thermoscientific

Thermo Scientific Sorvall WX+ Ultracentrifuge

Instruction Manual

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ThermoFisher SCIENTIFIC

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General description

The Thermo Scientific™ Sorvall™ WX+ Ultracentrifuge is designed to separate suspended solids of varying densities and particle sizes.

This is a series of products which are targeted to provide user-friendliness and reliability based on our many years of experience in developing centrifuges. This series offers many new features that we are confident will satisfy your requirements. These features include the following.

1. Maximum speed is 100,000 rpm (803,000 x g). (WX100+)
2. There is an integrated touchscreen with easy-to-see color liquid crystal display.
3. The language displayed can be switched between 10 languages, including English, French, German, Italian, Portuguese, Spanish, Russian, Dutch, Korean and Chinese.
4. Touch-sensitive color LCD and graphic user interface providing high contrast against a black background enable you to easily operate the system or to select various menus and functions by touching the icon on the display.
5. The real-time control feature enables you to set a start or end time, thus allowing you to operate your instrument at a desired date and time.
6. Centrifugal force (RCFmax and RCFavg) can be displayed and set (Note 1).
7. One thousand varieties of 30-step mode can be programmed to cover a wide range of applications such as step runs.
8. Various alert indicators notify the user of the causes of problems and the necessary steps to take in alleviating them. Troubleshooting is made easier and quicker.
9. Current centrifuge status can be identified at a glance from the signal light on the upper front edge of the centrifuge.
10. Space-saving design. The installation area required is 0.72 m2 (800 x 900 mm). Lower top deck allows easy installation and removal of the rotor.
11. These units rotate very quietly, and are thus well suited for personal use.
12. Visual balancing of samples is made easy.
13. The unit employs a CFC-free thermo-module cooling system which features strong cooling capacity.
14. In addition to a door lock and an imbalance detector, a dual overspeed detection system is incorporated to provide even greater overspeed protection.

Note 1: RCF = relative centrifugal force

Safety notices

Safety reminders

Carefully read and fully understand the following safety instructions.

- Operate your instrument in accordance with the instruction manual.
- Make sure to observe all safety precautions in the instruction manual and safety instructions on your unit. Failure to do so can result in personal injury and/or damage to the unit.
- If the instrument is used in a manner not specified by the manufacturer, the protection provided by the instrument may be impaired.
- The indications of the safety reminders are shown below. The signal words “DANGER”, “WARNING” and “CAUTION” are noted, together with the hazard alert symbols used in this manual.

DANGER	This signal word indicates an imminently hazardous situation which, if not successfully dealt with, could result in severe personal injury or possible death.
WARNING	This signal word indicates a potentially hazardous situation which if not successfully dealt with, could result in severe personal injury or possible death.
CAUTION	This signal word indicates a potentially hazardous situation which, if not successfully dealt with, could result in personal injury or severe damage to the instrument. This hazard alert symbol appears together with a signal word as a reminder to emphasize the importance of safety instructions.
NOTE	“NOTE” indicates a notice which has no direct bearing on personal safety.

- Do not perform any operation not specified in the instruction manual. If your instrument is found to have a problem, contact an authorized Thermo Fisher Scientific sales/service representative.
- Although the safety precautions in the instruction manual and the safety instructions on your instrument have been prepared with thoroughness, an unexpected situation may nevertheless arise. Observe the instructions in the instruction manual and always take care for your personal safety when operating this instrument.

Mechanical safety

WARNING

- Do not open the door while the rotor is spinning.
- Do not attempt to slow or stop the spinning rotor by hand.
- Do not incline or move the instrument while the rotor is spinning. Do not place any object on the instrument or lean against the instrument.
- Do not attempt to unlock the door forcibly while the rotor is spinning.
- The centrifuge itself may move if the rotor fails during high-speed rotation. Ensure that there is a 30 cm area around the centrifuge that will allow for such movement and do not allow individuals to enter that area during operation. Also do not place dangerous objects such as flammable or explosive materials on top of the centrifuge or in the surrounding area.
- The overspeed decal must match the maximum speed of the rotor, because the overspeed decal is a component critical in detecting rotor overspeed: If an overspeed decal that is not compatible with the rotor is attached, the rotor could break, resulting in damage to the ultracentrifuge.
- Repairs, disassembly, and other modifications to the centrifuge are strictly prohibited unless performed by an authorized Thermo Fisher Scientific sales/service representative.
- Do not use a rotor from another manufacturer without the consent of Thermo Fisher Scientific.
- Check the chemical resistance chart attached to the rotor, and do not use any sample which is incompatible with the rotor (including the buckets). Using such a sample could corrode the rotor (including the buckets).
- Do not exceed the allowable maximum rated speed of the rotor or buckets in use.
- Do not use corroded, scratched or cracked rotor, buckets or assemblies. Check that the rotor, buckets and assemblies are free of such abnormalities before operation.
- When using a swing rotor, check that the buckets are properly engaged with the rotor pins before operation. Incorrect installation can cause severe damage to the instrument. Make certain that all the rotor buckets are of the same type.
- If abnormal sounds or vibrations occur, immediately cease operation and contact an authorized Thermo Fisher Scientific sales/service representative.

CAUTION

- Before using a rotor, make sure to read through the rotor instruction manual.
- Check the chemical resistance chart attached to the rotor, and do not use any sample which is incompatible the tubes, tube caps, bottles, or bottle caps, etc.
  Using such a sample could corrode or deteriorate such parts and the sample might leak.
- Use the rotor tubes and bottles within their specified capacities (see the instruction manual).
- Do not use tubes/bottles that have exceeded their expected service life. Failure to comply with this could result in damage to tubes/bottles and the rotor and centrifuge.
  The expected service life of tubes/bottles depends on factors such as sample characteristics and the rotor speed and temperature employed.
  Always check for signs of deterioration and damage (cracks, deformation, etc.) on tubes/ bottles before using them. Do not use the tubes/ bottles if you detect such a problem.
- Mount the rotor onto the drive shaft gently and correctly.
- To avoid damaging the drive shaft, do not drop the rotor or apply excessive force to the drive shaft.

CAUTION

- Install the rotor carefully and securely on the drive shaft (crown) in the rotor chamber. Always place the rotor pin in the drive hole (crown hole) next to the crown pin.
- Take care not to get your hands or fingers caught in the door of the centrifuge.
- Maximum rotor speed depends on the tubes or adapters to be used. Follow the instructions in the rotor instruction manual.
- Sufficient balance can be achieved by placing approximately equivalent quantities of sample in the tubes; extreme differences in sample quantity must be avoided.
- Clean the inside of the drive hole (crown hole) of the rotor and the surface of the drive shaft (crown) of the centrifuge once a month.
- Storing the rotor on a shelf is permitted if the shelf provides adequate earthquake protection to prevent the rotor from falling.
- Do not pour any solution such as water, detergent or disinfectant directly into the rotor chamber. Take care to prevent leakage of the sample. Failure to comply with this may result in corrosion or deterioration of the bearings of the drive unit and/or the sensors.
- Use the rotor log book to manage the life of the rotor.
- It is important to manage the life of the rotor. The life of each rotor is unique and is dependent upon the frequency of use and the total running time. Do not use rotors whose service lifetime has been exceeded. If such an instrument it used, it can incur serious damage. (Comply with the rotor instruction manual).
- For details on zonal centrifugation, see the zonal rotor instruction manual.
- Do not press the touchscreen with a sharp-pointed object such as a ballpoint pen.
- Make sure to remove the rotor from the rotor chamber when the centrifuge is not in use over a long period or when the instrument is moved. Otherwise the drive shaft (crown) may be damaged.

Safety during installation and maintenance

DANGER

- To avoid electrical shock hazards, proceed as below when servicing the centrifuge.

1. Make sure to turn off the POWER switch and, if your centrifuge is equipped with a three-wire power cord, turn off the distribution board of your centrifuge room. Then wait at least three minutes before removing the covers from the centrifuge.
2. Make sure to turn off the POWER switch and, if your centrifuge is equipped with a power cord with plug, unplug the power cord from the outlet. Then wait at least three minutes before removing the covers from the centrifuge.

WARNING

- When a power failure occurs during operation, it takes three hours or more for the moving rotor to stop completely because the rotor chamber is depressurized and thus contains less air to brake the rotor. Make sure to allow sufficient time to elapse before opening the door of the rotor chamber.
- For maintenance and repair work on the rotors, tubes, etc., refer to the rotor instruction manual and the rotor, tube, bottle, and cap instruction manual.
- After installation and before any test run is performed, this ultracentrifuge requires an internal check by an authorized Thermo Fisher Scientific sales/service representative.
- Repairs, disassembly, and other modifications to the centrifuge are strictly prohibited unless performed by an authorized Thermo Fisher Scientific sales/service representative.

CAUTION

If the centrifuge is exposed to ultraviolet rays for an extended period of time, the color of the covers may change or the coating may peel off. After use, cover the centrifuge with a cloth to protect it from direct exposure.

Electrical safety

WARNING

- Your centrifuge must be grounded properly to avoid electrical shock hazards.

CAUTION

- Do not place containers holding liquid inside the rotor chamber or on or near the instrument. Liquids, if spilled, may get into the instrument and damage electrical components.
- If the instrument will not be used for a long time, open the main circuit breaker.

Protection against the risk of fire

WARNING

- This centrifuge has is not protected against explosion. Never use explosive or flammable samples or materials that generate strong chemical reactions. Do not centrifuge such materials in this instrument nor handle or store them near the instrument.

Chemical and biological safety

WARNING

- Take all necessary safety measures before using samples that are toxic or radioactive, or blood samples that are pathogenic or infectious. Use of such samples is at your own risk.
- Take all necessary safety measures when handling Risk Group II materials (as identified in the World Health Organization “Laboratory Biosafety Manual”), and ensure that more than one level of protection is provided if handling materials of a higher group.
- If the centrifuge, rotor, or an accessory is contaminated by samples that are toxic or radioactive, or blood samples that are pathogenic or infectious, make sure to decontaminate the item(s) in accordance with good laboratory procedures and methods.
- If there is a possibility that the centrifuge, rotor, or an accessory is contaminated by samples that might impair human health (for example, samples that are toxic or radioactive, or blood samples that are pathogenic or infectious), it is your responsibility to sterilize or decontaminate the centrifuge, rotor or accessory properly before requesting repairs from an authorized Thermo Fisher Scientific sales/service representative.
- It is your responsibility to sterilize and/or decontaminate the centrifuge, rotor or parts properly before returning them to an authorized Thermo Fisher Scientific sales/service representative.

NOTE

Notice on Earthquakes
Depending on its magnitude, an earthquake may cause damage to the centrifuge. If you observe any abnormality, immediately cease use of the centrifuge and request that it be inspected by a Thermo Fisher Scientific service representative.

Precaution Indications in this manual

The following information describes the precaution indications and the chapters/sections in which they appear in this manual.

Indication of DANGER

To avoid electrical shock hazards, proceed as below when servicing the centrifuge.

1. Make sure to turn off the POWER switch and, if your centrifuge is equipped with a three-wire power cord, turn off the distribution board of your centrifuge room. Then wait at least three minutes before removing the covers from the centrifuge.
2. Make sure to turn off the POWER switch and, if your centrifuge is equipped with a power cord with plug, unplug the power cord from the outlet. Then wait at least three minutes before removing the covers from the centrifuge (section Occurrences in the Event of Power Failure, 4. Maintenance, 5. Troubleshooting and 6. Installation).

Indication of WARNING

1. The overspeed decal must match the maximum speed of the rotor, because the overspeed decal is a component critical in detecting rotor overspeed: If an overspeed decal that is not compatible with the rotor is attached, the rotor could break, resulting in damage to the ultracentrifuge (section Rotor overspeed decal).
2. This centrifuge has is not protected against explosion. Never use explosive or flammable samples or materials that generate strong chemical reactions. Do not centrifuge such materials in this instrument nor handle or store them near the instrument.
3. Take all necessary safety measures before using samples that are toxic or radioactive, or blood samples that are pathogenic or infectious (section Run Preparation).
4. Do not incline or move the instrument while the rotor is spinning. Do not place any object on the instrument or lean against the instrument (section Basic Operation).
5. The centrifuge itself may move if the rotor fails during high-speed rotation. Ensure that there is a 30 cm area around the centrifuge that will allow for such movement and do not allow individuals to enter that area during operation. Also do not place dangerous objects such as flammable or explosive materials on top of the centrifuge or in the surrounding area (section Basic Operation and 6. Installation).
6. Never open the door during rotation.
7. Never touch the rotor during rotation (section Occurrences in the Event of Power Failure).
8. It can take more than three hours for the rotor to come to a complete stop because the rotor chamber is under vacuum. Before opening the door, wait until the rotor comes to a stop (section Occurrences in the Event of Power Failure).
9. Never touch the rotor while it is turning (section Occurrences in the Event of Power Failure).
10. If the centrifuge, rotor, or an accessory is contaminated by samples that are toxic or radioactive, or blood samples that are pathogenic or infectious, make sure to decontaminate the item(s) in accordance with good laboratory procedures and methods.
11. If there is a possibility that the centrifuge, rotor, or an accessory is contaminated by samples that might impair human health (for example, samples that are toxic or radioactive, or blood samples that are pathogenic or infectious), it is your responsibility to sterilize or decontaminate the centrifuge, rotor or accessory properly before requesting repairs from an authorized Thermo Fisher Scientific sales/service representative.
12. It is your responsibility to sterilize and/or decontaminate the centrifuge, rotor or parts properly before returning them to an authorized Thermo Fisher Scientific sales/service representative. In such cases, make a copy of the decontamination sheet at the end of this manual and fill it out, then attach it to the item to be returned. Thermo Fisher Scientific may question you as to how the centrifuge, rotor or part has been handled if the decontamination level is checked and judged to be insufficient by Thermo Scientific. It is your responsibility to bear the cost of sterilization or decontamination (chapter 4. Maintenance and chapter 5. Troubleshooting).
13. Performance of any unspecified repairs to or modification or disassembly of the centrifuge not listed in Table 5-1 is strictly prohibited by any person other than an authorized Thermo Fisher Scientific sales/service representative (section Alert Indicators).
14. Before changing the power voltage by manually selecting the desired winding on the internal transformer, turn off the power supply to the ultracentrifuge, then unplug the power cord from the wall outlet. Changing the voltage without taking these precautions exposes you to the possibility of electric shock (chapter 6. Installation).
15. Your ultracentrifuge must be properly grounded (chapter 6. Installation).
16. To avoid electric shock, do not touch the power cord with wet hands (chapter 6. Installation).
17. Do not hold the cord when disconnecting the power cord from the outlet. Instead, hold the plug (chapter 6. Installation).

Indication of CAUTION

1. When replacing the overspeed decal with a new one, be very careful not to damage the overspeed decal and rotor body (section Rotor overspeed decal).
2. Do not place containers holding liquid inside the rotor chamber, or on or near the centrifuge. Liquids, if spilled, can get into the instrument and damage electrical and mechanical components (section Run Preparation).
3. Do not press the touchscreen with a sharp-pointed object such as a ballpoint pen.
4. If abnormal sounds or vibrations occur, immediately cease operation and contact an authorized Thermo Fisher Scientific sales/service representative (section Basic Operation).
5. If you have selected a rotor on the Rotor Management screen, make sure to check that the selected rotor (on the Rotor Management screen) and the rotor that is installed in the centrifuge have an identical serial number. (The rotor serial number is also displayed in the Rotor indicator field on the Run screen.) If the serial number of the selected rotor differs from the serial number of the rotor installed in the centrifuge, you cannot control total run time and the total number of runs of both rotors (section Rotor Selection).
6. Take care not to get your hands or fingers caught in the door of the centrifuge (section Operation Procedures).
7. Zonal centrifugation includes performing operations during which the rotor turns while the door is open. Make sure to read though the “Zonal rotor instruction manual” before operation (section Zonal Operation Procedures).
8. Installing the cap on the rotor by hand while the rotor is turning: Perform this operation with care and make sure to follow the instructions in the instruction manual (section Zonal Operation Procedures).
9. Removing the cap from the rotor by hand and installing the seal assembly while the rotor is turning: Perform this operation with care and make sure to follow the instructions in the instruction manual (section Zonal Operation Procedures).
10. Never perform operations in a manner other than as described in this instruction manual (section Occurrences in the Event of Power Failure).
11. When the centrifuge will not be used for an extended period of time, keep the circuit breaker open (section Occurrences in the Event of Power Failure).
12. Do not perform any operation not specified in this manual. If your instrument is found to have a problem, contact an authorized Thermo Fisher Scientific sales/service representative (chapter 4. Maintenance and chapter 5. Troubleshooting).
13. Using any cleaning or sterilization method other than those recommended in this instruction manual may result in corrosion or deterioration of the centrifuge. Refer to the chemical resistance chart attached to the rotor or contact Thermo Fisher Scientific (chapter 4. Maintenance).
14. To sterilize the surface of the centrifuge and the rotor chamber, wipe them with a cloth moistened with 70 % ethanol. Using any method other than the above may result in corrosion or deterioration of the centrifuge. Refer to the chemical resistance chart provided with the rotor or contact Thermo Fisher Scientific. While we recommend that 70 % ethanol be used for sterilization, no guarantee of sterility or disinfection is expressed or implied. When sterilization or disinfection is a concern, consult your laboratory safety officer regarding the proper methods to use (chapter 4. Maintenance).
15. Do not pour any solution such as water, detergent or disinfectant directly into the rotor chamber. Otherwise, the bearings of the drive unit may become corroded or deteriorated (section 4. Maintenance).
16. Clean the inside of the drive hole (crown hole) of the rotor and the surface of the drive shaft (crown) of the centrifuge once a month. If the drive hole or the drive shaft is stained or any foreign matter has become adhered, the rotor may be installed improperly and come off during operation (section 4. Maintenance).
17. Your ultracentrifuge may be damaged if it is supplied with the incorrect voltage. Check the voltage before plugging the ultracentrifuge into a power source (chapter 6. Installation).
18. Make sure to remove the rotor from the rotor chamber when moving the centrifuge. After installation and before any test run is performed, this ultracentrifuge requires an internal check by an authorized Thermo Fisher Scientific sales/service representative (chapter 6. Installation).

Safety notices

⚠ WARNING

- Never use any material capable of producing flammable or explosive vapors.
- Be sure to take the necessary precautions before separating radioactive, toxic or pathogenic materials.

⚠ AVERTISSEMENT

- Ne jamais utiliser de matériau capable de produire des vapeurs inflammables ou explosives.
- Assu rez-vou s de prendre les précautions nécessaire s avant de trier des matières radioactives, toxiques ou pathogènes.

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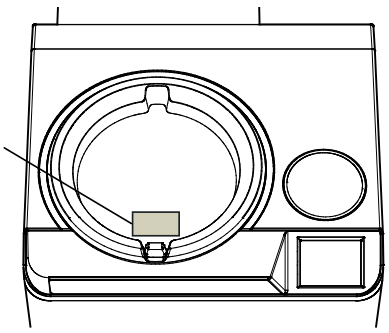

⚠ WARNING

Do not loosen the vacuum release screw during rotation. In the event of a power outage, operate according to the instruction manual.

⚠ AVERTISSEMENT

Ne pas ouvrir le couvercle de la chambre à air durant la rotation. Si vous êtes confrontés à une panne de courant, veuillez vous référer aux instructions du manuel.

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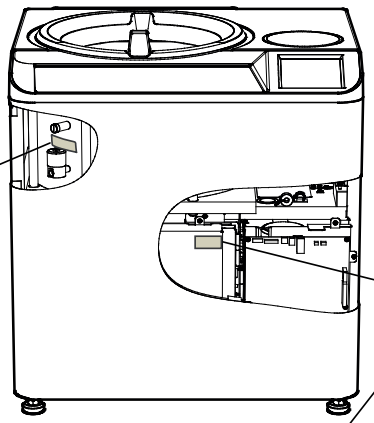

⚠ WARNING

Risk of electrical shock. Disconnect equipment from power supply before servicing and wait for at least three minutes.

⚠ AVERTISSEMENT

Risque de choc électrique. Débranchez le cordon d'alimentation avant l'entretien et attendre au moins trois minutes.

S310566

⚠ CAUTION

This cover should only be removed for power outages or other situations that are absolutely necessary. Always ma ke sure that the power source is off and follow the instructions in the manual.

⚠ AVERTISSEMENT

Ce couvercle doit uniquement être retiré en cas de panne de courant et d'autres situations qui rendent la manipulation absolument nécessaire. Assu rez-vou s toujours que la source d'alimentation est coupée et suivez les inst ructions du manuel.

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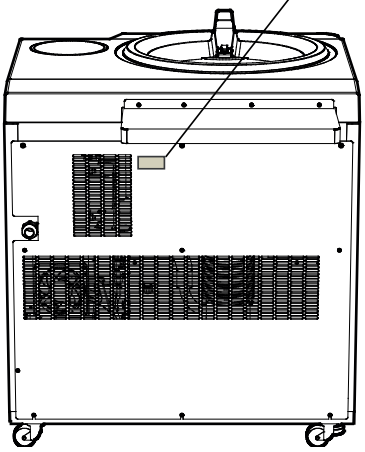


1. Specifications

Model	Sorvall WX100 Plus	Sorvall WX90 Plus	Sorvall WX80 Plus
Maximum speed	100,000 rpm	90,000 rpm	80,000 rpm
Maximum RCF*	802,000 x g (T-8100)	692,100 x g (T-890)	602,600 x g (T-880)
Speed control accuracy	±10 rpm (1,000 rpm to maximum speed)		
Acceleration/deceleration control	10-stage variable acceleration control, 10-stage braked deceleration control, plus coasting deceleration		
Rotor temperature control/ display accuracy	±0.5 °C (set temperature is from 0 °C to 40 °C)		
Set speed	1,000 rpm to maximum speed in increments of 100 rpm		
Set time	One minute to 999 hours and 59 minutes in increments of one minute, “Hold” for continuous operation		
Vacuum system	Oil rotary vacuum pump and oil diffusion pump combined Ultimate vacuum: below 1.3 Pa (0.01 Torr) (This value is achieved within 15 minutes after the rotor begins turning.)		
Noise level	51 dB (A scale) (measured 1 m from the front of the instrument)		
Maximum heat dissipation into room	1 kW or less		
Cooling method	Thermo-module cooling (CFC/HCFC/HFC-free)		
Screen display and operation	Color touch-sensitive LCD (65,000 colors)		
Interface	USB x2, LAN x1		
Applicable rotors	A rotor with an overspeed decal		
Dimensions	Width: 790 mm; Depth: 690 mm; Height: 880 mm Depth with safety cover mounted: 890 mm Height to the handle of the centrifuge door: 925 mm		
Weight	390 kg		
Power requirement**	Supply required Single phase 50/60 Hz 208, 220 Vac+/-10 %, 20 A maximum (normally 8 A) 230, 240 Vac+/-10 %, 16 A maximum (normally 7 A)		

Environmental conditions	▪ Ambient temperature for operation: 2 °C to 40 °C; ▪ Ambient temperature for performance guarantee: 10 °C to 30 °C; ▪ Indoor use; ▪ Altitude up to 2000 m; ▪ Maximum relative humidity 80 % for temperatures up to 31 °C decreasing linearly to 50 % relative humidity at 40 °C; ▪ Pollution level: 2; ▪ Overvoltage category II.

* RCF is an acronym for relative centrifugal force.

** The voltage to be used is the one you specified when purchasing the centrifuge.

CE

The Sorvall WX Plus Ultra series centrifuges satisfies CE marking requirements. The CE marking is an international symbol which shows that the product conforms to EC directives.

Standards related to these directives are as follows:

- Product safety (EN 61010-1 and EN 61010-2-020)
- Electromagnetic compatibility (EN 61326-1)

2. Description

External View of Ultracentrifuge

The Sorvall WX+ Ultra series centrifuges are floor models. These three types of ultracentrifuges have the same external appearance, except for the model name printed on front cover, and the same dimensions. Below is the external view of the Sorvall WX100+ Ultracentrifuge.

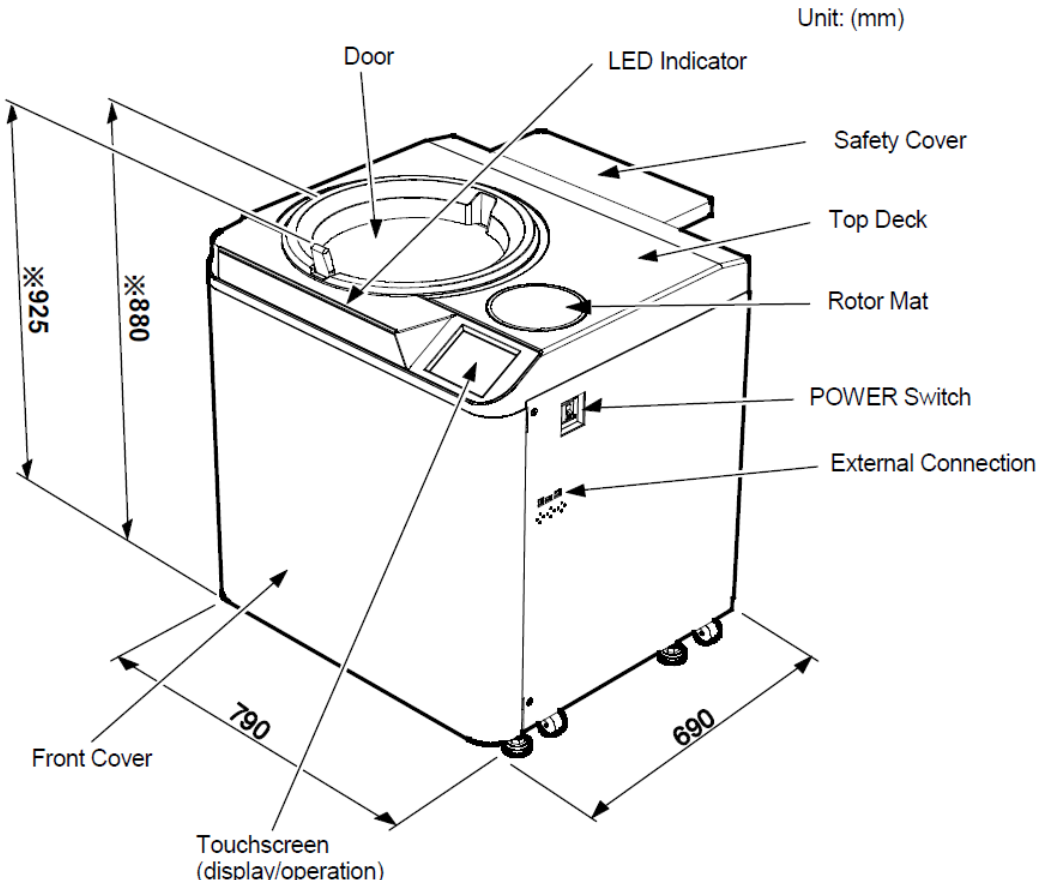


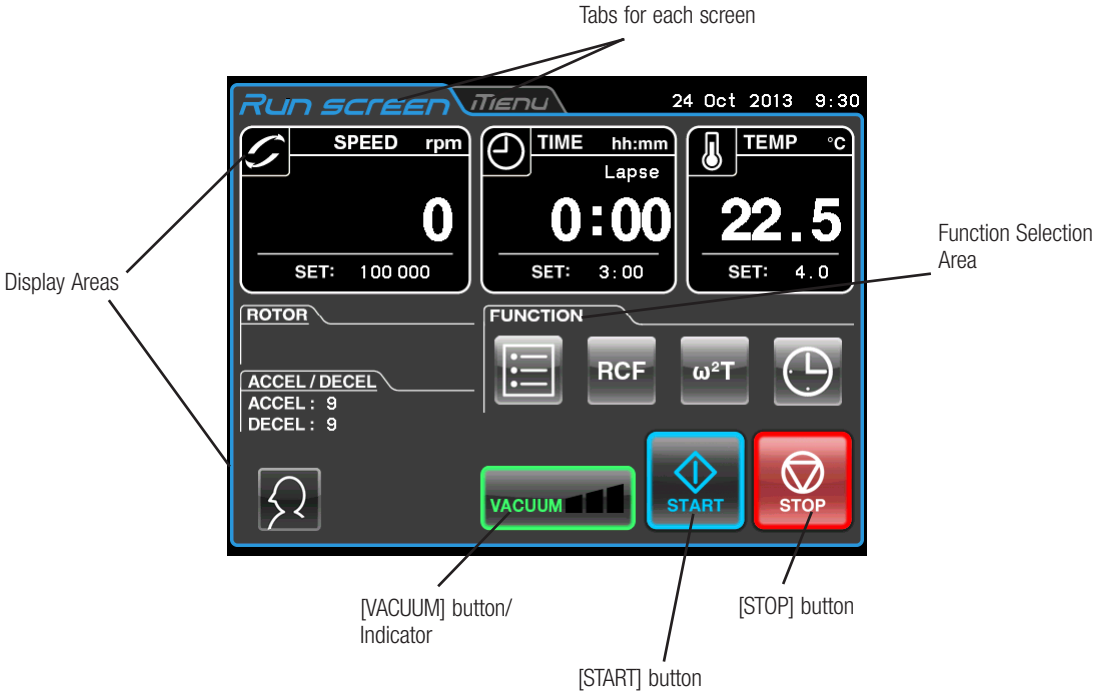
Figure 1: External view of Sorvall WX100+ Ultracentrifuge

NOTE	* *This height is measured from the floor surface.

Structure

Touchscreen and External Connection

The touchscreen with color liquid crystal display is integrated in the Sorvall WX+ Ultra series centrifuges. You can set the run parameters, perform an operation, and display a run history, programmed operation, and user customizations screens by pressing the screen Figure 2 shows the touchscreen.



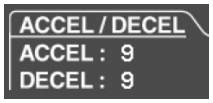
Display under normal operation

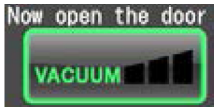
The following screen appears by pressing the [SPEED], [TIME], or [TEMP] button.

Display when setting the run conditions such as speed etc.

Figure 2: Touchscreen

Functions of the Run screen

No.	Name and symbol	Functions and actions
1	Display areas	These areas display various types of information. The SPEED (RCF), TIME, and TEMP areas display the current status in the upper part and the specified setting in the lower part. (For settings, see section Setting Run Parameters.)
	SPEED area (RCF area) 	▪ SPEED (Rotational speed indicator) (Upper part) Displays the speed in increments of 10 rpm at speeds below 5,000 rpm, and in increments of 100 rpm at 5,000 rpm or more. (Lower part) Used to set and display a speed from 1,000 rpm to the maximum speed in increments of 100 rpm. The lower two digits (1 and 10 positions) display zeros. For details on RCF, see section RCF (Relative Centrifugal Force) Display and Setting Function.
	TIME area 	▪ TIME (Running time indicator) (Upper part) Displays the remaining operation time. If the running time is set to HOLD, the upper part displays the time elapsed. (Lower part) Used to set, and display, a range from 1 minute to 999 hours 59 minutes in increments of minutes and hours.
	TEMP area 	▪ TEMP (Temperature indicator) (Upper part) Displays the temperature in increments of 0.1 °C. (Lower part) Used to set, and display, a temperature in the range from 0 °C to 40 °C, in increments of 0.1 °C When the pressure inside the rotor chamber is equal to the atmospheric pressure, the temperature inside the rotor chamber is held steady at 25 °C to prevent condensation from forming.
	Rotor indicator field 	▪ Press this field to select the desired rotor.
	ACCEL/DECEL field 	▪ Press this field to set the acceleration and deceleration rate ACCEL: Displays acceleration modes 1 through 9, as well as 0. DECEL: Displays deceleration modes 1 through 9, as well as 0 and free coasting (F).
	User area  or 	Press this area to select the desired user (see section Admin Function).
2	[VACUUM] button 	▪ Press this button to turn the vacuum pump on or off. When the vacuum pump is turned off, the pressure in the rotor chamber will change to equal the atmospheric pressure. (The vacuum pump cannot be turned off while the rotor is turning.) Temperature control begins as soon as the vacuum pump is turned on.

2	[VACUUM] button 	▪ The following four stages are displayed, depending on the vacuum inside the rotor chamber. 1.  Atmospheric state. The vacuum pump is not active. 2.  Low vacuum. The rotor remains at 4,000 rpm until the vacuum reaches medium level. 3.  Medium vacuum. 4.  High vacuum. ▪ The orange LED light blinks until the pressure in the rotor chamber equals the atmosphere pressure. ▪ “Now open the door” is displayed (see below) after the pressure in the rotor chamber equals the atmosphere pressure.  NOTE If the sample is sensitive to temperature increases, press the [START] button when the chamber is at a high vacuum level.
3	[START] button 	▪ Press this button to start rotor rotation. If [VACUUM] is off, pressing this button will start up the vacuum pump and initiate temperature control.
4	[STOP] button 	▪ Press this button to stop rotor rotation.
5	Function selection area	This centrifuge incorporates a number of features, such as step-mode operation and RTC (Real Time Control) operation. Buttons for these features are displayed and specified in the Function selection area.
	[PROGRAM] button 	▪ Press this button to select step-mode operation, etc. (see section Programmed Operation).
	[RCF] button 	▪ Press this button to display and set RCF (see section RCF (Relative Centrifugal Force) Display and Setting Function).
	[ω^2T] button 	▪ Press this button to set ω^2T (see section ω^2T Operation).
	[RTC] button 	▪ Press this button to select RTC (Real Time Control) operation (see section RTC (Real Time Control) Operation).

6	On-screen keypad  When entering the deceleration rate, [FREE] is displayed in place of [Hold].	▪ Use the on-screen keypad to enter numeric values for run parameters. **[: / .]** When entering a time: Switches from hours to minutes. **[Hold]** When entering the operation time: Sets continuous operation. **[FREE]** When entering deceleration conditions: Sets free coasting. **[CE]** Press this to cancel input (for example, if you enter the wrong number or the wrong value for a run parameter). **[Enter]** Press this to save the entered setting. **[X]** Press this to close the keypad display.

External connection

No.	Name and symbol	Functions and actions
7	USB (host side)  	▪ Use the USB connection to output the operation history of the centrifuge to a USB flash drive.
8	USB (device side)  	▪ Use for connecting the “himac ASSIST” provided or use for maintenance.
9	LAN  	▪ Use for connecting the “himac LogManager” (option).

Rotor Chamber

The structure of the rotor chamber (vacuum chamber) is shown in Figure 3 Rotor chamber.

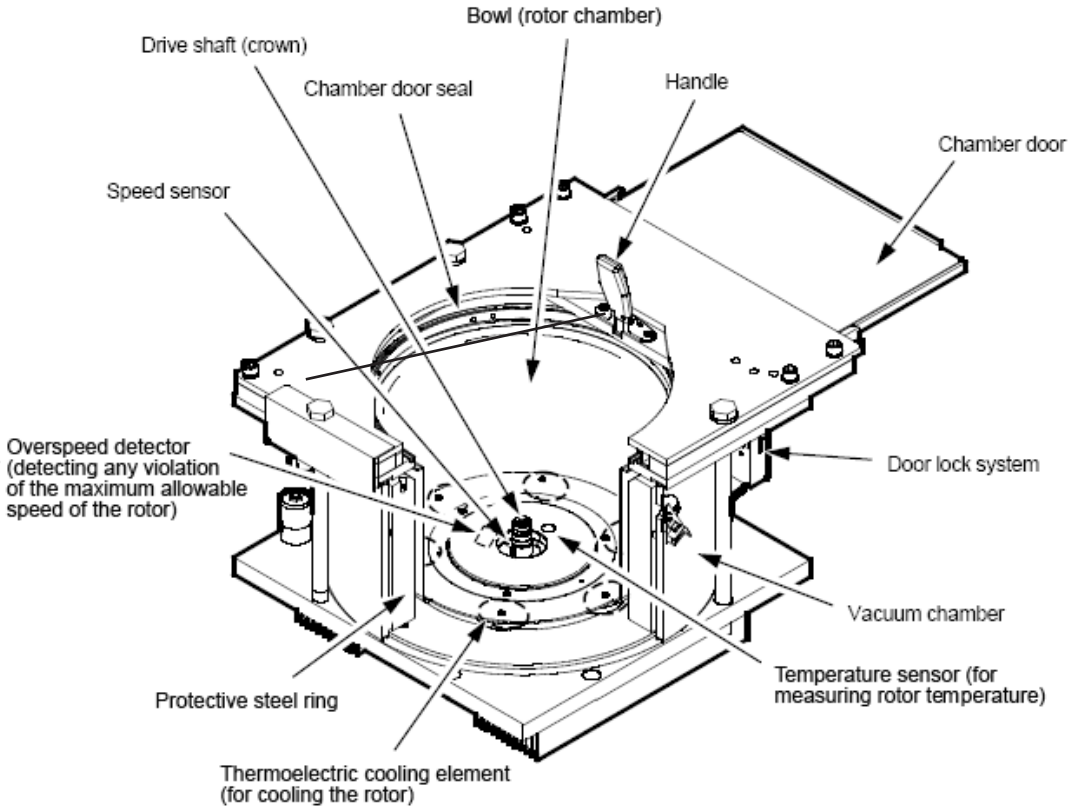


Figure 3: Rotor chamber

NOTE

If any sample or water drips onto the window of the temperature sensor, this may cause spurious detection. Should the sensor ever become wet, wipe it with a clean, dry cloth. Take care not to scratch the surface of the sensor.

