HERMLE **Z 287 A**

User Manual

HERMLE
LABORTECHNIK

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1. PRODUCT DESCRIPTION

1.1 Safety Instructions

This symbol indicates safety instructions and points of potential dangerous situations. Before using the centrifuge for the first time, please read the operating manual.

Failure to follow these instructions can result in personal injury and/or property damage:

Intended use includes the observation of all instructions, in the instruction manual, and administering inspection and maintenance.

1.2 Intended Purpose

This HERMLE centrifuge and its accessories are an in vitro diagnostic medical device within the meaning of the In Vitro Diagnostic Medical Devices Regulation (EU) 2017/746. This centrifuge is intended for the separation of mixtures of substances of different densities, in particular for the preparation and processing of samples from the human body in the context of an in vitro diagnostic application, in order to enable the intended use of the in vitro diagnostic medical device.

HERMLE centrifuges are intended exclusively for use in closed rooms under supervision and for operation by trained specialist personnel.

Only original HERMLE rotors and buckets and other accessories may be used. Any other use or use beyond this is considered improper use. HERMLE Labortechnik GmbH is not liable for any resulting damage. The contents of the operating instructions must be observed.

1.3 Contraindication

The HERMLE centrifuge and its accessories are intended exclusively for the above-mentioned purpose and must not be used to determine any measured values. After centrifugation, no components of human origin may be implanted or administered back into the body.

1.4 Brief Description

The unit type Z 287 A is a non-refrigerated universal centrifuge, which we offer in two voltage variations 230V or 120V.

The centrifuge can be used with swing-out rotors and angle rotors.

All parameters are accessible via buttons and selected with the control field. All pre-selected and current values will be shown permanently on the LCD-display.

The centrifuge is powered by a maintenance-free induction motor.

Detailed technical data are in Table 1: Technical Data, (see APPENDIX P.II).

1.5 Delivery Package

- 1 Centrifuge Z 287 A
- 1 Operating Manual Z 287 A
- 1 Rotor key
- 1 Power Cord

Rotor(s) / Accessories will be packaged separately.

1.6 Installation of the Centrifuge

1.6.1 Unpacking the Centrifuge

Model **Z 287 A** is supplied in a carton.

Remove the strap retainer, open the carton and remove the centrifuge. The instruction manual must be kept with the centrifuge at all times!

1.6.2 Space Requirements

The centrifuge should be installed on an even, vibration free and solid surface, if possible on a laboratory cabinet / table or some other solid vibration free surface.

During centrifugation, the centrifuge must be placed in a way, that there is a minimum space of 30 cm / 12 in on each side of the unit, according to EN 61010-2-020 standards.

Do not place the centrifuge next to a window or a heater where it could be disposed to excessive heat, as the performance of the unit is based on an ambient temperature of 23°C/73.4°F.

1.6.3 Installation

Follow these steps:

- Check whether the power supply corresponds with the one specified on the manufacturer's rating label, mounted on the rear panel.
- The line voltage circuit breaker is max. 10 A (Type K), slowly release for commonly used instruments.
- In case of emergency, there must be an emergency switch off installed outside of the room, in order to disconnect the power supply from the unit.
- Connect the centrifuge with the mains.
- (The socket for the power cord must be easy to reach, respectively easy to disconnect).
- Switch on, by using the mains power switch (2.2).
- Open the lid, by using the button LID.
- Remove the transport securing device of the motor

1.7 Signs- and Indication of the Centrifuge

1.7.1 Product Nameplate (Example)

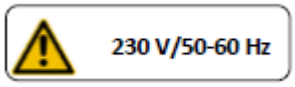
Company Address:	Hermle Labortechnik GmbH, Siemensstr. 25, D-78564 Wehingen
IVD	In-Vitro-Diagnostic Medical Device
TYPE:	Type Designation of the Product
REF:	Order No. of the Product
SN:	Serial No. of the Product
	Manufacturer
	Date of Manufacture
MAX. Drehzahl:	Max. Speed Allowed of the Unit
KIN. EN.:	Max. Kinetic Energy with Corresponding Rotor
U/I/f:	Allowable Voltage / Max. Current / Frequency
P:	Electrical Input Power
	Operating Manual Indication
	Labeling, Standards and Guidelines
	Instructions for Disposal
	RoHS-Compliance Label

1.7.2 Warning and Information Signs

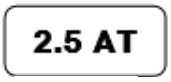
Four carriers must be used at all times on four places swing out rotors or damage will occur to the centrifuge. Such damage will not be covered under the product warranty

Attention! Check the fastening of the rotor nut before each run

Take off mains plug before opening the housing or the emergency release



Power Input

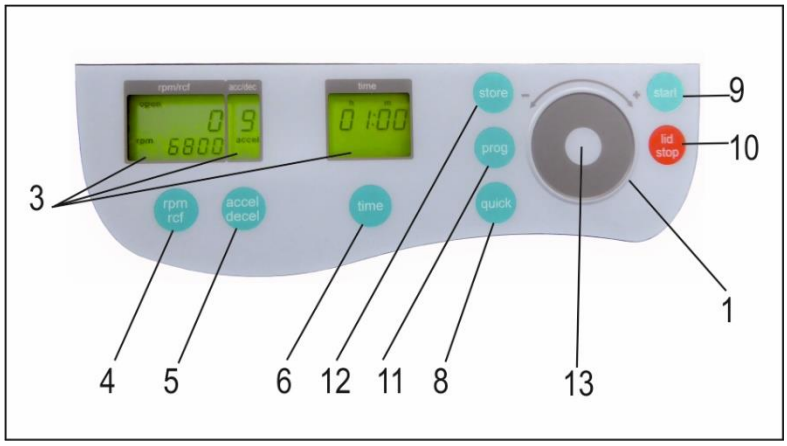


Fuse 2,5 AT

Direction of Rotation – clockwise rotation for the rotor drive

Biohazard Warning

1.8 Operating and Display Elements



1	**control field**	Run Parameters
3	**LCD**	Control Panel Display
4	**rpm/rcf**	Speed/ g-force
5	**accel/decel**	Acceleration / Deceleration Intensity
6	**time**	Centrifugation Time
8	**quick**	Short Running
9	**start**	Start Centrifugation
10	**lid/stop**	Lid Release / Stop Centrifugation
11	**prog**	Retrieving Stored Programs
12	**store**	Program Store
13	**LED light**	Shows the status of the centrifuge

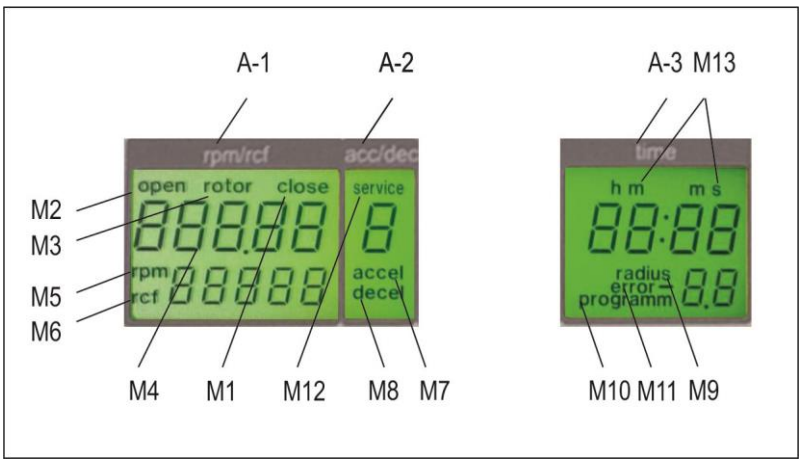
1.8.1 LED light

The LED light indicates the current operation state of the centrifuge. The following table shows all operating states.

