

accuSpin™ 1R

SERVICE MANUAL

12003449

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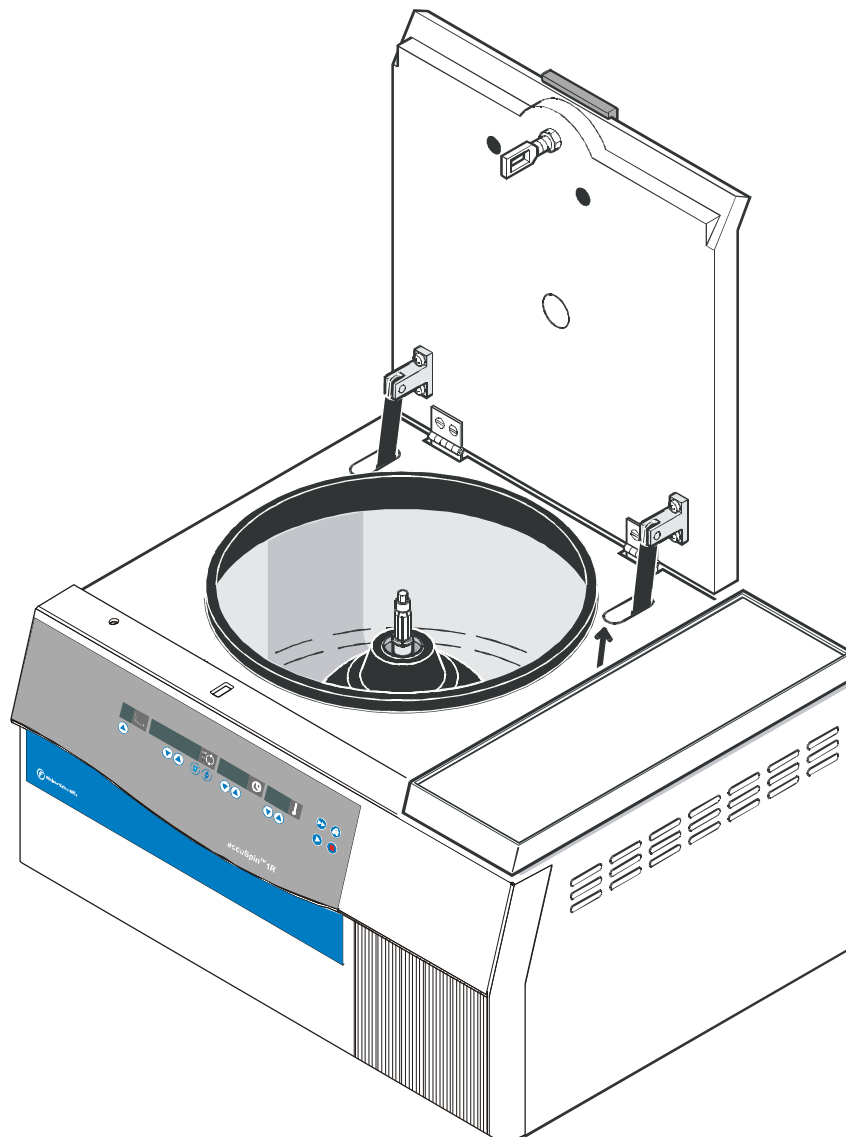


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2 Service

2.1 Servicing Schedule (Yearly Procedure)

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 (15 Amps slow blow characteristic)
- check condition of plug and wall socket - replace defective parts
- check cord condition and fixing - replace or refit it

2.1.1.2 Location and Mechanical Installation

- check the base (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
- check the levelling of the centrifuge - use a spirit level

2.1.1.3 Lid Locking Mechanism and Safety Device

- connect the centrifuge to power and switch ON
- check for easy lid closing and self-acting lid opening - if in disorder, readjust lid looped hook and/or hinges and smear hook slightly with grease
- 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 Cover

- open the lid and remove the rotor (for loosening turn 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 motor bearing or electronics, remove fluids with an injector and/or absorbent paper

2.1.1.5 Rotor and Bucket Condition and Sealing

- check the condition of rotor and buckets (especially all supporting or stressed partitions as jib arms, rim of bearing surface etc.): the rotor and/or buckets must not be used any longer, if there are visible traces of mechanical damage or rust
- check the condition of rotor and/or bucket sealing and replace in case of malfunction

2.1.1.6 Rotor Fixing and Motor Shaft

- 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 motor shaft: the centrifuge must not be used any longer, if the motor shaft is damaged
- the thread should be greased a little

2.1.1.7 Temperature Control Circuit

- check the air inlet slots in the front panel, at the side walls of the casing and at the rear panel for free ventilation, insufficient air flow will lead to an inadmissible temperature rise of compressor, motor and electronic parts
- clean the condenser with a vacuum cleaner, 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 and replace worn out motor rubber mounts, the motor if required or adjust the imbalance switch

2.1.2 *Maintenance Routine after Dismantling the Centrifuge Casing (see Section 5)*

2.1.2.1 *Motor Supporting Elements*

- check the supporting and damping motor elements and replace them at least every 3 years. We recommend a yearly change. A maintenance kit is available

2.1.2.2 *Imbalance Switch*

- check the function of the imbalance switch and if necessary readjust it (adjusting procedure see 2.4)

2.1.2.3 *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

2.1.2.4 *Ventilation and Proper Air Flow*

- check the function of all fans (parallel cut in and out) and the air flow direction (to motor and condenser from outside)
- check the air inlet slots in the casing and at the rear panel for free ventilation, insufficient air flow will lead to an inadmissible temperature rise of compressor, motor and electronic parts

2.1.2.5 *Lead and Screwing Connections*

- check the terminal and plug connections of leads on all boards and electrical components and replace defective parts
- check the screwing connections of boards, mechanical and electrical components and re-tighten them if necessary

2.1.2.6 *Protection Earth Core and Grounding Connections*

- check the protection earth core for continuity and all grounding plug connectors (see also 2.6 Electrical Safety Check)
- check insulation resistance and leakage 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 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
		Unit fuse or fuses on the main board defective	Replace it, if fuses blows again, search for other faults
	No low voltage supply for indication board	Faulty connection from CPU to indication board	Check connectors 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)
		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"	Lid solenoid is not sufficiently supplied with voltage	Missing mains voltage	Remedy see above, manual opening cord in bottom plate
		PTC resistor has released	After a waiting time of 2 minutes press key again
		Faulty driving or triac circuit	Replace the complete main board
	Faulty lid coil	Faulty winding of coil	Replace complete lid lock device
	Lid is not correctly locked	Lid bolt is jamming	Push lid centrally into lock and press the key again
		Lid is de-adjusted	Re-adjust the lid centrally
"Lid" appears in speed display	Lid was opened manually during run FORBIDDEN!	Forbidden intervention emergency opening device must only be used at standstill	Close lid immediately Pull and plug in power cord again, press start key to continue run, press stop key to finish run
	15V low voltage supply for frequency converter via the lid switches and motor over-temperature switch is interrupted during run	Lid switches or leads are interrupted	Check leads and connectors to micro switch, in case of a faulty micro switch, replace lid lock device completely
		Motor over temperature switch has tripped, blocked air flow to the motor only two phases are controlled to the motor	After cooling down check temperature switch with ohmmeter Check ventilation (fans) and proper air flow
			Check terminal connection XM and motor windings - approx. 11,5 Ohm between conductors - replace defective parts

Trouble Shooting (continued)

Error Indication	Error Cause	Possible Error Source	Corrective Procedure
„OPEN“ appears in speed display by supposed closed lid	15V low voltage supply for frequency converter via the lid switches and motor over-temperature switch is interrupted at standstill	Leads to lid switches interrupted or a defective lid switch	Check leads and connectors to micro switch, in case of a faulty micro switch, replace lid lock device completely
		Leads to motor over-temperature switch are interrupted	Check the motor over-temperature switch and leads for continuity, replace faulty parts (motor)
		15V low voltage supply on the main board is defective	Replace the main board
"bAL" message alternates with speed values	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.)
		Trunnions are not greased	Grease the trunnions
		Rotor itself has imbalance	Rotor must no longer be used, send back to factory
		Rotor fixing or drive shaft is damaged	Centrifuge must no longer be used, replace nut or drive
	Signal fault	Leads to imbalance switch are interrupted	Check leads with ohmmeter and replace if faulty
		Faulty imbalance switch	Check the calibration of the imbalance switch
imbalance but no "bAL" message	No imbalance cut-off	Faulty imbalance circuit component	Replace the main board
		Imbalance switch	Check the imbalance switch adjustment
		Circuits of main board	Replace the main board

2.3 Error Codes

Error Indication	Error Cause	Possible Error Source	Corrective Procedure	
"E-00" message appears in speed display	Rotor didn't turn	Rotor is jammed	Check for easy movement, remove jamming objects if required	
		Motor is jammed	Replace the motor	
	Motor didn't start	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
			Connections motor to power electronics	Check plug contacts and leads, replace defective parts
"E-02" message	Program sequence was disturbed	Motor windings	Replace the motor	
		Driving circuit, FETs	Replace the main board	
		Bad ground connect. Emi troubles	Check all ground connections tighten loose screws	
"E-03" message	Missing speed signal	Internal program error	Replace the CPU	
			Replace the main board	
"E-04" message	Faulty measuring of temperature values	See "E-00"	See "E-00"	
"E-04" message	Faulty measuring of temperature values	PT100 sensor, connecting lines or plug connection	Resistance test at $\vartheta_{\text{soil}}=20^{\circ}\text{C}$: 100Ω: -> display: $(-1\pm 1)^{\circ}\text{C}$ 120Ω: -> display: $(50\pm 1)^{\circ}\text{C}$	
		Defective circuit	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 over-temperature: display $>50^{\circ}\text{C}$	Compressor didn't work	Check leads, terminals, start relay, capacitor, compressor	
		Faulty cooling cycle refrigerant loss	Search for leakage and close it, evacuate and refill with new refrigerant	
"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	
"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-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 necessary	
		Defective micro switch or lid lock	Replace lid lock device	
		Faulty driving circuit	Replace the main board	

Error Codes (continued)

Error Indication	Error Cause	Possible Error Source	Corrective Procedure
„E-18“ message	Set rotor is #3455: drive is cut out in speed range from 0 to 1000rpm	Rotor #3455 is selected but an other rotor is physically installed	Install the selected rotor or select the Cat. No. Of the installed rotor
		Set speed is too low programmed, 1000rpm or below	Increase the set speed to min. 1100rpm Select the normal acceleration with the “brake” key
„E-19“ message	Wrong key board indication	Wrong NV-RAM	Replace the correct NV-RAM
		Wrong key board (incl. / without cooling) is installed	Replace the correct key board
“E-20” message	NV RAM doesn't match to CPU	Wrong NV RAM or CPU	Replace NV RAM Replace CPU
		Faulty motor or main board	Replace motor Replace main board
„E-21“ message	Acceleration too low	Big Imbalance	Remedy the imbalance
		Wrong NV-RAM	Replace the correct NV-RAM
„E-22“ message	NV-RAM and CPU didn't match	Wrong CPU	Replace the correct CPU

2.4 Test Points

2.4.1 Test Points 120V models

Test Points	Unit Value	Conditions
Mains terminal XN	120 V AC	All given values are related on 120V ($\pm 10\%$) mains voltage for board's supply
Terminal XM Motor voltage measured inter 2 motor leads after reaching selected speed (min. 2 minutes running time at the selected speed)	80 V AC	Rotor #3450 / buckets #3451 1.000 rpm
	135 V AC	2.000 rpm
	230 V AC	4.000 rpm
75 V AC 180 V AC 250 V AC	75 V AC	Rotor #3454 1.000 rpm
	180 V AC	3.000 rpm
	250 V AC	6.000 rpm
175 V AC 245 V AC 250 V AC	175 V AC	Rotor #3455 3.000 rpm
	245 V AC	6.000 rpm
	250 V AC	15.000 rpm
Motor current I_M cable (1,2,3)	Split-core transformer and True RMS-Multimeter	
	3 * 1,9A	Rotor #3450 with buckets #3451 / Set speed = 4.300rpm
	3 * 1,5A	Rotor #3454 / Set speed = 6.000rpm
3 * 0,7A	Rotor #3455 / Set speed = 15.000rpm	
Intermediate circuit voltage U_D inter U_+ (cathode of rectifying diode V07) and U_- (current control resistor R18)	330 V DC	At standstill
	360 V DC	During braking phase
	305 V DC	Rotor #3450 / buckets #3451 Set speed = 4.000rpm
	295 V DC	Shortly by max. Acceleration
310 V DC 295 V DC	310 V DC	Rotor #3454 Set speed = 6.000rpm
	295 V DC	Shortly by max. Acceleration
315 V DC 300 V DC	315 V DC	Rotor #3455 Set speed = 15.000rpm
	300 V DC	Shortly by max. Acceleration
	135 mV DC	Rotor #3450 / buckets #3451 Set speed = 4.000rpm
Current of intermediate circuit through control resistor R18 measured as voltage drop: $U = I \times R$	260 mV DC	Shortly by max. Acceleration
	-40 mV DC	Shortly during braking phase
	125 mV DC	Rotor #3454 Set speed = 6.000rpm
250 mV DC -50 mV DC	250 mV DC	Shortly by max. Acceleration
	-50 mV DC	Shortly during braking phase
90 mV DC 200 mV DC -20 mV DC	90 mV DC	Rotor #3455 Set speed = 15.000rpm
	200 mV DC	Shortly by max. Acceleration
-20 mV DC	Shortly during braking phase	
Motor winding resistance 20°C -insulation value	3x4,7 Ω > 10M Ω	Switch OFF unit, pull off motor plugs, measure inter 1 -> 2, 2 -> 3, 3 -> 1 resistance inter each phase and motor casing
Plug XA Lid micro switches	15V DC	Voltage drop across switch by open lid
Terminal XB Over temperature switch motor	15V DC	By closed lid and one disconnected lead
Terminal XC Resistance of lid solenoid	34,5 Ω	Switch OFF unit, resistance at 20°C
Terminal XD Brake resistor	150 Ω	Switch OFF unit, resistance at 20°C

Test Points 120V models (continued)

Test Points	Unit Value	Conditions
Plug XE Imbalance switch- voltage drop Inter pin 1 and 4	6,6 V DC 12 V DC 0,1 V DC 12 V DC	Plug inserted Plug removed Switch connected (plug re-inserted) If lead is interrupted
Terminal XG Compressor terminal box -insulation value	1Ω 4Ω 5Ω > 10MΩ	Switch OFF unit, compressor temp. 20°C Resistance 14 - 12 Resistance 14 - 13 Resistance 12 - 13 Resistance inter phase and motor casing
Terminal XK Fans	220Ω 385Ω	Switch OFF unit, resistance at 20°C Fan for motor Fan for electronic
Plug XU Temp. measuring	115mV 103mV 125mV	Chamber temperature 20°C (PT100: ≈ 108Ω) Chamber temperature -10°C (PT100: ≈ 96Ω) Chamber temperature 40°C (PT100: ≈ 116Ω)
Plug XW Speed detection - voltage drop Inter pin 3 and 1 Inter pin 3 and 2	12,0 V DC 1,3 V DC 0,5 V DC 10,5 V DC	Plug removed Diode voltage (plug re-inserted) Transistor is cut in (slot position) Transistor is cut out

2.4.2 Test Points 230V models

Test Points	Unit Value	Conditions
Mains terminal XN	230 V AC	All given values are related on 230V ($\pm 10\%$) mains voltage for board's supply
Terminal XM Motor voltage measured inter 2 motor leads after reaching selected speed (min. 2 minutes running time at the selected speed)	80 V AC	Rotor #3450 / buckets #3451 1.000 rpm
	135 V AC	2.000 rpm
	230 V AC	4.000 rpm
inter 2 motor leads after reaching selected speed (min. 2 minutes running time at the selected speed)	75 V AC	Rotor #3454 1.000 rpm
	180 V AC	3.000 rpm
	250 V AC	6.000 rpm
Motor current I_M cable (1,2,3)	175 V AC	Rotor #3455 3.000 rpm
	245 V AC	6.000 rpm
	250 V AC	15.000 rpm
Motor current I_M cable (1,2,3)	Split-core transformer and True RMS-Multimeter	
	3 * 1,9A	Rotor #3450 with buckets #3451 / Set speed = 4.300rpm
	3 * 1,5A	Rotor #3454 / Set speed = 6.000rpm
Intermediate circuit voltage U_D inter U_+ (cathode of rectifying diode V07) and U_- (current control resistor R18)	3 * 0,7A	Rotor #3455 / Set speed = 15.000rpm
	325 V DC	At standstill
	345 V DC	During braking phase
Intermediate circuit voltage U_D inter U_+ (cathode of rectifying diode V07) and U_- (current control resistor R18)	310 V DC	Rotor #3450 / buckets #3451 Set speed = 4.000rpm
	295 V DC	Shortly by max. Acceleration
	310 V DC	Rotor #3454 Set speed = 6.000rpm
Current of intermediate circuit through control resistor R18 measured as voltage drop: $U = I \times R$	295 V DC	Shortly by max. Acceleration
	315 V DC	Rotor #3455 Set speed = 15.000rpm
	300 V DC	Shortly by max. Acceleration
Current of intermediate circuit through control resistor R18 measured as voltage drop: $U = I \times R$	125 mV DC	Rotor #3450 / buckets #3451 Set speed = 4.000rpm
	260 mV DC	Shortly by max. Acceleration
	-40 mV DC	Shortly during braking phase
Current of intermediate circuit through control resistor R18 measured as voltage drop: $U = I \times R$	115 mV DC	Rotor #3454 Set speed = 6.000rpm
	230 mV DC	Shortly by max. Acceleration
	-50 mV DC	Shortly during braking phase
Current of intermediate circuit through control resistor R18 measured as voltage drop: $U = I \times R$	125 mV DC	Rotor #3455 Set speed = 15.000rpm
	230 mV DC	Shortly by max. Acceleration
	-20 mV DC	Shortly during braking phase
Motor winding resistance 20°C -insulation value	3x4,7 Ω > 10M Ω	Switch OFF unit, pull off motor plugs, measure inter 1 -> 2, 2 -> 3, 3 -> 1 resistance inter each phase and motor casing
Plug XA Lid micro switches	15V DC	Voltage drop across switch by open lid
Terminal XB Over temperature switch motor	15V DC	By closed lid and one disconnected lead
Terminal XC Resistance of lid solenoid	140 Ω	Switch OFF unit, resistance at 20°C
Terminal XD Brake resistor	150 Ω	Switch OFF unit, resistance at 20°C

Test Points 230V models (continued)

Test Points	Unit Value	Conditions
Plug XE Imbalance switch- voltage drop Inter pin 1 and 4	6,6 V DC 12 V DC 0,1 V DC 12 V DC	Plug inserted Plug removed Switch connected (plug re-inserted) If lead is interrupted
Terminal XG Compressor terminal box -insulation value	3,8Ω 14,2Ω 18Ω > 10MΩ	Switch OFF unit, compressor temp. 20°C Resistance 14 - 12 Resistance 14 - 13 Resistance 12 - 13 Resistance inter phase and motor casing
Terminal XK Fans	925Ω 1695Ω	Switch OFF unit, resistance at 20°C Fan for motor Fan for electronic
Plug XU Temp. measuring	115mV 103mV 125mV	Chamber temperature 20°C (PT100: ≈ 108Ω) Chamber temperature -10°C (PT100: ≈ 96Ω) Chamber temperature 40°C (PT100: ≈ 116Ω)
Plug XW Speed detection - voltage drop Inter pin 3 and 1 Inter pin 3 and 2	12,0 V DC 1,3 V DC 0,5 V DC 10,5 V DC	Plug removed Diode voltage (plug re-inserted) Transistor is cut in (slot position) Transistor is cut out

2.5 Imbalance Behaviour

- **Install** in table available **rotor(s)** in unloaded condition

Rotor	Run through weight	Cut off weight
75003450 with 75003451	approx. 10g	approx. 50g

- Insert rotor dependent **cut-off weights** and position them at angles of 90° to each other, the centrifuge must stop 4 times indicating “bAL” message - in case of false behaviour see trouble shooting: no “bAL” indication
- Insert the **admissible imbalance weights** in the same manner, the centrifuge must run through 4 times to maximum rotor speed

2.6 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. Bent heat air deflectors have to be realigned correctly

2.7 Electrical Safety Check

ATTENTION!

