**ZENTRIFUGEN**

# ROTANTA 46 RSC
# ROBOTIC



| | | |
|---|---|---|
| EN | **Operating Instructions**................................................... | **5** |

**Fig. 1**



**Fig. 2**

# $C\epsilon$

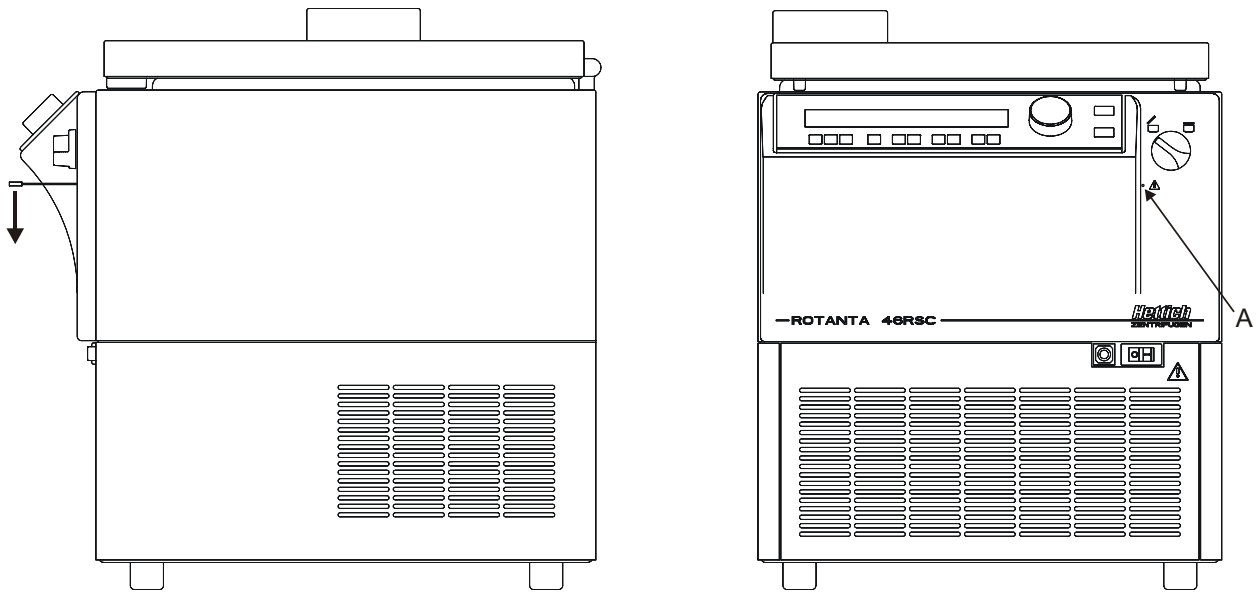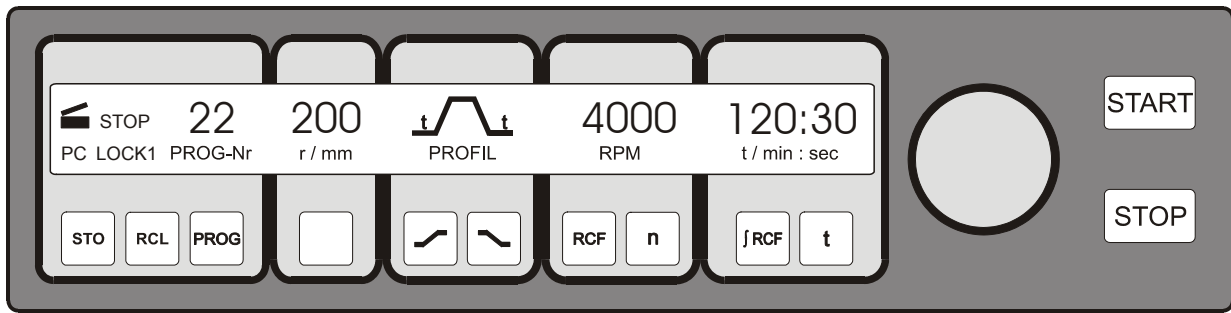## EG-Konformitätserklärung
## EC Conformity Declaration
## Déclaration de conformité CE
## Dichiarazione di conformità alle norme CEE

Andreas Hettich GmbH & Co. KG • Föhrenstraße 12 • D-78532 Tuttlingen • Germany

Das bezeichnete Gerät, inklusive Zubehör entspricht den aufgeführten EG-Richtlinien und Normen.

The denoted device, including accessories corresponds to the listed EC guidelines and standards.

L'appareil désigné, y compris les accessoires, correspond aux directives CE et aux normes énumérées.

L'apparecchio designato, compresi gli accessori, è conforme alle direttive CE e alle norme citate.

Geräteart, Type of device, Type d'appareil, Tipo di apparecchio:
**Laborzentrifuge mit Zubehör, Laboratory centrifuge with accessories, Centrifugeuse de laboratoire avec des accessoires, Centrifuga da laboratorio con accessori**

Typenbezeichnung, Type designation, Désignation de modèle, Contrassegno tipo:
**ROTANTA 46 RSC ROBOTIC**

EG-Richtlinien/Normen, EC guidelines/standards, Directives CE/Normes, Direttive/Norme CEE:
**2006/95/EG, EN 61010-1:2001, EN 61010-2-020:2006**

**2004/108/EG, EN 61326-1:2006**

**2006/42/EG, EN ISO 12100-1:2004, EN ISO 12100-2:2004**

**98/79/EG**

Tuttlingen, 28.09.2009

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**AB4817EN / Rev. 01 / 03.10**

**Contents**

## 1 Use according to specification

The machine presented here is a medical product (laboratory centrifuge) according to the IVD guideline 98/79/EG. The centrifuge is used to separate substances or substance mixtures with a density of max. 1.2 kg/dm³. This also includes substances and substance mixtures of human origin. The centrifuge is only intended to be used for this purpose. A different use or application over and above this is deemed not in accordance with the specifications. The company Andreas Hettich GmbH & Co. KG undertakes no liability for damages resulting therefrom.

Belonging to the application according to specification is also the observance of all references contained in the Instruction Manual and compliance with the inspection and maintenance works.

## 2 Residual risks

The machine is constructed according to the state of the art and the recognized technical safety regulations. Improper use and handling can result in dangers to life and limb of the user or third parties and impairments to the machine or to other material assets. The machine is only to be used for the specified applications and only in an impeccable technical safety condition.

Disturbances that can interfere with the safety are to be immediately rectified.

## 3 Technical specifications

| Manufacturer | Andreas Hettich GmbH & Co. KG D-78532 Tuttlingen | | | | |
|---|---|---|---|---|---|
| Model | ROTANTA 46 RSC ROBOTIC | | | | |
| Type | 4817, 4817-RS232, 4817-10, 4817-10-RS232, 4817-30-A, 4817-30-D, 4817-40, 4817-50 | 4817-08, 4817-08-RS232, 4817-18, 4817-18-RS232, 4817-38-A, 4817-38-D, 4817-48, 4817-58 | 4817-05, 4817-05-RS232, 4817-15, 4817-15-RS232, 4817-35-A, 4817-35-D, 4817-45, 4817-55 | 4817-01, 4817-01-RS232, 4817-11, 4817-11-RS232, 4817-31-A, 4817-31-D, 4817-41, 4817-51, | 4817-04, 4817-04-RS232, 4817-14, 4817-14-RS232, 4817-34-A, 4817-34-D, 4817-44, 4817-54 |
| Mains voltage ($\pm$ 10%) | 230-240 V 1~ | 200-220 V 1~ | 127 V 1~ | 110-120 V 1~ | 100 V 1~ |
| Mains frequency | 50-60 Hz | | | | |
| Connected load | max. 2000 VA | | | | |
| Cooling medium | R 404A | | | | |
| Max. capacity | 4 x 750 ml | | | | |
| Allowed density | 1.2 kg/dm$^3$ | | | | |
| Speed (RPM) | 7500 | | | | |
| Force (RCF) | 10062 | | | | |
| Kinetic energy | 50000 Nm | | | | |
| Obligatory inspection (BGR 500) | yes | | | | |
| Ambient conditions (EN / IEC 61010-1) | | | | | |
| – Set-up site | Indoors only | | | | |
| – Altitude | Up to 2000 m above sea level | | | | |
| – Ambient temperature | 5°C to 35°C | | | | |
| – Humidity | Maximum relative humidity 80% for temperatures up to 31°C, linearly decreasing to 50% relative humidity at 40°C. | | | | |
| – Excess-voltage category (IEC 60364-4-443) | II | | | | |
| – Pollution degree | 2 | | | | |
| Device protection class | I | | | | |
| | Not suitable for use in explosion-endangered areas. | | | | |
| EMC | | | | | |
| – Emitted interference, Interference immunity | EN / IEC 61326-1, Class B; FCC Class A | | | | |
| Noise level (dependent on rotor) | $\leq$ 62 dB(A) | | | | |
| Dimensions | | | | | |
| – Width | 548 mm | | | | |
| – Depth | 684 / 748* mm  (* with cables connected) | | | | |
| – Height | 684 mm | | | | |
| Weight | approx. 156 kg | | | | |

| Manufacturer | Andreas Hettich GmbH & Co. KG D-78532 Tuttlingen | | | | |
|---|---|---|---|---|---|
| Model | ROTANTA 46 RSC ROBOTIC | | | | |
| Type | 4817-70 | 4817-78 | 4817-75 | 4817-71 | 4817-74 |
| Mains voltage (± 10%) | 230-240 V 1~ | 200-220 V 1~ | 127 V 1~ | 110-120 V 1~ | 100 V 1~ |
| Mains frequency | 50-60 Hz | | | | |
| Connected load | max. 2000 VA | | | | |
| Cooling medium | R 404A | | | | |
| Max. capacity | 4 x 750 ml | | | | |
| Allowed density | 1.2 kg/dm$^3$ | | | | |
| Speed (RPM) | 7500 | | | | |
| Force (RCF) | 10062 | | | | |
| Kinetic energy | 50000 Nm | | | | |
| Obligatory inspection (BGR 500) | yes | | | | |
| Ambient conditions (EN / IEC 61010-1) | | | | | |
| – Set-up site | Indoors only | | | | |
| – Altitude | Up to 2000 m above sea level | | | | |
| – Ambient temperature | 5°C to 35°C | | | | |
| – Humidity | Maximum relative humidity 80% for temperatures up to 31°C, linearly decreasing to 50% relative humidity at 40°C. | | | | |
| – Excess-voltage category (IEC 60364-4-443) | II | | | | |
| – Pollution degree | 2 | | | | |
| Device protection class | I | | | | |
| | Not suitable for use in explosion-endangered areas. | | | | |
| EMC | | | | | |
| – Emitted interference, Interference immunity | EN / IEC 61326-1, Class B; FCC Class A | | | | |
| Noise level (dependent on rotor) | ≤ 62 dB(A) | | | | |
| Dimensions | | | | | |
| – Width | 548 mm | | | | |
| – Depth | 684 / 748* mm  (* with cables connected) | | | | |
| – Height | 723 mm | | | | |
| Weight | approx. 156 kg | | | | |

**4      Notes on safety**

☞ **No claim of warranty will be considered by the manufacturer unless ALL instructions in this manual have been followed.**

⚠ • **The centrifuge should be installed on a good, stable base.**

• **Before using the centrifuge absolutely check the rotor for firm placement.**

• **When the centrifuge is running, according to EN / IEC 61010-2-020, no persons, dangerous substances or objects may be within the safety margin of 300 mm around the centrifuge.**

• **Rotors, suspensions and accessories that possess traces of corrosion or mechanical damage or if their term of use has expired may not be used any longer.**

• **The centrifuge may no longer be put into operation when the centrifuging chamber has safety-related damages.**

• **With swing-out rotors the trunnions must be regularly lubricated (Hettich Lubricating Grease No. 4051) in order to ensure consistent swinging out of the hangers.**

• **Before the initial operation of your centrifuge you should read and pay attention to the operating instructions. Only personnel that has read and understood the operating instructions are allowed to operate the device.**

• If the ROTANTA 46 RSC ROBOTIC is not already part of a complete workstation supplied ready for use, a software specialist is required to integrate the centrifuge into the workstation.
The operating manual is therefore divided into one section with general operating and safety instructions for this centrifuge model, and another section with software information (see chapter "Description for Robotic") for program creation.

• Along with the operating instructions and the legal regulations on accident prevention, you should also follow the recognised professional regulations for working in a safe and professional manner. These operating instructions should be read in conjunction with any other instructions concerning accident prevention and environmental protection based on the national regulations of the country where the device is to be used.

• This centrifuge is a state-of-the-art piece of equipment which is extremely safe to operate. However, it can lead to danger for users or others if used by untrained staff, in an inappropriate way or for a purpose other than that it was designed for.

• The centrifuge must not be moved or knocked during operation.

• In case of fault or emergency release, never touch the rotor before it has stopped turning.

• To avoid damage due to condensate, when changing from a cold to a warm room the centrifuge must either heat up for at least 3 hours in the warm room before being connected to the mains, or run hot for 30 minutes in the cold room.

• Only the rotors and accessories approved by the manufacturer for this device may be used (see section "Anhang/Appendix, Rotoren und Zubehör/Rotors and accessories").

• The centrifuge rotor may only be loaded in accordance with the chapter "Loading the rotor".

• When centrifuging with maxim revolutions per minute the density of the materials or the material mixtures may not exceed 1.2 $kg/dm^3$.

• The centrifuge may only be operated when the balance is within the bounds of acceptability.

• The centrifuge may not be operated in explosion-endangered areas.

• The centrifuge must not be used with:
  − inflammable or explosive materials
  − materials that react with one another producing a lot of energy.

• If users have to centrifuge hazardous materials or compounds contaminated with toxic, radioactive or pathogenic micro-organisms, they must take appropriate measures.
For hazardous substances centrifuge containers with special screw caps must strictly be used. In addition to the screw cap centrifuge containers, for materials in hazard category 3 and 4 a biosafety system must be used (see the World Health Organisation's "Laboratory Biosafety Manual").
In a biosafety system, droplets and aerosols are prevented from escaping by a bioseal (packing ring).

If the hanger of a biosafety system is used without the lid, the packing ring must be removed from the hanger in order to prevent the packing ring from being damaged during the centrifugation run. Damaged packing rings must not be used to seal the biosafety system.

Without the use of a biosafety system the centrifuge is not microbiologically sealed in the sense of the EN / IEC 610101-2-020 standard.

- The centrifuge must not be operated with highly corrosive substances which could impair the mechanical integrity of rotors, hangers and accessories.

- Repairs must only be carried out by personnel authorised to do so by the manufacturer.

- Only original spare parts and original accessories licensed by the Andreas Hettich GmbH & Co. KG company are allowed to be utilised.

- The following safety regulations apply:
  EN / IEC 61010-1 and EN / IEC 61010-2-020 as well as their national deviations.

- The safe operation and reliability of the centrifuge can only be guaranteed if:
  − the centrifuge is operated in accordance with the operating instructions,
  − the electrical installation on the site where the centrifuge is installed conforms to the demands of EN / IEC stipulations,
  − prescribed tests to BGV A1, BGR 500 are carried out by an expert.

- With centrifuges for robotic use please pay attention the notes of the key operated switch.


## 5    Symbol meanings

Symbol on the machine:

Attention, general hazard area.
Before using the centrifuge implicitly read the operating instructions and pay attention to the safety relevant references!

Symbol in this document:

Attention, general hazard area.
This symbol refers to safety relevant warnings and indicates possibly dangerous situations.

The non-adherence to these warnings can lead to material damage and injury to personal.

Symbol on the machine and in this document:

Beware of hot surface.
Nonobservance of this warning can lead to material damage and personal injury.

Symbol on the machine:

Beware of squeezing the hands.

Symbol in this document:

This symbol refers to important circumstances.

Symbol on the machine and in this document:

Symbol for the separate collection of electric and electronic devices according to the guideline 2002/96/EG (WEEE). The device belongs to Group 8 (medical devices).

Applies in the countries of the European Union, as well as in Norway and Switzerland.

## 6    Delivery checklist

| | Centrifuge type | 4817, 4817-08, 4817-10, 4817-18, 4817-50, 4817-58 | 4817-01, 4817-04, 4817-05, 4817-11, 4817-14, 4817-15, 4817-51, 4817-54, 4817-55 | 4817-30-A, 4817-31-A, 4817-34-A, 4817-35-A, 4817-38-A, 4817-30-D, 4817-31-D, 4817-34-D, 4817-35-D, 4817-38-D | 4817-40, 4817-41, 4817-44, 4817-45, 4817-48 | 4817-RS232 4817-01-RS232 4817-04-RS232 4817-05-RS232 4817-08-RS232 4817-10-RS232 4817-11-RS232 4817-14-RS232 4817-15-RS232 4817-18-RS232 | 4817-70, 4817-71, 4817-74, 4817-75, 4817-78 |
|---|---|---|---|---|---|---|---|
| Qty. | Designation | Cat. no. | Cat. no. | Cat. no. | Cat. no. | | Cat. no. |
| 1 * | German connecting cable, length 2,5 m | E979 | E979 | ---- | E979 | E979 | E979 |
| | Swiss connecting cable, length 4 m | E2036 | E2036 | ---- | ---- | ---- | ---- |
| | UK connecting cable, length 4 m | E2038 | E2038 | ---- | ---- | ---- | ---- |
| | US connecting cable, length 2,5 m | E1737 | E1737 | ---- | E1737 | E1737 | E1737 |
| 1 | US connecting cable, length 4 m | ---- | ---- | E1771 | ---- | ---- | ---- |
| 1 | Release pin | E003 | E003 | E003 | E003 | E003 | E003 |
| 1 | Hex. pin driver (5 mm) | E613-2 | E613-2 | E613-2 | E613-2 | E613-2 | E613-2 |
| 1 | Cranked hex. pin driver (2.5 mm) | E2403 | E2403 | E2403 | E2403 | E2403 | E2403 |
| 1 | Torx-offset screwdriver (size T10) | ---- | ---- | ---- | ---- | ---- | E1869 |
| 1 | Opto-data-box | E1203 | E1826 | ---- | ---- | ---- | ---- |
| 1 | Fiber optic cable, length 5 m | E1464 | E1464 | ---- | ---- | ---- | ---- |
| 1 | Demo programme Robot | E1211 | E1211 | E1211 | E1211 | E1211 | E1211 |
| 1 | Connecting cable, 9 pole, length 2 m | ---- | ---- | ---- | E2460 | ---- | ---- |
| 1 | Connecting cable, 9 pole, length 3 m | ---- | ---- | ---- | ---- | E3156 | ---- |
| 1 | Connecting cable, 9 pole, length 3 m | ---- | ---- | X | ---- | ---- | ---- |
| 1 | Angled adapter for RS232 interface | ---- | ---- | ---- | ---- | E3169 | ---- |
| 2 | Key for key-operated switch | X | X | X | X | X | X |
| 1 | Lubricating grease for trunnions | 4051 | 4051 | 4051 | 4051 | 4051 | 4051 |
| 2 | Label for voltage and frequency | E2909 | E2909 | E2909 | E2909 | E2909 | E2909 |
| 1 | Manufacturing protocol | ---- | ---- | ---- | ---- | ---- | 204.210.04.00 |
| 1 | Notes on adjusting rotor position 1 | AH4815XX | AH4815XX | AH4815XX | AH4815XX | AH4815XX | AH4815XX |
| 1 | Notes on moving the equipment safely | AH4817XX | AH4817XX | AH4817XX | AH4817XX | AH4817XX | AH4817XX |
| 1 | Operating instructions | AB4817 | AB4817 | AB4817 | AB4817 | AB4817 | AB4817 |

* The connecting cable is included in the delivery as ordered.

