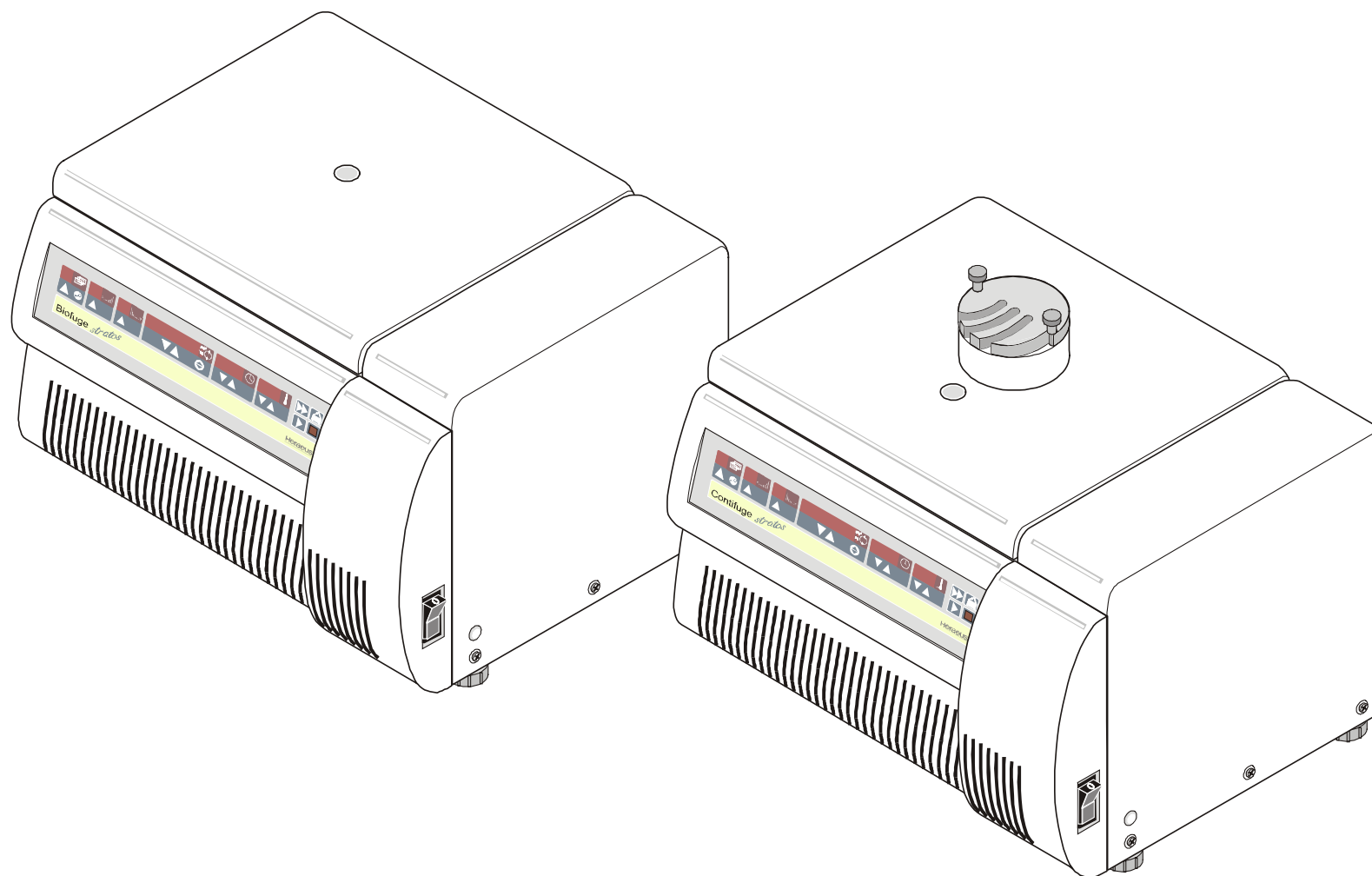


Biofuge® / Contifuge® *stratos*  
120V / 200V / 208V / 240V

SERVICE MANUAL

Cat. No. 12005284



## Technical Data

Line voltage	120V 60 Hz
Power consumption	1300 W (Biofuge stratos) 1450 W (Contifuge stratos)
Current draw	13,0 A (Biofuge stratos) 14,5 A (Contifuge stratos)
Heat rejection	4680 kJ/h (Biofuge stratos) 5220 kJ/h (Contifuge stratos)
Noise level	<60 dB(A)
Maximum speed	22.000 rpm (75003331)
Minimum speed	300 rpm
Maximum Kinetic Energy	37,2 kNm
Maximum g-force	44.912 x g (75003331)
Temperature selection	-19°C to +40°C
Environmental conditions	+2°C to +40°C
Max. Humidity	80% at 31°C ambient
Dimensions and Weight:	H395mm * W640mm * D595mm 134 kg

## Technical Data

Line voltage	208V 60 Hz
Power consumption	1500 W (Biofuge stratos) 1650 W (Contifuge stratos)
Current draw	8,5 A (Biofuge stratos) 9,5 A (Contifuge stratos)
Heat rejection	5400 kJ/h (Biofuge stratos) 5940 kJ/h (Contifuge stratos)
Noise level	<60 dB(A)
Maximum speed	23.300 rpm (75003331)
Minimum speed	300 rpm
Maximum Kinetic Energy	37,2 kNm
Maximum g-force	50.377 x g (75003331)
Temperature selection	-19°C to +40°C
Environmental conditions	+2°C to +40°C
Max. Humidity	80% at 31°C ambient
Dimensions and Weight:	H395mm * W640mm * D595mm 134 kg

## Technical Data

Line voltage	240V 60 Hz
Power consumption	1500 W (Biofuge stratos) 1650 W (Contifuge stratos)
Current draw	7,3 A (Biofuge stratos) 8,3 A (Contifuge stratos)
Heat rejection	5400 kJ/h (Biofuge stratos) 5940 kJ/h (Contifuge stratos)
Noise level	<60 dB(A)
Maximum speed	23.300 rpm (75003331)
Minimum speed	300 rpm
Maximum Kinetic Energy	37,2 kNm
Maximum g-force	50.377 x g (75003331)
Temperature selection	-19°C to +40°C
Environmental conditions	+2°C to +40°C
Max. Humidity	80% at 31°C ambient
Dimensions and Weight:	H395mm * W640mm * D595mm 134 kg

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Heraeus

# BIOFUGE® STRATOS HIGHSPEED TABLE TOP CENTRIFUGE

Intelligent centrifugation



Kendro Laboratory Products – a worldwide company  
formed by the merger of Heraeus Instruments and Sorvall

 **Kendro**  
Laboratory Products

# INTELLIGENT

Until now, intelligent technology has been reserved for floor standing centrifuges but, for the first time, it has now been used in the design of a refrigerated highspeed table top centrifuge – Biofuge stratos by Kendro Laboratory Products. Intelligent technology guarantees greatest benefits for the demanding user of a highspeed centrifuge.



## Lid closed – fully automatic

Gentle pushing of the lid automatically engages two locks – rapidly and safely.

## Safety in case of sample loss

The patented electronic imbalance recognition system is ideally matched to every rotor. It recognises imbalance even during a run.

- Large sample losses are detected during a run. The Biofuge stratos brakes automatically.
- Only imbalances caused by incorrect loading lead to error messages – false alarms are avoided.
- Inadmissible imbalances are detected specifically for every rotor. This protects the centrifuge's drive.



## Balancing by eye

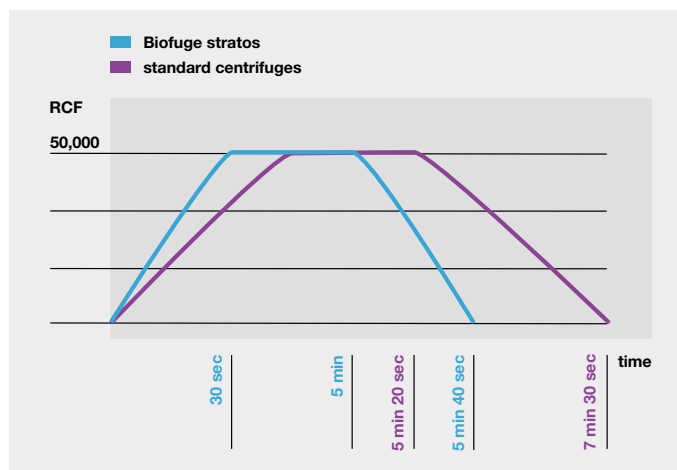
The Biofuge stratos is characterised by minimum noise, maximum imbalance stability and extreme reliability. An innovative drive with "active damping" was specifically designed for highspeed applications (see also page 6). The unique spindle drive offers many benefits.

- Your samples can be simply balanced by eye.
- Loud rotors and resuspended sediments become a thing of the past.
- Service costs for broken drive needles are avoided.



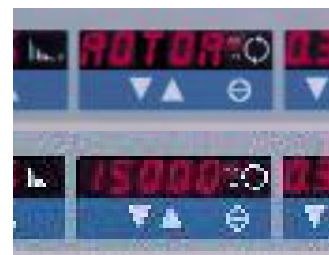


CERTIFIED IN ACCORDANCE WITH  
**EN ISO 9001**



### No waiting

A powerful drive accelerates the Biofuge stratos' rotors in record times: 50,000 x g in 30 seconds. The extremely short braking and acceleration times save a lot of time and allow increased sample throughput.



### Clear

The new Easycontrol user panel makes your work as simple as possible.

- Clear display of all values – no hidden functions
- Internationally recognised symbols
- Nine programs to save the most important run parameters
- "Pretemp" program for rapid pre-cooling

### Wrong speed? No problem.

Within a few seconds the automatic rotor recognition system detects if the programmed speed is too high. The Biofuge stratos' display signals the maximum permissible value for the rotor used. You can confirm this value by pressing the START key or you can enter a new value.

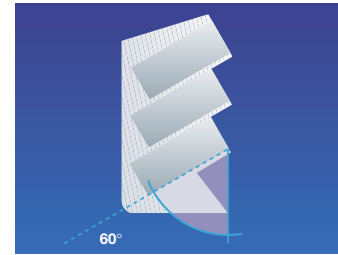


# FLEXIBLE

The Biofuge stratos' extensive range of rotors is outstanding. Ten rotors – fixed angle, microlitre, swing-out and continuous flow rotors are at your disposal. All common types of tube from 0.2 to 180 ml can be spun in the Biofuge stratos.

The new aerosol tight rotors and buckets offer the greatest possible user safety. During the rotors' development we have improved the sealing mechanism. The safe biological centrifugation with the Biofuge stratos' rotors was certified by the independent CAMR test institute in Porton-Down, Great Britain, using a microbiological test procedure.

Additional safety is provided by tubes with sealed lids. For this reason, Kendro has extended its range of accessories to include these tubes.



## High sample throughput

80 x 2 ml tubes can be spun in the drum rotor.

- New: a rack with a 60 ° angle converts the drum into a 48-place fixed angle rotor – with an identical RCF value for all samples.

## General purpose swing-out rotors

- A swing-out rotor for DIN, blood, conical and other tubes up to 180 ml.
- The bucket is suitable for extra long tubes up to 138 mm.
- A vertical swing-out rotor for microlitre plates ensures optimum sedimentation.



## highspeed fixed angle rotors

- All fixed angle rotors are aerosol tight.
- Reduced acceleration and braking times through reduced weight.
- A lid for all fixed angle and microlitre rotors avoids any possibility of confusion.





### Only at Heraeus®: continuous flow operation on a table top

- The Contifuge stratos provides time savings of several hours for sample volumes in excess of 20 l.
- The high RCF value guarantees the quantitative sedimentation in the field of bio-technology and for water sample examination.
- Titanium rotor for maximum chemical resistance.



### A new principle – Highconic®

10,000 x g for conical (Falcon® type) and highspeed tubes.

- As a result of the 45 ° angle, the sediment remains at the bottom of the tube.
- The flat angle prevents sample loss at the rim of the tube.



### 50,000 x g for 24 samples

A 24-place rotor provides high performance for 1.5 ml micro tubes.

- Acceleration in excess of 50,000 x g in only 30 seconds.

### Indefinitely autoclavable

The 24 x 2 ml rotor is particularly suitable for infectious samples.

- The special alloy rotor is indefinitely autoclavable.



# RELIABLE AND USER FRIENDLY

Kendro has set a new technological standard for high-speed table top centrifuges with the new spindle drive.

- high RCF values for all types of rotor
- extremely short acceleration and braking times
- balancing by eye
- extremely quiet run conditions
- outstandingly sturdy for everyday laboratory work
- very flexible as a result of an extensive range of rotors

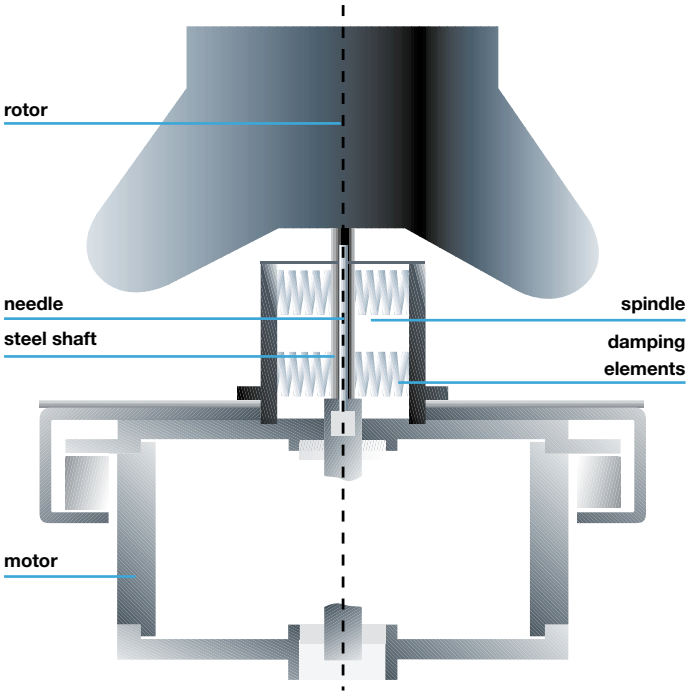
### Limited – the common needle drive

With a centrifuge, the motor's driving power is transferred to the rotor via a shaft. Common high-speed centrifuges achieve this via a flexible needle ("needle drive"), which is inexpensive and quite sufficient for the operation of high-speed fixed angle rotors up to 6 x 94 ml. The needle drive is not suitable when different rotors with high g-forces and very short acceleration and braking times are used:

- The needles often break when used for very short acceleration and braking times.
- Swing-out rotors are just as damaging.
- The needle drive is very sensitive to imbalance.
- Sample whirling can occur during braking at resonance speed.

### Intelligent – the Biofuge stratos' spindle drive

The spindle drive, which is unique for a table top centrifuge, features an elastic needle which is damped ("active damping", see illustration). The motor is totally independent from the rotor and does not feel any of the pressure and movements that the rotor causes. The spindle drive therefore offers indispensable benefits for the sophisticated user of a highspeed centrifuge.



Benefit	Customer usage
The spindle drive relieves the drive shaft from the weight of the rotor	Very short acceleration and braking times, no needle breakage
The sensitivity to imbalance is reduced	Exact balancing is not necessary (visual balancing)
Rotor resonance is damped	Sample sediments are not whirled during braking process
Rotor disturbance is reduced	No disturbing noises, extremely quiet operation, no damage to the motor bearing
The spindle tolerates the "hard" lowering of the rotors	The Biofuge stratos is very sturdy for everyday laboratory work
The spindle is supplied as a complete set including sensors	The entire spindle is easy to fit and service

# ECONOMICAL AND SPACE SAVING

## Flexible – the rotor diversity

With a selection of ten different rotors and numerous adaptors, the Biofuge stratos has the most flexible range of accessories on the table top centrifuge market. It is therefore a compact and application orientated centrifuge for every application in molecular biology, biochemical and medical research.

The table shows that some of the highspeed centrifuges available in the market cannot offer the Biofuge stratos' flexibility (centrifuge 1, 2 of the table). It is now possible to upgrade the Biofuge stratos with further rotors at any time. When on a limited budget, this is definitely more economical than purchasing an additional centrifuge with new rotors.

## Use of rotor types in highspeed table top centrifuges

Rotor type	Biofuge stratos	centrifuge 1	centrifuge 2	centrifuge 3	centrifuge 4
Microlitre rotor	■	■	■	■	■
Highspeed rotor	■	■	■	■	■
Falcon® fixed angle rotor	■	■ <sup>1</sup>		■ <sup>1</sup>	■ <sup>1</sup>
Swing-out rotor (Falcon®, DIN, blood tubes)	■		■	■	■
Microtitre plate rotor	■			■	■
Continuous flow rotor	■				

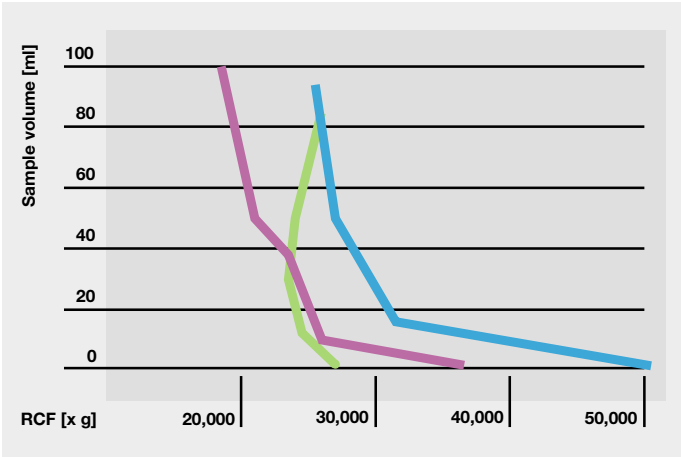
<sup>1</sup> Only partly suitable for Falcon® tubes due to steep angle

## Powerful – the RCF values

The Biofuge stratos' extreme flexibility is characterised by high RCF values for all rotors. Centrifuges with virtually comparable flexibility (centrifuge 3, 4 of the table/graph) are, however, considerably less powerful because they do not have the Biofuge stratos' pioneering spindle drive.

■ Biofuge stratos  
■ centrifuge 3  
■ centrifuge 4

## Highspeed angle rotors' RCF values and volumes



## Time saving – the run times

Short run times save time and consequently costs and they also increase the throughput of samples.

The graph opposite illustrates to which extent the Biofuge stratos' high RCF values and short braking times reduce the centrifuge's overall run time.

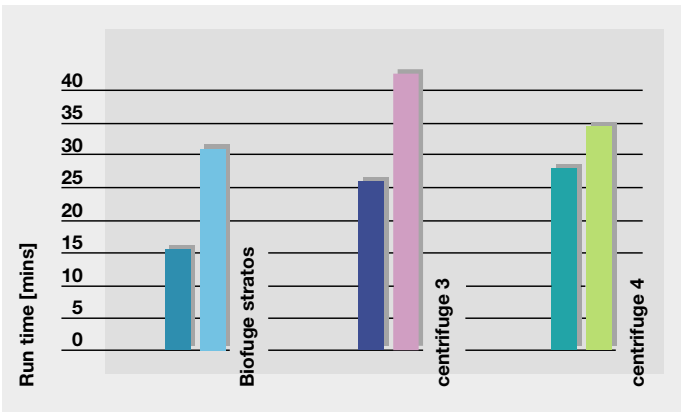
At maximum speed, a 8 x 50 ml rotor was operated for 30 minutes and a 24 x 1.5 ml rotor was spun for 15 minutes in the Biofuge stratos. After adding the braking

times, the entire centrifugation process' run time is established, as graphically illustrated.

Centrifuge 3 and 4 require a considerably longer run time to achieve the same separation results. This is due to the lower RCF values and partly the longer braking times.

■ 2 ml  
■ 50 ml  
■  
■

## Microlitre and fixed angle rotors' run times in highspeed table top centrifuges



# BIOLOGICALLY SAFE CENTRIFUGATION

In accordance with EN 61 010, when working with toxic and infectious materials, "it has to be guaranteed... depending on the biological agents' risk potential, that aerosols are either not created or cannot reach the work area's atmosphere". For centrifugation this results in the compelling necessity that both, tubes with sealed lid and rotors or swing-out buckets must be used with an aerosol tight cap.

## Sealed tubes

The Biofuge stratos' range of accessories was consistently designed for biologically safe centrifugation. New tubes with sealed lids for highspeed applications were included in the tube range (page 13 ff).

## Rotors – safe down to the smallest detail

The design of swing-out buckets and all fixed angle and microlitre rotors ensures a maximum seal.

At highspeeds the seals generally lose their effect when leaked liquid exerts a direct influence on them. At 50,000 x g, 1 ml of liquid puts a strain of 50 kg on the seals.

## Test guidelines

Every user is obliged to regularly check their centrifugation accessories. Kendro assists with a test procedure, described in the operating instructions, which is in accordance with British standards.

## Certified safety

The Biofuge stratos' aerosol tightness was certified by the independent CAMR test institute in Porton-Down, Great Britain, using a microbiological test procedure.

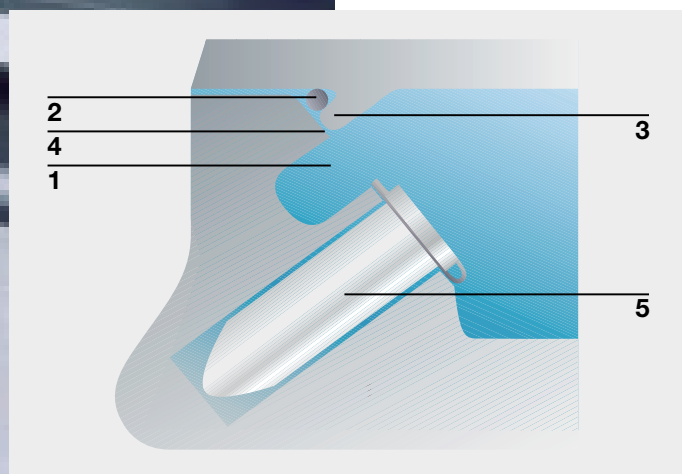




Angle rotors have a surrounding groove (1) above the tube boring which collects leaked liquids and aerosols which therefore cannot have an effect on the seal (2). The risk of spilling liquids is thus limited. This effect is supported by a liquid rejecter at the rotor lid (3) which, at the same time, holds the sealing ring.

An important detail is the inward pointing upper rotor edge (4). During a run the sealing ring presses against the centrifugal force and therefore actively supports the sealing effect. Furthermore, unscrewing the lid is very easy because the rotor lid including sealing ring lies on this edge.

The diagram illustrates the Biofuge stratos' angle rotor sealing principle.



- 1 Groove which is designed to collect leaked liquids and aerosols
- 2 Sealing ring
- 3 Liquid rejecter at the rotor lid
- 4 Inward pointing edge
- 5 Tube in the boring

# TECHNICAL DATA/ORDER NUMBERS

## Fixed angle rotors



Fixed angle rotors		6 x 94 ml	8 x 50 ml	16 x 16 ml	Highconic® rotor
Order no.		75003334	75003335	75003336	75003046
Angle	°	26	34	23	45
Max. speed	rpm	15,000 (13,000)*	15,000 (13,000)*	17,000 (14,000)*	8,500
Max. RCF		25,410 (19,083)*	26,920 (20,217)*	31,660 (21,475)*	10,015
Max. capacity	ml	6 x 94	8 x 50	16 x 16	6 x 50
Acceleration/braking time	s	70/60	75/60	60/55	35/40
Min. temp. at max. speed	°C	-5 (-10)*	-1 (-8)*	2 (-9)*	-18 (-14)*
Max. speed at 4 °C		15,000	15,000	17,000	8,500
Max./min. radius	cm	10.1/6.3	10.7/5.6	9.8/6.4	12.4/6.0
k-factor		531 (707)*	729 (970)*	373 (551)*	2,545
Distinctive features		aerosol tight	aerosol tight	aerosol tight	aerosol tight, indefinitely autoclavable (121 °C)

\* ( ) for use with Biofuge stratos 120 V/60 Hz version



## Adaptors for fixed angle rotors

Volume	Max. tube size		Rotor 75003334		Rotor 75003335		Rotor 75003336	
	D (mm)	L (mm)	Tubes per rotor	Order no. adaptor	Tubes per rotor	Order no. adaptor	Tubes per rotor	Order no. adaptor
1.5 ml	11	51	24	76002905	24	76002902	16	76002900
3.5 ml	11	91	24	75003091	24	76002903	16	76002901
6.5 ml	13	108	12	75003092	8	75003097	16	75003079
12 ml	16	89	12	75003093	8	75003098	–	–
16 ml	18	114	6	76002906	8	76002904	16	without ad.
38 ml	25	104	6	75003094	8	75003099	–	–
50 ml	29	114	6	75003014	8	without ad.	–	–
94 ml	38	114	6	without ad.	–	–	–	–

## Adaptors for Highconic® rotor 75003046

Volume	Max. tube size		Amount/ Rotor	Order no. Adaptor
	D (mm)	L (mm)		
4 x 1.5 ml	11	58	24	76002905
4 x 3.5 ml	11	103	24	75003091
2 x 6.5 ml	13	115	12	75003092
2 x 12 ml	16	96	12	75003093
1 x 16 ml	18	124	6	76002906
1 x 38 ml	25	112	6	75003094
1 x 50 ml	29	118	6	75003014
1 x 15 ml Falcon®	16.5	120	6	75003095
1 x 50 ml Falcon® 1)	30	117	6	75003096



1) Included in the price of the rotor

# TECHNICAL DATA/ORDER NUMBERS



## Microlitre rotors

Microlitre rotors		24 x 1.5/2 ml	24 x 1.5 ml	drum rotor
Order no.		75003332	75003331	75003044
Angle	°	45	45	60/90
Max. speed	rpm	17,000	23,300 (22,000)*	13,000
Max. RCF		28,110	50,377 (44,912)	16,438
Max. capacity	ml	24 x 1.5/2	24 x 1.5	80 x 2
Acceleration/braking time	s	27/35	30/40	30/35
Min. temp. at max. speed	°C	-13 (-8)*	8 (5)*	-15 (-12)*
Max. speed at 4°C		17,000	22,500	13,000
Max./min. radius	cm	8.7/5.9	8.3/5.9	8.7/3.8
k-factor		340	159 (179)*	1242
Distinctive features		aerosol tight, indefinitely autoclavable (121 °C)	aerosol tight	48-place angle rotor with 8 x rack 75001498

\* ( ) for use with Biofuge stratos 120 V/60 Hz version

## Adaptor sets for microlitre rotors 75003332 and 75003331

Adaptor sets with 24 reducer sleeves	Colour	Rotor 3332 Order no.	Rotor 3331 Order no.
for 0.5/0.6 ml microlitre tubes	turquoise	76003758	76003252
for 0.25/0.4 ml microlitre tubes	red	76003759	76003251 <sup>1)</sup>
for 0.2 ml PCR tubes	grey	76003750	76003250

<sup>1)</sup> Only suitable for 0.25 ml tubes



## Racks for the drum rotor 75003044

Rack for	Amount per		Colour	Order no.
	adaptor	Rotor		
1.5 ml microlitre tubes	10	80	yellow	76001499
1.5/2 ml microlitre tubes	10	80	red	76001244
0.3 ml microcapillary tubes	8	64	blue	76001246
0.5/0.6 ml microlitre tubes	15	120	green	76001247
0.25/0.4 ml microlitre tubes	20	160	yellow	76001248
1.5/2 ml microlitre tubes (60 ° angle)	6	48	white	75001498
PCR strips (each 8 tubes)	3	12	white	76001587





# TECHNICAL DATA/ORDER NUMBERS



## Swing-out rotors

Swing-out rotors	4 x 180 ml	2 x microtitre
Order no.	75003047	75003048
Order no. round bucket	75008172	–
Order no. aerosol tight cap	75008173	–
Max. speed	rpm	3,000
Max. RCF	4,863 (3,939)*	1,370
Max. capacity	ml	2 microtitre plate
Acceleration/braking time	s	30/35
Min. temp. at n <sub>max</sub>	°C	-19 (-15)*
Max./min. radius	cm	13.6/–
Distinctive features	aerosol tight	max. shelf height 5.7 cm

\* ( ) for use with Biofuge stratos 120 V/60 Hz version

## Adaptor for the round bucket 75008172 in swing-out rotor 75003047

Adaptor for	Max. tube size (mm)		Lid	Tube Rotor	Colour	Order no. adaptor
	D	L <sup>1)</sup>				
12 x 1.5/2 ml	11	42	13.6	48	black	75008190
9 x 7 ml DIN	13	125/135	15.2	36	yellow	75008189
7 x 7 ml blood collection	13	126/135	18.5	28	grey	75008188
7 x 15 ml DIN	18	126/135	18.5	28	red	75008186
4 x 15 ml blood collection	18	129/135	20	16	white	75008185
3 x 15 ml Falcon®	17	133/135	23.7	12	brown	75008187
1 x 25 ml DIN	25	126/135	27	4	orange	75008184
1 x 25 ml universal container	26	121/130	53	4	green	75008196
1 x 50 ml Falcon®	30	133/138	39	4	green/yellow	75008183
1 x 50 ml DIN	36	132/138	39	4	green	75008182
1 x 100 ml	45	128/133	47.5	4	blue	75008181
2 x US urine	17			8	brown/red	75008195

<sup>1)</sup> Length with/without aerosol tight cap  
D = max. diameter; L = max. tube length; cap = max. cap diameter



## Continuous flow rotor

Continuous flow rotor order no.	75003049	75003054
Max. speed	rpm	10,000
Max. RCF	25,040	8,665
Max. capacity	ml	400 ml sediment
Acceleration/braking time	s	36/35
Max./min. radius	cm	7.75/5.0
Distinctive features	indefinitely autoclavable (121 °C)	indefinitely autoclavable (121 °C)
Material	titan	coated aluminium

## Continuous flow rotor accessories

High performance insert for HCT 22,300 rotor	75015339
--	----------

# CENTRIFUGE TUBES AND TOPS

## Highspeed tubes with round bases

- made of polycarbonate with glass like transparency
- made of polypropylene with high chemical resistance



## Oak-Ridge buckets

- including aerosol tight cap
- for leakage free closing up to the edge of filled tubes
- recommended for centrifugation of critical substances



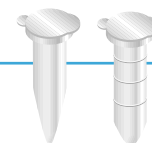
## Sealing plug

- to seal buckets with round bases as splash and dust protection



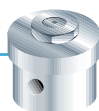
## Microlitre tubes

- for small volumes and high-speeds



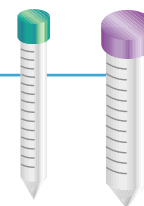
## Sealing caps

- for tight closing of smooth sided buckets
- unlimited use



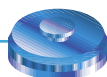
## Conical tubes

- "Falcon®" type
- for work with cell cultures



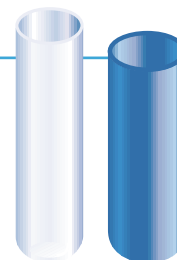
## Screw lid

- made of metal
- for tight closing of polycarbonate tubes with thread



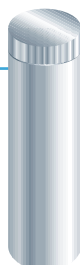
## Corex® glass

- if glass is indispensable
- for applications to 12,000 x g
- use always in combination with a rubber adaptor



## Stainless steel buckets

- with high chemical resistance
- sturdy and unlimited use



## Borosilicate glass

- for gravitational fields up to 4,000 x g
- with high chemical resistance
- indefinitely autoclavable

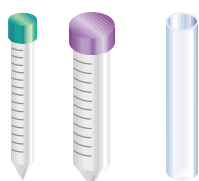


# CENTRIFUGE TUBES AND TOPS



**Micro tubes for microlitre rotors order no. 75003331, 75003332  
and drum rotor order no. 75003044**

Capacity	Type	Packed/unit	Order no.
0.4 ml	Microlitre tube, PE, with snap lid	1,000	76001166
1.5 ml	Microlitre tube, PE, with snap lid	500	76001163
	Microlitre tube, PP, with screw lid	500	76001148
2.0 ml	Microlitre tube, PE, with snap lid	500	76001169