Safety Devices

Protection of rotor chamber

Should the rotor spinning at high speed fail (or leave the drive shaft), the safety of the operator is ensured by the thick protective steel ring which encloses the bowl (Figure 3 Rotor chamber).

Imbalance detector

If, during operation, the vibration of the rotor becomes excessive due to serious imbalance or improper installation of buckets, the imbalance detector detects the situation and decelerates the rotor immediately.
However, the ultracentrifuge is designed to tolerate imbalances associated with balancing by eye - it is equipped with an imbalance-tolerant drive (For more information on the balancing of rotors, see section Rotor and Tube Preparations and Precautions).

Door lock system

The chamber door automatically locks for safety while the rotor is turning. When the power supply is off, the door remains locked. The door can only be opened and closed when the rotor is at rest and the rotor chamber is vented. Unless the door is closed, the rotor will not begin rotating except in zonal mode.
To open the door in the event of a power failure, see section Occurrences in the Event of Power Failure.

Speed sensor and overspeed detector

For protection in the event of entry errors the ultracentrifuge is provided with an automatic system to stop the rotor when its speed exceeds the maximum allowable speed. If a speed higher than the maximum permitted speed is set, the ultracentrifuge will detect the mistake before the speed reaches 3000 rpm, and then will display an alert message and decelerate the rotor to a stop.

Rotor overspeed decal

Overspeed decal

The overspeed decal located on the rotor base has alternating black and white bands.

The number of bands corresponds to the maximum permitted speed of the rotor (see Figure 4 Standard Rotor).

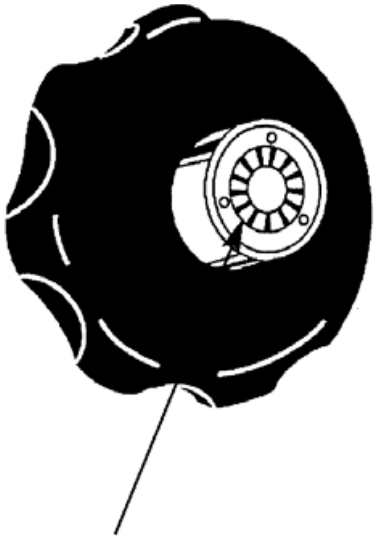


Figure 4: Standard Rotor

To protect the overspeed decal, make sure to store the rotor on the rotor stand provided (see Figure 5 Rotor stand).

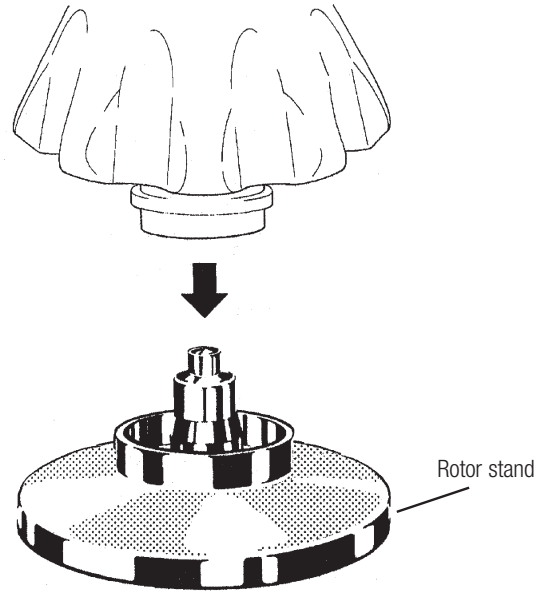


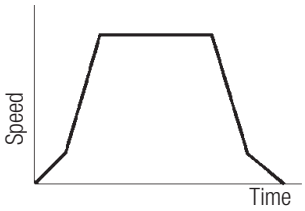
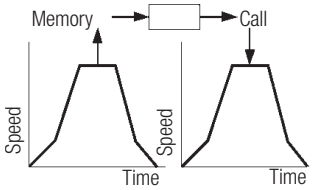
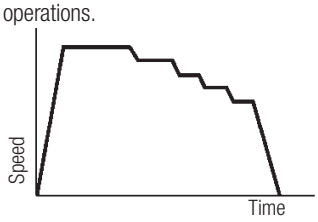
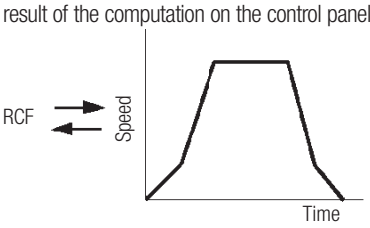
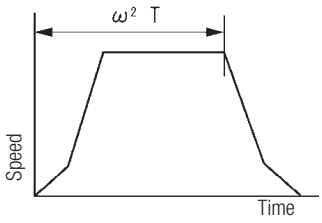
Figure 5: Rotor stand

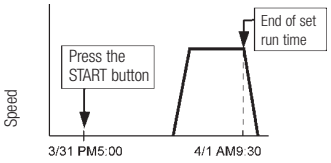
WARNING The overspeed decal must match the maximum speed of the rotor, because the overspeed decal is a component critical in detecting rotor overspeed:If an overspeed decal that is not compatible with the rotor is attached, the rotor could break, resulting in damage to the ultracentrifuge.

CAUTION When replacing the overspeed decal with a new one, be very careful not to damage the overspeed decal and rotor body.

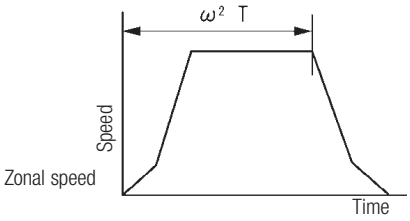
3. Operation

The centrifuge comes with a wide range of functions to support a broad spectrum of applications.
A brief description of each mode of operation is given below.

		Brief description	Reference
Normal operation			Section Basic Operation.
Function	Programmed operation	You can save set run parameters in memory for later use in repeated operation. 	Section How to Use the Function Selection Area. Section Programmed Operation.
	Step-mode operation	Normal operations can be combined in a sequence of operations. 	Section Step-Mode Operation Procedures.
	Displaying and setting RCF (Relative Centrifugal Force)	The centrifuge automatically computes RCF values from set speed, or speed from set values, and then displays the result of the computation on the control panel. 	Section RCF (Relative Centrifugal Force) Display and Setting Function.
	ω^2T operation	The centrifuge computes run time from speed and sets the ω^2T value. 	Section ω2T Operation.

Function	RTC operation (Real Time Control)	This function is used to perform a run between a set start time and end time. 	Section RTC (Real Time Control) Operation.

Special operation

	Brief description	Reference
Zonal operation	An operation that uses a zonal rotor. 	Section Features of the MENU Screen. Section Zonal Operation Procedures.

Run Preparation

WARNING

1. This centrifuge has is not protected against explosion. Never use explosive or flammable samples or materials that generate strong chemical reactions. Do not centrifuge such materials in this instrument nor handle or store them near the instrument.
2. Take all necessary safety measures before using samples that are toxic or radioactive or blood samples that are pathogenic or infectious.

CAUTION

Do not place containers holding liquid inside the rotor chamber, or on or near the centrifuge.
Liquids, if spilled, can get into the instrument and damage electrical and mechanical components.

Starting Up the Centrifuge

Before setting run parameters, display the Run screen (screen for setting run parameters).

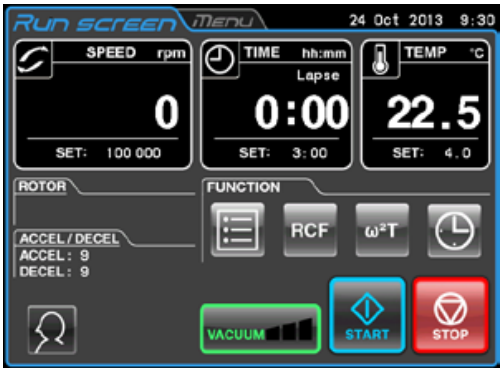
Displaying the Run screen (screen for setting run parameters).

1. Turn on the POWER switch.

2. The initial screen appears.

Initial screen

3. The Run screen appears.



Run screen

Figure 6: Initial Screen and Run Screen

Rotor and Tube Preparations and Precautions

The Sorvall WX+ Ultra series centrifuges allow you to balance samples, by eye. The difference between meniscus levels of opposing samples must be less than 5 mm (Figure 7 Balancing Samples), but some rotors are exceptions to this rule.
However, some tubes and bottles may trigger an imbalance alert in the case of certain rotor and sample combinations. If this happens, balance the samples more accurately.

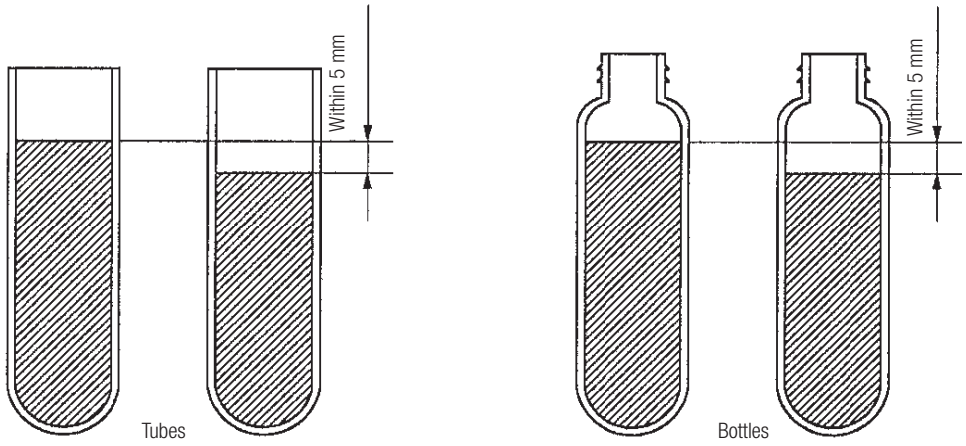


Figure 7: Balancing Samples

Note that partially filled tubes may impose speed limitations or lead to tube failure in the case of some rotors.
Tubes or bottles must be full in the following cases:

1. When thin tubes or seal tubes are used.
2. When thick tubes are loaded in a swing rotor.
3. When a bottle is used at 100,000 x g or more.

For more information on rotor and tube handling, refer to the “Rotor, tube, bottle and cap instruction manual “ and the instruction manual supplied with the rotor.

Basic Operation

WARNING

Do not incline or move the instrument while the rotor is spinning. Do not place any object on the instrument or lean against the instrument.

The centrifuge itself may move if the rotor fails during high-speed rotation. Ensure that there is a 30 cm area around the centrifuge that will allow for such movement and do not allow individuals to enter that area during operation. Also do not place dangerous objects such as flammable or explosive materials on top of the centrifuge or in the surrounding area.

CAUTION

Do not press the touchscreen with a sharp-pointed object such as a ballpoint pen.

If abnormal sounds or vibrations occur, immediately cease operation and contact an authorized Thermo Fisher Scientific sales/service representative.

Setting Run Parameters

This section will describe the Run screen, the starting point for basic operations. For information on screens displayed during normal operation and entering of run parameters, refer to section Touchscreen and External Connection.

Normal operation display

The screen for displaying run parameters and operating conditions is called the run screen.

SPEED, TIME and TEMP are displayed in two rows: The top row displays the current operating condition, while the bottom row displays the set value.

The acceleration (ACCEL) and deceleration (DECEL) fields display set values.

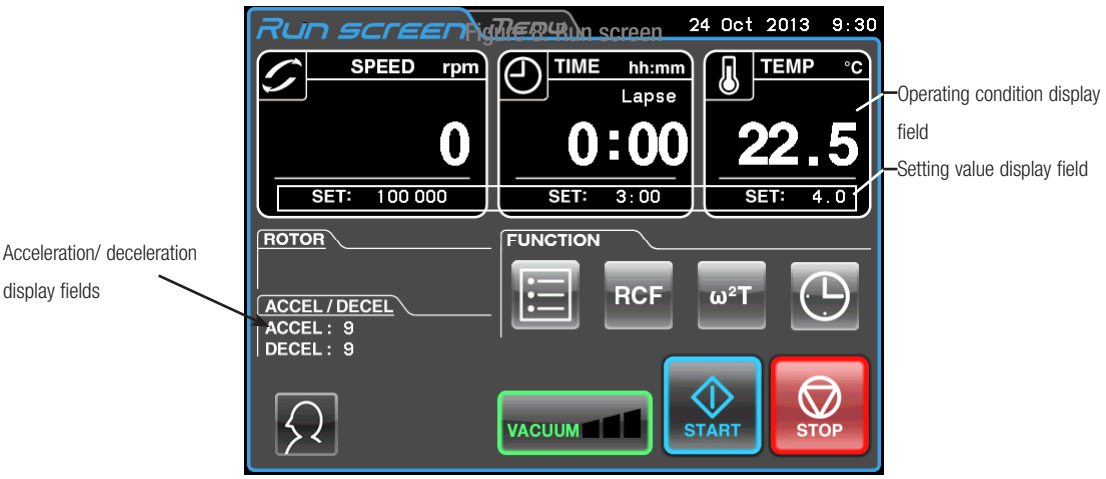
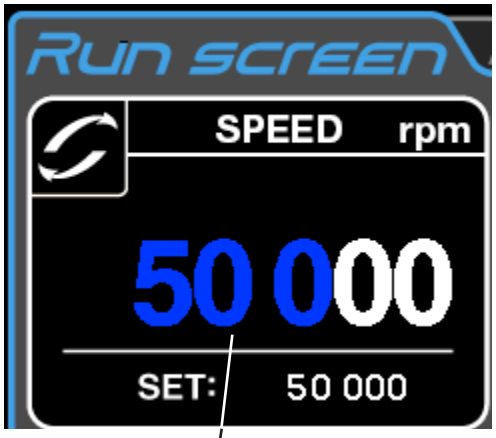


Figure 8 Run screen

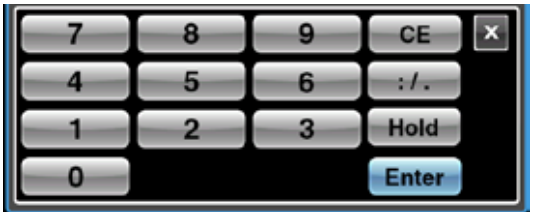
Display and operations when entering run parameters

Press the SPEED, TIME, TEMP, ACCEL or DECEL field on the touchscreen to display the on-screen keypad.

1. Press the field of the item you wish to set. The initial digits are displayed in blue.



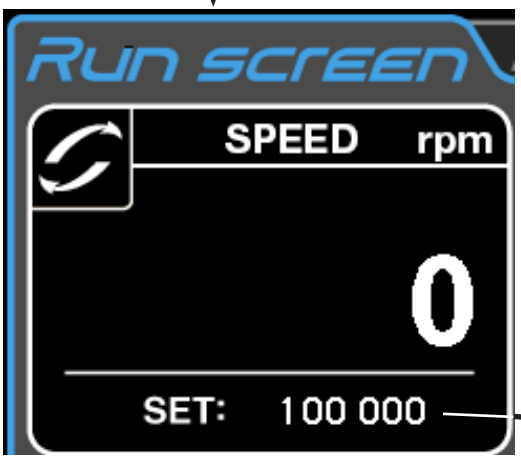
Color of initial digits: blue



On-screen keypad

2. Press the on-screen keypad to enter a numeric value.
Example: 100,000 rpm
Press [1] [0] [0] [0].

3. If you do not wish to make any other settings, press the [Enter] button on the on-screen keypad. If you also wish to make other settings, press the field you wish to set. This completes the first entry and the field is ready to accept your next entry.
Setting values are displayed in the setting value display field.



Setting value display field

Figure 9: Setting value display

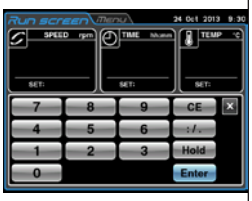
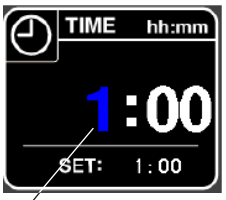
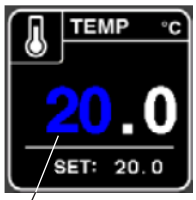
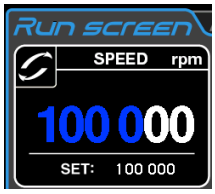
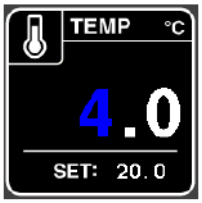
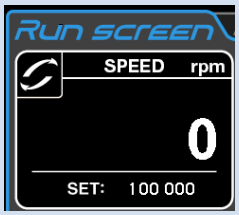
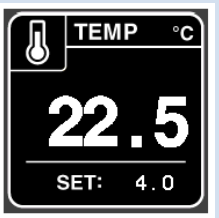
Methods for setting run parameters are described on the next page.

NOTE

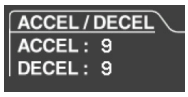
1. If you enter the wrong value, press the [CE] button and enter the correct value. If you have already pressed the [Enter] button, repeat the process and enter the correct value.
2. When more than one SPEED, TIME, or TEMP run parameter is selected, you do not need to press the [Enter] button. When you touch the field of another run parameter, the currently entered item is confirmed.
3. To set continuous run (HOLD) and specify the time during operation, enter the sum of time elapsed so far plus the desired remaining run time. For example, if the centrifuge has been running for 5 hours and you want operation to stop 1 hour and 30 minutes later, touch the TIME field and enter [6][: / .] [3] [0].

Setting speed, run time and temperature

Operation procedures are described below using examples.

Setting Item			Speed SPEED	Run time (TIME)	Temperature (TEMP)
Setting example			100,000 rpm	2 hours 30 minutes	4 °C
Operation procedure	1	Press the SPEED, TIME or TEMP field to display the on-screen keypad.			
	2	Each field displays the value set for the previous run. If the color of the initial digits of the setting are white, again press the field of the item you want to set. If the color of the initial digits is blue, go to step 3.	 Color: blue	 Color: blue	 Color: blue
	3	Press the on-screen keypad to enter a numeric value.  Each new digit that is entered is scrolled to the left.	1 0 0 0 The last two digits are fixed. 	2 :/. 3 0 Press the [: / .] button to move the cursor to the “minutes” position. To start a continuous run, press the [Hold] button. 	4 
	4	Check the entered value. To continue making other settings, press the field of the desired setting. When complete, press the [Enter] button. Use the [CE] button to cancel incorrect entries.	Set to 100,000 rpm. 	Set to 2:30. (2 hours 30 minutes) 	Set to 4°C. 
Setting range and units			Set a value between 1,000 rpm and maximum speed in 100 rpm increments.	Set a value up to 999 hours and 59 minutes in 1 minute increments.	Temperatures in the 0 to 40 °C range can be set in 0.1 °C increments.

Setting acceleration and deceleration mode

<table>
<tr><th colspan="3">Setting Item</th><th>Acceleration
(ACCEL)</th><th>Deceleration
(DECEL)</th></tr>
<tr><td colspan="3">Setting example</td><td>9</td><td>7</td></tr>
<tr><td rowspan="4">Operation procedureprocedure</td><td>1</td><td> 

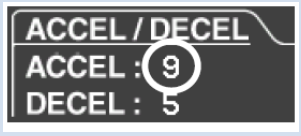
Press a field to display the on-screen keypad.</td><td> 
</td><td> 
</td></tr>
<tr><td>2</td><td>Press the field whose value you wish to set. The numeric values are displayed in blue.</td><td> 

Color: blue</td><td> 

Color: blue</td></tr>
<tr><td>3</td><td>Press the on-screen keypad to enter a numeric value.

</td><td>9

</td><td>7

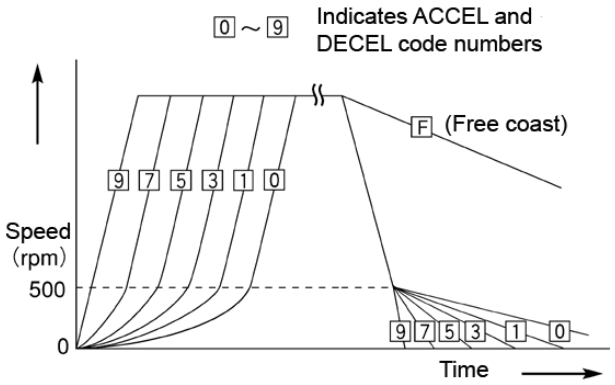

For free coast, press the (FREE) button</td></tr>
<tr><td>4</td><td>Check the entered value. To continue making other settings, press the field of the desired setting. When complete, press the [Enter] button. Use the [CE] button to cancel incorrect entries.</td><td>Set to 9.

</td><td>Set it to 7.

</td></tr>
<tr><td colspan="3">Setting range</td><td>1 to 9, 0</td><td>1 to 9,0
+
Free coast (FREE)</td></tr>
</table>

Acceleration and Deceleration Modes

In order to meet a wide variety of applications, the acceleration and deceleration rates can be adjusted between 0 and 500 rpm. By setting an ideal acceleration and deceleration time samples will not be disturbed; this improves efficiency and reduces centrifugation time.
The table below shows the relationship between ACCEL and DECEL code numbers and acceleration and deceleration time.

0 - 9: Indicates ACCEL and DECEL code numbers



Code No.	Acceleration (minutes) from 0 to 500 rpm	Deceleration (minutes) from 500 to 0 rpm
9	Minimum time (*1)	Minimum time (*1)
8	1	1
7	2	2
6	3	3
5	4	4
4	5	5
3	6	6
2	7	7
1	8	8
0	9	9
F(2)	-	Free coast from stable speed

*1 Minimum time: The time it takes the drive motor to accelerate and decelerate the rotor using maximum torque. This time will vary with rotor type and the mechanical resistance of the drive motor.
*2 DECEL code “F”: A deceleration method that does not involve brake control using the drive motor. The deceleration time will then vary widely depending on differences in the small mechanical resistance of the drive motor and the vacuum level of the rotor chamber and other factors.

Examples showing use of acceleration and deceleration modes

	Optimum numeric code		Separation characteristics
	ACCEL	DECEL	
Density gradient centrifugation using a vertical rotor	5	7	As the density gradient reorients during acceleration and deceleration, the gradient may be disturbed if samples are rapidly accelerated and decelerated.
Using CsCl density gradient sedimentation equilibrium centrifugation for DNA separation (when using a uniform liquid)	9	7	You can operate at maximum acceleration because the density gradient is not generated during the run. Slow deceleration is recommended in order to obtain sharp bands.
Pelleting using an angle rotor	9	9	Rapid unloading of samples is possible. (short separation time)
Density gradient centrifugation using swing bucket rotor	8	8	The sample and gradient do not reorient themselves. For this reason, there is less gradient turbulence than when using vertical rotor and good results can be obtained provided rapid acceleration or deceleration is avoided.

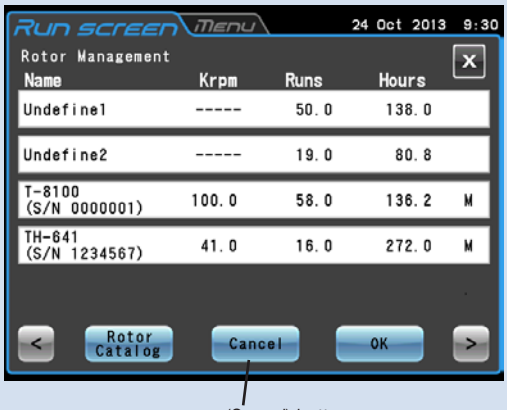
NOTE

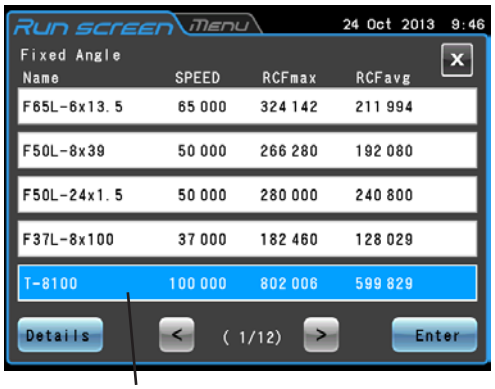
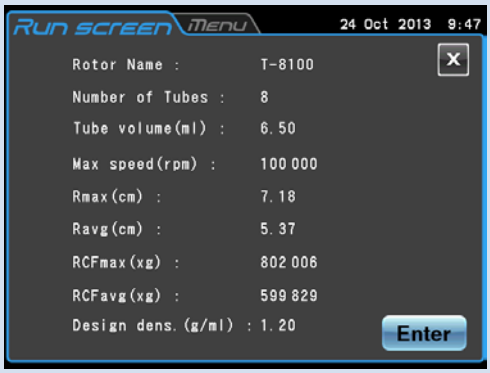
With a swinging bucket rotor, there is little difference with regard to turbulence if ACCEL/DECEL is less than or equal to 8. However, rotor swing may become severe in modes involving long acceleration times, and this could cause an imbalance alert to be triggered even within imbalance tolerance limits.

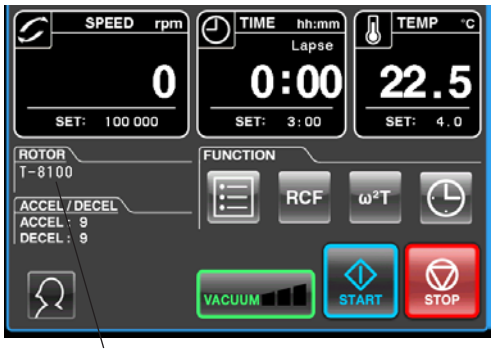
Rotor Selection

This centrifuge stores the maximum and average radius of each rotor in its internal memory. It provides a function that will automatically calculate and display the relative centrifugal force (RCF) from a set speed and calculate and display the speed from an RCF setting (for information, refer to section RCF (Relative Centrifugal Force) Display and Setting Function).
Correctly selecting the rotor allows you to manage total run time and number of runs.

Rotor selecting procedure

Step	Touchscreen operation	Screen displays and notes
1	Press the Rotor indicator field in the Run screen.  NOTE: A rotor is selected when the name of a rotor type is displayed in the Rotor indicator field. If you wish to use another type of rotor, follow the procedure below to select a different rotor.	▪ Rotor Management screen  (Cancel) button
2	Check that the desired rotor is displayed. If it is, select it and press the [OK] button.	▪ When the selected rotor field turns blue, press the [OK] button to return to the Run screen. ▪ The selected rotor type appears in the Rotor indicator field. ▪ You can select your rotor in the Rotor Management screen if you registered your rotor in advance. For information on how to register a rotor, refer to section Rotor management. ▪ If the name of the rotor type appears in the Rotor indicator field, you can use the [Cancel] button to clear it. CAUTION: If you have selected a rotor on the Rotor Management screen, make sure to check that the selected rotor (on the Rotor Management screen) and the rotor that is installed in the centrifuge have an identical serial number (the rotor serial number is also displayed in the Rotor indicator field on the Run screen). If the serial number of the selected rotor differs from the serial number of the rotor installed in the centrifuge, you cannot control total run time and the total number of runs of both rotors.

3	When the Rotor management screen does not display the desired rotor, press the [Rotor Catalog] button. In the ROTOR CATALOG screen, select the desired rotor type.	▪ ROTOR CATALOG screen 
4	In the screen displaying rotor types, press the field of the desired rotor. Check that the pressed field turns blue and press the [Enter] button.	▪ The screen for selecting a rotor appears.  The pressed field turns from white to blue.
	To confirm rotor details, press the rotor field to turn it blue and press the [Details] button. A window that allows you to check rotor information appears. If the selected rotor is shown, press the [Enter] button. To select a different rotor, press the [X] button to return to the Select rotor screen.	▪ The Rotor Details screen appears. 

5	The Run screen appears and the name of the selected rotor type is displayed in the Rotor indicator field.	▪ The Run screen appears.  Rotor indicator field

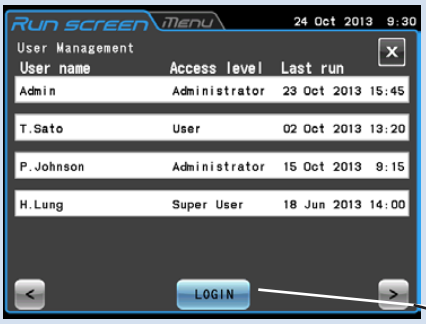
NOTE

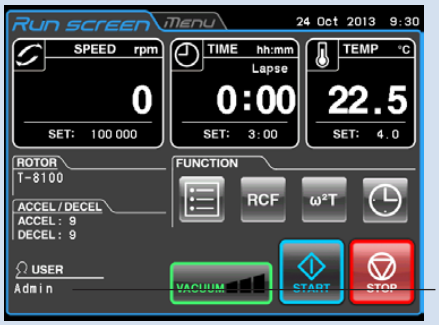
1. You cannot perform life management of a rotor simply by selecting a rotor in the ROTOR CATALOG screen. You must first register your rotor in the instrument (refer to section Rotor management).
2. By registering your rotor in the instrument in advance, it appears in the Select rotor screen, thus simplifying operation.

Logging in as a User

By registering users in the instrument, it will be possible to manage the operation history of users that log in. For information on how to register a user, refer to section User management.

User Login Procedures

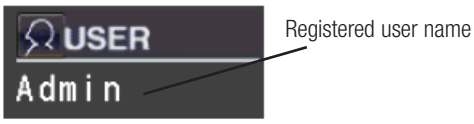
Step	Touchscreen operation	Screen displays and notes
1	Press the Display user field in the Run screen.  or 	▪ The User Management screen appears. 
2	In the User Management screen, press the field of the desired user name making sure that the pressed field turns blue. Then press the [LOGIN] button. (Admin is the registered factory default for this centrifuge.)	▪ The LOGIN screen appears. 
3	Enter the PIN on the on-screen keypad and press the [Enter] button. The PIN is the 4-digit number you register in section User management. (The default PIN for “Admin” is “1111.” If necessary, change the PIN.)	▪ The PIN is echoed as asterisks. 

Step	Touchscreen operation	Screen displays and notes
4	The user name appears in the USER area in the Run screen.	▪ The Run screen appears. 

NOTE

1. When the user lockout function described in section User lockout is enabled, you must login as a user to operate the centrifuge. This requires a user to be registered as described in section User management.
2. The icon in the USER area of the Run screen differs depending on whether or not the user is logged in.

Icon for unregistered user



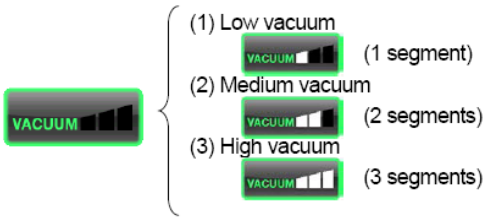
Icon for registered user

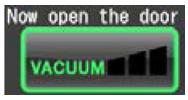
Operation Procedures

Below is a description of normal operating procedures.

CAUTION Take care not to get your hands or fingers caught in the door of the centrifuge.

NOTE Before you begin using your centrifuge, carefully read through the instruction manual for your rotor and make sure that the correct tube types and number of samples are supplied.

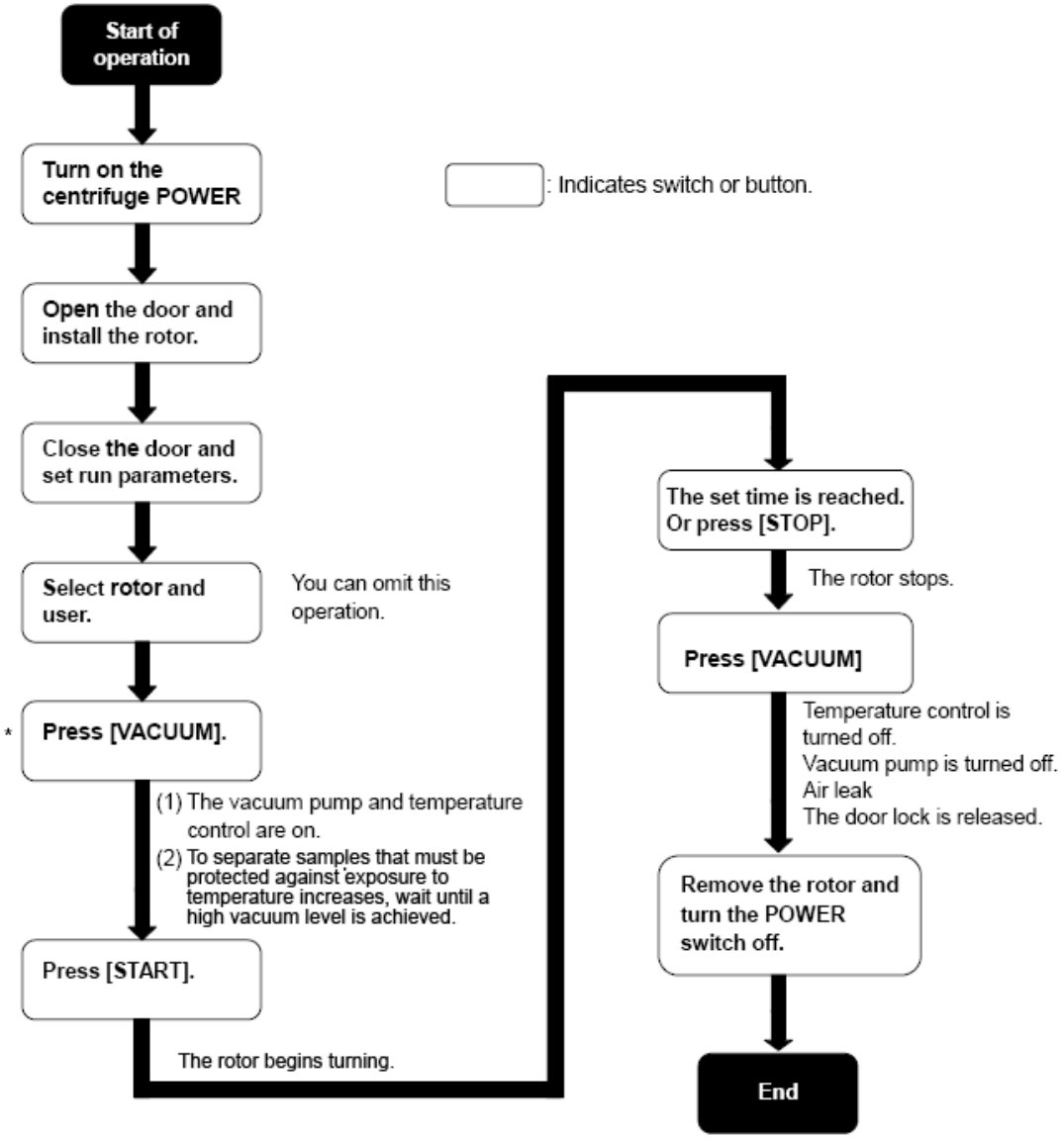
Step	Touchscreen operation	Centrifuge operations and notes
1	Turn on the centrifuge POWER switch.	▪ The touchscreen is displayed. ▪ The door lock is released. ▪ When Economy mode (see section Economy mode setting) is activated, tap the touchscreen. This deactivates Economy mode.
2	Open the door, install the rotor and close the door.	▪ Gently install the rotor on the crown. ▪ Read through the rotor instruction manual.
3	Set the run parameters.	▪ Set the run parameters according to the instructions in section Setting Run Parameters and section Acceleration and Deceleration Modes.
4	Select a rotor.	▪ Select a rotor according to the instructions in section Rotor Selection. You can skip this step.
5	Log in as a user.	▪ To log in as a user, follow the instructions in section Logging in as a User. You can skip this step.
6	Press the [VACUUM] button. (You can skip this step.) 	▪ Air is removed from the rotor chamber. ▪ Temperature control begins. ▪ The indicator of the [VACUUM] button displays the vacuum level in the rotor chamber.  ▪ If there is moisture or frost in the rotor chamber, it will take a long time to achieve a medium or high vacuum level. Use a cloth or similar material to wipe away any moisture or frost. ▪ Set a high vacuum level before pressing the START button to process samples sensitive to increases in temperature.

Step	Touchscreen operation	Centrifuge operations and notes
7	Press the [START] button. 	▪ The [START] button lamp blinks and the rotor starts turning. ▪ The timer begins operating. (If the actual run timer is set, the timer will start operating when the set speed is reached.) ▪ When the set speed is achieved, the [START] button lamp changes over to steady lighting and a white dot of light starts to spin around the button. ▪ The rotor remains in standby at 4,000 rpm until a medium vacuum level is reached.
8	Operation stops when the set centrifugation time has elapsed (end of run). Or press the [STOP] button. 	▪ The [STOP] button lamp blinks and the rotor starts decelerating.
9	The rotor stops.	▪ The [STOP] button changes over to steady lighting. ▪ The buzzer sounds to indicate the rotor has stopped.
10	Press the [VACUUM] button. 	▪ The vacuum pump stops, the air leak valve begins operating to return the rotor chamber to normal atmospheric pressure. ▪ The door lock is released and the door can be opened. ▪ When the rotor chamber returns to normal atmospheric pressure, the “Now open the door” message appears above the [VACUUM] button. 
11	Remove the rotor.	▪ Gently remove the rotor when it has stopped.