Color of LED light	Operating state
Green	Run complete, lid is closed
Yellow	Lid opened, no sleep mode
Red flashing fast	Error message
Red flashing slow	Centrifuge runs
Yellow flashing slow	Sleep mode
Red – Green flashing slow	Standard settings menu

1.8.2 LCD-Display

The following picture shows the individual elements of the LCD-Display.



Display Fields:

A-1	Display Field – "rpm/rcf"
A-2	Display Field – "acc/dec"
A-3	Display Field– "time"

Messages/Logo of the Display Field:

M1	„close“	M8	„decel“
M2	„open“	M9	„radius“
M3	„rotor“	M10	„programm“
M4	Rotor-Nr.	M11	„error“
M5	„rpm“	M12	„service”
M6	„rcf“	M13	h m s
M7	„accel“		

Indication:

After switching on the centrifuge, the display "rpm/rcf"(A-1) shows the current software version and after the model type (example with 207M).

Figure 1

1.8.3 Danger, Precautions and Warranty

This device may only be operated by a trained professional. Carefully, read the operating manual and be familiar with the functions of the device.

To protect people and the environment, the following precautions must be taken:

- During centrifugation, the presence of people and the arrangement of hazardous materials is strictly prohibited, within 30 cm/12 in around the centrifuge, according to the regulations of EN 61010-2-020.
- The HERMLE **Z 287 A** is non "explosion-proof" and must not be operated in explosion-endangered areas or locations. Centrifugation of flammable, explosive, radioactive, or such substances, which chemically react with high energy, is strictly prohibited. If used in such environment, this is at the users own expense.
- Never spin toxic or pathogenic material without adequate safety precautions, i.e. centrifugation of tubes with or without defective hermetic sealing, is strictly prohibited. The user is obliged to perform appropriate disinfection procedures, in case dangerous substances have contaminated the centrifuge and/or its' accessories. When centrifuging infectious substances, always pay attention to the General Laboratory Precautions. If necessary, contact your safety officer!
- It is prohibited to run the centrifuge, with rotors not manufactured for this unit.
- Under no circumstances open the lid of the centrifuge, while the rotor is still running or rotating with a speed of > 2m/s.

1.8.4 Following Rules Must Strictly be Adhered To:

- Do not operate the centrifuge if not installed correctly.
- Do not operate the centrifuge when dismounted (e.g. without housing).
- Do not run the centrifuge, if mechanical or electrical assembly groups have been tampered with, by unauthorized personnel.
- Do not use accessories such as rotors and adapters, that are not approved by HERMLE Labortechnik GmbH, except commercially available centrifuge tubes, made of glass or plastic.
- Do not spin extremely corrosive substances, as they may cause material damages and impair mechanical resistance.
- Do not operate the centrifuge with rotors or adapters, which show any signs of corrosion or mechanical damage.

The manufacturer is responsible for safety and reliability, of the centrifuge, only if:

- The unit is operated in accordance to this instruction manual.
- Modifications, repairs or other adjustments are performed by HERMLE-authorized personnel and the electrical installation of the related location corresponds to the IEC-regulations.

1.8.5 Warranty

The centrifuge has been subjected to thorough testing and quality control. In the unlikely case of any manufacturing faults occurring, the centrifuge and rotors are covered by warranty, for a period of two years, from date of delivery. This warranty becomes invalid in any case of mishandling, damage and/or negligence and further in any case of usage of inappropriate spare parts and / or accessories or unauthorized modification of the unit.

Technical modification rights are reserved, by the manufacturer, in regards to technical improvement!

1.9 Basic Adjustment

1.9.1 Access to the Mode: "Standard settings"

While starting this model, the following basic settings can be performed:

- Signal Turn On / Off
- Keybord Sound On / Off
- Sleep Mode On / Off

The following operating data can be retrieved in this menu:

- Number of Starts
- Operating Hours of Centrifuge
- Operating Hours of Motor
- Software Version
- Error List
- Function of the Imbalance Switch
- Operation of Keyboard
- Hardware Version
- Intermediate Circuit Voltage in Volt
- Display Tests

Open the centrifuge lid and shut off the main switch. Now switch on again the main switch. For approximately 3 seconds the software version and the model type will be shown in the display (see Figure 1). Press during this time the keys "time" (6) and "lid/stop" (10) simultaneously. As a result, a display test is administered for approx. 3 seconds. All possible indications will appear at the same time (see Figure 2). The LED light is flashing alternately with green and red color.

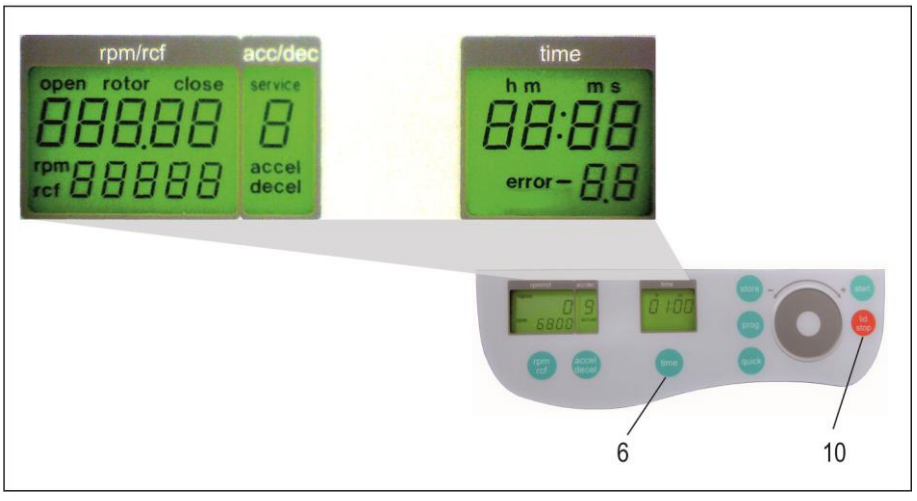


Figure 2

ATTENTION:

- **The normal program mode can be changed back again by switching off the centrifuge, for a short period!**
- **All changed settings must be confirmed by the key “store” or “start” (9). A confirmation screen will appear with the word, “store”, in the display “rpm/rcf” (A-1) - Only then the pre-selections are valid!**

1.9.2 Signal Turn On / Off

Proceed as illustrated, under point 1.9.1, to enter this program mode, press the key; "accel/decel" (5). In the display, "accel/decel" (A-2) flashes the word, "service". Select the letter, "L" with the control field (1). As a result, appearing in the display "rpm/rcf" (4), are the words, "On Sound". By pressing the key, "rpm/rcf" (4), the word "On" flashes, and the sound can be switched off with the control field (1), (see Figure 3).

After the settings have been stored by user, the normal program mode can be changed back again by switching off the centrifuge, for a short period.

