sigma
Laborzentrifugen
Laboratory Centrifuges

Operating Manual

Refrigerated Centrifuge

4-16K

from Serial No 128012

Version 11/2008, Rev. 1.01 - sb
English translation

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1 General Information

1.1 Importance of the Operating Manual

A fundamental requirement for the safe and trouble-free operation of the centrifuge is to be familiar with the fundamental safety instructions and all possible hazards.

The operating manual includes important information concerning the safe operation of the centrifuge.

This operating manual and in particular the notes on safety and hazards must be observed by all persons operating the centrifuge.

In addition, the local rules and regulations for the prevention of accidents must be complied with.

1.2 Intended Use

Centrifuges are power-driven machines that separate liquids from solid matter, liquid mixtures, or solid mixtures by centrifugal force. They are solely intended for this purpose. Any other use beyond this area of application is regarded as improper use.
SIGMA Laborzentrifugen GmbH cannot be held liable for any damage resulting from such improper use.

The intended use also includes

- observation of all the notes and instructions included in the operating manual and
- compliance with the care, cleaning, and maintenance instructions.

1.3 Warranty and Liability

The warranty and liability are subject to our "General Conditions" that were distributed to the operator upon the conclusion of the contract.

Warranty and liability claims are excluded if they are due to:

- Improper use.
- Non-compliance with the safety instructions and hazard warnings in the operating manual.
- Improper installation, start-up, operation, and maintanance of the centrifuge.

1.4 Copyright

The copyright concerning the operating manual remains Sigma Laborzentrifugen GmbH.

The operatin manual is solely intended for the operator and their personnel. It includes instructions and information that may not be

- duplicated,
- distributet, or
- communicated in any othe way

neither in full nor in parts.

Non-compliance may be prosecuted under criminal law.

1.5 Standards and Regulations

EU Declaration of Conformity (page 99).

1.6 Scope of Supply

The centrifuge comprises:

• 1 rotor wrench, size 13	Part no. 930 102
• 1 hexagon socket wrench (size 5)	Part no. 930 051
• 1 tube of grease for load bearing bolts	Part no. 70 284
• 20 ml slushing oil	Part no. 70 104

Documentation:

Operating Manual incl.

- Equipment Decontamination Certificate (Declaration of Decontamination, page 91)
- EG Declaration of Conformity (page 99)

Accessories

according to your order, our order confirmation, and our delivery note.

2 Design of the Centrifuge

2.1 Overview

1 Mains power switch
2 Stop key
3 Lid key
4 Lid
5 Display
6 Start key
7 Function knob

Fig. 2.1: Total view of the centrifuge

8 Name plate
(see page 12)
9 Mains power input
10 Equipotential bonding screw

Fig. 2.2: Rear view of the centrifuge

2.2 Name Plate

1 Manufacturer and registered office
2 Type name
3 Serial number
4 Max. speed
5 Kinetic energy
6 Max. density
7 Nominal voltage
8 Input fuse
9 Symbol for special disposal (see chapter 9)
10 CE mark in accordance with the directive 94/9/EC
11 Part number
12 Year of manufacture
13 Power consumption

Fig. 2.3: Name Plate

3 Safety

3.1 Marking of the Unit

International symbols used for SIGMA centrifuges:

Gefährliche elektrische Spannung
Dangerous voltage
Courant haute tension

Achtung, Betriebsanleitung lesen
Attention, consult instruction manual
Attention, consulter mode d'emploi

I

Ein (Netzverbindung)
On (Power)
Marche (mise sous tension)

O

Aus (Netzverbindung)
Off (Power)
Arrêt (mise hors tension)

Schutzleiteranschluss
Protective earth (ground)
Liaison à la terre

Erde
Earth (ground)
Terre

Netzstecker ziehen
Unplug mains plug
Tirer la fiche de prise

Vorsicht Quetschgefahr
Caution! Risk of bruising
Attention! Danger de blessure

Drehrichtungspfeil
Arrow direction of rotation
Flèche sens de rotation

Heiße Oberfläche
Hot surface
Surface chaude

Nicht mit dem Hausmüll entsorgen
Do not dispose as part of domestic waste
Ne pas jeter avec les déchets ménager

3.2 Explanation of the Symbols and Notes

This operating manual uses the following names and symbols to indicate hazards:

This symbol stands for a **direct** hazard to the life and health of persons.

Non-observance of these symbols **causes** serious health problems up to life-endangering injuries.

This symbol stands for a **direct** hazard to the life and health of persons due to electrical voltage.

Non-observance of these symbols **causes** serious health problems up to life-endangering injuries.

This symbol stands for a **potential** hazard to the life and health of persons.

Non-observance of these symbols **can** cause serious health problems up to life-endangering injuries.

This symbol indicates a potentially hazardous situation.

Non-observance of these notes can cause minor injuries or damage to property.

This symbol indicates important information.

3.3 Responsibility of the Operator

The operator is responsible to authorise only qualified personnel to work on the machine (see chapter 3.4 "Operating Personnel").

The areas of responsibility of the personnel concerning the operation, maintenance, and care of the unit must be clearly defined.

The safety-conscious work of the personnel in compliance with the operating manual and the relevant EC and national health and safety regulations as well as with the accident prevention regulations must be checked at regular intervals (e.g. every month).

Under the international rules for health and safety at work, the operator is obliged to:

- take measures in order to prevent all danger to life or health during work.
- ensure that centrifuges are operated properly and entirely as intended (see chapter 1.2 "Intended Use", page 9 of this Operating Manual).
- take measures for the safe opening of centrifuges (see 11.5 "Declaration of Decontamination").

3.4 Operating Personnel

Persons operating the unit must

- be familiar with the fundamental regulations concerning workplace safety and accident prevention
- have read and understood this operating manual (and in particular the safety sections and warning notes) and confirmed this with their signature.

3.5 Informal Safety Instructions

- This operating manual is part of the product.
- The operating manual must be kept at the location of use of the centrifuge. Ensure that it is accessible at all times.
- The operating manual must be handed over to any subsequent owner or operator of the centrifuge.
- Any changes made must be added to the operating manual.
- In addition to the operating manual, the general and local rules and regulations concerning the prevention of accidents and the protection of the environment must also be supplied.
- Safety and danger indications on the centrifuge must be kept readable at all times. If necessary, they must be replaced.

3.6 Safety Instructions

3.6.1 Electrical Safety

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

- Make sure the the wall socket is properly wired and earth-grounded.
- Check that the mains voltage agrees with the nominal voltage listed on the name plate.
- Do not place vessels containing liquid on the centrifuge lid or within the safety distance of 30 cm around the centrifuge. Spilled liquids my get into the centrifuge and damage electrical or mechanical components.
- Work on the power supply system must only be performed by certified electricians.
- Inspect the electrical equipment of the unit regularly. Defects such as loose or burnt cables must be eliminated immediately.

3.6.2 Mechanical Safety

For safe operation of the centrifuge, observe the following:

- Do not open the lid when the rotor is in motion!
- Do not reach into the rotor chamber when the rotor is in motion!
- Do not use the centrifuge if it was installed incorrectly.
- Do not use the centrifuge without panels.
- Do not use the centrifuge if the rotors and inserts show signs of corrosion or other defects.
- Only use the centrifuge with rotors and accessories that have been approved by the manufacturer. In case of doubt contact the manufacturer (see chapter 7.3 "Service Contact").
- Defective lid relieving devices could cause the centrifuge lid to fall (contact service, if necessary). Risk of crushing!
- Do not hit or move the centrifuge during its operation.
- Do not lean against or rest on the centrifuge during its operation.
- Do not spin any substances that could damage the material of the rotors and buckets of the centrifuge in any way. Highly corrosive substances, for example, damage the material and affect the mechanical strength of the rotors and buckets.
- Stop the centrifuge immediately in the event of a malfunction (see chapter 7 "Malfunctions and Error Correction") or contact the service of SIGMA Laborzentrifugen GmbH (see 7.3 "Service Contact").
- Ensure that all repairs are performed only by authorized and specialized personnel (see 7.3 "Service Contact").

- Check all of the safety-relevant parts of the centrifuge before every start-up for any visible signs of damage.
- Open the centrifuge when it is not in use so moisture can evaporate.

3.6.3 Fire Prevention

- Always use fuses with the same type and rating specified.
- Do not spin explosive or inflammable substances .
- Do not use the centrifuge within hazardous locations.

3.6.4 Chemical and Biological Safety

If pathogenic, toxic, or radioactive samples are intended to be used in the centrifuge, it is in the responsibility of the user to ensure that all necessary safety regulations, guidelines, precautions, and practices are adhered to accordingly.

- Spin infectious material in sealed rotors and buckets only in order to prevent the material from leaking into the centrifuge.
- Infectious, toxic, pathogenic, and radioactive substances must be centrifuged in certified rotors and vessels. Take suitable precautions for your own safety if there is a risk of toxic, radioactive, or pathogenic contamination.
- Materials that chemically react with each other with a high level of energy are prohibited.

- Keep informed about local measures to avoid harmful emissions (depending on the substances to be centrifuged).
- Protective clothing is not required for the operation of the centrifuge. The materials to be centrifuged may, however, require special safety measures (e.g. centrifugation of infectious, toxic, radioactive, or pathogenic substances).

3.6.5 Safety Instructions for Centrifugation

For safe operation, observe the following before starting the centrifuge:

- Ensure that the centrifuge was set up properly (see chapter 5 "Set-up and Connection“).
- Maintain a safety distance of at least 30 cm (12 inches) around the centrifuge.
- Do not store any dangerous goods in the safety area of the centrifuge.
- Do not stay in the safety area longer than what is absolutely necessary for the operation of the centrifuge.

- Only use the centrifuge with rotors and accessories that have been approved by the manufacturer. We explicitly warn against the use of equipment of poor quality. Breaking glass or bursting vessels can cause dangerous imbalances at high speeds.
- Ensure that rotor and buckets are correctly fitted (see 6.2.2 "Installation of Rotors and Accessories“).
- Observe the instructions on the installation of accessories (see 6.2.2.3).
- The rotor must be loaded symmetrically at equal weights.
- If liquids with a density > 1.2 g/cm^3 are used, reduce the speed (see 6.3.3.6 or 6.4.3.7 and 11.4.2 "Density").
- Do not use the centrifuge if the rotor is loaded asymmetrically.
- Do not use the centrifuge with tubes that are excessively long.

3.6.6 Service Life of Rotors and Accessories

The rotors and accessories have a limited service life.

- Perform regular checks (at least once per month) for safety reasons!
- Pay special attention to changes, such as corrosion, cracks, material abrasion etc.
- After 10 years, they must be inspected by the manufacturer.
- After 50,000 cycles, the rotor must be scrapped for reasons of safety.
- If other data concerning the service life are engraved on the rotor or bucket, these data shall apply accordingly!

3.6.7 Resistance of Plastics

Chemical influences have a strong effect on the polymeric chains of plastics, and therefore, on their physical properties. Plastic parts can be damaged if solvents, acids, or alkaline solutions are used.

- Refer to the resistance data (see chapter 11)!

3.7 Safety Devices

3.7.1 Lid Lock Device

The centrifuge can only be started when the lid is properly closed. The electrical lock must be locked. The lid can only be opened when the rotor has stopped. If the lid is opened by way of the emergency release system during operation, the centrifuge will immediately switch off and decelerate brakeless. If the lid is open, the drive is completely separated from the mains power supply, i.e. the centrifuge cannot be started (see 7.1.1 "Emergency Lid Release").

3.7.2 Standstill Monitoring

Opening of the centrifuge lid is only possible if the rotor is at a standstill. This standstill is checked by the microprocessor.

3.7.3 System Check

An internal system check monitors the data transfer and sensor signals with regard to plausibility. Errors are detected with extreme sensitivity and displayed as error messages in a dialog box (see 7.2 "Error Codes").

3.7.4 Ground Wire Check

For the ground wire check, there is an equipotential bonding screw on the rear panel of the centrifuge. A ground wire check can be carried out by authorized and specialized personnel using a suitable measuring instrument. Please contact the head of our service team (see 7.3 "Service Contact").

3.7.5 Imbalance Monitoring System

A dialog box may pop up or emit a sound signal in order to indcate that the centrifuge is in the inadmissible imbalance range. If the rotor is loaded unevenly, the drive will be switched off in the acceleration phase or during the run.

3.8 Measures in the Event of Hazards and Accidents

- If an emergency arises, switch off the centrifuge immediately!
- If in doubt, call the emergency doctor!

3.9 Remaining Hazards

The unit was built state-of-the-art and according to the accepted safety rules. Danger to life and limb of the operator, or of third parties, or impairments of the unit or other material assets cannot be completely excluded when the unit is being used.

Use the unit

- only for the purpose that it was originally intended for (see 1.2) and
- only if it is in a perfect running state.
- Immediately eliminate any problems that can affect safety.

4 Storage and Transport

4.1 Dimensions and Weight

Height:	489 mm
Height with opened lid:	940 mm
Width:	570 mm
Depth:	650 mm
Weight:	124 kg

Fig. 4.1: Dimensions and weight

4.2 Storage Conditions

The centrifuge can be stored for up to a year without any problems.

- Store the centrifuge only in dry rooms.
- The storage temperature must be above –20°C.
- If you would like to store it for more than one year, or if you intend to ship it overseas, please contact the manufacturer.

4.3 Notes on Transport

- Install the transport safety device (plastic screws on the bottom side of the centrifuge, see 5.2).
- Always lift the centrifuge with a lifting device.
- When lifting the centrifuge, always reach under the centrifuge from the side.

The centrifuge weighs approx. 124 kg!

- For transport use a suitable packaging, and if at all possible, the original packaging (see 5.1 accordingly).

5 Set-up and Connection

5.1 Unpacking the Centrifuge

The centrifuge is packaged in a wooden crate.

- After taking off the lid, remove the side panels.
- Remove the packaging material.
- Lift the centrifuge upwards with a lifting device to lift it safely. When lifting the centrifuge, always reach under the centrifuge from the side.

The centrifuge weighs approx. 124 kg!

- Retain the packaging for any possible future transport of the centrifuge.

5.2 Transport Safety Device

The transport safety device consists of two plastic screws which are located at the bottom panel..

The transport safety device must be removed prior to start-up because the screws lock the motor bearings!

Removal:

- Lift the centrifuge upwards at the front side. Always reach under from the side.
- Put a suitable object, e.g. a wooden block, between table and centrifuge. A coloured plastic screw can now be seen at the bottom panel.
- Unscrew the screws by hand anti-clockwise.
- Retain the transport safety device for the possibility of the return of the centrifuge.

5.3 Installation Site

Operate the centrifuge only in closed and dry rooms.

All the energy supplied to the centrifuge is converted into heat and emitted to ambient air.

- Ensure sufficient ventilation.
- Keep a safety distance of at least 30 cm from the wall so that the vents in the centrifuge remain fully effective.
- Do not position the centrifuge near heat generators.
- Avoid direct sunlight (UV radiation).
- The table must be stable and have a solid, even surface.
- Attention: During transport from cold to warmer places, condensational water will collect inside the centrifuge. It is important to allow sufficient time for drying (min. 24 h) before the centrifuge can be used again.

5.4 Power Supply

5.4.1 Connection

The operating voltage on the name plate must correspond to the local supply voltage!

This laboratory centrifuge is a unit of safety class I in accordance with DIN VDE 0700 and has a three-wire power cord (2.5 m) and a shockproof right-angle plug. They are equipped with temperature fuses.

- Switch the unit off by actuating the mains power switch.
- If they have tripped, let the fuses cool down for approximately 2 minutes.
- Switch the unit on. The fuses are reactivated.

5.4.2 Fuses

Typically, the centrifuges must be protected on-site with 16 Amp L or B fuses.

6 Using the Centrifuge

6.1 Initial Start-Up

Before the initial start-up, please ensure that your centrifuge is properly set up and installed (see chapter 5 "Set-up and Connection").

6.2 Switching the Centrifuge ON

- Press the mains power switch on the right side of the front (see Fig. 2.1, page 11).

The centrifuge display then illuminates. The centrifuge is ready for operation.

6.2.1 Opening and Closing the Lid

The lid can be opened if the centrifuge is at a standstill and if the lid key is illuminated.

- Press the lid key in order to open the lid (see 6.3.3.6 "Parameter Menu - Automatic Lid Opening Function ").

The centrifuge cannot be started if the lid is opened.

- To close, press slightly on the lid until the electrical lock is locked.

6.2.2 Installation of Rotors and Accessories

6.2.2.1 Installation of the Rotor

- Open the centrifuge lid by pressing the lid key.
- Unscrew the rotor tie-down screw from the motor shaft (counter-clockwise).
- Lower the rotor with its central bore straight down onto the motor shaft.
- Tighten the rotor tie-down screw clockwise with the supplied rotor wrench with 10 Nm. In doing so, hold the rotor at its outer rim.

After frequent use, the rotor tie-down screw must be loosened by some turns, the rotor has to be lifted and fastened again. This must be done once a day or after 20 cycles. This ensures a proper connection between the rotor and the motor shaft.

When using rotors for microtiter plate formats: Ensure that the plate holders are inserted <u>together</u> with the plates into the bucket.

- The lid screw serves for the fastening of the lid onto the rotor only, not for the fastening of the rotor onto the motor shaft.
- Follow the safety instructions and hazard warnings in chapter 3!

6.2.2.2 Installation of Angle Rotors with a Hermetically Sealed Lid

- Screw the rotor cover onto the rotor and tighten it.
- Lower the rotor with the cover onto the motor shaft .
- Insert the rotor tie-down screw into the motor shaft. Tighten the rotor tie-down screw with 10 Nm using the supplied rotor wrench so that the spring washer assembly is compressed tightly.
- The rotor can also be used without a cover.
- Slightly grease the rotor and lid seals after cleaning.
- The rotors can be installed or removed with a closed lid after loosening the rotor tie-down screw.
- Follow the safety instructions and hazard warnings in chapter 3!

1 Rotor tie down screw
2 Lid
3 Lid seals

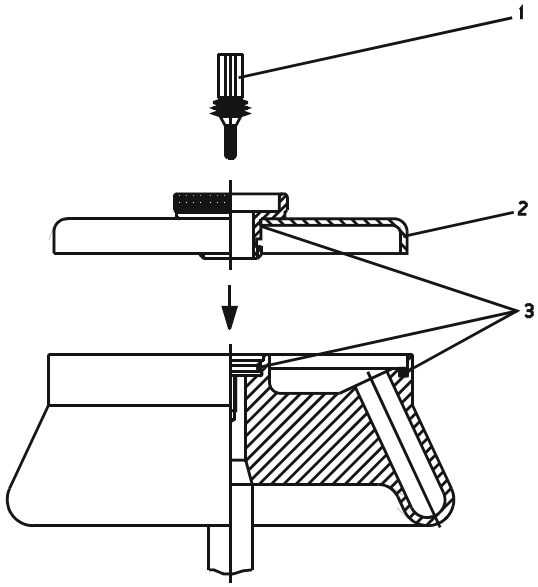


Fig. 6.1: Angel rotor with a hermetically sealed lid

6.2.2.3 Installation of Accessories

- Only use inserts that are suitable for the rotor (see 11.1 "Suitable Accessories").
- All four buckets of the swing-out rotor need to be installed when spinning.
- Always load the opposite inserts/buckets of the rotors with the same accessories and fill to avoid imbalance.

Centrifugation with different tube sizes:
Working with different tube sizes is possible. In this case, however, it is very important that opposite inserts are identical (see Fig. 6.2).

Centrifugation with low capacity: The tubes must be installed symmetrically so that the buckets and their inserts are loaded evenly (see Fig. 6.3).