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

- **Resistance check of protective conductor**

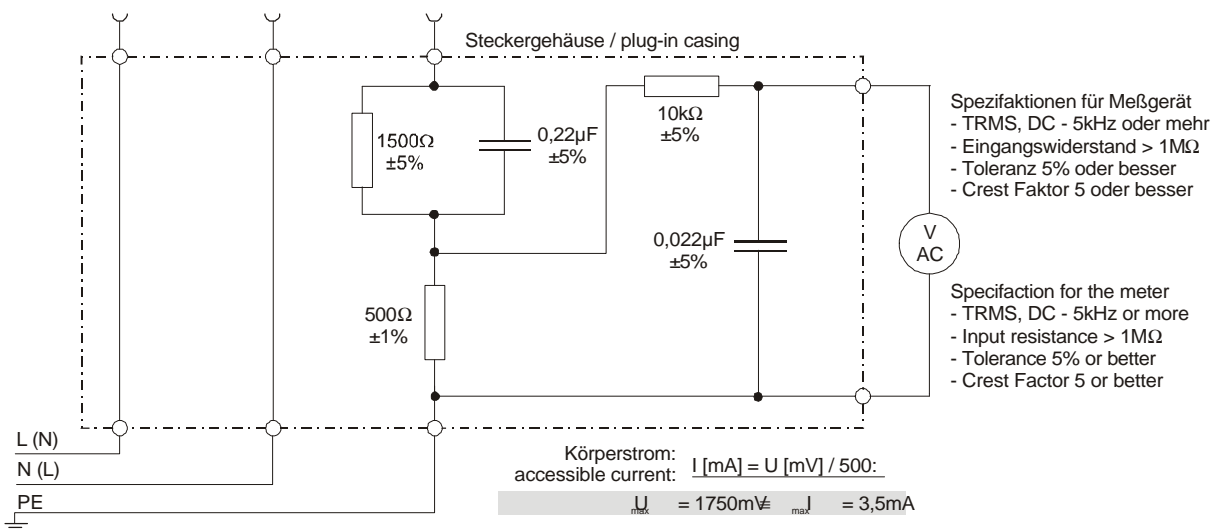
The measuring value of the resistance between the mains plug's grounding pin and the grounding conductors of the motor, electronic chassis and the casing must not exceed 200 mΩ

- **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 EN61010, IEC1010 and UL3101 such a fault condition can be reproduced by the following measuring circuit.



3 Functional Description

3.1 Block Functions

The accuSpin™ 1R is a refrigerated, microprocessor controlled low speed laboratory centrifuge with maintenance-free induction drive motor. The unit is constructed as bench top model with an extensive range of accessories.

The centrifuge is build on a low vibration solid polymer bottom plate, the housing is made of sheet steel and surrounds the bottom plate completely. The front panel is made of a resistant plastic material where a easy cleanable overlay is self-glued. Housing and front panel are fixed tightly together to the bottom plate.

The rotors are started directly with a frequency controlled main maintenance-free induction drive with high acceleration power. The drive is mounted with shock absorbers to the bottom plate and sealed with a rubber flange to the rotor chamber.

The unit is equipped with a compressor plant filled with CFC-free refrigerant for temperature control.

Following boards and components are located inside the unit (see block diagram page 4-1):

- Mains switch
- Main board with central processor and 2 fuses for board protection, one fuse for the compressor
- Indication board with key and display processor
- Three phase induction drive motor with an integrated thermal over-temperature switch (cut-out at 140°C).
- Speed detection board is mounted underneath the drive motor
- Imbalance switch with adjustable distance screw directed to the insulated contact plate which is mounted onto the drive motor
- Lid lock assembly with solenoid and 2 integrated micro switches
- Brake resistor mounted on a heat protection plate
- Temperature Sensor PT100 is fixed thermally insulated with a plastic clip onto a distance bushing inside the spin chamber
- Refrigeration unit (one phase induction drive motor with starting and running capacitor - controlled by a starting relay)
- Fans for cooling the motor / electronic components and the condenser of cooling unit

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 groups (see wiring diagram page 4-2 and 4-3)

- Board fusing (2x 15 Amps. slow blown)
- Mains voltage supply for compressor control relay K1 , fuse 15A slow blown
- Noise Filter for suppression of radio interference, caused by the fast switching power electronics (10 kHz), in accordance EN 55011 B.
- Power pack for 3 different low voltage levels and integrated protection circuit
- Triac control circuit for lid solenoid (release magnet)
- Mains rectifier for DC intermediate circuit supplying brake control path and frequency converter
- Micro controller (central processor unit) with circuits of imbalance and speed detection and temperature control

3.2.1 Power Pack

The power pack consists of a transformer with 2 different secondary coils, each connected to bridge rectifiers and voltage regulators for the following low voltage levels:

- 1) U1 = 5V: supplies central processor, key and indication board and circuit for temperature measuring
reference potential A1: protective conductor (GND)
 - 2) U2 = 12V: supplies the circuits of speed measuring and imbalance detection
reference potential A2
- U3 = 15V: stabilized - for the protection circuit: lid open, motor overtemperature and for control electronics of frequency converter
reference potential A3! mains potential!
EXERCISE CAUTION when measuring etc

3.2.2 Intermediate Circuit with Brake Chopper and Frequency Converter

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 mains rectifier and two connected reservoir capacitors which are softly charged, continuously supplied during operation and slowly discharged after power off.

- Brake Chopper
Electrical power is feed back into the intermediate circuit during motor deceleration (motor acts as generator). This braking power is transformed into heat by brake resistor R1 (terminal XD) so that the intermediate circuit voltage does not rise to an excessive level (level remains approximately constant see test points on main board). The brake resistor R1 is switched into the intermediate circuit by a fast switching (chopping) transistor. This transistor is controlled by the CPU via optical coupler stage.

Main Board Functions (continued)

- Frequency Converter

The motor is provided 3-phased with chopped direct voltage blocks. These blocks are variable in frequency and pulse width modulation and are dephased to 120° between the motor windings. Beginning with low frequency and small pulse width chopped blocks, both parameters will be increased up to the operators set speed. By this variation the acceleration power of the drive motor can be effected. For deceleration the frequency and pulse width parameters will be reduced. The frequency converter is protected against over current and over voltage.

3.2.3 Micro Controller (Central Processing Unit)

The controller block includes the central processor unit (CPU) 87C51FB and the data storage (NV-RAM) 9366 with the software identification No. for:

- CPU: 0498 (second displayed No. in speed field)
- RAM: 4599 (third displayed No. in speed field)

The second parts of these No.'s (displayed in the time field) will be upgraded if necessary. The ROM with control program is integrated in the CPU. The most important operating parameters (e.g. the maximum data or the last operator settings) are stored in the NV-RAM.

3.3 Key and Indication Board

The key and indication board is mounted behind the front panel. A special micro controller is located on this board controlling the 7-segment displays, the control key LED's and the operating keys.

The communication with the central processor on the main board takes place via serial data lines in both directions (plug XI).

Functions of keys elements

Keys	Designation	Function(s)
S6	Decel	Setting of brake profile
S7	Speed ↓	decrement of speed setting
S8	Speed ↑	Increment of speed setting
S9	Bucket	Setting of bucket code
S10	Rpm/rcf	Change between speed and g-force
S11	Time ↓	Decrement of time setting
S12	Time ↑	Increment of time setting
S13	Temp ↓	Decrement of temp setting
S14	Temp ↑	Increment of temp setting
S16	Quick run	Pulse function while button pushed
S17	Open	Push for lid opening
S18	Start	Press for starting the run
S19	Stop	Press for stopping the run

Functions of Indicating Elements

Indication	Designation	Function(s)
H04-H07, H12	Speed range	Speed in rpm (rounded to full 10 rpms) Rcf-value (xg) Brake cut off point Rotor or bucket no. Identifications no.'s of controller and nv-rams, Lid open condition („open") Centrifuge run is terminated („end") Error message („lid“, „E-xx“)
H13-H15	Time range	Centrifugal time in min (count down process) Count up process (hld) in min (count up process) Actual version number („xx“)
H18	LED RPM	Display shows the speed
H22	LED rcf	Display shows the g-force
H19, H20, H24; H25	LED circle	Active when rotor spinning
H16, H17,	temp- range	Temperature in °C
H1	Buzzer	Active when error comes up or at the end of a run

3.4 Speed Detection Board

The speed detection takes place opto-electronically through a slot in the motor shaft. A light-emitting infra-red diode and a photo-transistor are mounted on the speed detection board and located on opposing sides of the motor shaft (see page 4-9).

So 2 pulses per motor revolution are generated, by which the micro controller calculates the real rotor speed or rcf value. The speed detection board is connected to the main board via the 3-pin plug XW.

3.5 Cooling Unit with Capillary Injection

3.5.1 Refrigerant

- Type R134a
- Amount 350 g

3.5.2 Functional Description

The cooling unit consists of following components:

- Compressor power relay
- Starting relay with starting capacitor
- Compressor with connection box for starting relay
- Condenser (with radial fan)
- Drier cartridge and capillary tube
- Evaporator coil integrated in the armoured spin chamber

- **Temperature Control**

The set temperature range is defined from 0°C to 40°C. In dependence of the set values of rotor and temperature and the real speed value the CPU calculates the correct temperature level inside the closed spin chamber.

When the correct temperature level is reached, the CPU controls it by switching the compressor with aid of relay K1 (mounted on main board) ON and OFF.

The shortest compressor cut-out phase is 60 sec.

After the end of the pre-tempering phase (see section 1 - operating instructions - chapter 9) the indicated temperature is approx. the same as the temperature of rotor, buckets and accessories (allowed tolerances $\pm 2^\circ$).

- **Cooling System**

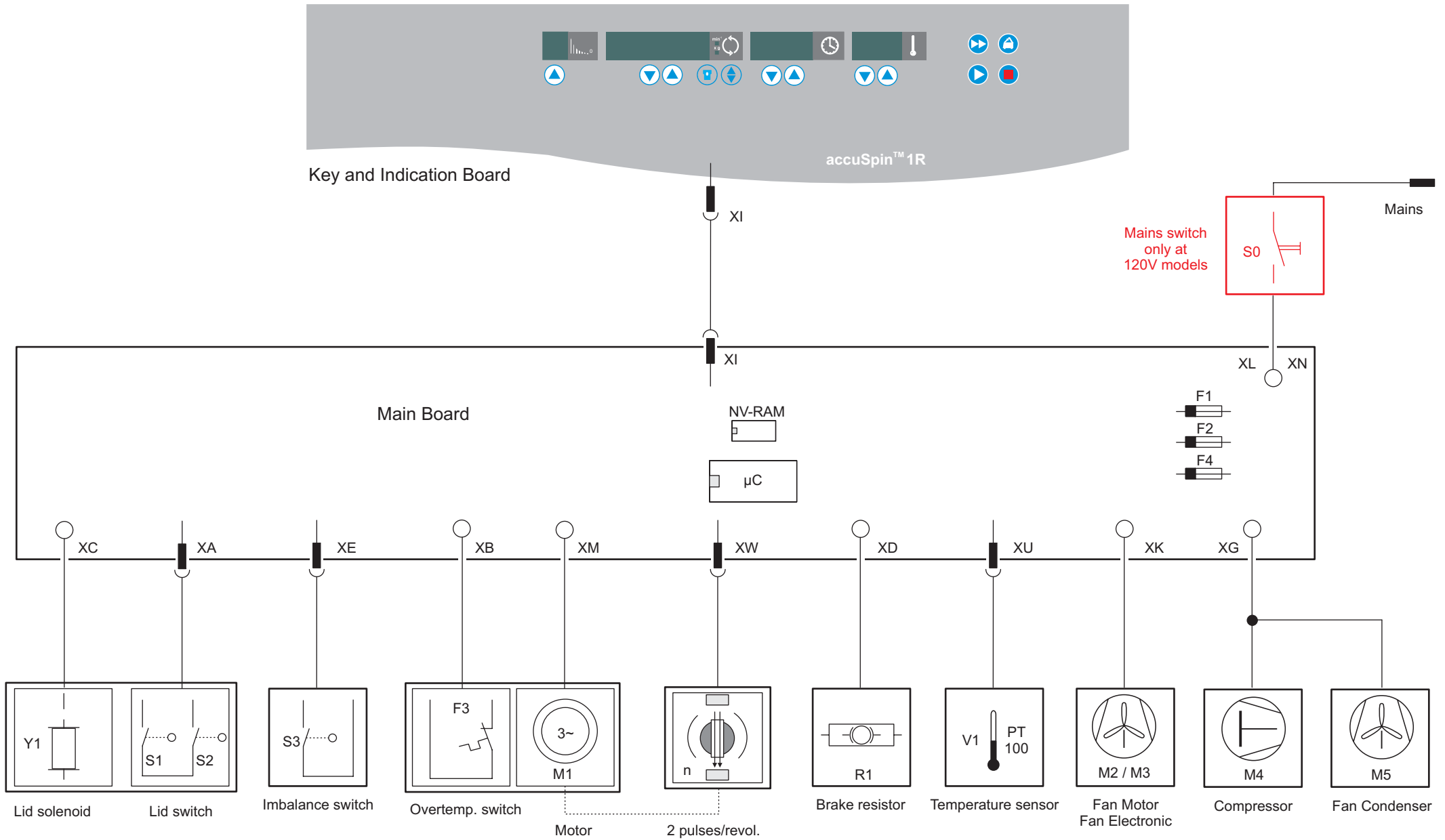
The evaporator absorbs the heat energy from the rotor chamber, the condenser emits the heat energy subsequently via the casing louvers to the room (tangible heat flow). The expansion part (capillary tubes) provides the necessary pressure drop and supplies the evaporator spiral tube with liquid refrigerant.

