



FC5916/FC5916R Service Manual

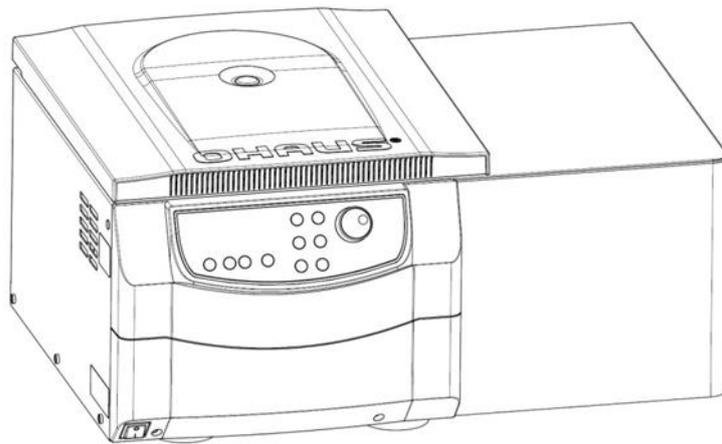


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1 GETTING STARTED

1.1 Introduction

This service manual contains the information needed to perform routine maintenance and service on the Ohaus centrifuge model FC5916/FC5916R.

Before servicing the equipment, you should be familiar with the Instruction Manual which is packed with every equipment.

1.2 Definition of Signal Warning and Symbols

Safety notes are marked with signal words and warning symbols. They show safety issues and warnings. Ignoring the safety notes may lead to personal injury, damage to the instrument, malfunctions and false results. The degree of danger is a part of a safety note and distinguishes the possible results of non-observance from each other.

Signal Words

| | |
|------------------|--|
| WARNING | For a hazardous situation with medium risk, possibly resulting in injuries or death if not avoided. |
| CAUTION | For a hazardous situation with low risk, resulting in damage to the device or the property or in the loss of data, or injuries if not avoided. |
| Attention | For important information about the products. May lead to equipment damage if not avoided. |
| Note | For useful information about the product. |

Warning Symbols



General Hazard



Electrical Shock Hazard



Alternating Current



Biohazard

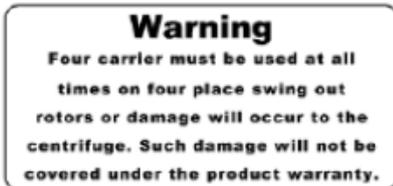


Explosion Hazard

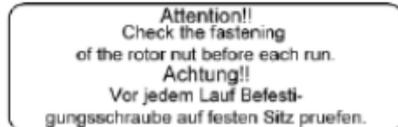


Corrosive Hazard

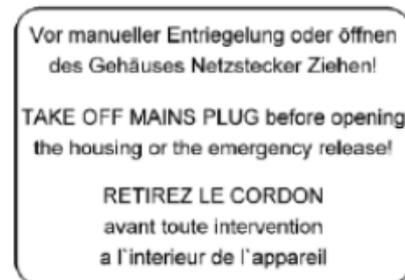
Warning and information signs on the surface of centrifuge.



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



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



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

1.3 Safety Precautions

1.3.1 User

OHAUS centrifuges are intended exclusively for indoor use and for use by qualified personnel. This device may only be operated by trained specialist staff. They must have carefully read the operating manual and be familiar with the function of the device.

1.3.2 Rotor and Accessories

Only OHAUS original rotors and accessories shall be used. Any other use or intended use is considered improper. OHAUS is not liable for damage resulting from improper use.



CAUTION:

Read all safety warnings before installing, making connections, or servicing this equipment. Failure to comply with these warnings could result in personal injury and/or property damage. Retain instructions for future reference.

1.3.3 Measures for your protection



WARNING: Never work in an environment subject to explosion hazards! The housing of the instrument is not gas tight. (Explosion hazard due to spark formation, corrosion caused by the ingress of gases)



WARNING: When using chemicals and solvents, comply with the instructions of the producer and the general lab safety rules.



WARNING: The centrifuge is not sealed. Use suitable protection measures when using the centrifuge for infectious and pathogenic samples. Follow appropriate safety precautions when handling these samples.

1.3.4 Exclude the following environmental influences

- Powerful vibrations
- Direct sunlight
- Atmospheric humidity greater than 80%
- Corrosive gases present
- Temperatures below 2 °C and above 35 °C
- Powerful electric or magnetic fields

**WARNING:**

Electrical shock hazards exist within the housing. The housing should only be opened by authorized and qualified personnel. Remove all power connections to the unit before opening.

1.3.5 Measures for operational safety

- Do not unscrew the two halves of the housing
- Dry off any liquid spills immediately! The instrument is not watertight
- Only use a power cord with a rating that exceeds the specifications on the equipment label.
- Only connect the power cord to a properly grounded power receptacle.
- Do not position the equipment such that it is difficult to disconnect the power cord from the power receptacle.
- Make sure that the power cord does not pose a potential obstacle or tripping hazard.
- The equipment is for indoor use only. Use the equipment only in dry locations.
- Use only approved accessories.
- Operate the equipment only under ambient conditions specified in these instructions.
- Disconnect the equipment from the power supply when cleaning.
- Do not operate the equipment in hazardous or unstable environments.
- Service should only be performed by authorized personnel

1.3.6 Danger and precautions



To protect people and the environment, the following precautions should be observed:

- During centrifugation, the presences of people are prohibited within 30 cm around the centrifuge according to the regulations of EN 61010-2-020.
- FC5916/FC5916R is not explosion-proof and must therefore not be operated in explosion-endangered areas or locations. Centrifugation of flammable, explosive, radioactive, or such substances, which chemically react with high energy, is strictly prohibited. The final decision on the risks associated with the use of such substances is the responsibility of the user of the centrifuge.
- Never spin toxic or pathogenic material without adequate safety precautions, i.e. centrifugation of buckets / tubes with missing or defective hermetic sealing is strictly prohibited. The user is obliged to perform appropriate disinfection procedures in case dangerous substances have contaminated the centrifuge and/or its accessories. When centrifuging infectious substances, always pay attention to the general laboratory precautions. If necessary, contact your safety officer!
- It is prohibited to run the centrifuge with rotors other than listed for this unit.

- Under no circumstances open the lid of the centrifuge while the rotor is still running or rotating with a speed of $> 2\text{m/s}$

1.4 Service Facilities

To service a centrifuge, the service area should meet the following requirements:

- Area must be clean and air must not contain excessive dust particles.
- Work surface must be stable and level.
- Use an approved Electro-Static Device.

1.5 Tools and Test Equipment Required

1.5.1 Standard Tools and Test Equipment

Flat and Philip screws drivers, tweezers, adjustable open wrenches and socket set (with drive socket sets from 4mm-14mm, Ratchet and drive extension bar.)



1.6 Transporting and Packing Centrifuge FC5916/FC5916R

1.6.1 Transport

- Please transport the device in the original packaging.
- Use a transport aid for transporting over longer distances.

1.6.2 Packing

Pack the centrifuge in reverse order using the equipment original packing.

1.7 Technical Data

1.7.1 Acceleration/ Deceleration times

FC5916 (120 V / 230 V) in sec

| Item No | Rotor Description | Model | Acceleration Time in sec | | Deceleration Time in sec | |
|----------|--|--------|--------------------------|---------|--------------------------|---------|
| | | | level 0 | level 9 | level 0 | level 9 |
| 30304361 | Rotor, Angle, 24x1.5/2.0ml, ID, Sealable | FC5916 | 204 | 21 | 421 | 30 |
| 30314821 | Rotor, Angle, 6x250ml FB, ID | FC5916 | 573 | 66 | 1903 | 84 |
| 30314824 | Rotor, Swing out, 2x3MTP, ID | FC5916 | 249 | 27 | 488 | 23 |
| 30314826 | Rotor, Angle, 6x85ml RB, ID | FC5916 | 463 | 48 | 1654 | 46 |
| 30314827 | Rotor, Angle, 4x85ml RB, ID, Hi | FC5916 | 448 | 50 | 1251 | 45 |
| 30314829 | Rotor, Angle, 10x50ml FA, ID | FC5916 | 480 | 60 | 1747 | 68 |
| 30314831 | Rotor, Angle, 6x50ml RB, ID, Hi | FC5916 | 264 | 28 | 921 | 32 |
| 30314833 | Rotor, Angle, 20x10ml RB, ID, Hi | FC5916 | 305 | 32 | 988 | 37 |
| 30314835 | Rotor, Angle, 44x1.5/2.0ml, ID | FC5916 | 233 | 25 | 283 | 30 |
| 30314836 | Rotor, Angle, 30x1.5/2.0ml, ID, Sealable | FC5916 | 221 | 23 | 561 | 30 |
| 30314838 | Rotor, Angle, 24x1.5/2.0ml, ID | FC5916 | 204 | 21 | 421 | 30 |
| 30314841 | Rotor, Angle, 4x8-w PCR Strip, ID | FC5916 | 100 | 12 | 201 | 12 |
| 30553085 | Rotor SwingOut 4x750ml D99mm ID SL | FC5916 | 483 | 47 | 1287 | 49 |
| 30553086 | Rotor Angle 4x500ml D69mm ID | FC5916 | 575 | 73 | 2317 | 82 |

FC5916R (120 V / 230 V) in sec

| Item No | Rotor Description | Model | Acceleration Time in sec | | Deceleration Time in sec | |
|----------|--|---------|--------------------------|---------|--------------------------|---------|
| | | | level 0 | level 9 | level 0 | level 9 |
| 30304361 | Rotor, Angle, 24x1.5/2.0ml, ID, Sealable | FC5916R | 204 | 21 | 421 | 30 |
| 30314821 | Rotor, Angle, 6x250ml FB, ID | FC5916R | 573 | 66 | 1903 | 84 |
| 30314824 | Rotor, Swing out, 2x3MTP, ID | FC5916R | 249 | 27 | 488 | 23 |
| 30314826 | Rotor, Angle, 6x85ml RB, ID | FC5916R | 549 | 69 | 1307 | 67 |
| 30314827 | Rotor, Angle, 4x85ml RB, ID, Hi | FC5916R | 448 | 50 | 1251 | 45 |
| 30314829 | Rotor, Angle, 10x50ml FA, ID | FC5916R | 480 | 60 | 1747 | 68 |
| 30314831 | Rotor, Angle, 6x50ml RB, ID, Hi | FC5916R | 264 | 28 | 921 | 32 |
| 30314833 | Rotor, Angle, 20x10ml RB, ID, Hi | FC5916R | 305 | 32 | 988 | 37 |
| 30314835 | Rotor, Angle, 44x1.5/2.0ml, ID | FC5916R | 233 | 25 | 500 | 25 |
| 30314836 | Rotor, Angle, 30x1.5/2.0ml, ID, Sealable | FC5916R | 221 | 23 | 561 | 30 |
| 30314838 | Rotor, Angle, 24x1.5/2.0ml, ID | FC5916R | 204 | 21 | 421 | 30 |
| 30314841 | Rotor, Angle, 4x8-w PCR Strip, ID | FC5916R | 100 | 12 | 201 | 12 |
| 30553085 | Rotor SwingOut 4x750ml D99mm ID SL | FC5916R | 551 | 55 | 1501 | 54 |
| 30553086 | Rotor Angle 4x500ml D69mm ID | FC5916R | 575 | 73 | 2317 | 82 |

Notes: The acceleration and deceleration times may have slight fluctuations that depend on the unit and are therefore guidelines only.