**Centrifuge tubes for the swing-out rotor order no. 75003047  
with swing-out bucket order no. 75008172**

Capacity	Type	Packed/unit	Order no.
1.5/2 ml	<b>for adaptor order no. 75008190:</b>		
	1.5 ml microlitre tube, PE, with snap lid	500	76001163
	1.5 ml microlitre tube, PP, with screw lid	500	76001148
	2.0 ml microlitre tube, PE, with snap lid	500	76001169
3.5 ml	<b>for adaptor order no. 75008189:</b>		
	tube with round base, PPCO, 3.5 ml	10	75002994
	tube with round base, PC, 3.5 ml	10	75003068
	sealing plug, PP	20	75003069
7 ml	<b>for adaptor order no. 75008189:</b>		
	borosilicate glass, DIN	100	76009001
15 ml	<b>for adaptor order no. 75008186:</b>		
	borosilicate glass, DIN	100	76009003
	borosilicate glass, DIN, graduated	1	75001137
	borosilicate glass, conical, 12.5 ml	100	76009002
	borosilicate glass, conical, graduated, 12.5 ml	1	75001136
	tube with round base, PP	1	76009080
15 ml con.	<b>for adaptor order no. 75008187:</b>		
	"Falcon®" type	125	76002845
25 ml	<b>for adaptor order no. 75008184:</b>		
	borosilicate glass, DIN	50	76009006
	borosilicate glass, DIN, graduated	1	75001143
50 ml	<b>for adaptor order no. 75008182:</b>		
	borosilicate glass, DIN	10	76009005
	borosilicate glass, DIN, graduated	1	75001138
	tube with round base, graduated, PC	1	76009093
	tube with round base, PP	1	76009082
	rubber pad for tube 76009093 and 76009082	1	76001805
50 ml con.	<b>for adaptor order no. 75008183:</b>		
	"Falcon®" type	25	76002844
100 ml	<b>for adaptor order no. 75008181:</b>		
	borosilicate glass, DIN	10	76009007
	borosilicate glass, DIN, graduated	1	75001146
	tube with round base, graduated, PC	1	76009095
	tube with round base, PP	1	76009084
180 ml	<b>use without adaptor:</b>		
	bottle incl. screw lid, PP	1	76003026

material descriptions: PC = polycarbonate, PP = polypropylene, PPCO = polypropylenecopolymer, PE = polyethylene

**Centrifuge tubes for fixed angle rotors order no. 75003046,75003334,  
75003335, 75003336**

Capacity	Type	Packed/unit	Order no.
<b>3.5 ml</b>	tube with round base, PPCO	10	75002994
	tube with round base, PC	10	75003068
	sealing plug, PP	20	75003069
<b>6.5 ml</b>	tube with round base, PC	10	75003071
	tube with round base, PPCO	10	75003072
	sealing plug, PP	20	75003073
<b>12 ml</b>	tube with round base, PC	1	76002804
	tube with round base, PPCO	1	76002856
	tube with round base, PC, with thread	1	75002805
	screw lid for tube 2805	1	75001559
	Oak-Ridge tube, PC, incl. aerosol tight cap	10	75003074
	Oak-Ridge tube, PPCO, incl. aerosol tight cap	10	75003075
<b>15 ml con.*</b>	"Falcon®" type	125	76002845
<b>16 ml</b>	tube with round base, PC	10	75002950
	tube with round base, PPCO	10	75002951
	sealing plug, PP	10	75002957
	tube with round base, stainless steel incl. screw lid	1	75002955
	Oak-Ridge tube, PC, incl. aerosol tight cap	10	75003076
	Oak-Ridge tube, PPCO, incl. aerosol tight cap	10	75003077
<b>38 ml</b>	tube with round base, PC	1	76002809
	tube with round base, PPCO	1	76002871
	sealing cap for tube 2809 and 2871	1	76001528
	tube with round base, PC, with thread	1	75002828
	screw lid for tube 2828	1	75001547
	Oak-Ridge tube, PC, incl. aerosol tight cap	10	75003078
	Oak-Ridge tube, PPCO, incl. aerosol tight cap	10	75003086
<b>50 ml</b>	tube with round base, PC	10	75002958
	tube with round base, PPCO	10	75002959
	sealing plug, PP	20	75002974
	bucket with round base, stainless steel, incl. screw lid	1	75002968
	Oak-Ridge tube, PC, incl. aerosol tight cap	10	75003087
	Oak-Ridge tube, PPCO, incl. aerosol tight cap	10	75003088
	Oak-Ridge tube, Teflon, incl. screw lid	2	75002966
	Corex® glass, 15 ml	1	75002954
	rubber adaptor for Corex® glass 2954	2	75002971
	Corex® glass, 25 ml with screw lid	1	75002970
	rubber adaptor for Corex® glass 2970	2	75002973
	Corex® glass, 30 ml	1	75002969
	rubber adaptor for Corex® glass 2969	2	75002972
<b>50 ml con.*</b>	"Falcon®" type	25	76002844
<b>94 ml</b>	tube with round base, PC	1	76002810
	sealing cap for tube 2810	1	75001568
	tube with round base, PC, with thread	1	75002829
	screw lid for 94 ml tube 2829	1	75001540
	tube with round base, PPCO thick	1	76002872
	tube with round base, PPCO thin	25	76002837
	tube with round base, stainless steel	1	75002883
	sealing cap for tubes 2837 and 2883	1	75001569
	Oak-Ridge tube, 85 ml PC	10	75002976



\* only for rotor 3046

# FAST AND PRECISE SERVICE

# TECHNICAL DATA/ORDER NUMBERS

## Biofuge stratos and Contifuge stratos

Drive		induction drive without carbon brushes
Control		microprocessor control through Easycontrol II
Min./max. speed	rpm	300/23,300, adjustable in increments of 10
Max. RCF		50,377
Max. capacity	ml	4 x 180
Braking/accel. curves		9/9
Programs		9 + 1 pre-cooling program
Noise at max. speed	dB	< 60
Run time		0 – 9 hrs 59 mins, continuous operation
Temperature range	°C	–19 to +40
Functions		RCF selection, Quick-run
Rotor recognition		automatic
Imbalance recognition		electronic, depending on speed and ideally suited to every rotor
Construction		galvanised steel chassis with armoured chamber
Equipment safety		lid lock and interlock (two automatic locks)
External dimensions (h x w x d)	mm	395 x 640 x 595
Weight (excluding rotor)	kg	134
Power consumption	W	1,400 W (cooling system ca. 900 W)
Test standards		manufactured and tested in accordance with EN 61 010-1, EN 61 010-2-020, EN 50 081-1, EN 50 082-1 Requiring approval in accordance with UVV VBG 7z

Type	Equipment	Order no.
Biofuge stratos	230 V, 50/60 Hz	75005282
	200/208 V, 50/60 Hz	75005284
	120 V/60 Hz	75005286
Contifuge stratos	230 V, 50/60 Hz	75005283
	200/208 V, 50/60 Hz	75005285

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## 2 Service

### 2.1 Servicing Schedule (yearly procedure recommended)

#### 2.1.1 Maintenance Routine without Dismantling the Centrifuge

##### 2.1.1.1 Electrical Installation and Safety

- Switch OFF the centrifuge and disconnect the unit from power, check voltage supply and mains fusing (16 Amps, slow blow characteristic)
- Check condition of plug and wall socket - (let) replace defective parts
- Check cord condition and fixing / connection - replace or refit it
- Check condition of instrument socket and replace it in case of bad contacts

##### 2.1.1.2 Location and Mechanical Installation

- Check the base (ground, table, lorry with lockable wheels etc.) For resonance-free and stable conditions
- Check for a well ventilated place and sufficient distances to walls or adjacent equipment, without exposition to direct sunlight
- Check the levelling of the centrifuge drive with use of a spirit level

##### 2.1.1.3 Lid Tumbler Mechanism and Safety Device

- Connect the centrifuge to power and switch ON
- Check for correct automatic lid closing and self-acting lid opening - if in disorder, readjust lid, swivel hinges, and/or locking devices
- Check the rubber gasket for lid's and bolt's sealing and replace, if damaged
- For checking the electronically safety circuit: start the centrifuge, let it shortly run and stop it, the lid must not be unlocked by the microprocessor as long as the speed is more than 60 rpm - if safety circuit is out of function, replace main board

##### 2.1.1.4 Cleanliness of Spin Chamber and Motor Casing

- Open the lid and remove the rotor (for loosening turn the T-handle Allen key (5mm) in arrow direction - see rim of rotor chamber)
- Clean the spin chamber with a dry and absorbent cloth (remove all dust and moisture - see also section for Cleaning)
- Check the cleanliness of the motor flange and take care of the annular slot around the motor shaft: penetrating fluids can damage the upper spindle bearing or electronics, remove fluids with an injector and/or absorbent paper

##### 2.1.1.5 Rotor and Accessories Condition and Sealing

- Clean the spin chamber with a dry and absorbent cloth (remove all dust and moisture - see also section for Cleaning)
- Check the condition of rotors and accessory parts (especially all supporting or stressed partitions): the rotor and/or accessory parts must not be used any longer, if there are visible traces of mechanical damage or rust

##### 2.1.1.6 Rotor Fixing and Drive Spindle

- Check the perfect condition of the collet chuck and replace it in case of malfunction (thread is worn out, horizontal grooves etc.)
- Check the condition of the drive spindle: the centrifuge must not be used any longer, if the drive spindle is damaged (e.g. Bend or it's bearings are worn out)

##### 2.1.1.7 Temperature Level

- Check the wire gauze (behind the air inlet slots) underneath the front panel for free ventilation, insufficient air flow will lead to an inadmissible temperature rise of compressor, motor and electronic parts

##### 2.1.1.8 Imbalance Behaviour

- Install available and empty rotors and check the imbalance behaviour with rotor dependant cut off and run through weights (see 2.4) and replace worn out motor rubber mounts, spindle or faulty main board

### 2.1.2 Maintenance Routine after Dismantling the Centrifuge Casing

#### 2.1.2.1 Motor Supporting Elements

- Check the supporting and damping elements of the drive motor and replace them in case of increased rubber abrasion or abundance of imbalance but at least every 6 years

#### 2.1.2.2 Braking Circuit

- Check the function of the braking circuit (warming up of brake resistor, even and noiseless brake effect) and replace defective parts in case of malfunction

#### 2.1.2.3 Lead and Screwing Connections

- Check the terminal and plug connections of all leads and on all boards and electrical components, tighten all loosen screwing connections, refit or replace defective parts
- Check the screwing connections of all boards, mechanical and electrical components and re-tighten them if necessary (use screw locking lacquer for motor mounts and lid lock assembly)

#### 2.1.2.4 Protection Earth Core and Grounding Connections

- Check the protection earth core for continuity and all grounding plug connectors
- Check isolation resistance and accessible current (see 2.6)



## 2.2 Trouble Shooting

Error Indication	Error Cause	Possible Error Source	Corrective Procedure
displays remain dark	no mains voltage supply	mains switch with integrated fuse or fuses on main board	switch on again, disconnect electric. components success., search for other faults
		mains fuse or circuit breaker failed	check fuse or circuit breaker and replace or switch on again
		faulty mains cord or instrument socket	check instrument cord and socket, replace defective parts
	no low voltage supply for indication board	faulty connection from CPU to indication board	check connections on CPU, indication board and connecting leads
		faulty indication or CPU board	replace main board completely
	interrupted program	NV-RAM out of socket or not correctly placed	insert the valid NV-RAM and push it correctly into socket
all display elements are shortly illuminated	CPU program reset may be caused by EMI	reduced voltage supply (<10%)	remedy the failure if the voltage drops often, use a voltage stabiliser
		bad or missing ground connection	check all ground connections and the ground connection of all boards
constant	interruption	parameter NV-RAM	no or defective NV-RAM
drive makes noises -no good separation result	mechanics	wear out of motor rubber mount	replace motor rubber mounts (at least every three years)
		spindle bearings	replace spindle completely
		motor bearings	replace motor completely
	electrical	defective terminal connection, faulty lead or motor winding	check voltage on motor terminal and winding resistances -see test points on boards
		faulty power electr.	replace main board
lid cannot be opened by key at standstill ->"E-17"	locking drive is not supplied with voltage	24V supply faulty relay K2 faulty driving circuit imbalance NV-RAM	check voltage for drive motor check switch. after power ON replace the main board no or defective NV-RAM
	locking motor	faulty motor winding	replace complete locking assy
	lid is not correctly locked	lid bolt is jamming	push lid centrally into lock and press the key again
		lid is deformed	re-adjust the lid centrally

Error Indication	Error Cause	Possible Error Source	Corrective Procedure
„rotor“ in speed display	wrong selection of detected rotor	inadmissible speed or rcf value was pre-selected	press start again (within 15s), else wait for rotor standstill, lid OPEN/CLOSE, set value, start
“bAL“ message appears in speed display	imbalance run	rotor not symmetrically loaded	open lid, check rotor loading, close lid again and restart
		base is not sturdy enough and comes into vibrations	change or reinforce the base (table, lorry with lockable wheels, etc.)
		centrifuge drive is not correctly levelled	level the drive correctly by means of unit's feet
		rotor itself has imbalance	rotor must no longer be used, send back to Kendro
		drive shaft or rotor fixing is damaged	centrifuge must no longer be used, replace chuck or spindle
	signal fault	imbalance NV-RAM	no or defective NV-RAM
		imbalance sensor, sensor board	replace spindle inclusive sensor board
imbalance but no “bAL“ message	no imbalance cut-off (see 2.4)	circuits of main board	replace the main board
		imbalance NV-RAM	wrong NV-RAM data
		imbalance sensor	replace spindle inclusive sensor board
“Lid“ appears in speed display	lid was opened manually during run	circuits of main board	replace the main board
		forbidden intervention emergency opening device must only be used at standstill	close lid immediately, turn power OFF/ON, press lid down for locking, press start key, press stop to finish run
	protection circuit (15V) interrupted during run	defective micro switch or leads or connectors to micro switch are interrupted	check leads and connectors to micro switch, in case of a faulty micro switch, replace lid lock device completely
„OPEn“ appears in speed display by supposedly closed lid	15V supply for protection circuit is interrupted at standstill	loose plug connectors	check plug connectors XA1 and XA2
		interrupted leads to micro switches	check leads to micro switches for continuity
		defective micro switch	in case of faulty micro switch replace lid lock completely

Trouble Shooting (continued)

Error Indication	Error Cause	Possible Error Source	Corrective Procedure
„E-00“, or „E-03“ message appears in speed display	rotor didn't turn	rotor is jammed	check for easy movement, remove any jamming objects
		spindle or motor is jammed	remove spindle or drive, replace defective parts
	missing speed signal test: turn rotor by hand, then close the lid	faulty plug or lead connection to speed detection board	check plug contacts and leads, measure speed signal on XW1/3, replace defective parts
		faulty processing circuit	replace main board
	motor didn't start	connections motor to power electronics	check plug contacts and leads, measure speed signal on XW1/3, replace defective parts
		motor windings	replace motor
		driving circuit, FETs	replace main board
„E-02“ message	program sequence was disturbed	bad ground connect. EMI troubles	check all ground connections tighten loose screws
		internal program error	replace the CPU
			replace the main board
„E-04“ message	faulty measuring of temperature values	PT100 sensor, connecting lines or plug connection	resistance test at $\vartheta_{\text{sol}}=20^{\circ}\text{C}$ : 100 $\Omega$ : -> display: $(-1\pm 1)^{\circ}\text{C}$ 120 $\Omega$ : -> display: $(50\pm 1)^{\circ}\text{C}$
		defective circuit	replace the main board
			replace the main board
„E-06“ message	data lines to key board were disturbed	data lines or soldering connections	check lines and soldering points, replace faulty parts
		CPU is defective	CPU exchange
		faulty key board	replace the main board
		faulty main board	replace the main board
„E-07“ message	chamber overtemperature: display $>50^{\circ}\text{C}$	compressor didn't work	check leads, terminals, start relay, capacitor, compressor
		faulty cooling cycle	exp. valve, refrigerant loss
„E-08“ message	over-voltage of intermediate circuit	defective leads or brake resistor	check leads and brake resistor, replace defective parts
		driving and/or braking circuits	replace the main board
„E-10“ message	NV-RAM is not initialised	Initialising of NV-RAM is not valid	check NV-RAM and socket, insert the correct NV-RAM

Trouble Shooting (continued)

Error Indication	Error Cause	Possible Error Source	Corrective Procedure
„E-11“ message	NV-RAM is faulty	no data transfer from NV-RAM to CPU	replace the NV-RAM
„E-12“ message	faulty temp. measuring	frequency of U/F converter out of limit	check sensor (see E-04) replace the main board
„E-14“ message	wrong or faulty rotor detection	a wrong rotor was installed	wait for standstill, open the lid and install a correct rotor
		mains voltage failure	press stop key, wait for standstill and restart
		wrong motor phase condition	check rotation direction, if necessary change 2 leads
		faulty detection cir.	replace the main board
„E-15“ message	checksum error	NV-RAM is wrong or defective	replace NV-Ram and insert correctly into socket
„E-16“ message	program interruption	CPU disturbed or defective	replace CPU and /or eliminate disturbance
„E-17“ message, lid didn't open	micro switch does not open after pressing lid	lid is blocked or jammed	press lid centrally in front down again, re-adjust if nec.
		defective micro switch or lid lock	replace lid lock device
		faulty driving circuit	replace the main board
„E-19“ message	wrong key board indication	wrong NV-RAM	Replace the correct NV-RAM
		wrong key board (incl./without cooling)	replace the correct key board
„E-22“ message	NV-RAM and CPU didn't match	wrong NV-RAM	Replace the correct NV-RAM
		wrong CPU	Replace the correct CPU
„E-23“ message	less voltage	mains voltage $< 175\text{v}$	connect to voltage stabilizer
	15V-protection circuit is disconnected	motor overtemp.	unsufficient cooling air flow
		switch has tripped	phase fault of drive motor
		overpressure switch of cooling plant has tripped	ambient temp. is too high heat transfer-> condenser/fans expansion valve didn't close
„E-24“ message	2.NV-RAM is missing	NV-RAM for curves is not (correctly) in place	insert the NV-RAM including accl./deceleration curves
„E-25“ message	pulsing fault of rotor detection	no rotor installed	install rotor correctly
		loose rotor screwing	tighten rotor sturdy
		big imbalance on start faulty pulse detection	rotor, spindle or motor bearing distance hall sensor, magnets

## 2.3 Test Points

Test Points	Unit Value	Conditions
mains terminal <b>XN</b> board's resistance	230V AC 1980Ω	all given values are related on 230V (±10%) mains voltage for board's supply
terminal <b>XM</b> motor voltage - values must be the same between all 3 motor leads ( <b>U,V,W</b> )	250V AC 250V AC 250V AC 250V AC	in each case measured inter 2 motor leads after reaching selected speed - <b>no effective values!</b> 3000min <sup>-1</sup> , swing-out rotor #3047 (4 x 180ml) 5000min <sup>-1</sup> 12000min <sup>-1</sup> , microliter rotor #3331 (24 x1.5ml) 23300min <sup>-1</sup>
motor current <b>I<sub>M</sub></b> cable ( <b>U,V,W</b> )	3 * 6A 3 * 5,2A 3 * 3,0A 3 * 5,0A	soft iron or digital effective measuring instr. maximum during acceleration (#3331, 36s) rotor #3047, set speed = 5000min <sup>-1</sup> , 560W rotor #3331, set speed = 23300min <sup>-1</sup> , 650W maximum during braking phase (#3331, 40s)
intermediate voltage <b>U<sub>D</sub></b> (inter brake resistor's solder pin and control resistor <b>R47</b> )	320V DC 350V DC 300V DC 295V DC 285V DC	at standstill max. during braking phase (#3331, 40s) rotor #3047, set speed = 5000min <sup>-1</sup> rotor #3331, set speed = 23300min <sup>-1</sup> shortly at maximum acceleration (#3331, 36s)
current <b>I<sub>D</sub></b> of intermediate circuit, (measured as voltage drop across control resistor R47) <b>U<sub>M</sub> = I<sub>D</sub> * R<sub>M</sub></b>	25mV DC 40mV DC 65mV DC 25mV DC 45mV DC 75mV DC 180mV DC -45mV DC	3000min <sup>-1</sup> , swing-out rotor #3047 4000min <sup>-1</sup> 5000min <sup>-1</sup> (shortest accel. / decel. time 55/60s) 12000min <sup>-1</sup> , microliter-rotor #3331 18000min <sup>-1</sup> 23300min <sup>-1</sup> shortly at maximum acceleration (#3331) shortly at maximum braking (#3331)
motor winding resistance 20°C -insulation value	3x1Ω > 10MΩ	switch OFF unit, pull off motor plugs, measure inter U -> V, V -> W, W -> U resistance inter each phase and motor casing
brake resistor terminal <b>XD</b>	75Ω	switch OFF unit, 2 resistors parallel connected, resistance at 20°C
plugs <b>XC1/2</b> lid motor bolt switches	8Ω 5V	condition at rest, resistance at 20°C 3 -> 4 (red) in series: 2 (XC1) -> 1 (XC2) with open lid
lid micro switches plug <b>XA1/2</b>	28V DC	voltage drop across both serial connected switches by open lid

Test Points	Unit Value	Conditions
motor over-temp. terminal <b>XO</b>	20V DC	voltage drop by one disconnected lead (error case) and linked terminal XR
over-press. Switch terminal <b>XR</b>	20V DC	voltage drop by one disconnected lead (error case) and linked terminal XO
front fans terminal <b>XF</b>	300Ω	switch OFF unit, 2 fans (M3+M5) parallel fans' resistance temperature 20°C
fans cooling plant terminal <b>XK</b>	200Ω	switch OFF unit, 3 fans (M4+M6+M7) parallel fans' resistance temperature 20°C
compressor terminal <b>YG</b> terminal box -insulation value	4Ω 14Ω > 10MΩ	switch OFF unit, compressor temp. 20°C resistance of main coil + (starting relay 0.1Ω) resistance of auxiliary coil (joints 13 -> 14) resistance inter phase and motor casing
hose pump socket <b>XV</b>	1,1A	external connection on unit's back side max. current load (rating power 250VA)
speed detection plug <b>XW</b> (1 ->3) (1 -> 2) speed: (n =	12V DC 10,7V 0,3V f	board with active filter circuit low voltage supply light barrier is passed through (slot position) light barrier is out (turn cone a little by hand) • 30) when centrifuge is running
temp. measuring plug <b>XE</b> (2 -> 3)	115mV 103mV 125mV	chamber temperature 20°C (PT100: ≈ 108Ω) chamber temperature -10°C (PT100: ≈ 96Ω) chamber temperature 40°C (PT100: ≈ 116Ω)
plug <b>XE</b> (5 -> 7) imbalance sensor (5 -> 9)	12V DC a(t)	low voltage supply of sensor board amplitude of lateral acceleration is rotor and speed dependent, analyzed for n > 250 rpm
rotor detection plug <b>XE</b> (1 -> 7)	5V DC 0V DC	per rotor revolution 2 different long pulses are separated from 2 different pulse pause lengths, this pulse mode is generated by 4 alternately polarized magnets

## 2.4 Imbalance Behavior

- **Install** in table available **rotor** in unloaded condition
- **set speed = 17,000 rpm at 208V / 240V units**
- **set speed = 14,000 rpm at 120V units**

Rotor	Run through weight	Cut off weight
Angle 16*16ml Alu #3336	< 6g	> 15g

- Insert rotor dependent **cut-off weights** and position them at angles of 90° to each other, the centrifuge must stop 4 times when the speed is above 300 rpm indicating the “bAL” message. It is possible that the centrifuge will accelerate to the maximum speed (17,000 rpm or 14,000 rpm) of the rotor before it stops and indicating the “bAL” message. This is not an abnormal behaviour
- Insert the **admissible imbalance weights** in the same manner, the centrifuge **must** run through 4 times to maximum rotor speed (17,000 rpm or 14,000 rpm) without indicating the “bAL” message

## 2.5 Cleaning of Instrument Parts

### ATTENTION - WARNING!

**The electrical and electronic components must not be cleaned with moist detergents!**

For Cleaning the centrifuge housing or its accessories see Operating Instructions section 1 (maintenance and care).

- **Electronic components**  
Clean dusty components carefully with a dry and soft brush and remove loose dust with a vacuum cleaner
- **Fans**  
Scratch off carefully with a knife or similar tool the crusted dirt from the fans' blades. Resulting grooves or marks must be removed subsequently with a fine abrasive cloth. Loose dirt is to remove with an absorbent cloth or vacuum cleaner
- **Vent holes**  
Remove dirt from the vent grid behind the front panel by using a brush and vacuum cleaner
- **Condensers of cooling plant**  
The louvers between the condensers' heat air deflectors have to be vacuum cleaned. In case of persistent dirt the unit must be carried to an appropriate place where the condensers can be cleaned with compressed air from inside to outside. Heat air deflectors which are out of shape have to be realigned correctly

## 2.6 Electrical Safety Check

### ATTENTION!

A final electrical safety check must be performed after each maintenance and/or repair!

- **Resistance check of protective conductor**

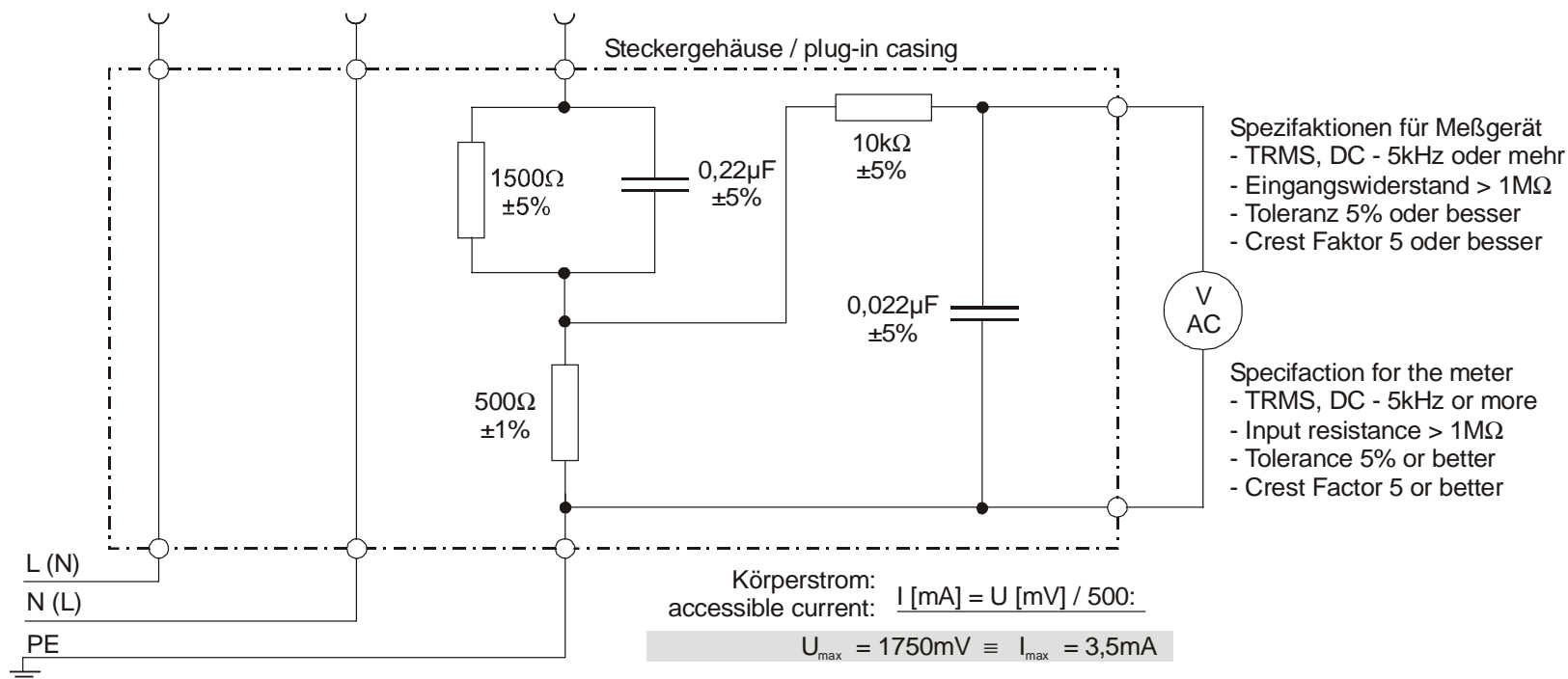
The measuring value of the resistance between the mains plug's grounding pin and the grounding conductors of the motor, electronic chassis and the casing must not exceed 200 mΩ

- **Insulation resistance Check**

Check also the insulation resistance between the poles of the mains plug and the grounding conductor; the resistance value must be more than 2 MΩ

- **Accessible current measured to EN 61 010**

The accessible current must not exceed 3.5 mAmps in single fault condition (interrupted protection earth wire)! In accordance with the EN61010, IEC1010 and UL3101 such a fault condition can be reproduced by the following measuring circuit





### 3 Functional Description

#### 3.1 Block Functions

The BIOFUGE stratos is a refrigerated microprocessor controlled high speed laboratory tabletop centrifuge with noise reduced induction drive motor incorporating automatic rotor and imbalance detection and self-closing lid tumbler systems.

The unit is equipped with following boards and components (block diagram 4-1):

- Instrument socket for mains cable on back side (units for 200V or 208V mains supply are equipped with step-up transformer)
- Two poles mains switch with integrated thermal over-current release F1 (14A)
- Main board (230V) with microprocessor part and power electronics
- Key and indication board (program: EASYCONTROL II with temp. display)
- Sensor board with temperature, imbalance and rotor detection sensors
- 3 phase induction motor with integrated thermal overtemp. switch (C. O. 155°C)
- Speed detection board with filter attached to the motor's bottom by screws
- 2 self-closing lid tumbler systems with 3 integrated micro switches each (mechanical bolt keeper, motor dislocking)
- 2 parallel brake resistors mounted on an angle support behind the fans in front
- Cooling plant with R404 compressor, expansion valve and over-pressure switch
- 5 equal axial-flow fans for power electronics, motor and cooling plant
- Connections (on back panel) for hose pump and serial interface (option for continuous flow operation)

#### 3.2 Main Board Functions

The **Main board** is mounted on a metal plate behind the front panel. The components on main board are arranged in following function blocks (see wiring diagram page 4-2 and 4-3).

- Noise filter in accordance with EN 55011 for motor and triac circuits
- Power pack for low voltage supply of microprocessor part and power electronics
- Triac driving circuits for compressor cut-in relay, for 2 independent fan wiring terminals and for connection of an external hose pump
- DC intermediate circuit for supply of frequency converter equipped with automatic loading and voltage (brake) controlling circuits
- Power part inclusive physically separated driving stages
- Microprocessor part with 2 controllers (CPU, imbalance) and ASIC80 comp.
- Driving component for 2 self-closing lid lock devices
- Interface component for serial RS232
- 3 exchangeable NV-Rams containing specific data of BIOFUGE stratos

#### 3.2.1 Low Voltage Supply

The power pack consists of 2 transformers, 2 bridge rectifiers and 3 voltage regulators, it generates the following low voltage levels:

- U1 = 5V: by switched-mode regulator LM2575T-5.0  
supplies all processors and its electronic components on main and indication board
- U2 = 12V: by fix voltage regulator 7812  
supplies sensor circuits on sensor and speed detection board
- U3 = 24V: unregulated  
is used for the driving of both lid lock motors and relays K2, K3;  
the reference potential of U1,U2,U3 is **A1**: connected to protective conductor (GND)
- U2 = 15V: by 2. transformer, rectifier and fix voltage regulator 7815  
serves for supply of driving of the power electronics via the protection circuit by closed lid switches  
reference potential: **A2 (UD-) CAUTION - MAINS POTENTIAL!**

#### 3.2.2 Intermediate Circuit

The DC intermediate circuit serves as an energy store between the AC power input and the transmitted motor performance. The intermediate circuit consists of a heat-sink-cooled bridge rectifier and several reservoir capacitors which are softly charged across a power resistor when ever the unit is switched on. After the loading time (CPU initialisation time) the power resistor is linked by the relay contacts of K3. When switching the unit off, the DC voltage of the intermediate circuit is discharged across a path of resistor and voltage monitoring LED H3.

#### 3.2.3 Brake Path

Electrical power is fed back into the intermediate circuit during motor deceleration (motor acts as generator). This braking power is transformed into heat by two parallel connected resistors so that the intermediate circuit voltage does not rise to an excessive level. The brake resistors are switched into the intermediate circuit by a fast switching transistor (pulse-width modulation, synchronised by the double mains frequency). This transistor is voltage dependent controlled by a self-acting stage (closed loop).

#### 3.2.4 Frequency Converter

The motor is 3-phased, provided with chopped direct voltage blocks (chopped frequency approx. 20kHz, amplitude is height of DC intermediate voltage). These blocks are variable in frequency and pulse-width modulation, 120° out of phase.



## Main Board Functions (continued)

These 3 phases are controlled during acceleration, running at set speed and deceleration (e.g. for small speed: low frequency and small pulse-width length will be affected). The FC is protected against over current, over temperature and over-voltage which will be indicated by LED H2.

### 3.2.5 Microcontroller (Central Processing Unit) Part

The software identification No's of the CPU and 2 data storage's (NV-RAMs) 9366 are sequentially displayed in speed and time fields:

- **CPU:** 590 xx (second No.)
- **RAM 1** (parameters): 4409 xx (third No.)
- **RAM 2** (curves): 4410 xx (fourth No.)