Fig. 6.2:
Permissible loading of the swing-out rotor with different tube sizes

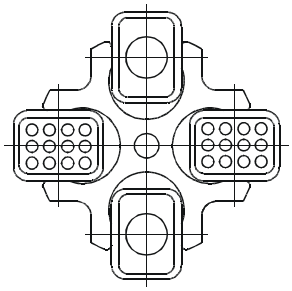
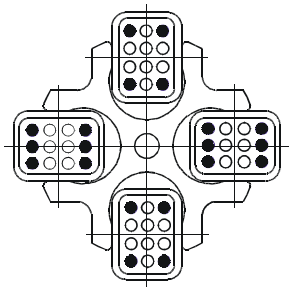


Fig. 6.3:
Permissible loading of the swing-out rotor



6.2.2.4 Adapters

In order to ensure easy handling, even if vessels of various sizes are used, carrier systems were developed.

- Load the opposite carriers with the same number of vessels and with the same weights in order to avoid imbalance.
- If all of the compartments of a carrier are not used, the buckets must be loaded evenly. Loading the edges of a bucket only is not permissible.

6.2.2.5 Tubes

- Load the tubes outside of the centrifuge. Liquids in the buckets or multiple carriers cause corrosion .
- Fill the tubes carefully and arrange them according to their weight. Imbalances result in the excessive wear of the bearings.
- In high-speed angle rotors, the tubes must be filled up to their useful volume (= the volume that is stated for the tube). If the vessels are only partially filled, they will deform. This may result in leaks at the seals that may become loose.
- When using glass tubes, please refer to the information provided by the manufacturer concerning the maximum speed for glass tubes.
- Observe the instructions on safety and hazards in chapter 3!

6.3 Spincontrol Comfort

6.3.1 Operating Panel

1 Centrifuge display
2 Function key
3 Start key
4 Stop key
5 Lid key

Fig. 6.4: Operating Panel

The centrifuge is started directly via the operating panel. When the centrifuge is switched on, all of the operating keys and displays will be illuminated for a short time. It is now ready for operation.

6.3.2 Centrifuge Display

The centrifuge display has the following display fields:

1 Speed field
2 RCF field
3 Time field
4 Temperature field
5 Program field
6 Rotor field
7 Parameters
8 Configurations

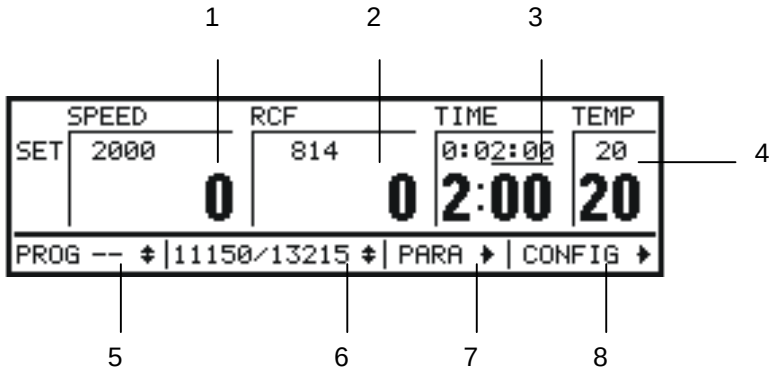


Fig. 6.5: Display Spincontrol Comfort

6.3.3 Manual Mode

6.3.3.1 Starting a Centrifugation Run

The centrifuge is ready for operation when the start key is illuminated.

- Press the start key in order to start a centrifugation run.

6.3.3.2 Interrupting a Centrifugation Run

- Press the stop key in order to interrupt a centrifugation run. The centrifugation run will be terminated prematurely.

Fast stop:

- Press the stop key for more than one second.

The centrifuge decelerates with the maximum deceleration curve. "Fast stop" appears in the display.

After a fast stop, the centrifuge lid must be opened before starting a new centrifugation run.

6.3.3.3 Interrupting a Deceleration Process

- Press the start key during a deceleration process in order to interrupt it and to restart the centrifuge.

6.3.3.4 Selection, Display, and Modification of Data

The display is in its default state. No area is inverted.

- Select a parameter by pressing or turning the function knob. The selected field will be inverted.
- Press the function knob in order to activate the modification mode. "SET" and the selected area will be inverted.
- Turn the function knob until the desired value is displayed.
- Press the function knob to confirm the selected value and to quit the modification mode. "SET" and the selected area will be deactivated.

After 20 seconds, the modification mode will be left automatically. The current values will be saved.

All entries beyond the permissible limits, or incorrect entries, will not be accepted.

6.3.3.5 Standard Menu

Set

If this area is inverted, the alteration mode is active (here in combination with the speed).

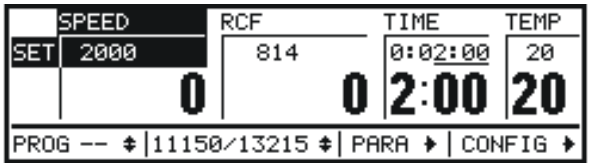


Fig. 6.6: "Set" function

Speed

In the upper section of the field, the set speed of the centrifuge is displayed. The actual speed is displayed below this value. The values are stated in revolutions per minute (rpm) and depend on the RCF values (see 11.4 "Formulae – Mathematical Relations "). The maximum speed values depend on the rotor that is used.

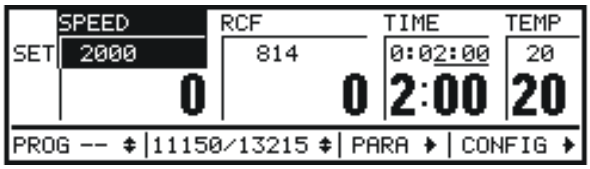


Fig. 6.7: Setting the speed

Relative Centrifugal Force (RCF)

The relative centrifugal force is the acceleration that the sample is subjected to. The set value of this parameter is displayed in the upper section of this field, with the actual value shown below. The values are stated in g (gravitational acceleration) and depend on the speed value (see 11.4 "Formulae – mathematical relation"). The maximum RCF values depend on the rotor that is used.

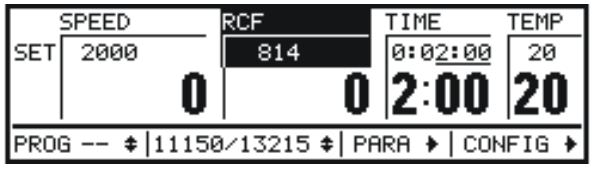


Fig. 6.8: Setting the rcf-value

Time

The set runtime is displayed in the upper section of this field, with the remaining runtime shown below. The runtime is defined as the period from the start of the centrifuge to the beginning of the deceleration phase. The maximum value is 9 h 59 min. The unit of the programmed centrifugation time is underlined.

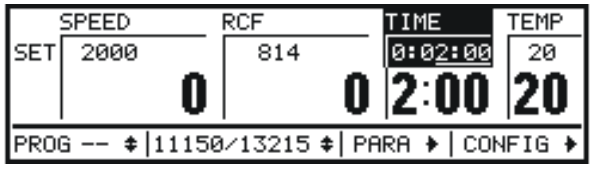


Fig.6.9: Setting the run time

The set value is indicated in hours, minutes, and seconds. The actual value has the same units as the set value and is displayed in hours:minutes, or in minutes:seconds if the value is below 10 minutes. Values greater than 59 will be automatically converted to the next higher unit.

Continuous Run

During the continuous run, the runtime of the centrifuge is unlimited and must be stopped manually. The centrifuge accelerates during the continuous run until the set speed is reached.

To start the continuous run of the centrifuge :

- Starting with the time setting 0:10 (see page 29), turn the knob counter-clockwise or
- Starting with the time setting 09:59, turn the knob clockwise to the next setting. "HOLD" will be displayed. After the start of the centrifuge, the elapsed time will be displayed.

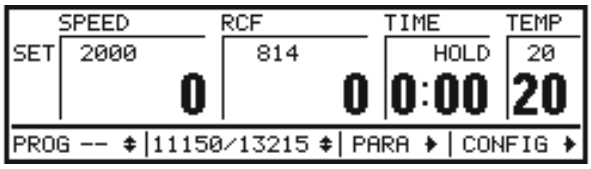


Fig. 6.10: Display of a continuous run

- Deactivate the continuous run by pressing the stop key or by entering a specific runtime.

Short Run

- Keep the start key pressed during the short run.

During the short run, the centrifuge accelerates with the maximum acceleration curve until the maximum speed of the rotor is reached.

When the start key is released, the centrifuge decelerates at maximum brake to a standstill.

Temperature

The set value is in the upper section of the area, underneath the actual temperature is displayed. Temperatures between -20 °C and +40 °C can be preselected.

In the centrifuges without an active heater, the temperatures above room temperature depend on the air friction of the turning rotor.

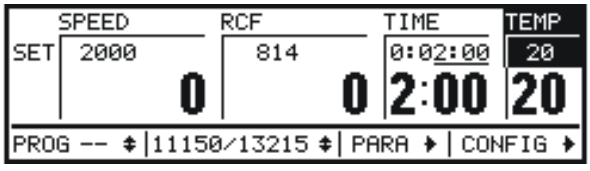


Fig. 6.11: Setting the temperature

The centrifuge 4-16KH with a heater enables the preselection of temperatures up to +60°C. The maximum rotor temperature that can actually be reached is 40-60°C, depending on the rotor and speed.

Program

In this field, the number of the actual program is displayed. (see 6.3.4 "Program Mode").

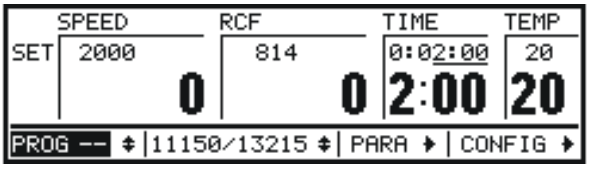


Fig. 6.12: Calling up the program list

Rotor Selection list / Automatical Rotor Identification

This field shows the rotor that is currently being used.

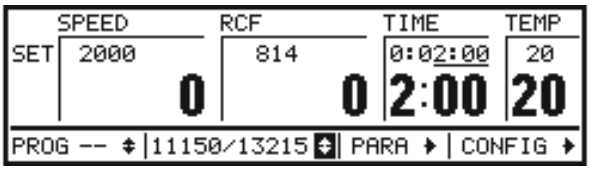


Fig. 6.13: Calling up the rotor selection list

Selection and change of the rotor number on a rotor selection list

- Select the double arrow (⇕) next to the rotor selection list and confirm the entry. An overview with the following data will be displayed:
  - Rotor number, and in some cases together with a bucket
  - max. speed
  - max. gravitational field
  - max. radius for calculation of the gravitational field
  - min. radius

NO	ROTOR	BUCKET	SPEED	RCF	RMAX	RMIN
3	11140	13127	5500	5648	167	80
4	11142		4500	3871	171	42
5	11144	13145	5000	2991	107	63
6	11148		13200	16363	84	44
7	11150	13215	5100	5292	182	88
8	11150	13220	4100	3007	160	113

Fig. 6.14: Rotor selection list

- Select the name of the rotor/bucket combination that is used and confirm it.

Selection of the rotor number in the main menu

- Select the rotor field and confirm it.
- Turn the knob. All of the possible rotor/bucket combinations will be displayed.
- Select a combination and confirm it. The selected combination will be loaded.

Identifying and adapting incorrectly set rotors

The centrifuge automatically identifies the rotor that is being currently used.

- If the system identifies a different rotor than the one that is set, if there are no different buckets for this rotor, and if the speed has not been adapted manually, the rotor input will be adapted automatically. The system will not display a message.
- If the system identifies a different rotor than the one that is set, and if there are different rotor/bucket combinations for this rotor, the system will automatically select the rotor with the lowest speed. The system will display a corresponding message so that the rotor can be selected manually.
- If the system identifies a different rotor than the one that is set, if the speed has been limited, and if there are no rotor/bucket combinations, a message will be displayed.

This prevents the maximum permissible speed from being exceeded.

6.3.3.6 Parameter Menu

For information on how to set the parameters, see 6.3.3.4 "Selection, Display, and Modification of Data".

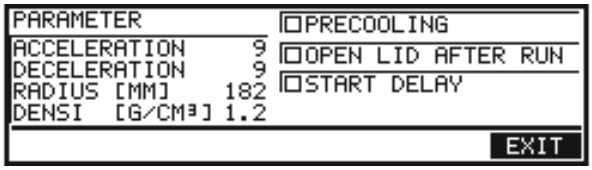


Fig. 6.15: Parameter menu

Acceleration

This function is used to select an acceleration curve. One can select a linear rise (curves 0-9) or a quadratic rise (curves 10-19). The acceleration curves 20-29 can be programmed as desired.

Their shape is explained in detail in 11.3.1 "Linear Curves" and 11.3.2 "Quadratic Curves".

Deceleration

This function is used in order to select a curve that decelerates the centrifuge to a standstill. Deceleration curves are inverted images of the acceleration curves and are labelled with identical numbers. Deceleration curve no. 0 represents a brakeless deceleration.

Radius

The radius determines the value of the relative centrifugal force (RCF) that the sample is subjected to. Normally, the maximum RCF value is displayed. If the value is reduced manually, a downward facing arrow (↓) will be displayed in the RCF field.

Density

If the density of the liquid is higher than 1.2 g/cm^3, the value must be adapted manually. This, in turn, reduces the maximum final speed (see 11.4.2 “Density“). A downward facing arrow (↓) will be displayed in the speed field. Values between 1.2 and 9.9 g/cm^3 are possible.

Standstill Cooling

Depending on the substances to be centrifuged, it may make sense to precool the centrifuge. The precooling prevents the cooled samples in the uncooled centrifuge from heating up to an inadmissible temperature.

If the standstill cooling is activated, the centrifuge starts to precool after it is switched on. The lid must be closed.

Caution

Unmoved air in the rotor chamber distorts the measuring and control behavior and causes the compressor to freeze overs. At temperatures below 0°C, aqueous liquids will freeze, making sedimentation impossible.

- Ensure that the rotor temperature will not fall below 0 °C if it is at a standstill!

Precooling at medium speed

Precooling at a standstill may distort the measurement results and subsequently cause increased wear of the mechanical components. We recommend precooling the centrifuge at medium speed with the precooling program "RAPID_TEMP":

- Select the option “Progr” in the “Standard” menu and confirm the selection. The program listwill be displayed.
- Select the desired program on the program list and confirm the selection.

The program will now be loaded. This is only possible if the actual temperature is above the set temperature. The program runs until the set value is reached. Then, a sound signal is issued.

Start Delay

If the start delay is activated, the centrifuge will not start until the preset time has elapsed.

Automatic Lid Opening Function

The Automatic-Lid-Open function must be activated so that the lid opens automatically when the rotor is at a standstill.

Caution

When the lid is open, the cooling is not active. Samples may warm up!

6.3.3.7 Configuration Menu

In the configuration mode, the default settings can be customised and the data can be read off.

Fig. 6.16: Configuration menu

Code

In order to prevent any unauthorised use of the centrifuge, the following functions can be blocked:

- Saving of programs
- Changing of parameters
- Loading of programs
- Start key

Blocking a function:

- Select the function that is to be blocked.
- Select the button "Activate code".
- Enter a four-digit code and confirm the entry.
- For safety reasons, the code must be entered a second time.

The blocking is now active.

If changes are made to a blocked function, the system will ask for the code prior to executing the change.

Unblocking a function

- Select the button "Delete code".
- Enter the code and confirm the entry.

The function is now unblocked.

Changing the code

- Select the button "Change code".
- Enter the old code and confirm the entry.
- Enter the new code.
- For safety reasons, the code must be entered a second time.

The code is now changed.

Language

The German or English languages can be selected as the menu language.

Screen

Various representation variants enable a zoomed representation of the display:

- RCF and speed in the standard size
- Speed enlarged (zoomed). The RCF display is eliminated.
- RCF enlarged (zoomed). The speed display is eliminated.

- Select the “Display” field in the configuration overview and confirm the selection. The display overview will be displayed.
- In order to set the display "SPEED - (ZOOM)“, select the corresponding line and confirm the selection.
- Quit the display by selecting and confirming “EXIT”. The system will return to the configuration overview.

After another confirmation, the standard menu will be displayed. The fields "SPEED“, "TIME“, and “TEMP“ are zoomed. The field “RCF” is eliminated.

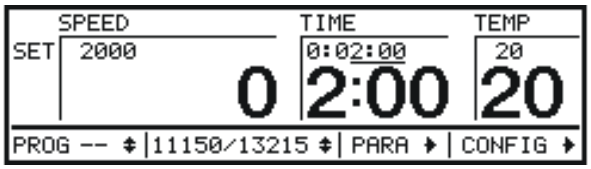


Fig. 6.17: Zoomed speed display

Fine Adjustment

This menu can be used to preselect the set speed in steps of 1 or 10 rpm, and the set time in steps of 1 min or 1 sec.

Regardless of the fine adjustment, the interval will increase if the knob is turned quickly.

Cycles

For each rotor/bucket combination, the number of cycles and runtime are stored.

Buzzer

In this menu, a sound signal can be selected for

- the end of a centrifugation run
- an imbalance message
- an error message.

The duration of the buzzer signal can be specified.

Sensor

The sensor overview shows various system data. In the event of a malfunction, these data facilitate an immediate diagnosis.

Info

The Info overview shows information such as the type of centrifuge, and EPROM version, number of cycles, the total runtime, as well as software version and date.

In the menus "Cycles", “Info“, and “Sensor“, the values can neither be entered nor changed.

Reset

This function resets the centrifuge and restores the factory settings. All of the programs, parameters, curves, and configurations will be deleted.

Curves

In this submenu, the user-defined acceleration and deceleration curves can be created and edited (see 6.3.3.8).

6.3.3.8 Curves Menu

The Curves menu is a submenu of the configuration menu. The curves function can be used to create user-specific acceleration and deceleration curves. 10 storage locations (no. 20-29) are available for this purpose.

For the interval no. 1, either a linear (LIN) or quadratic (QUAD) acceleration can be selected. The other acceleration curves are always linear.

Creation of the curves for variable accelerations and decelerations

- In the configuration mode, select the field "Curves" and confirm the selection. The curve overview will be displayed.
- Select the time display and confirm the selection.

Enter the desired time for interval no. 1 and confirm the entry. The display for internal no. 2 will be displayed simultaneously.

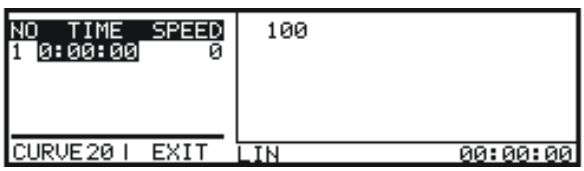


Fig. 6.18: Time value input into interval no. 1

- Select the speed field "SPEED" and confirm the selection.
- Select the speed value and confirm the selection. The curve that is created will be displayed together with the maximum curve speed.

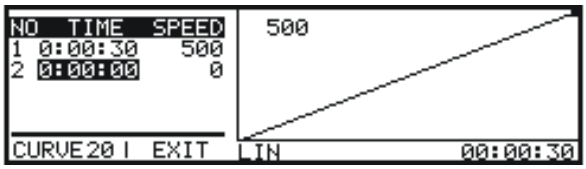


Fig. 6.19: Time value input into interval no. 2

- Activate the time display of the second interval and enter the desired time. The extended curve will be displayed.

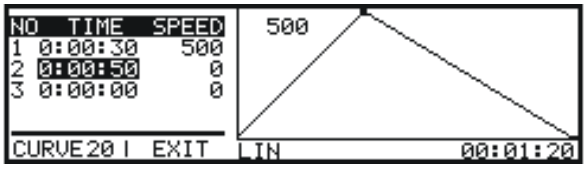


Fig. 6.20: Extended curve

- Select the speed field "SPEED" and enter a speed value. Confirm the entry.
- You can enter up to 10 intervals in this manner.
- Save the curve under a curve number between 20 and 29 together with the current operating parameters.
- Select “EXIT” and quit the curve mode by confirming the entry.

Only acceleration curves are programmed. The corresponding deceleration curves are generated by reflection.

If the curve speed of an interval exceeds the set speed in the operating mode, a dialog box will pop up.