1.7.2 Imbalance shut off data

FC5916 (120 V / 230 V)

Rotors where the Imbalance follow movement sensor

| Rotor-number | Shut off speed (approx. values) in rpm | Permitted imbalance in gram | Imbalance shut-off in gram |
|--------------|--|-----------------------------|----------------------------|
| 30314836 | 14700 | 2 | 3 |
| 30314826 | 10670 | 8 | 9 |
| 30314827 | 12500 | 7 | 8 |
| 30314821 | 850 | 16 | 17 |
| 30314831 | 12652 | 5 | 6 |
| 30314833 | 12000 | 5 | 6 |
| 30553086 | 6350 | 11 | 12 |
| 30314829 | 912 | 9 | 10 |
| 30314838 | 15880 | 2 | 3 |
| 30304361 | 10392 | 2 | 3 |
| 30314841 | No imbalance for this rotor because the PCR strips are very light. | | |
| 30314835 | 950 | 3 | 4 |

Imbalance adjusted with the **mechanical micro switch**. This rotor has to be adjusted with the mechanical micro switch.

| Rotor-number | Shut off speed (approx. values) in rpm | Permitted imbalance in gram | Imbalance shut-off in gram |
|--------------|--|-----------------------------|----------------------------|
| 30553085 | 830 | 21 | 22 |
| 30314824 | 340 | 27 | 28 |

FC5916R (120 V / 230 V)

Rotors where the Imbalance follow movement sensor

| Rotor-number | Shut off speed (approx. values) in rpm | Permitted imbalance in gramm | Imbalance shut-off in gramm |
|--------------|--|------------------------------|-----------------------------|
| 30314836 | 8904 | 3 | 4 |
| 30314826 | 1076 | 8 | 9 |
| 30314827 | 11100 | 5 | 6 |
| 30314821 | 996 | 12 | 13 |
| 30314831 | 1140 | 6 | 7 |
| 30314833 | 1060 | 8 | 9 |
| 30553086 | 1030 | 14 | 15 |
| 30314829 | 950 | 8 | 9 |
| 30314838 | 11040 | 2 | 3 |
| 30304361 | 10690 | 3 | 4 |
| 30314841 | No imbalance for this rotor because the PCR strips are very light. | | |
| 30314835 | 1840 | 3 | 4 |

Imbalance adjusted with the **mechanical micro switch**. This rotor has to be adjusted with the mechanical micro switch. See chapter 3.9.

| Rotor-number | Shut off speed (approx. values) in rpm | Permitted imbalance in gramm | Imbalance shut-off in gramm |
|--------------|--|------------------------------|-----------------------------|
| 30553085 | 880 | 20 | 21 |
| 30314824 | 496 | 35 | 36 |

1.7.3 Lowest temperatures FC5916R (120V / 230 V) at maximum speed

| Rotor number | Rotor Description | Model | Max Speed | N-max |
|--------------|--|---------|-----------|-------|
| 30304361 | Rotor, Angle, 24x1.5/2.0ml, ID, Sealable | FC5916R | 16000 rpm | 1 °C |
| 30314821 | Rotor, Angle, 6x250ml FB, ID | FC5916R | 8000 rpm | -1 °C |
| 30314824 | Rotor, Swing out, 2x3MTP, ID | FC5916R | 4500 rpm | -8 °C |
| 30314826 | Rotor, Angle, 6x85ml RB, ID | FC5916R | 13000 rpm | 8 °C |
| 30314827 | Rotor, Angle, 4x85ml RB, ID, Hi | FC5916R | 16000 rpm | 7 °C |
| 30314829 | Rotor, Angle, 10x50ml FA, ID | FC5916R | 10500 rpm | 2 °C |
| 30314831 | Rotor, Angle, 6x50ml RB, ID, Hi | FC5916R | 13000 rpm | -4 °C |
| 30314833 | Rotor, Angle, 20x10ml RB, ID, Hi | FC5916R | 12000 rpm | -2 °C |
| 30314835 | Rotor, Angle, 44x1.5/2.0ml, ID | FC5916R | 16000 rpm | 3 °C |
| 30314836 | Rotor, Angle, 30x1.5/2.0ml, ID, Sealable | FC5916R | 15000 rpm | 3 °C |
| 30314838 | Rotor, Angle, 24x1.5/2.0ml, ID | FC5916R | 16000 rpm | 1 °C |
| 30314841 | Rotor, Angle, 4x8-w PCR Strip, ID | FC5916R | 15000 rpm | -2 °C |
| 30553085 | Rotor SwingOut 4x750ml D99mm ID SL | FC5916R | 4500 rpm | 4 °C |
| 30553086 | Rotor Angle 4x500ml D69mm ID | FC5916R | 8000 rpm | 0 °C |

Room temperature: 23°C

The absolute end temperatures can be subject to fluctuations of $\pm 2^{\circ}\text{C}$ due to power tolerances of the refrigeration unit.

The lowest sample temperatures are depending on the ambient temperature. If the ambient temperature is increasing, the lowest sample temperature to be reached is increasing as well.

The acceleration times and deceleration times can be subject of small fluctuations, it depends from unit to unit, and are therefore approximate values only.

1.7.4 Specifications

| | | |
|--|---|------------------|
| Model | FC5916 | |
| Speed Range | 200 rpm -16000 rpm;10 rpm/set | |
| Maximum RCF | 24325 x g;10 x g/set | |
| Maximum Capacity(Rotor) | 4x750ml | |
| Temperature range(N/A) | Air cool | |
| Running Time | 10 sec to 99 hr 59 min 59 sec or continuous | |
| Noise level (depending on the rotor) | ≤ 63 ± 2 dB(A) | |
| Allowable density at maximum speed | 1.2 g/ml | |
| Allowable kinetic energy | 60629 Nm | |
| Mains power connection AC | 230 V ~ 50/60 Hz | 120 V ~ 50/60 Hz |
| Voltage fluctuation | ± 10 % | ± 10 % |
| Current consumption | 2.8 A | 5.6 A |
| Power consumption | 640 W | 680 W |
| Dimensions (W × D × H) | 540 x 670 x 390 mm | |
| | 21.3 x 26.4 x 15.4 in | |
| Net Weight (without rotor) | 85 kg | |
| | 187 lb | |
| Shipping Dimensions (W × D × H) | 780 x 670 x 590 mm | |
| | 30.7 x 26.4 x 23.3 in | |
| Shipping Weight (without rotor) | 98 kg | |
| | 216 lb | |
| Ambient conditions (EN/IEC 61010-1) | | |
| Environment | For indoor use only | |
| Altitude | Use up to an altitude of 2000 m | |
| Ambient temperature | 2°C up to 35 °C | |
| Max. relative humidity | Max. relative humidity 80 % for temperatures up to 31°C, decreasing linearly to 50 % relative humidity up to 35°C. | |
| Overvoltage category (IEC 60364-4-443) | II | |
| Degree of contamination | 2 | |
| Class of protection | I | |
| Not suitable for use in hazardous environments. | | |

| Model | FC5916R | |
|--|---|------------------|
| Speed Range | 200 rpm -16000 rpm;10 rpm/set | |
| Maximum RCF | 26331 x g;10 x g/set | |
| Maximum Capacity(Rotor) | 4x750ml | |
| Temperature range(Digital) | -20~40°C | |
| Running Time | 10 sec to 99 hr 59 min 59 sec or continuous | |
| Noise level (depending on the rotor) | ≤ 63 ± 2 dB(A) | |
| Allowable density at maximum speed | 1.2 g/ml | |
| Allowable kinetic energy | 54458 Nm | |
| Mains power connection AC | 230 V ~ 50/60 Hz | 120 V ~ 50/60 Hz |
| Voltage fluctuation | ± 10 % | ± 10 % |
| Current consumption | 7.2 A | 20 A |
| Power consumption | 1630 W | 1750 W |
| Dimensions (W × D × H) | 730 x 670 x 390 mm | |
| | 28.7 x 26.4 x 15.4 in | |
| Net Weight (without rotor) | 118 kg | |
| | 260 lb | |
| Shipping Dimensions (W × D × H) | 900 x 750 x 560 mm | |
| | 40.0 x 29.5 x 22.0 in | |
| Shipping Weight (without rotor) | 137 kg | |
| | 137 kg | |
| Ambient conditions (EN/IEC 61010-1) | | |
| Environment | for indoor use only | |
| Altitude | Use up to an altitude of 2000 m | |
| Ambient temperature | 2°C up to 35 °C | |
| Max. relative humidity | Max. relative humidity 80 % for temperatures up to 31°C, decreasing linearly to 50 % relative humidity up to 35°C. | |
| Overvoltage category (IEC 60364-4-443) | II | |
| Degree of contamination | 2 | |
| Class of protection | I | |
| Not suitable for use in hazardous environments. | | |

1.8 Service Instructions

1.8.1 General technical description

Model **FC5916** is a microprocessor controlled laboratory centrifuge.
Model **FC5916R** is a cooled microprocessor controlled laboratory centrifuge.

The actuation is a three phase asynchronous motor which is controlled by a frequency converter.

Both models have an independent error detection program, displaying possible errors and therefore supporting the trouble shooting process.

This unit is equipped with several safety features:

- Imbalance detection
- Motor over temperature protection
- Lid lock does not open until the standstill of the centrifuge
- Rotor over speed protection

Please follow below mentioned safety instructions for any kind of service actions:

- The capacitor of the frequency converter can be under voltage even when the unit is switched off.
- Do not leave units unsupervised, when parts of the housing have been removed and the unit is still connected to the main power supply.
- Do not bypass the lid's safety contacts and never work with the unit's lid open.
- Repairs on this equipment must be done in accordance with the relevant national codes and standards.

1.8.2 Electrical and electronic components

1.8.2.1 Power board

The power board is serving the low voltage supply of the centrifuge control system. The power board is electrically isolated and has a dielectric strength of DC 2.2 kV.



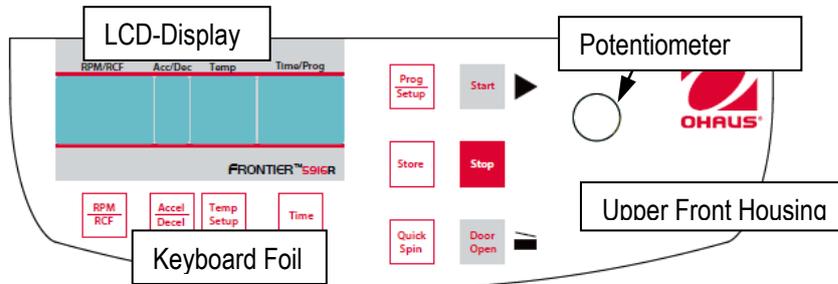
1.8.2.2 Control board (PCB)

The control board consists of one plate. The board can only be exchanged completely. If there is a defect you have to exchange the complete board. All signal lines lead to the control board. The PCB controls the entire centrifuge.



