![Hettich ZENTRIFUGEN logo]

Serial communication and PC parameters

ROTANTA 460 Robotic

ROTANTA 46 RSC ROBOTIC

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Contents

1.1 Robotic functions

The loading hatch is placed in the centrifuge lid. The hatch is opened by a motor.
The rotor is positioned and hold under the hatch.

1.2 Operating modes

1.2.1 Normal robotic operation

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

1.2.2 Adjusting / teaching operation and 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.

- Teaching of position 1

Please refer to the operation instruction chapter 30 "Setting rotor position 1"

- Close and open the hatch by the hatch motor drive

Only possible in key-operated switch position TEACH (left key position, the display shows "TEACH").

OPEN the hatch	Press ⌒ key
CLOSE the hatch	Press RPM key

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

The functions of the following keys are depending to key-operated switch position.

- STOP-key
The ◦OPEN / STOP◦ (Generation 1 STOP) key on the control panel is always active.

- **START-key**

The ◦START key on the control panel is normally active.
But the key function can be blocked / locked via the PC with the command LOCK 5
(see Parameter 00520 or 00633 / 00635).

2 Communication with Hettich centrifuges

2.1 Definition:

"Generation 2" is the updated communication for ROTANTA 460 ROBOTIC type 5680
"Generation 1" is the original communication for ROTANTA 46 RSC Robotic type 4815 / 4816 / 4817
The centrifuges of "Generation 2" (ROTANTA 460 ROBOTIC type 5680) accept mostly the original communication according to the definitions of "Generation 1".
Please find a more detailed description in chapter 4 and 5

2.2 General description

2.2.1 Setting of serial interface

- 9600 Bit/s
- Format:
    - 1 start-bit
    - 7 data bits
    - 1 parity-bit (even parity)
    - 1 stop-bit

2.2.2 Control characters 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	= Block Code Check = Checksum of the relevant data in hex. (EXOR – summary of the with BCC marked bytes)

2.2.3 Used telegrams

2.2.3.1 ENQUIRY-Telegram (transmission request)

Data link to the addressed centrifuge establishment to transmit the value (V=VAL)
of the parameter (C=CODE)
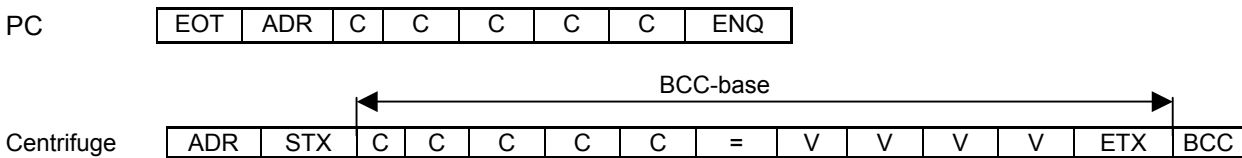
2.2.3.2 SELECT-Telegram (transmission of data or command)

Data transmission of value V to the parameter C of the addressed centrifuge.
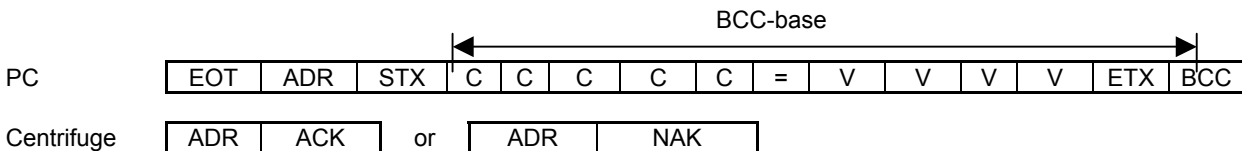
The characters are transmitted hexadecimal coded.
For a better readability here these characters are always displayed as ASCII-Symbols!

2.2.4   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	(send)	30	30	36	30	33	(all in hex)

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

0	1	F	4	(send)	30	31	46	34	(all in hex)

Hexadecimal coded characters are transmitted!

2.3   Time behaviour for serial operation

2.3.1   Time for one ENQUIRY-Telegram

ENQUIRY from PC	Reaction time	Answer of the centrifuge
8 digits		14 digits
approx. 9 ms	5...150 ms	approx. 16 ms

PC

Centrifuge

2.3.2   Time for one SELECT-Telegram

Command for PC	Reaction time centrifuge	Answer centrifuge
15 digits		2 digits
approx. 17 ms	20...150 ms	approx. 2 ms

PC
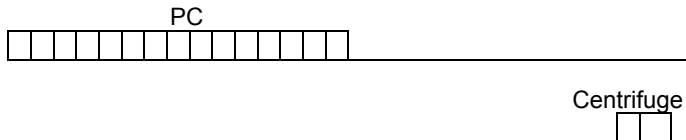
Centrifuge

The reaction time of the centrifuge depends on the respective working order.
A busy centrifuge, e.g. during a centrifugation or positioning, uses more computing time and so the reaction time is up to 150 ms. If there is no 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 times.
That means: If there is still no answer after the third transmission attempt, the telegram has to be cancelled to examine the cause of the error.

2.3.3   Rhythm of request

We suggest the following communication timing:
During centrifugation: Parameter 00634
During positioning: Parameter 00634 once per second and parameter 00640 (Generation 1) or parameter 00528 (Generation 2) twice per second. Please refer also to chapter 2.11.5 "Query of actual values"

EN

2.4 Examples for Telegrams

2.4.1 Example for an ENQUIRY-Telegram:

PC transmits to address 29: "What is" the content of parameter 00604 (actual speed).

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 will answer: the 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

2.4.2 Example for a SELECT-Telegram:

PC transmits to address 29, Parameter 00603; "set the speed" to 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

2.5   Address of the Centrifuge / Change the address

Each centrifuge that is being communicated with must 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. The Hettich-BUS system manages 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] = $5D_{hex}$ Default address

> ☞ Default address / factory settings address is ']' = 29.

Change the address of the centrifuge using the control panel

- Keep the PROG key held down for 8 seconds.
  After 8 seconds, **Machine Menu** appears in the display.
- Press the PROG - key as often as necessary until the **->Settings** is displayed.
- Press the START - key , the PROG - key as often as necessary until the **->PC Address =]** is displayed .
- Use the adjusting knob Ŏ to setup the desired PC Address .
- Press the START - key, **Store Settings …** and then **->Settings** is displayed .
- Press the OPEN / STOP (Generation 1 STOP) - key twice to leave the ***** Machine Menu *****.

2.6   Principle for serial communication

The PC requires an available RS 232 interface.

> ☞ **The key-operated switch has to be in position LOCK 2 (right key position).**
>
> **The centrifuge accept commands from PC only in position LOCK 2**

Centrifuges are terminals (slaves) and answer only if they receive an ENQURIY - or SELECT - telegram.

2.6.1   Detection of the "Generation 2"

Send an ENQUIRY telegram with address"$" to parameter 00600 (centrifuge identification).
The robotic centrifuge of Generation 1 (type 4815 to 4817 will return: [ADR] : NAK
The robotic centrifuge of Generation 2 (type 5680) will return "1234"
Please refer to chapter 2.10, parameter 00600

Example (Centrifuge with default address "]" is connected:

PC	EOT	$	0	0	6	0	0	ENQ					
Cent	]	STX	0	0	6	0	0	=	1	2	3	4	ETX	DC

Please refer to chapter 2.8, "Parameter-No.: 00600"

2.6.2 General information for positioning and hatch commands:

The centrifuge acknowledges the transmission of the command with "ACK" when a positioning or hatch command was sent and executes the command.

> **Important information for the positioning:**
>
> Centrifuges of **"Generation 2"** (software 01.xx):
> During the executing of a positioning command (the rotor moves) ALL OTHER positioning commands will be ignored.
> The centrifuge will acknowledge the additional positioning commands with ACK but the command will be ignored. The centrifuge does not execute the second command during processing of the first command). The additional commands will be flushed.
> Therefore please wait with the next positioning command until the ongoing positioning is finished.
>
> Centrifuges of **"Generation 1"** (software 4.xxx):
> During the executing of a positioning command (the rotor moves) the ongoing positioning will immediately be cancelled and the last sent positioning command will be executed.

You can use
- parameter 00640 to handle position 1, 2 3 and 4 with 2-place or 4-place rotors
  (using the protocol of "Generation 1"),
- parameter 00524 and 00526 to handle ALL positions with ALL rotors
  (using the protocol of "Generation 2").

Time-out:
Each rotor position (1 ... 48) is fixed (held in position) for maximum 20 minutes.
After **20 minutes** the fixed position (electronical positioning and the electromagnetic brake) is automatically deactivated. If the position is needed again please send the command for this position again.

Software-Lock via serial interface

To avoid complications with START commands (by pressing the START-key at the control panel), the software provide the feature LOCK 5. Then the ⌾START - key is locked, only the ⌾OPEN / STOP⌾ (Generation 1 STOP) -key is active.
Please refer to chapter 2.10.1 (Parameter-No.: 00520) and chapter 2.10.2 (Parameter-No.: 00633)

2.7 General format of parameter content (V = VAL = Value)

V	V	V	V
MSD	LSD	MSD	LSD

Lowbyte = LSB

Highbyte = MSB
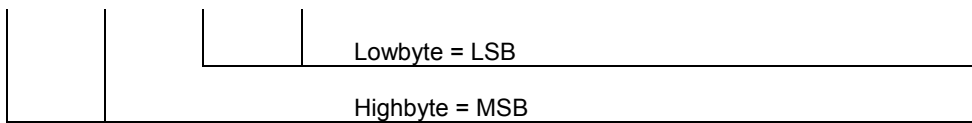
Bit	3...0	3...0	3...0	3...0	= 4 digit
Bit	7....... 0		7...... 0		= 2 byte
Bit	15..0				= 1 word

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

Values are sent 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 parameters are hexadecimal (numeral) coded:
- Time   00500, 00501, 00502, 00503, 00504, 00505, 00533, 00601, 00602, 00613, 00614, 00615 and 00616
- Speed   00420,00422,00603, 00604, 00605 and 00617
- RCF   00606, 00607 and 00608
- Radius   00620
- Temperature   00618, 00619 (with scale, to prevent negative values)
- Software-Version   00636
- Positioning   00524
- Rotor cycle commands   00560,561,562,563,564,565,566,567,568
- Nr. of centrifugation starts   00569,570

Some parameters are bit coded, partial bit and partial numeral coded
             e.g. parameter 00634, 00635, 00640, 00685 etc.

Control by serial interface:
Almost all functions, offered by the control panel, can be called up via the interface.
In chapter 3 is a cookbook, in chapter 3.7 are examples, where the most important commands and inquiries are presented:
- START and STOP
- Open and close the hatch
- Move rotor to position X
    48 positions are possible, the permitted positions are depending to the installed rotor
- Call up already stored programs

2.8   Synopsis of the parameters

Para-meter	Content	Compatible to		Access: R = read RW = read/write
		Generation 1	Generation 2	
00420	Actual rotor speed (speed of the rotor tacho) in RPM Use only to calculate the slippage!		X	R
00422	Motor field rotating speed		X	R
00470	External operating hours (High Word)		X	R
00471	External operating hours (Low Word)		X	R
00472	Internal operating hours (High Word)		X	R
00473	Internal operating hours (Low Word)		X	R
00500	Set runtime (hours)		X	RW
00501	Actual runtime (hours)		X	R
00502	Set runtime (minutes)		X	RW
00503	Actual runtime (minutes)		X	R
00504	Set runtime (seconds)		X	RW
00505	Actual runtime (seconds)		X	R
00512	Show RCF or RPM mode in the display		X	RW
00513	Dual Timing Mode , timing begins at start or on end of acceleration			RW
00518	Actual program number		X	R
00519	Program info		X	R
00520	Software lock command		X	RW
00521	Control command		X	W
00522	Enable the active/current program block		X	W
00523	Program command		X	W
00524	Target position		X	RW
00526	Positioning and hatch command		X	W
00528	Positioning and hatch state		X	R
00533	Positioning timeout			R
00537	Centrifuge type and version		X	R
00563	Actual cycles of the actual rotor (High Word)			R
00564	Actual cycles of the actual rotor (Low Word)			R
00565	Preset cycles of the actual rotor (High Word)			R
00566	Preset cycles of the actual rotor (Low Word)			R
00567	Total cycles of the actual rotor (High Word)			R
00568	Total cycles of the actual rotor (Low Word)			R
00569	Number of centrifugation starts (High Word)			R
00570	Number of centrifugation starts (Low Word)			R
00600	Centrifuge ID		X	R
00601	Set run-time	X	X	RW
00602	Actual run-time	X	X	R
00603	Set speed	X	X	RW
00604	Actual speed	X	X	R
00605	Maximum rotor speed	X	X	R
00606	Set-RCF	X	X	RW
00607	Actual-RCF	X	X	R
00608	Maximum-RCF of rotor	X	X	R
00609	$\int$ RCF/RZB-actual 1.word MSW	X	X	R
00610	$\int$ RCF/RZB-actual 2.word LSW	X	X	R
00611	Run-up (acceleration)	X	X	RW
00612	Run-down (brake)	X	X	RW

Para meter	Content	Compatible to		Access: R = read RW = read/write
		Generation 1	Generation 2	
00613	Minimum run-up time	X	X	R
00614	Maximum run-up time	X	X	R
00615	Minimum run-down time	X	X	R
00616	Maximum run-down time	X	X	R
00617	Brake switch off speed	X	X	RW
00618	Set temperature	X	X	RW
00619	Actual value of temperature	X	X	R
00620	Radius	X	X	RW
00630	Program-Info	X	X 1*)	R
00631	Program-command from PC	X	X 1*)	RW
00633	Control command	X	X	RW
00634	Centrifuge state 1	X	X	R
00635	Centrifuge state 2	X	X	R
00636	Software version	X	X	R
00639	Clear errors , teaching of position 1	X	X	RW
00640	Positioning	X	X	RW
00685	SIOF (serial input output failure state)	X	X	R

1*) The parameter is compatible with the exception of Lowbyte bit 6 and 7

2.9   Short introduction of positioning with the "new" communication of Generation 2

This chapter shows only a short introduction. All details will be described in chapter 2.10.
Please find in chapter 3 a cookbook of the procedures and examples for serial operation.

2.9.1   Parameter 00524 (definition of the target):

Highbyte: even number of rotor positions , 2 up to 48 , depending on the rotor .

7		(not relevant)
6		(not relevant)
5	MSb	6-bit digit,
4		which indicates the maximum number of rotor positions ,
3		
2		only even numbers (i.e. 2 , 4 , 6..48) can be used .
1		
0	LSb	

Lowbyte: target position (maximum = Highbyte)

7		(not relevant)
6		(not relevant)
5	MSb	
4		6-bit digit,
3		which indicates number of the target rotor position ,
2		from 1 to the possible rotor positions (maximum number of rotor positions).
1		
0	LSb	

2.9.2   Parameter 00526 (control commands for positioning and hatch)

Lowbyte: Positioning command

    01h: move to position slow ,
    02h: move to position fast ,
    40h: cancel positioning (i.e. if the positioning fails, the current positioning should be deactivated or
            the current positioning is disabled with "timeout")
    60h: open hatch
    70h: close hatch
    80h: terminate positioning

⚠	**The positioning mode will be terminated automatically (like the command 00526 = 0080) by:** – **closing of the hatch** – **switching the key-switch from LOCK 2 to LOCK 3** – **switching the key-switch from LOCK 2 to LOCK 1 (TEACH-mode)** – **starting the centrifugation**

2.9.3   Parameter 00528 (information about positioning and hatch state)

Highbyte: General settings (bit 7) hatch state (bit 0 to 6)

7	1 =	magnetic brake implemented
6	1 =	hatch timeout (pos error 42 is set)
5	1 =	hatch open
4	1 =	hatch closed
3	1 =	lid lock of hatch is closed
2	1 =	hatch is moving , general information during opening or closing the hatch
1	1 =	hatch is opening , bit is set during hatch is opening also bit 2 is set .
0	1 =	hatch is closing , bit is set during hatch is closing also bit 2 is set .

Lowbyte: Position state

7	1 =	command " positioning end " is given
6	1 =	command " positioning stop " is given
5	1 =	magnetic brake is active
4	1 =	positioning error
3	1 =	positioning timeout (warning)
2	1 =	position reached
1	1 =	position mode is active (description see chapter " operating states ")
0	1 =	command "goto target position " is active , rotor is moving

2.9.4   Parameter 00521 (control commands for centrifugation)

Parameter 00521 is responsible for centrifugation.
Lowbyte:

7		not relevant
6		not relevant
5		not relevant
4		not relevant
3		not relevant
2		Not relevant
1	1=	start centrifugation
0	1=	stop centrifugation

- **START**
  Requirement: Key-switch is in position Lock 2
  SELECT-Command: 00521 = 0002 (start centrifugation).
- **STOP**
  SELECT-Command: 00521 = 0001 (stop centrifugation).