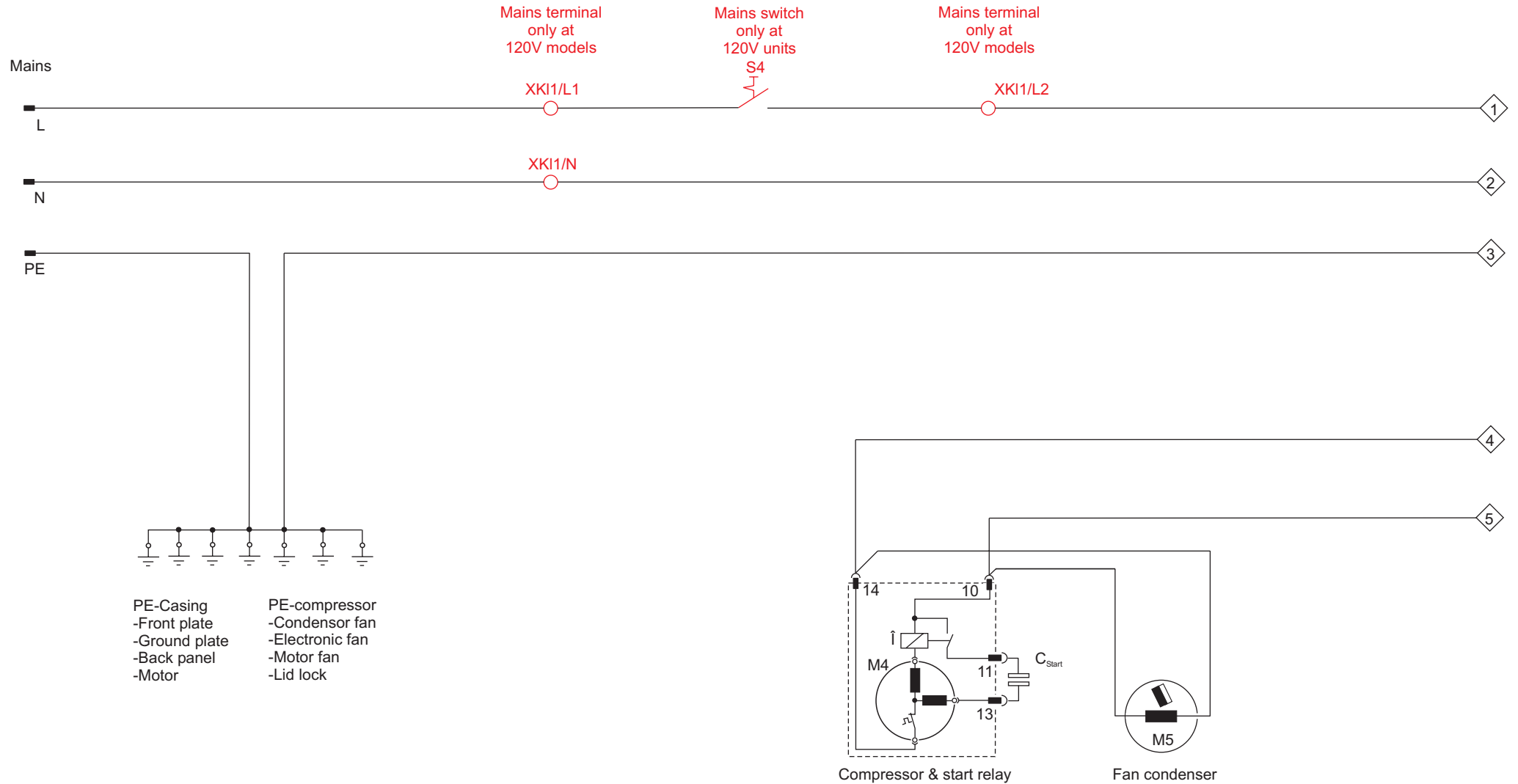
3.5.3 Suction Pressure Test

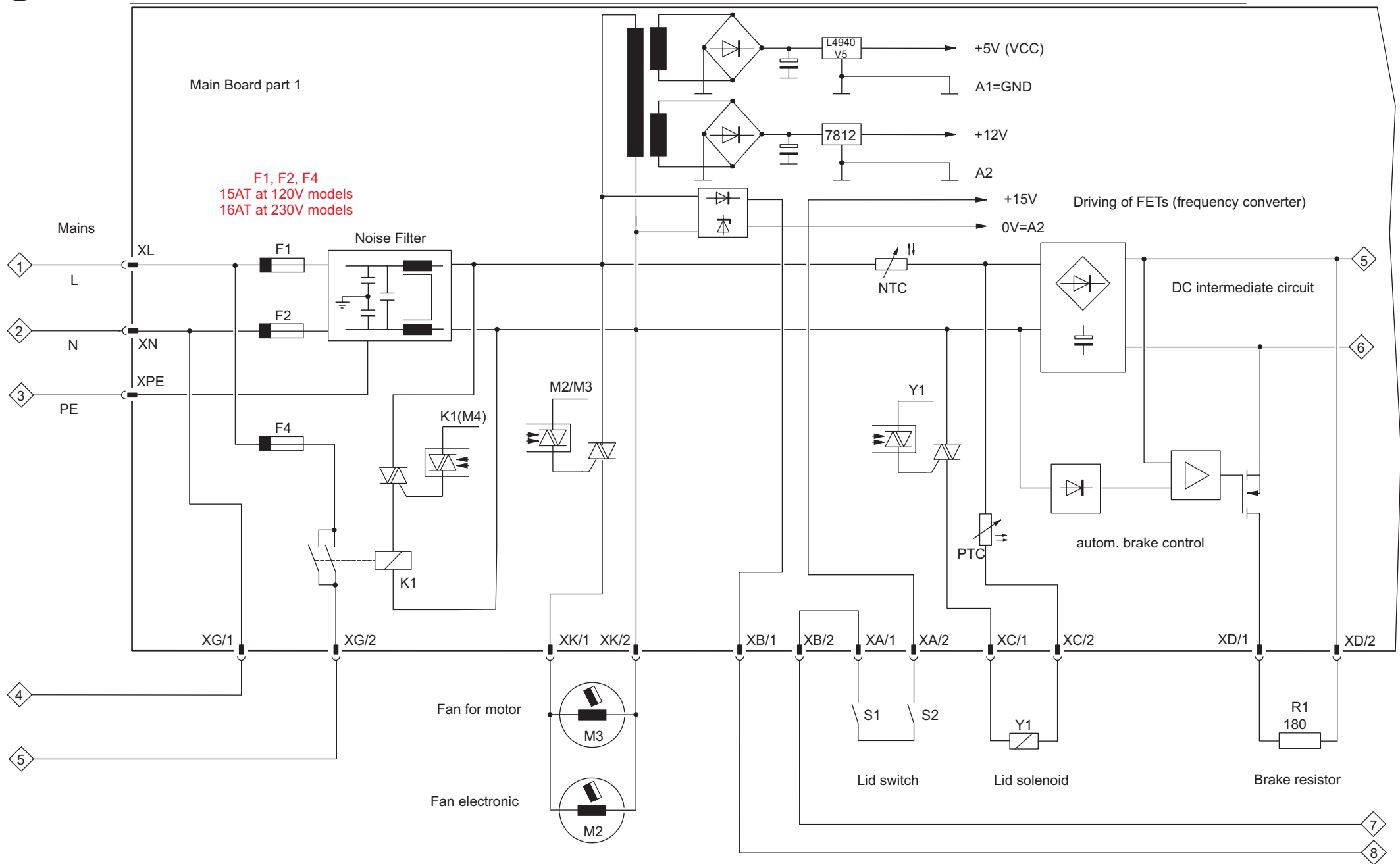
- Dismantle the front panel (see section 5, page 1)
- Screw pressure gauge onto measuring nozzle (suction side on compressor) inflation pressure (pressure balance after longer standstill) approx. 3 bar at ambient temperature
- Set temperature to 0°C and start
- Reading of suction pressure after 2 min. is approx. 0.5 - 0.8 bar

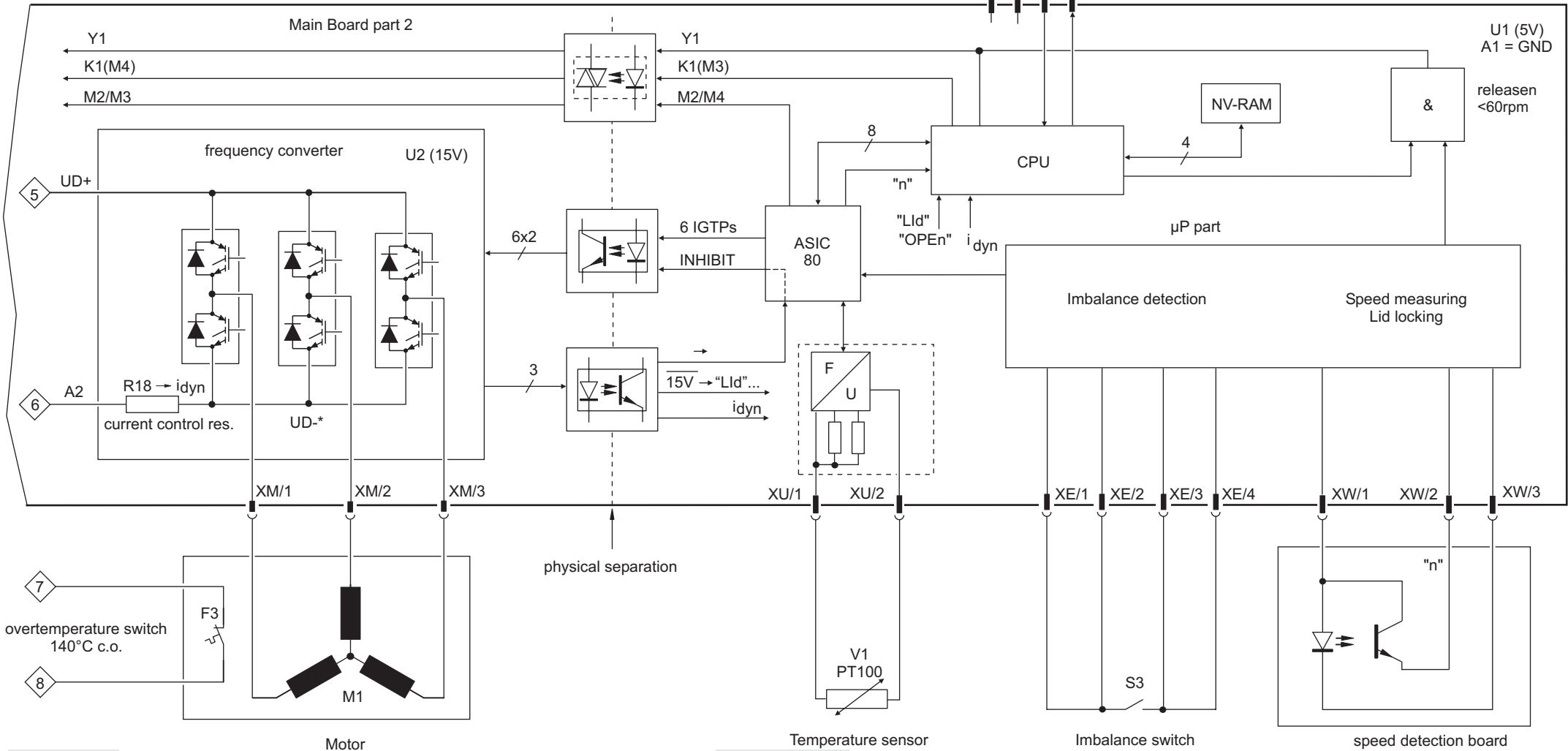
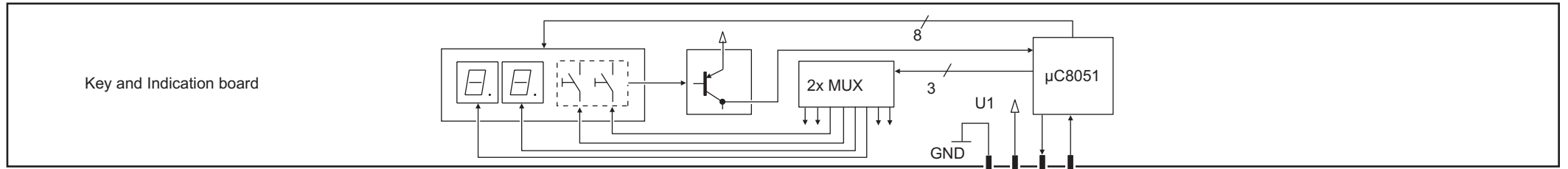
3.5.4 Component Parts of Unit (listed in flow direction)

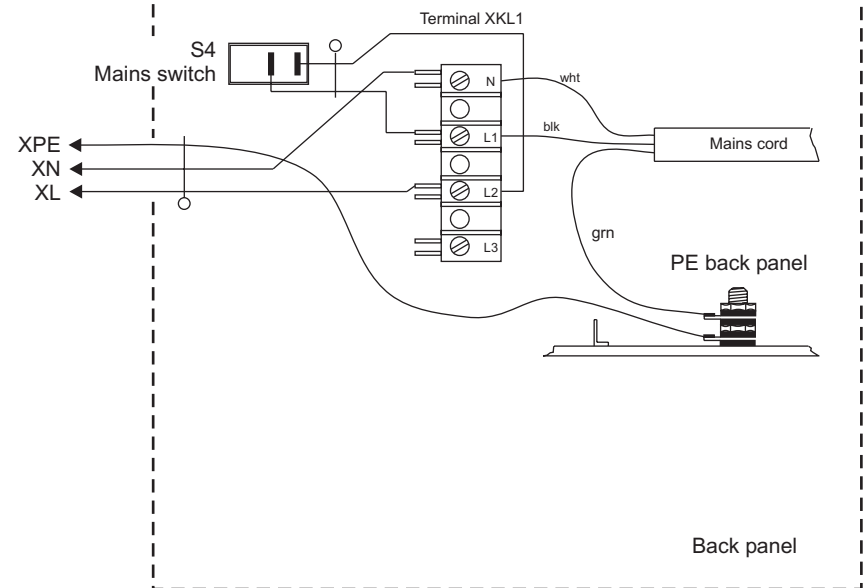
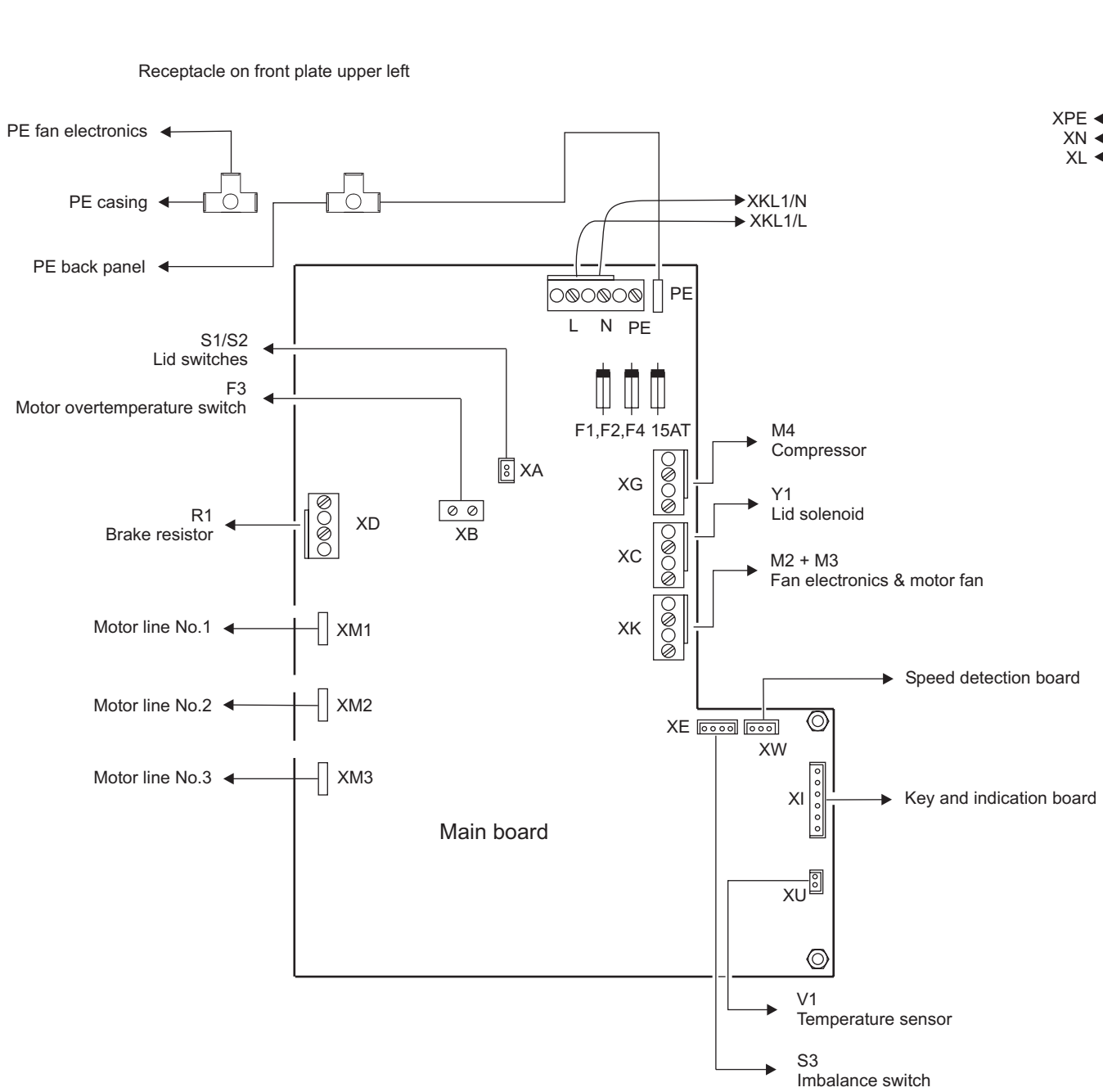
- compressor with Schrader valve (low-pressure side)
- condenser with radial fan
- dryer cartridge
- capillary tube (not interchangeable)
- evaporator integrated in the spin chamber
- suction line