NOTE

If the rotor chamber is not properly evacuated before operation, or room temperature is low (10C or less), evacuation may take some time and the centrifuge will operate at 4,000 rpm. If the chamber is not properly evacuated, the rotor may slow down before the set speed is obtained so that evacuation can continue. Therefore, it is recommended that you use the [VACUUM] button to evacuate the chamber before operation for about 15 minutes or until the indicator above the [VACUUM] button indicates that a high vacuum level has been achieved.

Figure 10 Operation Procedures is an overview of the procedures described above.
See section Zonal Operation Procedures for information on using a zonal rotor.



* You can start operation using [START] without having to press [VACUUM]. Then the vacuum pump will start up when [START] is pressed and the rotor will stabilize at 4,000 rpm until the set vacuum level is achieved.

Figure 10: Operation Procedures

How to Use the Function Selection Area

This centrifuge provides programmed operation including step-mode operation, RCF display and setting function, ω^2T display and setting function and Real Time Control (RTC), which can be used to operate the centrifuge at a preset date and time, and a host of other functions. These features are displayed and controlled using the Function Selection Area in the Run screen.

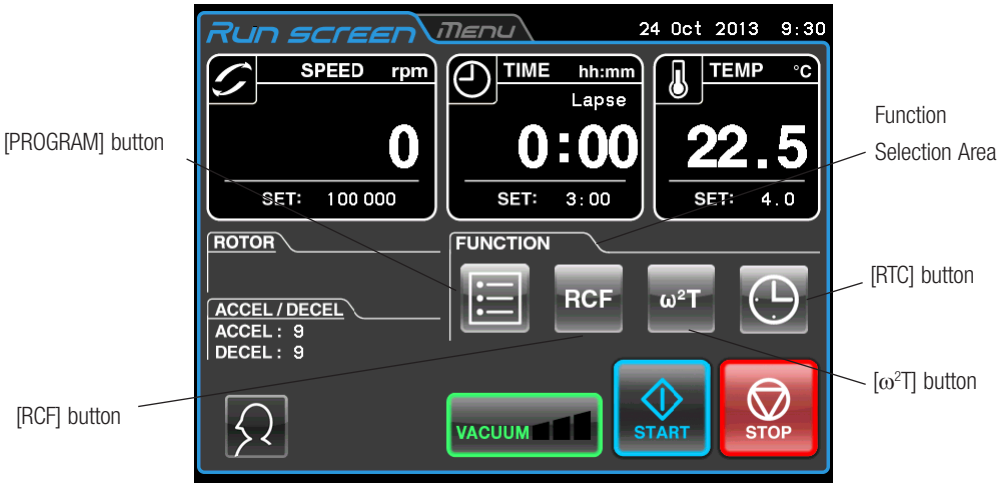


Figure 11: Run screen

Name	Icon (Button)	Function
Program		You can save run parameters in memory for later use in repeated operation. This feature also allows step-mode operation that can combine a number of run parameters in a sequence of operations.
RCF		The centrifuge automatically computes and displays RCF values from set speed, or speed from set RCF values.
ω^2T		This function is used to indicate ω^2T, the centrifugal effect (a value obtained by adding the run time to the angular velocity squared). Operation can be stopped when the set ω^2T value is obtained.
RTC		Sets a start time or end time and runs the centrifuge at a desired date and time.

The above features can be used in combination.

NOTE To combine [PROGRAM] and [RTC], first set [PROGRAM] and then [RTC]. Once [RTC] is activated, you cannot change the run time and set [PROGRAM].

Programmed Operation

When a set of centrifuging conditions is to be used frequently, it is inconvenient to enter these every time you wish to perform centrifugation.

This centrifuge has a programmed operation feature that stores run parameters. Storing frequently used run parameters allows you to call these up when you need them, thus saving setup time (the stored run parameters remain in memory even when the POWER switch is turned off.)

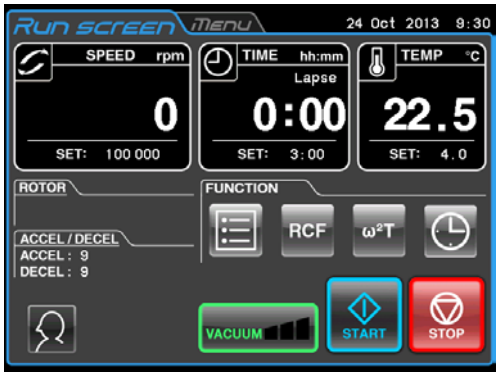
As shown in the figure below, the centrifuge has a program area that can store up to 1,000 memory items, each of which can contain up to 30 step conditions.

By storing multiple steps in a memory unit you can change the speed, run time, temperature and other parameters during operation.

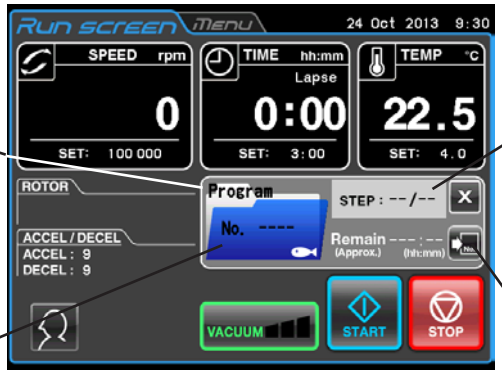
Memory unit 1	Step 1	Step 2	.....	Step 30
Memory unit 2	Step 1	Step 2	.....	Step 30
Memory unit 3	Step 1	Step 2	.....	Step 30
•	•	•	.....	•
•	•	•	.....	•
•	•	•	.....	•
•	•	•	.....	•
•	•	•	.....	•
Memory unit 1,000	Step 1	Step 2	.....	Step 30

Figure 12: Program area

Basic operation of the programmed operation feature



Press the [PROGRAM] button.



Program display screen

Step operation display

The Function Selection Area switches to the Program display screen.

[Folder] button

[PROGRAM No.] button

If the registered program number is not known

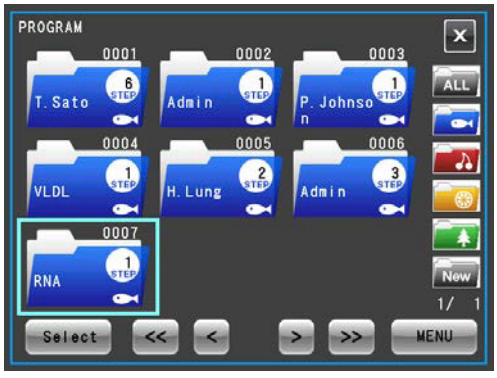
If the registered program number is known

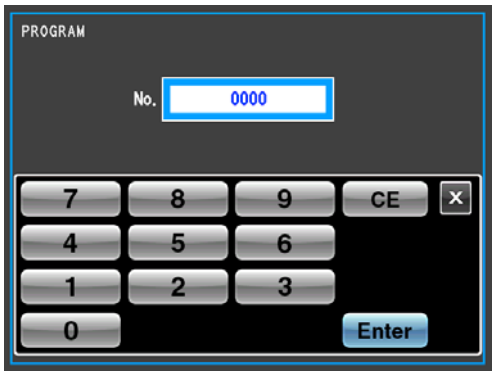
Press the [Folder] button

Press the [PROGRAM No.] button.

The Program No. entry screen appears

The Program list screen appears.

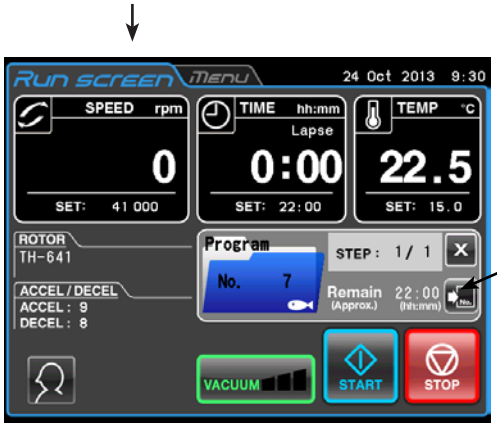




Select a program folder; check that the folder turns blue before pressing the [Select] button.

Use the on-screen keypad to enter the number of the desired program and press the [Enter] button.

Use the [<<], [<] , [>] and [>>] buttons to turn pages.



When the Run screen appears, the registered run parameters are set.
The program number is displayed in the [Folder] button on the Program display screen.
When multiple steps are registered, the step operation display indicates the total number of steps and the current step.

Press the [START] button.

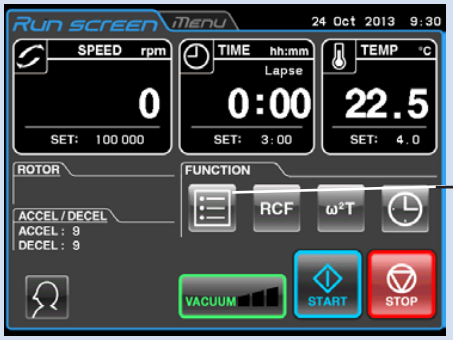
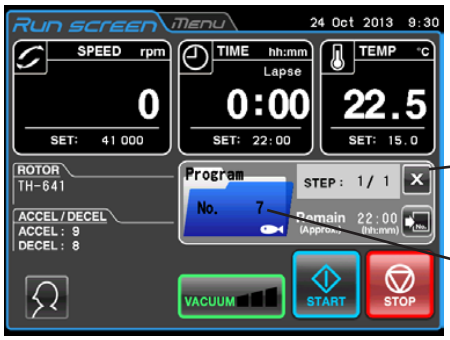
NOTE

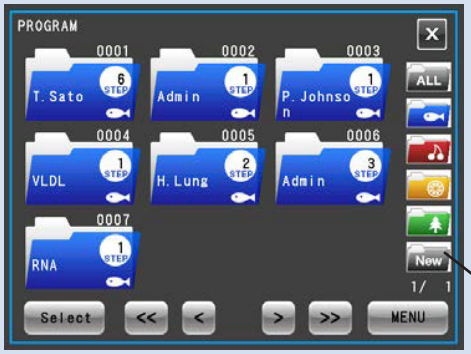
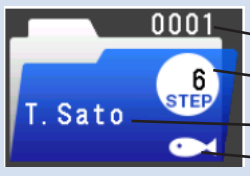
1. Programs cannot be registered, changed or deleted during operation. Perform these operations when the centrifuge is not running.
2. When the screen is closed by pressing the [X] button in the Program display screen after a program has been called up, the Function Selection area appears again but program operation remains enabled. The [Program] button changes to blue to indicate that the program is still enabled.
3. If the POWER switch is turned off while the Program display screen is open, the Program display screen will be closed when the centrifuge is restarted and the Function Selection area will appear. However, the program will still remain enabled and the [Program] button will turn light blue as described in 2) above.
4. Pressing the [START] button when the [Program] button is lit blue (and a program is enabled) starts up the program, and the Function Selection area is replaced by the Program display screen.
5. To cancel the program operation called up, call up another program or change the run parameters.

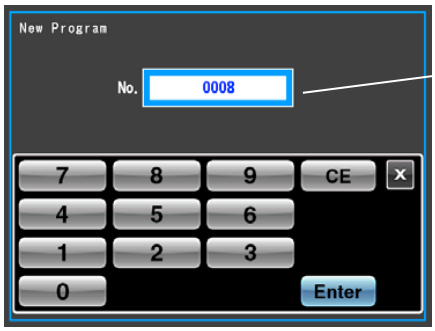
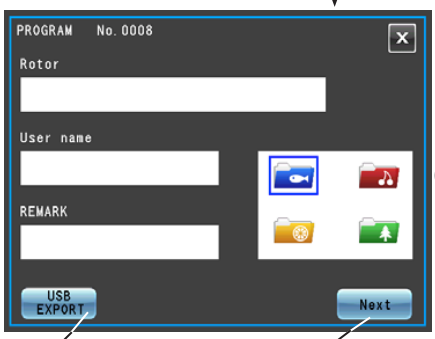
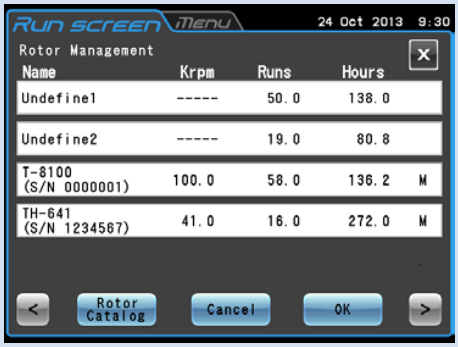
Procedures for Entering a Program

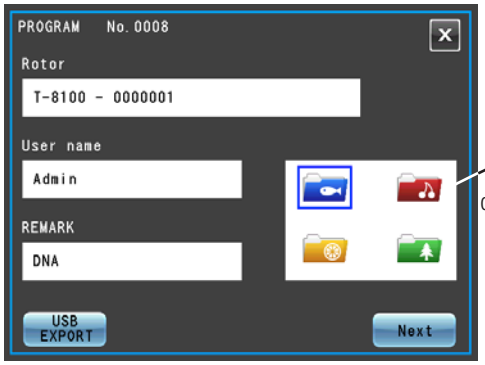
Procedures for entering run parameters

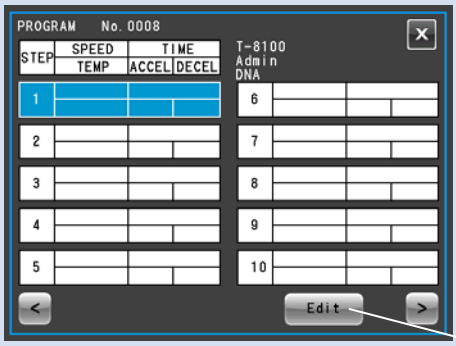
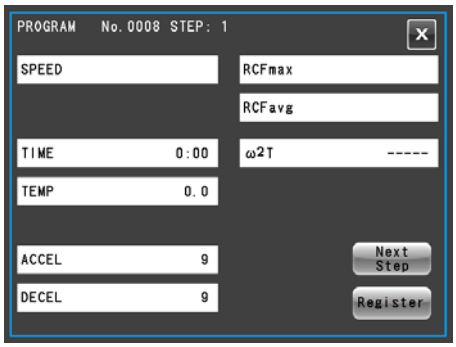
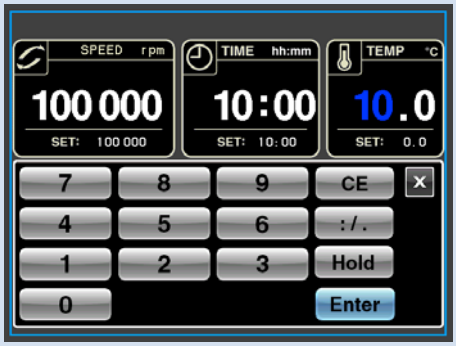
The procedures for entering run parameters are described below.

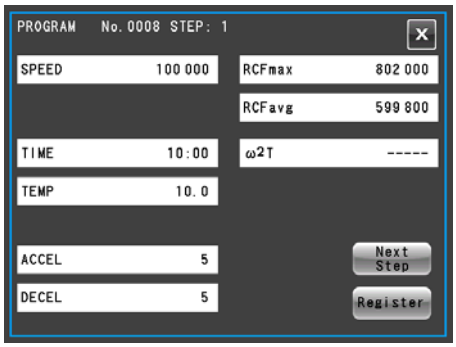
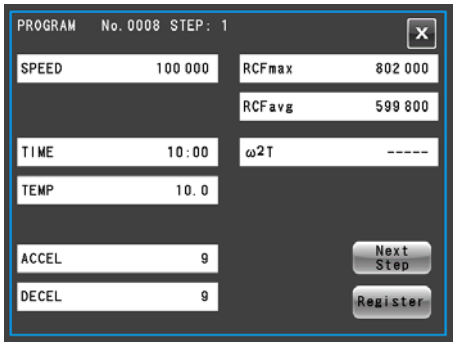
Step	Touchscreen operation	Screen displays and notes
1	Turn on the centrifuge POWER switch.	▪ The Run screen appears.  [PROGRAM] button
2	Press the [Program] button in the Function Selection area of the Run screen. 	▪ The Function Selection Area switches to the Program display screen.  Program display screen [Folder] button ▪ If a program number is displayed in the [Folder] button, this indicates that the run parameters in that program have been set.

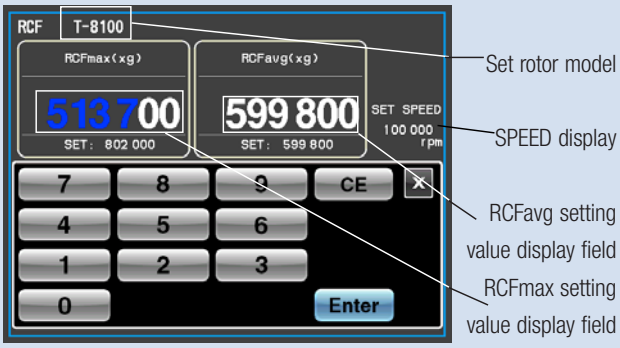
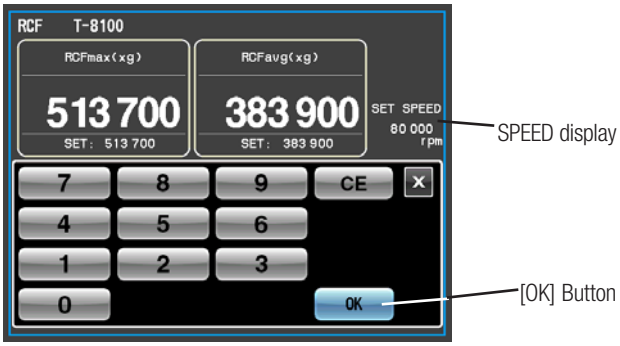
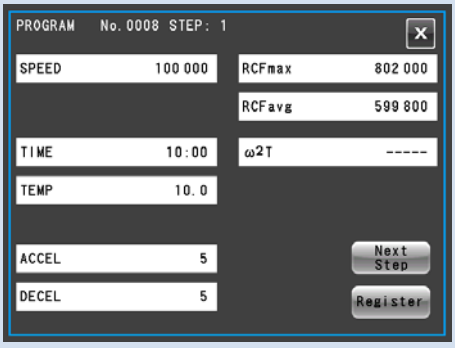
3	Press the [Folder] button in the Program display screen. 	▪ The Run screen replaces the Program list screen. ▪ Program folders come in four colors. ▪ The program list can be displayed in different colors.  [New Folder] button Program list display  [All folder] button: Press to display all set programs on the screen in number order.  [Blue folder] button: Press to display only programs set in blue folders on the screen.  [Red folder] button: Press to display only programs set in red folders on the screen.  [Yellow folder] button: Press to display only programs set in yellow folders on the screen.  [Green folder] button: Press to display only programs set in green folders on the  [New folder] button: Press to enter new programs.  [Previous page] button: Press to display the previous page of the program list. Use the [<<] button to move several pages back.  [Next page] button: Press to display the next page of the program list. Use the [>>] button to move several pages ahead. Program list display  Displays the program number. Displays the set number of steps. Displays the user name or remark. Displays the folder design. (Depends on color of program folder.)

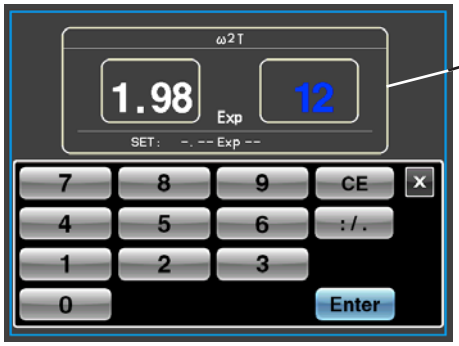
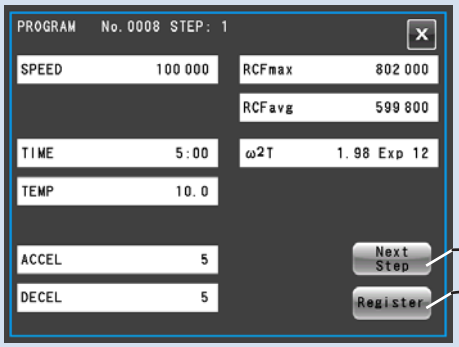
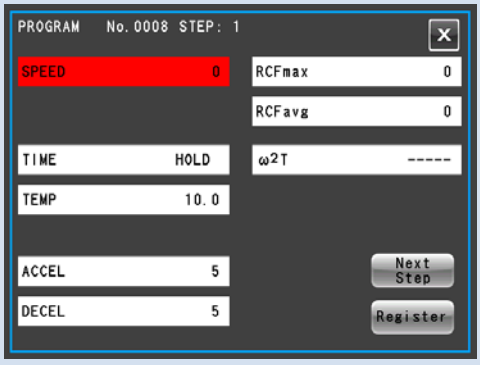
4	Press the [New Folder] button.  To enter the folder, press the [Enter] button. To select a different number, use the on-screen keypad to select the desired number and press the [Enter] button. (The [Enter] button will not accept entry of a program number already entered.)	▪ The Program No. entry screen appears.  Program No. entry field The unregistered program with the lowest number is displayed when the screen changes. ▪ The Program registration screen  Rotor model display/ registration field Registered user display/registration field Remarks display/ registration field Folder color display/ registration field [USB EXPORT] button [Next] button NOTE For information on USB EXPORT, see section Outputting and Reusing Run History Display and Run Parameters.
5	Press the white area in the rotor model display/entry field ((1)) to select a rotor. (You can omit this operation.)	▪ The Rotor Management screen appears.  ▪ Select the rotor you wish to use and press the [OK] button. ▪ If the rotor you wish to use cannot be found in the Rotor Management screen, press the [Rotor Catalog] button and select a rotor from this screen. ▪ The selected rotor is displayed in the rotor model display/registration field ((1)) in the program entry screen. ▪ For details, refer to section Setting Run Parameters.

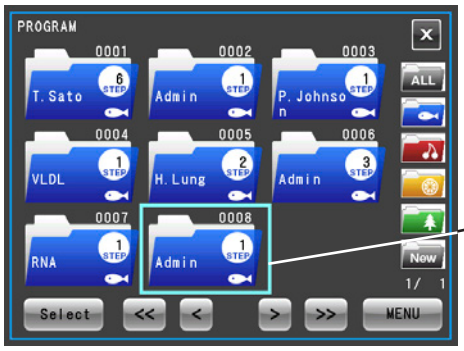
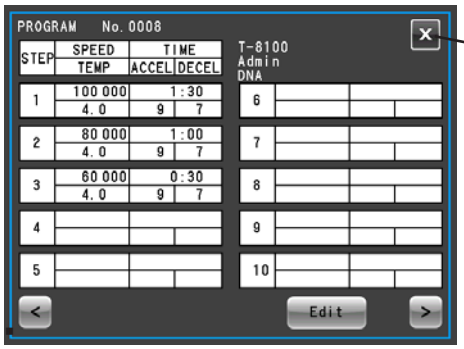
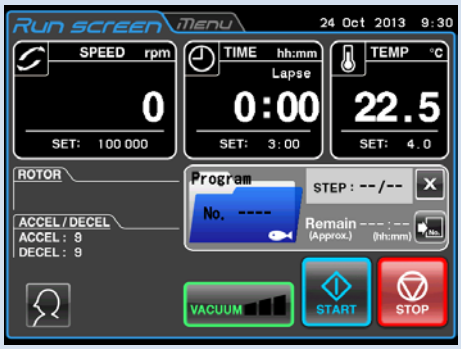
6	Press the white area in the Registered user display/registration field ((2)) to select a user. (You can omit this operation.)	▪ The User Management screen appears.  ▪ Select the user name you wish to use and press the [LOGIN] button. ▪ Enter the PIN and press the [Enter] button. ▪ The user selected in the Registered user display/registration field ((2)) of the Program registration screen now appears. ▪ For details, refer to section Logging in as a User.
7	Press the white area in the Remarks display/registration field ((3)) to enter a remark. (You can omit this operation.)	▪ The Remarks entry screen appears.  ▪ Enter a remark and press the [Enter] button. ▪ You can enter a character string consisting of up to 16 characters. ▪ Remarks entered in the Remarks display/registration field ((3)) of the program registration screen now appear.
8	Select the color of the folder you wish to register in the Folder color display/registration field ((4)).	 ▪ The selected folder is surrounded by a blue frame. ▪ Check the registered data and press the [Next] button

9	Press the field as in Step 1, check that the field turns blue and press the [Edit] button.	 PROGRAM No. 0008 STEP SPEED TEMP TIME ACCEL DECEL T-8100 Admin DNA 1 2 3 4 5 6 7 8 9 10 Edit >[Edit] button
10	Press the white area in the SPEED setting value display field ((1)). (You can press the TIME ((2)) or TEMP ((3)) setting value display fields and make similar settings.)	▪ The run parameter entry/display screen appears.  SPEED setting value display field TIME setting value display field TEMP setting value display field ACCEL setting value display field DECEL setting value display field RCFmax setting value display field RCFavg setting value display field ω^2T setting value display field
11	Enter SPEED, TIME and TEMP run parameters. Example) SPEED: 100,000 rpm TIME: 10:00 TEMP: 10.0 °C NOTE 1) A SPEED entry is not required when an RCF value is set. 2) A TIME entry is not required when a ω^2T value is set.	▪ SPEED, TIME, TEMP display fields and the on-screen keypad appear.  ▪ Press the display field of the item you wish to set, enter run parameters using the on-screen keypad and press the [Enter] button. ▪ The [Enter] button is replaced by the [OK] button. ▪ For details, refer to section Setting Run Parameters.

12	Check the entry and press the [OK] button.	▪ The run parameter entry/display screen reappears.  ▪ The SPEED, TIME, TEMP display fields and the on-screen keypad appear. ▪ Selecting a rotor in step 5 will make it possible to compute and display RCFmax and RCFavg values from the set SPEED value.
13	Press the white area in the ACCEL setting display field ((4)) or the DECEL setting value display field ((5)) and set the acceleration and deceleration modes. Example) ACCEL: 5 DECEL: 5	▪ The ACCEL/DECEL setting screen appears.  ▪ Enter the desired code number and press the [Enter] button. ▪ The [Enter] button is replaced by the [OK] button. Check the setting and press the [OK] button. The run parameter entry/display screen reappears. ▪ For details, see Setting acceleration and deceleration mode in section Setting Run Parameters. ▪ To set an RCF or ω^2T value, proceed to step 14 and step 17, respectively.
14	To set an RCF value, press the white area in the RCFmax setting display field ((6)) or the RCFavg setting display field ((7)). NOTE Actions up to step 16 are only required when setting an RCF value.	▪ The run parameter entry/display screen reappears.  NOTE To set an RCF value, the rotor must first be set. Set the flow as described in step 5. If a rotor has not been set, the operation will not be accepted.

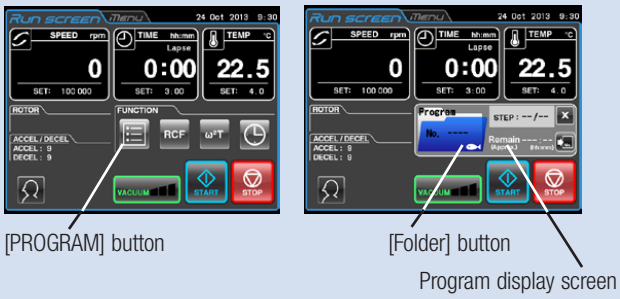
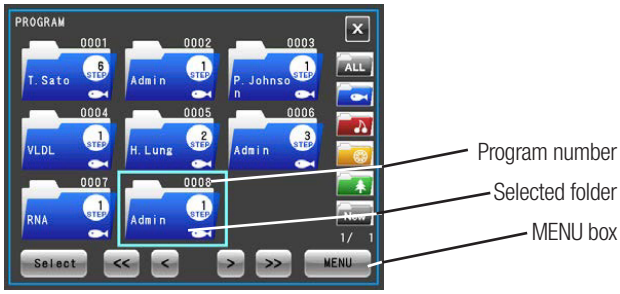
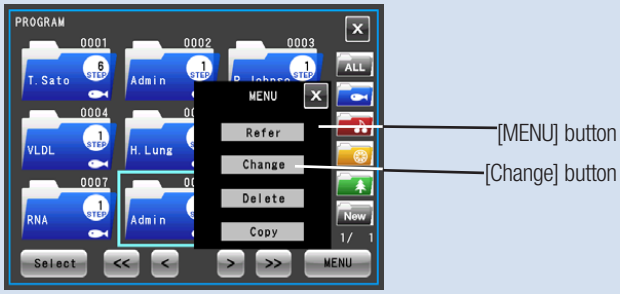
15	Press the display area of the item you wish to set and enter the desired value. Example: RCFmax: 513,700 x g	▪ The RCF setting screen appears.  ▪ When an RCFmax or RCFavg value is entered, the other value is automatically computed and displayed. ▪ Enter the desired value and press the [Enter] button.
16	Check the set value and the value computed from this and press the [OK] button.	▪ The RCFavg value is computed from the set RCFmax value and displayed.  ▪ The SPEED value computed from the set RCF value and information on the rotor is displayed in the SPEED display. NOTE If the SPEED value entered in step 11 differs from the SPEED value computed from the RCF value set here, the value entered in step 11 is replaced with the computed value.
17	To set a ω^2T value, press the white area in the ω^2T setting value display field. ((8)). NOTE Operations 17 and 18 are only required when setting a ω^2T value.	▪ The run parameter entry/display screen reappears.  NOTE To set a ω^2T value, SPEED must first be set. This operation is not accepted if the SPEED has not been set.

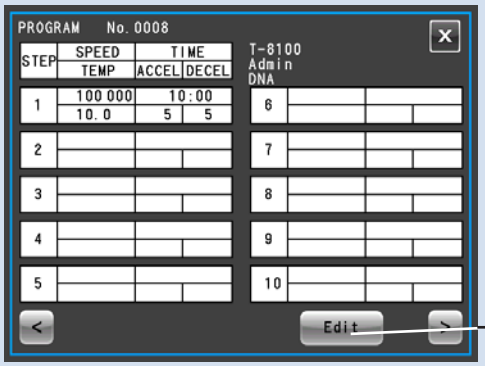
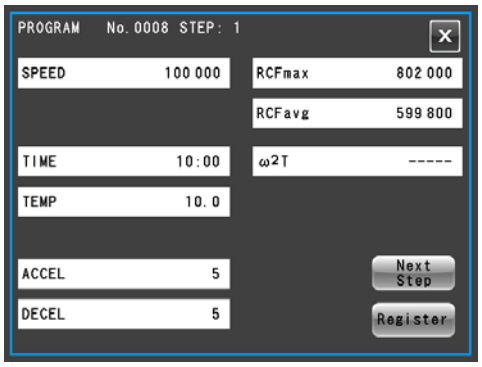
18	Press the ω^2T display area and enter the desired value. Example) ω^2T: 1.98×10^{12}	▪ The ω^2T setting screen appears.  ω^2T display, (Left area) Mantissa, (Right area) Exponent ▪ Enter the desired value and press the [Enter] button.
19	The [Enter] button is replaced by the [OK] button. Check the entered value and press the [OK] button.	▪ The run parameter entry/display screen reappears.  [Next Step] button [Register] button ▪ The TIME (run time) computed from the SPEED value and the ω2T value set in steps 17 and 18 is displayed in the TIME setting value field. ▪ To register step-mode operations, press the [Next Step] button and enter the next run parameter. For details, refer to section Step-Mode Operation Procedures. NOTE Pressing the [Register] button when no numeric value is entered in the SPEED, TIME, TEMP, ACCEL or DECEL field will generate an error, and the field where the error occurred turns red. An inappropriate setting value will also cause the field with the error to be displayed in red. Example: When SPEED and TIME are not set  2) Make sure to set the SPEED, TIME, TEMP, ACCEL and DECEL run parameters. (Program registration and operation can be performed without entering RCFmax, RCFavg or ω^2T.) 3) RCFmax and RCFavg cannot be registered without installing a rotor. 4) ω^2T cannot be registered without setting the SPEED.

20	Check the setting and press the [Register] button.	When a normal operation is registered ▪ The Program list screen appears.  Program registered in this example When a step-mode operation is registered ▪ The Check registered condition screen appears.  [X] button ▪ Pressing the [X] button in the Check registered parameter screen opens the Program list screen.
21	Check that the registered program has been added to the program list and press the [X] button.	▪ The Run screen reappears. 
22	Press the [X] button in the program display screen.	The Function Selection area reappears in the Program display screen.

Procedures for changing program run parameters

The following describes how to change run parameters for registered programs.

Step	Touchscreen operation	Screen displays and notes
1	Press the [PROGRAM] button in the Run screen (in the Function Selection Area).	
2	Press the [Folder] button on the Program display screen and press the number of the program in the program list you wish to change. This example shows how to change registered data for program No. 0008.	▪ The Program list screen appears. ▪ The selected folder is surrounded by a blue frame. 
3	Press the [MENU] button.	▪ The MENU box appears in the Program list screen. 
4	Press the [Change] button in the MENU box and make changes as described in steps 5 to 8 in Procedures for entering run parameters.	▪ The Program registration screen appears. ▪ The registered data is displayed on the screen. 

5	To change run parameters, press the [Next] button.	▪ The Run parameter setting/display screen appears. 
6	Press a field in Step 1, check that the field turns blue and press the [Edit] button.	▪ The run parameter entry/display screen appears.  ▪ When registering multiple run parameters (step-mode operation registration), press the STEP you wish to change and press the [Edit] button.
7	Press the field of the run parameter you wish to change and change the registration as described in steps 10 to 18 in Procedures for entering run parameters.	▪ To add new run parameters, press the empty area (STEP 2 in this example) after the registered STEP and press the [Edit] button.
8	Check the changes and press the [Register] button.	

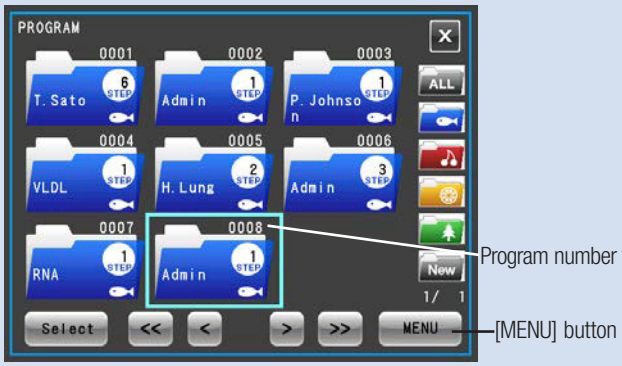
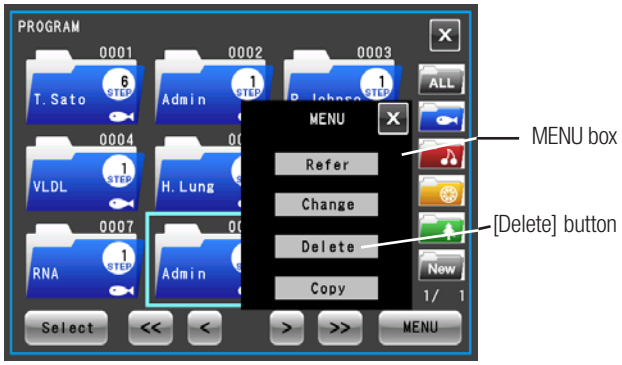
NOTE

1) When changes are stored, the previous run parameter is deleted and the changed parameter becomes effective.

2) Run parameters cannot be recorded during operation (when the rotor is turning). Perform this operation when the centrifuge is not running.

Procedure for deleting programs

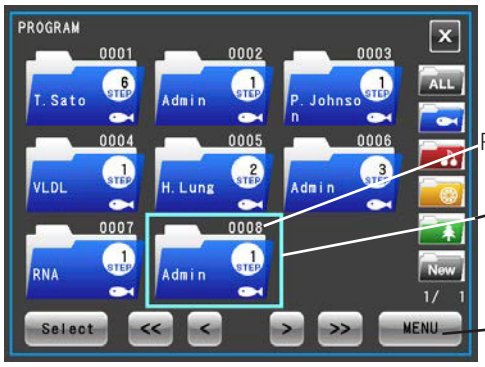
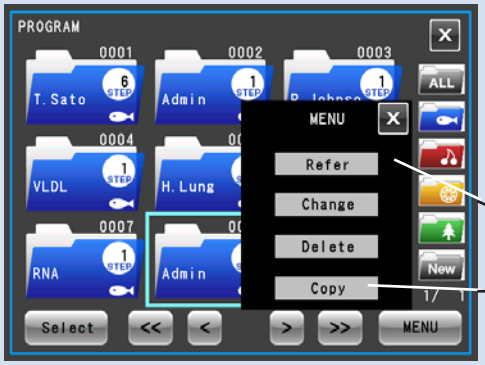
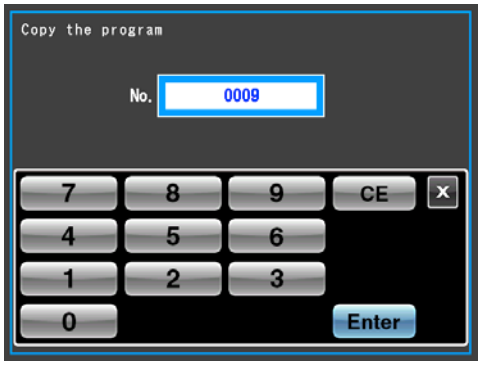
The following describes how to delete registered programs.

