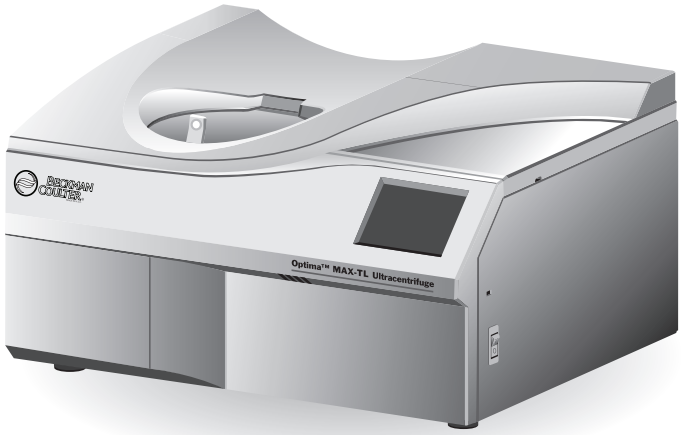
Instructions For Use

Optima MAX-TL

Ultracentrifuge



PN A96722AF
August 2022

Beckman Coulter, Inc.
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Brea, CA 92821 U.S.A.

BECKMAN COULTER

Optima MAX-TL
Ultracentrifuge
PN A96722AF (June 2022)

Contact Us
If you have any questions, contact our Customer Support Center.

- Worldwide, find us via our website at *www.beckman.com/support/technical*
- In the USA and Canada, call us at 1-800-369-0333.
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Glossary of Symbols is available at beckman.com/techdocs (PN C24689).

May be covered by one or more pat. - see www.beckman.com/patents

Original Instructions

Revision History

Your Optima MAX-TL documentation can be found on our website. For updates, go to www.beckman.com/techdocs and download the latest version of the manual or system help for your instrument.

Revision AC, March 2017
Updates were made to the following section:
- Multiple Compliance Label

Revision AD, August 2018
Updates were made to the following section:
- CHAPTER 3, User Message Chart

Revision AE, June 2020
Updates were made to the following sections:
- CHAPTER 2, Installing the Rotor
- CHAPTER 2, Manual Run

Revision AF, August 2022
Updates were made to the following section:
- *Safety Notice*, *Multiple Compliance Label*

Note: *Changes that are part of the most recent revision are indicated in text by a bar in the margin of the amended page.*

Safety Notice

Read all product manuals and consult with Beckman Coulter-trained personnel before attempting to operate instrument. Do not attempt to perform any procedure before carefully reading all instructions. Always follow product labeling and manufacturer's recommendations. If in doubt as to how to proceed in any situation, contact your Beckman Coulter Representative.

Alerts for Warning, Caution, Important, and Note

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

IMPORTANT IMPORTANT is used for comments that add value to the step or procedure being performed. Following the advice in the Important adds benefit to the performance of a piece of equipment or to a process.

NOTE NOTE is used to call attention to notable information that should be followed during installation, use, or servicing of this equipment.

Safety During Installation and/or Maintenance

This ultracentrifuge is designed to be installed by a Beckman Coulter Field Service representative. Installation by anyone other than authorized Beckman Coulter personnel invalidates any warranty covering the ultracentrifuge.

This ultracentrifuge weighs 105 kg (230 lb). Do not attempt to lift or move it without assistance.

Any servicing of this equipment that requires removal of any covers can expose parts which involve the risk of electric shock or personal injury. Make sure that the power switch is off and the ultracentrifuge is disconnected from the main power source by removing the Mains (power) plug from the outlet receptacle, and refer such servicing to qualified personnel.

Do not replace any ultracentrifuge components with parts not specified for use on this ultracentrifuge.

Electrical Safety

To reduce the risk of electrical shock, this equipment uses a three-wire electrical cord and plug to connect the ultracentrifuge to earth-ground. To preserve this safety feature:

- Make sure that the matching wall outlet receptacle is properly wired and earth-grounded. Check that the line voltage agrees with the voltage listed on the name-rating plate affixed to the ultracentrifuge.
- Never use a three-to-two wire plug adapter.
- Never use a two-wire extension cord or a two-wire non-grounding a type of multiple-outlet receptacle strip.
- Do not install the ultracentrifuge on a ground fault-protected power source.

Do not place containers holding liquid on or near the chamber door. If they spill, liquid may get into the ultracentrifuge and damage electrical or mechanical components.

Safety Against Risk of Fire

Fuses protect certain electrical circuits within this ultracentrifuge against overcurrent conditions. For continued protection against the risk of fire, replace only with the same type and rating specified.

This ultracentrifuge is not designed for use with materials capable of developing flammable or explosive vapors. Do not ultracentrifuge such materials (such as chloroform or ethyl alcohol) in this ultracentrifuge nor handle or store them within the required 30-cm (1-ft) area surrounding the ultracentrifuge.

Mechanical Safety

For safe operation of the equipment, observe the following:

- Use only the rotors and accessories designed for use in this ultracentrifuge.
- Do not exceed the maximum rated speed of the rotor in use.
- Do not lift or move the ultracentrifuge while the rotor is spinning.
- NEVER attempt to slow or stop the rotor by hand.
- NEVER attempt to override the door interlock system while the rotor is spinning.
- In the event of a power failure, do not attempt to retrieve the sample from the ultracentrifuge for at least 1 hour. Then follow the instructions for sample recovery in CHAPTER 3, *Troubleshooting*.

Chemical and Biological Safety

Normal operation may involve the use of solutions and test samples that are pathogenic, toxic, or radioactive. Such materials should not be used in this ultracentrifuge, however, unless *all necessary safety precautions are taken*.

- Observe all cautionary information printed on the original solution containers prior to their use.
- Handle body fluids with care because they can transmit disease. No known test offers complete assurance that they are free of micro-organisms. Some of the most virulent — Hepatitis (B and C) and HIV (I-V) viruses, atypical mycobacteria, and certain systemic fungi — further emphasize the need for aerosol protection. Handle other infectious samples according to good laboratory procedures and methods to prevent spread of disease. Because spills may generate aerosols, observe proper safety precautions for aerosol containment. Do not run toxic, pathogenic, or radioactive materials in this ultracentrifuge without taking appropriate safety precautions. Biosafe containment should be used when Risk Group II materials (as identified in the World Health Organization *Laboratory Biosafety Manual* are handled; materials of a higher group require more than one level of protection.
- Dispose of all waste solutions according to appropriate environmental health and safety guidelines.

It is your responsibility to decontaminate the ultracentrifuge and accessories before requesting service by Beckman Coulter.

Symbols and Labels

This section provides information for some labels and symbols appearing on the Optima MAX-TL instrument housing. These labels and symbols may be associated with user-serviceable procedures. Individual hazards associated with a specific procedure in this manual may use these labels and symbols, and are included in Warnings or Cautions within the procedures for that task.

Biohazard

This caution symbol indicates biohazardous risk from possible patient specimen contamination.

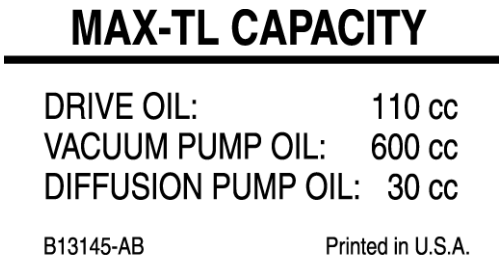
Caution Symbol

This symbol indicates a caution message and appears adjacent to an explanation or other symbols that define the caution.

High Voltage Danger

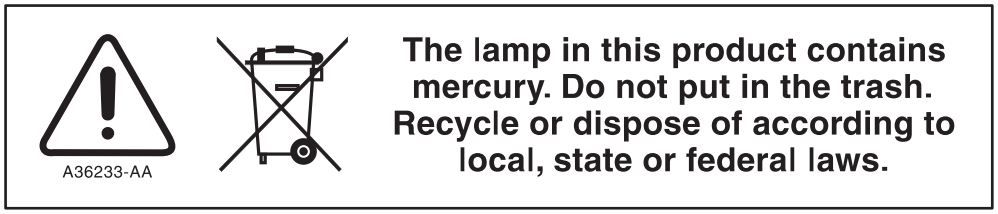
This symbol indicates high voltage is present or that there is a risk of electric shock when working in this area. Operation, replacement or servicing of any components where contact with bare, live hazardous parts could occur, possibly resulting in electric shock, should only be performed by your Beckman Coulter representative.

MAX-TL Oil Capacity



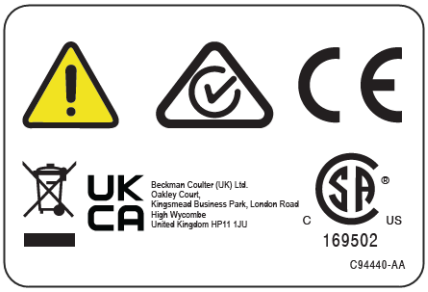
This label indicates oil capacities for the indicated subsystems.

Mercury Lamp Warning



This label indicates the lamp in the product contains mercury and should not be put in the trash.

Multiple Compliance Label



- Recycling – Refer to the Recycling Label section in this document.
- CE – A "CE" mark indicates that a product has been assessed before being placed on the market, and has been found to meet European Union safety, health, and/or environmental protection requirements.
- UK CA — A "UKCA" mark indicates that a product has been assessed before being placed in the UK market, and has been found to meet UK safety, health, and/or environmental protection requirements.
- 169502 – This label indicates recognition by a Nationally Recognized Testing Laboratory (NRTL) that the instrument has met the relevant product safety standards.

  NOTE 169502 is applicable to North American models only.

- The RCM mark is intended for use on products that comply with Australian Communications Media Authority (ACMA) EMC Requirements.

Protective Ground

This symbol is used to indicate a protective ground. This instrument must be properly grounded. Do not under any circumstances operate the instrument unless it is properly grounded.

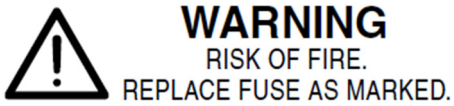
Recycling Label

This symbol is required in accordance with the Waste Electrical and Electronic Equipment (WEEE) Directive of the European Union. The presence of this marking on the product indicates:

- the device was put on the European Market after August 13, 2005 and
- the device is not to be disposed of via the municipal waste collection system of any member state of the European Union.

It is very important that customers understand and follow all laws regarding the proper decontamination and safe disposal of electrical equipment. For Beckman Coulter products bearing this label, please contact your dealer or local Beckman Coulter office for details on the take-back program that will facilitate the proper collection, treatment, recovery, recycling and safe disposal of the device.

Risk of Fire Warning



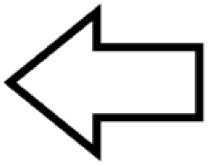
Before replacing fuses, shut off power and disconnect the power cord. Failure to do so can cause electric shock and/or equipment damage. Replace fuses only with approved type and rating replacement fuse.

RoHS Caution

This label and materials declaration table (the Table of Hazardous Substance's Name and Concentration) are to meet People's Republic of China Electronic Industry Standard SJ/T11364-2006“Marking for Control of Pollution Caused by Electronic Information Products” requirements.

This logo indicates that this electronic information product contains certain toxic or hazardous elements, and can be used safely during its environmental protection use period. The number in the middle of the logo indicates the environmental protection use period for the product. The outer circle indicates that the product can be recycled. The logo also signifies that the product should be recycled immediately after its environmental protection use period has expired. The date on the label indicates the date of manufacture.

Rotor Rotation

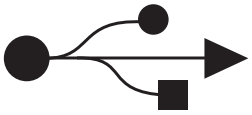


This indicates the direction of instrument rotor rotation.

Static Sensitive Area Caution

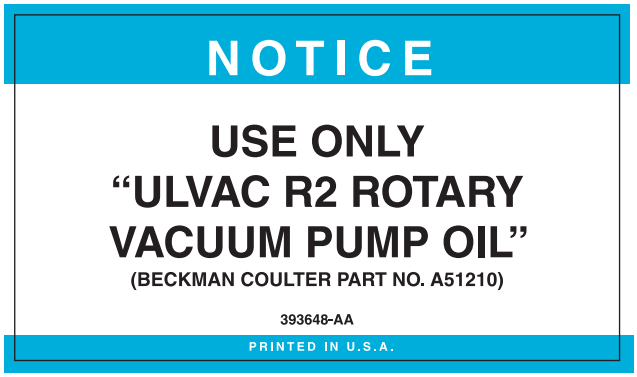
Indicates an area of the instrument which is sensitive to static electrostatic discharge (ESD). To prevent damage due to electrostatic discharge, always wear a properly earth-grounded wrist strap while operating this instrument. For details on proper grounding, see IEEE standard P1100.

Universal Serial Bus (USB)



This symbol indicates the location of a universal serial bus (USB) connector.

Vacuum Pump Oil Notice



This label indicates to use only ULVAC R2 rotary vacuum pump oil (Beckman Coulter part number A51210).

240 VAC Warning

This symbol indicates that the instrument has been configured for operation at 240 VAC. Consult with a Beckman Coulter service engineer for use at other line voltages.

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Beckman Coulter, Inc.
Optima MAX-TL Ultracentrifuge Warranty

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Introduction

Certification

Beckman Coulter Optima MAX-TL ultracentrifuges are manufactured in a facility that maintains certifications to both ISO 9001:2008 and ISO 13485:2003. The Optima MAX-TL has been designed and tested to be compliant (when used with Beckman Coulter rotors) with the laboratory equipment requirements of applicable regulatory agencies. Declarations of conformity and certificates of compliance are available at www.beckman.com.

Scope of Manual

This manual is designed to familiarize you with the Optima MAX-TL Ultracentrifuge, its functions, specifications, operation, and routine operator care and maintenance. We recommend that you read this entire manual, especially the *Safety Notice* section and all safety-related information, before operating the ultracentrifuge or performing ultracentrifuge maintenance.

- CHAPTER 1, *Description* contains system specifications and a brief physical and functional description of the ultracentrifuge, including the operating controls and indicators.
- CHAPTER 2, *Operation* contains ultracentrifuge operating procedures.
- CHAPTER 3, *Troubleshooting* lists diagnostic messages and other possible malfunctions, together with probable causes and suggested corrective actions.
- CHAPTER 4, *Care and Maintenance* contains procedures for routine operator care and maintenance, as well as a brief list of supplies, replacement parts, and accessories.
- APPENDIX A, *Preinstallation Requirements* describes the space and power requirements for installing and connecting the ultracentrifuge.

NOTE If the ultracentrifuge is used in a manner other than that specified in this manual, the safety and performance of this equipment could be impaired. Further, the use of any equipment other than that recommended by Beckman Coulter has not been evaluated for safety. Use of any equipment not specifically recommended in this manual and/or the appropriate rotor manual is the sole responsibility of the user.

Conventions

Certain symbols are used in the product labeling to call out safety-related and other important information. These international symbols may also be displayed on the centrifuge and are reproduced on the inside of the back cover of this manual.

Typographic Conventions

Certain typographic conventions are used throughout this manual to distinguish names of user interface components, such as buttons and displays.

- Touchscreen buttons (for example, **START** or **VACUUM**) appear in capital letters in boldface.
- Display names (for example, **SPEED** or **TIME hr:mm** appear in boldface.

CFC-Free Centrifugation

To ensure minimal environmental impact, no CFCs are used in the manufacture or operation of the Optima MAX-TL Ultracentrifuge.