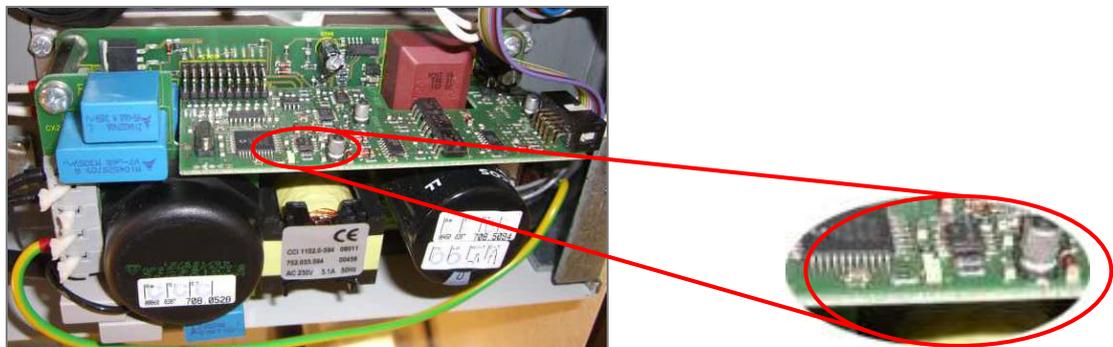
1.8.2.3 Control panel

The control panel consists of one LCD-display, one incremental shaft encoder, the upper front housing and the foil keyboard. These parts can be exchanged separate. The incremental shaft encoder regulates all parameters which are adjustable by pressing a key and which are indicated in the LCD-display. In the speed display of the control panel the error message is indicated if there should occur any trouble



1.8.2.4 Frequency converter

The frequency converter generates the drive signals for the asynchronous motor. The converter leads the current generated by the motor during deceleration to a heating resistor to reduce the current. The frequency converter is connected with the power board by a serial interface. There is a green LED on the converter which flashes when the frequency converter is working correctly. A defect of the converter will be indicated in the speed display as an error no.

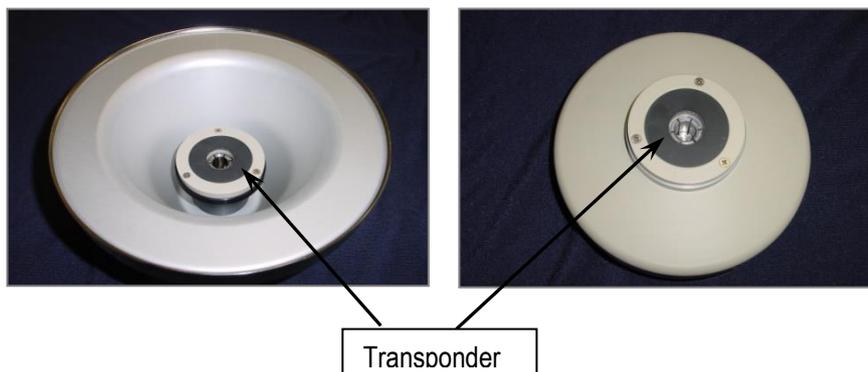
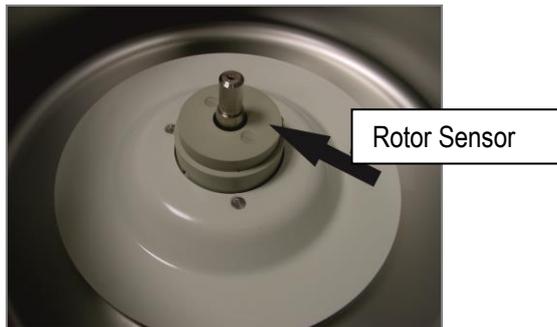


1.8.2.5 Rotor recognition and over speed protection

The centrifuge will recognize the inputted rotor through the rotor identification transponder and the Rotor Sensor belonging to it right after the insert automatically. As soon as the lid is closed, the rotor number will be indicated in the speed display. The transponder has integrated a RFID chip inside.

If the pre-selected rpm is higher as the permitted rpm of the rotor, the speed indication in the display will be regulated to the maximum speed permitted by this rotor.

The regulation will accelerate the rotor only to the permitted rpm of the rotor.



1.8.2.6 Speed signal

The actual speed is extracted by a hall-effect-sensor placed on the lower side of the motor.

There is a „preset/actual“comparison in the control board. Thereupon a new “preset-signal” is given by the control board to the converter.



1.8.2.7 Lid contact

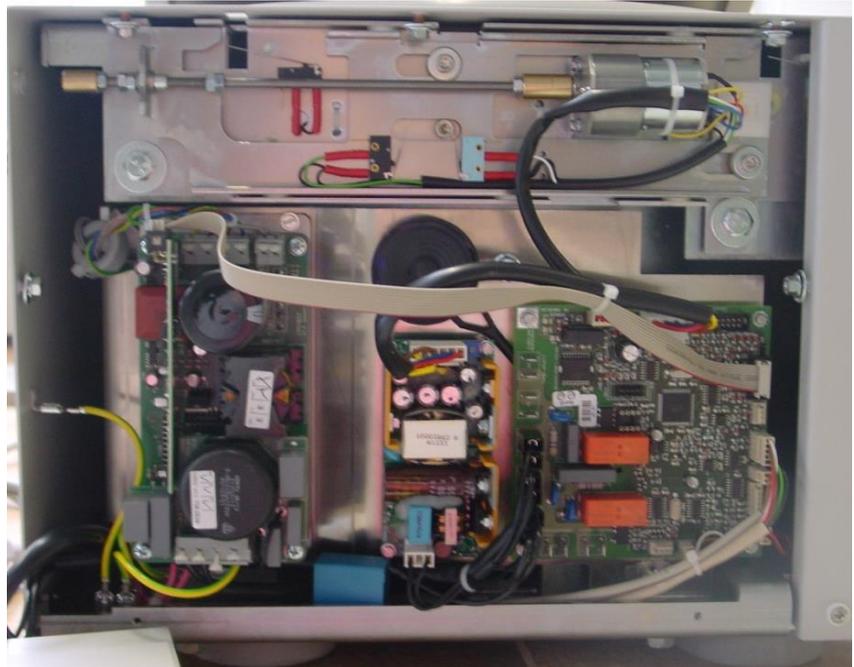
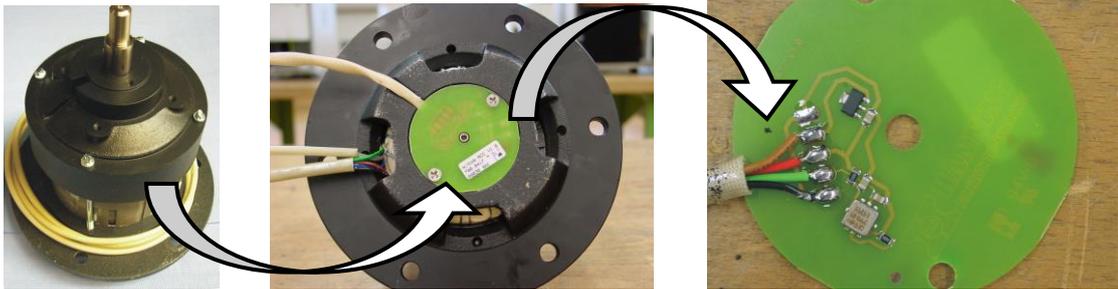
The micro switch in the mechanism of the lid lock controls the correct closing of the centrifuge lid.

The switch may never be bypassed.

The lid lock, receiving its signal from the control board, is unlatched by a DC motor.

1.8.2.8 Imbalance detection

The imbalance detection is effected by a movement sensor, which is mounted in the motor and is controlling the oscillating motion of the motor. The unit stops when the oscillating motions are too strong. Therefore, you have to follow the adjustment instructions stated by the manufacturer.



2 SERVICE MENU

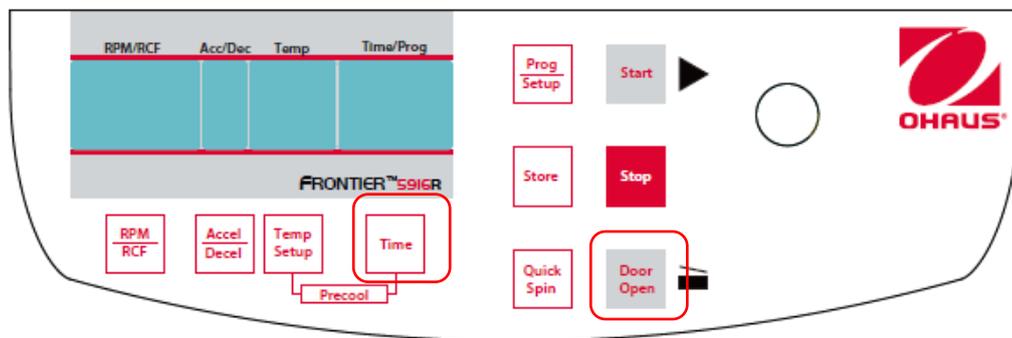
Part 1 is accessible for the **USER** and different points can be read respectively settled. This is also described in the instruction manual.

Part 2 is for internal use respectively for OHAUS trained service personnel only.

2.1 Activation of the operation menu

The menu can be started as follows:

- Open lid of the centrifuge and switch off main switch.
- Press the keys **Time** and **Door Open** hold them and at the same time switch on the unit.



- After the indication displays flash on, let go of the **Time** and **Door Open**. In the display „rpm/rcf“ the stored type of the centrifuge (i.e. **5916R**) and below a letter (i.e. **c**) is indicated for about 2 seconds. The letter stands for the different versions of the units which are currently stored in the control board:

for **c** = cool
 for **h** = heat
 for **no** = nothing

Now it follows a display test for about 5 seconds as shown here under.



Now you have entered the **Service mode**. By pressing the key **Accel/Decel** you go to the submenus.

Now in the display „accel/decel“ the word „service“ will flash. Only when this word is flashing, you can scroll through the further submenus with the potentiometer.

You have to repeat this step constantly to enter the different submenus.

2.1.1 Submenu Motor starts:

Here you can read off the number of motor starts.

- Activate the operation menu as described under „Activation of the operation menu (Part 1)“.
- Turn the potentiometer until the special digit „A“ appears in the service display.



Now the number of motor starts is indicated.

2.1.2 Submenu Duty cycle

Here you can read off the duty cycle of the unit.

- Activate the operation menu as described under „Activation of the operation menu (Part 1)“.
- Turn the potentiometer, until the special digit „H“ appears in the service display.



Now the duty cycle of the unit is indicated.

2.1.3 Submenu Running time of the motor

Here you can read off the operating hours of the motor.

- Activate the operation menu as described under „Activation of the operation menu (Part 1)“.
- Turn the potentiometer, until the special digit „h“ appears in the service display.



Now the running time of the motor is indicated.

2.1.4 Submenu Software status

Here you can read of the software status.

- Activate the operation menu as described under „Activation of the operation menu (Part 1)“.
- Turn the potentiometer, until the special digit „S“ appears in the service display.



Now the software status is indicated.

2.1.5 Submenu Software status of the frequency converter

Here you can read of the software status of the frequency converter.

- Activate the operation menu as described under „Activation of the operation menu (Part 1)“.
- Turn the potentiometer, until the special digit „r“ appears in the service display.



Now the software status of the frequency converter is indicated.

2.1.6 Submenu Error memory

Here the 99 last occurred error messages can be indicated.

- Activate the operation menu as described under „Activation of the operation menu (Part 1)“.
- Turn the potentiometer, until the special digit „E“ appears in the service display.



- By pressing the key RPM/RCF the display „rpm/rcf“ is activated and now you can scroll through the error list either with the potentiometer.
- Now the 99 last occurred error messages are indicated either by turning the potentiometer, whereas the first two numbers do describe the place number and the last two numbers do describe the occurred error.

- According to the software status, individual error messages may not be indicated resp. may have slight deviations.

2.1.7 Submenu Setup of the temperature (for refrigerated units only)

Here you can change the temperature unit from degree Celsius (°C) to degree Fahrenheit (°F).

- Activate the operation menu as described under „Activation of the operation menu (Part 1)“.
- Turn the potentiometer, until the special digit „c“ appears in the service display.



- By pressing the key **RPM/RCF** the display „rpm/rcf“ is now activated and you can setup the respective temperature unit with the potentiometer.
- Now the temperature is indicated in °C resp. in °F during the normal operation.