Fig. 6.21: Dialog box concerning the curve speed

Cut:	The curve speed in an interval will automatically be limited to the set speed in the operating mode.
Admit:	The curve speed in an interval will be allowed.
Cancel:	A stop occurs. Starting is impossible without a change of the curve speed in an interval.

Modification of existing curves

- Activate the field “CURVES” in the configuration menu.
- Select the curve that is to be modified and change the individual values as described above.

Centrifugation curves

It is also possible to create centrifugation curves. The following conditions must be fulfilled:

- The preselected maximum final speed of an interval corresponds to the set speed for the centrifugation run.
- The sum of the intervals corresponds to the set time of the centrifugation run. The last speed checkpoint of an interval equals 0.

6.3.3.9 Modification of the Contrast

- Press the stop key and turn the function knob one notch to the left. A dialog box will be displayed.
- Modify the contrast of the centrifuge display and confirm the modification.

Fig. 6.22: Contrast dialog box

6.3.3.10 Imbalance Monitoring

An imbalance dialog box will be displayed in the event of an inadmissible imbalance. The centrifugation run cannot be continued and the centrifuge will be stopped with maximum deceleration power.

Fig. 6.23: Imbalance dialog box

Reason: Improper loading of the centrifuge or a malfunction during the operation (e.g. glass breakage) that in turn prevented the centrifuge from rotating steadily.

- Eliminate the cause of the imbalance (see chapter 7 "Malfunctions and Error Correction") and restart the centrifuge.

6.3.3.11 Modification of Parameter Values during the Centrifugation Run

(see 6.3.3.4 “Selection, Display, and Modification of Data"):

Modification possible	Modification impossible	(De-)Activation possible
Speed	Rotor	Continuous run
RCF	Program	Standstill cooling
Runtime	Radius	Start delay
Temperature	Density	Automatic lid opening function
Acceleration curve		
Deceleration curve		

6.3.4 Program Mode

A program includes all of the data that are required for a centrifugation run.

Attention: Temperature profiles cannot be created!

With a program, certain sedimentation results can be repeated under identical conditions.

Programs can be loaded, executed, modified, and deleted at any time.

A maximum of 50 programs can be stored under the numbers 1 - 50.

"--" means that the values that are currently set are not a stored program.

The programs can be protected against unauthorised use, modification, or deletion with the aid of a code (see 6.3.3.7 "Configuration Menu").

6.3.4.1 Loading a Program

1. Loading a program by entering a program number

- Select the program field ("PROG-") and confirm the selection.
- Turn the knob. As a result, all of the programs that have already been saved and the current ("--") setting will be displayed one after the other.
- Select a program and confirm the selection. A dialog box will be displayed (Fig. 6.25).
- Select "LOAD" and confirm the selection.

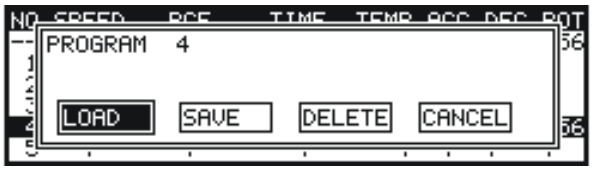


Fig. 6.24: Loading a program

2. Loading a program from the program selection list

- Select the double arrow (⇕) next to the program selection list and confirm the selection. An overview of all of the programs that have already been saved will be displayed. The current setting will be displayed under "-".
- Select a program and confirm the selection. A dialog box will be displayed (Fig. 6.25).
- Select "LOAD" and confirm the selection.

6.3.4.2 Saving a Program

- Enter the parameters that are to be included in the program.
- Select the double arrow (⇕) next to the program selection list and confirm the selection. An overview of all of the programs that have already been saved, and of the free program storage locations will be displayed.
- Select the desired program storage location from the program selection list and confirm the selection. A dialog box will be displayed.
- Select "SAVE" and confirm the selection.

The program is now saved.

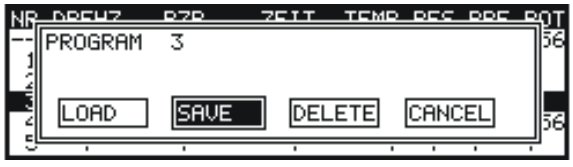


Fig. 6.25: Saving a program

6.3.4.3 Deleting a program

- Select the double arrow (⇕) next to the program selection list and confirm the selection. An overview with all of the programs that have already been saved will be displayed.
- Select the program that is to be deleted and confirm the selection. A dialog box will be displayed.
- Select "DELETE" and confirm the selection.

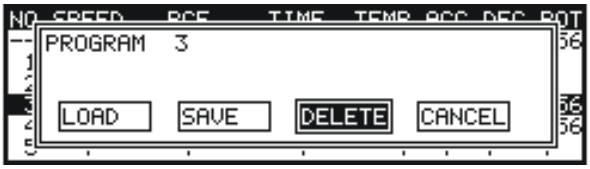


Fig. 6.26: Deleting a program

6.4 Spincontrol Professional

6.4.1 Operating Panel

The centrifuge is started directly via the operating panel. When the centrifuge is switched on, all of the operating keys and displays will be illuminated for a short time. It is now ready for operation.

1 Start key
2 Centrifuge display
3 Function knob
4 Stop key
5 Lid key

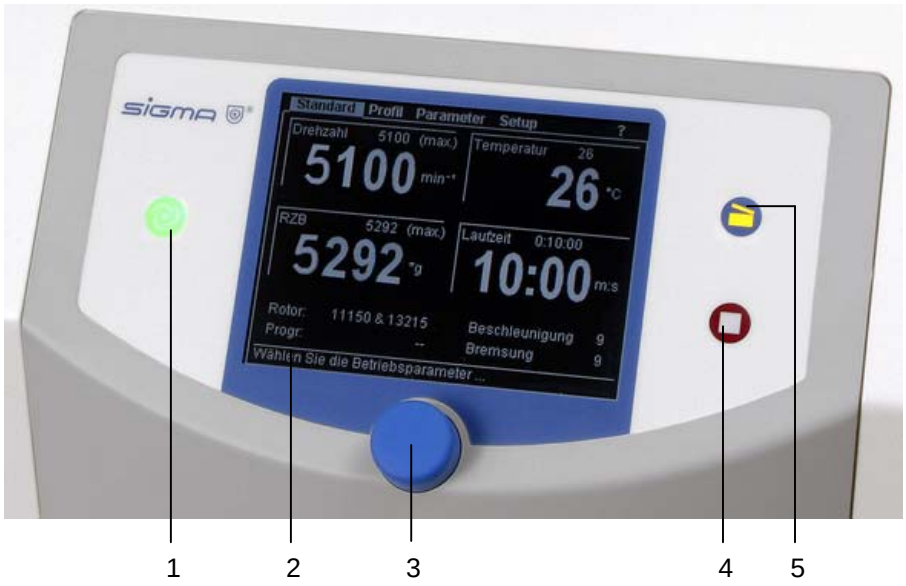


Fig. 6.27: Operating Panel Spincontrol Professional

6.4.2 Centrifuge display

The centrifuge display has the following display fields:

1 Menu bar
2 Speed field
3 RCF field
4 Rotor field
5 Program field
6 Status bar
7 Temperature field
8 Runtime field
9 Acceleration
10 Deceleration (brake)

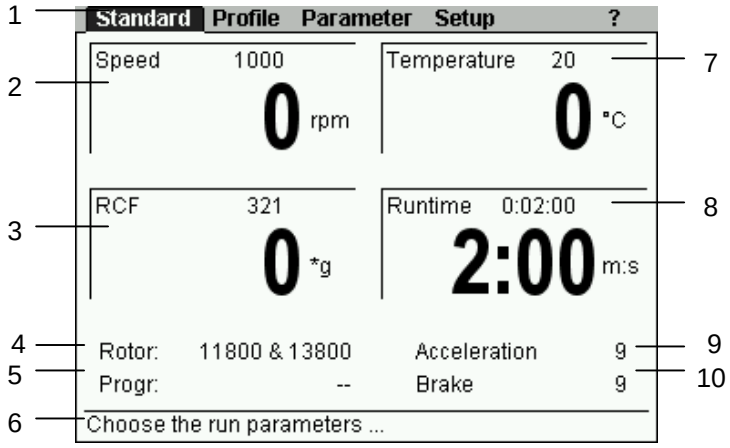


Fig. 6.28: Centrfuge display Spincontrol Professional

6.4.3 Manual Mode

6.4.3.1 Starting a Centrifugation Run

The centrifuge is ready for operation when the start key is illuminated.

- Press the start key in order to start a centrifugation run.

6.4.3.2 Interrupting a Centrifugation Run

- Press the stop key in order to interrupt a centrifugation run. The centrifugation run will be terminated prematurely.

If the stop key is pressed while a free curve is being executed, the centrifuge will be decelerated constantly with the current value up to a complete standstill without the consideration of the rest of the deceleration curve.

Fast stop:

- Press the stop key for more than three seconds.

The centrifuge decelerates with the maximum deceleration curve.

After a fast stop, the centrifuge lid must be opened before a new centrifugation run can be started.

A fast stop can also be triggered during a normal deceleration, e.g. in order to speed up the deceleration.

When a fast stop is triggered, “FAST STOP” will be displayed in the speed field.

6.4.3.3 Interrupting a Deceleration Process

- Press the start key during a deceleration process in order to interrupt it and to restart the centrifuge.

6.4.3.4 Selection, Display, and Modification of Data

The standard menu is displayed. No area is inverted.

- Turn the function knob in order to select a field. The set value of the field starts to flash.
- Press the function knob. The display starts to flash and the modification mode is active.
- Turn the function knob in order to modify the set value of the selected field.
- Press the function knob again to confirm the entry and to quit the modification mode.

6.4.3.5 Standard Menu

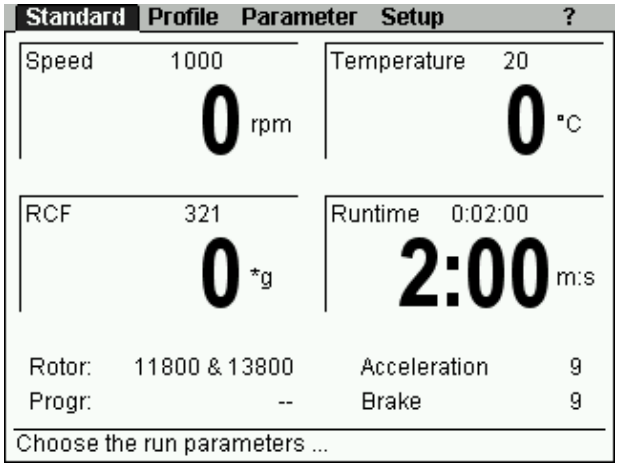


Abb. 6.29: Standard Menu

This menu is displayed a few seconds after the centrifuge has been switched on.

The following parameters can be displayed and modified:

Speed

In the upper section of the field, the set speed of the centrifuge is displayed. The actual speed is displayed below this value. The values are stated in revolutions per minute (rpm) and depend on the RCF values (see 11.4 "Formulae – Mathematical Relations "). The maximum speed values depend on the rotor that is used.

Relative Centrifugal Force (RCF)

The relative centrifugal force is the acceleration that the sample is subjected to. The set value of this parameter is displayed in the upper section of this field, with the actual value shown below. The values are stated in g (gravitational acceleration) and depend on the speed value (see11.4 "Formulae – mathematical relation"). The maximum RCF values depend on the rotor that is used.

Temperature

The set temperature is displayed in the upper section of the area, with the current rotor chamber temperature shown below. Temperatures between -20 °C and +40 °C can be preselected.

In the centrifuges without an active heater, the temperatures above room temperature depend on the air friction of the running motor.

The centrifuge 4-16KH with a heater enables the preselection of temperatures up to +60°C. The maximum rotor temperature that can actually be reached is 40-60°C, depending on the rotor and speed.

Runtime

The set runtime is displayed in the upper section of this field, with the remaining runtime shown below. The runtime is defined as the period from the start of the centrifuge to the beginning of the deceleration phase. The maximum value is 99 h 59 min 59 sec.

In the “Setup” menu, one can specify that the counting of the runtime is not to be started until the set speed is reached (see 6.4.3.8 "Setup Menu"). In this case, the symbol "**!**" appears in the speed field.

Continuous Run

During the continuous run, the runtime of the centrifuge is unlimited and must be stopped manually. The centrifuge accelerates during the continuous run until the set speed is reached.

- Select the field “Runtime” and confirm the selection. The display flashes when it is activated
- Select the time 0:00:00 and confirm the selection. "Infinite" will be displayed. After the start of the centrifuge, the elapsed time will be displayed.
- Deactivate the continuous run by pressing the stop key or by entering a specific run time.

Short Run

- Keep the start key pressed during the short run.

During the short run, the centrifuge accelerates with the set acceleration curve until the maximum speed of the rotor is reached.

If the acceleration curve is a free curve (20-29), the centrifuge will accelerate to maximum. The runtime will be counted up and the “short run” will be displayed in the speed field.

When the start key is released, the centrifuge decelerates with the set deceleration curve to a standstill. If the deceleration curve is a free curve (20-29), the centrifuge decelerates with maximum power.

Rotor: Rotor Selection List/ Automatical Rotor Identification

This field shows the rotor that is currently being used.

- Select the field "Rotor" and confirm the selection. A list with all of the possible rotors without buckets is displayed.
- Select the desired rotor. All of the possible rotor/bucket combinations and additional information for each combination will be displayed.
- Select a rotor/bucket combination and confirm the selection. Press the function knob in order to accept the data.

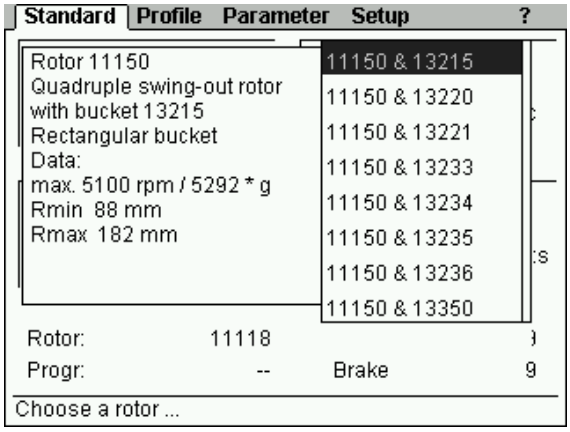


Fig. 6.30: Rotor Selection List

Identifying and adapting incorrectly set rotors

The centrifuge automatically identifies the rotor that is being currently used.

- If the system identifies a different rotor than the one that is set, if there are no different buckets for this rotor, and if the speed has not been adapted manually, the rotor input will be adapted automatically. The system will not display a message.
- If the system identifies a different rotor than the one that is set, and if there are different rotor/bucket combinations for this rotor, the system will automatically select the rotor with the lowest speed. The system will display a corresponding message so that the rotor can be selected manually.
- If the system identifies a different rotor than the one that is set, if the speed has been limited, and if there are no rotor/bucket combinations, a message will be displayed.

This prevents the maximum permissible speed from being exceeded.

Progr.: Program List

This field in the standard menu shows the program that is currently loaded. When the field is selected, the program list is displayed (for information on how to work with the programs, see 6.4.4 "Program Mode").

The precooling program “RAPID_TEMP“cannot be deleted.

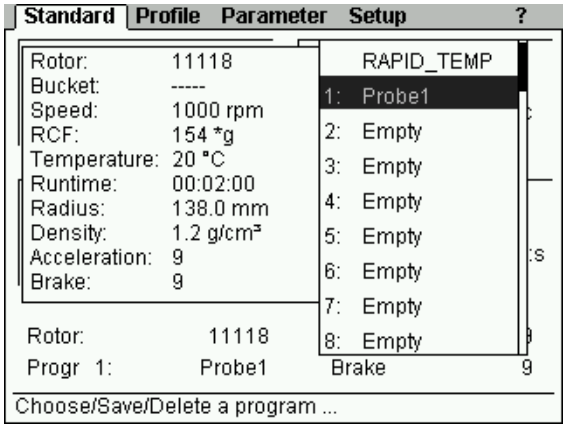


Fig. 6.31: Program selection list

Acceleration

This function is used to select an acceleration curve. One can select a linear rise (curves 0-9) or a quadratic rise (curves 10-19). The acceleration curves 20-29 can be programmed as desired.

Their shape is explained in detail in 11.3.1 "Linear Curves" and 11.3.2 "Quadratic Curves".

Deceleration (Brake)

This function is used in order to select a curve that decelerates the centrifuge to a standstill. Deceleration curves are inverted images of the acceleration curves and are labelled with identical numbers. Deceleration curve no. 0 represents a brakeless deceleration.

6.4.3.6 Profile Menu

This menu shows the profiles that are used. A profile begins and ends with 0 speed. The vertical axis shows the speed and the horizontal axis shows the time.

Changing the scale:

- Select the value that is to be changed. The activated display flashes.
- Change the value and confirm it.

The value is saved.

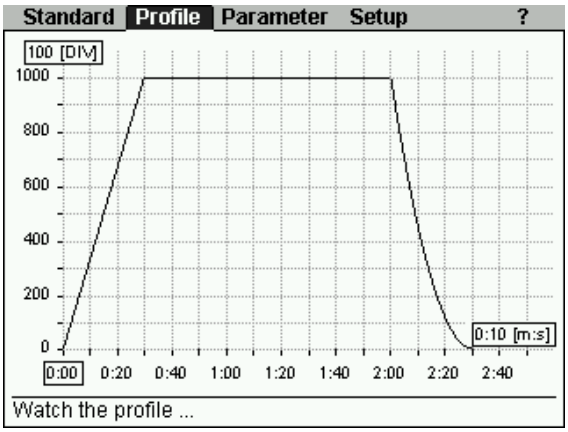


Fig. 6.32: Profile menu

6.4.3.7 Parameter Menu

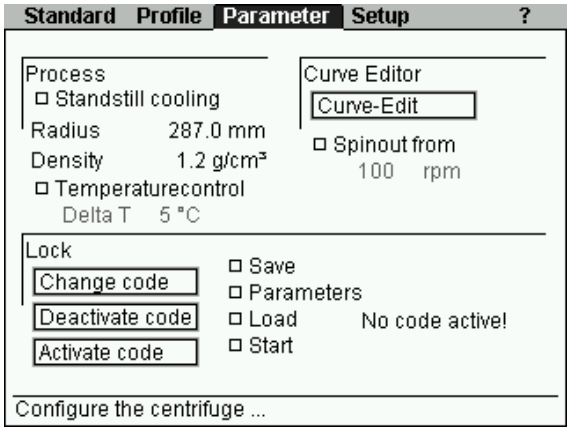


Fig. 6.33: Parameter menu

Process

Standstill cooling

Depending on the substances to be centrifuged, it may make sense to precool the centrifuge. The precooling prevents the cooled samples in the uncooled centrifuge from heating up to an inadmissible temperature.

If the standstill cooling is activated, the centrifuge starts to precool after it is switched on. In the runtime field, the symbol "❄" is displayed. The lid must be closed.

Caution

Unmoved air in the rotor chamber distorts the measuring and control behavior and causes the compressor to freeze overs. At temperatures below 0°C, aqueous liquids will freeze, making sedimentation impossible.

- Ensure that the rotor temperature will not fall below 0 °C if it is at a standstill!

Precooling at medium speed

Precooling at a standstill may distort the measurement results and subsequently cause increased wear of the mechanical components. We recommend precooling the centrifuge at medium speed with the precooling program "RAPID_TEMP":

- Select the option “Progr” in the “Standard” menu and confirm the selection. The program list will be displayed.
- Select the desired program on the program list and confirm the selection.

The program will now be loaded. This is only possible if the actual temperature is above the set temperature. The program runs until the set value is reached. Then, a sound signal is issued.

Radius

The radius determines the value of the relative centrifugal force (RCF) that the sample is subjected to. Normally, the maximum RCF value is displayed. If the value is reduced manually, a downward facing arrow (↓) will be displayed in the RCF field.