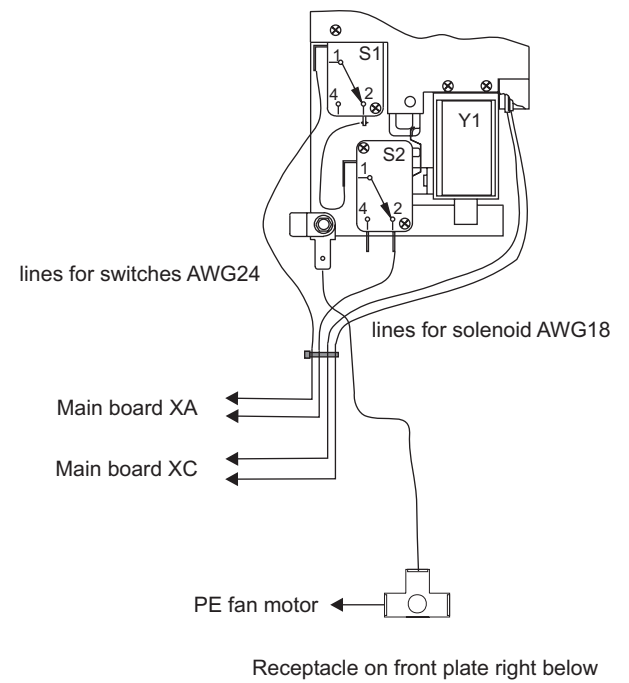


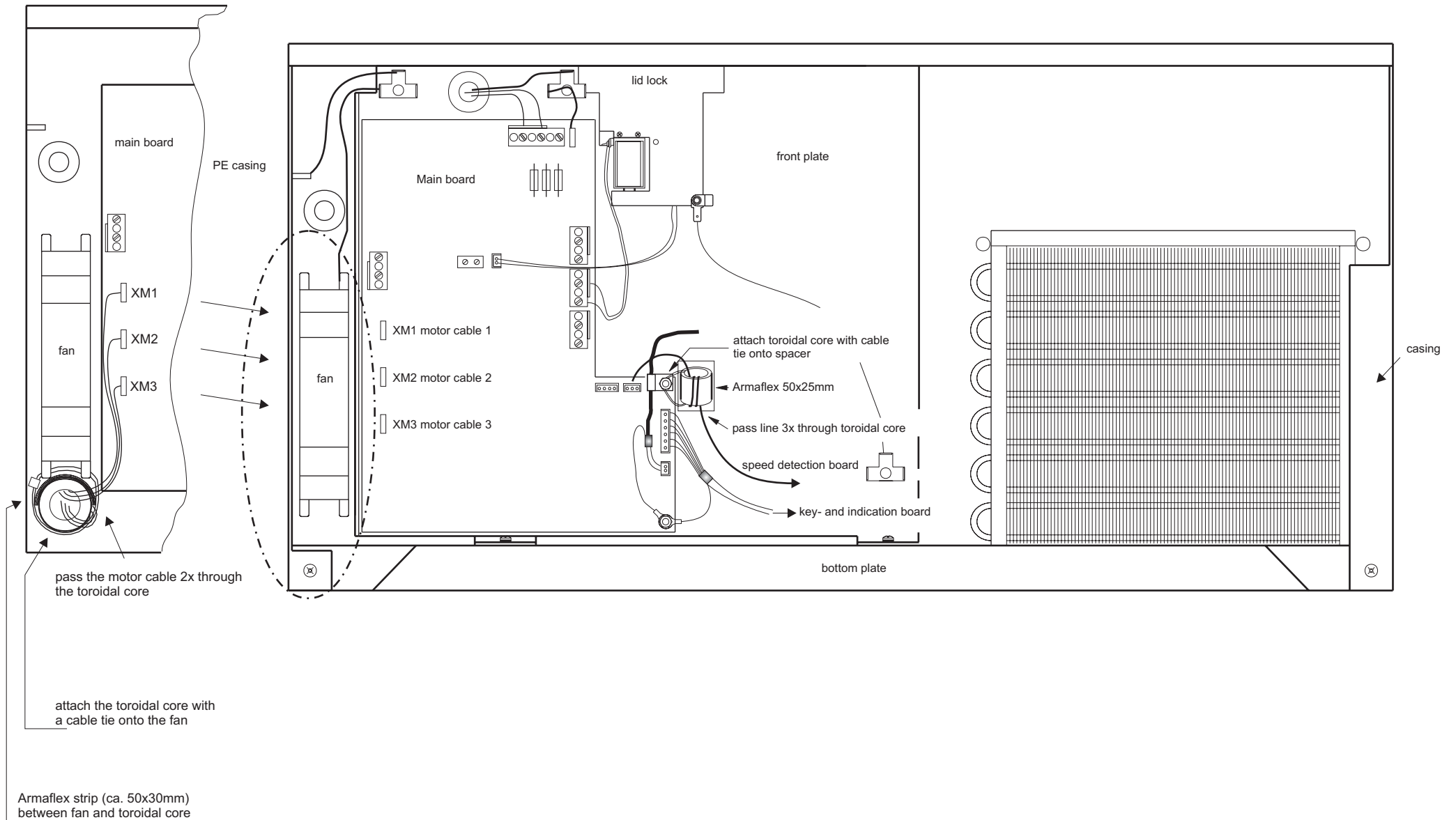




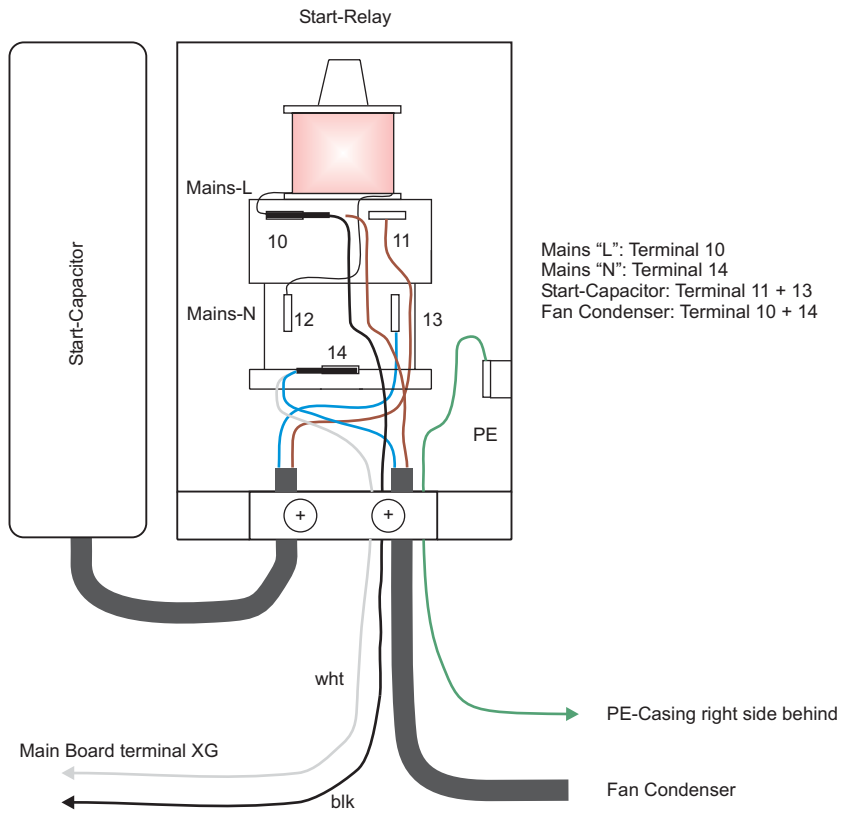


Connections of lid lock assembly

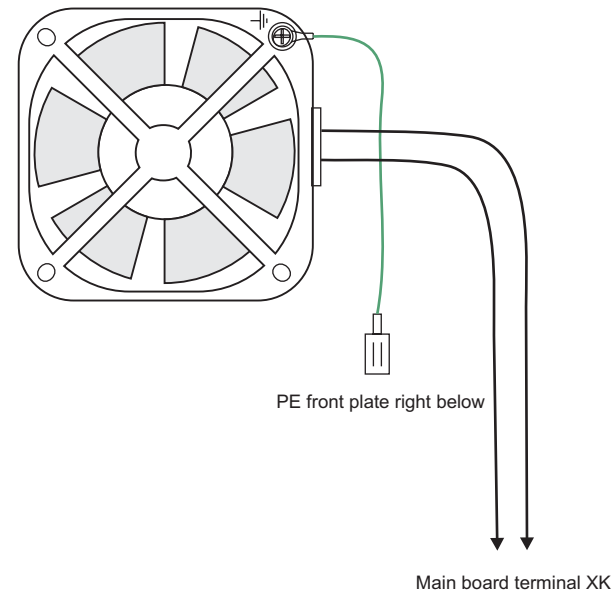




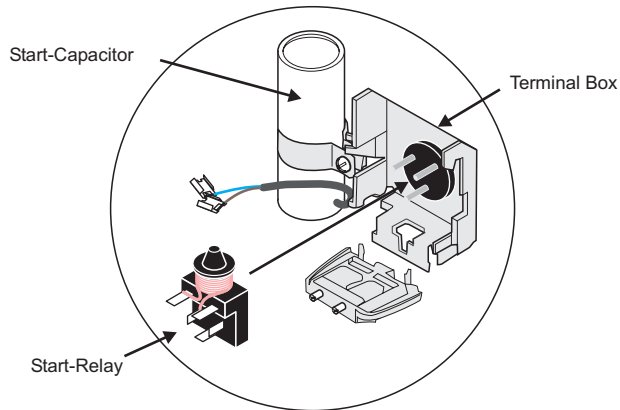
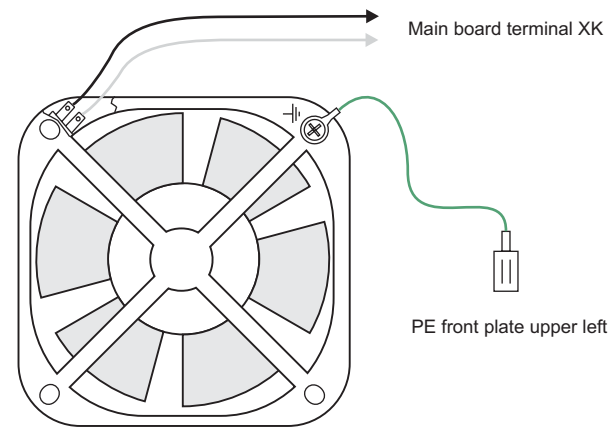
Connection Diagram Compressor