CHAPTER 1

Description

Introduction

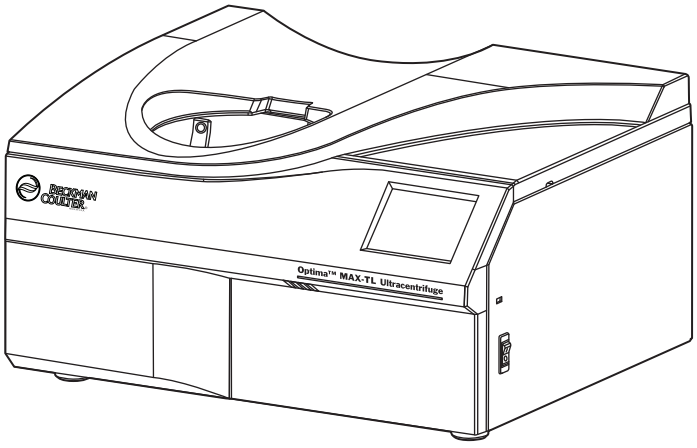
This chapter provides a brief physical and functional description of the Beckman Coulter Optima MAX-TL ultracentrifuge. The operating controls and indicators are also described; instructions for their use are in CHAPTER 2, Operation. Chemical compatibilities of materials listed in this manual can be found in Chemical Resistances *(publication IN-175). Refer to the applicable rotor manuals for rotor descriptions.*

Ultracentrifuge Function and Safety Features

Ultracentrifuge Function

The Optima MAX-TL microprocessor-controlled tabletop ultracentrifuge (see Figure 1.1) generates high centrifugal forces for a variety of applications. The ultracentrifuge design features a variable-frequency induction drive, thermoelectric temperature control system, self-purging vacuum system, rotor overspeed identification system, program memory that contains multiple five-step programs, and a choice of acceleration and deceleration rates.

Figure 1.1 The Optima MAX-TL Ultracentrifuge



Manual and programmed operations are available from the integrated touchscreen interface.

- In manual operation, you enter the individual run parameters before beginning each run.
- In programmed operation, you can duplicate runs quickly and accurately by selecting previously entered programs and running them again.

Use the Optima MAX-TL Ultracentrifuge for applications requiring high force fields that are capable of separating and isolating small particles (virus, bacteria, and subcellular components like

mitochondria) and large molecules (peptides, DNA, proteins). These samples are derived from a variety of natural and synthesized components.

Safety Features

The Optima MAX-TL ultracentrifuge has been designed and tested to operate safely indoors at altitudes up to 2000 m (6562 ft). Ultracentrifuge safety features are described below.

Door

The steel chamber door has an electromechanical door-locking mechanism to prevent operator contact with a spinning rotor. To lock and unlock the door, press the **VACUUM** button on the touchscreen.

When there is a power failure, the door lock can be tripped manually for sample recovery. See CHAPTER 3, *Troubleshooting*.

Barrier Ring

A structural steel armor ring acts as the primary barrier, surrounded by a steel secondary barrier ring to provide full protection for the operator.

Imbalance Detector

An imbalance detector monitors the rotor during the run, causing automatic shutdown if rotor loads are severely out of balance. At low speeds, an incorrectly loaded rotor can cause an imbalance. Rotor instability can also occur if the ultracentrifuge is moved, or if it is not resting level on the work surface. See CHAPTER 3, *Troubleshooting*.

Overspeed and Rotor Identification System

The overspeed system, which includes magnetic speed sensors in the rotor chamber and magnets on the bottom of each rotor, continuously monitors the rotor during centrifugation. At 1000 RPM, the system identifies the maximum permitted speed.

Ultracentrifuge Chassis

Rotor Chamber

The steel chamber is coated with a chemical-resistant finish to resist corrosion. The rotor drive hub and speed sensors are visible in the bottom of the chamber.

Vacuum System

A diffusion pump, in series with a mechanical vacuum pump, reduces chamber pressure to below 10 microns (1.34 Pa). The vacuum system turns on when you press the **VACUUM** button on the

touchscreen, or when you start a run. When the vacuum system is turned on, a self-purging system continuously removes moisture from the vacuum system.

There are two ways to start the vacuum system (there must be power to the ultracentrifuge):

1. To start pumping air out of the chamber manually, press the **VACUUM** button.

   The chamber door locks and the vacuum system starts.

2. To start the vacuum system for a run, place the rotor in the chamber, close the door, and press the **START** button.

   The door locks, the rotor starts spinning, and the vacuum system starts.

The **VACUUM** button on the touchscreen interface turns green when the vacuum system is activated. The button displays the vacuum level in microns.

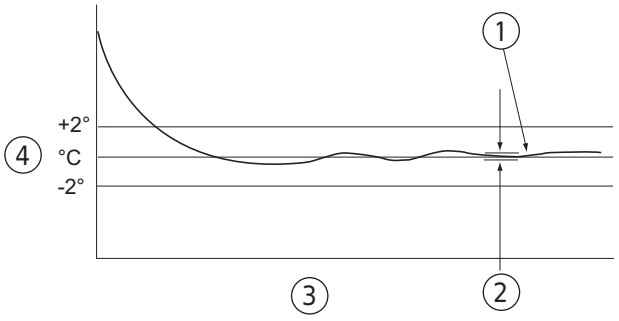
To release the vacuum system, press the **VACUUM** button after the rotor has come to a complete stop. This unlocks the door and turns off the vacuum system, including the mechanical and diffusion pumps.

Temperature Sensing and Control

The solid-state thermoelectric temperature control system uses only forced air — no coolant is required. With the power on, the temperature control system is activated when the door is closed. and the vacuum system is turned on. Run temperature can be set between 0 and 40°C.

A sensor in the rotor chamber continuously monitors chamber temperature. The microprocessor calculates the required chamber temperature to maintain the selected rotor temperature. Peak-to-peak fluctuations of rotor temperature (after reaching thermoequilibrium) will be within 0.1°C (see Figure 1.2).

Figure 1.2 Temperature Control Diagram



1. Actual rotor temperature
2. 0.1° (peak-to-peak fluctuation)
3. Time
4. Set Temperature

Drive

The air-cooled, direct-drive induction motor is frequency controlled, with no gears or brushes. In addition, the drive does not require an oil vacuum seal or external oil reservoir. It is externally cooled by forced air and internally cooled by oil. The drive delivers ultra-smooth, quiet performance.

Controls and Indicators

Power Switch

The power switch, located on the right-hand side of the ultracentrifuge, controls electrical power to the ultracentrifuge. When the instrument is first turned on, a splash screen (or welcome screen) will initially be displayed until the user interface is launched. The power switch is also a circuit breaker that will trip to cut off power in the event of a power overload. The power switch must be turned on before the chamber door can be opened. In the event of a power failure, you can retrieve your sample manually. For more information, see *Retrieving Your Sample in Case of Power Failure* in CHAPTER 3, *Troubleshooting*.

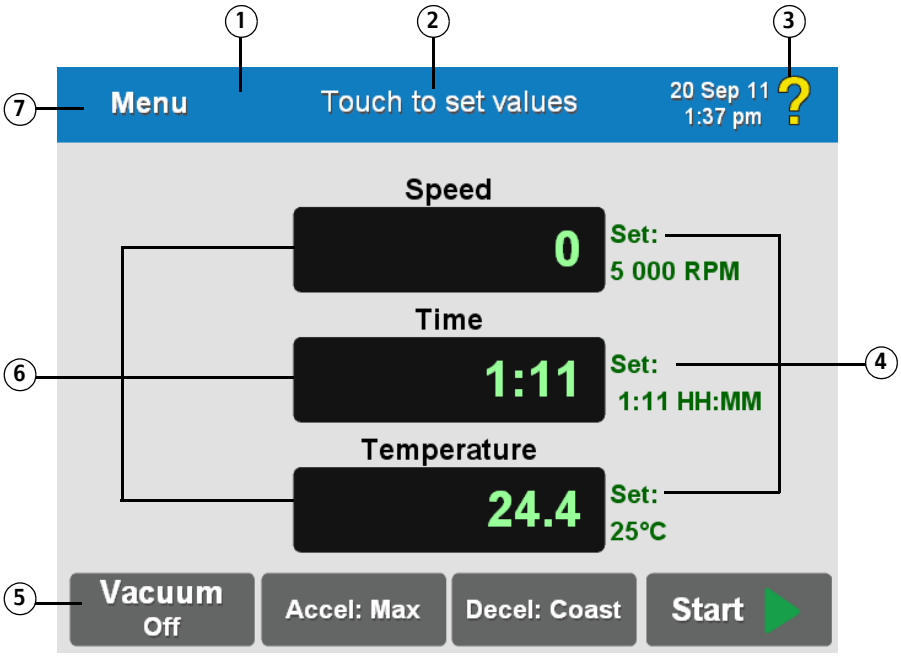
Touchscreen Interface

The operation of the ultracentrifuge is controlled via the touchscreen interface display, which comprises touch-sensitive display fields and buttons for entering and displaying run parameters and program information. When you press a button, additional screens may appear to allow you to enter or select more information. Figure 1.3 points out the elements of the touchscreen interface.

Use your fingertip to press the buttons on the touchscreen. A short beep sounds each time you press a button.

During operation (Run mode), the Speed, Time, and Temp display fields provide real-time status.

Figure 1.3 Touchscreen Interface



1. Windshield
2. Screen instructions
3. Help button
4. Set values
5. Buttons
6. Display fields
7. Menu button

The buttons and display fields on the Main screen are described briefly below. For complete information and instructions on using the touchscreen interface, see CHAPTER 2, *Operation*.

Touchscreen Element	Description
Color-coded windshield	The windshield changes color to indicate the current state of the ultracentrifuge: • Blue indicates Set-up mode. • Green indicates that a run is in progress (Run mode). • Red indicates a diagnostic or user alert. A message is displayed to provide information and allow you to take the appropriate action. The center of the windshield displays instructions for entering parameters and other commands in each screen.
Menu **Back**	Press the **Menu** button in the upper left-hand corner of the screen to open the menu. When you are working in other screens, the **Menu** button changes to the **Back** button to allow you to navigate back to the previous screen. The menu options are: • **Program** – Displays a list of programmed runs and provides an interface from which to set up new programs. • **System** – Opens the **System options** screen. If no user with Administrator privileges is logged in, opens the User Login screen.

Touchscreen Element	Description
Help	Press the **Help** button in the upper right-hand corner of the screen to display an online help window. The help text that appears applies to the information in the current screen.
Speed	Press the **Speed** button to select the speed. The set speed appears above this button, which doubles as a display field for the actual run speed. When the speed is increasing (rotor acceleration), animated arrows in the display field point upward. When the speed is decreasing (rotor deceleration), the animated arrows point downward.
Time	Press the **Time** button to select the run duration in hours and minutes. This button doubles as a display field for the actual run time as follows: In a timed run, this display field indicates the remaining run time in hours and minutes. The time display begins counting down when you press the **START** button; it continues counting down to 0. Animated arrows will point downward. The run automatically ends when the set time reaches 0 and deceleration begins (a tone sounds when the rotor stops spinning). If a malfunction shuts down the ultracentrifuge during a run, the countdown stops and the time that remained when the run stopped stays in the display. By comparing this time with the original set time, you can determine when the run ended.
Temp	Press the **Temp** button to select the rotor temperature in degree Celsius at thermoequilibrium. The set temperature appears above this button, which doubles as a display field for the actual run temperature.
VACUUM	Press the **VACUUM** button to start or stop the vacuum system.
START **STOP**	Press the **START** button to start a run. To stop a run, press the **STOP** button.
Accel/Decel	Displays a screen in which to select the acceleration and deceleration rates.

Name Rating Plate

A name rating plate is affixed to the rear of the ultracentrifuge. When contacting Beckman Coulter regarding your ultracentrifuge, always mention the serial number and model number. You can also view the serial number and other information by pressing the **Help** button, then pressing the **About** button in the **Help** screen.

Specifications

Only values with tolerances or limits are guaranteed data. Values without tolerances are informative data, without guarantee.

Control Features

Specifications	Description
Speed	• Set speed: — 5000 to 120,000 RPM in 1000-RPM increments • Speed display: — actual rotor speed in 100-RPM increments above 5000 RPM and 10-RPM increments at speeds below 5000 RPM • Speed control: — actual rotor speed, ±50 RPM of set speed
Time	• Set time: — to 99 hours 59 minutes • Time display: — Timed run: indicates run time remaining — Programmed operation: indicates time remaining in step
Temperature	• Set temperature: — 0 to 40°C in 1° increments • Temperature control (after equilibration): — ±2°C of set temperature • Temperature display: — actual rotor temperature in 0.1° increments • Ambient temperature range: — 15 to 35°C
Acceleration	10 acceleration profiles—9 slow rates from 0 to 5000 RPM followed by full acceleration to set speed; or maximum acceleration
Deceleration	11 deceleration profiles —10 slow rates from 5000 to 0 RPM, including coasting to a stop without brake; or full dynamic braking from set speed

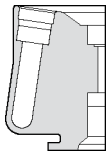
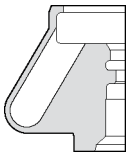
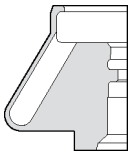
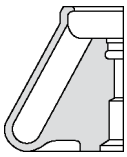
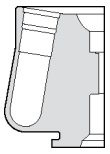
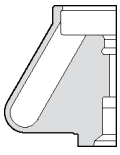
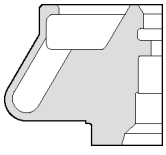
Physical Data

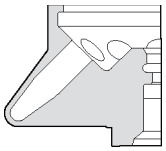
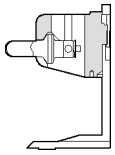
Specification	Description
Width	73.9 cm (29.1 in.)
Depth	61.7 cm (24.3 in.)
Height	• Front left: 34.5 cm (13.6 in.) • Rear right: 39.4 cm (15.5 in.)
Weight	105 kg (230 lb)
Ventilation Clearances (sides and rear)	7.6 cm (3.0 in.)
Finishes	• Touchscreen panel: — coated polycarbonate • Top surface: — acrylic baking enamel • Other surfaces: — general purpose paint
Electrical Supply	Class 1
Vacuum	below 10 microns (1.34 Pa)
Electrical Requirements	• 220/240 VAC~, 6 A, 50 Hz • 120 VAC~, 12 A, 50/60 Hz • 100 VAC~, 12 A, 50/60 Hz
Humidity Restrictions	<75% (noncondensing)
Maximum Heat Dissipation into Room Under Steady-State Conditions	2400 Btu/hr (0.7 kW)
Noise Level 1 m in front of ultracentrifuge	<47 dB(A)
Installation (overvoltage) Category	II
Pollution Degree	2[a]

a. Normally, only nonconductive pollution occurs; occasionally, however, a temporary conductivity caused by condensation must be expected.

Available Rotors

All Beckman Coulter TL-series rotors can be used in the Optima MAX-TL ultracentrifuge. The rotors are described in individual manuals that accompany each rotor. Information on rotors and accessories is also available in *Rotors and Tubes for Tabletop Preparative Ultracentrifuges* (TLR-IM) and in the Beckman Coulter *Ultracentrifuge Rotors, Tubes & Accessories* catalog (publication BR-8101).