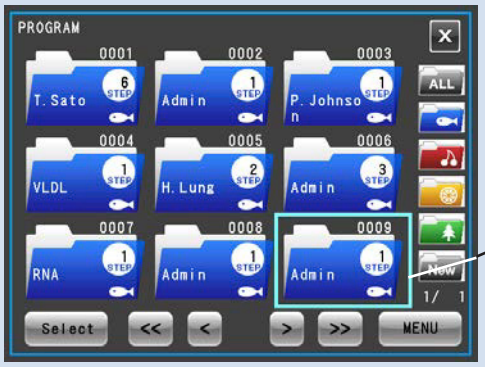
Step	Touchscreen operation	Screen displays and notes
1	Open the Program list screen and press the program folder you wish to delete as described in step 1 in Procedures for changing program run parameters. This example shows how to delete program No. 0008.	▪ The program list appears and the frame of the selected folder turns blue. 
2	Press the [MENU] button.	The MENU box appears in the Program list screen. 
3	Press the [Delete] button in the Edit field.	▪ A delete confirmation message appears. 
4	Press the [YES] button in the Delete confirmation message.	▪ The file selected in the program list is deleted. NOTE A program that is deleted cannot be restored. Check carefully before deleting any files.

Operation procedures for copying programs

The following describes how to copy a registered program and register the result as a new program.

This is a convenient method to use when you wish to register a new program by changing part of a registered program.

Step	Touchscreen operation	Screen displays and notes
1	Open the Program list screen following step 1 in Procedures for changing program run parameters.	
2	Press the program folder you wish to copy from the program list. This example shows how to copy program No. 0008.	▪ The Program list screen appears. 
3	Press the [MENU] button.	▪ The MENU box appears in the Program list screen. 
4	Press the [Copy] button in the MENU field and enter the number of the program you wish to register.	▪ The Program No. entry screen appears.  ▪ The unregistered program with the lowest number is displayed when the screen changes. ▪ To register to another number, press the Program No. entry field and enter the desired number using the on-screen keypad.

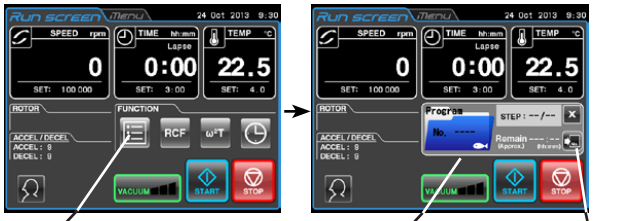
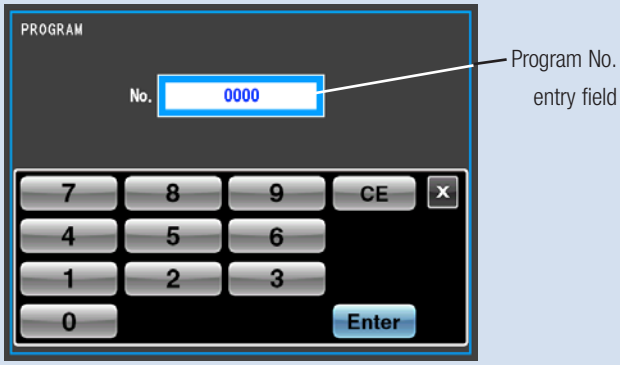
5	Press the [Enter] button. (The [Enter] button will not accept entry of a program number already entered.)	▪ The Program list screen appears.  The copied and newly registered program folder ▪ The copied program is now registered under a new number.

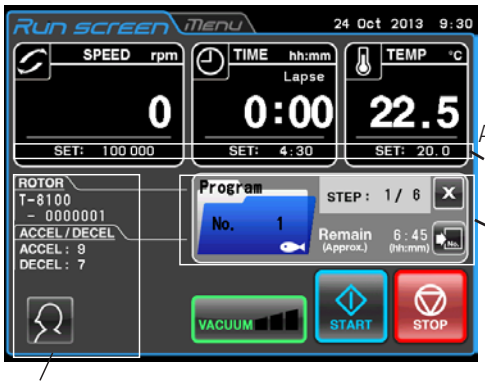
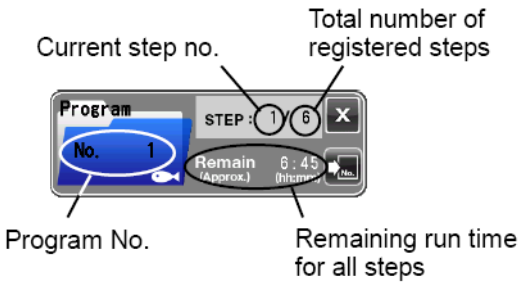
Programmed Operation Procedures

The following describes procedures for “programmed operations” by calling up registered run parameters.

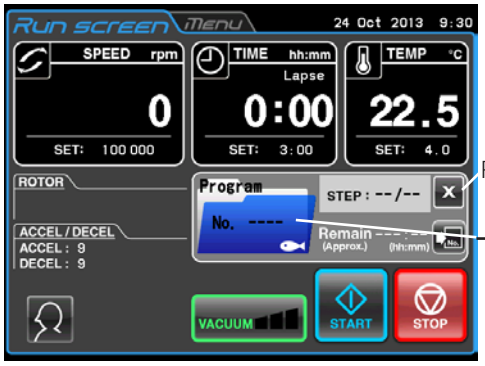
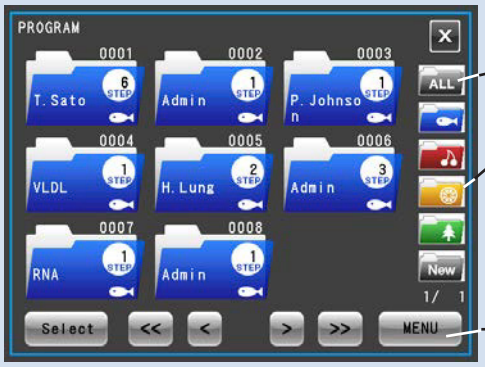
This is convenient when you wish to use the same run parameters repeatedly.

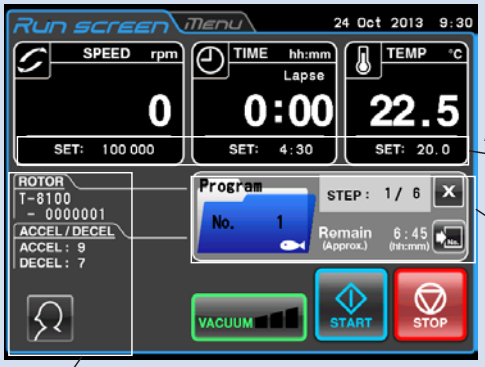
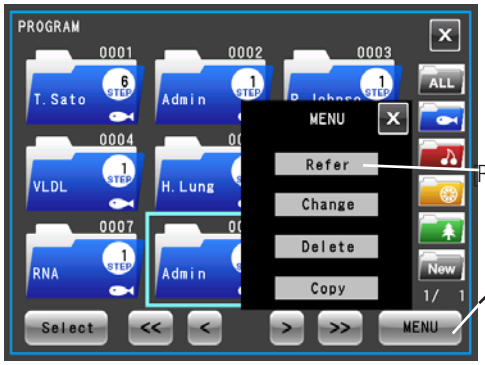
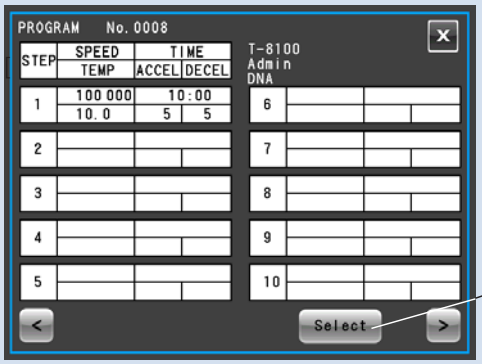
(1) If the registered program number is known

Step	Touchscreen operation	Screen displays and notes
1	Turn on the centrifuge POWER switch.	The Run screen appears.
2	Press the [PROGRAM] button in the Function Selection Area.	
3	Press the [Program No.] button on the Program display screen.	▪ The Program No. entry screen appears. 

4	Use the on-screen keypad to enter the number of the program you wish to call up and press the [Enter] button.	▪ The display once again shows the Run screen.  ▪ The number of the program called up is displayed in the Program display screen. ▪ You are now able to set and display run parameters (SPEED, TIME, TEMP, ACEL/DECEL, ROTOR, USER). ▪ The Program display screen displays the following data.  For details regarding step mode operation, refer to section Step-Mode Operation Procedures in section Step-Mode Operation Procedures
5	Do not change the run parameters after starting a run.	▪ Operate the centrifuge according to the instructions given in section Operation Procedures. NOTE If you reenter (change) the run parameters (such as SPEED, TIME, etc.) after having called up a program, this will cancel the program called up.

(2) If the registered program number is not known

Step	Touchscreen operation	Screen displays and notes
1	Turn on the centrifuge POWER switch.	The Run screen appears.
2	Press the [PROGRAM] button in the Function Selection Area.	▪ The Function Selection Area switches to the Program display screen. 
3	Press the [Folder] button on the Program display screen.	▪ The Run screen replaces the Program list screen. 
4	a) If the color or design of the registered folder is known, press the button with that color (or design). b) If the color or design of the registered folder is not known, press the [ALL] button.	▪ Pressing a color (or design) button will display only the program(s) registered under that color (design). ▪ Pressing the [ALL] button will display all folders in order, regardless of their color (or design). ▪ Use the [<<], [<], [>] and [>>] buttons to turn pages.

5	a) If the [Folder] button display shows the program folder you wish to call up, press that [Folder] button. Check that the periphery of the folder turns blue and press the [Select] button.	▪ The display once again shows the Run screen. 
	b-1) To confirm registered data, press the [Folder] button you wish to verify, and press the [MENU] button after the folder turns blue.	▪ The MENU box appears in the Program list screen. 
	b-2) Press the [Reference] button in the [MENU] field. Press the [Select] button if the target program appears.	▪ The Check registered parameter screen appears  ▪ If the program that appears is not the program you wanted, press the [X] button to return to the Program list screen and check a different folder.
6	Do not change the run parameters after calling up the program.	▪ Operate the centrifuge according to the instructions given in section Operation Procedures. ▪ If you reenter (change) the run parameters (such as SPEED, TIME, etc.) after having called up a program, this will cancel the program called up.

NOTE

To combine programmed operation and RTC operation (refer to section RTC (Real Time Control) Operation), set RTC after calling up the program. When a program is to include step-mode operation, the run time of all steps must be calculated in order to compute the RTC start time, as the program cannot be called up once RTC has been set.

Step-Mode Operation Procedures

This centrifuge is provided with a “step-mode operation” function that can store two or more run parameters in one program memory area and a total of 30 steps. This allows changes in speed, run time, temperature and other conditions during operation.
For example, you could set the speed of a step to 0 rpm to stop rotation to enable opening and closing vacuum leaks and doors. This makes it possible to register in advance the repeated counting of samples that are removed and processed during each run under the same separation conditions, thus ensuring that samples are not processed too many or too few times.
Operation procedures are described below using examples.

Registration Procedures for Step-Mode Operation

[Setting example]
The following describes the setup procedures for continuous operation under the three-step run parameters shown in the figure below.
In this example, the operations described in Figure 13 Example of step-mode operations are to be performed automatically.

	Step 1	Step 2	Step 3
Speed	100,000 rpm	80,000 rpm	60,000 rpm
Run time	1 h 30 min	1 h	30 min
Temperature	4.0 °C	4.0 °C	4.0 °C
Acceleration mode	9	9	9
Deceleration mode	9	9	7

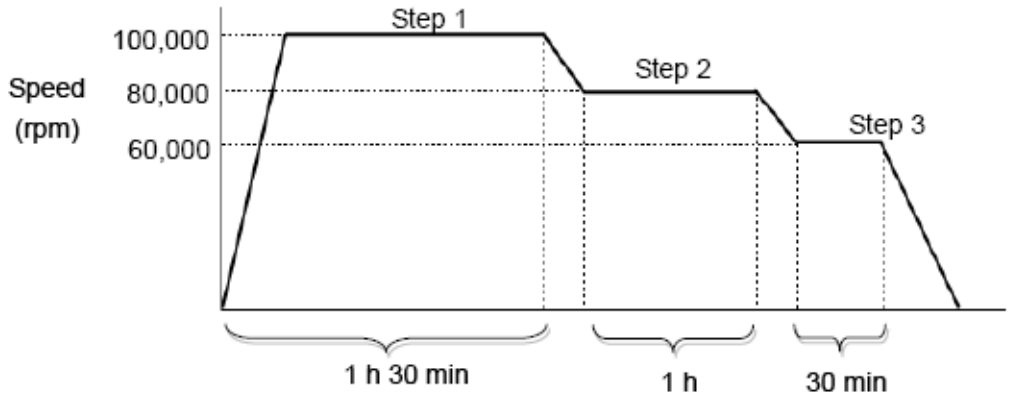
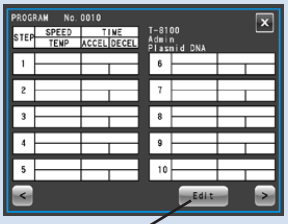
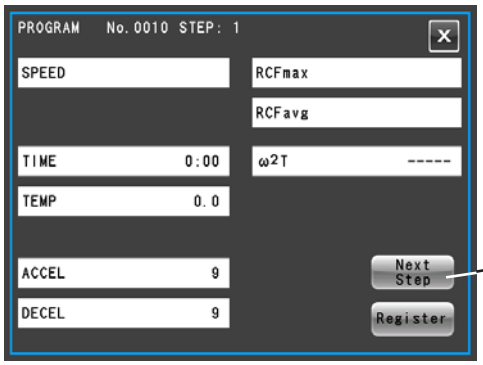
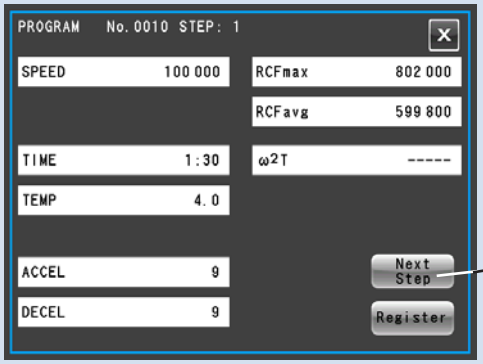
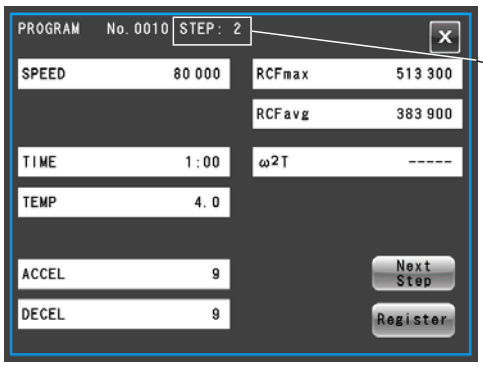
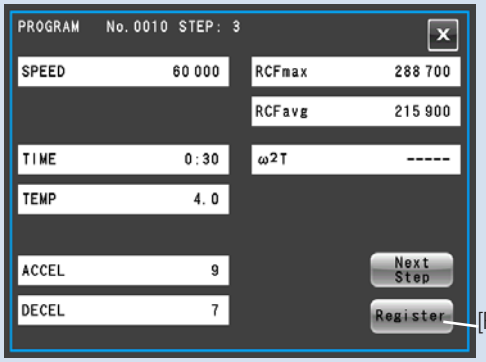
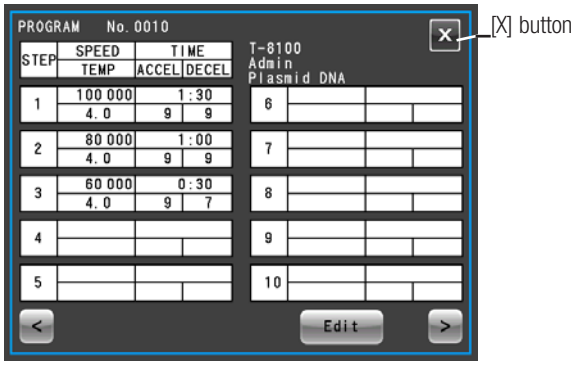
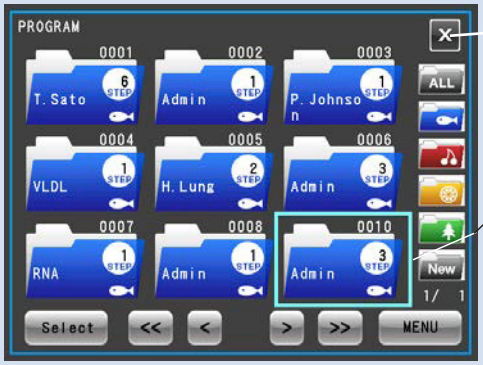


Figure 13: Example of step-mode operations

Step	Touchscreen operation	Screen displays and notes
1	As described in steps 1 to 8 in Procedures for entering run parameters in section Procedures for Entering a Program, enter the program number, registered rotor, user and remarks, select a folder color and press the [Next] button. In this example, the steps are stored in program number 10.	▪ Program registration screen  [Next] button Run parameter setting/display  [Edit] button
2	Press a field in Step 1, check that the field turns blue and press the [Edit] button.	▪ The run parameter entry/display screen appears.  [Next Step] button
3	Enter the run parameters for step 1 from the run parameter entry/display screen. STEP 1 SPEED: 100,000 rpm TIME 1 h 30 min TEMP 4.0 °C ACCEL: 9 DECEL: 9	▪ The run parameter entry/display screen appears.  [Next Step] button Registering a rotor will make it possible to compute and display RCFmax and RCFavg values from the set SPEED value.
4	Press the [Next Step] button and enter the run parameters for step 2 from the run parameter entry/display screen for step 2. STEP 2 SPEED: 80,000 rpm TIME : 1 h TEMP: 4.0 °C ACCEL: 9 DECEL: 9	▪ The Run parameter entry/display screen shown in step 2 appears.  Entry screen STEP No. ▪ The value entered in STEP 1 is copied to the run parameter entry/display screen.

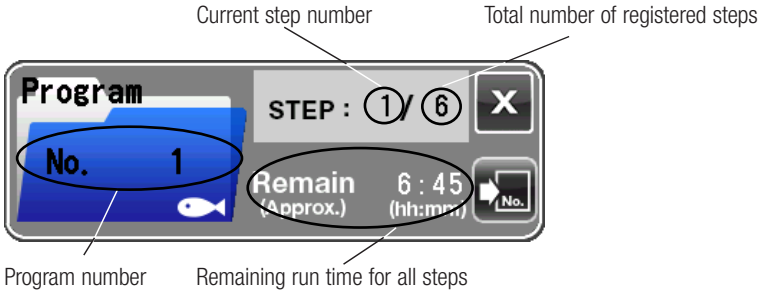
5	Press the [Next Step] button and enter the run parameters for step 3 from the run parameter entry/display screen for step 3. STEP 2 SPEED: 60,000 rpm TIME: 30 min TEMP: 4.0 °C ACCEL: 9 DECEL: 7	▪ The run parameter entry/display screen in STEP 3 appears.  ▪ As in STEP 1, the value entered in STEP 2 is copied to the run parameter entry/display screen.
6	Press the [Register] button.	▪ The run parameter setting/display screen reappears.  ▪ The values entered are displayed in the STEP 1, 2 and 3 fields. ▪ To correct entry errors, press the STEP field you wish to correct and press the [Edit] button when the field turns blue.
7	Check the entries displayed for each step in the run parameter setting/display screen. If these are correct, press the [X] button and press the [X] button on the Program registration screen.	▪ The Program list screen reappears. 
8	Check that the folder you just registered has been added to and is displayed on the Program list screen before pressing the [X] button.	▪ The Run screen reappears.

Step-Mode Operation Procedures

Call up the number of the program where the step-mode operation is registered and run it according to the instructions in section Operation Procedures.

Once you have called up the program, begin operation without changing the run parameters. (Changing the run parameters will cancel the program called up.)

1. The Program display screen in the Run screen displays the following data.
   The remaining run time for all steps is the total TIME (run time) for all set steps, minus the time that the centrifuge has already run. (In this example, the run has not started yet, so the total 3 hour run time is displayed as the remaining run time).
   Since this time does not include the deceleration time between different steps, it does not indicate the exact time remaining. Use this information as a rough indication of the time remaining.



2. When acceleration is performed before the next step begins, the acceleration time is included in the time remaining. However, time for deceleration is not counted, and the time count resumes when the following step begins.
3. Run parameters cannot be stored during operation (while the rotor is turning). Perform this operation when the centrifuge is not running.
4. To combine step-mode operation and RTC (Real Time Control) operation (refer to section RTC (Real Time Control) Operation), set RTC after calling up the program.
   The centrifuge totals the run time for all programmed operation steps and calculates the RTC start time.
   Programs cannot be called up after RTC has been set.
5. If a step stores a speed exceeding the maximum allowable speed for your rotor, the incorrect SPEED setting alert will be triggered. Check the speed settings in all steps and correct as necessary.
6. Press the [STOP] button if you need to stop the run. This will stop the rotor and prevent the centrifuge from proceeding to the next step.

Procedures for Registering Step-Mode Operation that Includes Stops

Follow the instructions in Registration Procedures for Step-Mode Operation. Perform the registration procedures described below.

[Setting example]

The following describes the setup procedures for continuous operation under the five run parameters (including a 0 rpm setting) shown in the figure below.

The operations described in Figure 14 Example of step-mode operations which include stops, if the instructions for this example are followed, will be performed automatically.

	Step 1	Step 2	Step 3	Step 4	Step 5
Speed	50,000 rpm	0 rpm	50,000 rpm	0 rpm	50,000 rpm
Run time	1 hour	HOLD	1 hour	HOLD	1 hour
Temperature	15.0 °C	15.0 °C	15.0 °C	15.0 °C	15.0 °C
Acceleration mode	9	—	9	—	9
Deceleration mode	7	—	7	—	7

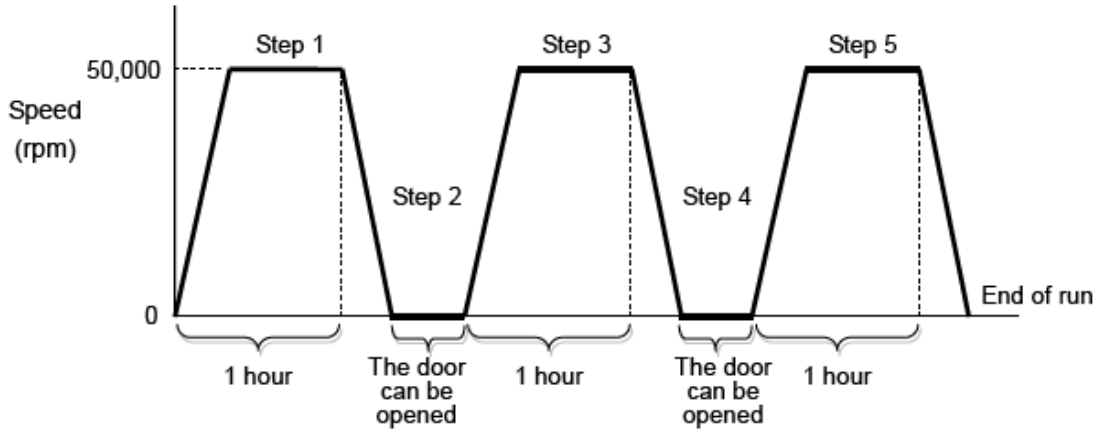
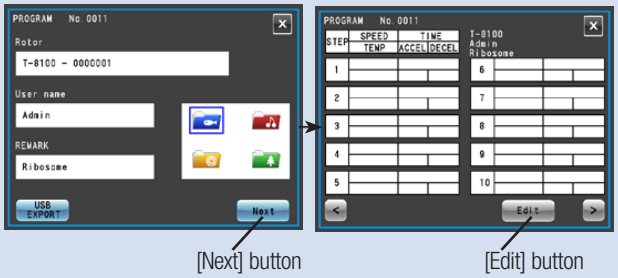
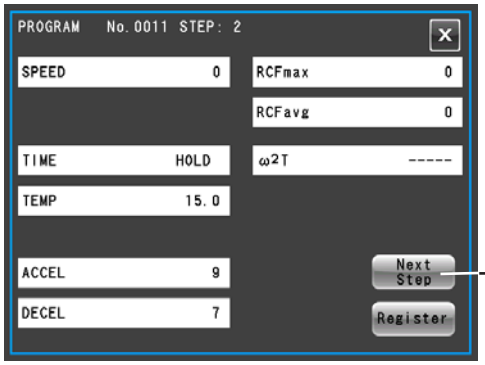
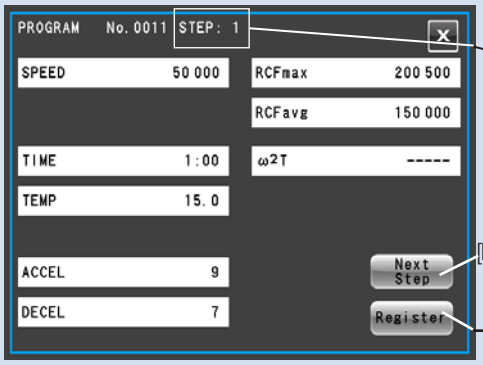
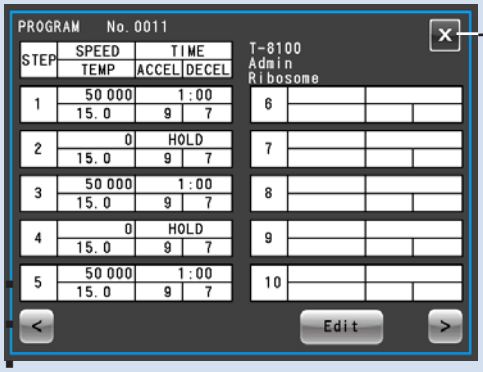
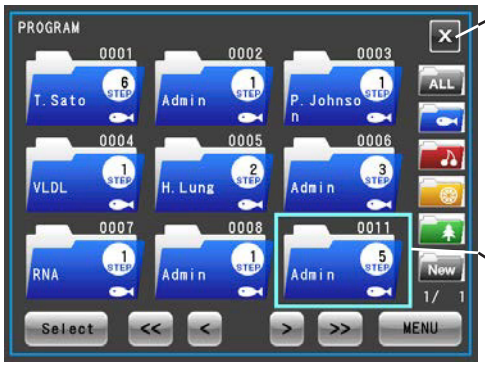


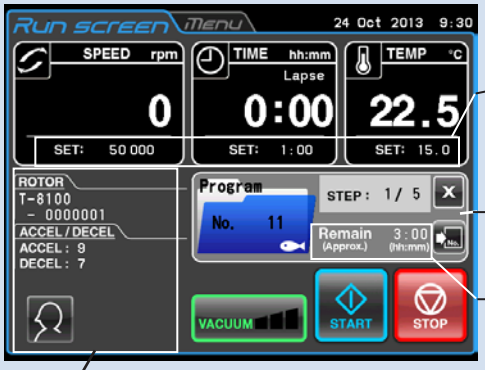
Figure 14: Example of step-mode operations which include stops

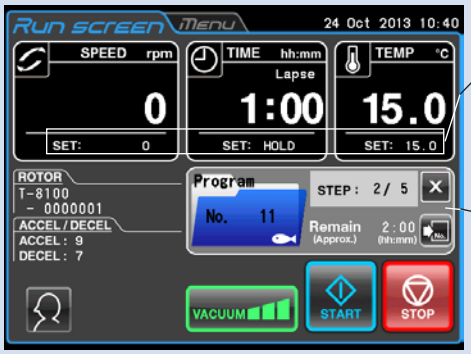
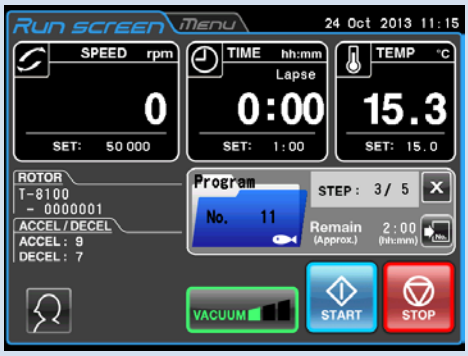
Step	Touchscreen operation	Screen displays and notes
1	As described in steps 1 to 8 in Procedures for entering run parameters in section Procedures for Entering a Program, enter the program number, registered rotor, user and remarks, select a folder color and press the [Next] button. In this example, the steps are stored in program No. 11, blue folder.	▪ Program registration screen Run parameter setting/display screen 

2	Enter the run parameters for step 1 as described in "(1) Registration Procedures for Step-Mode Runs." STEP 1 SPEED: 50,000 rpm TIME: 1 hour TEMP: 15.0 °C ACCEL: 9 DECEL: 7	▪ The run parameter entry/display screen appears.  ▪ Registering a rotor will make it possible to compute and display RCFmax and RCFavg values from the set SPEED value.
3	Press the [Next Step] button and enter the run parameters for step 2 from the run parameter entry/display screen. STEP 2 SPEED: 0 rpm TEMP: 15.0 °C	▪ The Run parameter entry/display screen shown in step 2 appears.  ▪ When a SPEED of 0 rpm is set, TIME is automatically set to "HOLD." ▪ An arbitrary TIME setting cannot be made.
4	Press the [Next Step] button and enter the run parameters for step 5 from step 3.	
5	Finally, press the [Register] button.	▪ The Run parameter setting screen reappears.  ▪ The values entered are displayed in the STEP 1 to 5 fields. ▪ To correct entry errors, press the STEP field you wish to correct, and press the [Edit] button to make corrections when the field turns blue.

6	Check the entries displayed for each step in the run parameter setting/display screen. If these are correct, press the [X] button and press the [X] button on the Program registration screen.	▪ The Program list screen reappears. 

Procedures for Step-Mode Operations that Include Stops

Step	Touchscreen operation	Screen displays and notes
1	Call up the desired program according to the instructions in section Programmed Operation Procedures. In this example, program No. 11, registered in the previous procedure, is called up.	▪ The Program display screen appears in the run screen.  ▪ The number of the program called up is displayed in the Program display screen. ▪ You are now able to set and display run parameters (SPEED, TIME, TEMP, ACEL/DECEL, ROTOR, USER). ▪ The run time for the 0 rpm setting is not included in the remaining run time for step operation.
2	Install the rotor, close the door and press the [START] button according to the instructions in section Operation Procedures. When processing samples sensitive to increases in temperature, press the [VACUUM] button to obtain a high vacuum level in the rotor chamber before pressing the [START] button.	▪ The vacuum pump starts operating and temperature control begins. ▪ The [START] button lamp flashes and the rotor starts turning. ▪ The indicator of the [VACUUM] button displays the vacuum level in the rotor chamber. ▪ The time count begins. ▪ When the set speed is reached, the [START] button lamp changes over to steady lighting and a white dot of light starts to spin around the button. ▪ The rotor remains in standby at 4,000 rpm until a medium vacuum level is reached.

3	When the run time for step 1 has elapsed, processing proceeds to step 2 and the rotor decelerates and stops.	▪ The Program display screen in the Run screen proceeds to step 2.  A run parameter called up from the program Program display screen ▪ The Program display screen proceeds to step 2 and SPEED is set to 0 rpm and TIME to “Hold”.
4	When the rotor stops turning, press the [VACUUM] button to return the rotor chamber to normal atmospheric pressure, open the door and remove the rotor.	▪ Process the samples as necessary.
5	Install the rotor again and close the door before pressing the [START] button. When processing samples sensitive to increases in temperature, press the [VACUUM] button to obtain a high vacuum level in the rotor chamber before pressing the [START] button.	▪ The Program display screen in the Run screen proceeds to step 3.  ▪ For a step where the speed is set to [0] rpm, the user must press the [START] button to proceed to the next step of processing. After performing the required processing, install the rotor, close the door and make sure to press the [START] button.
6	Repeat these operations as required.	

NOTE

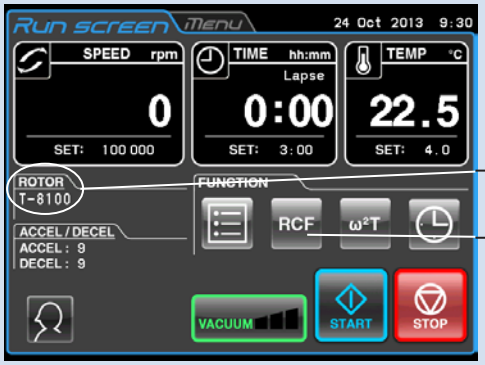
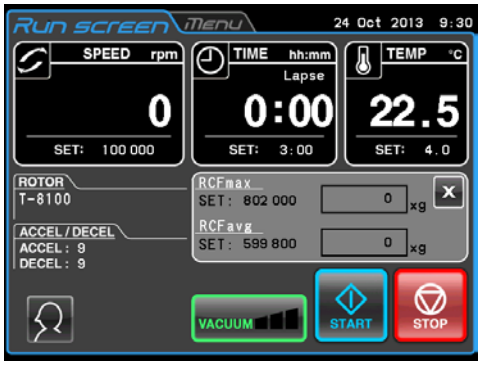
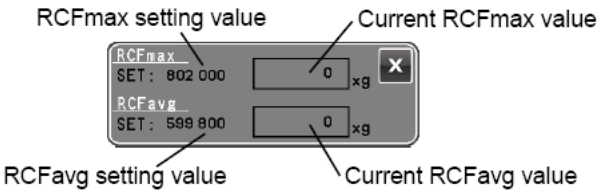
1. If the run parameters are changed during step operation or during the “0” rpm step, the program will be canceled and no further steps will be processed.
2. When the rotor is removed for performing a “0” rpm step, close the door of the rotor chamber until the rotor is installed again to prevent unnecessary moisture buildup in the rotor chamber.
3. In a step-mode operation which includes stops, run time calculation of all steps does not include the run time of [0] rpm steps. Step-mode operation cannot be combined with RTC (Real Time Control) operation (refer to section RTC (Real Time Control) Operation).

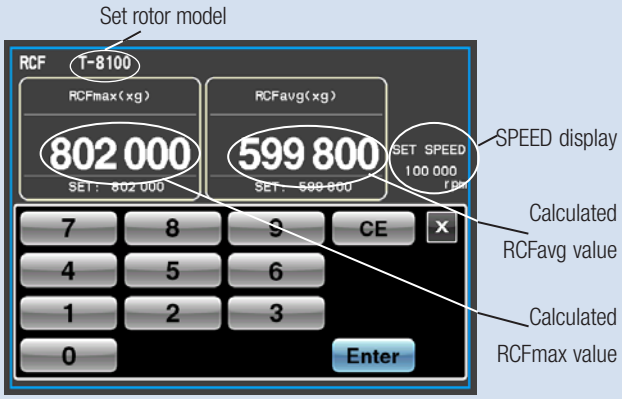
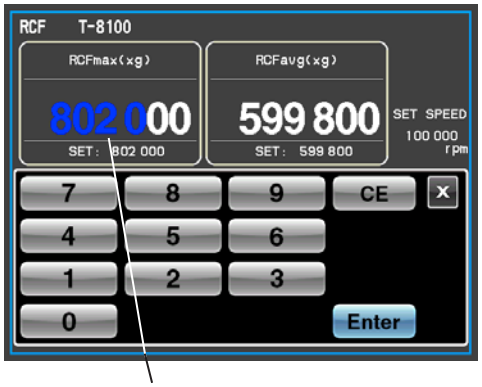
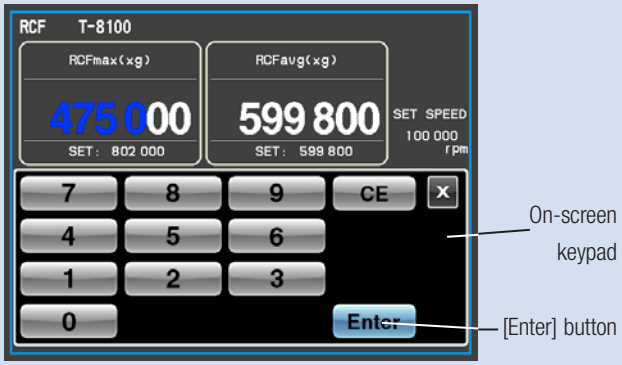
RCF (Relative Centrifugal Force) Display and Setting Function

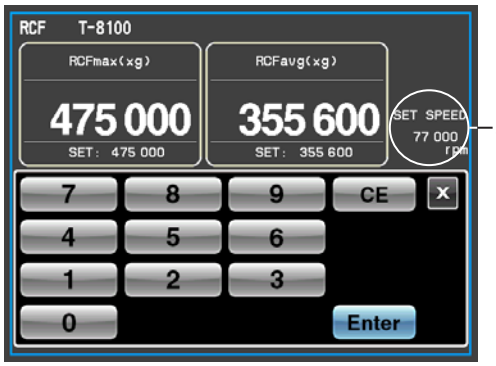
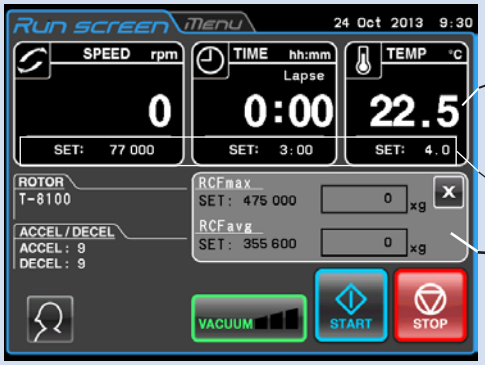
This centrifuge stores the maximum and average radii of each rotor in internal memory. When a speed is set, the centrifuge automatically calculates and displays the RCFmax value (the maximum centrifugal force of each rotor) and the RCFavg value (the average centrifugal force of each rotor). Likewise, when an RCFmax value or RCFavg value is set, the centrifuge will automatically calculate and display the speed. The following is a description of how to display and set RCF.

