

Repair instructions

EBA 21



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1 Introduction

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



Interventions and modifications at centrifuges, which have been conducted by persons not authorized by the HETTICH company, are at their own risk and entail the loss of all guarantee and liability claims. In such an event any guarantee claim or liability claim against the HETTICH company expires.

- Only original spare parts and original accessories licensed by the Hettich company are allowed to be utilised.



If no original spare parts or no original accessories are used, any guarantee claim or liability claim against the HETTICH company ceases to exist.

- Information about the operation of the centrifuge please see operating instructions.
- We reserve all rights for these technical documents.

2 Symbol meanings



Symbol on the machine:

Attention, general hazard area.

Before using the centrifuge implicitly read the operating instructions and pay attention to the safety relevant references!



Symbol in the repair instructions:

Attention, general hazard area.

This symbol refers to safety relevant warnings and indicates possibly dangerous situations.

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



Warning! Danger for human lives by electric shock.



This symbol refers to important circumstances.



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

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

3 Description of the centrifuge

These microprocessor controlled centrifuges mainly consist of the following electrical components:

- Control panel, microprocessor controlled
- Supply board
- Frequency converter with braking chopper (motor control), microprocessor controlled
- Motor with speed sensor (speedometer) and imbalance switch
- Brake resistor
- Lid lock

3.1 Control panel (A4)

The control panel is the brain or the master of the centrifuge. This MASTER controls its SLAVE via a serial data bus system. This SLAVE is the following component:

- frequency converter

The control panel carries out the following tasks:

- Managing operator entries and controlling the LCD display
- Saving of 3 run programs
- Controlling the components:
 - frequency converter via the release line and the serial interface
- Evaluating the speed sensor (speedometer)
- Evaluating the imbalance switch
- Evaluating the frequency converter error message line
- Evaluating the message line lid lock open/closed
- Triggering the relay for the lid lock solenoid when the rotor has standstill
- Type of serial interface:
 - 5 Volt interface with three wires (16-pole flat ribbon cable, pole 6, 8 and 11)
- The voltage supply for the control panel is provided by the supply board via the flat ribbon cable:
 - + 10...15 Volt pole 1, 2
 - GND pole 15, 16

3.2 Supply board (A1)

The supply board carries out the following tasks:

- Current supply 12 V DC and 5 V DC for the supply board
- Current supply 12 V DC for the control panel
- Slot X5 for message line lid lock open/closed. Transmission of the signal to the control panel via opto-coupler.
- Voltage supply for the speed sensor (speedometer)
- Slot for speed sensor cable and transmission of the speed pulses to the control panel and to the frequency converter
- Triggering the relay for the lid lock solenoid when the rotor has standstill
- Slot for imbalance switch and direct transmission of the imbalance signal to the control panel

- The 5 Volt interface with three wires is transferred to a RS 485 interface with two wires.
Interface for the frequency converter: RS 485 interface via two wires
- Transmitting the main enable signal (= Hardware STOP) control panel ⇒ frequency converter
- Transmitting the error line (= FC-ERROR) frequency converter ⇒ control panel

3.3 Frequency converter (A2)

The frequency converter carries out the following tasks:

- Generating the motor current supply
(three-phase current with variable frequency and voltage)
Functional description: The supply voltage is rectified, smoothed and chopped into a pulse width pattern in three bridge elements with a microprocessor.
- Monitoring the motor current
- Evaluating the overtemperature switch in the motor (only 115V version)
- The braking chopper transfers the electrical energy produced during braking, in the 230 V version from a voltage of approx. 390 Volt and in the 115 V version from a voltage of approx. 200 Volt, to the brake resistor in a controlled manner.
- SLAVE behaviour (the requests and commands of the control panel are transmitted via the serial interface):
RS 485 Volt interface with two wires
(10-pole flat ribbon cable, pole 3 and 5)
- Evaluating the main enable signal (= Hardware STOP) for the frequency converter
(10-pole flat ribbon cable, pole 7)
- Evaluating possible errors and handling the error line (= FC-ERROR)
(10-pole flat ribbon cable, pole 4)
- The following are defined by the control panel via the serial interface:
 - Speed
 - Starting and brake levels
 - Control commands START, BRAKE, STOP
- LED status displays:

In the standby status	the green LED illuminates
In the run status	the green LED illuminates
In the error status	the green LED flashes

If the frequency converter processor detects an error, it switches off automatically and sets the error line (FC-ERROR). Then the control panel inquires the type of error via the serial interface.

3.4 Special features

- Multiprocessor concept:
If a processor stops working, the other processor still continue monitoring its area. If there is a control panel failure, the frequency converter automatically switches off the drive if no inquiries are made via the interface for longer than 60 seconds.
- Interface concept:
The information transmission is monitored with an additional check sum.
- Hardware concept:
All safety related switches are break contacts. This also ensures that loose contacts and cable rupture can be detected.

3.5 Brake resistor (R1)

- An overtemperature fuse protects the brake resistor against fire. If the braking chopper has a short circuit, the brake resistor becomes hot due to the high current, and the overtemperature fuse cuts off the frequency converter from the mains supply.

3.6 Motor / tacho system

- The motor is a three-phase asynchronous motor with two pairs of poles.
- A speed sensor (speedometer) which is screwed onto the motor receives
 - the rotor code information and
 - the speed information (6 pulses per revolution)from the magnets of the tacho ring attached to the rotor.
- The control panel monitors and regulates the ACTUAL speed.
 - Double safety: In addition, the frequency converter has been programmed in such a way that it is not possible to set a speed value which is higher than the permissible rotor speed. The frequency converter monitors the speed and switches off the drive at excess speed (error message "ERROR 84").
- The control panel monitors the rotor standstill.
 - The lid can only be opened when the control panel has detected standstill.

3.7 Lid lock

- Opening of the lid lock is prevented by a latch. The lid lock can only be opened when the relay on the supply board is energized by the control panel. This occurs when the rotor is at standstill and mains power is applied. A solenoid is energized and releases the latch.
- The centrifuge can only be started when the lid is closed. A microswitch on the lid lock detects the position of the lid lock.

3.8 Imbalance switch

- A switch (break contact) detects imbalance.
- Imbalance is detected only in running mode (starting, centrifuging and braking).
- If imbalance is detected, the drive is brought to a standstill.

3.9 Safety devices

- Mains input ⇒ Mains fuses
- Radio interference suppression filter ⇒ between supply board and frequency converter
- Frequency converter ⇒ electronically protected
- Motor ⇒ overtemperature switch > 135 °C

4 Troubleshooting procedures

- Fuses in installation in which centrifuge is installed are intact.
- Mains input fuses of centrifuge are intact.
- Supply voltage present at (see circuit diagram):
 - Connecting cable
 - Appliance plug
 - Mains switch
 - Supply board, plug X5 (pin 1, pin 5)
- Look for the displayed error code in the chapter "Error messages".
- Remedy the error according to the instructions.
- Carry out a functional check after every repair and whenever a component is replaced, see chapter "Functional check after a repair".

5 Error messages

5.1 MAINS RESET

- Switch off the mains switch.
- Wait for 10 seconds and then switch on the mains switch again.

5.2 Brief description

Error designation	No.	Brief description	Page
TACHO-ERROR	01	Speedometer pulses break down during rotation	12
TACHO-ERROR	02	No speedometer pulses after start command	12
IMBALANCE	(03)*	Imbalance on motor axle	13
CONTROL-ERROR	04	Lid lock error, lid opened without recognizing that motor had stopped	13
N > MAX	05	Excessive speed error, 250 RPM above n-max of rotor	14
ROTORCODE	10	Invalid rotor code	14
MAINS INTERRUPT	(11)*	Mains interruption	14
VERSION-ERROR	12	Error in initialization	15
N < MIN	13	Speed error, slippage is too great	15
CONTROL-ERROR	21	Control panel – error: speed	15
CONTROL-ERROR	22	Control panel – error: I ² C bus	15
CONTROL-ERROR	23	Control panel – error: display memory	15
CONTROL-ERROR	24	Control panel – error: clock timeout	15
CONTROL-ERROR	25	Control panel – error: EEPROM	15
CONTROL-ERROR	26	Control panel – error: driver defective	15
N > ROTOR-MAX	---	Control panel – error: nominal speed is higher than permitted rotor speed or nominal RCF is higher than permitted rotor RCF	16

* Error number will not be displayed

Error designation	No.	Brief description	Page
SER I/O-ERROR	30	No connection between control panel and serial interface	16
SER I/O-ERROR	31	No connection between frequency converter and serial interface	16
SER I/O-ERROR	33	Data incorrectly transmitted from the componentry	16
SER I/O-ERROR	34	Data incorrectly transmitted between control panel and frequency converter	17
SER I/O-ERROR	36	No acknowledgement (NAK) from frequency converter to control panel	17
FU/CCI-ERROR	60	Faulty release signal to frequency converter	17
FU/CCI-ERROR	61	Frequency converter - error: computing section	18
FU/CCI-ERROR	62	Frequency converter - error: undervoltage	18
FU/CCI-ERROR	63	Frequency converter - error: overcurrent	18
FU/CCI-ERROR	64	Frequency converter - error: overvoltage	19
FU/CCI-ERROR	67	Frequency converter - error: overtemperature in motor (only 115V)	19
FU/CCI-ERROR	68	Frequency converter - error: overtemperature in frequency converter	19
FU/CCI-ERROR	69	Frequency converter - error: EEPROM	19
FU/CCI-ERROR	84	Frequency converter - error: Frequency converter recognizes excess speed	20
FU/CCI-ERROR	85	Frequency converter - error: "Watchdog" in frequency converter had triggered	20

5.3 Description and elimination of errors

TACHO - ERROR 01

Error	During centrifugation the speedometer pulses are interrupted.
Error consequence	The rotor slows down until it stops. After the rotor stops, there is a DC braking for 30 sec. An MAINS RESET during slowing-down causes a DC braking for 3 min. After the DC braking, the "open the lid" release takes place.
Cause of error / measurements	<ul style="list-style-type: none"> • Speed sensor (speedometer) defective or loose contact on plug. Measure speedometer pulses on plug X4 / supply board (pin 4 - pin 2). • Flat ribbon cable to control panel, or flat ribbon cable to frequency converter is defective. Measure speedometer pulses on control panel / plug X1 (pin 14) and on frequency converter / plug S501 (pin 8). • Supply board or control panel or frequency converter is defective.
Error code reset	Open the lid. Turn the rotor by hand and perform a MAINS RESET while the rotor is turning.