2.9.5   Special functions: ACK, NAK and SIOF

- If a 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 valid values
- With read-out SIOF ENQUIRY-Telegram to parameter 00685):
  - a SIO - error can be detected.
  - enables serial interface for SELECT-telegrams.
  - with SIOF-enquiry all SIOF-Error-bit will be reset by the centrifuge.

2.10 Detailed description of the parameters

Used abbreviations:

Gen. 1   **Generation 1:** Machines of family
ROTANTA 46 RSC (Types 4815, 4816 and 4817)
The parameter is possible for the "old" families.

Gen. 2   **Generation 2:** Machines of family
ROTANTA 460 ROBOTIC (Type 5680)
The parameter is only possible for these machines

Gen. 1 + 2   **Generation 1 and 2:**
The parameter is possible for **BOTH** families.
ROTANTA 46 RSC **AND** ROTANTA 460 ROBOTIC
The parameter is 100% compatible.

Gen. (1) + 2   **Generation 1 (not to 100%) and Generation 2:**
The parameter is subtotal / to 100% compatible.
Please read the detailed description

Access: **R**   **Read:**   Parameter access is "read only"; A SELECT telegram will cause a NAK
Access: **W**   **Write:**   Parameter access is "write only"; An ENQUIRY telegram will cause a NAK
Access: **RW**   **ReadWrite:**   Parameter access is "read" and "write".

☞ **The centrifuge accepts <u>SELECT-telegrams</u> only in Key-Lock position "LOCK 2",
therefore the key-operated switch has to be in position LOCK 2 (right key-position).**

<u>ENQUIRY-telegrams</u> are always possible, independent of the Key-Lock position.

2.10.1 Parameters for "Generation 2" (only valid / possible with / for Generation 2)

2.10.1.1 Speed parameters

Parameter-No.: 00420	Actual rotor speed	Gen. 2	Access: R

Speed of the rotor tacho in RPM; Use only to calculate the slippage

Structure:

MSD	LSD	MSD	LSD

Actual rotor speed LSB
Actual rotor MSB

Display: RPM = revolutions per minute
Range: 50 up to 20 000 RPM

Parameter-No.: 00422	Motor field rotating speed	Gen. 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Actual set rotation speed LSB
Actual set rotation speed MSB

Display: RPM = revolution per minute
Range: 50 up to 20 000 RPM

☞ **Slippage = Motor field rotating speed (00420) - Actual rotor speed (00422)**

2.10.1.2 Parameters for operating time and operting cycle

☞ The operating hours are stored as "long value" in seconds.
Calculation : Value in seconds = (High Word * 65536) + Low Word

Parameter-No.: 00470	External operating hours (High Word)	Gen. 2	Access: **R**

☞ The operating hours are "sum up" into the "internal" and the "external" operating hours.
Internal operating hours: Total time that the device was switched on (power-on time).
External operating hours: Total time of centrifugation (centrifugation time).

Structure:

MSD	LSD	MSD	LSD

Lowbyte : External operating hours
Highbyte: External operating hours

External operating hours (High Word)
Range: 0000H…FFFFH

Parameter-No.: 00471	External operating hours (Low Word)	Gen. 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: External operating time
Highbyte: External operating time

External operating hours (Low Word)
Range: 0000H…FFFFH

Parameter-No.: 00472	Internal operating hours (High Word)	Gen. 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Internal operating hours
Highbyte: Internal operating hours

Internal operating hours (High Word)
Range: 0000H…FFFFH

Parameter-No.: 00473	Internal operating hours (Low Word)	Gen. 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Internal operating time
Highbyte: Internal operating time
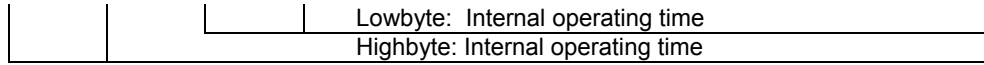
Internal operating hours (Low Word)
Range: 0000H…FFFFH

☞ The operating hours are stored as "long value" in seconds.
Calculation : Value in seconds = (High Word * 65536) + Low Word

Parameter-No.: 00474	Number of centrifugation starts	Gen. 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Number of starts
Highbyte: Number of starts
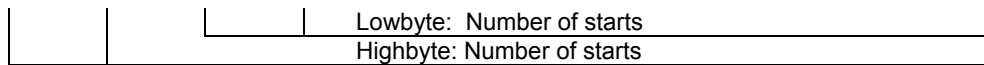
The value is the totally number of centrifugation runs, the range is: 0000H…FFFFH (0 – 656535)

2.10.1.3   Time parameters

The time parameters of the "Generation 2" :
-      set time (00500, 00502 and 00504)
-      actual time (00501, 00503 and 00505)
are alternative to the parameters of the "Generation 1"
-      set time (00601)
-      actual time (00602).

Note:
- The value range of the 005xx time parameters is up to 99 hours, 59 minutes and 59 seconds
 - The value of the parameters 00601 and 00602 are restricted to 59999 seconds
        (16 hours 39 minutes and 59 seconds).

☞ Please refer also to parameter 00513 (Dual Timing Mode)

Parameter-No.: 00500	Set runtime (hours)	Gen. 2	Access: **RW**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Set runtime hours
Highbyte: Always 00
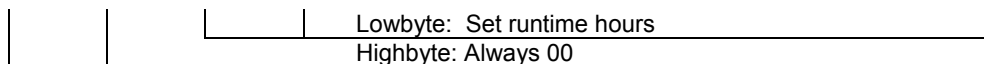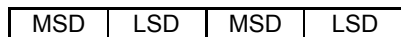
Input: set runtime hours
Range: 0000H…0063H (= 0d .. 99d) hours

Parameter-No.: 00501	Actual runtime (hours)	Gen. 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Actual runtime hours
Highbyte: Always 00

Range: 0000H…0063H (= 0d ..99d) hours

Parameter-No.: 00502	Set runtime (minutes)	Gen. 2	Access: **RW**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Set runtime minutes
Highbyte: Allways 00

Input: set runtime minutes
Range: 0000H…003DH (= 0d ..59d) minutes

☞   take notice to Parameter 00513 (Dual Timing Mode)

Parameter-No.: 00503	Actual runtime (minutes)	Gen. 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Actual runtime minutes
Highbyte: Allways 00

Parameter-No.: 00504	Set runtime (seconds)	Gen. 2	Access: **RW**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Set runtime seconds
Highbyte: Allways 00

Input: set runtime
Range: 0000_{hex} to $003D_{hex}$ = 0_{dec} to 59_{dec} in seconds

Parameter-No.: 00505	Actual runtime (seconds)	Gen. 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Actual runtime seconds
Highbyte: Allways 00

☞   Parameter 00500 to 00505 are used if the runtime is higher than 16 hours.
Otherwise parameter 00601 (runtime in sec from 0...59999) can be used.

Advantage of parameter 00601: Only one parameter is needed

2.10.1.4 Miscellaneous parameters part 1

Parameter-No.: 00512	Show RCF or RPM mode in the display	Gen. 2	Access: **RW**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: RCF / RPM mode
Highbyte: Not relevant

Lowbyte : RCF / RPM mode

7		not relevant
6		not relevant
5		not relevant
4		not relevant
3		not relevant
2		not relevant
1		not relevant
0		1 = rcf mode 0 = rpm mode

☞ If the radius (parameter 00620) is changed, the display will automatically show the RCF mode.
If the set speed (parameter 00603) is changed, the display will automatically show the RPM mode.

Parameter-No.: 00513	Dual Timing Mode	Gen. 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Dual timing mode on/off
Highbyte: Not relevant

Lowbyte : Dual timing mode

7		not relevant
6		not relevant
5		not relevant
4		not relevant
3		not relevant
2		not relevant
1		not relevant
0		1 = dual timing mode on 0 = dual timing mode off

☞ Dual timing mode **on** means : Running time counter starts when set speed is reached.
Dual timing mode **off** means : Running ting time counter starts at start of centrifugation

Parameter-No.: 00518	Actual program number	Gen. 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Actual program number
Highbyte: Not relevant
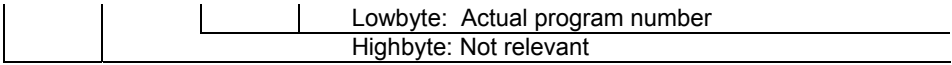
Lowbyte: Actual program number

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

Active program number (0 to 99), that will be executed with the next start of centrifugation,
or active program number (0 to 99) while centrifugation is running.

Parameter-No.: 00519	Program info	Gen. 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Program-info
Highbyte: Program-number (0 up to 99)
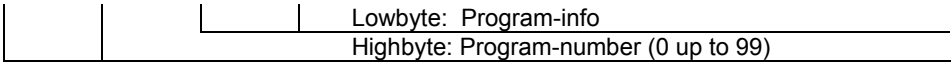
Highbyte: Program-number (0 up to 99)

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

Lowbyte: Program-info

7	1=	not relevant
6	1=	not relevant
5	1 =	not relevant
4	1 =	program exits (always set to 1)
3	1 =	program stored
2	1 =	program read
1	1 =	not relevant
0	1 =	program assumed and set to active program

Parameter-No.: 00520	Software lock command	Gen. 2	Access: RW

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Software lock commands
Highbyte: Not relevant
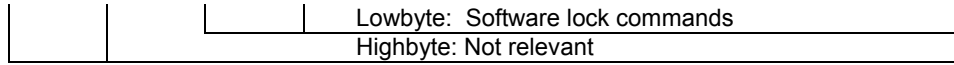
Lowbyte:

7		not relevant
6		not relevant
5		not relevant
4		not relevant
3	1=	clear LOCK 5
2	1=	not relevant
1	1=	not relevant
0	1=	set LOCK 5 , prevents start of centrifugation with start - key of the control panel .

If LOCK 5 is set, start of centrifugation with the START - key on the control panel is blocked.

Parameter-No.: 00521	Control command	Gen. 2	Access: W

Structure:
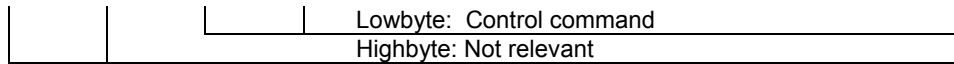
MSD	LSD	MSD	LSD

Lowbyte: Control command
Highbyte: Not relevant

Lowbyte:

7		not relevant
6		not relevant
5		not relevant
4		not relevant
3		not relevant
2		Not relevant
1	1=	start centrifugation
0	1=	stop centrifugation

ALL following conditions have to be TRUE to start the centrifugation:
- Lid locking is closed.
- The hatch is closed (part 1)   =   the red switch at the hatch is connected,
- The hatch is closed (part 2)   =   the blue switch at the hatch is connected,
- The positioning mode **is not** active.

Parameter-No.: 00522	Enable the active/current program block	Gen. 2	Access: W

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Activate changed values
Highbyte: Not relevant

Lowbyte:

7		not relevant
6		not relevant
5		not relevant
4		not relevant
3	1=	discard edited set values
2		not relevant
1		not relevant
0	1=	make changed values valid , activate changed values

☞ Note: Do never enable a "not relevant" bit (do not set to '1').

By set the Lowbyte bit 7 to '1': All changed values from the active /current program block are now valid. Explanation see chapter 3.6 "How to store and recall programs".

Active/current program block	
run-up level	(parameter 611)
nominal speed	(parameter 603)
run-down level	(parameter 612)
nominal run-time	(parameter 601) or 500,502 and 504
nominal temperature	(parameter 618)
radius	(parameter 620)
brake switch off speed	(parameter 617)
program flags	(0 = rpm- 1 = rcf-mode default = 0)

Parameter-No.: 00523	Recall or store a program	Gen. 2	Access: W

Requirement: Key-Lock is in position LOCK 2

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Recall or store command
Highbyte: Program-number (0 up to 89)
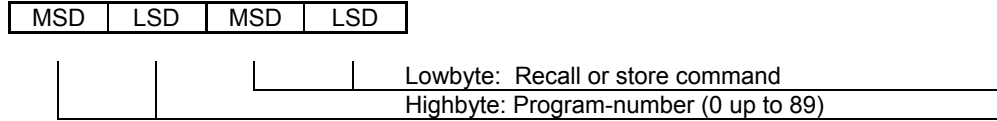
Highbyte: program-number (0 up to 89 RCL , 1 up to 89 STO)

7	1 =	(not relevant)
6	MSb	
5		
4		
3		7-bit digit, which indicates the program-number to recall or store
2		
1		
0	LSb	

Lowbyte: program command

7		
6		
5		
4		
3		7-bit digit, which indicates the program command
2		
1		
0		

Lowbyte = 01 : RCL
Stored program from the EEPROM will be copied to the edit block

Lowbyte = 04 : RCL & activate
Stored program from the EEPROM will be copied to the active/current program block
and make this program block active

Lowbyte = 08 : STO
Copy the edit block to the EEPROM

Lowbyte = 18h : STO & activate
Copy the edit block to the EEPROM and to the active/current program block
and make this program block active.

Explanation see chapter 3.6 "How to store and recall programs".

Note: a program is a "set of parameters".

Active/current program block	
run-up level	(parameter 611)
nominal speed	(parameter 603)
run-down level	(parameter 612)
nominal run-time	(parameter 601) or 500,502 and 504
nominal temperature	(parameter 618)
radius	(parameter 620)
brake switch off speed	(parameter 617)
program flags	(0 = rpm- 1 = rcf-mode default = 0)

2.10.1.5 Positioning parameters

Parameter-No.: 00524	Target rotor position	Gen. 2	Access: **RW**

Requirement: Key-Lock is in position LOCK 2

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Target rotor position (1..48)
Highbyte: Number of rotor positions (2..48)

Highbyte: Even number of rotor positions , 2 up to 48 , depending on the rotor .

7		(not relevant)
6		(not relevant)
5	MSb	6-bit digit,
4		which indicates the maximum number of rotor positions ,
3		
2		only even numbers (i.e. 2 , 4 , 6..48) can be used .
1		
0	LSb	

Lowbyte: Target position (maximum = Highbyte)

7		(not relevant)
6		(not relevant)
5	MSb	
4		6-bit digit,
3		which indicates number of the target rotor position ,
2		1… maximum (number of rotor positions).
1		
0	LSb	

Parameter-No.: 00526	Positioning and hatch command	Gen. 2	Access: **W**

Requirement: Key-Lock is in position LOCK 2 and rotor "has" standstill and LID is closed

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Positioning and hatch command
Highbyte: Not relevant

Lowbyte: Positioning and hatch command
Lowbyte = 01h: move to position (slow) [1]
Lowbyte = 02h: move to position (fast) [1]
Lowbyte = 40h: cancel positioning (but stay in positioning mode)
Lowbyte = 60h: open hatch
Lowbyte = 70h: close hatch
Lowbyte = 80h: terminate positioning (has to be set mandatory before starting centrifugation).

☞ Note: To save time, "set rotor position" (00524) and "move to position" can be sent while hatch is opening.

1) Positioning speed:
Slow: Original speed, as implemented in Generation 1. Used for agitation sensitive samples.
Fast: Enhanced speed for fastest positioning. Caution ! Use it only for not agitation sensitive samples.

Parameter-No.: 00528	Positioning and hatch state	Gen. 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Position state
Highbyte: Hatch state
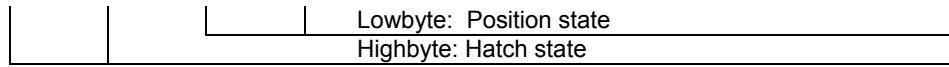
Highbyte: General settings (bit 7) hatch state (bit 0..6)

7	1 =	magnetic brake implemented
6	1 =	hatch timeout (pos error 42 is set)
5	1 =	hatch open
4	1 =	hatch closed
3	1 =	lid lock of hatch is closed
2	1 =	hatch is moving , general information during opening or closing the hatch
1	1 =	hatch is opening , bit is set during hatch is opening also bit 2 is set .
0	1 =	hatch is closing , bit is set during hatch is closing also bit 2 is set .