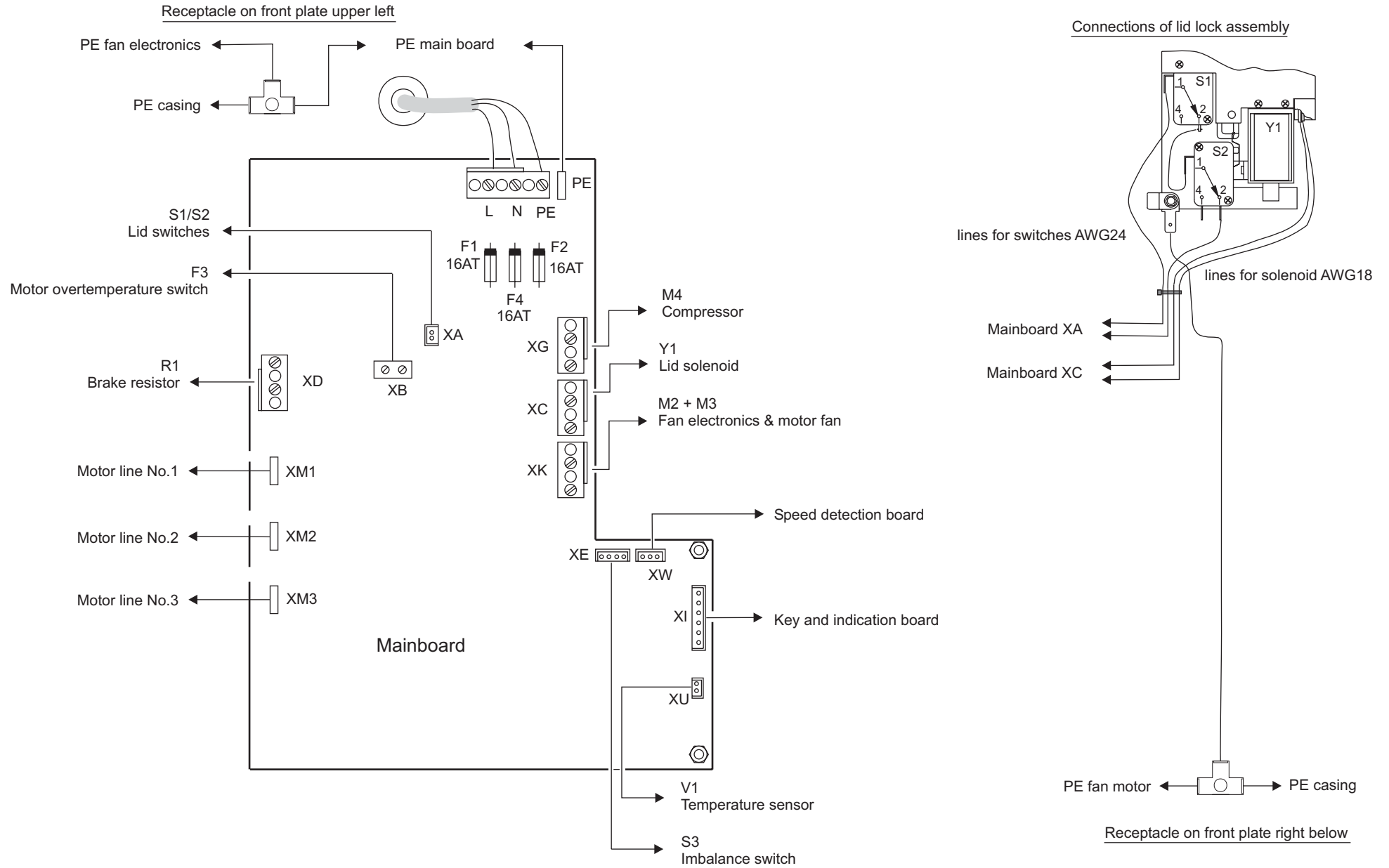


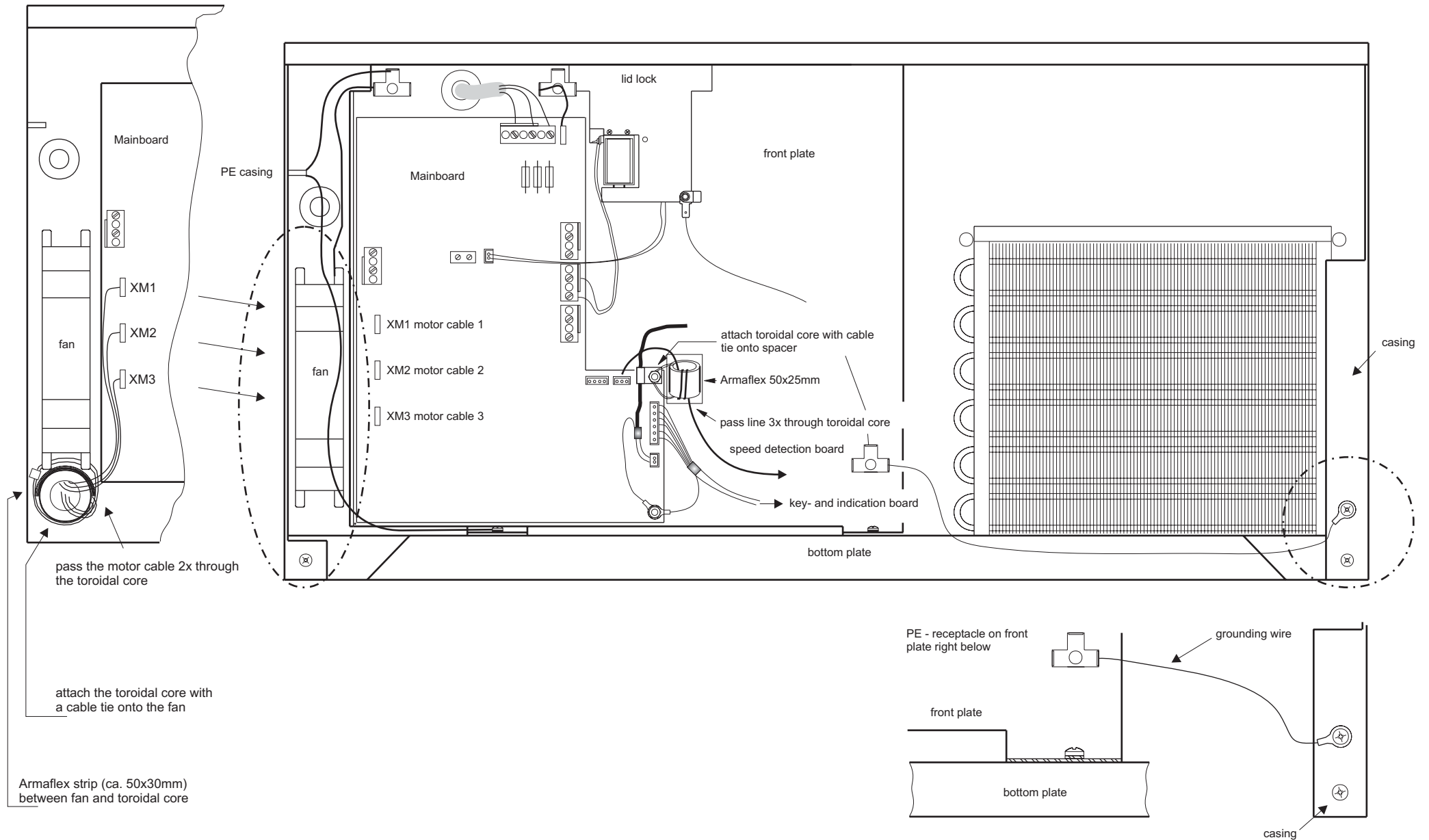
Connection Diagram Motor Fan



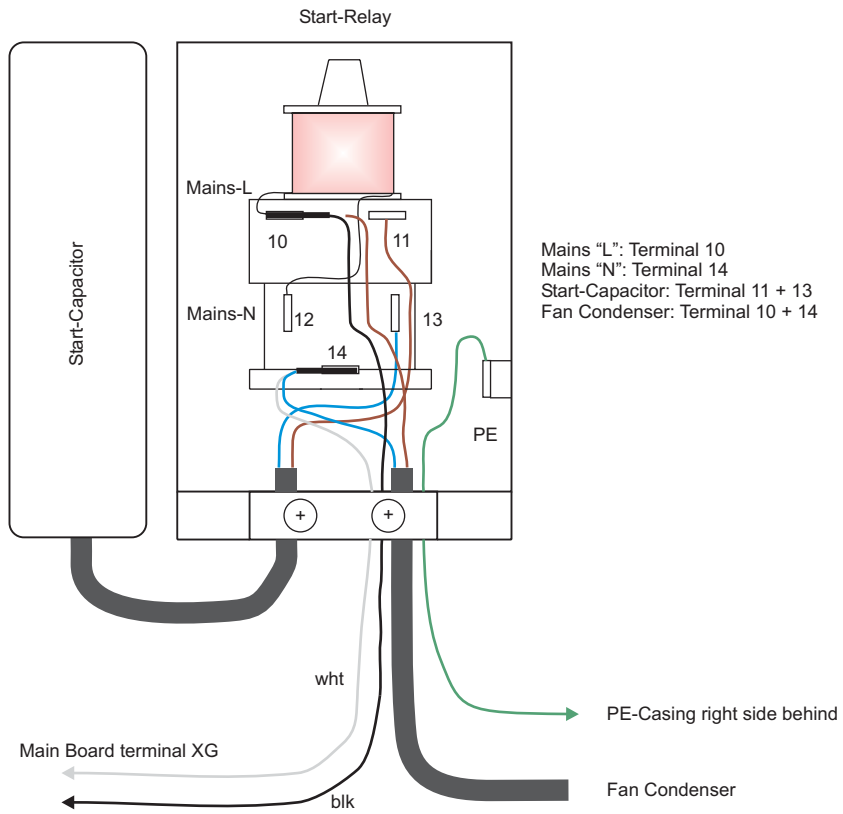
Connection Diagram Fan Electronics



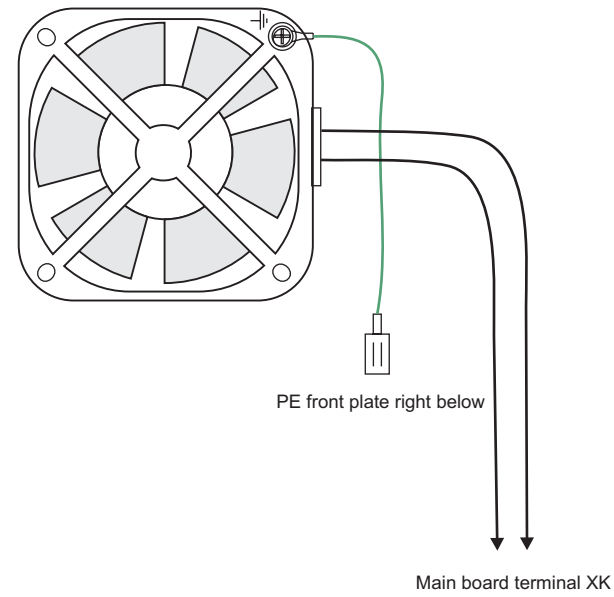




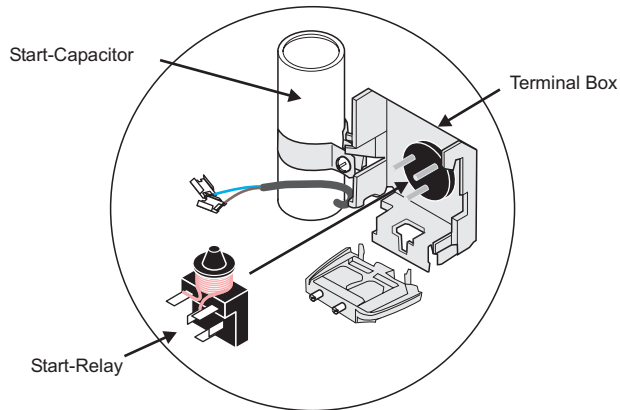
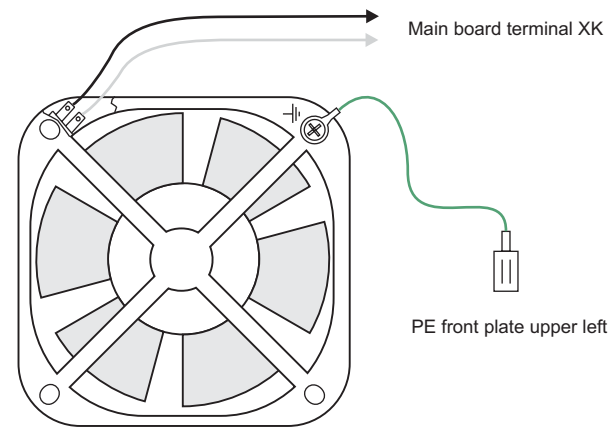
Connection Diagram Compressor