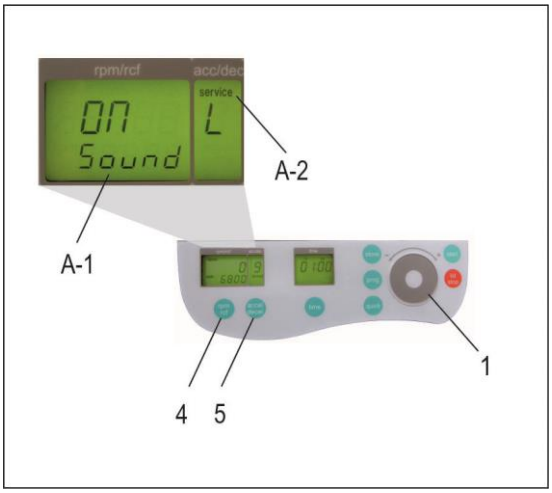


Figure 3

1.9.3 Keyboard Sound Turn On / Off

Proceed as illustrated, under point 1.8.2, to enter this program mode, press the key, "accel/decel" (5). In the display, "accel/decel" (A-2) flashes the word, "service". Select the letter "b" with the control field (1). As a result, appearing in the display, "rpm/rcf" (A-1), the word "ON/BEEP". After pressing the key, "rpm/rcf" (4), turn the keyboard sound (On) or (Off), with the rotorary field (1), (see Figure 4).

After the settings have been stored by user, the normal program mode can be changed back again by switching off the centrifuge, for a short period.

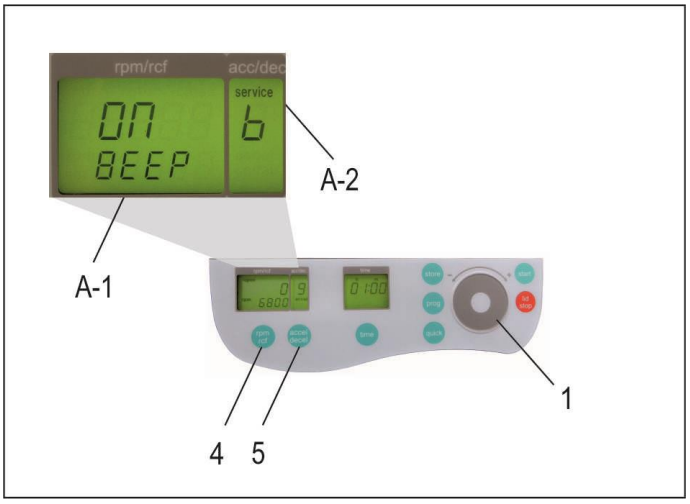


Figure 4

1.9.4 Sleep Mode On / Off

After not using the centrifuge for 5 minutes with opened lid, the display automatically switches off. The display is switching off and the LED light is flashing slowly with yellow color. By pressing any bottom, it switches on again. Proceed as illustrated, under point 1.8.2, to enter this program mode, press the key, "accel/decel" (5). In the display, "accel/decel" (A-2) flashes the word, "service". Select the letter "I" with the control field (1). As a result, appearing in the display, "rpm/rcf" (A-1), the word "SLEEP". After pressing the key, "rpm/rcf" (4), turn the sleep mode function (On) or (Off), with the rotorary field (1).

After the settings have been stored by user, the normal program mode can be changed back again by switching off the centrifuge, for a short period.

1.9.5 Retrieving Operation Data

In the function, "Basic Adjustments" the operating data, of the centrifuge, can be retrieved.
Please proceed as described, under point 1.9.1, to enter this program mode.

Press the key "accel/decel" (5). In the display, "accel/decel" (A-2) flashes the word, "service".

With the control field (1) the following information can be retrieved:

A = Previous Starts of the Centrifuge
H = Previous Operating Hours
h = Running Time of the Motor
S = Software Version
E = List of Previous Error Messages
F = Function of the Imbalance Sensor
P = Operating of Keyboard
d = Hardware-Version
U = Intermediate Circuit Voltage in Volt

The list of the last 99 error messages can be looked over by pressing the key “rpm/rcf” (4) and leaf through it with the control field (1). The respective error codes appear in the display “rpm/rc” (A-1) (see Figure 5). The first two numbers indicate the appeared errors ongoing from 00 to 99, the last two numbers indicate the error code. Please refer to, Table 5: Error Messages, (see APPENDIX IV).

Switch off the centrifuge, to return to the normal program mode.

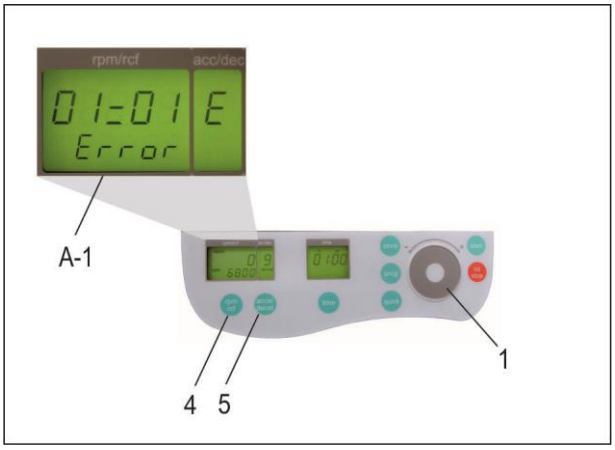


Figure 5

2. OPERATING

2.1 Mounting and Loading the Rotor

2.1.1 Installation of Rotors

Clean the drive shaft and the rotor shaft with a clean, grease-free piece of cloth. Place the rotor onto the drive shaft, (see Figure 6). Please be sure that the rotor is fully installed onto the motor shaft.

Figure 6

Figure 7

Hold the rotor with one hand and secure the rotor to the shaft, by turning the rotor nut clockwise (see Figure 7)

Some rotors have to be locked with the rotor key. Therefore, hold the rotor with one hand and secure it by turning the fixing nut clockwise (see Figure 8). The rotor key is supplied with the respective rotor.

Figure 8

ATTENTION:

For safety, always ensure that the rotor nut is tightened before each run!

Do not operate the centrifuge with rotors or adapters that show any signs of corrosion or mechanical damage.

Do not operate with extremely corrosive substances, which could damage the rotor and the centrifuge.

2.1.2 Loading the Angle Rotor

Rotors must be loaded symmetrically and with equal weight, (see Figure 9 and 10). The adapter may only be loaded with the appropriate vessels. The weight differences between the filled vessels should be kept as low as possible. Therefore, we recommend to weigh with a balance. This reduces the wear of drive and the acoustic operating noise.

Each rotor indicates what the maximum capacity is per hole. (It is allowed to operate e.g. a 24-place-rotor with 2 or 4 loaded tubes only, but the loaded borings must be opposite of each other).

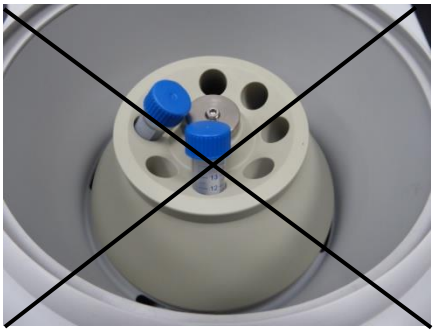


Figure 9: WRONG

Figure 10: RIGHT

2.1.3 Loading and Overloading of Rotors

All approved rotors are listed with the maximum speed and maximum filling weight in, Table 2: Permissible Net Weight, (see APPENDIX P. III).

The maximum load permitted for the rotor is determined by the manufacturer, as well as the maximum speed allowed for this rotor (see label on rotor), must not be exceeded. The liquid the rotors are loaded with, should have a max. homogeneous density of 1.2 g/ml or less when the rotor is running at maximum speed.

In order to spin liquids with a higher density, the speed has to be reduced, according to the following formula:

$$\text{Reduced speed } n_{red} = \sqrt{\frac{1{,}2}{higher\ density}} \times \text{max. speed } (n_{max}) \text{ of the rotor}$$

Example:

$$n_{red} = \sqrt{\frac{1{,}2}{1{,}7}} \times 4.000 = 3.360 \text{ rpm}$$

If In case of any questions, please contact the manufacturer!