Rotor Profile	Description	Max RPM/ *k* factor[a]	Max RCF[b] (× *g*) at r_{max}	Number of Tubes × Nominal Capacity	Rotor Manual Number
	TLN-120 Near Vertical Tube 8° Angle	120,000 7	585,000	8 × 1.2 mL	TL-TB-017
	TLA-120.2 Fixed Angle 30° Angle	120,000 8	627,000	10 × 2.0 mL	TL-TB-016
	TLA-120.1 Fixed Angle 30° Angle	120,000 8	627,000	14 × 0.5 mL	TL-TB-015
	TLA-110 Fixed Angle 28° Angle	110,000 20	657,000	8 × 5.1 mL	TL-TB-019
	TLN-100 Near Vertical Tube 9° Angle	100,000 14	450,000	8 × 3.9 mL	TL-TB-013
	TLA-100.3 Fixed Angle 30° Angle	100,000 14	541,000	6 × 3.5 mL	TL-TB-011
	TLA-100 Fixed Angle 30° Angle	100,000 7	436,000	20 × 0.2 mL	TL-TB-003

Rotor Profile	Description	Max RPM/ *k* factor[a]	Max RCF[b] (× *g*) at r_{max}	Number of Tubes × Nominal Capacity	Rotor Manual Number
	TLA-55 Fixed Angle 45° Angle	55,000 66	186,000	12 × 1.5 mL	TL-TB-020
	TLS-55 Swinging Bucket 90° Angle[c]	55,000 50	259,000	4 × 2.2 mL	TL-TB-006

a. Maximum speeds are based on a solution density of 1.7 g/mL for all rotors. The *k* factors are listed for all Beckman Coulter rotors (using the largest-volume tube) as a measure of the rotor's relative pelleting efficiency.

b. Relative Centrifugal Field (RCF) is used to describe and compare the strength of the fields generated by different size rotors and different operating speeds. RCF is measured in units of multiples of the earth's gravitational field, abbreviated (*g*). The formula for calculating the strength of a particular centrifugal field is: $RCF = 1.12r\,(RPM/1000)^2$
where *r* is the radius in millimeters from the center of rotation to some point within the rotor; RPM is the speed of rotation in revolutions per minute.

c. At speed.

CHAPTER 2

Operation

Introduction

This chapter contains manual and programmed operating procedures. A summary is provided at the start of this section for experienced users.

⚠ WARNING

Normal operation may involve the use of solutions and test samples that are pathogenic, toxic, or radioactive. Handle body fluids with care because they can transmit disease. No known test offers complete assurance that they are free of micro-organisms. Some of the most virulent — Hepatitis (B and C) and HIV (I-V) viruses, atypical mycobacteria, and certain systemic fungi — further emphasize the need for aerosol protection. Handle other infectious samples according to good laboratory procedures and methods to prevent spread of disease. Because spills may generate aerosols, observe proper safety precautions for aerosol containment. Do not run toxic, pathogenic, or radioactive materials in this ultracentrifuge without taking appropriate safety precautions. Biosafe containment should be used when Risk Group II materials (as identified in the World Health Organization *Laboratory Biosafety Manual*) are handled; materials of a higher group require more than one level of protection.

⚠ WARNING

Do not use the ultracentrifuge in the vicinity of flammable liquids or vapors, and do not run such materials in the ultracentrifuge. Do not lean on the ultracentrifuge or place items on it while it is operating.

Touchscreen Interface

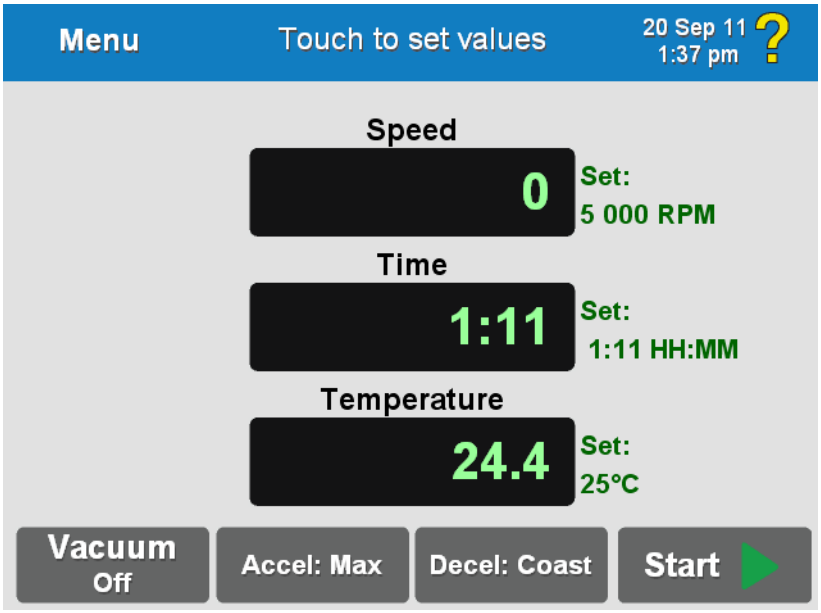
The touchscreen interface (see Figure 2.1) comprises menu options and touch-sensitive display fields and buttons for entering and displaying run parameters and program information. When you press a button or select a menu option, additional screens appear to allow you to enter or select more information.

You may configure the ultracentrifuge touchscreen for user interaction with different languages. See *Set Interface Language*.

Use your fingertip to press the buttons on the touchscreen.

A short beep sounds each time you press a button on the touchscreen (unless the audio volume has been muted by your administrator).

Figure 2.1 Touchscreen Interface Main Screen



Modes of Operation

Setup Mode

During Setup mode, the ultracentrifuge is available for setting a run. The windshield is blue.

Run Mode

During Run mode, the windshield is green to indicate that a run is in progress. These parameters can be changed during Run mode: speed, time, temperature, and Accel/Decel; however, if the run is above 5000 RPM, the new Accel value will be ignored and the new Decel value will be used.

Some System Option functions can be performed in Run mode. For more information, see *System Operations*.

Diagnostics/User Messages

When a condition arises that requires operator attention, the windshield turns red. Press the windshield to open a dialog showing the diagnostic message. User messages communicate information about the ultracentrifuge or alert you to an abnormal condition. For more information, see CHAPTER 3, *Troubleshooting*.

Summary of Optima MAX-TL Run Procedures

This section provides a quick view of the steps for running the ultracentrifuge both manually and via a program. This is provided as a reference after you become familiar with using the ultracentrifuge and the touchscreen interface. For detailed procedures that include images of the interface screens, see *Manual Operation*, *Programmed Operation*.

For non-room temperature runs, prepare the system as described under Ultracentrifuge Pre-Run Cooling or Warming.

Ultracentrifuge and Rotor Preparation

Prepare the rotor for centrifugation as described in the applicable rotor manual.

NOTE To achieve optimum ultracentrifuge performance, follow these instructions between runs: Leave the ultracentrifuge powered on, the door closed, and the vacuum turned on. You do not need to leave a rotor inside the chamber.

Installing the Rotor

The power must always be turned on before you can unlock and open the chamber door.

1 Turn the power on (**I**).

The touchscreen interface display turns on and is available.

To end a run for any reason, do not turn the power off.

Press the **STOP** button.

2 Try opening the door.

a. If the chamber is under vacuum and the door is locked, press the **VACUUM** button to vent the chamber and unlock the door.

- The ultracentrifuge will accept this command only when the rotor is at rest.
- You can hear a slight hissing sound when the chamber vents.
- Do not attempt to open the chamber door for several minutes or until an audible bell chime is heard after pressing the **VACUUM** button. This ensures the vacuum chamber is completely vented so the door can be opened.

3 After the chamber has been vented, use the door handle to slide the door open.

4 Install the rotor according to the directions in the rotor manual.

Ensure that the rotor is seated on the drive hub.

NOTE When installing a rotor on the drive hub, lock it in place by gently pressing the plunger in the rotor down until you hear a click. When you remove your finger, the plunger will remain depressed if it is properly engaged. If the plunger pops up, repeat the procedure, then try to gently lift the rotor to ensure that it is locked.

5 Close the chamber door.

To keep the chamber clean and dry, leave the door closed whenever possible.

Ultracentrifuge Pre-Run Cooling or Warming

Follow these steps to precool or warm the ultracentrifuge.

1 Press the **Temp** button on the Main screen.

The **Enter run temperature** screen appears.

2 Enter the temperature, and press the **OK** button to accept.

The entered temperature becomes the set temperature that appears to the right of the **Temp** button on the Main screen.

3 Close the door.

4 Press the **VACUUM** button to turn the vacuum system on.

Note that it is not necessary to use the **START** button.

Pre-run cooling or warming begins.

NOTE In addition to precooling or warming the ultracentrifuge, cool or warm the rotor outside the ultracentrifuge to the required temperature before the run for fast temperature equilibration.

Manual Run

This section is provided as a quick reference for executing a manual run. For detailed procedures of each step accompanied by screen shots of the touchscreen interface, see *Manual Operation*.

1 Turn the power on (**I**).

2 Install the rotor according to the applicable rotor manual, then close the chamber door.

- Turn the vacuum system on 30 minutes prior to starting a centrifuge cycle with samples. This allows the vacuum system to warm up and eliminate any moisture condensation within the system.

3 Press the **Speed** button, then enter the run speed (5000 to 120,000 RPM).

4 Press the **Time** button, then enter the run time (up to 99 hours, 59 minutes).

5 Press the **Temp** button, then enter the required run temperature (0 to 40°C).

6 To accept the default Accel/Decel rates of Max (maximum), go to Step 7.

This step is optional.

a. Select the **Accel/Decel** menu option, and select the acceleration rate number, from Max (fastest) to 9 (slowest).

b. Select the deceleration rate number, from Max (fastest) to 0 (coast).

You can skip this step and accept the default rates of Max (maximum).

7 Press the **START** button to start the run.

- The instrument may take up to 20 minutes to reach the 5 micron vacuum level.

Programmed Run

This section is provided as a quick reference for executing a programmed run. This procedure assumes that programmed runs have been created and saved. For detailed procedures of each step accompanied by screen shots of the touchscreen interface, see *Programmed Operation*.

1 Turn the power switch to on (**I**).

2 Install the rotor according to the applicable rotor manual, then close the chamber door.

3 Select the **Program** menu option, then select a program from the list.

4 Press the **OK** button to load the program parameters.

5 Press the **START** button to start the run.

Manual Operation

This section includes detailed procedures for entering run parameters for manual operation.

Preparing the Ultracentrifuge

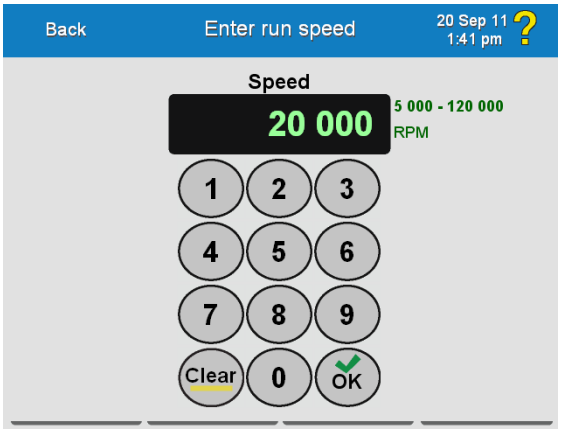
In the first step of a manual run, install the rotor and perform any precooling or prewarming procedures that may be required. For more information and detailed steps, see *Ultracentrifuge and Rotor Preparation*.

Entering Run Speed

Run speed ranges from 5000 to 120,000 RPM. If no new speed is entered, the ultracentrifuge automatically selects the last entered speed. The last three digits of the run speed are fixed as zeros and cannot be changed. For example, to enter a run speed of 100,000 RPM, type 100 on the keypad display.

1 On the Main screen, press the **Speed** button.

The **Enter run speed** screen appears.



The acceptable values for speed are shown to the right of the display field: from 5000 to 120,000 RPM.

2 Enter the speed on the keypad display, and press the **OK** button to accept.

The Main screen returns to view, and the set speed appears to the right of the Speed display

NOTE If you enter an RPM value greater than 120,000, the **OK** button will be grayed out.

3 To change to the new allowable run speed at any time during a manual run, repeat Steps 1 and 2.

The rotor will accelerate or decelerate to the new speed if a run is in process.

NOTE At approximately 1000 rpm, the instrument will detect the rated speed for the installed rotor. If the set speed exceeds the rated speed for the rotor, the set speed will be automatically reduced to the rated speed for the rotor.

Entering Run Time

The time display begins counting down when the rotor begins to spin. The run time automatically terminates when the set time reaches zero.

Timed Mode

Run time can be set for up to 99 hours and 59 minutes. If no new run time is entered, the ultracentrifuge automatically selects the last entered run time. The Time display begins counting down when the rotor starts to spin. The run automatically terminates and the rotor begins to decelerate when the set time reaches zero. A tone sounds when the rotor has stopped (unless the audio volume has been muted).

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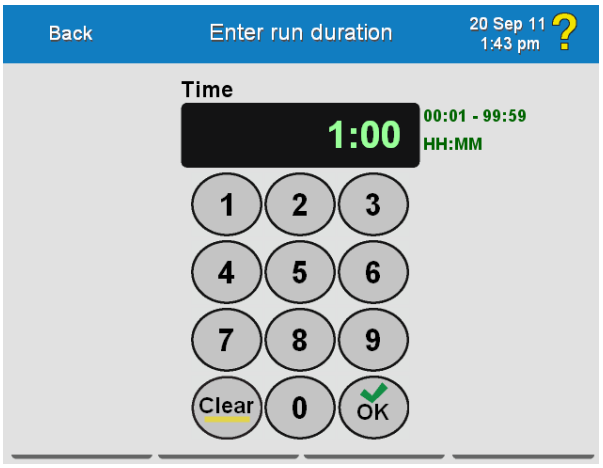
1 On the Main screen, press the **Time** button.

The **Enter run duration** screen appears.

The acceptable values for run duration are shown to the right of the display field: from 00:01 to 99:59 HH:MM.



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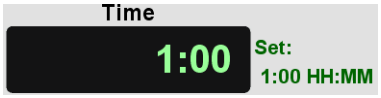
2 Enter the time on the keypad display, and press the **OK** button to accept.

The Main screen returns to view, and the set time appears to the right of the Time display.



If you enter a number of minutes greater than 59, the ultracentrifuge automatically recalculates the time in hours and minutes.

---

3 To change the set time at any time during a manual run, repeat Steps 1 and 2.

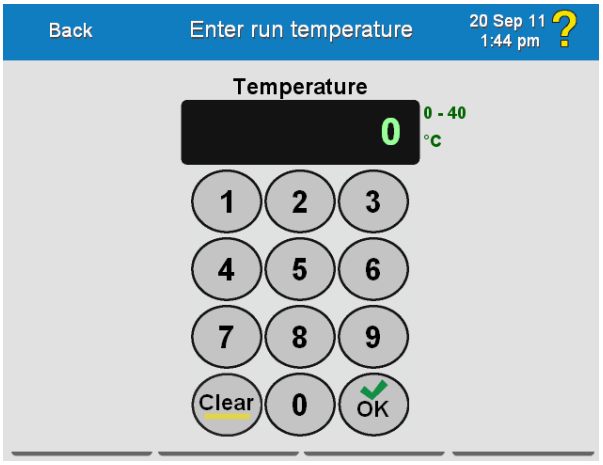
The ultracentrifuge will adjust to the new run duration.

Entering Run Temperature

Run temperature can be set from 0 to 40°C. If no new value is entered, the ultracentrifuge automatically uses the last entered temperature. If you clear the previous entry, 25°C is used as the operating temperature.

1 On the Main screen, press the **Temp** button.

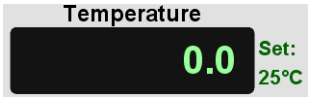
The **Enter run temperature** screen appears.