NOTE

1. When the centrifuge calculates the RCF value from the set speed or the current speed, these numeric values may deviate slightly from one another.
2. Some of the rotors available for this centrifuge have external and internal tube cavities (Refer to the instruction manual supplied with the rotor.) When rotors having both internal and external tube cavities are used, the instrument can calculate the speed and RCF value of the external tube cavities.

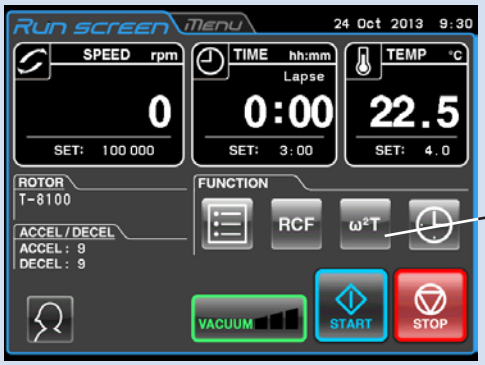
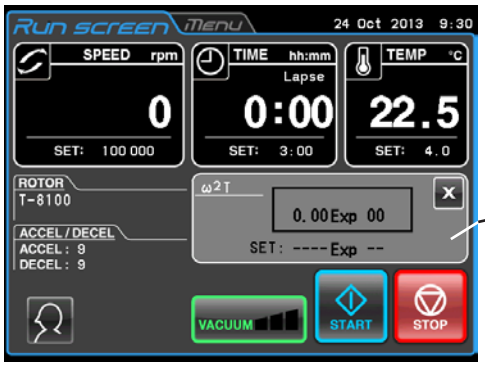
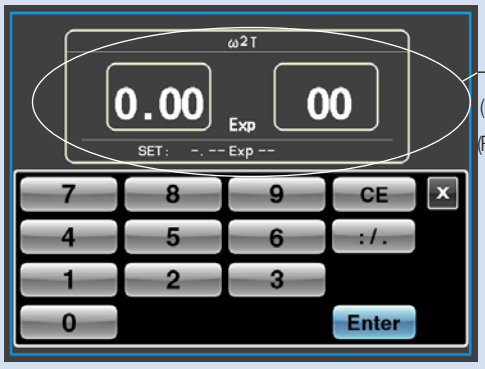
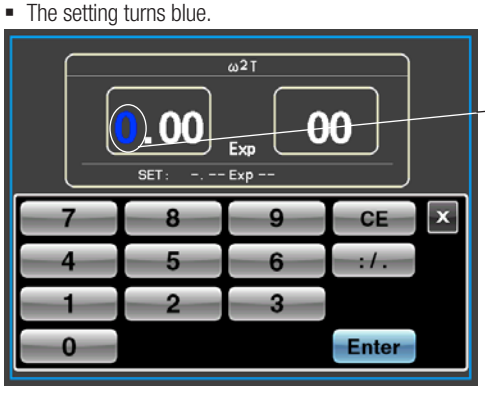
Step	Touchscreen operation	Screen displays and notes
1	Press the rotor indicator field in the Run screen. If the desired rotor has not been set, press the rotor indicator field to select the desired rotor. For information on how to select a rotor, refer to section Rotor Selection.	
2	Press the [RCF] button in the Function Selection area of the Run screen.	▪ The Function Selection area changes over to the RCF display screen.  RCF display screen ▪ The [RCF] button is not enabled when no rotor has been installed. (The RCF display screen cannot be accessed.) ▪ The RCF display screen displays the following data. 

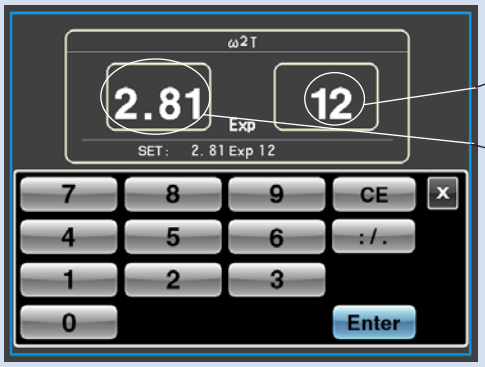
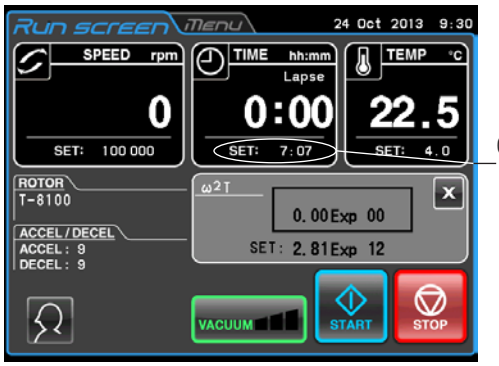
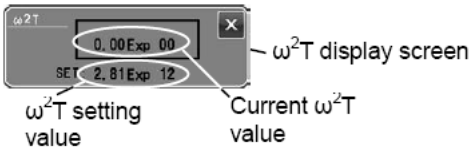
3	Press the RCF display screen field.	▪ The RCF setting screen appears.  ▪ The RCF setting screen displays the RCFmax and RCFavg values computed from the currently displayed SPEED value and the rotor set in step 1.
4	Press the field of the item you wish to set. In this example, 475,000 x g will be set as the RCFmax value which is displayed when the RCF field is pressed.	▪ The set value turns blue indicating it is waiting for user input.  All except the last two digits turn blue.
5	Press the on-screen keypad to enter a setting value.	▪ The value entered is displayed in blue. 

6	Check the value entered and press the [Enter] button.	▪ The entered value is confirmed.  SPEED display ▪ Calculates and displays the RCFavg value from the RCFmax value entered and the rotor set in step 1 (the value in this case is 355,000 x g). ▪ Calculates and displays in the SPEED display the SPEED from the RCFmax value entered and the rotor set in step 1 (the value in this case is 355,000 x g). ▪ Use the same procedure as for RCFmax to set RCFavg.
7	Press the [X] button to return to the Run screen.	▪ The Run screen appears.  Operating condition display field Setting value display field RCF display screen ▪ The RCF display screen shows the set RCFmax/RCFavg values. ▪ The SPEED setting value display field sets and displays the value (76,900 rpm) calculated from the RCF value.

ω^2T Operation

This function is used to indicate ω^2T, the centrifugal effect (a value obtained by adding the run time to the angular velocity squared). When the same rotor is used, setting the ω^2T makes it possible to produce a centrifugation pattern that is easily reproducible.

Step	Touchscreen operation	Screen displays and notes
1	Set the speed according to the instructions in section Setting Run Parameters.	 [ω^2T] button
2	Press the [ω^2T] button in the Function Selection Area on the Run screen.	▪ The Function Selection Area changes over to the ω^2T display screen.  ω^2T display
3	Press the ω^2T display screen field.	▪ The ω^2T setting screen appears.  ω^2T setting value (Left area) Mantissa (Right area) Exponent
4	Press the field of the item you wish to set.	▪ The setting turns blue.  blue

5	Press the on-screen keypad to enter a setting value. When the mantissa has been entered, press the exponent entry field, enter the exponent and press the [Enter] button. Example: To enter [2.81 x 10^{12}]	 ▪ Press the [: /.] button to enter mantissa decimals.
6	Press the [X] button on the on-screen keypad.	▪ The Run screen reappears.  ▪ The ω^2T display screen displays the following data.  ▪ The run time (7h07min) is computed from set speed and the ω2T value and is displayed in the Run time area. ▪ When the ω^2T set value and the current ω^2T value are identical, deceleration begins and the current ω^2T value shows the total value until the rotor stops.

NOTE

1. If you reset the SPEED or TIME after having set the ω^2T value, this will cancel ω^2T operation.
2. Pressing the [X] button in the ω^2T display screen will redisplay the Function Selection Area, but the ω^2T setting is retained and the [ω^2T] button turns blue.
3. To cancel ω^2T operation, change the speed or run time setting.

RTC (Real Time Control) Operation

This centrifuge contains an internal clock allowing you to operate the centrifuge between a set start time and end time. This function for operating the centrifuge between set time intervals is called Real Time Control (RTC).
The RTC operation procedures are described below using examples.

Example: To operate the centrifuge under the following run parameters, beginning with rotor installation on October 24 and removing the samples around 9:30 the next morning.

1. Rotor: T-8100
2. Speed: 100,000 rpm
3. Separation time: 3 hours
4. Control temperature: 4 °C
5. Acceleration mode: 9
6. Deceleration mode: 9

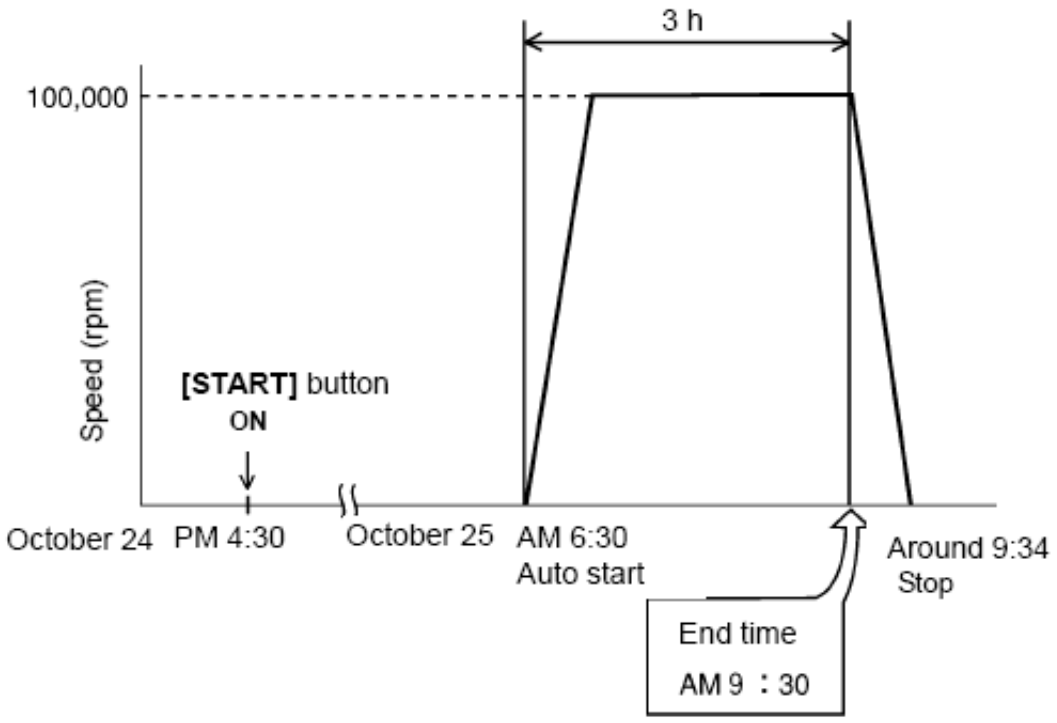
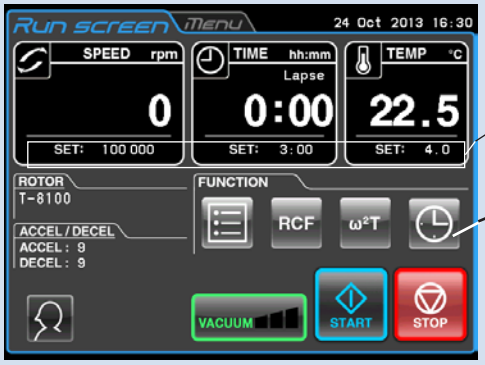
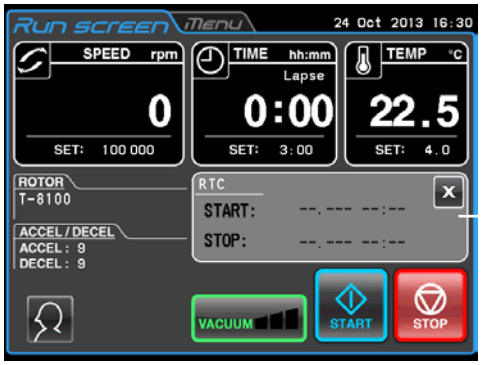
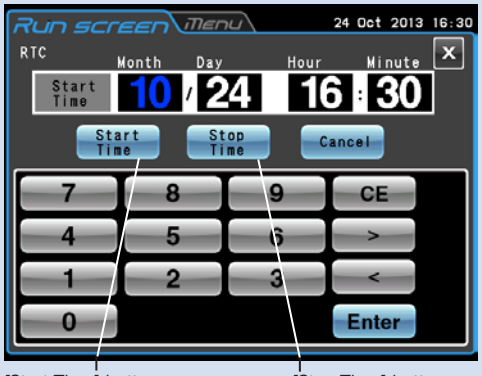
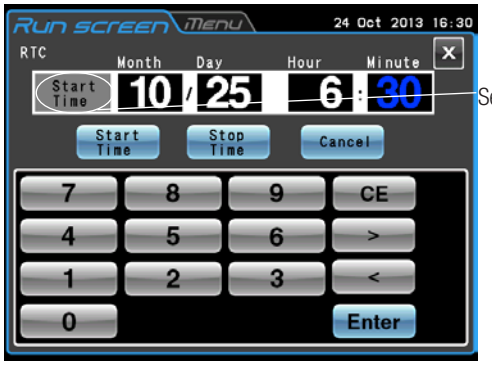
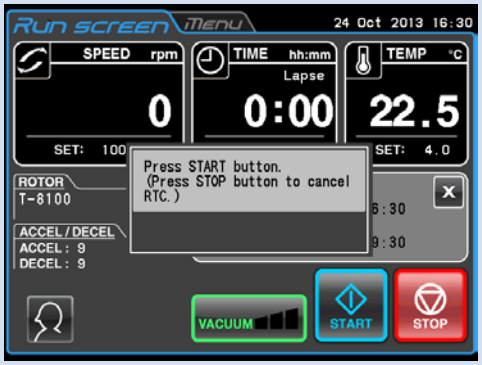
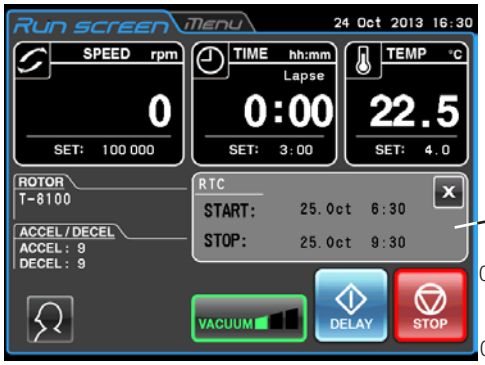


Figure 15: Example of RTC operation

In this example, set the above run parameters (1) to (6), then set the RTC operation start time to 6:30 on October 25, and start the centrifuge.
(Note that the same operation will be performed if you set an end time of 9:30 instead of the start time (6:30).)

Step	Touchscreen operation	Screen displays and notes
1	Set run parameters according to the instructions in section Setting Run Parameters.	▪ The set value is displayed in the setting value display field.  Setting value display field [RTC] button ▪ When setting run parameters, do not set HOLD, but enter a numeric value for the run time (separation time).
2	Press the [RTC] button in the Function Selection Area of the Run screen.	▪ The set value is displayed in the setting value display field.  RTC display
3	Press the RTC display screen field.	▪ The RTC setting screen appears.  [Start Time] button [Stop Time] button ▪ The current date and time are displayed, the month is displayed in blue and the unit is ready to accept entries.

4	To set the start time, press the [Start Time] button and to set the stop time, press the [Stop Time] button. Enter the start time and stop time using the on-screen keypad.	 Set state display ▪ Press the [Start Time] button to display the [Start Time] in the Set state display and press the [Stop Time] to display the [Stop Time] in the set state display. ▪ Press the input fields to make them ready to accept entries. Use the [<] and [>] buttons to switch between items (month, day, hour, minute). ▪ Enter a numeral between 0 and 23 (24-hour clock) for [Hour]. ▪ Enter a date and time later than the current time. The stop time should take centrifugation time into account and the centrifugation start time should be set to a time later than current time.
5	Press the [Enter] button.	▪ A message prompting you to check operation appears. 
6	Press the [START] button. RTC will not start unless you press the [START] button. The [STOP] button allows you to cancel the RTC operation setting.	 RTC display (Upper row) Operation start time (Lower row) Operation stop time ▪ The vacuum pump starts up and temperature control begins. ▪ The RTC display screen shows the START time and STOP time, indicating that RTC operation is ready to start. ▪ The centrifuge will start automatically at the set time.

1. In the following situations RTC cannot be set.
   - » When TIME (run time) is set to HOLD (continuous operation) in the Run screen: Change the run time (centrifugation time) to a numeric value instead of HOLD.
   - » When it is past the start time:
     Set the start time to a time later than the current time.
   - » When the start time is more than 20 days later than the current date:
     Set to a time that is within 20 days of the current date.
2. To change the TIME (run time) on the Run screen after setting RTC, cancel RTC and reset the TIME. To cancel RTC, press the [STOP] button or press the RTC field and press the [Cancel] button on the RTC setting screen.
3. When logging in as a user (refer to section Logging in as a User), press the [Cancel] button in the RTC screen to display the PIN entry field shown below. Enter your log in PIN or the administrator PIN in this field.

4. To combine programmed operation (including step-mode operation) and RTC operation, set RTC after calling up the program. The centrifuge totals the run time for all programmed operation steps to calculate the RTC start time. Programs cannot be called up after RTC has been set.
   RTC operation is not possible when step-mode operation includes a 0 rpm step.
5. Press the [STOP] or [Cancel] button to stop a run during operation or standby. This cancels RTC operation and stops the rotor.

Features of the MENU Screen

These features have been designed to make your Sorvall WX+ Ultra series centrifuge easier to use by including, for example, the Run History function shown in Figure 16 MENU screen.

The MENU screen can be displayed by pressing the MENU tab on the touchscreen.

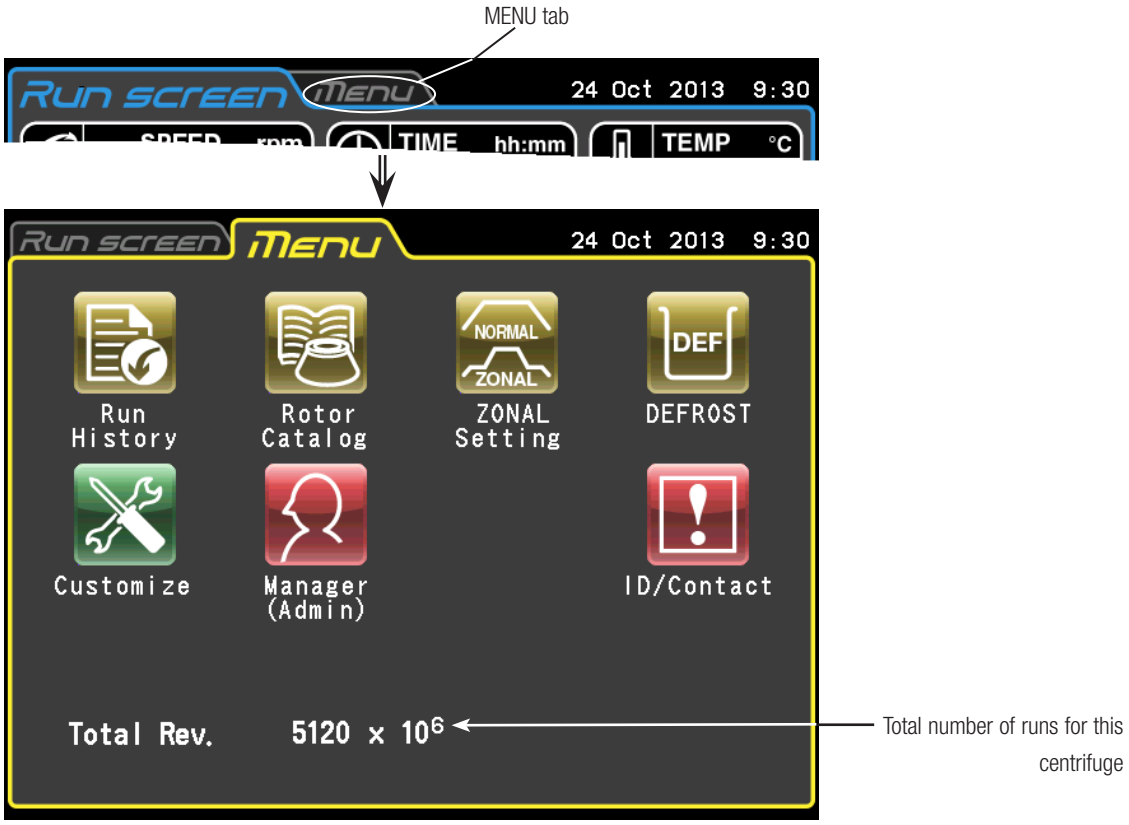
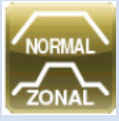


Figure 16: MENU screen

The functions of the MENU screen icons are described below.

Name	Icon	Function
Run History	 Run History	The centrifuge can automatically store up to 5,120 run parameters from past runs. For details, refer to section Outputting and Reusing Run History Display and Run Parameters.
Rotor Catalog	 Rotor Catalog	Allows you to browse available rotors and their specifications. For details, refer to section Rotor Catalog.
Zonal Settings	 Zonal Settings	Allows you to switch between normal and zonal operation. For details, refer to section Zonal Operation Procedures.
Defrost function	 DEFROST	Starts the Defrost function that heats the rotor chamber to quickly remove frost and moisture. For details, refer to section Defrost.

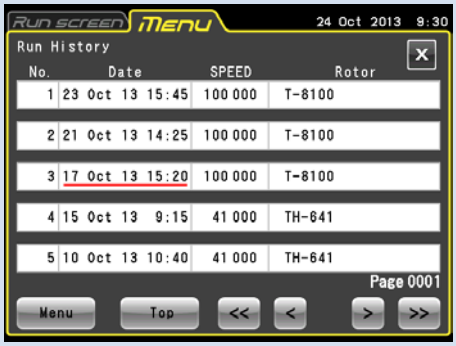
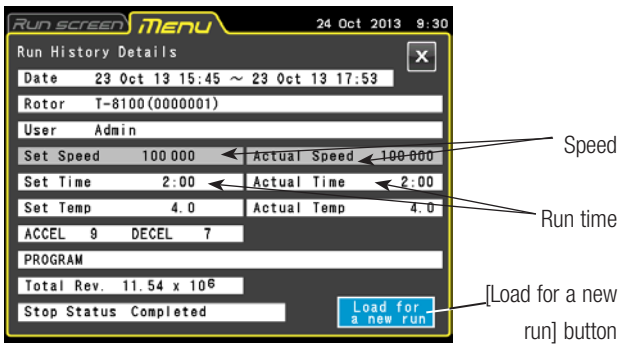
Customize	 Customize	Allows you to adjust screen displays, the stop signal and other settings in a way that works best for you. For details, refer to section Customizing.
Manager (Admin)	 Manager (Admin)	Allows you to set administrator functions such as user lockout, etc. For details, refer to section Admin Function.
Instrument ID Service Contact	 ID / Contact	Enter an ID to identify your instrument. For details, refer to section Instrument ID, Service Contact Information.

Press the icon for the function you wish to use and select from the options that appear.

Outputting and Reusing Run History Display and Run Parameters

The centrifuge can automatically store a run history containing up to 5,120 run parameters. The run history can be used for checking operation and for reuse, to verify the user and rotor performance and output data in CSV format.

Checking and reusing Run History

Step	Touchscreen operation	Screen displays and notes
1	Press the [Run History] button on the MENU screen.	▪ The Run History screen appears.  ▪ The Run History displays events in order by date. ▪ Press the [<] and [>] buttons to scroll through the Run History screen page by page. ▪ Press the [<<] and [>>] buttons to browse the Run History screen 10 pages at a time. ▪ Use the [Top] button to move to the top of the Run History screen.
2	Press the row for the history item in the Run History you want more information on.	▪ The Run History Details screen appears.  ▪ When a rotor is selected while loading for a new run, the speed field will be displayed in gray. Pressing this field will change the display in the following order: SPEED --> RCFmax --> RCFavg. ▪ In the history of ω_2T operation, the run time field is displayed in gray. Pressing this field will change the display in the following order: TIME--> ω_2T. ▪ When an alert occurs, the Stop condition field provides details on the alert.

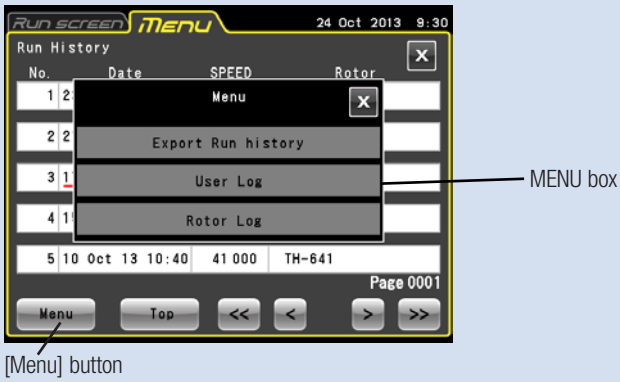
3	Press the [Load for a new run] to use the run parameters in the Run history details screen.	▪ The touchscreen displays the Run screen again and the run parameters in the history are set.
	Press the [X] button to view a different run history.	▪ The touchscreen displays the Run history screen again.
	If the run history is no longer needed, press the Run screen tab.	▪ The touchscreen displays the Run screen again.

NOTE

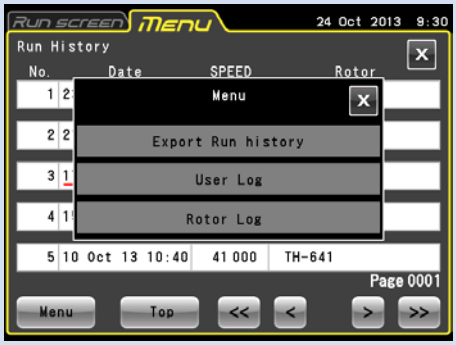
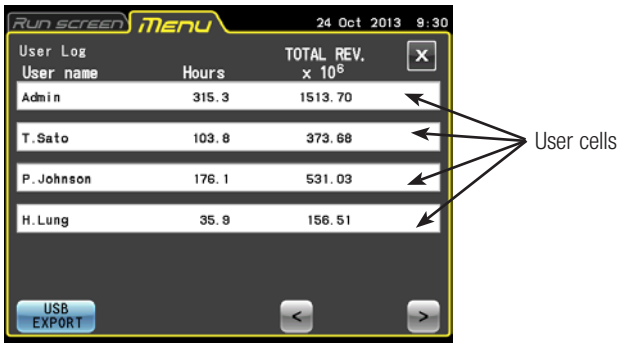
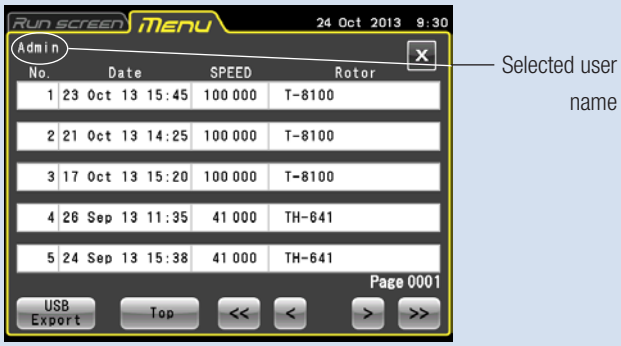
In the Run History screen, dates underlined in red indicate when an alert occurred, and the Stop condition field of the Run history details screen provides information on the alert.

Using Run History output and user/rotor run history

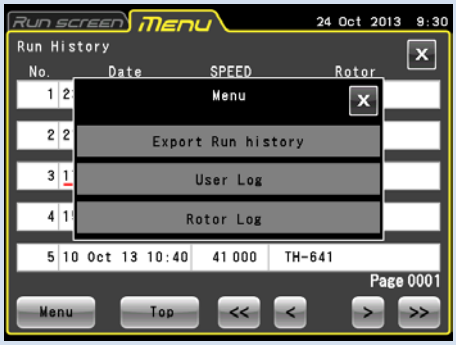
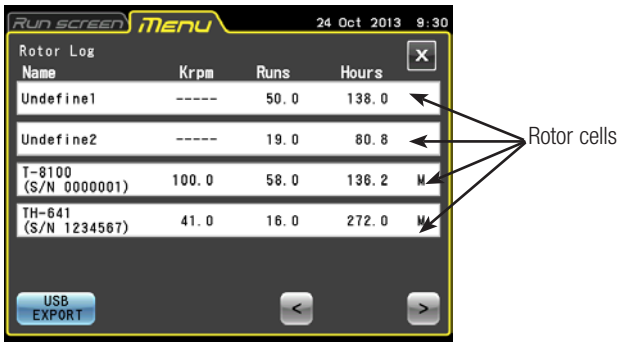
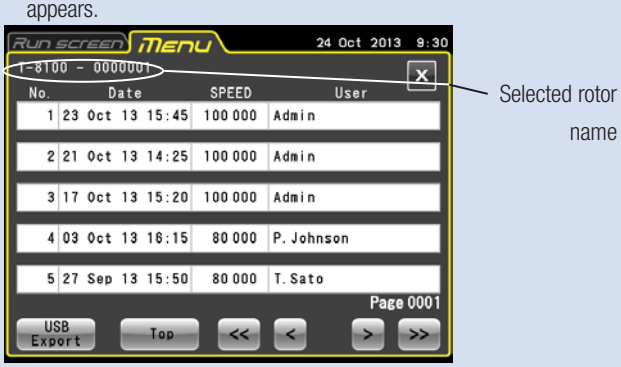
Outputting Run History

Step	Touchscreen operation	Screen displays and notes
1	Press the [Run History] button on the MENU screen and press the [Menu] button at the bottom left of the Run History screen.	▪ The Menu box in Run History appears 
2	Insert a USB flash drive into the USB (host) port and press the [Export Run history] button in the MENU box.	▪ This outputs the recorded run history to external media in CSV file format. ▪ For details on inserting a USB flash drive, refer to section Touchscreen and External Connection. ▪ No special procedure is required to remove a USB flash drive. Remove the flash drive when loading is complete. NOTE The centrifuge does not support secure USB flash drives.

Checking and Using User Run History

Step	Touchscreen operation	Screen displays and notes
1	Press the [Menu] button at the bottom left of the Run History screen.	▪ The Menu box in Run History appears 
2	Press the [User Log] button in the Menu box.	▪ The User Run History screen appears.  NOTE 1) Pressing the [USB EXPORT] button at the bottom left of the screen outputs the total operation results per user to a USB flash drive in CSV file format. 2) The centrifuge does not support secure USB flash drives.
3	Press the cell of the user whose information you wish to view. In this example, the run history for a user with the user name [Admin] is shown.	▪ The selected Run History List screen for the selected user appears.  ▪ This allows you to check User History details as described in Checking and reusing Run History. You can also use this function to reuse history data.

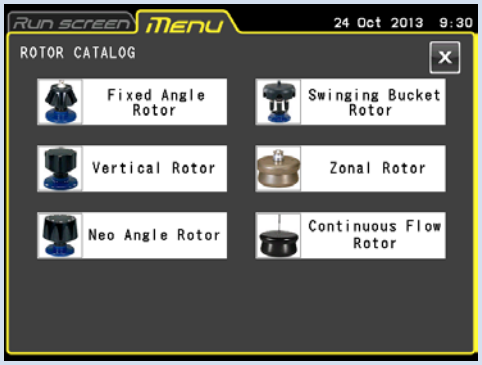
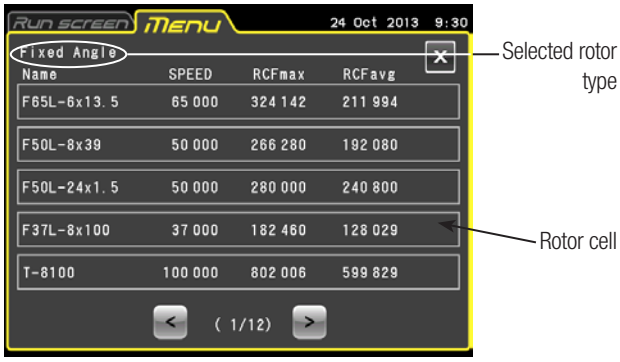
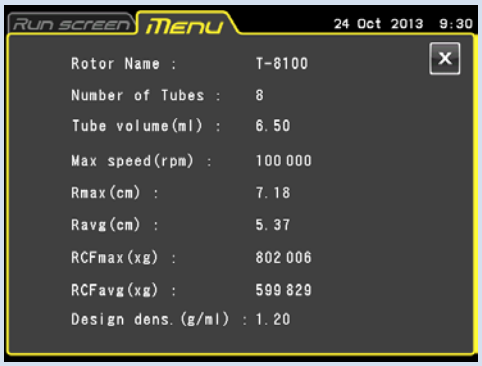
Checking and Using Rotor Run History

Step	Touchscreen operation	Screen displays and notes
1	Press the [Menu] button at the bottom left of the Run History screen.	▪ The Menu box in Run History appears 
2	Press the [Rotor Log] button in the Menu box.	▪ The Rotor Run History screen appears.  NOTE 1) Pressing the [USB EXPORT] button at the bottom left of the screen outputs the run history per rotor to a USB flash drive in CSV file format. 2) The centrifuge does not support secure USB flash drives.
3	Press the cell of the rotor whose information you wish to view. In this example, the run history for the [T-8100] rotor is shown.	▪ The selected Rotor Run History List screen for the selected rotor appears.  ▪ This allows you to check User History details as described in Checking and reusing Run History. You can also use this function to reuse history data.

Rotor Catalog

This catalog provides information on rotor models and rotor specifications.

Example showing how to reference the catalog

Step	Touchscreen operation	Screen displays and notes
1	Press the [Rotor Catalog] button in the MENU screen.	▪ The ROTOR CATALOG screen appears. 
2	In the ROTOR CATALOG screen, press the field of the desired rotor type. Press the [<] and [>] buttons to turn pages.	▪ The Rotor List screen appears. 
3	Press the desired rotor cell to open the Rotor details screen.	▪ A screen showing rotor specifications appears. 
4	Use the [X] button to return to the previous page. Use the MENU tab to return to the previous MENU screen. Use the Run screen tab to return to the Run screen.	▪ The Touchscreen again displays the previous screen, the MENU screen or the Run screen.

Zonal Operation Procedures

Zonal operation uses a zonal rotor for density gradient centrifugation to efficiently process large-volume samples. Zonal operation involves the following three zonal modes.

1. With the door open, the rotor turns at low-speed (* zonal speed) to allow loading of samples.
2. Samples are brought up to set speed (high speed) for separation.
3. The rotor decelerates to zonal speed, the air leak valve opens to vent the rotor chamber to enable the door to be opened and the samples removed.

* Zonal speed: A rotor speed used when loading and unloading samples. Normally the speed is set to 3,000 rpm, but to allow optimum speed setting, it is possible to set a speed between 2,000 and 3,000 rpm in 100 rpm increments. For information on methods for changing run speeds, refer to section Zonal speed.