The rotor(s) and associated accessories are included in the delivery in the quantity ordered.

## 7    Unpacking the centrifuge

- Lift the carton upward and remove the padding.
- 
  ⚠️  Do not lift by the front panel.

  Observe the weight of the centrifuge, refer to chapter "Technical specifications".

  With a suitable number of helpers, hold the centrifuge on both sides and lift down from the pallet.


## 8    Initial operation

- According to the laboratory instrument standards EN / IEC 61010-2-020 an emergency switch to separate power supply in the event of a failure must be installed in the building electrical system.
  This switch has to be placed remote from the centrifuge, preferred outside of the room in which the centrifuge is installed or near by the exit of this room.
- **Position the centrifuge in a stable and level manner in a suitable place. During set-up, the required safety margin of 300 mm around the centrifuge is to be kept according to EN / IEC 61010-2-020**.

  ⚠️  **When the centrifuge is running, according to EN / IEC 61010-2-020, no persons, dangerous substances or objects may be within the safety margin of 300 mm around the centrifuge.**

- Do not place any object in front of the ventiduct.
  Keep a ventilation area of 300 mm around the ventiduct.
- Check whether the mains voltage tallies with the statement on the type plate.
- Connect the centrifuge with the connection cable to a standard mains socket. For connection ratings refer to Chapter "Technical specification".
- Turn on the mains switch. Switch position "**I**".
  The following display follows:
  1. Type of centrifuge, 2. The last rotor code detected by the rotor identification and the maximum speed of the rotor (n-max-Rotor), 3.The programme version, 4. The last utilised programme or programme 1.
- Open the lid.
- Remove the transport safety device (see instruction sheet on "Moving the equipment safely").


## 9    Opening and closing the lid

### 9.1    Opening the lid

☞  The lid can only be opened when the centrifuge is switched on and the rotor is at rest. If it cannot be opened under these circumstances, see the section on "Emergency release".

- Rotate the turning handle on the front panel to the left. On the display, symbol ▬ is changing into ◿.
- Open the lid.


### 9.2    Closing the lid

⚠️  Do not bang the lid shut.

- Place the lid and lightly press down the front edge of the lid.
- Turn the handle on the front panel to the right. On the display, symbol ◿ is changing into ▬.

## 10 Installation and removal of the rotor
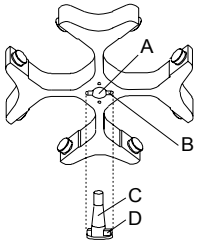
- Clean the motor shaft (C) and the rotor drilling (A), and lightly grease the motor shaft afterwards. Dirt particles between the motor shaft and the rotor hinder a perfect seating of the rotor and cause an irregular operation.
- Place the rotor vertically on the motor shaft. The motor shaft dog (D) has to fit in the rotor slot (B). The alignment of the groove is labelled on the rotor.
- Tighten the rotor tension nut with the supplied wrench by turning in a clockwise direction.
- Check the rotor for firm seating.
- Loosening the rotor: Loosen the tension nut by turning in a counter clockwise direction, and turning until the working point for lifting. After passing the working point for lifting the rotor is loosened from the motor shaft cone. Turn the tension nut until the rotor is able to be lifted from the motor shaft.

## 11 Loading the rotor

⚠ Standard centrifuge containers of glass will not stand RCF values exceeding 4000 (DIN 58970, pg. 2).

- Check the rotor for firm seating.
  With swing-out rotors all rotor positions must be lined with **identical** hangers. Certain hangers are marked with the number of the rotor position. These hangers may only be used in the respective rotor position. Hangers that are marked with a set number (e.g. S001/4) may only be used in the set.
- The rotors and hangers may only be loaded symmetrically. The centrifuge containers have to be distributed evenly on all rotor positions. For authorised combinations see Chapter "Anhang/Appendix, Rotoren und Zubehör/Rotors and accessories".
  In the case of angle rotors all possible rotor positions must be loaded, see chapter "Anhang/Appendix, Rotoren und Zubehör/Rotors and accessories".
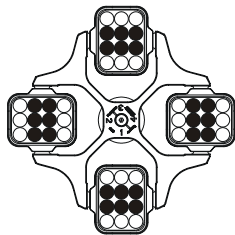
Rotor is evenly loaded
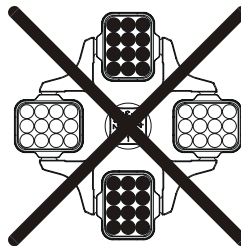
**Not permitted!**
Rotor is not evenly loaded

- On certain hangers, the weight of the maximum load or the weight of the maximum load and the maximum weight of the completely loaded hanger is specified. This weight may not be exceeded. In case of exception, see chapter " Centrifugation of materials or mixtures of materials with a density higher than 1.2 kg/dm$^3$".The weight specified for the maximum loading includes the total weight of adapter, frame, centrifuging container and content.
- In containers with rubber inserts, the same number of rubber inserts must always be among the centrifuge containers.
- Always fill the centrifuge containers outside of the centrifuge.
- No liquid should be allowed to enter the centrifugal chamber during filling and swinging out of the hangers.
- The maximum filling quantity for the centrifuge containers specified by the manufacturer must not be exceeded.
- In order to maintain the weight differences within the centrifuge container as marginal as possible, a consistent fill level in the containers is to be heeded.

## 12 Control and display devices

See figure on page 2.

Fig. 2:  Display and operating panel

## 12.1 Status symbols

Lid open.

Lid closed.

**↻** Rotation indicator. The indication appears while the centrifuge is running as long as the rotor is turning.

**STOP** Centrifugation run stopped or finished. Indication after completion of the centrifugation run as long as the rotor is turning. The indicator flashes following an emergency stop.

**LOCK 1,** Keyswitch position (for centrifuges with keyswitch only).
**LOCK 2**

**LOCK 4,** Program interlocking when serial communication provided (for centrifuges with serial communication only).
**LOCK 5**

**PC, ~~PC~~** Serial communication (for centrifuges with serial communication only).

Operating errors or faults that occur are shown symbolically in the display (see Chapter "Faults").

## 12.2   Control knob

⟳ For setting the individual parameters.
Turning anticlockwise reduces the value. Turning clockwise increases the value.

## 12.3   Keys and set-up options

**t** Running time, parameter t/min:sec
1. Parameter t/min: Adjustable from 1 - 999 min, in 1 min steps.
2. Parameter t/ :sec Adjustable from 1 - 59 s, in 1 second steps.
3. Continuous running "---:--"

**∫RCF** Interrogation of the integral RCF, parameter ∫RCF.

**n** 1. Speed, parameter RPM
A numerical value from 50 RPM up to the maximum speed of the rotor (n-max-Rotor) can be set. Maximum speed of the rotor, see Chapter "Anhang/Appendix, Rotoren und Zubehör/Rotors and accessories". Adjustable in steps of 10.
2. Interrogation of the maximum speed of the rotor, parameter n-max-Rotor.

**RCF** 1. Relative centrifugal force, parameter RCF/RZB
A numerical value can be set, which gives a speed between 50 RPM and the maximum speed of the rotor (n-max-Rotor). Adjustable in steps of 1.
2. Interrogation of the maximum RCF of the rotor, parameter RCF-max-Rotor.

**⟋** Run-up parameters
1. Run-up steps, parameter ⟋ 1-9. Step 9 = shortest run-up time, ... Step 1 = longest run-up time.
2. Run-up time, parameter ⟋min:sec. The time range that can be set is dependent upon the set speed.

**⟍** Run-down parameters
1. Braking steps, parameter ⟍ 0-9. R = linear braking curve, B = similar to an exponential braking curve.
Step R9, B9 = short run-down time, ... Step R1, B1 = long run-down time, Step R0 = unbraked run-down.
2. Run-down time, parameter ⟍min:sec. The time range that can be set is dependent upon the set speed.
3. Brake de-energisation speed, parameter n$^{(\cdot)}$/RPM
After reaching this speed, unbraked run-down occurs.

**▢** 1. Temperature setpoint, parameter T/°C (for centrifuges with cooling only). Adjustable from -20°C to +40°C, in 1°C steps (heating/cooling option settable between -20°C and +60°C / +90°C). The lowest temperature that can be achieved is dependent upon the rotor (see Chapter "Anhang/Appendix, Rotoren und Zubehör/Rotors and accessories").
2. Centrifuging radius, parameter r/mm. Entry in mm. Centrifuging radius, see Chapter "Anhang/Appendix, Rotoren und Zubehör/Rotors and accessories".

**START** 1. Start centrifugation run. The rotation indicator ↻ appears.
2. Acceptance of changes during the centrifugation run.

**STOP** Stop centrifugation run.
The rotor decelerates with the preset run-down parameters. Pressing the key twice will initiate an emergency stop.

**PROG** Select program location, parameter PROG-Nr.

**RCL** Calling up of programs.

**STO** Saving of programs.
89 programs can be saved (program locations 1 to 89). Note: The program locations "**----**" and 90 to 99 are used as automatic buffers (see Chapter "Automatic buffer"). No programs can be saved in these program locations.

## 13    Entering centrifugation parameters

> ☞ It is only possible to enter a parameter when the input field is displayed inversely (dark background). An inverse input field will go off automatically after 10 seconds.

### 13.1    Running time

#### 13.1.1    Time selection
- Press the ⊞ key repeatedly until the parameter t/min: or t/ :sec is displayed. The input field will be displayed inversely.
- Set the desired value by means of the control knob ⟳ .

#### 13.1.2    Continuous running
- Select the parameters t/min: and t/ :sec one after the other (see Chapter "Time selection"), and set both to zero using the control knob ⟳ . "---:--" will be displayed in the input field.

### 13.2    Speed (RPM)
- Press the ⊡ key repeatedly until the parameter RPM is displayed and the input field is shown inversely.
- Set the desired value by means of the control knob ⟳ .

### 13.3    Relative centrifugal force (RCF/RZB)
- Press the RCF key repeatedly until the parameter RCF/RZB is displayed and the input field is shown inversely.
- Set the desired value by means of the control knob ⟳ .

The centrifuging radius indicator will flash while the adjustment is being made.

### 13.4    Run-up and run-down parameters
The run-up and run-down parameters that have been set are displayed.

x: 1-9 = run-up step, t = run-up time

y: R1-R9, B1-B9 = braking step, R0 = unbraked run-down, t = run-down time, $n^{(\cdot)}$ = brake de-energisation speed

#### 13.4.1    Run-up step
- Press the ⊿ key repeatedly until the parameter ⌐1-9 or ⌐ is displayed. The input field will be displayed inversely.
- Set the desired step by means of the control knob ⟳ .

#### 13.4.2    Run-up time
- Press the ⊿ key repeatedly until the parameter ⌐min:sec is displayed. The input field will be displayed inversely.
- Set the desired value by means of the control knob ⟳ .

If a run-up time is set that is longer than the running time, the centrifugation run will end before the set speed is reached.

#### 13.4.3    Braking step
- Press the ⊾ key repeatedly until the parameter ⌐0-9 or ⌐ is displayed. The input field will be displayed inversely.
- Set the desired step by means of the control knob ⟳ .

B-braking steps can only be set for special rotors.

#### 13.4.4    Run-down time
If a brake de-energisation speed has been set, it is not possible to set a run-down time.
- Press the ⊾ key repeatedly until the parameter ⌐min:sec is displayed. The input field will be displayed inversely.
- Set the desired value by means of the control knob ⟳ .

### 13.4.5   Brake de-energisation speed

- Press the ⬔ key repeatedly until the parameter $n^{(\cdot)}$/RPM is displayed. The input field will be displayed inversely.
- Set the desired value by means of the control knob ↻ .

## 13.5   Radius/Temperature

### 13.5.1   Radius

- Press the ☐ key repeatedly until the parameter r/mm is displayed and the input field is shown inversely.
- Set the desired value by means of the control knob ↻ .

The value of the RCF/RZB adapts automatically when the radius is changed; this is shown by the indication flashing.

### 13.5.2   Temperature (for centrifuges with cooling only)

- Press the ☐ key repeatedly until the parameter T/°C is displayed and the input field is shown inversely.
- Set the desired value by means of the control knob ↻ .

## 13.6   Automatic buffer

The buffer comprises the program locations "**----**" and 90 to 99. Every time a centrifugation run is started, modified centrifugation data are automatically stored in program location "**----**". The modified centrifugation data for the last 11 centrifugation runs are stored in the buffer and can be called up (see Chapter "Calling up programs").

## 14   Programming

### 14.1   Entering / modifying programs

- Set the desired parameters (see Chapter "Entering centrifugation parameters").
- Press the PROG key in order to select the parameter PROG-Nr. The input field will be displayed inversely.
- Set the desired program location by means of the control knob ↻ .
  If the program location indicator flashes, then this program location has already had centrifugation data assigned to it. In this case, set a free program location or overwrite the centrifugation data by continuing.
- Press the STO key once to save the settings in the desired program location.
  Press the STO key twice to overwrite centrifugation data already stored.

### 14.2   Calling up programs

- Press the PROG key in order to select the parameter PROG-Nr. The input field will be displayed inversely.
- Set the desired program location by means of the control knob ↻ .
- Press the RCL key. The centrifugation data for the selected program location will be displayed.

## 15   Centrifugation

⚠ When the centrifuge is running, according to EN / IEC 61010-2-020, no persons, dangerous substances or objects may be within the safety margin of 300 mm around the centrifuge.

☞ If the permissible weight difference within the rotor loading has been exceeded, the drive shuts down during the start-up, and **IMBALANCE / UNWUCHT** is displayed.

If the speed in the selected program is higher than the maximum speed of the rotor (n-max-Rotor), it will not be possible to start a centrifugation run. The message **N > ROTOR MAX 96** will be displayed (see Chapter "Faults").

A centrifugation run can be stopped at any time by pushing the key STOP .

It is possible to switch over between RPM and RCF display at any time using the n and RCF keys. When working with the RCF display, it is necessary to enter the centrifuging radius.

If ⬓ **OPEN** ⬓ **OEFFNEN** is displayed, a further operation of the centrifuge is only possible after opening the lid once.

If **R xx n-max xxxxx** is displayed, then no centrifugation run has taken place as the rotor was changed beforehand, refer to Chapter " Rotor Identification ".

- Switch on the mains supply switch. Switch position I.
- Load the rotor and close the centrifuge lid.

### 15.1 Centrifugation with time selection

- Set the time or call up a program with a pre-set time (see Chapter "Entering centrifugation parameters" or "Calling up programs").
- Press the [START] key. The rotation indicator ↻ will appear as long as the rotor is turning.
- When the time has expired or if the centrifugation run is interrupted by pressing the [STOP] key, run-down will take place with the selected run-down parameters. When the rotor comes to a stop, the ⊟ symbol will flash in the display until the lid is opened.

During the centrifugation run, the speed of the rotor or the RCF value resulting from this, the sample temperature (for centrifuges with cooling only) and the remaining time will be displayed.

### 15.2 Continuous running

- Select the ---:-- symbol or call up a continuous running program (see Chapter "Entering centrifugation parameters" or "Calling up programs").
- Press the [START] key. The rotation indicator ↻ will appear as long as the rotor is turning. The time count starts from 00:00.
- Press the [STOP] key to stop the centrifugation run. Run-down will take place with the selected run-down parameters. When the rotor comes to a stop, the ⊟ symbol will flash in the display until the lid is opened.

During the centrifugation run, the speed of the rotor or the RCF value resulting from this, the sample temperature (for centrifuges with cooling only) and the time run will be displayed.

## 16 Changing settings during the centrifugation run.

The running time, the speed, the relative centrifugal force (RCF/RZB), the run-up and run-down parameters as well as the temperature (for centrifuges with cooling only) can be changed while the centrifuge is running.

The parameters can only be changed one at a time and in succession.

- Select the desired parameter and change the value using the control knob ↻ (see Chapter "Entering centrifugation parameters").
- Press the [START] key. The modified setting will be stored in program location "**----**" (see Chapter "Automatic buffer"). The original program will not be overwritten.

## 17 Integral RCF (∫RCF)

The integral RCF (∫RCF) is a measure for the sedimentation effect ($\int n^2 \, dt$). This numerical value is used to compare centrifugation runs. To interrogate the integral RCF, press and hold the [∫RCF] key.

## 18 Displaying the maximum speed of the rotor

- Press the [n] key repeatedly until the parameter RPM is displayed and the input field is shown inversely.
- Press the [n] key once more and hold it pressed; the maximum speed of the rotor (n-max-Rotor) will be displayed.

## 19 Displaying the maximum RCF of the rotor

- Press the [RCF] key repeatedly until the parameter RCF/RZB is displayed and the input field is shown inversely.
- Press the [RCF] key once more and hold it pressed; the maximum RCF of the rotor (RCF-max-Rotor) will be displayed.

## 20 Emergency stop

- Press the [STOP] key twice. The **STOP** symbol will flash in the display.