Lowbyte: Position state

7	1 =	command " positioning end " is given
6	1 =	command " positioning stop " is given
5	1 =	magnetic brake is active
4	1 =	positioning error
3	1 =	positioning timeout (warning)
2	1 =	position reached
1	1 =	position mode is active (description see chapter "" operating states ")
0	1 =	command "goto target position " is active , rotor is moving

Parameter-No.: 00533	Positioning timeout	Gen. 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Positioning timeout in seconds ,
             Range: 10…100s
Highbyte: Not relevant
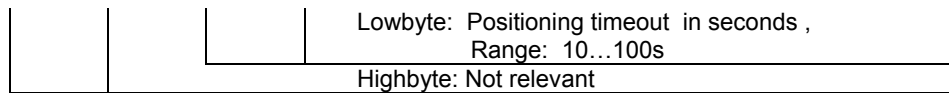
The target position should be reached within this time.
Otherwise, the warning "positioning timeout" is set (Parameter 00528 Lowbyte bit 3 = '1').
This procedure is repeated 3 times.
After three trials (3 x "positioning timeout") the "positioning error" is set (Parameter 00528 Lowbyte bit 4 = '1')

2.10.1.6   Miscellaneous parameters part 2

Parameter-No.: 00537	Centrifuge type and version	Gen. 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Centrifuge type
Highbyte: Centrifuge version
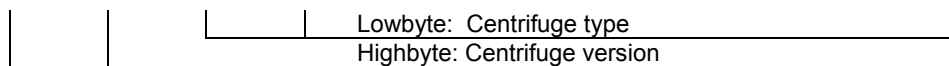
2.10.1.7 Parameters for rotor cycle function

Note: For following rotors is the rotor cycle counter –by factory setting- enabled

Rotor number	Rotor	preset with rotor cycle limit (factory setting)
2	4444	yes
13	5699-R	yes
14	5622	yes

☞	Please refer to chapter 3.8 and parameter 00635

Used abbreviations: High Word = (HW)
                        Low Word = (LW)

Parameter-No.: 00563	Actual cycles of the actual rotor (High Word)	Gen. 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Actual cycles of the actual rotor (HW)
Highbyte: Actual cycles of the actual rotor (HW)
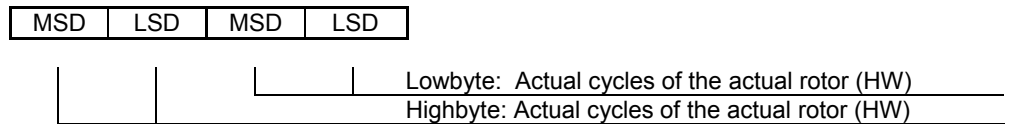
Parameter-No.: 00564	Actual cycles of the actual rotor (Low Word)	Gen. 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Actual cycles of the actual rotor (LW)
Highbyte: Actual cycles of the actual rotor (LW)
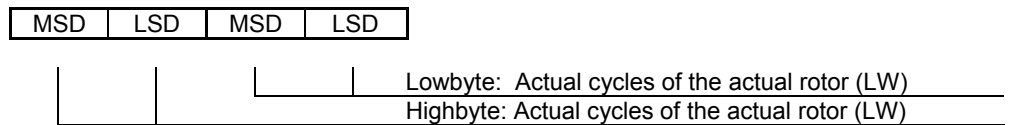
Parameter-No.: 00565	Preset cycles of the actual rotor (High Word)	Gen. 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Preset cycles of the actual rotor (HW)
Highbyte: Preset cycles of the actual rotor (HW)
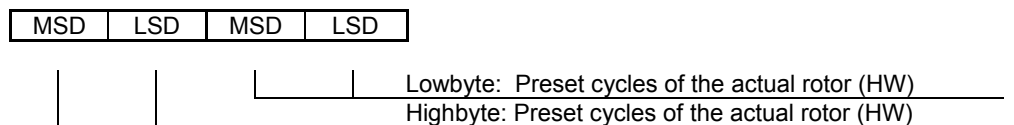
Parameter-No.: 00566	Preset cycles of the actual rotor (Low Word)	Gen. 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Preset cycles of the actual rotor (LW)
Highbyte: Preset cycles of the actual rotor (LW)
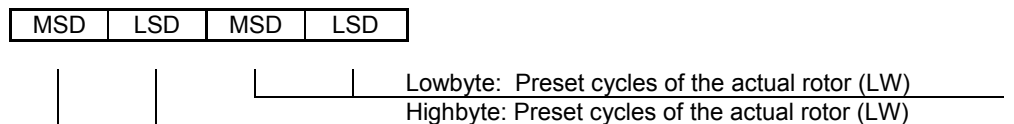
| Parameter-No.: 00567 | Total cycles of the actual rotor (High Word) | Gen. 2 | Access: **R** |

Structure:

| MSD | LSD | MSD | LSD |

Lowbyte: Total cycles of the actual rotor (HW)
Highbyte: Total cycles of the actual rotor (HW)
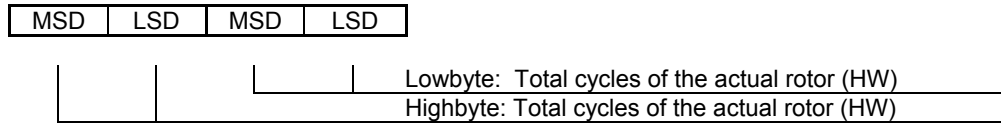
| Parameter-No.: 00568 | Total cycles of the actual rotor (Low Word) | Gen. 2 | Access: **R** |

Structure:

| MSD | LSD | MSD | LSD |

Lowbyte: Total cycles of the actual rotor (LW)
Highbyte: Total cycles of the actual rotor (LW)
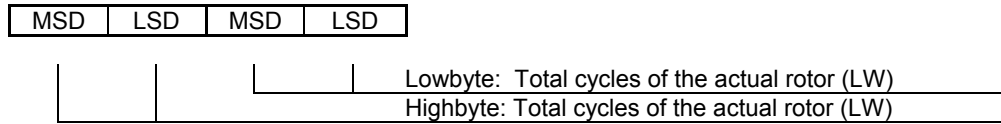
Counter for Starts of the machine (Starts of centrifugation runs):

| Parameter-No.: 00569 | Number of centrifugation starts (High Word) | Gen. 2 | Access: **R** |

Structure:

| MSD | LSD | MSD | LSD |

Lowbyte: Number of centrifugation starts (HW)
Highbyte: Number of centrifugation starts (HW)
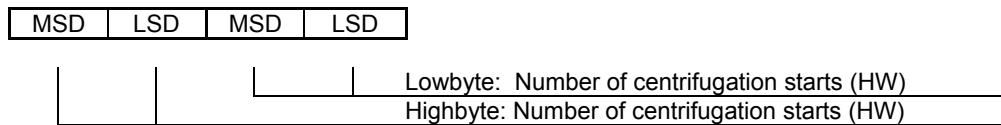
| Parameter-No.: 00570 | Number of centrifugation starts (Low Word) | Gen. 2 | Access: **R** |

Structure:

| MSD | LSD | MSD | LSD |

Lowbyte: Number of centrifugation starts (LW)
Highbyte: Number of centrifugation starts (LW)
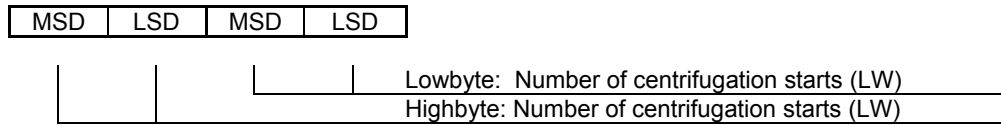
2.10.1.8   Miscellaneous parameters part 3

| Parameter-No.: 00600 | centrifuge identification | Gen. 2 | Access: **R** |

Structure:

| MSD | LSD | MSD | LSD |

Lowbyte: "34" (ASCII)
Highbyte: "12" (ASCII)
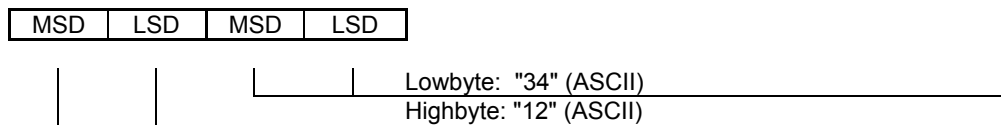
☞ Note : For"Generation 2" (type 5680): The return value is "1234",
for "Generation 1" (type 4815 to 4817): The return is :[ADR] : NAK

2.10.2   Parameters for Generation 1 <u>and</u> Generation 2

Parameter-No.: 00601	Set run-time	Gen. 1 + 2	Access: **RW**

Structure:

MSD	LSD	MSD	LSD

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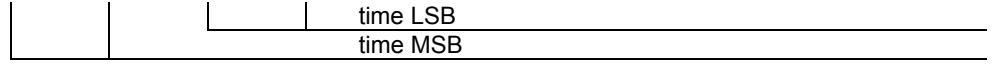
Input: Seconds
Range: 0 = continuous run, time run = 1 up to 59,999 sec (999 min : 59 sec)

Parameter-No.: 00602	Actual run-time	Gen. 1 + 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

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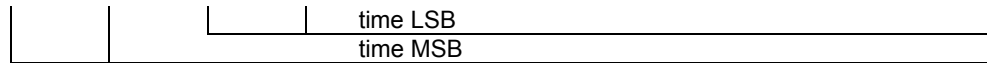
Display: Seconds
Range: 0 up to 59,999 sec (999 min:59 sec)

Parameter-No.: 00603	Set-speed	Gen. 1 + 2	Access: **RW**

Structure:

MSD	LSD	MSD	LSD

		Set speed LSB
		Set speed MSB
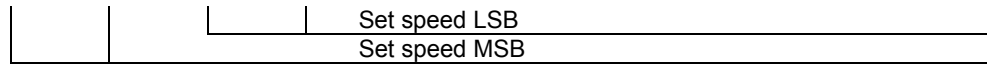
Input: RPM = revolutions per minute
Range: 50 up to the maximum rotor speed (see parameter 00605)

Parameter-No.: 00604	Actual-speed	Gen. 1 + 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

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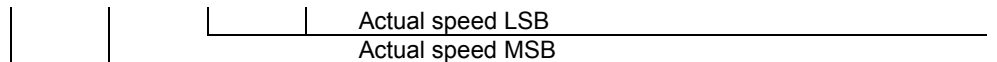
Display: RPM = **R**evolutions **P**er **M**inute
Range: 50 up to 20,000 RPM

Parameter-No: 00605	Maximum rotor speed	Gen. 1 + 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

max. speed LSB
max. speed MSB
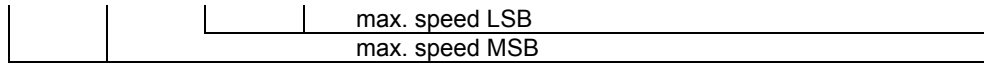
Display: RPM = revolutions per minute
          The value depends on the used rotor
Range: 50 up to 20 000 RPM

Parameter-No.: 00606	Set RCF	Gen. 1 + 2	Access: **RW**

Structure:

MSD	LSD	MSD	LSD

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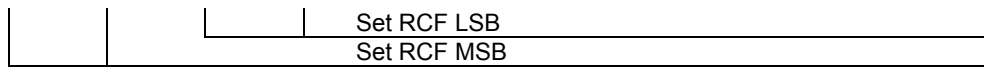
Input: RCF; Number without dimensions (multiple gravity)
Range: 1 up to max. Rotor-RCF (see Parameter 00608)

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	Gen. 1 + 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

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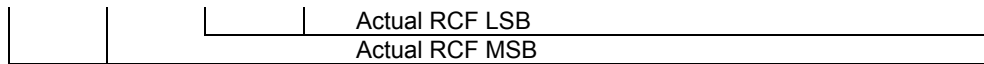
Display: Number without dimensions (multiple gravity)
Range: 1 up to 30 000 RCF

Parameter-No.: 00608	Maximum-Rotor-RCF	Gen. 1 + 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Maximum RCF LSB
Maximum 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

∫ RCF

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

The complete information has to be determined by the ENQUIRY of **two** parameters

Parameter-No.: 00609	∫ RCF/RZB 1st Word MSW	Gen. 1 + 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

∫ RCF LSB

∫ RCF MSB

31--------------------Bit--------------------16
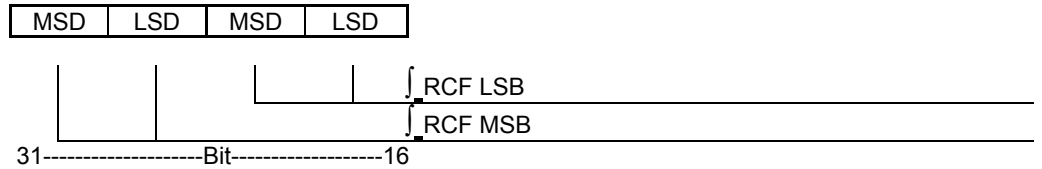
Parameter-No.: 00610	∫ RCF/RZB 2nd Word MSW	Gen. 1 + 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

∫ RCF LSB

∫ RCF MSB

15--------------------Bit--------------------0
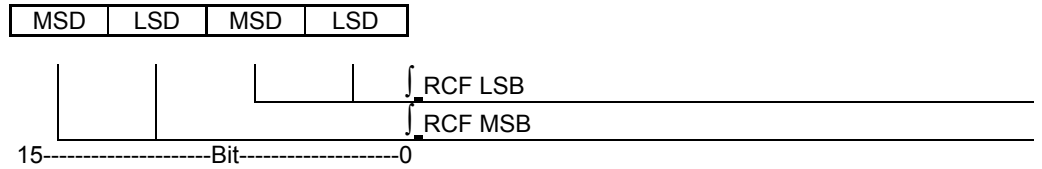
!! There are only values, therefore bit 31 is always 0 !!
Bit 31   : sign (0 = positive, 1=negativ)
Bit 30...23   : Exponent (two's complement with offset $127_{dezimal}$)
        Bit 23 = 2^0
        Bit 24 = 2^1
        Bit 25 = 2^2
        Bit 26 = 2^3
        Bit 27 = 2^4
        Bit 28 = 2^5
        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 /acceleration	Gen. 1 + 2	Access: RW

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Run-up parameter
Highbyte: Run-up parameter

Highbyte:

7		1= level 0= Time
6		
5		
4		
3		
2		7-bit digit MSB
1		
0		

Lowbyte:

7		
6		
5		
4		
3		8-bit digit LSB
2		
1		
0		

1st possibility: Run-up-level
Run-up level, if Highbyte -Bit 7- =1
Range: 1 up to 9

2nd possibility: Run-up time
Run-up time, if Highbyte -Bit 7- =0
Time in seconds

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 / braking	Gen. 1 + 2	Access: RW

Structure:
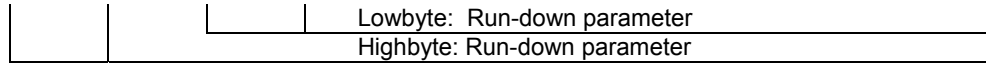
MSD	LSD	MSD	LSD

Lowbyte: Run-down parameter
Highbyte: Run-down parameter

Highbyte:

7		1= Level , 0= Time
6		
5		
4		
3		7-bit digit MSB
2		
1		
0		

Lowbyte:

7		
6		
5		
4		
3		8-bit digit LSB
2		
1		
0		

1st possibility: run-down level
run-down level, if Highbyte -Bit 7- =1
range: 0 up to 9

2nd possibility: run-down time
run-down time, if Highbyte -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	Gen. 1 + 2	Access: **R**

Parameter-No.: 00614	Maximum run-up-time	Gen. 1 + 2	Access: **R**

Parameter-No.: 00615	Minimum run-down-time	Gen. 1 + 2	Access: **R**

Parameter-No.: 00616	Maximum run-down-time	Gen. 1 + 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Time LSB
Highbyte: Time MSB

Highbyte:

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

Lowbyte:

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	Gen. 1 + 2	Access: **RW**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: LSB
Highbyte: MSB

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

Parameter-No.: 00618	Set-Temperature		Gen. 1 + 2	Access: **RW**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Set temperature

Highbyte: Always 00
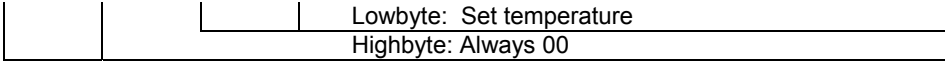
Input: Temperature in degree Celsius

Range: Cooled centrifuges: -20 up to +40 °C

Heated/Cooled centrifuges: -20 up to +60 °C

Format: Data is transmitted standardized: with offset 25° (T_{min} = 25)

See also 00619 actual temperature

Formula: Transmitted data = (Set value + Tmin) *2

Parameter-No.: 00619	Temperature-actual value		Gen. 1 + 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Actual temperature

Highbyte: Always 00
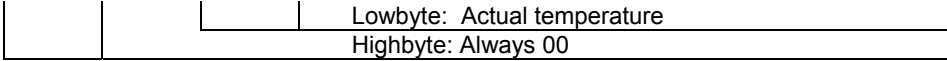
Display: Temperature value in Celsius

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 = (Set value - T_{min}) *2

e.g.: -25°C = 0X00

-10°C = 0X1E

+40°C = 0X82

+102°C = 0XFE

Parameter-No.: 00620	Radius		Gen. 1 + 2	Access: **RW**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Radius (LSB)

Highbyte: Radius (MSB)
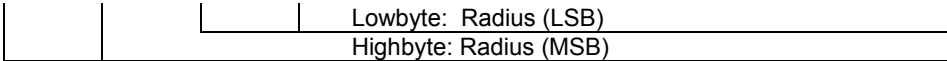
Range: rotor radius [mm] from 10 up to 330.