The acceptable values for run temperature are shown to the right of the display field: from 0 to 40°C.

2 Enter the temperature on the keypad, and press the **OK** button to accept.

The Main screen returns to view, and the set run temperature appears to the right of the Time display.



NOTE If you enter a temperature value greater than 40, the **OK** button will be grayed out.

3 To change the set temperature at any time during a manual run, repeat Steps 1 and 2.

The ultracentrifuge accepts the new temperature immediately.

NOTE If the rotor temperature is not within 3°C above the set temperature for more than 40 minutes, a diagnostic message appears. If a run is in progress, the rotor will decelerate to a stop. See CHAPTER 3, *Troubleshooting*.

Entering Acceleration and Deceleration Rates

The ultracentrifuge provides ten acceleration rates and eleven deceleration rates to protect the gradient and sample-to-gradient interface. Table 2.1 lists these rates by their corresponding numbers on the touchscreen interface. Acceleration time is the time it takes a rotor to reach 5000 RPM from rest. At 5000 RPM, maximum acceleration takes over until the rotor reaches set speed. Deceleration time is the time it takes a rotor to decelerate from 5000 to rest. From set speed to 5000, the rotor decelerates with full dynamic braking.

Table 2.1 Acceleration and Deceleration Rates

Touchscreen Number	ACCEL Time from 0 to 5000 RPM (MM:SS)	DECEL Time from 5000 to 0 RPM (MM:SS)
Max	0:15[a]	0:15[a]
1	0:30	1:00
2	1:00	1:30
3	1:30	2:00
4	2:00	2:30
5	2:30	3:00
6	3:00	4:00
7	3:30	6:00
8	4:00	8:00
9	5:00	10:00
0	N/A	Coasting stop from set speed without braking

a. Maximum rate. If no touchscreen number is selected, the rotor will accelerate and/or decelerate at the maximum rates.

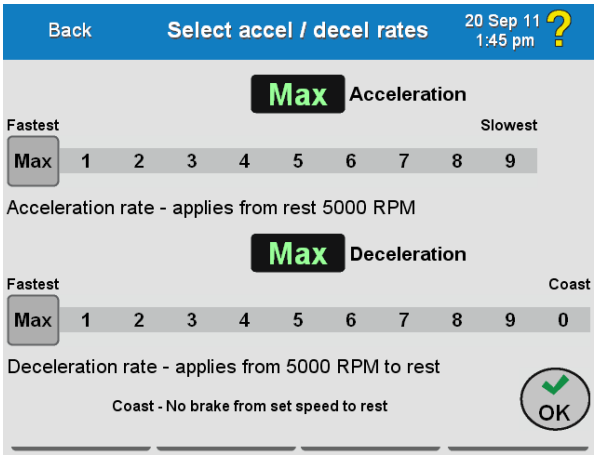
If you use the default rates of maximum, the ultracentrifuge automatically accelerates and decelerates at maximum rate. When you change either the acceleration or deceleration rate, Accel and Decel buttons display appear on thee Main screen showing the selected rates. You can then change the rates using these buttons as an alternative to using the **Accel**/**Decel** menu option.

---

1 On the Main screen, press either the **Accel** or **Decel** button in the bottom center.

The **Select accel/decel rates** screen appears.

The default value for both is **Max** (maximum speed).



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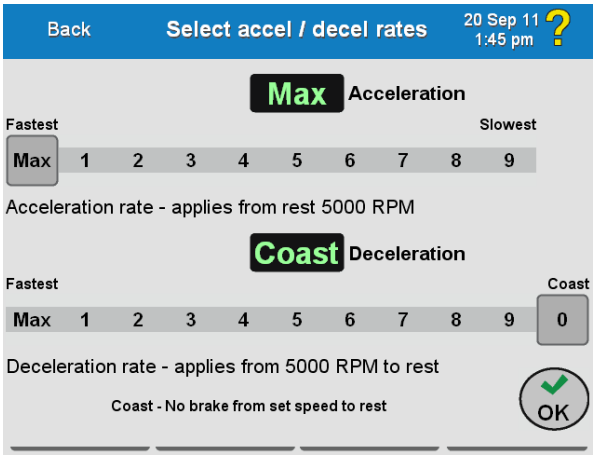
2 Press the desired rate(s) by pressing the appropriate number on the sliders.

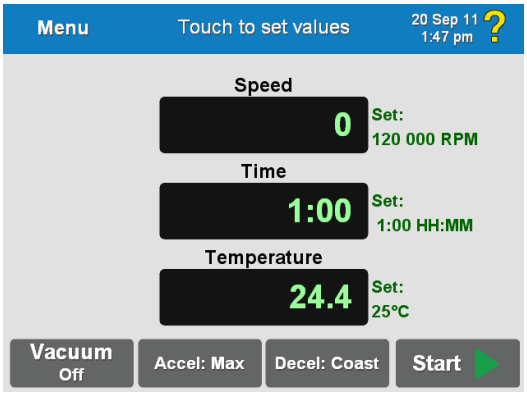
The time duration for the rate you select is displayed in the fields above your selection.

If you select a deceleration rate of Coast, "**Coast**" appears, as shown in this example.



3 Press the **OK** button to accept.

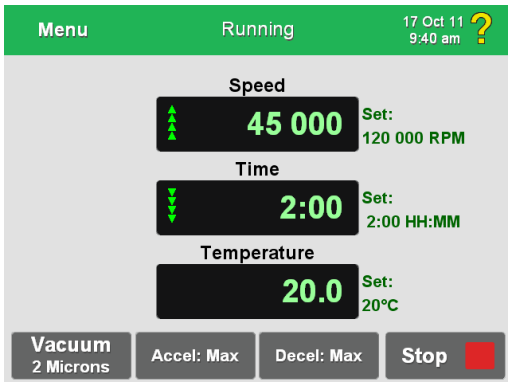
If either rate is set to anything other than Max, the **Accel** and **Decel** buttons appear on the Main screen showing the selected rates.



Starting a Run

1 On the Main screen, press the **START** button.

- The rotor starts spinning.
- The vacuum system turns on unless it was previously turned on.
- The **VACUUM** button turns green and the vacuum level is displayed.
- The touchscreen windshield turns green.
- Animated arrows in the Speed, Time, and Temp display fields represent the ultracentrifuge's progress until the set values are reached.
- The **START** button changes to the **STOP** button.



The run will end automatically when the Time display counts down to zero, and a tone will sound.

NOTE Some features are not accessible during a run.

2 After the run has concluded, you can repeat the run using the same parameters.

To do this, press the **START** button.

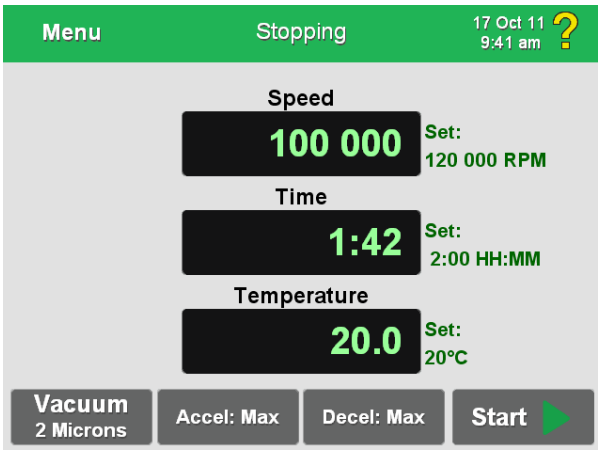
The set parameters will be used for the next run.

NOTE Keep the chamber door closed between runs.

Stopping a Run

1 If you want to stop a run manually, press the **STOP** button on the Main screen.

Any time a run is stopping, it is indicated on the Main screen.



2 When the run stops and the time reaches **0**, you can press the **VACUUM** button to turn off the vacuum system and vent the vacuum.

The chamber door unlocks so you can open it and remove your sample.

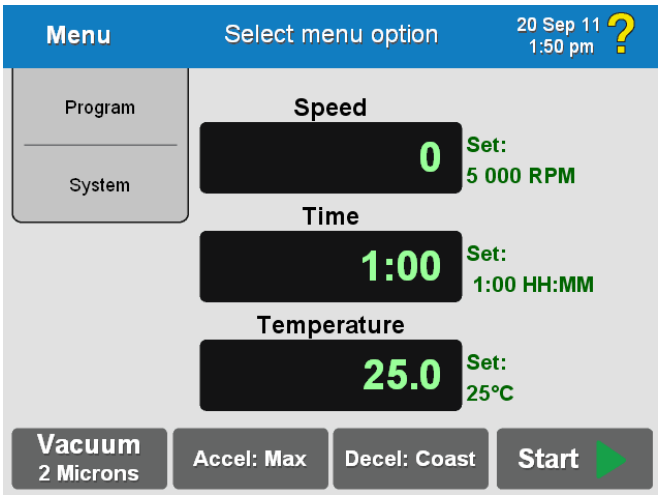
Programmed Operation

You can store programs in ultracentrifuge memory. Each program can contain up to five steps (a step contains a set of run parameters). Programs are retained in memory even after powering down the ultracentrifuge.

Creating a New Program

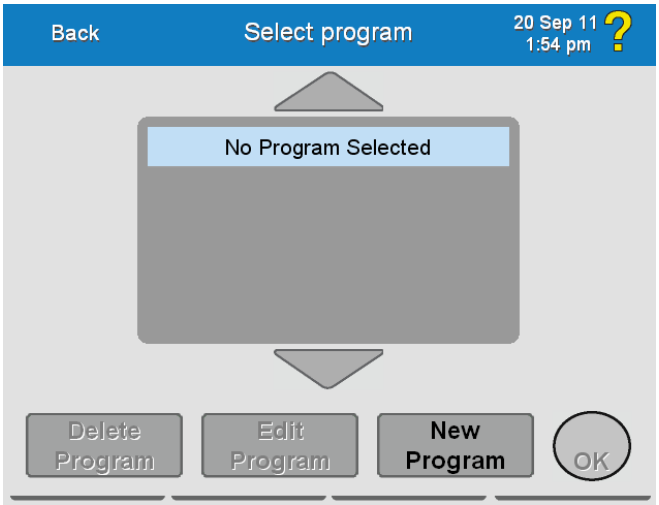
1 In the Main screen, press the **Menu** button.

The list of menu options appears.



2 Select **Program**.

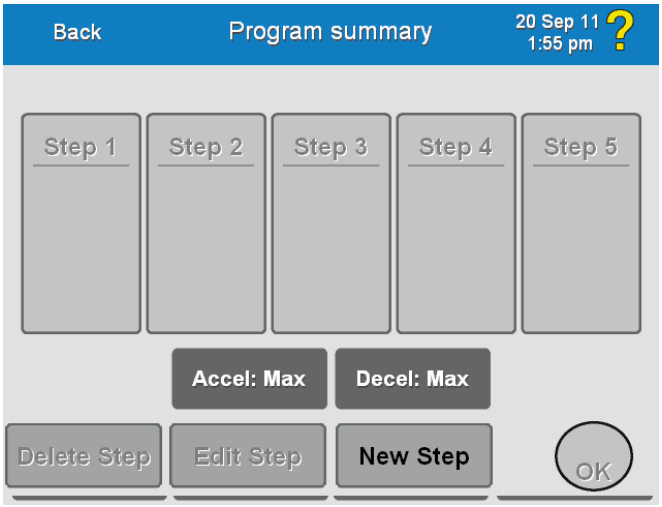
The **Select program** screen appears.



If no programs have been created and saved, the screen will be blank.

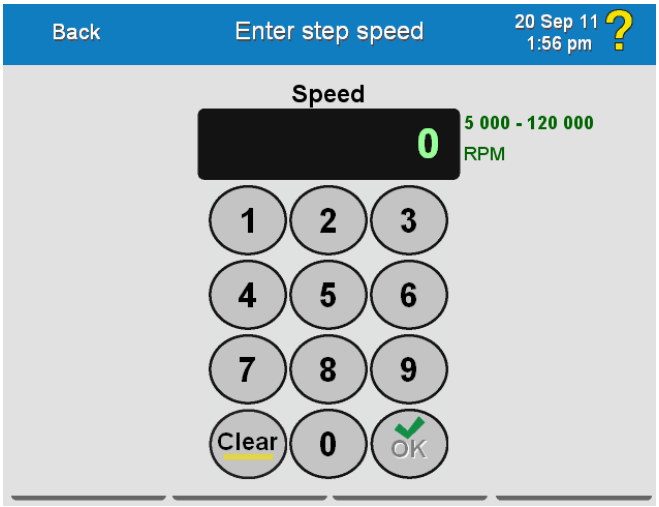
3 Press the **New Program** button.

The **Program summary** screen appears.



4 Press the **New Step** button.

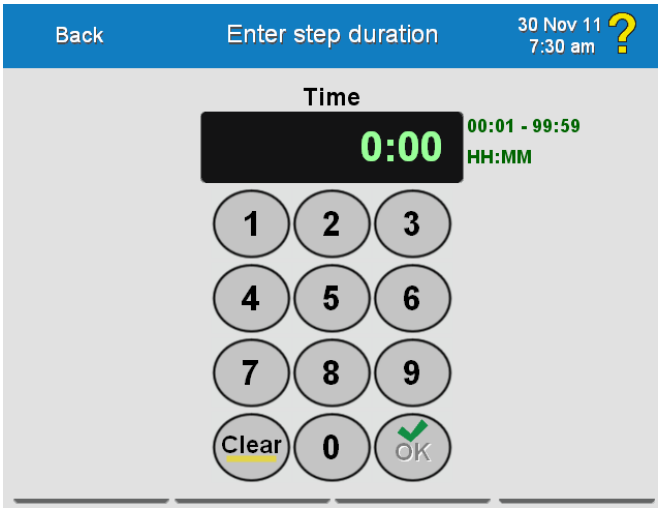
The **Enter step speed** screen appears.



The acceptable values for run speed are shown to the right of the display field: from 5000 to 120,000 RPM, depending on the selected rotor.

5 Enter the speed on the keypad display, and press the **OK** button to accept.

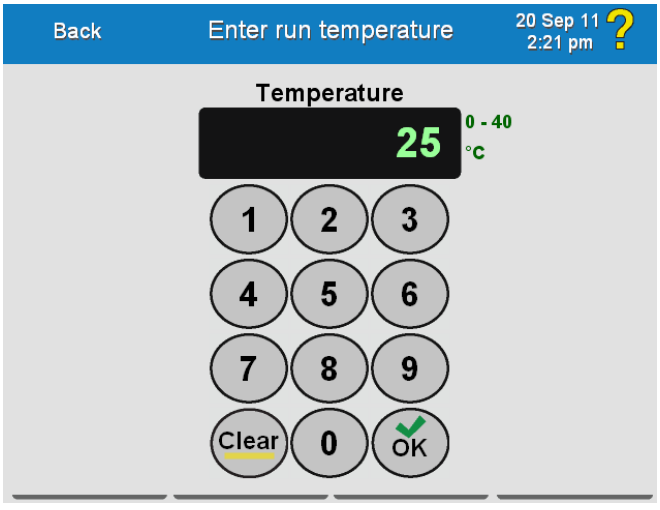
The **Enter step duration** screen appears.



The acceptable values for run duration are shown to the right of the display field: from 00:01 to 99:59 HH:MM.

6 Enter the run time on the keypad display, and press the **OK** button to accept.

The **Enter step temperature** screen appears.