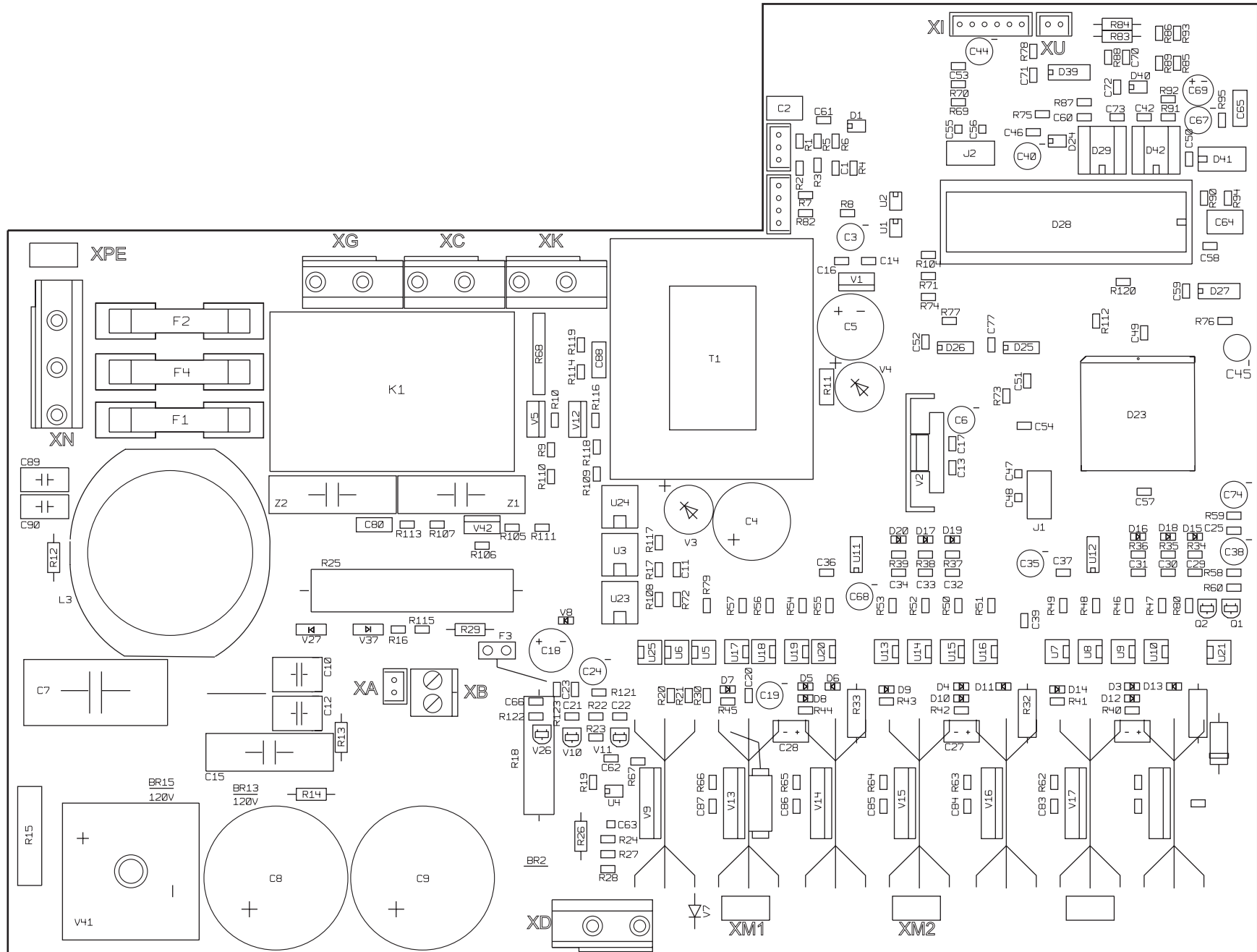


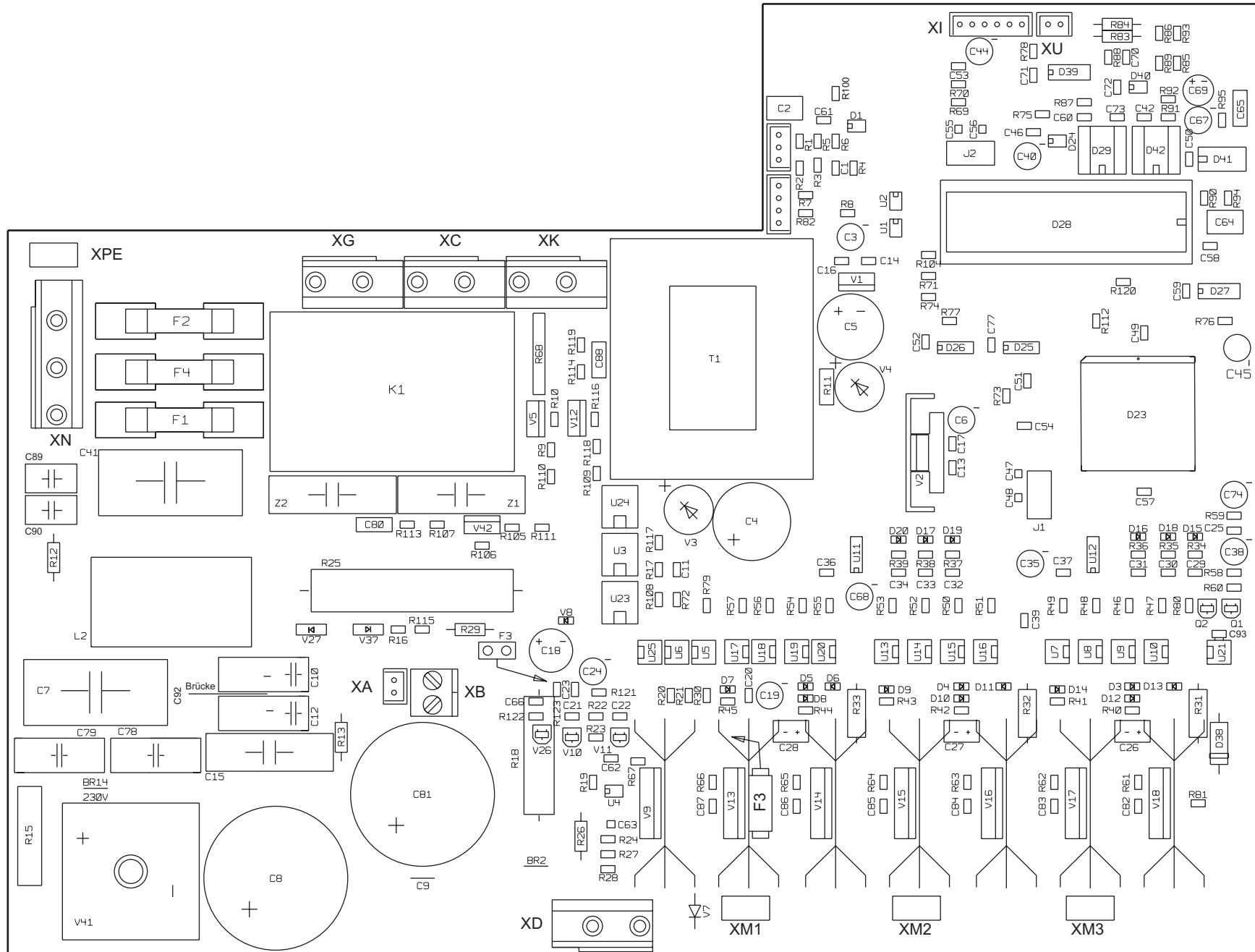
Connection Diagram Motor Fan

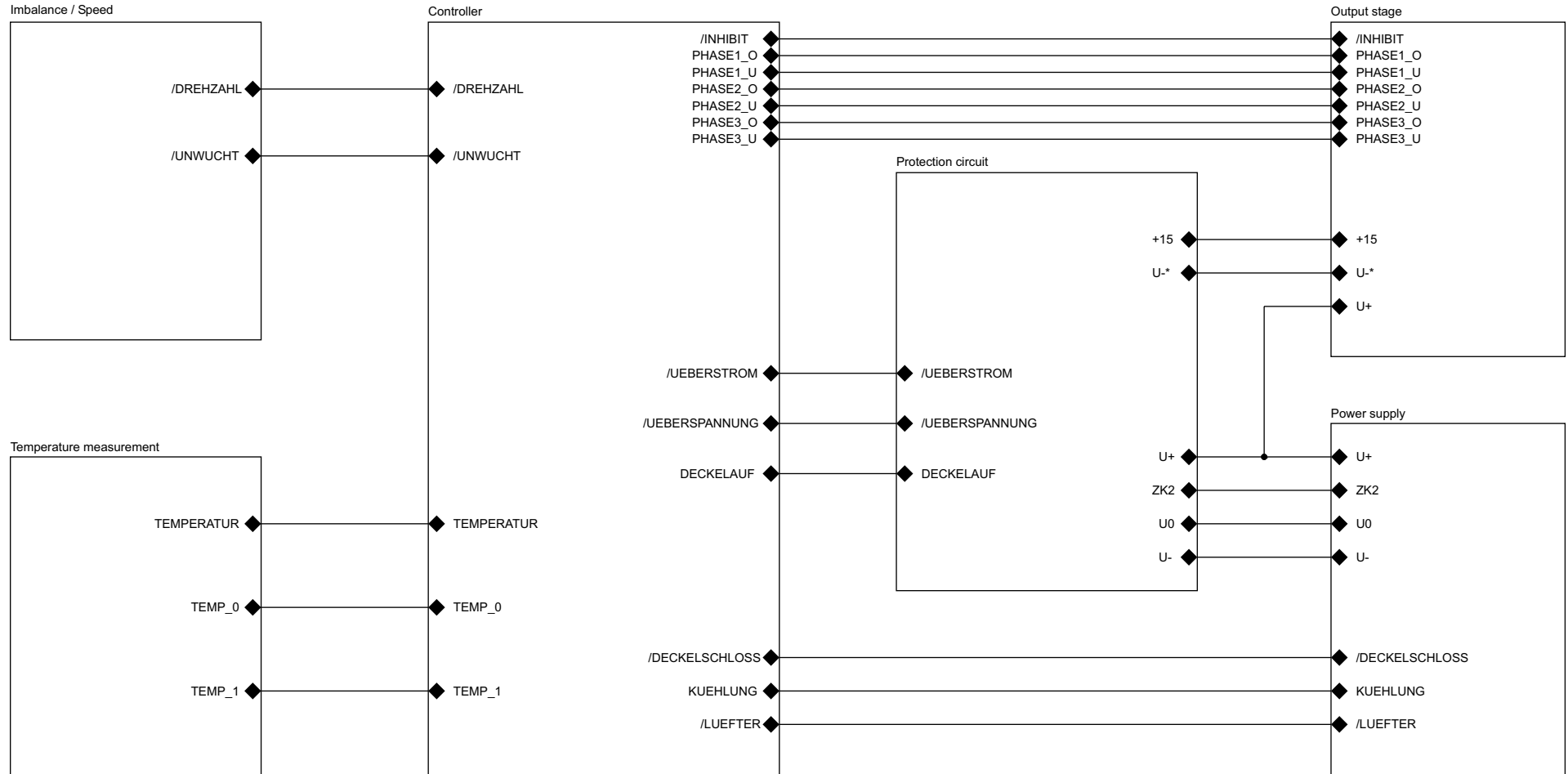


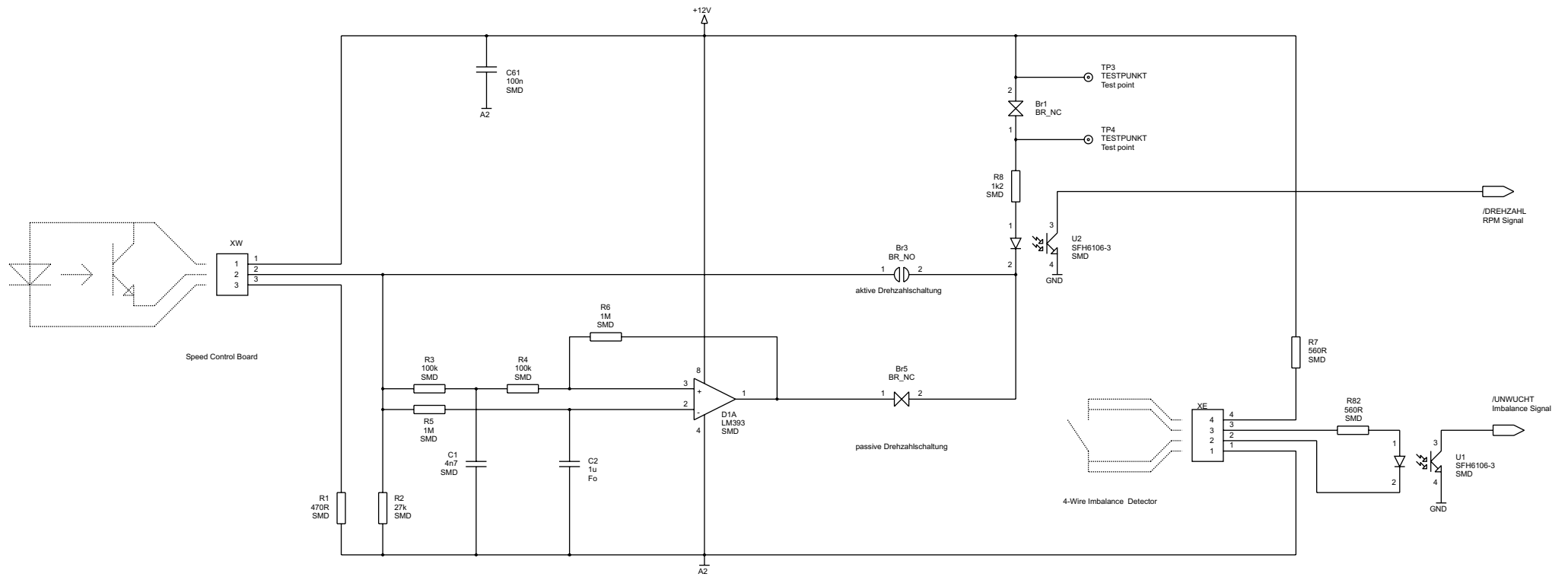
Connection Diagram Fan Electronics

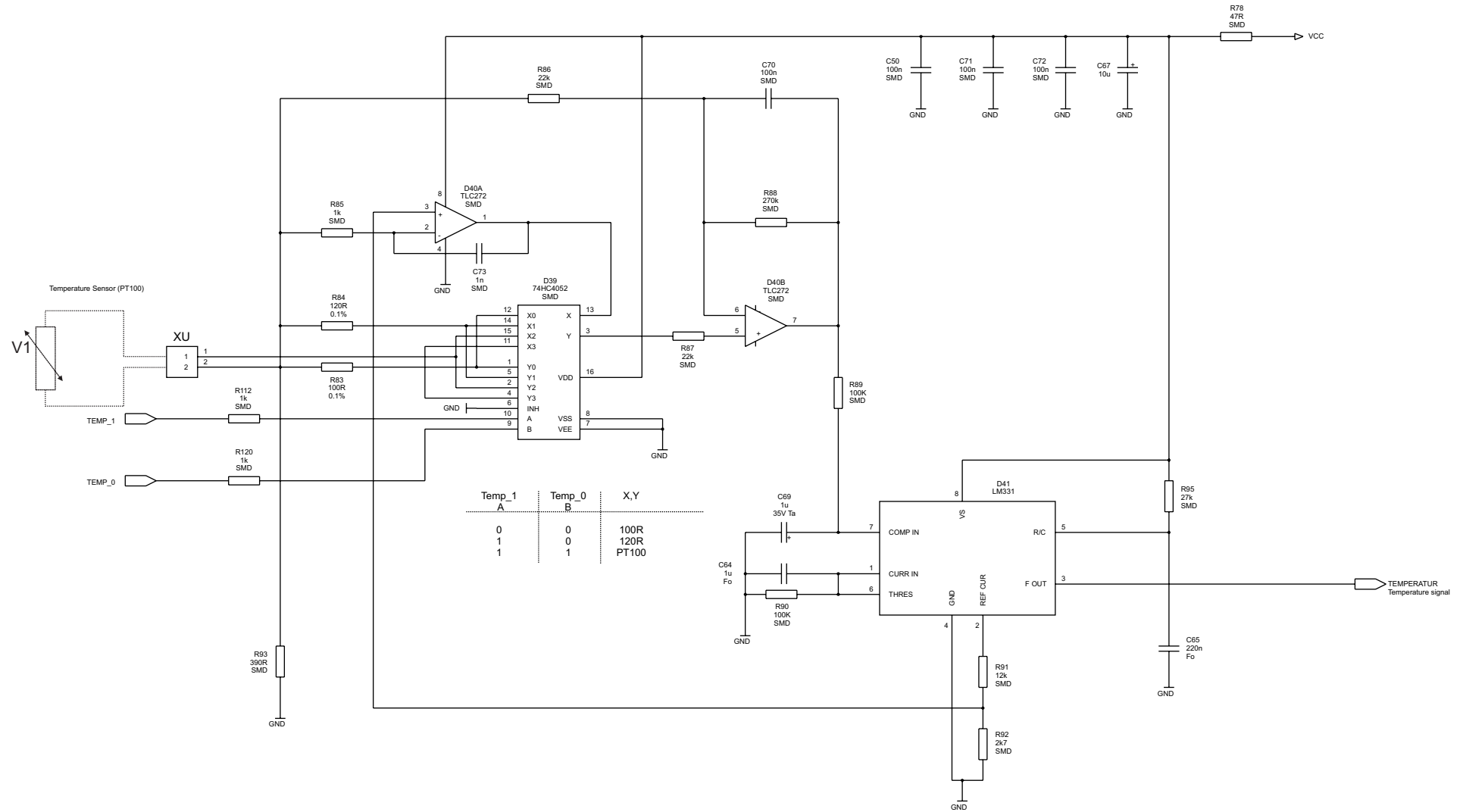


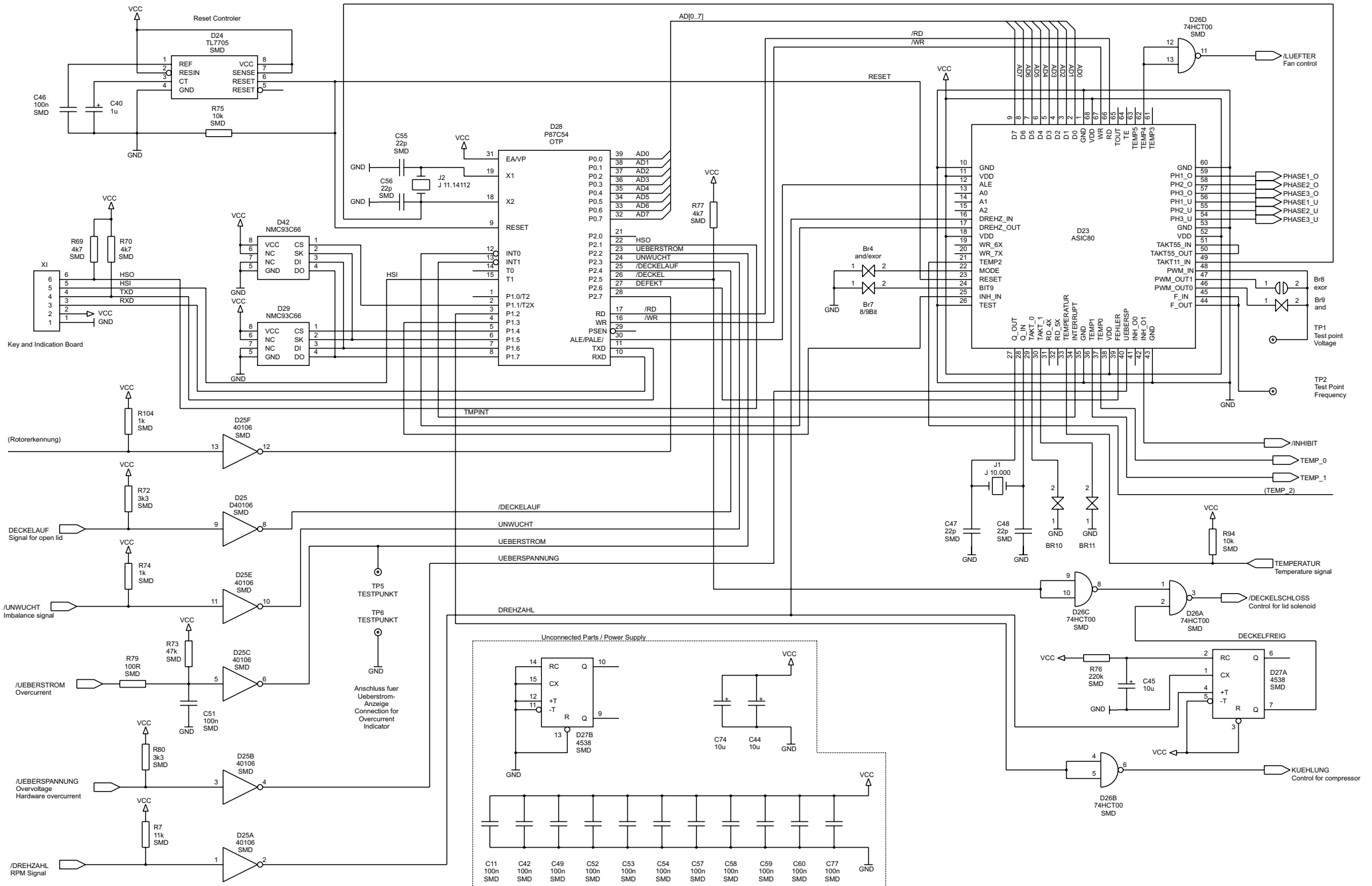


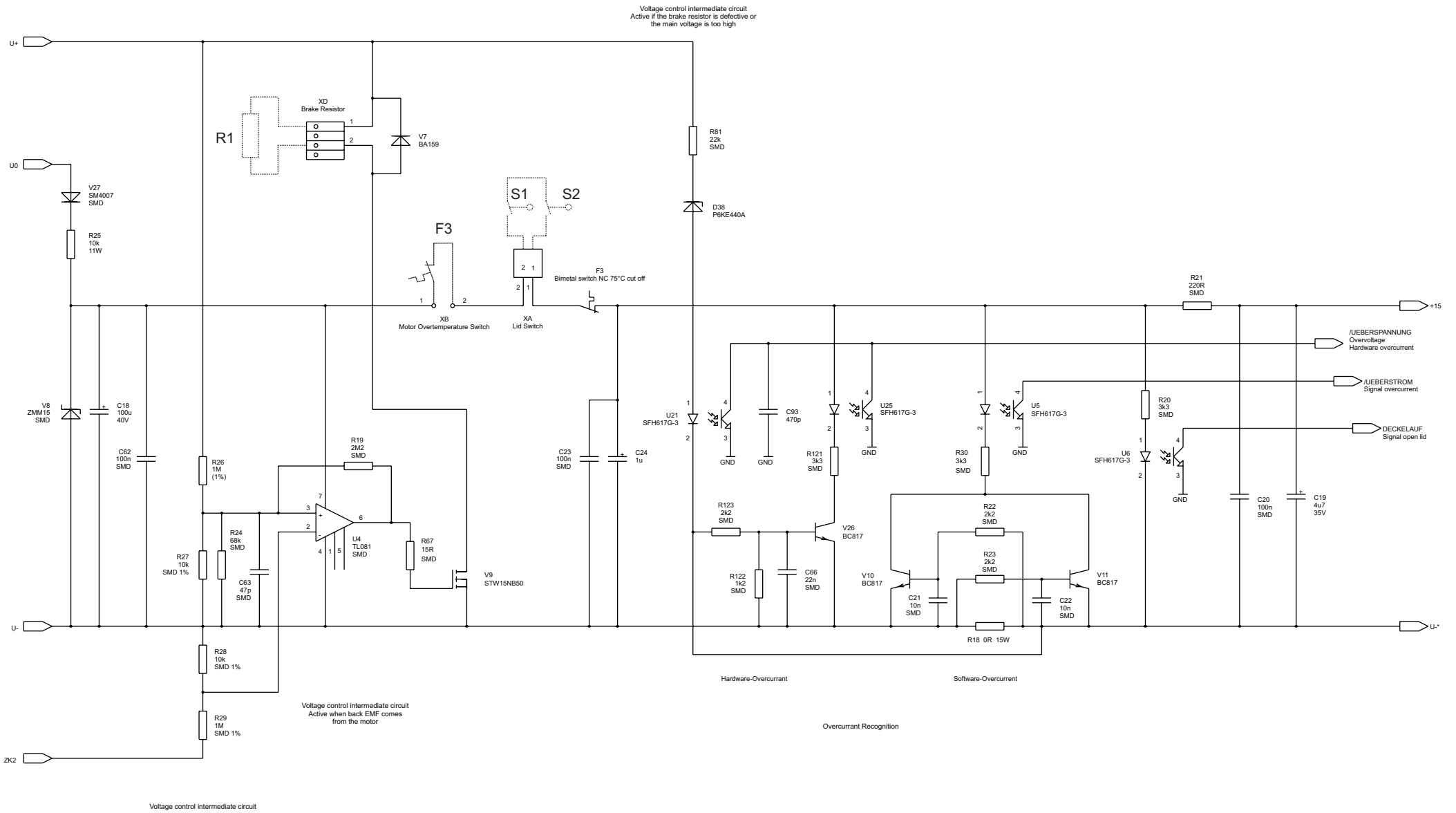


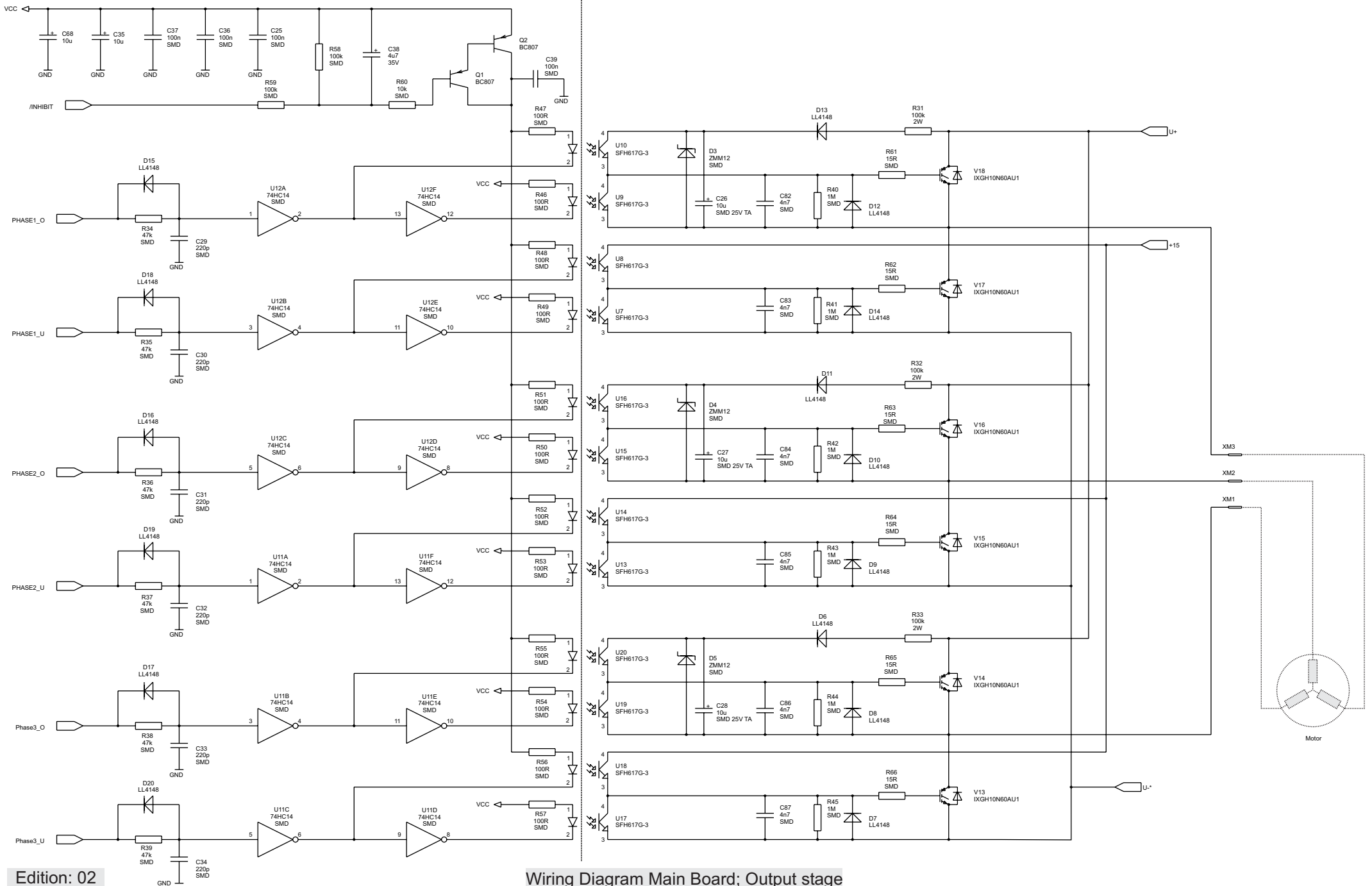






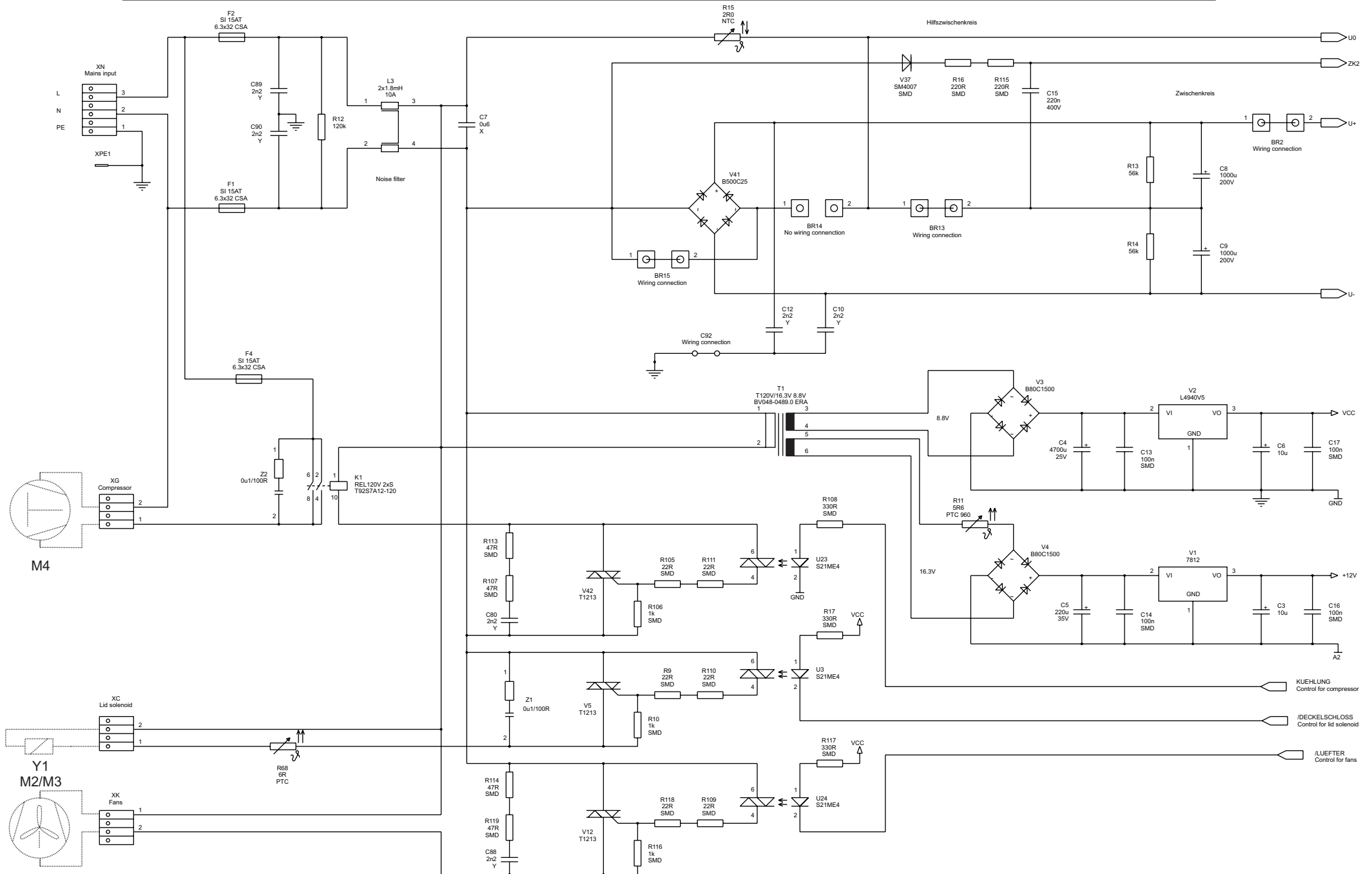






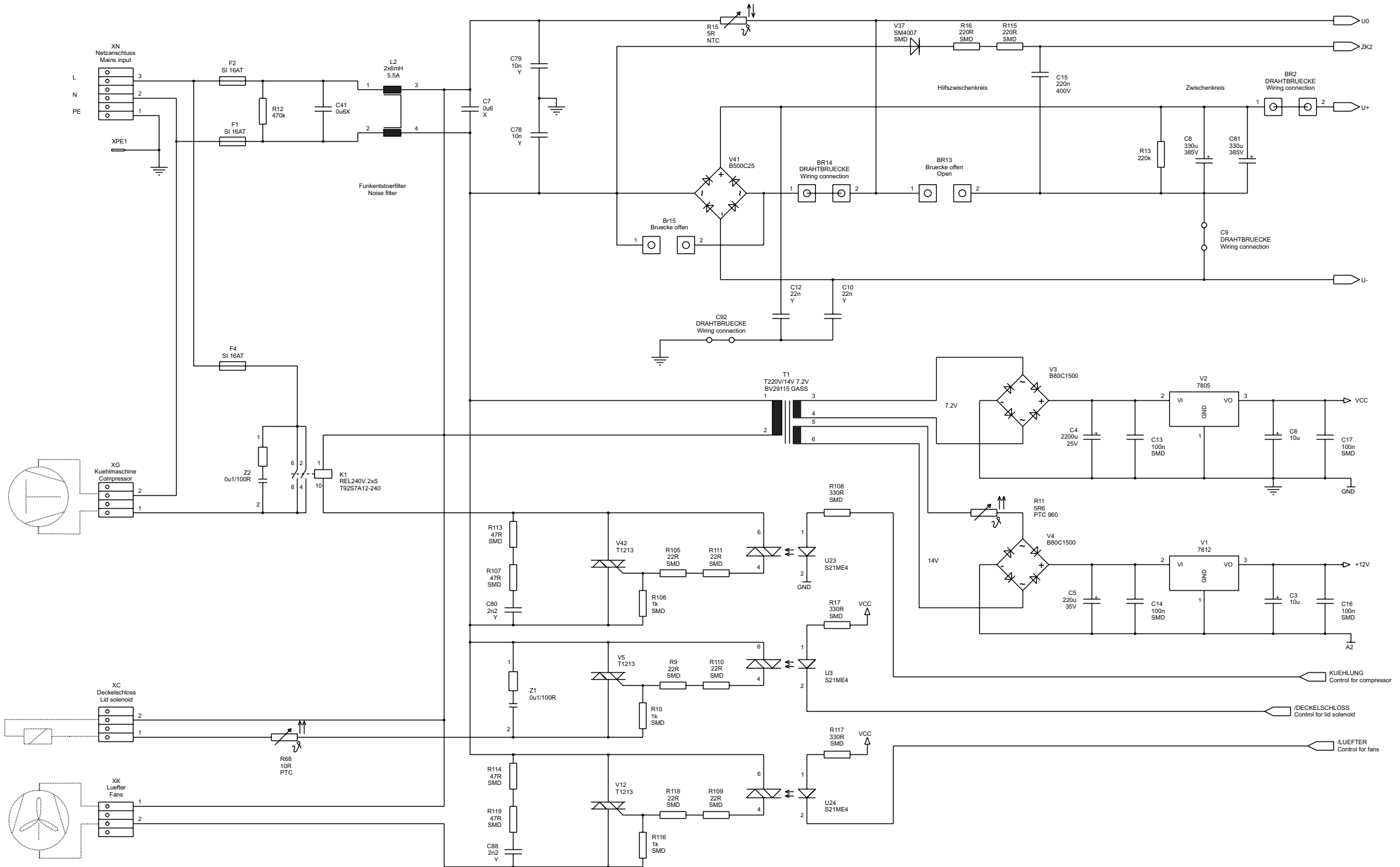
Edition: 02

Wiring Diagram Main Board; Output stage



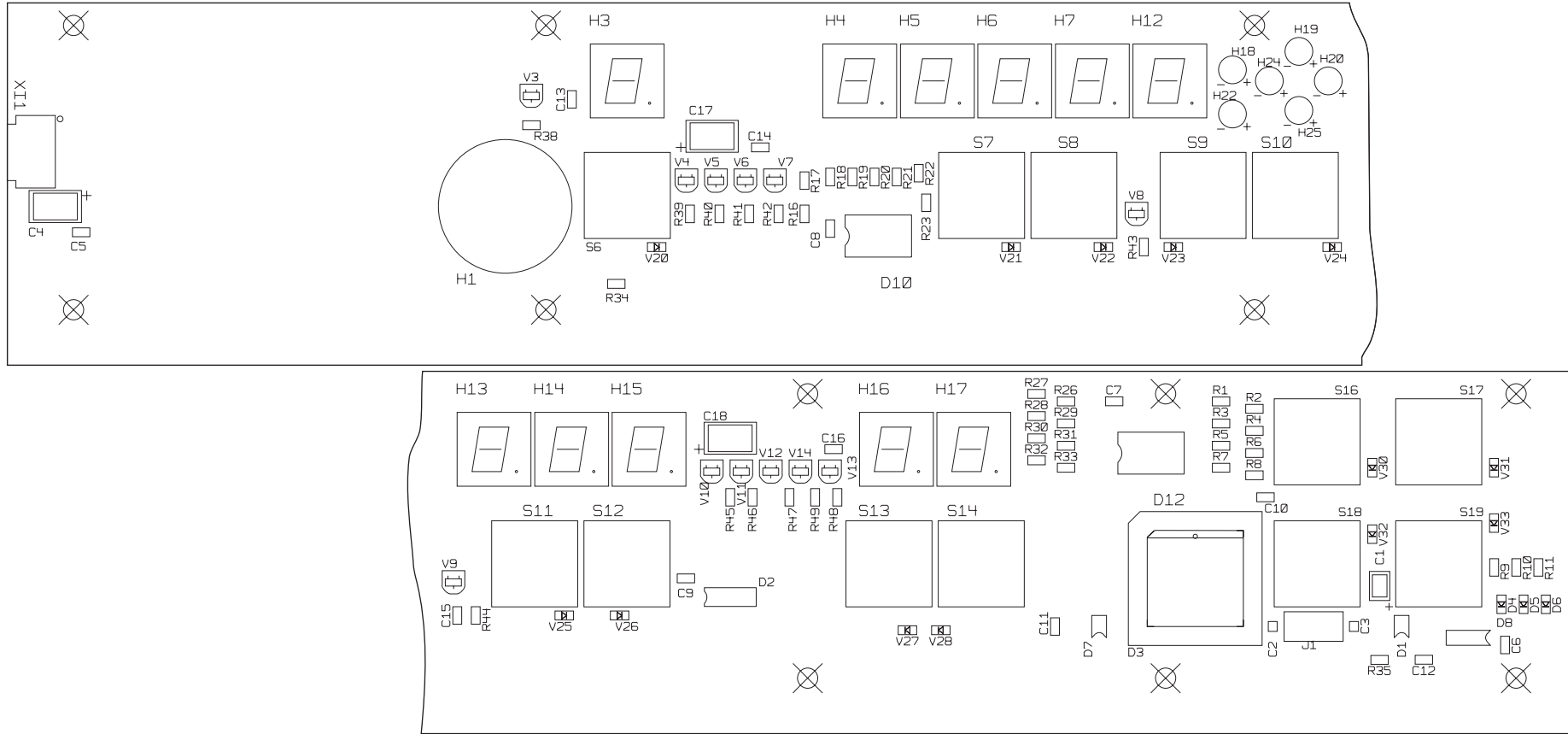
Edition: 02