TACHO - ERROR 02

Error	There are no speedometer pulses on the control panel after start-up.
Error consequence	The rotor slows down until it stops. After the rotor stops, there is a DC braking for 30 sec. An MAINS RESET during slowing-down causes a DC braking for 3 min. After the DC braking, the "open the lid" release takes place.
Cause of error / measurements	<ul style="list-style-type: none"> • Start-up took place without the rotor. • Motor not connected. • Motor is defective. • Speed sensor (speedometer) defective, or loose contact on plug. Measure speedometer pulses on plug X4 / supply board (pin 4 - pin 2). • Flat ribbon cable to control panel, or flat ribbon cable to frequency converter is defective. Measure speedometer pulses on control panel / plug X1 (pin 14) and on frequency converter / plug S501 (pin 8). • No release signal to frequency converter. • Supply board or control panel or frequency converter is defective.
Error code reset	Open the lid. Turn the rotor by hand and perform a MAINS RESET while the rotor is turning.

IMBALANCE

Error	Imbalance on motor axle.
Error consequence	The centrifuge slows down until the "open the lid" release occurs.
Cause of error / measurements	<ul style="list-style-type: none">• Weight difference in rotor components.• Supporting lugs not lubricated.• False IMBALANCE MODE is set (see chapter "Imbalance Mode").• Imbalance switch not connected.• Imbalance switch is defective. Measure on supply board / plug X3 (pin 4), see chapter "Mains supply with supply board (A1)".• Loose contact in cable or plug.• Flat ribbon cable to control panel is defective. Measure on control panel / plug X1 (pin 12)• control panel or supply board is defective.
Error code reset	Open the lid or perform a MAINS RESET.

CONTROL - ERROR 04

Error	Lid lock is open during centrifugation.
Error consequence	Slowing down until the "open the lid" release occurs.
Cause of error	<ul style="list-style-type: none">• Lid lock is defective and can be opened during centrifugation.• Loose contact in cable or in plug.• Flat ribbon cable to control panel is defective.• Control panel or supply board is defective.
Measurement	Measure on supply board / plug X5 (pin 6) and on control panel / plug X1 (pin 5).
Error code reset	Perform a MAINS RESET.

N > MAX 05

Error Excess speed. The speed recognised by the speed sensor (speedometer) is 250 RPM greater than the n-max speed of the rotor.

Error consequence The centrifuge slows down until the "open the lid" release occurs.

Cause of error

- Insulation of speed sensor (speedometer) cable is defective.
- Loose contact on speed sensor (speedometer) cable.
- Speed sensor (speedometer) is defective.
- Flat ribbon cable to control panel is defective.
- Control panel or frequency converter or supply board is defective.

Error code reset Perform a MAINS RESET.

ROTORCODE 10

Error An invalid rotor code was read during start-up.

Error consequence The centrifuge slows down until the "open the lid" release occurs.

Cause of error

- Magnetic coding on rotor is defective.
- Speedometer system is defective.
- Loose contact on speed sensor (speedometer) plug
- Motor is rotating in the wrong direction.

Error code reset Open the lid or perform a MAINS RESET.

MAINS INTERRUPT

Error Interruption of mains supply during centrifugation.

Error consequence The centrifuge slows down until the "open the lid" release occurs.

- Switching on at the mains during centrifugation causes slowing-down until the "open the lid" release occurs.
- Switching on at the mains when the rotor has stopped brings about the "open the lid" release.

Cause of error

- Power supply has failed.
- Loose contact in electrical connections.
- Flat ribbon cable to control panel is defective.

Error code reset Open the lid and press the **START** key.



This error **cannot** be reset by a MAINS RESET

VERSION - ERROR 12

Error	Differences in the initialization from control panel (EPROM) or frequency converter.
Error consequence	No further user operation is possible.
Cause of error	<ul style="list-style-type: none">• An incorrect EPROM has been plugged into control panel.• Centrifuge is not initialised. Carry out an initialization, see chapter "Initialization".
Error code reset	Perform a MAINS RESET.

N < MIN 13

Error	Insufficient speed, motor slippage is too large. The centrifuge control can readjust the speed by max. 5 % (control limit). This error is displayed if the rotor speed (ACTUAL speed) is lower than the SET speed - 5%.
Error consequence	The centrifuge slows down until the "open the lid" release occurs.
Cause of error	<ul style="list-style-type: none">• Motor is labouring (damage to bearings).• Motor has a short-circuited coil (coil is defective).• Loose contact in the electrical connections.• Frequency converter is defective.• Release signal to frequency converter was interrupted during centrifugation.
Error code reset	Open the lid and perform a MAINS RESET.

CONTROL - ERROR 21 - 26

Error	Internal error in control panel.
Error consequence	The centrifuge slows down until the "open the lid" release occurs.
Cause of error	<ul style="list-style-type: none">• Control panel is defective.
Error code reset	Perform a MAINS RESET.

N > ROTOR-MAX

Error	Error in the entered program
Error consequence	Further operation is not possible.
Cause of error	SET speed or SET RCF is higher than the permissible rotor speed or permissible rotor RCF.
Error code reset	Carry out a MAINS RESET or open the lid. Reduce the speed or RCF in the entered program to the permissible rotor speed or permissible rotor RCF.

SER I/O - ERROR 30 and ERROR 31

Error	Control panel has no connection to the component frequency converter via serial interface.
Error consequence	The centrifuge slows down until the "open the lid" release occurs.
Cause of error	<ul style="list-style-type: none">• Plug S501 on the frequency converter is not plugged.• Flat ribbon cable to frequency converter is defective.• There is no voltage on frequency converter.• Cables on connector S102 are not or wrong plugged.• overtemperature fuse on brake resistor has blown or is not connected.• Control panel or frequency converter is defective.
Error code reset	Perform a MAINS RESET.

SER I/O - ERROR 33

Error	Control panel is not receiving correct data from frequency converter.
Error consequence	The centrifuge slows down until the "open the lid" release occurs.
Cause of error	<ul style="list-style-type: none">• Flat ribbon cable to frequency converter is defective.• Control panel or frequency converter is defective.
Error code reset	Perform a MAINS RESET.

SER I/O - ERROR 34

Error	Control panel is not receiving correct data from frequency converter.
Error consequence	The centrifuge slows down until the "open the lid" release occurs.
Cause of error	<ul style="list-style-type: none">• Flat ribbon cable to frequency converter is defective.• Control panel or frequency converter is defective.
Error code reset	Perform a MAINS RESET.


SER I/O - ERROR 36

Error	Frequency converter sends signal NAK to the control panel after receiving an unknown command. NAK (not acknowledged).
Error consequence	The centrifuge slows down until the "open the lid" release occurs.
Cause of error	<ul style="list-style-type: none">• Flat ribbon cable to frequency converter is defective.• Frequency converter is defective.• Control panel is defective.
Error code reset	Perform a MAINS RESET.

FU / CCI - ERROR 60

Error	The release signal was not correctly transmitted to frequency converter. The evaluation of the release signal only occurs once after MAINS RESET.
Error consequence	No further user operation is possible.
Cause of error	<ul style="list-style-type: none">• Flat ribbon cable to frequency converter is defective.• Flat ribbon cable to control panel is defective.• Supply board is defective.
Measurement	Also see at control panel -X1 (PIN 4) and frequency converter -S501 (PIN 7).

General Notice for FU / CCI - ERROR 61 to FU / CCI - ERROR 69

	Error consequence	<ul style="list-style-type: none"> • Frequency converter switches independently. • The rotor freewheels, coasting. • No further user operation is possible.
	Error code reset	<ul style="list-style-type: none"> • Mains switch is OFF. Switch mains switch to ON after 1 min.
	Measurement	<ul style="list-style-type: none"> • Also see at frequency converter -X501 (PIN 4) and control panel -X1 (PIN 13).

FU / CCI - ERROR 61

Error	Error in computing section.
Cause of error	<ul style="list-style-type: none"> • Flat ribbon cable is defective. • Frequency converter is defective.

FU / CCI - ERROR 62

Error	Undervoltage. Mains voltage less than 20% as nominal voltage.
Cause of error	<ul style="list-style-type: none"> • Supply voltage too low, see chapter "Short the mains choke coil (L1)". • Flat ribbon cable is defective. • Frequency converter is defective.
Measurement	Also see at frequency converter, U_{DC} .

FU / CCI - ERROR 63

Error	Overcurrent.
Cause of error	<ul style="list-style-type: none"> • Short circuit in motor. • Motor impedance is too low. • Flat ribbon cable is defective. • Frequency converter is defective.

FU / CCI - ERROR 64

Error	Voltage in intermediate circuit: >410 V DC at 230 V >205 V DC at 115 V This error normally only occurs when the drive is being braked.
Cause of error	<ul style="list-style-type: none">• Brake resistor is defective.• Flat ribbon cable is defective.• Frequency converter is defective.
Measurement	Also see at frequency converter, U_{DC} .

FU / CCI - ERROR 67

Error	Only centrifuges with 115 V. Overtemperature in the motor. The cable "overtemperature" in the motor has high impedance.
Cause of error	<ul style="list-style-type: none">• Overtemperature switch opens because of overtemperature in the motor• Flat ribbon cable is defective.• Frequency converter is defective.• Motor is defective
Measurement	Also see at frequency converter, remove plug S2 and measure at the plug Switch closed: $\approx 0 \Omega$ opened: $\infty \Omega$

FU / CCI - ERROR 68

Error	Overtemperature in frequency converter.
Cause of error	<ul style="list-style-type: none">• Insufficient heat abduction from frequency converter to centrifuge housing. There is no, or not enough, heat-conducting paste between frequency converter and housing.• Full-load operation and an ambient temperature $> 45^{\circ}\text{C}$.• Flat ribbon cable is defective.• Frequency converter is defective.