In the case of an emergency stop, run-down takes place with braking step R9 (shortest run-down time). If braking step R0 was selected, the run-down time will be longer than with braking step R9 for technical reasons.

**21    Audible signal**

The audible signal sounds in accordance with the following philosophy:

| OFF | • at 2 s intervals on the occurrence of a fault |
|---|---|
| ON1 | • at 2 s intervals on the occurrence of a fault<br>• at 30 s intervals on completion of a centrifugation run and the rotor coming to rest. |
| ON2 | • at 2 s intervals on the occurrence of a fault<br>• at 30 s intervals on completion of a centrifugation run and the rotor coming to rest.<br>• every time a key is pressed |

The audible signal is silenced by opening the lid or pressing any key.

The signal can be set as follows when the rotor is at standstill.
- Open the lid.
- Press and hold the ⊤ key for 8 seconds.
  After 8 seconds **SOUND / BELL XXX** will be displayed.
- Set the desired function (OFF, ON1, ON2) by means of the control knob ⟲ .
- Press the START key to save the setting.
  **∗∗∗ ok ∗∗∗** will be displayed briefly as a confirmation.


**22    Interrogating the operating hours**

It is only possible to interrogate the operating hours when the rotor is at standstill.
- Open the lid.
- Press and hold the ⊤ key for 8 seconds.
  After 8 seconds **SOUND / BELL XXX** will be displayed.
- Press the ⊤ key once more.
  The operating hours (**CONTROL:** ) for the centrifuge will be displayed.
  The operating hours display will go off automatically after 10 seconds.


**23    Setting the date and time**

It is only possible to set the date and time when the rotor is at standstill.
- Open the lid.
- Press and hold the ⊤ key for 8 seconds.
  After 8 seconds **SOUND / BELL XXX** will be displayed.
- Press the ⊤ key twice more.
  The date and time will be displayed (a: year, mon: month, d: day, h: hours, min: minutes).
- Press the ☐ key repeatedly until the input field for the desired parameter is shown inversely.
- Set the desired value by means of the control knob ⟲ .
- Press the START key to save the setting.
  **∗∗∗ ok ∗∗∗** will be displayed briefly as a confirmation.
- To exit the date and time set-up, press any key apart from the ☐, ⊤ and START keys.


**24    Centrifugation data displayed after switching on.**

After switching on, the centrifugation data for program 1 or for the program last used will be displayed. This can be set as follows:
- Open the lid.
- Switch the mains supply switch off and on again. Switch position I.
- Press the STOP key when the first visual change appears in the display (inverse display).
  **PROGRAM 1**, **LAST PROGRAM** will be displayed.
- Set the desired function by means of the control knob ⟲.
- Press the START key to save the setting.
  **∗∗∗ ok ∗∗∗** will be displayed briefly as a confirmation.


**25    Immediate display of the centrifugation data after switching on**

- Switch on the mains supply switch. Switch position I.
- Press any key apart from the STOP key when the first visual change appears in the display (inverse display). The centrifugation data will be displayed immediately.

## 26 Key-operated switch (for centrifuges with key-operated switch only).

The following program interlocks can be set by the key-operated switch:

Left key position: **LOCK 1** will be displayed.

Programs can be called up but not changed.

Right key position: **LOCK 2** will be displayed.

No programs can be called up or changed.

Middle key position: no status display.

No program interlock. Programs can be called up and changed.

## 27 Program linking (for centrifuges with program linking only).

Several centrifugation runs can be linked together with the help of the program linking function.

### 27.1 Linking programs

> ☞ Program linking is only possible with programs in which run-up and braking steps have been set.
>
> Before linking, the programs must be stored in the desired sequence either by entering the program or by calling up the program (see Chapter "Programming").
>
> The program locations must be consecutive (e.g. program locations 10+11+12).

1. Press the PROG key in order to select the parameter PROG-Nr. The input field will be displayed inversely.
2. Set the program location for the first program (XX+) by means of the control knob ⟳ .
3. Press the RCL key. The centrifugation data for the selected program location will be displayed.
4. Press the PROG key twice in order to select the parameter PR-PART. The input field will be displayed inversely.
5. Press the STO key twice. The program will be linked and the program number for the next program location (+XX+) will be displayed.
6. Press the RCL key twice. The centrifugation data for the selected program location will be displayed.
7. Press the STO key twice. The program will be linked and the program number for the next program location (+XX+) will be displayed.
8. Keep repeating steps 6 and 7 until all programs have been linked.
9. Press the PROG key to exit. The program number for the last program (+XX) will be displayed.

### 27.2 Changing program links

- Call up the desired program (see Chapter "Calling up programs"), change the desired parameters (see Chapter "Entering centrifugation parameters"), and save the modified centrifugation data to the same program location (see Chapter "Entering / modifying programs"). As a result of saving, the program linking will be removed.
- Re-link the programs (see Chapter "Linking programs").

### 27.3 Centrifugation run with program linking

- Press the PROG key twice in order to select the parameter PR-PART. The input field will be displayed inversely.
- Set the program location for the first program (XX+) by means of the control knob ⟳ .
- Press the RCL key. The centrifugation data for the selected program location will be displayed.
- Press the START key. The rotation indicator ↻ will appear as long as the rotor is turning.
  The run-up and braking steps for the program linking will be displayed:

  

  First program (XX+)
  **x:** Run-up step for the first program

  **PR-PART**

  

  Next program (+XX+)
  **x:** Run-up step for the next program

  **PR-PART**

  

  Last program (+XX)
  **x:** Run-up step for the last program
  **y:** Braking step for the last program

  **PR-PART**
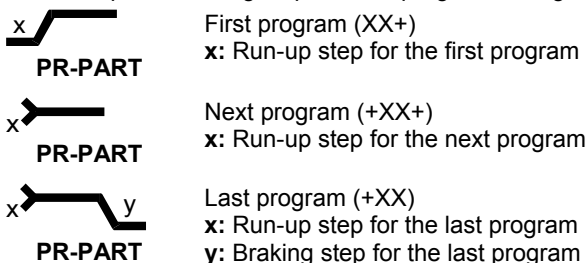
- When the time in the last program has expired, run-down will take place with the braking step of the last program. If the centrifugation run is interrupted by pressing the STOP key, run-down will take place with the braking step of the program running at the time.

### 27.4 Deleting program linking

- Press the PROG key in order to display the parameter PROG-Nr. The input field will be displayed inversely.
- Set the program location for the first program (XX+) by means of the control knob ○.
- Press the RCL key. The centrifugation data for the selected program location will be displayed.
- Press the PROG key twice in order to display the parameter PR-PART. The input field will be displayed inversely.
- Press the STO key twice.
- Press the PROG key.

### 28   Cooling (only in centrifuges with cooling)

The temperature set-point can be adjusted from -20°C to +40°C. The lowest obtainable temperature is dependent on the rotor (see Chapter "Anhang/Appendix, Rotoren und Zubehör/Rotors and accessories"). If the actual temperature and the set temperature deviate more than 5 °C, the temperature value in the display will start to flash on and off.

### 28.1   Standby-cooling

With rotor standstill and closed lid the centrifugal chamber is cooled to the pre-selected temperature. The temperature set-point is shown in the display.

### 28.2   Pre-cooling the rotor

For rapid pre-cooling of the unloaded rotor and the accessories, it is recommended that the centrifuge is run with the continuous running settings and a speed of ca. 20% of the maximum rotor speed.

### 29   Heating (only on centrifuges with heating/cooling option)

During operation of the centrifuge the centrifuge chamber can be heated as required to the preselected temperature. The heating is switched off when the rotor is stationary.

> ⚠ Risk of burning! The surface temperature of the heating element in the centrifugal chamber of the centrifuge can reach 500°C / 932°F. Do not touch the heating element.

### 30   Relative centrifugal force (RCF)

The relative centrifugal force (RCF) is given as a multiple of the acceleration of gravity (g). It is a unit-free value and serves to compare the separation and sedimentation performance.

These values are calculated using the formula below:

$$RCF = \left(\frac{RPM}{1000}\right)^2 \times r \times 1{,}118 \qquad \Rightarrow \qquad RPM = \sqrt{\frac{RCF}{r \times 1{,}118}} \times 1000$$

RCF  = relative centrifugal force
RPM  = rotational speed (revolutions per minute)
  r  = centrifugal radius in mm =  distance from the centre of the turning axis to the bottom of the centrifuge.
                                   For more on the centrifugal radius see the chapter " Anhang/Appendix,
                                   Rotoren und Zubehör/Rotors and accessories".

> ☞ The relative centrifugal force (RCF) stands in relation to the revolutions per minute and the centrifugal radius.

## 31 Centrifugation of materials or mixtures of materials with a density higher than 1.2 kg/dm$^3$

When centrifuging with maxim revolutions per minute the density of the materials or the material mixtures may not exceed 1.2 kg/dm$^3$.

The speed must be reduced for materials or mixtures of materials with a higher density.

The permissible speed can be calculated using the following formula:

$$\text{Reduced speed } (n_{red}) = \sqrt{\frac{1.2}{\text{Greater density [kg/dm³]}}} \times \text{maximum speed [RPM]}$$

e.g.: maximum speed RPM 4000, density 1.6 kg/dm$^3$

$$n_{red} = \sqrt{\frac{1.2 \text{ kg/dm³}}{1.6 \text{ kg/dm³}}} \times 4000 \text{ RPM} = 3464 \text{ RPM}$$

In the exceptional case that the maximum loading indicated on the hanger is exceeded, the speed must also be reduced.

The permissible speed can be calculated using the following formula:

$$\text{Reduced speed } (n_{red}) = \sqrt{\frac{\text{maximum load [g]}}{\text{actual load [g]}}} \times \text{maximum speed [RPM]}$$

e.g.: maximum speed RPM 4000, maximum load 300 g, actual load 350 g

$$n_{red} = \sqrt{\frac{300 \text{ g}}{350 \text{ g}}} \times 4000 \text{ RPM} = 3703 \text{ RPM}$$

If in doubt you should obtain clarification from the manufacturer.

## 32 Rotor Identification

After every start of a centrifugation run the rotor utilised is identified.

After a change of rotor the drive switches off and the rotor code (R xx) as well as the maximum rotational speed (n-max=xxxxx) of the rotor are displayed.

> ☞ A further operation of the centrifuge is only possible after pressing the START key.
>
> If, following a rotor change, the maximum speed of the rotor is less than the set speed, the speed is limited to the maximum speed of the rotor.

## 33 Emergency release

The lid cannot be opened during power failure. An emergency release has to be executed by hand.

> ⚠ For emergency release disconnect the centrifuge from the mains.
>
> Open the lid only during rotor standstill.
>
> Only the plastic release pin provided may be used for emergency release.

See figure on page 2.

- Switch off the mains switch (switch position "0").
- Look through the window in the lid to be sure that the rotor has come to a standstill.
- Insert the release pin (see scope of supply) horizontally into the hole (Fig. 1, A). Insert the release pin up to the point at which the turning knob can be rotated to the left when the pin is pushed downwards.
- Open the lid.

## 34 Maintenance and servicing

> ⚠ Pull the mains plug before cleaning.
>
> Before any other cleaning or decontamination process other than that recommended by the manufacturer is applied, the user has to check with the manufacturer that the planned process does not damage the device.

- Centrifuges, rotors and accessories must not be cleaned in rinsing machines.
- They may only be cleaned by hand and disinfected with liquids.
- The water temperature must be between 20 – 25°C.
- Only detergents/disinfectants may be used which:
  - have a pH between 5 - 8
  - do not contain caustic alkalis, peroxides, chlorine compounds, acids and alkaline solutions

- In order to prevent appearances of corrosion through cleaning agents or disinfectants, the application guide from the manufacturer of the cleaning agent or disinfectant are absolutely to be heeded.

## 34.1 Centrifuge (housing, lid and centrifuging chamber)

### 34.1.1 Surface cleaning and care

- Clean the centrifuge housing and the centrifuging chamber regularly, using soap or a mild detergent and a damp cloth if required. For one thing, this services purposes of hygiene, and it also prevents corrosion through adhering impurities.
- Ingredients of suitable detergents:
  soap, anionic tensides, non-ionic tensides.
- After using detergents, remove the detergent residue by wiping with a damp cloth.
- The surfaces must be dried immediately after cleaning.
- In the event of condensation water formation, dry the centrifugal chamber by wiping out with an absorbent cloth.
- Lightly rub the rubber seal of the centrifuge chamber with talcum powder or a rubber care product after each cleaning.
- The centrifuging chamber is to be checked for damage once a year.

> ⚠ If damage is found which is relevant to safety, the centrifuge may no longer be put into operation. In this case, notify Customer Service.

### 34.1.2 Surface disinfection

- If infectious materials penetrates into the centrifugal chamber this is to be disinfected immediately.
- Ingredients of suitable disinfectants:
  ethanol, n-propanol, isopropyl alcohol, glutardialdehyde, quaternary ammonium compounds.
- After using disinfectants, remove the disinfectant residue by wiping with a damp cloth.
- The surfaces must be dried immediately after disinfecting.

### 34.1.3 Removal of radioactive contaminants

- The agent must be specifically labelled as being an agent for removing radioactive contaminants.
- Ingredients of suitable agents for removing radioactive contaminants:
  anionic tensides, non-ionic tensides, polyhydrated ethanol.
- After removing the radioactive contaminants, remove the agent residue by wiping with a damp cloth.
- The surfaces must be dried directly after removing the radioactive contaminants.

## 34.2 Rotors and Attachments

### 34.2.1 Cleaning and care

- In order to prevent corrosion and material changes, rotors and accessories must be cleaned regularly with soap or a mild detergent and a damp cloth. Cleaning is recommended at least once a week. Contaminants must be removed immediately.
- Ingredients of suitable detergents:
  soap, anionic tensides, non-ionic tensides.
- After using detergents, remove detergent residue by rinsing with water (only outside of the centrifuge) or wipe off with a damp cloth.
- The rotors and accessories must be dried directly after cleaning.
- Angle rotors, container and hanger made of aluminium are to be lightly greased after drying using acid-free grease, e.g. vaseline.
- In order to prevent corrosion as a result of moisture between the rotor and the motor shaft, the rotor should be disassembled and cleaned at least once a month, and the motor shaft should be lightly greased.
- The rotors and the accessory parts have to be checked on a monthly basis for wear and corrosion. For swing-out rotors, it is important to check the area of the lifting lugs, for hangers, the grooves and the base should be checked for cracks.

> ⚠ Rotors and attachments may no longer be utilised upon indication of wear and tear or corrosion.

- Check the firm seating of the rotor on a weekly basis.

### 34.2.2 Disinfection

- If infectious material should get on the rotors or accessories, they must be appropriately disinfected.
- Ingredients of suitable disinfectants:
  glutaraldehyde, propanol, ethyl hexanol, anionic tensides, corrosion inhibitors.
- After using disinfectants, remove disinfectant residue by rinsing with water (only outside of the centrifuge) or wipe off with a damp cloth.
- The rotors and accessories must be dried directly after disinfection.

### 34.2.3 Removal of radioactive contaminants

- The agent must be specifically labelled as being an agent for the removal of radioactive contaminants.
- Ingredients of suitable agents for removing radioactive contaminants:
  anionic tensides, non-ionic tensides, polyhydrated ethanol.
- After removing the radioactive contaminants, remove agent residue by rinsing with water (only outside of the centrifuge) or wipe off with a damp cloth.
- The rotors and accessories must be dried directly after removing the radioactive contaminants.

### 34.2.4 Trunnions

With swing-out rotors the trunnions must be regularly lubricated (Hettich Lubricating Grease No. 4051) in order to ensure consistent swinging out of the hangers.

### 34.2.5 Rotors and accessories with limited service lives

The use of certain rotors, hangers and accessory parts is limited by time.
These are marked with the maximum permitted number of operating cycles or with an expiration date and the maximum permitted number of operating cycles or just with the expiration date; e.g.:
- "einsetzbar bis Ende: IV. Quartal 2011 / usable until end of: IV. Quarter 2011" or
  "einsetzbar bis Ende Monat/Jahr: 10/2011 / usable until end of month/year: 10/2011"
- "Max. Lauf Zyklen / max. cycles: 40000".

| ⚠ | For safety reasons, rotors, hangers and accessory parts may no longer be used if either the indicated maximum number of operating cycles or the indicated expiration date has been reached. |
|---|---|

### 34.3 Autoclaving

Swing-out rotors, angle rotors made of aluminium, suspension made of metal, lids with bio-containment as well as stands and reductions can be autoclaved at 121° C / 250°F (20 mins).
Otherwise you must ask the manufacturer.
No statement can be made about the degree of sterility.

| ⚠ | The lids of the rotors and containers must be removed prior to autoclaving. |
|---|---|
| | Autoclaving accelerates the ageing process of plastics. In addition, autoclaving may discolour plastics. |
| | We recommend that the packing rings of the bio-safety system be replaced after autoclaving. |

### 34.4 Centrifuge containers

- With leakiness or after the breakage of centrifuging containers broken container parts and leaked centrifugation material are to be completely removed.
- The rubber inserts as well as the plastic sleeves of the rotors are to be replaced after a glass breakage.

⚠ Remaining glass splitters cause further glass breakage!

- If this concerns infectious material, a disinfection process is to be executed immediately.

### 35 Faults

If the fault cannot be eliminated with the help of the fault table, please inform Customer Service.

Please specify the type of centrifuge and the serial number. Both numbers can be found on the name plate of the centrifuge.