Attention: After all points have been reviewed and/or set up, you have to press shortly the key **Start** to store all parameters. Otherwise the setups were all for nothing.

If the storage has been successful in the display „rpm/rcf“ the value of the imbalance sensor and the word „StorE“ are indicated.



2.1.8 Submenu Setup of the signal generator

Here you can switch on resp. switch off the signal generator (audible sound).

- Activate the operation menu as described under „Activation of the operation menu (Part 1)“.
- Turn the potentiometer, until the special digit „L“ appears in the service display.



- By pressing the key **RPM/RCF** the display „rpm/rcf“ is now activated and you can setup the respective option with the potentiometer.
- Now the audible sound is activated resp. not activated by the end of the run or when an error message will occur.

Attention: In case that the signal generator is switch off, the keypad tone and the audible error message will also be suppressed.
 The keypad tone has to be switched on again after the reactivation of the signal generator.
 However the audible error message is automatically activated if the signal generator has been reactivated.

Attention: After all points have been reviewed and/or set up, you have to press shortly the key **Start** to store all parameters. Otherwise the setups were all for nothing. If the storage has been successful in the display „rpm/rcf“ the value of the imbalance sensor and the word „StorE“ are indicated.



2.1.9 Submenu Setup of the keypad tone

Here you can switch on resp. switch off the keypad tone.

- Activate the operation menu as described under „Activation of the operation menu (Part 1)“.
- Turn the potentiometer, until the special digit „b“ appears in the service display.



- By pressing the key **RPM/RCF** the display „rpm/rcf“ is now activated and you can setup the respective option with the potentiometer.
- Now the keypad tone is either activated or not activated.

Attention: In case that the signal generator is switched off, the keypad tone and the audible error message will also be suppressed.
 The keypad tone has to be switched on again after the reactivation of the signal generator.

Attention: After all points have been reviewed and/or set up, you have to press shortly the key **Start** to store all parameters. Otherwise the setups were all for nothing. If the storage has been successful in the display „rpm/rcf“ the value of the imbalance sensor and the word „StorE“ are indicated.



2.1.10 Submenu Setup volume of the signal generator

Here you can setup the volume of the loudspeaker in case the signal generator is activated.

- Activate the operation menu as described under „Activation of the operation menu (Part 1)“.
- Turn the potentiometer, until the special digit „u“ appears in the service display.



- By pressing the key **RPM/RCF** the display „rpm/rcf“ is now activated and you can setup the respective option with the potentiometer.
- At the end of the run you can now hear the audible sound in the setup volume whereas 0 is the most quiet setup and 9 the loudest one.

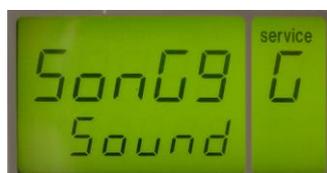
Attention: After all points have been reviewed and/or set up, you have to press shortly the key **Start** to store all parameters. Otherwise the setups were all for nothing. If the storage has been successful in the display „rpm/rcf“ the value of the imbalance sensor and the word „StorE“ are indicated.



2.1.11 Submenu Setup of the signal melody

Here you can setup the melody at the end of the run in case the signal generator is activated.

- Activate the operation menu as described under „Activation of the operation menu (Part 1)“.
- Turn the potentiometer, until the special digit „G“ appears in the service display.



- By pressing the key **RPM/RCF** the display „rpm/rcf“ is now activated and you can setup the respective option with the potentiometer.
- Now the setup melody will be played by the end of the run, whereas you can choose between 0 and 9 setups (anyway 10 melodies).

Attention: After all points have been reviewed and/or set up, you have to press shortly the key **Start** to store all parameters. Otherwise the setups were all for nothing. If the storage has been successful in the display „rpm/rcf“ the value of the imbalance sensor and the word „StorE“ are indicated.



2.1.12 Submenu Check and calibration of the imbalance sensor

Here you can check or re-calibrate the imbalance sensor.

- Activate the operation menu as described under „Activation of the operation menu (Part 1)“.
- Turn the potentiometer, until the special digit „F“ appears in the service display.



- In the bottom line the real current value is indicated. In case this value can be between "105-125" or "62-74", because of the different movement sensors. The upper value should be „C 115“ +/- 2 or at "C 0" + 2.

Attention: This setup should be done by service personnel only.

- If the word „Error“ appears in the display, the imbalance sensor is defective and you have to replace the whole rotary encoder board (mounted on the below side of the motor).



Attention: In case you have to replace the motor or the rotary encoder board for any reason, a new calibration is required **urgently**.

Attention: After all points have been reviewed and/or set up, you have to press shortly the key **Start** to store all parameters. Otherwise the setups were all for nothing. If the storage has been successful in the display „rpm/rcf“ the value of the imbalance sensor and the word „StorE“ are indicated.



2.1.13 Submenu Indication of the imbalance value of the rotor

Here you can read off the imbalance value of the rotor transponder.

- Activate the operation menu as described under „Activation of the operation menu (Part 1)“.
- Turn the potentiometer, until the special digit „Y“ appears in the service display.



- In the bottom line the real imbalance value is indicated. In the top line the rotor number is indicated.

Attention: To get access to this menu and read off the imbalance value, you have to close the lid of the unit before „**Activate the operation menu**“.

2.1.14 Submenu Keyboard test

The keyboard test is used for checking the correct function of the foil keyboard.

- Activate the operation menu as described under „Activation of the operation menu (Part 1)“.
- Turn the potentiometer, until the special digit „P“ appears in the service display.



- By pressing each key the word „PrESS“ switches from the bottom to the top line. The key **Accel/Decel** excluded.

2.1.15 Submenu Indication of the revision number of the control panel

Check of the external imbalance sensor:

Here you can read off the revisions number of the control board. From the revision number 2 and the software version 1.33 on or higher, you have the possibility to check the function of the imbalance sensor.

- Activate the operation menu as described under „Activation of the operation menu (Part 1)“.
- Turn the potentiometer, until the special digit „d“ appears in the service display.



• Example: Revision number 0 without automatical check

Revision number 1 with automatical check (in this case (off))

2.2 Activation of the Service menu (Part 2)

By pressing the key **stop** for longer than one second you will be asked for a code in the display „rpm/rcf“. Adjust the code to **“9876“** by the potentiometer and press once again the key **stop**.



Now you can carry out the below shown adjustments

2.2.1 Submenu Adjustment of the centrifuge type

Here you can adjust the different centrifuge types that are stored on the control board.

- Activate the operation menu as described under „Activation of the operation menu (Part 1)“.
- Activate the service menu as described under „Activation of the service menu (Part 2)“.
- Turn the potentiometer, until the special digit „t“ appears in the service display.

- Examples:



- By pressing the key **RPM/RCF** the display „rpm/rcf“ is now activated and you can setup the respective option either with the potentiometer or by pressing the key **up/down**.

Attention: Please do not adjust any other centrifuge types than the mentioned one on the type label of the unit. Otherwise there may occur defects both in the electronic and the mechanic components.

Attention: After all points have been reviewed and/or set up, you have to press shortly the key **Start** to store all parameters. Otherwise the setups were all for nothing. If the storage has been successful in the display „rpm/rcf“ the value of the imbalance sensor and the word „StorE“ are indicated.



2.2.2 Submenu Adjustment of the operation mode

Here you can adjust the different operation modes stored on the control board.

- Activate the operation menu as described under „Activation of the operation menu (Part 1)“.
- Activate the service menu as described under „Activation of the service menu (Part 2)“.
- Turn the potentiometer, until the special digit „C“ appears in the service display. Do not confuse with „c“ **Submenu Setup of the temperature**.



- By pressing the key **RPM/RCF** the display „rpm/rcf“ is now activated and you can setup the respective option with the potentiometer.
- As we have already mentioned in the beginning this letters will appear when you switch on the unit during the normal operation.

Attention: After all points have been reviewed and/or set up, you have to press shortly the key **Start** to store all parameters. Otherwise the setups were all for nothing. If the storage has been successful in the display „rpm/rcf“ the value of the imbalance sensor and the word „StorE“ are indicated.



2.2.3 Submenu Adjustment/Correction of the imbalance cut off value

You can adjust or correct the imbalance cut off value. In the factory an imbalance cut off value have been setup. With this settled value the unit should run through. Through the transportation or the setup of the unit it may occur that this value will react differently.

In case the unit does already cut off at the adjusted value you can increase this value by adjusting this value > 0. In case the unit does not cut off until you can decrease this value by adjusting this value < 0. The suitable value must be settled by service personnel only.

After the correction there is another check indispensable. You have to make several tests.

- Activate the operation menu as described under 7.3.1 „**Activation of the operation menu (Part 1)**“.
- Activate the operation menu as described under 7.3.2 „**Activation of the service menu (Part 2)**“.
- Press the button "accel/decel" (5). Turn the potentiometer (1) until the special digit „U“ appears in the display "acc/dec" (A-2).



- Press the button "rpm/rcf" (4). The display "rpm/rcf" (A-1) is now activated and you can choose the respective setup between -30 and 20 with the potentiometer (1).

Attention: After all points have been reviewed and/or set up, you have to press shortly the key **Start** to store all parameters. Otherwise the setups were all for nothing. If the storage has been successful in the display „rpm/rcf“ the value of the imbalance sensor and the word „StorE“ are indicated.



2.2.4 Submenu Activating/Deactivating of the electrical Imbalance

Here you can adjust the mechanical imbalance switch (see chapter 3.9), then you have to switch off the electronic movement sensor as follows:

- Activate the operation menu as described under „Activation of the operation menu (Part 1)“.
- Activate the service menu as described under „Activation of the service menu (Part 2)“.
- Turn the potentiometer, until the special digit „C“ appears in the service display. Do not confuse with „c“ Submenu Setup of the temperature.
- Press the key "time" (6). In the display "rpm/rcf" (A-1) the word "b-SEN, AUS" (see figure) is now indicated. **The electronic imbalance detector is now not longer activated!**



- Turn the device off and turn it on again. The word "UA" appears now in the display "time" (A-3), see picture below. Now you can adjust the mechanical imbalance detector, "Adjustment of the mechanical imbalance detector".



3 MAINTENANCE / REPAIR PROCEDURES



WARNING: Electrical shock hazards exist within the housing. The housing should only be opened by authorized and qualified personnel. Remove all power connections to the unit before opening.

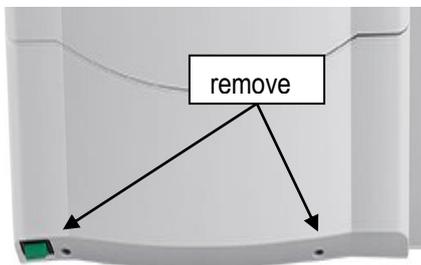


WARNING: After performing any kind of assembling work, please make sure all the grounded contacts are connected correctly!

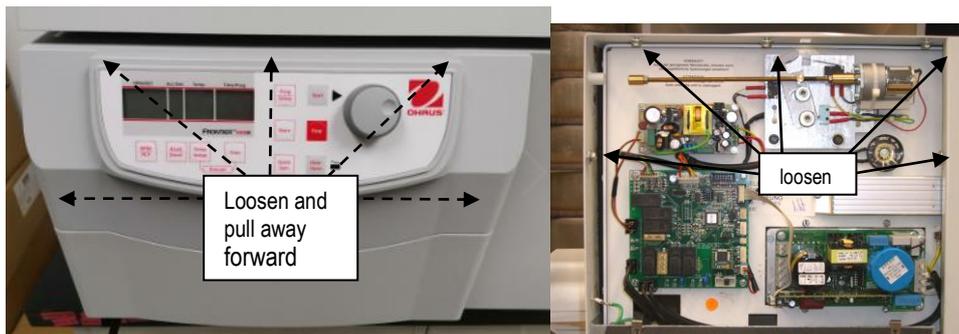
3.1 Replacing the front housing, the incremental shaft encoder, the display and the foil keyboard

Replacing the front housing

- Remove the lower covering by turn out the 2 screws.



