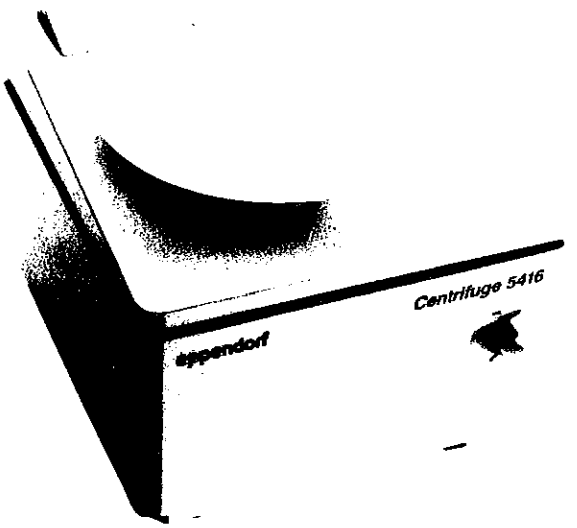
Centrifuge 5416



eppendorf

9 Kurzanleitung

Mit der Kurzanleitung nur nach Kenntnis der ausführlichen Bedienungsanleitung arbeiten.

- Zentrifuge einschalten.
- Mit Pfeiltaste > Datenfelder "min" oder "rpm" aktivieren, mit auf/ab-Pfeiltasten gewünschte Daten eingeben.
- Zentrifugendeckel mit Drehgriff öffnen (nach links drehen).
- ***Sichere Befestigung*** des Rotors kontrollieren (vergl. Abschnitt 2.3).
- Rotor achsensymmetrisch mit ***gleich schweren Gefäßen/Gehängen*** bestücken.
  Bei Ausschwingrotoren müssen ***alle*** Plätze mit Gehängen bestückt werden.
  Rotordeckel aufsetzen (bei allen Festwinkelrotoren mit Ausnahme Rotor 12 x 15 ml, Typ 16 F 12-17).
- Zentrifugendeckel schließen (Drehgriff nach rechts).
- Taste ***Start*** drücken.

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1 Introduction

Dear Customer,

The Centrifuge 5416 is a bench-top centrifuge for research and industrial laboratories in the life sciences (biochemistry, molecular biology, microbiology, botany, zoology), clinical chemistry, pharmacy and chemistry.

Due to its compact design, the centrifuge requires little bench space. The 5416 model is extremely versatile and can be used for a wide variety of applications. It meets the latest safety regulations.

The centrifuge reaches speeds of up to:

15,000 rpm (= 23,000 g) with 24 micro test tubes (1.5 ml and 2.0 ml),

11,000 rpm (= 13,800 g) with 12 centrifuge tubes < 85 ml (max. 6 x 85 ml).

Most preparative centrifugations can thus be accomplished with the 5416 model. A maximum speed of 15,000 rpm can be reached with the haematocrit rotor.

The following rotor types can be installed in the centrifuge: swing-bucket, fixed-angle, drum, haematocrit, microtiter plate and the cytology swing-bucket rotor for preparing microscopic cell preparations.

The centrifuge is easy to operate. Its functions include: short centrifugation, slow rotor acceleration/deceleration, rotor deceleration without braking. Each of these functions can be selected just by pressing a few keys. Alternatively, the rotational speed (rpm) or relative centrifugal force (g-number) is displayed.

The Centrifuge 5416 is characterized by its high-quality material and design and is sure to become indispensable in your daily routine.

Please refer to our "Accessory guide for the Centrifuges 5416/5403" for a complete list of rotors, carriers, buckets and tube adapters.

2 Installation

2.1 Safety precautions

According to recommendations of the IEC 1010 - 2 - 020, a safety distance of 30 cm should be observed around the centrifuge during centrifugation. No objects whose destruction may cause damage should be positioned in this space.

It must not be operated in a hazardous or flammable environment and must not be used to centrifuge explosive or highly reactive substances.

When handling toxic or radioactive liquids or pathogenical bacteria out of Risk Group II (see World Health Organization: "Laboratory Biosafety Manual"), the use of aerosol-tight beakers is recommended (see "Accessory guide for the Centrifuges 5416/5403".