☞ Perform a MAINS RESET:
  − Switch off the mains switch (switch position "0").
  − Wait at least 10 seconds and then switch on the mains switch again (switch position "I").

| Message / fault | | Cause | Remedy |
|---|---|---|---|
| No display | --- | No voltage. Overvoltage protection tripped out. | − Check supply voltage. <br> − Mains switch ON. |
| TACHO - ERROR | 01 | Faulty speedometer. | − Open the cover. <br> − Switch off the mains switch (switch position "0"). <br> − Wait at least 10 seconds. <br> − Turn the rotor vigorously by hand. <br> − Switch on the mains switch again (switch position "I"). The rotor must turn during switch-on.. |
| | 02 | No rotor installed. Defective motor, frequency converter or drive. | |
| IMBALANCE / UNWUCHT | (03) * | The rotor is unevenly loaded. | − Open lid. <br> − Check the loading of the rotor, see chapter "Loading the rotor". <br> − Repeat the centrifugation run. |
| CONTROL - ERROR | 04, 06 - 09 | Error in lid locking or lid closure. | − Perform a MAINS RESET. |
| N > MAX | 05 | Rotation too fast | |
| N < MIN | 13 | Rotation too slow | |
| ROTORCODE | 10 | Incorrect rotor coding | |
| MAINS INTERRUPT | (11) * | Power failure during the centrifugation run. (The centrifugation run was not finished.) | − Open lid. <br> − Push START button. <br> − Repeat the centrifugation run if necessary. |
| VERSIONS-ERROR | 12 | Mismatch between electronic components | − Perform a MAINS RESET. |
| SER I/O - ERROR | 30 - 38 | Error / defective interface | |
| POS - ERROR | 40 - 46 | Error / defective positioning or hatch drive | |
| ° C * - ERROR | 50 – 56, 58 | Error / defective cooling | |
| LOCK - ERROR | 57 | Error / defective program locking | |
| FU / CCI - ERROR | 60 - 83 | Error / defective motor control | |
| CONTROL-ERROR | 26, 90 – 95, 97 - 99 | Error / defective control unit | |
| N > ROTOR-MAX | 96 | Speed in the selected program greater than the maximum speed of the rotor (n-max-Rotor). | − Check the set speed. Reduce the set speed |

* Error number do not appear in the display.
All error numbers can be read out via parameter 00634.

## 36    Description for Robotic

The loading hatch is placed in the centrifuge lid.
The centrifuge opens the hatch by a gear motor.

The precision of each rotor position is better than 0,6 mm.

### 36.1    Operational modes

#### 36.1.1    Normal robotic operation

The key-operated switch has to be in position LOCK 2 (right key position) and the key must be pulled off.
Additionaly in the complete arrangement the centrifuge has to be protected against unauthorized penetration and manipulation.

#### 36.1.2    Adjusting and initializing operation respectively handling of the centrifuge without serial interface

> ⚠ It is only allowed for skilled maintenance staff to work in the adjusting and initializing operation.
>
> After the adjusting and initializing operation the key-operated switch has to be in position LOCK 2 (right key position) and the key must be pulled off.
>
> To protect the key against unauthorized access keep it in a save place.

This is depending to key-operated switch position.

**STOP**
The STOP key on the control panel is always active.

**START**
The START key on the control panel is normaly active.
This key can be locked via the PC with LOCK 5 (see chapter "Description of PARAMETER", Parameter 00633).

**Close and open the hatch by using the gear motor**

Only possible in key-operated switch position LOCK 1 (left key position).

| OPEN the hatch | Press key RCL |
|---|---|
| CLOSE the hatch | Press key STO |

Notice: The hatch drive acts as long as the key is pressed.

### 36.2 Introduction for serial operation

### 36.2.1 HETTICH Centrifuge-BUS
**Setting of serial interface**

- 9600 Bit/s
- Format: - 1 Start-Bit
- 7 Data bit
- 1 Paritybit (even parity)
- 1 Stop-Bit

**Used transmission control and abbreviations:**

STX = 02 hex: Start of text
ETX = 03 hex: End of text
EOT = 04 hex: End of transmission
ENQ = 05 hex: Enquiry of data
ACK = 06 hex: Acknowledge
NAK = 15 hex: Not acknowledged
ADR = Address of the centrifuge Range: 'A' to 'Z' and '[' , '\' and ']'
C = CODE = Parameter-Address -> 5 Byte ASCII (always 5-digits)
= = 3D hex: spacer between CODE and VAL
V = VALUE (VAL) = Value -> 4 Byte ASCII (always 4-digits)
BCC = Binary Code Check = Checksum of the relevant data in hex.
(EXOR – summary of the with BCC mraked bytes)

### 36.2.2 Used telegrams:

### 36.2.2.1 ENQUIRY-Telegram = transmission request
data link to the addressed centrifuge establishment to transmit the value ( V=VAL ) of the parameter (C=CODE)

PC | EOT | ADR | C | C | C | C | C | ENQ |

BCC-base

Centrifuge | ADR | STX | C | C | C | C | C | = | V | V | V | V | ETX | BCC |

PC | EOT |
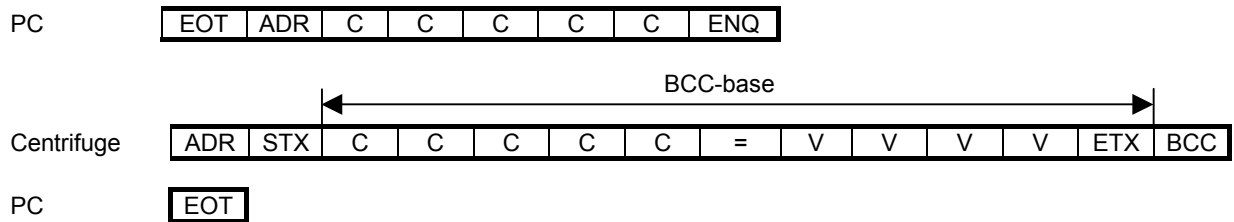
### 36.2.2.2 SELECT-Telegram = data-, or command transmission
Data transmission of value V to the parameter C of the addressed centrifuges.

BCC-base

PC | EOT | ADR | STX | C | C | C | C | C | = | V | V | V | V | ETX | BCC |

Centrifuge | ADR | ACK | or | ADR | NAK |

PC | EOT |
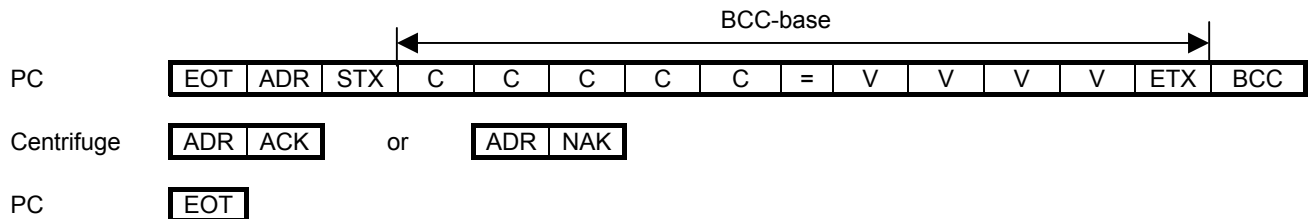
**The characters are transmitted hexadecimal coded. For a better readability here these characters are always displayed as ASCII-Symbols!**

Additional explanation for the protocol:

**ADR** = centrifuge-address (see also section "Address of the Centrifuge")

**C** = Parameter-Code (Parameter-Address)
5 digit **C**ODE, the first two HEX digits are always 0
e.g.: Parameter-Address of the target speed

| 0 | 0 | 6 | 0 | 3 |
|---|---|---|---|---|
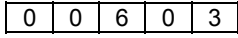
**V** = Parameter-Value
4-digits **V**AL, **V**ALUE which displays the contents.
e.g.: 500 RPM

| 0 | 1 | F | 4 |
|---|---|---|---|
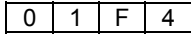
**Always only hexadecimal coded characters are transmitted!**

## 36.3 Time behaviour for serial operation

### 36.3.1 Time for one ENQUIRY-Telegram

| ENQUIRY from PC | Reaction time | Answer of the centrifuge | Reaction time PC | END of transmission |
|---|---|---|---|---|
| 8 digits | | 14 digits | | 1 digit |
| approx. 9 ms | 20...150 ms | approx. 16 ms | 15 ms | approx. 1 ms |

PC
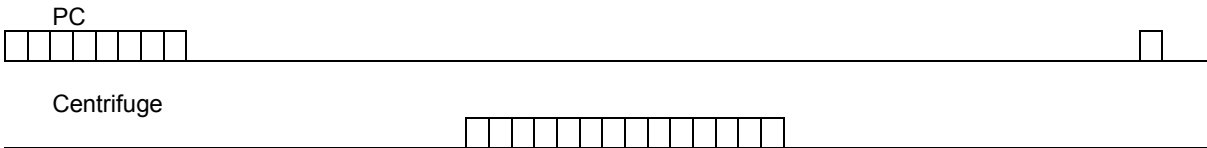
Centrifuge

### 36.3.2 Time for one SELECT-Telegram

| Command for PC | Reaction time centrifuge | Answer centrifuge | Reaction time PC | END by PC |
|---|---|---|---|---|
| 15 digits | | 2 digits | | 1 digit |
| approx. 17 ms | 20...150 ms | approx. 2 ms | 15 ms | approx. 1 ms |

PC
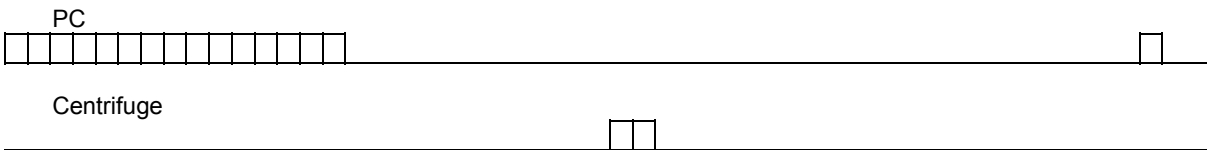
Centrifuge

The reaction time of the centrifuge depends on the respective working order.
A busy control-panel μP, e.g. during a centrifugation, uses more computing time and so the reaction time is up to 150 ms. If there is on answer from the centrifuge after 150 ms, it can be assumed that there is a serial Error.

In case of an error the telegram should be repeated 2 to 3 times. If there is still no answer after the third transmission attempt, the telegram has to be cancelled to examine the cause of the Error.

Example for an ENQUIRY-Telegram:

PC transmit to address 29: content of parameter 00604 (actual speed) required.

| EOT | ADR | C | C | C | C | C | ENQ | schematic |
|-----|-----|---|---|---|---|---|-----|-----------|

| EOT | ] | 0 | 0 | 6 | 0 | 4 | ENQ | ASCII |
|-----|---|---|---|---|---|---|-----|-------|

| 04 | 5D | 30 | 30 | 36 | 30 | 34 | 05 | HEX |
|----|----|----|----|----|----|----|----|-----|

Centrifuge with address 29 answer: content of parameter 00604 (actual speed) = 500

BCC ← →

| ADR | STX | C | C | C | C | C | = | V | V | V | V | ETX | BCC | schematic |
|-----|-----|---|---|---|---|---|---|---|---|---|---|-----|-----|-----------|

| ] | STX | 0 | 0 | 6 | 0 | 4 | = | 0 | 1 | F | 4 | ETX | | ASCII |
|---|-----|---|---|---|---|---|---|---|---|---|---|-----|--|-------|

| 5D | 02 | 30 | 30 | 36 | 30 | 34 | 3D | 30 | 31 | 46 | 34 | 03 | 7F | HEX |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|

End of telegram by PC:

| EOT | schematic |
|-----|-----------|

| EOT | ASCII |
|-----|-------|

| 04 | HEX |
|----|-----|

Example for SELECT-Telegram:

PC transmit, to address 29, Parameter 00603; rated speed 1500 RPM:

BCC ← →

| EOT | ADR | STX | C | C | C | C | C | = | V | V | V | V | ETX | BCC | schematic |
|-----|-----|-----|---|---|---|---|---|---|---|---|---|---|-----|-----|-----------|

| EOT | ] | STX | 0 | 0 | 6 | 0 | 3 | = | 0 | 5 | D | C | ETX | BCC | ASCII |
|-----|---|-----|---|---|---|---|---|---|---|---|---|---|-----|-----|-------|

| 04 | 5D | 02 | 30 | 30 | 36 | 30 | 33 | 3D | 30 | 35 | 44 | 43 | 03 | 09 | HEX |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|

Centrifuge answers:

| ADR | ACK | or | ADR | NAK | schematic |
|-----|-----|----|-----|-----|-----------|

| ] | ACK | or | ] | NAK | ASCII |
|---|-----|----|---|-----|-------|

| 5D | 06 | or | 5D | 15 | HEX |
|----|----|----|----|----|-----|

End of telegram by PC:

| EOT | schematic |
|-----|-----------|

| EOT | ASCIII |
|-----|--------|

| 04 | HEX |
|----|-----|

## 36.4  Address of the Centrifuge

Each centrifuge that is being communicated with has to have its own address.

The PC uses this address to communicate with the centrifuge. This serial address can be compared with the name of a person.

Each address in a system can only be given ONCE. In the Hettich-BUS system there can be managed up to 29 centrifuges.

Address range:

      1. Address    A = 41$_{hex}$
      2. Address    B = 42$_{hex}$
         to
    26. Address    Z = 5A$_{hex}$
         and
    27. Address    [ = 5B$_{hex}$
    28. Address    \ = 5C$_{hex}$
    29. Address    ] = 5D$_{hex}$

The address set ex works is the last one ( ] = 29. address ). This address must be correctly set by the customer.

Starting with address "A", each centrifuge has to get its own address in ascending order.

The order of addresses should not be interrupted as the PC would waste time for the query of an address not given.

If the rotor is at standstill and the lid is opened, the address can be set in the following manner:

- Switch the mains switch on.
- Press the STOP key when the first visual change appears in the display (inverse display, background gets dark). **PROGRAM 1**, **LAST PROGRAM** will be displayed.
- Press the STOP key so often until **ADRESS ]** will be displayed.
- Set the desired address by means of the control knob ↻.
- Press the START key to save the setting. ∗∗∗ **ok** ∗∗∗ will be displayed briefly as a confirmation.
- To exit the menu press any key apart from the STOP and START key.

## 36.5  Principle for serial communication

The PC requires an available RS 232 interface. The enclosed Opto Data Box converts the signal from RS 232 into light signals. All the data will be transmitted by an fiber optic cable. With this kind of cable data can by transmitted absolutely clear of strays via hundreds of meters.

- **The key-operated switch has to be in position LOCK 2 (right key position).** The centrifuge obeys commands of a PC only in position LOCK 2 (Turn key clockwise to end-position; display shows **LOCK 2**). That means the centrifuge accepts only the START and STOP key of the control panel, all other keys are blocked.

- **Centrifuges are terminals** (slaves), they answer only if they get an ENQURIY or SELECT telegram from the PC.

- **Rhythm of request:** Interrogation sequence of the parameter 00634 and 00640 should be at least all 5 sec.

- **Time delay** between sequential protocols:

  During the run:               >= 500 ms, that means only 1 protocol per sec.
  Centrifuge is in standstill:    >= 250 ms, that means max. 2 protocols per sec.

  Take care for this cycles between the protocols, because the centrifuge needs this time for internal operations.

- **Command for positioning:**

  ⚠     When using a 2-times rotor it is only allowed to go to position 1 and 3.

  After a positioning command ( Pos 1....Pos 4 ) the centrifuge acknowledges this command with ACK. Then this command is stored in the control panel.
  Only after executing this command the next positioning command can be stored.
  The centrifuge acknowledges an new positioning command with ACK but it ignorates this command and do not store it.

- If one of above mentioned positioning commands is transmitted and the centrifuge accepts it with ACK. Do not repeat it because this can cause sporadic the Error POS-ERROR 40.

- After each centrifugation (at standstill) the centrifuge will positioning the rotor automatically on Rotor position 1.

- Each rotor position (1 ... 4) will be fixed by the magnetic brake.
  After 10 minutes the brake release automatically that means if the last position is needed, the command for this position has to be sent again (see also section 36.11.2 to 36.11.5).

- **Program-Lock via serial interface**
  To avoid complication by parameter setting at the control panel, the software is applied with an additional software locking.

    LOCK 4      corresponds to the program lock LOCK 2 only START and STOP key are active.
    LOCK 5      also START key is locked, only the STOP key is active.
                    The centrifuge has to be in LOCK 5 by control via the serial interface of the PC.

Recommendation for "newcomer":

All the used centrifugation programs should be stored in the control panel.
The most convenient way to input these programs is the input directly on the control panel by using the keys and the control knob (see section "Entering centrifuging data").
For programming on the control panel the key-operated switch has to be in middle position (no LOCK in the display).

## 36.6 Summary of centrifuge parameter

| Parameter | Content | Access | R = read<br>R/W = read/write |
|-----------|---------|--------|------------------------------|
| 00601 | nominal run-time | | R/W |
| 00602 | actual run-time | | R |
| 00603 | nominal speed | | R/W |
| 00604 | actual speed | | R |
| 00605 | maximum speed of rotor | | R |
| 00606 | nominal-RCF | | R/W |
| 00607 | actual-RCF | | R |
| 00608 | maximum-RCF of rotor | | R |
| 00609 | ∫ RCF/RZB-actual 1.word MSW | | R |
| 00610 | ∫ RCF/RZB-actual 2.word LSW | | R |
| 00611 | Run-up | | R/W |
| 00612 | Run-down ( brake ) | | R/W |
| 00613 | minimum Run-up time | | R |
| 00614 | maximum Run-up time | | R |
| 00615 | minimum Run-down time | | R |
| 00616 | maximum Run-down time | | R |
| 00617 | Brake switch off speed | | R/W |
| 00618 | nominal value of temperature | | R/W |
| 00619 | actual value of temperature | | R |
| 00620 | Radius | | R/W |
| 00630 | Program-Info | | R |
| 00631 | Program-commands from PC | | R/W |
| 00632 | Information about centrifuge | | R |
| 00633 | Set-commands from PC | | R/W |
| 00634 | State of centrifuge 1 | | R |
| 00635 | State of centrifuge 2 | | R |
| 00636 | Software-version of control panel | | R |
| 00639 | Error reset and position 1 adjustment | | R/W |
| 00640 | State of positioning | | R |
| | Command for positioning | | R/W |
| 00685 | SIOF (Serial Input Output Failure)-state | | R |

## 36.7 General format of parameter content

| V | V | V | V |
|---|---|---|---|
| MSD | LSD | MSD | LSD |

byte 2 = LOW-byte = LSB

byte 1 = HIGH-byte = MSB
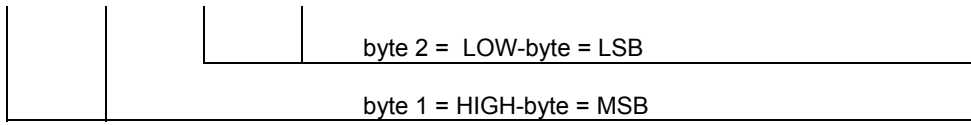
| Bit | 3...0 | 3...0 | 3...0 | 3...0 | = 4 digit |
|-----|-------|-------|-------|-------|-----------|
| Bit | 7....... ........0 | | 7...... .........0 | | = 2 byte |
| Bit | 15.............................. ....0 | | | | = 1 word |

Explanation:
- V: VAL = Value
- MSD/LSD: Most/Least significant Digit (Digit = Nibble = half byte)
- MSB/LSB: Most/Least significant Byte
- MSb/LSb: Most/Least significant Bit

Values are send or received in principle as 4 –digit characters.
Each digit has a range: from $30_{hex}$ = '0' to $39_{hex}$ = '9'
and from $41_{hex}$ = 'A' to $46_{hex}$ = 'F'.