The actually indicated version No.'s (xx) are displayed in the time field and will be upgraded if program or data changes are necessary.

The control program (ROM) is integrated in the controller component. The most important operating parameters (e.g. the maximum data for all rotors, the last operator settings, the basic values for speed and temperature controlling, data of acceleration and deceleration curves as well as 9 data sets of program places plus pre-temperation program) are stored in the non volatile (NV)-RAMs.

The actual value of all centrifugation cycles ("CYL") is also shown in the display (as fifth No.) when ever the unit is powered on, before the check routine for all program places puts an end to the initialisation time (approx. 18s).

The CPU co-operates with the ASIC 80 component via the 8 bit data bus and some control lines. The ASIC 80 is a specially designed integrated circuit for the driving of Heraeus centrifuges (with induction motor), containing a pulse counting stage for speed measuring and some protecting functions for the power electronics.

An other micro-controller (592) and NV-RAM (4434) are serving the tasks for automatic imbalance and lid release control (see also 3.5)

### 3.3 Speed Detection Board

On a small board, which is attached underneath the motor, the circuits for speed detection and signal shaping are arranged. The motor speed is optically detected by an infra-red light barrier. The motor axle has a slot at the same level as the light barrier. This effects that the light beam will be interrupted twice during one motor revolution. A following pulse shaping stage on board forms square-topped pulses which are led via XW2 to the main board where they are passed on to imbalance controller (see 3.5.3) and further to ASIC80 component. The speed pulses are counted by an integrated circuit stage of the ASIC80 component to give the CPU a hand with fast calculation of the exact motor speed.

### 3.4 Key and Indication Board

The key and indication board is mounted behind the operating panel. The connection to the main board is done by a screened 6 polar cable by which the serial data transfer as well as the low voltage supply of 5V is verified. The 7-segment displays, the control LED's and the operating keys are managed by an own controller unit (first identification No. 591) in multiplex processing.

For the programming serves EASYCONTROL II (see Operating Instructions)

#### Functions of keys elements

keys	designation	function(s)
S1	arrow to right	<b>start</b> , to set a centrifugal run in rotation <b>terminates the time out</b> when changing set values switches over to acceleration during braking phase
S2	square symbol	<b>stop</b> , to terminate the centrifugal run manually <b>switches off the buzzer</b> when activated terminates time out when changing brake setting
S3	double arrow	<b>quick run</b> , to start - keep the key pressed
S4	lid symbol	<b>to open the lid</b> (only possible at standstill)
S5	temp. arrow up	to <b>increase</b> the value of the <b>set temperature</b>
S6	temp. arrow down	to <b>decrease</b> the value of the <b>set temperature</b>
S5+S6	<b>at the same time</b>	steps on the <b>setting</b> temperature <b>digit position</b>
S7	time arrow up	to <b>increase</b> the value of the <b>set time</b>
S8	time arrow down	to <b>decrease</b> the value of the <b>set time</b>
S7+S8	<b>at the same time</b>	steps on the <b>setting</b> time <b>digit position</b>
S9	rcf arrow up/down	to <b>switch over</b> from <b>speed to rcf</b> value and back
S10	speed arrow up	to <b>increase</b> the value of the <b>set speed/rcf</b>
S11	speed arrow down	to <b>decrease</b> the value of the <b>set speed/rcf</b>
S10+S11	<b>at the same time</b>	steps on the <b>setting</b> speed/rcf <b>digit position</b>
S12	brake arrow up	<b>brake curves</b> - setting
S13	accel. arrow up	<b>acceleration</b> curves - setting
S14	program arrow up	selection of <b>program No.</b>
S15	programming key	<b>storing</b> of programs

#### Functions of Indicating Elements

indicat.	designation	function(s)
H1	program digit	1-9 free selection of program storing places „P“ program for pre-cooling or pre-heating „-“ no stored program in process „≡“ quick run in process
H2	accel. curve digit	selection of 1-9 defined acceleration curves
H3	decel. curve digit	selection of 1-9 defined deceleration curves (9 max)
H4-H8	speed range	speed in rpm (rounded to full 10 rpms) rotor not yet detected (xxx „.“) rcf-value (xg) or not yet possible to calculate „-----“ identifications no.'s of controller and NV-RAMs, lid open condition („OPeN") centrifuge run is terminated („End") wrong rotor's max. speed („rotor") imbalance load („bAL") and error messages („Lid“, „E-xx")
H9-H11	time range	centrifugal time in h.min (count down process) count up process (hld) in h.min (count up process) actual version number („xx")
H12,H13	temperature range	sample temperature in °C± 2K when pre-cooling or pre-heating process is terminated
H14	allocation LED	for speed indication
H15	allocation LED	for rcf indication

### 3.5 Sensor Board

#### 3.5.1 Temperature Measuring

The temperature inside of the rotor chamber is measured by a PT100 sensor. The sensor's head is inserted into a guide boring of the motor rubber flange, its wires are soldered on the sensor board. The signal is led across the 9 pinning plug connection of the spindle and the screened flat cable to the main board (XE2+3) where a voltage to frequency converter converts the PT100 resistance changes into a variable frequency. This frequency is processed by the ASIC80 and finally read in by the CPU over the data bus. The calibration of the F/U converter in the range of 0°C to 50°C is regularly controlled by 2 resistors of 0.1% tolerance.

#### 3.5.2 Rotor Indication

In the rotor's bottom either 2 or 4 magnets are forced, being alternately arranged in polarity and positioned to each other to different distances on a constant circular ring (segment steps of 20°). On a holder a Hall sensor is exactly fixed below, which connecting lines are soldered to the sensor board. The magnets are switching a flip-flop stage by which different pulse lengths and pulse intermissions are generated during one rotor rotation. By this signal the CPU is able to detect up to 65 different rotors and the correct direction of rotation, too (wrong direction leads to error E-14).

#### 3.5.3 Rotor Indication

In a defined distance to the drive axle a piezoelectric acceleration detector is fixed below the spindle casing. Dependent of the rotor imbalance this sensor generates an analogous voltage signal which is led via a following band-pass filter to plug connection XE/9 on main board, where it is analysed by an own micro-controller (type 87C51, identification No. of control program: 592). When the CPU (590) has identified the installed rotor type, the imbalance controller gets this code to read in a rotor and speed dependent imbalance limitation curve from a third NV-RAM (4434). The analogue imbalance signal is filtered, converted into digital form and continuously compared with this specific limitation curve. If the actual imbalance signal will rise at any speed beyond the limit, the error signal for imbalance load "bAL" is switched over to the CPU. An additional task of the imbalance controller is the surveillance of the lid's unlocked condition: Both lid motors can only be supplied with 24V by relay K2 if the speed is less than 60 rpm.

To support a safe imbalance detection additional, the specific pulse mode of the identified rotor will be supervised up to 3000 rpm approximately. In case of big imbalance loads the rotor carries on a relative motion to the fix mounted Hall sensor by which the specific pulse mode is changed. This condition is analysed by the CPU and leads to error indication "E-25".

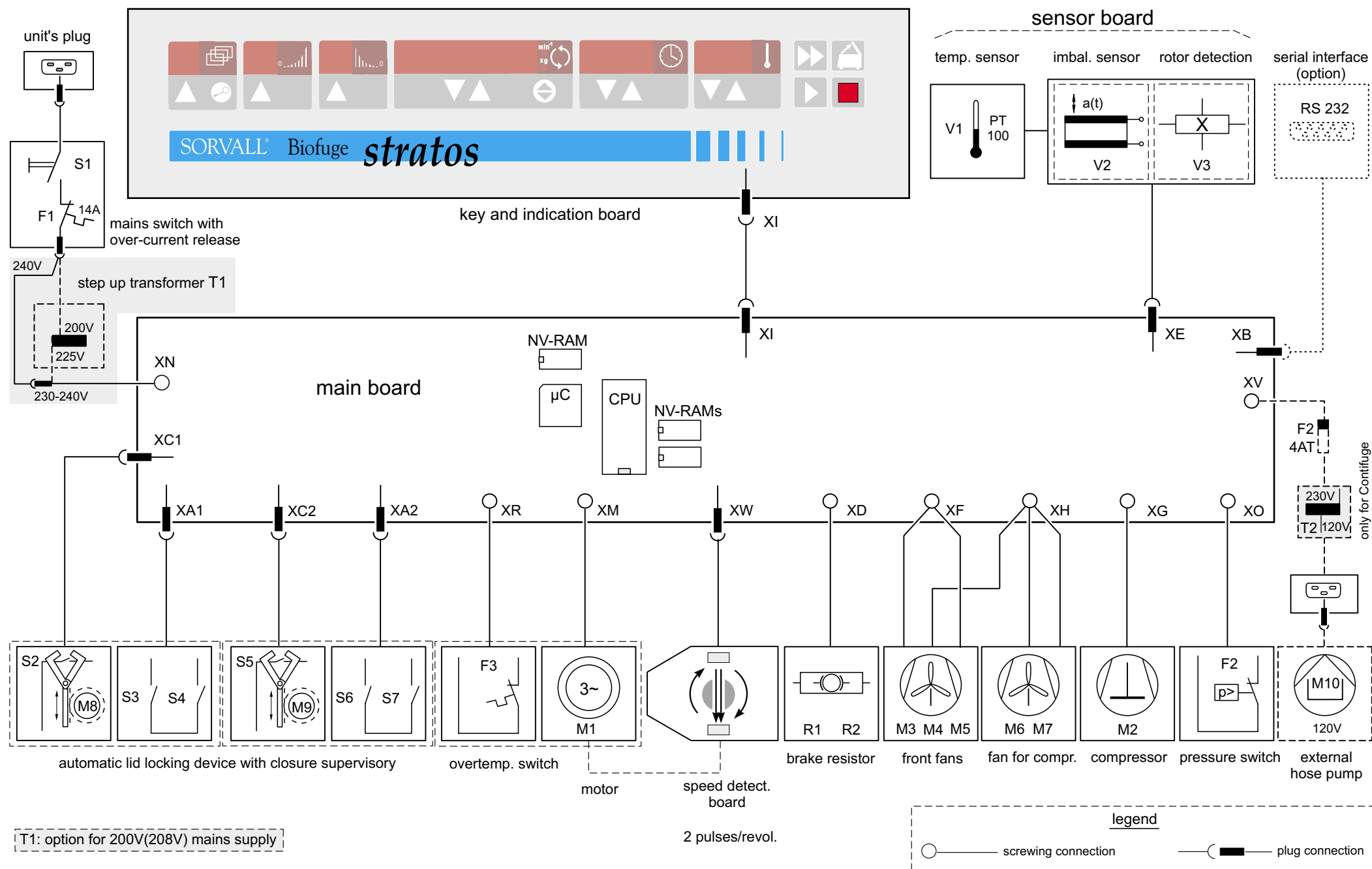
### 3.6 Cooling plant

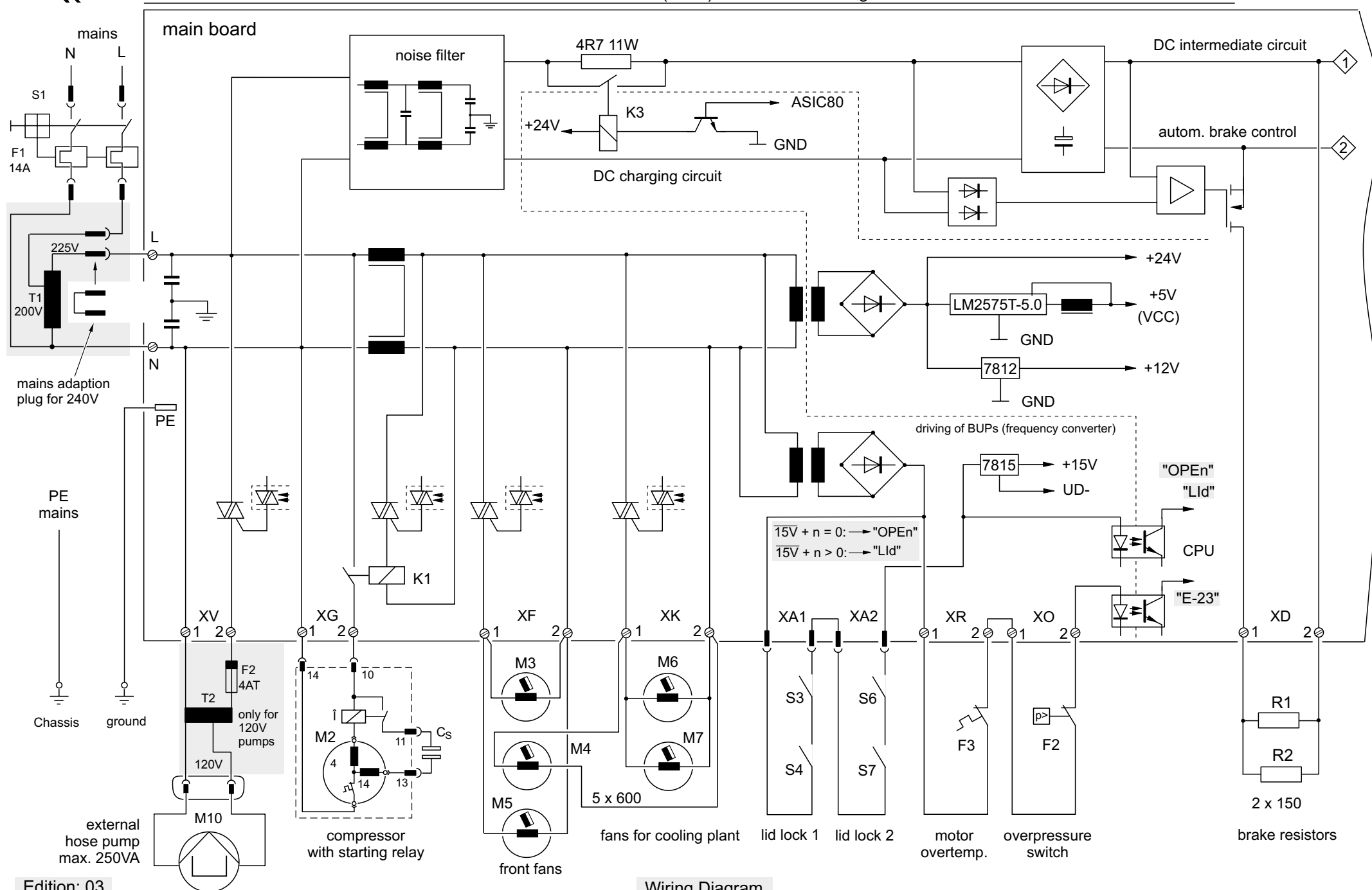
The Biofuge stratos is equipped with a high-grade cooling plant, to meet its requirements of driving power and compact design. The CFC free refrigerant R404A evaporates at low temperatures ( $\leq -20^{\circ}\text{C}$ ) and absorbs through this the frictional heat from chamber produced by the fast spinning rotor. 5 fans serve for even air flow through condenser so that the refrigerant's condensing temperature is kept on a low level (lateral front fans are only switched on, if  $n > 0$  rpm).

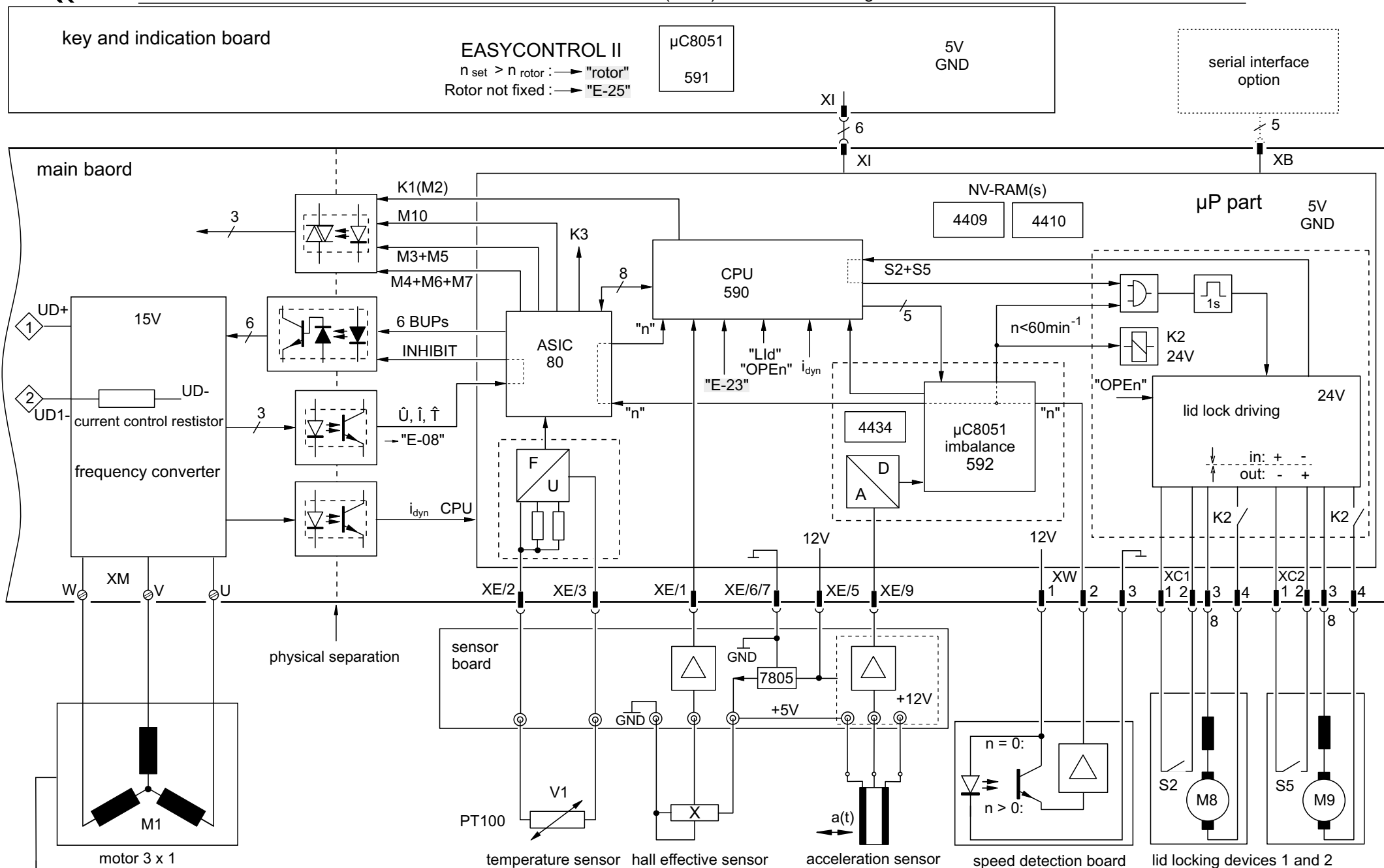
A specially designed coaxial heat exchanger serves for essential undercooling of the condensed refrigerant to ensure an optimum evaporation and a perfect operation of the expansion valve.

To maintain low evaporation and resultant condensation temperatures on one hand and to support the starting procedure of the compressor on other hand, a thermostatic expansion valve with 3.0bara MOP is used.

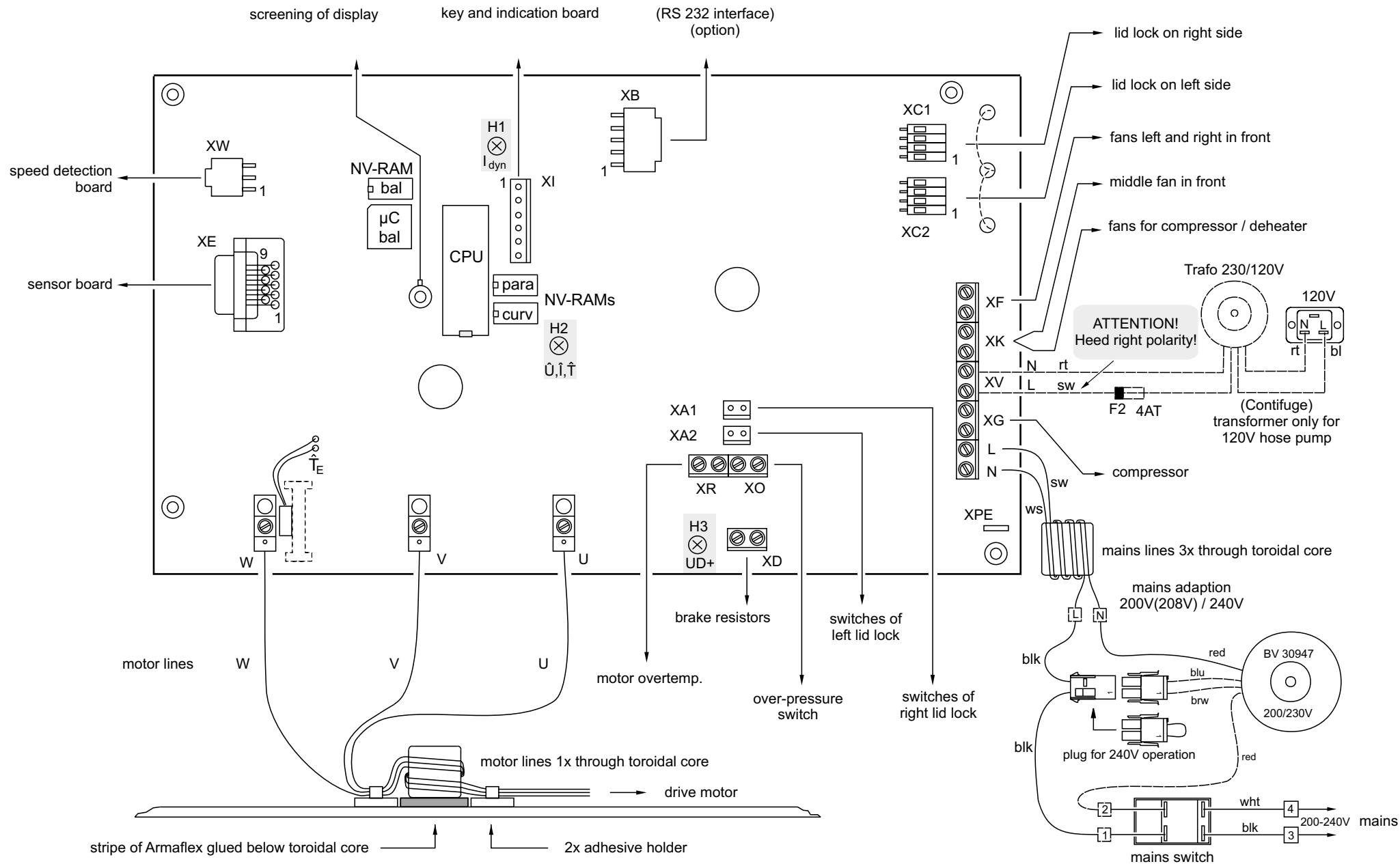
The minimum achievable sample temperatures are depending on speed, rotor type and a little on ambient temperature. After a compensating time, given by the pre-cooling or pre-heating program as optimal result, the rotor has reached the selected set temperature within a tolerance of  $\pm 2\text{K}$ .