FU / CCI - ERROR 69

Error	EEPROM in frequency converter is defective.
Cause of error	<ul style="list-style-type: none">• Flat ribbon cable is defective.• Frequency converter is defective

FU / CCI - ERROR 84

Error	Frequency converter recognises excess speed. During rotation the speedometer pulses (6 per revolution) are controlled by the frequency converter. This control is independent from the control panel. The frequency converter switches the centrifuge off, when the maximum speed of the rotor is exceeded more than 500 rpm.
Cause of error	<ul style="list-style-type: none">• Flat ribbon cable is defective.• Frequency converter is defective.
Measurement	Also see at supply board-X4 (PIN 4) and frequency converter - S501 (PIN 8).

FU / CCI - ERROR 85

Error	“Watchdog” in frequency converter Discrepancy in program procedure
Cause of error	<ul style="list-style-type: none">• Flat ribbon cable is defective.• Frequency converter is defective.
Error code reset	Perform a MAINS RESET.

6 Settings and interrogations

6.1 Initialization

Initialization means adjusting the frequency converter to the centrifuge. Observe the following instructions when replacing the frequency converter:

- The frequency converter must be adjusted to the centrifuge.
- The suitable EPROM for the machine version must be plugged in the control panel.

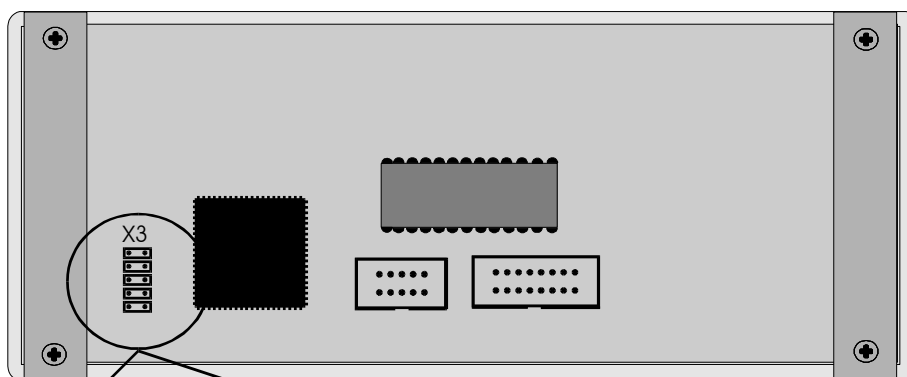
If the above settings do not match, **VERSION – ERROR 12** is displayed after the mains supply is switched on.

6.1.1 Prerequisites for the initialization

An initialization can be carried out only if the rotor has standstill and the lid is open.

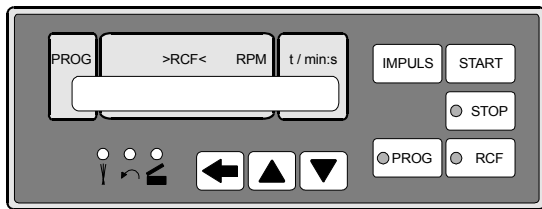
Before the initialization:

- Open the lid.
- Switch off the mains switch.
- Plug each a jumper on the coding strip X3 of the control panel at position 3 and 4 (see figure).



0	<input checked="" type="checkbox"/>	Werkseinstellung	0	<input checked="" type="checkbox"/>	Initialisierungs-Mode
1	<input type="checkbox"/>	Factory setting	1	<input type="checkbox"/>	
2	<input type="checkbox"/>		2	<input type="checkbox"/>	
3	<input type="checkbox"/>		3	<input checked="" type="checkbox"/>	Initialisierungs-Mode
4	<input type="checkbox"/>		4	<input checked="" type="checkbox"/>	Initialization-Mode

6.1.2 Initializing the centrifuge




An initialization must be carried out:

- after replacing the frequency converter.



The frequency converter must be adjusted to the centrifuge.


1. Prepare the centrifuge for the initialization (see chapter "Prerequisites for the initialization").

2. Switch on the mains switch → Display: *** INIT – MODE ***

3. Press the  key → Display: **VERS 04 °C/* 00**
 Machine version ↑ ↑
 Cooling version (00 = without cooling)

4. Press the  key → Display: **IMBALANCE MODE 2**

5. Press the  or  key to set IMBALANCE MODE 1 or IMBALANCE MODE 2. Now press the **START** key to save this setting. Information about IMBALANCE MODE see chapter "Imbalance Mode".

6. Press the  key → Display: **PARAM – INIT 0000**
 Machine version ↑ ↑
 Number of initialisations

7. Press the **START** key → Display: ***** OK *****
 followed by **PARAM - INIT 4001**
 Machine version ↑ ↑
 Number of initialisations

8. Switch off the mains switch.

9. Remove both jumpers on the coding strip X3 of the control panel from position 3 and 4.



Plug a jumper on the coding strip X3 of the control panel at position 0 ("Watchdog").

6.2 Imbalance Mode

From programme version 3.00 it is necessary to set the imbalance mode during the initialization.

Depending on the supply board version IMBALANCE MODE 1 or IMBALANCE MODE 2 must be selected.



If the incorrect imbalance mode is selected, the display shows error "IMBALANCE" permanently !

6.3 Parameter interrogation

It is only possible to interrogate the parameters when the rotor is at standstill.

- Keep the key pressed (approx. 8 s) until the following is displayed:
 1. **SOUND /** Acoustic signal
BELL ON
or OFF
- Press the key. Whenever you press the key, the display changes as shown below:
 2. **CONTROL: XXX h** Working hours
 3. **VERS 19 °C / * 01** Machine version, cooling version
 4. **FU/ CI - 1000** Frequency converter type
 5. **FU/CCI - S. 00.XX** Frequency converter software version
- To exit the parameter interrogation, press any key apart from the , and keys.

Among the parameters listed here, only parameter 1. and 2. can be changed.

6.4 Acoustic Signal

The acoustic signal sounds:

- Upon the appearance of a disturbance in 3 second intervals.
- After completion of a centrifugation run and rotor standstill in 30 second intervals.









The acoustic signal is stopped by opening the lid or pressing any key.

The signal can be activated or deactivated after completion of the centrifugation run (if the rotor is at standstill) in the following manner:

- Hold down the key for 8 seconds.
After 8 seconds, **SOUND / BELL XXX** appears in the display.
- Set **OFF** or **ON** with the key or .
- Press the key in order to store the setting.
As confirmation, ***** ok ***** will be displayed for a short period.

6.5 Working hours

You can check and change the working hours only if the rotor is at standstill.


- Keep the  key pressed for 8 seconds.
After 8 seconds, **SOUND / BELL XXX** will be displayed.
- Press the  key again.
The working hours (**CONTROL:**) of the centrifuge will be displayed.
- To exit the working hours check screen, press the  or  key.
Press the  key to set the working hours.
- Set the working hours with the  and  keys.
- Press the  key to save the setting.
***** ok ***** is displayed for a short time to confirm that the setting has been saved.

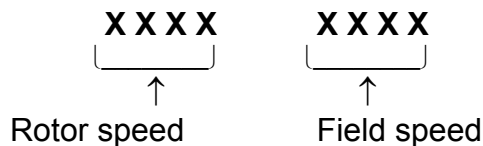
6.6 Checking the motor slippage

The centrifuge control can readjust the speed by max. 5 % (control limit).

The error (N < MIN 13) is displayed if the rotor speed (ACTUAL speed) is lower than the SET speed minus 5%.

Checking the slippage:

- Start a centrifugation run and wait until the set speed is achieved.
- Keep the  key pressed (approx. 8 s) until the following is displayed:



Slippage = (field speed) - (rotor speed)

The slippage display automatically disappears after 8 seconds.

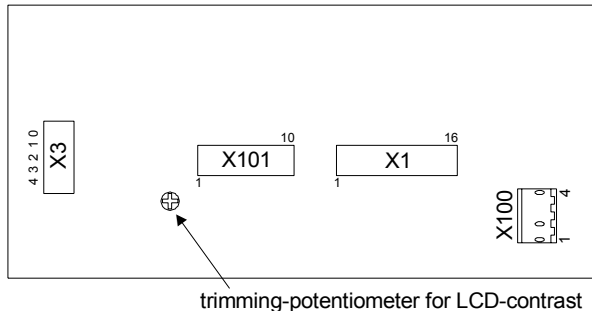
6.7 Setting the display contrast

The contrast of the display has been preset by the manufacturer. However, you can readjust it.

Use a screwdriver with insulated shank to make this setting as there is a risk of short circuit on the printed circuit board.

Use the screwdriver to set the contrast on the trimming potentiometer on the rear side of the control panel (see figure).

Rear side of the control panel:



6.8 Imbalance switch-off

The permissible imbalance is specified for rotor 1416 by the indication of the difference in weight of opposite rotor positions.

When having a difference in weight within the range of 7g to 15g during run-up, the drive has to switch off before reaching 1500 RPM.

The imbalance switch-off is adjusted by changing the distance of the imbalance switch.

With a test run with the indicated differences in weight the imbalance switch-off will be checked.

Adjusting the imbalance switch:

Old version of the imbalance switch:

- Set the permissible imbalance by bending the rocker switch of the imbalance switch carefully.
- Check the imbalance switch-off with a test run.

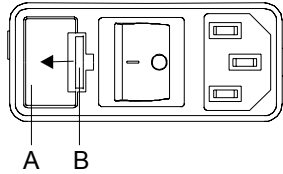
New version of the imbalance switch:

- Loosen both screws at the angle bracket of the imbalance switch on the outer part of the housing floor until you can shift it.
- Set the permissible imbalance by shifting the angle bracket.
- Tighten both screws at the angle bracket of the imbalance switch again.
- Check the imbalance switch-off with a test run.