The information (VAL) of one parameter can cover the range $0000_{hex}$ to $FFFF_{hex}$
(0 up to 65535) with one transmission.

The following parameter are hexadecimal coded:
- Times                    00601, 00602, 00613, 00614, 00615 and 00616
- Speed                    00603, 00604, 00605 and 00617
- RCF                      00606, 00607 and 00608
- Radius                   00620
- Temperature             00618, 00619 (with scale, to prevent negative values)
- Software-Version        00636

Some informations are bit coded and / or numeral coded,
e.g. Parameter 00630 and 00631:

Byte 1

| 7 | 1 = | | bit-coded |
|---|-----|---|-----------|
| 6 | MSb | | numeral 7 Bit |
| 5 | | | numeral 7 Bit |
| 4 | | | numeral 7 Bit |
| 3 | | | numeral 7 Bit |
| 2 | | | numeral 7 Bit |
| 1 | | | numeral 7 Bit |
| 0 | LSb | | numeral 7 Bit |

Byte 2

| 7 | MSb | numeral 2 Bit |
|---|-----|---------------|
| 6 | LSb | numeral 2 Bit |
| 5 | 1 = | bit-coded |
| 4 | 1 = | bit-coded |
| 3 | 1 = | bit-coded |
| 2 | 1 = | bit-coded |
| 1 | 1 = | bit-coded |
| 0 | 1 = | bit-coded |

**bit 7**
bit-information
**bit 6 to Bit 0**
numeral (7bit)
range: 0 ... 127 (0 ... $7F_{hex}$)

**bit 6 and bit 7**
numeral (2bit)
range 0 ... 3
**bit 5 to bit 0**
bit-Information

Almost all functions offered by the control panel, can be called up via the interface.
In the following chapter the most important commands and inquiries which are necessary for the positioning are presented:
- START and STOP
- Open and close the hatch
- Move rotor to position 1 to 4
- Call up stored programs

### 36.8 Introduction in the most important parameters for serial drive of the centrifuge

(This chapter shows only a short introduction.) All details will be described in the following chapter "Description of PARAMETER". In chapter "Example for enquiry and command" procedures and examples for serial operation are mentioned.

#### 36.8.1 Parameter for positioning (00640):

<u>Commands</u> (Byte 2)

| 7 | MSb | Lid control-bit 3 |
|---|-----|-------------------|
| 6 |     | Lid control-bit 2 |
| 5 |     | Lid control-bit 1 |
| 4 | LSb | Lid control-bit 0 |
| 3 | 1 = | Go to position 4 |
| 2 | 1 = | Go to position 3 |
| 1 | 1 = | Go to position 2 |
| 0 | 1 = | Go to position 1 |

- **Open the hatch**
  In Byte 2 are used Bit 4-7

  | SELECT-Command to 00640 with $0060_{hex}$ |
  |---|
  | Lid control-bit 1 and 2 set = Bit 5 and Bit 6 ( $6_{hex}$ ) |

  The lid control-bits will be reset , after command execute.

- **Close the hatch**
  In Byte 2 are used Bit4-7

  | SELECT-command to 00640 with $0070_{hex}$ |
  |---|
  | Lid control-bits 0, 1 and 2 are set = Bit 4, Bit 5 and Bit 6 ( $7_{hex}$ ) |

  The lid control-bits will be reset , after command execute.

- **Go to position**
  In byte 2 are used bit (0 –3)
  Position 1    Bit0 set = $1_{hex} \rightarrow$ SELECT-command for: 00640 with $0001_{hex}$
  Position 2    Bit1 set = $2_{hex} \rightarrow$ SELECT-command for: 00640 with $0002_{hex}$
  Position 3    Bit2 set = $4_{hex} \rightarrow$ SELECT-command for: 00640 with $0004_{hex}$
  Position 4    Bit3 set = $8_{hex} \rightarrow$ SELECT-command for: 00640 with $0008_{hex}$

  | ⚠ | When using a 2-times rotor it is only allowed to go to position 1 and 3. |
  |---|---|

<u>State-Informations</u> (Byte 1)

| 7 | 1 = | Magnetic brake is active |
|---|-----|--------------------------|
| 6 | 1 = | Hatch is open (from Software version 4.006) |
| 5 | 1 = | |
| 4 | 1 = | Hatch is closed |
| 3 | 1 = | Rotor in position 4 |
| 2 | 1 = | Rotor in position 3 |
| 1 | 1 = | Rotor in position 2 |
| 0 | 1 = | Rotor in position 1 |

The state bits from the control panel are set as long as the status is active

**From software version 4.006:**

|  | hatch is open | hatch is closed |
|---|---|---|
| 00634 Byte 2 | | Bit 0  = 0 |
| 00640 Byte 1 | Bit 6  = 1 | &&    Bit 4  = 1 |

**Up to software version 4.005:**

|  | hatch is open | hatch is closed |
|---|---|---|
| 00634 Byte 2 | | Bit 0  = 0 |
| 00640 Byte 1 | Bit 4  = 0 | &&    Bit 4  = 1 |
| 00640 Byte 2 | &&    Bit 5  = 0 | |
|  | &&    Bit 6  = 0 | |

If the hatch is complete open, the command bits will be reset.

### 36.8.2 Parameter for centrifuge state (00634)

Byte 1:

| 7 | 1 = | Centrifuge Error (Error-no. in bit 0...6) |
|---|-----|-------------------------------------------|
| 6 | MSb | |
| 5 | | 7-bit digit: |
| 4 | | − Centrifuge-Error no. (when bit 7 = 1), |
| 3 | | or |
| 2 | | − just called program number, shown in display, |
| 1 | | if no Error (bit 7 = 0) |
| 0 | LSb | |

Byte 2:

| 7 | 1 = | State has changed |
|---|-----|-------------------|
| 6 | MSb | Program-ID (see 00631) |
| 5 | LSb | Program-ID (see 00631) |
| 4 | 1 = | Run-down |
| 3 | 1 = | Centrifugation |
| 2 | 1 = | Run-up |
| 1 | 1 = | Stand still |
| 0 | 1 = | Lid open |

- **Lid and hatch is closed (machine is closed)**
  Byte 2      Bit 0 is reset.
  Bit is reset, if the lid and the hatch is closed.

- **Lid or hatch is open (machine is open)**
  Byte 2      Bit 0 is set.
  Bit is set, as soon as the lid or hatch is open. This bit corresponds to the lid indication on the control panel.

- **Standstill of centrifuge, lid or hatch can be opened**
  Byte 2      Bit 1 is set.

- **Centrifuge in run-up**
  Byte 2      Bit 2 is set.

- **Centrifuge in run, nominal speed reached**
  Byte 2      Bit 3 is set.

- **Centrifuge in run-down**
  Byte 2      Bit 4 is set.

- **Program-ID**
  Byte 2      Bit 5 and 6 (binary coded, range 0 – 3)

  0: "normal" centrifuging-program

  

  1-3:   ID for program sequence (PR-PART)
         1 = Start of program
         2 = Middle part of program
         3 = End of program

  e.g: One program sequence which consists of 4 program parts

  

  | 1. Part = 1 | Middle-Part = 2 | Middle-Part = 2 | End-Part = 3 |
  |-------------|-----------------|-----------------|--------------|
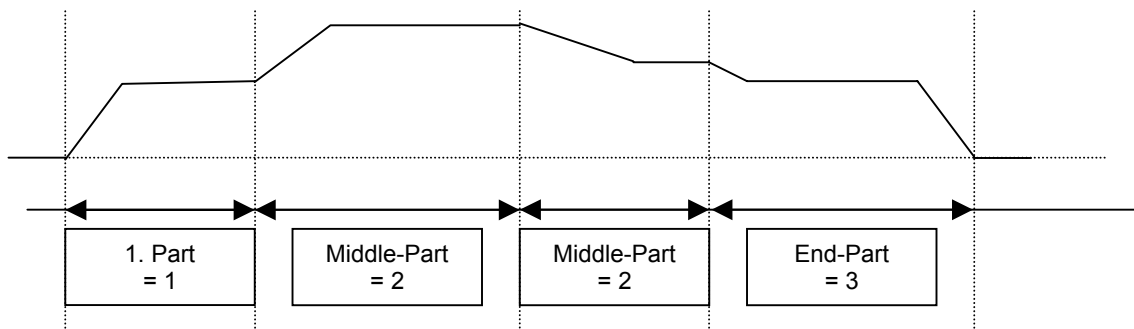
- **Modification**
  Parameter 00634 Byte 2, Bit 7
  This bit is set by the centrifuge, when recognising the following:

  1. Rotor changed
  2. Hardware-Lock (Key-operated-switch) changed
  3. Centrifuge started by a user using the control panel.
  4. Centrifuge stopped by a user using the control panel.
  5. Control panel recognises standstill after a centrifugation
  6. Centrifuge stopped with an error message

  After reading parameter 00634 by PC, this bit is cleared automatically by the control panel.

- **Numerical Information**
  Parameter 00634 Byte 1, Bit 0 to 6
  The information is binary coded only bit 0 to bit 6 within a range up to
  $127 = FF_{HEX.}$
  Either the actual program no. (bit 7 = 0) or the centrifuge error number is stored (bit 7 = 1).
  If it is a program or an error number depends on bit 7 (see next item).

- **Program-, or Error-Information**
  If bit 7 is cleared, the current program number is set in same byte in bit 0 to bit 6.
  If bit 7 is set, the centrifuge stops with an error message. Bit 0 to 6 contain the current error number.

### 36.8.3  Control commands for centrifugation

The following commands are available via parameter 00633.

- **START**
  SELECT-Command on parameter: 00633 with $0042_{hex}$ (set Start-bit and LOCK 4-bit).

- **STOP**
  SELECT-Command on parameter: 00633 with $0001_{hex}$ (set Stop-bit).
  Only in case of emergency or in continuous run- mode the centrifuge should be stopped using the serial
  interface. In run-time the centrifuge stopped at end of running time.

- **RCL Program**
  This correspond to press the RCL key on the control panel (an already stored program is recalled into the display,
  so that user is able to start it).
  1. Write to the parameter 00631 Byte 1, Bit 0 to Bit 6 the program number (pp). Possible program numbers 0 to
     99 and 100 (100 = program "----").

  2. Set Parameter 00631 Byte 2, Bit 2.
     $\rightarrow$ SELECT-command on parameter: 00631 with program number $(pp)04_{hex}$.

### 36.8.4  Special functions: ACK, NAK and SIOF

- If one centrifuge is answering with NAK to a telegram, the SIOF parameter (00685) has to read –out. The
  enclosed Info-bit will be reset with the read-out of the parameter.
- Only with deleted bits in SIOF, the centrifuge will accept an order by SELECT.
- SIOF-Bits will be set:
  - after switch on the centrifuge (mains reset)
  - by ENQUIRY a non existent parameter
  - by SELECT a non existent parameter
  - by SELECT a "read only" parameter
  - by SELECT non vaild values
  - by SELECT to parameter 00631, in case of overwriting an existing program (safety procedure).
- With read-out SIOF:
  - a serial interface Error can be detected.
  - enable serial interface for SELECT-telegrams. With SIOF-enquiry all SIOF-Error-bit will be reset by the
    centrifuge.

## 36.9    Description of PARAMETER

| Parameter-No.: 00601 | Set run-time | Access **Read/Write** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

time LSB
time MSB
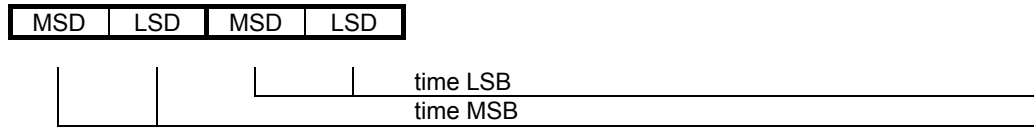
Input:      Seconds
Range:      0 = continuos run, time run = 1 up to 59,999 sec (999min:59sec)


| Parameter-No.: 00602 | Actual run-time | Access **Read** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

time LSB
time MSB
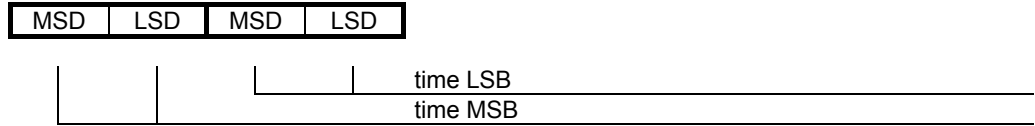
Display:    Seconds
Range:      0 up to 59,999 sec (999 min:59 sec)


| Parameter-No.: 00603 | Set-speed | Access **Read/Write** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

Nominal speed LSB
Nominal speed MSB
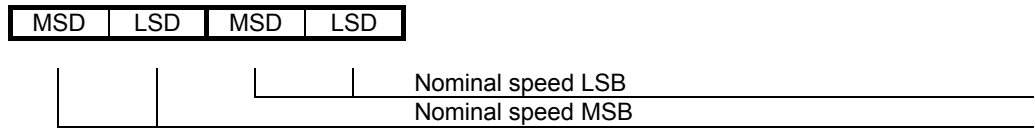
Input:      RPM = revolutions per minute
Range:      50 up to max. Rotor-speed (see parameter 00605)


| Parameter-No.: 00604 | Actual-speed | Access **Read** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

Actual speed LSB
Actual speed MSB
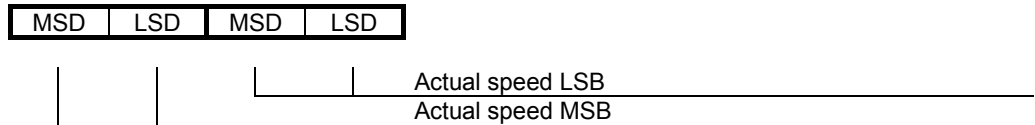
Display:    RPM = **R**evolution **P**er **M**inute
Range:      50 up to 20,000 RPM


| Parameter-No: 00605 | Maximum rotor speed | Access **Read** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

max. speed LSB
max. speed MSB
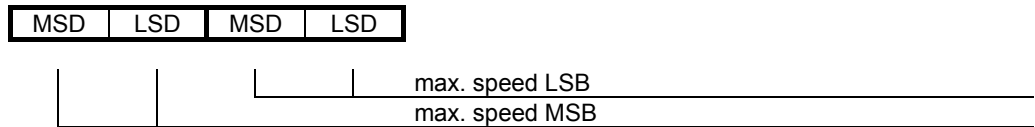
Display:    RPM = **R**evolutions **P**er **M**inute
            This value depends on the used rotor
Range:      50 up to 20,000 RPM

| Parameter-No.: 00606 | Set RCF/RZB | Access **Read/Write** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

RCF LSB
RCF MSB

Input: RCF; Number without dimensions (multiple gravity)
Range: 1 up to max. Rotor-RCF (see Parameter 00608)

RCF-Formula: $RCF \approx 1{,}118 \times r \times \left(\dfrac{n}{1000}\right)^2$    r = radius in mm
n = speed in RPM

| Parameter-No.: 00607 | Actual-RCF/RZB | Access **Read** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

RCF LSB
RCF MSB

Display: Number without dimensions (multiple gravity)
Range: 1 up to 30,000 RCF

| Parameter-No.: 00608 | Maximum Rotor-RCF | Access **Read** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

RCF LSB
RCF MSB

Display: Number without dimensions (multiple gravity)
The value depends on the used rotor (max. rotor speed 00605) and radius 00620
Range: 1 up to 30,000

Description:    ∫ **RCF/RZB : float-number**    Format according to IEEE-754-Standard
(width = 32 Bit)

The complete information has to be determined by two parameters

| Parameter-No.: 00609 | ∫ **RCF/RZB  1.Word MSW** | Access **Read** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

RCF LSB
RCF MSB
31--------------------Bit--------------------16

| Parameter-No.: 00610 | ∫ RCF/RZB  2.Word LSW | Access **Read** |
|---|---|---|

Structure:

```
  MSD   LSD   MSD   LSD
                          RCF LSB
                          RCF MSB
  15--------------------Bit--------------------0
```
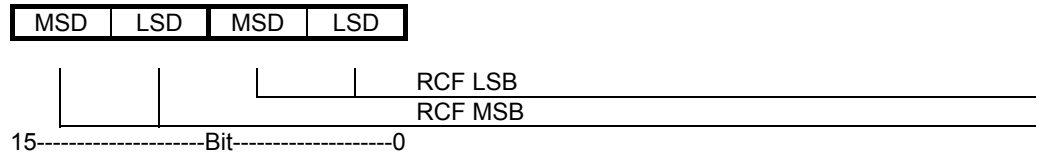
!! There are only values, therefore bit 31 is always 0 !!
Bit 31          : sign ( 0 = positive, 1=negativ )
Bit 30...23     : Exponent ( two's complement with offset $127_{dezimal}$)
                 Bit 23 = $2^0$
                 Bit 24 = $2^1$
                 Bit 25 = $2^2$
                 Bit 26 = $2^3$
                 Bit 27 = $2^4$
                 Bit 28 = $2^5$
                 Bit 29 = $2^6$
                 Bit 30 = $2^7$

Bit 22...0      : normalised mantissa ( range 1...2 )
Number 1 always exist and is not stored as a Bit.
                 Bit 22 = $2^{-1}$ = 0.5
                 Bit 21 = $2^{-2}$ = 0.25
                 Bit 20 = $2^{-3}$ = 0.125
                 Bit 19 = $2^{-4}$ = 0.0625
                 etc
                 Bit 0 = $2^{-23}$

Commutation formula:          $X = (-1)^{sign} * Mantissa * 2^{Exponent -127}$

| Parameter-No.: 00611 | Run-up | Access **Read/Write** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

Run-up parameter Byte 2
Run-up parameter Byte 1

Byte 1

| 7 | 1= level   0= time |
|---|---|
| 6 | MSB ( Bit 14 ) |
| 5 | |
| 4 | |
| 3 | 7-bit digit MSB |
| 2 | |
| 1 | |
| 0 | |

Byte 2

| 7 | |
|---|---|
| 6 | |
| 5 | |
| 4 | 8-bit digit LSB |
| 3 | |
| 2 | |
| 1 | |
| 0 | Lsb ( Bit 0 ) |

1. Possibility: Run-up-level
Run-up level, if Byte 1 -Bit 7- =1
Range: 1 up to 9

2. Possibility: Run-up time
Run-up time, if Byte 1 -Bit 7- =0
Time in second
range: 1 up to 5,999 seconds ( 99 min : 59 sec )

Values out of minimum or maximum are automatically set to the minimum or maximum value.