If such liquids are spilled in the rotor or rotor chamber by mistake, the centrifuge must be cleaned carefully and properly (see Sec. 5).

Before using cleaning or decontamination methods other than those stated by the manufacturer, the user should consult the manufacturer to ensure that the intended methods does not damage the device.

Extensive regulations on handling bacteria or biological material out of this or higher risk groups are defined in national and international regulations.

Before plugging in the centrifuge, compare your power supply with the electrical requirements listed on the identification plate located on the back of the centrifuge.

The rotor and rotor cover must always be securely fastened (see Sec. 2.3). The rotor must be loaded symmetrically (see Sec. 4.2).

Repairs must only be performed by an Eppendorf authorized service technician. Only use original rotors and spare parts recommended by Eppendorf.

2.2 Installing the device

Remove the transport safety device first (see supplement sheet).

Place the centrifuge onto a level, horizontal surface and make sure that all its rubber feet are firmly planted. There should be at least 10 cm clearance behind the centrifuge so that sufficient ventilation is ensured.

Before switching on the centrifuge, connect it to the power supply with the main power cable. The device socket is at the bottom of the rear panel on the right. The main power switch is at the bottom of the front panel.

When the centrifuge is switched on for the first time, the nominal values of the test run performed in the factory appear in the display. The control lamp "Lid released" lights up on the control panel.

2.3 Mounting/Dismounting the rotors

Mount the rotor onto the drive axle of the centrifuge making sure the rotor is seated onto the spindle. If necessary, turn the rotor nut conterclockwise slightly using the hexagon key in the accessories.

Then secure the rotor nut by turning ***clockwise*** using the hexagon key until it is hand-tight.

The rotor must always be properly seated on the motor axle before centrifugation is started.

Press ***Start*** and let the centrifuge run briefly and then press ***Stop*** to stop it. During this process, the rotor code is read and stored.

To release the rotor, insert the hexagon key into the rotor and turn the rotor nut counterclockwise. As soon as it moves freely after slight resistance, it can be removed.

The aluminum cover of the rotor for micro test tubes (Type 16 F 24 - 11) and of the fixed-angle rotor 6 x 85 ml (Type 16 F 6 - 38) has an opening in the center so that it does not have to be removed when mouting/ dismounting the rotor.

2.4 Delivery package

1 Centrifuge 5416
1 Main power cable
1 Instruction manual
1 Hexagon key
1 Vaseline spray
1 Set of fuses

3 Operating controls

Please open up the fold-back cover at the front of this manual.

3.1 Operating controls of the centrifuge (Fig. 1)

Main power switch (1) at the bottom of the front panel. ***Device socket*** at the right of the rear panel. The ***fuseholder*** is integrated in the device socket.

The ***keypad, display*** and ***control lamps*** (2) are located on the ***centrifuge lid*** (3).

Opening and ***closing*** the centrifuge lid:
Turn the ***knob*** (4) on the front panel counterclockwise. The knob is released electrically as long as the centrifuge is ***switched on*** and is ***not in operation***.
When switched off, the centrifuge cannot be opened with the knob.

To ***close*** the centrifuge lid, turn the knob ***clockwise***.

Opening for the ***emergency lid release*** (5) of the centrifuge.

During centrifugation air is vented through ***slits*** in the ***rear of the lid*** and extracted through openings in the base of the housing.

3.2 Rotor chamber (Fig. 2)

Rotor chamber seal (6).

The motor and its ***axle*** (7) are covered by a plastic casing.

A sensor for rotor recognition and rotational speed (8) is located next to the motor axle.

3.3 Keypad and display

3.3.1 Select key and arrow keys

With ***Select***, each of the following display fields can be selected:

Time in min
Rotational speed rpm in min^{-1}

The fields are activated by repeatedly pressing this key. The activated field is placed in angular brackets > <.

The brackets move to the value in the next field. The brackets move from right to left, then back to right etc.

A selected field remains activated for 10 s after the key has been pressed. The brackets then disappear.

The arrow keys change the value displayed in the activated data field by one increment every time the key is pressed. If the key is held down, the values are browsed up/down.

3.3.2 Display field

When the centrifuge is switched on, the ***values selected*** for the last run appear in the display.