- Pull the lower edge of the covering away from the mounting plate.
- Pull the covering out of the upper guiding rail.
- Loosen the 5 screws under the control panel and pull away the panel forward.



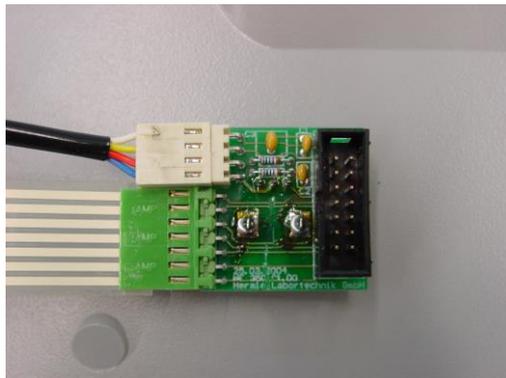
- Remove the interface cable on the control board.

Replacing the incremental shaft encoder

- Remove the cap on top of the incremental shaft encoder.
- With a socket wrench you can loosen the fastening nut, now.

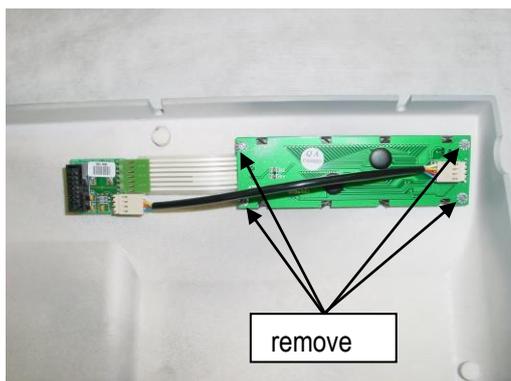


- Loosen all electrical contacts to the shaft encoder on the back of the front housing.



Replacing the display

- Loosen all electrical contacts to the display on the back of the front housing.
- Remove the 4 fastening screws of the display and pull away the display upwards.

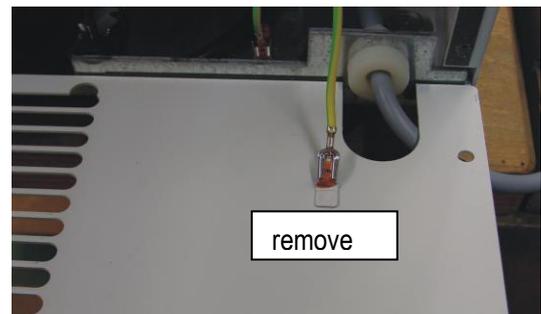
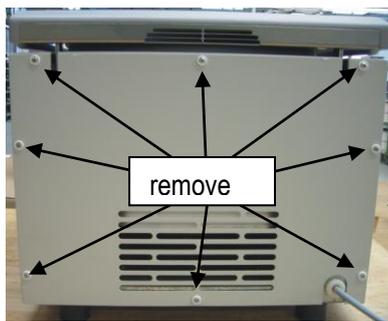


Replacing the foil keyboard

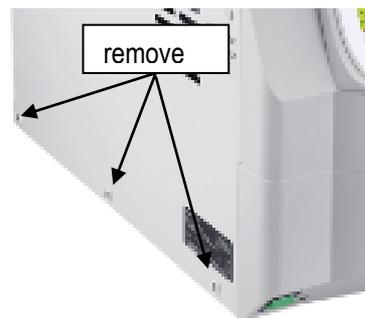
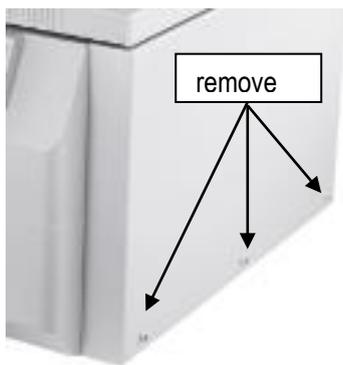
- Remove the incremental shaft encoder and the display.
- Peel off the defective foil keyboard and clean the remaining glued joints.
- Glue the new foil keyboard precisely in the recess.
Make sure the foil matches precisely and the window of the foil keyboard lies exactly over the display.
- Re-assemble the control panel in reversed order and mount it back in the front housing.

3.2 Removing the housing and the lid gasket GLUED

- Remove the control panel as described in chapter 3.1.
- Remove the back wall plate and its electrical earthing.



- Remove all screws at the lower side of the housing and its electrical earthing.

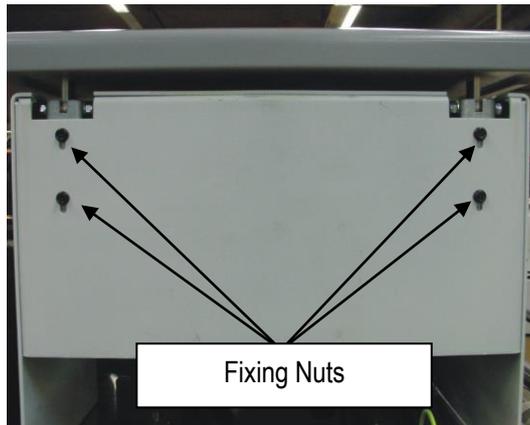


- Remove the housing upwards.
- Re-assemble the unit in reverse order.
- Take care that the fixing ends are at the back part of the chamber. Start the mounting always with this glued ends. You can use a small Allan key. Push it between sealing and rotor chamber. Pull the sealing in a circular movement towards the chamber's center.



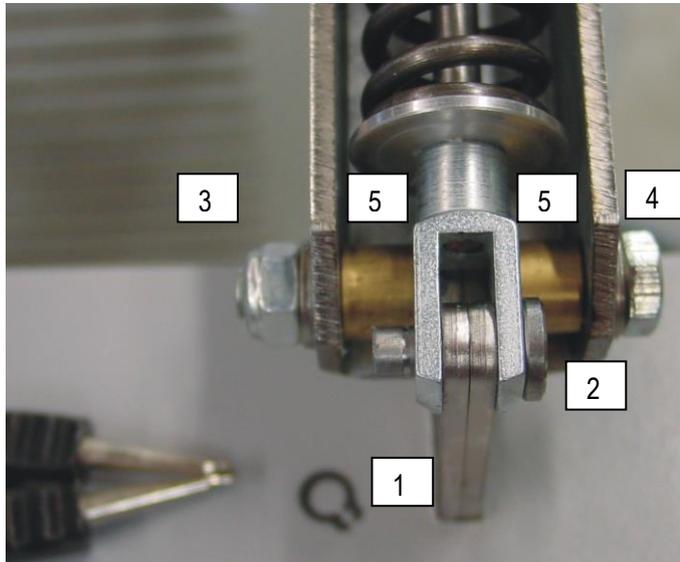
3.3 Removing the lid

- Remove the control panel and housing as described in chapter 3.1 and 3.2.
- Open the lid as wide as possible.
- Hold the lid with one hand and remove the fixing nuts of the hinges.
- The lid can now be removed completely.



3.4 Removing the hinges

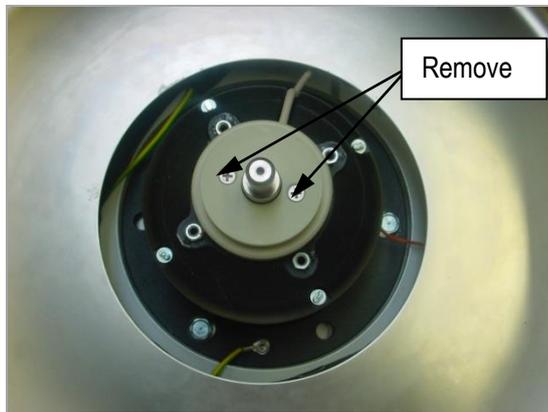
- Remove the retaining ring (1) at the hinge bolt (2) and push it out.
- Loosen the looking nut (3) end remove the screw (4) and the sleeves (5).



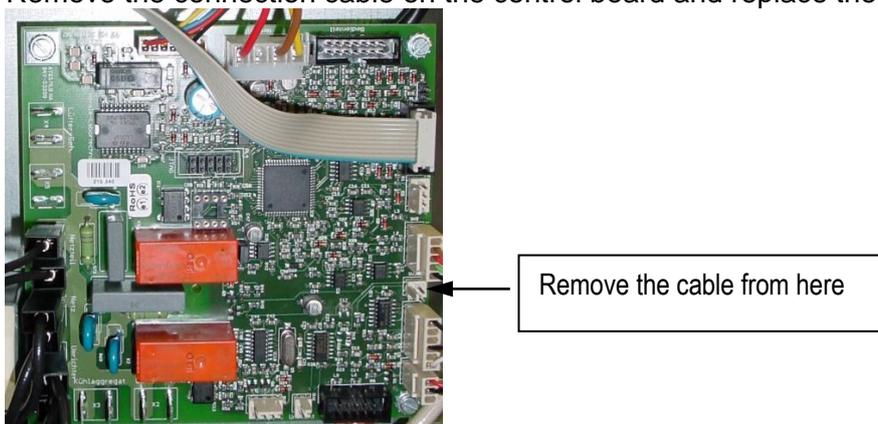
- Re-assemble the lid in reverse order. Please use a new looking nut (3).
- Make sure the lid rests on the lid gasket straight and continuous. Tighten the fastening screws firmly after the adjustment.

3.5 Replacing the motor and the Rotor Sensor

- Remove the screws of the motor covering.
- Remove the screws of the Rotor Sensor.



- Remove the lower covering of the front housing as described in chapter 3.1.
- Remove the connection cable on the control board and replace the Rotor Sensor.

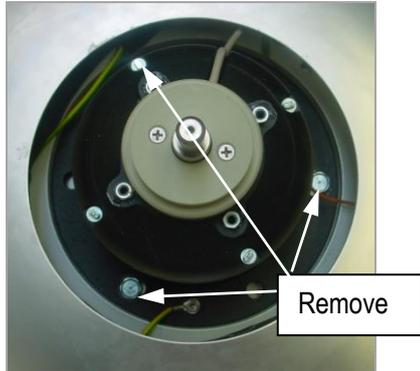


- Re-assemble the unit in reverse order.

Replacing the motor

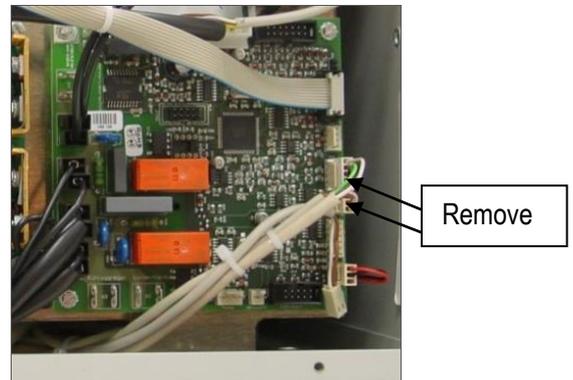
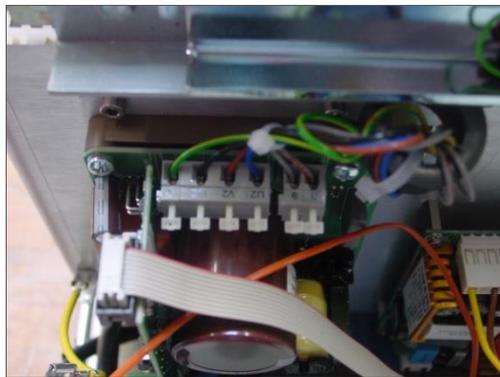
- Remove the front cover as described in chapter 3.1.
- Remove the Rotor sensor as described 3.5.