7 Change mains input fuse



Switch off the mains switch and separate the centrifuge from the mains!



The fuse holder (A) with the mains input fuses is located next to the mains switch.

- Remove the connecting cable from the machine plug socket.
- Press the snap-fit (B) against the fuse holder (A) and remove.
- Exchange defective mains input fuses.



Only use fuses with the rating defined for the type.
See the following table.

- Reinsert the fuse holder until the snap-fit clicks shut.
- Reconnect the centrifuge to the mains supply.

Model	Type	Fuse	Order no.
EBA 21	1004, 1004-30	T 3,15 AH/250V	E997
EBA 21	1004-01, 1004-31	T 6,3 AH/250V	2266

8 Functional check after a repair

After a repair a functional check of the unit must be carried out.

For functional check a test run with the loaded rotor must be performed.

During the test run the followings must be checked:

- Function of the keys, the display and the LEDs.
- Run-up and slow-down time, max. speed of the rotor. Values see operating instructions chapter "Anhang/Appendix, Rotoren und Zubehör/Rotors and accessories".
- Sample temperature. Values see operating instructions chapter "Anhang/Appendix, Rotoren und Zubehör/Rotors and accessories".
- Imbalance switch-off. Values see chapter "Imbalance switch-off".
- Current consumption. Values see chapter "Technical specifications".

After the test run a safety test must be carried out. Check the following values:

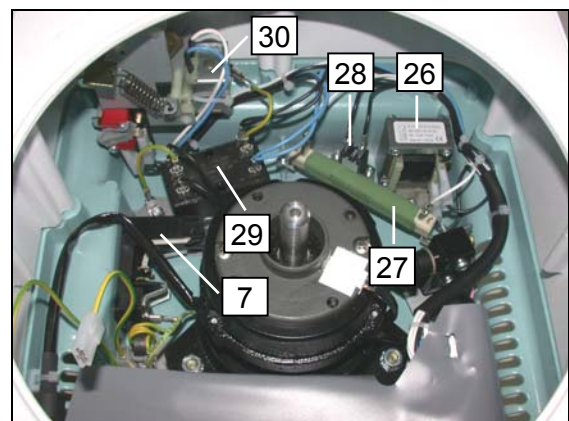
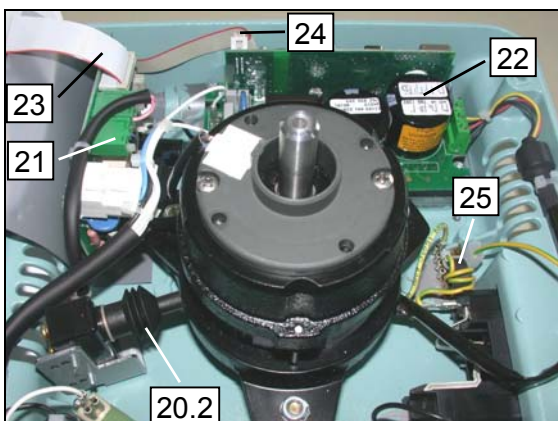
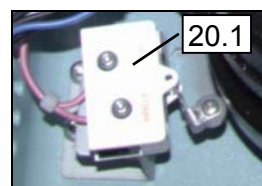
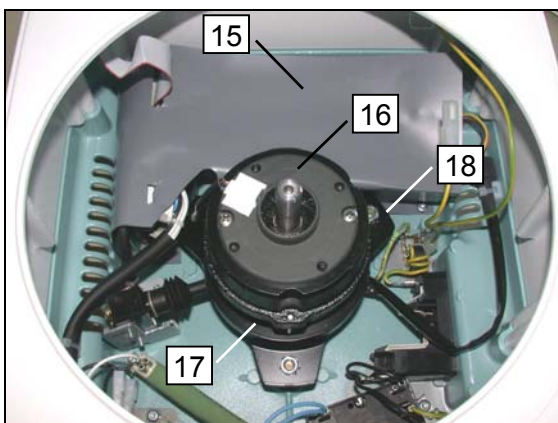
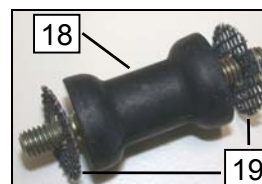
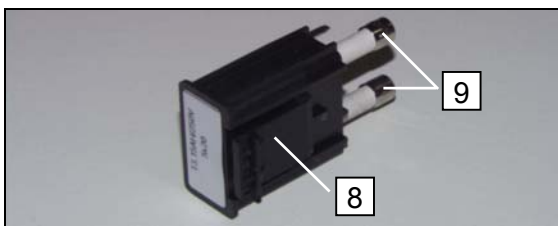
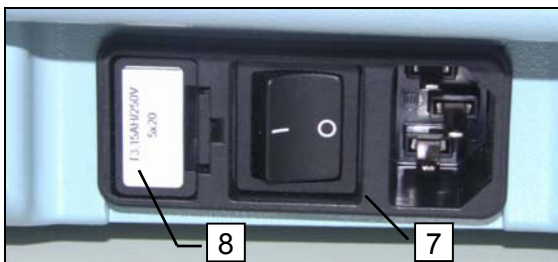
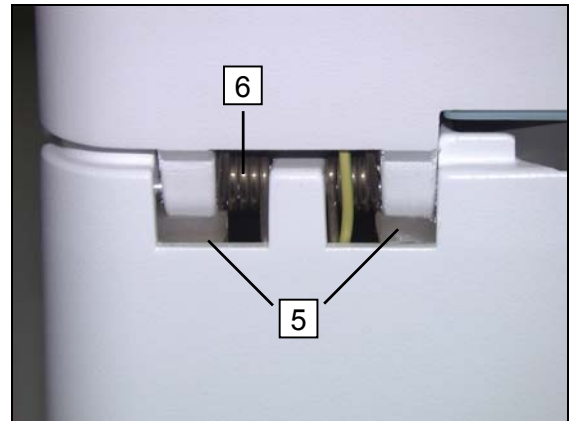
- Insulation resistance > 2 MΩ
 - Protective conductor resistance < 0.2 Ω
 - Leakage current < 3.5 mA *
- * limit according to EN 61010-1

A laboratory centrifuge do not belong to those medical appliances which may be tested according to the regulation IEC 60601-1 or corresponding national medical electronic standards. Laboratory centrifuges are classified as laboratory equipment.

The regulations applying to laboratory equipment are IEC 61010-1 or European standard EN 61010-1.

9 General arrangement of the components

Item	Components	Abbrevia- tion	plug	Connection at boards	Circuit diagram in chapter
1	Rubber foot	---	---	---	---
2	Turning handle	---	---	---	---
3	Sight glass and gluing ring	---	---	---	---
4	Control panel	A4	---	---	12.2.7, 12.2.8
5	Frictional rubber	---	---	---	---
6	Leg spring	---	---	---	---
7	Appliance plug combination element (without fuse holder)	Q1	---	---	12.2.2, 12.2.3
8	Fuse holder	---	---	---	---
9	Fuse	F1, F2	---	---	12.2.2, 12.2.3
10	Lid moulding	---	---	---	---
11	Hook	---	---	---	---
12	Centrifuge chamber	---	---	---	---
13	Motor cover	---	---	---	---
14	Packing ring	---	---	---	---
15	Covering foil	---	---	---	---
16	Speed sensor	B3	X4	A1	12.2.2, 12.2.3, 12.2.5
17	Motor	M1	S101	A2	12.2.9, 12.2.10
18	Rubber-metal bearing	---	---	---	---
19	Anti-twist device	---	---	---	---
20.1	Imbalance switch (old version)	S1	X3	A1	12.2.2, 12.2.3, 12.2.5
20.2	Imbalance switch (new version)	S1	X3	A1	12.2.2, 12.2.3, 12.2.5
21	Supply board	A1	---	---	12.2.2, 12.2.3, 12.2.4, 12.2.5
22	Frequency converter	A2	---	---	12.2.9, 12.2.10
23	Flat ribbon cable 16-pole	---	A1/X2, A4/X1	A1, A4	12.2.2, 12.2.3, 12.2.4, 12.2.5, 12.2.7, 12.2.8
24	Flat ribbon cable 10-pole	---	A1/X9, A2/S501	A1, A2	12.2.2, 12.2.3, 12.2.4, 12.2.5, 12.2.9, 12.2.10
25	Ferrite ring (only in 230 V version)	L2	---	---	12.2.2
26	Mains choke coil	L1	---	---	12.2.9, 12.2.10
27	Brake resistor	R1	P1, P10	A2	12.2.9, 12.2.10
28	Overtemperature fuse	F3	---	---	12.2.9, 12.2.10
29	Radio interference suppression filter	Z1	---	---	12.2.2, 12.2.3, 12.2.5
30	Lid lock	Y1	X5	A1	12.2.2, 12.2.3, 12.2.5



10 Mounting and removing components



Wait at least 2 minutes after disconnecting the centrifuge from the mains, until the intermediate circuit capacitors of the frequency converter are unloaded.

All components can be mounted and removed through the centrifuge chamber. For that purpose the centrifuge chamber must be taken out, see chapter "Removing the centrifuge chamber".

The supply board and the frequency converter are protected against humidity by a plastic foil. After a replacement of the boards the plastic foil must be installed again correctly, see Fig. 1.