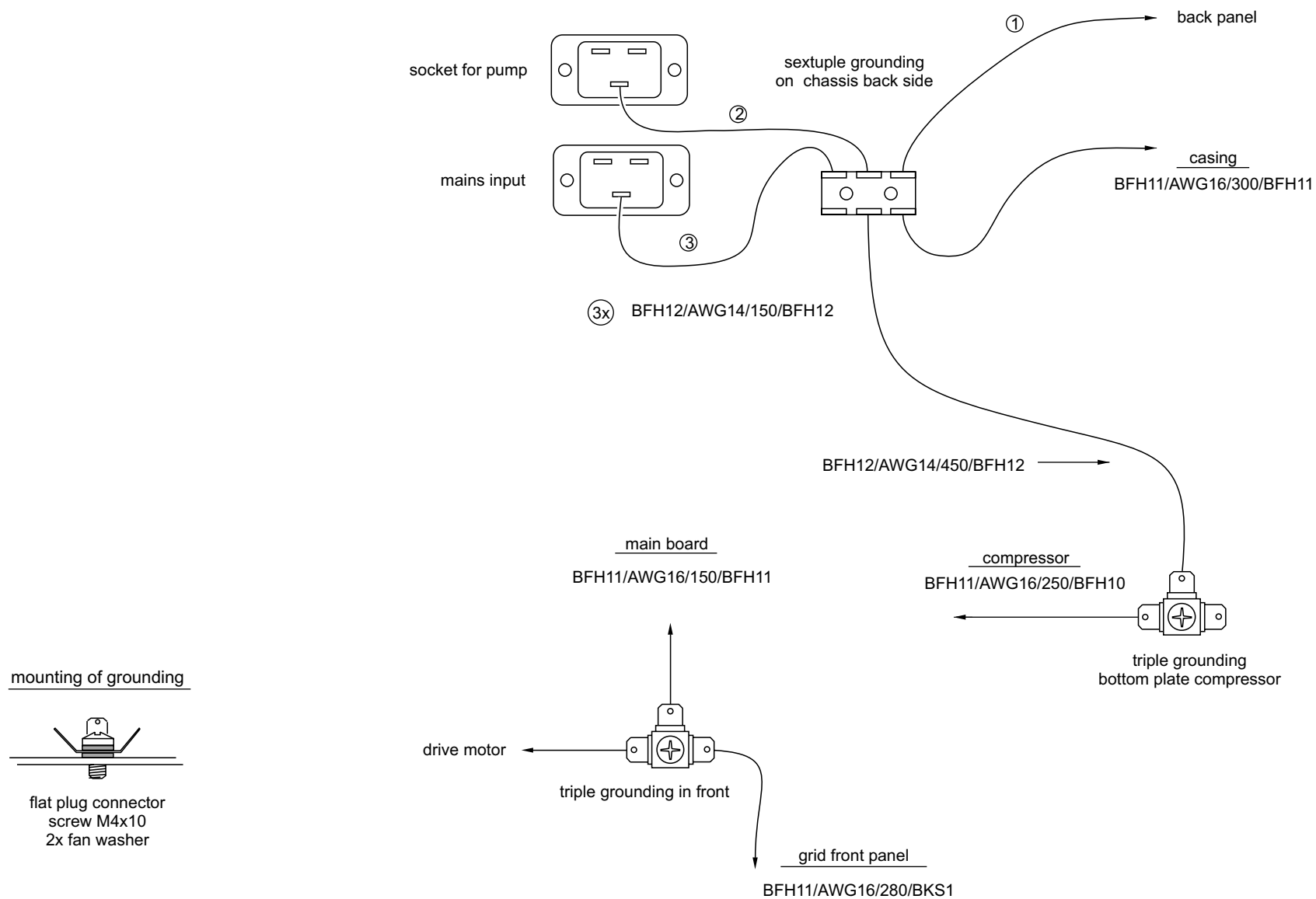


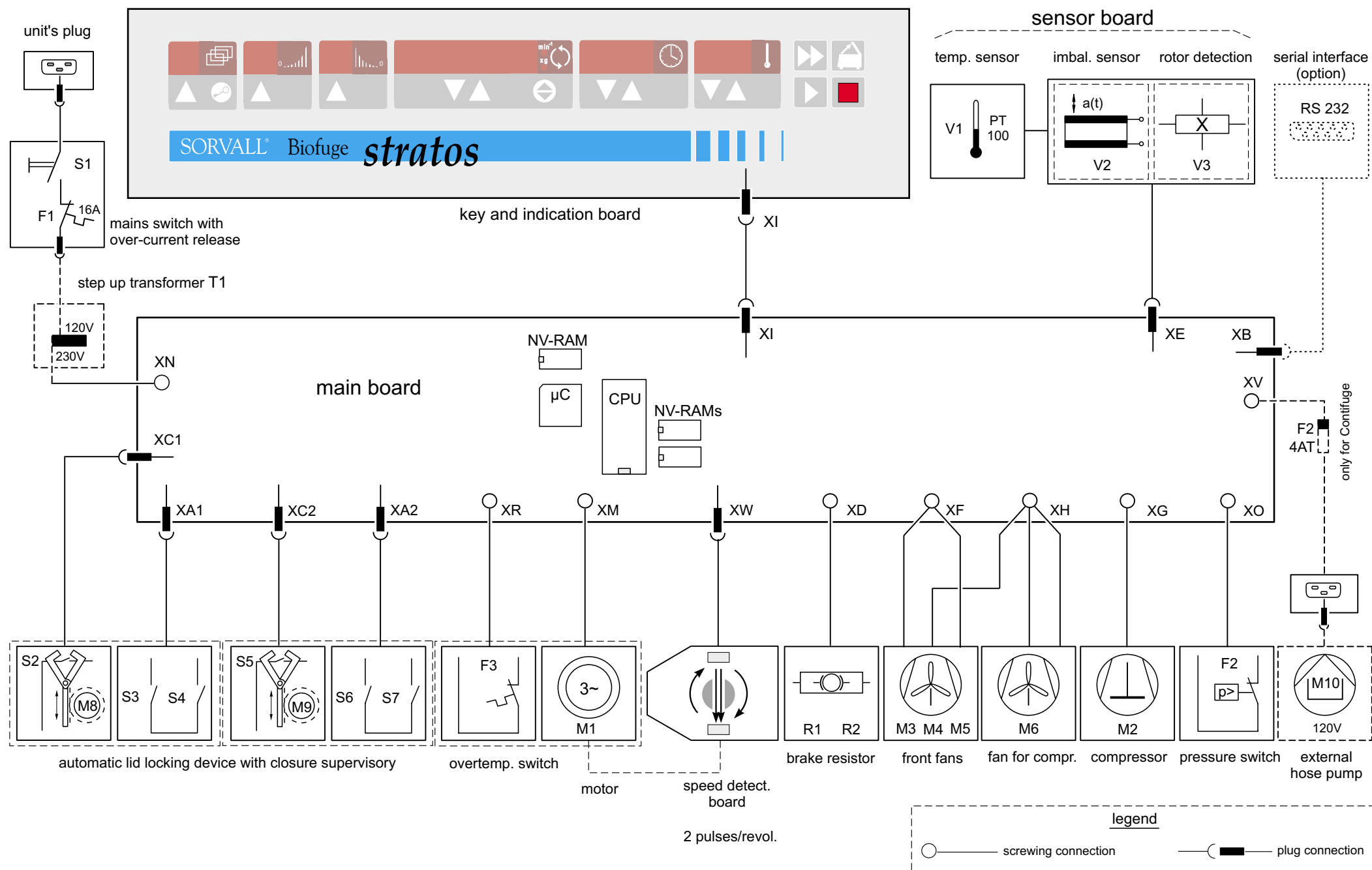


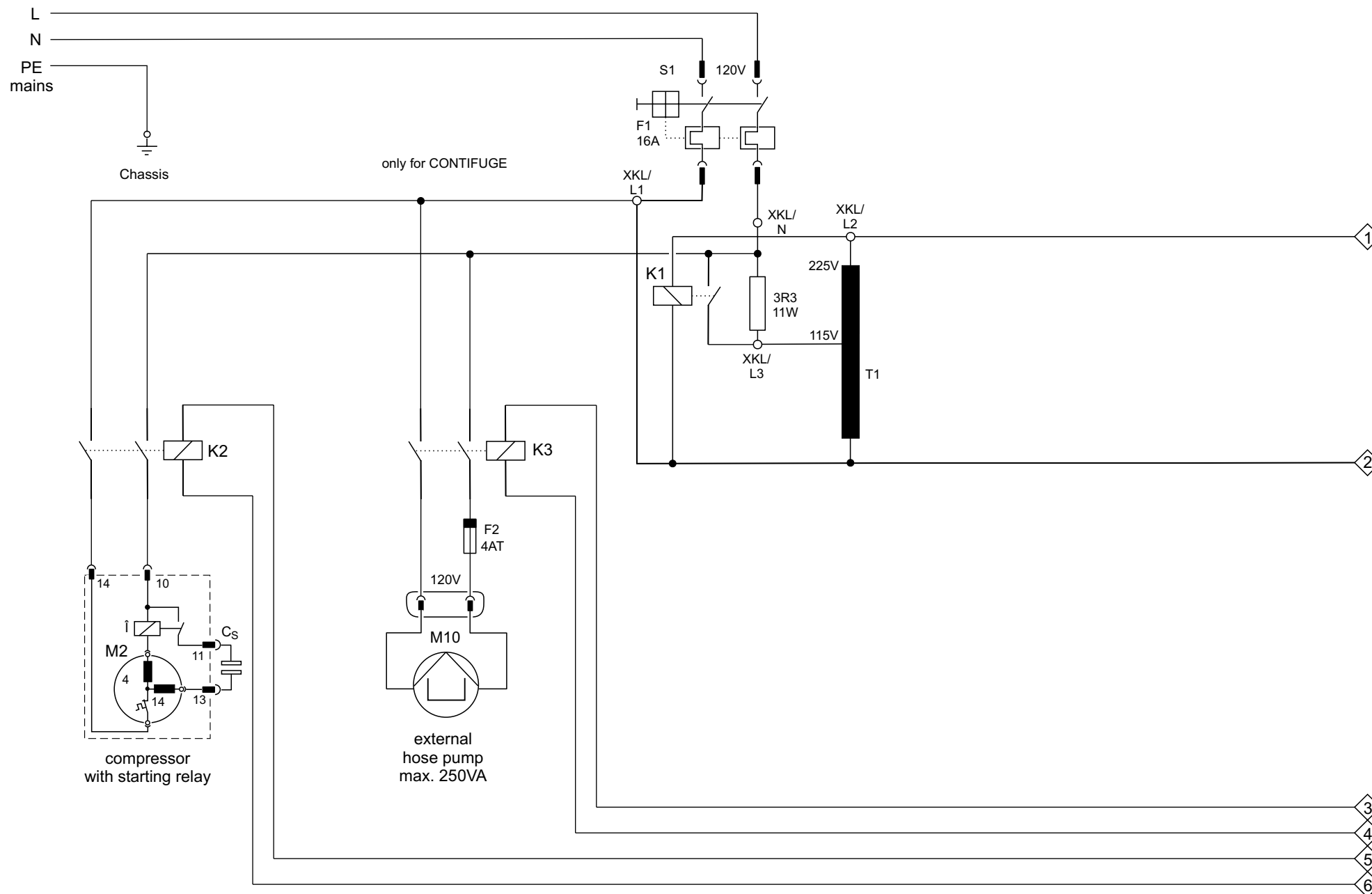


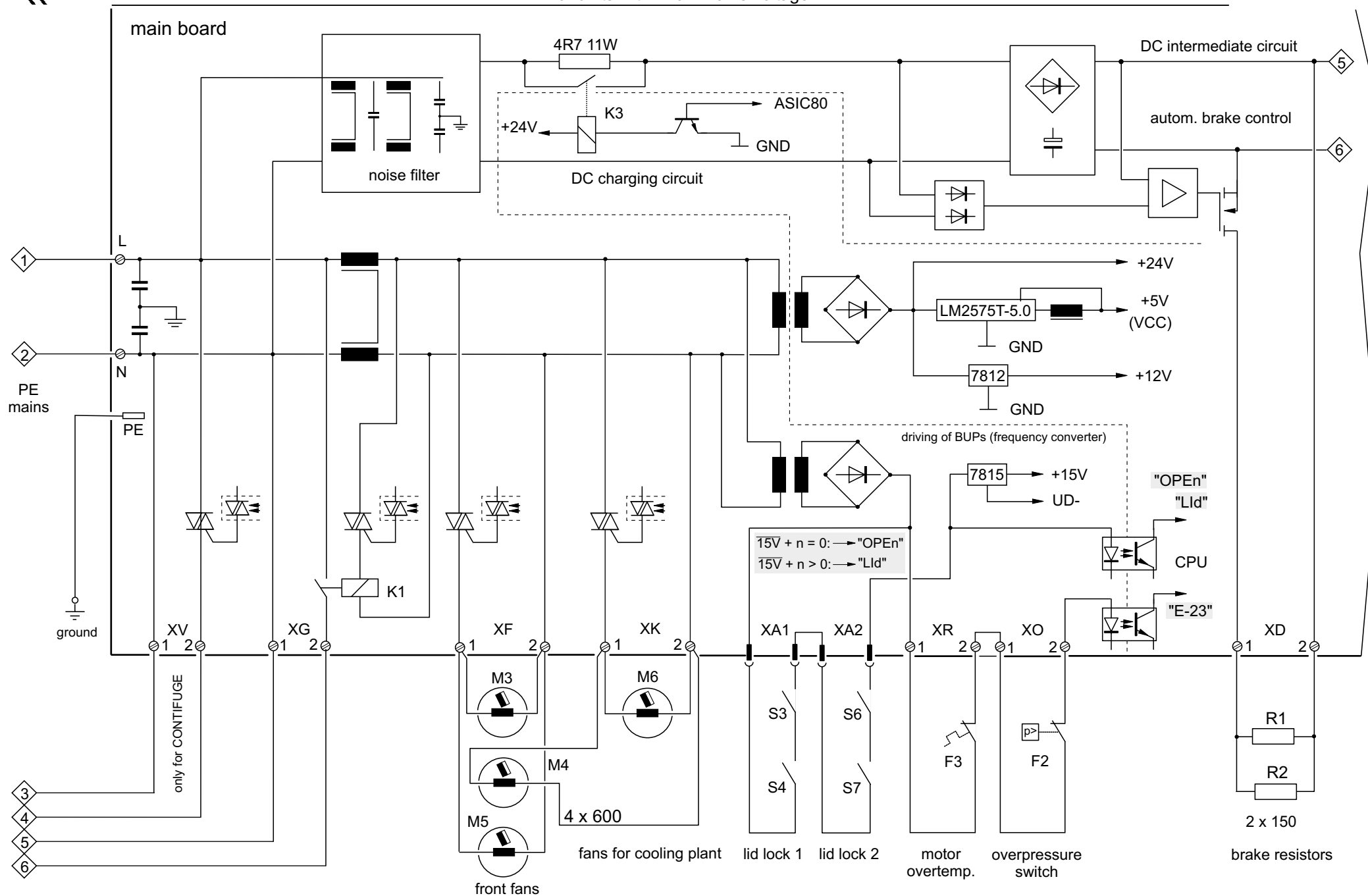






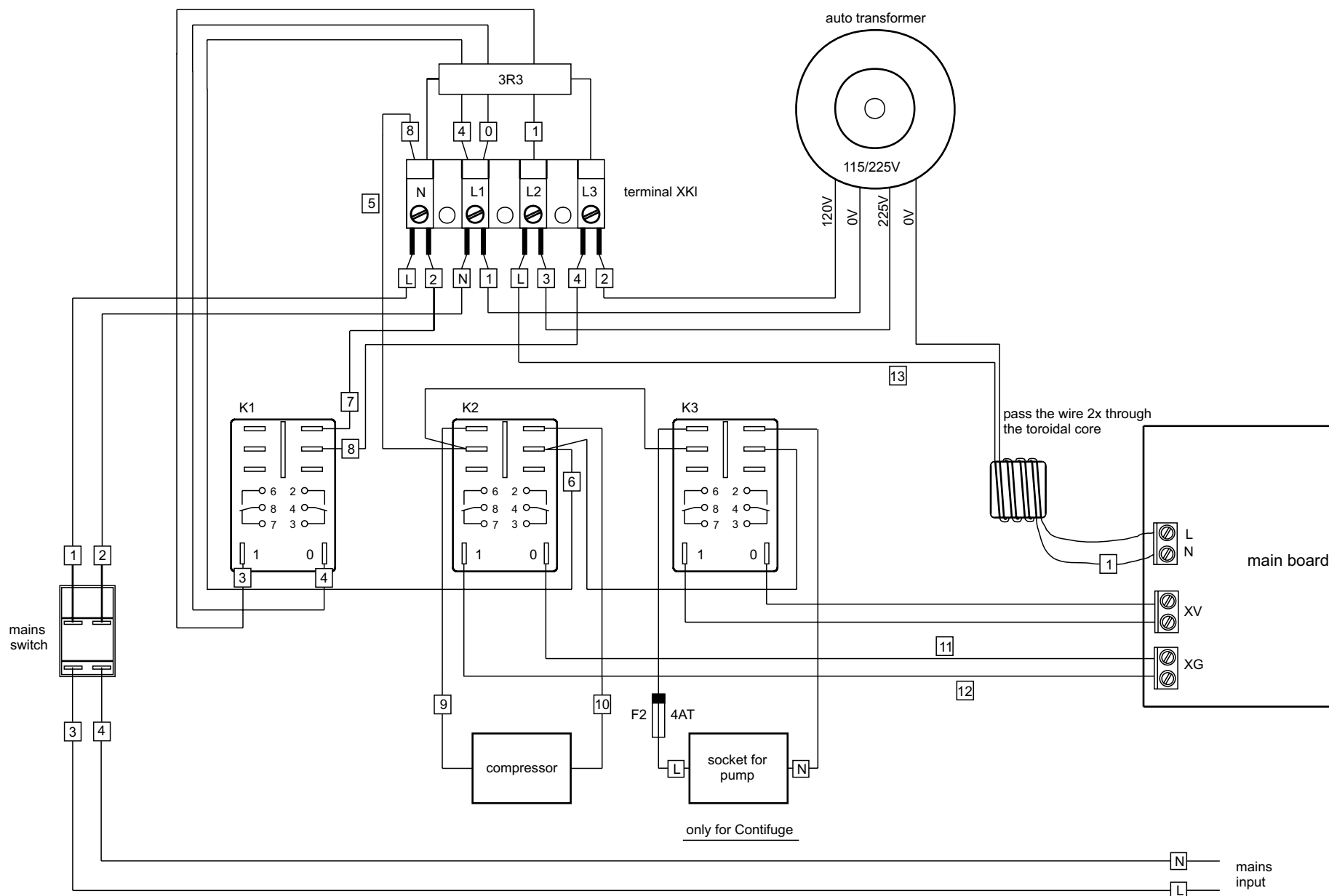


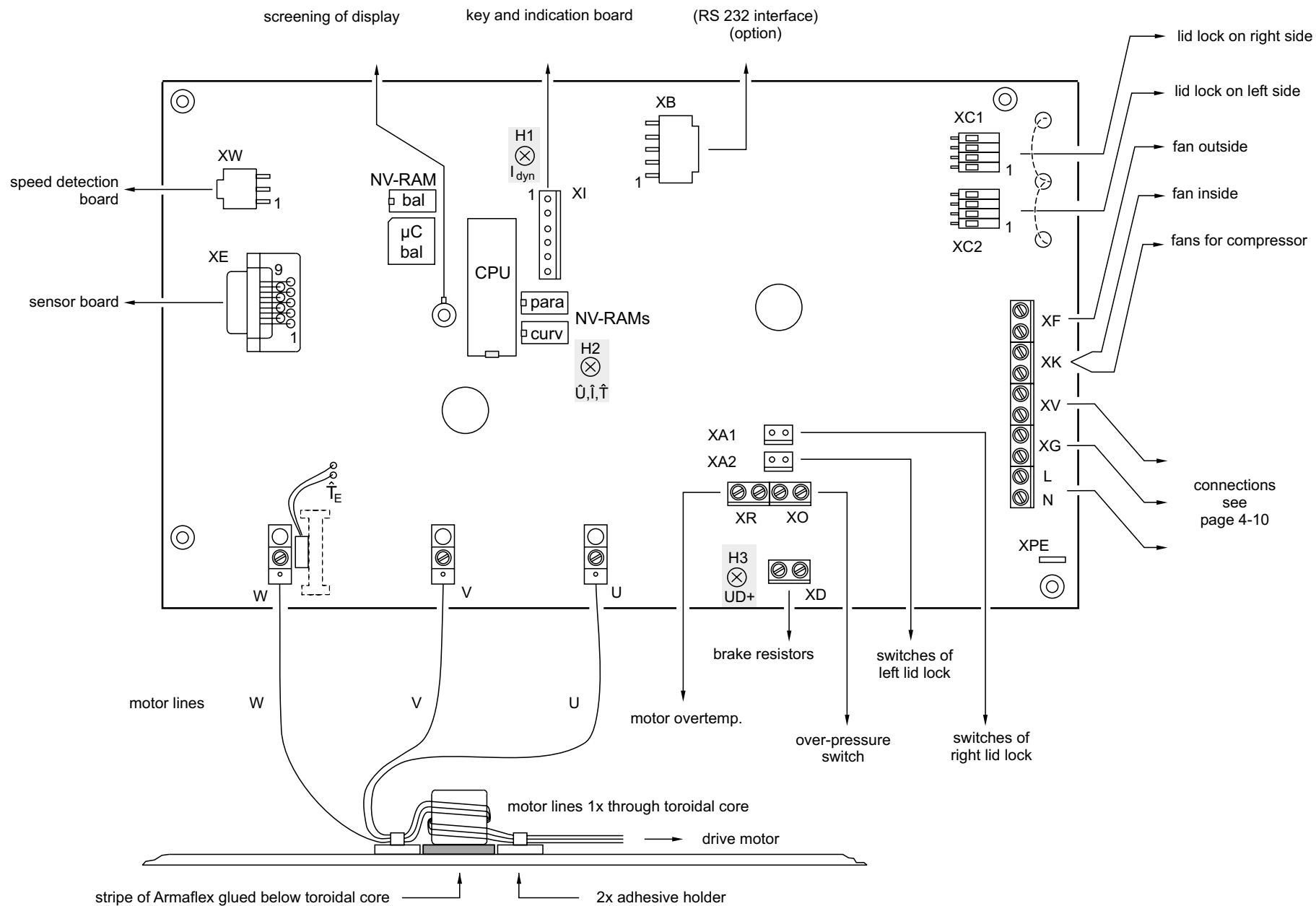


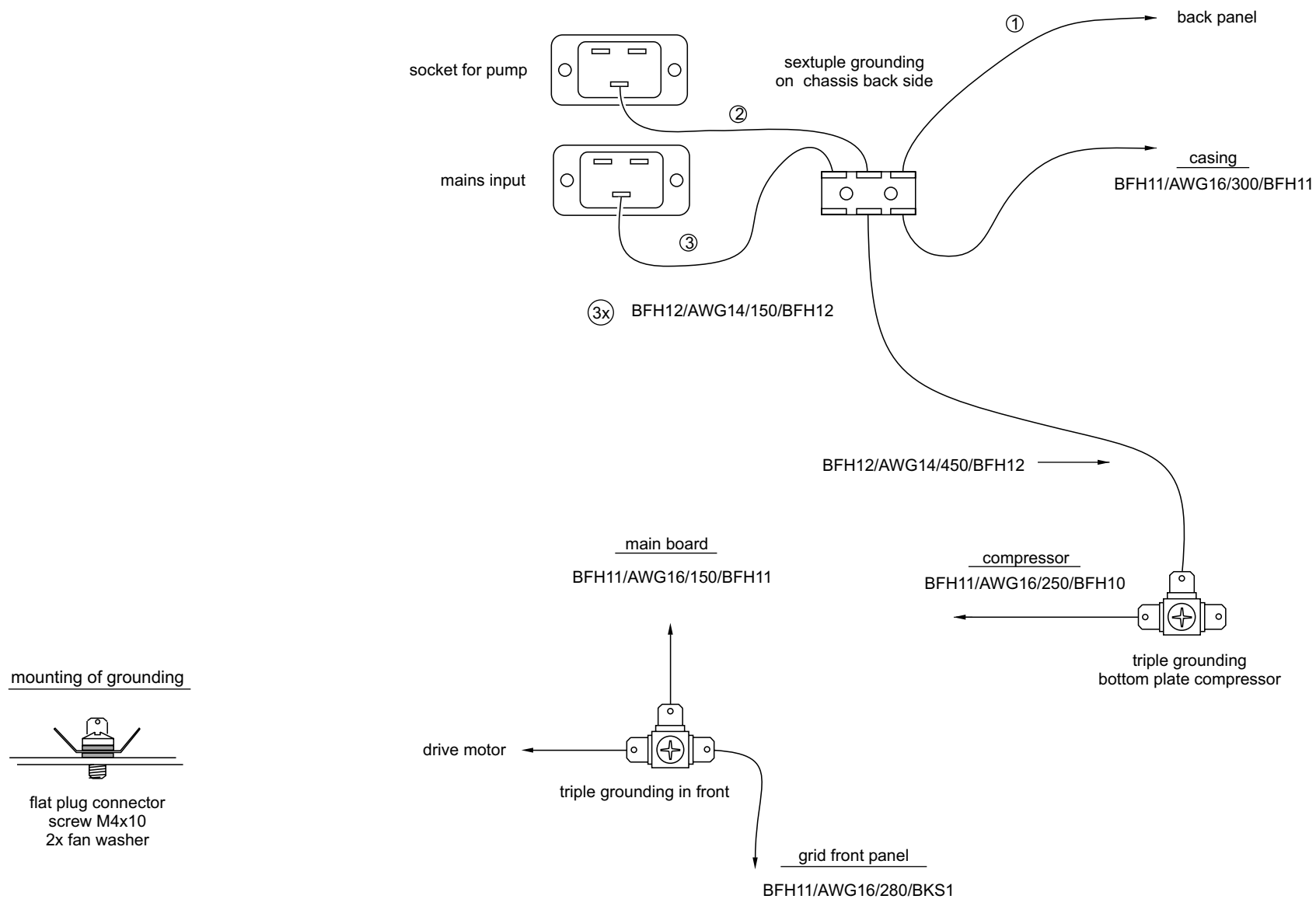




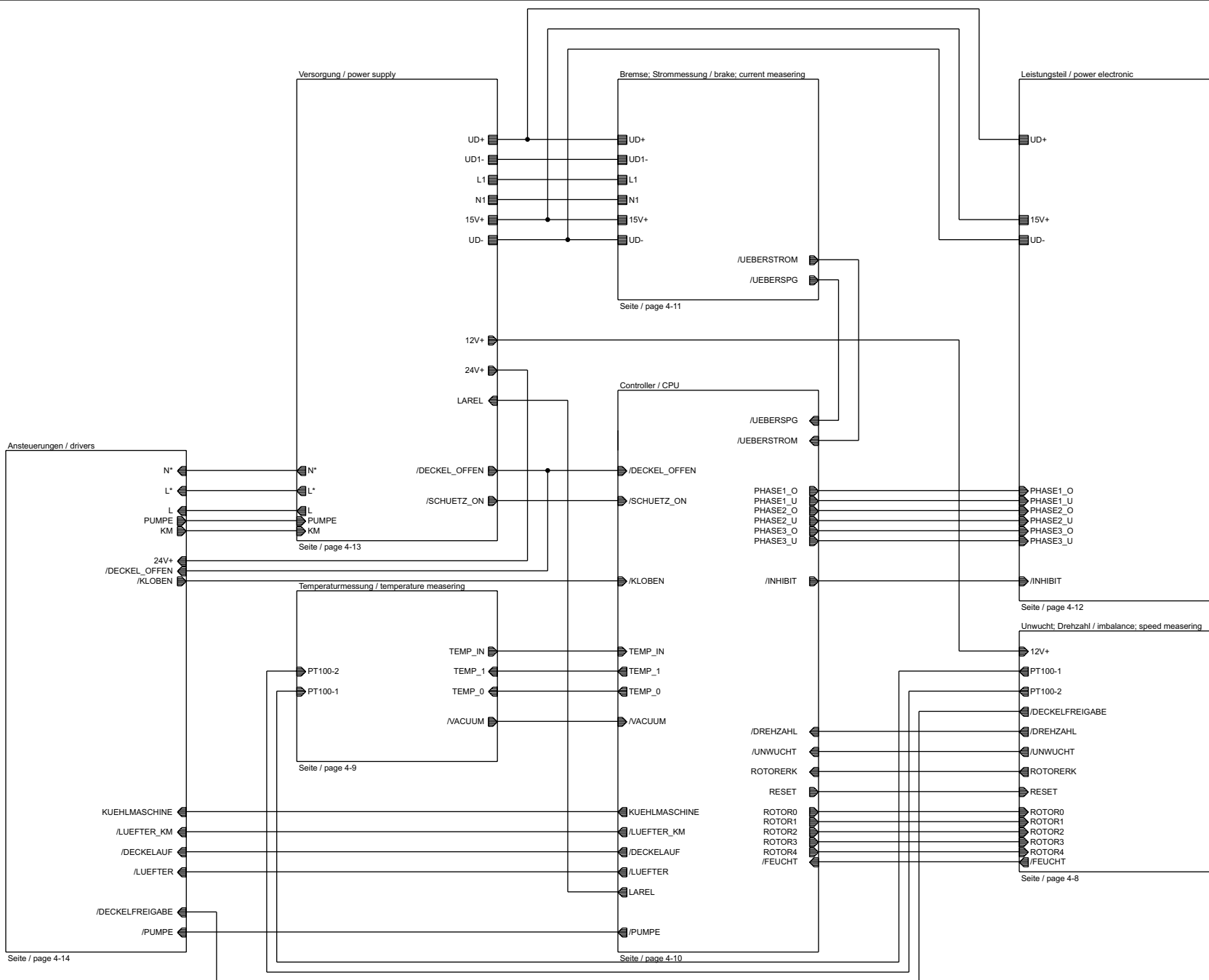


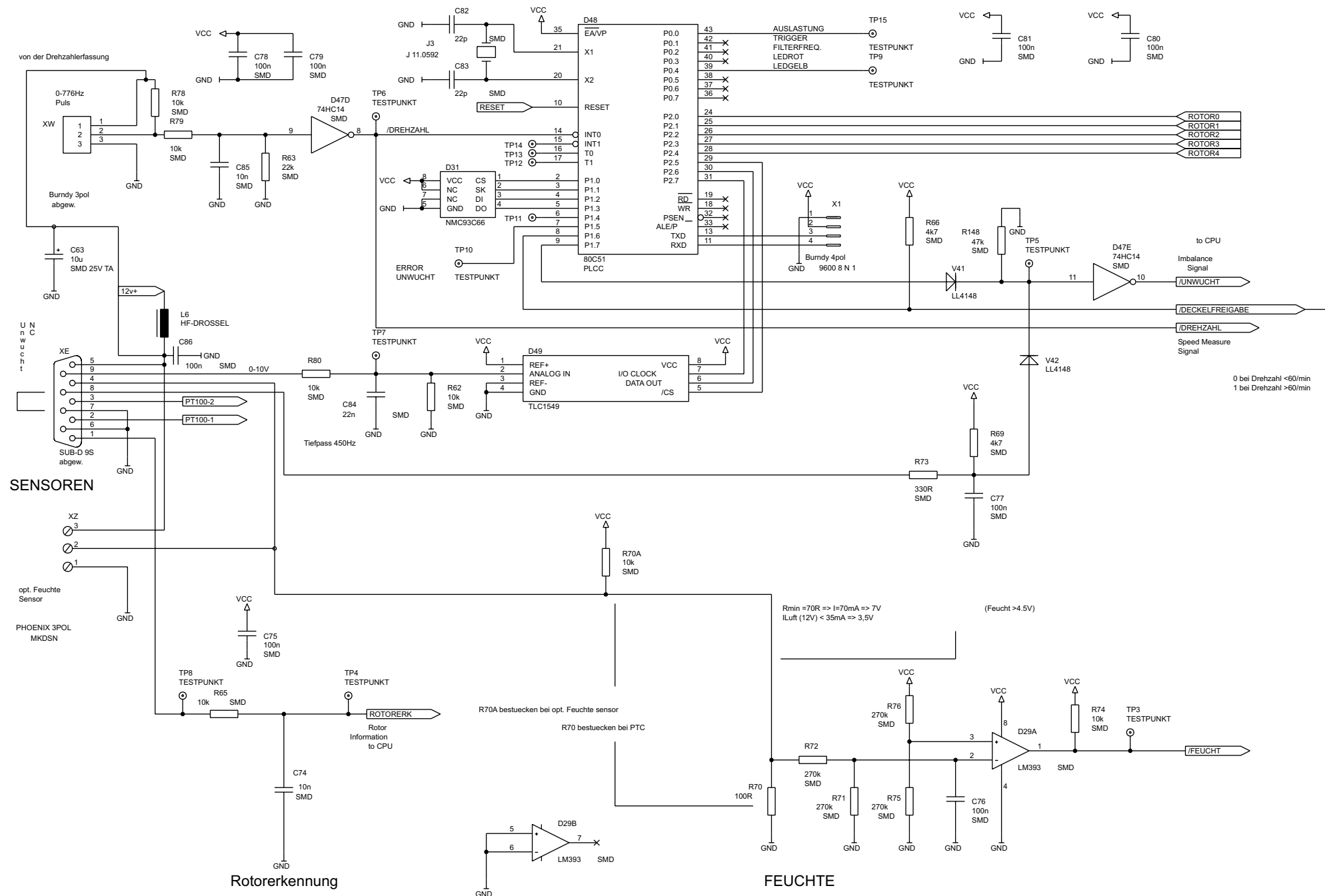




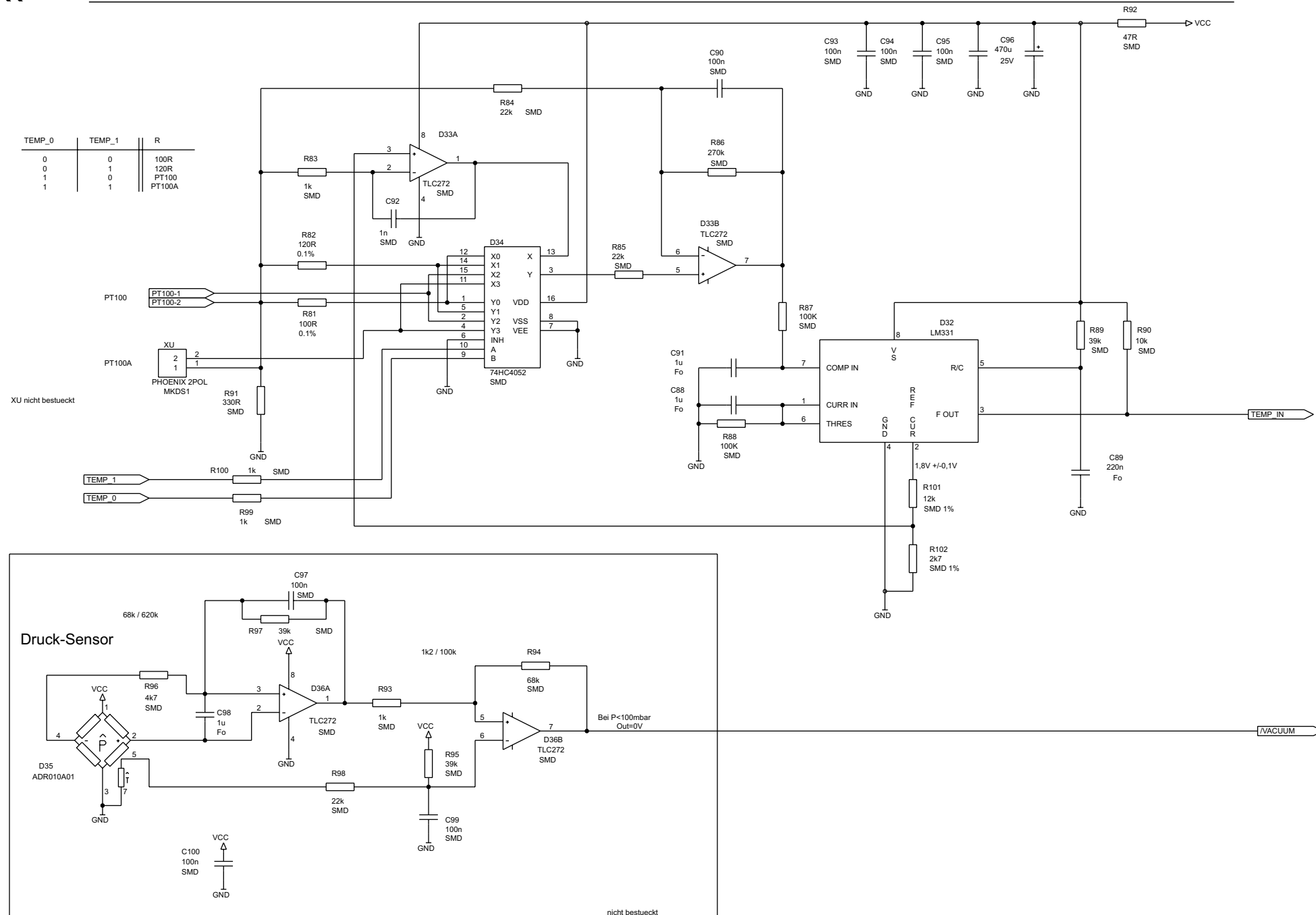


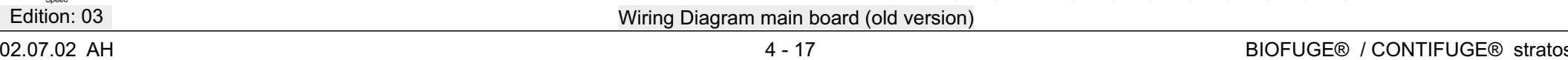


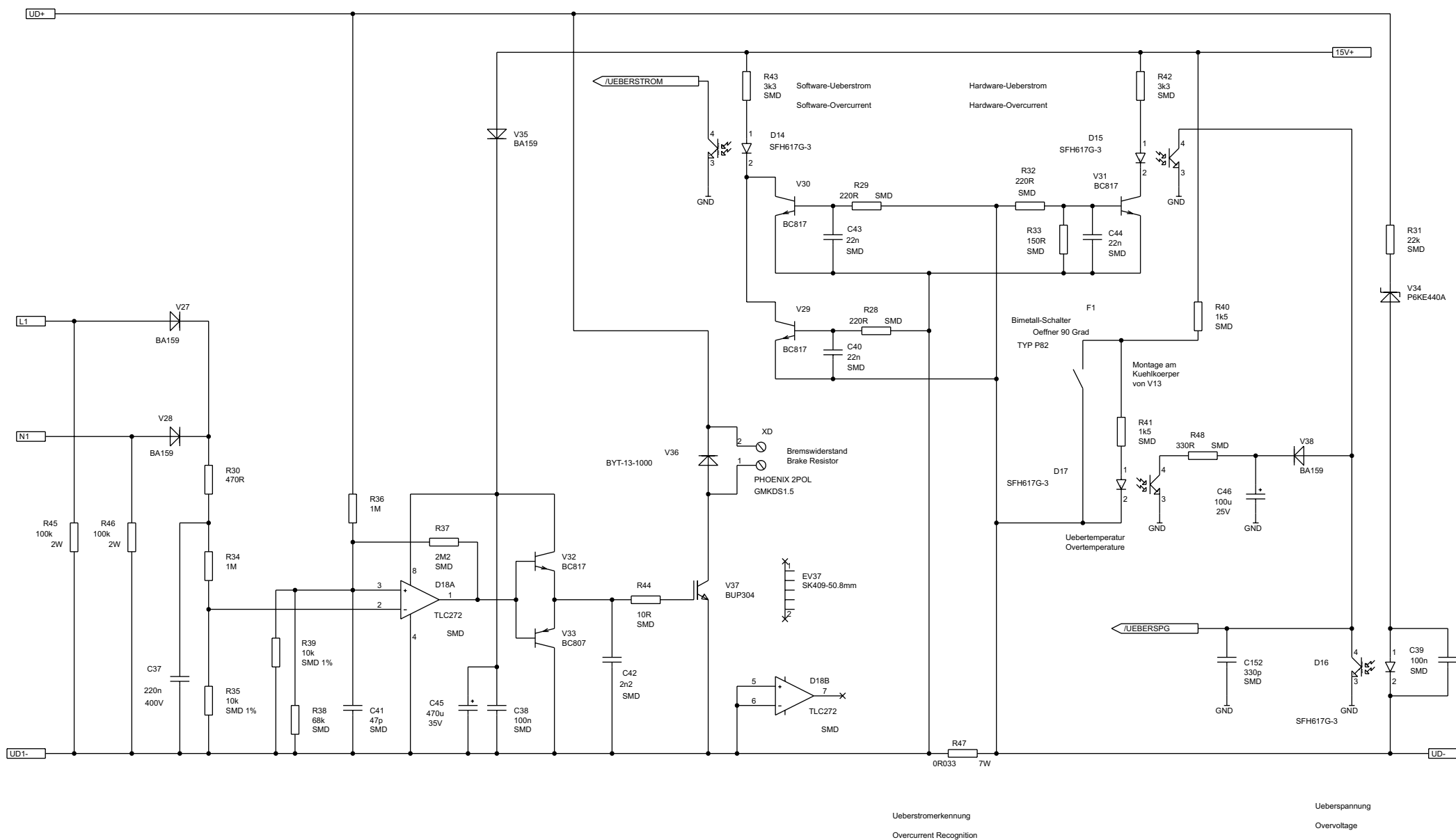


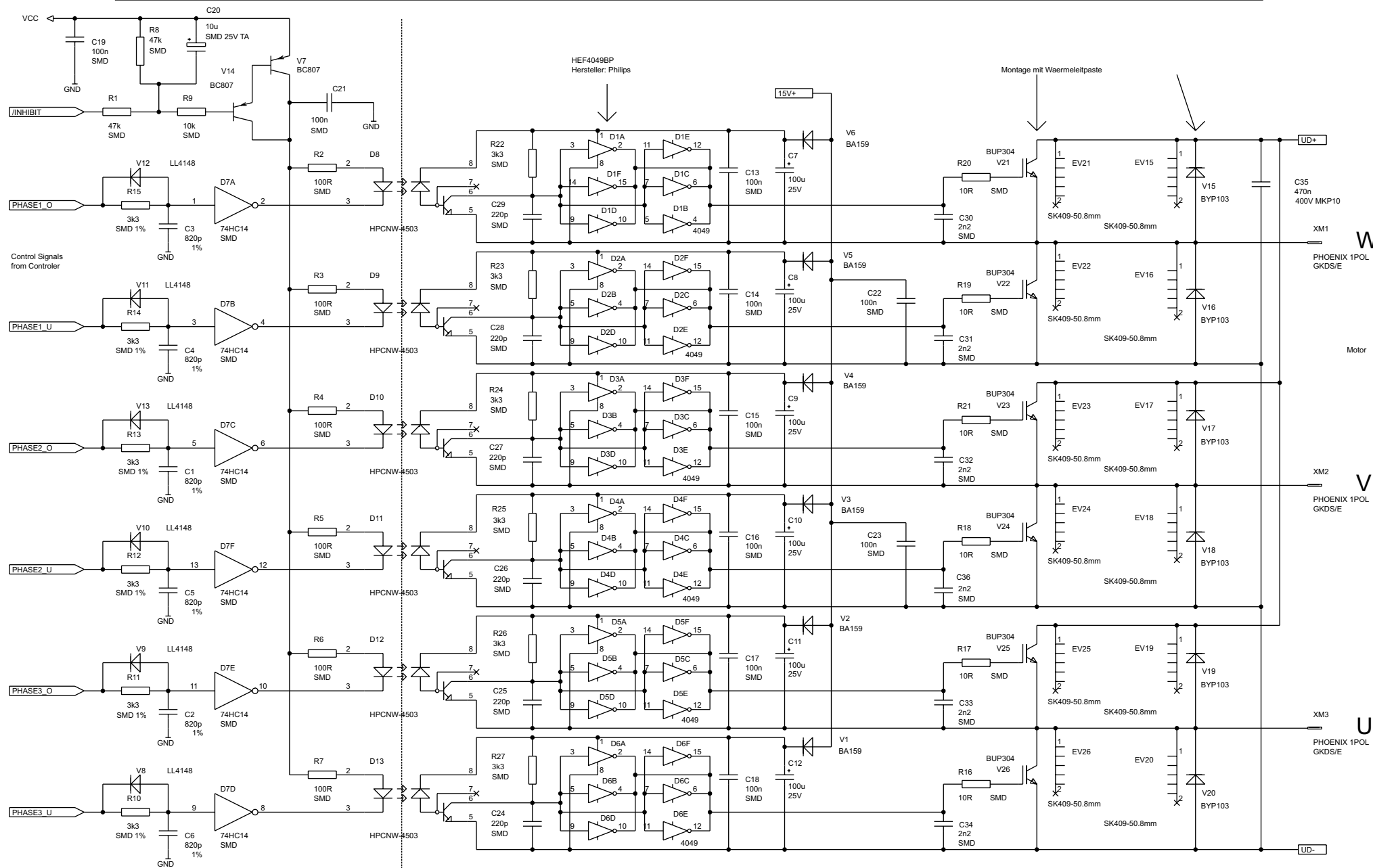






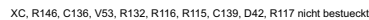




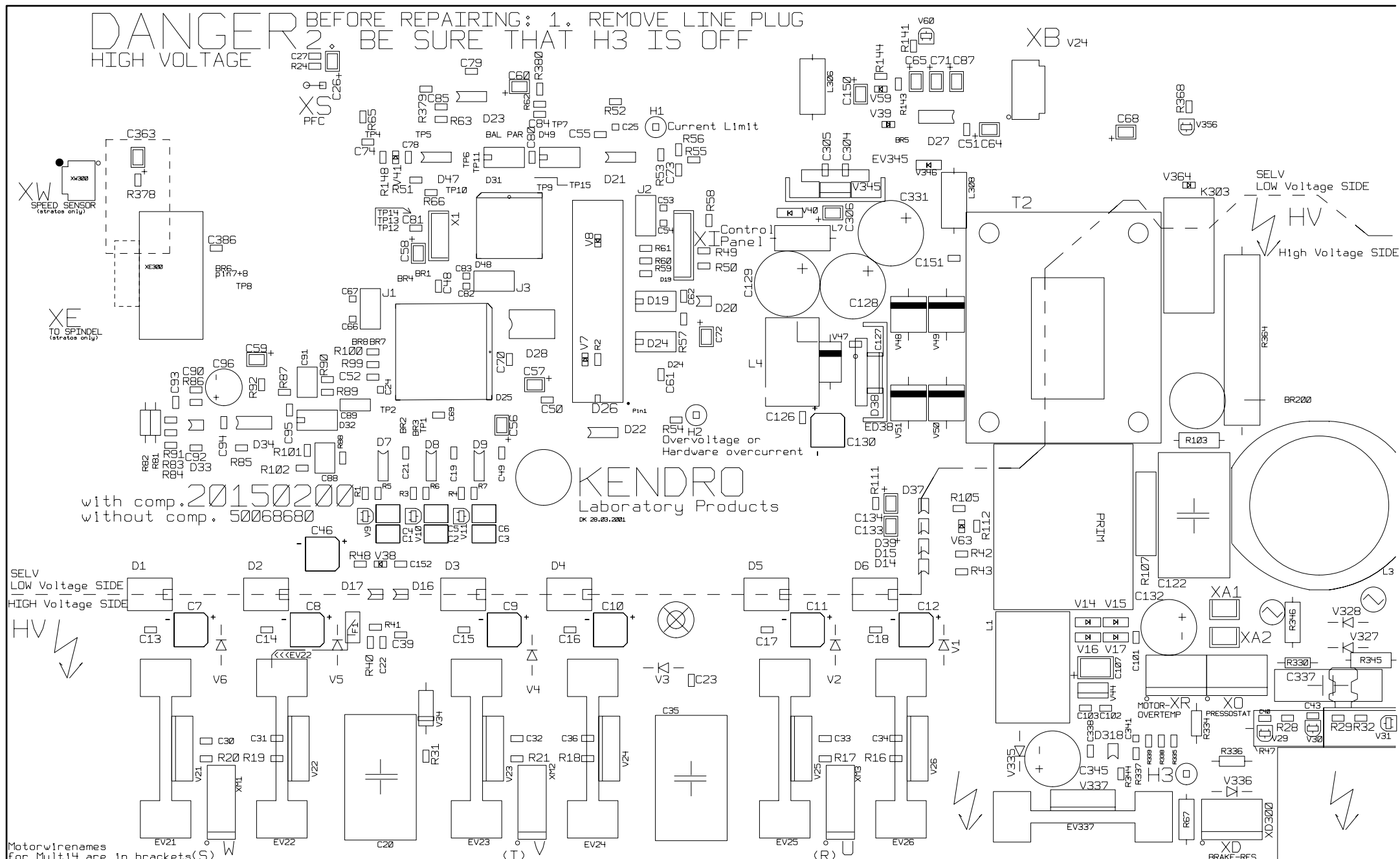




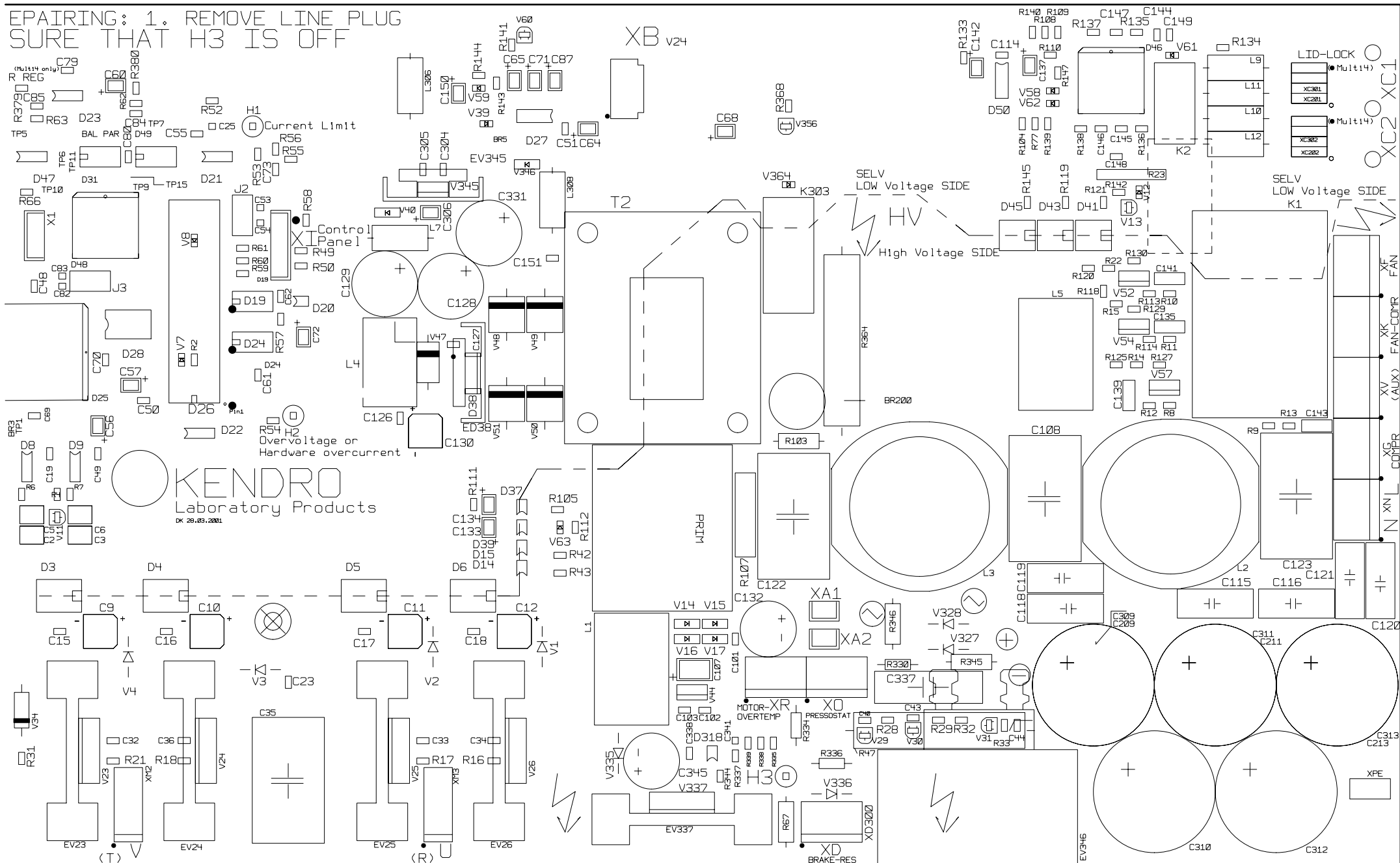
BIOFUGE® / CONTIFUGE® stratos

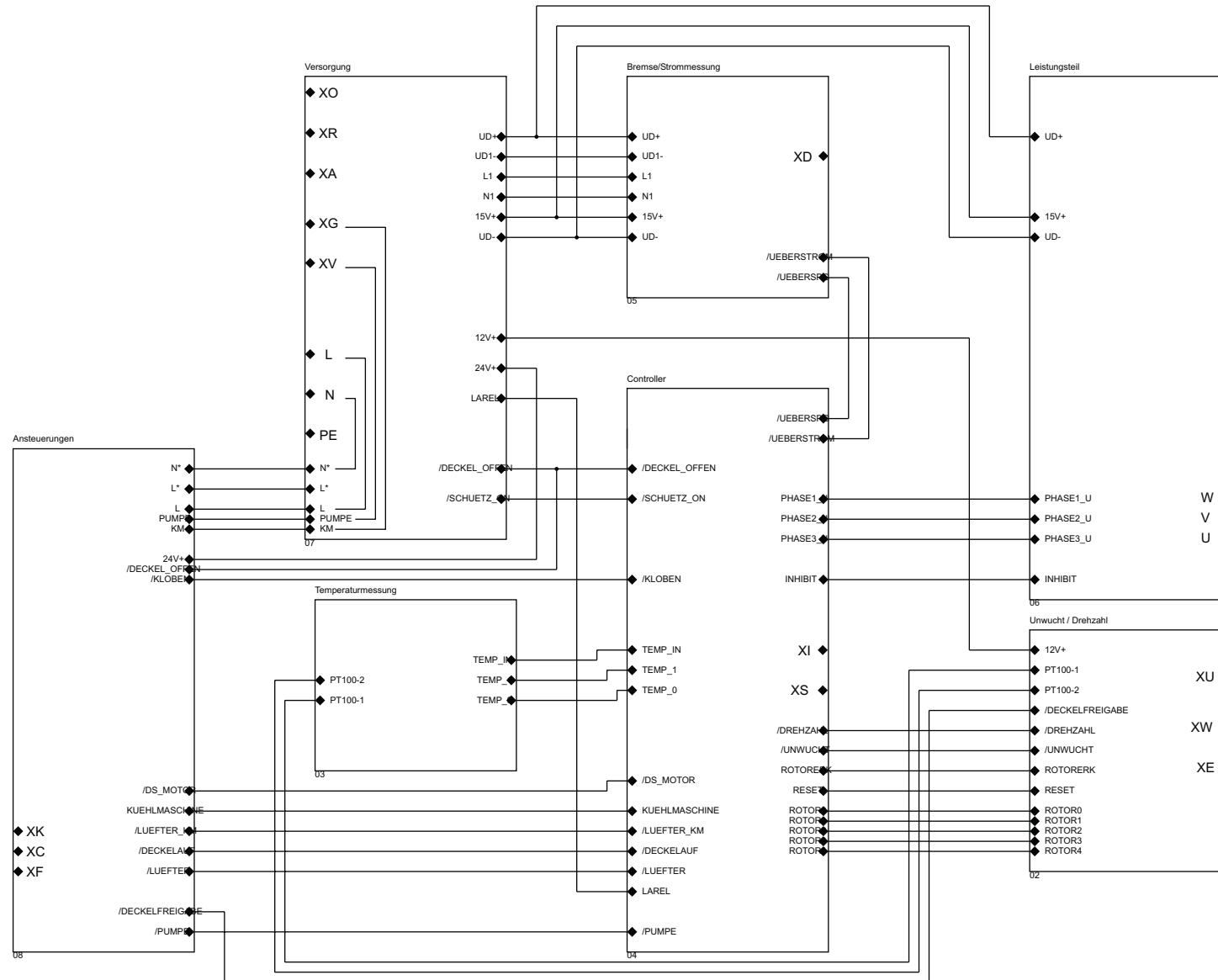


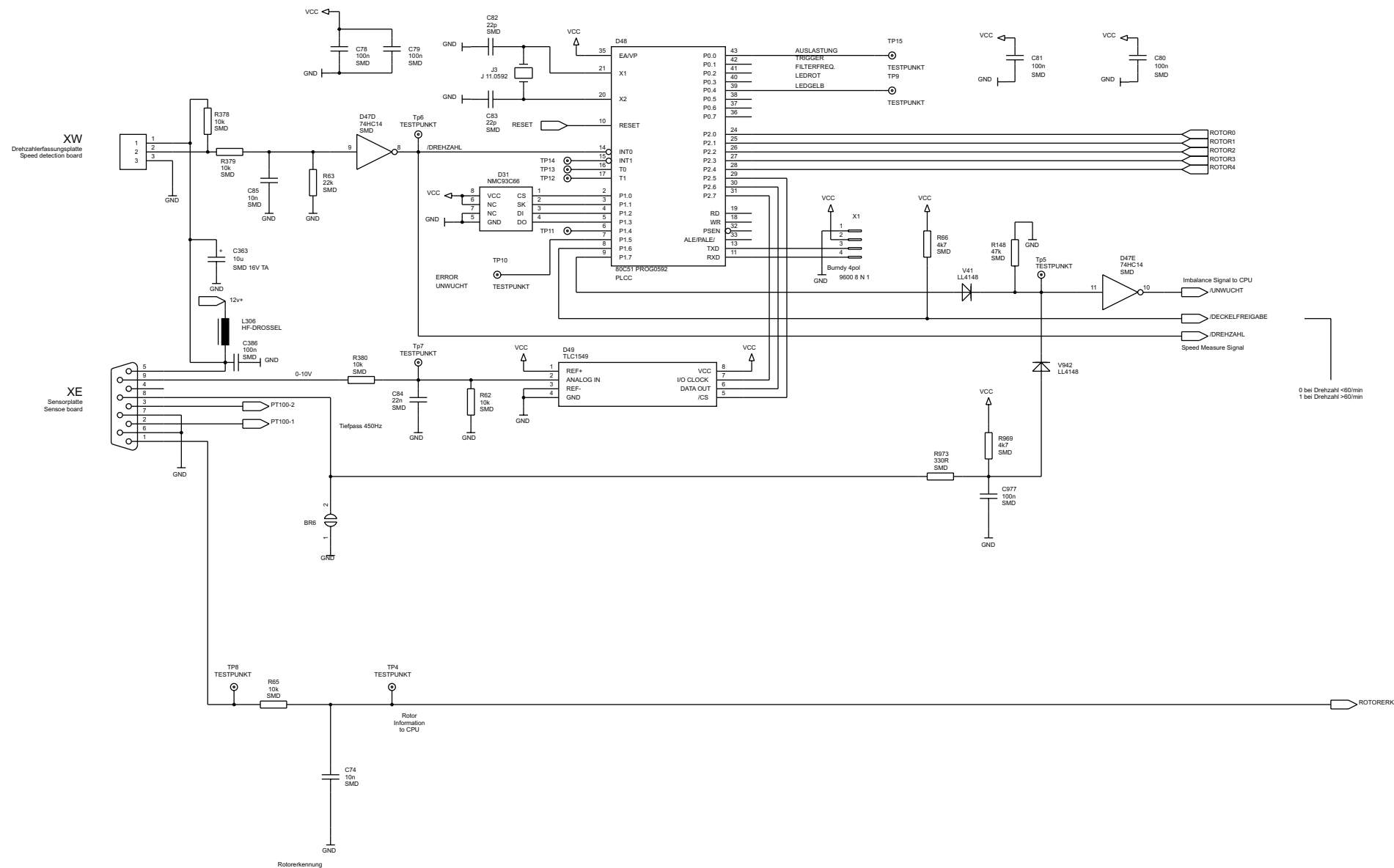