Wiring Diagram Main Board; Power supply 120V model

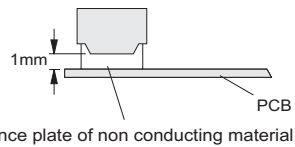


Edition: 02

Wiring Diagram Main Board; Power supply 230V model



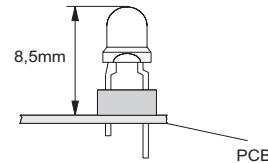
Seven segment LED



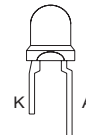
Seven segment LEDs

LED's

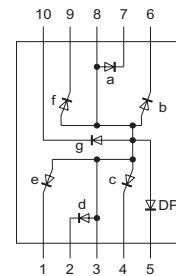
LED's HLMP on sockets with pins to top

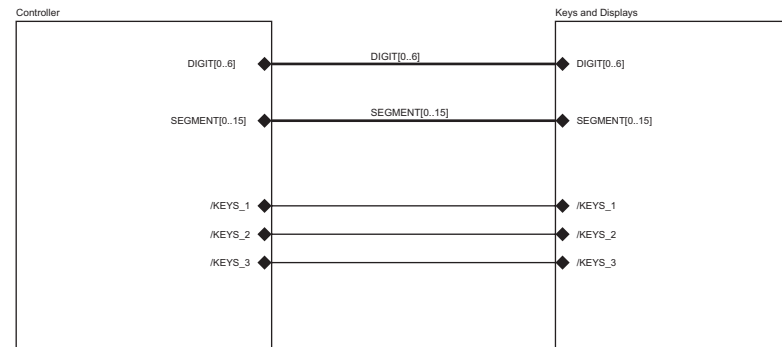


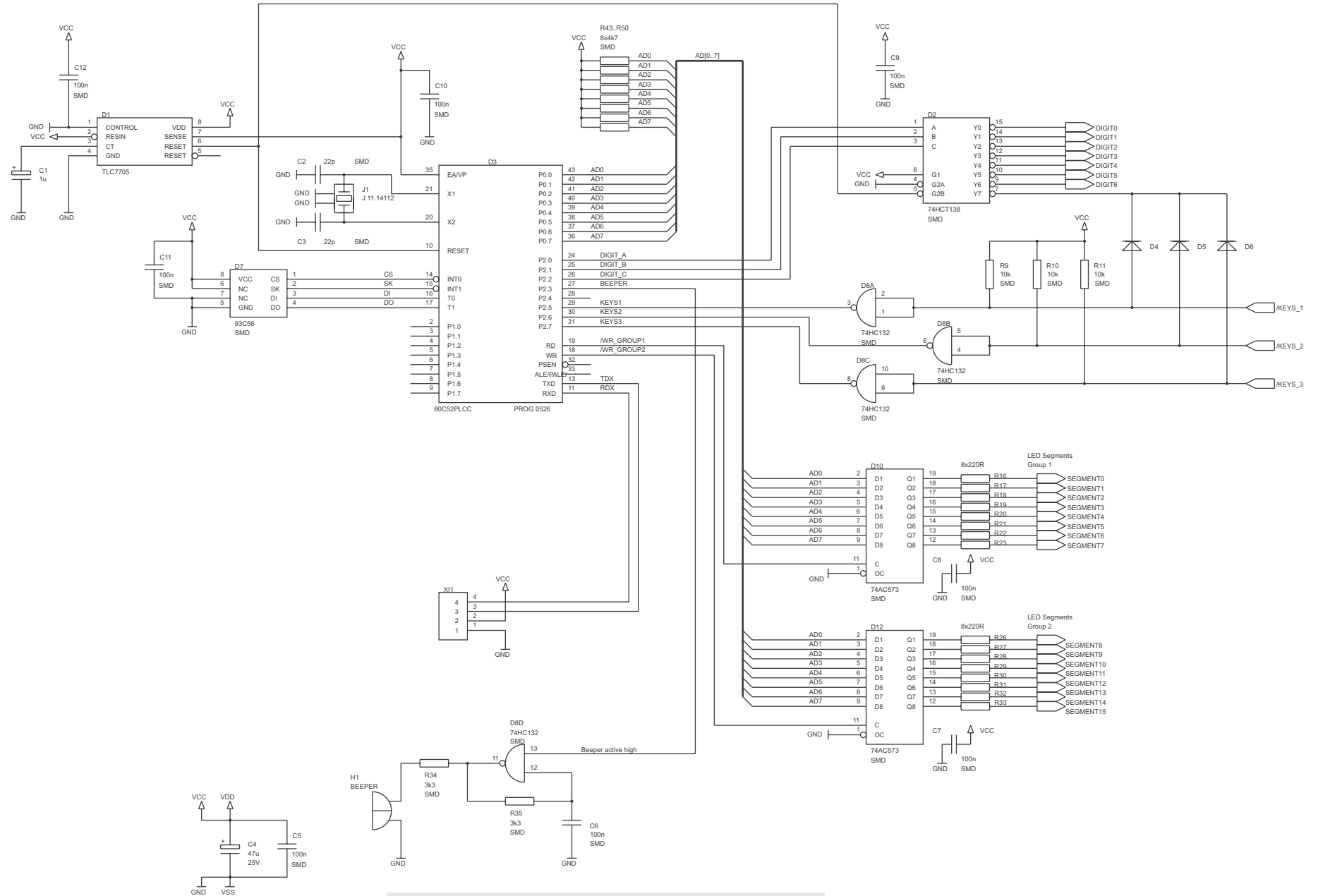
Line verification of HLMP 3mm

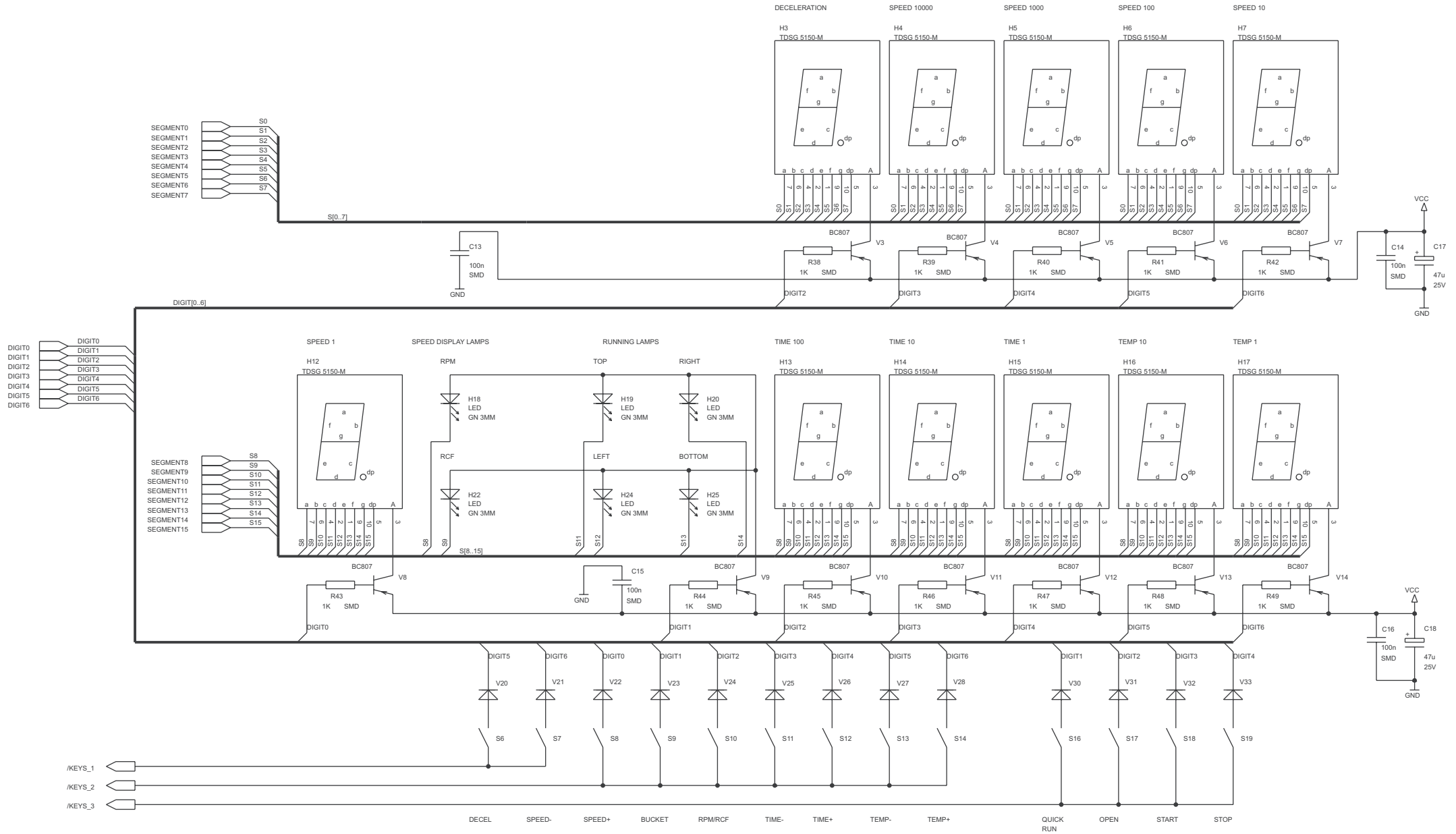


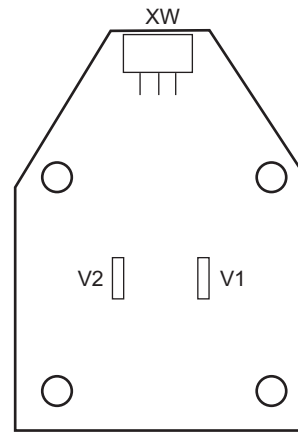
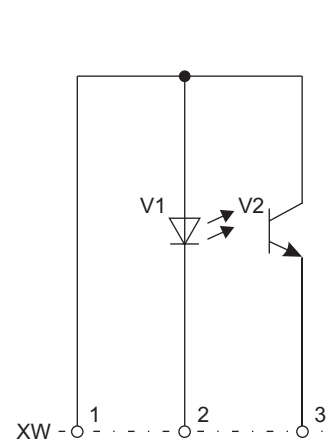
Top view TDSG 5150-M



