Thermo Scientific

Compass Centrifugation Software
for Thermo Scientific Sorvall WX+ Floor Ultra Centrifuges

Instruction Manual

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Thank you very much for selecting Thermo Scientific™ Compass centrifugation software for the Thermo Scientific™ Sorvall™ WX+ Ultra Series centrifuges.

This Compass centrifugation software is a calculation/simulation system for centrifuge support, compatible with Windows® 7 or Windows® 8. Compass centrifugation software helps determine appropriate run conditions prior to starting centrifugal separation, and calculates optimum centrifuge and rotor run conditions for materials in which proper run conditions are unknown.

Read this manual thoroughly to use Compass centrifugation software correctly.

Note: This manual does not explain the basic common operations of Windows. When using Windows for the first time, please consult the appropriate manuals.
## CONTENTS

### 1. Setting up Compass centrifugation software
- Setting up Compass centrifugation software ........................................... 1-1
  - Environment required for setup ......................................................... 1-1
  - Setup procedure .............................................................................. 1-2

### 2. How to use Compass centrifugation software
- Starting Compass centrifugation software ........................................ 2-1
- Selecting a calculating function ....................................................... 2-2
- Setting calculation parameters ......................................................... 2-3
  - Setting the rotor ............................................................................ 2-3
  - Entering run conditions ................................................................. 2-4
  - Entering density gradient conditions ............................................. 2-4
  - Entering sample conditions ............................................................ 2-5
- Executing simulation ....................................................................... 2-6
- Using simulation results for other applications ............................... 2-7
  - Copying calculation results ............................................................ 2-7
  - Saving calculation results ............................................................... 2-8
- Printing or outputting calculation results ......................................... 2-8
- Transmitting calculation results to the centrifuge ......................... 2-9
  - USB driver setup .......................................................................... 2-9
  - Transmitting calculation results ..................................................... 2-18
  - Special settings ............................................................................ 2-20
- Exiting Compass centrifugation software ........................................ 2-20

### 3. Compass centrifugation software Calculating Functions
- K-factors and pelleting times ........................................................... 3-2
  - Convert speed and force ................................................................. 3-2
  - Calculation of K-factors ................................................................. 3-3
  - Calculation of pelleting times ....................................................... 3-3
  - Calculation of run time integral .................................................... 3-4
  - Time conversion for rotors ............................................................. 3-5
1. Setting up Compass centrifugation software

To use Compass centrifugation software, the Compass centrifugation software program must be installed on a compatible personal computer system.

Topics in this section:
- Setting up Compass centrifugation software
- Starting and exiting Compass centrifugation software

Setting up Compass centrifugation software

To use Compass centrifugation software, a series of specially compressed files stored in the product disk of the personal computer hard disk must be used. Accordingly, even if copied as is, Compass centrifugation software cannot run. To set up Compass centrifugation software, use the setup program stored in the product disk.

Environment required for setup

Before setting up Compass centrifugation software, check that the personal computer being used meets the following requirements:

- Operating system
  - Windows 7 Home Premium / Windows 7 Professional / Windows 7 Ultimate
  - Windows 8 / Windows 8 Pro
  - When Windows 8 is installed on your personal computer, setting up Microsoft® .NET Framework 3.5 is required (see 1-5 “Setting up Microsoft .NET Framework3.5”)
- A personal computer that runs Windows 7 or Windows 8, and has one CD-ROM drive.

- When transmitting simulation results to the centrifuge as run conditions:
  - A personal computer with a USB port for transmitting run conditions to the WX+ series ultracentrifuge (USB communication is not available for a 64-bit Windows 7 and a 64-bit Windows 8.)
- A display with resolution of 800 x 600 or more (recommended resolution: 1024 x 768 or more), and is compatible with Windows
- A hard disk free space of 100 MB or more
- A mouse or other pointing device compatible with Windows
Setup procedure

Set up Compass centrifugation software according to the following procedure.