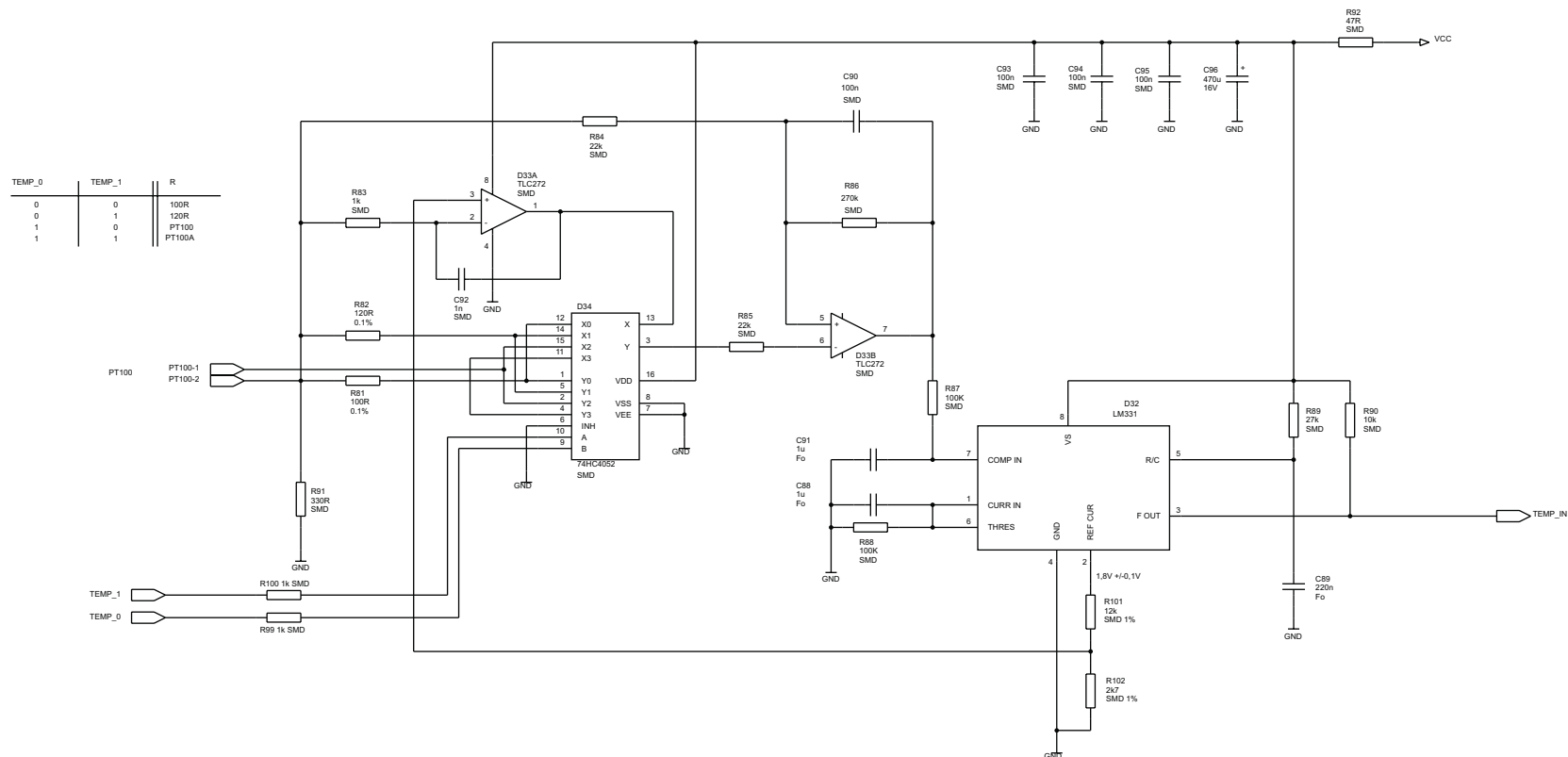


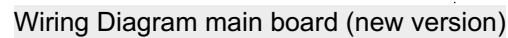
PAIRING: 1. REMOVE LINE PLUG  
SURE THAT H3 IS OFF



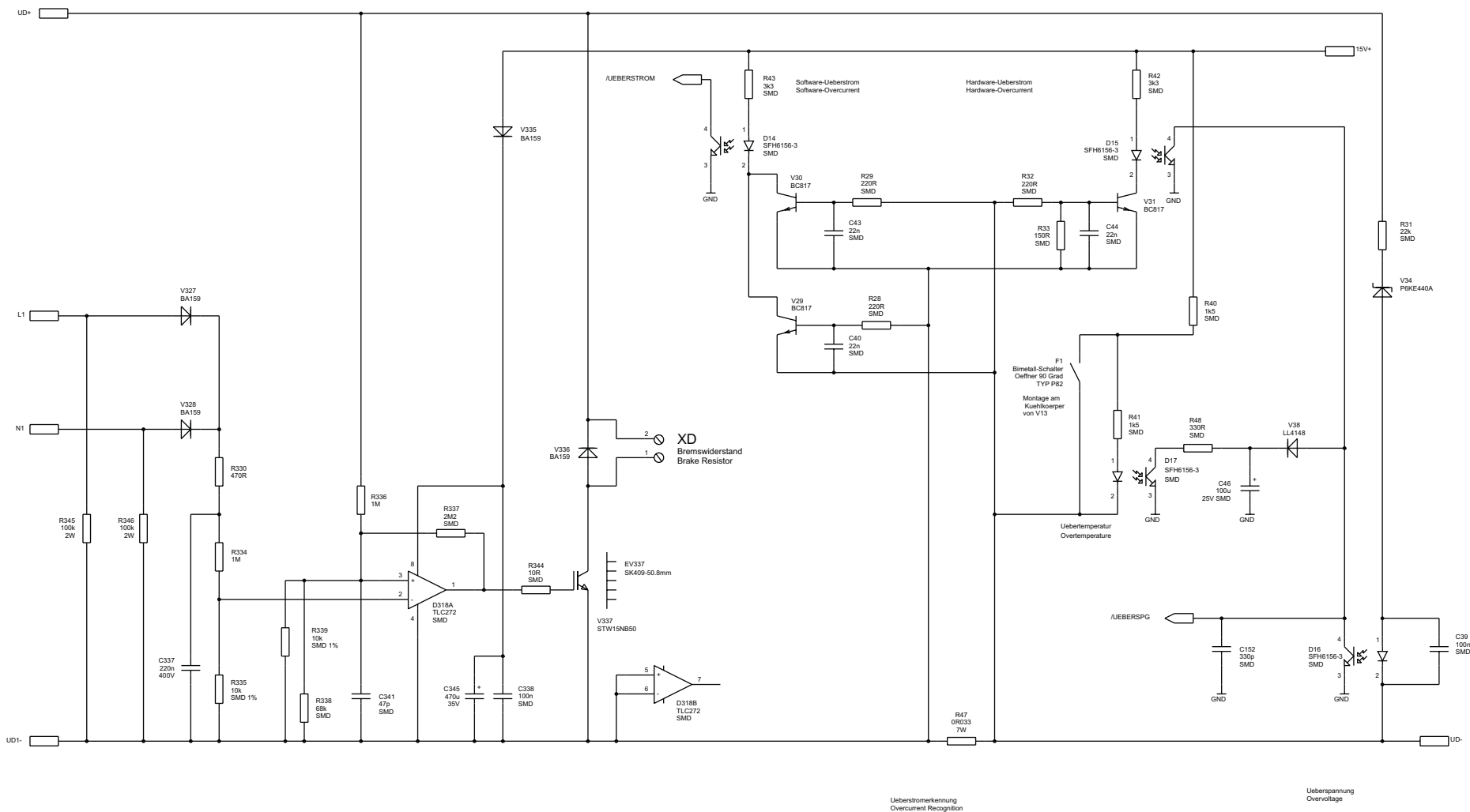


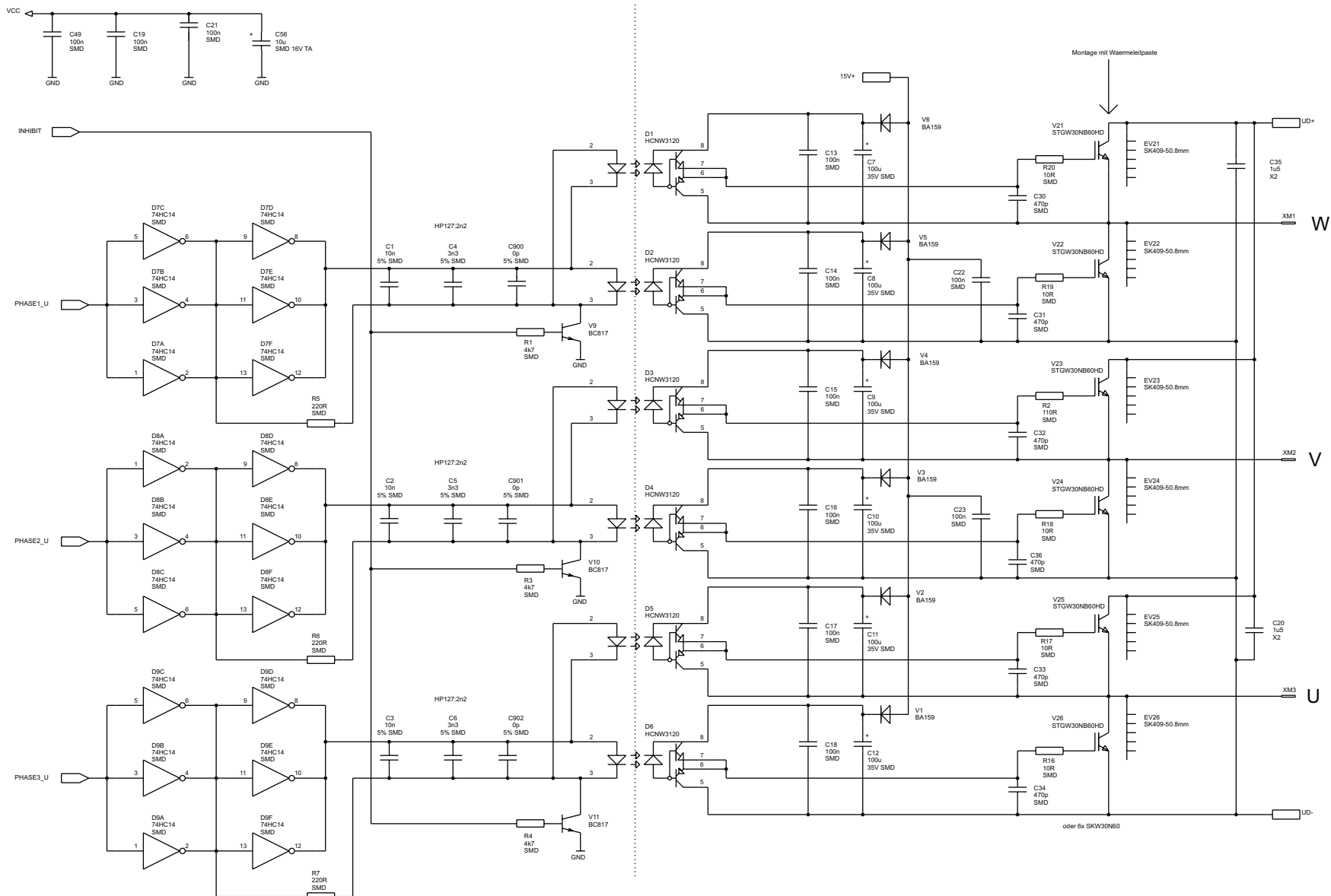










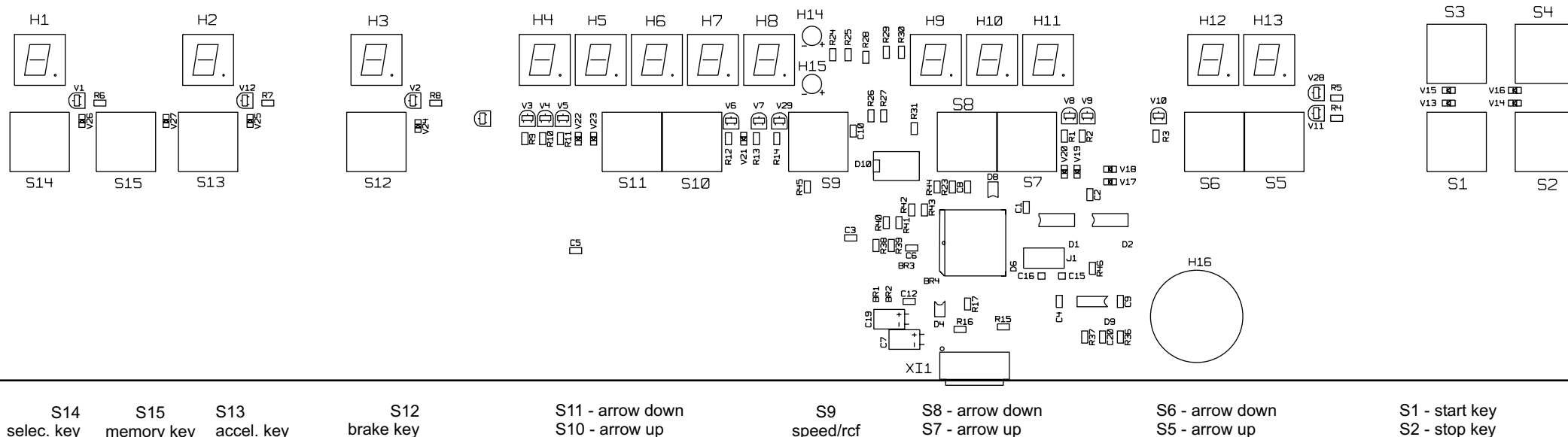


Motor





H1 prog. No. H2 accel. curve H3 decel. curve H4 - H8 speed/rcf display H14, H15 speed/rcf H9 - H11 time display H12, H13 temperature display S3 quick run key S4 lid key



### seven segment LEDs

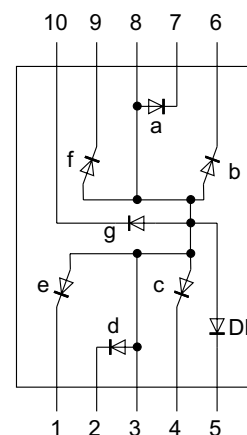
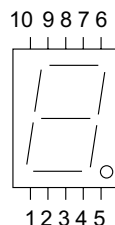
distance of seven segment LEDs to printed circuit board = 1mm

seven segment LED

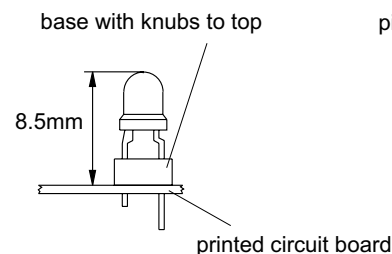


Keep this distance by underplacement of a 1mm thick spacer plate of non conducting material.  
Spacer plate can be left below the seven segment LEDs.