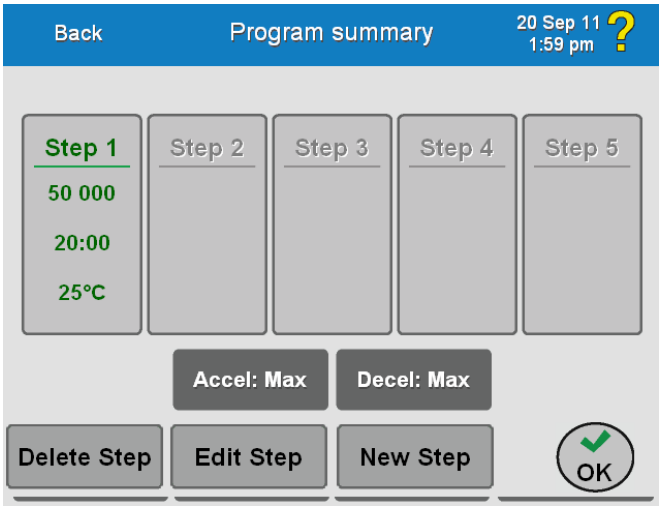


If you enter a number of minutes greater than 59, the ultracentrifuge automatically recalculates the time in hours and minutes.

The acceptable values for run temperature are shown to the right of the display field: from 0 to 40°C.

7 Enter the temperature on the keypad display, and press the **OK** button to accept.

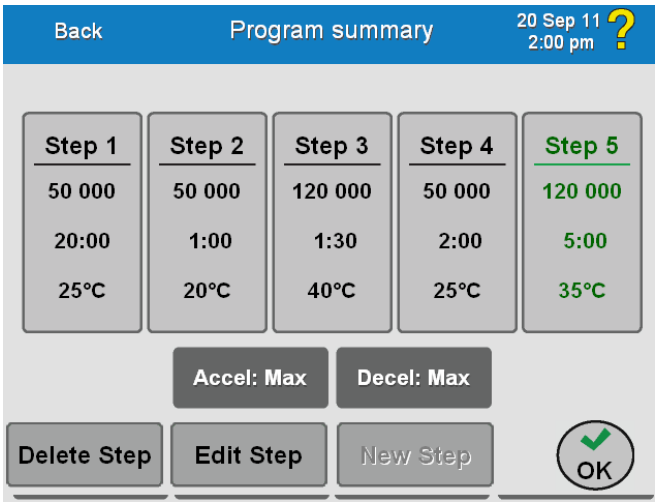
The **Program summary** screen appears and displays the parameters for the first step.



If you enter a number greater than 40, the **OK** button will be grayed out.

8 Repeat Steps 6 – 9 to enter the parameters for up to five steps for a complete run.

The **Program summary** screen displays the parameters of the steps you've entered.

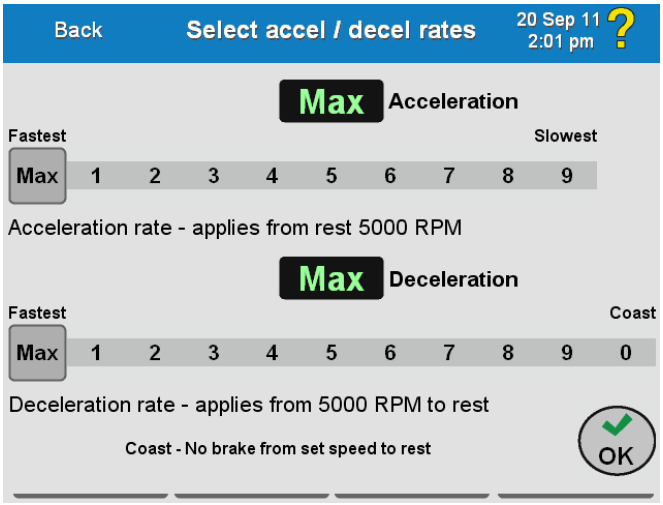


The Accel value is for the first step in the program, and the Decel value is for the last step in the program.

After you enter five steps, the **New Step** button is grayed out.

9 To change the acceleration/deceleration rates, press either the **Accel** or **Decel** button.

The **Select accel/decel rates** screen appears.

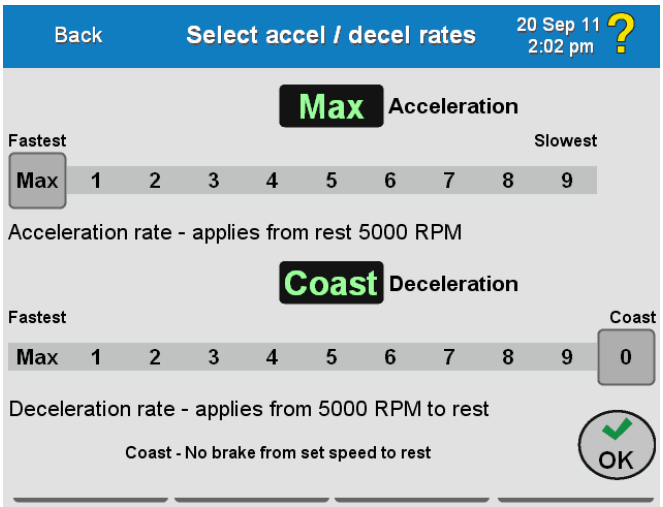


To use the maximum values for both rates, go to Step 12.

Note that the default rates of "**Max**" (maximum) appear in the Time field.

10 Select the desired rates by touching the corresponding numbers.

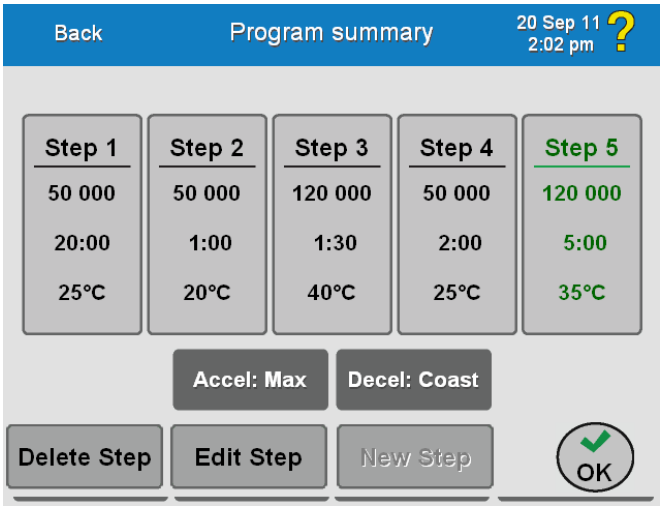
The approximate time duration for the rate you select is displayed above your selection.



If you select a deceleration rate of coast, "**Coast**" appears in the Time field.

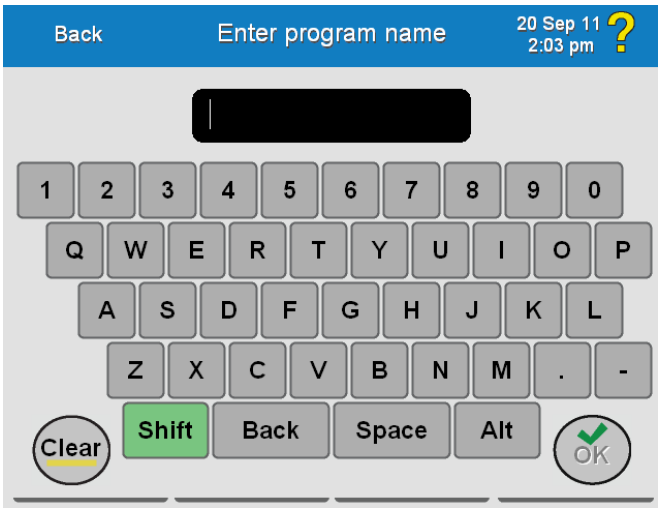
11 Press the **OK** button to accept.

The rates you select display on the **Program summary** screen.



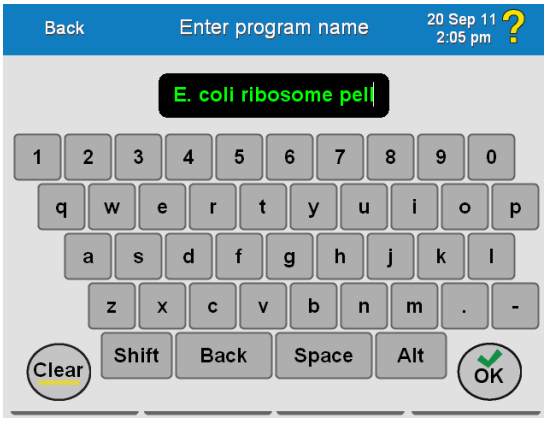
12 Press the **OK** button to accept.

The **Enter program name** screen appears.



13 Type the name of the program using the keypad just as you would a keyboard.

The name of the program appears at the top of the screen.



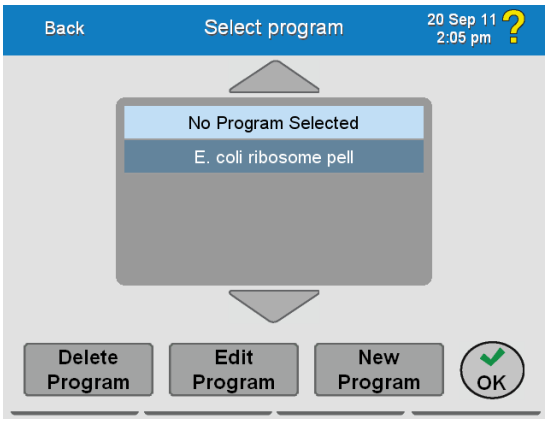
a. Note that the **Shift** key is green to indicate that uppercase letters are the default. To enter lowercase letters, press the **Shift** key.

b. Press **Back Space** to erase entered characters one at a time.

c. To clear the entire entry, press **Clear.**

14 Press the **OK** button to accept.

The name of the program appears in the list of programs.



You now have a new, saved program in memory.

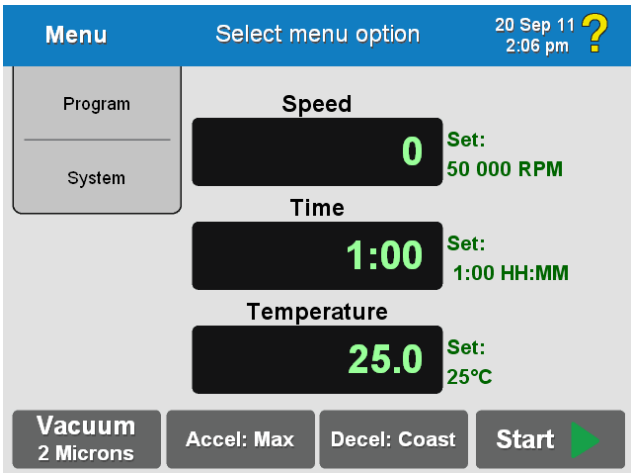
NOTE Pressing the **OK** button with a program name selected in this screen loads the program into the ultracentrifuge.

15 Repeat this procedure to add and save additional programs.

Starting a Programmed Run

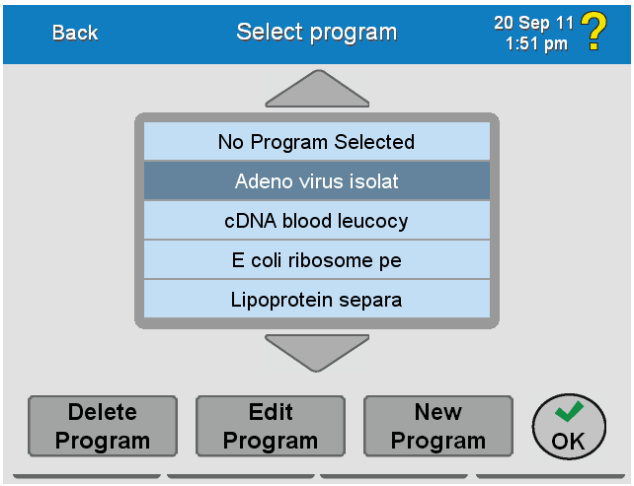
1 In the Main screen, press the **Menu** button.

The list of menu options appears.



2 Select **Program**.

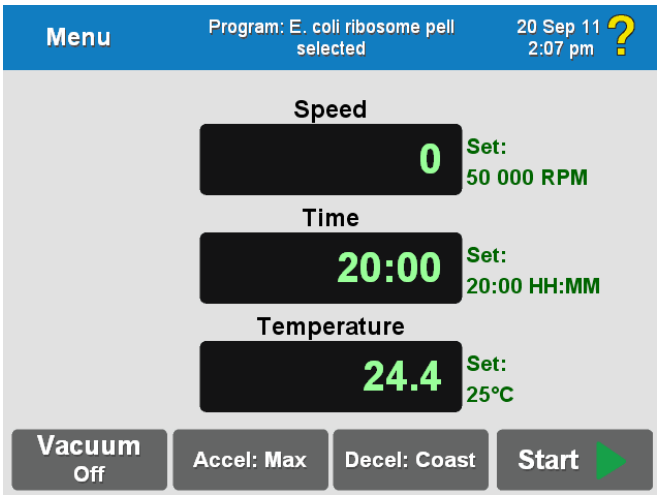
The **Select program** screen appears.



NOTE If **No Program Selected** is highlighted in this list, it means that no saved program is currently selected.

3 Select the name of the program you want to run, and press the **OK** button.

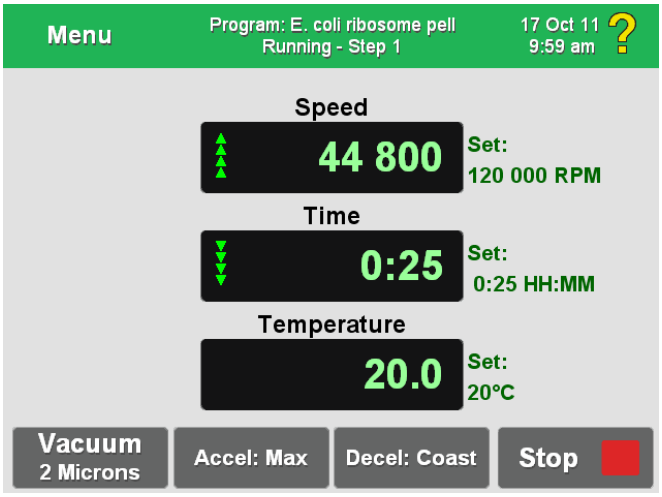
The Main screen returns to view, and the name of the selected program appears in the windshield.



The run parameters for the first step appear to the right of the display fields in the Main screen.

4 Press the **START** button.

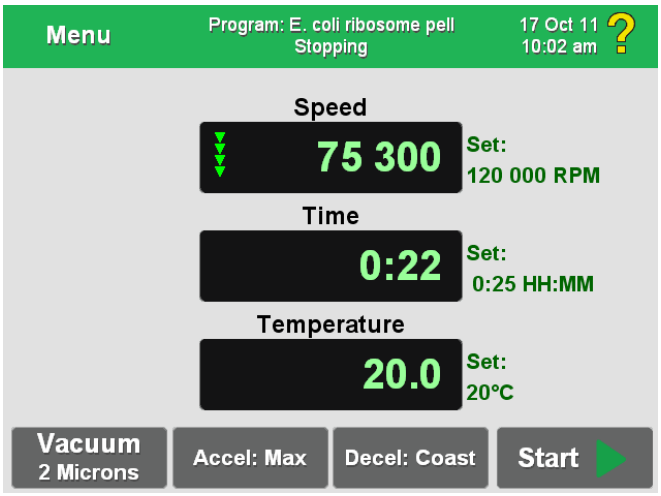
The Main screen reflects the start of the run.