Density

If the density of the liquid is higher than 1.2 g/cm^3, the value must be adapted manually. This, in turn, reduces the maximum final speed (see 11.4.2 “Density“). A downward facing arrow (↓) will be displayed in the speed field. Values between 1.2 and 9.9 g/cm^3 are possible.

Temperature control

The temperature control function is used to set the desired warning threshold delta T in steps of 1°C or 1°F.

- Select the temperature control function and confirm the selection.
- Set the desired warning threshold delta T.

If the temperature control function is active, the symbol ± is displayed in the temperature display in the standard menu.

In this case, the centrifuge can only be started if the current temperature in the window is between the preset temperature in the standard menu and the warning threshold delta T.

If the temperature leaves this window during the centrifugation run, a warning message will be displayed once.

A short run, however, can be started at any time.

Standstill cooling and precooling are also possible at any time.

Lock

In order to prevent any unauthorised use of the centrifuge, the following functions can be blocked:

- Saving of programs
- Changing of parameters
- Loading of programs
- Start key

Blocking a function:

- Select the function that is to be blocked. The preceding functions will also be automatically selected (example: If the Parameter function is selected, the Save function will also be selected).
- Select the button "Activate code".
- Enter a four-digit code and confirm the entry.

The blocking is now active. A padlock symbol "🔒" will be displayed in the status line.

If changes are made to a blocked function, the system will ask for the code prior to executing the change.

Unblocking a function

- Select the button "Deactivate code".
- Enter the code and confirm the entry.

The function is now unblocked.

Changing the code

- Select the button "Change code".
- Enter the old code and confirm the entry.
- Enter the new code.
- For safety reasons, the code must be entered a second time.

The code is now changed.

Curve Editor

The Curve Editor function can be used to create and edit user-specific acceleration and deceleration curves. General information concerning this subject can be found in chapter 11.3 "Acceleration and Deceleration Curves".

Creating and editing an acceleration curve:

- Select the option "Curve Editor". A submenu will be displayed (see Fig. 6.33).
- Select a curve number between 20 and 29 under "Curve“. If the selected curve number is already used, the saved curve will be displayed.
- Define the interval number of the process under “Int”. For every curve, up to nine intervals can be entered.
- Enter the interval time under “Time”.
- Enter the desired acceleration under "RPM“ or "RCF". The values are interdependent.
- For the first interval, a linear or quadratic rise can be selected under "QUAD/LIN“. All of the other intervals are linear.

The field “Total” shows the total runtime of the process. The maximum runtime of a curve is 16 hours.

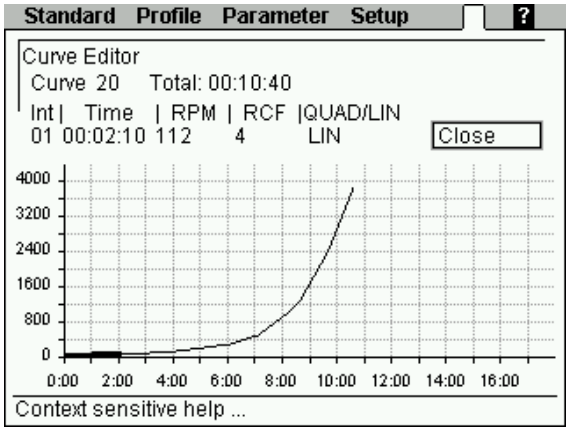


Fig. 6.34: Curve editor

After the start key has been pressed, no other acceleration curve can be selected. During the actual run, no free deceleration curve can be set.

Programmable curves are deactivated in the short run and in the precooling program "RAPID_TEMP". If a free curve is set when the centrifuge is started, curve 9 will be selected automatically. When the centrifugation run is over, the old value will be restored.

Programmable curves are not profiles. In order to create a profile, they must be combined in a program together with a run phase (see 6.4.4 "Program Mode").

Brakeless deceleration as of a set speed

If this function is active, the drive will be disconnected if the actual speed is below the set speed. As a result, the rotor decelerates and stops in a brakeless manner.

A brakeless deceleration, in particular with heavy rotors and at high speeds, can take a lot of time! (Depending on the rotor and load, the speed will be reduced by approximately 0.5 to 1 rpm per second.)

If the brakeless deceleration is active, "+0" is displayed next to the deceleration curve.

- The brakeless deceleration can be interrupted by a fast stop or by restarting the centrifuge.

6.4.3.8 Setup Menu

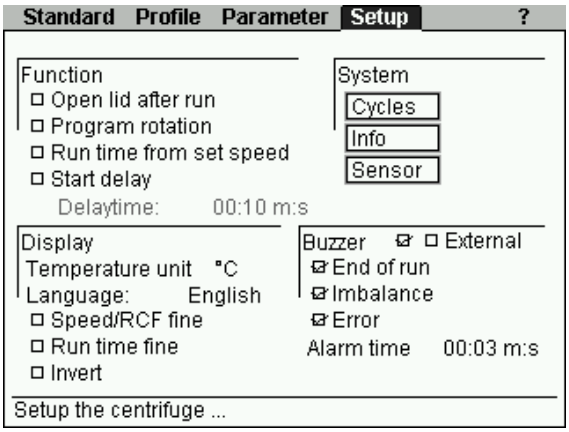


Fig. 6.35: Setup menu

Function

Open lid after run

The Auto-Lid-Open function must be activated so that the lid opens automatically at the end of the operation.

When the lid is open, the cooling is not active. Samples may warm up!

Program rotation

See chapter 6.4.4.4 "Automatic Program rotation"

Run time from set speed

If this function is active, the runtime will not be measured until the set speed is reached. The clock symbol "**!**" will be displayed in the runtime field in the standard menu. If a free acceleration curve is selected, this setting has no effect. The symbol will not be displayed although the option is selected.

Start delay

If the start delay function is active, the centrifuge will not start until the preset time has elapsed. The symbol "⌛" will be displayed in the time field.

Display

Temperature unit

- Select between °C (Celsius) and °F (Fahrenheit)

Language

Various languages are available.

If a language is selected by mistake, it can be changed on any screen as follows:

- Press and hold the stop key.
- Turn the function knob one notch to the left and then one notch to the right.
- Release the stop key. The window "Language" will be displayed.
- Select the desired language.

Speed/RCF fine and

Runtime fine

This menu can be used to preselect the set speed in steps of 1 or 10 rpm, and the set time in steps of 1 min or 1 sec.

Regardless of the fine adjustment, the interval will increase if the knob is turned quickly.

Invert

This function switches the display from black/white to white/black.

Buzzer

In this menu, a sound signal can be selected for

- the end of a centrifugation run
- an imbalance message
- an error message.

The duration of the buzzer signal can be specified.

System

The following system data are displayed:

- Cycles
- Info
- Sensor

In the menus "Cycles", “Info“, and “Sensor“, the values can neither be entered nor changed.

6.4.3.9 Help menu

The help menu provides short descriptions of the control elements of the selected option.

Activating/deactivating the help function

- Select the question mark in the menu bar and confirm it.

Parameters can be changed when the help function is activated.

- Quit the help function by selecting the question mark again.

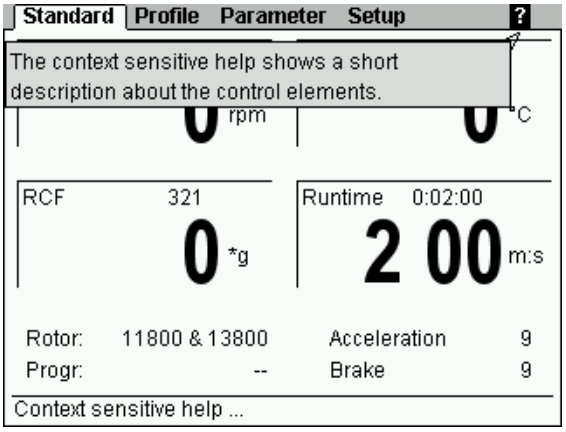


Fig.6.36: Help menu

6.4.3.10 Changing the Contrast

- Press and hold the stop key and turn the function knob one notch to the left. A dialog box will be displayed.
- Adjust the contrast of the centrifuge display and confirm the change.

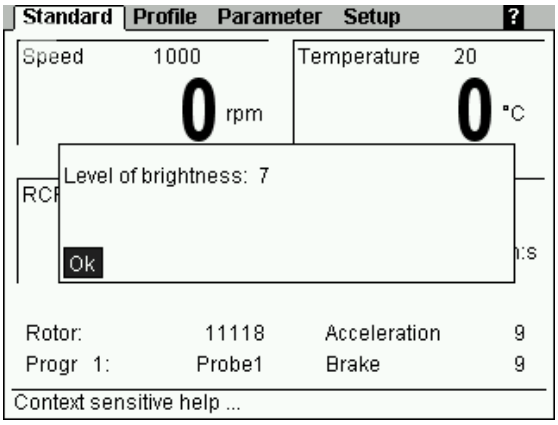


Fig.6.37: Dialog box for changing the contrast

6.4.3.11 Modification of Parameter Values during the Centrifugation Run

(see 6.4.3.4 “Selection, Display, and Modification of Data"):

Modification possible	Modification impossible	(De-)Activating possible
Speed	Rotor	Continuous run
RCF	Program	Standstill cooling
Runtime	Radius	Start delay
Temperature	Density	Automatic lid opening function
Acceleration curve (except for free curves)		
Deceleration curve (brake)		

Parameter changes concerning the speed, RCF, and time do not refer to acceleration or deceleration processes, but rather to the run phase.

6.4.4 Program Mode

A program contains all data that are required for a centrifuge run.

Attention: Temperature profiles cannot be created!

With a program, certain sedimentation results can be repeated under identical conditions.

Programs can be loaded, executed, modified, and deleted at any time.

A maximum of 60 programs can be stored under the numbers 1 - 60. The precooling program "RAPID_TEMP" does not occupy any storage location and cannot be delted. It is used to cool the centrifuge without vessels.

"--" means that the values that are currently set are not a stored program.

The programs can be protected against unauthorised use, modification, or deletion with the aid of a code (see 6.4.3.7 "Parameter Menu").

6.4.4.1 Loading a Program

- Select the option "Progr" from the “Standard” menu and confirm the selection. The program selection list will be displayed.
- Select the desired program from the list and confirm the selection.

The program is now loaded.

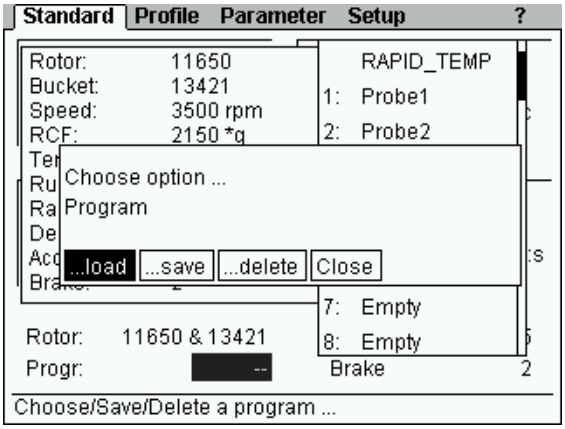


Fig. 6.38: Loading a program

6.4.4.2 Saving a Program

- Enter the parameters that are to be included in the program.
- Select the option „Progr“ and confirm the selection. The program selection list will be displayed.
- Select a storage location from the program selection list.
- Save the program under the desired name. The characters can be entered when the cursor flashes in the text field. Turn the function knob in order to select a character and press it to confirm the selection. Then, press the knob again in order to enter the next characters. The maximum number of characters is 19.
- When the program name is complete, select the option “save” and confirm it.

The program is now saved.

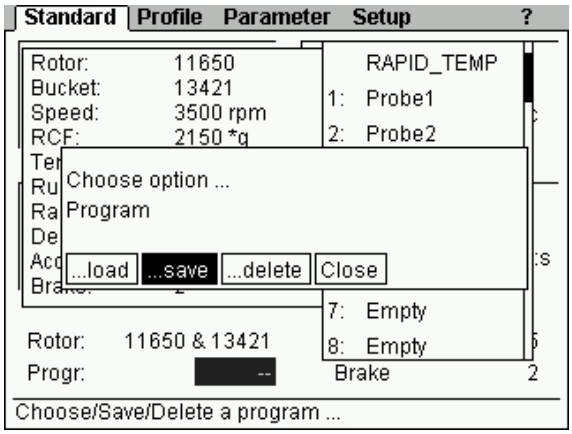


Fig. 6.39: Saving a program

6.4.4.3 Deleting a Program

- Select the option „Progr“ and confirm the selection. The program selection list will be displayed.
- Select the desired program.
- Select the option "Delete" and confirm it.

The program is now deleted.

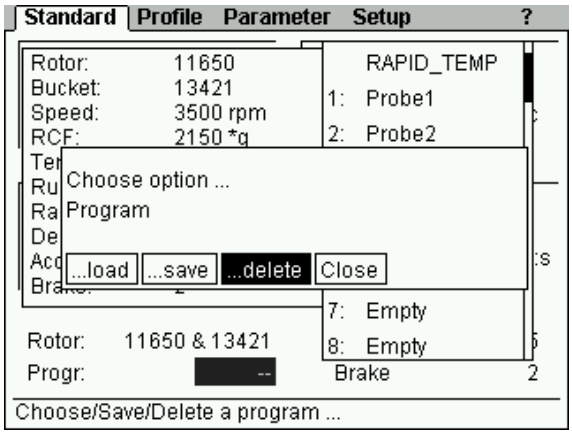


Fig. 6.40: Deleting a program

6.4.4.4 Automatic Program Rotation

With the program rotation, programs can be run directly one after another.

- Select "Program rotation" in the "Setup“ menu.

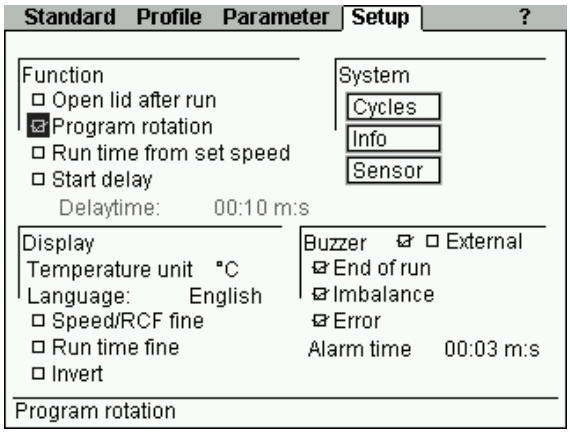


Fig. 6.41: Program rotation function

The current program is loaded and can be started. After the end of the run, the next program will be loaded and started automatically. The rotation ends with the first empty location and restarts from the beginning:

Example 1: Loading of sample 1
Rotation: sample 1, sample 2, sample 3, sample 1,...

Example 2: Loading of sample 2
Rotation: sample 2, sample 3, sample 2,...

While the program rotation is active, an arrow is displayed in the program field (see Fig. 6.42).

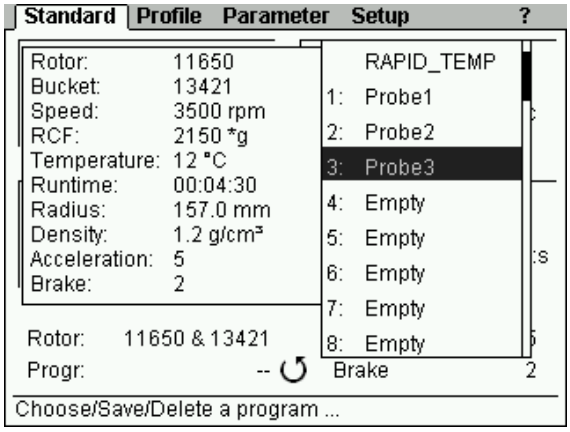


Abb. 6.42: Automatic program rotation

6.5 Switching the Centrifuge OFF

- Open the centrifuge when it is not in use so moisture can evaporate. This prevents the increased wear of the motor bearings.
- Press the mains power switch on the front of the right side.

7 Malfunctions and Error Correction

7.1 General Malfunctions

Malfunctions are indicated by a dialogue box. If the sound signal is activated, it sounds when the error message is displayed.

- Eliminate the source of the problem (see tables in fig. 7.1 and 7.3).
- Acknowledge the error messages by pressing the knob.

Only Spincontrol Comfort:

Error messages that are caused by the power circuit board are marked with a “P” in front of the error code.

Only Spincontrol Professional:

Error messages can be eliminated by pressing the lid key. The error itself will not be eliminated, but the centrifuge can be operated again.

Type of error	Possible reason	Correction
No indication on the display	No power in the mains supply	Check fuse in the mains supply
	Power cord is not plugged in	Plug in power cord correctly
	Fuses have tripped	Reactivate temerature fuse (see 5.4.1 "Connection")
	Mains power switch off	Switch mains power switch on
	Lid is not closed correctly	Close lid.
Centrifuge cannot be started: Start key LED is not illuminated	Several	Power off/on. If the error occurs again, contact service
Centrifuge cannot be started: Lid key LED flashes	The lid lock is not closed correctly	Open and close lid. If the error occurs again, contact service
Centrifuge decelerates during operation	Brief mains power failure	Press start key in order to restart the centrifuge
	System error	Power off/on. If the error occurs again, contact service
Centrifuge decelerates during operation, imbalance dialogue box is displayed	- improper loading - Centrifuge is inclined - Drive problem - centrifuge was moved during run	Balance loading and restart the centrifuge. If the error occurs again, contact service
	- ungreased load-bearing bolts	Clean and grease load-bearing bolts
Lid cannot be opened	Lid lock has not released	Unlock the lid manually (see 7.1.1) and contact service
	Lid seal sticks	Clean the lid seal and apply talcum powder
Temperature value cannot be reached	Condenser dirty	Clean the condenser. If the error occurs again, contact service
Hard running noise during the centrifugation	Screws of the transport safety device are not removed	Remove screws of the transport safety device (see 5.2)

Fig. 7.1: Possible error causes

7.1.1 Emergency Lid Release

In the event of a power failure, it is possible to manually open the centrifuge lid.

- Switch off the mains power switch and disconnect the power cord from the socket.
- Remove the plug (1) at the left side of front panel, e.g. with a screw driver (see fig. 7.2).
- Unlock the motorized lid locks with the supplied hexagon socket wrench (size 5) by turning it to the left.
- Then, reinsert the plugs.

The lid may only be unlocked and opened when the rotor is at a standstill.

If the lid is opened with the emergency lid release during operation, the centrifuge will be switched off immediately and decelerate without brake.

Fig. 7.2: Position of the opening for the emergency lid release

7.2 Error Codes

Error no.	Kind of error	Measure	Note
1-9	System error	• allow to slow down • power off/on	All these errors stop the centrifuge or cause it to decelerate brakeless
10-19	Speedometer error	• allow to slow down • power off/on	
20-29	Motor error	• power off/on • ensure ventilation	
30-39	EEPROM error	• allow to slow down • power off/on	With error 34, 35, 36, the centrifuge will stop; with error 37, 38 error message only
40-45	Temperature error (only for refrigerated centrifuges)	• allow to slow down • power off/on • allow to cool down • provide better ventilation	
46-49	Imbalance error	• allow to slow down • power off • eliminate the imbalance	
50-59	Lid error	• press lid key • close lid • remove foreign matter from the opening of the lid lock device	With error 50 and 51, the centrifuge will stop
60-69	Process error	• allow to slow down • power off/on	With error 60 message "power failure during run", with error 61, message "stop after power on"
70-79	Communication error	• allow to slow down • power off/on	
80-89	Parameter error	• allow to slow down • power off/on • provide for better ventilation	With error 83, error message only
90-99	Other errors	• check connections	

Fig. 7.3: Error codes

If it is impossible to eliminate the errors, contact the service (see 7.3)!