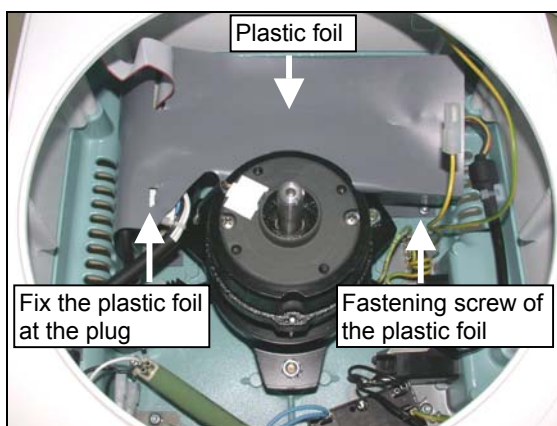


Fig. 1

When replacing the frequency converter, make sure that there is sufficient heat conduction paste between the frequency converter and the housing. If necessary, scrape off the heat conduction paste from the old frequency converter and apply it on the new frequency converter.

While mounting the rubber-metal bearings, make sure that there is an anti-twist device on both sides of the bearing to prevent it from turning.

After exchange of the imbalance switch, the imbalance switch-off must be checked as described in chapter "Imbalance switch-off".

10.1 Removing the centrifuge chamber

- Open the lid.
- Switch off the mains switch and disconnect the centrifuge from the mains supply.
- Remove the rotor.
- Undo both screws on the motor cover and remove the motor cover.
- Take out the centrifuge chamber and unplug the protective conductor from the centrifuge chamber.

11 Short the mains choke coil (L1)



In countries, in which the European standard EN 61000-3-2 applies it is not allowed to short the mains choke coil.

The mains choke coil reduces the mains input current below the limit values stated in the above mentioned European standard.

If the centrifuge is run with undervoltage, that is mains frequency 50 Hz with a voltage < 205 V or mains frequency 60 Hz with a voltage < 210 V the voltage drop of the mains choke coil can cause the error FU / CCI - ERROR 62.

The short of the mains choke coil will increase the supply voltage of the frequency converter.

- Pull both plugs (Fig. 2, a) from the mains choke coil.
- Cut off both plugs and connect the ends of both cables together with a luster terminal (Fig. 3, a).

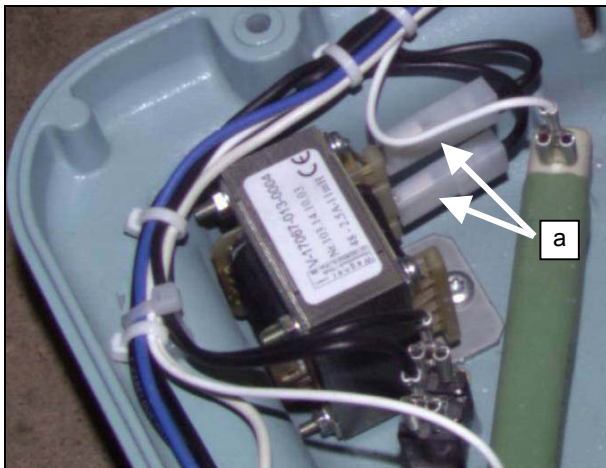


Fig. 2

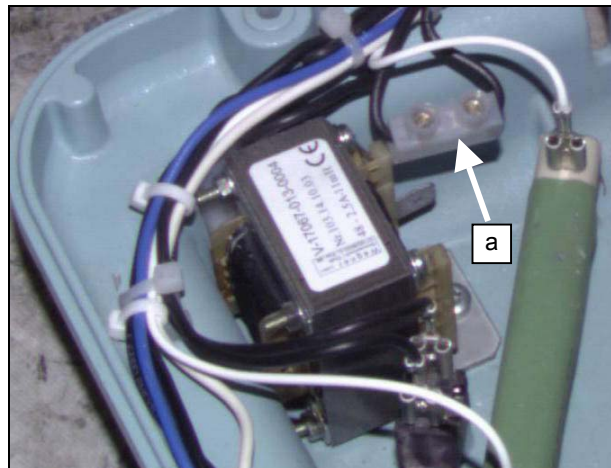
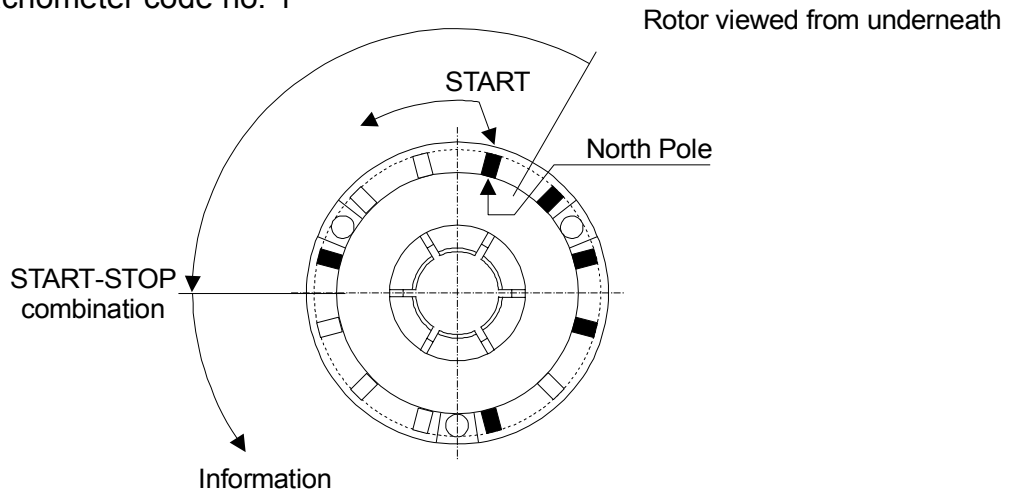


Fig. 3

12 Technical documents

12.1 Tachometer code configuration of the rotors

Example: tachometer code no. 1



tachometer code determines:

1. maximum speed of rotor
2. run up and braking ramps
3. control response of electronics

e.g. Rotor 1624

1001,00010111,



rotor code

Start / Stop combination.

The begin of the Start / Stop combination is marked with a white dot.

0 = no magnet (empty place), 1 = magnet inserted

Tachometer code-no.	Configuration	Rotor
0	1001 0000 1111	
1	1001 0001 0111	1095
2	1001 0001 1011	1089
3	1001 0001 1101	1416
4	1001 0001 1110	1116
5	1001 0100 0111	
6	1001 0101 0101	1030
7	1001 0101 0110	1112
8	1001 0101 1010	1135
9	1001 0110 0011	1450
10	1001 0111 0001	E778
11	1001 1000 0111	1114, 1115, 1118, 1118-01, 1120, 1126
12	1001 1000 1011	
13	1001 1000 1101	
14	1001 1000 0011	SK 55.92
15	1001 1100 0011	

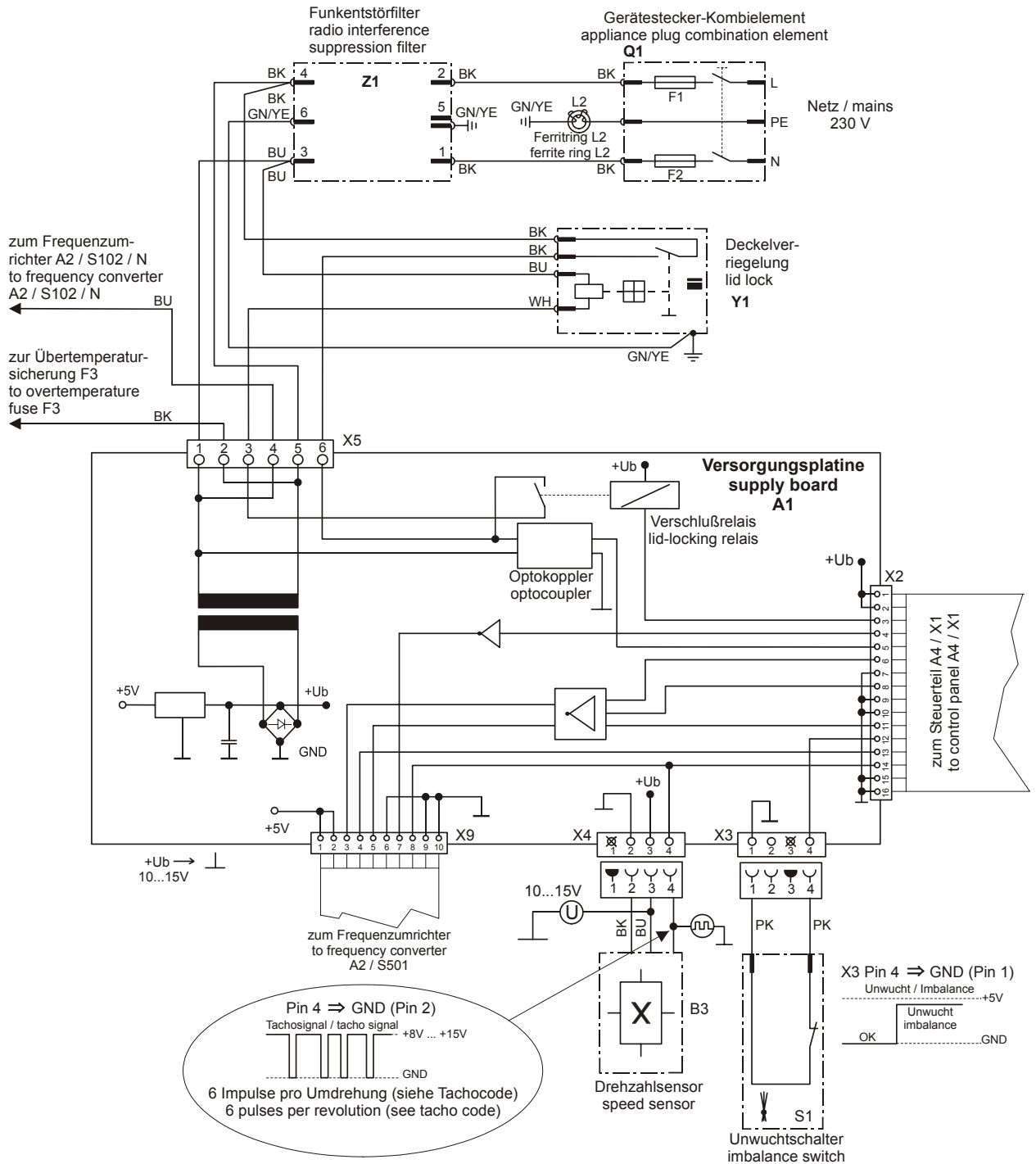
This tacho code can be measured on plug X4 of the tacho sensor B3 (see also chapter "Circuit diagrams").