This screen updates continuously to reflect the progress of each step in the program.

5 To terminate a run for any reason, press the **STOP** button.

The run will end automatically when the Time display counts down to zero for the last step in the program.



When the rotor comes to a complete stop, a tone will sound.

6 To exit from program mode:

a. Press the **Menu** button in the Main screen.

b. In the Select Program screen, select **No Program Selected**.

c. Press **OK**.

The Main screen returns to view so that you can enter parameters manually.

d. Alternatively, you can try changing a parameter such as speed, time, or temperature.

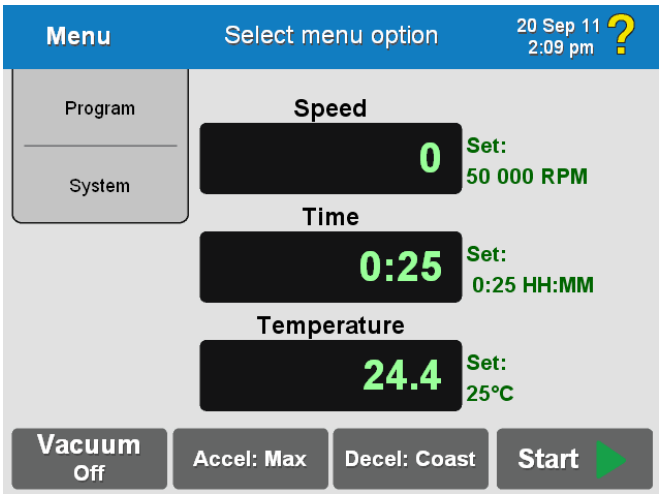
A message appears asking you to confirm that you want to exit from program mode.

Making Changes to a Program

You can modify any part of a program: the steps, the Accel/Decel rates.

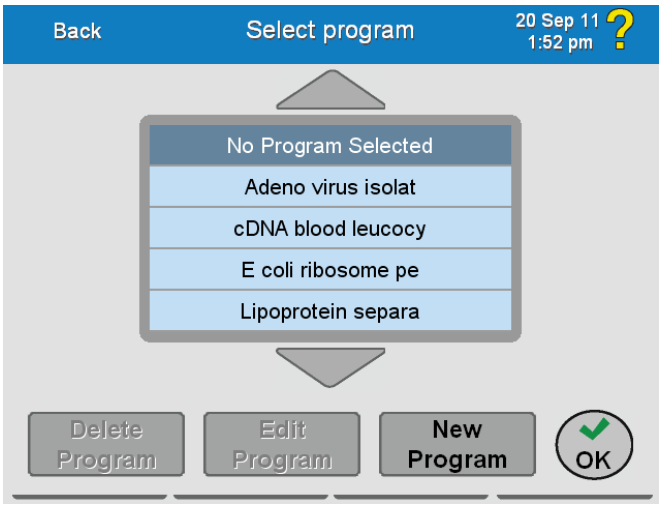
1 In the Main screen, press the **Menu** button.

The list of menu options appears.



2 Select **Program**.

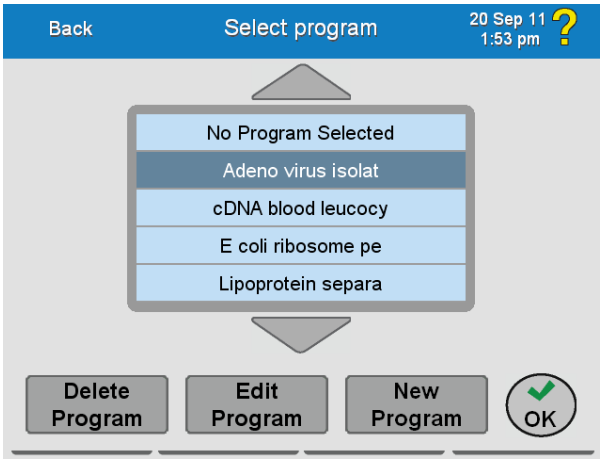
The **Select program** screen appears.



If necessary, use the arrows to bring additional program names into view.

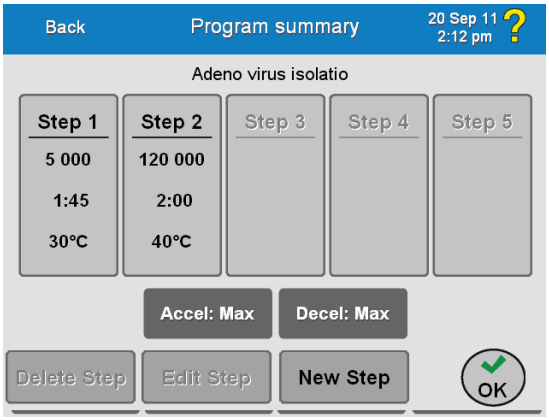
3 Select the name of the program you want to modify.

The name of the program is highlighted, and the **Edit Program** button becomes available.



4 Press the **Edit Program** button.

The **Program summary** screen displays the steps and other parameters of the selected program.



5 You can do any of the following:

a. *Delete a step*. Select the desired step and press the **Delete Step** button.

b. *Edit a step*. Select the desired step and press the **Edit Step** button.

For more information, see *Creating a New Program*.

c. *Add a step* (if there are fewer than five steps in the program). Press the **New Step** button.

For more information, see *Creating a New Program*.

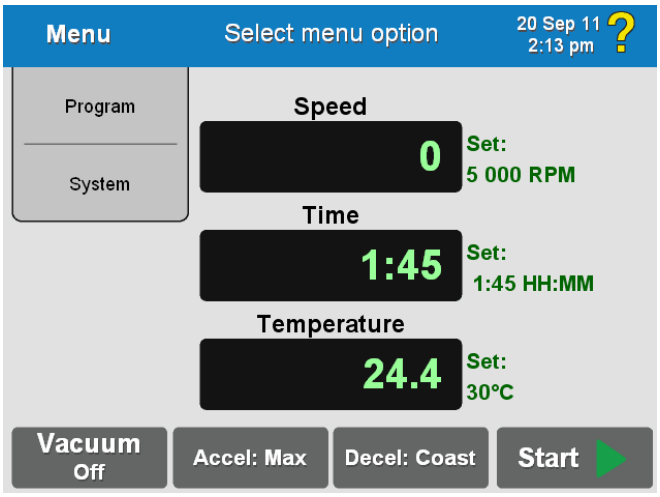
d. *Change the Accel/Decel rates.*

For more information, see *Creating a New Program*.

Deleting a Program

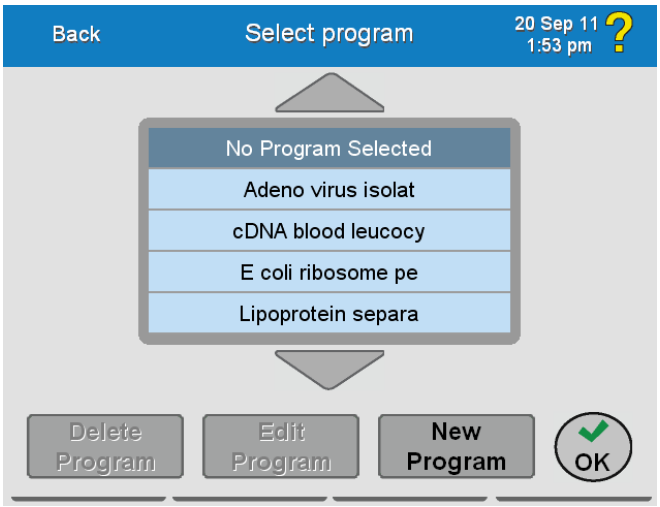
1 In the Main screen, press the **Menu** button.

The list of menu options appears.



2 Select **Program**.

The **Select program** screen appears.



3 Select the name of the program you want to delete.

The name of the program is highlighted, and the **Delete Program** button becomes available. If necessary, use the arrows to bring additional program names into view.

4 To delete the program, press the **Delete Program** button.

A confirmation message appears.

5 Press the **Yes** button.

The program is deleted and removed from the list of saved programs.

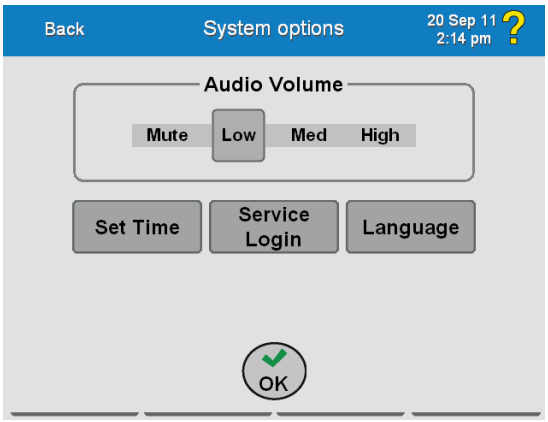
System Operations

This section describes the procedures performed during system operation. The user performs system level operations, such as setting interface language, setting the date and time, or setting audio volume. Any user may perform these functions.

Accessing System Options

1 On the Main screen, press the **Menu** button, and select **System**.

The **System options** screen appears.



2 You can do the following from this screen:

a. *Set the audio volume.*

See *Setting Audio Volume*.

b. *Set the interface language.*

See *Set Interface Language*.

c. *Set the date and time.*

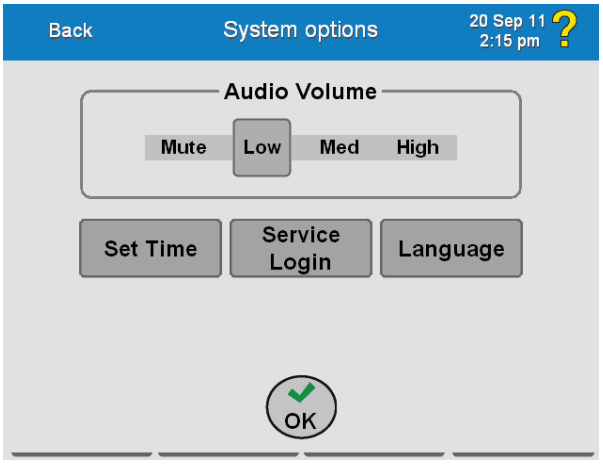
See *Setting the Date and Time*.

Set Interface Language

You may configure the ultracentrifuge touchscreen for user interaction with different languages. Follow the steps below to configure language settings.

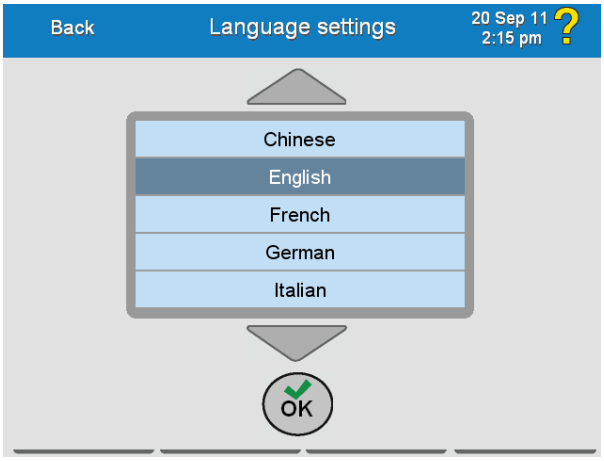
1 On the Main screen, press the **Menu** button, and select **System**.

The **System options** screen appears.



2 Press the **Language** button.

The **Language settings** screen appears.

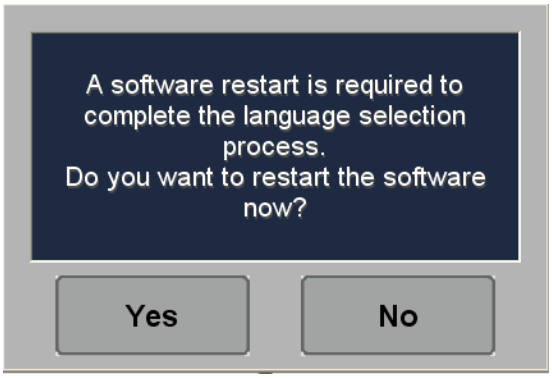


3 Press a language from the language options list.

NOTE Select either the Up or Down arrow keys to view the full list of available languages.

4 Press **OK**.

A screen appears and prompts you to restart the system.



5 Press **Yes**.

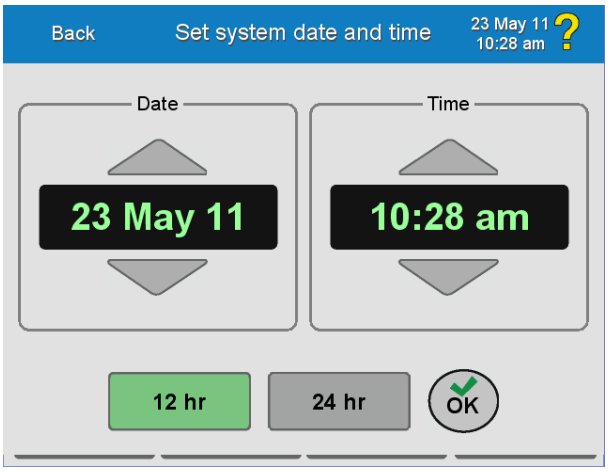
The system restarts and displays the selected language.

Setting the Date and Time

1 Go to the **System options** screen as described in *Accessing System Options*.

2 Press the **Set Time** button.

The **Set system date and time** screen appears.



3 Press the large arrows to set the desired date and time.

The time and date are set.

a. To change the date or time rapidly, hold down the corresponding arrow.

4 Press either **12 hr** or **24 hr** to configure the system to display time in either 12- or 24-hour format.

a. Press the **OK** button to accept.

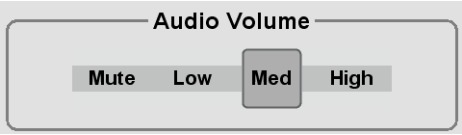
Time and date configurations are set, and the **System options** screen returns to view.

Setting Audio Volume

1 Go to the **System options** screen as described in *Accessing System Options*.

2 Select the desired audio volume.

The audio levels are: **Mute**, **Low**, **Med**, **High**.



3 Press the **OK** button to accept.

The audio level adjusts to the new volume level, and the Main screen returns to view.

CHAPTER 3

Troubleshooting

Introduction

This chapter lists possible malfunctions, together with probable causes and corrective actions. Maintenance procedures are described in CHAPTER 4, *Care and Maintenance*.

For any problems not covered here, call Beckman Coulter Customer Service at 1-800-742-2345 (U.S.A. or Canada) or contact your local Beckman Coulter Representative.

User Messages

Messages pop up on the touchscreen interface to communicate information about the ultracentrifuge or to alert you to conditions that require your attention. Dialog boxes with diagnostic messages contain a red border, as shown in the example in Figure 3.1. The possible diagnostic types are:

- CPU
- Power
- Speed
- Vacuum
- Temperature
- Drive
- Imbalance
- Door

NOTE The user should wait 10 seconds between turning instrument power off and then turning power on to clear an error condition.