Minimum- / maximum-value: see parameter 00613 and 00614

Conversion from level to the corresponding time or reverse:
Here is a table necessary to allocate level and time to each centrifuge and each rotor.

| Parameter-No.: 00612 | Run-down | Access **Read/Write** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

Run-down parameter Byte 2

Run-down parameter Byte 1

Byte 1

| 7 | 1= Level   0= Time |
|---|---|
| 6 | Msb ( Bit 14 ) |
| 5 | |
| 4 | |
| 3 | 7-bit digit MSB |
| 2 | |
| 1 | |
| 0 | |

Byte 2

| 7 | |
|---|---|
| 6 | |
| 5 | |
| 4 | 8-bit digit LSB |
| 3 | |
| 2 | |
| 1 | |
| 0 | Lsb ( Bit 0 ) |

1. Possibility: run-down level
run-down level, if Byte 1 -Bit 7- =1
range: 0 up to 9

2. possibility: run-down time
run-down time, if Byte 1 -Bit 7- =0
time in second
range: 1 up to 5,999 second ( 99 min : 59 sec )

Values out of minimum or maximum are automatically set to the minimum or maximum value.

Minimum- / maximum-value: see parameter 00615 and 00616

Conversion from level to the corresponding time or reverse:
Here is a table necessary to allocate level and time to each centrifuge and each rotor.

| Parameter-No.: 00613 | Minimum run-up-time | Access **Read** |
| --- | --- | --- |

| Parameter-No.: 00614 | Maximum run-up-time | Access **Read** |
| --- | --- | --- |

| Parameter-No.: 00615 | Minimum run-down-time | Access **Read** |
| --- | --- | --- |

| Parameter-No.: 00616 | Maximum run-down-time | Access **Read** |
| --- | --- | --- |

Structure:

| MSD | LSD | MSD | LSD |
| --- | --- | --- | --- |

Time LSB
Time MSB

Byte 1

| 7 | 1=  ( not used ) |
| --- | --- |
| 6 | Msb ( Bit 14 ) |
| 5 | |
| 4 | |
| 3 | 7-bit digit MSB |
| 2 | |
| 1 | |
| 0 | |

Byte 2

| 7 | |
| --- | --- |
| 6 | |
| 5 | |
| 4 | 8-bit digit LSB |
| 3 | |
| 2 | |
| 1 | |
| 0 | Lsb ( Bit 0 ) |
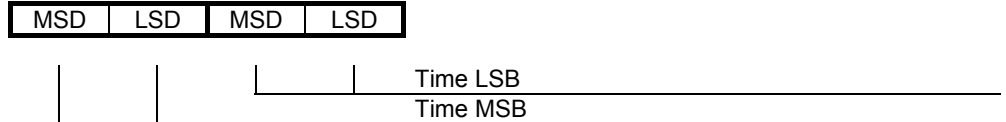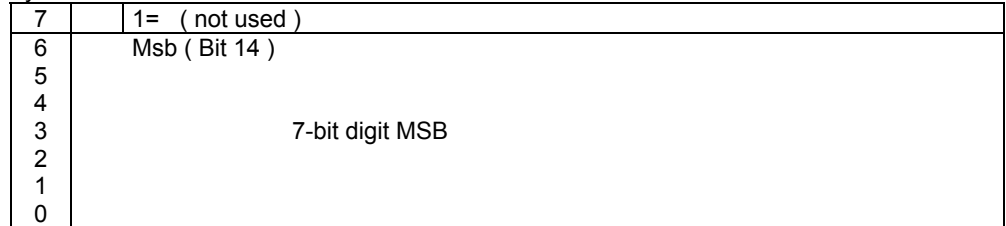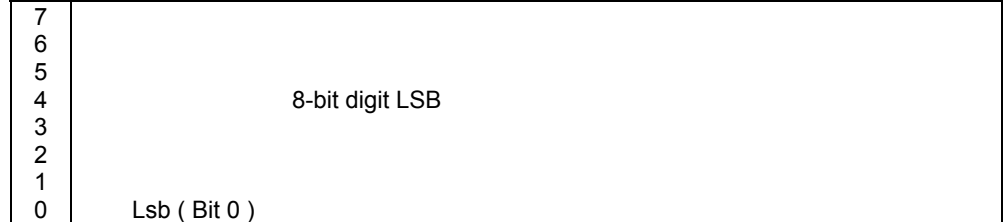
Display: Time in seconds
Range: 1 up to 5,999 seconds ( 99 min : 59 sec )

| Parameter-No.: 00617 | Brake-switch-off-speed | Access **Read/Write** |
| --- | --- | --- |

Structure:

| MSD | LSD | MSD | LSD |
| --- | --- | --- | --- |

speed LSB
speed MSB
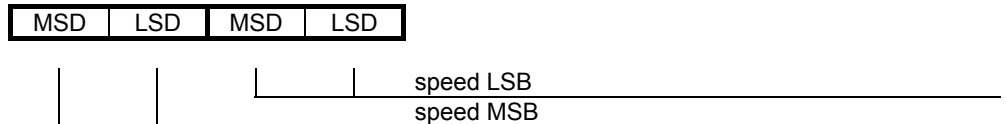
Display: Speed (RPM), at which the centrifuge runs down without braking.
Range: 50 up to Nominal-Speed (00603) (max. 20,000 RPM)
Only values lower than the nominal speed have to be transferred via the interface.

| Parameter-No.: 00618 | Set -Temperature | Access **Read/Write** |
| --- | --- | --- |

Structure:

| MSD | LSD | MSD | LSD |
| --- | --- | --- | --- |

Nominal temperature
always 00
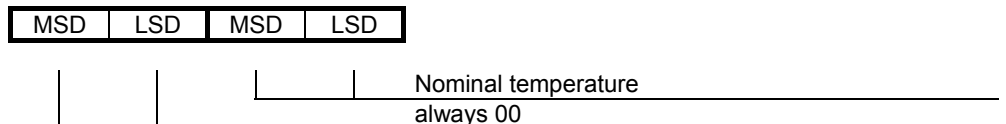
Input: Temperature in degree Celsius
Range: Cooled centrifuges:          -20 up to +40 °C
Heated/Cooled centrifuges:   -20 up to +60 °C
Format: Data is transmitted standardised: with offset 25° ($T_{min}$ = 25)
see also 00619 actual temperature
Formula: transmitted data  = (Nominal value + $T_{min}$) *2

| Parameter-No: 00619 | Temperature-actual value | Access **Read** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

          actual temperature
          always 00

Display:    Temperature value in Celsius
Range:     -25 up to +102 °C

Format:    Data is transmitted standardised: with offset 25° ($T_{min}$ = 25)
             see also 00619 actual temperature
Formula:   transmitted data = (Nominal value - $T_{min}$) *2

e.g.:      -25°C  = 0X00
        -10°C  = 0X1E
      +40°C  = 0X82
   +102°C  = 0XFE

| Parameter-No.: 00620 | Radius | Access **Read/Write** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

          Radius (LSB)
          Radius (MSB)

Range:    1 up to 500

The range of the radius is not checked by the centrifuge. The correct radius has to be limited by the PC: Maximum radius ROTANTA 46 = 220 mm

| Parameter-No.: 00630 | Program-Info | Access **Read** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

          Program-Info
          Program-Number (0 up to 99)

Byte 1

| 7 | 1 = | (not used) |
|---|---|---|
| 6 | MSb | |
| 5 | | |
| 4 | | |
| 3 | | 7-bit digit, which indicates the program-number, |
| 2 | | |
| 1 | | |
| 0 | LSb | |

Byte 2 Information from control panel (centrifuge)

| 7 | MSb | Programm-ID |
|---|---|---|
| 6 | LSb | Program-ID |
| 5 | 1 = | |
| 4 | 1 = | PROG already exists (security bit) |
| 3 | 1 = | Program stored (STO) |
| 2 | 1 = | Program recalled (RCL) |
| 1 | 1 = | |
| 0 | 1 = | PROG written to serial parameter |

| Parameter-No.: 00631 | Program-command from PC | Access Read/Write |
| --- | --- | --- |

Structure:

| MSD | LSD | MSD | LSD |
| --- | --- | --- | --- |

| | Program-command |
| --- | --- |
| | Program-number (0 up to 99) |

Byte 1

| | | |
| --- | --- | --- |
| 7 | 1 = | (not used) |
| 6 | MSb | |
| 5 | | |
| 4 | | |
| 3 | | 7-bit digit, which indicates the program number, |
| 2 | | |
| 1 | | |
| 0 | LSb | |

Byte 2  Program-command from PC

| | | |
| --- | --- | --- |
| 7 | MSb | Program-ID |
| 6 | LSb | Program-ID |
| 5 | 1 = | |
| 4 | 1 = | PROG overwrite (overwrite confirmation) |
| 3 | 1 = | STO Program |
| 2 | 1 = | RCL Program |
| 1 | 1 = | Hand over program-ID |
| 0 | 1 = | Write program in serial parameter |

| Bit 7 | Bit 6 | Program-ID: |
| --- | --- | --- |
| 0 | 0 | Profile (standalone) |
| 0 | 1 | Sequential program first part |
| 1 | 0 | Sequential program middle part |
| 1 | 1 | Sequential program last part |

| Parameter-No: 00632 | Centrifuge-ID | Access Read |
| --- | --- | --- |

Structure:

| MSD | LSD | MSD | LSD |
| --- | --- | --- | --- |

| | Code plug Byte 2 |
| --- | --- |
| | Code plug Byte 1 |
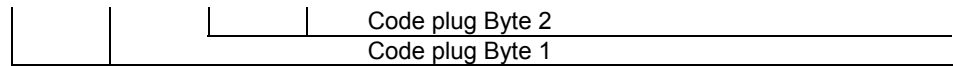
Byte 1

| | | | |
| --- | --- | --- | --- |
| 7 | MSb | Jumper A7 | Machine Bit 3 |
| 6 | | Jumper A6 | Machine Bit 2 |
| 5 | | Jumper A5 | Machine Bit 1 |
| 4 | LSb | Jumper A4 | Machine Bit 0 |
| 3 | 1 = | Jumper A3 | |
| 2 | MSb | Jumper A2 | Cooling Bit 2 |
| 1 | | Jumper A1 | Cooling Bit 1 |
| 0 | LSb | Jumper A0 | Cooling Bit 0 |

Byte 2

| | | | |
| --- | --- | --- | --- |
| 7 | 1 = | Jumper B7 | |
| 6 | 1 = | Jumper B6 | Sequential programs possible |
| 5 | 1 = | Jumper B5 | |
| 4 | 1 = | Jumper B4 | Serial communication PC to Centrifuge |
| 3 | 1 = | Jumper B3 | |
| 2 | 1 = | Jumper B2 | Service-Mode 3 |
| 1 | 1 = | Jumper B1 | Service-Mode 2 |
| 0 | 1 = | Jumper B0 | Service-Mode 1 |

For ROTANTA 46 RSC ROBOTIC: The result of the telegram has to be as the following:

| ADR | STX | 0 | 0 | 6 | 3 | 2 | = | 3 | 1 | 1 | X | ETX | BCC |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |

or with sequential program:

| ADR | STX | 0 | 0 | 6 | 3 | 2 | = | 3 | 1 | 5 | X | ETX | BCC |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |

(X : Value can depends to the set service jumpers)

| Parameter-No: 00633 | Control-command | Access **Read/Write** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

Control-command
Command for Report
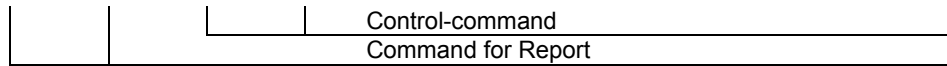
Byte 1

| 7 | 1 = | Report requested |
|---|---|---|
| 6 | 1 = | Report terminated |
| 5 | 1 = | |
| 4 | 1 = | |
| 3 | 1 = | |
| 2 | 1 = | |
| 1 | 1 = | |
| 0 | 1 = | |

Bit "Report desired" has a static function, i.e. it is set by the PC, it has to be waited after **each** centrifugation for bit "terminated". Then the centrifuge can be restarted again.

Byte 2  Control-Command

| 7 | 1 = | LOCK 5 (Input locked, excluding STOP) |
|---|---|---|
| 6 | 1 = | LOCK 4 (Input locked = LOCK 2) |
| 5 | 1 = | |
| 4 | 1 = | |
| 3 | 1 = | Modification of nominal value is required |
| 2 | 1 = | |
| 1 | 1 = | START |
| 0 | 1 = | STOP |

| Parameter-No: 00634 | State of centrifuge 1 | Access **Read** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

State of centrifuge  / control panel
Error of program-number
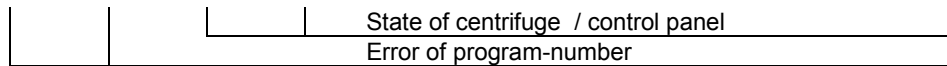
Byte 1:

| 7 | 1 = | Centrifuge Error (Error no. in Bit 0...6) |
|---|---|---|
| 6 | MSb | |
| 5 | | 7-bit digit: |
| 4 | | −  Centrifuge-Error (Bit 7 = 1), |
| 3 | | or |
| 2 | | −  just called program no. is indicated in display, |
| 1 | | if no Error (Bit 7 = 0) |
| 0 | LSb | |

Byte 2  Status Centrifuge / control panel

| 7 | 1 = | State has changed |
|---|---|---|
| 6 | MSb | Program-ID  (see 00631) |
| 5 | LSb | Program-ID  (see 00631) |
| 4 | 1 = | Run-down |
| 3 | 1 = | Centrifugation |
| 2 | 1 = | Run-up |
| 1 | 1 = | Stand still |
| 0 | 1 = | Lid or/and hatch open |

| Parameter-No.: 00635 | State of centrifuge 2 | Access **Read** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

State of centrifuge
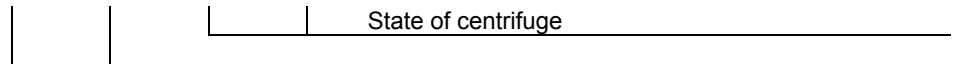
Byte 1

| 7 | 1 = | |
|---|---|---|
| 6 | 1 = | |
| 5 | 1 = | |
| 4 | 1 = | |
| 3 | 1 = | |
| 2 | 1 = | |
| 1 | 1 = | |
| 0 | 1 = | |

Byte 2  State of centrifuge

| 7 | MSb | Rotor code Bit 3 |
|---|---|---|
| 6 | | Rotor code Bit 2 |
| 5 | | Rotor code Bit 1 |
| 4 | LSb | Rotor code Bit 0 |
| 3 | 1 = | |
| 2 | MSb | Lock-state  Bit 2 |
| 1 | | Lock-state  Bit 1 |
| 0 | LSb | Lock-state  Bit 0 |

**Lock-state:**         **Rotor code:**
1 =  LOCK 1         Rotor code 0
2 =  LOCK 2         Rotor code 1
3 =  LOCK 3         up to
4 =  LOCK 4         Rotor code 15
5 =  LOCK 5

| Parameter-No.: 00636 | Software-Version | Access **Read** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

Software-Vers. Byte 2
Software-Vers. Byte 1
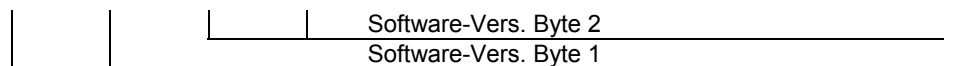
Example:
Software-Version **1.234** is stored as follows: Byte 1: 12, Byte 2: 34

| Parameter-Nr: 00639 | ERROR RESET and POSITION 1 ADJUSTMENT | ACCESS **Read/Write** |
|---|---|---|

**ERROR RESET via serial interface**

A SELECT-Telegramm to Parameter 00639 with "0815" = " 30 38 31 35 " resets an error message.
Requirements: Rotor is in standstill.
Only the following error messages can be reset:

ERROR 01 up to inclusive ERROR 11 (MAINS-INTERRUPT)
ERROR 13
ERROR 26
ERROR 30 up to inclusive ERROR 37
ERROR 40 up to inclusive ERROR 46
ERROR 51 up to inclusive ERROR 55
ERROR 57
ERROR 58

All the other errors messages are either important for the safety (e.g. VERSIONS-ERROR 12) or will be reset by the hardware during a mains reset. There is no direct software access to the hardware.

The following error messages can be reset by the serial protocol. But if the problem is caused by a hardware fault the error will come up again by the cyclic detection of the control panel:

ERROR 30 up to inclusive ERROR 37
ERROR 51 up to inclusive ERROR 55

The following error messages have to be reset by a mains reset:

ERROR 12
ERROR 60
ERROR 60 up to ERROR 69
ERROR 90 up to ERROR 99

---

☞ Before and after write commands (SELECT-Telegrams) to parameter 00639 (Error reset and activating POS-MENUE 3) an ENQUIRY-Telegram has to be sent to parameter 00685 (Clear SIOF bits).

When reseting the error take care about the described sequence.