7.3 Service Contact

If service is required:

- use the **online service request** form at
  www.sigma-zentrifugen.de → [Contacts] → [Service requests]

or contact

- SIGMA Laborzentrifugen GmbH
  An der Unteren Söse 50
  37520 Osterode (Germany)
  Tel. +49 (0) 55 22 / 50 07-8425
  Fax +49 (0) 55 22 / 50 07-9425
  E-mail: info@sigma-zentrifugen.de
- or one of our agencies abroad.

- If you would like to utilise our service, please state the type of your centrifuge and its serial number.
- Make use of our online service request on the Internet. Please use the request form (see above) on our website.

8 Maintenance and Service

The centrifuge, rotor, and accessories are subject to high mechanical stress. Thorough maintenance performed by the user extends the service life and prevents premature failure.

If corrosion or other damage occurs due to improper care, the manufacturer cannot be held liable or subject to any warranty claims.

- Use soap water or other water-soluble, mild cleaning agents with a pH value between 6 and 8 for cleaning the centrifuge and the accessories.
- Avoid corrosive and aggressive substances.
- Do not use solvents.
- Do not use agents with abrasive particles.
- Do not expose the centrifuge and rotors to intensive UV radiation or thermal stress (e.g. by heat generators).

8.1 Maintenance

8.1.1 Centrifuge

- Disconnect the power cord from the wall outlet or instrument receptacle before cleaning.
- Carefully remove all liquids, including water and particularly all the solvents, acids, and alkaline solutions from the rotor chamber using a cloth in order to avoid damage to the motor bearings.
- If the centrifuge has been contaminated with toxic, radioactive, or pathogenic substances, clean the rotor chamber immediately with a suitable decontamination agent (depending on the type of contamination).

Take suitable precautions for your own safety if there is a risk of toxic, radioactive, or pathogenic contamination.

- Grease the motor shaft slightly after cleaning (Grease for load-bearing bolts part no. 70284).

8.1.2 Accessories

For the care of the accessories, special safety measures must be considered as these are measures that will ensure operational safety at the same time.

- Immediately rinse off the rotor, buckets, or accessories if any liquids that may cause corrosion come into contact with them.
- Clean the accessories outside the centrifuge once a week or preferably after each use. Rubber cushions should be removed, cleaned and dried.
- If the rotors or accessories have been contaminated with toxic, radioactive, or pathogenic substances, clean them immediately with a suitable decontamination agent (depending on the type of contamination). Take suitable precautions for your own safety if there is a risk of toxic, radioactive, or pathogenic contamination.
- Dry the accessories with a soft cloth or in a drying chamber at approx. 50°C.

8.1.2.1 Plastic Accessories

The chemical resistance of plastic decreases with rising temperatures (e.g. during drying, see Resistance Data in chapter 11 "Appendix").

- If solvents, acids, or alkaline solutions have been used, clean the plastic accessories thoroughly.

8.1.2.2 Aluminium Accessories

Especially aluminum parts are susceptible to corrosion.

- Acid-containing cleaning agents and alkaline cleaning agents must be avoided.
- Grease aluminum parts at least once a week with slushing oil for protection against corrosion (part no. 70104).

This essentially increases their service life and reduces susceptibility to corrosion.

8.1.3 Rotors, Buckets and Multiple Carriers

Rotors, buckets, and multiple carriers are produced with highest precision, in order to withstand the permanent high stress with high gravitational fields.

Chemical reactions as well as stress-corrosion (combination of oscillating pressure and chemical reaction) can affect or destroy the metals. Barely detectable cracks on the surface can expand and weaken the material without any visible signs.

Check the material regularly (at least once a month) for

- cracks
- visible damage of the surface
- pressure marks
- signs of corrosion
- other changes.

- Check the bores of the rotors and multiple carriers.
- Replace any damaged components immediately for your own safety.
- Grease rotor, lid seal and adapters at least once a week with slushing oil (part no. 70104).
- Grease the rotor tie-down screw after cleaning with grease for load-bearing bolts (part no. 70284).

8.1.4 Load-bearing Bolts

Only greased load-bearing bolts ensure the even swinging of the buckets, and therefore, the quiet run of the centrifuge. Non-greased bolts can lead to a system shut-down due to imbalances.

- Apply a small quantity of grease (part no. 70284) to the load-bearing bolts of the rotor and the buckets after each cleaning.

8.1.5 Glass Breakage

- In the case of glass breakage, immediately remove all glass particles (e.g. with a vacuum cleaner). Replace the rubber cushions since even thorough cleaning will not remove all glass particles.

Glass particles will damage the surface coating (e.g. anodizing) of the buckets, which will then lead to corrosion.

Glass particles in the rubber cushions of the buckets will cause glass breakage again.

Glass particles on the pivot bearing of the load-bearing bolts prevent the buckets and carriers from swinging evenly, which will cause an imbalance.

Glass particles in the rotor chamber will cause metal abrasion due to the strong air circulation. This metal dust will not only pollute the rotor chamber, rotor, and materials to be centrifuged but also damage the surfaces of the accessories, rotors, and rotor chamber.

In order to completely remove the glass particles and the metal dust from the rotor chamber:

- Grease the upper third of the rotor chamber with e.g. Vaseline.
- Then, let the rotor rotate for a few minutes at a moderate speed (approximately. 2,000 rpm). The glass and metal particles will now collect at the greased part.
- Remove the grease with the glass and metal particles with a cloth.
- If necessary, repeat this procedure.

8.1.6 Condenser

In order to cool the refrigerant that is compressed by the refrigeration unit, a lamellar condenser is used. It is cooled by air.

Dust and dirt obstruct the cooling flow of air. Dust on condenser pipes and lamellas reduces the heat exchange and thus the performance of the refrigeration unit. This is why the installation site should be as clean as possible.

- Check the condenser at least once a month for dirt and clean it if necessary.
- If you have any queries, please contact service (see 7.3 "Service Contact").

8.2 Sterilization and Disinfection of the Rotor Chamber and Accessories

- Use commercially-available disinfectants such as, for example, Sagrotan®, Buraton®, or Terralin® (available at chemist's shops or drugstores).
- The centrifuges and the accessories consist of various materials. A possible incompatibility must be considered.
- Before using cleaning or decontamination agents that were not recommended by us, contact the manufacturer to ensure that such a procedure will not damage the centrifuge.
- For autoclaving, consider the continuous heat resistance of the individual materials (see 8.2.1 "Autoclaving").

Please contact us if you have any queries. (see 7.3 "Service Contact").

If dangerous materials (e.g. infectious and pathogenic substances) are used, the centrifuge and accessories must be disinfected.

8.2.1. Autoclaving

The service life of the accessories essentially depends on the frequency of autoclaving and use.

- Replace the accessories immediately when the parts show changes in color or structure or in the occurrence of leaks etc.
- During autoclaving, the caps of the tubes must not be screwed on in order to avoid the deformation of the tubes.

It cannot be excluded that plastic parts, e.g. lids or carriers, may deform during autoclaving.

Accessories	max. temp. (°C)	min. time	max. time	max. cycles
Glass tubes	134-138	3	40	-
Polycarbonate tubes	115-118	30	40	20
Polypropylene copolymer tubes	115-121	30	40	30
Teflon tubes	134-138	3	5	100
Aluminium rotors	134-138	3	20	-
Polycarbonate/Polyallomer lids for angle rotors	115-118	30	40	20
Polysulfone lids for angle rotors	134-138	3	5	100
Aluminium buckets	134-138	3	20	-
Polysulfone caps for buckets	134-138	3	5	100
Rubber adapter	115-118	30	40	-
Round carriers made of polypropylene	115-118	30	40	-
ditto, made of polyallomer and polycarbonate	115-118	30	40	-
Rectangular carriers made of polypropylene	115-118	30	40	-
ditto, made of polyallomer and polycarbonate	115-118	30	40	-

Fig. 8.1: Autoclaving table

8.3 Service

If service is required:

- use the **online service request** form at
  www.sigma-zentrifugen.de → [Contacts] → [Service requests]

or contact

- SIGMA Laborzentrifugen GmbH
  An der Unteren Söse 50
  37520 Osterode (Germany)
  Tel. +49 (0) 55 22 / 50 07-8425
  Fax +49 (0) 55 22 / 50 07-9425
  E-mail: info@sigma-zentrifugen.de
- or one of our agencies abroad.

- If you would like to utilise our service, please state the type of your centrifuge and its serial number.
- Make use of our online service request on the Internet. Please use the request form (see above) on our website.

9 Disposal

9.1 Disposal of the Centrifuge

In accordance with the directive 2002/96/EC, SIGMA centrifuges are marked with the symbol shown to the left. This symbol means that it is not permissible to dispose of the unit among household trash.

- You can return these centrifuges free of cost to SIGMA Laborzentrifugen GmbH.
- Ensure that the unit is decontaminated. Fill in the enclosed declaration of decontamination (page 93).
- Comply with any other applicable local rules and regulations.

9.2 Disposal of the Packaging

- Use the packaging to return the centrifuge for disposal or
- Dispose of the packaging, after having separated the individual materials.
- Comply with all local rules and regulations.

10 Technical Data

Manufacturer:	S I G M A Laborzentrifugen GmbH An der Unteren Söse 50 37520 Osterode (Germany)
Type:	4-16K
Electr. Connection: Protection class: IP Code:	see name plate I 20
Connected load (kVA): Power consumption (kW): Max. current consumption (A):	3,1 2,3 11
Performance data Max. speed (rpm): Max. capacity (ml): Max. gravitational field (x g): Max. kin. energy (Nm):	 15 000 2 600 25 155 62 703
Other parameters Time range: Spincontrol Comfort Spincontrol Professional Temperature range: Heater (Special equipment): Storage locations: Spincontrol Comfort Spincontrol Professional	 short run, continuous run, 10 sec – 9 h 59 min 10 sec – 99 h 59 min -20 to +40°C -20 to +60°C 50 60
Physical data Height (mm): Height with opened lid (mm) : Width (mm): Depth (mm): Weight (kg): EMC as per EN 61326: Noise level (dBA):	 489 940 570 650 124 Class B 62 (at max. speed)

Fig. 10.1: Technical Data

10.1 Ambient Conditions

- The figures are valid for an ambient temperature of +23°C ± 2 °C and a nominal voltage of 220-240V ± 5 %. The minimum temperature is < +4 °C and depends on the rotor type, speed, and ambient temperature.
- Allowable ambient temperature +10°C to +35°C.
- Max. humidity 80%.
- Special equipment Heater: In order to reach the stated final temperature, the rotor and buckets must be preheated by running at approximately 1,500 rpm. The maximum rotor temperature that can actually be reached is 40-60°C, depending on the rotor and speed.

11 Appendix

11.1 Suitable Accessories

Part no.	Description	Max. speed (min^{-1})	Max. gravitational field (x g)
11650	Swing-out rotor, 4 place, for buckets 13421, 13450	4 700	
13421	Bucket for microtiter- and deepwellplates, incl. plate holder no. 17979 radius max. 15.7 cm radius min. 9.4 cm max. height of plates 60 mm, 1 set = 4 pcs.	4 700	3 877 2 321
13450	Round bucket, sealable with cap no. 17170, for the round carrier system Ø 100, (no. 17649 - 17699), for 650 ml tube no. 13456 , adapter no. 13654, max. tube length 140 mm, 1 set = 2 pcs.		
17653	Round carrier for 26 reaction vials 1.5/2.2 ml, max. Ø 11 mm, e.g. no. 15008, 15040, 1 set = 2 pcs.		
17651	Round carrier for 20 tubes 4 - 7 ml, flat bottom, max. Ø 15.5/18 x 50 - 75 mm, e.g. Monovette, Primavette, 1 set = 2 pcs.		
17652	Round carrier for 36 round bottom tubes 5 ml, max. Ø 12.5 x 60 - 80 mm, e.g. no. RIA tube 15060, hemolyse tubes, 1 set = 2 pcs.		
17656	Round carrier for 22 round bottom tubes 5 - 6 ml, max. Ø 13.5/17.5 x 70 - 90 mm, e.g. no. RIA tube 15060 Vacutainer -, hemolyse tubes, 1 set = 2 pcs.		
17654	Round carrier for 32 round bottom tubes approx. 7 ml, max. Ø 12.5 x 85 - 115 mm, e.g. no. 15007, 15027, 1 set = 2 pcs.		
17658	Round carrier for 19 round bottom tubes 9 - 15 ml, max. Ø 17.2/19.5 x 85 - 115 mm, e.g. no. 15015, 15020, 15022, 15023, 15024 and Monovettes 9 - 10 ml, 1 set = 2 pcs.		
17655	Round carrier for 20 round bottom tubes 10 - 12 ml, max. Ø 16.2/18 x 65 - 90 mm, e.g. no. 15000, 15010, 15039, 1 set = 2 pcs.		
17659	Round carrier for 12 culture tubes 15 ml no. 15115 Ø max. 23 mm, 1 set = 2 pcs.		
17660	Round carrier for 15 culture tubes 15 ml with caps Ø max. 22 mm, 1 set = 2 pcs.		
17670	Round carrier for 8 round bottom tubes 25 - 30 ml, max. Ø 25.4/30 x 90 - 115 mm, e.g. no. 15025, 15026, 15029, 15030, 15032, 15033, 1 set = 2 pcs.		
17662	Round carrier for 7 tubes 30 ml, flat bottom or skirt, max. Ø 25/31 x 65 - 95 mm, e.g. Sterilin tube 30 ml, Barloworld Scientific Ltd., 1 set = 2 pcs.		
17676	Round carrier for 7 round bottom tubes 40 - 50 ml with screw cap, max. Ø 29/32 x 90 - 115 mm,		

Part no.	Description	Max. speed (min^{-1})	Max. gravitational field (x g)
17675	Round carrier for 4 round bottom tubes 50 ml, max. Ø 35/38 x 90 - 115 mm, e.g. 15049, 15056, 15050, 1 set = 2 pcs.		
17677	Round carrier for 5 culture tubes 50 ml, e.g. no. 15151, Nunc, Corning, Falcon and Greiner, 1 set = 2 pcs.		
17678	Round carrier for 5 culture tubes 50 ml with skirt or flat bottom, max. Ø 29.4/36 x 90 - 120 mm, 1 set = 2 pcs.		
17649	Round carrier for 7 culture tubes 50 ml, e.g. no. 15151, max. Ø 29/36 x 90 - 115 mm, 1 set = 2 pcs.		
17685	Round carrier for 3 tubes with screw cap 78 - 85 ml, max. Ø 38/40 x 90 - 110 mm, e.g. no. 13085, 15074, 15075, 15076, 15080, 1 set = 2 pcs.		
17690	Round carrier incl. rubber cushion no. 16051, for 2 round bottom tubes approx. 100 ml, max. Ø 45/47 x 85 - 110 mm, e.g. no. 15100, 15102, 15103, 15106, 1 set = 2 pcs.		
17692	Round carrier for 1 bottle with flat bottom approx. 125 ml, max. Ø 51 x 90 - 115 mm, e.g. no. 15125, 1 set = 2 pcs.		
13456	Polypropylene tube with flat bottom, 650 ml, Ø 100 x 111 mm, sealable with cap 17123		
17694	Round carrier for 1 bottle 150 or 200 ml with pointed bottom angle 88°, max. Ø 60 x 120 - 140 mm, e.g. Nalgene 150 and 200 ml, 1 set = 2 pcs.		
17696	Round carrier for 1 bottle with flat bottom 200 ml approx., max. Ø 57 x 90 - 115 mm, e.g. no. 15202, 15203, 1 set = 2 pcs.		
17693	Round carrier for 1 bottle with pointed bottom approx. 200ml, angle 60°, max. Ø 61.5 x 140 - 164 mm e.g. no. 15175, 15174 Corning tubes, up to 172mm in 13650 only without cap 17170, 13450 up to 140mm, 1 set = 2 pcs.		
17698	Round carrier for 1 bottle with flat bottom 250 ml, max. Ø 61.5 x 90 - 125 mm, e.g. no. 13255, 15247, 15248, 15249, 1 set = 2 pcs.		
13654	Adapter for 1 bottle 500 to 750 ml, Ø 85 x 130 - 173 mm, e.g. no. 15500, 15501, 15750, 15751, in 13450 only 15500, 15501, 1 set = 2 pcs.		
17682	Round carrier for 1 Corning bottle 500 ml, no. 431123, angle 75°, Ø 96 x 150 mm, pointed bottom, 1 set = 2 pcs.		
11150	Swing-out rotor, 4 place, for buckets no. 13215, 13220, 13221, 13233, 13234, 13235, 13236, 13350	4 100	
13215	Rectangular bucket, suitable for the system of rectangular carriers no. 18000 - 18200, sealable with cap no. 17112, max. tube length 115 mm, 1 set = 2 pcs.		

Part no.	Description	Max. speed (min^{-1})	Max. gravitational field (x g)
13220	Bucket for microtiter plates, permissible data with rotor 11150: radius corner 16.6 cm radius max. 16.0 cm radius min. 11.3 cm max. height of plates 51 mm 1 set = 2 pcs	4 100	3 120 3 007 2 124
13221	Bucket for microtiter plates, incl. plate holder no. 17979, permissible Data with rotor 11150: radius corner 16.6 cm radius max. 16.0 cm radius min. 10.0 cm max. height of plates 56 mm, 1 set = 2 pcs.	5 100	4 827 4 653 2 908
13233	Multiple carrier for 50 x tubes approx. 5 ml, max. Ø 12.5 x 70 - 90 mm, e.g. RIA tube no. 15060, 1 set = 2 pcs.		
13234	Multiple carrier for 4 x 100 ml for tubes max. Ø 45 x 92 - 100 mm e.g. no. 15100, 15102, 15103, 15106, incl. rubber cushion no. 16051, 1 set = 2 pcs.		
13235	Multiple carrier for 7 culture tubes 50 ml no. 15151, 1 set = 2 pcs.		
13236	Multiple carrier for 12 culture tubes 15 ml no. 15115 1 set = 2 pcs.		
13350	Round bucket, sealable with caps 17134 or 17135, for round carriers Ø 85 mm no. 17345 - 17402 and 500 ml bottles no. 15500, 15501, max. tube length 130 mm, 1 set = 2 pcs., max. radius 19.0 cm, min. radius 8.7 cm	5 100	5 525
17112	Rectangular polysulfone sealing cap, clear, for bucket no. 13215, incl. 1 set clips no. 17118, 1 set = 2 pcs.		
17134	Round aluminium sealing cap, for bucket no. 13350, 1 set = 2 pcs.		
17135	Round polysulfone sealing cap, clear, for bucket no. 13350, 1 set = 2 pcs.		
11151	Swing-out rotor 48 x 15 ml complete, no. 11150, incl. 2 sets rectangular buckets no. 13215, 2 sets rectangular carriers no. 18015 and 48 PS-tubes 15 ml no. 15020	5 100	5 292
17350	ound carrier for 24 reaction vials 0.5/0.75 ml, max. Ø 8/10 x 28/31 mm, e.g. no. 15005, 1 set = 2 pcs.		
17353	Round carrier for 20 reaction vials 1.5/2.2 ml, max. Ø 11 mm, e.g. no. 15008, 15040, 1 set = 2 pcs.		
17351	Round carrier for 12 flat bottom tubes 4 - 7 ml, flat bottom, max. Ø 15.5/18 x 50 - 75 mm, e.g. Monovettes 4 ml, 1 set = 2 pcs.		
17352	Round carrier for 25 round bottom tubes 5 ml, max. Ø 12.5/13.5 x 65 - 80 mm, e.g. no. 15060, RIA - tubes, hemolyse tubes, 1 set = 2 pcs.		