- Remove the ground cable from the ground plate
- Remove the screws of the motor fixing



- Remove the connection cables leading to the motor on the control board and on the frequency converter.

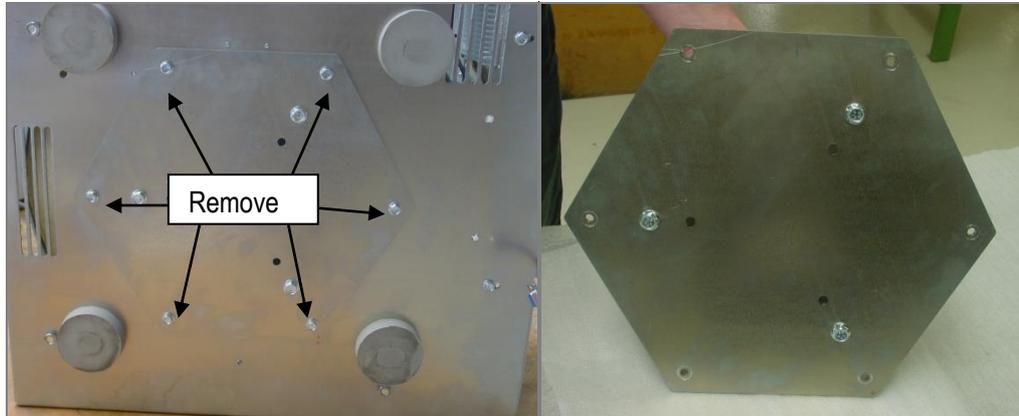
- 1.) Motor temperature on the frequency converter
- 2.) Current supply motor on the frequency converter
 - a.) U2 = black
 - b.) V2 = brown
 - c.) W2 = blue
 - d.) δ = motor temperature
 - e.) Grounding = yellow/green
- 3.) Speed and imbalance sensor on the control board



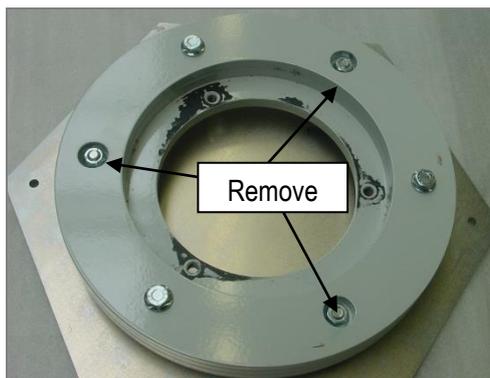
- Lift the motor out of the unit
- When re-assembling the spare motor, take care of the wirings, as they must not be jammed.
- When tightening the motor mount screws, please pay attention the motor rubber mounts are not being twisted.
- When connecting the motor with the electricity, take care of the rotating direction (Direction of arrow).
- Re-assemble the unit in reverse order.

Replacing the motor rubber mounts

- Remove the motor as described above.
- Tip the device carefully on a soft surface to the back and remove the six screws of the ground plate



- Remove the hexagonal metal plate and place it on a soft grounding.



- Remove the screws of the motor rubber bearings.
- Put in the new motor rubber mounts and reassemble the unit in reverse order.

ATTENTION: Please take care after tipping and put back the unit on the feet that the unit will be switched off for approx. 90 minutes, so that the oil in the compressor can depose again.

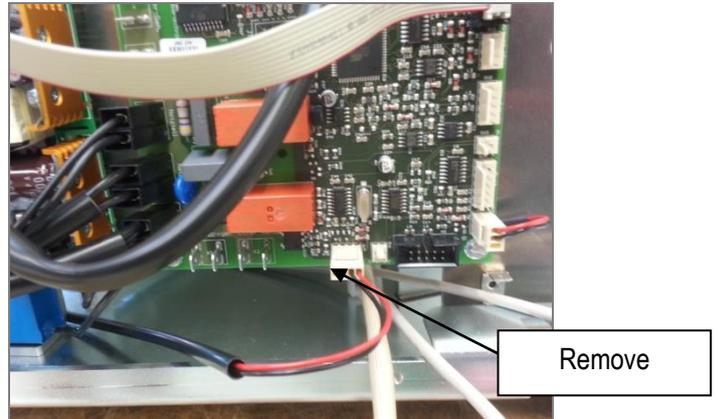
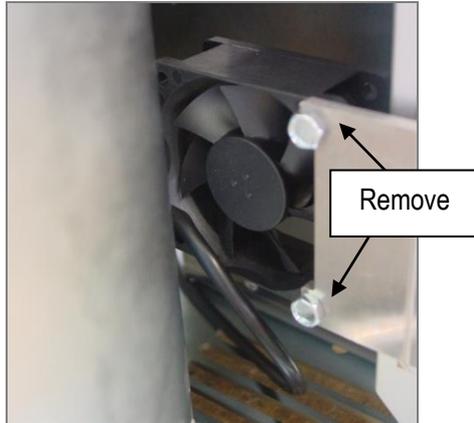
- Take care that the motor is placed straight and centered in the rotor chamber. The distance of the center of the motor shaft to the wall of the rotor chamber must be strictly adhered. When tightening the motor rubber mounts, also take care that they are not being twisted.

ATTENTION: After place the new motor please look into chapter 2.2.4

3.6 Replacing the fan

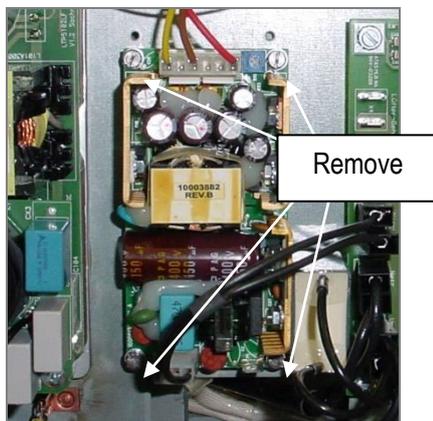
- Remove the front cover as described in chapter 3.1.
- Remove the housing as described in chapter 3.2.
- On the back of the electronic mounting plate is the fan placed. Remove the cable connection to the power board.

- Remove the fixing screws of the fan and remove it.
- Replace the fan and connect the wires. Reassemble the unit in reverse order.



3.7 Replacing the power board

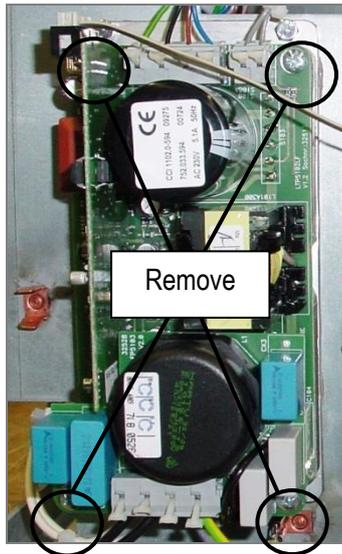
- Remove the front cover as described in chapter 3.1.
- Remove all cable connections to the power board.
- Remove screws 1-4 (see figure).



- Re-assemble the unit in reverse order.

3.8 Replacing the frequency converter

- Remove the lower covering of the front housing as described in chapter 3.1.
- Remove all cable connections to the frequency converter.
- Remove screws and remove the frequency converter from the unit



- ATTENTION: Before placing a new converter into the unit, put some heat conducting paste onto the fixing surface.
- Re-assemble the unit in reverse order.

3.9 Checkup the imbalance sensor

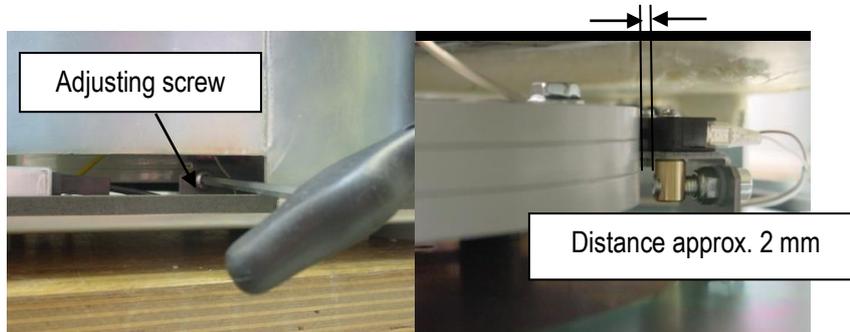
- From software version 1.60 it is possible to adjust/correct the imbalance value.
- Should appear any difficulties with the imbalance, please give us an exact description of it as well as the serial number of the unit and the rotor type.
- You can check up the imbalance sensor with the operation menu.

Replacing the imbalance and speed sensor

- Remove the lower covering of the front housing as described in chapter 2.1.
- Remove the motor as described in chapter 3.4.
- Lay the motor down on its side and remove the two fixing screws of the green circuit board on the rear side.
- Replace the board and re-assemble the unit in reverse order.

**Mechanic micro switch:
Replacing the imbalance micro switch**

- Remove the front cover as described in chapter 3.1.
- Remove the housing.
- Remove all defective parts as imbalance micro switch, angles or spring plates.
- Adjust the imbalance micro switch



Adjustment of the imbalance micro switch

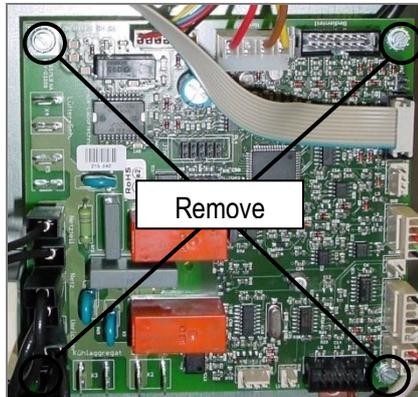
- Shut off the movement sensor first.
- Put a rotor into the unit and fasten the rotor nut.
- Load one hole of the rotor with the listed imbalance shut off weight.
- Adjust the acceleration- (accel) and the deceleration level (decel) on the control board to level imbalance switch
- Start the centrifuge. The unit must shut off when reaching the listed speed of the resp. rotor
- In case the unit does not shut off you have to loosen the fixing screws of the imbalance sensor. Adjust the imbalance sensor more sensitive with the adjusting screw (left turn, minus direction).



- Repeat those steps as often as the listed value of the imbalance shut-off table is reached.
- Switch off the unit with error message 01 and fill the rotor with the permitted imbalance weight.
- The unit must not shut off after the start. In case the unit shuts off, you have to lower the sensibility of the sensor.
- In case you have to readjust the imbalance sensor when testing the permitted imbalance weight, you have to repeat the procedure with the imbalance shut off.
- Turn the unit off and on -> the movement sensor is turned on again.

3.10 Replacing the control board

- Remove the front cover as described in chapter 3.1.
- Remove all electrical connections on the control board.
- Remove the 4 screws and remove the control board out of the unit.