12.2 Circuit diagrams

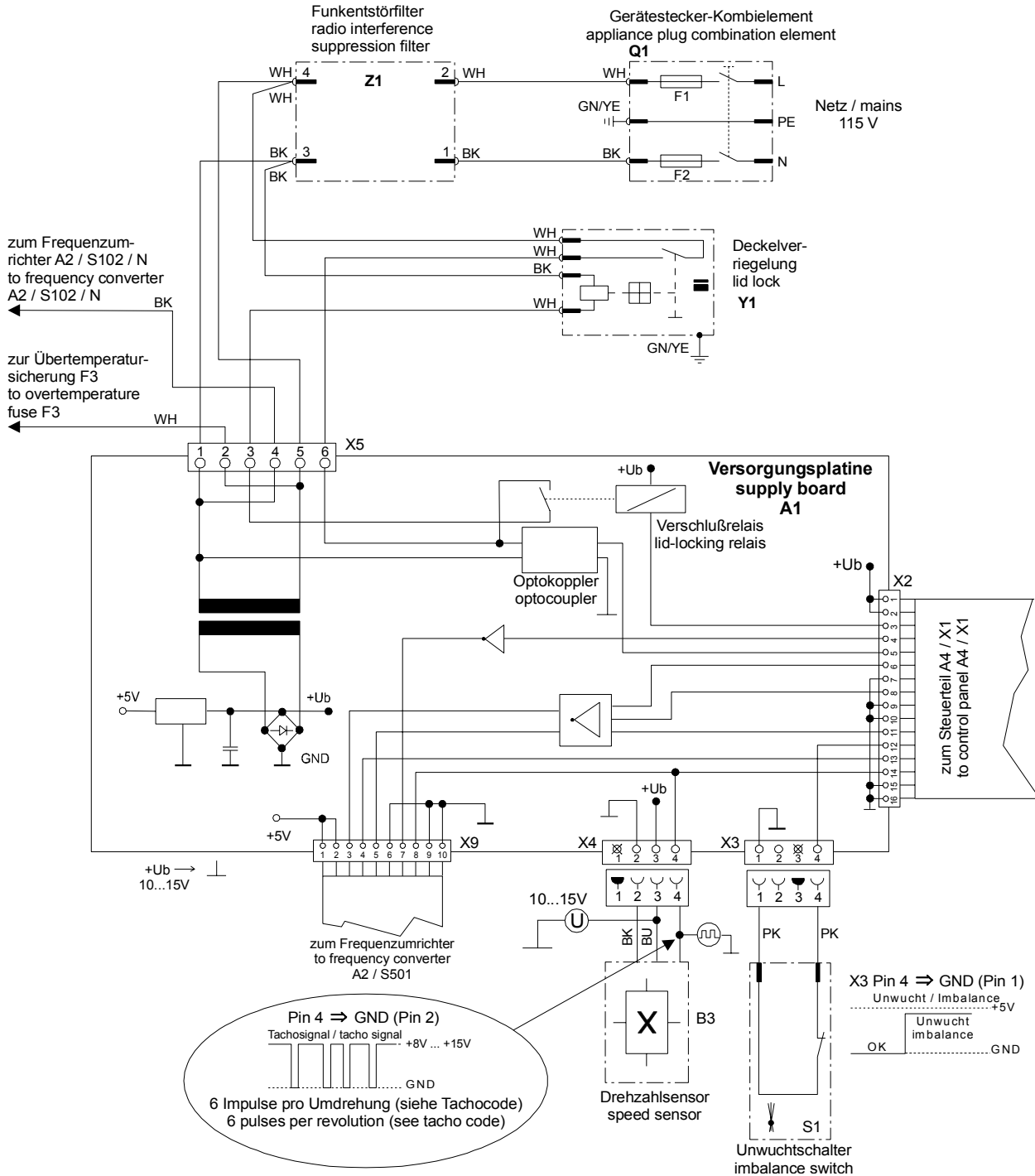
12.2.1 Abbreviations of the cable colours

Abbreviation	Colour
BK	black
BN	brown
BU	blue
GD	gold
GN	green
GNYE	green-yellow
GY	grey
OG	orange
PK	pink
RD	red
SR	silver
TQ	turquoise
Transp.	transparent
VT	violet
WH	white
YE	yellow

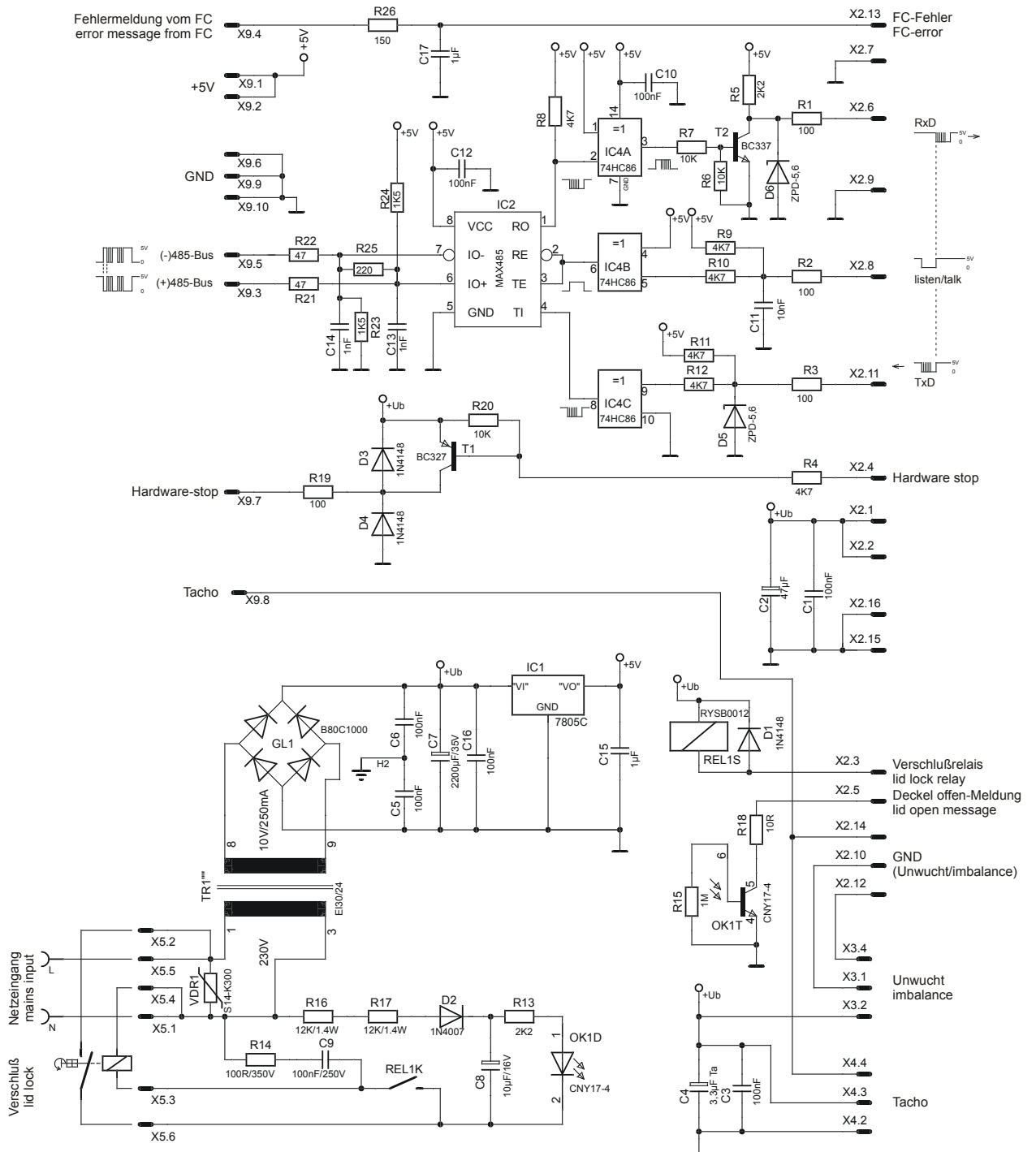
12.2.2 Mains supply with supply board (A1) 230 V