Figure 3.1 Example User Message on Touchscreen Interface

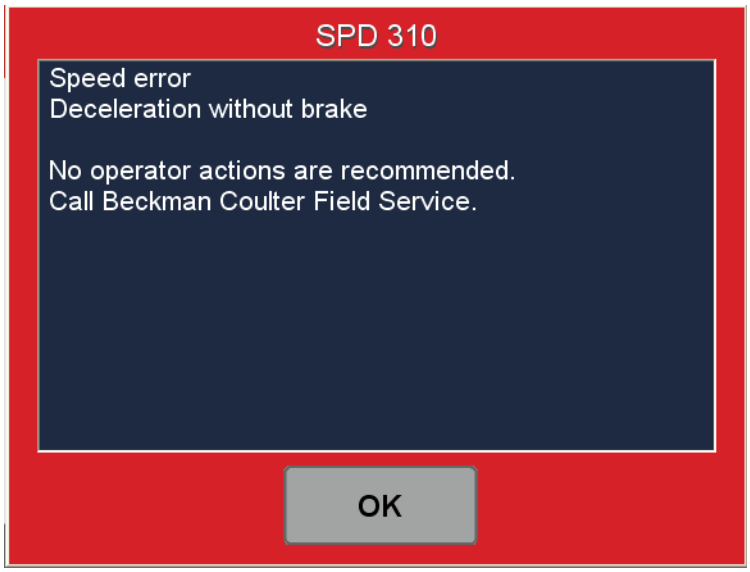


Table 3.1 User Message Chart

Message	Definition/Result	Possible Cause and Recommended Action
CPU Errors 101 through 113	Microprocessor malfunction or loss of program memory/Deceleration without brake	• If the microprocessor malfunction was caused by power failure, the error can be cleared by turning power off and back on; otherwise, no user action. (In case of program memory loss, the ultracentrifuge is still functional for manual operation.) • Call Beckman Coulter Customer Service.[a]
Power Errors 201 and 202	Loss of power during centrifugation	A power outage has occurred during the run. If power is restored while the rotor is spinning, the run will resume. If the rotor came to a stop, however, restart the run.
Power Error 203	Loss of power during centrifugation/Deceleration without brake	A power outage has occurred during the run. Power was restored, but the run could not continue. **1.** Turn the ultracentrifuge power off and back on. **2.** If the problem persists, call Beckman Coulter Customer Service.[a]
Power Errors 204 through 207	Power supply error/Deceleration without brake	No user actions are recommended. Call Beckman Coulter Customer Service.[a]
Speed Error 301	No rotor installed/Deceleration with brake	**NOTE.** This condition will result in a 5-minute delay before the diagnostic message can be cleared and the door opened. The power *MUST* be left on so the ultracentrifuge can calculate when the delay period is completed. If power to the ultracentrifuge is lost or turned off, the remaining delay period is preserved, and the door will remain locked when power is restored until the delay period is completed. **1.** Verify that the rotor is installed properly. **2.** If the problem persists, call Beckman Coulter Customer Service.[a]

Table 3.1 User Message Chart *(Continued)*

Message	Definition/Result	Possible Cause and Recommended Action
Speed Errors 302 and 303	Speed error/Deceleration without brake	**NOTE.** This condition will result in a 166-minute delay before the diagnostic message can be cleared and the door opened. The power *MUST* be left on so the ultracentrifuge can calculate when the delay period is completed. If power to the ultracentrifuge is lost or turned off, the remaining delay period is preserved, and the door will remain locked when power is restored until the delay period is completed. **1.** Verify that the rotor is installed properly. **2.** Verify that the ultracentrifuge is resting on a level surface. **3.** Verify that the set speed is correct for the rotor in use. **4.** Verify that the rotor load is within the limits specified in the rotor manual. **5.** Verify that the magnets on the bottom of the rotor are undamaged. **6.** If the message persists, call Beckman Coulter Customer Service.[a]
Speed Error 304	Speed error/Deceleration without brake	This message indicates an overspeed condition. **1.** Verify that the rotor is installed properly. **2.** Verify that the ultracentrifuge is resting on a level surface. **3.** Verify that the magnets on the bottom of the rotor are undamaged. **4.** If the message persists, call Beckman Coulter Customer Service.[a]
Speed Error 305	Speed error/Deceleration with brake	This message indicates a speed signal problem. **1.** Verify that the rotor is installed properly. **2.** Verify that the ultracentrifuge is resting on a level surface. **3.** Verify that the magnets on the bottom of the rotor are undamaged. **4.** If the message persists, call Beckman Coulter Customer Service.[a]
Speed Errors 306 and 307	Speed error/Deceleration with brake	No user actions are recommended. Call Beckman Coulter Customer Service.[a]
Speed Error 308	Set speed is above the maximum speed of the installed rotor/set speed is reset to the rotor maximum and the run continues	No user action is required.
Speed Errors 309 and 310	Speed error/Deceleration with brake	No user actions are recommended. Call Beckman Coulter Customer Service.[a]

Table 3.1 User Message Chart *(Continued)*

Message	Definition/Result	Possible Cause and Recommended Action
Vacuum Error 401	Chamber pressure is above 500 microns/Deceleration with brake	**1.** Make sure that the door O-ring is clean, undamaged, and properly lubricated. **2.** Check for sample leakage. Clean and dry the rotor chamber if needed. **3.** If the problem persists, call Beckman Coulter Customer Service.[a]
Vacuum Error 402	Chamber pressure is above 31.5 microns for longer than 5 minutes/ If ultracentrifuge is running, it decelerates with brake	**1.** Make sure that the door O-ring is clean, undamaged, and properly lubricated. **2.** Check for sample leakage. Clean and dry the rotor chamber if needed. **3.** If the problem persists, call Beckman Coulter Customer Service.[a]
Vacuum Error 403	Chamber pressure didn't reach 31.5 microns within 45 minutes/If ultracentrifuge is running, it decelerates with brake	**1.** Make sure that the door O-ring is clean, undamaged, and properly lubricated. **2.** Check for sample leakage. Clean and dry the rotor chamber if needed. **3.** If the problem persists, call Beckman Coulter Customer Service.[a]
Vacuum Error 404	Vacuum level error/Deceleration with brake	**1.** Make sure that the door O-ring is clean, undamaged, and properly lubricated. **2.** Check for sample leakage. Clean and dry the rotor chamber if needed. **3.** If the problem persists, call Beckman Coulter Customer Service.[a]
Vacuum Error 405	Vacuum not venting properly/Deceleration with brake	No user action. Call Beckman Coulter Customer Service.[a]
Vacuum Error 406	Vacuum offset error/Deceleration with brake	No user action. Call Beckman Coulter Customer Service.[a]
Temperature Errors 501 through 504	Excessive or uncontrolled rotor temperature/Deceleration with brake	No user action. Call Beckman Coulter Customer Service.[a]
Drive Error 601	Drive error/Deceleration without brake	No user action. Call Beckman Coulter Customer Service.[a]
Drive Error 602	Drive overheated/Deceleration without brake	No user action. Call Beckman Coulter Customer Service.[a]

Table 3.1 User Message Chart *(Continued)*

Message	Definition/Result	Possible Cause and Recommended Action
Drive Errors 603 through 605	Drive error/Deceleration without brake	Note: This condition will result in a 166-minute delay before the diagnostic message can be cleared and the door opened. The power *MUST* be left on so the ultracentrifuge can calculate when the delay period is completed. If power to the ultracentrifuge is lost or turned off, the remaining delay period is preserved, and the door will remain locked when power is restored until the delay period is completed. No operator action. Call Beckman Coulter Customer Service.[a]
Drive Error 606	Drive error/Deceleration without brake	Note: This condition will result in a 166-minute delay before the diagnostic message can be cleared and the door opened. The power *MUST* be left on so the ultracentrifuge can calculate when the delay period is completed. If power to the ultracentrifuge is lost or turned off, the remaining delay period is preserved, and the door will remain locked when power is restored until the delay period is completed. **1.** Check that the rotor is properly installed. **2.** Check that the ultracentrifuge is resting on a level surface. **3.** Check that the magnets on the rotor bottom are undamaged. **4.** If the message persists, call Beckman Coulter Customer Service.[a]
Drive Error 607	Drive error/Deceleration without brake	**1.** Press OK to clear the error. **2.** If the error message is still displayed, turn instrument power off and back on. **3.** If the problem persists, call Beckman Coulter Customer Service.[a]
Drive Error 608	Drive error/Deceleration without brake	**1.** Wait for the rotor to decelerate to 0 rpm. **2.** Press OK to clear the error. **3.** If the error message is still displayed, turn instrument power off and back on. **4.** If the problem persists, call Beckman Coulter Customer Service.[a]
Drive Error 609	Drive error/Deceleration without brake	**1.** Press OK to clear the error. **2.** If the error message is still displayed, turn instrument power off and back on. **3.** If the problem persists, call Beckman Coulter Customer Service.[a]
Imbalance Error 701	Rotor imbalance detected/Deceleration with brake	**1.** Verify that the rotor is secured to the drive hub. **2.** Check for proper balance and placement of tubes and/or buckets. **3.** Restart the run. **4.** If the problem persists, call Beckman Coulter Customer Service.[a]
Door Errors 801 through 803	Door open or unlocked/Deceleration with brake	**1.** Close the door properly and restart the run. **2.** If the problem persists, call Beckman Coulter Customer Service.[a]

a. Call Beckman Coulter Customer Service at 1-800-742-2345 (U.S.A. or Canada) or contact your local Beckman Coulter Representative.

Retrieving Your Sample in Case of Power Failure

If facility power fails only momentarily, the ultracentrifuge will resume operation (where it left off) when power is restored and the rotor will return to set speed. However, if the rotor came to a complete stop, you will need to restart the run when the power is restored. In either case, the **POWER** message will appear on the touchscreen interface to indicate that a power outage has occurred.

⚠ WARNING

Any maintenance procedure requiring removal of a panel exposes the operator to the possibility of electrical shock and/or mechanical injury. Therefore, turn the power OFF (O) and disconnect the ultracentrifuge from the main power source by removing the Mains (power) plug from the outlet receptacle, and refer such maintenance to service personnel.

In the event of an extended power failure, it may be necessary to trip the door-locking mechanism manually to remove the rotor and retrieve your sample.

⚠ WARNING

The following procedure should be implemented only when absolutely necessary and only by qualified service personnel.

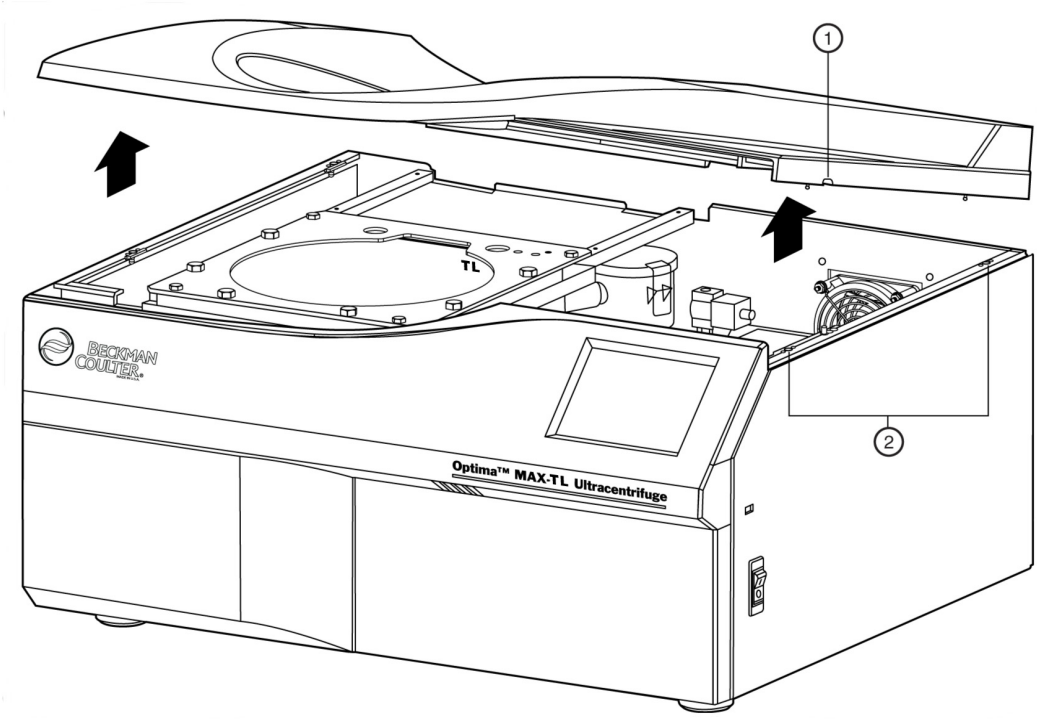
1 Turn the power off (**O**) and disconnect the power cord from the main power source by removing the Mains (power) plug from the outlet receptacle.

2 The underside of the top cover is fitted with tabs that snap inside clips in the side panels (see Figure 3.2). By inserting the blade of a flat-head screwdriver into the release slot on either side of the ultracentrifuge, you can pop off the top cover of the ultracentrifuge.

⚠ CAUTION

LISTEN CAREFULLY! Do not proceed if any sound or vibration is coming from the drive.

Figure 3.2 Removing the Top Cover of the Ultracentrifuge



1. Release slot (located on right and left sides)
2. Clips for securing cover

3 Remove the top cover and set it aside.

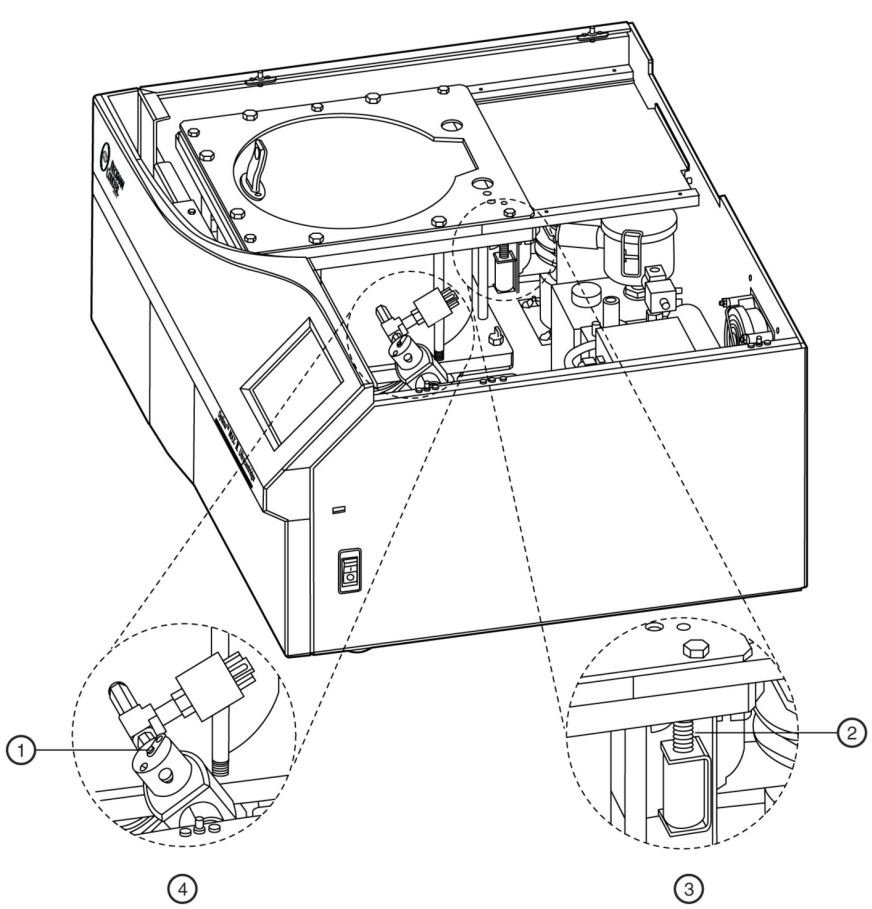
4 Locate the vacuum solenoid valve (see Figure 3.3), and turn the screw clockwise until you hear air rush into the chamber.