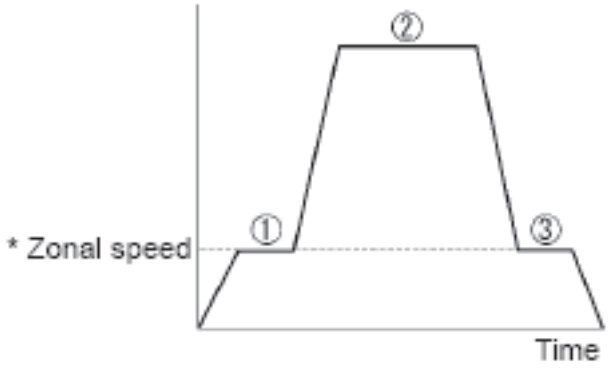


Figure 17: Zonal Operation Modes

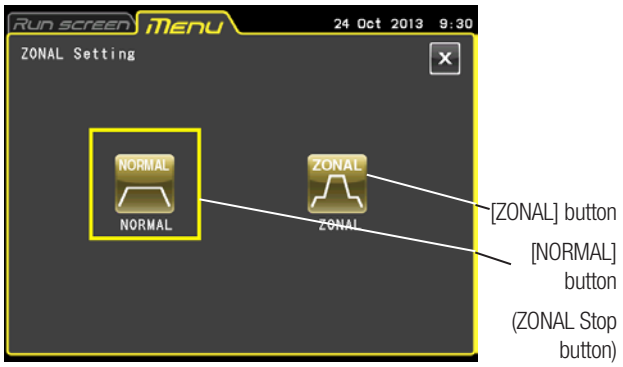
CAUTION

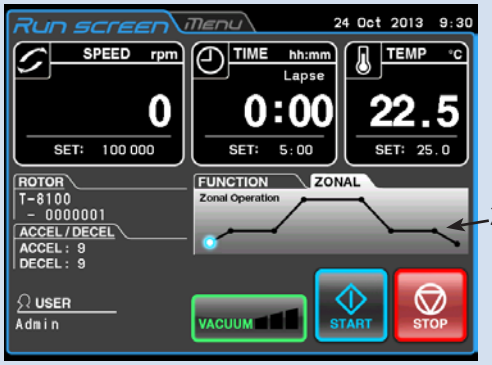
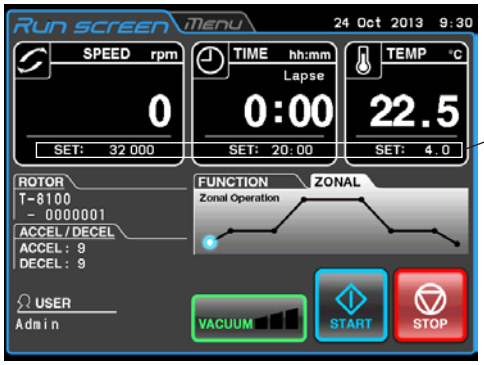
Zonal centrifugation includes performing operations during which the rotor turns while the door is open. Make sure to read through the "Zonal rotor instruction manual" before operation.

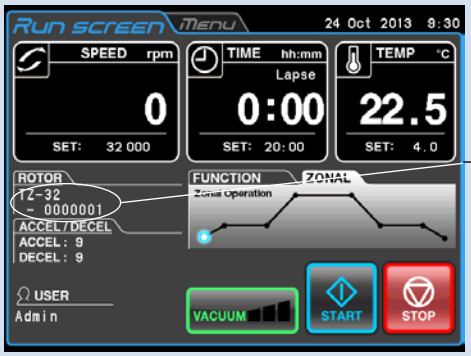
NOTE

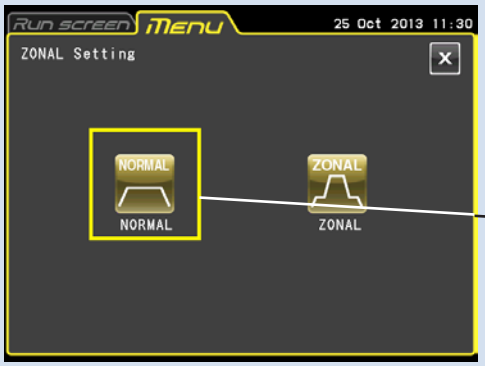
When zonal operation is set, zonal-specific temperature control (temperature control for unpainted rotors) should be used. Using rotors other than zonal rotors will result in small deviations in the temperature displayed. If you intend to use the TCF-32 continuous flow rotor (a black painted rotor) for zonal operation, contact a Thermo Fisher Scientific sales/service representative.

Zonal Operation Procedures

Step	Touchscreen operation	Screen displays and notes
1	Prepare zonal operation as described in the "Zonal rotor instruction manual."	
2	Press the [ZONAL setting] button in the MENU screen.	▪ Zonal setting screen appears. 

3	Press the [ZONAL] button on the ZONAL setting screen.	▪ The Set Validation No. screen appears. 
4	Enter “30” for the PIN on the on-screen keypad and press the [Enter] button. [3] [0] [Enter]	▪ ZONAL operation is enabled when the [ZONAL] button is surrounded by a yellow frame. 
5	Press the Run screen tab.	▪ The Run screen appears.  Zonal operation chart ▪ The ZONAL tab is added to the Function Selection Area and the zonal operation chart is displayed. ▪ The MENU screen will reappear if the [MENU] tab or the [X] button is pressed instead of the Run screen tab.
6	Set run parameters for high speed according to the instructions in section Setting Run Parameters.	▪ The run parameters appear in the setting value display field in the Run screen.  Setting value display field

7	Press the Rotor indicator field to select a zonal rotor as described in section Rotor Selection.	▪ The selected rotor type appears in the Rotor indicator field.  Rotor indicator field
8	Press the [START] button.	▪ The rotor accelerates to zonal speed (normally 3,000 rpm) and stabilizes. ▪ The zonal operation chart uses a blue light to indicate the progress of the run. ▪ Load the samples and install the cap on the rotor bearing. CAUTION: Installing the cap on the rotor by hand while the rotor is turning: Perform this operation with care and make sure to follow the instructions in the instruction manual.
9	Press the [VACUUM] button to start the vacuum pump and press the [START] button again.	▪ A dialog box appears, asking you to confirm whether it is all right to accelerate to high speed.  ▪ Check the run parameters and press the [YES] button. ▪ The rotor accelerates to the set speed and stabilizes. NOTE 1) The set run time starts counting down when you press the [START] button. However, you can change the run time range to count down only when the rotor is turning at a stable speed (refer to section Actual run timer). 2) Run time during vacuum standby (4,000 rpm) is not counted down.
10	The set time has elapsed. (Time out) To stop before the set time elapses, press the [STOP] button.	▪ When the set time has elapsed, the rotor decelerates and stabilizes at the zonal speed. ▪ The zonal operation chart uses a steady or blinking red light to indicate the progress of the run. ▪ When the speed stabilizes, a buzzer sounds.
11	When the rotor stabilizes at zonal speed, press the [VACUUM] button.	▪ The vacuum pump stops and the rotor chamber is vented to return to normal atmospheric pressure. ▪ The door lock is released.

12	Open the door, remove the cap, install the seal assembly and unload the samples.	CAUTION: Removing the cap from the rotor by hand and installing the seal assembly while the rotor is turning: Perform this operation with care and make sure to follow the instructions in the instruction manual.
13	Press the [STOP] button.	▪ A dialog box appears asking whether it is OK to decelerate and stop.  ▪ Check that samples have been unloaded and press the [YES] button. ▪ The rotor decelerates and stops.
14	Remove the rotor.	▪ Gently remove the rotor when it has stopped turning.
15	To stop zonal operation, press the MENU tab and press the [ZONAL setting] button in the MENU screen.	▪ The ZONAL setting screen appears.  [NORMAL] button (ZONAL Stop button)
16	Press the [NORMAL] button; check that the button is now surrounded by a yellow frame before pressing the Run screen tab.	▪ The display once again shows the Run screen. ▪ The Zonal tab is hidden and the Function Selection Area reappears.

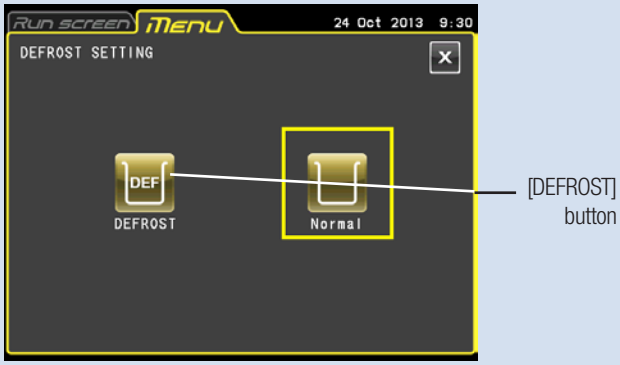
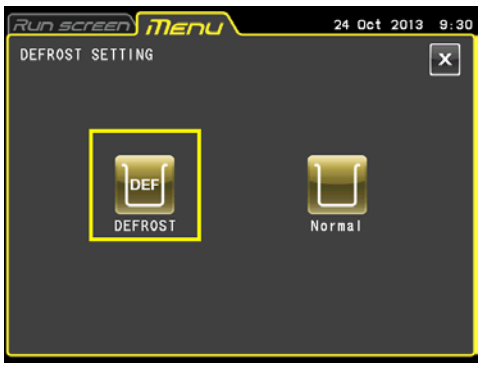
Defrost

The presence of frost or moisture in the rotor chamber (especially in the bowl) prior to a run will considerably lengthen the time it will take to reach a high vacuum level. This centrifuge comes with a defrost function that heats and evacuates the bowl to quickly remove frost and moisture.

Enable the defrost function in the following situations to remove frost and dry the rotor chamber.

1. To defrost and dry the rotor chamber before rotor operation and after removing the rotor.
2. To prevent condensation in the rotor chamber after ending a run when the rotor is removed.

Defrost method

Step	Touchscreen operation	Screen displays and notes
1	Press the [DEFROST] button in the MENU screen.	▪ The Defrost setting screen appears. 
2	If the rotor is turning, press the [DEFROST] button. If the rotor is standing still, check that the door is closed before pressing the [DEFROST] button. To stop defrosting, press the [Normal] button.	▪ The [DEFROST] button is surrounded by a yellow frame to indicate that defrosting has started.  ▪ Pressing the [DEFROST] button when the rotor is standing still will immediately start the defrosting function. NOTE If the [DEFROST] button is pressed when the rotor is standing still and the door is open, the function will be disabled a few seconds later and the Function Selection Area in the Run screen will display a “Door open” alert. Be sure to close the door when starting defrosting after the rotor has stopped.
3	Press the Run screen tab.	▪ The touchscreen displays the Run screen again. ▪ [Defrost] is indicated above the [VACUUM] button. 

Reference

As described below, the defrost function operates differently depending on centrifuge status when defrosting is started. Evacuation is performed simultaneously with defrosting.

	Enabling defrosting when the rotor is standing still	Enabling defrosting when the rotor is turning
Operation details	Defrosting begins when selected and continues for 10 minutes. When defrosting ends, the air leak valve is automatically activated. If the vacuum pump is not operating, it will begin operating when the defrost function is selected. When defrosting ends, the vacuum pump stops operating and the air leak valve is activated to vent the chamber.	Defrosting begins when the rotor speed starts to decelerate and continues for 10 minutes. After defrosting ends, the temperature is controlled until the air leak valve is activated and the chamber is vented.
Canceling	Press the [VACUUM] button to activate the air leak valve and stop defrosting.	Press the [DEFROST] button from the “MENU” tab and select [Normal].

1. Be sure to close the door when defrosting is started after the rotor has stopped.
2. Wipe the rotor chamber dry if there is an excess of moisture.
3. Enabling the defrost function while the rotor is turning starts the defrosting function when the rotor decelerates. Then the bowl is heated for 10 minutes and evacuation continues. Regardless of whether the rotor is still rotating or has stopped after 10 minutes, temperature control will resume if the [VACUUM] button is On. If the defrost function is enabled, set the [VACUUM] button to Off as soon as the rotor stops and remove the rotor.
4. When defrosting is enabled in zonal operation, defrosting begins when the rotor decelerates. When defrosting ends after 10 minutes, temperature control resumes unless the air leak valve is activated and the chamber is vented.
5. The temperature increase caused by the defrosting operation (10 minutes) is less than 1 °C.

Customizing

This function allows you to adjust Run screen displays, the stop signal, sound volume, screen backlight brightness and other functions to your preferences.

Press the [Customize] button in the MENU screen to open the CUSTOM screen with the icons for setting and changing zoom display, the stop signal and other functions shown in Figure 18 CUSTOM screen.

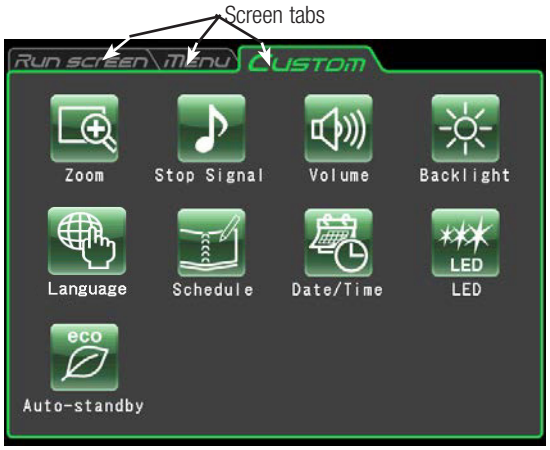


Figure 18: CUSTOM screen

The functions of the CUSTOM screen icons are described below.

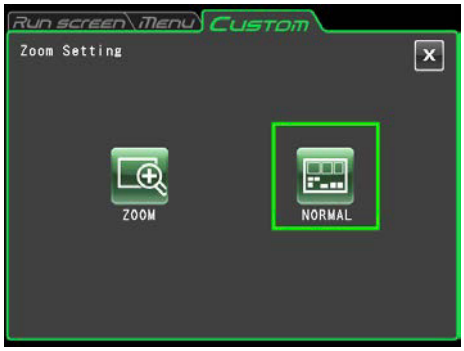
Name	Icon	Function
Zoom	 Zoom	Allows you to change the appearance of the Run screen display (for details, refer to section Zoom display setting).
Stop signal	 Stop Signal	This function provides a selection of six sounds including 5 tunes and an electric beep (for details, refer to section Stop signal setting).
Sound volume	 Volume	Adjusts the sound volume of the stop signal (for details, refer to section Sound volume adjustment).
Back light	 Backlight	Adjusts the screen backlight (for details, refer to section Backlight adjustment and dimming backlight mode setting).
Display language	 Language	This function provides a selection of languges (for details, refer to section Language switch button).
Schedule	 Schedule	Enables registration of a centrifuging schedule (for details, refer to section Schedule).

Date/Time	 Date/Time	Use for making date and time settings (for details, refer to section Date/time setting).
Status display lamp	 LED	Use to set status displays (LED indicator) (for details, refer to section Status display (LED indicator) lamp setting).
Economy mode	 Auto-standby	Sets economy mode (auto standby mode) (for details, refer to section Economy mode setting).

Press the icon for the function you wish to use and select from the options that appear. After completing the settings, press the tab of the screen you wish to return to (i.e. the Run screen).

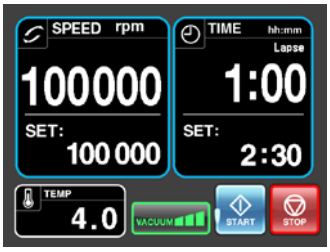
Zoom display setting

Select the zoom function to enlarge the speed and run time display on the Run screen display.



1. [NORMAL] button: Select to display the normal Run screen.
2. [ZOOM] button: Select to enlarge the speed and run time display 20 seconds after reaching the set speed.

Figure 19: Zoom setting screen



Normal screen Zoom screen

Press either the [NORMAL] or [ZOOM] button to select display mode.

Confirm that the selected button is surrounded by a green frame before pressing the CUSTOM tab or [X] button to store the setting.

To switch from the zoom screen to the normal screen during operation, press anywhere in the display area except the [STOP] button. The zoom screen will then automatically return to the normal screen in 20 seconds.

Stop signal setting

Select to change the stop signal. This function provides a selection of six sounds including 5 tunes and an electric beep.

Figure 20: Stop signal setting screen

Pressing the selected stop signal field will sound the signal, and the field turns blue.

Press the [Enter] button to store the settings.

To make other CUSTOM screen settings, press the [X] button or the CUSTOM tab.

Sound volume adjustment

Adjusts the sound volume of the stop signal.

More green segments in the indicator bar means a higher sound volume. The stop signal does not sound when all segments in the indicator bar are black.

Use the sound volume adjustment buttons as described below.

Press [<] to lower the sound volume.

Press [>] to raise the sound volume.

Press [ ] to mute the sound.

Press [ ] to set full volume.

Press the CUSTOM tab or the [X] button to return to the CUSTOM screen and confirm the settings.

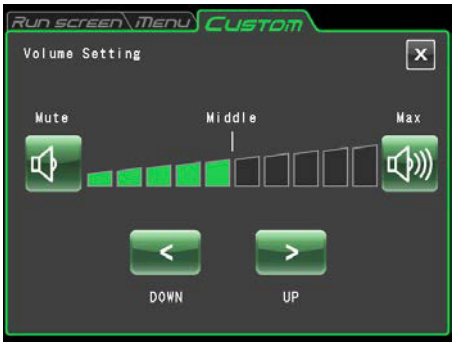


Figure 21: Sound volume setting screen

Backlight adjustment and dimming backlight mode setting

Adjusts screen brightness and sets the dimming backlight mode.

1. Adjusting screen brightness
   More green segments in the indicator bar mean a brighter screen. When all segments are black, the backlight is set to its darkest level.
   Use the following buttons to adjust screen brightness.
   Press [<] to darken the screen.
   Press [>] to brighten the screen.

Press the CUSTOM tab or the [X] button to return to the CUSTOM screen and confirm the settings.

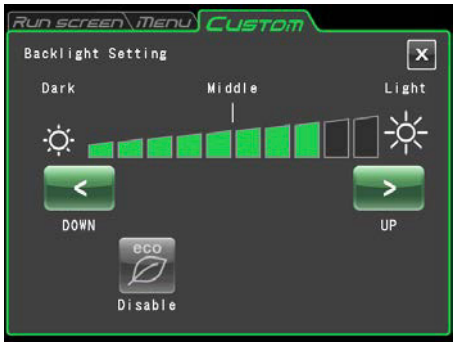


Figure 22: Backlight setting screen (When the dimming backlight mode is disabled)

Setting dimming backlight mode

The dimming backlight mode allows you to dim unnecessary touchscreen lighting, for example, when you are not using it or during operation.

Each press of the [ ] button either enables or disables this function.

- Enabling dimming backlight mode opens the dimming backlight mode dialog box shown in Figure 23 Dialog box that appears when dimming backlight mode is enabled for setting the time when dimming backlight mode is enabled.

Figure 23: Dialog box that appears when dimming backlight mode is enabled

- Pressing "□min." when the dimming backlight mode is enabled opens the screen shown in Figure 24 Screen for setting the time period after which the backlight will be dimmed that allows you to set the time when the dimming backlight mode will begin. You can set a time between 1 and 180 minutes in one minute increments.
- If you do not touch the screen during the time period set, the backlight will be set to its darkest level.
- Touching the screen while in dimming backlight mode will return normal brightness to the screen adjusted in step (1).
- Pressing [Dimming only while stop] will dim the backlight only when the rotor is not turning and pressing [Dimming even while operation] will dim the lighting after the set time period during operation as well.

Figure 24: Screen for setting the time period after which the backlight will be dimmed

Language switch button

Select to change the language. This function provides a selection of languages.

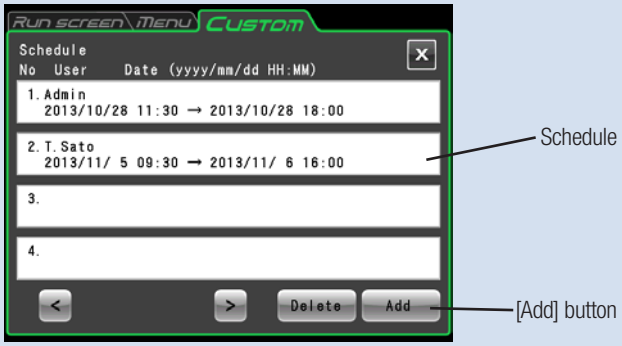
Press the selected language field.The selected field turns blue.
Press the CUSTOM tab or [X] button to store the settings.

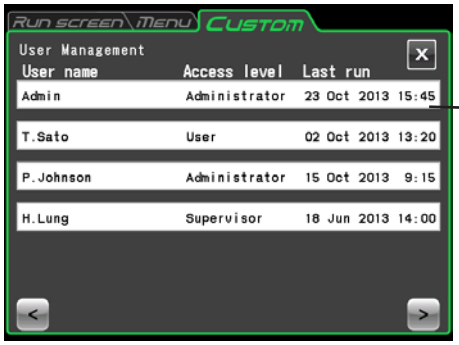
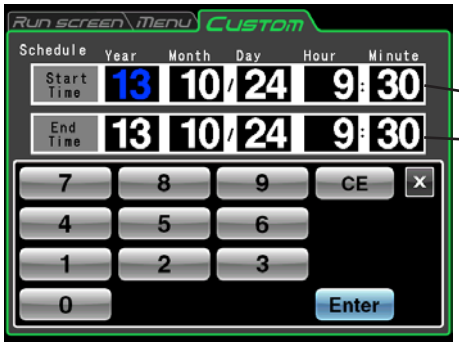
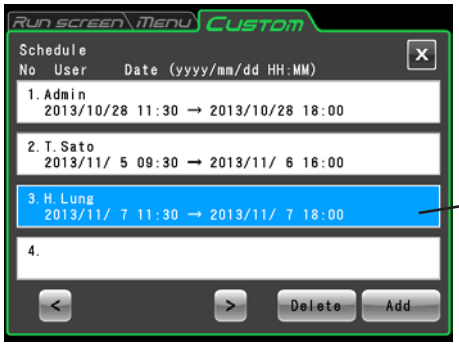
Figure 25: Language setting screen

Schedule

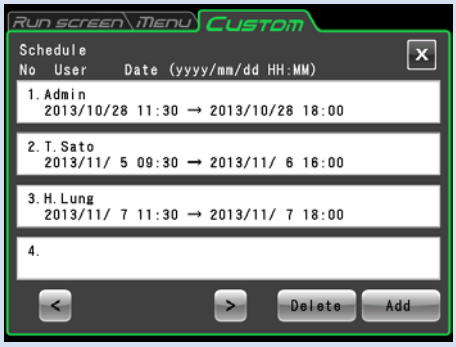
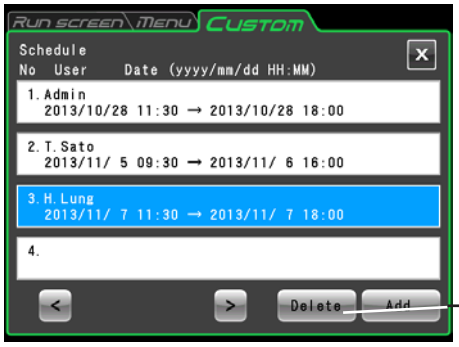
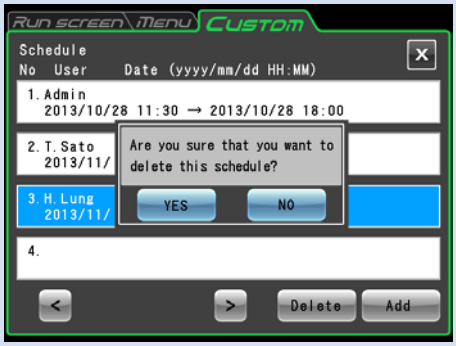
This centrifuge allows you to record (register) up to 40 schedules. The following describes how to record (register) a schedule. Note that a user registration is required for this operation.

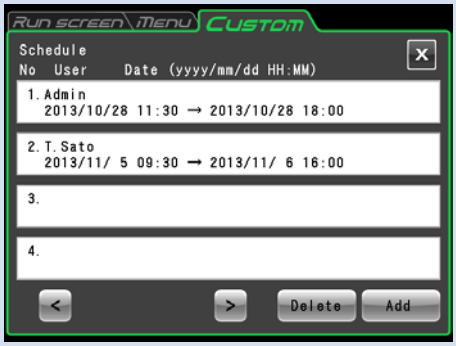
Method for registering centrifuge schedules

Step	Touchscreen operation	Instrument operations and notes
1	Press the [Schedule] button. 	▪ The CUSTOM screen is replaced by the Schedule screen. 

2	Press the [Add] button.	▪ The User list screen appears.  ▪ Use the [<] and [>] buttons to turn pages in the user list.
3	Press the cell of the user whose schedule you wish to register.	▪ The User PIN field appears. 
4	Enter the PIN of the selected user and press the [Enter] button.	▪ The Schedule date/time entry screen appears. 
5	Press the cell you are interested in and enter the desired date and time using the on-screen keypad.	NOTE Enter a time later than the current time.
6	Enter the desired schedule time and press the [Enter] button.	▪ The Schedule list screen appears.  ▪ The Schedule list shows registered schedules. ▪ Press the [X] button, the CUSTOM tab, the Run screen tab or the MENU tab.

Method for canceling centrifuge schedules

Step	Touchscreen operation	Instrument operations and notes
1	Press the [Schedule] button. 	▪ The CUSTOM screen is replaced by the Schedule screen. 
2	Press the schedule cell you wish to delete.	▪ The selected cell turns blue.  ▪ Use the [<] and [>] buttons to turn pages in the schedule list.
3	Check the schedule details of the cell that has turned blue and press the [Delete] button.	▪ A delete confirmation message appears. 
4	Press the [YES] button to delete or [NO] to cancel.	▪ The User PIN field appears. 

5	Enter the PIN of the user who registered the schedule and press the [Enter] button.	▪ The Schedule list screen appears.  ▪ The selected schedule is deleted from the schedule list. ▪ Press the CUSTOM tab, the [X] button, the Run screen tab or the MENU tab.

Method for changing centrifuge schedules

To change a schedule, first delete the schedule according to the procedure described in "2) Method for canceling centrifuge schedules," then reregister it on the desired date as described in "1) Method for registering centrifuge schedules."

Date/time setting

Use this function to adjust the time of the internal clock. RTC operation requires an accurate time setting.

Press the field of the item you wish to set. The selected field is displayed in red. Making certain that the field of the item you want to set is red, use the on-screen keypad to enter the current date and time.

Instead of pressing a field, you can use the [<] and [>] buttons on the on-screen keypad to move the red area.

Press the [Enter] button when all entries have been made.

The CUSTOM screen reappears.

Figure 26: Time setting screen

Status display (LED indicator) lamp setting

Sets the display color, brightness and lighting pattern of the status display lamp (LED indicator) beside the rotor chamber door to indicate instrument operating conditions.

The display color, brightness and display pattern of the status display lamp can be set for the operating conditions described below. Set as required for each operating environment.

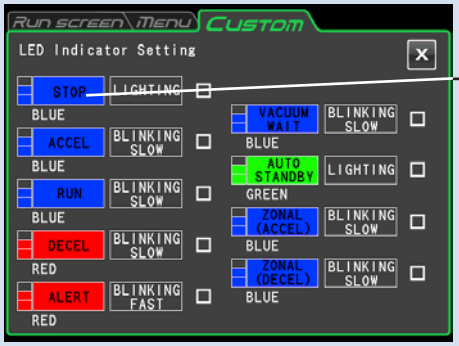
1. Available display colors, brightness and display patterns

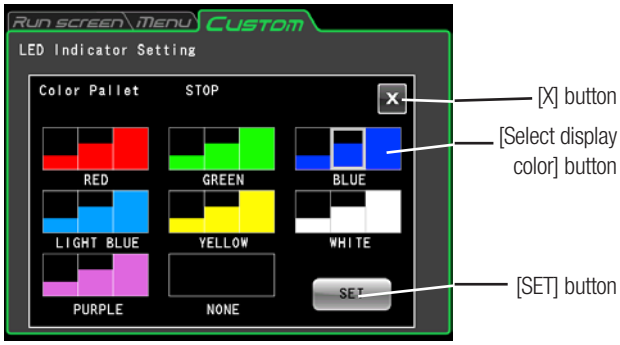
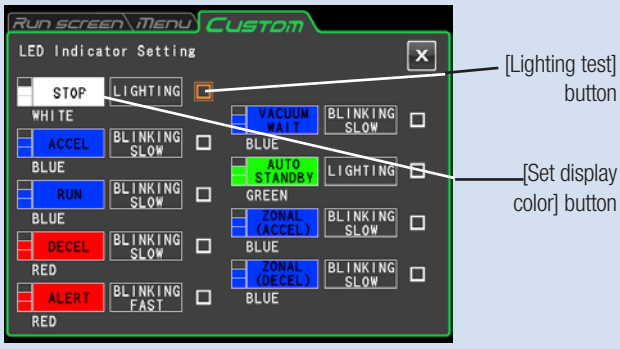
- Display color: The following 8 selections, which include 7 colors (blue, red, green, light blue, yellow, white, pink) and the lamp off setting
- Brightness: 3 levels
- Lamp display patterns: A total of four patterns: steady lighting, rapid blinking, slow blinking, fade (a gradual and repeated dimming)

2. Available operating conditions and factory defaults

Available operating conditions	**Factory defaults**		
	Display color	**Display pattern**	**Brightness**
1 When stopped	blue	Steady lighting	Intermediate
2 During acceleration	blue	Slow blinking	
3 When stabilized	blue	Slow blinking	
4 During deceleration	red	Slow blinking	
5 During evacuation	blue	Slow blinking	
6 Economy mode	green	Steady lighting	
7 When accelerating to zonal speed (normally 3,000 rpm)	blue	Slow blinking	
8 When decelerating from zonal speed	blue	Slow blinking	
9 When an alert occurs	red	Rapid blinking	

3. Method for setting display colors for status display lamp

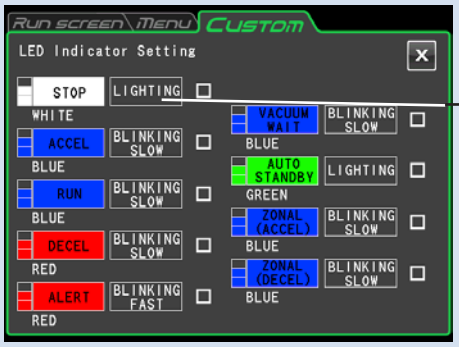
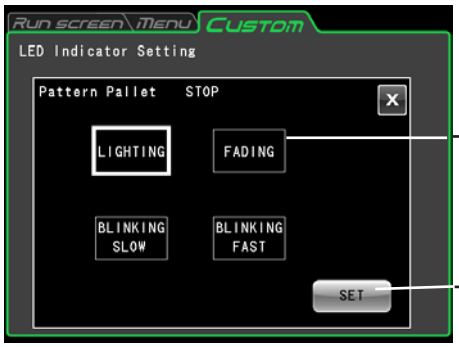
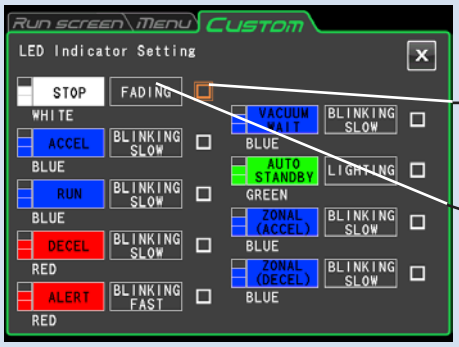
Step	**Touchscreen operation**	**Instrument operations and notes**
1	Press the [LED] button. 	▪ The LED indicator setting screen appears.  [Set display color] button

2	Press the [Set display color] button for the operating condition you wish to change. Example: To change the display color for [When stopped] from blue to white	▪ The Color palette screen appears.  ▪ The buttons for selecting display color are shown at 3 different levels of brightness. ▪ The selected color (blue) and brightness (intermediate) are surrounded by a white frame.
3	Select the desired color and brightness from the color palette screen, press the [Select display color] button. Then make certain that the selected button is surrounded by a white frame before pressing the [SET] button. NOTE You must press the [SET] button to complete the setting.	▪ The LED indicator setting screen appears.  ▪ The [Set display color] button assumes the qualities selected in the color palette screen (white and intermediate brightness). ▪ The [Lighting test] button ( ) to the right changes to an object in a double orange colored frame and the status display lamp (LED indicator) is test displayed in the selected color.
4	Press the CUSTOM tab, the [X] button, the Run screen tab or the MENU tab.	▪ Press the CUSTOM tab or the [X] button to return to the CUSTOM screen. ▪ Press the Run screen tab or MENU tab to return to the respective screen.

NOTE

1. If an alert color and pattern are selected for something other than an alert, a message appears, notifying you that such a choice will make it more difficult to differentiate it from an alert. It is recommended that you use a different color or pattern to distinguish it from an alert.
2. If a selected color or pattern combination is already in use for another display color when you are changing an alert display color or pattern, a message appears, notifying you that the selected color is already in use. As in case 1), it is recommended that you use a different color or pattern.

3. Method for setting display patterns for the status display lamp

Step	Touchscreen operation	Instrument operations and notes
1	Press the [LED] button. 	▪ The LED indicator setting screen appears.  [Set pattern] screen
2	Press the [Set pattern] button for the operating condition you wish to change. Example: To change from the [Steady lighting] pattern to the fade pattern	▪ The Pattern palette screen appears.  [Select pattern] button [SET] button
3	Press the [Select pattern] button for the desired pattern in the pattern palette. Then make certain that the selected button is surrounded by a white frame before pressing the [SET] button. NOTE You must press the [SET] button to complete the setting.	▪ The LED indicator setting screen appears.  [Lighting test] button [Set pattern] button ▪ The appearance of the [Set pattern] button changes to the pattern selected (fade) in the pattern palette screen. ▪ The [Lighting test] button ( ) to the right changes to an object in a double orange colored frame and the status display lamp (LED indicator) is test displayed in the selected pattern.
4	Press the CUSTOM tab, the [X] button, the Run screen tab or the MENU tab.	▪ Press the CUSTOM tab or the [X] button to return to the CUSTOM screen. ▪ Press the Run screen tab or MENU tab to return to the respective screen.

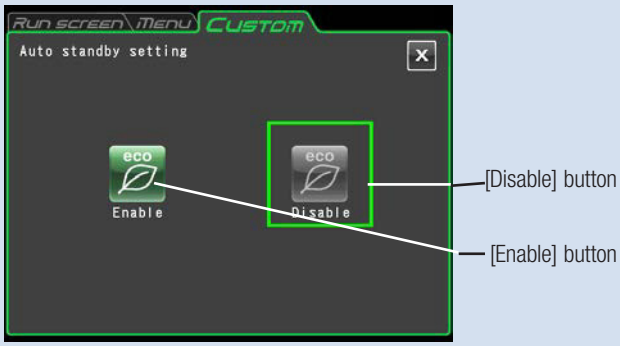
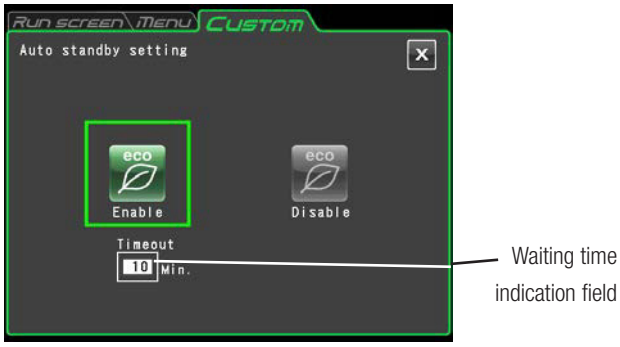
NOTE

If [Steady lighting] is selected for a display pattern in [Auto standby], lighting will continue even if a transition is made to economy mode (for details, refer to Economy mode setting). To turn off the LED indicator in economy mode, select [NONE] in the Color palette screen.

Economy mode setting

When economy mode is enabled, the touchscreen backlight will automatically dim and the cooling fan will stop turning to reduce power consumption when the centrifuge has been left idle for a preset period of time.

Method for activating economy mode

Step	Touchscreen operation	Instrument operations and notes
1	Press the [Auto-standby] button.	▪ The Set auto standby screen appears. 
2	Press the [Enable] button to activate economy mode.	▪ The [Enable] button is surrounded by a green frame and the time until the economy mode is activated is shown. 
3	Check time left until economy mode is activated and touch the waiting time indication field if you wish to change it.	▪ The Set auto standby waiting time screen appears. 
4	Enter the waiting time using the on-screen keypad, press the [Enter] button to confirm and press the [X] button. Example: Changing waiting time until economy mode is activated to 10 minutes	▪ The time in the waiting time indication field changes to the set value. 

5	Press the “CUSTOM” tab, the [X] button, the Run screen tab or the MENU tab.	▪ Press the CUSTOM tab or the [X] button to return to the CUSTOM screen. ▪ Press the Run screen tab or MENU tab to return to the respective screen. ▪ To disable economy mode, press the [Auto-standby] button and the [Disable] button.

NOTE

1. Economy mode is enabled only when the rotor is at a standstill and the vacuum pump is not in operation.
2. While in economy mode, the backlight on the touchscreen is dimmed, the cooling system is switched off and no electricity is supplied for releasing the door lock. If the door is locked when the centrifuge enters economy mode, the door is locked and cannot be opened.
3. To temporarily cancel economy mode, touch the touchscreen. This will enable all operations and the door can be opened.
4. Even if economy mode is temporarily canceled, the centrifuge will reactivate economy mode when the set wait time has elapsed, provided the rotor is at a standstill and the vacuum pump is not in operation.
5. When room temperature is high and the instrument needs to be cooled, the cooling fan may continue operating even when economy mode is engaged.
6. The waiting time until economy mode is activated can be set to a time between 1 and 180 minutes.
7. As the touchscreen backlight is dimmed in economy mode, it may be difficult to recognize that the instrument is on. For this reason, make sure to turn it off when you have completed a run.
8. The status display lamp (LED indicator) can be set to continue operation in economy mode to make it easier to see that the instrument is supplied with power. For details, refer to (8) “Status display lamp (LED indicator) setting.”