12.2.3 Mains supply with supply board (A1) 115 V



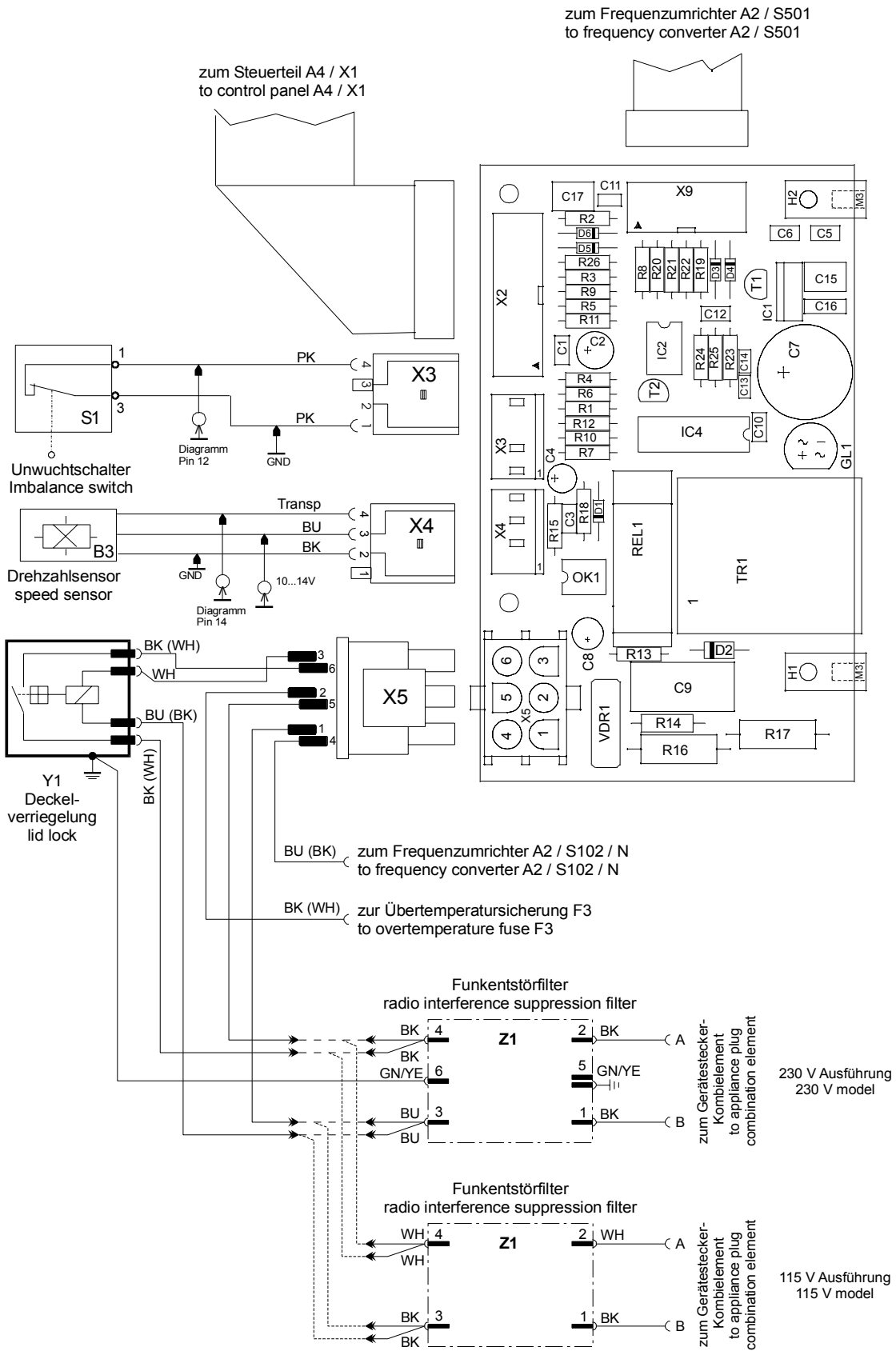
12.2.4 Circuit diagram supply board (A1)



120V Version	
TR1	120V/10V
R16	Brücke/bridge
VDR1	S14K150

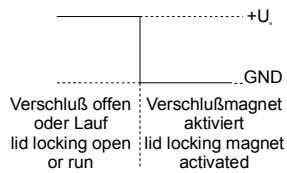
FC: Frequenzumrichter / frequency converter

12.2.5 Connecting- and component diagram supply board (A1)

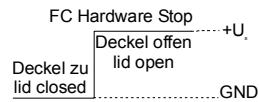


12.2.6 Signals in the flat ribbon cable between control panel (A4) and supply board (A1)

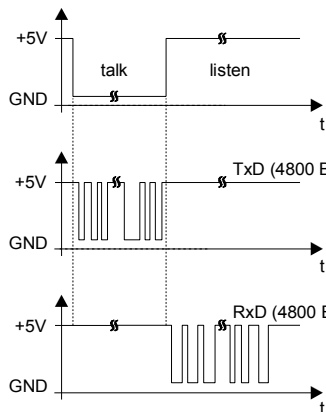
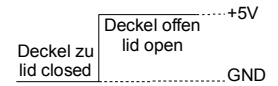
X1 Pin 3 ⇒ GND



X1 Pin 4 ⇒ GND



X1 Pin 5 ⇒ GND



X1 Pin 8 ⇒ GND

ser. Schnittstelle vom CP
ser. interface from CP

X1 Pin 11 ⇒ GND

ser. Schnittstelle vom CP
ser. interface from CP

X1 Pin 6 ⇒ GND

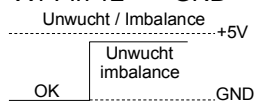
ser. Schnittstelle zum CP
ser. interface to CP

X1 Pin 7 ⇒ GND : 0V

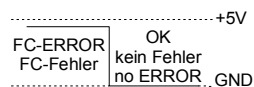
X1 Pin 9 ⇒ GND : 0V

X1 Pin 10 ⇒ GND : 0V

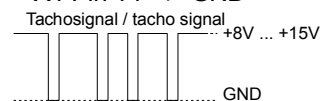
X1 Pin 12 ⇒ GND



X1 Pin 13 ⇒ GND

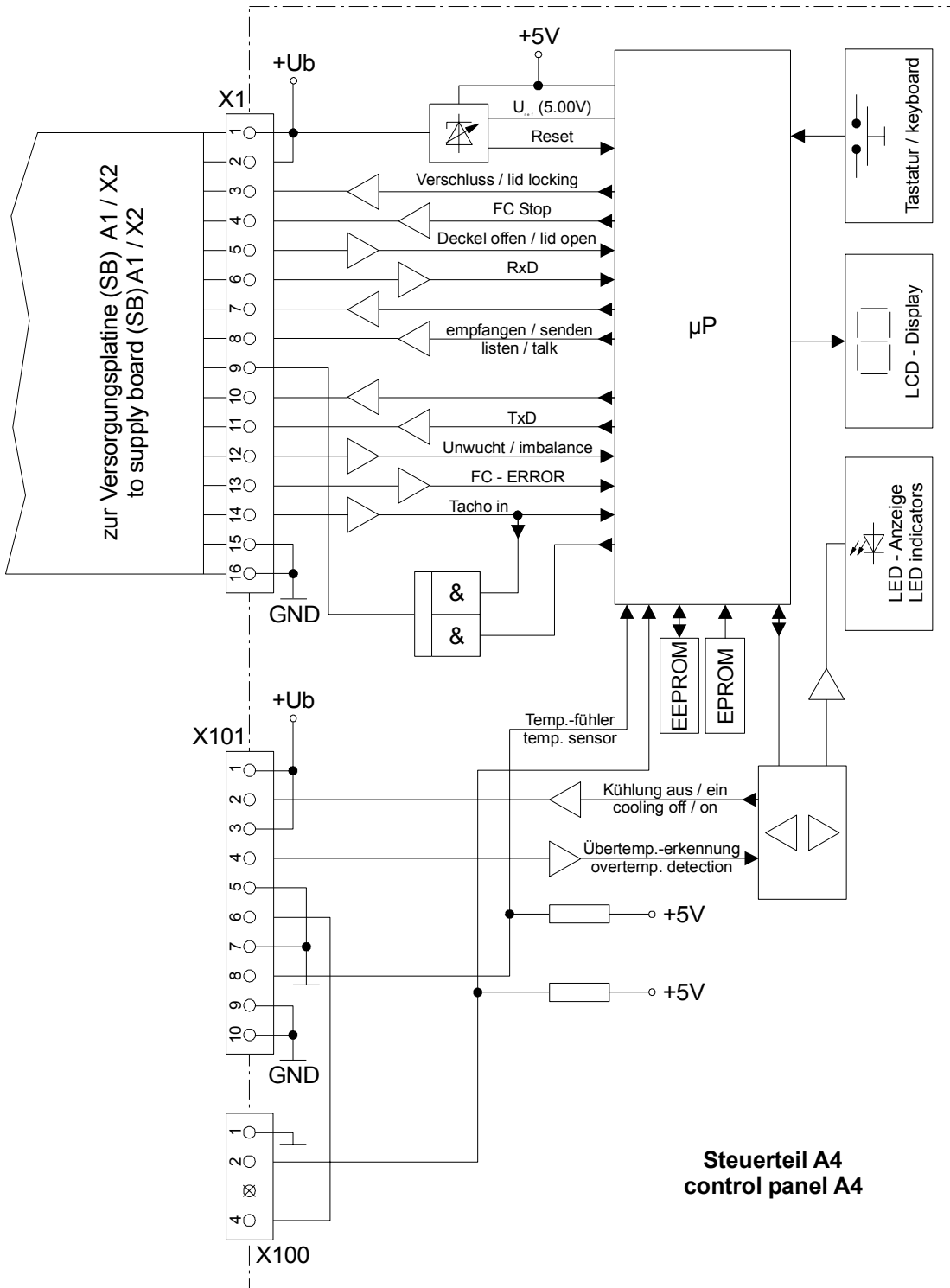


X1 Pin 14 ⇒ GND

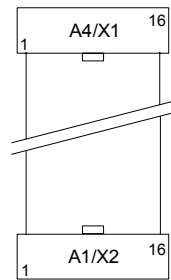
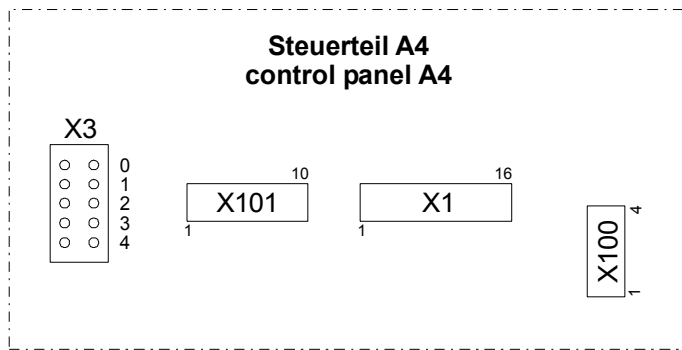