top view  
H1 - H13 HDSP5551

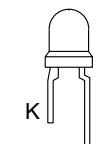


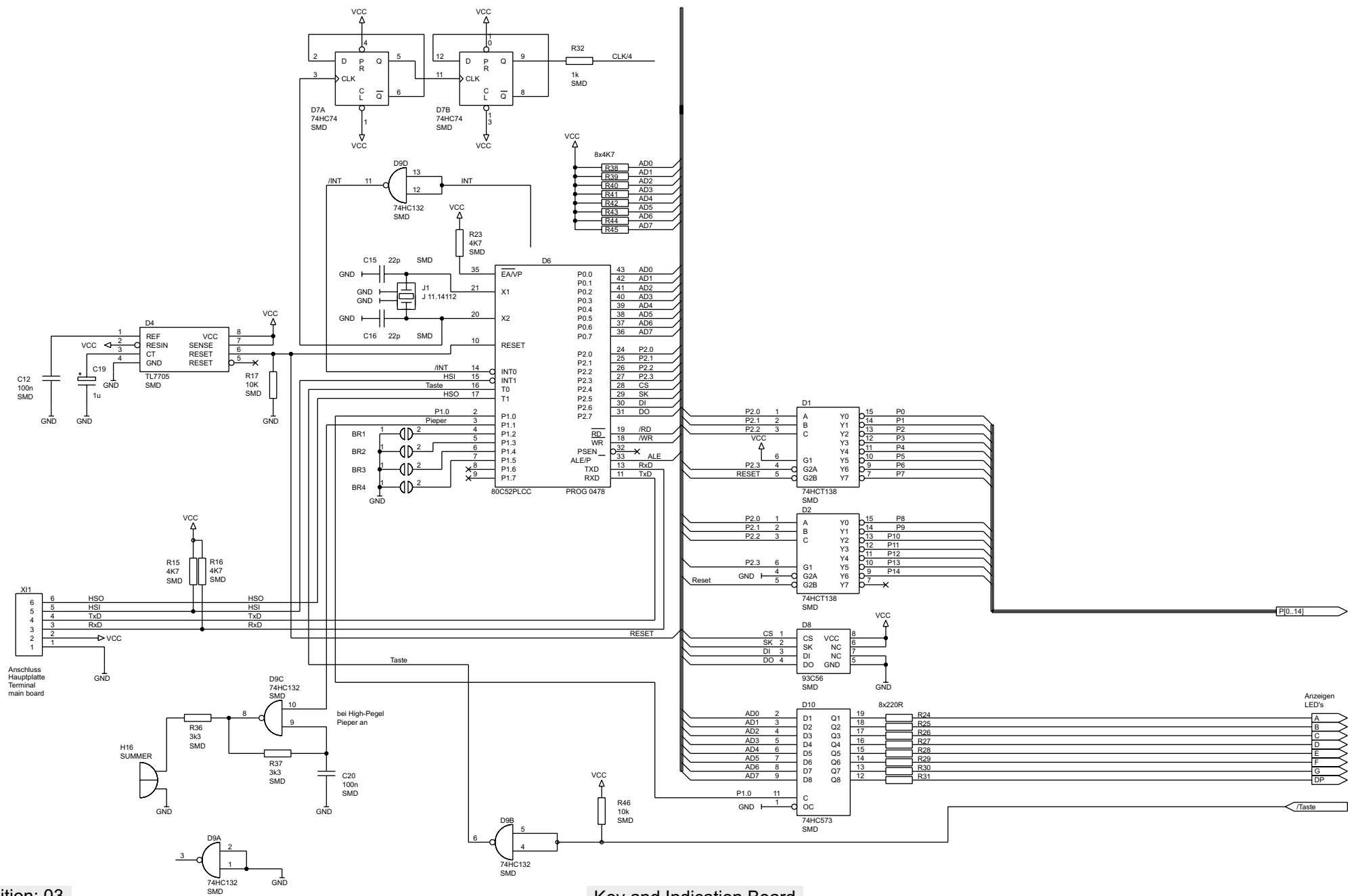
### LEDs



pinning of HLMP 3mm

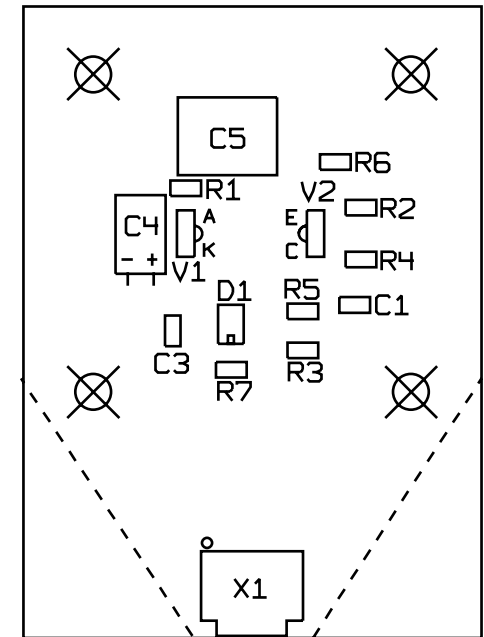
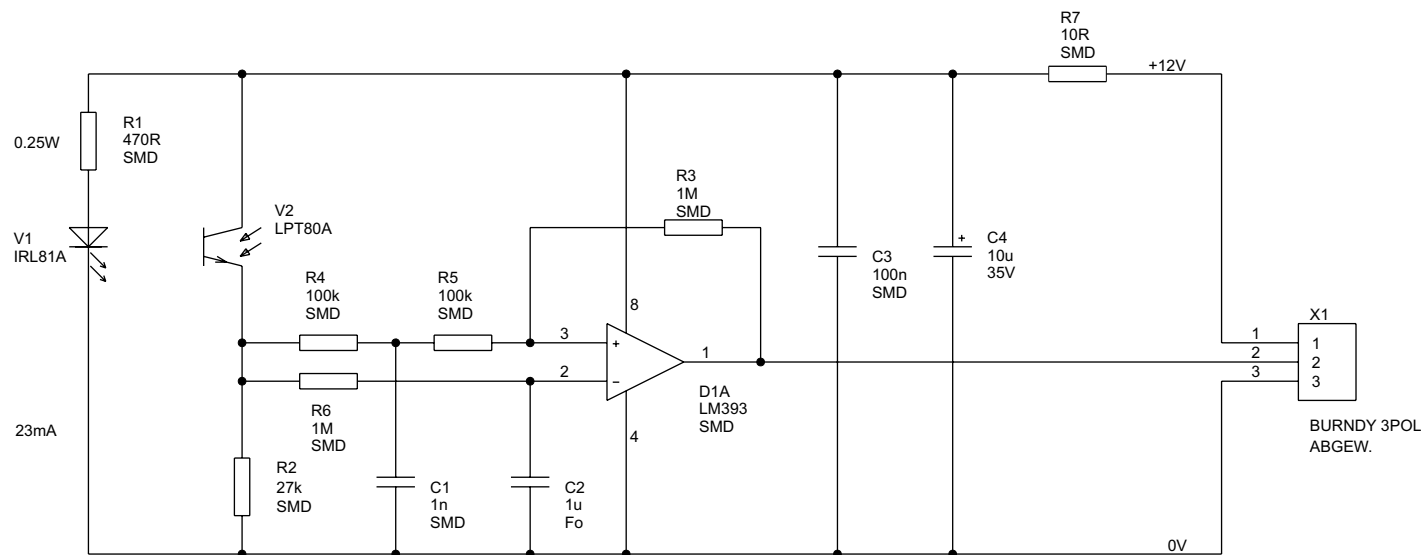
H14 - H15

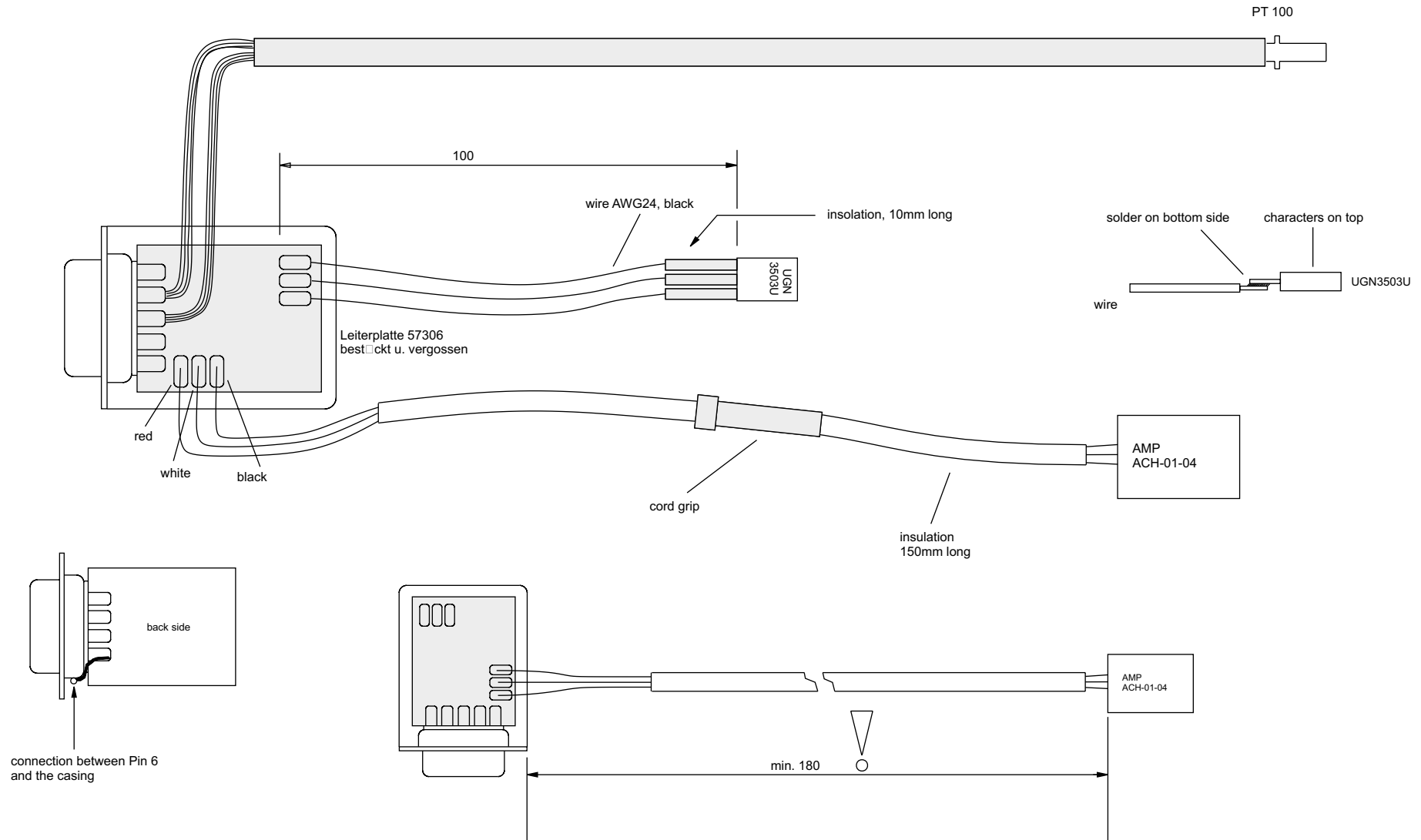


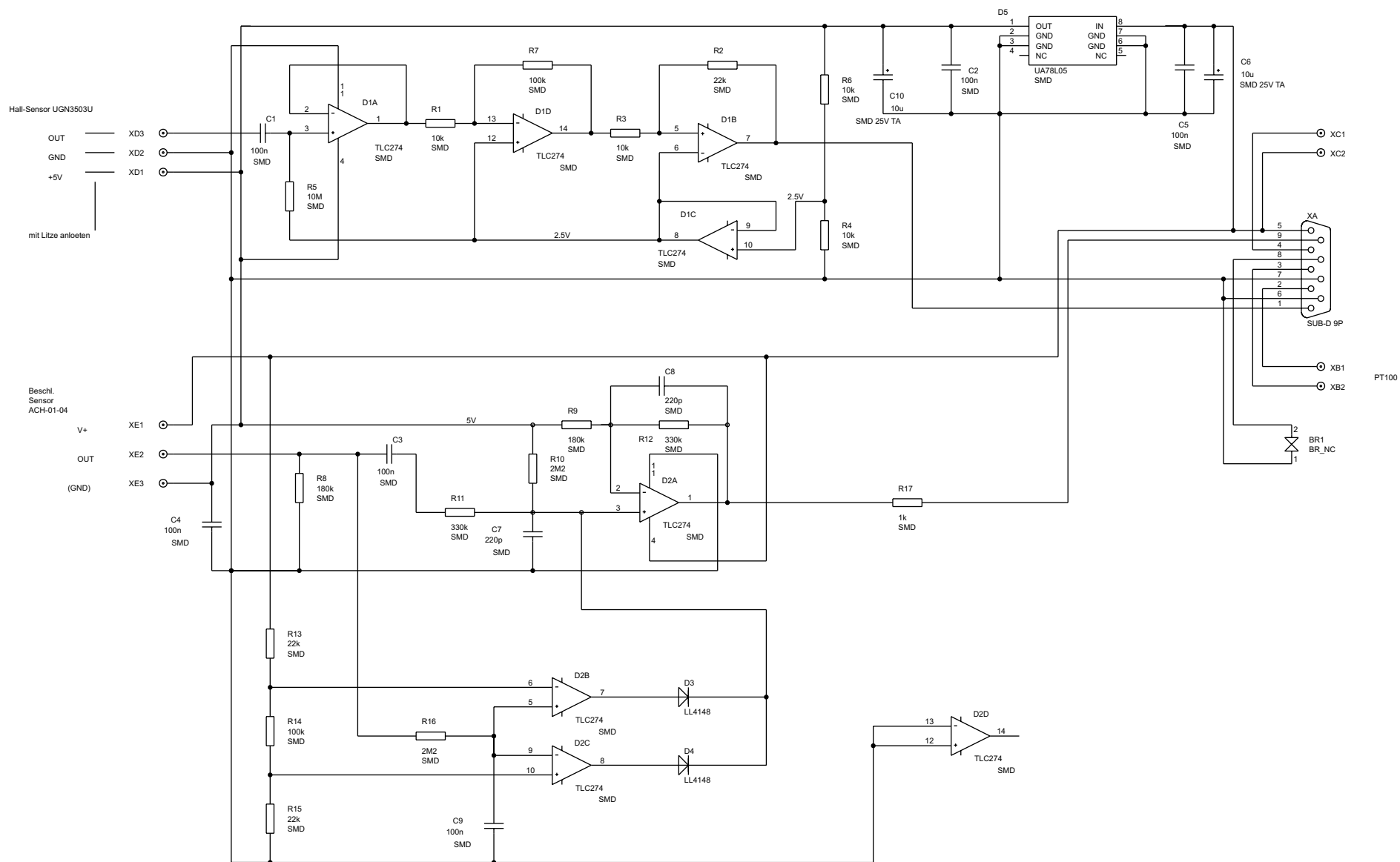


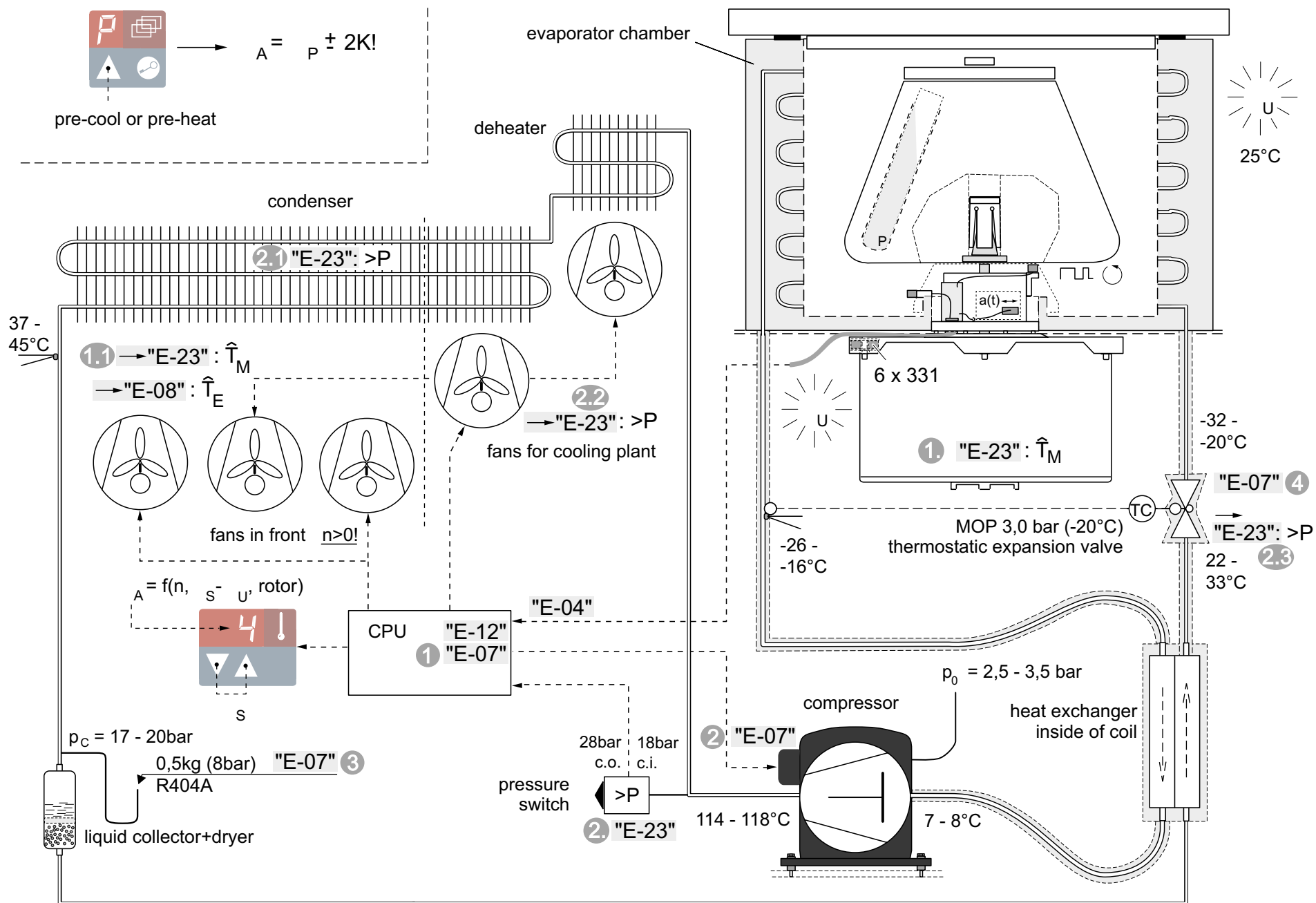














## 5 Disassembly of Instrument parts

The index numbers stated in ( ) reappear within the spare part figures (block diagram, schematic diagram of cooling plant) and the spare part lists.

### 5.1 Dismantling the Housing

#### 5.1.1 Front Panel (100)

- open the lid, switch off the unit and **pull out the mains plug**
- remove both front screws on each side
- pull out the front panel's bottom rim so far from casing's inside until the panel's mounting straps stand out
- press the front panel down (out of the upper guide rail)
- disconnect the lines from main switch, grounding receptacle and main board and unscrew the screening
- remove the front panel and deposit on back side
- Reassemble the front panel analogously in reverse order and take care that the white O-seal (101) is correctly pressed in seat

#### 5.1.2 Lid (130)

- open the lid, switch off the unit and **pull out the mains plug**
- knock carefully the joint bolts (136) for upper attaching of gas lid stays (135) out of joint blocks (137) **with its three notches ahead** by use of hammer and pin punches (but press the bolts in with non notches ahead by use of pliers)
- push an adequate screw driver into one bolt's place to keep the gas lid stay in position and to avoid lid's slamming
- remove the 4 screws for lid's attaching on both hinges
- take the screw driver out of joint blocks to separate lid from gas stay and remove the lid from casing
- When reassembling the lid take care that both bolt keepers (131) engage the lock entries concentric and stand out of the screw-in hollow exactly for 43 to 44mm

#### 5.1.3 Back Panel (128)

- open the lid, switch off the unit and **pull out the mains plug**
- if the back panel is not accessible clear the unit's left side to place it's width over here, then lift the rear left foot and push a thin and sliding layer under it
- lift the unit with help of a second person on it's right side and turn it over the rear foot to the left side (90° angle)
- remove the 8 rear and 5 upper screws for back panel's attaching on casing and frame
- unplug the grounding line and remove the back panel
- Reassemble the back panel analogously in reverse order

#### 5.1.4 Casing (120)

- remove the front panel (100) - see 5.1.1; remove the lid (130) - see 5.1.2; remove the back panel (128) - see 5.1.3
- unscrew the rotor and take it out
- remove the 4 remaining screws on both sides
- disconnect the grounding line and remove the casing with lid (121) and bolt holes sealing (122) in vertical position from armoured chamber and frame
- reassemble the casing analogously in reverse order and take care of the correct lid sealing seat (121)

#### 5.1.5 Automatic Lid Locking System (325)

**The automatic lid locking system with integrated lid switches is only available as one spare part set!**

- dismantle the front panel (100) - see 5.1.1
- cut off the plug's cable ties of the electromotorical lid tumbler systems and pull off the plugs **XC1** and **XC2**
- unplug the connectors for lid micro switches **XA1/XA2**, sensor **XE** and speed detection board **XW** and unscrew the screening
- remove the attaching screws of mounting plate (140) from casing (4 upper counter-sunk) and intermediate frame (2 Allen screws, main board's borings)
- pull the mounting plate on it's lower rim to front to loosen it from the anti noise tape glued on intermediate frame
- turn the mounting plate over to the right side and secure it against falling down (e.g. by cable tie)
- untie the emergency lid opening cord and pull out of guide tubes
- remove the screws of the lid locking system for attaching on mounting plate and replace the lock
- when reassembling the lock adjust it concentric to bolt keeper's position and remount the unit analogously in reverse order. At older units it is possible that the holes for the lid locking system in the mounting plate must be modified. Switch the instrument back to power and check the automatic closing and self-acting opening functions

#### 5.1.6 Gas Lid Stays (135)

- open the lid, switch off the unit, **pull out the mains plug** and remove the rotor
- remove the lid - see 5.1.3; remove the casing - see 5.1.4
- remove the attaching screws for the lower joint blocks
- knock carefully the joint bolts (136) for lower attaching of gas lid stays (135) out of joint blocks (137) **with its three notches ahead** by use of hammer and pin punches (but press the bolt in with non notches ahead by use of pliers)
- replace both worn out gas lid stays and reinstall the new gas lid stays analogously in reverse order

## 5.2 Replacement of Electrical Components

### 5.2.1 NV-RAMs (302,303,306), CPU (301) on the Main Board

- Notice old displayed identification and version numbers of CPU and NV-RAMs when powering on (2./3./4. No. in sequence, numbers of controller and NV-RAM for imbalance function are not indicated)
- open the wiring diagram and remove the front panel (100) - see 5.1.1
- **ATTENTION - CMOS components! Discharge your body before handling!** Pull CPU and/or NV-RAMs carefully out of socket using chip
- reinsert the new IC's correctly - the chip gaps of all NV-RAMs (hidden under the label) must point to the left, the CPU's gap must point to ground - and then press the chip(s) in
- Put the front panel back in position, switch power ON, check the displayed identification and version numbers of the new ICs and refit the front panel.

### 5.2.2 Main Board Replacement (300)

- dismantle the front panel (100) - see 5.1.1
- cut free the cable ties and disconnect the single plug connectors for electro-motorical lid locking systems **XC1/2**, lid micro switches **XA1/2**, speed detection board **XW**, sensor board **XE**, display board **XI** and serial interface **XB** (for continuous flow operation only) and unscrew the screenings
- unscrew the terminal connections for fans **XF/XK**, pump socket **XV**, compressor **XG**, mains supply **XL,XN**, pressostat **XO**, motor overtemperature switch **XR**, brake resistors **XD**, motor lines **U,V,W** and fix the lines on right side
- unscrew the 11 nuts for main board's attaching, remove them together with washers and take out the main board
- **touch a grounded receptacle to discharge your body before touching the sensitive CMOS components!** Take the new CPU and/or NV-RAMs (301-303, 306) out of box (or re-use the old ones when in **perfect** condition) and insert them into sockets of the new main board (if necessary, remove the placed but nonprogrammed NV-RAMs before)
- remount the new main board with all nuts and washers
- **do not mix up disconnected cables during re-connection!**
- reassemble the device in reverse order and perform a test run, **making sure the drive turns in the right direction** (see imprinted arrow on rim of rotor chamber)!

### 5.2.3 Main Board Replacement (300)

- remove the front panel (100) - see 5.1.1
- remove the attaching screws and take out the indication board
- unplug the connecting line to main board and transfer to new board
- reassemble the indication board analogously in reverse order, check controller identification and refit the front panel

### 5.2.4 Sensor Board and Spindle completely (320)

- The sensor board is part of the spindle and cannot be ordered separately! For replacing the sensor board (320) - see 5.3.1

### 5.2.5 Speed Detection Board (335)

- remove the drive with mounting plate - see 5.3.2 and deposit upside down
- remove the screws and lock washers and take out the board
- unplug the connecting line to main board and transfer to new detection board
- remount the speed detection board (plug position: left to back), reassemble the unit analogously in reverse order and perform a test run.

### 5.2.6 Fans (225)

- **front fans:** remove mounting plate (140) for main board / lid locks - see 5.1.5
- remove the terminal connections for fans **XF/XK** and brake resistors **XD**
- unscrew the metal sheet for air conducting (141) and take it out
- remove both screws for fans' angle attaching on bottom plate and take out the angle inclusive fans and brake resistors
- **compressor fans:** dismantle the casing (120) - see 5.1.4
- unscrew terminal connection **XK** and open the wiring harness
- remove the self-tapping screws from fan's casing, take out the **upper** fan first
- then remove the lower fan (if defective) together with housing, replace it and reassemble the unit analogously in reverse order. Perform a test run

### 5.2.7 Brake Resistor (340)

- remove the front fans - see 5.2.6
- check the resistance of both brake resistors and replace defective resistor(s)
- check the cleanliness of air louvers and clean them if necessary, pay attention to good heat transmission
- Reassemble the device analogously in reverse order. Perform some short test runs with brake curve 9

### 5.3 Replacement of Drive Components

**For these activities the Service Tool Cat. No. 70904442 is required.**

#### 5.3.1 Spindle (320)

- Open the lid, switch off the unit, **pull out the mains plug** and remove the rotor
- Remove the rubber flange (321), pull temperature sensor out of guide boring
- Take out the foam insulation parts carefully
- Loosen the 6 Allen screws (5mm) with use of the rotor key
- Remove 2 opposite screws and screw-in both delivered screws with little more length (M6x20) for 2-3 turns
- Then turn out the 4 remaining screws evenly and in alternation until the motor just hangs on the both longer screws
- Finally turn out both longer screws evenly to put the motor carefully down onto bottom plate
- Turn the spindle a little when pulling it carefully to top
- **Fill the torx (hole of knockout spindle) completely with OPTIMOL PL paste (329)**
- Reassemble the spindle analogously in reverse order: Insert the lock washers and lift the motor first with both longer screws. Then refit the 4 screws and finally replace the longer screws by the shorter ones. The 2 longer screws must not be tightened at all!
- After replacing the spindle a special set up run must be started, see 5.3.2

#### 5.3.2 Perform Spindle (320) set up run

##### Attention!

**After replacing the spindle a special set up run must be execute.** The set up run works after starting automatically and it takes about 7½ hours for complete execution. **Until this has not been done it is not recommended to run the maximum speed.**

For execution the set up run a rotor with a minimum top speed of 17,000 rpm (14,000 rpm at 120V units) is required. Use preferably the rotor 75003336.

The set up run is starting as follows:

- Switch on the centrifuge and select the following parameter:  
Running time = 3 minutes, set speed = 17,000 rpm (14,000 rpm at 120V units)
- Switch off the centrifuge
- Press and hold both arrow keys in the speed section, the RCF key and switch the centrifuge on
- Wait until the display shows "LAGEr", then select a running time of 5 minutes
- Remove fingers from push buttons and wait until the display shows "L" in the program number section
- Press the "start" key

The centrifuge will start with 300 rpm, after 3 minutes run time the centrifuge will stop. After a short waiting period the set speed will be automatically set step by step higher until finally it runs 17,000 rpm. (14,000 rpm at 120V units) When the set up run has finished the indication "L" in the program number section will be deleted. The centrifuge is running at 17,000 rpm (14,000 rpm at 120V units) until it will be stopped by the user. Now the centrifuge is unrestricted usable.

#### 5.3.3 Drive Motor (330)

- remove the front panel (100) - see 5.1.1
- disconnect the leads for motor **U,V,W** and over temperature switch **XR**, unplug the grounding wire **PE** from casing's receptacle
- unscrew the font fans' angle and turn over completely to right side - see 5.2.6
- unscrew the spindle (320) to put motor down - see 5.3.1
- unscrew the solid-type cable and remove motor with rubber supporting plate
- remove speed detection board and transfer to new motor - see 5.2.5
- remove 6 upper Allen screws and lock washers, turn supporting plate to angle of 30° to uncover the motor's fishplate and take off the rubber supporting plate
- check the rubber mounts (331) and in case of replacement - see 5.3.3
- transfer the rubber supporting plate onto the motor (arrows on top of plate must point in motor's mounting position to the left) and tighten the screws by hand
- loosen the 3 attaching screws of the centering ring disk, fit the delivered centering device in so that the 6 threat holes are accessible then retighten the screws
- remove the centering device, check that the ring disk and supporting plate won't touch the upper motor's bearing plate, then secure the screws with lacquer
- fill the torx (hole of knockout spindle) completely with OPTIMOL PL paste (329) and fit the ARMAFLEX ring disk around the upper motor bearing
- glue the noise absorbent stripes onto the lower motor's bearing plate (on front and back side of motor's mounting position: motor lines right side in front)
- reassemble motor and spindle analogously in reverse order and perform a test run. Check the sense of rotation (see imprinted arrow direction) and mix up 2 leads on terminals **U,V,W** in case of disorder



#### 5.3.4 Motor rubber Mounts (331)

The 6 rubber supports (331) and the 12 double-sided sandpaper discs (332) must be replaced at the same time in case of bad condition but at least every 6 years!

All 6 rubber mounts must only be exchanged completely!

- Remove the drive motor and unscrew the rubber supporting plate - see 5.3.2
- fix 6 sandpaper discs onto one side of rubber mounts with instant glue (motor's attaching side - serves to a following easier mounting to motor's fishplate)
- deposit supporting plate upside down, unscrew rubber mounts and recycle them
- insert new rubber mounts (unglued side) with remaining 6 sandpaper discs, apply lock washers on supporting plate and tighten the screws by hand
- fit the supporting plate onto motor, apply the lock washers and attach the motor with the screws sturdy onto rubber mounts
- remount the drive motor and retighten the spindle - see 5.3.1 and 5.3.2
- reassemble the device analogously in reverse order. At last perform a test run

#### 5.4 Replacement of Parts of the Cooling Plant

First of all is to figure out that high ambient temperatures ( $\vartheta_U > 35^\circ\text{C}$ ), insufficient heat transfer (e.g. polluted condenser, deheater, air gaps) or electrical errors (like defective fans, sensor or main board, starting relay or capacitor) can be excluded from the cooling problem (see function diagram of cooling plant 4-10: pressure / temperature ranges are valid for continuous cooling at max. speed,  $\vartheta_U = 25^\circ\text{C}$ )!