2.1.4 Rotor Identification

The model Z 287 A comes with an automatic rotor identification system. Place the rotor on the motor shaft as described in 2.1.1 and close the centrifuge lid. The centrifuge immediately recognizes the rotor and shows its item number on the display.

2.1.5 Removing the Rotor

Untighten the rotor nut completely, counter-clockwise. Lift the rotor vertically out of the centrifuge (see Figure 7 and Figure 8).

2.2 Power Switch and Fuse

The power switch and the fuse are located on the back side of the centrifuge

Figure 11

In case of a faulty fuse, first disconnect the power cord from the mains supply.
Then open the fuse drawer and replace the fuse with 2.5 AT.

If the fuse triggers again after mains connection, please search the cause of the error and eliminate it.

ATTENTION:

After turning on the power switch, open and close the centrifuge lid first, before starting the centrifuge.

2.3 Lid

2.3.1 Lid Release

After the run, properly close the lid of the centrifuge, appearing in the display, "rpm/rcf"(A-1) with the word, "close" (M1). At the same time the actual rotor type “221.59” is shown in the display. By pressing the key, "lid/stop" (10), the lid of centrifuge can be released. As soon as the lid is completely released, the word, "open" (M2) appears. The lid of the centrifuge is now able to be opened.

For all number marked text, please refer to Figure 12.

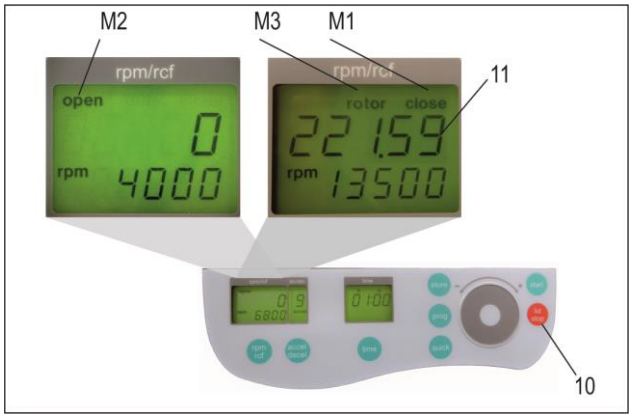


Figure 12

2.3.2 Lid Lock

The lid must only be closed slightly. After closing the lid, the word "open" (M2) will no longer be displayed. As a sign that the centrifuge is ready for starting, appearing in the display, "rpm/rcf"(A-1), the word "close" (M1). Simultaneously, the word "rotor" (M3) appears, as well as the code number of the rotor, which is in the centrifuge, along with all rotor specific data, for example: max. speed, acceleration etc., are available.

Please refer to Figure 12.

ATTENTION:

Before closing the lid, please check if the rotor is tightened.

2.4 Pre-Selection

2.4.1 Pre-Selection of Speed and RCF-Value

By Selecting the key, "rpm/rcf" (4), pre-selection is activated. By pressing the key once, the word "rpm" (M5) flashes. By pressing the key again, the pre-selection of the centrifugal forces can be chosen. The flashing word, "rcf" (M6), will appear.

The desired values can be selected, with the control field (1). In the display (A-1), the regulated value is shown permanently: before, during and after the run.

This pre-selected value will be stored, as long as a new pre-selection is made.

For all number marked text, please refer to Figure 13.

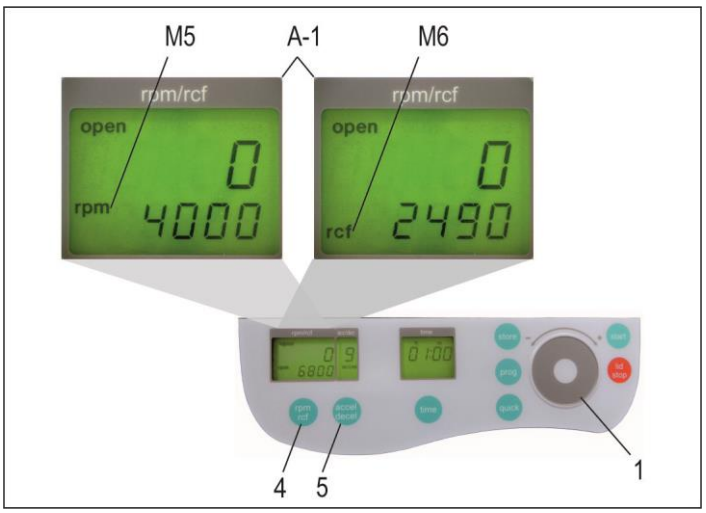


Figure 13

As long as the centrifuge lidis opened, the speed is adjustable between 200 rpm and the maximum revolution of the centrifuge.

If the centrifuge lid is closed, the speed can only be pre-selected up to the maximum permissible revolution of the selected rotor type. It is the same with the pre-selection of the RCF-Value. The setting range is between 20 xg and the maximum permissible centrifugal force of the rotor.

See Table 3: Max. Speed and RCF-Values for Permissible Rotors, (see APPENDIX P. III). All important values are listed on this table.

ATTENTION:

Please notice the maximum permissible revolutions of the test tubes (Producer Indication)! See also chapter 3.1.6

2.4.2 Pre-Selection of Running Time

The running time can be pre-selected in 3 different ranges: from 10 seconds up to 99 hours 59 minutes.

1. Range from: 10 seconds up to 59 minutes 50 seconds, in steps of 10 seconds
2. Range from: 1 hour up to 99 hours 59 minutes, in steps of 1 minutes
3. Range: Continuous Run "cont", can be interrupted by the key, "stop" (10).

- The running time can be pre-selected, with the lid opened or closed.
- To activate the setting of the running time, press the key "time" (6).
- In the display, "time" (A-3) flashes the indication: "m : s" or "h : m", depending on the previous setting.

To set the desired value, use the control field (1). After exceeding 59 min 50 sec, the indication changes automatically to, "h : m". After exceeding 99 hours 59 min, the word "cont" appears in the display, "time" (A-3).

The continuous run can only be interrupted by pressing the key, "stop" (10). The time counts down, as soon as the set speed is reached.

For all number marked text, please refer to Figure 14.

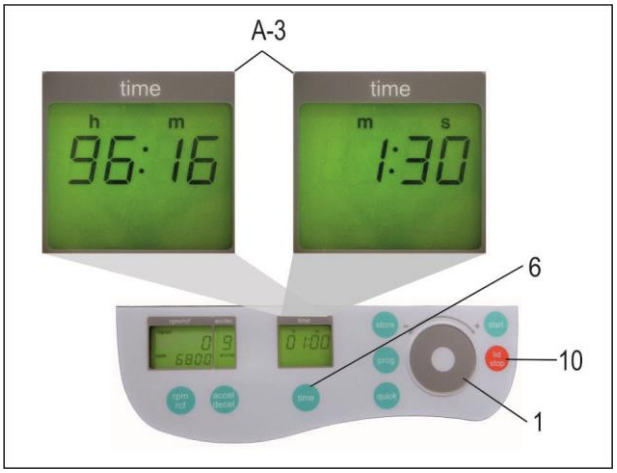


Figure 14

2.4.3 Pre-Selection of Brake Intensity and Acceleration

Selecting the key, "accel/decel" (5), this function is activated.