Part no.	Description	Max. speed (min^{-1})	Max. gravitational field (x g)
17356	Round carrier for 16 round bottom tubes 5 - 6 ml, max. Ø 13.5/17.5 x 70 - 90 mm, e.g. no. RIA tube 15060, Vacutainer, hemolyse tubes, 1 set = 2 pcs.		
17354	Round carrier for 16 round bottom tubes 7 ml, max. Ø 12.5 x 85 - 115 mm, e.g. no. 15007, 15027, 1 set = 2 pcs.		
17355	Round carrier for 12 round bottom tubes 10 - 12 ml, max. Ø 16.2/19 x 65 - 90 mm, e.g. no. 15000, 15010, 15039, 1 set = 2 pcs.		
17358	Round carrier for 12 round bottom tubes 10 - 15 ml, max. Ø 17.2/19.5 x 90 - 115 mm, e.g. no. 15015, 15020, 15022, 15023, 15024 and Monovettes 9 - 10 ml, 1 set = 2 pcs.		
17359	Round carrier for 9 culture tubes 15 ml, max. cap Ø 23 mm, e.g. no. 15115, 1 set = 2 pcs.		
17360	Round carrier for 10 culture tubes 15 ml, max. cap Ø 22 mm, 1 set = 2 pcs.		
17370	Round carrier for 5 round bottom tubes 25 - 30 ml, max. Ø 25.4/29 x 85 - 115 mm, e.g. no. 15025, 15026, 15029, 15030, 15032, 15033, 1 set = 2 pcs.		
17362	Round carrier for 5 tube 30 ml, flat bottom or skirt, max. Ø 25/31 x 65 - 95 mm, e.g. Sterilin tube 30 ml, Barloworld Scientific Ltd., 1 set = 2 pcs.		
17376	Round carrier for 4 round bottom tubes with screw cap 40 - 50 ml, max. Ø 29/34 x 85 - 110 mm, e.g. no. 15051, 15052, 15054, (13055 with 13350/13550 only), 1 set = 2 pcs.		
17375	Round carrier for 3 round bottom tubes 50 ml, max. Ø 35/38 x 90 - 110 mm, e.g. no. 15049, 15050, 15056, 1 set = 2 pcs.		
17377	Round carrier for 4 culture tubes 50 ml, e.g. no. 15151, 1 set = 2 pcs.		
17378	Round carrier for 4 culture tubes 50 ml with skirt or flat bottom, max. Ø 29.4/36 x 90 - 120 mm, 1 set = 2 pcs.		
17385	Round carrier for 1 tube 78 - 85 ml, max. Ø 38/40 x 85 - 115 mm, e.g. no. 13085, 15074, 15075, 15076, 15080, 1 set = 2 pcs.		
17390	Round carrier incl. rubber cushion no. 16051, for 1 round bottom tube 100 ml, max. Ø 45/50 x 85 - 110 mm, e.g. no. 15100, 15102, 15103, 15106, 1 set = 2 pcs.		
17395	Round carrier for 1 bottle with flat bottom 125 ml, max. Ø 51 x 90 - 115 mm, e.g. no. 15125, 1 set = 2 pcs.		
17401	Round carrier incl. rubber cushion no. 16250 for 1 round bottom tube 175 - 250 ml, max. Ø 57.5 x 90 - 137 mm with 13350 and 150 mm with 13550, e.g. no. 15201, 15206, 15250, 15251, 15254, 1 set = 2 pcs.		

Part no.	Description	Max. speed (min^{-1})	Max. gravitational field (x g)
17393	Round carrier for 1 bottle 175 - 250 ml with pointed bottom angle 60°, max. Ø 61.5 x 120 - 165 mm, e.g. no. 15174, 15175, 1 set = 2 pcs.		
17402	Round carrier for 1 bottle 150 or 200 ml with pointed bottom angle 88°, max. Ø 60 x 120 - 140 mm, e.g. Nalgene 150 and 200 ml, 1 set = 2 pcs.		
17400	Round carrier for 1 bottle with flat bottom 200 ml, max. Ø 57 x 90 - 115 mm, e.g. no. 15202, 15203, 1 set = 2 pcs.		
17347	Round carrier for 1 bottle with flat bottom, 250 ml, max. Ø 61.5 x 90 - 125 mm, e.g. no. 15247, 15248, 15249; (13255 with 13350/13550 only), 1 set = 2 pcs.		
15500	Polycarbonate bottle 500 ml, Ø 85 x 135 mm, incl. screw cap		
15501	Polypropylene Co-Polymer (PPCO) bottle 500 ml, Ø 85 x 135 mm, incl. screw cap		
11156	Swing-out rotor, 6 place, for buckets no. 13127; bucket 13127: max. radius 19.1 cm, min. radius 9.7 cm	5 100	5 554
13127	Rectangular bucket, sealable with cap no. 17112, for the system of rectangular carriers no. 18000 - 18200, max. tube length 115 mm, 1 set = 2 pcs.	5 100	5 554
18002	Rectangular carrier for 20 reaction vials 1.5/2.2 ml, max. Ø 11 mm, e.g. no. 15008, 15040, 1 set = 2 pcs.		
18003	Upper part for 18002 for + 20 reaction vials 1.5/2.2 ml, max. Ø 11 mm, e.g. no. 15008, 15040, 1 set = 2 pcs.		
18005	Rectangular carrier for 20 tubes approx. 5 ml, flat and round bottom, max. Ø 12.2 x 60 - 75 mm, e.g. no. RIA tube 15060, 1 set = 2 pcs.		
18105	Rectangular carrier for 20 tubes approx. 5 ml, flat and round bottom, decantable, max. Ø 12.2 x 60 - 75 mm, e.g. no. RIA tube 15060, 1 set = 2 pcs.		
18009	Rectangular carrier for 20 round bottom tubes 5 - 6 ml, max. Ø 12.8 x 70 - 90 mm, e.g. no. Hemolyse, RIA tube 15060, 1 set = 2 pcs.		
18012	Rectangular carrier for 12 tubes 6 - 7 ml, max. Ø 13.5/18 x 65 - 90 mm, e.g Vacutainer, 1 set = 2 pcs.		
18007	Rectangular carrier for 20 tubes approx. 7 ml, flat and round bottom, max. Ø 12.3 x 80 - 105 mm, e.g. no. 15007, 15027, 1 set = 2 pcs.		
18010	Rectangular carrier for 12 tubes 10 - 12 ml, flat and round bottom, max. Ø 16.8/17.5 x 60 - 85 mm, e.g. no. 15000, 15010, 15039, 1 set = 2 pcs.		
18015	Rectangular carrier for 12 tubes 10 - 15 ml, flat and round bottom, max. Ø 17 x 90 - 105 mm, e.g. no. 15015, 15020, 15022, 15023, 15024, 1 set = 2 pcs.		

Part no.	Description	Max. speed (min^{-1})	Max. gravitational field (x g)
18115	Rectangular carrier for 12 glass tubes 10 - 15 ml, decantable, max. Ø 17 x 90 - 105 mm, e.g. no. 15015, 15020, 15022, 15023, 15024, 1 set = 2 pcs.		
18016	Rectangular carrier for 4 culture tubes 15 ml no. 15115 1 set = 2 pcs.		
18018	Rectangular carrier for 6 culture tubes 15 ml, e.g. no. 15115 without cap 17112, 1 set = 2 pcs.		
18017	Rectangular carrier for 10 tubes approx. 15 ml, max. Ø 17.5/19.5 x 80 - 112 mm, e.g. 15015, 15020, 15022, 15023, 15024, Monovettes 9 - 10 ml, 1 set = 2 pcs.		
18025	Rectangular carrier for 5 round bottom tubes approx. 25 ml, max. Ø 24 x 85 - 105 mm, e.g. no. 15025, 15026, 1 set = 2 pcs.		
18030	Rectangular carrier for 5 round bottom tubes 27 - 30 ml, max. Ø 25.4/27.5 x 80 - 110 mm, e.g. no. 15029, 15030, 15032, 1 set = 2 pcs.		
18022	Rectangular carrier for 4 tubes 30 ml, flat bottom or skirt, max. Ø 25/31 x 65 - 95 mm, e.g. Sterilin tube 30 ml, Barloworld Scientific Ltd., 1 set = 2 pcs.		
18051	Rectangular carrier for 2 round bottom tubes 40 - 50 ml, max. Ø 29/35 x 80 - 110 mm, e.g. no. 13055, 15051, 15052, 15054, 1 set = 2 pcs.		
18050	Rectangular carrier for 2 round bottom tubes approx. 50 ml, max. Ø 35/38 x 85 - 110 mm, e.g. no. 15049, 15050, 15056, 1 set = 2 pcs.		
18052	Rectangular carrier for 2 culture tubes 50 ml no. 15151 1 set = 2 pcs.		
18053	Rectangular carrier for 2 culture tube 50 ml with skirt or flat bottom, max. Ø 29.4/36 x 90 - 120 mm, 1 set = 2 pcs.		
18085	Rectangular carrier for 1 round bottom tube 78 - 85 ml, max. Ø 38/40 x 85 - 112 mm, e.g. no. 13085, 15074, 15075, 15076, 15080, 1 set = 2 pcs.		
18100	Rectangular carrier for 1 round bottom tube approx. 100 ml, max. Ø 45.5/48 x 85 - 110 mm, e.g. no. 15100, 15102, 15103, 15106, 1 set = 2 pcs.		
18125	Rectangular carrier for 1 bottle 125 mlwith flat bottom and screw cap, max. Ø 51 x 90 - 120 mm, e.g. no. 15125, 1 set = 2 pcs.		
18250	Rectangular carrier for 1 tube 175 - 250 ml incl. rubber cushion no. 16051, max. Ø 57 x 90 - 137 mm, e.g. no. 15201, 15206, 15250, 15251, 15254 (In 13127, 13215 not possible: 15250, 15251, 15254), 1 set = 2 pcs.		
18200	Rectangular carrier for 1 bottle with flat bottom and screw cap 200 ml, max. Ø 57 x 90 - 115 mm, e.g. no. 15202, 15203, 1 set = 2 pcs.		

Part no.	Description	Max. speed (min^{-1})	Max. gravitational field (x g)
11157	Swing-out rotor 72 x 15 ml complete, no. 11156, incl. 3 sets rectangular buckets no. 13127, 3 sets rectangular carriers no. 18015 and 72 PS-tubes 15 ml no. 15020 max. Radius 19,1 cm, min. Radius 9,7 cm	5 100	5 554
11118	Swing-out rotor for microtiter plates, incl. 1 set carriers no. 13218, sealable with caps no. 17108, incl. plate holder no. 17978, radius corner 15.15 cm radius max. 13.8 cm radius min. 5.8 cm max. height of plates 80 mm	5 700	5 503 5 013 2 107
13218	Bucket for microtiter plates, sealable with cap no. 17108, incl. plate holder no. 17978, max. height of plates approx. 80 mm, 1 set = 2 pcs.		
17108	Polysulfone sealing cap, clear, incl. 2 sets clips no. 17118, 1 set = 2 pcs.		
17118	Clip for sealing caps, 1 set = 2 pcs.		
17978	Plate holder for bucket no. 13218, 1 set = 2 pcs.		
12165	Angle rotor 6 x 85 ml, for tubes no. 13085, 15074, 15075, 15076, 15080, incl. hermetic aluminium lid no. 17855, max. radius 9.8 cm, min. radius 2.7 cm, angle 25°	14 000	21 475
12166	Angle rotor 8 x 50 ml, for tubes no. 13055, 15051, 15052, 15054, incl. hermetic aluminium lid no. 17847, max. radius 9.6 cm, min. radius 3.3 cm, angle 25°	14 000	21 036
12172	Angle rotor 12 x 30 ml, for tubes no. 15029, 15030, 15032, incl. hermetic aluminium lid no. 17845, max. radius 11.0 cm, min. radius 5.1 cm, angle 30°	14 000	24 104
12168	Angle rotor 20 x 10 ml, for tubes no. 15000, 15010, 15039, incl. hermetic aluminium lid no. 17846, max. radius 9.8 cm, min. radius 5.8 cm, angle 25°	14 000	21 475
12130	Angle rotor 30 x 1.5/2.2 ml, for e.g. reaction vials no. 15008, 15040, incl. hermetic aluminium lid no. 17844, max. radius 10.0 cm, min. radius 6.7 cm, angle 45°	15 000	25 155
11148	Swing-out rotor 32 x 1,5/2,2 ml, incl. 4 sets buckets no. 13124, for e.g. reaction vials no. 15008, 15040, incl. hermetic aluminium lid no. 17880, max. radius 8.4 cm, min. radius 4.4 cm	13 200	16 363
12201	Angle rotor 100 x 1.5/2.2 ml, for e.g. reaction vials no. 15008, 15040 (2 lines, angle 45°), incl. hermetic aluminium lid no. 17896 max. radius 16.3/15.18 cm, min. radius 13.11/11.9 cm	9 600	16 795/ 15 641
12169	Angle rotor for 8 x 50 ml culture, e.g.no. 15151, incl. hermetic aluminium lid no. 17858, max. radius 10.4 cm, min. radius 4.3 cm, angle 25°	13 500	21 191
13060	Adapter for 1 culture tube 15 ml no. 15115, 1 set = 2 pcs.		

Part no.	Description	Max. speed (min^{-1})	Max. gravitational field (x g)
12170	Angle rotor for 12 x 15 ml culture, e.g. no. 15115 incl. hermetic aluminium lid no. 17859, max. radius 10.0 cm, min. radius 4.6 cm, angle 25°	13 500	20 376
12174	Angle rotor for 24 x 15 ml culture, 2 lines with same RCF-value, e.g. no. 15115, incl. hermetic aluminium lid no. 17883 max. radius 12.6 cm, min. radius 6.3 cm	12 000	20 285
12256-H	Angle rotor 6 x 250 ml, for bottles no. 13255, 15247, 15248, 15249 and adapters 14122 - 14134, sealable with hermetic aluminium lid no. 17893, max. radius 14.5 cm, min. radius 3.9 cm, angle 30°	11 200	20 335

Adapters, steel tubes and plastic tubes

Part no.	Description
13000	Adapter for reaction vials 0.25/0.4 ml no. 15014, suitable for 11148, 12130, 12201, 17353, 17653, 18002, 18003, 1 set = 2 pcs
13002	Adapter for reaction vials 0.5/0.75 ml, Ø 7.9/10 x 28/31 mm,e.g. no. 15005, suitable for 11148, 12130, 12201, 17353, 17653, 18002, 18003, 1 set = 2 pcs.
13021	Adapter for PCR-tube 0.2 ml, e.g no. 15042, suitable for 11148, 12130, 12201, 17353, 17653, 18002, 18003, 1 set = 2 pcs.
13079	Bottomadapter for 1 tube 50 ml, e.g. no. 15051, 15052, 15054, suitable for 12169, 1 set = 2 pcs.
13080	Adapter for 1 culture tube 50 ml, e.g. no. 15151, suitable for 12165, 1 set = 2 pcs.
13081	Adapter for 1 culture tube 15 ml, e.g. no. 15115, , suitable for 12165, 1 set = 2 pcs.
13082	Adapter for 1 tube 50 ml, max. Ø 28.8 x 105 - 115 mm, e.g. no. 13055, 15051, 15052, 15054, suitable for 12165, 1 set = 2 pcs
13083	Adapter for 1 tube 30 ml, max. Ø 25.5 x 90 - 100 mm, e.g. no. 15029, 15030, 15032, suitable for 12165, 1 set = 2 pcs
13084	Adapter, for 2 tubes 10 ml, Ø 16/17.5 x 75 - 90 mm, e.g. no. 15000, 15010, 15039, suitable for 12165, 1 set = 2 pcs.
15005	Reaction vials 0.5 ml, 100 pcs. per pack, suitable for 13002, 17350
15008	Reaction vials 1.5 ml, 100 pcs. per pack, suitable for 11148, 12130, 12201, 17353, 17653, 18002, 18003
15040	Reaction vials 2.2 ml, 100 pcs. per pack, suitable for 11148, 12130, 12201, 17353, 17653, 18002, 18003
15014	Reaction vials made of polypropylene 0.4 ml, 100 pcs. per pack, suitable for 13000
15060	Polystyrene tube 5 ml (RIA), Ø 12 x 75 mm, suitable for 13233, 17352, 17356, 17652, 17656, 18005, 18009, 18105
15000	Polyfluor tube 10 ml, Ø 16.1 x 81.1 mm, incl. screw cap, suitable for 12168, 13084, 17355, 17655, 18010
15010	Polycarbonate tube 10 ml, Ø 16.1 x 81.1 mm, incl. screw cap, suitable for 12168, 13084, 17355, 17655, 18010

Part no.	Description
15039	Polypropylene Co-Polymer (PPCO) tube 10 ml, Ø 16.1 x 81.1 mm, incl. screw cap, suitable for 12168, 13084, 17355, 17655, 18010
15020	Polystyrene tube 14 ml, Ø 17 x 100 mm, suitable for 17358, 17658, 18015, 18115
15021	Polypropylene stopper for tubes no. 15020, 15023
15023	Polypropylene Co-Polymer (PPCO) tube 14 ml, Ø 17 x 100 mm, suitable for 17358, 17658, 18015, 18115
15115	Culture tube Nunc, 15 ml, pointed bottom, polypropylene, incl. screw cap Ø 23 mm, suitable for 13060, 13081, 13236, 17359, 17360, 17660, 18016
15029	Polyfluor tube 28 ml, Ø 25.3 x 96 mm, incl. screw cap, suitable for 12172, 13083, 17370, 17670, 18030
15030	Polycarbonate tube 30 ml, Ø 25.3 x 98 mm, incl. screw cap, suitable for 12172, 13083, 17370, 17670, 18030
15032	Polypropylene Co-Polymer (PPCO) tube 27 ml, Ø 25.3 x 97 mm, incl. screw cap, ∅ 25,3 x 97 mm, suitable for 12172, 13083, 17370, 17670, 18030
15049	Polycarbonate tube 65 ml, Ø 34 x 100 mm, graduated, suitable for 17375, 17675, 18050
13055	Stainless steel tube 50 ml, Ø 28.5 x 101.5 mm, sealable with cap no. 17054, suitable for 12166, 13082, 17376, 17676, 18051
17054	Stainless steel sealing cap
15051	Polyfluor tube 38 ml, Ø 28.5 x 107 mm, incl. screw cap, suitable for 12166, 13079, 13082, 17376, 17676, 18051
15052	Polypropylene Co-Polymer (PPCO) tube 42 ml, Ø 28.8 x 107 mm, incl. screw cap, suitable for 12166, 13079, 13082, 17376, 17676, 18051
15054	Polycarbonate tube 42 ml, Ø 28.8 x 107 mm, incl. screw cap, suitable for 12166, 13079, 13082, 17376, 17676, 18051
15151	Culture tube Nunc, 50 ml, pointed bottom, polypropylene, incl. screw cap, suitable for 12169, 13080, 13235, 17377, 17677, 18052
13085	Stainless steel tube 85 ml, Ø 38 x 103 mm, sealable with cap no. 17185, suitable for 12165, 17385, 18085
17185	Round stainless steel sealing cap
15074	Polycarbonate tube 82 ml, Ø 38 x 108 mm, incl. special aluminium screw cap with seal for high speeds, suitable for 12165, 17385, 18085
15075	Polycarbonate tube 82 ml, Ø 38 x 112 mm, incl. screw cap, suitable for 12165, 17385, 18085
15076	Polypropylene Co-Polymer (PPCO) tube 78 ml, Ø 38 x 112 mm, incl. screw cap, suitable for 12165, 17385, 18085
15080	Polyfluor tube 81 ml, Ø 38 x 112 mm, incl. screw cap, suitable for 12165, 17385, 18085
15102	Polypropylene tube 120 ml, Ø 45 x 100 mm, suitable for 17390, 17690, 18100
15103	Polycarbonate tube 110 ml, Ø 45 x 100 mm, graduated, suitable for 17390, 17690, 18100
15125	Polypropylene bottle 145 ml, Ø 51 x 99 mm, incl. screw cap, suitable for 17395, 17692, 18125
15175	Polypropylene bottle 200 ml, Ø 61.5 x 139 mm, pointed bottom, 60°, graduated up to 175 ml (Nalgene no. 3143-0175), suitable for 17393