Procedure for replacing defective components of the cooling cycle:

- dismantle the casing - see 5.1. and mount pierce valves onto the service lines
- when gauging too little static pressure perform a leakage test ( $\text{N}_2$  max. 25bars)
- discharge the refrigerant with suction device into recycling bottle
- in case of compressor (210) fault, let the oil run out into a bowl to recycle it
- unsolder defective component(s) and replace the dryer/collector assy (235), too
- let a little amount of dry nitrogen gas stream through the tubes when soldering to avoid scaling on the tube's inner surface
- do the evacuation and refill the system with the exact amount of liquid refrigerant on the pressure side via a new external dryer (check amount with a balance or filling cylinder, resolder the service lines tight after finishing work)
- reassemble the device and perform a cooling power test run



131



122

130

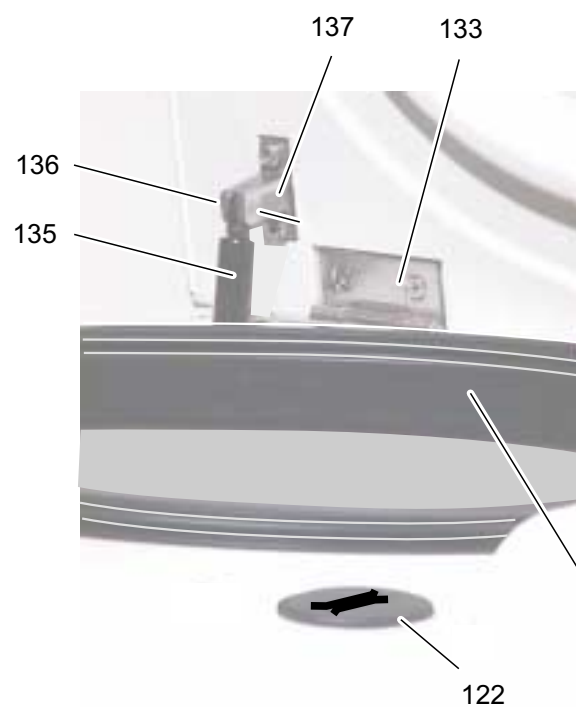
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102

100

326

120



137

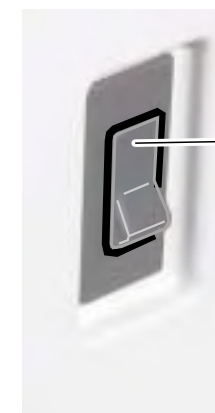
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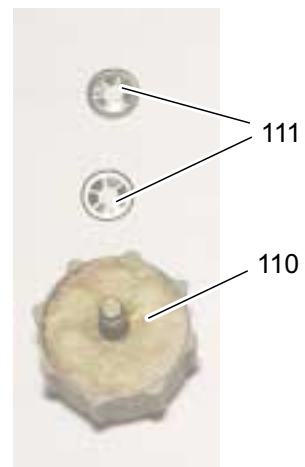
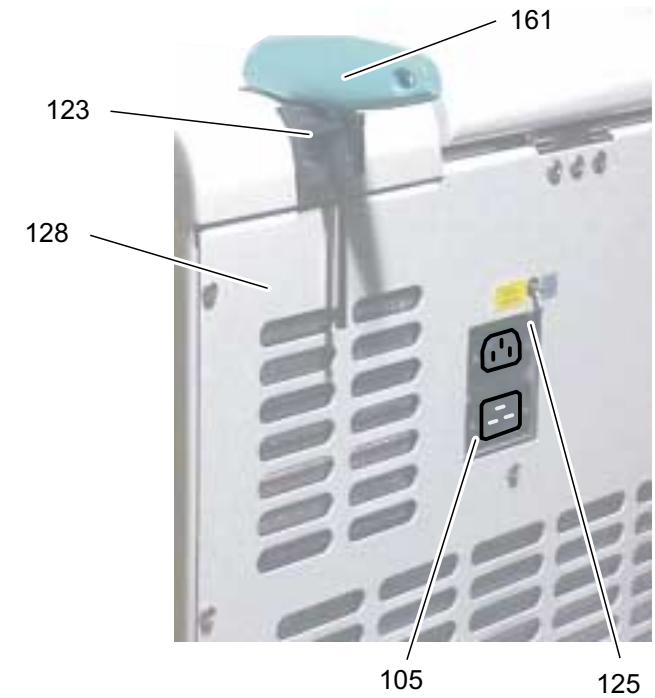
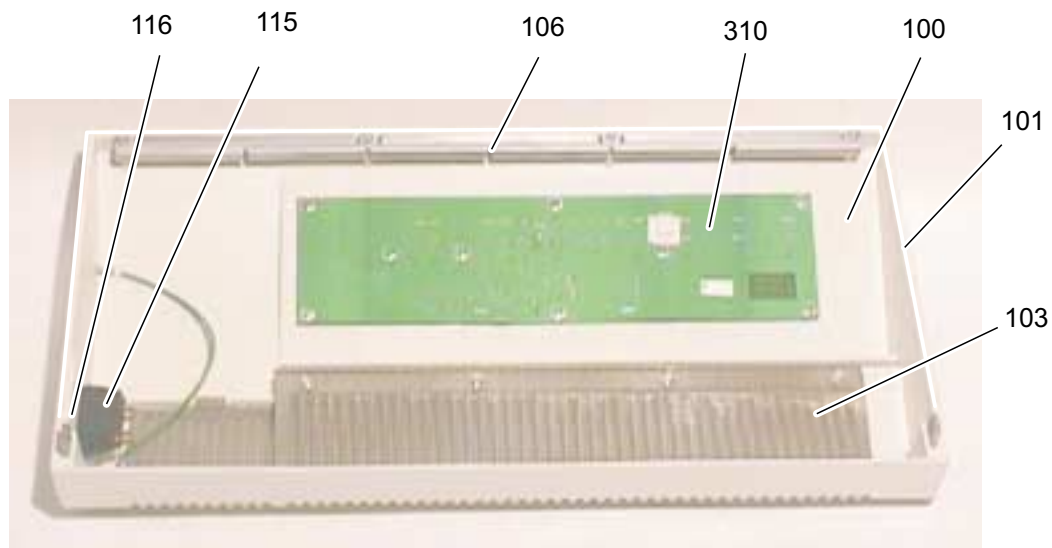
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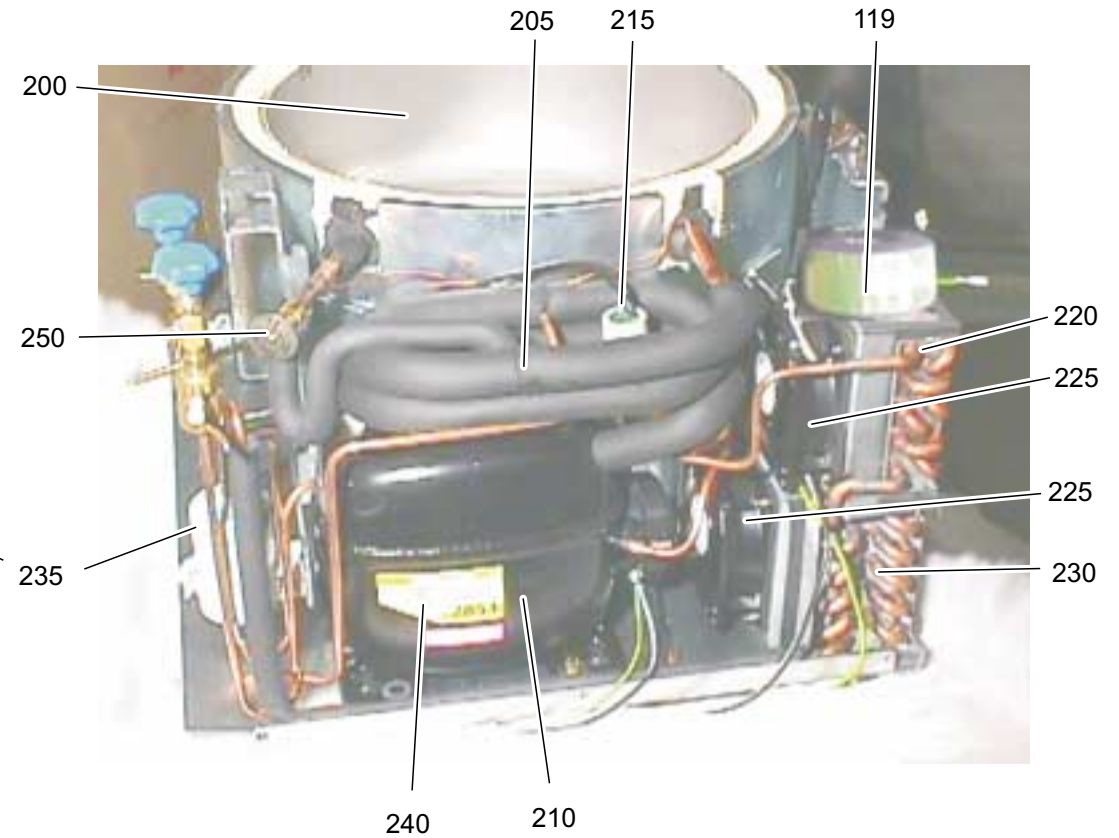
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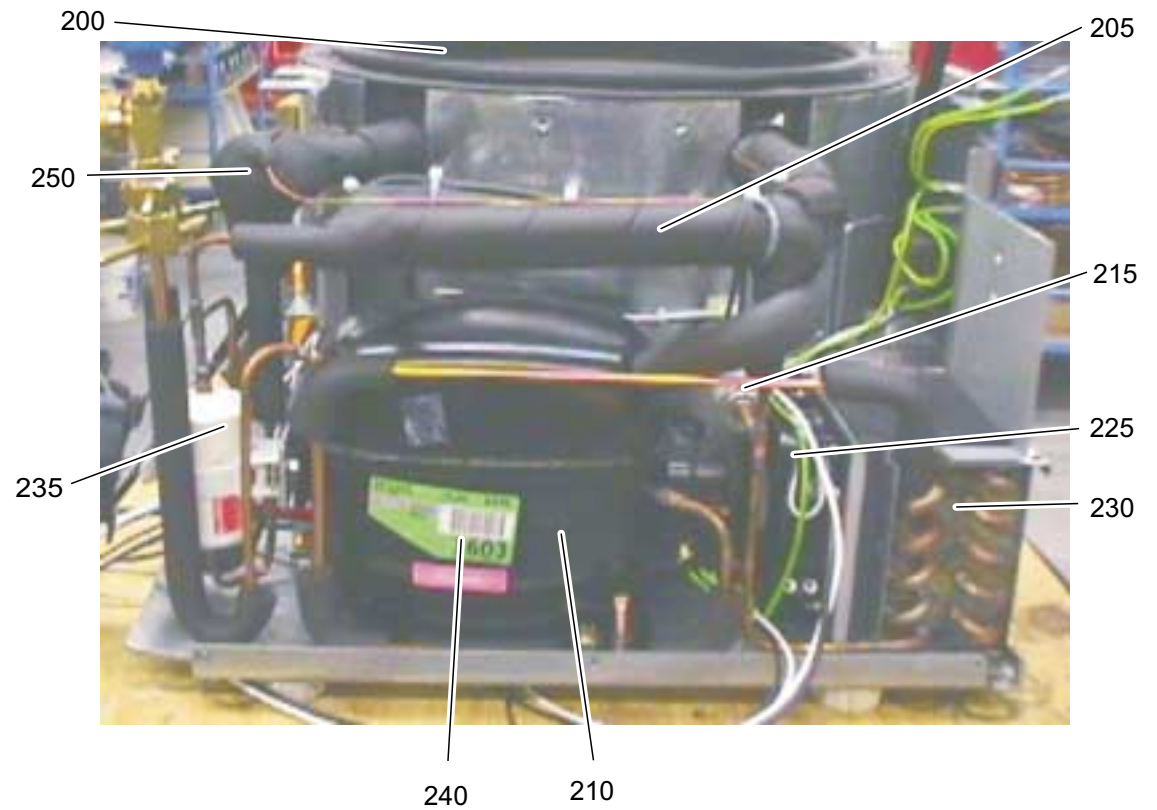
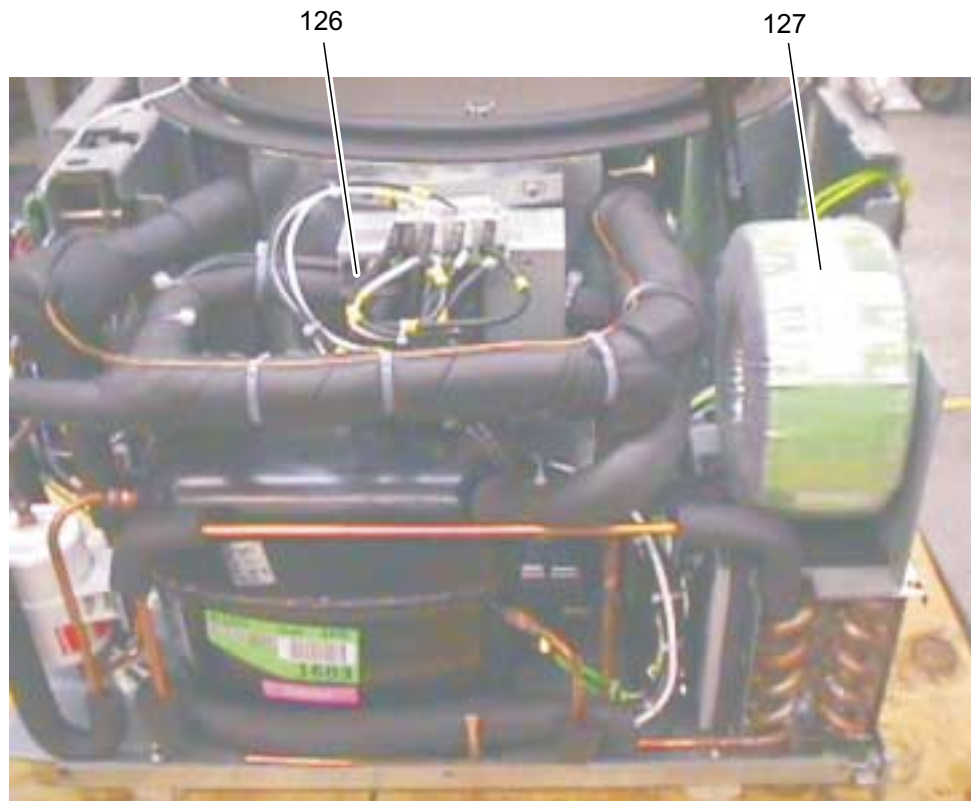




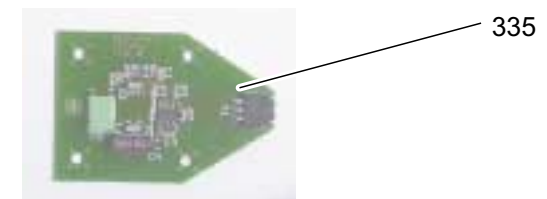
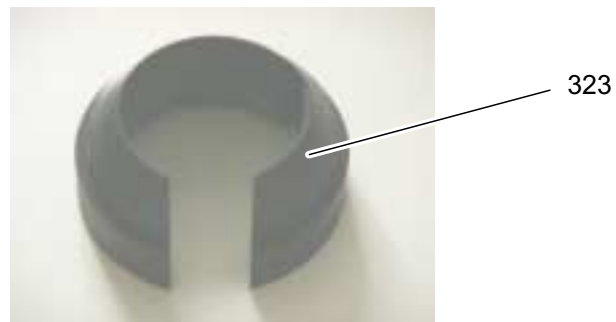
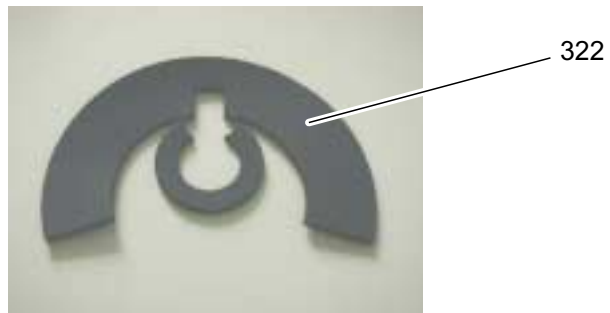
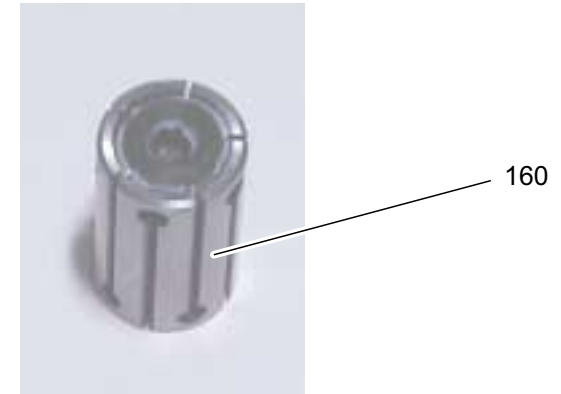
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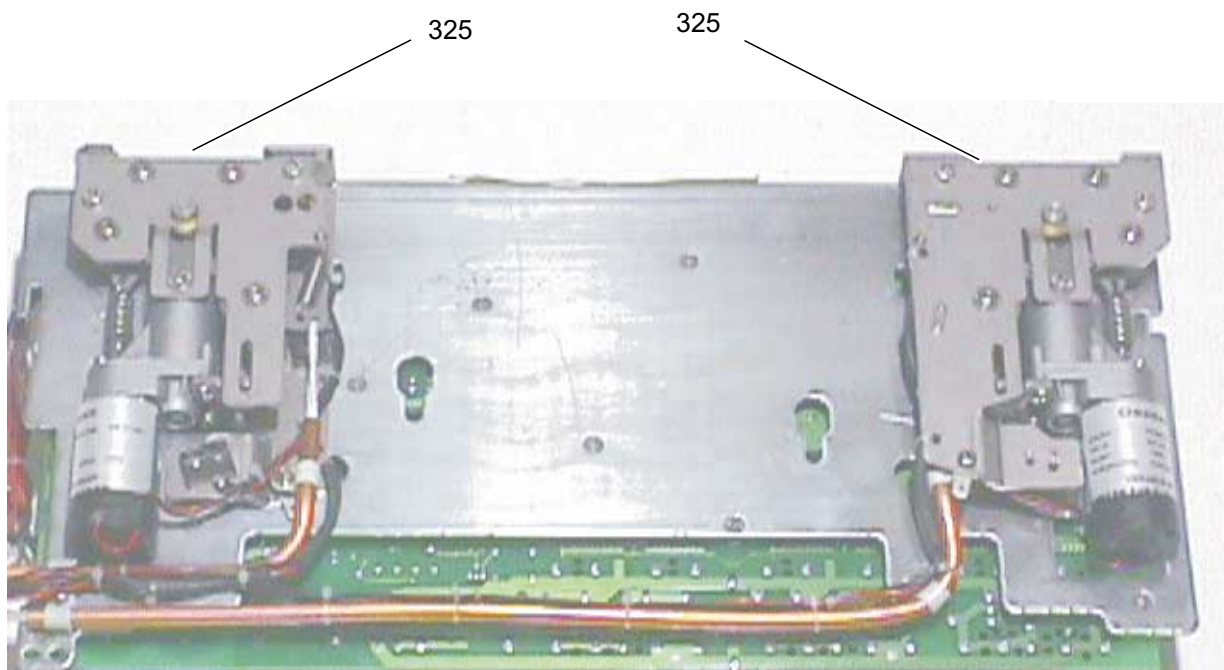
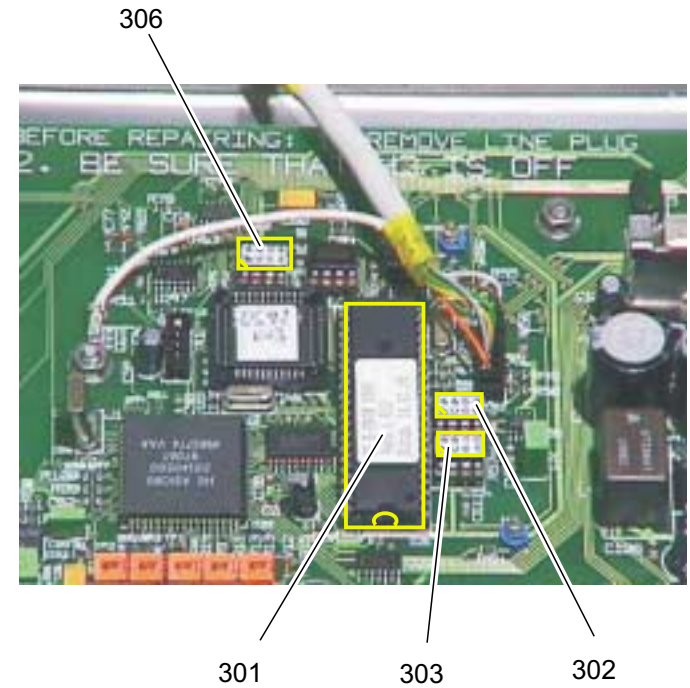
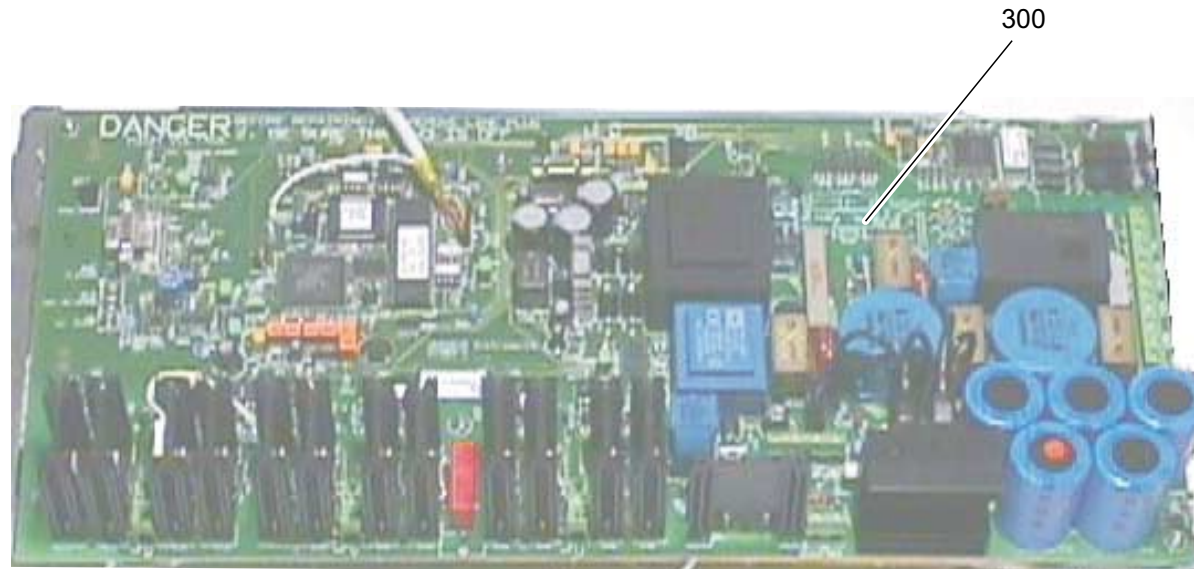
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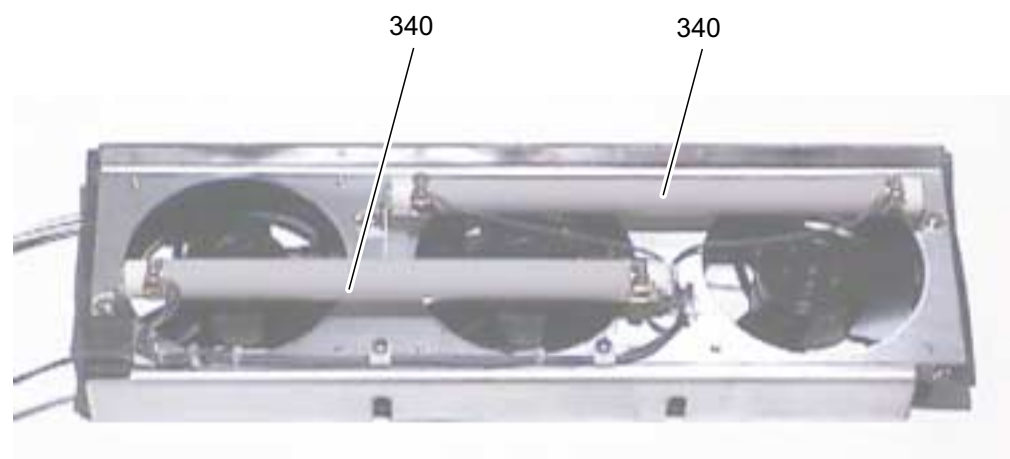
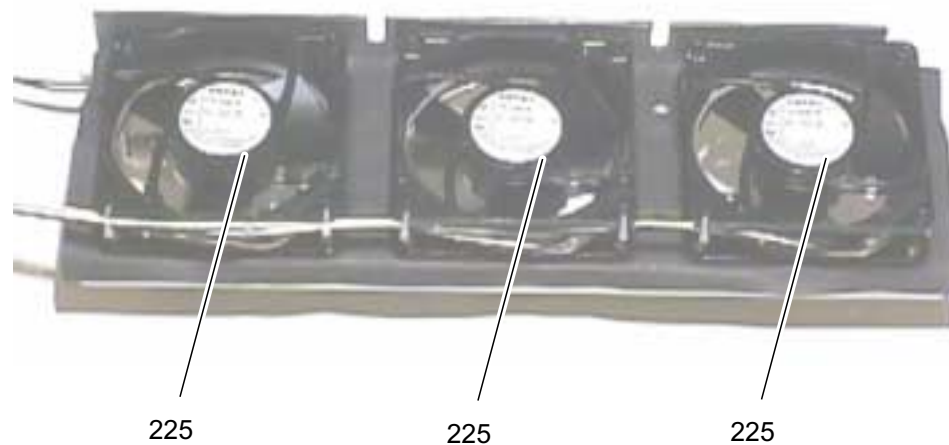
















## Spare-Part-List

## Kendro Laboratory Products

Plant Osterode

**75005284 - 01**

**BIOFUGE STRATOS 200V (208V) 50/60HZ**

from Serial-No. 259862

to Serial-No.

Index	Partno.	Text
100	20057204	FRONTPANEL
101	20290625	SEAL (FOAM RUBBER)
102	20057230	FOIL, STRATOS
103	70057233	GRILL
104	20190270	MAINS CABLE
105	20180661	SOCKET
106	70057225	TRACK
110	20057215	FOOT
111	20480261	CLIP WASHER
115	20180659	OVERCURRENT SWITCH
116	20180668	FRAME FOR 20180659
120	70057201	HOUSING
121	20290561	SEAL
122	20057216	RUBBER
123	20057228	TOOL HOLDER
125	20180660	SOCKET
128	70057218	BACKPANEL
130	20904408	LID
131	20057217	HOOK
133	20057273	HINGE
135	20310418	GAS LID STAY
136	20490287	PIN
137	20023748	HINGE BRACKET
160	20904430	COLLET CHUCK
161	20360073	SCREW DRIVER
200	70904402	COOLING CHAMBER COMPLETE
205	70904431	HEAT EXCHANGER
210	20240493	COMPRESSOR
215	20240578	HIGH-PRESSURE CONTROL SWITCH
220	20057141	CONDENSER
225	20210381	FAN
230	20057102	CONDENSER
235	20240577	FILTER DRYER
240	20270100	FREON R 404 A
250	20240585	INJECTION VALVE TKS 1, MOP-20°C,
300	20150127	PCB, MAIN 230V/50/60HZ
301	70904568	CPU
302	70904409	NV RAM

## Spare-Part-List

Kendro Laboratory Products

Plant Osterode

**75005284 - 01**

**BIOFUGE STRATOS 200V (208V) 50/60HZ**

from Serial-No. 259862

to Serial-No.

Index	Partno.	Text
303	70904410	NV RAM
306	70904434	NV RAM
310	20150122	PCB, DISPLAY
320	70904401	SPINDLE, COMPLETE
321	20057014	FLANGE
322	20057515	INSULATION
323	20057096	INSULATION
325	70904405	LIDLOCK
326	20310316	CLIP
327	20170325	TRANSFORMER 200/225 12A
329	20270138	GREASE OPTIMOL 100 ML
330	20210382	MOTOR
331	20300077	ANTIVIBRATION MOUNT
332	20480257	SANDWASHER
333	70057006	MOTORBASE
334	70057008	CENTERRING
335	20150102	SPEEDINDICATION
340	20160685	RESISTOR 150R 150W

## Spare-Part-List

## Kendro Laboratory Products

Plant Osterode

**75005285 - 01**

**CONTIFUGE STRATOS 200V (208V) 50/60HZ**

from Serial-No. 261461

to Serial-No.

Index	Partno.	Text
100	20057204	FRONTPANEL
101	20290625	SEAL (FOAM RUBBER)
102	20057243	FOIL, STRATOS
103	70057233	GRILL
104	20190270	MAINS CABLE
105	20180661	SOCKET
106	70057225	TRACK
110	20057215	FOOT
111	20480261	CLIP WASHER
115	20180659	OVERCURRENT SWITCH
116	20180668	FRAME FOR 20180659
119	20170326	AUTO-TRANSFORMER 230/120 V 50/6
120	70057201	HOUSING
121	20290561	SEAL
122	20057216	RUBBER
123	20057228	TOOL HOLDER
125	20180660	SOCKET
128	70057218	BACKPANEL
130	20904407	LID, COMPLETE - CONTI
131	20057217	HOOK
133	20057273	HINGE
135	20310418	GAS LID STAY
136	20490287	PIN
137	20023748	HINGE BRACKET
140	70904417	LID INSERT
141	20057241	ADJUSTMENT TOOL, CONT. FLOW R
142	20057226	HOLDER
143	20430313	SCREW
144	70053585	CLIP
145	70053586	CLIP
146	70053587	BOLT M6
147	20056462	INSERT
149	20510001	BOLT
150	20057222	ADAPTER
151	20057239	WASHER
152	20510005	
160	20904430	COLLET CHUCK
161	20360073	SCREW DRIVER

## Spare-Part-List

## Kendro Laboratory Products

Plant Osterode

**75005285 - 01**

**CONTIFUGE STRATOS 200V (208V) 50/60HZ**

from Serial-No. 261461

to Serial-No.

Index	Partno.	Text
200	70904402	COOLING CHAMBER COMPLETE
205	70904431	HEATEXCHANGER
210	20240493	COMPRESSOR
215	20240578	HIGH-PRESSURE CONTROLL SWITCH
220	20057141	CONDENSER
225	20210381	FAN
230	20057102	CONDENSER
235	20240577	FILTERDRYER
240	20270100	FREON R 404 A
250	20240585	INJECTION VALVE TKS 1, MOP-20°C,
300	20150127	PCB, MAIN 230V/50/60HZ
301	70904568	CPU
302	70904409	NV RAM
303	70904410	NV RAM
306	70904434	NV RAM
310	20150122	PCB, DISPLAY
320	70904401	SPINDLE, COMPLETE
321	20057014	FLANGE
322	20057515	INSULATION
323	20057096	INSULATION
325	70904405	LIDLOCK
326	20310316	CLIP
327	20170325	TRANSFORMER 200/225 12A
329	20270138	GREASE OPTIMOL 100 ML
330	20210382	MOTOR
331	20300077	ANTIVIBRATION MOUNT
332	20480257	SANDWASHER
333	70057006	MOTORBASE
334	70057008	CENTERRING
335	20150102	SPEEDINDICATION
340	20160685	RESISTOR 150R 150W

## Spare-Part-List

Kendro Laboratory Products

Plant Osterode

**75005286 -01**

**BIOFUGE STRATOS 120V 60 HZ**

from Serial-No. 263698

to Serial-No.

Index	Partno.	Text
100	20057204	FRONTPANEL
101	20290625	SEAL (FOAM RUBBER)
102	20057230	FOIL, STRATOS
103	70057233	GRILL
104	20190274	POWER CORD 20A/125V
105	20180661	SOCKET
106	70057225	TRACK
110	20057215	FOOT
111	20480261	CLIP WASHER
115	20180671	SWITCH W OVERLOADPROT. 16 A
116	20180668	FRAME FOR 20180659
120	70057201	HOUSING
121	20290561	SEAL
122	20057216	RUBBER
123	20057228	TOOL HOLDER
125	20180660	SOCKET
126	20130221	RELAIS
127	20170327	AUTO-TRANSFORMER 115/225V 7A
128	70057218	BACKPANEL
130	20904408	LID
131	20057217	HOOK
133	20057273	HINGE
135	20310418	GAS LID STAY
136	20490287	PIN
137	20023748	HINGE BRACKET
160	20904430	COLLET CHUCK
161	20360073	SCREW DRIVER
200	70904402	COOLING CHAMBER COMPLETE
205	70904431	HEATEXCHANGER
210	20240591	COMPRESSOR SC 12CLX 120V/60 HZ
215	20240578	HIGH-PRESSURE CONTROLL SWITCH
225	20210381	FAN
230	20057102	CONDENSER
235	20240577	FILTERDRYER
240	20270100	FREON R 404 A
250	20240585	INJECTION VALVE TKS 1, MOP-20°C,
300	20150127	PCB, MAIN 230V/50/60HZ
301	70904568	CPU

## Spare-Part-List

Kendro Laboratory Products

Plant Osterode

**75005286 -01**

**BIOFUGE STRATOS 120V 60 HZ**

from Serial-No. 263698

to Serial-No.