During the run, the ***actual values*** of the parameters are displayed (rotational speed and time). As soon as a run is complete, the selected values are displayed again.

To display the ***selected values during centrifugation***, press ***Select***.

min

The spin time can be set from 1–99 mins in 1 minute increments.

During a run, the ***remaining time*** is displayed in minutes. The ***last remaining*** minute is counted down in ***seconds***.

If ∞ is selected, the centrifuge runs as long as desired. ∞ is the lowest value which can be set. The ***elapsed*** time is displayed in ***minutes***.

The ***elapsed time*** is counted down in ***seconds*** during short centrifugation (***Short spin*** key).

During a "Soft Start/Stop" run, the level of the deceleration speed is displayed in the time field during rotor deceleration (see Sec. 4.1.3).

rpm,(g x 100)

The rotational speeds rpm (= revolutions per minute) can be set from 250 to 15,000 rpm. For rotational speeds < 10,000, in increments of 10 rpm. For rotational speeds > 10,000 in increments of 100 rpm.

For every individual rotor, the highest rotational speed which can be set is specified by the centrifuge:

During the first revolutions, the centrifuge reads the coding of the rotor used.

The maximum permitted rotational speed is displayed briefly in the data field: "n - max = xxxx".

If this value is less than the rotational speed selected, the run is stopped.

The maximum permitted rotational speed of the rotor then appears as a nominal value in the display.

The display can be switched over to relative centrifugal force (g-number, see Sec. 4.3).

3.3.3 Keypad

Start

Starts centrifugation.

Stop

Stops centrifugation.

Soft Start/Stop

The centrifuge accelerates slowly and decelerates without activating the braking circuit. (Programming the acceleration and deceleration speeds, see Sec. 4.1.3).

Short spin

The centrifuge runs as long as this key is pressed.

Control lamps:

Lid released:
Lights up when rotor is at a complete stop (before and after a run).

Centrifuge running:
Indicates that the centrifuge is in operation.

Imbalance:
Lights up when the rotor is imbalanced (e.g. unsymmetrical loading). The run is interrupted.

The ***Stop***, and ***Soft Start/Stop*** keys have a control lamp. When one of these functions is selected, the appropriate lamp lights up.

4 Centrifuging

4.1 Operation

4.1.1 Routine centrifugation

Switch on the device (main power switch is turned to "On").

Set the desired data (spin time and rotational speed) with ***Select*** and the ***Up*** and ***Down*** arrow keys .

Before mounting or dismounting the rotor, read Sec. 2.3.

Load the rotor (see Sec. 4.2) and close the centrifuge lid (control lamp lights up).
Press ***Start*** to start the run.

At the end of the selected time or if the run is interrupted with ***Stop***, the braking circuit is activated and the rotor brought to a standstill. When the rotor is at a complete stop, the control lamp "Lid released" lights up and the material which has been centrifuged can be removed.

The table on Page 30 lists the ***acceleration*** and ***deceleration*** times of the various rotors. The deceleration time of the rotor is not included in the spin time.

4.1.2 Modifying the selected values during the run

During routine centrifugation, the selected values are displayed instead of the actual values if ***Select*** is pressed.

The desired field is activated by repeatedly pressing this key.

Hold down ***Select*** and set a new value using the arrow keys.

After modification, if ***Start*** is pressed whilst ***Select*** is held down, the centrifuge regulates its run according to the new value entered. After entry of a new spin time, counting begins again (elapsed time t = 0 min).

4.1.3 Centrifugation with soft start/stop

During centrifugation in the density gradient or the pelletization of substances which are difficult to sediment, vibration-free acceleration and deceleration of the rotor is of great importance.

This can be optimized by setting a suitably ***slow*** acceleration and deceleration speed.

Longer acceleration/deceleration times for the rotors can be selected in 8 levels:

- Switch off the "Soft Start/Stop" function (green lamp in keypad lights up).
- Activate the rotational speed field with the ***Select*** key (see Sec. 3.3.1).
- Press the ***Select*** key; the ***symbol for rotor acceleration*** appears in the field. The desired level (1–8), displayed as a figure next to this symbol, is set with the cursor keys.
- Press the ***Select*** key: the ***symbol for rotor deceleration*** appears. The desired level is set with the cursor keys. Level 0 = rotor deceleration without braking.