---

1. ENQUIRY-Telegram to parameter 00685 (Clear SIOF bits).

| PC | | EOT | ADR | 0 | 0 | 6 | 8 | 5 | ENQ | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | STX | 0 | 0 | 6 | 8 | 5 | = | 0 | 0 | X | X | ETX | BCC |
| PC | | EOT | | | | | | | | | | | | | |

2. SELECT-Telegram to parameter 00639=0815hex (Error reset)

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 9 | = | 0 | 8 | 1 | 5 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

3. ENQUIRY-Telegram to parameter 00685 (Clear SIOF bits) (Without the ENQUIRY-Telegram the
   next SELECT-Telegram will be answered with NAK)

| PC | | EOT | ADR | 0 | 0 | 6 | 8 | 5 | ENQ | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | STX | 0 | 0 | 6 | 8 | 5 | = | 0 | 0 | X | X | ETX | BCC |
| PC | | EOT | | | | | | | | | | | | | |

**Adjust Position 1 and store it in the control unit via serial protocol**

**POSITION-MODE**: The POS-MENUE 3 "Adjust Position 1 and store it in the control unit" can also be done via software.

**Advantage:** It's possible to adjust Position 1 without removing the cover and without setting the service jumpers.

**Requirements:** Key-operated switch is in position LOCK 2 (right key position). Otherwise the centrifuge answers to every SELECT command with "NAK"

**Sequence:**

> ☞ Before and after write commands (SELECT-Telegrams) to parameter 00639 (Error reset and activating POS-MENUE 3) an ENQUIRY-Telegram has to be sent to parameter 00685 (Clear SIOF bits).
>
> Take care about the described sequence.

1. Call up menue: SELECT to Parameter 00639 with "0100".
   The display shows POSITION-MODE.

   1.1 ENQUIRY-Telegram to parameter 00685 (Clear SIOF bits).

| PC | EOT | ADR | 0 | 0 | 6 | 8 | 5 | ENQ | | | | | | |
|----|-----|-----|---|---|---|---|---|-----|---|---|---|---|-----|-----|
| Cent | ADR | STX | 0 | 0 | 6 | 8 | 5 | = | 0 | 0 | X | X | ETX | BCC |
| PC | EOT | | | | | | | | | | | | | |

   1.2 SELECT-Telegram to parameter 00639=0100hex (Call up POSITIONING MENUE)

| PC | EOT | ADR | STX | 0 | 0 | 6 | 3 | 9 | = | 0 | 1 | 0 | 0 | ETX | BCC |
|----|-----|-----|-----|---|---|---|---|---|---|---|---|---|---|-----|-----|
| Cent | ADR | ACK | | | | | | | | | | | | | |
| PC | EOT | | | | | | | | | | | | | | |

   1.3 ENQUIRY-Telegram to parameter 00685 (Clear SIOF bits) (Without the ENQUIRY-Telegram the next SELECT-Telegram will be answered with NAK)

| PC | EOT | ADR | 0 | 0 | 6 | 8 | 5 | ENQ | | | | | | |
|----|-----|-----|---|---|---|---|---|-----|---|---|---|---|-----|-----|
| Cent | ADR | STX | 0 | 0 | 6 | 8 | 5 | = | 0 | 0 | X | X | ETX | BCC |
| PC | EOT | | | | | | | | | | | | | |

2. Turn the rotor to position 1.

> ☞ The rotor must be within a range of 45° to position 0.

3. Store this position by a SELECT telegram to Parameter 00639 with "0101".

   3.1 SELECT-Telegram to parameter 00639=0101hex (Store position)

| PC | EOT | ADR | STX | 0 | 0 | 6 | 3 | 9 | = | 0 | 1 | 0 | 1 | ETX | BCC |
|----|-----|-----|-----|---|---|---|---|---|---|---|---|---|---|-----|-----|
| Cent | ADR | ACK | | | | | | | | | | | | | |
| PC | EOT | | | | | | | | | | | | | | |

   3.2 ENQUIRY-Telegram to parameter 00685 (Clear SIOF bits) (Without the ENQUIRY-Telegram the next SELECT-Telegram will be answered with NAK)

| PC | EOT | ADR | 0 | 0 | 6 | 8 | 5 | ENQ | | | | | | |
|----|-----|-----|---|---|---|---|---|-----|---|---|---|---|-----|-----|
| Cent | ADR | STX | 0 | 0 | 6 | 8 | 5 | = | 0 | 0 | X | X | ETX | BCC |
| PC | EOT | | | | | | | | | | | | | |

4. End the menue: SELECT to Parameter 00639 with "0102".
   4.1 SELECT-Telegram to parameter 00639=0102hex (Exit POSITIONING MENUE)

| PC | EOT | ADR | STX | 0 | 0 | 6 | 3 | 9 | = | 0 | 1 | 0 | 2 | ETX | BCC |
|----|-----|-----|-----|---|---|---|---|---|---|---|---|---|---|-----|-----|
| Zent | ADR | ACK | | | | | | | | | | | | | |
| PC | EOT | | | | | | | | | | | | | | |

   4.2 ENQUIRY-Telegram to parameter 00685 (Clear SIOF bits) (Without the ENQUIRY-Telegram the next SELECT-Telegram will be answered with NAK)

| PC | EOT | ADR | 0 | 0 | 6 | 8 | 5 | ENQ | | | | | | |
|----|-----|-----|---|---|---|---|---|-----|---|---|---|---|-----|-----|
| Zent | ADR | STX | 0 | 0 | 6 | 8 | 5 | = | 0 | 0 | X | X | ETX | BCC |
| PC | EOT | | | | | | | | | | | | | |

After this procedure the centrifuge changes back to the normal operating mode.
Note: Within the procedure the machine is completely locked, that means before the menue has not finished (00639 with "0102") the centrifuge answers to all other serial commands with "NAK".

From software version V 4.050 or higher an assistant for correct programming of position 1 is included. The rotor position 1 now can only be stored within an "appropriate" range.

This assistant is active as long as "POS-MENUE 3" is selected. For rotor position 1 a certain range is approved. That means, if the user wants to store position 1, the rotor has to be in the range of 10° to 80° distance to position 0. This distance is measured in the Hettich direction of rotation (anticlockwise). When trying to program the position 1 in the invalid range the command will not be accepted.

- If the programming is done via the Control Panel with button STO the display shows: **IMPOSSIBLE**.
- If the programming is done via the PC (with a SELECT command "00639 = 0101") the command is not accepted and the serial answer is a "NAK" (no error message appears in the display). After the NAK the parameter 00685 (SIOF) has to be enquired via ENQUIRY-Telegramm.
  The answer will be: ">ADR< STX  0 0 6 8 5 = 0 0 A 0 ETX >BCC<".

If the message IMPOSSIBLE appears although the position is correct; the zero position of the incremental encoder is not correct adjusted or the rotor is installed 180° misplaced.

| Parameter-No: 00640 | Positioning | Access **Read/Write** |
|---|---|---|

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

Positioning-command  (Read/Write)
State of positioning   (Read)
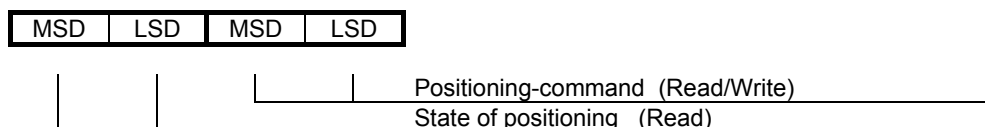
Byte 1  State of positioning

| 7 | 1 = | Magnetic brake is active |
|---|---|---|
| 6 | 1 = | Hatch is opened ( from software version 4.006 ) |
| 5 | 1 = | Not used |
| 4 | 1 = | Hatch is closed |
| 3 | 1 = | Rotor in position 4 |
| 2 | 1 = | Rotor in position 3 |
| 1 | 1 = | Rotor in position 2 |
| 0 | 1 = | Rotor in position 1 |

Byte 2  Commands for control panel

| 7 | MSb | Lid control command (Bit 3) |
|---|---|---|
| 6 | | Lid control command (Bit 2) |
| 5 | | Lid control command (Bit 1) |
| 4 | LSb | Lid control command (Bit 0) |
| 3 | 1 = | Go to position 4 |
| 2 | 1 = | Go to position 3 |
| 1 | 1 = | Go to position 2 |
| 0 | 1 = | Go to position 1 |

Command for hatch control

| 6 = | open hatch |
|---|---|
| 7 = | close hatch |

⚠ When using a 2-times rotor it is only allowed to go to position 1 and 3.

| Parameter-No: 00685 | State-Byte SIOF<br>Error state of serial interface | Access **Read** |
|---|---|---|

**S**erial **I**nput **O**utput **F**ailure

Structure:

| MSD | LSD | MSD | LSD |
|---|---|---|---|

|  |  | SIOF from Server |
|---|---|---|
|  |  | filled with 00 |
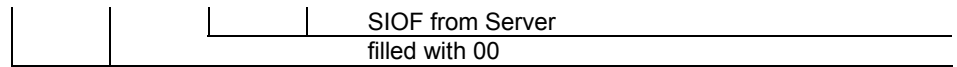
Byte 2  SIOF PC

| 7 | 1 = | improper value |
|---|---|---|
| 6 | 1 = | Modification not permitted (read only) |
| 5 | 1 = | Parameter unknown |
| 4 | 1 = |  |
| 3 | 1 = |  |
| 2 | 1 = |  |
| 1 | 1 = |  |
| 0 | 1 = | Power On (after Reset) |

If the control panel answers with NAK (0X15), the SIOF-parameter has to be enquired, before another ENQUIERY – or SELECT telegram can be sent.

After reading the SIOF – Error bits are cleared.

Reaction to a ENQUIRY-Telegram:
- Parameter is known: Answer according to the protocol.
- Parameter is unknown: Answer with NAK.

Reaction to a SELECT-Telegram:
- Parameter and value are OK, take over of the value or perform of command
  ACK will be send.
- Parameter is not a write parameter, parameter is unknown,
  Value is out of range or preceding reset of the Answer with NAK.

The control panel modify the following SIOF bits after a NAK answer:
- After a mains reset of the centrifuge                              Bit 0  = 1.
- If the PC will access to not existing parameter                   Bit 5  = 1.
- If the PC will access to a READ-only parameter with SELECT        Bit 6  = 1.
- If the value is out of range                                      Bit 7  = 1.

## 36.10  Additional informations

### 36.10.1  Serial communication and displaying

Serial communication is only possible, if jumper B4 on the supply board is set.
If the PC communicates continuously every 10 sec, the display shows the symbol for PC-communication.
If the PC does not report within 10 sec, the symbol is crossed until the next communication.
During a malfunction of the serial communication, the control panel proceeds with the actual program.

### 36.10.2  Content of serial parameter

The control panel writes the same values to the serial parameter, as they are shown on the display.

### 36.10.3 Software-Lock

Some commands need a software-lock.

| Hardware-Lock | | Software-Lock |
|---|---|---|
| LOCK 1 | << >> | not possible |
| LOCK 2 | << >> | LOCK 4 |
| not possible | << >> | LOCK 5 |

LOCK 5: All keys except STOP key are locked.

If a software-lock is active by the PC, the display shows LOCK 4 or LOCK 5.
If there is a crash of the serial communication and the software-lock is activated, the centrifuge proceeds with the current program.
The locked keys can only be reactivated by doing a mains reset.

### 36.10.4 Checking values for validity

The control panel checks the values-received from the PC – immediately for validity.
Desired nominal values which are not in a valid won't be accepted.
After a wrong value the respective bit (non-valid value) in parameter SIOF is set and a NAK is sent.

### 36.10.5 Limitations

- Only during standstill a program can be
    - read,
    - modified,
    - stored (STO)
    - recalled (RCL) from the memory of the control panel.
- Only the program which is shown on the display can be started
- Nominal values can also be modified during run-time (not during run down). However only <u>one</u> nominal values can be modified per procedure.
- Enquiry of information about the centrifuge (00632) is only permitted in standstill

### 36.10.6 Query of actual values

The actual values during centrifuge-mode
    - Run-up
    - centrifuging
    - Run-down (brake)
can be queried.
A delay time of 50 ms between the individual ENQUIRY-telegrams is necessary.

### 36.10.7 Set bit of the modification

The modification bit is found in parameter "State of centrifuge1"
Parameter-No: 00634 byte 2, bit7

Modifications during run-time of a centrifuge can be recognised by continuous querying of this parameter.

This bit is set by the control panel, when the centrifuge recognises one of the following modifications:
1. Rotor was changed
2. Hardware-lock was changed
3. Centrifuge was started by user at the control panel
4. Centrifuge was stopped by user at the control panel
5. A new program no. (new PR-PART) was indicated within program in sequence
6. Control panel recognises standstill after centrifugation
7. Centrifuge stopped with Error message

After enquiring parameter "State of centrifuge 1" -with set bit- by the PC, the modification bit is cleared by the control panel.

### 36.11 Example for enquiry and command

<u>Note:</u> The locking of user inputs (LOCK 4) is not necessary with all of the following commands, but it is recommended to activate a software lock (LOCK 4) to avoid a conflict between user input at the centrifuge and PC-Input.

**36.11.1  Open the hatch**

SELECT: Open the hatch !

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 4 | 0 | = | 0 | 0 | 6 | 0 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

ENQUIRY: Hatch open ? (If necessary repeat)

| PC | | EOT | ADR | 0 | 0 | 6 | 4 | 0 | ENQ | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | STX | 0 | 0 | 6 | 4 | 0 | = | V | V | V | V | ETX | BCC |
| PC | | EOT | | | | | | | | | | | | | |

**Evaluation of VAL, if hatch open or closed:**

From software version 4.006

Evaluation of VAL in C
```
        if      ( 00640-byte1_bit6==1 )
                { hatch is completely open }
```

Up to software version 4.005

The command bits are cleared by the centrifuge, if the order command is excuted.
If the hatch is approx. 10 % open the bit 4 of parameter 00640 is cleared. the command bits in byte 2 remain in set position till the hatch is complete open.
Note: In the meantime it is not allowed to send a SELECT telegram to parameter 00640.

Example in C:
Enquiry: is the hatch complete open:
```
        if (    ( 00640_byte1_bit4 == 0 )
            &&  ( 00640_byte2_bit5 == 0 )
            &&  ( 00640_byte2_bit6 == 0 )   )
                { hatch is completely open }
```

**36.11.2  Go to position 1 and check the reached position**

Note: After standstill the centrifuge position the rotor to position1 automatically.

SELECT: Go to position 1.

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 4 | 0 | = | 0 | 0 | 0 | 1 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

ENQUIRY to parameter 00640 (if necessary repeat)

| PC | | EOT | ADR | 0 | 0 | 6 | 4 | 0 | ENQ | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | STX | 0 | 0 | 6 | 4 | 0 | = | V | V | V | V | ETX | BCC |
| PC | | EOT | | | | | | | | | | | | | |

Evaluation of VAL in C:
```
        if (    ( 00640_byte1_bit0 == 1 )
            &&  ( 00640_byte1_bit7 == 1 )  )
                { rotor in position 1 }
```

**36.11.3  Go to position 2 and check the reached position**

⚠  When using a 2-times rotor it is only allowed to go to position 1 and 3.

SELECT: Go to position 2

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 4 | 0 | = | 0 | 0 | 0 | 2 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

ENQUIRY to parameter 00640 (if necessary repeat)

| PC | | EOT | ADR | 0 | 0 | 6 | 4 | 0 | ENQ | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | STX | 0 | 0 | 6 | 4 | 0 | = | V | V | V | V | ETX | BCC |
| PC | | EOT | | | | | | | | | | | | | |

Evaluation of VAL in C:
```
        if (        ( 00640_byte1_bit1 == 1 )
            &&    ( 00640_byte1_bit7 == 1 ) )
                    { rotor in position 2 }
```

**36.11.4  Go to position 3 and check the reached position**

SELECT: Go to position 3

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 4 | 0 | = | 0 | 0 | 0 | 4 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

ENQUIRY to parameter 00640 (if necessary repeat)

| PC | | EOT | ADR | 0 | 0 | 6 | 4 | 0 | ENQ | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | STX | 0 | 0 | 6 | 4 | 0 | = | V | V | V | V | ETX | BCC |
| PC | | EOT | | | | | | | | | | | | | |

Evaluation of VAL in C:
```
        if (        ( 00640_byte1_bit2 == 1 )
            &&    ( 00640_byte1_bit7 == 1 ) )
                    { rotor in position 3 }
```

**36.11.5  Go to position 4 and check the reached position.**

⚠  When using a 2-times rotor it is only allowed to go to position 1 and 3.

SELECT: Go to position 4

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 4 | 0 | = | 0 | 0 | 0 | 8 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

ENQUIRY to parameter 00640 (if necessary repeat)

| PC | | EOT | ADR | 0 | 0 | 6 | 4 | 0 | ENQ | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | STX | 0 | 0 | 6 | 4 | 0 | = | V | V | V | V | ETX | BCC |
| PC | | EOT | | | | | | | | | | | | | |

Evaluation of VAL in C:
```
        if (        ( 00640_byte1_bit3 == 1 )
            &&    ( 00640_byte1_bit7 == 1 ) )
                    { rotor in position 4 }
```

Attention: After the rotor has reached a position (1...4) the control panel switch off the magnetic brake after 10 min and the positioning is lost. if this position is needed an new command has to be set.

### 36.11.6 Close the hatch

SELECT: Close the hatch!