Index	Partno.	Text
302	70904450	NV RAM
303	70904410	NV RAM
306	70904434	NV RAM
310	20150122	PCB, DISPLAY
320	70904401	SPINDLE, COMPLETE
321	20057014	FLANGE
322	20057515	INSULATION
323	20057096	INSULATION
325	70904405	LIDLOCK
326	20310316	CLIP
329	20270138	GREASE OPTIMOL 100 ML
330	20210382	MOTOR
331	20300077	ANTIVIBRATION MOUNT
332	20480257	SANDWASHER
333	70057006	MOTORBASE
334	70057008	CENTERRING
335	20150102	SPEEDINDICATION
340	20160685	RESISTOR 150R 150W

## Spare-Part-List

## Kendro Laboratory Products

Plant Osterode

**75005293 - 01**

**BIOFUGE STRATOS 120V SORVALL**

from Serial-No. 280107

to Serial-No.

Index	Partno.	Text
100	20057204	FRONTPANEL
101	20290625	SEAL (FOAM RUBBER)
102	20057183	OVERLAY SORVALL BIOFUGE STRAT
103	70057233	GRILL
104	20190274	POWER CORD 20A/125V
104	20190264	MAINS CABLE
105	20180661	SOCKET
106	70057225	TRACK
110	20057215	FOOT
111	20480261	CLIP WASHER
115	20180671	SWITCH W OVERLOADPROT. 16 A
116	20180668	FRAME FOR 20180659
120	70057201	HOUSING
121	20290561	SEAL
122	20057216	RUBBER
123	20057228	TOOL HOLDER
125	20180660	SOCKET
126	20130221	RELAIS
127	20170327	AUTO-TRANSFORMER 115/225V 7A
128	70057218	BACKPANEL
130	20904408	LID
131	20057217	HOOK
133	20057273	HINGE
135	20310418	GAS LID STAY
136	20490287	PIN
137	20023748	HINGE BRACKET
160	20904430	COLLET CHUCK
161	20360073	SCREW DRIVER
200	70904402	COOLING CHAMBER COMPLETE
205	70904431	HEATEXCHANGER
210	20240591	COMPRESSOR SC 12CLX 120V/60 HZ
215	20240578	HIGH-PRESSURE CONTROLL SWITCH
225	20210381	FAN
230	20057102	CONDENSER
235	20240577	FILTERDRYER
240	20270100	FREON R 404 A
250	20240585	INJECTION VALVE TKS 1, MOP-20°C,
300	20150127	PCB, MAIN 230V/50/60HZ



## Spare-Part-List

Kendro Laboratory Products

Plant Osterode

**75005293 - 01**

**BIOFUGE STRATOS 120V SORVALL**

from Serial-No. 280107

to Serial-No.

Index	Partno.	Text
301	70904568	CPU
302	70904450	NV RAM
303	70904410	NV RAM
306	70904434	NV RAM
310	20150122	PCB, DISPLAY
320	70904401	SPINDLE, COMPLETE
321	20057014	FLANGE
322	20057515	INSULATION
323	20057096	INSULATION
325	70904405	LIDLOCK
326	20310316	CLIP
329	20270138	GREASE OPTIMOL 100 ML
330	20210382	MOTOR
331	20300077	ANTIVIBRATION MOUNT
332	20480257	SANDWASHER
333	70057006	MOTORBASE
334	70057008	CENTERRING
335	20150102	SPEEDINDICATION
340	20160685	RESISTOR 150R 150W

## Spare-Part-List

## Kendro Laboratory Products

Plant Osterode

**75005294 - 01**

**BIOFUGE STRATOS 200(208)V SORVALL**

from Serial-No.

to Serial-No.

Index	Partno.	Text
100	20057204	FRONTPANEL
101	20290625	SEAL (FOAM RUBBER)
102	20057183	OVERLAY SORVALL BIOFUGE STRAT
103	70057233	GRILL
104	20190270	MAINS CABLE
105	20180661	SOCKET
106	70057225	TRACK
110	20057215	FOOT
111	20480261	CLIP WASHER
115	20180659	OVERCURRENT SWITCH
116	20180668	FRAME FOR 20180659
120	70057201	HOUSING
121	20290561	SEAL
122	20057216	RUBBER
123	20057228	TOOL HOLDER
125	20180660	SOCKET
128	70057218	BACKPANEL
130	20904408	LID
131	20057217	HOOK
133	20057273	HINGE
135	20310418	GAS LID STAY
136	20490287	PIN
137	20023748	HINGE BRACKET
160	20904430	COLLET CHUCK
161	20360073	SCREW DRIVER
200	70904402	COOLING CHAMBER COMPLETE
205	70904431	HEAT EXCHANGER
210	20240493	COMPRESSOR
215	20240578	HIGH-PRESSURE CONTROL SWITCH
220	20057141	CONDENSER
225	20210381	FAN
230	20057102	CONDENSER
235	20240577	FILTER DRYER
240	20270100	FREON R 404 A
250	20240585	INJECTION VALVE TKS 1, MOP-20°C,
300	20150127	PCB, MAIN 230V/50/60HZ
301	70904568	CPU
302	70904409	NV RAM

## Spare-Part-List

Kendro Laboratory Products

Plant Osterode

**75005294 - 01**

**BIOFUGE STRATOS 200(208)V SORVALL**

from Serial-No.

to Serial-No.

Index	Partno.	Text
303	70904410	NV RAM
306	70904434	NV RAM
310	20150122	PCB, DISPLAY
320	70904401	SPINDLE, COMPLETE
321	20057014	FLANGE
322	20057515	INSULATION
323	20057096	INSULATION
325	70904405	LIDLOCK
326	20310316	CLIP
327	20170325	TRANSFORMER 200/225 12A
329	20270138	GREASE OPTIMOL 100 ML
330	20210382	MOTOR
331	20300077	ANTIVIBRATION MOUNT
332	20480257	SANDWASHER
333	70057006	MOTORBASE
334	70057008	CENTERRING
335	20150102	SPEEDINDICATION
340	20160685	RESISTOR 150R 150W

## Spare-Part-List

## Kendro Laboratory Products

Plant Osterode

**75005296 - 01**

**CONTIFUGE STRATOS 208V SORVALL**

from Serial-No. 280221

to Serial-No.

Index	Partno.	Text
100	20057204	FRONTPANEL
101	20290625	SEAL (FOAM RUBBER)
102	20057184	OVERLAY - SORVALL CONTIFUGE ST
103	70057233	GRILL
104	20190270	MAINS CABLE
105	20180661	SOCKET
106	70057225	TRACK
110	20057215	FOOT
111	20480261	CLIP WASHER
115	20180659	OVERCURRENT SWITCH
116	20180668	FRAME FOR 20180659
119	20170326	AUTO-TRANSFORMER 230/120 V 50/6
120	70057201	HOUSING
121	20290561	SEAL
122	20057216	RUBBER
123	20057228	TOOL HOLDER
125	20180660	SOCKET
128	70057218	BACKPANEL
130	20904407	LID, COMPLETE - CONTI
131	20057217	HOOK
133	20057273	HINGE
135	20310418	GAS LID STAY
136	20490287	PIN
137	20023748	HINGE BRACKET
140	70904417	LID INSERT
141	20057241	ADJUSTMENT TOOL, CONT. FLOW R
142	20057226	HOLDER
143	20430313	SCREW
144	70053585	CLIP
145	70053586	CLIP
146	70053587	BOLT M6
147	20056462	INSERT
149	20510001	BOLT
150	20057222	ADAPTER
151	20057239	WASHER
152	20510005	
160	20904430	COLLET CHUCK
161	20360073	SCREW DRIVER

## Spare-Part-List

## Kendro Laboratory Products

Plant Osterode

**75005296 - 01**

**CONTIFUGE STRATOS 208V SORVALL**

from Serial-No. 280221

to Serial-No.

Index	Partno.	Text
200	70904402	COOLING CHAMBER COMPLETE
205	70904431	HEATEXCHANGER
210	20240493	COMPRESSOR
215	20240578	HIGH-PRESSURE CONTROLL SWITCH
220	20057141	CONDENSER
225	20210381	FAN
230	20057102	CONDENSER
235	20240577	FILTERDRYER
240	20270100	FREON R 404 A
250	20240585	INJECTION VALVE TKS 1, MOP-20°C,
300	20150127	PCB, MAIN 230V/50/60HZ
301	70904568	CPU
302	70904409	NV RAM
303	70904410	NV RAM
306	70904434	NV RAM
310	20150122	PCB, DISPLAY
320	70904401	SPINDLE, COMPLETE
321	20057014	FLANGE
322	20057515	INSULATION
323	20057096	INSULATION
325	70904405	LIDLOCK
326	20310316	CLIP
327	20170325	TRANSFORMER 200/225 12A
329	20270138	GREASE OPTIMOL 100 ML
330	20210382	MOTOR
331	20300077	ANTIVIBRATION MOUNT
332	20480257	SANDWASHER
333	70057006	MOTORBASE
334	70057008	CENTERRING
335	20150102	SPEEDINDICATION
340	20160685	RESISTOR 150R 150W

## Kendro service Information

# Heraeus Centrifuges

## PREVENTIVE MAINTENANCE CHECKLIST

Biofuge stratos  
Contifuge stratos

Type  
S/N

### Rotor Inspection

- o Check for corrosion and wear
- o Inspect rotor lid locking screw
- Serial numbers:
  - 75003044.....
  - 75003046.....
  - 75003047.....
  - 75003048.....
  - 75003049.....
  - 75003331.....
  - 75003332.....
  - 75003334.....
  - 75003335.....
  - 75003336.....

### Performance Checks

- o Acceleration time \_\_\_\_\_seconds
- o instrument top speed \_\_\_\_\_rpm
- o Deceleration time \_\_\_\_\_seconds
- o Time (10 minute set) \_\_\_\_\_actual min:sec
- o Temperature (4° set) \_\_\_\_\_actual (°C)

### Imbalance

- o Centrifuge stable and level
- o Centrifuge shuts off w/proper weight

### Safety test

- o Accessible leakage current <3500µA
- o Insulation resistance >10 Megaohm
- o Earth Conductor Resistance <0.2 Ohm

### Preliminary Checks

- o Clean inst. & condenser coils
- o Rotor chamber (defrost)
- o Inst. environment  
(level & clearance)

### Pre-run Checks

- o Ground continuity
- o Line voltage \_\_\_\_\_V AC
- o Display segments on power-up
- o Microprocessor Initialization (if required)
- o Door interlock and latch
- o Drive stop & Door unlatch (50 rpm)
- o Compressor current draw
- o Fan operation (condenser & compressor)

### Mechanical

- o Motor bearings
- o Refrigerant leaks

# Kendro service Information

**Comments:**

S.R. Signature \_\_\_\_\_  
Date of Service \_\_\_\_\_

# **Calibration Certification Procedure**

## **Biofuge stratos / Contifuge stratos**

**Revised - 20/06/2002**

### **1. General**

Successfully completing the Preventive Maintenance Checklist and Calibration Certification Procedure as outlined will ensure that the instrument is properly maintained and calibrated to Kendro specifications.

### **2. Equipment Required**

- Digital Multimeter
- Temperature Meter w/probe
- Stopwatch
- Photo Tachometer
- Safety Tester
- Biofuge stratos / Contifuge stratos Service Manual
- Centrifuge Operating Manual

**Note:** Check calibration due date on all test equipment before starting certification.

### **3. Documentation Required**

- Preventive Maintenance Procedure and Checklist (Service Manual)
- Calibration Certification Procedure and Form
- Certification Label
- Certificate of calibration for each piece of test equipment used to perform the certification
- Training Certificate

### **Preventive Maintenance Check**

- Perform Preventive Maintenance checks as outlined in the Kendro Service Manual to ensure the instrument is in good working order without performing any calibrations.
- Complete the Preventive Maintenance Checklist. (calibration data will be filled in after Certification)

### **Calibration Certification**

#### **• SPEED**

Install a rotor, set the speed control to 3000 rpm and start the centrifuge. When the speed has stabilized, measure the actual speed with an external tach (photo tach on multimeter where speed = frequency[no conversion]). Record measured speed and displayed speed in the speed section of the certification form. Set the speed control to max. rpm and after stabilization, record measured speed and displayed speed in the speed section of the certification form. Determine if the speeds recorded meet the specifications on the form. If the specifications are met, proceed to the next section. A recalibration of the instrument is not possible.



# **Calibration Certification Procedure**

## **Biofuge stratos / Contifuge stratos**

- **TEMPERATURE**

Place water into the rotor or bucket. Select a temperature of +4°C, maximum allowed speed of the rotor and time of minimum 3 hours. After that record the displayed temperature, measured temperature inside rotor or bucket after rotor has come to rest, in the temperature section of the certification form. Repeat the test at 15°C. Record the values in the temperature section of the certification form. Determine if the temperature values recorded meet the specifications on the form. If the specifications are met, proceed to the next section. A recalibration of the instrument is not possible. Initial the temperature section. To pre-cool the rotor select pre-cooling program of the centrifuge.

- **TIME**

Using a stopwatch, check the timer by setting a 10 minute run. Start the centrifuge and measure from the time the start button is pushed until the timer switches to stop. Record the measured time in the time section of the form. Determine if the time value recorded meets the specifications in the form. If the specifications are met, proceed to the next section. A recalibration of the instrument is not possible. Initial the time section.

- **SAFETY TEST**

Using safety tester and connect the centrifuge to it. Measure Insulation resistance.. Select to Earth Conductor resistance and touch with probe all mechanical part of the centrifuge. Resistance must be <0.2 ohms at all points otherwise check for good grounding. Measure accessible current to procedure in the service manual.

### **Documentation**

After filling in the certification information complete the following documentation:

- Log test equipment data on calibration certification form.
- Review P.M.checklist and calibration certification form to ensure that all data and required information has been recorded properly.(including your signature and date)
- Fill out a certification label and place it on the right side of the centrifuge where visible or at a location selected by the customer.
- Ask the customer to sign the calibration certification form and place a copy in the customer's Certification Record Book for that centrifuge.
- Place copies of the P.M. checklist and Field Service Report in the same Record Book.
- Provide copies of your training certificate and test equipment calibration certificates if requested by the customer.



**Preventive Maintenance Checklist Complete**  
Vorbeugende Wartungsliste, vollstdg



**Repair and Calibration Recertification**  
Reparatur und Wiederholungskalibrierung

**Account Name:**

**Account Address:**

**Instrument Model:**

**Serial Number:**

**Report Number:**

**Date:**

### Performance Certification / Durchführung

#### SPEED / DREHZAHL

Standard Test			Rotor Used:			
Set Speed (rpm)	Tolerance (whichever is greater)	Displayed Speed (rpm)	Measured Speed (rpm)	Meets Spec. (y/n)	Measured Speed after Cal.(rpm)	Passed (Initials)
4500	+0/-2%,min10 rpm					
10000	+0/-2%,min10 rpm					
Custom Test			Rotor Used:			
	-0/+2%,min10 rpm					
	-0/+2%,min10 rpm					

#### TEMPERATURE / TEMPERATUR

Standard Test			Rotor Used:			
Calibration Temp. (°C)	Tolerance (K)	Displayed Temp. (°C)	Measured Temp. (°C)	Meets Spec. (y/n)	Measured Temp.after Cal. (°C)	Passed (Initials)
+4	+/- 2					
+15	+/- 2					
Custom Test			Rotor Used:			
	+/- 2					
	+/- 2					
	+/- 2					

#### TIME / ZEIT

Standard Test		Rotor Used:			
Timer Set (min.)	Tolerance (sec.)	Measured Time (m/s)	Meets Spec. (y/n)	Measured Time after Cal (m/s)	Passed (Initials)
10	+5%				
Custom Test		Rotor Used:			
	+5%				
	+5%				
	+5%				

#### TEST EQUIPMENT / PRÜFMITTEL

Type	Model	Serial Number	Date of Next Calibration
Stopwatch			
Temperature Meter			
Photo Tachometer			
Safety Tester			

#### SAFETY TEST / SICHERHEITSTEST

Insulations resistance >10 Megaohm	Earth Conductor Resistance <0.2 Ohm	Accessible Current <3500µA	

**Revised 20/06/02**

Certified By: \_\_\_\_\_ Reviewed By: \_\_\_\_\_ Expiration Date \_\_\_\_\_

Signature

Date

Customer Signature

Date

## ÄNDERUNGSNACHRICHTEN

BIOFUGE / CONTIFUGE stratos

Inhaltsverzeichnis – Sektion 8

ÄN. Nr.	Änderung	Datum	Seite	Ausg.
307	Software (CPU 590V14 und Tastenfeld-Prozessor 591V10)	01/99	7-2/3	01
322	Änderung der Beschaltung des A/D Wandlers in der Temperaturmessung zur Verhinderung des Fehlers „E-04“	10/01	7-4/5	01
327	Der Prozessor auf der Hauptplatte erhält eine neue Art. Nr.	04/02	7-6	01

## TECHNICAL BULLETINS

BIOFUGE / CONTIFUGE stratos

Table of Contents – Section 8

TB. No.	Change	Date	Page	Edition
307	Software (CPU 590V14 and indication processor 591V10)	01/99	7-2/3	01
322	Modification of the A/D converter of the temperature measurement circuit to prevent E-04 errors	10/01	7-4/5	01
327	New part number for the processor on the main board	04/02	7-6	01

## Änderungsnachricht Nr. 307

### 1. Technische Änderung

- Software (CPU 590V14 und Tastenfeld-Prozessor 591V10)

### 2. Betreffende Geräte

Diese Änderung gilt für alle Varianten der BIOFUGE / CONTIFUGE stratos und ist werksseitig durchgeführt ab:

Gerät	Ausführung	Bestell-Nr.	Fabrik-Nr.
Biofuge stratos	230V 50Hz	75005282	261.624
Contifuge stratos	230V 50Hz	75005283	262.649
Contifuge stratos	208/240V 50/60Hz	75005285	262.845

### 3. Änderungsgrund

- Verbesserte Temperaturanzeige-Dynamik (Angleichung des Anzeigewertes an den tatsächlichen Proben-Istwert; Anzeige konnte unter bestimmten Betriebsbedingungen **bei korrektem Istwert** zu niedrig sein)
- Ergänzung eines erweiterten Zeit-Einstellbereiches, der eine Zeitvorwahl von 1h bis 99h ermöglicht (wird von CONTI-Kunden benötigt).
- Überarbeitung der Programmüberprüfungsroutinen während der Einschaltphase d. Gerätes (verbesserte Datensicherheit gespeicherter Programme).

### 4. Geltungsbereich

Diese Änderung ist bei Geräten vor o.a. Fabrik-Nummern nur dann auszuführen, wenn ein Kunde die o.a. Verbesserungen wünscht.

### 5. Änderungsdurchführung

ACHTUNG! Ein Mischbetrieb von alter und neuer Software ist nicht gestattet! CPU und Tastenfeld µC müssen gemeinsam getauscht werden!

- Austausch der CPU (301, siehe Service Manual 5.2.1 auf Seite 5 - 3) und
- Austausch des Tastenfeld-Prozessors (Ident.-Nr.: 591, siehe Service Manual 5.2.3 auf Seite 5 - 4)

Gerät einschalten, Software-Identifikationsnummern kontrollieren, Testlauf durchführen und Gerät wieder ordnungsgemäß installieren.

## Technical Bulletin No. 307

### 1. Engineering Change

- Software (CPU 590V14 and indication processor 591V10).
- Extension of Service Manual for CONTIFUGE stratos and voltage variants

### 2. Reference to Units

This change is valid for all variants of BIOFUGE / CONTIFUGE stratos and is effective from in table given Serial No.'s onwards:

Model	Edition	Cat. No.	Serial No.
Biofuge stratos	230V 50Hz	75005282	261.624
Contifuge stratos	230V 50Hz	75005283	262.649
Contifuge stratos	208/240V 50/60Hz	75005285	262.845

### 3. Reason for change

- Improved dynamic of temperature indication (adaptation of displayed value to actual sample value; indication could have been too low, although **the sample temperature was correct**).
- Implementation of an additional time setting range for verification of time selection from 1h up to 99h (required for continuous flow operation).
- Rework of the program checking routine when switching the unit to power (improved data safety for user programs).

### 4. Validity

This change is only to perform on units before the above mentioned Serial No's, if a client wants to have these improvements.

### 5. Modification

ATTENTION! Mixed operation of old and new software is not permitted! Both, CPU and indication µC must be replaced at once!

- Exchange of CPU (301 - see Service 5.2.1 on Page 5 – 3) and
- Exchange of indication µC (identification No. 591, see Service Manual 5.2.3 on page 5 – 4).

Switch power ON and check the software identification numbers. Perform a test run and finally reinstall the unit accordingly to regulations.

**HINWEIS!**

Aktivierung des erweiterten Zeit-Einstellbereiches „00h“:

- Programm-**Schlüsseltaste** gedrückt halten und
- mit der „Pfeil-Auf“-Taste des **Drehzahl**feldes von „bEEP“ auf „t-SEt“ um-schalten und bei weiterhin gedrückter Schlüsseltaste
- mit der „Pfeil-Auf“-Taste des **Zeit**feldes den Bereich von „0.00“ auf „00h“ umschalten

Nach jeder Umschaltung des Zeitbereiches wird automatisch der „hLd“-Be-trieb generiert! Gespeicherte Programme mit Laufzeiten < 1h werden im „00h“ Format bei Aufruf mit „0h“ angezeigt. Beim Start wird aber die programmierte Laufzeit korrekt abgearbeitet und auch im „0.00“ Format angezeigt.

**6. Anlagen**

Titel	Aus-gabe	Sekt. Seite	Vorlage Archiv	Bild Archiv
Inhaltsverz. SM Biof./Contifuge stratos	01	0 - 1	Strat_0	-
Blockschaltb.-Ergänz. Conti 200-240V	01	4 - 1	Stra_4_1	B_str_b
Stromlaufpl.-Ergänz. Conti 200-240V	01	4 - 2	Stra_4_1	HP127_s1
Klemmplan-Ergänz. Conti 200-240V	01	4 - 4	Stra_4_1	HP127_k1
Ausschnitt Stromlaufplan 120V	00	4 - 11	Str_4a_1	S_120V
Ausschnitt Klemmplan 120V	00	4 - 12	Str_4a_1	K_120V
Ersatzteil-Liste Contifuge 200/240V	01	6 - 7,8	5285	-
Ersatzteil-Liste Biofuge 120V	01	6-9,10	5286	-
Inhaltsverz. Änderungsnachrichten	01	7 - 1	Strato_7	-

Service Manual Seiten 0-1, 4-1/4 sind auszutauschen!

**7. Benötigte / entfallende Teile**

benötigt	Anz.	Bestell-Nr.	geändert
1. CPU 590V14	1	70000590	1. CPU 590V12
2. Tastenfeld-µC 591V10	1	70000591	2. µC 591V09

**8. Lagerbestände**

Alte Versionen der CPU und des Tastenfeld-Prozessors entfernen, entsorgen und durch neue ersetzen.

**NOTE!**

Activation of the advanced time setting range “00h”:

- Keep the **“key symbol”** key pressed and
- use the “Up key” of the **speed** display to switch over from “bEEP” to “t-SEt” message and keep the key symbol key pressed further on
- to toggle between both time setting ranges “0.00” and “00h” back and forth using the “Up key” of the **time** display

After each toggling of time range the “hLd” operation mode is automatically activated! Stored user programs with running times of less than 1h will be indicated as “0h” (in the “00h” mode) during recalling. But the correct running time will be counted down and indicated, if those programs will be started.

**6. Appendix**

Title	Edition	Sect. Page	Original File	Original Figure
Table of Cont. of SM Biof./Contif. stratos	01	0 - 1	Strat_0	-
Block Diagr. supplement Conti 200-240V	01	4 - 1	Stra_4_1	B_str_b
Connect. Diagr. supplement. Conti 200-240V	01	4 - 2	Stra_4_1	HP127_s1
Wiring Diagr. supplement Conti 200-240V	01	4 - 4	Stra_4_1	HP127_k1
Cutting of Wiring Diagram of 120V Mains	00	4 - 11	Str_4a_1	S_120V
Cutting of Connection Diagram of 120V	00	4 - 12	Str_4a_1	K_120V
Spare Part List of Contifuge 200/240V	01	6 - 7,8	5285	-
Spare Part List of Biofuge 120V	01	6-9,10	5286	-
Table of Contents of Technical Bulletins	01	7 - 1	Strato_7	-

Service Manual's pages 0-1, 4-1/4 are to exchange!

**7. Required / Outgoing Parts**

Required	Num.	Cat. No.	Change
1. CPU 590V14	1	70000590	1. CPU 590V12
2. Indication µC 591V10	1	70000591	2. µC 591V09

**8. Stockage / Obsolete Parts**

Old versions of CPU and indication µC have to be removed and recycled and replaced by new ones.

## Änderungsnachricht Nr. 322

### 1. Technische Änderung

Hauptplatte 4, 7, 22, 23, 127, 169, 170 und 175, Änderung der Beschaltung des A/D Wandlers in der Temperaturmessung zur Verhinderung des Fehlers „E-04“ (fehlerhafte Temperaturmessung)

### 1. Änderungsgrund

Auf Grund von Temperatureinflüssen und Bauteiltoleranzen kann es in seltenen Fällen zu einer Störung der Temperaturmessung kommen ( E-04 ). Der A/D-Wandler wird in einem solchen Fall außerhalb seines Arbeitsbereiches betrieben. Die Änderung verschiebt den Arbeitspunkt des A/D-Wandlers, so daß eine Überschreitung des Bereiches ausgeschlossen wird.

Dieses Verhalten eines A/D-Wandlers zeigt sich nicht immer bei der ersten Inbetriebnahme eines Gerätes, sondern wird erst in den folgenden Wochen des Einsatzes deutlich. Zeigt sich die Fehlermeldung E-04 in den ersten Betriebswochen eines Gerätes nicht, liegt der Arbeitspunkt des A/D-Wandler im vorgesehenen Bereich. Ein vorsorglicher Austausch der Elektronik ist nicht erforderlich.

### 2. Betreffende Geräte

Von dieser Änderung sind folgende Geräte betroffen:

Geräte	Hauptplatte	Bestell-Nr.
Biofuge 13R/15R, 230V Versionen	Hauptplatte 4	20150045
Biofuge 13R/15R, 120V Versionen	Hauptplatte 4 CSA	20150065
Megafuge 3.0R/RS, 230V Versionen	Hauptplatte 7	20150080
Varifuge 3.0R/RS, 230V Versionen	Hauptplatte 7	20150080
Megafuge 3.0R/RS, 120V/208V Versionen	Hauptplatte 7 CSA	20150081
Varifuge 3.0R/RS, 208V/240V Versionen	Hauptplatte 7 CSA	20150081
Megafuge 1.0+2.0R/RS, 230V Versionen	Hauptplatte 22	20150091
Megafuge 1.0+2.0R/RS, 120V Versionen	Hauptplatte 23	20150092
Labofuge 400R, 230V Versionen	Hauptplatte 22	20150091
Labofuge 400R, 120V Versionen	Hauptplatte 32	20150114
Biofuge / Contifuge stratos, alle Versionen	Hauptplatte 127	20150127
Biofuge primo R, 120V Versionen	Hauptplatte 169	20150169
Biofuge primo R, 230V Versionen	Hauptplatte 170	20150170
Cryofuge 6000i + 8500i, alle Versionen	Hauptplatte 175	20150175

## Technical Bulletin No. 322

### 1. Engineering Change

Mainboard 4, 7, 22, 23, 127, 169, 170 and 175, Modification of the A/D converter of the temperature measurement circuit to prevent E-04 errors

### 2. Reason for Change

Due to tolerances in components and temperature variation in some cases it could happen that temperature measurement will be disturbed (E-04) The working point of characteristic of the A/D converter is then out of range. The modification onboard now prevents this.

Unfortunately these phenomena will not occur during test period at the factory and it will come up after some weeks working. If the E-4 will not come during first few weeks after installation normally it never will come up. A previous change is not necessary.

### 3. Reference to Units

This change is valid for:

Units	Main board	Part No..
Biofuge 13R/15R, 230V Versions	Main board 4	20150045
Biofuge 13R/15R, 120V Versions	Main board 4 CSA	20150065
Megafuge 3.0R/RS, 230V Versions	Main board 7	20150080
Varifuge 3.0R/RS, 230V Versions	Main board 7	20150080
Megafuge 3.0R/RS, 120V/208V Versions	Main board 7 CSA	20150081
Varifuge 3.0R/RS, 208V/240V Versions	Main board 7 CSA	20150081
Megafuge 1.0+2.0R/RS, 230V Versions	Main board 22	20150091
Megafuge 1.0+2.0R/RS, 120V Versions	Main board 23	20150092
Labofuge 400R, 230V Versions	Main board 22	20150091
Labofuge 400R, 120V Versions	Main board 32	20150114
Biofuge / Contifuge stratos, all Versions	Main board 127	20150127
Biofuge primo R, 120V Versions	Main board 169	20150169
Biofuge primo R, 230V Versions	Main board 170	20150170
Cryofuge 6000i + 8500i, all Versions	Main board 175	20150175

### 3. Änderungsdurchführung

Tritt bei einer der oben genannten Hauptplatten der Fehler „E-04“ auf und sind andere Fehlerquellen (Fühlerbruch, Kurzschluß im Fühler) nicht gegeben, ist die Hauptplatte zu wechseln. Eine Änderung der Bauteile im Feld ist wegen der SMD Bestückung der Leiterplatten nicht möglich.

Bei Geräten innerhalb der Garantie erfolgt der Austausch der Hauptplatte kostenlos, danach ist der Austausch kostenpflichtig.

### 5. Lagerbestände

Die Wahrscheinlichkeit für das Auftreten des Fehlers ist sehr gering. Austausch oder Nacharbeit von Lagerbeständen ist nicht erforderlich.

### 4. Modification

If E-04 comes up at one of the main boards make sure that no other component (short sensor or bypassed sensor) caused this problem the main board has to be replaced. A modification in the field is not possible because of SMD components.

All units during warranty time which need a replacement are free of charge. Out of warranty replacement will be invoiced.

### 5. Stocking / Obsolete Parts

The probability that this error will occur is very insignificant, so it is not necessary to replace the stocking parts.

## Änderungsnachricht Nr. 327

### 2. Technische Änderung

Der Prozessor auf der Hauptplatte erhält eine neue Art. Nr.

### 4. Betreffende Geräte

Gerät	Bestell Nr.	Fabrik Nr.
BIOFUGE® STRATOS 230V 50/60HZ	75005282	
CONTIFUGE® STRATOS 230V 50/60HZ	75005283	
BIOFUGE® STRATOS 200/208/240V 50/60HZ	75005284	
CONTIFUGE® STRATOS 200/208/240V 50/60HZ	75005285	
BIOFUGE® STRATOS 120V 60HZ	75005286	
BIOFUGE STRATOS 200V 50/60HZ CF23R	75005288	
BIOFUGE STRATOS 230V SORVALL	75005289	
BIOFUGE STRATOS 120V SORVALL	75005293	
BIOFUGE STRATOS 200/208/240V SORVALL	75005294	
CONTIFUGE STRATOS 200/208/240V SORVALL	75005296	
CONTIFUGE STRATOS 230V SORVALL	75005297	

### 5. Geltungsbereich

Diese Änderung ist zu beachten wenn bei den oben genannten Geräten der Prozessor ersetzt werden soll.

### 6. Änderungsdurchführung

Siehe Service Manual, Sektion 5.2.1

### 7. Benötigte / entfallende Teile

benötigt	Bestell Nr.	auslaufend	Bestell Nr.
Prozessor	70904568	Prozessor	70000590

### 6. Lagerbestände

Lagerbestände des Prozessors 70000590 können weiter verwendet werden.

## Technical Bulletin No. 327 / U80

### 5. Engineering Change

New part number for the processor on the main board.

### 6. Reference to Units

Model	Cat. No.	Serial No.
BIOFUGE® STRATOS 230V 50/60HZ	75005282	
CONTIFUGE® STRATOS 230V 50/60HZ	75005283	
BIOFUGE® STRATOS 200/208/240V 50/60HZ	75005284	
CONTIFUGE® STRATOS 200/208/240V 50/60HZ	75005285	
BIOFUGE® STRATOS 120V 60HZ	75005286	
BIOFUGE STRATOS 200V 50/60HZ CF23R	75005288	
BIOFUGE STRATOS 230V SORVALL	75005289	
BIOFUGE STRATOS 120V SORVALL	75005293	
BIOFUGE STRATOS 200/208/240V SORVALL	75005294	
CONTIFUGE STRATOS 200/208/240V SORVALL	75005296	
CONTIFUGE STRATOS 230V SORVALL	75005297	

### 7. Validity

Please note this change when a processor must be replaced in one of the above mentioned units.

### 8. Modification

See Service Manual, section 5.2.1

### 6. Required / Outgoing Parts

Required	Part No.	Change	Part No.
Processor	70904568	Processor	70000590

### 7. Stocking / Obsolete Parts

Stocked parts of the processor 70000590 can be used.