The programming of this function can also be performed during the run (not during rotor deceleration). If the values are modified during rotor acceleration, the acceleration speed is adjusted appropriately.

The values entered are not deleted when the centrifuge is switched off. They are available every time ***Soft Start/Stop*** is selected until they are modified.

Acceleration/Deceleration times can be calculated as standard values (dependent on the load of the rotor) with the following formula:

Acceleration/Deceleration time level x =
(Acceleration/Deceleration time during routine centrifugation) x (10 – level x).

(10 – level x) e.g. for level 7 = 3.

The table contains the acceleration/deceleration times during routine centrifugation (1st line) and during "Soft Start/Stop" level 1 (2nd line).

The deceleration time for light rotors can be less at level 0 (without braking) than at level 1.

During deceleration, the function cannot be switched off. However, if ***Stop*** is pressed in addition to "Soft Start/Stop", the rotor can be brought to a standstill with an activated braking circuit. (The red control lamp of the key flashes in this case).

The "Soft Start/Stop" function is also effective with the "Short spin" function.

4.1.4 Short centrifugation (Short spin)

This function is suitable for rapid preparation of substances which are easy to pelletize or for rapid re-pelletization. The centrifuge runs at the selected speed as long as the key is held down.

Deceleration of the rotor with or without activating the braking circuit takes place as soon as the key is released.

The centrifuge can be re-started after it has come to a complete stop.

Please observe the following when using the rotor 16 F-24-11:

The rotor imprint "max. 15,000 rpm 5416: max. 10 min, 5403: max. ∞ min"

has the following significance:

In the Centrifuge 5416, the rotor can heat up ≥ 10 °C above room temperature in 10 minutes at rotational speeds > 11,000 rpm (standard values: at 13,000 rpm heats up 15 °C after 10 min; at 15,000 rpm heats up 15 °C after 10 min).

In the Centrifuge 5403, the lowest cooling temperature which can be maintained at 15,000 rpm is + 15 °C after 1 hour operating time and 23 °C ambient temperature; at 11,000 rpm, it is + 4 °C.

Time and temperature parameters of the rotors

The data listed should be treated as standard values.

	24 x 1.5/2.0 ml Type 16 F 24 - 11	12 x 10 ml Type 16 F 12 - 16	12 x 15 ml Type 16 F 12 - 17	6 x 30/50 ml Type 16 F 6 - 28	6 x 85 ml Type 16 F 6 - 38	4 x 100 ml Type 16 A 4 - 44	8 x 15 ml Type 16 A 8 - 17
Acceleration/Deceleration time in seconds	35/35	60/60	32/32	60/60	60/65	35/35	25/25
Acceleration/Deceleration time "Soft Start/Stop" in seconds, Level 1	295/290	510/510	275/280	510/480	530/535	300/305	190/190

	Drum-rotor 60 x 1.5/2,0 ml Type 16 T 60 - 11	MT-plate rotor Type 16 M 2 - MT	Haematocrit rotor Type 16 H 24 - 2	Swing-bucke rotor for cytology Type 16 A 6 - 18
Acceleration/Deceleration time in seconds	30/30	33/33	17/17	22/25
Acceleration/Deceleration time "Soft Start/Stop" in seconds, Level 1	295/290	270/282	145/145	190/190

4.2 Loading the rotors

The rotors must be loaded symmetrically to the axle: ***opposing*** tubes/buckets must be of the ***same type*** and ***weight***.

The maximum permitted weight of a filled tube and adapter is stated on each rotor.

Swing-bucket rotors:

All positions must be provided with buckets.

A mixed load of carriers and buckets, e.g. two carriers and two buckets opposite each other in the rotor 4 x 100 ml (Type 16 A 4 - 44), is permitted.

Centrifuge tubes for volumes in the milliliter range can be regarded as having the same weight if they are filled to the same level.

Only use ***centrifuge tubes*** when the adapters and carriers are lined with ***rubber***.
Pay attention to the maximum g-numbers of the tubes used.

