directly using the swab, or by using a sprayer.

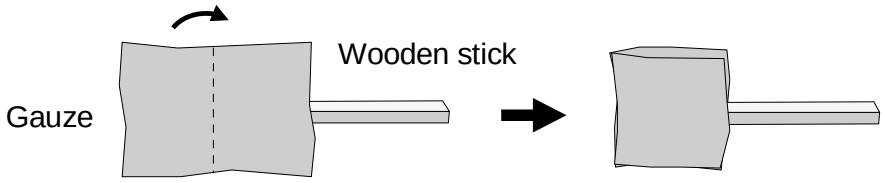


Cleaning swab fabrication

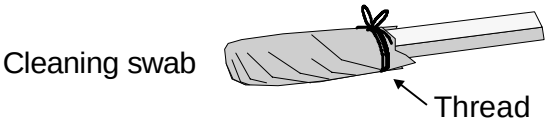
■ Required materials

Gauze, thread, wood sticks (Do not use a metal rod, because it may damage the rotor.)

1) Wind an appropriate amount of gauze around one end of the wooden stick.



2) Securely fasten the gauze to the stick with some thread.
Now, you have completed the cleaning tool



4－5. Greasing

⚠CAUTION

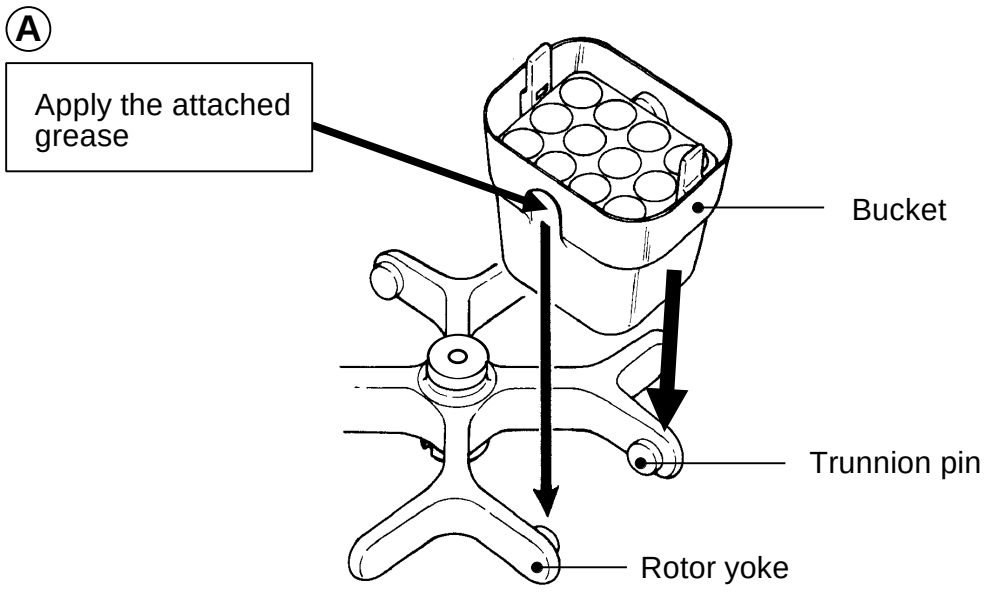
Be careful to maintain lubrication by ensuring that a proper amount of grease is present in all bucket grooves (section "A" in the schematic diagram below). A lack of grease may allow violent vibration to occur, resulting in damage to the centrifuge.

NOTE

1) If the buckets do not swing up smoothly as the rotor is spun up to speed, apply the attached grease to the section A shown in sketch below. The buckets should then swing up smoothly.
2) Wipe off any dirt or congealed material before applying fresh grease, using alcohol or acetone.
3) If the buckets do not swing up properly after applying the grease, contact your local dealer for an inspection.
4) When the provided grease is used up, purchase replacement grease of the following code number from your nearest local dealer.

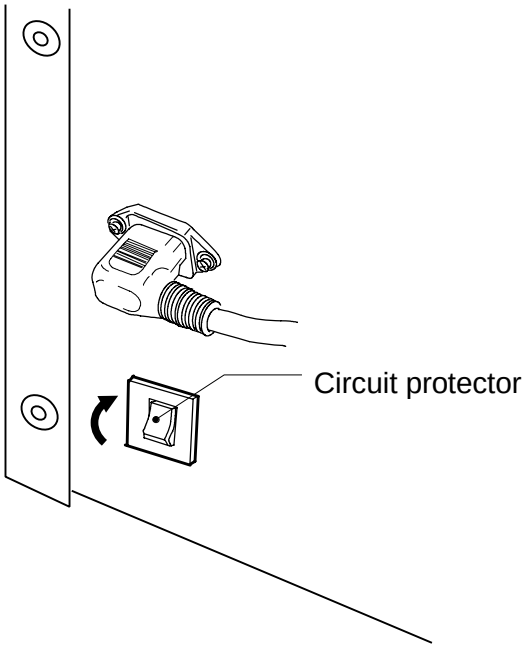
Rotor	Grease code No.
PT-21M (ST-410M)	K70284
ST-722M (ST-720M) ST-2504MS	067-0040

( ) of rotor is discontinued.