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 4 | 0 | = | 0 | 0 | 6 | 0 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

ENQUIRY: Is the hatch closed ? (if necessary repeat)

| PC | | EOT | ADR | 0 | 0 | 6 | 4 | 0 | ENQ | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | STX | 0 | 0 | 6 | 4 | 0 | = | V | V | V | V | ETX | BCC |
| PC | | EOT | | | | | | | | | | | | | |

ENQUIRY: Is the lid closed ? (if necessary repeat)

| PC | | EOT | ADR | 0 | 0 | 6 | 3 | 4 | ENQ | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | STX | 0 | 0 | 6 | 3 | 4 | = | V | V | V | V | ETX | BCC |
| PC | | EOT | | | | | | | | | | | | | |

Evaluation of VAL, if hatch is closed:
For secure it is meaningful to include the State 1.
Example in C:
Enquiry, if the hatch is closed completely:
```
if (       ( 00640_byte1_bit4 == 1 )
     &&    ( 00634_byte2_bit0 == 0 ) )
             { Hatch is closed and centrifuge can be started }
```

### 36.11.7 Start the centrifuge!

SELECT: to 00633 with LOCK 4

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 3 | = | 0 | 0 | 4 | 2 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

ENQUIRY to Parameter 00634 (enquiry until standstill is indicated)

| PC | | EOT | ADR | 0 | 0 | 6 | 3 | 4 | ENQ | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | STX | 0 | 0 | 6 | 3 | 4 | = | V | V | V | V | ETX | BCC |
| PC | | EOT | | | | | | | | | | | | | |

Evaluation of VAL:
```
if (   00634_byte2_bit1 == 1    )
            { standstill of centrifuge }
       else
            { Centrifuge in run, no standstill, query the parameter 00634 again }
```

additional evaluation of safety:
```
if (   00634_byte1_bit7 == 0    )
            { centrifuge without Error; OK }
       else
            { centrifuge stopped with Error, calculate the Error-No. in byte1 bit0...bit6 }
```

### 36.11.8 STOP per PC = Emergency stop

SELECT: to 00633

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 3 | = | 0 | 0 | 0 | 1 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

### 36.11.9 Cancel Software-lock LOCK 4 or LOCK 5

SELECT: to 00633

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 3 | = | 0 | 0 | 0 | 0 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

**36.11.10 Change the Nominal Values in stand still or during the run**

(only possible if Program-LOCK 5 is active)

Only <u>one</u> parameter can be modified per procedure.

1. Lock user-input: SELECT to 00633 (set Byte 2, Bit 7)

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 3 | = | 0 | 0 | 8 | 0 | ETX | BCC |
|----|--|-----|-----|-----|---|---|---|---|---|---|---|---|---|---|-----|-----|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

2. <u>Write an new nominal parameter</u>:
006XX = 00601, 00603, 00606, 00611, 00612, 00617, 00618 or 00620

| PC | | EOT | ADR | STX | 0 | 0 | 6 | x | x | = | V | V | V | V | ETX | BCC |
|----|--|-----|-----|-----|---|---|---|---|---|---|---|---|---|---|-----|-----|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

3. Next: SELECT: execute the change of the nominal value and still leave LOCK 5.

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 3 | = | 0 | 0 | 8 | 8 | ETX | BCC |
|----|--|-----|-----|-----|---|---|---|---|---|---|---|---|---|---|-----|-----|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

Is the nominal value out of the input-range, in SIOF (00685) bit 7 will be set and the centrifuge answers with:

| Cent | | ADR | NAK |
|------|--|-----|-----|

then enquiry is necessary:
ENQUIRY to parameter 00685

| PC | | EOT | ADR | 0 | 0 | 6 | 8 | 5 | ENQ | | | | | | |
|----|--|-----|-----|---|---|---|---|---|-----|---|---|---|---|-----|-----|
| Cent | | ADR | STX | 0 | 0 | 6 | 8 | 5 | = | V | V | V | V | ETX | BCC |
| PC | | EOT | | | | | | | | | | | | | |

This Error bit is erased after call up of SIOF and the centrifuge can be input again by SELECT.

Note: If a program was used before, the centrifuge stores the modification under program 100 (corresponds to the display indication: Program "----").

**36.11.11 Recall (RCL) a program stored in the control panel, ready to start**

(only possible with Program LOCK 5)

1. Lock user input: SELECT to 00633 (set Byte 2, Bit 7)

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 3 | = | 0 | 0 | 8 | 0 | ETX | BCC |
|----|--|-----|-----|-----|---|---|---|---|---|---|---|---|---|---|-----|-----|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

2. Write Program-No. in 00631 Byte 1, Bit 0...Bit 6 (xx) and set in byte 2, bit 2.

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 1 | = | x | x | 0 | 4 | ETX | BCC |
|----|--|-----|-----|-----|---|---|---|---|---|---|---|---|---|---|-----|-----|

<u>Program exists:</u>

| Cent | | Program and program-no will be write in the display |
|------|--|-----|
| Cent | | Program no. and program ID will be registered in parameter 00630. Confirmation bit 2 is set in byte 2 |
| Cent | | Delete contents of 00631 |
| Cent | | Update of parameter 00634 |
| Cent | | ADR | ACK |
| PC | | EOT | |

If the program is not available, bit 5 of SIOF (00685) will be set and the contents of 00631 will be deleted and the centrifuge answers with:

| Cent | | ADR | NAK |
|------|--|-----|-----|
| PC | | EOT | |

### 36.11.12 Change the values of a stored program and read out via serial interface

1. Lock user-input: SELECT to 00633 (set Byte 2, Bit 7)

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 3 | = | 0 | 0 | 8 | 0 | ETX | BCC |
|------|---|-----|-----|-----|---|---|---|---|---|---|---|---|---|---|-----|-----|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

2. Write program-no. in 00631 Byte 1, Bit 0...Bit 6 (xx) and set Byte 2, Bit 0.

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 1 | = | x | x | 0 | 1 | ETX | BCC |
|----|---|-----|-----|-----|---|---|---|---|---|---|---|---|---|---|-----|-----|

Program exists:

| Cent | | Program-values will be writen in serial parameter 00601, 00603, 00606, 00611, 00612, 00617, 00618 and 00620. |
|------|---|---|
| Cent | | Program no and program ID will be registered in parameter 00630. Confirmation bit 0 is set in byte 2. |
| Cent | | ADR ACK |
| PC | | EOT |

Values can be read-out by ENQUIRY telegrams to the above mentioned parameter (CC).

| PC | | EOT | ADR | 0 | 0 | 6 | C | C | ENQ | | | | | | | |
|------|---|-----|-----|-----|---|---|---|---|-----|---|---|---|---|---|-----|-----|
| Cent | | ADR | STX | 0 | 0 | 6 | C | C | = | V | V | V | V | ETX | BCC | |
| PC | | EOT | | | | | | | | | | | | | | |

etc

Important: The PC have to delete the contents of 00631 with an SELECT-telegram.

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 1 | = | 0 | 0 | 0 | 0 | ETX | BCC |
|------|---|-----|-----|-----|---|---|---|---|---|---|---|---|---|---|-----|-----|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

If the program is not existing, in SIOF (00685) bit 5 will be set and the centrifuge answers with:

| Cent | | ADR | NAK |
|------|---|-----|-----|
| PC | | EOT | |

Important: Delete the contents of 00631 with an SELECT afterwards.

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 1 | = | 0 | 0 | 0 | 0 | ETX | BCC |
|------|---|-----|-----|-----|---|---|---|---|---|---|---|---|---|---|-----|-----|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

**36.11.13 The PC writes an new program which will be stored in the control panel**

1. Lock the user input: SELECT to 00633 (set Byte 2, Bit 7)

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 3 | = | 0 | 0 | 8 | 0 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

2. Write the values (VVVV) of the program by SELECT into the different parameters (CC): 00601, 00603, 00606, 00611, 00612, 00617, 00618 and 00620.

| PC | | EOT | ADR | STX | 0 | 0 | 6 | C | C | = | V | V | V | V | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

3. Fill in the program no. (XX) and the program ID (Y) in 00631 and set bit 3 of byte 2.

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 1 | = | x | x | Y | 8 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Program not existing (empty):

| Cent | | Store the program values in the corresponding program | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | Program no. and program ID will be registered in parameter 00630. For confirmation bit 2 is set in byte 3. | | | | | | | | | | | | | | |
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

Important: The PC have to delete the contents of 00631 with an SELECT-telegram afterwards.

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 1 | = | 0 | 0 | 0 | 0 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

Program is already existing:

| Cent | | The program number and program ID will be written in parameter 00630, for secure the bit 4 of byte 2 will be set. | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | Bit 6 of SIOF is set.. | | | | | | | | | | | | | | |
| Cent | | ADR | NAK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

*Possibility 1: the old program remains "survives"*
Important: The PC have to delete the contents of 00631 with an SELECT-telegram.

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 1 | = | 0 | 0 | 0 | 0 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

*Possibility 2: Old program will be overwrite with new parameters:*
The PC writes the program no. (XX), the program ID (Y), the command bit (byte 2, bit 3) and additional the overwrite-confirmation-bit (Byte 2, Bit 4, i.e. Y+1) by SELECT to the parameter 00631.

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 1 | = | x | x | Y+1 | 8 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

Important: The PC have to delete the contents of 00631 with an SELECT-telegram.

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 1 | = | 0 | 0 | 0 | 0 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

### 36.11.14 Enquiry for program ID

For programming of programs in sequence the knowledge of already stored programs are important. The sequence of the single programs which together will form a program in sequence have to be uninterrupted. If not the program in sequence will be deleted.

1. Lock the user input: SELECT to 00633 (set Byte 2, Bit 7)

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 3 | = | 0 | 0 | 8 | 0 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

2. Fill the program no.(XX) in 00631 and set the bit 1 of byte 2 as a command.

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 1 | = | x | x | 0 | 2 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Program is existing:

| Cent | | Fill in the program no. and the program ID in parameter 00630. | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

The info can be read-out via the parameter 00630.

| PC | | EOT | A | 0 | 0 | 6 | 3 | 0 | ENQ | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | STX | 0 | 0 | 6 | 3 | 0 | = | V | V | V | V | ETX | BCC | |
| PC | | EOT | | | | | | | | | | | | | | |

Program is not existing:

| Cent | | Bit 5 in SIOF will be set. | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | NAK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |
| Cent | | Contents of 00631 will be delete. | | | | | | | | | | | | | | |

### 36.11.15 Centrifuging report after standstill

The control panel keeps following actual values in the corresponding parameters for reporting the centrifugation (until the next start):

| | |
|---|---|
| 00602 | actual run-time at STOP<br>(run-time which was shown in the display at beginning of braking)<br>At continuous run: actual-value at STOP<br>At end of time: time from START to STOP |
| 00604 | actual-speed at STOP<br>(The speed which was shown in the display before STOP) |
| 00609 and 00610 | ∫RCF-Value at standstill<br>(The RCF which was shown in the display before STOP) |
| 00619 | actual-temperature |

If reporting is demanded (parameter 00633 byte 1, bit 7 is set) these values have to be read by the PC, before restarting the centrifuge.

1. Set protocol bit: SELECT to 00633 (set Byte 1, Bit 7)

| PC | | EOT | ADR | STX | 0 | 0 | 6 | 3 | 3 | = | 8 | 0 | 0 | 0 | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cent | | ADR | ACK | | | | | | | | | | | | | |
| PC | | EOT | | | | | | | | | | | | | | |

2. Enquiry to parameter 00634, if standstill is recognised. At standstill the centrifuge is setting the standstill bit and the modification bit.
   With the set protocol bit the display will show REPORT after centrifugation (at standstill).
   Then the centrifuge is completely locked.
   If the communication brakes down (PC will not set bit 6) the REPORT mode will quit after 60 seconds automatically and again the Nominal value-menu will be shown in the display. Afterwards the centrifuge can be started.
   All of these correspond to SELELCT with 00C0 hex. The bit "Report required" remains set.

3.  This state kept for maximum 60 s. During this time the PC have to enquire the wished actual values by ENQUIRY to the relevant parameters (XX).

| PC   | EOT | ADR | 0 | 0 | 6 | X | X | ENQ |   |   |   |   |     |     |
|------|-----|-----|---|---|---|---|---|-----|---|---|---|---|-----|-----|
| Cent | ADR | STX | 0 | 0 | 6 | X | X | =   | V | V | V | V | ETX | BCC |
| PC   | EOT |     |   |   |   |   |   |     |   |   |   |   |     |     |

etc

4.  If the PC has got all requested data it has to inform the centrifuge that the recording has been finished. At the same time the PC has to determine the recording for the next centrifugation:
    Set bit "Recording finished" and let the bit "Recording requested" set: Select telegram on 00633 with 00C0hex.

| PC   | EOT | ADR | STX | 0 | 0 | 6 | 3 | 3 | = | C | 0 | 0 | 0 | ETX | BCC |
|------|-----|-----|-----|---|---|---|---|---|---|---|---|---|---|-----|-----|
| Cent | ADR | ACK |     |   |   |   |   |   |   |   |   |   |   |     |     |
| PC   | EOT |     |     |   |   |   |   |   |   |   |   |   |   |     |     |

5.  The centrifuge finished the REPORT-mode immediately , delete the command bit "protocol finished" and shows the nominal values in the display.
    The centrifuge can be started.

6.  If another protocol no more required, the PC has to delete the bit "protocol required" (00633 Byte 1, Bit 7).

| PC   | EOT | ADR | STX | 0 | 0 | 6 | 3 | 3 | = | 0 | 0 | 0 | 0 | ETX | BCC |
|------|-----|-----|-----|---|---|---|---|---|---|---|---|---|---|-----|-----|
| Cent | ADR | ACK |     |   |   |   |   |   |   |   |   |   |   |     |     |
| PC   | EOT |     |     |   |   |   |   |   |   |   |   |   |   |     |     |

With an Mains Reset (switch off and on the centrifuge) the REPORT-mode can also be deleted.

## 37  Acceptance of the centrifuges for repair

If the centrifuge is returned to the manufacturer for repair, it must be decontaminated and cleaned to protect persons, environment and material.

We reserve the right to accept contaminated centrifuges.

Costs incurred for cleaning and disinfection are to be charged to the customer.

We ask for your understanding in this matter.

## 38  Disposal

Before disposal, the device must be decontaminated and cleaned to protect people, the environment and property.

When you are disposing of the device, the respective statutory rules must be observed.

Pursuant to guideline 2002/96/EC (WEEE), all devices supplied after August 13, 2005 may not be disposed as part of domestic waste. The device belongs to group 8 (medical devices) and is categorized in the business-to-business field.
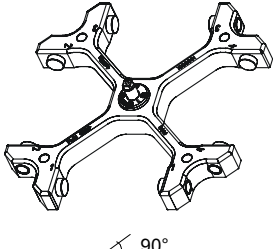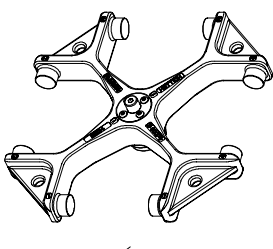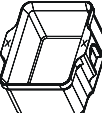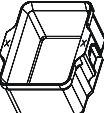
The icon of the crossed-out trash can shows that the device may not be disposed as part of domestic waste.

The waste disposal guidelines of the individual EC countries might vary. If necessary, contact your supplier.

## 39    Anhang / Appendix

### 39.1    Rotoren und Zubehör / Rotors and accessories

| 4444 | | 4412-R | 4426-R | 4428-R | 4464-R | 4467-R | | |
|---|---|---|---|---|---|---|---|---|
| **Ausschwingrotor 4-fach / Swing out rotor 4-times**<br><br>∡ 90° | | | | | | | | |
| Verwendungsdauer / service life | Jahre / years | | | | | | | |
| Max. Laufzyklen / max. cycles | | 80000 | 200000 | 80000 | 200000 | | | |
| Max. Beladung / max. load | g | 800 | | 700 | 800 | 700 | | |
| Drehzahl / speed | RPM | 4500 | | | | | | |
| RZB / RCF | 2) | 4460 | 4618 | 4302 | 4392 | 4369 | | |
| Radius / radius | mm 3) | 197 | 204 | 190 | 194 | 193 | | |
| ⟋ 9 (97%) | sec | 78 | | | | | | |
| ⟍ 9 | sec | 75 | | | | | | |
| Temperatur / temperature | °C 1) | 6 | | | | | | |

| 5624 | | 5628-R | SK 33.05 | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Ausschwingrotor 4-fach / Swing out rotor 4-times**<br><br>∡ 90° | | | | | | | | |
| Verwendungsdauer / service life | Jahre / years | 5 | | | | | | |
| Max. Laufzyklen / max. cycles | | 80000 | | | | | | |
| Max. Beladung / max. load | g 4) | 800 | | | | | | |
| Drehzahl / speed | RPM | 4600 | | | | | | |
| RZB / RCF | 2) | 4258 | | | | | | |
| Radius / radius | mm 3) | 180 | | | | | | |
| ⟋ 9 (97%) | sec | 90 | | | | | | |
| ⟍ 9 | sec | 95 | | | | | | |
| Temperatur / temperature | °C 1) | 10 | | | | | | |

1) Tiefste erreichbare Temperatur bei maximaler Drehzahl, 1 h Laufzeit und 20°C Raumtemperatur
2) Zentrifugiergefäße aus Glas nur belastbar bis RZB 4000
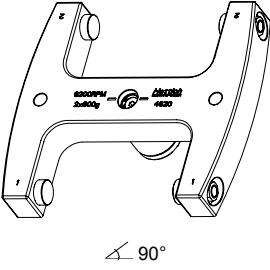3) Maximaler Radius, gemessen bis zum Gehängeboden
4) Maximal zulässige Beladung je Gehänge

1) Lowest possible temperature during maximum speed, 1 h running time and 20°C ambient temperature
2) Centrifuge containers of glass will not stand RCF values exceeding 4000
3) Maximum radius, measured to the bottom of the hanger
4) Maximum permissible load per hanger

| 4620 | 4623-R | SK 32.05 | | | | |
|---|---|---|---|---|---|---|
| **Ausschwingrotor 4-fach / Swing out rotor 4-times**  ∡ 90° |  |  | | | | |
| Verwendungsdauer / service life — Jahre / years | 5 | | | | | |
| Max. Laufzyklen / max. cycles | 80000 | | | | | |
| Max. Beladung / max. load — g [4] | 500 | | | | | |
| Drehzahl / speed — RPM | 6200 | | | | | |
| RZB / RCF — [2] | 5845 | | | | | |
| Radius / radius — mm [3] | 136 | | | | | |
| ⟋ 9 (97%) — sec | 38 | | | | | |
| ⟍ 9 — sec | 40 | | | | | |
| Temperatur / temperature — °C [1] | 12 | | | | | |

1) Tiefste erreichbare Temperatur bei maximaler Drehzahl, 1 h Laufzeit und 20°C Raumtemperatur
2) Zentrifugiergefäße aus Glas nur belastbar bis RZB 4000
3) Maximaler Radius, gemessen bis zum Gehängeboden
4) Maximal zulässige Beladung je Gehänge

1) Lowest possible temperature during maximum speed, 1 h running time and 20°C ambient temperature
2) Centrifuge containers of glass will not stand RCF values exceeding 4000
3) Maximum radius, measured to the bottom of the hanger
4) Maximum permissible load per hanger