All fixed-angle rotors (exception: the rotor 12 x 15 ml, Type 16 F 12 - 17) have a ***cover***. The cover of the ***haematocrit rotor*** and ***drum rotor*** secures the capillary tubes and carriers in their positions and therefore ***must*** always be attached.

We recommend that the rotor cover is always used as it reduces the generation of heat due to friction in the air of the rotor chamber and the power required by the centrifuge. Always check that the cover is securely fastened. If it does not need to be screwed tight, it must have locked onto the drive axle (indicated by clicking noise).

4.3 Switching over and converting rpm/g-numbers

Switching over rpm/g-numbers

Activate rotational speed field with ***Select*** key (see Sec. 3.3.1). Press both cursor keys simultaneously.

The g-number (multiply by 100) appears in square brackets.

Switch back to rpm in the same way.

Switchover can be performed at any time (yet not during rotor deceleration).

The selected setting (rpm or g-number) is not deleted when the centrifuge is switched off.

For rotor Type 16 A 4-44 (swing-bucket rotor 4 x 100 ml), the g-number for the adapter-dependent largest radius (148 mm) is stated. For the 12 x 10 ml rotors (Type 16 F 12 - 16) and the cyto rotor (Type 16 A 6 - 18), which cannot be distinguished from 2 other rotors with the same maximum rotational speed, the values displayed must be multiplied with 0.89 or 0.84 respectively.

Converting rpm/g-numbers

The ***rotational*** speed in rpm (revolutions per minute) can be converted into a ***relative centrifugal force*** RCF (g-number = multiple of the acceleration due to gravity g) according to the formula:

$$\text{g-number} = 1.118 \times 10^{-5} \times r \times (\text{rpm})^2$$

r = Distance from the center of the rotor in cm

rpm = Rotational speed in revolutions/min

Vice versa:

$$\text{rpm} = \sqrt{\frac{\text{g-number} \times 10^5}{1.118 \times r}}$$

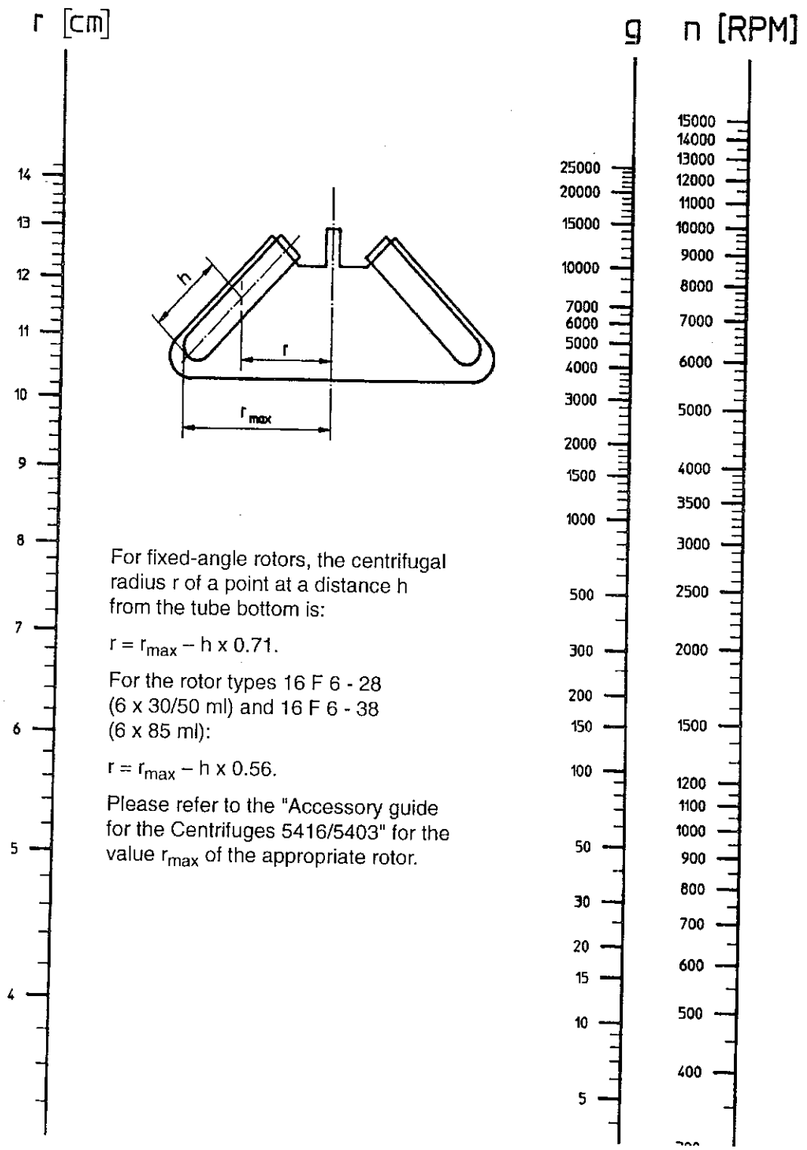
These values can also be determined with a sufficient degree of accuracy using a nomogram (see Page 32).