By pressing the key once, the word "accel" (M7) flashes, in the display "accel/decel" (A-2). The desired acceleration can be pre-selected, with the control field (1). The value 0 is equivalent to the lowest acceleration and the value 9 is equivalent to the highest acceleration.

By pressing the key "accel/decel" (5) twice, in the display "accel/decel" (A-2), indicates the word "decel" (M8). Now the desired brake intensity can be pre-selected, with the control field (1). The value 9 is equivalent to the shortest possible brake time and the value 0 to longest possible brake time.

For all number marked text, please refer to Figure 15.

See Table 4: "Acceleration and Deceleration Times", (APPENDIX P. IV). This table shows the acceleration and deceleration times, for the acceleration and deceleration stages 0 and 9, for permissible rotors.

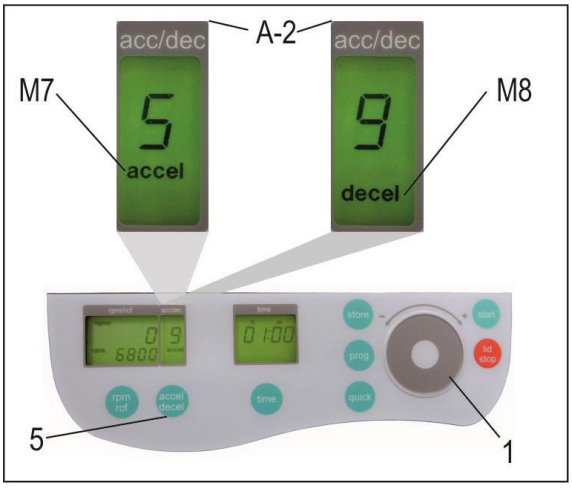


Figure 15

2.5 Radius Correction

If adapters or reducers are being used, it could change the centrifugal radius of the respective rotor. In that case, the radius can be corrected manually.

Please proceed as follows:

First close the centrifuge lid and press afterwards the key "time" (6) and the key "prog" (11) at the same time and hold down.

In the display, "time" (A-3), appears the word "radius" (M9). With the control field (1), pre-select the respective radius correction, (see Table 3, APPENDIX P. IV), in steps of 0.1cm.

As soon as the radius correction is set, the word "radius" (M9) appears. This text remains visible until the radius correction is set back to 0.

For all number marked text, please refer to Figure 16.

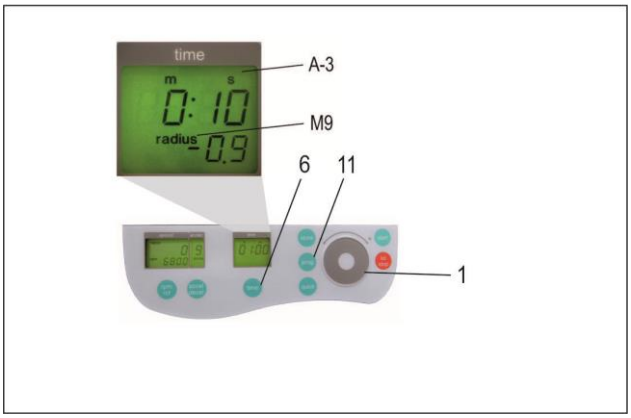


Figure 16

2.6 Program

2.6.1 Storage of Programs

The program stores up to 99 runs, with all relevant parameters, including the used rotors. Any free program number is available and can be retrieved.

Put the rotor into the centrifuge. By pressing the key, "prog" (11), in the display "time" (A-3) appears the word "program", (see Figure 17). With the control field (1), choose the desired program number.

If a program number is already occupied, in the display "rpm/rcf" (A-1), the words "rotor" (M3) and e.g. "221.57" (M4) will appear, (see Figure 18). Free program numbers will appear as 0.

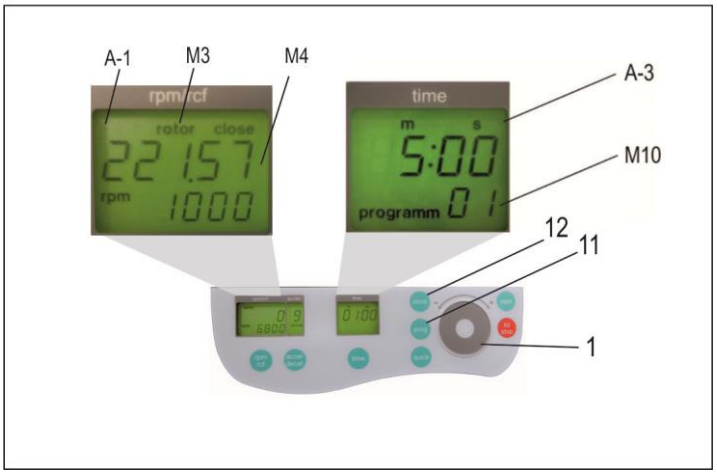


Figure 17

Close the lid of the centrifuge, now proceed as described above, to set all important run parameters. If the lid isn´t closed, when storing the program in the display "rpm/rcf" (A-1), flashes alternately the word "FirSt" and "CLOSE Lid" (see Figure 18). When starting the run without storing the program, in the display "rpm/rcf" (A-1), flashes alternately the word "First" and "PrESS StoreE", (see Figure 19).

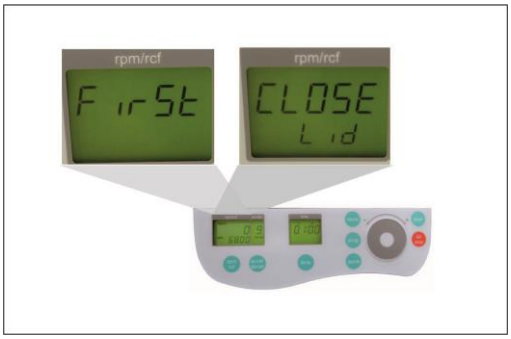


Figure 18

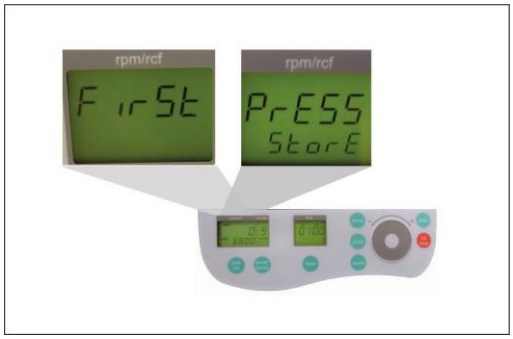


Figure 19

For alteration of data, press the key "store" (12), for approx. 1 second. If the program is stored correctly, the word "StorE" appears in the display "rpm/rcf" (A-1). As a result, the word "program" (M10) disappears. As soon as the key "store" (12) is no longer displayed, the word "programm xx" (M10) reappears, (the xx stands for the chosen program place).

If all program numbers are occupied, take an old number that is not needed any longer and replace it with the new parameters.

2.6.2 Recall of Stored Programs

To recall stored programs, press the key "prog" (11), with the lid already closed. Inside the display "time" (A-3), appears "programm --"(M10). With the control field (1), pre-select the desired program number. In the respective displays, the stored values, for that program, will appear.