Part no.	Description
15202	Polypropylene Co-Polymer (PPCO) bottle 190 ml, Ø 56 x 112 mm incl. screw cap, suitable for 17400, 17696, 18200
15203	Polycarbonate bottle 207 ml, Ø 56 x 113 mm, incl. screw cap, suitable for 17400, 17696, 18200
13255	Stainless steel bottle 250 ml, Ø 61.4 x 125 mm, sealable with cap no. 17256, suitable for 12256-H, 17347, 17698
17256	Round stainless steel sealing cap
15247	Polyfluor bottle 250 ml, Ø 61.4 x 122 mm, incl. screw cap, suitable for 12256-H, 17347, 17698
15248	Polycarbonate bottle 250 ml, Ø 61.4 x 125 mm, incl. screw cap, suitable for 12256-H, 17347, 17698
15249	Polypropylene Co-Polymer (PPCO) bottle 250 ml, Ø 61.4 x 125 mm, incl. screw cap, suitable for 12256-H, 17347, 17698
15251	Polypropylene tube 250 ml, Ø 57 x 135 mm, suitable for 17401, 17695

Centrifuge Glass Tubes

Part no.	Description
15007	Centrifuge glass tube 6 ml, Ø 12 x 100 mm, suitable for 17354, 17654, 18007, 18107
15027	Centrifuge glass tube 6 ml, Ø 12 x 100 mm, graduated, suitable for 17354, 17654, 18007, 18107
15015	Centrifuge glass tube 10 - 12 ml, Ø 16 x 100 mm, suitable for 17358, 17658, 18015, 18115
15024	Centrifuge glass tube 12 ml, Ø 16 x 100 mm, graduated, suitable for 17358, 17658, 18015, 18115
15022	Special glass tube 13.5 ml, Ø 17 x 110 mm, max. allowable speed 7000 min^{-1}, suitable for 12166 with 16018 and in 12165 with 16019
15025	Centrifuge glass tube 26 ml, Ø 24 x 100 mm, suitable for 17670, 18025
15026	Centrifuge glass tube 27 ml, Ø 24 x 100 mm, graduated, suitable for 17670, 18025
15033	Special glass tube 32 ml, Ø 24 x 105 mm, max. allowable speed 7000 min^{-1}, suitable for 12166 with 16030 and in 12165 with 16031, 17670
15050	entrifuge glass tube 58 ml, Ø 34 x 100 mm, suitable for 17375, 17675, 18050
15056	Centrifuge glass tube 58 ml, Ø 34 x 100 ml, graduated, suitable for 17375, 17675, 18050
15100	Centrifuge glass tube 100 ml, Ø 44 x 100 mm, suitable for 17390, 17690, 18100
15106	Centrifuge glass tube 100 ml, Ø 44 x 100 mm, graduated up to 80 ml, suitable for 17390, 17690, 18100
15201	Centrifuge glass tube 200 ml, Ø 56 x 112 mm, suitable for 13201, 17401, 17695
15206	Centrifuge glass tube 200 ml, Ø 56 x 113 mm, graduated, suitable for 13201, 17401, 17695
15250	Centrifuge glass tube 230 ml, Ø 56 x 134 mmm, suitable for 17401, 17695
15254	Centrifuge glass tube 230 ml, Ø 56 x 135 mm, graduated, suitable for 17401, 17695

Further Accessories

Part no.	Description
16018	Rubber adapter for special glass tube 15 ml no. 15022 and for glass tube no. 15085, 1 set = 2 pcs.
16019	Rubber adapter for special glass tubes no. 15015, 15022 and 15085, 1 set = 2 pcs.
16030	Rubber adapter for glass tube no. 15025, 15033 and 15086, 1 set = 2 pcs.
16031	Rubber adapter for special glass tube 30 ml no. 15033, 15086, for glass tube 25 ml no. 15025, 1 set = 2 pcs.
16906	Rubber cushion for rectangular carrier 5 x 25 ml, 1 set = 2 pcs.
16907	Rubber cushion for rectangular carrier 2 x 50 ml, 1 set = 2 pcs.
16908	Rubber cushion for rectangular carrier 1 x 100 ml, 1 set = 2 pcs.
16909	Rubber cushion for rectangular carriers, 1 set = 2 pcs.
17118	Clip for sealing caps, 1 set = 2 pcs.
17893	Lid hermetic for rotor 12256-H incl. tool no. 17985
17985	Tool for the easy loosening and tightening of the lid screw of angle rotors, suitable for lid no. 17893

Further accessories available upon request.

Maximum speed for tubes

Some tubes, such as centrifuge glass tubes, microtubes, culture tubes, fluoropolymer tubes and especially high-volume tubes can be used in our rotors, buckets, and adapterss at higher speeds than their breaking limit.

- Always fill the tubes up to their useful volume (= the volume that is stated for the tube).
- Attention: At speeds above 8,000 rpm, there is an increased risk of breakage, in particular for 250 ml bottles.
- Follow the manufacturer’s recommendations.

11.2 Grafical Representation of the Rotors

The graphical representation of the rotors shows the maximum and minimum radii of the accessories used. If necessary, the values must be manually calculated (see 11.4.1 "RCF“, page 87).

Fig 11.1:

Minimum and maximum radius of a swing-out rotor

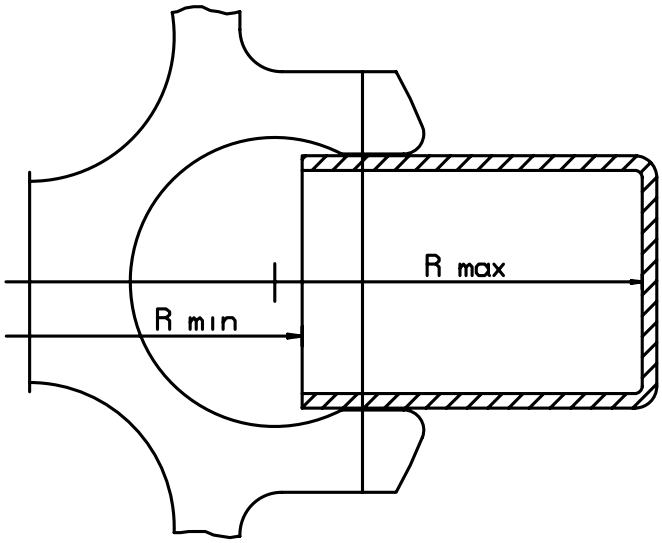
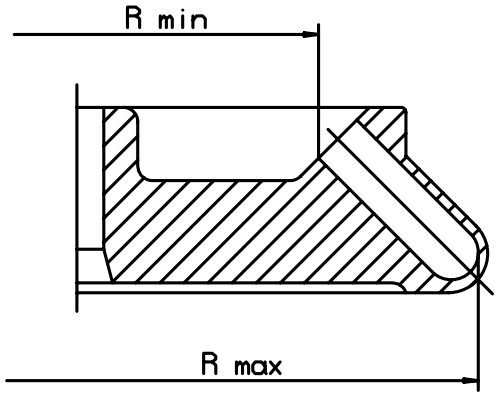


Fig. 11.2:

Minimum and maximum radius of an angle rotor



11.3 Acceleration and Deceleration Curves

11.3.1 Linear Curves

The slope of the fixed acceleration curves defines the time that is required to accelerate the rotor by 1,000 rpm.

Linear as well as quadratic curves are numbered in the direction of increasing acceleration (from right to left).

The deceleration curves are inverted images of the acceleration curves and are assigned the same numbers. An exception is curve 0. It decelerates brakeless.

In general, the runtime, until the set speed is reached, depends on the moment of inertia of the rotor.

Linear slope (curves 0 - 9)

Curve 9 is a special case compared to the other curves. The centrifuge accelerates with maximum power. The runtime, until the set speed is reached, depends solely on the moment of inertia of the rotor.

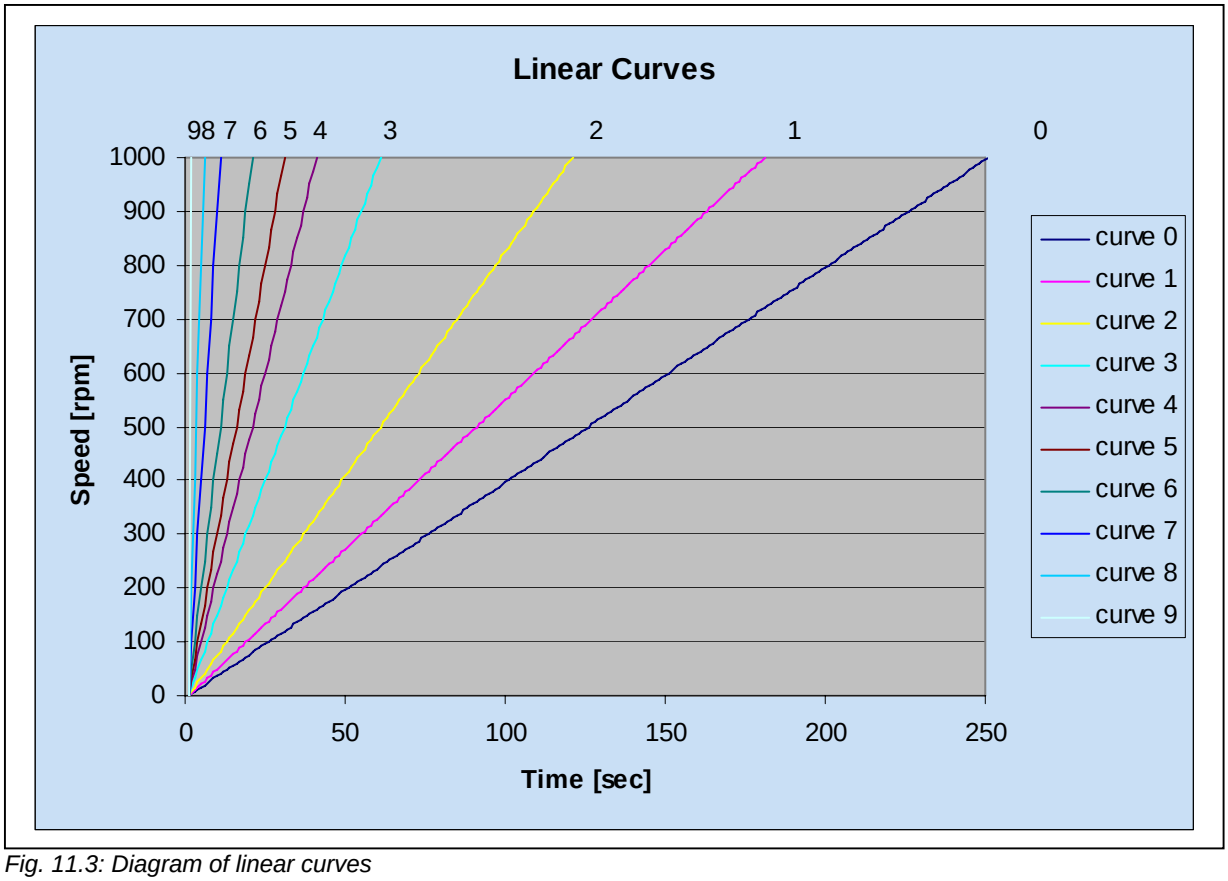


Fig. 11.3: Diagram of linear curves

Linear curve no.	Slope
0	4 [rpm / sec]
1	6 [rpm / sec]
2	8 [rpm / sec]
3	17 [rpm / sec]
4	25 [rpm / sec]
5	33 [rpm / sec]
6	50 [rpm / sec]
7	100 [rpm / sec]
8	200 [rpm / sec]
9	1000 [rpm / sec]

Fig. 11.4: Slope of linear curves

11.3.2 Quadratic Curves

The deceleration curves are inverted images of the acceleration curves and are assigned the same numbers.

Quadratic slope (curves 10 - 19)

Curve 19 is a special case compared to the other curves. The centrifuge accelerates with maximum power. The runtime depends solely on the moment of inertia of the rotor.

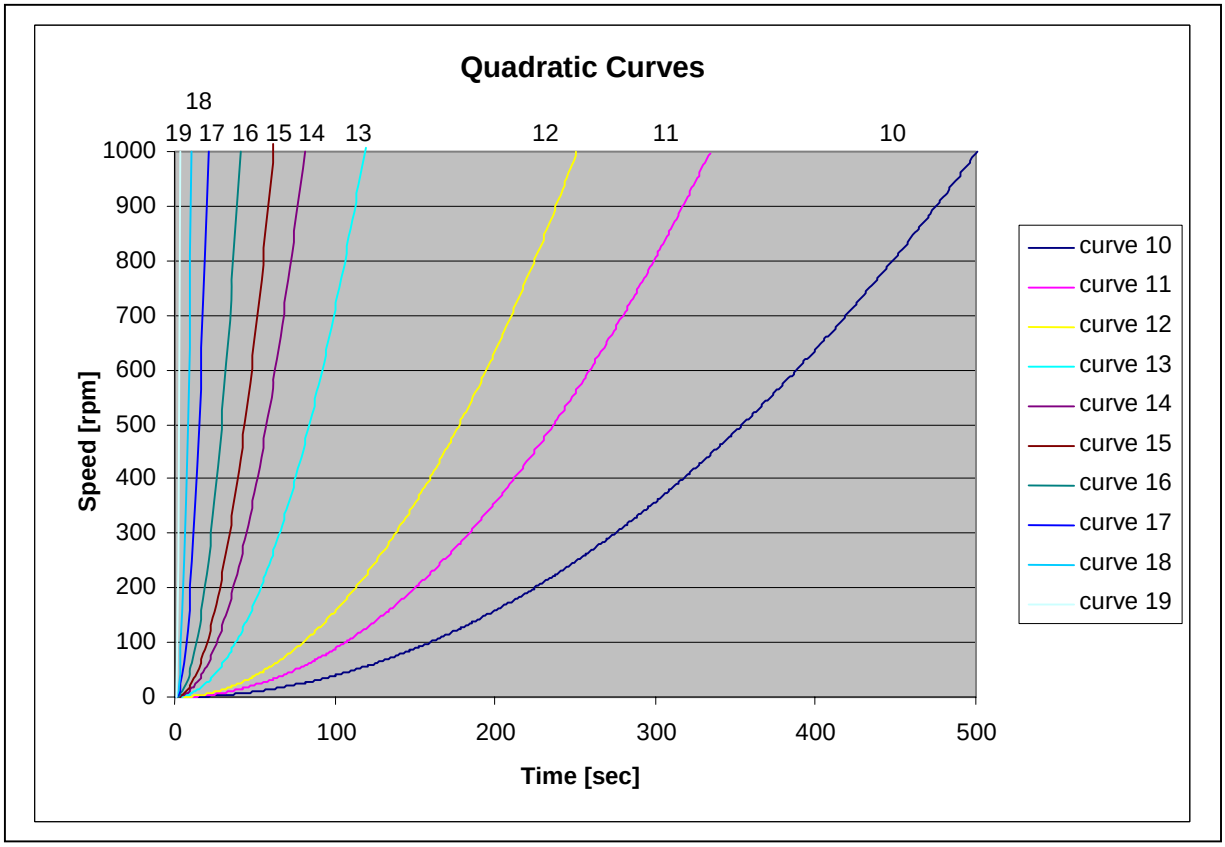


Fig. 11.5: Diagram of quadratic curves

Quadratic curve no.	Time until 1,000 rpm	Slope as of 1,000 rpm
10	500 sec	4 [rpm / sec]
11	333 sec	6 [rpm / sec]
12	250 sec	8 [rpm / sec]
13	118 sec	17 [rpm / sec]
14	80 sec	25 [rpm / sec]
15	60 sec	33 [rpm / sec]
16	40 sec	50 [rpm / sec]
17	20 sec	100 [rpm / sec]
18	10 sec	200 [rpm / sec]
19	2 sec	1000 [rpm / sec]

Fig. 11.6: Slope of quadratic curves

11.4 Formulae - Mathematical Relations

11.4.1 Relative Centrifugal Force (RCF)

The parameters speed, RCF, and the group rotor and radius cannot be specified independently. They are interrelated via the following formula:

$$RCF = 11.18 \times 10\text{-}6 \times r \times n2$$

If two values are given, the third value is determined by the equation. If then the speed or the rotation radius is changed, the resulting RCF will be recalculated. If the RCF is altered, the speed will be adapted accordingly under the consideration of the radius.

r = radius in cm

n = speed in min^{-1}

RCF without dimension

11.4.2 Density

If the density of the liquid is higher than 1.2 g/cm3, the maximum permissible speed of the centrifuge is calculated according to the following formula:

$$n = n_{max} \times \sqrt{(1.2 / Rho)}$$

Rho = density in g/cm3

11.4.3 Speed-Gravitational-Field-Diagram

Additional help can be found in the enclosed speed-gravitational-field-diagram (see fig. 11.7, next page).

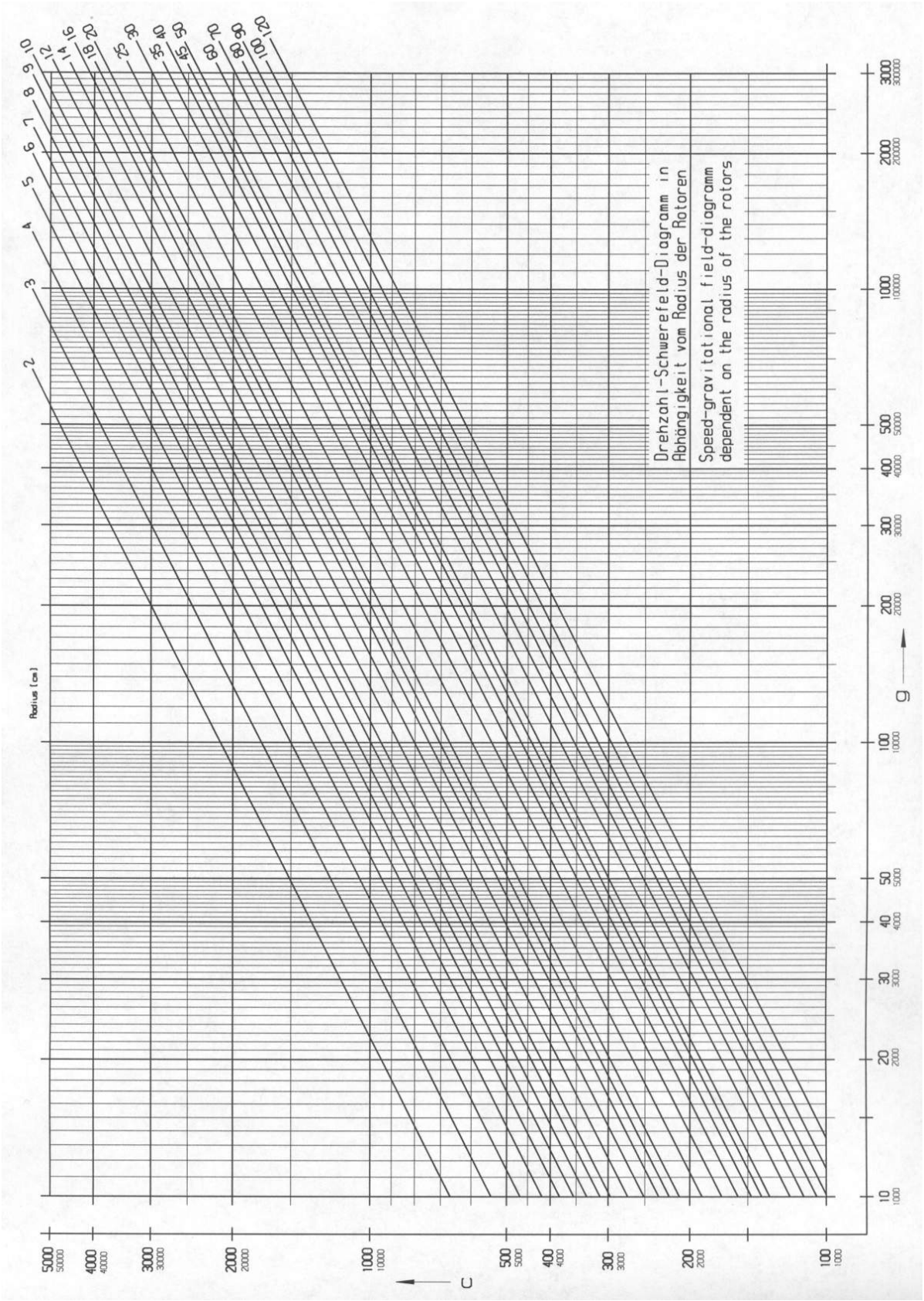


Fig. 11.7: Speed-Grravitational-Field Diagram

11.5 Return Declaration and Declaration of Decontamination

The Return Declaration (page 91) and the Declaration of Decontamination (page 93) serve for maintaining the safety and health of our employees.