The chamber vacuum is released.

a. If you hear a whining noise, the rotor is still spinning. Close the valve and wait until the noise stops.

When the sound of rushing air stops, the vacuum is vented.

Figure 3.3 Door Lock System



1. Screws
2. Spring loaded pin
3. Door lock system
4. Vacuum solenoid

5 Turn the screw counterclockwise to its closed position.

6 Locate the door lock system (see Figure 3.3), and push the spring-loaded pin down to unlock the door.

If the rotor is still spinning, close the door and wait.

The drive is very quiet and may emit no audible sounds below 10,000 RPM.

⚠ WARNING

NEVER try to slow or stop the rotor by hand.

7 Open the door and remove your sample.

8 To replace the top cover of the ultracentrifuge, line up the tabs with the openings on the side panels, and press down firmly until all sides and corners of the cover snap securely into place.

Circuit Breaker

If the circuit breaker/power switch on the ultracentrifuge trips repeatedly, call Beckman Coulter Customer Service.* The circuit breaker/power switch is on the right-hand side of the ultracentrifuge.

* Call Customer Serivce at 1-800-742-2345 (U.S.A. or Canada) or contact your local Beckman Coulter Representative.

CHAPTER 4

Care and Maintenance

Introduction

This chapter contains care and maintenance procedures that should be performed regularly. For maintenance not covered in this manual call Beckman Coulter Customer Service at 1-800-742-2345 (U.S.A. or Canada) or contact your local Beckman Coulter Representative.

User messages and recommended actions are discussed in CHAPTER 3, *Troubleshooting. Refer to the applicable rotor manual and* Rotors and Tubes *for instructions on the care of rotors and their accessories.*

Ultracentrifuge Care

⚠ WARNING

Any maintenance procedure requiring removal of a panel exposes the operator to the possibility of electrical shock and/or mechanical injury. Therefore, turn the power OFF (O) and disconnect the ultracentrifuge from the main power source by removing the Mains (power) plug from the outlet receptacle, and refer such maintenance to service personnel.

Vacuum System

For optimum performance of the vacuum system, keep the chamber O-ring (A31988) and area around the O-ring clean. (Ultracentrifuge O-rings have not been designed as bioseals for aerosol containment.) Wipe the area with a cloth dampened with a mild detergent such as Solution 555 (339555). Dilute the detergent with water (10 parts water to 1 part detergent).

Chamber O-Ring

Clean the O-ring every three or four months with alcohol and a lint-free cloth or tissue and coat it lightly, but evenly, with silicone vacuum grease (335148).

Purging Moisture from the Vacuum Pump Oil

If a chamber pressure of 500 microns cannot be reached in about 3 minutes, there may be moisture in the vacuum pump oil. To purge this moisture:

1 Leave the ultracentrifuge turned on with the door closed and the vacuum pump turned on for about 3 hours or, if convenient, overnight.

2 Call Beckman Coulter Field Service to change the vacuum oil if it remains contaminated.

(The ultracentrifuge will continue to display a **VACUUM** message after following the instruction in Step 1.)

Drive Hub

Check the drive hub and regularly wipe it clean as needed.

Air-Intake and Exhaust Louvers

Regularly verify that the air-intake and exhaust louvers are clean and unblocked. Use a vacuum cleaner or damp cloth to clean them.

Cleaning

NOTE Before using any cleaning or decontamination methods, except those recommended by the manufacturer, users should check with the manufacturer that the proposed method will not damage this equipment.

Ultracentrifuge Surfaces

Keep ultracentrifuge surfaces clean by wiping them with a cloth dampened with a mild detergent such as Solution 555. Dilute the detergent with water (10 parts water to 1 part detergent). If salts or other corrosive materials are used, however, or if spillage occurs, wash all affected areas immediately. Do not allow corrosive materials to dry on the ultracentrifuge. (Be careful not to spill liquid on the ultracentrifuge where electrical or mechanical components could get damaged.)

Touchscreen Display

To clean the touchscreen, use any standard glass cleaner (non-ammonia based). Do not spray cleaner or pour liquid on the screen. Always spray or apply the cleaner on an antistatic cloth first, then gently wipe the touchscreen.

Decontamination

If the ultracentrifuge and/or accessories are contaminated with radioactive or pathogenic solutions, perform appropriate decontamination procedures Refer to *Chemical Resistances* (IN-175) to be sure the decontamination method does not damage any part of the ultracentrifuge.

Sterilization and Disinfection

The top working surface is finished with acrylic baking enamel; the sides are finished with general purpose paint. Ethanol (70%) may be used on both these surfaces. See *Chemical Resistances* for more information on chemical resistance of ultracentrifuge and accessory materials.

⚠ CAUTION

Ethanol is a flammability hazard. Do not use it in or near operating ultracentrifuges.

While Beckman Coulter has tested these methods and found that they do not damage the ultracentrifuge, no guarantee of sterility or disinfection is expressed or implied. When sterilization or disinfection is a concern, consult your laboratory safety officer regarding proper methods to use.

Storage and Transport

To ensure that the ultracentrifuge does not get damaged, call Beckman Coulter Customer Service at 1-800-742-2345 (U.S.A. or Canada) or contact your local Beckman Coulter Representative for specific instructions and/or assistance in preparing the equipment for transport or long-term storage. Temperature and humidity requirements for storage should meet the environmental requirements described under *Specifications* in CHAPTER 1, *Description*.

Supply List

Call Beckman Coulter Customer Service at 1-800-742-2345 (U.S.A. or Canada) or visit www.beckman.com for information about ordering parts, supplies, and publications. For your convenience, a partial list is given below. See the Beckman Coulter *Ultracentrifuge Rotors, Tubes & Accessories* catalog (BR-8101, available at www.beckman.com/techdocs) for detailed information on ordering rotors, tubes, and accessories.

Refer to the applicable rotor manual for materials and supplies needed for rotors.

Supplies

NOTE For MSDS information, go to the Beckman Coulter website at www.beckman.com.

Descirption	Part Number
Spinkote lubricant (2 oz)	306812
Silicone vacuum grease (1 oz)	335148
Solution 555 (1 qt)	339555

Optional Accessories

Descirption	Part Number
HEPA filter kit	350799

APPENDIX A

Preinstallation Requirements

Introduction

Preinstallation requirements have been provided for your Optima MAX-TL ultracentrifuge. The following information is included in case the ultracentrifuge must be relocated.

NOTE This ultracentrifuge is designed to be installed by Beckman Coulter Field Service. Installation by anyone other than authorized Beckman Coulter personnel invalidates any warranty covering the ultracentrifuge.

Space Requirements

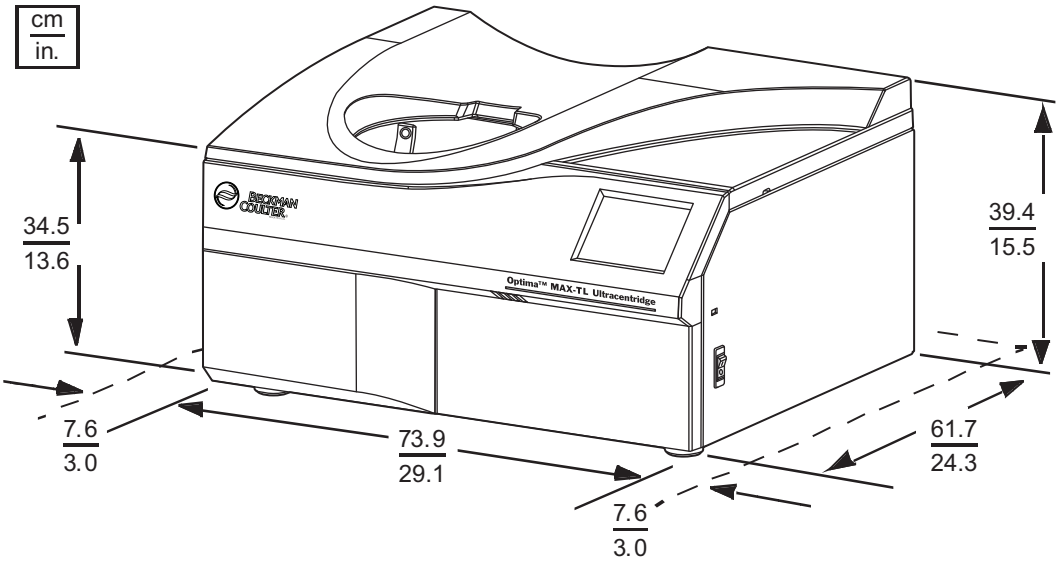
⚠ WARNING

Do not place the ultracentrifuge near areas containing flammable reagents or combustible fluids. Vapors from these materials could enter the ultracentrifuge air system and be ignited by the motor. Maintain a 30-cm (1-ft) clearance envelope around the ultracentrifuge while it is running. No persons or any hazardous materials should be within this clearance boundary while the ultracentrifuge is operating, except to change operating controls, if required.

If it is necessary to move the ultracentrifuge, maintain the following conditions:

- Select a location away from heat-producing laboratory equipment, with sufficient ventilation to allow heat dissipation.
- Position the ultracentrifuge on a level surface, such as a sturdy table or laboratory bench that can support the weight of the ultracentrifuge 105 kg (230 lb) and resist vibration. Place the ultracentrifuge at least 5.1 cm (2 in.) from the front edge of the laboratory bench.
- In addition to space for the ultracentrifuge itself (see Figure A.1 for dimensions), allow 7.6 cm (3-in.) clearances at the sides and back to ensure sufficient air circulation. The ultracentrifuge must have adequate air ventilation to ensure compliance to local requirements for vapors produced during operation.
- Relative humidity should not exceed 75% (noncondensing).

Figure A.1 Dimensions of the Optima MAX-TL Ultracentrifuge



Electrical Requirements

Voltage ranges	220/240 VAC~, 6 A, 50 Hz 120 VAC~, 12 A, 50/60 Hz 100 VAC~, 12 A, 50/60 Hz

To reduce the risk of electrical shock, this ultracentrifuge uses a 1.83-m (6-ft) three-wire electrical cord to be attached to the IEC 320/CEE-20 AC power connector at the rear of the ultracentrifuge and a plug to connect to earth-ground. (A plug that meets your local electrical and safety requirements was supplied with the ultracentrifuge. Contact your local Beckman Coulter office for specific information regarding local requirements.) To preserve this safety feature:

1 Make sure that the matching wall outlet receptacle is properly wired and earth-grounded.

- **a.** Verify that the line voltage agrees with the voltage listed on the name rating plate affixed to the ultracentrifuge.
- **b.** The Mains (power) plug is the disconnect device and must remain easily accessible.

  Position the ultracentrifuge so that it is easy to remove the Mains (power) plug from the outlet receptacle.
- **c.** Then plug in both ends of the ultracentrifuge power cord.

2 Never use a three-to-two wire plug adapter.

3 Never use a two-wire extension cord or a two-wire non-grounding type of multiple-outlet receptacle strip.

4 If there is any question about voltage, have a qualified service person measure it under load while the drive is operating.

To ensure optimal safety, the ultracentrifuge should be wired to a remote emergency switch (preferably outside the room where the ultracentrifuge is housed, or adjacent to the exit from that room). In case of a malfunction, the ultracentrifuge can be disconnected from the main power source by removing the Mains (power) plug from the outlet receptacle.

Beckman Coulter, Inc.
Optima MAX-TL Ultracentrifuge Warranty

Subject to the exceptions and upon the conditions specified below, Beckman Coulter agrees to correct, either by repair, or at its election by replacement, any defects of material or workmanship which develop within one (1) year after delivery of the Optima MAX-TL Ultracentrifuge (the product), to the original Buyer by Beckman Coulter or by an authorized representative provided that investigation and factory inspection by Beckman Coulter discloses that such defect developed under normal and proper use.

Some components and accessories by their nature are not intended to and will not function for as long as one (1) year. A complete list of such components or accessories is maintained at the factory and at each Beckman Coulter District Sales Office. The lists applicable to the products sold hereunder shall be deemed to be part of this warranty. If any such component or accessory fails to give reasonable service for a reasonable period of time, Beckman Coulter will repair or, at its election, replace such component or accessory. What constitutes either reasonable service and a reasonable period of time shall be determined solely by Beckman Coulter.

Replacement
Any product claimed to be defective must, if requested by Beckman Coulter, be returned to the factory, transportation charges prepaid, and will be returned to Buyer with the transportation charges collect unless the product is found to be defective, in which case Beckman Coulter will pay all transportation charges.

Conditions
Beckman Coulter makes no warranty concerning products or accessories not manufactured by it. In the event of failure of any such product or accessory, Beckman Coulter will give reasonable assistance to the Buyer in obtaining from the respective manufacturer whatever adjustment is reasonable in light of the manufacturer's own warranty.

See the warranty that accompanies each rotor for ultracentrifuge rotor warranty information. Beckman Coulter shall be released from all obligations under all warranties, either expressed or implied, if the product(s) covered hereby are repaired or modified by persons other than its own authorized service personnel, unless such repair by others is made with the written consent of Beckman Coulter, or unless such repair in the sole opinion of Beckman Coulter is minor, or unless such modification is merely the installation of a new Beckman Coulter plug-in component for such product(s).

Special Drive Warranty
During the instrument warranty period (one year), there will be no charge for drive replacement if the drive unit is installed, serviced, and operated in accordance with the conditions listed below. During the second through tenth year of use the drive replacement costs, excluding labor and travel, will be covered by warranty if the drive unit is installed, serviced, and operated in accordance with the conditions listed below. This applies to units not under service contract.*

* For details of drive coverage with a service contact, contact your local Beckman Coulter service representative.

Conditions

1. The drive has been operated only within its rated speed and temperature ranges.
2. The drive unit has not been subjected to unequal loading, improper rotor installation, corrosion from material spilled onto the hub or accumulated in the chamber of the instrument.
3. The drive unit has not been disassembled, modified, or repaired, except by Beckman Coulter personnel.
4. The drive unit was installed by a Beckman Coulter Field Service representative.
5. The instrument in which the drive unit has been used and operated, and its associated rotors, were manufactured by Beckman Coulter and serviced only by Beckman Coulter Field Service representatives.

Disclaimer

IT IS EXPRESSLY AGREED THAT THE ABOVE WARRANTY SHALL BE IN LIEU OF ALL WARRANTIES OF FITNESS AND OF THE WARRANTY OF MERCHANTABILITY AND THAT BECKMAN COULTER, INC. SHALL HAVE NO LIABILITY FOR SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND WHATSOEVER ARISING OUT OF THE MANUFACTURE, USE, SALE, HANDLING, REPAIR, MAINTENANCE, OR REPLACEMENT OF THE PRODUCT.

Related Documents

Rotors & Tubes for Beckman Coulter Tabletop Preparative Ultracentrifuges
PN TLR-IM-9

- Rotors
- Tubes and Accessories
- Using Tubes and Accessories
- Using Rotors
- Care and Maintenance
- Chemical Resistances
- The Use of Cesium Chloride Curves
- Gradient Materials
- References
- Glossary

Chemical Resistances for Beckman Coulter Centrifugation Products
PN IN-175

Ultracentrifuge Rotors, Tubes, & Accessories Catalog
PN BR-8101