Admin Function

This function allows you to access administrator functions such as changing the display language.

Press the [Admin] button on the MENU screen to open the ADMIN screen shown in Figure 26 ADMIN screen. This screen provides icons for controlling functions such as user management and user lockout.

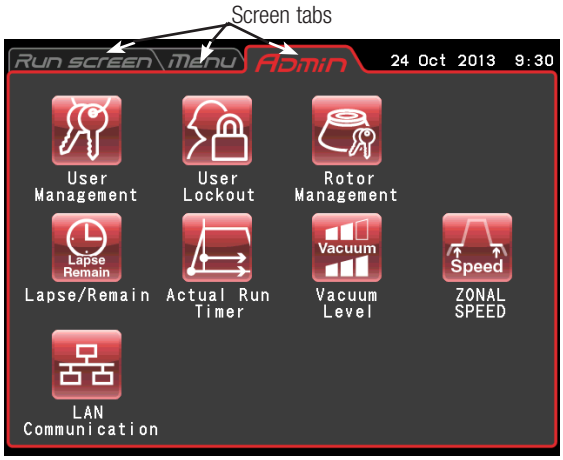


Figure 27: ADMIN screen

The functions of the ADMIN screen icons are described below.

Name	Icon	Function
User management	 User Management	Users can be registered or deleted (for details, refer to section User management).
User lockout	 User Lockout	You can restrict the number of users (for details, refer to Section User lockout).
Rotor management	 Rotor Management	You can control total run time and number of runs (for details, refer to section Rotor management).
Run time indication	 Lapse/Remain	Allows you to change the centrifuge run time indication (for details, refer to section Run time indication).
Actual run timer	 Actual Run Timer	Allows you to select the actual run timer (for details, refer to section Actual run timer).
Vacuum level	 Vacuum Level	Allows you to set the vacuum conditions when the centrifuge starts accelerating from vacuum standby state to the set speed (for details, refer to section Vacuum level).

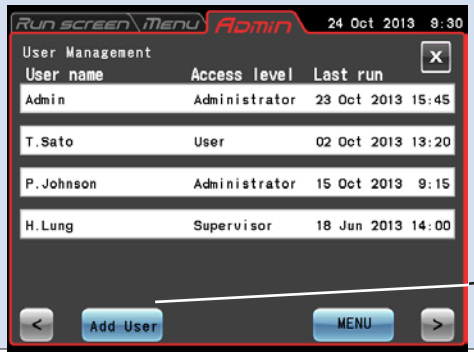
Zonal speed	 ZONAL SPEED	Zonal speed can be changed between 2,000 and 3,000 rpm in increments of 100 rpm (for details, refer to section Zonal speed).
LAN communications	 LAN Communication	Connects and disconnects LAN communications (for details, refer to section LAN communications).

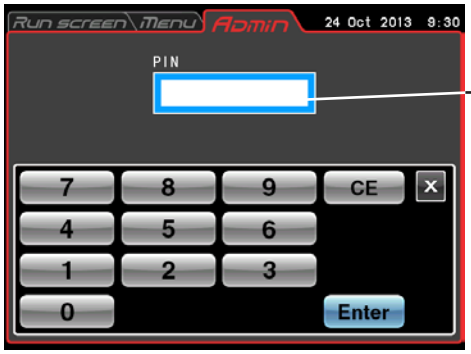
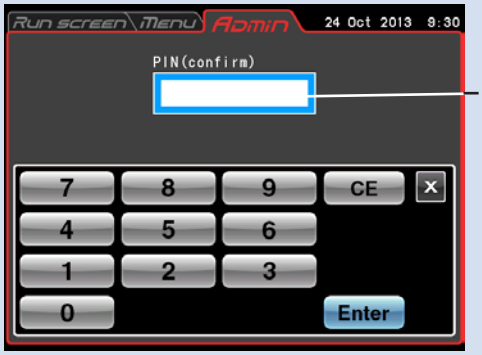
Press the icon for the function you wish to use and select from the options that appear. After completing the settings, press the tab of the screen you wish to return to (i.e. the Run screen).

User management

The centrifuge can register (store) up to 50 users who are managed at three different management levels. Methods for registering users and changing user information are described below. User registration makes it possible to manage user run histories or control user operation.

Method for registering users

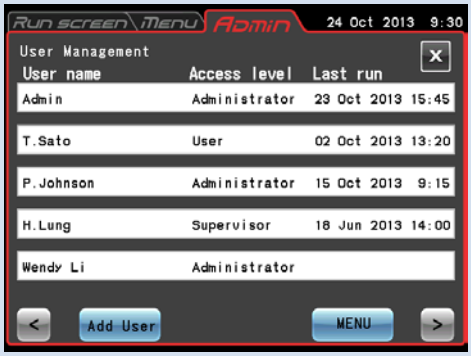
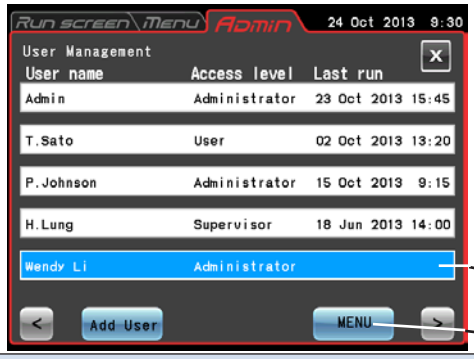
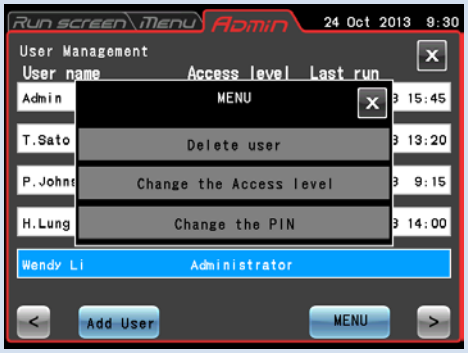
Step	Touchscreen operation	Screen displays and notes
1	Press the [User Management] button. 	▪ The Admin screen replaces the user management screen.  [Add user] button
2	Press the [Add User] button.	▪ The Register user name screen appears.  User name field ▪ The buttons in the Register user name screen have the following functions. [Shift] button: Press to switch from lower case to upper case letters. [Clear] button: Deletes all characters in the User name field. [Space] button: Enters a space at the rightmost position in the User name field. [Delete] button: Deletes the character in the User name field starting from the rightmost position. [Enter] button: Press to register the entered user name. The Register PIN screen appears. [X] button: Press to return to the User management screen.

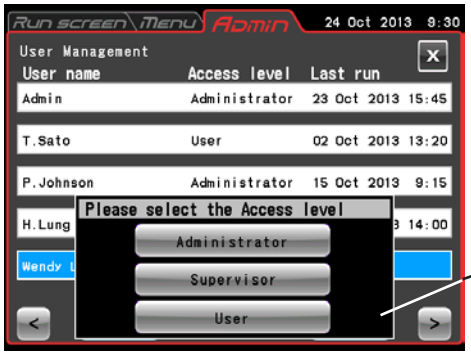
3	Enter the name of the user you wish to register.	▪ The user entered in the User name field is displayed. 
4	Check the entry and press the [Enter] button.	▪ The Register PIN screen appears. 
5	Enter a PIN (four numeric digits) and press the [Enter] button.	▪ The Check PIN registration screen appears. 

6	Again enter the PIN entered in step 5 and press the [Enter] button.	▪ An Access level dialog box appears.  Access level dialog box ▪ An access level setting makes it possible to control access at three different levels. ▪ The user lockout function can only be used if enabled. For details, refer to section User lockout. ▪ The following access levels are provided. Administrator: Allowed to perform any operation. Supervisor: Allowed to set and change run parameters, select programs and other operations. User: Allowed to perform START, STOP and VACUUM operations. For details, refer to Table 1 Operations at each access level.
7	Select an access level.	▪ The User Management screen reappears.  Added user The added user name and access level are displayed again.
8	Press the ADMIN tab, the [X] button, the Run screen tab or the MENU tab.	▪ Press the ADMIN tab or the [X] button to return to the ADMIN screen. ▪ Press the Run screen tab or MENU tab to return to the respective screen.

NOTE In the factory defaults, the user name [Admin] is registered as having an access level of [Administrator] and a PIN of [1111].

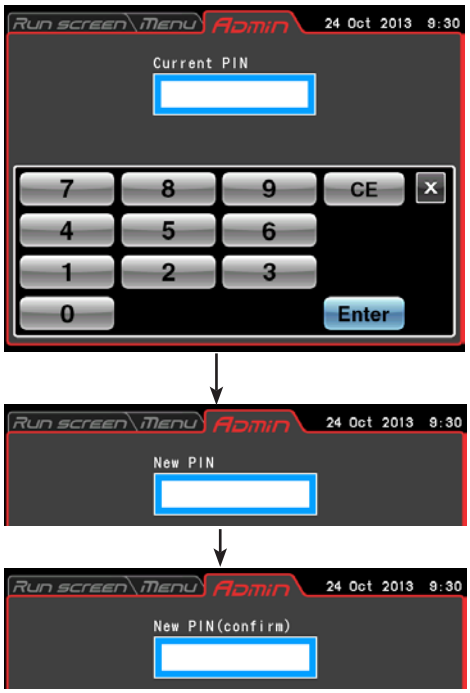
Method for deleting users and changing registered information

Step	Touchscreen operation	Screen displays and notes
1	Press the [User Management] button. 	▪ The Admin screen replaces the user management screen. 
2	Press the User field of the user you wish to delete or whose registered information you wish to change.	▪ The selected user field changes from white to blue.  Selected user field [MENU] button
3	Press the [MENU] button.	▪ The Menu box appears. 
4-1	Press the [Delete user] button to delete a registered user.	▪ A delete confirmation message appears.  Delete confirmation message
	Press the [YES] button to open the PIN field.	▪ Enter the PIN of the user you wish to delete and press the [Enter] button. ▪ The next time the User management screen is opened the user field will be deleted.

<table>
<tr><td>4-2</td><td>Press the [Change the Access level] button to change the access level.</td><td>▪ The Select access level field appears.
 
</td></tr>
<tr><td></td><td>Press the access level you wish to change; this opens the PIN field.</td><td>▪ Enter the user PIN you wish to change and press the [Enter] button.
▪ The next time the User management screen is opened the access level of the user field will be changed.</td></tr>
<tr><td>4-3</td><td>Press the [Change the PIN] button to change the PIN.

(1) A field for entering the current PIN appears. Enter the current PIN and press the [Enter] button.

(2) A screen for entering a new PIN appears. Enter the new PIN and press the [Enter] button.

(3) A field for confirming the PIN appears. Enter the PIN entered in step 2 and press the [Enter] button.</td><td>▪ The field for entering the current PIN appears.
 

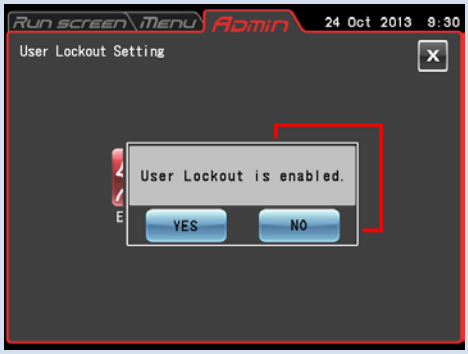
▪ The PIN is confirmed and the User management screen reappears.</td></tr>
</table>

NOTE The user name cannot be changed. If such a change should be necessary, delete the user name and create a new registration.

User lockout

When enabled, User lockout makes it possible to control user access at three different levels.

Method for setting user lockout

Step	Touchscreen operation	Screen displays and notes
1	Log in as a user as described in section Logging in as a Logging in as a User.	▪ The user logging in must have [Administrator] privileges.
2	Press the [User Lockout] button. 	▪ The Set user lockout screen appears.  ▪ The selected button is shown inside a red frame (in this example, Disable is selected).
3	Press the [Enable] button. Press the [Disable] button.	▪ A dialog box for enabling user lockout appears.  ▪ This dialog box does not appear when lockout is changed from enable to disable. The [Disable] button is surrounded by a red frame and user lockout is disabled.
4	Press the [YES] button.	▪ The [Enable] button is surrounded by a red frame and user lockout is enabled. ▪ Press the ADMIN tab or the [X] button to return to the ADMIN screen.

Method for enabling user lockout

Press the USER area in the Run screen as described in section Logging in as a User and select a registered user. Further operation is not possible without logging in as a user. The user access level determines which operations are permitted.

NOTE

1. Only a user logged in with [Administrator] privileges can enable the user lockout function.
2. The user lockout function can be used only if users are registered. Register users as described in (1) “User Management.”
3. When user lockout is enabled, a user must be logged in to use the touchscreen.
4. Once user lockout is enabled, only a user with an Administrator access level can call up the Admin screen. Disabling the user lockout function requires that a user having an administrator access level is logged in.
5. In the factory defaults, the user name [Admin] is registered as having an access level of [Administrator] and a PIN of [1111].
6. The operations permitted to users at each access level during user lockout are listed below.

Table 1 Operations at each access level

			Administrator	Supervisor	User
Run screen	Change run parameters		o	o	×
	Clear alerts		o	o	×
	START, STOP, VACUUM button operations		o	o	o
	Select rotors		o	o	×
	User login		o	o	o
Function	Programmed operation	Register, change, delete	o	×	×
		Select	o	o	o
	RCF function w2 function	Change	o	o	×
		Reference	o	o	×
	RTC function	Register, change, delete	o	o	×
		Reference	o	o	×
MENU	Run History	Check	o	o	×
		External (USB) output	o	×	×
		Run parameter reuse	o	o	×
	Rotor Catalog		o	o	o
	Zonal setting		o	o	×
	Defrost function		o	o	o
	Instrument ID, Service Contact Information	Register	o	×	×
		Reference	o	o	×
Customize	Zoom display setting		o	o	×
	Stop signal setting		o	o	o
	Sound volume adjustment		o	o	o
	Back light	Brightness adjustment	o	o	×
		Dimming mode setting	o	o	×
	Display language switching		o	o	×
	Register, change and reference schedules		o	o	×
	Date/time setting		o	o	o
	Status display (LED indicator) lamp setting		o	o	×
	Economy mode setting		o	o	×
Admin	Admin function		o	×	×

o: Enable ×: Disable

Rotor management

You can register the rotor and its serial number in the instrument to use in setting operations and controlling total run time and number of runs.

It is very important to manage the life of each rotor you use with the ultracentrifuge. The warranted life of the rotor varies depending on the type of rotor, the material the rotor is fabricated from and the policy of the rotor manufacturer. The warranted life of a Thermo Ultracentrifuge rotor is defined by a maximum number of runs. Other manufacturers use a combination of either the maximum number of runs or a maximum number of hours to limit the warranted life of the rotor.
Some rotors have both a primary and a secondary service life. The primary service life is defined as the initial usage at speeds up to the maximum rated speed of the rotor. Once this primary service life is expended, the rotor has a secondary service life at speeds up to a maximum rotor speed which is typically limited to 90 % of the original maximum rated speed.

Rotor life management

In order to comply with warranty requirements, rotor use must be documented in the rotor log book provided with the ultracentrifuge. Additionally, the Sorvall WX+ Ultra series centrifuges have the capability to keep track of the number of runs and hours of use for each rotor. This information can be used to automatically notify the user of the need for down-rating at the end of the primary service life and to preclude the use of rotors once their warranted service life as defined by these parameters has come to an end.
To utilize this feature, the ultracentrifuge must record each time a rotor is used. This requires that a rotor be initially registered in the Rotor Management software. Each time the rotor is used in the Sorvall WX+ Ultra series centrifuge, it must be selected from the Rotor Management screen prior to starting the run. Additionally, should the rotor be used in other ultracentrifuges, the Rotor Management information can be edited to record this usage. Rotors may also be deleted from the Rotor Management Screen if they are no longer to be used.
If you use the rotor beyond its maximum permitted service life, a serious accident may occur. (For more information, see rotor instruction manual.)

Automatic rotor down-rating

You can register a rotor in the ultracentrifuge before use. After the rotor has been registered, you can utilize the rotor management feature of the ultracentrifuge each time a run is made using the rotor.
When the registered rotor comes close to the end of its service life, the ultracentrifuge indicates this by displaying a message on the screen.
When the rotor reaches the end of its primary service life, the ultracentrifuge down-rates its maximum permitted speed and indicates an asterisk (*) to the right of the [krpm] indication in the Rotor management screen (refer to section Rotor Selection) simultaneous with the change in maximum permitted speed. Once the maximum permitted speed has been down-rated, the actual speed of the rotor is automatically restricted within the new limits.

NOTE

The rotor service life management data stored in the ultracentrifuge is not covered by the warranty. When a rotor is used with the ultracentrifuge, make sure to record the rotor management data in the rotor log book.
If the rotor log book is not maintained correctly, the rotor will not be warranted.

Automatic rotor exclusion

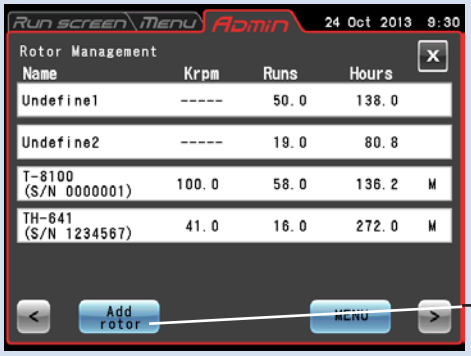
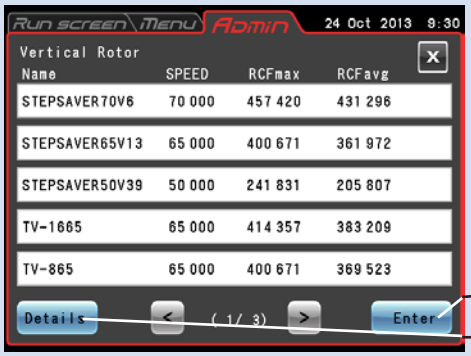
When a registered rotor reaches the end of its service life, the ultracentrifuge indicates this by displaying a message on the screen. Subsequent runs of this registered rotor are precluded.

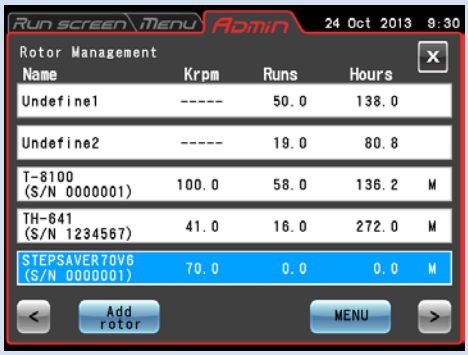
Registering a rotor

A standard rotor can be registered when you use the rotor management feature of the ultracentrifuge.

If the rotor has not been registered, the feature does not operate for the rotor. To register a rotor, use the procedure described below.

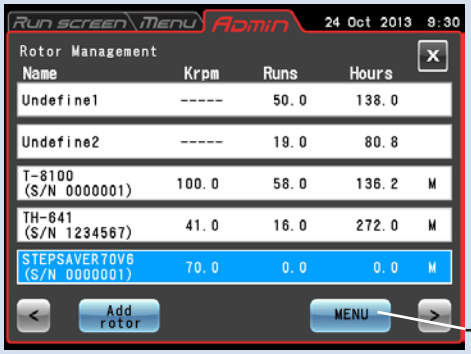
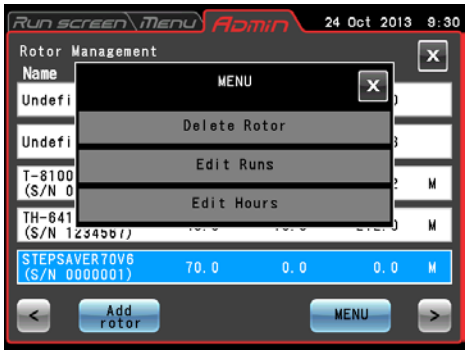
Procedure for registering a new rotor

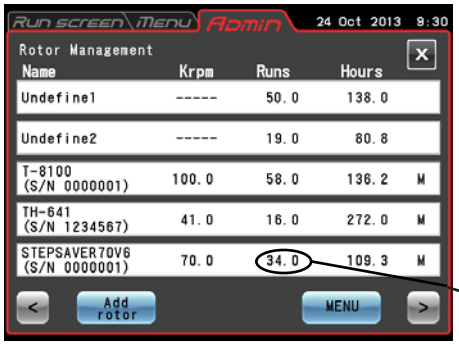
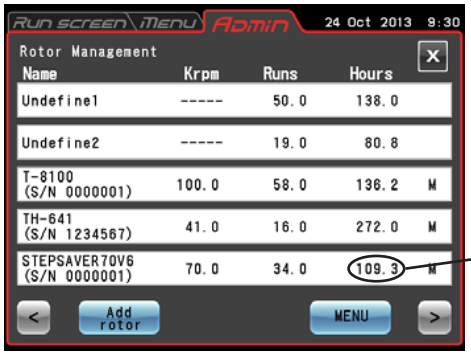
Step	Touchscreen operation	Screen display and notes
1	Press the [Rotor Management] button. 	▪ The Rotor Management screen appears.  [Add rotor] button
2	Press the [Add rotor] button.	▪ The ROTOR CATALOG screen appears. 
3	In the ROTOR CATALOG screen, select the desired rotor type.	▪ The Rotor list screen appears.  [Enter] button [Details] button
4	Select a rotor for registration. Check that the field turns blue and press the [Enter] button. Select a rotor, press the [Details] button to open the Rotor details screen to check rotor specifications.	▪ The Serial number (S/N) field appears. 

5	Enter the serial number (S/N) and press the [Enter] button.	▪ The Rotor Management screen appears.  ▪ The added rotor and its serial number are displayed. ▪ An “M” (for manual) appears at the right end of the field for the added rotor indicating that it is a rotor with an overspeed decal.

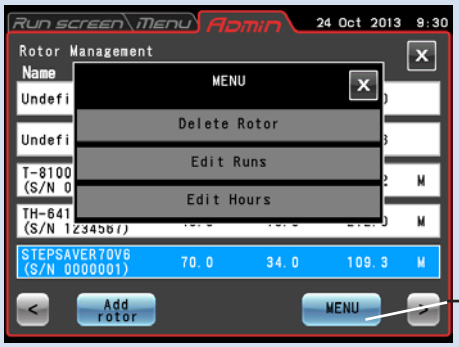
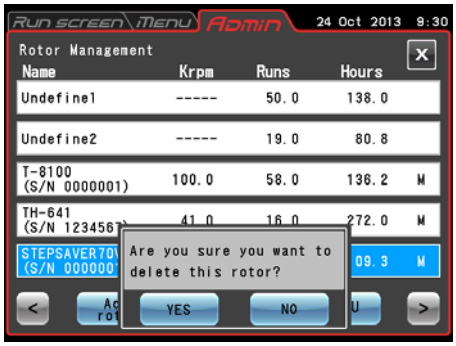
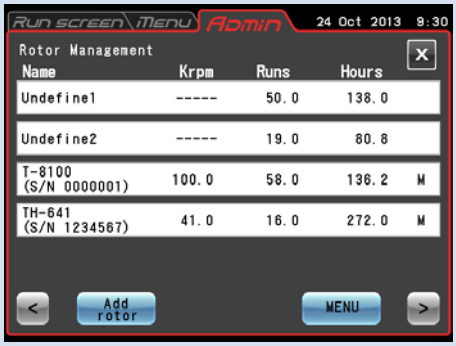
Procedures for registering a rotor that has already been used

The following example describes how to register a rotor that has been used previously in another centrifuge.
In registering this rotor, the Run history to date (total run time and number of runs) must be entered.
After registration and use in this centrifuge, the rotor is used in another centrifuge. Before the rotor can be used in this centrifuge again, the performance results from the other centrifuge must be added to enable correct management of run time and number of runs.

Step	Touchscreen operation	Screen display and notes
1	Press the [Rotor Management] button, select a rotor for registration and enter the serial number.	▪ The added rotor is displayed in the Rotor management screen. 
2	Check that the field of the rotor registered in step 1 is blue and then press the [MENU] button. If the field of the rotor registered in step 1 is not blue, press the field of the rotor registered in step 1. Check that the field of the rotor registered in step 1 is blue and then press the [MENU] button.	▪ The MENU box appears in the Rotor management screen. 

3	Press the [Edit Runs] button in the menu box.	▪ The Number of runs field appears. 
4	From the “Rotor log” find the total number of runs the rotor was used in the other centrifuge, enter this number and press the [Enter] button. If usage data has already been entered, add the usage data for the other centrifuge. A value that is lower than the currently registered number of times cannot be entered.	▪ The Rotor management screen reappears and the entered time is displayed in the Total run time indicator in the field of the selected rotor. 
5	Again select the rotor you wish to register, press the [MENU] button and press the [Edit Hours] button in the menu box.	▪ The Total run time entry screen appears. 
6	From the “Rotor log” find the total run time the rotor was used in the other centrifuge, enter this and press the [Enter] button. If usage data has already been entered, add the usage data for the other centrifuge. Use the [:/ .] button to enter decimals. A value that is lower than the currently registered time cannot be entered.	▪ The Rotor management screen reappears and the entered number of runs is displayed in the Total number of runs indicator in the field of the selected rotor. 
7	Press the Run screen tab to return to the Run screen.	▪ The display once again shows the Run screen.

Procedure for deleting a registered rotor

Step	Touchscreen operation	Screen display and notes
1	Press the Rotor management button, select the rotor for deletion and press the [MENU] button.	▪ The MENU box appears in the Rotor management screen. 
2	Press the [Delete Rotor] button in the menu box.	▪ A delete confirmation message appears. 
3	Press the [YES] button in the delete confirmation box.	▪ The selected rotor is deleted from the Rotor management screen. 
4	Press the Run screen tab to return to the Run screen.	▪ The display once again shows the Run screen.

NOTE

1. Undefined 1 is the default selection that is automatically made when a rotor is installed without selecting Undefined 2 or another rotor from the rotor list. It records the run history of all rotors that are installed in the same way.
2. Select Undefined 2 rotor for a specific rotor whose run history you wish to record without registering it.
3. Undefined 1 rotor and undefined 2 rotor cannot be deleted.

Run time indication

Select either the elapsed time or remaining time as run time.
Note that when the run time setting is set to [HOLD], elapsed time is automatically selected.

1. [Elapsed] button:
   Elapsed time is displayed in the centrifuge run time indication field in the Run screen and “Lapse” is indicated to the right above the display field.
2. [Remaining] button:
   Remaining time is displayed in the centrifuge run time indication field in the Run screen and “Remain” is indicated to the right above the display field.

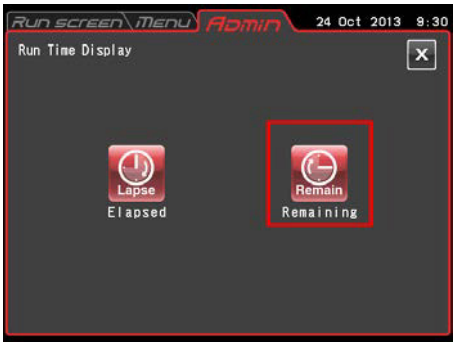


Figure 28: Set run time indication screen

Press to select either the [Elapsed] or the [Remaining]. Make certain that the selected button is surrounded by a red frame before pressing the [X] button or ADMIN tab to store the setting.

Actual run timer

You can set the run time to start counting down either when the [START] button is pressed or when the set speed is obtained.

1. [Enable] button: Run time is counted down when the set speed is obtained.
2. [Disable] button: Run time is counted down immediately after the [START] button is pressed.

Figure 29: Actual run timer setting screen

Press to select either the [Enable] or the [Disable]. Make certain that the selected button is surrounded by a red frame before pressing the [X] button or ADMIN tab to store the setting.

Vacuum level

You can select a vacuum level when acceleration starts after the vacuum waiting time at 4,000 rpm has elapsed. Select Start high vacuum to prevent a temperature increase caused by wind.

1. [Medium] button:
   When the vacuum level in the rotor chamber reaches about 133 Pa, the vacuum waiting time ends and the rotor starts accelerating to set speed. This occurs when two segments in the [VACUUM] button indicator light up.
2. [High] button:
   When the vacuum level in the rotor chamber reaches about 13 Pa, the vacuum waiting time ends and the rotor starts accelerating to set speed. This occurs when three segments in the [VACUUM] button indicator light up.

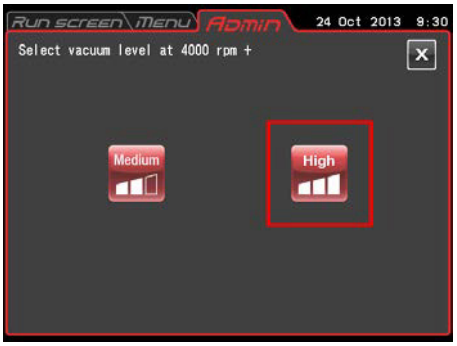


Figure 30: Start vacuum Setting screen

Press to select either the [Medium] or the [High] button. Make certain that the selected button is surrounded by a red frame before pressing the [X] button or ADMIN tab to store the setting.

Zonal speed

Zonal speed can be set between 2,000 and 3,000 rpm in increments of 100 rpm.

Step	Touchscreen operation	Screen display and notes
1	Press the [ZONAL SPEED] button. 	▪ The ZONAL speed setting screen appears and the currently set speed is displayed in black characters. 
2	Enter the desired speed using the on-screen keypad and press the [Enter] button.	▪ The value entered is displayed in blue. ▪ Pressing the [Enter] button turns the ZONAL speed indication black, indicating that the setting has been recorded.
3	Press the ADMIN tab, the [X] button, the Run screen tab or the MENU tab.	▪ Press the ADMIN tab or the [X] button to return to the ADMIN screen. ▪ Press the Run screen tab or MENU tab to return to the respective screen.

LAN communications

Connects and disconnects LAN communications. When the centrifuge is connected to a LAN, the “LogManager” software can be used for communications and storing of operation results.
To connect to a LAN, insert a LAN cable into the LAN port in the external connections on the right side of the instrument.

1. [Connect] button: Opens LAN communications. When the centrifuge is connected to a LAN, an icon indicating LAN connection status appears on the right side of the Menu tab.

The LAN is correctly connected.

The LAN is not properly connected. Check LAN cable connection on the instrument side, start up the “LogManager” and check LAN network operation.

2. [Disconnect] button: Closes LAN communications.

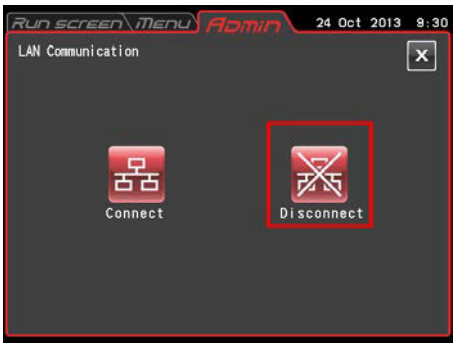
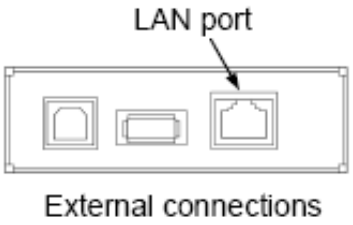


Figure 31: Set LAN communication screen

Press to select either the [Connect] or the [Disconnect] button. Make certain that the selected button is surrounded by a red frame before pressing the ADMIN tab or [X] button to store the setting.

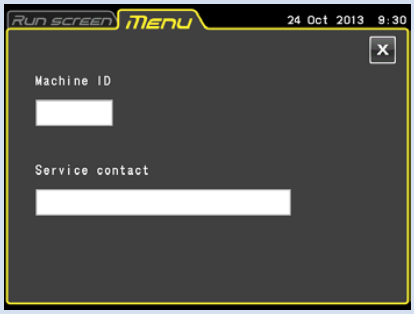
NOTE

1. Some screens may not display a LAN connection status icon.
2. The LAN port is located among the external connections on the right side of the instrument (refer to section External View of Ultracentrifuge).



Instrument ID, Service Contact Information

When multiple instruments are used, set separate IDs in each. Service contact information and other data can be stored as memos.

Step	Touchscreen operation	Screen display and notes
1	Press the [ID/Contact] button.	▪ The instrument ID, service contact display/setting screen appears. 
2	Press the Instrument ID.	▪ The instrument ID entry screen appears.  ▪ Enter an alphanumeric character string and press the [Enter] button. The instrument ID and the service contact display/setting screen reappear showing the entered ID in the instrument ID field. ▪ You can enter a character string with up to 6 characters.
3	Press the service contact field.	The Service contact field appears.  ▪ Enter a memo for the contact address of the authorized service center and press the [Enter] button. The instrument ID and the service contact display/setting screen reappear displaying the entered memo. ▪ You can enter a character string with up to 30 characters.
4	Press the MENU tab, [X] button or the Run screen tab.	▪ Press the MENU tab or the [X] button to return to the MENU screen. ▪ Press the Run screen tab to display the Run screen.

Occurrences in the Event of Power Failure

DANGER

To avoid electrical shock hazards, proceed as below when servicing the centrifuge.
1) Make sure to turn off the POWER switch and, if your centrifuge is equipped with a three-wire power cord, turn off the distribution board of your centrifuge room. Then wait at least three minutes before removing the covers from the centrifuge.
2) Make sure to turn off the POWER switch and, if your centrifuge is equipped with a power cord with plug, unplug the power cord from the outlet. Then wait at least three minutes before removing the covers from the centrifuge.

WARNING

Never open the door during rotation.
Never touch the rotor during rotation.

CAUTION

Never perform operations in a manner other than as described in this instruction manual.

Rotation of the rotor

The rotor coasts to a stop. If power is restored when the current speed is above 500 rpm, the rotor will be automatically accelerated to the set speed. If it is restored when the current speed is below 500 rpm, the rotor will decelerate to a stop.

Panel displays

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

Removing the rotor from the ultracentrifuge

First open the chamber door, then remove the rotor according to the following procedure:

1. Check that the rotor is at rest. Listen carefully for any sounds coming from the drive.

WARNING

It can take more than three hours for the rotor to come to a complete stop because the rotor chamber is under vacuum.
Before opening the door, wait until the rotor comes to a stop.

2. Turn off the POWER switch and open the power circuit breaker for the ultracentrifuge.
3. Remove the four M5 hexagon head bolts which fix the front cover in place from both sides and pull down the front cover by pulling its lower edge forward. Then remove the front cover. The upper edge of the front cover is engaged by insertion.

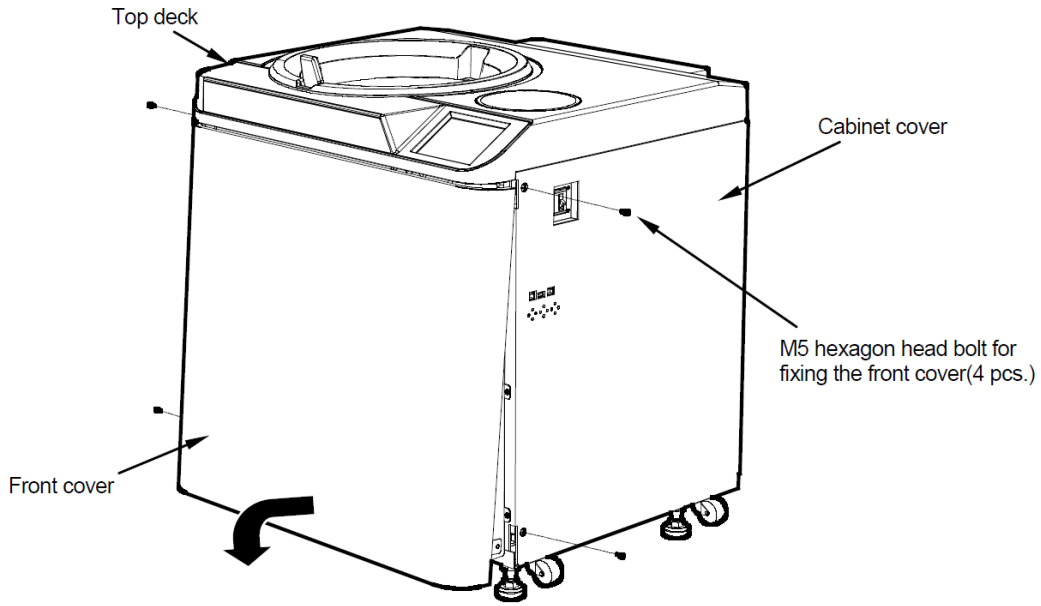


Figure 32: Removing the front cover

4. Open the air vent (by turning the vacuum release screw on the left of the vacuum chamber counterclockwise) to let air into the rotor chamber. When the pressure in the rotor chamber reaches atmospheric pressure, make sure to remember to tighten the vacuum release screw as it was before (see Figure 32 Ultracentrifuge with the front cover removed.)