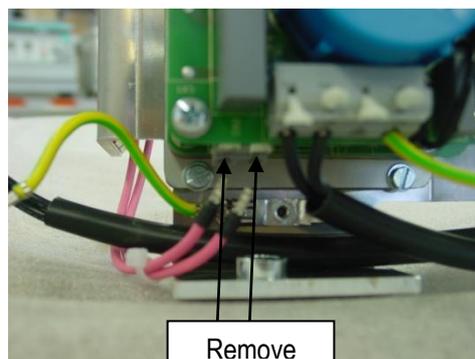
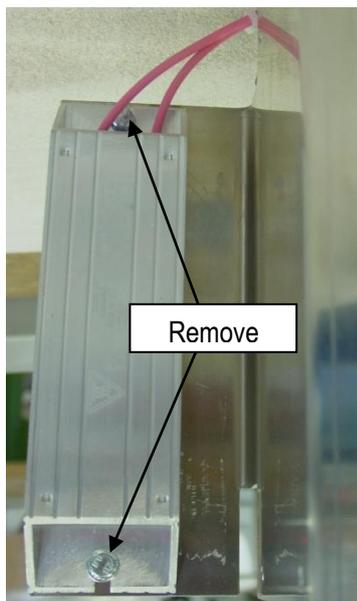
- Put in the new control board, plug in all electrical connections and re-assemble the unit in reverse order.

ATTENTION:

In case of replacing the control board you have to adjust the unit.

3.11 Replacing the break resistor

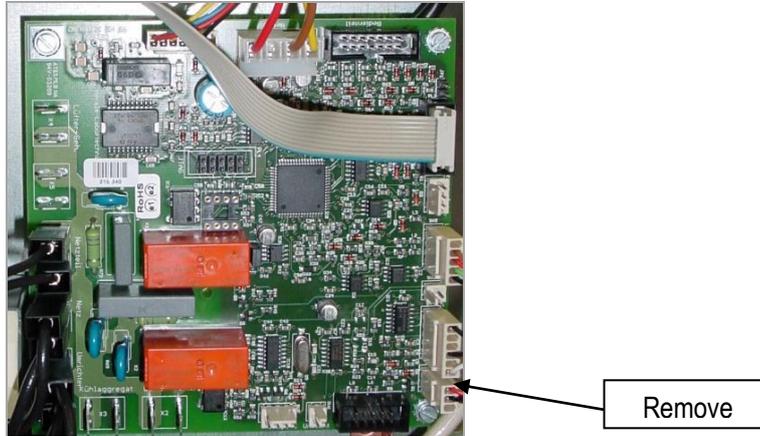
- Remove the front cover as described in chapter 3.1.
- Remove the housing as described in chapter 3.2.
- Remove all electrical connections on the frequency converter.
- Remove the screws and remove the break resistor.



- Put in the new break resistor, plug in all electrical connections and re-assemble the unit in reverse order.

3.12 Replacing the the loudspeaker

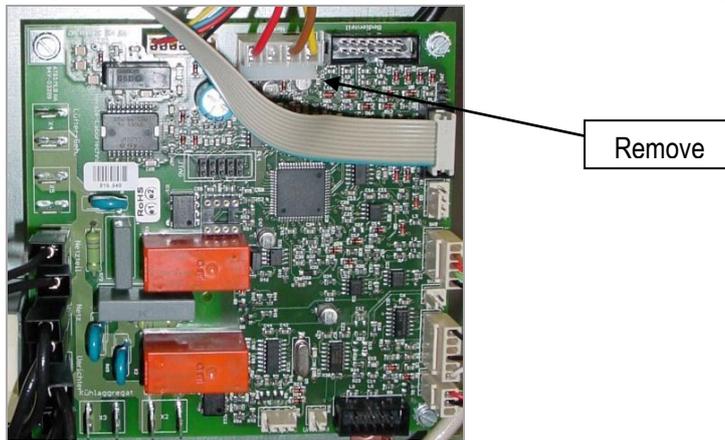
- Remove the front cover as described in chapter 3.1.
- Remove all electrical connections on the control board



- Go with a flat, sharp item (knife or screwdriver) under the signal transmitter and lift it up with slight efforts.
- Fix the new signal transmitter with double-sided adhesive tape and re-assemble the unit in reverse order.

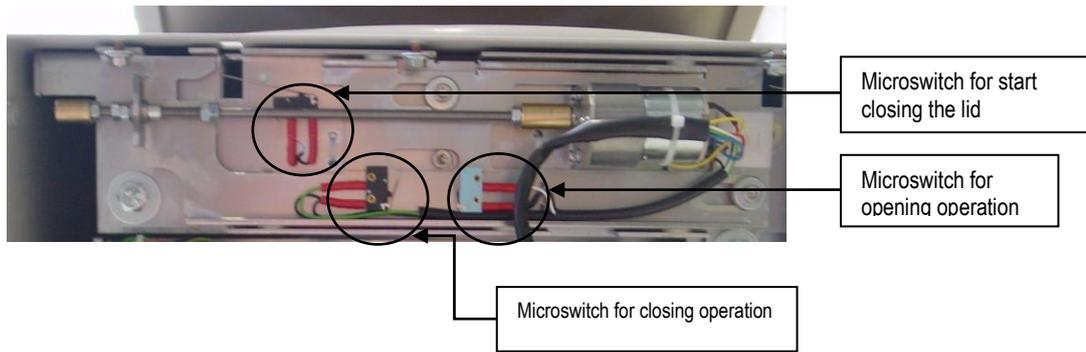
3.13 Replacing/ Adjustment of the lid lock

- Remove the front cover as described in chapter 3.1.
- Remove all electrical connections on the control board



- Remove the fixing screws and put in the new lid lock.





- Keep attention through adjustment of the lid lock, that the lid lies straight and continuous on the lid sealing. After adjustment tighten the screw well.

Adjustment:

- 1.) Lay the lid onto the centrifuges seal. Afterwards tighten the screws of the hinges under a little pressure onto the lid.
- 2.) Put some washers underneath of the lid lock, in that way that the lid latch is centric to the closing bar.
- 3.) Adjust the high of the lid lock, that the distance between the lid up to the housing is about 4 mm.
- 4.) Bent the steel nib of the upper micro switch in that way, that it is given the signal after the lid latch has pressed the steel nib under the level of the bar. The motor of the lid lock should not be blocked during the closing of the lock. Otherwise you have to repeat the steps 3.) and 4.).
- 5.) Perhaps you have to bent the steel nibs of the other micro switches of the end stops into their position.
- 6.) Tighten all the screws well.

3.14 Replacing the temperature sensor (FC5916R only)

- Remove the front cover as described in chapter 3.1.
- Remove the electrical supply on the control board.



- Remove the motor rubber covering by pulling it out simply.



- Pull out the temperature sensor from the rubber motor cover. Hold therefore the underneath rubber nose, which held the sensor housing in its position. Press afterwards the rubber nose together and push it towards the hole.
- Reassemble the unit in reverse order.

3.15 Refrigeration system (FC5916R only)



CAUTION: Only certified/qualified service personal should be performing the repair and service of the refrigeration system.

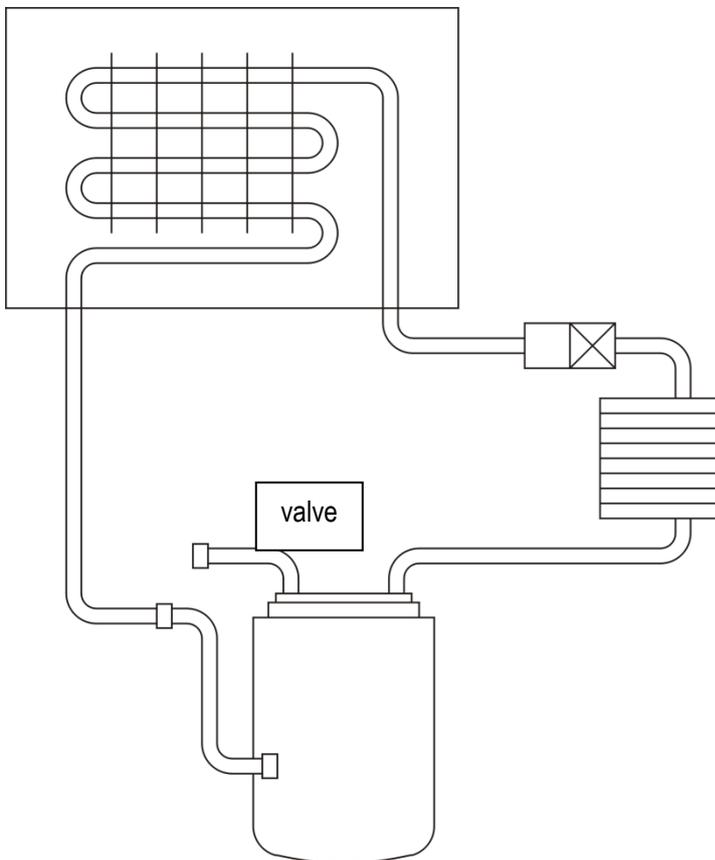
Functional description of the refrigeration system

The expansion valve regulates how much refrigerant is being led to the evaporator. The compressor makes the refrigerant available in the collective dryer. A sensor is continuously measuring the temperature at the evaporator output. Through this, the injection nozzle of the expansion valve is controlled and the evaporator is supplied with the max. necessary amount of refrigerant. Therefore, maximum capability of the refrigeration system can be reached at any status of operation. As soon as the required pre-set temperature is reached, the compressor will switch off. When the temperature rises again, the compressor will switch on again.

The response time of the compressor is controlled with a microprocessor control. The processor receives the chamber temperature data through a temperature sensor placed in the rotor chamber. As the actual sample temperature may not be identical to the temperature measured in the rotor chamber, the micro processor will calculate the sample temperature for the rotor in use. This temperature value is indicated in the temperature display.

The temperature adjustment of the micro processor is based on this calculated temperature value. Therefore, the user always gets the exactly requested sample temperature ($\pm 1^{\circ}\text{C}$). The samples are not being damaged through over or lower temperature.

Refrigeration scheme



Emptying and filling the refrigeration system (refrigerant R 452a)

For this performance you need a refrigerant suction plant with container, a vacuum pump, a vacuum measuring device, a measuring device for refrigerants and a manometer combination.

The refrigeration system has the CFC-free refrigerant type R 452 a.

Emptying the refrigeration system:

- Remove the housing, until the refrigeration set is exposed.
- Connect the suction plant to the valve.
- Remove the refrigerant from the system.
- You can now perform necessary repairs.

Filling the refrigeration system:

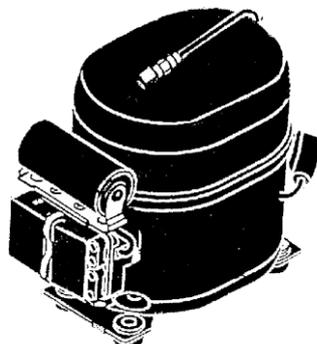
- Connect the vacuum pump, the manometer combination and the refrigerant bottle (R 452 a) to the valve.

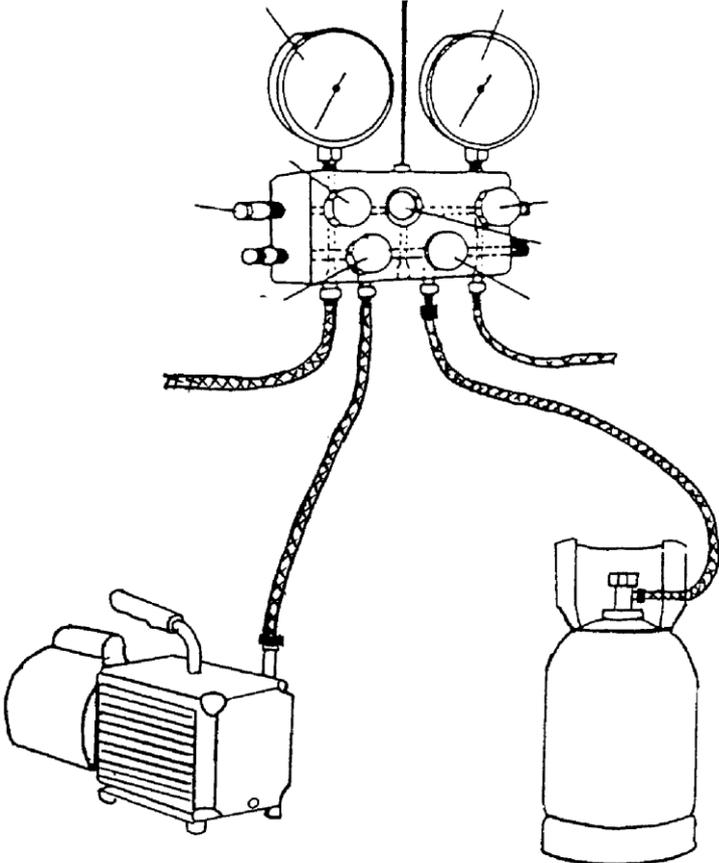


The picture is just symbolic, it is not for the model FC 5916 R!