Fill out the forms and attach them when returning centrifuges, accessories, and spare parts. Please understand that we cannot carry out any work before we have the declarations.

- Make some copies of the following pages

or

- use the online form download:
  www.sigma-zentrifugen.de → [Service Area] → [Form Download]

!!! Note – this form must be glued onto the outside of the box !!!

Return Declaration

	YES	NO
Decontamination declaration inside:	☐	☐
Unit / component contaminated:	☐	☐
Unit / component unused:	☐	☐

Thank you very much for a brief problem description.
This may reduce the repair costs.

Please make some copies before removing this page!

Declaration of Decontamination by the Operator

Concerning the contamination of centrifuges, accessories, and spare parts.

This declaration may only be filled out and signed by authorized staff.

Repair order no. _____ Date _____

Type of unit _____ Serial no. _____ Year _____
Type of unit _____ Serial no. _____ Year _____
Type of unit _____ Serial no. _____ Year _____
Type of unit _____ Serial no. _____ Year _____

Accessories _____

_____

Are the components free from harmful substances? YES ☐ NO ☐

If not, which substances has the equipment come into contact with?

Names of the substances _____

_____

Remarks: _____

(e.g. to handle with gloves only) _____

General characteristics of the substances

Caustic ☐ Toxic ☐ Corrosive ☐

Explosive ☐ Biologically hazardous ☐ Radioactive ☐

In Combination with which substances can hazardous mixtures develop?

Names of the substances _____

_____

Have the components been cleaned before shipment! YES ☐ NO ☐

Is the equipment decontaminated and not harmful to human health? YES ☐ NO ☐

Prior to repair, radioactive contaminated components must be decontaminated according to the valid regulations for radiation protection!

Legally Binding Declaration

I / we hereby declare that the information on this declaration is correct and complete.

Company/Institute _____

Street _____

Postcode, City _____

Phone _____ Fax _____

Name _____

Date _____

Signature _____ Stamp _____

Resistance Data

Resistant at +20 °C

- no data 1 resistant 2 practically resistant 3 partially resistant 4 not resistant		Concentration	High Density Polyethylene	Polyamide	Polycarbonate	Polyoxymethylene	Polypropylene	Polysulfone	Polyvinyl chloride, hard	Polyvinyl chlorid, weak	Polytetrafluorethylene	Aluminum
Medium	**Formula**	**[%]**	**HDPE**	**PA**	**PC**	**POM**	**PP**	**PSU**	**PVC**	**PVC**	**PTFE**	**AL**
Acetaldehyde	C_2H_4O	40	3	2	4	2	3	4	4	-	1	1
Acetamide	C_2H_5NO	saturated	1	1	4	1	1	4	4	-	1	1
Acetone	C_3H_6O	100	1	1	4	1	1	4	4	-	1	1
Acrylonitrile	C_3H_3N	100	1	1	4	3	3	4	4	4	1	1
Allyl alcohol	C_3H_6O	96	1	3	3	2	2	2	2	4	1	1
Aluminum chloride	$AlCl_3$	saturated	1	3	2	4	1	-	1	-	1	4
Aluminum sulfate	$Al_2(SO_4)_3$	10	1	1	1	3	1	1	1	1	1	1
Ammonium chloride	$(NH_4)Cl$	aqueous	1	1	1	2	1	1	1	1	1	3
Ammonium hydroxide	$NH_3 + H_2O$	30	1	3	4	1	1	2	1	-	1	1
Aniline	C_6H_7N	100	1	3	4	1	2	4	4	4	1	1
Anisole	C_7H_8O	100	3	4	4	1	4	4	2	-	1	1
Antimony trichloride	$SbCl_3$	90	1	4	1	4	1	-	1	-	1	4
Benzaldehyde	C_7H_6O	100	1	3	4	1	1	3	4	4	1	1
Benzene	C_6H_6	100	3	2	4	1	3	4	4	-	1	1
Boric acid	H_3BO_3	aqueous	1	3	1	2	1	-	-	-	1	1
Butyl acrylate	$C_7H_{12}O_2$	100	1	2	4	2	3	4	4	4	1	1
Butyl alcohol, normal	$C_4H_{10}O$	100	1	1	2	1	1	2	2	4	1	1
Calcium chloride	$CaCl_2$	alcoholic	1	4	2	3	1	-	-	4	1	3
Carbon disulfide	CS_2	100	4	3	4	2	4	4	4	4	1	1
Carbon tetrachloride (TETRA)	CCl_4	100	4	4	4	2	4	4	4	4	1	1
Chlorine	Cl_2	100	4	4	4	4	4	4	4	4	1	3
Chlorine water	$Cl_2 \times H_2O$		3	4	4	4	3	-	3	3	1	4
Chlorobenzene	C_6H_5Cl	100	3	4	4	1	3	4	4	4	1	1
Chloroform	$CHCl_3$	100	3	3	4	4	3	4	4	4	1	3
Chromic acid	CrO_3	10	1	4	2	4	1	4	1	-	1	1
Chromic potassium sulfate	$KCr(SO_4)_2 \times 12H_2O$	saturated	1	2	1	3	1	-	1	-	1	3
Citric acid	$C_6H_8O_7$	10	1	1	1	2	1	1	1	1	1	1
Citric acid	$C_6H_8O_7$	50	1	3	1	2	1	-	-	-	1	1
Copper sulfate	$CuSO_4 \times 5H_2O$	10	1	1	1	1	1	1	1	1	1	4
Cyclohexanol	$C_6H_{12}O$	100	1	1	3	1	1	1	1	4	1	1
Decane	$C_{10}H_{22}$	100	-	1	2	1	3	-	-	-	1	1
Diaminoethane	$C_2H_8N_2$	100	1	1	3	1	1	-	3	4	1	1
Diesel fuel	—	100	1	1	3	1	1	-	1	3	1	1
Dimethyl formamide (DMF)	C_3D_7NO	100	1	1	4	1	1	4	3	-	1	1
Dimethyl sulfoxide (DMSO)	C_2H_6SO	100	1	2	4	1	1	4	4	-	1	1
Dimethylaniline	$C_8H_{11}N$	100	-	3	4	2	4	-	-	-	1	1

Resistant at +20 °C

- no data 1 resistant 2 practically resistant 3 partially resistant 4 not resistant		Concentration	High Density Polyethylene	Polyamide	Polycarbonate	Polyoxymethylene	Polypropylene	Polysulfone	Polyvinyl chloride, hard	Polyvinyl chlorid, weak	Polytetrafluorethylene	Aluminum
Medium	**Formula**	**[%]**	**HDPE**	**PA**	**PC**	**POM**	**PP**	**PSU**	**PVC**	**PVC**	**PTFE**	**AL**
Dioxane	$C_4H_8O_2$	100	2	1	4	1	3	2	3	4	1	1
Dipropylene glycol (mono)methyl ether	$C_4H_{10}O$	100	3	1	4	1	4	4	4	4	1	1
Ethyl acetate	$C_4H_8O_2$	100	1	1	4	1	1	4	4	4	1	1
Ethylene chloride	$C_2H_4Cl_2$	100	3	3	4	1	3	4	4	4	1	1
Ferrous chloride	$FeCl_2$	saturated	1	3	1	3	1	1	1	1	1	4
Formaldehyde solution	CH_2O	30	1	3	1	1	1	-	-	-	1	1
Formic acid	CH_2O_2	100	1	4	3	4	1	3	3	1	1	1
Furfural	$C_5H_4O_2$	100	1	3	3	2	4	-	-	-	1	1
Gasoline	C_5H_{12} - $C_{12}H_{26}$	100	2	1	3	1	3	3	2	-	1	1
Glycerol	$C_3H_8O_3$	100	1	1	3	1	1	1	1	2	1	1
Heptane, normal	C_7H_{16}	100	2	1	1	1	2	1	2	4	1	1
Hexane, n-	C_6H_{14}	100	2	1	2	1	2	1	2	4	1	1
Hydrogen chloride	HCl	5	1	4	1	4	1	1	1	-	1	4
Hydrogen chloride	HCl	concentrated	1	4	4	4	1	1	2	3	1	4
Hydrogen peroxide	H_2O_2	3	1	3	1	1	1	1	1	-	1	3
Hydrogen peroxide	H_2O_2	30	1	4	1	4	1	1	1	-	1	3
Hydrogen sulfide	H_2S	10	1	1	1	1	1	1	1	3	1	1
Iodine, tincture of	I_2		1	4	3	1	1	-	4	4	1	1
Isopropyl alcohol	C_3H_8O	100	1	1	1	1	1	1	1	4	1	2
Lactic acid	$C_3H_6O_3$	3	1	3	1	2	1	1	2	-	1	1
Magnesium chloride	$MgCl_2$	10	1	1	1	1	1	1	1	1	1	1
Mercuric chloride	$HgCl_2$	10	1	4	1	3	1	1	1	1	1	4
Mercury	Hg	100	1	1	1	1	1	1	1	3	1	3
Methyl acetate	$C_3H_6O_2$	100	1	1	4	2	1	-	4	4	1	1
Methyl alcohol	CH_4O	100	1	2	4	1	1	3	1	3	1	1
Methyl benzene	C_7H_8	100	3	1	4	1	3	4	4	4	1	1
Methyl ethyl ketone (MEK)	C_4H_8O	100	1	1	4	1	1	4	4	4	1	1
Methylene chloride	CH_2Cl_2	100	4	3	4	3	3	4	4	4	1	1
Mineral oil	—	100	1	1	1	1	1	1	1	-	1	1
Nitric acid	HNO_3	10	1	4	1	4	1	1	1	-	1	3
Nitric acid	HNO_3	100	4	4	4	4	4	-	4	-	1	1
Nitrobenzene	$C_6H_5NO_2$	100	3	4	4	3	2	4	4	4	1	1
Oleic acid	$C_{18}H_{34}O_2$	100	1	1	1	2	1	-	1	-	1	1
Oxalic acid	$C_2H_2O_4$ x $2H_2O$	100	1	3	1	4	1	1	1	1	1	1
Ozone	O_3	100	3	4	1	4	3	1	1	-	1	2
Petroleum	—	100	1	1	3	1	1	1	1	3	1	1
Phenol	C_6H_6O	10	1	4	4	4	1	4	1	3	1	1
Phenol	C_6H_6O	100	2	4	4	4	1	3	4	3	1	1
Phosphoric acid	H_3PO_4	20	1	4	2	4	1	-	-	-	1	4
Phosphorus pentachloride	PCl_5	100	-	4	4	4	1	-	4	4	1	1

Resistant at +20 °C

- no data 1 resistant 2 practically resistant 3 partially resistant 4 not resistant		Concentration	High Density Polyethylene	Polyamide	Polycarbonate	Polyoxymethylene	Polypropylene	Polysulfone	Polyvinyl chloride, hard	Polyvinyl chlorid, weak	Polytetrafluorethylene	Aluminum
Medium	**Formula**	**[%]**	**HDPE**	**PA**	**PC**	**POM**	**PP**	**PSU**	**PVC**	**PVC**	**PTFE**	**AL**
Potassium hydrogen carbonate	$CHKO_3$	saturated	1	1	2	1	1	-	-	-	1	4
Potassium hydroxide	KOH	30	1	1	4	3	1	1	1	1	1	4
Potassium hydroxide	KOH	50	1	1	4	3	1	1	1	1	1	4
Potassium nitrate	KNO_3	10	1	1	1	1	1	-	-	-	1	1
Potassium permanganate	$KMnO_4$	100	1	4	1	1	1	-	1	-	1	1
Pyridine	C_5H_5N	100	1	1	4	1	3	4	4	4	1	1
Resorcinol	$C_6H_6O_2$	5	1	4	2	3	1	4	2	-	1	2
Silver nitrate	$AgNO_3$	100	1	1	1	1	1	1	1	1	1	4
Sodium bisulfite	$NaHSO_3$	10	1	1	2	4	1	-	-	-	1	1
Sodium carbonate	Na_2CO_3	10	1	1	1	1	1	-	-	-	1	3
Sodium chloride	NaCl	30	1	1	1	1	1	1	1	1	1	3
Sodium hydroxide	NaOH	30	1	1	4	1	1	1	1	1	1	4
Sodium hydroxide	NaOH	50	1	1	4	1	1	1	1	-	1	4
Sodium sulfate	Na_2SO_4	10	1	1	1	1	1	1	1	1	1	1
Spirits	C_2H_6O	96	1	1	1	1	1	1	1	3	1	1
Styrene	C_8H_8	100	4	1	4	1	3	-	4	4	1	1
Sulfuric acid	H_2SO_4	6	1	4	1	4	1	1	1	-	1	3
Sulfuric acid	H_2SO_4	fuming	4	4	4	4	4	4	4	4	1	3
Tallow	—	100	1	1	1	1	1	-	1	1	1	1
Tetrahydrofuran (THF)	C_4H_8O	100	3	1	4	1	3	4	4	4	1	1
Tetrahydronaphthalene	$C_{10}H_{12}$	100	3	1	4	1	4	4	4	4	1	1
Thionyl chloride	Cl_2SO	100	4	4	4	2	4	4	4	4	1	3
Transformer oil	—	100	1	1	3	3	1	1	1	-	1	1
Trichloroethane	$C_2H_3Cl_3$	100	3	3	4	2	4	4	4	4	1	4
Urea	CH_4N_2O	10	1	1	1	1	1	-	-	-	1	1
Urine	—	100	1	1	1	1	1	-	1	1	1	2
Vinegar	$C_2H_4O_2$	10	1	4	1	1	1	1	1	1	1	1
Vinegar	$C_2H_4O_2$	90	1	4	4	4	1	3	1	4	1	1
Wax	—	100	-	1	1		1	-	-	-	1	1
Wines	—	100	1	1	1	2	1	1	1	1	1	4
Xylene	C_8H_{10}	100	3	1	4	1	4	4	4	4	1	1
Zinc chloride	$SnCl_2$	10	1	4	2	2	1	-	-	-	1	4

Konformitätserklärung

(73/23/EWG; 89/336/EWG; 98/37/EWG)

Declaration of Conformity

(73/23/CEE; 89/336/CEE; 98/37/CEE)

Déclaration de conformité

(73/23/CEE; 89/336/CEE; 98/37/CEE)

Die nachfolgend bezeichnete Maschine wurde in Übereinstimmung mit den Richtlinien 2006/42/EG; 2006/95/EG und 2004/108/EG hergestellt und geprüft.
The following machine is manufactured and tested in compliance with directives 2006/42/EG; 2006/95/EG und 2004/108/EG.
La machine désignée ci-dessous est produit et examiné conforme aux directives 2006/42/EG; 2006/95/EG und 2004/108/EG

Bezeichnung der Maschine: Machine: Désignation de la machine:	Laborzentrifuge Laboratory Centrifuge Centrifugeuse de laboratoire
Maschinentyp : Type: Type de la machine:	4 – 16K
Bestell Nr. : Part No.: Réf. usine:	10469, 10470, 10471, 10472, 10473, 10474, 10475 10476, 10477, 10478, 10479
Normen: Standards: Normes :	EN 61010-2-020:2007 EN 61000-3-2:2006; EN 61000-3-3:1995, A2:2005 EN 61326-1:2006

Sigma Laborzentrifugen
An der Unteren Söse 50
D-37520 Osterode

15.09.2008

Geschäftsführer
Managing Director
Directeur Gérant

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

TÜV SÜD Management Service

CERTIFICATE

The Certification Body
of TÜV Management Service GmbH
certifies that

Sigma Laborzentrifugen GmbH
An der Unteren Söse 50
D-37520 Osterode

has established and applies
a Quality Management System for

**Development, Production and Sales
of Laboratory Centrifuges**

An audit was performed, Report No. **70012917**
Proof has been furnished that the requirements
according to

ISO 9001: 2000

are fulfilled. The certificate is valid until **2009-01-25**
Certificate Registration No. **12 100 18422/01 TMS**

Munich, 2006-02-02

QMS-TGA-ZM-07-92

12 Index

Info

Pay attention to the detailed Operating Manual, especially to the safety instruction in chapter 3!

1 Mains power switch
2 Stop key
3 Lid key
4 Lid
5 Display
6 Start key
7 Function knob

Total view of the centrifuge

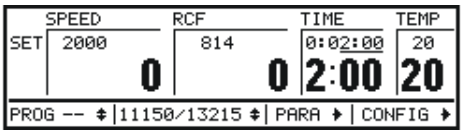
8 Name plate
9 Mains power input
10 Equipotential bonding screw

Rear view of the centrifuge

1. Before the initial start-up, please ensure that your centrifuge is properly set up and installed (see chapter 5).
2. Press the mains power switch on the right side of the front to switch on the centrifuge.
3. Open the lid and install the rotor according to the detailed operating instructions (see chapter 6.2.2).
4. Close the lid.

5. Enter run parameters:

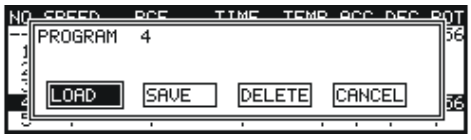
Spincontrol Comfort



Manual Mode

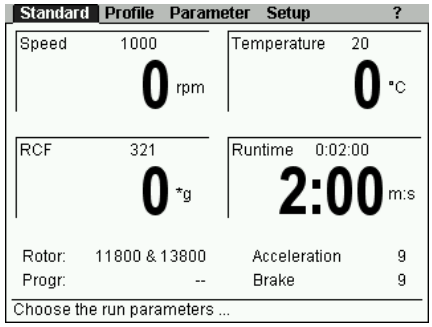
- Select a parameter by pressing or turning the function knob. The selected field will be inverted.
- Press the function knob in order to activate the modification mode. "SET" and the selected area will be inverted.
- Turn the function knob until the desired value is displayed.
- Press the function knob to confirm the selected value and to quit the modification mode. "SET" and the selected area will be deactivated.

Program Mode



- Select the program field ("PROG-") and confirm the selection.
- Turn the knob. As a result, all of the programs that have already been saved and the current ("--") setting will be displayed one after the other.
- Select a program and confirm the selection. A dialog box will be displayed.
- Select "LOAD" and confirm the selection.

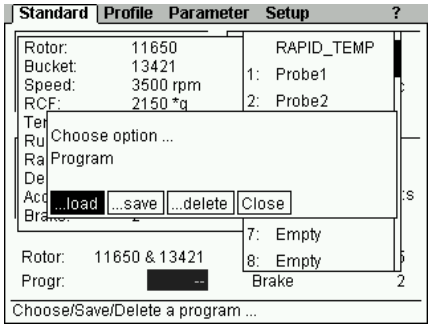
Spincontrol Professional



Manual Mode

- Turn the function knob in order to select a field. The set value of the field starts to flash.
- Press the function knob. The display starts to flash and the modification mode is active.
- Turn the function knob in order to modify the set value of the selected field.
- Press the function knob again to confirm the entry and to quit the modification mode.

Program Mode



- Select the option "Progr" from the “Standard” menu and confirm the selection. The program selection list will be displayed .
- Select the desired program from the list and confirm the selection.

6. Press the start key to start a centrifugation run.

7. Parameter values can be modified during the centrifugation run as described under "Manual Mode" in this document.

8. The centrifugation run can be interrupted at any time by pressing the stop key.