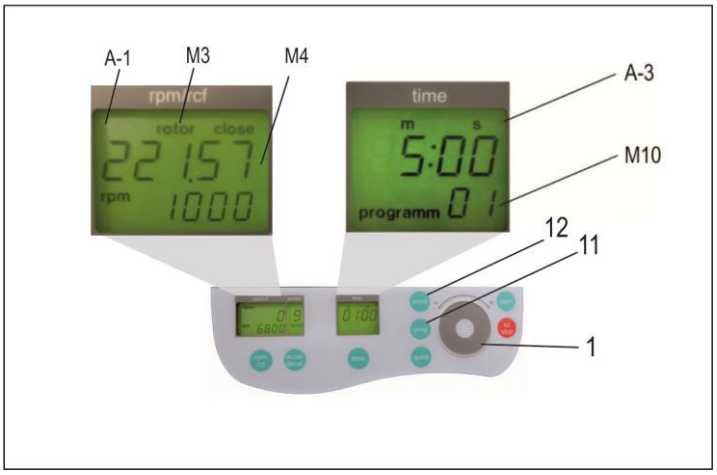


Figure 20

2.6.3 Leaving Program Mode

To leave the program mode, press the key, "prog" (11). Then, inside the display "time", appears the word "programm".

Set the display to "programm--" (M10) with the control field (1).

For all number marked text, please refer to Figure 20.

2.7 Starting and Stopping the Centrifuge

2.7.1 Starting the Centrifuge

Start the centrifuge with either the "start" key (9), or the "quick" key (8). With the "start" key (9), stored runs or runs with manually pre-selected parameters can be started. During the centrifugation the LED light is flashing slowly with red color. When the respective pre-selected running time has ended, the centrifuge will stop automatically.
With the "quick" key (8), start runs, which will last a few seconds, can be initiated. By pressing the "quick" key (8), the centrifuge accelerates up to the pre-selected revolution. In the display "time" (A-3), the passed running time is indicated from the moment the "quick" key (8) is pressed. By releasing the "quick" key (8), the centrifuge stops and the running time is indicated, until the lid is opened.

For all number marked text, please refer to Figure 21.

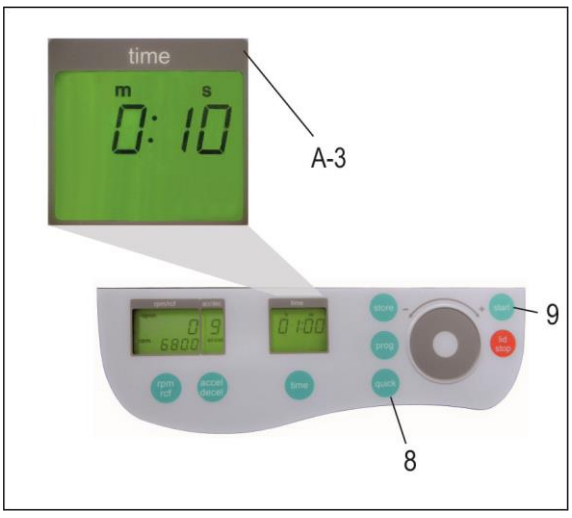


Figure 21

2.7.2 The “STOP” KEY

With the "stop" key (10), the run time can be interrupted, at any time, (see Figure 22). After pressing the key, the centrifuge decelerates with the respective pre-selected intensity, down to a standstill. After the centrifugation is finished, the LED lights with green color.

Figure 22

2.8 Imbalance Detection

In case the rotor is not equally loaded, the drive will turn off, during acceleration. The rotor decelerates to a standstill.

When in the display "time" (A-3), the word "error" (M11) along with the number "01" appears, the weight difference of the samples are too large. Weigh out the samples exactly!

Load the rotor as described in Chapters: 2.1.2 and 2.1.3.

When inside the display "time" (A-3), the word "error" along with the number "02" appears, (see Figure 23). Potential reason for this error can be: The imbalance switch is defective. If an error code occurs, the LED is flashing rapidly with red color.

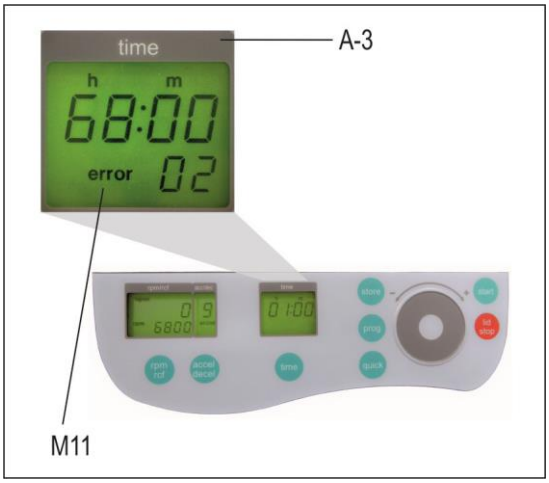


Figure 23

3. MAINTENANCE

3.1 Maintenance and Cleaning

3.1.1 General

Maintenance:

Maintenance of the centrifuge is dependent on prolonging the life of the rotor, the rotor chamber and the rotor accessories.

Don´t use acid detergents and/or burnished polish.

Breakage of rotors can be caused by the slightest damages.

In case of metallic rotor parts or the motor shaft becoming in touch with corrosive substances, the affected area must be cleaned, thoroughly.

Corrosive substances, such as, must be avoided: alkalis, alkaline soap solutions, alkaline amines, concentrated acids, solutions containing heavy metals, water-free chlorinated solvents, saline solutions, e.g. salt water, phenol, halogenated hydrocarbons.

Maintenance – Unit, Rotor, Accessories:

- Turn the device off and disconnect from the power supply, before beginning any cleaning or disinfecting. Do not pour liquids into the housing interior.
- Spray disinfectant on the device.
- Thorough cleaning not only has its purpose in hygiene, but also in avoiding pollution based corrosion.
- In order to avoid damaging anodized parts, such as rotors, reduction plates etc.; only pH-neutral Detergents, with a pH-value of 6-8, may be used for cleaning. Alkaline cleaning agents must not be used, (pH-value > 8).
- After cleaning, please ensure all parts are dried thoroughly, either by hand or in a hot-air cabinet (Max. Temperature + 50°C/122°F).
- It is necessary to coat anodized aluminium parts with anti-corrosion oil regularly, in order to increase their life-span and reduce corrosion predisposition.
- Due to humidity or not hermetically sealed samples, condensation may form. The condensation has to be removed from the rotor chamber, with a soft cloth regularly.

The maintenance procedure has to be repeated every 10 to 15 runs, but at least once at week!

- Connect the unit to the power supply, after the equipment is completely dry.
- Do not implement disinfection with UV-, beta- and gamma-rays or other high energy radiation.

3.1.2 Cleaning and Disinfection of the Unit

1. Open the lid, before turning off the unit. Disconnect from the power supply.
2. Open the rotor nut, by turning the rotor key counter-clockwise.
3. Remove the rotor.
4. For cleaning and disinfection of the unit and the rotor chamber, use the above mentioned cleaner.
5. Clean all accessible areas of the device and its accessories, including the power cord, with a damp cloth.
6. Wash the rubber seals and rotor chamber thoroughly, with water.
7. Rub the dry rubber seals with glycerol or talc, to prevent these from becoming brittle. Other components of the unit, e.g. the lid lock, motor shaft and rotor, should **not** be greased.
8. Dry the motor shaft with a soft, dry and lint-free cloth.
9. Examine the unit and accessories for damage.

Remove adherent dust, at least every 6 months, from the ventilation slots in the centrifuge, by using a soft brush.

*Before doing so, please switch off the unit and disconnect from the power supply.