- Evacuate the refrigeration system for approx. 30 min.
- Switch off the vacuum pump.
- Make sure that the reached vacuum stays constant after switching the pump off, otherwise the system is leaky.
- Fill the refrigeration set with **540 g** refrigerant type R 452 a.
- Check all tube connections with a leakage detection device for possible leakage.

ATTENTION: You must use refrigerant type R 452 a only!
Filling amount is 540 g!





4 TROUBLE SHOOTING

4.1 Error messages: Cause / Solution

Preface:

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

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

Always, please keep us informed about any kind of error occurring, which is not listed in this chapter. Only through your information we are able to improve and complete this instruction manual.

Many thanks in advance for your support.

OHAUS Corporation

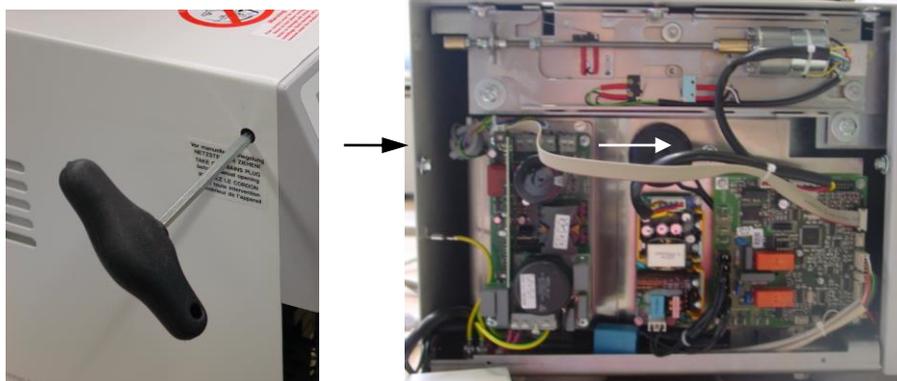
4.2 Survey of possible error messages and their solutions

4.2.1 Lid release during power failure (Emergency Lid Release)

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

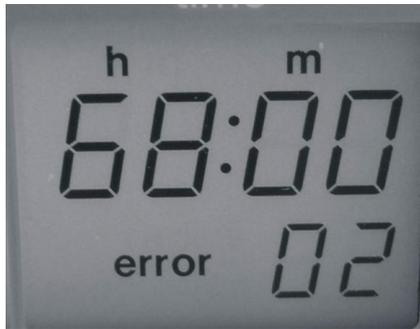
Please proceed as follows:

- Switch the centrifuge off and unplug the power cord.
- At the left side of the centrifuge there is a plastic stopper.
- Remove this stopper. Behind it there is a hexagon nut.
- Take the delivered box spanner, put him in the hole and lock the box spanner with the hexagon nut.
- Now turn the box spanner to the right side (clockwise) up to the limit.
ATTENTION: Just turn to the limit, don't tighten the nut.
- Now open the lid of the centrifuge.
- Turn the hexagon nut back to its position.
- Switch the centrifuge on again, for go on working.



4.2.2 Description of the error message system

The error message is shown in the "Time/Prog" display. At the same time the word "error 02" is indicated in the display.



4.2.3 Errors that may be indicated in the LCD display

| Error No. | Description | Cause |
|-----------|--|---|
| 01 | Imbalance arose | Excessive acceleration at the sensor |
| 02 | Imbalance sensor is defective | Rotary encoder circuit board is defective, cable break, plug is loose (between control unit to frequency converter), control unit is defective. From control revision no.2 it may also be the power supply or the four-pole connection cable to the defective control unit. |
| 04 | Imbalance switch has been activated for longer than 5 seconds | Imbalance switch incorrectly adjusted, imbalance switch is defective, cable break, plug is loose (between control unit to frequency converter), control unit is defective |
| 08 | Transponder in the rotor is defective or incorrect/missing data in the rotor database | The transponder in the rotor disk has a fault in memory. It can also be an error in the memory of the microcontroller. |
| 14 | Problem with the speed sensor. Lid is closed for a certain time. The blocking time is shown in the display and replaced with "CLOSE Lid". (From 10.06.09 Version 1.33) | Rotary encoder circuit board is defective, cable break, plug is loosen (between control unit to frequency converter), motor is blocked, control unit is defective, frequency converter is defective. |
| 33 | Open lid while rotor is running | Lid has been opened during rotating with the emergency release, control switch of the lid lock is defective, cable break, plug is loosen (between control unit to frequency converter), control is defective. |
| 34 | Lid contact defective | Control switch of the lid lock is defective |
| 38 | Lid motor is blocked | Control switch of the lid lock is defective |
| 40 | Communication with frequency converter disturbed during start | At revision no.1 it could be, that the frequency relay is defective, cable break, plug is loosen (between control to frequency converter), |

| | | |
|----------|--|--|
| | (Position request not understood at the start) | frequency converter is defective, control unit is defective. |
| 41 | Communication with frequency converter disturbed during stop (Position request not understood at the stop) | At revision no.1 it could be, that the frequency relay is defective, cable break, plug is loosen (between control board to frequency converter), frequency converter is defective, control is defective |
| 42 | Short circuit in the frequency converter | Frequency converter defective, motor defective |
| 43 | Under voltage frequency converter | Brief power failure, At revision no.1 it could be, that the frequency relay is defective, cable break, plug is loosen (between control board to frequency converter) |
| 44 | Over voltage frequency converter | Break resistant is defective, the rotor is braked to strong |
| 45 | Over temperature frequency converter | Motor runs hard, ventilation is defective, frequency converter is not cooled enough |
| 46 | Over temperature motor | Motor runs hard, ventilation is defective |
| 47 | Over current frequency converter | Frequency converter is defective, motor is defective |
| 48 | Timeout between control unit and frequency converter | Software of the unit has a black out |
| 49 | Other error frequency converter | Summary of very specific error, which should normally not occur. (No release, internal timing error, system error, reset by watch dog, start a trial with direction of rotation error, program memory CRC error) |
| 55 | Overspeed | Transmission error, firmware error, frequency converter us defective. |
| 70 | Timeout at control unit through the RS232 interface | RS232 connection is interrupted. |
| 99 | Rotor is not allowed in this centrifuge | The number of the inserted rotor does not exist in the data record of the software. |
| rotor no | No rotor detected | It was no rotor installed. Transponder in the rotor is defective or missing, antenna defective, cable break, plug is loosen, control board defective. In rare cases a transponder-antenna combination can cause a reduce range, that a conversation can't occur. |
| FALSE | The rotor, which is stored in the program, does not match with the inserted rotor. | There was chosen a program, in which a certain rotor is stored, but the inserted rotor is another one. |

5 MAINTENANCE

5.1 Service and maintenance

5.1.1 Maintenance and cleaning

Maintenance:

Maintenance of the centrifuge is confined to keeping the rotor, the rotor chamber and the rotor accessories clean as well as to regularly lubricating the rotor insert bolts of a swing out rotor (if available).

Vaseline, available in nearly each store, is the most suitable lubricant. The Vaseline must be free of resin and acids. Lubricants containing molybdate and graphite are not allowed.

Please pay special attention to anodized aluminium parts. Breakage of rotors can be caused even by slightest damages.

In case of rotors, buckets or tube racks getting in touch with corrosive substances the concerned spots have to be cleaned carefully.

Corrosive substances are for instance:

- Alkalis
- Alkaline soap solutions
- Alkaline amines
- Concentrated acids
- Solutions containing heavy metals
- Water-free chlorinated solvents
- Saline solutions, e.g. salt water
- Phenol
- Halogenated hydrocarbons



Cleaning – units, rotors, accessories:

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



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

- Connect the unit to the power supply, after the equipment is completely dry.
- Do not carry out disinfection with UV-, beta- and gamma-rays or other high energy radiation.
- Metal rotors can be autoclaved.
- Rotor lid and adapters can also be autoclaved (max. 121°C, 20 min).
- The tube racks are made of PP and can **not** be autoclaved at 134°C.

5.1.2 Cleaning and disinfection of the unit

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



Attention: Remove at least every six months adherent dust from the ventilation slots in the centrifuge by using a brush.

5.1.3 Cleaning and disinfection of the rotor

1. Clean and disinfect the rotors, rotor lids and adapters with the above mentioned cleaner.
2. Use a bottle brush to clean and disinfect the rotor bores.
3. Rotoren, Rotordeckel und Adapter gründlich mit Wasser abspülen. Besonders die Rotorbohrungen von Festwinkelrotoren beachten.
4. For drying of the rotors and accessories set them on a towel. Place the angle rotors with bores down, to dry them to.
5. Dry the rotor cone with a soft, dry and lint-free cloth and look for damage. Do not grease the rotor cone.
6. Place the dry motor onto the motor shaft.
7. Pull the rotor nut tight by using the rotor-key.

5.1.4 Disinfection of aluminium-rotors

In case of infectious material spilling into the centrifuge, the rotor and rotor chamber have to be disinfected right after the run. Rotors may be autoclaved at a maximum temperature of 121°C.

5.1.5 Disinfection of PP-rotors

Autoclaving

The recommended time for autoclaving: 15 – 20 min at 121°C (1 bar)

 **Attention: The sterilization time of 20 min. must not be exceeded. Sterilization again and again will cause reduction of the mechanical resistance of the plastic material**

Before the autoclaving the PP-rotor and adapter must thoroughly be cleaned to avoid the burning in of dirty residues.

You can disregard the consequences of some chemical residues to plastic materials at ambient temperatures. But at the high temperatures of the autoclaving those residues may corrode and destroy the plastic. The objects must be thoroughly washed up with distilled water after the cleaning but before the autoclaving. Residues of any cleaning liquids may cause fissures, whitening and stains.

Gassterilization

Boxes, bottles and rotors may be gassterilized with Ethylenoxyd. According to the duration of the application you may give long enough an airing to the items after the sterilization and before using them again.

 **Attention: Because the temperature may rise during the sterilization, rotors, boxes and bottles must not be closed respectively must be totally unscrewed**

Chemical sterilization

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

 **Attention: Before applying any other cleaning resp. Decontamination method than recommended by the manufacturer, contact the manufacturer to ensure that it will not damage the unit or the rotor.**

5.1.6 Glass breakage

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

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

 **Attention: Please check the relevant specifications of the tubes centrifuges with the manufacturer!**

5.1.7 Lifetime of rotors, round and rectangular buckets, accessories

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

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

Condition for the operating life:

Proper use, damage-free condition, recommended care.



Ohaus Corporation
7 Campus Drive
Suite 310
Parsippany, NJ 07054 USA
Tel: +1 (973) 377-9000
Fax: +1 (973) 944-7177
With offices worldwide

www.ohaus.com



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