1. Exit all Windows® applications.
2. Insert the Compass centrifugation software setup CD in the CD-ROM drive of the personal computer.
   - “AutoPlay” screen appears. Select the “CompassInst.exe” on the “AutoPlay” screen.
   - If the setup program does not start, run CompassInst.exe in the CD-ROM drive.
3. “MENU” appears.
   - Select the [SETUP] for setting up the Compass centrifugation software.
   - If you select the [INSTRUCTION MANUAL(PDF)], you can view the Compass centrifugation software instruction manual (PDF).

   ![Compass Setup Window]

   - If the following screen appears while the Compass centrifugation is set up, wait until “Crystal Reports Basic Runtime for Visual Studio 2008” installation has completed.

   ![Crystal Reports Basic Runtime for Visual Studio 2008]

   - “User Account Control” screen appears. (Program name: Crystal Reports Basic Runtime for Visual Studio 2008)
     Select “Yes” on the “User Account Control” screen.
3. The setup program then starts.
Follow the procedure below to set up Compass centrifugation software.

(1) Click the [Next] button.

(2) Select [I Agree] and then click the [Next] button.
(3) Click the [Next] button.

(4) Setup has been completed. Click the [Close] button.

After the setup has been completed, the group named "Compass" is registered in the Start menu.
NOTE “Setting up Microsoft® .NET Framework 3.5”

Perform the following procedure to check the current setting of the “Microsoft® .NET Framework 3.5” and select the features.

(1) Select the [Start] and the [Control Panel] to open the control panel. Select the [Programs] on the control panel.

(2) Select the [Programs and Features].
Setting up Compass centrifugation software

(3) Select the [Turn Windows features on or off].

(4) If the [.NET Framework 3.5] check box is cleared, click the [.NET Framework 3.5] check box and [OK] button.

Setup has been completed.
2. How to use Compass centrifugation software

This section explains a series of operations from the determination of a centrifuge method for a sample to the transmission of resulting data to the centrifuge using Compass centrifugation software, according to practical operations for calculation.

In the following example, the samples of 5S, 10S and 15S are separated by rate zonal separation on a sucrose density gradient, using a TH641 swinging bucket rotor.

Starting Compass centrifugation software

To start Compass centrifugation software, perform one of the following operations.

- Select the [Compass] group after clicking on [Start]-[Program].
- Click on [Compass. 5.1] in the [Compass] group.

After starting Compass centrifugation software, the startup screen, then the Compass centrifugation software main screen appear.
Selecting a calculation function

The Compass centrifugation software calculation functions are listed in the tree view menu on the left side of the screen. In this menu, select a target item for calculation. In this case, select [Swinging bucket rotor rate-zonal simulations]:

1. Click on the [Rate-Zonal Separations] folder of the tree view menu.
2. Calculation and simulation options appear under the [Rate-Zonal Separations] folder.
3. Click on [Swinging bucket rotor rate-zonal simulations].
4. The [Swinging bucket rotor rate-zonal simulations] calculation screen appears on the left side of the screen.
Setting calculation parameters

After a calculation function, set the parameters required for calculation or simulation. In the case of [Swinging bucket rotor rate-zonal simulations], the following parameters must be set:

- Setting the rotor
- Entering run conditions
- Entering density gradient conditions
- Entering sample conditions

Setting the rotor


2. Click on one of [ultracentrifuge] or [micro-ultracentrifuge]. The radio button of the selected item will turn on. In this example, select [ultracentrifuge].

3. In the drop-down list box, select the rotor type to be used for the calculation. In this example, only [Swinging bucket rotor] can be selected.

4. Select the rotor to be used for calculation in the rotor list, and click on the [OK] button. In this example, select [TH-641].

When a rotor has been correctly selected, the rotor name, Rmax, Rmin, and maximum speed values are displayed on the [Rotor properties] frame of the calculation screen.
How to use Compass centrifugation software

Entering run conditions
In this example, assume the operation of 41,000 rpm x 720 min is performed.