Reading the nomogram:

The unknown value (g, r or n) to two known values is required. Place a ruler at the known values and read off the unknown value at the intersection point of the line formed with the ruler and the scale for the unknown value. Values between two scale graduations have to be interpolated.

In the "Accessory guide for the Centrifuges 5416/5403", the RCF values for the rotors are calculated with the maximum radius (r_{max} = distance from the center of the rotor to the extreme point of the liquid column).

NOMOGRAM



For fixed-angle rotors, the centrifugal radius r of a point at a distance h from the tube bottom is:

$r = r_{max} - h \times 0.71$.

For the rotor types 16 F 6 - 28 (6 x 30/50 ml) and 16 F 6 - 38 (6 x 85 ml):

$r = r_{max} - h \times 0.56$.

Please refer to the "Accessory guide for the Centrifuges 5416/5403" for the value r_{max} of the appropriate rotor.

4.4 Opening the centrifuge in the case of a power failure

If the centrifuge lid cannot be opened with the knob due to a power failure, the locking mechanism can be opened mechanically.

Emergency lid release: wait until the rotor has come to a complete stop. Take the hexagon key for fastening the rotor and place it vertically into the opening for the emergency lid release and press upward slightly (see Fig. 1).
Turn the knob counterclockwise during this process: the lid opens.

5 Maintenance and cleaning

5.1 Centrifuge

The drive of the Centrifuge 5416 does not require any maintenance (frequency controlled, collector-free motor; no motor brushes).

To ensure that your device is always in perfect working order, please observe the following:

Clean the surfaces of the housing and the rotor chamber with diluted soap solution, detergent or isopropanol. Wipe cleaned surfaces with a dry cloth.

Decontaminate the rotor chamber with disinfectants containing alcohol.

5.2 Rotors

Rotors and buckets are exposed to high loads. Check that they are clean and in perfect mechanical order:

- If liquid enters the ***rotors*** or ***buckets***, wipe away immediately.
  For this purpose, only neutral cleaning agents and disinfectants (e.g. Extran® neutral, 70 % ethanol) must be used.
  After cleaning, rinse with distilled water and dry thoroughly. In particular, alkaline liquids (pH > 7) and concentrated saline solutions attack the anodized aluminum bodies.
- Regular lubrication of the anodized aluminum rotors and buckets with anticorrosive agent increases their lifetime (see Sec. 8, Ordering information).
- Handle rotors with care. Rotors which have fallen onto hard surfaces (e.g. a stone floor) can probably not be used again.
- Always grease the locking pins of the swing-bucket rotors lightly (see Sec. 8, "Ordering information"), so that the buckets can swing out without jerking (can result in imbalance or disturbance of loose sediments).
- The aerosol-tight buckets, their seal and cover are autoclavable (121 °C, 20 min). If tubes break, leave the buckets tightly sealed before autoclaving. The seals must then be exchanged (see Sec. 8, "Ordering information"). If the lid is attached loosely, the seals can be autoclaved several times.
- The tight seal of the aerosol-tight buckets is tested in accordance with British Standards 4402 "Safety requirements for laboratory centrifuges", Appendix D.
- In the case of ***glass breakage***, clean the bores, carriers and rubber inserts of the rotors carefully (otherwise broken glass can cause glass breakage again).