5. Pull the door unlocking wire on the right side of the vacuum chamber and, at the same time, push the door handle. This opens the door. When opening the door, make certain that the rotor is not turning. If it is still turning, close the door immediately.

WARNING Never touch the rotor while it is turning.

6. Remove the rotor. Once it is removed, close the air vent and put the front cover back on the ultracentrifuge. Insert the top edge of the front cover into the bottom edge of the front side of the top deck and place the bottom edge of the front cover on the support plate of the front cover by reversing the removal procedure. Push the front cover against the frame so that there is no space between the front cover and the frame. Then fix the front cover on the frame using the four M5 hexagon head bolts.

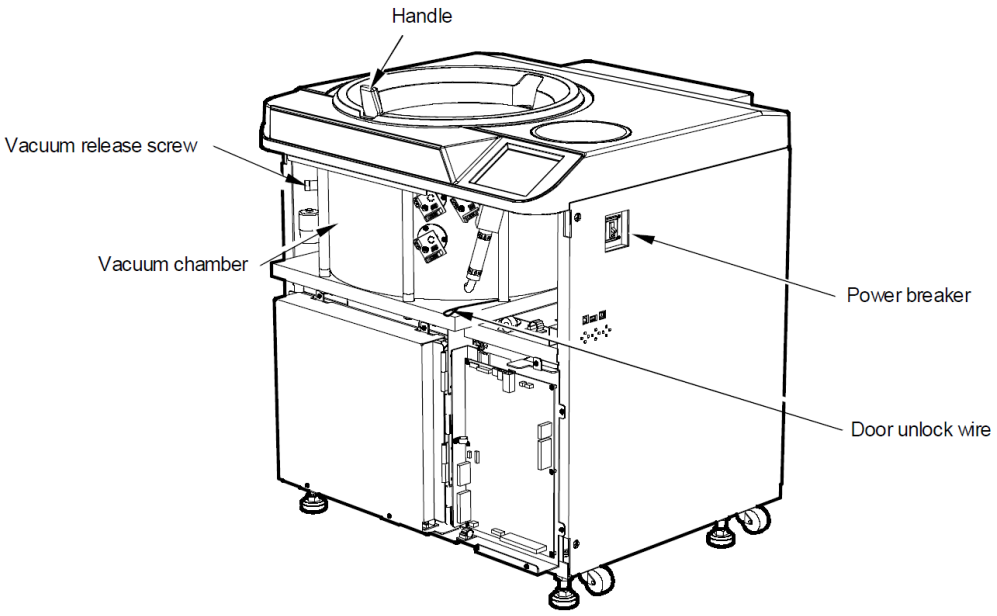


Figure 33: Ultracentrifuge with the front cover removed

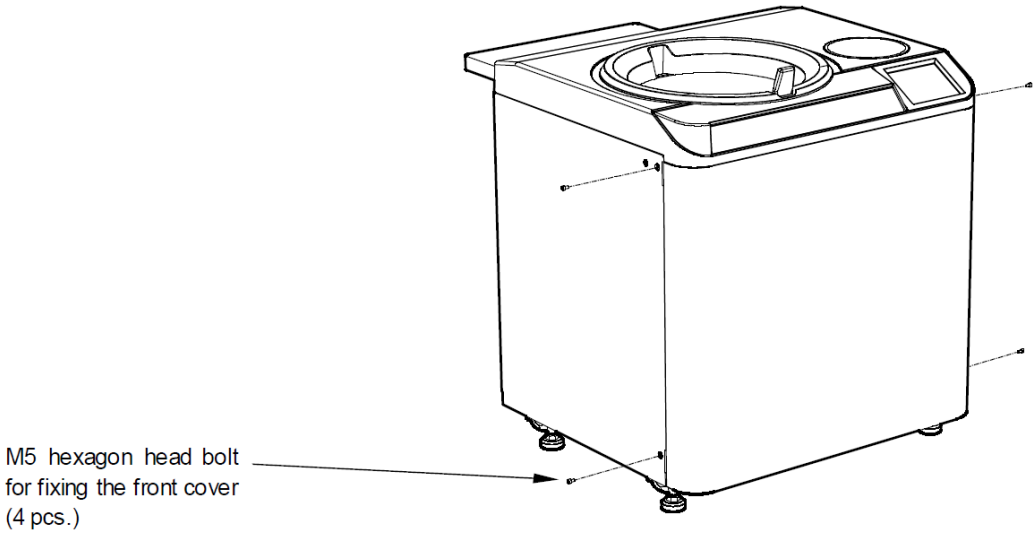


Figure 34: Installing the front cover

7. Turn on the power breaker.

CAUTION When the centrifuge will not be used for a long time, keep the power breaker off.

4. Maintenance

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

DANGER

To avoid electrical shock hazards, proceed as below when servicing the centrifuge.

Make sure to turn off the POWER switch and, if your centrifuge is equipped with a three-wire power cord, turn off the distribution board of your centrifuge room. Then wait at least three minutes before removing the covers from the centrifuge.

Make sure to turn off the POWER switch and, if your centrifuge is equipped with a power cord with plug, unplug the power cord from the outlet. Then wait at least three minutes before removing the covers from the centrifuge.

WARNING

If the centrifuge, rotor, or an accessory is contaminated by samples that are toxic or radioactive, or blood samples that are pathogenic or infectious, make sure to decontaminate the item(s) in accordance with good laboratory procedures and methods.

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

It is your responsibility to sterilize and/or decontaminate the centrifuge, rotor or parts properly before returning them to an authorized Thermo Fisher Scientific sales/service representative. In such cases, make a copy of the decontamination sheet at the end of this manual and fill it out, then attach it to the item to be returned.
Thermo Fisher Scientific may question you as to how the centrifuge, rotor or part has been handled if the decontamination level is checked and judged to be insufficient by Thermo Scientific. It is your responsibility to bear the cost of sterilization or decontamination.
If you have any questions, please contact your Thermo Fisher Scientific representative. Note that Thermo Fisher Scientific cannot repair or inspect the centrifuge, the rotor, or the accessory unless sterilization or decontamination is completed.

CAUTION

Do not perform any operation not specified in this manual. If your instrument is found to have a problem, contact an authorized Thermo Fisher Scientific sales/service representative.

This centrifuge does not require complicated maintenance and inspection activities. To enjoy extended, safe and trouble-free use of this centrifuge, observe the following instructions.

CAUTION

Using any cleaning or sterilization method other than those recommended in this instruction manual may result in corrosion or deterioration of the centrifuge. Refer to the chemical resistance chart attached to the rotor or contact Thermo Fisher Scientific.

CAUTION

To sterilize the surface of the centrifuge and the rotor chamber, wipe them with a cloth moistened with 70 % ethanol. Using any method other than the above may result in corrosion or deterioration of the centrifuge. Refer to the chemical resistance chart provided with the rotor or contact Thermo Fisher Scientific. While we recommend that 70 % ethanol be used for sterilization, no guarantee of sterility or disinfection is expressed or implied. When sterilization or disinfection is a concern, consult your laboratory safety officer regarding the proper methods to use.

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

Rotor Chamber

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

To maintain the rotor chamber, follow the instructions given below:

1. When the ultracentrifuge is not in use, keep the rotor chamber ventilated.
2. If the bowl is moist, wipe it with a clean, dry cloth or sponge.
3. If the rotor chamber is dirty, wipe it with a clean cloth or sponge dampened with a dilute solution of mild, non-alkaline detergent. While doing this, be careful not to touch the window of the temperature sensor.
4. If the door seal O-ring is dusty or scratched, it will be impossible to achieve a high vacuum level. Always keep the door seal O-ring clean. When the ultracentrifuge is used frequently, remove the door seal O-ring and wipe it with a clean, soft cloth, then apply a light coat of vacuum grease every three to four months (otherwise once a year). If the door seal O-ring is damaged, replace it. Wipe the groove for the door seal O-ring with a clean, soft cloth dampened with alcohol or a similar solvent.

Drive Shaft (Crown)

CAUTION Clean the inside of the drive hole (crown hole) of the rotor and the surface of the drive shaft (crown) of the centrifuge once a month. If the drive hole or the drive shaft is stained or any foreign matter has become adhered, the rotor may be installed improperly and come off during operation.

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

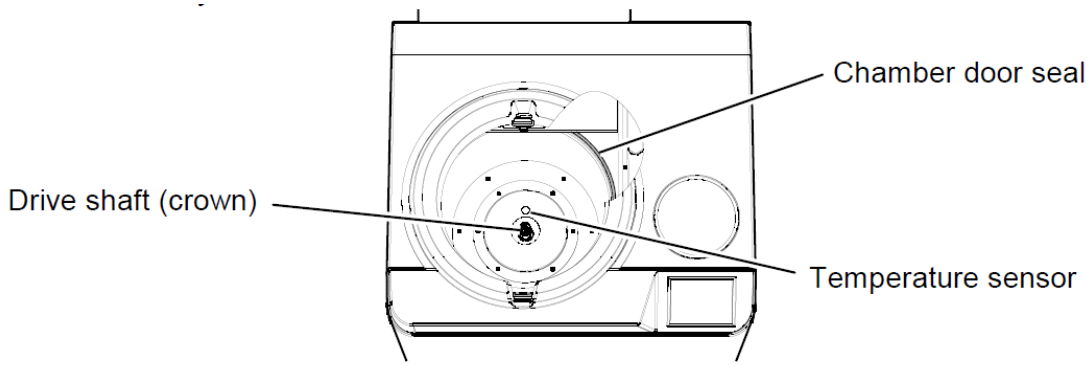


Figure 35: Rotor chamber

Cabinet

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

Others

Storage period of service parts

Service parts are kept in stock ten years after the discontinuation of production. The term “service parts” means the parts that are necessary to ensure the correct functioning of the centrifuge.

5. Troubleshooting

Make sure to read and keep in mind the following cautionary information before performing troubleshooting activities.

DANGER

To avoid electrical shock hazards, proceed as below when servicing the centrifuge.

1) Make sure to turn off the POWER switch and, if your centrifuge is equipped with a three-wire power cord, turn off the distribution board of your centrifuge room. Then wait at least three minutes before removing the covers from the centrifuge.

2) Make sure to turn off the POWER switch and, if your centrifuge is equipped with a power cord with plug, unplug the power cord from the outlet. Then wait at least three minutes before removing the covers from the centrifuge.

WARNING

If the centrifuge, rotor, or an accessory is contaminated by samples that are toxic or radioactive, or blood samples that are pathogenic or infectious, make sure to decontaminate the item(s) in accordance with good laboratory procedures and methods.

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

It is your responsibility to sterilize and/or decontaminate the centrifuge, rotor, or parts properly before returning them to an authorized Thermo Fisher Scientific sales/service representative. In such cases, make a copy of the decontamination sheet at the end of this manual and fill it out, then attach it to the item to be returned. Thermo Fisher Scientific may question you as to how the centrifuge, rotor or part has been handled if the decontamination level is checked and judged to be insufficient by Thermo Scientific.

It is your responsibility to bear the cost of sterilization or decontamination. If you have any questions, please contact a Thermo Fisher Scientific representative. Note that Thermo Fisher Scientific cannot repair or inspect the centrifuge, the rotor, or the accessory unless sterilization or decontamination is completed.

CAUTION

Do not perform any operation not specified in this manual. If your instrument is found to have a problem, contact an authorized Thermo Fisher Scientific sales/service representative.

This ultracentrifuge incorporates a “self-diagnosis feature” that diagnoses the cause of any problem which may occur when you start the centrifuge or while it is in operation.

Alert Indicators

If any problem occurs, this machine produces a buzzer sound and displays an alert message in the FUNCTION area of the Run screen to warn of the problem.

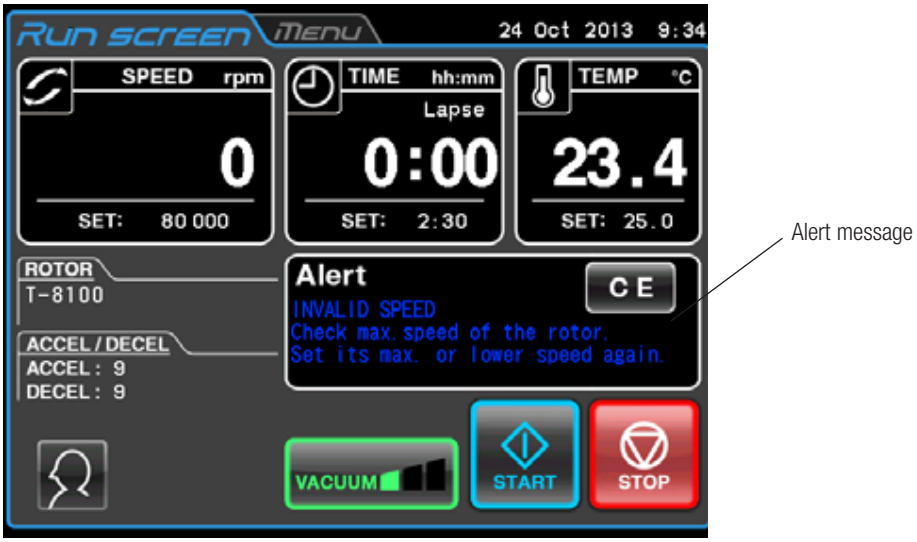


Figure 36: Displaying an alert message

If an alert message appears, remove the cause of the problem as described below and press the [CE] button. You will then be able to resume centrifugation.

WARNING Performance of any unspecified repairs to or modification or disassembly of the centrifuge not listed in Table 5-1 is strictly prohibited by any person other than an authorized Thermo Fisher Scientific sales/service representative.

If the alert message persists even after you have done what is specified below, contact a service representative to order a repair.

Table 2 Alert List

Alert message	Cause	Action
POWER FAILURE	1. A power failure occurred while the rotor was turning.	▪ Unless the set run time has elapsed, restart the run. ▪ If the instrument was automatically restored and the rotor is turning at set speed, then allow the run to continue.
	Refer also to section Occurrences in the Event of Power Failure	
INVALID SPEED	1. Rotor speed is set higher than the maximum allowable speed.	▪ Set the speed within their permitted limits.
IMBALANCE	1. Rotor is not properly balanced, and abnormal vibration has occurred in the rotor. 2. Rotor cover or cap is not properly tightened. 3. The ACCEL/DECEL code numbers that you chose are not applicable. (Applicable ACCEL/DECEL code numbers are limited depending on the rotors.)	▪ Check if the sample tubes exceed allowable imbalance level. ▪ Check if any one of the tubes is deformed, and if there is any sign of sample leakage. ▪ Securely tighten the rotor cover or cap. ▪ Check whether the ACCEL/DECEL code number setting is applicable to this rotor (refer to the rotor instruction manual).

SET ROTOR or NO ROTOR	1. Incorrect rotor is selected. 2. No rotor is installed.	▪ Select the correct rotor. ▪ Install the rotor.
ROOM TEMP	1. High room temperature 2. The centrifuge surroundings do not allow free air circulation.	▪ Lower the room temperature. ▪ Remove the objects surrounding the centrifuge.
VACUUM	1. Required vacuum level cannot be achieved. 2. After a satisfactorily high vacuum level had been achieved, it decreased (as a result of sample leakage, for example).	▪ Wipe off the moisture from inside the rotor chamber. ▪ Clean the chamber door seal, then apply a thin coat of vacuum grease (refer to section 4. Maintenance.) ▪ Check if the sample is leaking from the rotor and/or tubes.
CLOSE DOOR	1. The [VACUUM] or [START] button has been pressed with the chamber door left open.	▪ Close the door completely and press the [VACUUM] or [START] button.
Power supply voltage	1. The power supply voltage has dropped.	▪ Check the power supply voltage.
Rotor Service Life 1	1. The rotor is approaching its final (secondary) service life. When a “Rotor service life 1” alert signal occurs, this indicates that the rotor will reach its final service life once it has been operated twenty times or for 100 hours or less.	▪ Check the total number of runs and hours on the Rotor Management screen. Do not use the rotor any more when it reaches its final service life. Refer to the instruction manuals for each rotor.
Rotor Life 2	1. The rotor has nearly reached the end of its primary service life. When a “Rotor life 2” alert signal occurs, this indicates that the rotor will reach the end of its primary service life once it has been operated twenty times or for 100 hours or less.	▪ Check the total number of runs and hours on the Rotor Management screen. If the rotor has reached the primary life, contact a Thermo Fisher Scientific authorized sales/ service representative to inspect the rotor.
Rotor Life 3	1. There is too much information on the registered rotors to enter the data on the additional rotors.	▪ Register the additional rotors after deleting unnecessary registered rotors on the Rotor Management screen.
Rotor Life 4	1. The rotor is approaching its final (secondary) service life.	▪ Do not use the rotor any more when it reaches its final service life. Scrap this rotor.

Diagnosed Problems Requiring Maintenance

If any alert message between E11 and E86 appears, the ultracentrifuge requires maintenance by a service representative. When ordering a repair, inform us of the alert code you have received.

NOTE If the "E13: Unexpected MPG pulse" alert message appears, this alert message is impossible to clear until the rotor stops.

NOTE Be sure to contact a Thermo Fisher Scientific service representative if the alert message "VACUUM" persists even after you have taken the steps specified above. There may be an abnormality in the heater of the oil diffusion pump. Be sure to contact a Thermo Fisher Scientific service representative if the alert message "E35: DP heater thermistor abnormality" appears. There may be an abnormality in the heater of the oil diffusion pump.

User-Corrected Problems

If the ultracentrifuge does not function although no problems have been reported, proceed as follows:

Symptom	Cause	Remedy
The ultracentrifuge cannot be energized be by turning on the POWER switch.	The circuit breaker connected to the ultracentrifuge is tripped.	▪ Reset the circuit breaker, then turn on the POWER switch.
The rotor cannot cool down or the rotor temperature is rising.	Poor vacuum	▪ Check whether the oil for the vacuum pump needs replacing. ▪ Clean or replace the door seal O-ring.
	The room temperature is higher than 30 °C.	▪ If there is an air conditioner working near the ultracentrifuge, run it at a lower room temperature setting. ▪ If there is no air conditioner working near the ultracentrifuge, lower the set speed.
	The rotor surface contains droplets of water.	▪ Wipe the water off the rotor with a soft cloth.
	The window portion of the temperature sensor contains droplets of water.	▪ Wipe the water off the temperature sensor with a soft cloth, being careful not to touch the sensor with your finger.

6. Installation

Installation or relocation of your centrifuge must be performed by an authorized Thermo Fisher Scientific service representative. Contact your local dealer or a Thermo Fisher Scientific service representative. In order to use the ultracentrifuge fully and safely, follow the installation instructions given below.

DANGER

To avoid electrical shock hazards, proceed as below when servicing the centrifuge.
1) Make sure to turn off the POWER switch and, if your centrifuge is equipped with a three-wire power cord, turn off the distribution board of your centrifuge room. Then wait at least three minutes before removing the covers from the centrifuge.
2) Make sure to turn off the POWER switch and, if your centrifuge is equipped with a power cord with plug, unplug the power cord from the outlet. Then wait at least three minutes before removing the covers from the centrifuge.

WARNING

Before changing the power voltage by manually selecting the desired winding on the internal transformer, turn off the power supply to the ultracentrifuge, then unplug the power cord from the wall outlet. Changing the voltage without taking these precautions exposes you to the possibility of electric shock.

CAUTION

Your ultracentrifuge may be damaged if it is supplied with the incorrect voltage. Check the voltage before plugging the ultracentrifuge into a power source.

Power requirement

The power source specifications are indicated on the rating label which is located on the left side of the instrument. Make sure to read the rating label. If the power source specifications do not match the available power source, you can change the power source specifications by manually selecting the desired winding on the internal transformer.
Provide an emergency switch (circuit breaker) intended for this centrifuge only to use in turning off the centrifuge power in the event of failure. It is recommended to provide this switch outside of the centrifuge room or near the exit of the centrifuge room. Additionally, this emergency switch should be marked as the disconnecting device for this centrifuge.
Your ultracentrifuge can be operated on one of the following four power voltages: 208 Vac (50/60 Hz, 20 A), 220 Vac (50/60 Hz, 20 A), 230 Vac (50/60 Hz, 16 A), or 240 Vac (50/60 Hz, 16 A). You can change the voltage by manually selecting the desired winding on the internal transformer.
If the plug (Part No.84440401) is included as one of the accessories to your centrifuge and you connect the power cord to a wall outlet, do not position any object so that it impedes disconnecting the power cord from the outlet. If you fail to observe this, you will not be able to disconnect the power cord from the receptacle when you detect an abnormality.

Installation location

1. Install the ultracentrifuge on a concrete, stone or hardwood floor. Avoid such places as soft or carpeted floors which transmit external vibrations to the ultracentrifuge.
2. Ambient temperature for operation is 2 to 40 °C. If the room temperature rises above 30 °C, the temperature of the rotor may exceed specified limits. Avoid installing the ultracentrifuge in direct sunlight or in an area whose ambient temperature exceeds 30 °C.
3. The ultracentrifuge requires clearance greater than 20 cm at its rear wall and floor space of at least 90 x 90 cm (See Figure 36 Place of installation). Ensure the instrument surroundings allow free air circulation. Avoid installing the ultracentrifuge near any other heat-generating machine/equipment, as this may reduce the cooling capacity of the ultracentrifuge.

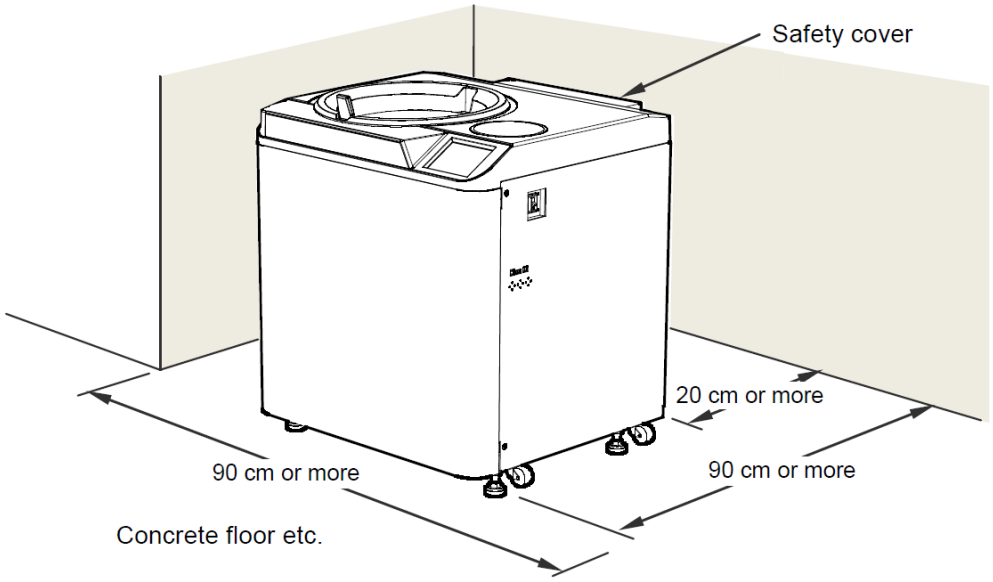


Figure 37: Place of installation

WARNING

The centrifuge itself may move if the rotor fails during high-speed rotation. Ensure that there is a 30 cm area around the centrifuge that will allow for such movement and do not allow individuals to enter that area during operation. Also do not place dangerous objects such as flammable or explosive materials on top of the centrifuge or in the surrounding area.

Fixing the safety cover

The ultracentrifuge is shipped with the safety cover removed from its rear side. When installing the ultracentrifuge, remove the packing and insert the lower part of the safety cover into the two hooks which protrude from the frame, then secure it using the six M4 connecting screws (See Figure 37 Securing the safety cover).

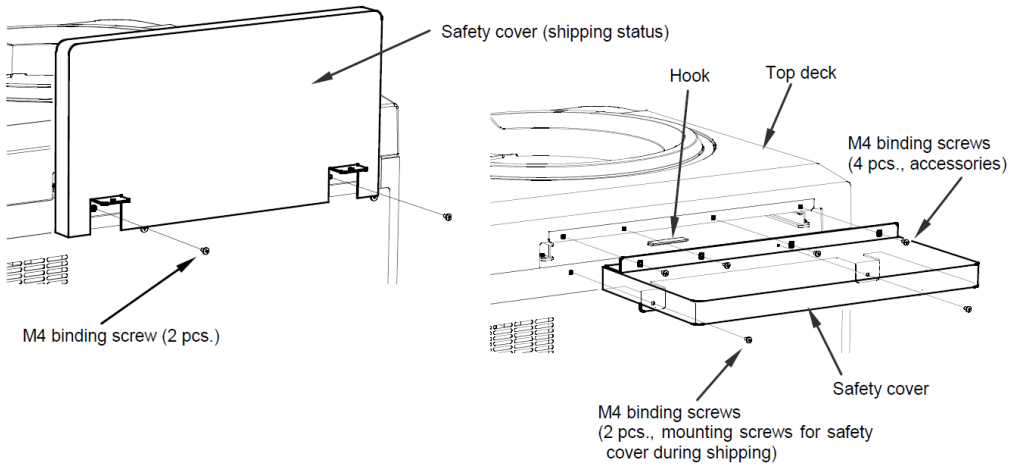


Figure 38: Securing the safety cover

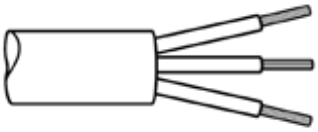
Connecting the power cord

WARNING Your ultracentrifuge must be properly grounded.

WARNING Do not touch the power cord with wet hands to avoid electrical shocks.

All electrical connections should be carried out by a suitable qualified person.

1. When your centrifuge is equipped with a three-wire power cord (see below), plug the power cord coming from the rear of the centrifuge into the jack on the distribution board in accordance with ANSI/NFPA 70, NEC, with CSA C22.1, CEC, Part or with vire is a ground wire. Your centrifuge must be grounded properly.



Black (Neutral)
Green/Yellow (Protective earth)
Black (Line)

2. If the plug (Part No.84440401) is included as one of the accessories to your centrifuge and you wish to connect the power cord to the wall outlet (NEMA 6-30R), connect the plug to the end of the power cord. For any other connection, comply with local electrical codes. Your centrifuge must be grounded properly.

WARNING Do not hold the cord when disconnecting the power cord from the outlet. Instead, hold the plug.

Leveling

1. Turn the four leveling screws with a wrench to lift the caster about 10 to 20 mm off the floor as shown in Figure 38 Leveling operation.
2. Turn on the POWER switch and open the chamber door. Then turn off the POWER switch again. If the power cord is not yet connected, remove the front cover and then open the door according to the instructions given in section Occurrences in the Event of Power Failure.

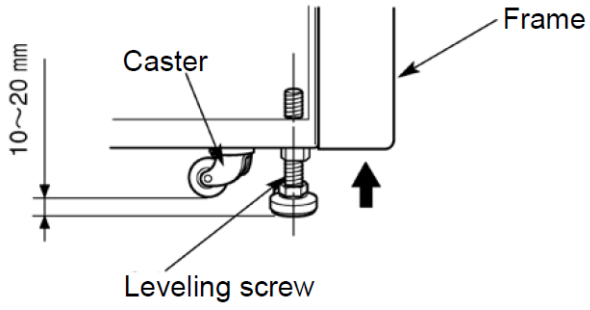


Figure 39: Leveling operation

3. Place the level across the top of the drive shaft in the rotor chamber (see Figure 39 Level Placement). Turn the four leveling screws until the bubble in the level indicates the instrument is level.
4. When the instrument is level, check that the four leveling screws are secured to the floor.

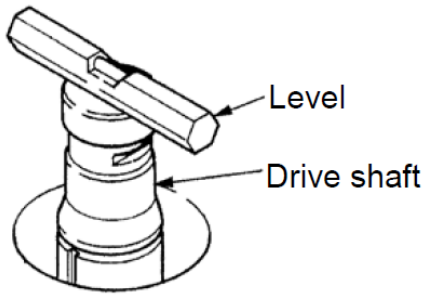


Figure 40: Level Placement

5. Moving the ultracentrifuge

   When moving the ultracentrifuge, disconnect the power cord and unscrew the leveling screws with a wrench to lower the caster to the floor. Raise the leveling screws enough to remove the leveling pads, then move the ultracentrifuge. After moving, be sure to install and level the instrument again.

CAUTION Make sure to remove the rotor from the rotor chamber when moving the centrifuge. After installation and before any test run is performed, this ultracentrifuge requires an internal check by an authorized Thermo Fisher Scientific sales/service representative.

7. Warranty for the Thermo Scientific Sorvall WX Plus Ultra Series Centrifuge

THERMO FISHER SCIENTIFIC MAKES NO WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, INCLUDING THAT OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE EXCEPT AS STATED IN THIS WARRANTY POLICY STATEMENT.

Subject to the exceptions and upon the conditions specified in this Warranty Policy Statement, Thermo Fisher Scientific warrants each Sorvall WX Plus Ultra series centrifuge (instrument) to be free from defects in material or workmanship for a period of one (1) year from the date of installation of any such instrument. Thermo Fisher Scientific agrees to correct, either by repair or, at Thermo Fisher Scientific's discretion, by replacement, any defects in material or workmanship which develop within one (1) year after installation of any such instrument, provided that investigation and/or factory inspection by Thermo Fisher Scientific discloses that such defect developed under normal and proper usage. The exceptions and conditions mentioned above are the following:

1. Some components and accessories by their nature are not intended to and will not function for the length of the warranty period. If any such component or accessory manufactured by Thermo Fisher Scientific and part of the instrument sold fails to give reasonable service for a reasonable period of time, Thermo Fisher Scientific will, at its discretion, replace or repair such component or accessory. What constitutes reasonable service and what constitutes a reasonable period of time shall be determined solely by Thermo Fisher Scientific, after Thermo Fisher Scientific is in possession of all the facts concerning operating conditions and other pertinent factors and after such component or accessory has been investigated and/or factory inspected by Thermo Fisher Scientific.
2. All items claimed as defective must be returned to Thermo Fisher Scientific, transportation charges prepaid, and will be returned to the Purchaser with transportation charges prepaid. Thermo Fisher Scientific will be released from all obligations under this warranty in the event that any such instruments have been installed by, or repairs or modifications made by, persons other than its own service personnel or service personnel authorized by it unless such installation, modification and/or repairs by others are made with the prior written consent of Thermo Fisher Scientific.
3. Thermo Fisher Scientific is not obliged to incorporate into any instrument any design, engineering, or performance change developed after delivery of the instrument to the original purchaser. In addition to the foregoing one (1) year warranty and subject to the foregoing exceptions and conditions, Thermo Fisher Scientific warrants the drive assembly of the Sorvall WX Plus Ultra series centrifuge to be free from defects in material or workmanship for ten (10) years from the date of ultracentrifuge installation, subject to all the conditions, limitations, and other aspects of warranty expressed above and to the following further conditions:

   a. The instrument shall be operated only within its rated maximum speed and temperature in accordance with the instructions in this manual.

   b. The drive unit shall not be overloaded nor loaded with an unbalanced rotor or an improper rotor and it shall be free from any corrosion or rust caused by spilled sample or solution on the drive spindle or in the chamber.

   c. The drive unit shall not be modified, disassembled, or repaired by any party but Thermo Fisher Scientific or by a service representative authorized, in writing, by Thermo Fisher Scientific. If any defect should occur to the drive unit within the aforesaid warranty period and accumulated number of revolutions, the defective drive unit shall be replaced at no cost to the Purchaser. Extended Warranties are conditional on the instrument being correctly maintained by authorized Service Representatives on an annual basis.

THERMO FISHER SCIENTIFIC EXPRESSLY DISCLAIMS ANY LIABILITY TO ITS CUSTOMERS, DEALERS, AND REPRESENTATIVES, AND TO USERS OF ITS PRODUCTS, AND TO ANY OTHER PERSON OR PERSONS FOR SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND AND FROM ANY CAUSE WHATSOEVER ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE SALE, HANDLING, REPAIR, MAINTENANCE OR REPLACEMENT ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE USE OF SAID PRODUCTS.

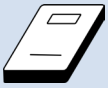
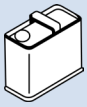
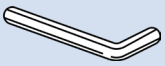
Representations and warranties made by any person, including dealers and representatives of Thermo Fisher Scientific, which are inconsistent or in conflict with the terms of this warranty (including but not limited to the limitations of the liability of Thermo Fisher Scientific as set forth above), shall not be binding upon Thermo Fisher Scientific unless made in writing and approved by Thermo Fisher Scientific.

NO CLAIM OF ANY KIND, WHETHER IT IS FOR GOODS DELIVERED OR FOR NON-DELIVERY OF GOODS, SHALL BE GREATER IN AMOUNT THAN THE PURCHASE PRICE OF THE GOODS IN RESPECT OF WHICH SUCH DAMAGES ARE CLAIMED, AND FAILURE TO GIVE NOTICE OF CLAIM WITHIN NINETY (90) DAYS FROM THE DATE OF DELIVERY OR THE DATE FIXED FOR DELIVERY, OR AS OTHERWISE PROVIDED IN THIS WARRANTY POLICY STATEMENT, SHALL CONSTITUTE A WAIVER BY THE PURCHASER OF ALL CLAIMS IN RESPECT OF SUCH GOODS.

No charges or expenses incident to any claim will be allowed unless approved by an authorized representative of Thermo Fisher Scientific in writing. Goods shall not be returned to Thermo Fisher Scientific without Thermo Fisher Scientific's permission.

8. Supply List

The items below are those supplied with the ultracentrifuge.

Item Name	Part No.	Q'ty	Item drawing	Remarks
Instruction manual		1		
Simulation CD assembly		1		"Compass" Software
Vacuum pump oil	45128	1		Supplied in 1-liter NEO VAC Containers (MR100)
M4 connecting screw		4		
Hex bar wrench		1		
Vacuum grease	65937	1		

Service Decontamination

Policy

WARNING Due to the characteristics of the samples likely to be processed, biological or radioactive contamination may occur. Always be aware of this possibility and take normal precautions. Use appropriate decontamination procedures in the event of exposure.

If a centrifuge or rotor which has been used with radioactive or pathogenic material requires servicing by Thermo personnel, either at the customer's laboratory or at a Thermo facility, comply with the following procedure to ensure the safety of all personnel:

1. Clean the centrifuge to be serviced of all encrusted material and decontaminate (see section 4. Maintenance of centrifuge) it prior to servicing by the Thermo representative or returning it to the Thermo facility. There must be no radioactivity detectable by survey equipment.
   The Sorvall Product Guide contains descriptions of commonly used decontamination methods and a chart showing the compatibility of these methods with various materials. The section 4. Maintenance of this instruction manual contains specific guidance about cleaning and decontamination methods appropriate for the product it describes.
   Clean and decontaminate your centrifuge as follows:
   a. Remove the rotor from the rotor chamber.
   b. Decontaminate the door and rotor chamber using an appropriate method.
2. Complete and attach the Decontamination Information
   Certificate (in the back of your rotor or instrument manual) to the centrifuge before servicing or return to a Thermo facility.
   If this Certificate is not available, attach a written statement verifying decontamination (name of the contaminant and the decontamination method used).

If the centrifuge must be returned to a Thermo facility:

1. Contact your Thermo representative to obtain a Return Service Order Number (RSO No.); have on hand the name and serial number of the centrifuge or rotor and the repairs required.
2. Send item(s) with the RSO No. clearly marked on the outside of the packaging to the address obtained from your Thermo representative.

NOTE United States federal regulations require that parts and instruments must be decontaminated before being transported. Outside the United States, check local regulations.

If the centrifuge to be serviced does not have a Decontamination Information Certificate attached and, in Thermo's opinion, presents a potential radioactive or biological hazard, the Thermo representative will not service the equipment until proper decontamination and certification is complete. If Thermo receives a centrifuge at its Service facilities which, in its opinion, is a radioactive or biological hazard, the sender will be contacted for instructions as to disposition of the equipment. Disposition costs will be borne by the sender. Decontamination Information Certificates are included with these instructions. Additional certificates are available from the local Account Representative or Field Service Engineer. In the event these certificates are not available, a written statement certifying that the unit has been properly decontaminated and outlining the procedures used will be acceptable.

NOTE The Field Service Engineer will note on the Customer Service Repair Report if decontamination was required and, if so, what the contaminant was and what procedure was used. If no decontamination was required, it will be so stated.

WEEE Compliance

This product is required to comply with the European Union`s Waste Electrical & Electronic Equipment (WEEE) Directive 2012/19/EU. It is marked with the following symbol:

Thermo Fisher Scientific has contracted with one or more recycling/disposal companies in each EU Member State, and this product should be disposed of or recycled through them. Further information on Thermo Fisher Scientific`s compliance with these Directives, the recyclers in your country, and information on Thermo Fisher Scientific products which may assist in the detection of substances subject to the RoHS Directive are available at www.thermo.com/WEEERoHS.

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50145792 is the original instruction manual.

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