1. Enter [41,000] (rpm) as the rotor speed to be used for calculation in the Speed input box.
2. Enter [720] (min) as the centrifuge run time in the Run time input box.

Entering density gradient conditions
In this example, it is assumed that 0.5 ml of sample solution is overlayed on the 12 ml of 5 to 20% sucrose density gradient solution prepared in the tube and the operation is performed at 4 degrees Celsius.

1. Enter [12] (ml) of density gradient solution in the gradient vol. input box.
2. Enter [0.5] (ml) of sample solution to be overlayed on the density gradient solution in the Sample vol. input box.
4. Enter [5] (%) as the top concentration and [20] (%) as the bottom concentration of the sucrose density gradient solution in the sucrose concentration input box, respectively.

After entering the above parameters, the calculation screen of [Swinging bucket rotor rate-zonal simulation] is displayed as shown below.
Entering sample conditions

In this example, it is assumed that 5S, 10S and 15S are used as protein samples and they are contained 30%, 50%, and 20% in the sample solution, respectively.

1. Enter [1.3] (g/ml) as the buoyant density of protein in the sucrose solution in the density input box.

2. Click on the [Sample Particle Setting] button provided on the [Particle] frame on the calculation screen, and the [Sample particle] dialog box will open.

3. Enter [3] as the type of sample particle to be separated in the sample-number input box of the [Sample particle] dialog box.

4. According to the numeric value entered above, the entry in the S-value input box and in the percentage input box is enabled. Enter [5] as the firsts sample s-value and [30] (%) as its percentage in the first S-value input box and percentage input box.

5. Likewise, enter [10] as the S-value and [50] (%) as the percentage in the second input boxes, and enter [15] as the S-value and [20] (%) as the percentage in the third input boxes.

6. After completion of every entry, click on the [OK] button to close the [Sample particle] dialog box.

[Sample particle] Dialog Box
Executing simulation

After setting all the parameters, click on the [Calc.] button of the calculation screen. The separation status results of the centrifugal separation are calculated based on the entered parameters, and graphically displayed in the lower part of the calculation screen.

![Graph of Results](image)

When the [Table] radio button is clicked on, the display of the results change to the table format. This table shows the calculated s-value of the sample contained in each fraction after fractionating the centrifuged sample into 25 parts.
Using simulation results for other applications

The Compass centrifugation software calculation results can be copied to the Clipboard or saved to the disk so that they may be used for other applications.Copied data can be pasted into other Windows programs, such as Microsoft Word, Excel, or Powerpoint.

Copying calculation results

To copy a table

1. Select the target cell range to be copied.
   - Click on the cell of the upper left corner in the selection range and drag the mouse to the cell located in the lower right corner. Or click on the cell of the upper left corner in the block selection range and click on the cell of the lower right corner while pressing the Shift key.
   - To select the whole table, execute [Edit]-[Select all] in the menu.

2. Copy the selected cell.
   - Execute [Edit]-[Copy] in the menu or click on the copy icon (買い物袋) on the tool bar.

To copy a graph:

1. Select a target graph to be copied.
   - Click on the graph to be copied. A borderline is displayed around the graph to indicate that the graph has been selected.

2. Copy the selected graph.
   - Execute [Edit]-[Copy] in the menu or click on the copy icon (買い物袋) on the tool bar.

Note: The graph is copied to the Clipboard in bit-mapped format. To enlarge the graph for use, a figure of meta-file format is recommended.

   To use a graph of meta-file format, save the graph in a file before use by referring to [Saving calculation results].
Saving calculation results

To save a table
Execute [File]-[Save Table] in the menu or click on the save icon (    ) on the tool bar.
When the save table dialog box is opened, enter a proper name and the click on the [Save] button.

Save format
Tables are saved in the text format, in which adjacent cells are separated from each other by tab character.