6 Impulse pro Umdrehung
siehe Tachocode
6 pulses per revolution
see tachocode

12.2.7 Block diagram control panel (A4)

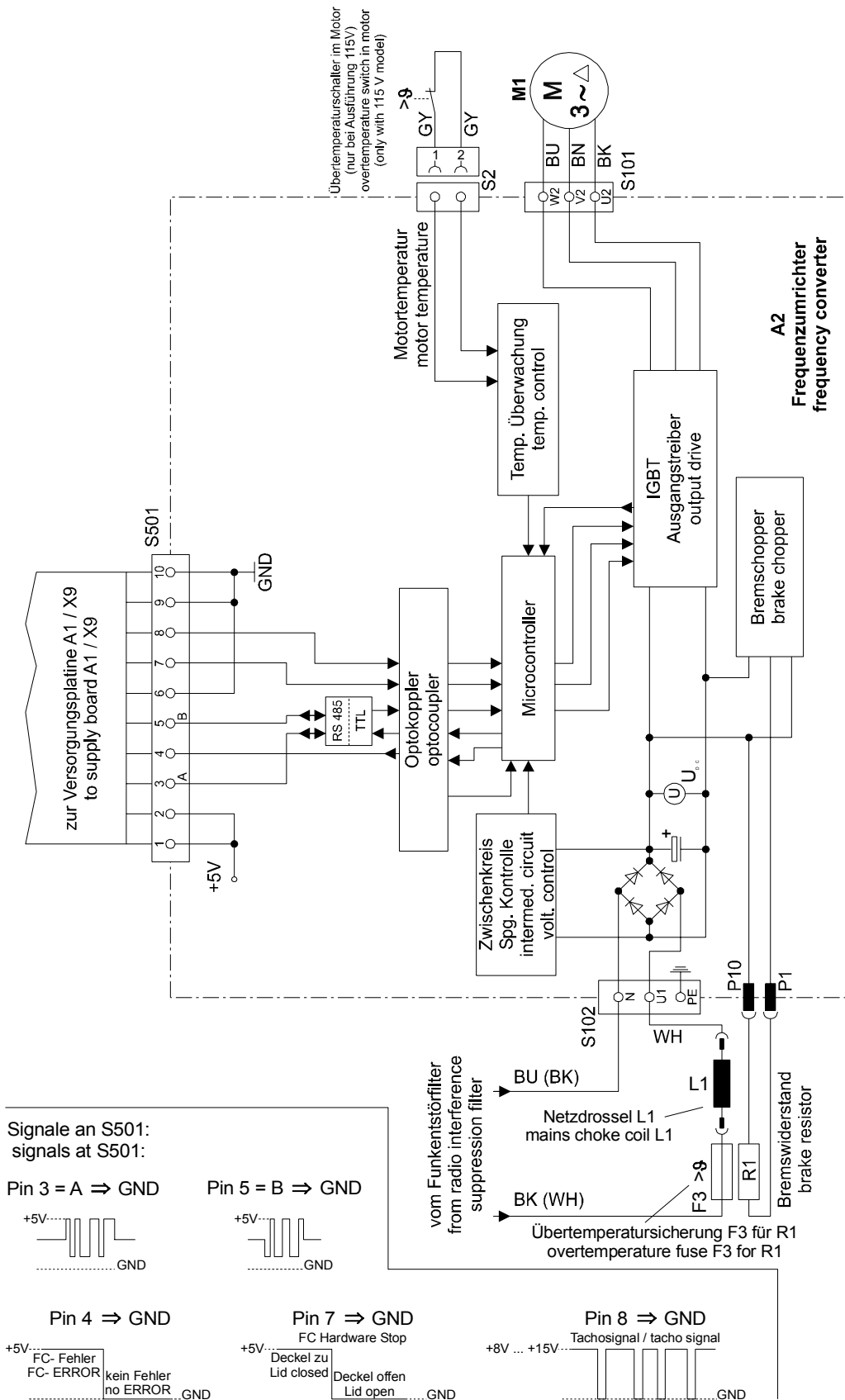


12.2.8 Connecting diagram control panel (A4)

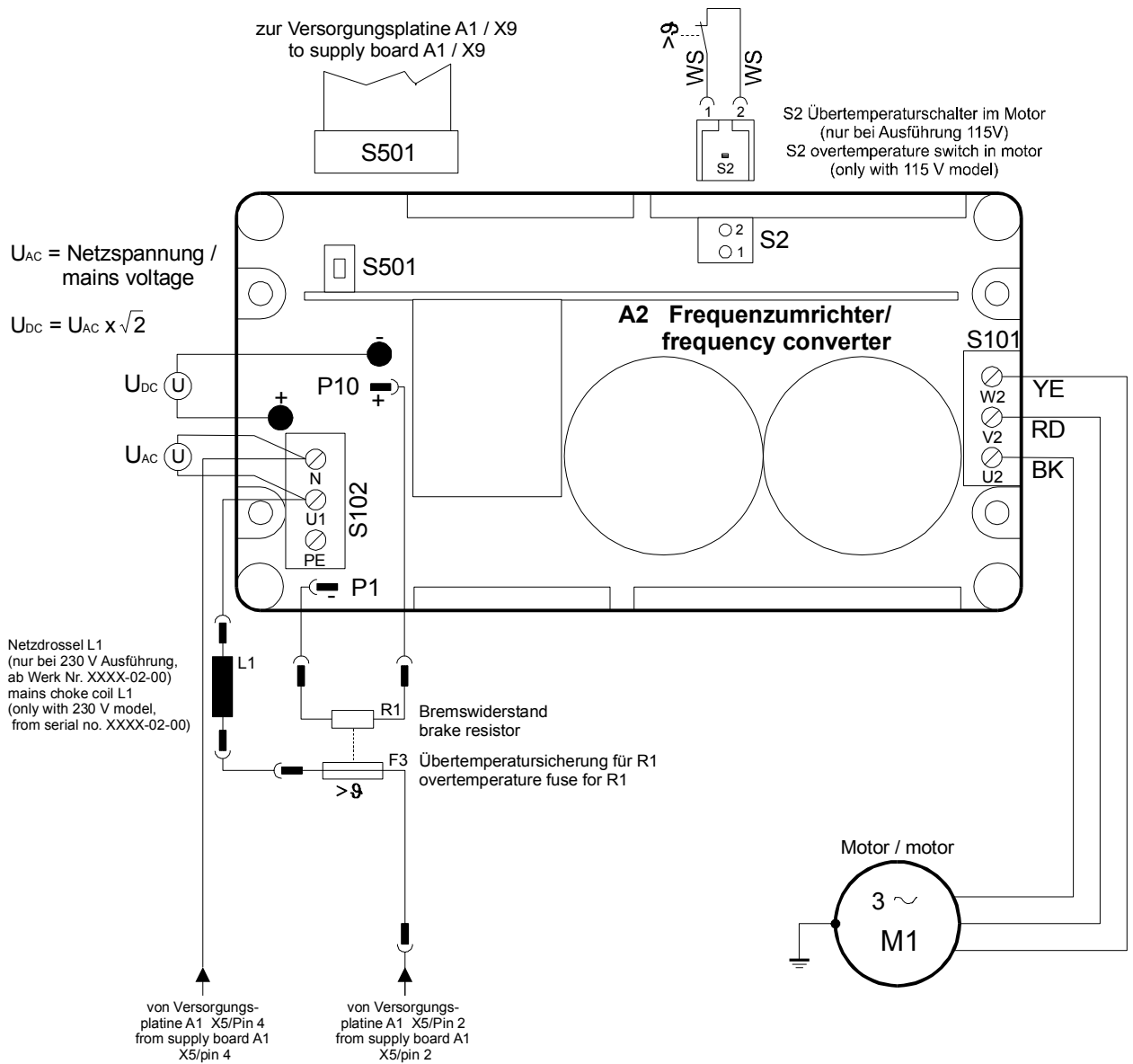


zur Versorgungsplatine
to supply board

12.2.9 Block diagram frequency converter (A2) and signals in flat ribbon cable between frequency converter (A2) and supply board (A1)



12.2.10 Connecting diagram frequency converter (A2)



Brake resistor (R1):
230 V Version: 330 Ω
115 V Version: 82 Ω

Motor resistance value (M1; cold motor, between 2 wires):
230 V Version: 8.4 Ω
115 V Version: 2.1 Ω

12.3 Technical specifications

Hersteller / Manufacturer	Hettich Zentrifugen D-78532 Tuttlingen			
Typenbezeichnung / Model	EBA 21			
Verkaufs-Nr. / Product no.	1004	1004-30	1004-01	1004-31
Netzspannung / Mains voltage ($\pm 10\%$)	220 – 240 V 1~		110 – 127 V 1 ~	
Netzfrequenz / Mains frequency	50 – 60 Hz		50 – 60 Hz	
Anschlusswert / Connected load	500 VA		550 VA	
Stromaufnahme / Current consumption	2.75 A		5.0 A	
Kapazität max. / Max. capacity	6 x 50 ml			
zulässige Dichte / Max. density	1.2 kg/dm ³			
Drehzahl / Speed RPM	18000			
Beschlg. / Force RCF	23907			
Kinetische Energie / Kinetic energy	8100 Nm			
Prüfpflicht / Obligatory inspection	nein / no			
Aufstellungsort / Environment – Umgebungstemp. / Ambient temperature – relative Feuchte / Relative humidity	2°C bis 40°C / 2°C up to 40°C max. 80% bis 31°C, linear abnehmend bis zu 50% bei 40°C / max. 80% up to 31°C, descending in a linear pattern down to 50% at 40°C			
Geräteschutzklasse / Class of protection	I			
EMV / EMC – Störaussendung (Funkentstörung) / Emission (Radio interference suppression) – Störfestigkeit / Immunity	EN 55011 Gruppe 1, Klasse B / Group 1, Class B EN 61000-3-2 EN 61000-3-3 EN 61000-6-2		FCC Class B ----	
Geräuschpegel (rotorabhängig) / Noise level (dependent on rotor)	58 – 66 dB(A)			
Abmessungen / Dimensions • Breite / Width • Tiefe / Depth • Höhe / Height	275 mm 330 mm 247 mm 299 mm 247 mm 299 mm			
Gewicht ca. / Weight approx.	11 kg		11 kg	