4－6. Inspection of Circuit Protector

The circuit protector is automatically activated when the electric circuit failure or overcurrent occurs.
In such a case, the white portion of the circuit protector, located on the rear side of the centrifuge, will stick out.



Recovery procedure is as follows :

（1）Turn off the power switch.

（2）After the rotor stops completely, open the lid and check the rotor.
▶ Refer to page 5-8 [5-4. Opening the lid during power failure].

（3）Close the lid , and then push the sticking out white portion until it becomes unseen.

（4）Turn on the power switch.

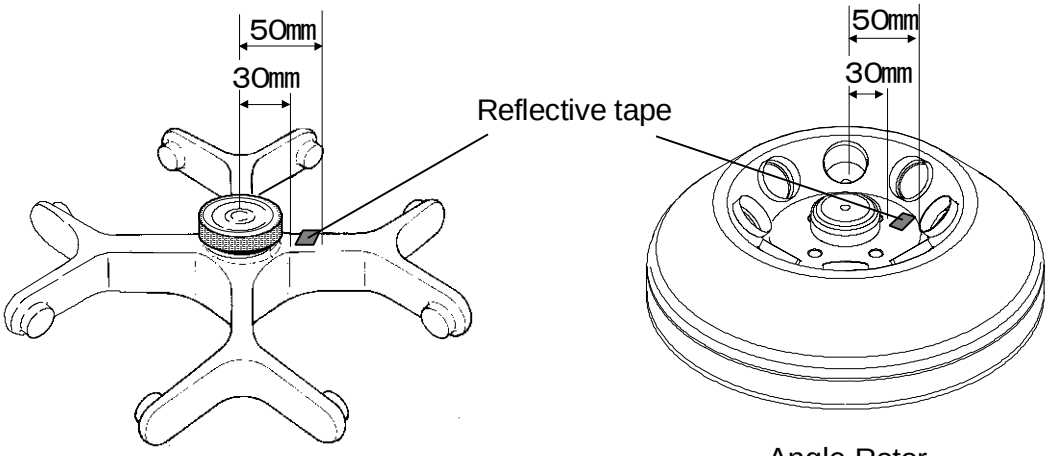
（5） Re - start operation and see if it works.

If the circuit protector is activated again, contact your local dealer.

4－7. Using the Viewport

A Viewport is provided at the top of the lid.
Through the Viewport, the actual rate of rotation can be measured, using a photoelectric tachometer.

(1) When using a photoelectric tachometer, place a piece of reflective tape 30 - 50 mm away from the center of the rotor.

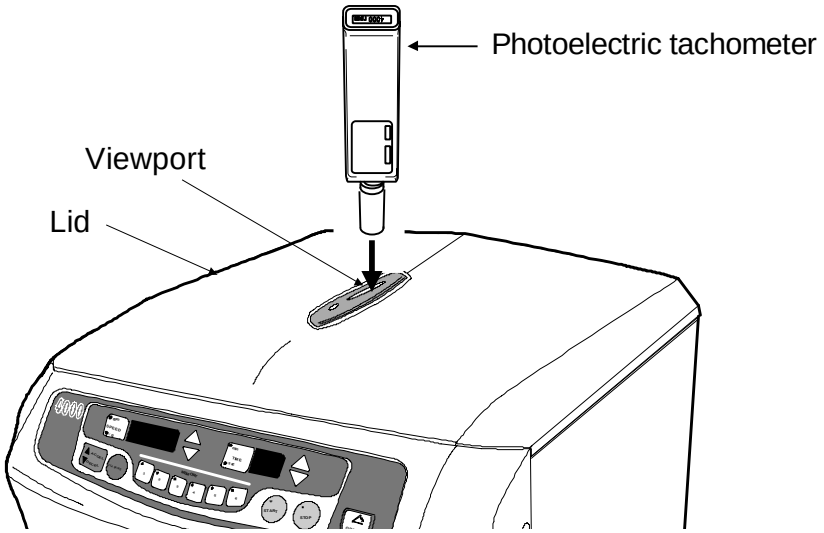


Swinging Bucket Rotor

Angle Rotor

(2) Mount the rotor on the drive shaft.
▶ Refer to "Mounting the Rotor" in the rotor instruction manual.