To save a graph:
Execute [File]-[Save Graph] in the menu or click on the save graph icon (    ) on the tool bar.
When the save graph dialog box is opened, enter a proper name, select a save format, and click on the [Save] button.

Save format
Both meta-file format and bit-mapped format are applicable to saving graphs. To enlarge a graph for use, saving it in the meta-file format is recommended.

Printing or outputting calculation results

The Compass centrifugation software calculation results can be printed with a Windows compatible printer. Be aware that the print layout may differ slightly from the screen layout.

To print calculation results, execute [File]-[Print] in the menu or click on the print icon (    ) on the tool bar.

To print the calculation results, click on the print icon (    ) in the [PrintPreview] dialog box. When the print dialog box appears, change the settings as required, and then click the [OK] button.

To set the print dialog, refer to your Windows instruction manual.

To output the calculation results to a file, click on the export icon (    ) in the [PrintPreview] dialog box to open a dialog box for export. In the export dialog box, enter the name of the file to which to output the calculation results, select the type of file (Excel, Word, or PDF), and then click the [Save] button.
Transmitting calculation results to the centrifuge

When the personal computer that runs Compass centrifugation software is connected to the main unit of the centrifuge with a USB cable, the run conditions used for executing Compass centrifugation software can be transmitted to the centrifuge. Consequently, the execution results of Compass centrifugation software can be reproduced on the centrifuge.

When you use the USB cable to connect the WX+ Ultra series centrifuge to your personal computer for the first time, the [Device driver software was not successfully installed] message appears. See the “Setting up the USB driver for Compass centrifugation software”.

Setting up the USB driver for Compass centrifugation software

When Compass centrifugation software is used for the WX+ Ultra series centrifuge for the first time, the [Device driver software was not successfully installed] message box appears when the centrifuge is connected to the personal computer. Then, follow the procedure below to set up a USB driver.

(1) Insert the Compass centrifugation software setup CD into the CD-ROM drive of the personal computer.

(2) Open the start menu and select “Computer”. Then select “System properties” on the “Computer” screen.
(3) Select the [Device Manager]

(4) Right-click the [Unknown device] in the [Other Devices], then select [Update Driver Software...] from the context menu.

(5) Select [Browse my computer for driver software].
(6) Select the [Include subfolders] check box and then click the [Browse] button.

(7) When the [Browse For Folder] dialog box appears, select the folder "USBdrv7" in the CD-ROM drive, and then click the [OK] button.

(8) Click the [Next] button.
(9) Select [Install this driver software anyway].

(10) Click the [Close] button.

USB driver setup for Compass centrifugation software for the WX+ Ultra series centrifuge is now completed.
Transmitting calculation results

1. Display the [Send Run condition] dialog box.
   After completion of calculation, execute [Centrifuge]-[Send Run condition] in the menu or click on the run condition transfer icon ( ) on the tool bar.

2. Enter an undefined parameter.
   Each parameter input box on the [Transfer of run conditions] dialog box indicates the parameters set or calculated on Compass centrifugation software.
   If there is any parameter that is not yet set, enter this undefined parameter in the corresponding parameter input box that is free.
   A set parameter can be changed if necessary.

3. Set the registration memory.
   To register the run conditions to be transmitted in the memory of the main unit of the centrifuge, set the registration memory.
   (1) Activate off the [Memory Storage] check box on the [Memory setting] frame.
   (2) The program name input box for registration memory selection becomes effective.

   Enter the program name to be registered in the input box. (The program name must be up to 1000 digits.)

   If these conditions are not to be registered in the memory of the centrifuge, remove the check off mark in the [Memory Storage] check box on the [Memory setting] frame.
4. Transfer the run conditions.

After completion of each parameter entry, click on the [OK] button. The transmission of the run conditions will start. If any entered parameter exceeds the allowable input range, an error window will be displayed. In this case, delete the error window and enter a correct value, then click on the [OK] button once again.