3.1.3 Cleaning and Disinfection of the Rotor

1. Clean and disinfect: the rotors and adapters, with the cleaner previously mentioned above.
2. Use a bottle brush to clean and disinfect the rotor bores.
3. Rinse the rotor and adapter, with clear water. Particularly, the drillings of the angle rotors.
4. When drying the rotor and adapter, set on a towel. Place the angle rotor, with bores down, to dry.
5. Dry the rotor cone with a soft, dry and lint-free cloth, check for damage. Do not grease the rotor cone.
6. Put the dry rotor back on the motor shaft.
7. Fix the rotor by turning the rotor nut clockwise.

3.1.4 Disinfection of PP-Rotors

ATTENTION Polypropylene rotors **must not** be autoclaved!

Gas Sterilization

Adapters, bottles and rotors may be gas sterilized, with Ethylenoxyd. According to the duration of the application, allow items to properly air out, after the sterilization and before usage.

ATTENTION: The temperature may rise during the sterilization; rotors, adapters and bottles should not be fully closed, keep completely unscrewed.

Chemical Sterilization

Bottles, adapters and rotors may be treated, with the usual liquid disinfectants.

ATTENTION: Before applying any other cleaning resp. decontamination method other than what was recommended by the manufacturer, please contact the manufacturer to ensure that it will not damage the unit or the rotor.

3.1.5 Disinfection of Aluminum Rotors

In case of infectious material spilling into the centrifuge, the rotor and rotor chamber have to be disinfected, promptly after the run. Rotors may be autoclaved. The recommended time for autoclaving: 15 – 20 min at 121°C/250°F, (2.15 bar).

3.1.6 Glass Breakage

With high g-values, the rate of glass tube breakage increases. Glass splinters have to be removed immediately from rotor, adapters and the rotor chamber itself. Fine glass splinters will scratch and therefore damage the protective surface coating of a rotor. If glass splinters remain in the rotor chamber, fine metal dust will build up, due to air circulation. This very fine, black metal dust will severely pollute the rotor chamber, the rotor and the samples.

If necessary, replace the adapters, tubes and accessories, to avoid further damage. Check the rotor bores regularly, for residue and damage.

ATTENTION: Please check the relevant specifications of the tubes with the manufacturer!

3.2 Lifetime of Rotors and Accessories

Rotors and rotor lid made of aluminum or stainless steel, have a operating time of **max. 7 years** from first use.

Transparent rotor lids and caps, made of PC or PP, as well as rotors, tube racks and adapters of PP, have a maximum operating time of up to **3 years,** from first time use.

Conditions for the Operating Time:

Proper use, damage-free condition, recommended care.

4. TROUBLE SHOOTING

4.1 Error Message: Problem / Solution

The error messages are listed to help localize possible errors faster.

The possible error referred to in this chapter may not always be the case, as they are only theoretically occurring errors and solutions.

Always keep us informed about any kind of error occurring, which is not listed in this chapter. With this information provided, we are able to improve and complete this operation manual.

Many thanks in advance for your support.

HERMLE Labortechnik GmbH

4.2 Survey of Possible Error Messages and Solutions

4.2.1 Lid Release during Power Failure (Emergency Lid Release)

In case of power failure or malfunction, the lid of the centrifuge can be opened manually, in order to protect samples.

Please proceed as follows:

- Switch off the centrifuge and unplug the power cord, wait until the rotor has come to a standstill (this may take several minutes)
- On the left hand, bottom side of the centrifuge housing, there is a plastic stopper (see Figure 24). Remove this stopper. Fastened to it, is a string which is connected to the lid lock..
- Pull the string slightly and the lid will open.
- Open the lid of the centrifuge.
- Switch the centrifuge on again, to proceed with regular function.

Figure 24

4.2.2 Description of the Error Message System

The error message, "error" (M11), is shown in the "time" (A-3) display, (see Figure 25). For more detailed informations, refer to Table 2: "Error Messages", (see Appendix P. IV).

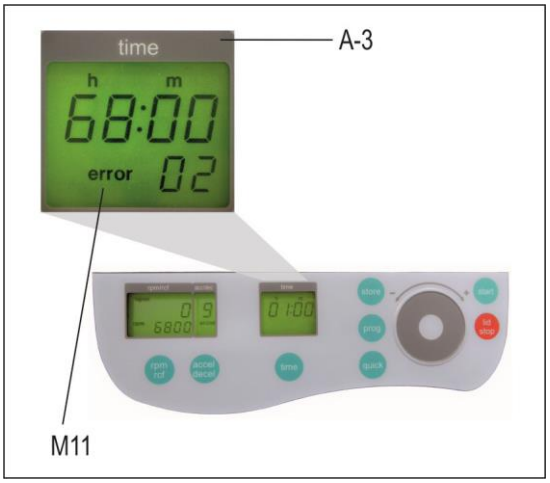


Figure 25

5. RECEIPT OF CENTRIFUGES TO REPAIR

Health risk from contaminated equipment, rotors and accessories

In case of returning the centrifuge for repairing to the manufacturer, please know the following:

The centrifuge **must** be decontaminated and cleaned, before shipment to Hermle Labortechnik, for the protection of persons, environment and material.

Decontamination certificate at goods return delivery (see APPENDIX P. VII)

We reserve the right to accept contaminated centrifuges.

Furthermore, all costs that may have occurred during the cleaning and disinfection of the units will go to the debit of the customer's account.

Return of Power Cords

In case of a return of a centrifuge, we also ask you to send its power cord. This eliminates the risk of a faulty power cord. If no power cord is attached to the centrifuge, a new one will be delivered and charged.

We ask for your understanding.

6. TRANSPORT, STORAGE AND DISPOSAL

6.1 Transport

Before transporting, take out the rotor.
Only transport the unit in its' original packaging.
Use a transport aid, for transporting over longer distances, to fix the motor shaft.

	Air Temperature	Rel. Humidity	Air Pressure
General Transportation	-25 to 60 °C	10 to 75 %	30 to 106 kPa

6.2 Storage

During storage of the centrifuge, the following environmental conditions must be observed:

	Air Temperature	Rel. Humidity	Air Pressure
Transport Packaging	-25 to 55 °C	10 to 75 %	70 to 106 kPa

6.3 Disposal

Information on the disposal of electrical and electronic equipment in the European Community:

Within the European Community, disposal for electrically powered equipment is dictated by national regulations based on the EU Directive 2012/19/EC on Waste Electrical and Electronic Equipment (WEEE2).

According to this directive, all devices supplied **after** 13.08.2005 in the business-to-business sector, in which this product is classified, may no longer be disposed of with municipal waste or household waste. To document this, they are marked with the following label:

As this device is a device used exclusively for business purposes (B2B), it must not be handed into public waste disposal companies.

The device can be disposed of by stating the date of purchase and the device number at:

Hermle Labortechnik GmbH, Siemensstraße 21, 78564 Wehingen,WEEE-Reg. No. DE 55649821

For all devices delivered before 13.08.2005, the last user is responsible for proper disposal.