(3) After turning the power ON, set the photoelectric tachometer so that its tip is right above the Viewport on the lid. The photoelectric tachometer can then measure the actual rotation rate.



Do not apply force to the Viewport from inside the lid.

4－8. Spare Parts Supply

NOTE

Spare parts (parts necessary to the maintenance of equipment functions) will be available for ten (10) years after production of the particular product is discontinued (except spare parts which we are unable to procure). We therefore beg your indulgence and recommend that you be prepared for some situations in which certain repairs are impossible due to a lack of spare parts.

4－9. Consumable Parts

We recommend you to replace the following consumable parts periodically in order to maintain this centrifuge in good condition.
For replacement of the consumable parts, please contact your local dealer.

Code No.	Description	Replacement time
020-0210	Gas spring（Left）Y0006	When the power to push up the lid becomes weak, replace the right and left gas springs at the same time. As to the location of gas spring, refer to page 1-1.
020-0019	Gas spring（Right）Y0007	

4－10. Manufacturer requirements at Repair or Maintenance

We cannot repair or inspect a centrifuge if it has not been properly washed or sterilized beforehand, or if it has been used in an RI facility or a facility operating at a level higher than P2. Please ensure that each machine has been properly washed and sterilized before offering it for repair or inspection.

Cont'd. on next page.

[1] Required information when submitting an inquiry

Required information	NOTE
1. Model	4000 / 4200
2. Serial number	_____ [Ex.] H10015 See the product label on the left side panel of centrifuge.
3. Software version number	No. _____ Refer to Section "Control of Software Version" on page 3-16.
4. Troubleshooting	Provide as detailed a description as possible of the trouble encountered. _____ _____ _____ _____ _____ _____

[2] Required information that must be attached to the centrifuge in the form of a note

(1) If you have pertinent information on your handling of biohazards, fill out the items below, and affix this information to the centrifuge.

1. Environment where the centrifuge is used
2. Sample
3. Required measures taken to cope with the biohazard

(2) Please attach a "Contaminant Elimination Certificate" to the centrifuge.
▶ Refer to Page 4-11 and 4-12.

4－11. Product Preparation When Returning Units for Repair or for Other Reasons

［1］Remove any contaminants from units or items that will be returned for servicing

Prior to sending back our products (including accessories) for repair or for other reasons, be sure to remove any and all contaminants.

［2］Attach a Contaminant Elimination Certificate

To eliminate possibly harmful contaminants, the user must take appropriate action on his or her initiative. Fill out a "Contaminant Elimination Certificate" as shown on page 4-12, and attach it to the item to be returned.

[Caution]

"Contaminant" means radioactive materials, poisonous materials, contagious pathogens, and so on. The preparatory procedure to eliminate all traces of such contaminants therefore varies depending on the respective materials. Please take appropriate action to prevent any possible hazard to personnel who will be handing the machine, equipment or parts.

［3］Equipment contamination elimination goal

The elimination of contaminants from the equipment is aimed to safeguard the persons who will inspect and repair the returned products at our facilities.

［4］If a Contaminant Elimination Certificate is not attached:

If a "Contaminant Elimination Certificate" is not attached to the returned products we receive, we will contact the person in charge to confirm the details.

If we cannot confirm that potentially hazardous contaminants have been properly eliminated, and we find that we cannot adequately deal with such matters ourselves, we may return the products to the customer without taking further action.

［5］Contaminant elimination fee

If we are forced to perform the work of eliminating contaminants, we may request that you pay a fee. Please note this stipulation beforehand.

Cont’d. on next page.

Please make a copy of this page and fill out the relevant details.

Contaminant Elimination Certificate

Date : , ,

Name:

Company / Institute:

Department:

Tel: Fax:

Address:

We hereby certify that contaminant elimination for this equipment has been performed as follows:

Type of unit: Serial No.

Type of unit: Serial No.

Accessories :

Date when contamination elimination was carried out.