Upon completion of transmission, the message window will indicate the end of transmission.

[Transfer of run conditions] Dialog Box
Special settings

For a continuous run (hold run):
Enter [HOLD] in the run time input box.

For a free coast:
Enter [F] in the run time input box.

For a multi-step run:
As a matter of centrifuge specifications, a multi-step run must be started after registration in the memory. Accordingly, in the case of a multi-step run, the [Memory storage] check box is always in the check off status.

Exiting Compass centrifugation software

To exit Compass centrifugation software, click on [File]-[Exit] on the menu or click X in upper right hand corner.
3. Compass centrifugation software Calculating Functions

Compass centrifugation software is provided with various calculating and simulating functions for centrifuge support. This section outlines the calculation and simulation functions mounted on Compass centrifugation software.
K-factors and pelleting times

This option includes many functions to calculate important parameters used as references for pelleting efficiency.

From this option, the following calculation functions are available:

- Convert speed and force
- Calculation of K-factors
- Calculation of pelleting times
- Calculation of run time integral
- Time conversion for rotors

Convert speed and force

This computation function converts the speed and centrifugal force for the selected rotor.

**Calculation results:**

- RCFmax \( (x \ g) \)
  
  The centrifugal force at Rmax can be performed by operating the selected rotor at the maximum speed.

- Speed (rpm)
  
  The speed is calculated when [RCF -> Speed] has been selected as a calculation item. This is the speed required to obtain the previously entered centrifugal force at the entered radius of rotation.

- RCF \( (x \ g) \)
  
  This item is calculated when [Speed -> RCF] has been selected as a calculation item. This is the centrifugal force to be obtained at the entered radius of rotation when the rotor is operated at the previously entered speed.

![Image of Convert speed and force calculator](image)

Calculation of Speed and Centrifugal Force
Calculation of K-factors

This function calculates the K-factor and K*-factor of the selected rotor. Generally, the K*-factor is a value calculated for protein, however a K*-value can also be calculated for a sample other than protein.

**Calculation results:**

- **RCFmax (x g)**
  - The centrifugal force at Rmax that can be obtained by operating the selected rotor at the maximum speed.

- **K-factor (x g)**
  - The K-factor can be obtained by operating the selected rotor at the specified speed.

- **K*-factor (x g)**
  - K*-factor for the selected sample that can be obtained by operating the selected rotor at the specified speed.

![Calculation of K-factors](image)

**Calculation of pelleting times**

This function calculates the time required to pellet biological samples such as RNA, DNA, or cell organelles.

In addition to sample selection in the list, this function can also calculate the time required to pellet an arbitrary sample when the s-value and density of the sample are entered.

**Calculation results**

- **Pelleting time**
  - Time required to pellet the selected sample in the set run conditions.
Calculation of run time integral

\( \omega^2 t \) is a parameter that indicates the total centrifugal effect after execution of centrifugal separation. This function also helps ensure run-to-run reproducibility.

This calculation calculates the run time integral (\( \omega^2 t \)) for running the centrifuge.

**Calculation results:**

- Run time integral (\( \omega^2 t \))

  Run time integral in entered conditions.
Time conversion for rotors

When performing centrifugal separation operations, you may wish to change the rotor or centrifuge. In these cases, it is necessary to determine run conditions for another rotor to obtain separation results equivalent to the former centrifugal separation.

This function can calculate run conditions such as obtaining the equivalent separation results after the rotor has been changed.

Calculation results:

- Run time (min)
  - Run time required for the changed rotor.

![Time conversion for Rotor Types](image-url)

Time Conversion of Rotor Types
Derating centrifuge rotors

When centrifuging a very-high-density solution, centrifugal separation may not be safely permitted at the maximum speed of the rotor in use. The allowable maximum speed (the maximum speed that allows a real run) of the rotor is restricted by the density of the solution used for separation.