  Broken glass at the locking pins of the rotors causes uneven swinging out of the buckets.

  Broken glass in the rotor chamber causes abrasion at the rotor chamber wall and the rotor during the run and must be removed.

6 Troubleshooting table

To ease troubleshooting, the ***Centrifuge 5416*** indicates defects with an error message in the display.

Error	*Cause*	*Solution*
"Rotor-Code" (Display flashes).	– Rotor code not recognized.	Switch main power off for a short time and on again. Call service, if the error occurs repeatedly.
"!no rotor!" (Display flashes). Control lamp "Centrifuge running" flashes.	– Centrifuge was started without rotor. – Speed recognition defective.	Wait 3 min until control lamp "Lid released" lights up. Open lid by turning the knob. Mount rotor, turn clockwise by hand. Switch main power off for a short time and on again. Call service, if the error occurs repeatedly.
"Imbalance" (Display flashes). Control lamp "Imbalance" lights up.	– Rotor not loaded symmetrically. – Rotor not securely tightened.	Load rotor symmetrically (see Sec. 4.2). Tighten rotor securely (see Sec. 2.3).
"INTERRUPT" (Display flashes). Control lamp "Lid released" lights up after rotor has come to stop.	– Power supply interrupted.	Press ***Start*** key; the values selected for the last run appear in the display. The centrifuge can then be restarted.
"Volt<min" (Display flashes) Control lamp "Lid released" lights up after rotor has come to stop.	– Line voltage < minimum voltage.	After re-establishing correct line voltage: Switch main power off for a short time and on again. Press ***Start*** key; the values selected for the last run appear in the display. The centrifuge can then be restarted.

The error messages "!rpm>max(C)!", "!CCI-Temp!" and "Error 5–8" refer to the converter in the power unit of the centrifuge. If they cannot be eliminated by actuating the main power switch (on/off) and pressing ***Start*** (when "INTERRUPT" flashes in the display), call the service.

7 Technical data

Centrifuge 5416

Power supply:see identification plate	
Power requirement:	450 W
Continuous sound level:	70 dB(A)
Max. rotational speed:	15,000 rpm
Max. load:	6 x 85 ml
Max. density of material to be centrifuged:	1.2 g/ml
Max. kinetic energy:	14,000 Nm
Dimensions (H x W x D):	31.5 x 40.0 x 44.0 cm
Weight:	26.5 kg

Technical specifications subject to change!

Please refer to our "Accessory guide for the Centrifuges 5416/5403" for the technical data of the rotors.

8 Ordering information

All rotors are delivered without carriers, buckets and adapters. Please refer to our "Accessory guide for the Centrifuges 5416/5403" for ordering information on these articles.

Centrifuge 5416 230 V/50 Hz and 60 Hz Other versions available on request!	5416 000.028
Fixed-angle rotor 24 x 1.5/2.0 ml 45°, with cover 11,000 rpm (12,445 g) Type 16 F 24 - 11	5416 400.000
Fixed-angle rotor 12 x 10 ml 45°, with cover 11,000 rpm (11,498 g) Type 16 F 12 - 16	5416 401.006
Fixed-angle rotor 12 x 15 ml 45°, complete with sleeves 6,000 rpm (4,024 g) Type 16 F 12 - 17	5416 404.005
Fixed-angle rotor 6 x 30/50 ml 34°, with cover 11,000 rpm (12,851/12,716 g) Type 16 F 6 - 28	5416 402.002
Fixed-angle rotor 6 x 85 ml 34°, with cover 11,000 rpm (13,798 g) Type 16 F 6 - 38*	5416 403.009
Swing-bucket rotor 4 x 100 ml 5,000 rpm (4,137 g) Type 16 A 4 - 44	5416 407.004
Swing-bucket rotor 8 x 15 ml complete with sleeves 4,000 rpm (2,325 g) Type 16 A 8 - 17	5416 409.007
Drum rotor 60 x 1.5/2.0 ml with cover 15,000 rpm (18,866 g) Type 16 T 60 - 11	5416 410.005
Microtiter plate rotor 2 x 4 MT plates 4,000 rpm (1,968 g) Type 16 M 2 - MT	5416 405.001
Haematocrit rotor for 24 capillary tubes with cover 15,000 rpm (20,878 g) Type 16 H 24 - 2	5416 406.008

Swing-bucket rotor for cytology 4,000 rpm (1,950 g) Type 16 A 6 - 18	5416 408.000

*The type code contains important information, illustrated by the following example:

Type "16 F 6 - 38" = type code of a ***f***ixed-angle rotor which can be mounted in the Centrifuge 5403 ***and*** 5***4******16*** with ***6*** bores for tubes of ***38*** mm diameter.
38 mm diameter is typical for a 85 ml tube.