Date: , ,

Contaminants:

Method used:

Dealer notification:

Signature:

Section 6 Specifications

6－1. Centrifuge

Max. speed	Model 4000 : 6,000 rpm, Model 4200 : 16,000 rpm
Max. RCF	Model 4000 : 5,350 × g, Model 4200 : 23,470 × g
Max. Capacity	1,020 ml
Control system	Invertor Microprocessor control, Speed, Centrifugal force, time, acceleration / deceleration, 5 memory
Acceleration/Deceleration	Rapid, Slow, Super slow
Alarm display	Lid open, Imbalance, over speed, Function for detecting an occurrence of electrical abnormality in motor, inverter, speed sensor.
Speed setting	Digital display, Model 4000 : 300-6,000 rpm, in 10 rpm steps Model 4200 : 300-16,000 rpm, in 10 rpm steps
Speed indication	Digital display, 0-10 rpm, in 1 rpm steps Model 4000 : 10-6,300 rpm, in 10 rpm steps Model 4200 : 10-16,300 rpm, in 10 rpm steps
RCF setting	Digital display, Model 4000 : 10-5,350 × g, in 10 × g steps Model 4200 : 10-23,470 × g, in 10 × g steps
RCF indication	Digital display, Model 4000 : 0-5,900 × g, in 10 × g steps Model 4200 : 0-24,360 × g, in 10 × g steps
Timer setting and indication	Digital display, with Hold and Electric buzzer, Flashing From 1 sec. to 99 min 59 sec., in 1 sec. increments setting From 0 sec. to 59 sec., in 1 sec. increments indication From 1 min. to 99 min., in 1 min. increments indication
Rated voltage and Rated current	Model 4000 110 V 50/60 Hz 7.2 A 115 V 50/60 Hz 6.6 A 200 V 50/60 Hz 3.8 A 220 V 50/60 Hz 3.5 A 230 V 50/60 Hz 3.4 A 240 V 50/60 Hz 3.2 A Model 4200 110 V 50/60 Hz 7.2 A 115 V 50/60 Hz 7.5 A 120 V 50/60 Hz 7.1 A 200 V 50/60 Hz 3.8 A 220 V 50/60 Hz 3.5 A 230 V 50/60 Hz 3.3 A 240 V 50/60 Hz 3.2 A
Power consumption and Heat out put	Model 4000 110-115 V 540 W, 1.9 MJ/h 200 V 550 W, 2.0 MJ/h 220-240 V 560 W, 2.0 MJ/h Model 4200 110-120 V 540 W, 1.9 MJ/h 200-240 V 550 W, 2.0 MJ/h
Dimensions, Weight	44(W) × 56 (D) × 31(H) cm Model 4000 110-115 V 36 kg 200-230 V 38 kg Model 4200 110-120 V 38 kg 200-230 V 40 kg
Test standard	IEC 61010-2-020
Operation environment	Temperature : 10 to 40 ℃ Atmospheric pressure : 70 to 106 kpa (700 to 1,060 mbar) Humidity : 30 to 85%

Section 7 Dispose of the centrifuge unit, rotor, and accessories

Dispose of the centrifuge unit, rotor, and accessories according to local practices for the disposal of industrial waste.

If you encounter problems concerning proper disposal, contact your nearest dealer.