The range of the radius is not checked by the centrifuge. The correct radius has to be limited by the PC:

☞ After setting the radius, display is always in RCF mode

Parameter-No.: 00630	Program-Info	Gen. 1 + 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Program-Info
Highbyte: Program-Number (0 up to 99)
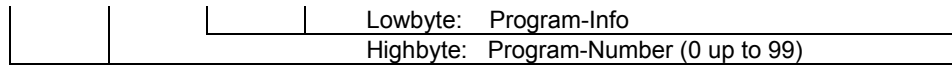
Highbyte:

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

Lowbyte: Information about program

7	MSb	not relevant Please refer to the following note (🖘 Note:)
6	LSb	not relevant
5	1 =	
4	1 =	not relevant , all programs are existing , bit is always 0
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	Gen. 1 + 2	Access: **RW**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Program-command
Highbyte: Program-number (0 up to 99)

Highbyte: Program-number (0 up to 99)

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

Lowbyte: Program-command from PC

7	MSb	not relevant Please refer to the following note (🖘 Note:)
6	LSb	not relevant
5	1 =	not relevant
4	1 =	PROG overwrite (overwrite confirmation)
3	1 =	STO Program, Bit 4 (PROG) has also to be set to 1
2	1 =	RCL Program
1	1 =	not relevant
0	1 =	write program in serial parameter

🖘 Note: Parameter 00630 and 00631 Lowbyte, Bit 6 and 7 are no longer available.
The Program-ID – bits (Lowbyte, Bit 6 und 7) are always 0
Therefore the program is always "Profile (standalone)".
The declaration of the sequential programs is now completely different.
We believe that the feature "sequential programs" is not used in the robotic application.
Please contact Hettich if you use the "sequential programs" and if you need the detailed information about the new function.

Parameter-No.: 00633	Control-command	Gen. 1 + 2	Access: RW

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Control-command
Highbyte: Command for Report
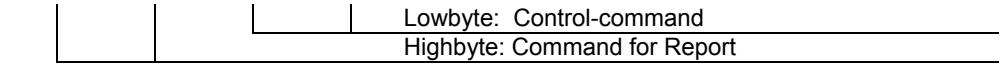
Highbyte:

7	1 =	Report requested
6	1 =	Report terminated
5	1 =	not relevant
4	1 =	not relevant
3	1 =	not relevant
2	1 =	not relevant
1	1 =	not relevant
0	1 =	not relevant

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.

Lowbyte: Control-Command

7	1 =	LOCK 5 (Input locked, excluding STOP)
6	1 =	LOCK 4 (Input locked = LOCK 2)
5	1 =	not relevant
4	1 =	not relevant
3	1 =	Modification of nominal value is required
2	1 =	not relevant
1	1 =	START centrifugation
0	1 =	STOP centrifugation

Parameter-No: 00634	Centrifuge state 1	Gen. 1 + 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Centrife state 1
Highbyte: Centrifuge state 1
      (Error- or program-number)
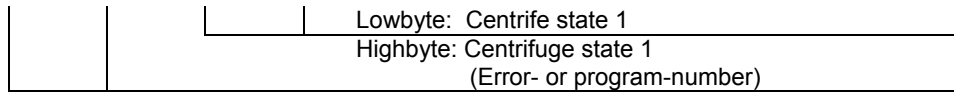
Highbyte: Centrifuge state 1

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

Lowbyte: Centrifuge state 1

7	1 =	Centrifuge status has changed , check parameter 00635
6	MSb	not relevant
5	LSb	not relevant
4	1 =	Run-down (brake)
3	1 =	Centrifugation
2	1 =	Run-up (acceleration)
1	1 =	Stand still
0	1 =	Centrifugation is not possible

Lowbyte Bit 7 (Centrifuge status as changed) is set:
- Key-Lock status was changed .
- standstill changed to run
- rotor was changed
- stop centrifugation
- stand still after run
- error´s
- mains interrupt
- status changed to teaching
- status has changed , check parameter 00635

Lowbyte Bit 0 is 1:   - Centrifugation is not possible
Lowbyte Bit 0 is 0:   - Centrifugation is possible

The following conditions have to be TRUE to start the centrifugation:
- the lid locking is closed.
- the hatch is closed (part 1)   =   the end switch at the hatch is contacted,
- the hatch is closed (part 2)   =   the end switch for lid is closed is contacted,
- the positioning mode **is not** active.

Parameter-No.: 00635	Centrifuge state 2	Gen. 1 + 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Centrifuge state 2
    (Rotor number and Key-Lock state)
Highbyte: Centrifuge state 2
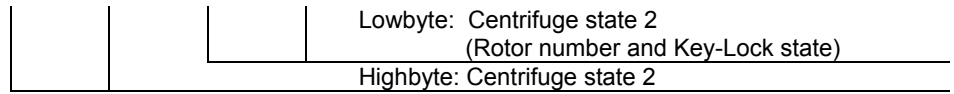
Highbyte: Centrifuge state 2

7	1 =		Rotor cycle counter for the actual rotor is activated (> 0)	[*1]
6	1 =		Maximum rotor cycles are exceeded	[*1]
5	1 =		The setting menu for rotor cycles is processed, the limit value is confirmed	[*1]
4	1 =		not relevant	
3	1 =		The rotor was changed (After START is a new rotor code detected)	
2	1 =		No rotor (no rotor tacho pulses detected)	
1	1 =		Lid is closed (Switch under the lid locking is closed)	
0	1 =		Lid is open (Switch under the lid locking is not closed)	

[*1] : Please refer to chapter 2.10.1.7 "Parameters for rotor cycle function"
      and to chapter 3.8 "Rotor cycles commands"

Lowbyte: Centrifuge state 2

7	MSb	
6		4-bit rotor number (rotor code number from 0 to 15)
5		Please refer to parameter 00560.
4	LSb	
3		not relevant
2	MSb	3-bit Key-Lock state Bit 2
1		Bit 1
0	LSb	Bit 0

Key-Lock state   1 = LOCK 1 : Key-Lock state 1 (left position) "teachmode",
         description see chapter "Setting rotor position 1" Teach
         position 1 "and operation instruction chapter "Setting rotor
         position 1"
       2 = LOCK 2 : Key-Lock state 2 (right position),
         the centrifuge accepts commands from the PC
         only the START- and STOP-key is active,
       3 = LOCK 3 : Key-Lock state 3 (middle position)
       4 = LOCK 4 : Software LOCK (like LOCK 2)
       5 = LOCK 5 : Software LOCK: only the STOP-key is active
         (ALL other keys are blocked)

Parameter-No.: 00636	Software-Version	Gen. 1 + 2	Access: **R**

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Software-Version Nibble 3 and 4
Highbyte: Software-Version Nibble 1 and 2
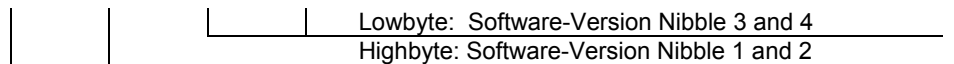
Example:
Software-Version **1.06** is stored as follows: Highbyte: "01", Lowbyte: "06"

Generation 1:   The numbering for the robotic software is: "4xxx"
            Examples: The centrifuge with software version 4.090 will answer "4090"
                    The centrifuge with software version 4.110 will answer "4110"
Generation 2:   The numbering for the software is: "01xx"
            Examples: The centrifuge with software version 01.09 will answer "0109"
                    The centrifuge with software version 01.12 will answer "0112"

Parameter-No.: 00639	Reset errors, Teaching of position 1	Gen. 1 + 2	Access: **RW**

1. Reset errors:

A SELECT-Telegram to Parameter 00639 with "0815" = " 30 38 31 35 " reset error messages.
Requirements: Rotor is in standstill, Key-Lock is in LOCK2 (right position).

☞ The following error messages have to be reset by a mains reset:
ERROR 1 , 2 , 96 (tacho errors) , 12 (versions error) , 62 (wrong motor code)

2. Teaching of Position 1 and store it in the control unit via serial protocol:

Requirements: Rotor is in standstill, Key-Lock is in LOCK2 (right) position.

Theory: The rotor position 1 (bucket no. 1 is under the hatch) is determined by the incremental encoder tracks A and B. This rotor position must be set by hand and then stored in the control panel.
The angular distance from position N (zero pulse) to rotor position 1 is determined by
the encoding pulses of the incremental encoder.
Beginning at position N (zero pulse) the pulses are counted up to rotor position 1 when turning the rotor counter-clockwise.
When the START-Key is pressed, the control panel stores the calculated pulses.

Sequence:

Send a SELECT telegram to Parameter 00639 with value "0100" to start the adjusting (teaching).

The display shows:
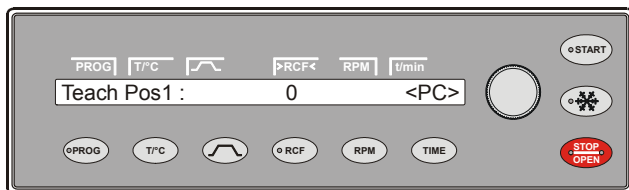
Setting:
- Turn the rotor slowly counter-clockwise by hand **until the centrifuge beeps.**
    --> Therewith the position N (zero pulse) is detected.
  After reaching the position N (zero pulse) the actual position is shown in the display

The display shows:

Continue to turn the rotor slowly in the Hettich direction (counter-clockwise) until the desired position 1 has been reached and hold this position.

Send a SELECT telegram to Parameter 00639 with value "0101" to save Position 1 in the EEPOM.

The display shows:

Send a SELECT telegram to Parameter 00639 with value "0102" to leave the adjusting (teach) mode.

Parameter-No.: 00640	State and command for positioning	Gen. 1 + 2	Access: **RW**

> ⚠ This parameter is only for the hatch control and for 2 place or 4 place rotors.

Structure:

MSD	LSD	MSD	LSD

Lowbyte: Positioning-command (Read/Write)
Highbyte: State of positioning   (Read)

Highbyte: State of positioning

7	1 =	Magnetic brake is active
6	1 =	Hatch is opened
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

Lowbyte: 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

Parameter-No.: 00685	State-Byte SIOF serial state of centrifuge	Gen. 1 + 2	Access: R

Serial **I**nput **O**utput **F**ailure
Structure:

MSD	LSD	MSD	LSD

Lowbyte: SIOF from centrifuge
Highbyte: Not relevant

Lowbyte: SIOF

7	1 =	improper value or command not allowed
6	1 =	modification not permitted (read only parameter)
5	1 =	wrong or unknown parameter
4	1 =	framing error , wrong STX , ETX , ENQ or "="
3	1 =	wrong BCC checksum
2	1 =	
1	1 =	SIOF parity error ,
0	1 =	Power On (after Reset , mains interrupt)

Generation 2: The bits 1, 3 and 4 are new.

If a telegram is answered with NAK (0X15), the reason for the "not acknowledge" can be determined by reading of parameter 00685.
The SIOF-parameter has to be enquired, before another ENQUIERY – or SELECT telegram can be sent.
The SIOF bits are accordant modified.
Note: After reading the SIOF parameter the bits are cleared automatically.

Reaction to an ENQUIRY-Telegram:
- If the parameter is possible ("known"): The centrifuge will answer according to the explained protocol.
- If the centrifuge answers with NAK: The reason can be:
  - the parameter is unknown (bit 5 is '1'),
  - the sent protocol is not correct (bit 4 is '1') or (bit 1 is '1')

Reaction to a SELECT-Telegram:
- If parameter and value are OK: The centrifuge will answer with ACK;
  - and the value is be accepted
  - or the command will be executed..
- If parameter and value are not OK: The centrifuge will answer with NAK;
  The reason can be:
  - the parameter is unknown (bit 5 is '1'),
  - the sent protocol is not correct (bit 4 is '1') or (bit 1 is '1') or (bit 3 is '1'),
  - the parameter is not a write parameter (bit 6 is '1'),
  - the sent value is out of range or (bit 7 is '1')
  - the centrifuge detects "reset" and the SIOF was not read.

⚠️ The following explanation (chapters 2 and 3) describe only the "new" communication according to the updated possibilities of "Generation 2".

The communication and the serial commands of "Generation 1" are still valid for the most parameters. Please refer to the chapter 5 " Communication with machines of Generation 2 according to the still valid communication of Generation 1"
The description and the cookbook of "Generation 1" is explained in the operating instruction of ROTANTA 46 RSC (types 4815 / 4816 and 4817) in chapter 36

2.11 Additional features of communication with "Generation 2"

2.11.1 Serial communication and visual detection of the communication

If the PC communicates continuously (at least every 10 sec), the yellow LED in the (PROG) switch lights up.
The LED "dies down" if the PC does not communicate again within 10 sec.

2.11.2 Software-Lock

LOCK 5: Start of centrifugation by the (⊙START) - Key is blocked.
If a software-lock is activated by the PC (param.00520), the display shows LOCK 5.
If the serial communication stops and the software-lock is active, the centrifuge proceeds with the current program.
Without the serial link the locked keys can only be reactivated by performing a mains reset
("power off"   and   "power on").

2.11.3 Checking values for validity (value has to be inside the allowed range)

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

2.11.4 Limitations

- Only during standstill a program can be
    – stored (STO) to the memory (EEPROM)
    – recalled (RCL) from the memory (EEPROM)
- Set values can also be modified during centrifugation (not during run-down / brake).

2.11.5 Query of actual values

Please refer to chapter 2.3.3 "Rhythm of request"
We recommend to enquire the actual value / condition **during centrifugation** at least once per Second
(for "just-in-time" - information)
    The important values are:
        – actual status (acceleration, centrifugation, brake, standstill)
        – actual runtime
        – actual speed , RPM or RCF
        – actual temperature
        – ∫ RCF/RZB
A delay time of approx. 400 ms between the individual ENQUIRY-telegrams is necessary during centrifugation run.

2.11.6   Hatch and positioning commands

☞	Check standstill after a centrifugation run before sending any hatch- or positioning commands

2.11.7   Bit of modification

The communication provide a "modification bit" in parameter "Centrifuge state 1"
Parameter-No: 00634 Lowbyte, bit7

The following changes / modifications "trigger" (set) the "modification bit":

    - Key-Lock status was changed, e.g. Key-Lock status is changed to "teaching"
    - Centrifugation was started
    - Centrifugation was stopped
    - Centrifugation was finished (standstill after run).
    - Rotor was changed
    - Error is detected
    - Mains interrupt is detected (after power-on)

After enquiring parameter "Centrifuge state 1" the modification bit is automatically cleared.
The benefit of this function is:
You have only to enquire one parameter (00634) to "detected" several changes. After such a modification the
other parameters (e.g. 00635) should be enquired.