Accessories

Hexagonal key for securing rotor	5416 301.001
Vaseline spray as anticorrosive agent for aluminum rotors and for lubricating the locking pins of swing-bucket rotors	5416 302.008
Seals for aerosol-tight beakers (set of 4)	5416 351.009

Eppendorf tubes

0.5 ml Safe-Lock Microcentrifuge Tubes with patented lid latch, graduation scale and writing area Minimum ordering quantity: 500	
colorless	0030 121.023
yellow	0030 121.112
red	0030 121.120
blue	0030 121.139
green	0030 121.147
mixed (assortment of above colors)	0030 121.708
amber (light protection)	0030 121.155
0.5 ml Safe-Lock Microcentrifuge Tubes, Eppendorf Biopur, individually sealed Minimum ordering quantity: 50	0030 121.570
1.5 ml Safe-Lock Microcentrifuge Tubes with patented lid latch, graduation scale and writing areas Minimum ordering quantity: 1,000	
colorless	0030 120.086
yellow	0030 120.159
red	0030 120.167
blue	0030 120.175
green	0030 120.183
mixed (assortment of above colors)	0030 121.694
amber (light protection)	0030 120.191
1.5 ml Safe-Lock Microcentrifuge Tubes, Eppendorf Biopur, individually sealed Minimum ordering quantity: 100	0030 121.589
2.0 ml Safe-Lock Microcentrifuge Tubes with patented lid latch, graduation scale and writing areas Minimum ordering quantity: 1,000	
colorless	0030 120.094
yellow	0030 120.205
red	0030 120.213
blue	0030 120.221
green	0030 120.230
mixed (assortment of above colors)	0030 121.686
amber (light protection)	0030 120.248
2.0 ml Safe-Lock Microcentrifuge Tubes, Eppendorf Biopur, individually sealed Minimum ordering quantity: 100	0030 121.597
1.7 ml Safe-Twist Screw Cap Tubes with graduation scale and writing area	
500 tubes, colorless 500 caps, colorless	0030 122.003
500 tubes, colorless 500 caps, yellow	0030 122.011
500 tubes, colorless 500 caps, red	0030 122.020
500 tubes, colorless 500 caps, blue	0030 122.046
500 tubes, colorless 500 caps, green	0030 122.038
500 tubes, colorless 5 x 100 caps in all colors except amber	0030 122.054
500 tubes, amber 500 caps, amber	0030 122.062
0.4 ml centrifuge tubes with cover Minimum ordering quantity: 1,000	0013 036.004
Black fine fiber tip pen	0013 088.101
Micropestle (set of 10)	0030 120.973

Important note:
Please use the original accessories recommended by Eppendorf. Using spare parts or disposables which we have not recommended can reduce the precision, accuracy and life of the Centrifuge 5416. We do not honor any warranty or accept any responsibility for damage resulting from such action.

9 Short instructions

The short instructions should only be used if the user is fully acquainted with the detailed operating instructions, otherwise errors may occur.

- Switch on the centrifuge.
- With the arrow key ">", activate the "min", or "rpm" data field. Select the desired value with the ***Up*** or ***Down*** arrow keys.
- Open the centrifuge lid by turning the knob counterclockwise.
- Check that the rotor is ***securely tightened*** (see Sec. 2.3).
- Load the rotor symmetrically to the axle with ***tubes/buckets of the same weight***.
  All positions of swing-bucket rotors must be equipped with buckets.
  Attach rotor cover (to all fixed-angle rotors with the exception of the rotor 12 x 15 ml, Type 16 F 12 - 17).
- Close centrifuge lid by turning knob clockwise.
- Press ***Start***.