6.4 RoHS Declaration of Conformity

HERMLE Labortechnik GmbH, Siemensstraße 25, 78564 Wehingen, Germany, hereby declares that all components produced are in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 31.03.2015 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

7. APPENDIX

Table 1: Technical Data

Manufacturer	HERMLE Labortechnik GmbH, 78564 Wehingen			
Type	Z 287 A			
Dimensions				
Width	35 cm			
Depth	43 cm			
Height	26 cm			
Weight without rotor	18 kg			
Max. Speed	14,000 rpm			
Max. Volume	6 x 50ml			
Max. RCF	16,058 x g			
Allowable Density	1.2 kg/dm^3			
Allowable Kinetic Energy	2,511 Nm			
Mains Power Connection AC	230 V / 50-60 Hz 1 ph		120 V / 50-60 Hz 1 ph	
Voltage Fluctuation	± 10 %		± 10 %	
Current Consumption	1.1 A		2.0 A	
Power Consumption	170 W		170 W	
Radio Interference	IEC 61326-1			
Audit Requirement (BGR 500)	no			
Ambient Conditions (EN/IEC 61010-1)				
Environment	For Indoor Use Only			
High	Use up to an altitude of 2000 m above MSL			
Ambient Temperature	2°C up to 35 °C			
Max. Relative Humidity	Max. relative humidity 80 % for temperatures up to 31°C, decreasing linearly to 50% relative humidity up to 35°C			
Overvoltage Category (IEC 60364-4-443)	II			
Degree of Contamination	2			
Class of Protection	I			
Not suitable for use in hazardous environments				
EMV Interference Emission, Noise Immunity	EN / IEC 61326-1 Category B	FCC Class B	EN / IEC 61326-1 Category B	FCC Class B
Noise Level (depending on the rotor)	≤ 65 dB(A)			
Write from Operator				
Inventory-No.:				
Monitoring-No.:				
Environment:				
Maintenance Contract:				
Responsible Service Office	**HERMLE Labortechnik GmbH**		**or dealer service office**	
	Siemensstraße 25			
	78564 Wehingen			
	Tel.: (49) 7426 / 96 22-17			
	Fax: (49) 7426 / 96 22-49			
Responsible Dealer				

Table 2: Permissible Net Weight

Rotor Number	Max. Speed	Permissible Net Weight
220.95 V09	14,000 rpm	43 g
221.54 V04	6,000 rpm	300 g
221.55 V04	6,000 rpm	432 g
221.57 V02	8,000 rpm	200 g
221.59 V09	12,000 rpm	91 g
221.60 V03	13,000 rpm	4,8 g
221.75 V03	12,000 rpm	91 g
221.77 V01	3,800 rpm	400 g
221.78 V01	5,000 rpm	120 g
221.79 V01	5,000 rpm	96 g
221.80 V01	5,000 rpm	240 g

Table 3: Max. Speed and RCF-Values for Permissible Rotors

Rotor Number	Max. Speed	RCF Value
220.95 V09	14,000 rpm	15.994 xg
221.54 V04	6,000 rpm	4.427 xg
221.55 V04	6,000 rpm	4.427 xg
221.57 V02	8,000 rpm	6.153 xg
221.59 V06	12,000 rpm	13.683 xg
221.60 V03	13,000 rpm	16.058 xg
221.75 V03	12,000 rpm	13.683 xg
221.77 V01	3,800 rpm	1.453 xg
221.78 V01	5,000 rpm	3.437 xg
221.79 V01	5,000 rpm	3.717 xg
221.80 V01	5,000 rpm	3.633 xg

Table 4: Acceleration and Deceleration Times

	Acceleration Values		Deceleration Values	
Rotor Number	Level 0	Level 9	Level 0	Level 9
220.95 V09	140	19	145	21
221.54 V04	295	34	317	38
221.55 V04	293	34	317	38
221.57 V02	198	22	212	23
221.59 V06	198	23	211	24
221.60 V03	319	30	334	33
221.75 V03	198	18	213	27
221.77 V01	182	23	193	29
221.78 V01	241	26	250	31
221.79 V01	240	25	253	32
221.80 V01	242	26	252	33
	in seconds			
	Acceleration Time from 0 rpm-> n_{max}		Deceleration Time von n_{max} -> 0 rpm	

Table 5: Error Messages

Error-No.	Describtion
1	Imbalance
2	Imbalance sensor is defective
14	Problem with speed sensor
15	Standstill monitoring defective
16	Wrong dircention of rotoration of the motor
18	Device gets too warm, cool down
33	Open lid while motor is running
34	Lid contact defective
43	Undervoltage frequency converter
44	Overvoltage frequency converter
47	Error current detection
55	Overspeed
80	Memory Error intern EEPROM
81	Memory Error intern EEPROM, program data
99	Rotor not permitted

Table 6: Radius Correction

Rotor No.	*Adapter Item No.*	*Radius (cm)*	*Correction (cm)*
Angle Rotor **220.95 V09**		7.3	**0**
	704.004	7.0	**0.3**
	704.005	6.3	**1.0**
Angle Rotor **221.54 V04**		11.0	**0**
	701.011	10.6	**0.4**
	701.012	9.1	**1.9**
	701.015	7.7	**3.4**
	701.018	10.5	**0.5**
Angle Rotor **221.55 V04**		11	**0**
	708.019	10.7	**0.3**
	708.003	10.3	**0.7**
	708.004	10.6	**0.4**
	708.030	10.8	**0.2**
	701.011	10.2	**0.8**
	701.012	8.3	**2.7**
	701.015	6.7	**4.3**
Angle Rotor **221.57 V02**		8.6	**0**
	701.011	8.3	**0.3**
	701.012	7.0	**1.6**
	701.015	5.6	**3.0**
Angle Rotor **221.59 V06**		8.5	**0**
	704.004	8.2	**0.3**
	704.005	7.4	**1.1**
Angle Rotor **221.60 V03**		8.5	**0**
Angle Rotor **221.75 V03**		8.5	**0**
	704.004	8.2	**0.3**
	704.005	7.4	**1.1**
Swing Out Rotor **221.77 V01**		9.0	**0**
Swing Out Rotor **221.78 V01**		12.3	**0**

Table 6: Radius Correction

Rotor No.	*Adapter Item No.*	*Radius (cm)*	*Correction (cm)*
Swing Out Rotor **221.79 V01**		13.3	**0**
Swing Out Rotor **221.80 V01**		13.0	**0**
	708.051	12.8	**0.2**

Table 7: Symbols- / Abbreviations

Symbol /	Unit	Describtion
n (=rpm)	[min^{-1}]	revolutions per minute
RZB(=rcf)	[x g]	relative centrifugal force
PP	-	Polypropylen
PC	-	Polycarbonat
accel	-	acceleration
decel	-	deceleration
prog	-	program

Redemption Form: Decontamination Certificate

Decontamination Certificate of Goods Returned Upon Delivery

Enclose all returned shipping items and modules necessary!

The completely full declaration about the decontamination is prerequisite for the assumption and further processing of the return. If no corresponding explanation is enclosed, we carry out decontamination with costs at your expense.

Surname; Last name: _____

Organization / Company: _____

Street: _____

ZIP CODE: _____ **place:** _____

Telephone: _____ **fax:** _____

E-Mail: _____

Please fill out in block capitals!

Pos.	Quantity	Decontaminated Object	Serial No.	Description / Comment
1				
2				
3				
4				

Are the parts listed above in touch with the following substances?

Health endangering watery solutions, buffers, acids, alkalis:……..... ☐ Yes ☐ No

Potentially infectious agents: …….. ☐ Yes ☐ No

Organic reagents and solvent: ……..……..... ☐ Yes ☐ No

Radioactive substances: ……..…☐ α..☐ β..☐ γ.. ☐ Yes ☐ No

Health endangering proteins: ……..... ☐ Yes ☐ No

DNA: ……. ☐ Yes ☐ No

Have these substances reached the equipment/assembly? …….. ☐ Yes ☐ No

If so, which ones:

_____

Description of the measures for the decontamination of the listed parts:

I confirm the proper decontamination:

Company/Dept ._____ Place and Date: _____

Signature of the authorized person: _____