2.12   State of the centrifuge after power on and general operating states.

- "State of the centrifuge" and the required ENQUIRY protocol after power on.
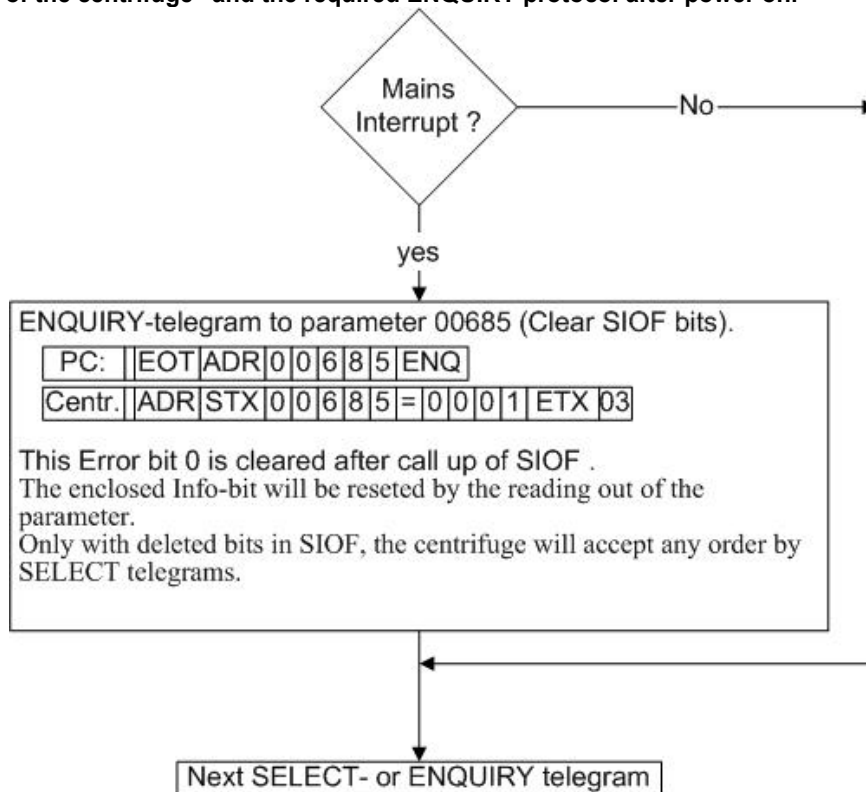
☞	Each SELECT telegram replies a "NAK" , as long as the "Power On" bit is set

- Operating states:
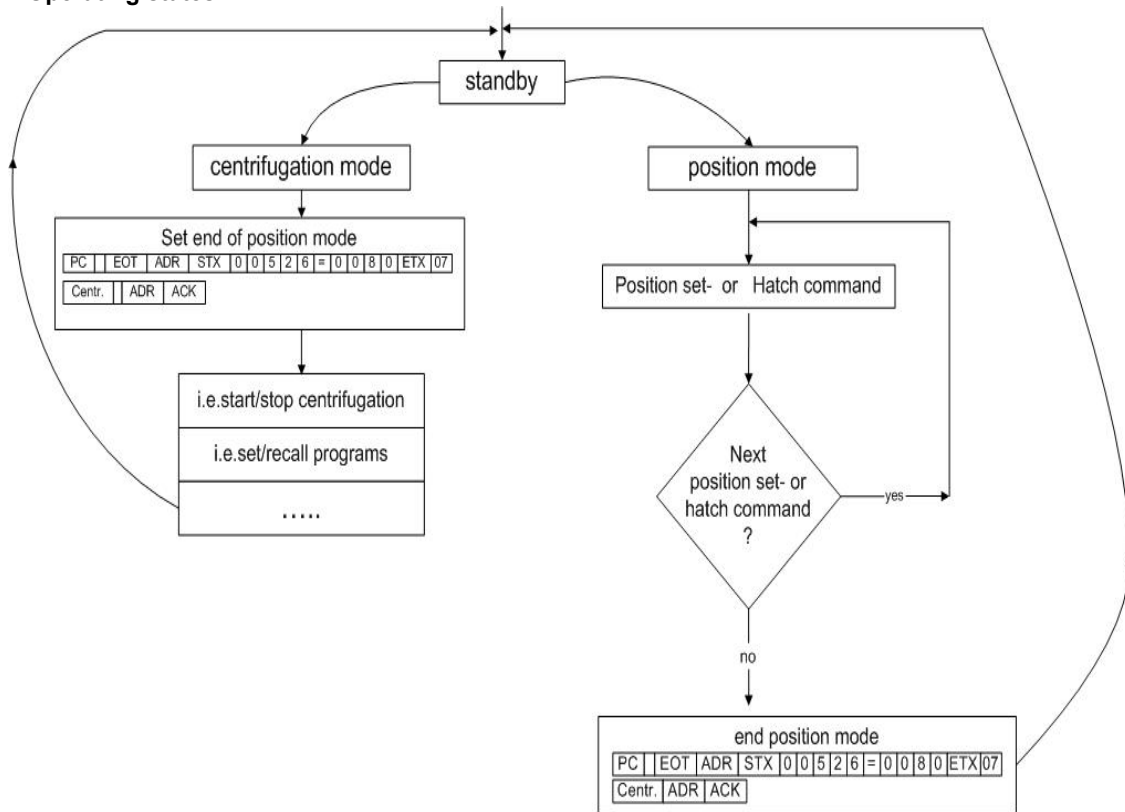
The internal states are subdivided into:
- Standby = Standstill (no centrifugation mode, no position mode).
       The lid is open or closed.
- Centrifugation mode: Machine is running / centrifugating.
- Positioning mode: Hatch is open and / or positioning command was sent.
  The positioning mode will be terminated:
  - Manually by switching the Key-Lock to middle position (position 3)
  - Per remote by serial telegram (SELECT "00526=0080")
  - Automatically by:
    - Closing the hatch
    - Activating the TEACH-menu (00639=0100)
    - Detecting an error
    - Timeout after 20 minutes continuous staying / positioning in one position.

3 Cookbook for serial control of "Generation 2"

The following items explain the main commands to control the machines of "Generation 2".

3.1 Open the hatch

```
                    ┌──────────────────────────────────────────────────┐
                    │                 Check for LOCK 2                   │
                    │  ┌─────┬───┬─────┬───┬─┬─┬─┬─┬─┬───┐              │
                    │  │ PC: │   │ EOT │ADR│0│0│6│3│5│ENQ│              │
                    │  ├─────┼───┼─────┼───┼─┼─┼─┼─┼─┼───┼─┬─┬─┬─┬───┬──┐
                    │  │Centr│ADR│ STX │0│0│6│3│5│=│x│x│x│2│ETX│03│
                    └──────────────────────────────────────────────────┘
       no
```


Check for LOCK 2
PC: | | EOT | ADR | 0 | 0 | 6 | 3 | 5 | ENQ
Centr. | ADR | STX | 0 | 0 | 6 | 3 | 5 | = | x | x | x | 2 | ETX | 03

Command Open hatch
PC | | EOT | ADR | STX | 0 | 0 | 5 | 2 | 6 | = | 0 | 0 | 6 | 0 | ETX | 09

ACK from centriguge
Centr. | ADR | ACK

Check hatch status
PC: | | EOT | ADR | 0 | 0 | 5 | 2 | 8 | ENQ

Request from centrifuge =
Centr. | ADR | STX | 0 | 0 | 5 | 2 | 8 | = | 2 | 0 | x | x | ETX | 03 — no

Hatch is open

yes

Operating state : standby
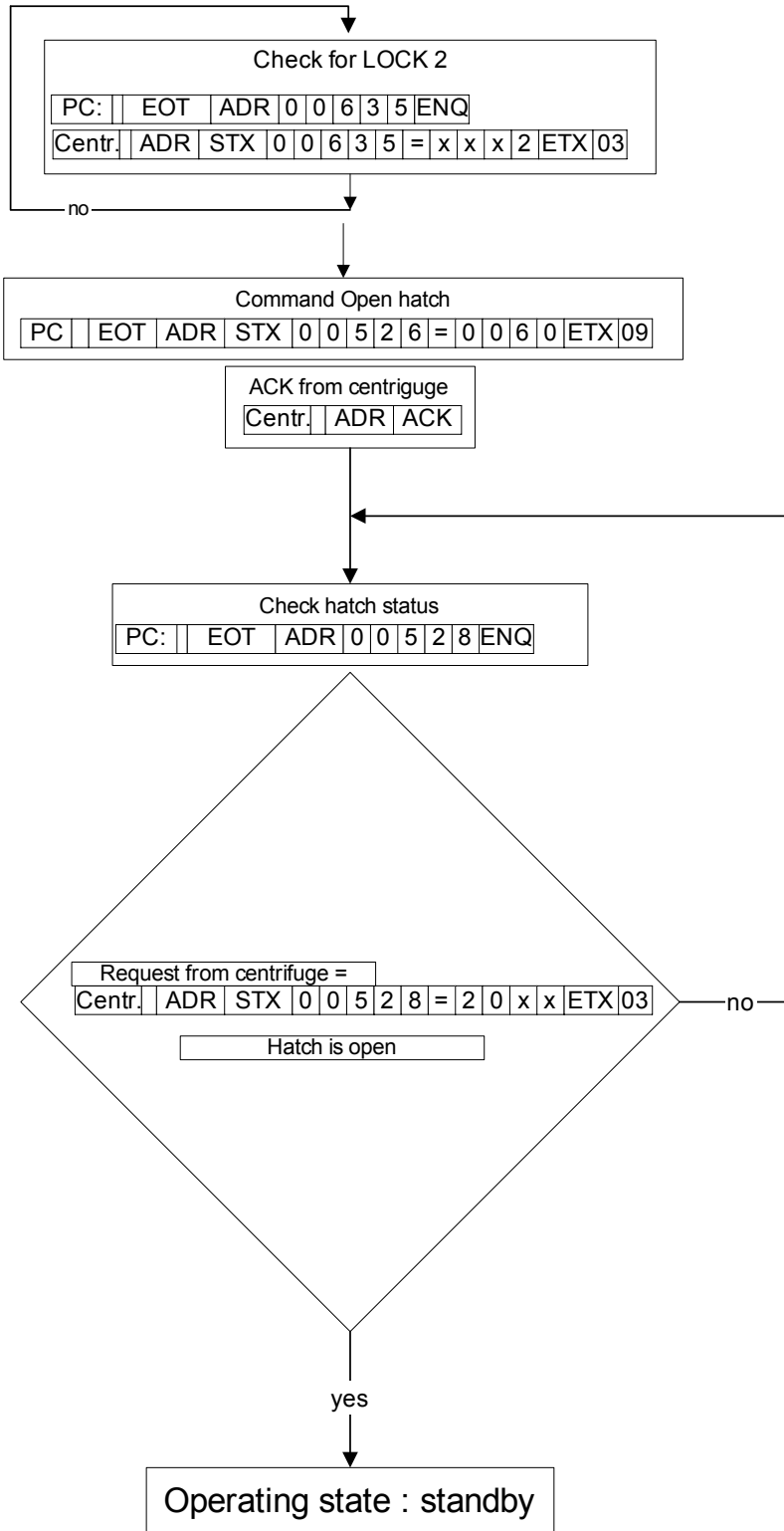
Please refer also to the example in chapter 3.7.6

3.2 Close the hatch

```
Check for LOCK 2
PC:  |  | EOT | ADR | 0 | 0 | 6 | 3 | 5 | ENQ
Centr. | ADR | STX | 0 | 0 | 6 | 3 | 5 | = | x | x | x | 2 | ETX | 03
```

no

```
Command Close hatch
PC |  | EOT | ADR | STX | 0 | 0 | 5 | 2 | 6 | = | 0 | 0 | 7 | 0 | ETX | 09
```

```
ACK from centriguge
Centr. |  | ADR | ACK
```

```
Check hatch status
PC:  |  | EOT  | ADR | 0 | 0 | 5 | 2 | 8 | ENQ
```

```
Request from centrifuge =
Centr. |  | ADR | STX | 0 | 0 | 5 | 2 | 8 | = | 1 | 0 | x | x | ETX | 03
                                                Hatch is closed
```

no

yes

```
Operating state :  standby
```
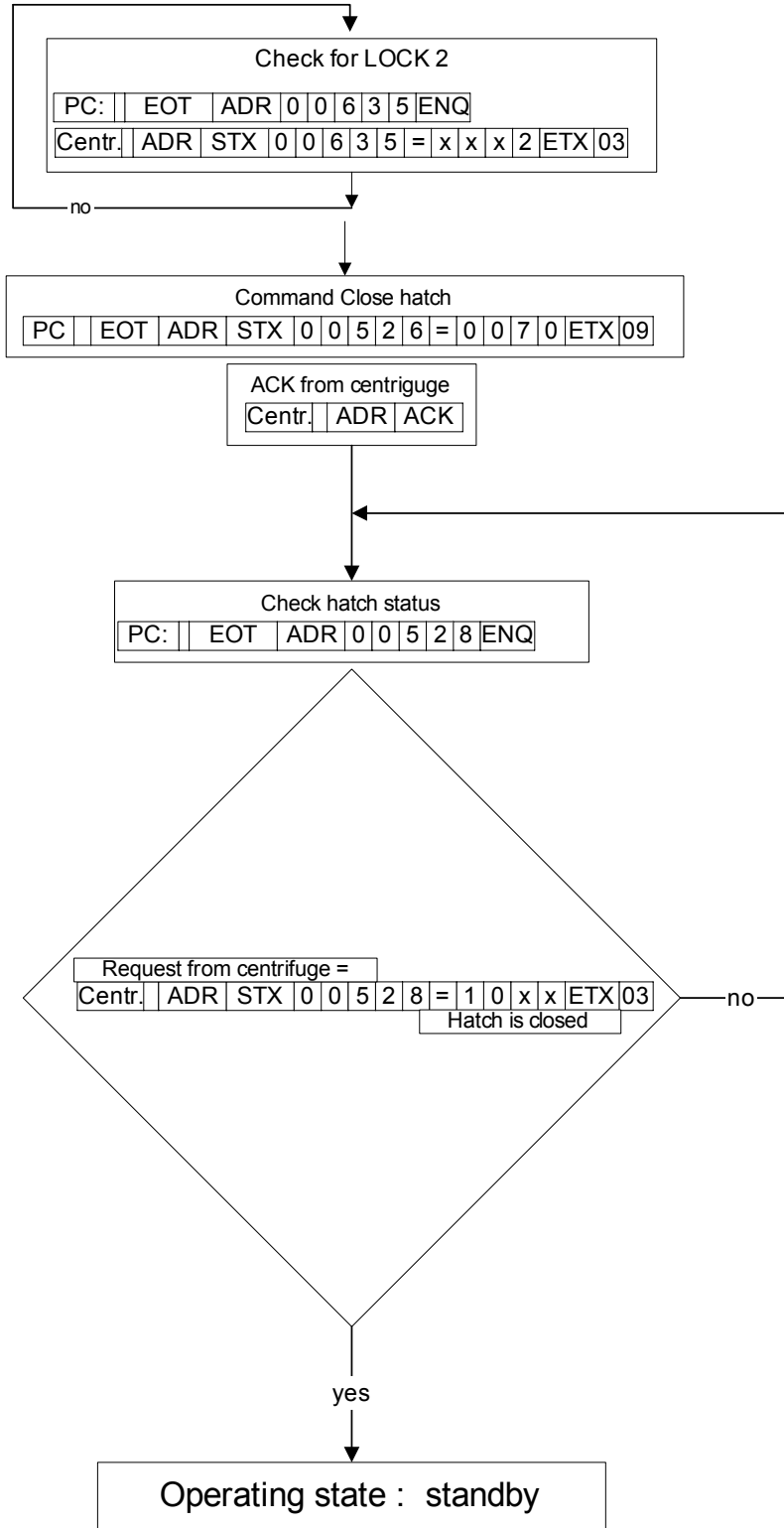
Please refer also to the example in chapter 3.7.9