This program calculates the allowable maximum speed of the rotor when a high-concentration solution is used.

**Calculation results:**

- **Allowable maximum speed (rpm)**
  
The maximum speed of the selected rotor applicable to the case where a high concentration solution is used.

- **Effective derating (%)**
  
The effective derating rate shows the necessary derating percentage for the maximum speed of the selected rotor.

![Calculation of Allowable Maximum Speed](image)
Rate-zonal separations

One method of centrifuging a sample using a density gradient solution is "Rate zonal separation (rate zonal centrifugation)". This method overlays a sample on the density gradient solution, previously prepared in a centrifuge tube, and centrifuges the sample. In this case, the sample is separated into different particles based on their s-values in the density gradient solution.

This option includes the calculation and simulation functions related to rate zonal separation, especially with a density gradient solution of sucrose, which is commonly employed.

- S-values in swinging bucket rotors
- S-values in vertical rotors
- S-values in fixed angle rotors
- Swinging bucket rotor rate-zonal simulations
- Enhanced rate zonal simulation

S-values in swinging bucket rotors

This calculation function calculates the S-value and approximate molecular weight of the sample contained in each fraction. Rate zonal separation is simulated on a continuous sucrose density gradient using a swinging bucket rotor. The function also displays the relationship between sample sizes (S-values) and sample concentration values of the content.

**Calculation results**

- S-value
  
  S-value of a sample particle with the largest size in the sample contained in the fraction.

- Approximate molecular weight

  Molecular weight of a sample particle with the largest size in the sample contained in the fraction.

- Graph of s-values and activation values

  A graph indicating the correlation between s-values and activation values, and between s-values and sucrose concentration values.

**Switching the calculation results**

When complete, the results are displayed in tabular form in the lower part of the calculation screen. Clicking on the [GRAPH] radio button switches the current display to "Graph of s-values and activation values". This graph shows the correlation between s-values and activation values, and between s-values and sucrose concentration values in entered run conditions.

After completion of calculations, the radio button can be switched at any time to display a graph or table.
S-values in vertical rotors

This calculation function calculates the s-value and approximate molecular weight of the sample contained in each fraction that can be obtained by rate zonal separation on a continuous sucrose density gradient using a vertical rotor. The function also displays the correlation between the sample sizes (S-values) and concentration values of the content.

This calculation function is the same as [Calculation of S-values in swinging bucket rotors] with the exception of using vertical rotors.

S-values in fixed angle rotors

This calculation function calculates the S-value and approximate molecular weight of the sample contained in each fraction that can be obtained by rate zonal separation on continuous sucrose density gradient using a swinging bucket rotor. The function also displays the correlation between sample sizes (S-values) and concentration values of the content.

This calculation function is the same as [Calculation of S-values in swinging bucket rotors] with the exception of using angle rotors.
Swinging bucket rotor rate-zonal simulations

This calculation function simulates the sedimentation and diffusion status of the sample during rate zonal separation on continuous sucrose density gradient in a swinging bucket rotor.

The function also displays the calculated S-value of the sample contained in each fraction after fractionating the centrifuged sample into 25 parts.

**Calculation results**

- Simulation graph of rate zonal separation
  - A graph indicating the sedimentation and diffusion status of the sample after the rate zonal separation.
- Correspondence table between fractions and S-values after fractionation
  - Corresponding table between each fraction and the S-value of the sample particles contained in it after the centrifuged sample is fractionated into 25 parts.

**Switching the simulation results**

When the simulation is complete, the results are displayed in the lower part of the calculation screen. Clicking on the [Table] radio button switches the current result display to the table display. This table shows the calculated S-values of the sample contained in each fraction after the centrifuged sample is fractionated into 25 parts.

After that, clicking the [Graph] radio button displays the graph shown below in the lower part of the calculation screen.