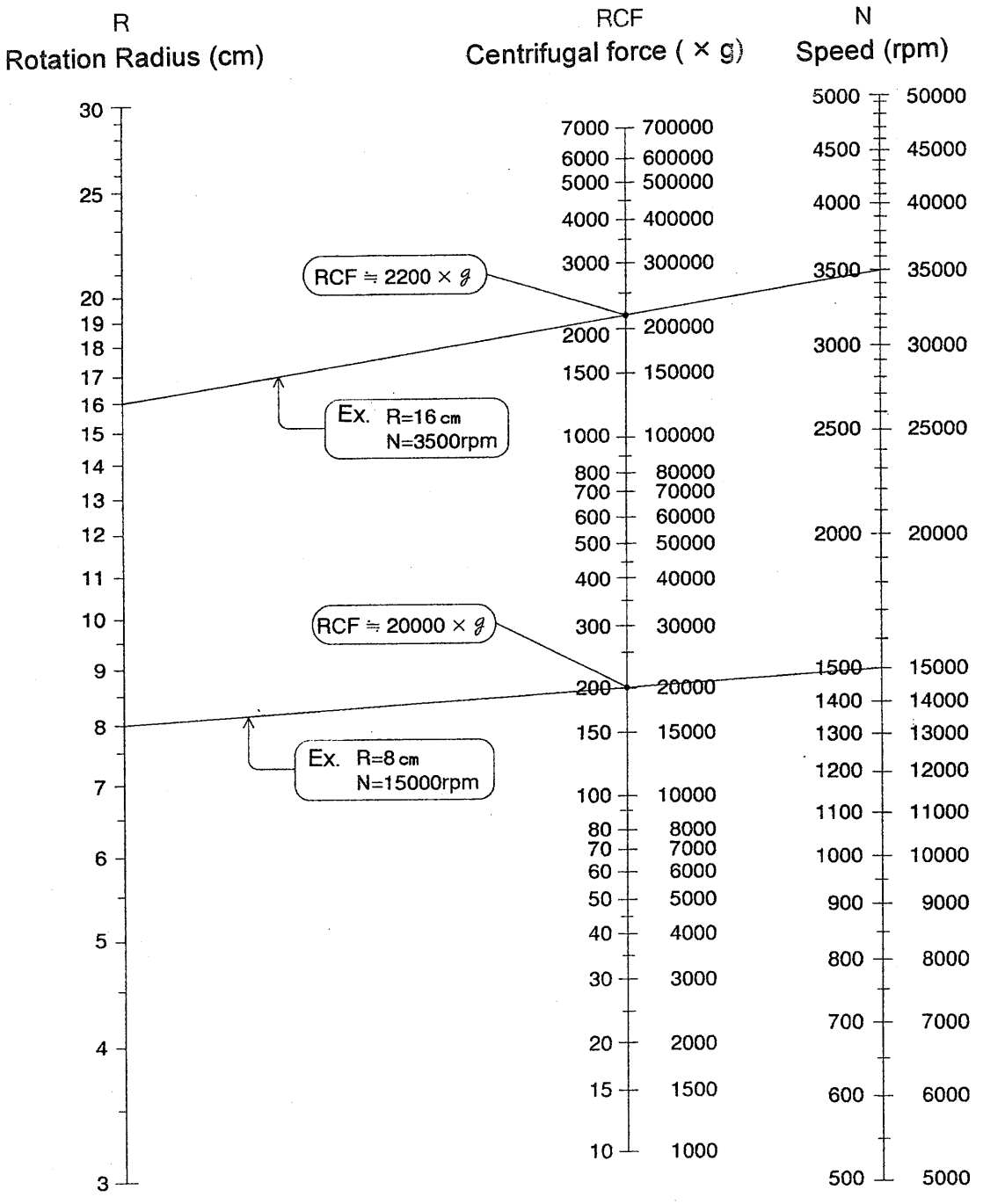
If the centrifuge unit, rotor, or accessories to be discarded are contaminated with radioactive, explosive, toxic or infectious substances that may be harmful to people's health, you must notify the waste handlers concerning the details of such contaminants.

Section 8. Parts List

8－1. Recommended Spare Parts

Code No.	Description	Use , standard	Q'ty
014-0096	Micro switch	D2SW-01L3H	4
029-0028	Speed sensor		1
029-0079	CTL PC board	Model 4000	1
029-0080	CTL PC board	Model 4200	1
029-0056	LED PC board		1
014-0324	Relay	AJM5211F, DC12V	2
017-0021	Motor	Model 4000	1
017-0022	Motor	Model 4200	1
017-0023	Geared motor	TG-205B-GL-83-F307, 24 V	1
112-0017	Enamel resistor	100 Ω 120W, Model 4200	1
014-0244	Inverter	VFNC3S-1004P, Model 4000 For 100-115 V	1
014-0245	Inverter	VFNC3S-2004PL, Model 4000 For 200-240V	1
014-0146	Inverter	VFS11-2007PM-AN, Model 4200	1
014-3330	Imbalance sensor		1
014-4470	Circuit protector	W28 × Q1A-8, For 200-240 V	1
014-1190	Circuit protector	W28 × Q1A-15, For 100-120 V	1
014-0154	Noise Filter	SUP-J15G-E, For 100-120 V	1
014-8120	Noise Filter	GL-2080C4, For 200-240 V	1
014-0181	Noise Filter	SUP-ET15-ER-0, EMC	1
014-8130	Noise Filter	RG-208F, For 200-240 V	1
014-0157	Switching regulator	CWA015-12	1
014-0630	Rotor sensor assembly		1
014-0064	Power switch	AJ921001WW3F	1

Nomograph for Centrifugal Force Calculation



How to use this Nomograph

1. You can get centrifugal force (RCF) with line connection between rotation radius (cm) and speed (rpm).
2. You can get speed (rpm) with line connection between rotation radius (cm) and centrifugal

Calculating Centrifugal force

$$RCF = 11.18 \times \left(\frac{N}{1000}\right)^2 \times R$$

RCF : Centrifugal force (× g)
R : Rotation Radius (cm)
N : Speed (rpm)