3.3   Set rotor position

Example: Goto Position 4 with a 24-place rotor.
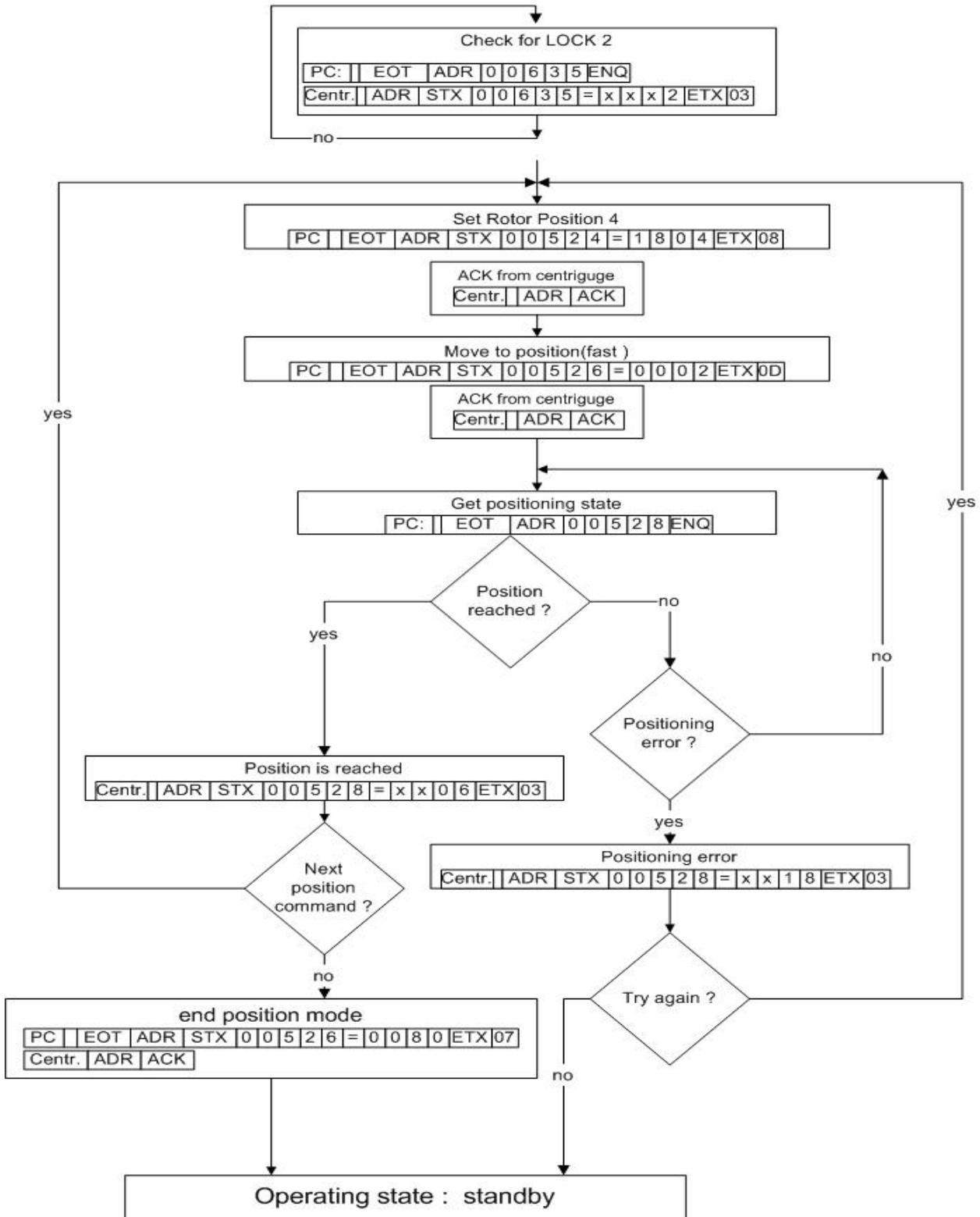
Please refer also to the example in chapter 3.7.7 and 3.7.8

3.4   Start centrifugation

```
                    ┌──────────────────────────────────────────┐
                    │           Check for LOCK 2               │
                    │ ┌──────────────────────────────────────┐ │
                    │ │PC: │ │ EOT │ ADR │0│0│6│3│5│ENQ│      │ │
                    │ ├──────────────────────────────────────┤ │
                    │ │Centr.│ ADR │ STX │0│0│6│3│5│=│x│x│x│2│ETX│03││
                    │ └──────────────────────────────────────┘ │
    ──no──                                                      │
                    ┌──────────────────────────────────────────┐
                    │ Check the centrifuge for standstill and for lid and hatch are closed │
                    │ ┌────────────────────────────────────────┐ │
                    │ │ PC: │ │ EOT │ ADR │0│0│6│3│4│ENQ│       │ │
                    │ ├────────────────────────────────────────┤ │
                    │ │Centr.│ ADR │ STX │0│0│6│3│4│=│x│x│x│2│ETX│03││
                    │ └────────────────────────────────────────┘ │
    ──no──                                                        │
                    ┌──────────────────────────────────────────┐
                    │        Command Start centrifugation      │
                    │PC│ │ EOT │ADR│ STX │0│0│5│2│1│=│0│0│0│2│ETX│06│ │
                    └──────────────────────────────────────────┘
                         ┌──────────────────────────┐
                         │    ACK from centriguge   │
                         │Centr.│ │ ADR │ ACK        │
                         └──────────────────────────┘
                    ┌──────────────────────────────────────────┐
                    │   Operating state :  standby             │
                    └──────────────────────────────────────────┘
```
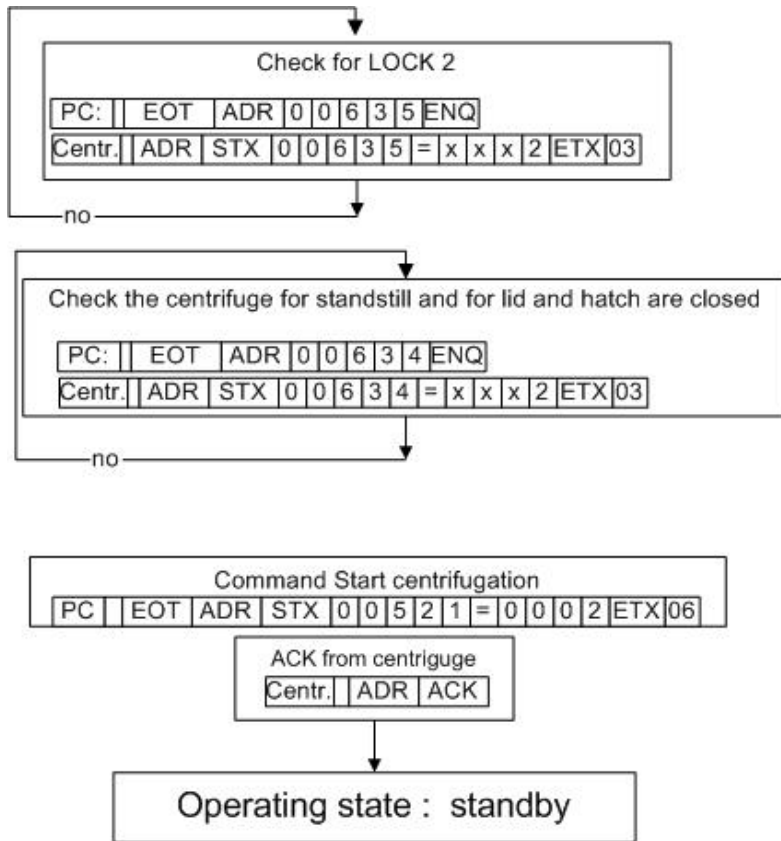
Please refer also to the example in chapter 3.7.11

3.5   Stop centrifugation

```
                    ┌──────────────────────────────────────────┐
                    │           Check for LOCK 2               │
                    │ ┌──────────────────────────────────────┐ │
                    │ │PC: │ │ EOT │ ADR │0│0│6│3│5│ENQ│      │ │
                    │ ├──────────────────────────────────────┤ │
                    │ │Centr.│ ADR │ STX │0│0│6│3│5│=│x│x│x│2│ETX│03││
                    │ └──────────────────────────────────────┘ │
    ──no──                                                      │
                    ┌──────────────────────────────────────────┐
                    │        Command Stop centrifugation       │
                    │PC│ │ EOT │ADR│ STX │0│0│5│2│1│=│0│0│0│1│ETX│08│ │
                    └──────────────────────────────────────────┘
                         ┌──────────────────────────┐
                         │    ACK from centriguge   │
                         │Centr.│ │ ADR │ ACK        │
                         └──────────────────────────┘
                    ┌──────────────────────────────────────────┐
                    │   Operating state :  standby             │
                    └──────────────────────────────────────────┘
```
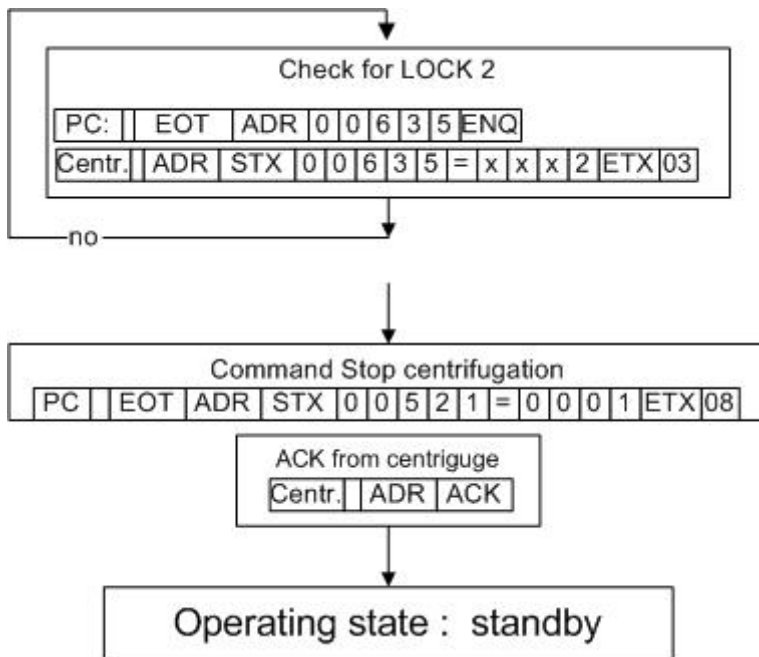
Please refer also to the example in chapter 3.7.12

3.6 How to store and recall programs

3.6.1 Recall program to edit:

Parameter 00523 Highbyte= program number(1..89) ,Lowbyte =**01** .
Program block is copied from the EEPROM to the RAM (=edit block) .
Set values can now be changed .

3.6.2 Recall program and set this program active:

Parameter 00523 Highbyte= program number(1..89) ,Lowbyte =**04** .
Program block is copied from the EEPROM to the (ram) edit block
and to the active/current program block ,this program will run at the next start of centrifugation .

3.6.3 Store program:

Parameter 00523 Highbyte= program number(1..89) , Lowbyte =**08** .
store the edit block to the EEPROM .

3.6.4 Store program and set this program active:

Parameter 00523 Highbyte= program number(1..89) , Lowbyte =**18** .
store the edit block to the EEPROM and enable the active/current program block .
This program will run at the next start of centrifugation .

EEPROM program structure , 89 program blocks

program nr 89	
run-up level	(parameter 611 , default = 9)

program nr 88	
run-up level	(parameter 611 , default = 9)
nominal speed	(parameter 603 , default = 500 rpm)
run-down level	(parameter 612 , default = 9)
nominal run-time	(parameter 601 , default = 60 s)
nominal temperature	(parameter 618 , default = 20)
radius	(parameter 620 , default = 220)
brake switch off speed	(parameter 617 , default = 0)
program flags	(0 = rpm- 1 = rcf-mode default = 0)

program nr 2	
run-up level	(parameter 611 , default = 9)

program nr 1	
run-up level	(parameter 611 , default = 9)
nominal speed	(parameter 603 , default = 500 rpm)
run-down level	(parameter 612 , default = 9)
nominal run-time	(parameter 601 , default = 60 s)
nominal temperature	(parameter 618 , default = 20)
radius	(parameter 620 , default = 220)
brake switch off speed	(parameter 617 , default = 0)
program flags	(0 = rpm- 1 = rcf-mode default = 0)

edit block (ram)	
run-up level	(parameter 611 , default = 9)
nominal speed	(parameter 603 , default = 500 rpm)
run-down level	(parameter 612 , default = 9)
nominal run-time	(parameter 601 , default = 60 s)
nominal temperature	(parameter 618 , default = 20)
radius	(parameter 620 , default = 220)
brake switch off speed	(parameter 617 , default = 0)
program flags	(0 = rpm- 1 = rcf-mode default = 0)

active/current program block	
run-up level	(parameter 611)
nominal speed	(parameter 603)
run-down level	(parameter 612)
nominal run-time	(parameter 601)
nominal temperature	(parameter 618)
radius	(parameter 620)
brake switch off speed	(parameter 617)
program flags	(0 = rpm- 1 = rcf-mode default = 0)

Please refer also to parameter 00523 and to the example in chapter 3.7.5 and on chapter 3.7.10

3.6.5 Write a new program and store it in the machine memory (EEPROM)

Example:
set run-time	=	20 minutes (1200 sec.)
radius (in mm)	=	110
set speed	=	2000 rpm
run-up-level	=	7
run-down-level	=	4
store to program nr	=	5
set display to RPM mode		

Check for LOCK 2

PC: | | EOT | ADR | 0 | 0 | 6 | 3 | 5 | ENQ
Centr. | | ADR | STX | 0 | 0 | 6 | 3 | 5 | = | x | x | x | 2 | ETX | 03

—no—

Set nominal runtime 20 min. = 1200 sec

PC | | EOT | ADR | STX | 0 | 0 | 6 | 0 | 1 | = | 0 | 4 | B | 0 | ETX | 7F

ACK from centriguge

Centr. | | ADR | ACK

Set radius 110 mm

PC | | EOT | ADR | STX | 0 | 0 | 6 | 2 | 0 | = | 0 | 0 | 6 | E | ETX | 79

ACK from centriguge

Centr. | | ADR | ACK

Set nominal speed 2000 rpm

PC | | EOT | ADR | STX | 0 | 0 | 6 | 0 | 3 | = | 0 | 7 | D | 0 | ETX | 78

ACK from centriguge

Centr. | | ADR | ACK

Set run-up-level 7

PC | | EOT | ADR | STX | 0 | 0 | 6 | 1 | 1 | = | 8 | 0 | 0 | 7 | ETX | 07

ACK from centriguge

Centr. | | ADR | ACK

Set run-down-level 4

PC | | EOT | ADR | STX | 0 | 0 | 6 | 1 | 2 | = | 8 | 0 | 0 | 4 | ETX | 07

ACK from centriguge

Centr. | | ADR | ACK

Store to prognr 5 and activate progr 5

PC | | EOT | ADR | STX | 0 | 0 | 5 | 2 | 3 | = | 0 | 5 | 1 | 8 | ETX | 06

ACK from centriguge

Centr. | | ADR | ACK

Operating state : standby

Please refer also to parameter 00523

3.6.6 Recall and activate an already stored program

Example : Recall and activate program number 5

Check for LOCK 2
PC:		EOT	ADR	0	0	6	3	5	ENQ
Centr.	ADR	STX	0	0	6	3	5	=	x	x	x	2	ETX	03

—no—
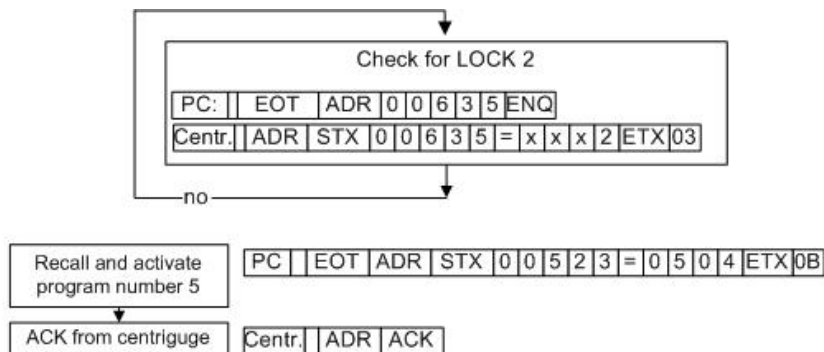
| Recall and activate program number 5 | PC | | EOT | ADR | STX | 0 | 0 | 5 | 2 | 3 | = | 0 | 5 | 0 | 4 | ETX | 0B |
| ACK from centrifuge | Centr. | | ADR | ACK |

| Optionally read out the activated parameters |

Read nominal run-time	PC:		EOT	ADR	0	0	6	0	1	ENQ	Centr.	ADR	STX	0	0	6	0	1	=	0	4	B	0	ETX	7F
Read nominal speed	PC:		EOT	ADR	0	0	6	0	3	ENQ	Centr.	ADR	STX	0	0	6	0	3	=	0	7	D	0	ETX	78
Read run-up level	PC:		EOT	ADR	0	0	6	1	1	ENQ	Centr.	ADR	STX	0	0	6	1	1	=	8	0	0	7	ETX	07
Read run-down level	PC:		EOT	ADR	0	0	6	1	2	ENQ	Centr.	ADR	STX	0	0	6	1	2	=	8	0	0	5	ETX	06
Read radius	PC:		EOT	ADR	0	0	6	2	0	ENQ	Centr.	ADR	STX	0	0	6	2	0	=	0	0	6	E	ETX	79
Read nominal rcf	PC:		EOT	ADR	0	0	6	0	6	ENQ	Centr.	ADR	STX	0	0	6	0	6	=	0	01	E	C	ETX	09

Please refer also to parameter 00523

3.7 Protocol Examples

The following example shows a typically serial communication routine:
1. Start-up sequence (after centrifuge mains on during the beginning of serial communication
2. Cyclic sequence during standstill and positioning
3. Change the Nominal Values in stand still or during the run
4. The PC writes a program which will be stored in the control panel
   (compatible with ROTANTA 46 RSC Robotic type 4815 / 4816 / 4817)
5. The PC recalls and activates a program
   (compatible with ROTANTA 46 RSC Robotic type 4815 / 4816 / 4817)
6. Command to open the hatch is sent and waiting for the execution of the command
7. Command for position 1 is sent and waiting for the execution of the command.
8. Command for position 4 is sent and waiting for the execution of the command.
9. Command to close the hatch is sent and waiting for the execution of the command
10. Prearrangement for a centrifugation:
    Command for the recall of program 6 is sent and waiting for the execution of the command
11. Command to START the centrifuge is sent and waiting for the execution of the command.
12. Start

Note: The key-operated switch has to be in position LOCK 2 (right key position).
The centrifuge accept commands from PC only in position LOCK 2 .