After completion of calculation, the radio button can be switched at any time to display a graph or table.
Enhanced rate zonal simulation

This function simulates not only rate zonal separation on continuous density gradient using a swinging bucket rotor, but also centrifugal separation on continuous density gradient other than sucrose using various types of rotors or using 2-step gradient, and a multi-step run. It takes some time to calculate a simulation result, but separation conditions can be set in detail.

Calculation result

➢ Simulation graph of rate zonal separation

A graph indicating the sedimentation and diffusion status of the sample after execution of the rate zonal separation.

Simulation of rate zonal separation—Extended version
Isopycnic separations

In addition to [Rate zonal separation], [Isopycnic centrifugation] is available as another centrifuge method using a density gradient solution. This method forms a sample band (separation layer) at a position in which the density of the sample is balanced with the density of the density gradient solution formed in the centrifuge tube.

The rate zonal separation is classified by a method executed by creating a density gradient in the tube in advance, and a method executed using a solvent (self-forming gradient) that forms a density gradient by centrifugal operation.

This option includes the calculation and simulation functions of a density gradient solution prepared by executing centrifugal separation, based on the rate zonal separation.

From this option, the following calculating functions are available.

- Time for gradient formation
- Position of isoconcentration point
- Fast isopycnic simulation
- Enhanced isopycnic simulation
- Simulation of lipoprotein separations
- Calculation of crystallization times

Time for gradient formation

This function calculates the time required to form a density gradient solution, and the time and position for the sample to reach the equilibrium point when centrifugal separation is performed using a self-forming gradient solution.

Calculation results:

- Gradient forming time
  Time required to form a density gradient.
- Time for the sample to reach the equilibrium point
  Time for the entered sample to reach the equilibrium point.
- Position in which the sample reaches the equilibrium point (cm)
  A radius of rotation (sample separation layer position) in which the sample reaches the equilibrium point.
Calculation of Density Gradient Forming Time

Position of isoconcentration point

This calculating function calculates the position of the density gradient equilibrium point and the density of the density gradient solution at the entered radius of rotation, when centrifugal separation is performed using a self-forming gradient solution.

Calculation results:

- Density gradient equilibrium point (cm)
  Density gradient equilibrium point (point where the density of the density gradient solution is equal to the initial density) of the selected rotor.

- Density (g/ml)
  The density of the density gradient solution at the entered radius of rotation.
Fast isopycnic simulation

This simulating function simulates the separation layer forming status when isopycnic centrifugation is performed using a self-forming gradient solution.

This function can also simulate, in simplified form, the case where centrifugation is performed using a homogeneous solution. Separation conditions cannot be set in detail, but a simulation result can be obtained in a short time.

Calculation result

- Simulation graph of isopycnic centrifugation

A graph indicating the separation layer forming status when isopycnic centrifugation is performed.

![Simulation of isopycnic centrifugation-Simplified version](image)

Calculation result
Enhanced isopycnic simulation

This simulating function simulates the separation layer forming status when isopycnic centrifugation is performed.

This function can simulate not only the case where centrifugal separation is performed using a homogeneous solution, but also the case where centrifugal separation is performed using a 2-step gradient, and also in the case of a multi-step run.

It takes some time to calculate a simulation result, but separation conditions can be set in detail.

Calculation result

➢ Simulation graph of isopycnic centrifugation

A graph indicating the sedimentation and diffusion status of the sample when isopycnic centrifugation is performed.

Simulation of isopycnic centrifugation-Extended version
Simulation of lipoprotein separations

This function simulates the separation layer forming status when lipoprotein separation is performed by flotation.

This simulation consists of the following 2 steps.

- First step: Separation using a low-density solution
  The NaCl/EDTA solution is overlayed and centrifuged on the sample of blood serum, to cause Chylomicron and VLDL to float.

- Second step: Separation using a high-density solution
  To the sample from which the above separation layers of Chylomicron and VLDL have been taken out, add a 15% Kbr solution to adjust the density and perform centrifugation to separate LDL and HDL from each other.

Calculation result

- Simulation graph of lipoprotein separation
  A graph indicating the sedimentation and diffusion status of the sample when lipoprotein is performed by flotation.
Calculation of crystallization times

In the case of isopycnic centrifugation, if the centrifugal force is too strong or the initial density of the density gradient solution is too thick, crystals of density gradient forming material may precipitate during centrifugation.

When such crystals of density gradient forming material precipitate during centrifugation, an unbalanced run may be caused, and the run may be stopped by the diagnostic function of the centrifuge.

This calculation function estimates the crystal separating time by the initial density of the density gradient solution during a run, and displays the results graphically on the screen.

**Calculation results:**
- A graph indicating rotor speeds and crystal separating times

This graph indicates the relationship between the rotor speeds and the crystal separating times of the density gradient forming material at the respective speeds.

![Graph showing the relationship between rotor speeds and time to crystallization](image)

**Calculation of Crystallization Times**
Concentrations of solutions

There are some types of units to represent solution concentration. In practice, preparing a solution may require the mutual conversion of them.

This option converts among refractive index, density (g/ml), % concentration (w/v), % concentration (w/w), and mol concentration with regard to various types of solutions that are often used in experiments.

Calculation results:

- Refractive index
- Density (g/ml)
- % concentration (w/v)
- % concentration (w/w)
- mol concentration
Molecular parameters

The important molecular parameters related to centrifugal separation are molecular weight, S-value (sedimentation coefficient), partial specific volume, and frictional coefficient. These 4 parameters are related to one another and a strict physical relationship exists between them.

This option calculates one remaining parameter by giving 3 parameters out of these 4 parameters.
Utilities

Molecular properties

This utility is used to display the properties of bio-macromolecules.

Using this utility allows you to know such properties as [S-value], [diffusion coefficient], [partial specific volume], and [frictional coefficient] of major macromolecules.

To start the macromolecule properties list, execute [Utility]-[Molecular Properties] in the menu or click on Molecular Properties icon on the tool bar.

Displayed properties:

- S-value
- Diffusion coefficient
- Partial specific volume
- Molecular weight
- Frictional coefficient
Chemical resistance

This utility indicates the resistance of tube and rotor materials to various chemicals.

Using this utility can protect the tube and rotor against damage, and using tubes with a high resistance to an applied solution can also protect the tubes against damage during centrifugal separation.

For starting the chemical resistance list, execute [Utility]-[Chemical Resistance] in the menu or click on the Chemical Resistance icon ( ) on the tool bar.

Note: Because no organized chemical resistance data exists for materials under stress of centrifugation, this data is intended to be used only as a guide to the selection of tube materials. When in doubt, we recommend testing of sample lots. Be aware that this list includes flammable and explosive substances which you are warned against using in your centrifuge.
S-value/density diagrams

This utility indicates the distribution of buoyant density and s-values of various bio-samples in major density gradient solutions.

This utility approximates the s-value and density of the target sample for separation, especially, as a reference for determining run conditions using a density gradient solution.

To start the s-value/density diagram, execute [Utility]-[S-value/density diagrams] in the menu or click on the S-value/Density Diagrams icon ( ) on the tool bar.
Rotor catalog

This utility is used to display the registered rotor specifications (properties).

To start the rotor catalog, execute [Utility]-[Rotor Catalog] in the menu or click on the Rotor Catalog icon ( ) on the tool bar.

**Editing the rotor catalog**

Every calculating function of Compass centrifugation software uses rotor catalogue data for the rotor parameters to be used in the calculation function, and in the rotor list to be displayed.

While Compass centrifugation software is in operation, calculation may be required about a rotor that is not found in the rotor list (for example, a discontinued rotor model or a rotor with an adapter).

In such a case, Compass centrifugation software is equipped with a function to add or delete a rotor to/from the rotor catalog, and a function to change the rotor properties.
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