STX = 02 hex , ETX = 03 hex , EOT= 04 hex , ENQ = 05 hex ,ACK = 06 hex , NAK = 15 hex

Abbreviation for column 1 :   E = ENQUIRY – telegram (value request) ,
     S = SELECT – telegram (data-, or command-transmission).

3.7.1 Sequence after starting PC communcation

1	Serial data	Description
E	:EOT:T:00685:ENQ :T:STX:00685=0000:ETX:[05]	Read SIOF , activate "serial commands" Clear reset bit etc …

E	:EOT:T:00537:ENQ
	:T:STX:00537=C800:ETX:[07]
		Read the centrifuge ID , to get the centrifuge type
		Highbyte: Centrifuge type
		Lowbyte: Type of cooling
		        Centrifuge type C800 = Rotanta 460 + pos
		        i.E. Centrifuge type F800 = SK 20.08

E	:EOT:T:00528:ENQ :T:STX:00528=1800:ETX:[08]	Read the positioning and hatch state , Highbyte: = Hatch state , hatch is closed , lid lock of hatch is closed Lowbyte = Positioning state
E	:EOT:T:00634:ENQ :T:STX:00634=0162:ETX:[0A]	Read Centrifuge state 1 Highbyte: Just called program no is 1 Lowbyte : Centrifuge state = stand still (Bit 5 and 6 only for internal use)
E	:EOT:T:00635:ENQ :T:STX:00635=0292:ETX:[07]	Read Centrifuge state 2 Highbyte : Not relevant , Lowbyte : Rotor number 9, 2 = Key-Lock 2
E	:EOT:T:00524:ENQ :T:STX:00524=0602:ETX:[0A]	Read target rotor position Highbyte : Maximum number of rotorpositions = 6, Lowbyte : Number of actual rotorpositions = 2

3.7.2 Cyclic enquiry during standstill and positioning:

3.7.2.1 Possibility 1
Enquire positioning-state and centrifuge-state 1 and analyse the information of the centrifuge state 1. If 00634, Lowbyte, bit 7 is set ("Centrifuge state has changed") then enquire additionally the parameter 00635.

1	Serial data	Description
E	:EOT:T:00634:ENQ :T:STX:00634=0162:ETX:[0A]	Enquire "Centrifuge state 1" Highbyte : Just called program-No. is 1 Lowbyte : Centrifuge state is: Stand still (Bit 5 and 6 only for internal use)
E	:EOT:T:00528:ENQ T:STX:00528=1A06:ETX:[77]	Enquire "Positioning and hatch state" Highbyte : Hatch is closed , lid lock of hatch is closed Lowbyte : position reached , position mode is active
E	:EOT:T:00634:ENQ :T:STX:00634=0162:ETX:[0A]	Enquire "Centrifuge state 1" Highbyte : Just called program-No. is 1 Lowbyte : Centrifuge state is: Stand still (Bit 5 and 6 only for internal use)
E	:EOT:T:00528:ENQ T:STX:00528=1A06:ETX:[77]	Highbyte : Hatch is closed , lid lock of hatch is closed Lowbyte : Position reached , position mode is active
E	:EOT:T:00634:ENQ :T:STX:00634=01E2:ETX:[79]	Enquire "Centrifuge state 1" Highbyte : Just called program-No. is 1 Lowbyte : Centrifuge state is: – Bit 7: Centrifuge status has changed; Please enquire 00635 = "Centrifuge state 2" – Bit 5 and 6: Only for internal use, do not use them – Bit 1: Stand still
E	:EOT:T:00635:ENQ :T:STX:00635=0294:ETX:[01]	Enquire "Centrifuge state 2" Highbyte : Not relevant , Lowbyte : Rotor number = 9 , Key-Lock = 3 Key-Lock position was changed.
E	:EOT:T:00528:ENQ T:STX:00528= …	
E	:EOT:T:00634:ENQ T:STX:00634= …	

3.7.2.2 Cyclic enquiry during positioning:
Possibility 2
Enquire Centrifuge state 1, Centrifuge state 2 and positioning and hatch state

1	Serial data	Description
E	:EOT:T:00634:ENQ :T:STX:00634=0162:ETX:[0A]	Enquire "Centrifuge state 1" Highbyte : Just called program no is 1 Lowbyte : Centrifuge State: Stand still (Bit 5 and 6 only for internal use)
E	:EOT:T:00635:ENQ :T:STX:00635=0292:ETX:[07]	Enquire "Centrifuge state 2" Highbyte : Not relevant , Lowbyte : Rotor number = 9 , Key-Lock = 2
E	:EOT:T:00528:ENQ T:STX:00528=1A06:ETX:[77]	Enquire "Positioning and hatch state" Highbyte : Hatch is closed , lid lock of hatch is closed Lowbyte : Position reached , position mode is active

3.7.3 Change the Nominal Values in stand still or during the run

Note:
- Multiple parameters can be modified by the explained procedure.

1. Lock user-input to LOCK 5: SELECT to 00633 (set Lowbyte, 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 new nominal parameter / parameters</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. Execute the change of the nominal value / values (and keep LOCK 5 set).

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

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

Cent		ADR	NAK

Then ENQUIRY of parameter 00685 is necessary

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

The SIOF-Error bit is erased after enquire the SIOF and other parameters can be changed by SELECT.

☞	After the change of one / or of several parameters, the centrifuge indicates the actual program by marking the program number "in brackets". Example: Program-No. before the change: 1 Program-No. after the change: (1)

3.7.4 The PC writes a program which will be stored in the centrifuge

(compatible with ROTANTA 46 RSC Robotic type 4815 / 4816 / 4817)

1. Lock the user input: SELECT to 00633 (set Lowbyte, 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													

3 Lock the user input and modify the set value

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

4.Unlock the user input

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

3.7.5 The PC recalls and activates a program

(compatible with ROTANTA 46 RSC Robotic type 4815 / 4816 / 4817)

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

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

2. .Recall program number 1

PC		EOT	ADR	STX	0	0	6	3	1	=	0	1	0	4	ETX	BCC
Cent		ADR	ACK													

3Unlock the user input

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

3.7.6 Open the hatch

Example with adress "'T'

1	Serial data	Description
S	:EOT:T:STX:00526=0060:ETX:[09] T:ACK:	Command to open the hatch
E	:EOT:T:00528:ENQ T:STX:00528=1A06:ETX:[77]	Highbyte : Hatch is closed , lid lock of hatch is closed Lowbyte : Position reached , position mode is active
E	:EOT:T:00634:ENQ: T:STX:00634= …	………………………
E	:EOT:T:00528:ENQ: T:STX:00528=1E06:ETX:[73]	Highbyte : Hatch is closed, lid lock of hatch is closed ,hatch is moving, hatch is opening Lowbyte : Position reached , position mode is active
E	:EOT:T:00634:ENQ: T:STX:00634= …	………………………
E	:EOT:T:00528:ENQ: :T:STX:00528=0606:ETX:[01]	Highbyte : Hatch is moving , hatch is opening Lowbyte : Position reached , position mode is active
E	:EOT:T:00634:ENQ: T:STX:00634= …	………………………
E	:EOT:T:00528:ENQ: T:STX:00528=2006:ETX:[01]	Highbyte : Hatch is open Lowbyte : Position reached , position mode is active
E	:EOT:T:00634:ENQ: T:STX:00634=0163:ETX:[0B]	Read Centrifuge state 1 Highbyte : Just called program-no. is 1 Lowbyte : Centrifuge state stand still , Centrifugation not possible
E	:EOT:T:00635:ENQ: T:STX:00635=0292:ETX:[07]	Read Centrifuge state 2 Highbyte : Not relevant , Lowbyte : Rotor number = 9 , Key-Lock = 2
E	:EOT:T:00528:ENQ: T:STX:00528=2006:ETX:[01]	Highbyte : Hatch is open , Lowbyte : Position reached , position mode is active

3.7.7 Set Rotor target rotor position 1

Example with adress "'T'

1	Serial data	Description
S	:EOT:T:STX:00524=0601:ETX:[0A] :T:ACK:	Set target rotor position 1 , maximum number of rotor positions = 6 Acknowledge
S	:EOT:T:STX:00526=0002:ETX:[0D] :T:ACK:	Move to position (fast) Acknowledge
E	:EOT:T:00528:ENQ T:STX:00528=1803:ETX:[0B]	Read the positioning and hatch state Highbyte : Hatch is closed , lid lock of hatch is closed Lowbyte : Position mode is active , rotor is moving
	………………………	…….
E	:EOT:T:00528:ENQ T:STX:00528=1806:ETX:[0E]	Read the positioning and hatch state Highbyte : Hatch is closed , lid lock of hatch is closed Lowbyte : Position mode is active , position reached
E	:EOT:T:00634:ENQ: ENQ:T:STX:00634=0163:ETX:[0B]	Read Centrifuge state 1 Highbyte : Just called program no is 1 Lowbyte : Centrifuge state = stand still , Centrifugation not possible
	………………………	………………………

3.7.8   Set target rotor position 4

Example with adress "'T'

1	Serial data	Description
S	:EOT:T:STX:00524=0604:ETX:[0F] :T:ACK:	Set target rotor position 4 , = maximum number of rotor positions = 6 Acknowledge
S	:EOT:T:STX:00526=0002:ETX:[0D] :T:ACK:	Move to position 2 (fast) Acknowledge
E	:EOT:T:00528:ENQ: :T:STX:00528=2003:ETX:[01]	Highbyte : Hatch is open Lowbyte : Position mode is active , rotor is moving
	………………………	………………………
E	:EOT:T:00528:ENQ: :T:STX:00528=2006:ETX:[05]	Highbyte : Hatch is open Lowbyte : Position mode is active , position reached
E	:EOT:T:00524:ENQ :T:STX:00524=0602:ETX:[0A]	Read target rotor position Highbyte : Maximum number of rotor positions = 6, Lowbyte : Number of actual rotor positions = 2

3.7.9   Close the hatch

Example with adress "'T'

1	Serial data	Description
S	:EOT:T:STX:00526=0070:ETX:[08] T:ACK:	Close the hatch
E	:EOT:T:00528:ENQ: :T:STX:00528=2100:ETX:[02]	Highbyte : Hatch is open , hatch is closing Lowbyte : Positioning state (in this example not relevant)
	………………………	………………………
E	:EOT:T:00528:ENQ: :T:STX:00528=2500:ETX:[06]	Highbyte : Hatch is open , hatch is closing , hatch is moving Lowbyte : Positioning state (in this example not relevant)
	………………………	………………………
E	:EOT:T:00528:ENQ: :T:STX:00528=0500:ETX:[04]	Highbyte : Hatch is closing , hatch is moving Lowbyte : Positioning state (in this example not relevant)
	………………………	………………………
E	:EOT:T:00528:ENQ: :T:STX:00528=1800:ETX:[08]	Highbyte : Hatch is closed , lid lock of hatch is closed Lowbyte : Positioning state (in this example not relevant)

3.7.10   Recall Program No 6

Example with adress "'T'

1	Serial data	Description
S	:EOT:T:STX:00523=0604:ETX:[08] T:ACK:	Highbyte : Program No = 6 Lowbyte : Recall and activate
E	:EOT:T:00634:ENQ: T:STX:00634=0662:ETX:[09]	Read Centrifuge state 1 Highbyte : Just called program no is 6 Lowbyte : Centrifuge state = stand still

3.7.11 Start centrifugation

Example with adress "'T'

1	Serial data	Description
S	:EOT:T:STX:00526=0080:ETX:[07] T:ACK:	Terminate positioning
S	:EOT:T:STX:00523=0104:ETX:[0F] T:ACK:	Highbyte : Set Program No = 1 Lowbyte : Recall and activate
E	:EOT:T:00634:ENQ: T:STX:00634=0122:ETX:[09]	Read Centrifuge state 1 Highbyte : Just called program no is 1 Lowbyte : Centrifuge state = stand still
E	:EOT:T:00528:ENQ: :T:STX:00528=1800:ETX:[08]	Highbyte : Hatch is closed , lid lock of hatch is closed Lowbyte : Positioning state
E	:EOT:T:00634:ENQ: T:STX:00634=0662:ETX:[09]	Read Centrifuge state 1 Highbyte : Just called program no is 6 Lowbyte : Centrifuge state = stand still , Centrifugation possible
S	:EOT:T:STX:00521=0002:ETX:[0A] T:ACK:	Start centrifugation
E	:EOT:T:00634:ENQ: T:STX:00634=0122:ETX:[09]	Read Centrifuge state 1 Highbyte : Just called program no is 1 Lowbyte : Centrifuge state = stand still
	………………………	………………………
E	:EOT:T:00634:ENQ: T:STX:00634=01E4:ETX:[7F]	Read Centrifuge state 1 Highbyte : Just called program no is 1 , Lowbyte : Centrifuge state was changed , run-up (acceleration)
	………………………	………………………
E	:EOT:T:00634:ENQ: T:STX:00634=0188:ETX:[01]	Read Centrifuge state 1 Highbyte : Just called program no is 1 , Lowbyte : Centrifuge state was changed , centrifugation
	………………………	………………………

3.7.12 Stop centrifugation

Example with adress "'T'

1	Serial data	Description
E	:EOT:T:00634:ENQ: T:STX:00634=0168:ETX:[00]	Read Centrifuge state 1 Highbyte : Just called program no is 1 , Lowbyte : Centrifuge state = centrifugation
S	:EOT:T:STX:00521=0001:ETX:[09] T:ACK:	Stop centrifugation
E	:EOT:T:00634:ENQ: T:STX:00634=01F0:ETX:[00]	Read Centrifuge state 1 Highbyte : Just called program no is 1 , Lowbyte : Centrifuge state was changed , run-down (brake)
	………………………	………………………

3.7.13 Wait for standstill and the automatical position 1 and terminate positioning

Example with adress "'T'

1	Serial data	Description
E	:EOT:T:00634:ENQ: T:STX:00634=01E2:ETX:[79]	Read Centrifuge state 1 Highbyte : Just called program no is 1 , Lowbyte : Centrifuge state was changed , stand still
	……………………….	………………………
E	:EOT:T:00634:ENQ: T:STX:00634=0162:ETX:[0A]	Read Centrifuge state 1 Highbyte : Just called program no is 1 , Lowbyte : Stand still
E	:EOT:T:00528:ENQ: :T:STX:00528=1801:ETX:[09]	Highbyte : Hatch is closed , lid lock of hatch is closed Lowbyte : "goto target position " is active , rotor is moving
	……………………….	………………………
E	:EOT:T:00528:ENQ: :T:STX:00528=1803:ETX:[0B]	Highbyte : Hatch is closed , lid lock of hatch is closed Lowbyte : Position mode is active ,"goto target position" is active , rotor is moving
	……………………….	………………………
E	:EOT:T:00528:ENQ: :T:STX:00528=1806:ETX:[0E]	Highbyte : Hatch is closed , lid lock of hatch is closed Lowbyte : Position mode is active , position reached
S	:EOT:T:STX:00526=0080:ETX:[07] T:ACK:	Terminate positioning

3.8   Rotor cycles commands

3.8.1   General description

Rotors and accessories with limited service lives
The use of certain rotors, hangers and accessory parts is limited by time and by the number of operating cycles = centrifugation runs.
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.:
Expiration date:
- "einsetzbar bis Ende Monat/Jahr: 08/2014 / usable until end of month/year: 08/2014"
Maximum permitted number of operating cycles:
- "Max. Laufzyklen / max. cycles: 200000".

⚠	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.

3.8.2   Cycle counter

☞	The use of the cycle counter is only practical if always will be worked with the same set of hangers.

The centrifuge has a cycle counter which count the operating cycles (centrifugation runs) of the different rotors.
Hettich factory setting:
The following rotors are preset with rotor cycle limits:

Rotor number	Rotor	preset with rotor cycle limit (factory setting)
2	4444	yes
5	4620	yes
13	5699-R	yes
14	5622	yes

Please refer also to chapter 2.10.1.7 " Parameters for rotor cycle function "

After starting the first centrifugation run with a rotor which is not yet recognized by the rotor identification, the centrifugation run is stopped. An automatic menu is displayed where the technician has to set the limit.
This is the limit how often a centrifugation run with the rotor, hangers and accessory parts can be started.
Note: Then menu procedure is a manual job (has to be done by skilled technicians).

With rotors and hangers that are not marked with the maximum permitted number of operating cycles the cycle counter must be disabled.

During the manual operating the user / operator will see the information " * MAX ROTORCYCLES PASSED * " in the display. The next run will be "blocked". This indication / blockade can be cleared by pressing the START – key again. Please refer to the operating manual.

☞ In the remote operating the PC will not "see" the display information.
Therefore the PC-software has to enquire the cycle counter information.

If the limit is exceeded the user / operator has to be informed to change the parts (rotor, hangers and accessory parts hangers etc.). After the change of the parts the user / operator has to reset the counter by a "manual" menu, using the operating panel.

3.8.3 Check the general information about the "conditions" of rotor cycle counter

Repeated explanation according to "**Parameter-No.: 00635; State of centrifuge 2**"
If Highbyte **Bit 7 = 0** : The rotor cycle counter for the actual rotor is NOT activated.
If Highbyte **Bit 7 = 1** : The rotor cycle counter for the actual rotor is activated.
  Then the Highbyte Bit 6 has to be checked.
If Highbyte **Bit 6 = 0** : The rotor cycles are NOT achieved or exceeded.
If Highbyte **Bit 6 = 1** : The rotor cycles are achieved or exceeded.
  Then the operator has to be informed:
    Change the rotor, hangers or accessory parts.
If Highbyte **Bit 5 = 0** : The setting menu for rotor cycles is not yet processed,
      the limit value is not confirmed.
If Highbyte **Bit 5 = 1** : The setting menu for rotor cycles is processed,
      the limit value is confirmed

Example 1: Rotor cycles are activated but not "exceeded"

	Serial data	Description

E	:EOT:]:00635:ENQ
	]:STX:00635=A222:ETX:<7D>
		Read Centrifuge state 2
		Highbyte = - Bit 7 is set
		              (rotor cycle counter for the actual rotor is activated)
		          - Bit 5 is set,
		            (the setting menu for rotor cycles is processed,
		                the limit value is confirmed)
		          - Bit 1 is set (LID is closed)
		Lowbyte = rotor number 2 ,Lock2

Example 2: Rotor cycles are activated and "exceeded"

	Serial data	Description

E	:EOT:]:00635:ENQ
	]:STX:00635=E222:ETX:<79>
		Read Centrifuge state 2
		Highbyte = - Bit 7 is set
		              (rotor cycle counter for the actual rotor is activated)
		          - Bit 6 is set,
		            (the rotor cycles are exceeded
		          - Bit 5 is set,
		            (the setting menu for rotor cycles is processed,
		                the limit value is confirmed)
		          - Bit 1 is set (LID is closed)
		Lowbyte = rotor number 2 ,Lock2

Then the operator has to be informed: **Change the rotor, hangers or accessory parts**.

Example 3: Check preset cycles of the actual rotor

	Serial data	Description
E	:EOT:]:00565:ENQ]:STX:00565=0001:ETX:<09>	Highbyte: Preset cycles of the actual rotor (HW) Lowbyte: Preset cycles of the actual rotor (HW) =10000hex=65656d
E	:EOT:]:00566:ENQ:]:STX:00566=3880:ETX:<08>	Highbyte: Preset cycles of the actual rotor (LW) Lowbyte: Preset cycles of the actual rotor (LW) =3880hex=14464d

Total preset cycles of the actual rotor is 13880hex = 80000d

Example 4: Check actual cycles of the actual rotor

	Serial data	Description
E	:EOT:]:00563:ENQ]:STX:00563=0001:ETX:<0F>	Highbyte: Actual cycles of the actual rotor (HW) Lowbyte: Actual cycles of the actual rotor (HW)

		=10000hex=65656d
E	:EOT:]:00564:ENQ:]:STX:00566=024D:ETX:<7B>	Highbyte: Actual cycles of the actual rotor (LW) Lowbyte: Actual cycles of the actual rotor (LW) =024Dhex=589d

Total preset cycles of the actual rotor is 1024Dhex = 66125d

Example 5:   Somebody placed a new rotor inside the machine.
          This rotor is not "Hettich factory set" and therefore the rotor cycles of the rotor are not "set".
          The PC starts the "new" rotor by a serial command

	Serial data	Description
S	:EOT:]:STX:00633=0002:ETX:<0A>]:ACK:	Start centrifugation

The "new" rotor is recognized by the rotor identification.
Therefore the centrifugation run is automatically stopped, the centrifugation run is not complete.
An automatic menu is activated in the control panel display. But the PC will not watch the display.

Note: The menu procedure is a manual job. This has to be done by skilled technician..
Explanation of the menu:

After standstill, the display shows "Enter max cycles = 〈 30000〉 "

- Set the rotor cycle limit (the specified number of cycles, marked on the hangers i.e. 80000) by using the adjusting knob or disable rotorcyles
- Press the START – key to store the setting.
- For confirmation the display will show: "**Store max cycles ... "**

	Serial data	Description
S	:EOT:]:STX:00633=0002:ETX:<0A>]:ACK:	Start centrifugation

The PC can detect this behaviour by enquire the parameter 00635:

	Serial data	**Description**

E	:EOT:]:00635:ENQ
	]:STX:00635=0222:ETX:<0C>
		Read Centrifuge state 2
		Highbyte = - Bit 7 is not set
		            (Rotor cycle counter for the actual rotor is **not** activated)
		          - Bit 6 is not set,
		            (the rotor cycles are not exceeded
		          - Bit 5 is not set,
		            (the setting menu for rotor cycles is **not** processed,
		                the limit value is not confirmed)
		          - Bit 1 is set (LID is closed)
		Lowbyte = rotor number 2 ,Lock2

If that occurs: Please inform the operator:

Proceed the rotor cycle setting menu and set the limit.

4 Comparison between the serial communication Generation 1 and Generation 2

"Generation 1" is valid / used for ROTANTA 46 RSC Robotic type 4815 / 4816 / 4817

"Generation 2" is valid / for ROTANTA 460 ROBOTIC type 5680

☞	This chapter is for specialists who already know the communication of Generation 1.

The serial communication "Generation 2" is 99% compatible to the communication of "Generation 1"

4.1 The serial protocol (hardware, settings and telegrams) remain constant.

These are:
- the settings of the serial interface (baudrate, transmission control)
- the used telegrams,
- the general format and
- the time behaviour

4.2 Brief introduction of the differences:

a. The parameters 00630 and 00631 are slightly different:
   00631 Lowbyte, Bit 6 and 7 are no longer available.

b. The parameter 00632 is no longer available (the jumpers are not present, the hardware is completely different

c. The parameters 00634 is slightly different
   - Bit 6 and Bit 5 (sequential programs) are no longer relevant ,
   - Bit 0: The meaning is changed:
      It is now "Centrifugation is not possible" instead of "Lid or/and hatch open"

d. The parameters 00635 is slightly different
   - Additional information in the Highbyte

e. The parameters 00636 is slightly different
   The numbering is now 01.xx, no longer 4.xxx

f. The parameters 00685 is slightly different
   - Additional bits in the Lowbyte
      - bit 1 = SIOF parity error
      - bit 3 = wrong BCC checksum
      - bit 4 = framing error (wrong 'STX' , 'ETX' , 'ENQ' or '=')

4.3 List of parameters:

☞				Note : Access:	R = read, RW= read/write,

Parameter	Type 4815 4816 4817	Type 5680	Description		Access
00470	-	new	External operating hours (High Word)		R
00471	-	new	External operating hours (Low Word)		R
00472	-	new	Internal operating hours (High Word)		R
00473	-	new	Internal operating hours (Low Word)		R
00474	-	new	The value is the cumulative number of centrifugation runs		R
			Note: The following nominal time (set time) parameters 00500, 00502 and 00504 and the actual / real time parameters 00501, 00503 and 00505 are alternative to the parameters 00601 and 00602. The value of the parameters 00601 and 00602 are restricted to 59999 seconds (16 hours 39 minutes and 59 seconds). The value range of the 005xx time parameters is up to 99 hours, 59 minutes and 59 seconds		
Parameter	Type 4815 4816 4817	Type 5680	Description		Access
00500	-	new	Set runtime (hours)		RW
00501	-	new	Actual runtime (hours)		R
00502	-	new	Set runtime (minutes)		RW

00503	-	new	Actual runtime (minutes)	R
00504	-	new	Set runtime (seconds)	RW
00505	-	new	Actual runtime (seconds)	R
00512			Display RCF or RPM mode in the display Note: If the radius (parameter 00620) is changed, the display is automatically in RCF mode. If set speed (parameter 00603) is changed the display is automatically in RPM mode.	RW
00518	-	new	Actual program number. Active program number (0..99) , which will be executed on next start of centrifugation or active program number (0..99) while running .	R
00519	-	new	Program info	R
00520	-	new	Software lock command; If LOCK 5 is set, start of centrifugation with the Start - key on the control panel is blocked.	RW

00521	-	new	Control command , start and stop centrifugation
			START of the centrifugation is only possible if ALL of the following conditions are TRUE:
			- lid locking is closed.
			- the hatch is closed (part 1) = the switch that detects
			                       "lid is closed" is contacted,
			- the hatch is closed (part 2) = the witch that detects
			                       "hatch is closed" is contacted,
			- the positioning mode is not active.
				W

00522	-	new	Enable the active/current program block	W
00523	-	new	Program command , recall/activate or store/activate programs	W

00524	-	new	Positioning command:
			Lowbyte: 6-bit digit, which indicates the number of the target rotor position ,
			       Range: 1 up to maximum (number of rotor positions).
			Highbyte: Even number of rotor positions,
			       2 up to 48, depending to the rotor.
				RW

00526	-	new	Positioning and hatch command	W
00528	-	new	Positioning and hatch state	R
00537	-	new	centrifuge type and version	R
00563	-	new	Actual cycles of the actual rotor (High Word)	R
00564	-	new	Actual cycles of the actual rotor (Low Word)	R
00565	-	new	Preset cycles of the actual rotor (High Word)	R
00566	-	new	Preset cycles of the actual rotor (Low Word)	R
00567	-	new	Total cycles of the actual rotor (High Word)	R
00568	-	new	Total cycles of the actual rotor (Low Word)	R
00569	-	new	Number of centrifugation starts (High Word)	R
00570	-	new	Number of centrifugation starts (Low Word)	R

Parameter	Type 4815 4816 4817	Type 5680	Description	Access
00600	-	new	centrifuge ID , for the new generation the return value is: [ADR] ; "00600=1234" for the old generation the return value is: [ADR] ; [NAK]	R
00601	√	compatible	Set run-time	RW
00602	√	compatible	Actual run-time	R
00603	√	compatible	Set speed	RW
00604	√	compatible	Actual speed	R
00605	√	compatible	Maximum rotor speed	R
00606	√	compatible	Set-RCF	RW
00607	√	compatible	Actual-RCF	R
00608	√	compatible	Maximum-RCF of rotor	R
00609	√	compatible	∫ RCF/RZB-actual 1.word MSW	R
00610	√	compatible	∫ RCF/RZB-actual 2.word LSW	R
00611	√	compatible	Run-up (acceleration)	RW
00612	√	compatible	Run-down (brake)	RW
00613	√	compatible	Minimum run-up time	R
00614	V	compatible	Maximum run-up time	R
00615	√	compatible	Minimum run-down time	R
00616	√	compatible	Maximum run-down time	R
00617	√	compatible	Brake switch off speed	RW
00618	√	compatible	Set temperature	RW
00619	√	compatible	Actual value of temperature	R
00620	√	compatible	Radius (range 10 mm – 330 mm)	RW
00630	√	virtually compatible	**Program –Info** Difference: The Program-ID – bits (Lowbyte, Bit 6 und 7) are always 0 Therefore the program is ever "Profile (standalone)". The declaration of the sequential programs is now completely different. But we believe that the feature "sequential programs" is not used in the robotic application. Please contact Hettich if you use the "sequential programs" and if you need the detailed information about the new function.	R
00631	√	virtually compatible	**Program-commands from PC** Difference: Difference: The Program-ID – bits (Lowbyte, Bit 6 und 7) are always 0 Therefore the program is ever "Profile (standalone)". The declaration of the sequential programs is now completely different. But we believe that the feature "sequential programs" is not used in the robotic application. Please contact Hettich if you use the "sequential programs" and if you need the detailed information about the new function..	RW
00632	√	No longer existing	**Centrifuge-ID** Difference: There are no adequate jumpers. Therefore this parameter is no longer valid / existing	R
00633	√	compatible	**Set-commands from PC**	RW

Parameter	Type 4815 4816 4817	Type 5680	Description	Access
00634	√	virtually compatible	**Centrifuge state 1** Difference: - Bit 6 and Bit 5 (sequential programs) are no longer relevant , - Bit 0 : The meaning is changed: It is now "Centrifugation is not possible" instead of "Lid or/and hatch open"	R
00635	√	virtually compatible	**Centrifuge State 2** Difference: - Additional information in the Highbyte	R
00636	√	virtually compatible	**Software version** Difference: The numbering is now 01.xx, no longer 4.xxx	R
00639	√	compatible	**ERROR RESET and POSITION 1 ADJUSTMENT** Clear errors , activate teach mode (teach position 1)	RW
00640	√	compatible	State and command for hatch and positioning (only for 4-place rotors)	RW
00685	√	virtually compatible.	**SIOF (serial input output failure state)** Difference: Additional bits in the Lowbyte: -bit 1 = SIOF parity error -bit 3 = wrong BCC checksum -bit 4 = framing error (wrong 'STX' , 'ETX' , 'ENQ' or '=')	R

5 Communication with Generation 2 according to the still valid communication of Generation 1

Note: 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.

5.1 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:

Evaluation of VAL in C

  if (00640 Highbyte_bit6==1)
    { hatch is completely open }

5.2 Go to position 1 and check the reached position

Note: After standstill the centrifuge will 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

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 Highbyte_bit0 == 1)
   && (00640 Highbyte_bit7 == 1))
    { rotor is in position 1 , magnetic brake is active }

5.3 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

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 Highbyte_bit1 == 1)
   && (00640 Highbyte_bit7 == 1))
    { rotor is in position 2 , magnetic brake is active }

5.4 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

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 Highbyte_bit2 == 1)
          && (00640 Highbyte_bit7 == 1))
                { rotor is in position 3 , magnetic brake is active }

5.5 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

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 Highbyte_bit3 == 1)
    &&   (00640 Highbyte_bit7 == 1))
                { rotor is in position 4 , magnetic brake is active }

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.

5.6 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 Centrifuge state 1.
Example in C:
Enquiry, if the hatch is closed completely:

        if ((00640 Highbyte_bit4 == 1)
          && (00634 Lowbyte_byte2_bit0 == 0))
                { Hatch is closed and centrifuge can be started }

5.7 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 Lowbyte_bit1 == 1   )
>> { standstill of centrifuge }
>
> else
>> { Centrifuge in run, no standstill, query the parameter 00634 again }

additional evaluation of safety:
> if (00634 Highbyte_bit7 == 0   )
>> { centrifuge without Error; OK }
>
> else
>> { centrifuge stopped with Error, calculate the Error-No. in Highbyte bit0...bit6 }

5.8 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														

5.9 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														

5.10 Change the Nominal Values in stand still or during the run

Note: - With "Generation 2" it is not necessary to set LOCK 5,
      but it will not cause a problem if LOCK 5 is set (to be confirm with "Generation 1"
   - Multiple parameters could be modified by one procedure
     but it will not cause a problem if only one parameter is modified (to be confirm with "Generation 1"

1. <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														

2. 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 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 "----").

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

Note: - With "Generation 2" it is not necessary to set LOCK 5,
      but it will not cause a problem if LOCK 5 is set (to be confirm with "Generation 1"

Write Program-No. in parameter 00631 Highbyte , Bit 0...Bit 6 (xx) and set in Lowbyte, bit 2.

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

Cent	Program is shown in the display and program is active
Cent	Program will be registered in parameter 00630
Cent	Delete contents of 00631
Cent	Update of parameter 00634

Cent	ADR	ACK
PC	EOT	

5.12 Change and store the values of a program

Note: - With "Generation 2" it is not necessary to set LOCK 5,
      but it will not cause a problem if LOCK 5 is set (to be confirm with "Generation 1"

1. <u>Write new nominal parameters</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														

2. Write Program-No. in 00631 Highbyte , Bit 0...Bit 6 (xx) and set in Lowbyte, bit 3 and bit 4.

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

3.Recall and activate program

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