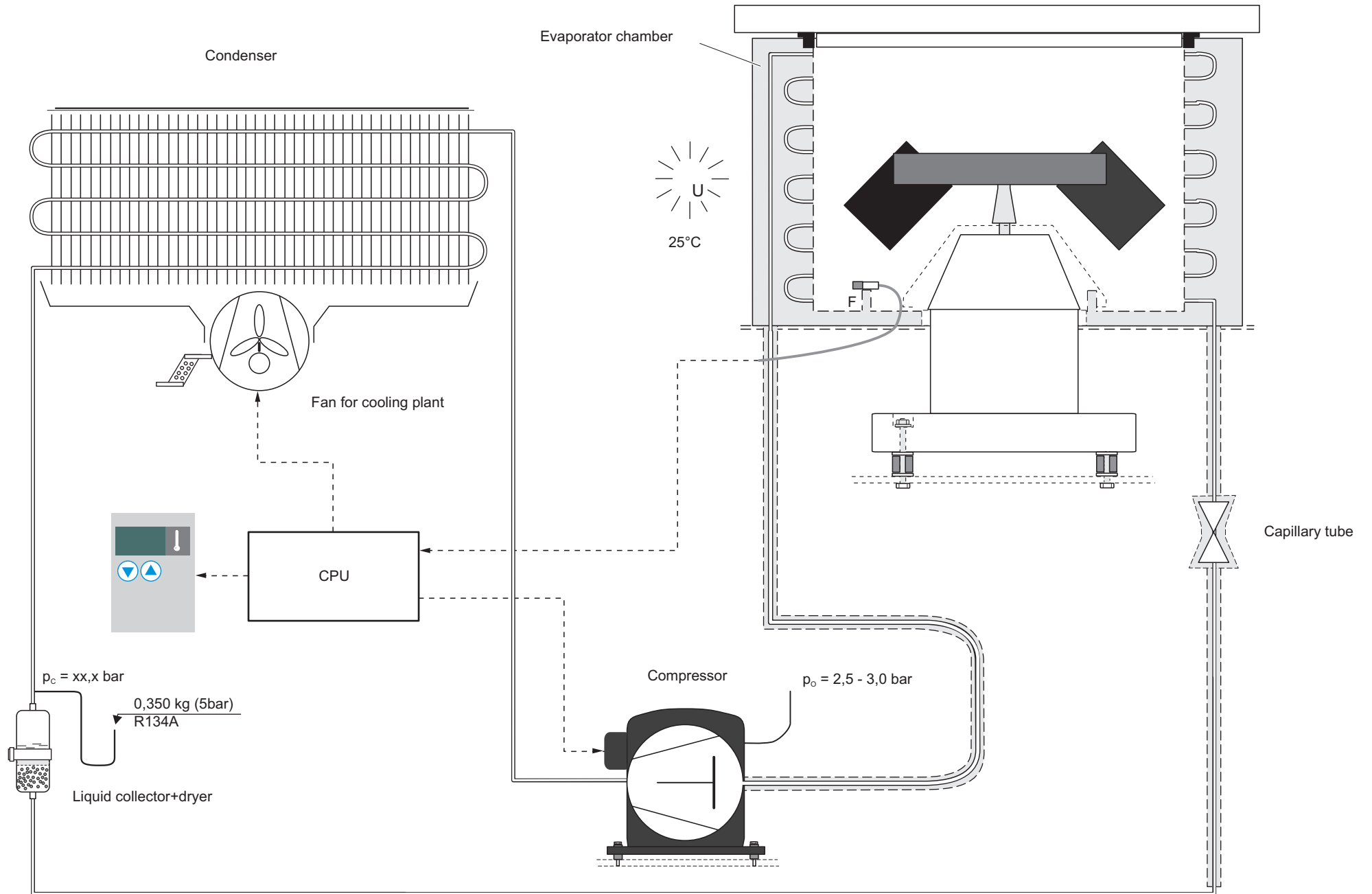








V2
NPN phototransistor



5 Disassembly of Instrument Parts

The index numbers stated in () reappear within the breakdown drawings and the spare part lists.

5.1 Dismantling the Housing

5.1.1 Front panel (201)

- Open the door and pull out the mains plug
- Remove the deposit (105)
- Unscrew the two Philips screws from the top and bottom of the front panel
- Grip the front panel's upper frame on both sides, pull forwards and depose it face down in front of unit
- Pull out plug **XI** and loosen the screen of the key and indication board
- Refitting the front panel is performed analogously in reverse order

5.1.2 Dismantling the Back Panel (101)

1. 120V models

- Open the door and pull out the mains plug
- Unscrew the cross-recessed screws (7x) from the rear panel
- Take off the rear panel and unplug the cable connection to the main board at mains terminal **L2** and **N**
- Unscrew the ground connection and put down the rear panel
- Refitting the rear panel is performed analogously in reverse order

2. 230V models

- Open the door and pull out the mains plug
- Unscrew the cross-recessed screws (7x) from the back panel
- Take off the back panel and pull the cable inlet and the mains cable downwards of the slot
- Unplug the ground connection and put down the back panel
- Refitting the back panel is performed analogously in reverse order

5.1.3 Dismantling the Lid (110)

- Open the door, pull out the mains plug and remove the rear panel (see 5.1.2)
- Unscrew 4 screws (114) from both hinges and remove screws and washers
- Push both bolts (116) carefully through the gas lid stay holder (117) from out to inner side
- Remove the door **ATTENTION!** For door replacement transfer both hinges (115), the locking bolt (120) and handle (123) onto the new lid. Screw will be reached after removing the blue handle part (123)
- Refitting the lid plate is performed analogously in reverse order

5.1.4 Dismantling the Housing (220)

- Open the door, pull out the mains plug and remove the front panel (see 5.1.1)
- Remove the back panel (see 5.1.2)
- Remove the door (see 5.1.3)
- Unscrew the lid lock device and depose it carefully
- Remove all fastening screws from the casing
- Remove all leads from the grounding connectors inside the front casing
- Lift the front casing upwards via the gas lid stay, at the same time pull the housing a little bit sideways
- Refitting the housing is performed analogously in reverse order

5.2 Replacing Sealing Components

5.2.1 *Replace the Door gasket (227)*

- Open the door, pull out the mains plug
- Remove the housing (see 5.1.4)
- Pull gasket from bowl
- When reassembling the gasket first push it on the bowl then put the housing in place and pull the gasket round the hole

5.2.2 *Replace the Rubber Flange*

- Open the door, pull out the mains plug
- Unscrew the rotor in direction of arrow by means of a 6mm socket wrench (318) and remove the rotor from collet chuck (319)
- Free lower rim of cover by pulling in towards the centre and upwards, working all the way round to remove it
- Before the installation of the new rubber flange can be performed it is necessary to glue an insulation inside the rubber flange. Clean the adhesion surface area with ISOPROPANOL.. The insulation (134) is one-sided self-adhesive, take off the protective foil and glue the insulation onto the rubber flange
- Refitting the rubber flange is performed analogously in reverse order

5.3 Replacing Mechanical Components

5.3.1 *Replace the latch assembly (230)*

The locking device with integrated lid switches is only available as one spare part set!

- Open the door, pull out the mains plug
- Remove the front panel (see 5.1.1)
- Disconnect **XC** leads for the lid solenoid and unplug **XA** for integrated lid switches and grounding wire
- Unscrew both upper screws (232) for the fixing claws (231); when doing hold the locking device (230) in place
- Depose locking device carefully
- Press the plastic stopper (133) out of the bottom plate, untie the release cord and pull it out of the guide eyes
- Transfer leads to the new locking device and refit the locking device in reverse order
- Adjust the lid lock assembly lateral in such a way that the snatch block (120) attached to the lid engages concentrically into its slot! Check proper function by opening and closing the door repeatedly
- Refitting is performed analogously in reverse order

5.3.2 *Replace the Gas Lid Stay*

- Open the door, pull out the mains plug
- Remove rear panel (see 5.1.2)
- Push joint bolt from outside to inside by a pin puncher trough the joint block
- Loosen the screws for the lower joint block (303) and remove the screws with nuts and lock washers
- Take the gas lid stay out to the back
- Knock carefully the joint bolt (116) out of the joint block 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 worn out gas lid stay and reinstall the new gas lid stay analogously in reverse order and remount the unit completely

5.3.3 *Replace the Device Feet (326)*

- The rear feet can easily be removed after removing of the rear panel
- The front feet on the left side can be replaced after removing of the front panel. For replacing the right and the middle feet on the front side it is necessary to remove the housing and unscrew the fastening screw of condenser and fan.
- Reassemble the device analogously in reverse order

5.4 Replacing Electrical Components

5.4.1 Replace fuses (241) on main board

- Open the door, pull out the mains plug
- Remove front panel (see 5.1.1)
- Check the fuses and if necessary replace them by equivalent and undamaged parts
- Perform a test run and search for blowing cause
- Reassemble the device analogously in reverse order

5.4.2 Replace NV-RAM (243) on the Main Board

- Notice old displayed identification and version numbers of CPU and NV-RAM when powering on (2./3. No. in sequence)
- Open the door, pull out the mains plug and remove the front panel (see 5.1.1)
- **ATTENTION - CMOS components! Discharge your body before handling!** Pull NV-RAM carefully out of socket using chip removal tool
- Reinsert the new IC's correctly
- Reassemble the device analogously in reverse order and check the displayed NV-RAM's version number
- **Note!** A new NV-RAM version will include parameter changes (e.g. new rotor type or any speed limitations etc.) which can be verified in the display

5.4.3 Replace Microcontroller (242) on the Main Board

- Notice old displayed identification and version number of CPU when powering on (2. No. in sequence)
- Open the door, pull out the mains plug and remove the front panel (see 5.1.1)
- **ATTENTION - CMOS components! Discharge your body before handling!** Pull NV-RAM carefully out of socket using chip removal tool
- Reinsert the new IC correctly
- Reassemble the device analogously in reverse order and check the displayed Controller's version number
- **Note!** A new Controller version will include program changes (e.g. modifications of control functions) which might be verified only by measuring performances

5.4.4 Replace the Main Board (240)

- Open the door, pull out the mains plug and remove the front panel (see 5.1.1)
- Disconnect all terminal connections as: mains supply XN, fans XK, lid solenoid XC, brake resistor XD, compressor XG and over temperature switch XB
- Pull out all plug: ground conductor **PE**, imbalance sensor **XE**, lid switches **XA**, motor **XM**, speed detection **XW** and indication board **XI**
- Unscrew all fastening nuts of the main board, remove the washers, loosen the screening and subsequently the board
- **ATTENTION - CMOS components! Discharge your body before handling!** Take the CPU (242) and NV-RAM (243) out of box (or re-use the old but trouble-free components) and insert them into the empty sockets of the new main board
- Mount the new board onto the spacer screws, replace the washers and retighten all nuts
- **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)!

5.4.5 Replace the Key and Indication Board (210)

- Open the door, pull out the mains plug and remove the front panel (see 5.1.1)
- Unscrew all fastening screws (211) of the key and indication board and remove all washers and the board itself
- Reassemble the new key and indication board in reverse order
- Reconnect plug **XI** and perform a test run

5.4.6 Replace the Speed Detection Board (210)

- Open the door, pull out the mains plug and remove the motor (see 5.5.1)
- Mark board position, unscrew 4 Philips screws and remove them together with washers
- 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)!

5.4.7 Replace the Brake Resistor (330)

- Open the door, pull out the mains plug and remove the rear panel (see 5.1.2)
- Remove screw from outer bracket (331) and pull the brake resistor off the inner angle fitting
- Remove the brake resistor, unscrew the leads and transfer it to the new brake resistor
- Reassemble the new brake resistor in reverse order and perform a test run

5.4.8 Replace the Temperature Sensor (370)

- Open the door, pull out the mains plug and remove the front panel (see 5.1.1)
- Loosen the rotor and remove it
- Pull out plug **XU**, loosen the screening and the clamp at the cable
- Unscrew the lid lock and dispose it carefully (see 5.3.1)
- Loosen the chassis complete with the main board and turn it to side
- Unscrew the screwing for the insulation pass through (375) underneath the chamber
- Loosen the screw (373) for the clamp (371) at the temperature sensor (370) in the chamber
- Press insulation pass through out in upwards direction and pull it together with the sensor out of the chamber
- Reassemble the new temperature sensor in reverse order, the insulation pass through must be sealed with silicone adhesive in the chamber hole
- Perform a test run with temperature measuring

5.4.9 Replace the Mains Cable (340) and Switch (140)

1. 120V models

- Open the door, pull out the mains plug and remove the back panel (see 5.1.2)
- Disconnect mains cable from mains terminal **L1, N** and ground wire **PE**
- Loosen the screws at the cable clamp and pull out the mains cable
- Switch: Mark the connecting leads before unplugging them and press the defective switch (140) out of the casing
- Reassemble the device in reverse order and perform a test run^

2. 230V models

- Open the door, pull out the mains plug and remove the front panel and the back panel (see 5.1.1 and 5.1.2)
- Disconnect mains cable from terminal **XN** and ground wire **PE**
- Set the leads free and loosen the screw for the cable clamp
- Tie a string to the mains cable to allow easier installation of the new cord
- Remove the defective cable
- Connect and fasten the new cable in reverse order
- Reassemble the device in reverse order and perform a test run

5.5 Replacing Drive Components

5.5.1 Replace the motor (310)

- Open the door, pull out the mains plug and remove the front panel (see 5.1.1)
- Remove the rubber flange (see 5.1.5)
- Disconnect the leads for motor **XM**, over temperature switch **XB** and from the grounding connector and **PE**
- Tie a string to the lead to allow easier handling of the new motor
- Unscrew the 3 M6 nuts (311) with a 10mm socket wrench and remove them together with the washers (312)
- Take out the motor to the top – watch the string
- Disconnect the plug **XW** on the speed detection board and remove the motor out of the bowl
- For motor replacement transfer the speed detection board (320) to new motor (see 5.4.6)
- Reassemble the motor analogously in reverse order and fasten the 3 M6 nuts using a torque key (adjustment: 10Nm)
- 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)!

5.5.2 Replace the Motor supports (314)

ATTENTION!

All 3 rubber supports (314) have to be replaced at the same time and at least every three years! The 6 double-sided sandpaper washer have be exchanged as well. We recommend a yearly change. A maintenance kit is available.

- Open the door, pull out the mains plug and remove the drive motor (see 5.5.1)
- Tilt the device onto its side (on a towel)
- Unscrew 3 hexagon head screws (316) and replace all three anti-vibration mounts as well as the 6 sandpaper washers
- Fasten the new motor supports evenly (use a torque wrench: 10 Nm) and secure the nuts with screw locking lac
- 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)!

5.6 Fans

5.6.1 Replace the electronic fan (260)

The fan (260) has the task to cool the FET on main board. For proper working the air must be sucked into the unit's casing.

- Open the door, pull out the mains plug and remove the front panel (see 5.1.1)
- Remove the housing (see 5.1.4)
- Remove the fan wires from terminal **XH**
- Unscrew the fan from chassis and remove it
- Connect lead to new fan and put the fan in place. **Pay attention to air flow direction (imprinted arrow)**
- Remove feritte core and transfer it to the new fan
- Reassemble the device in reverse order and perform a test run

5.6.2 Replace the motor fan (341)

- Open the door, pull out the mains plug and remove the front panel (see 5.1.1)
- Remove the fan wires from terminal **XH**
- Unscrew the lid lock and dispose it carefully (see 5.3.1)
- Loosen the chassis complete with the main board and turn it to side
- Unscrew the 2 fastening screws (343) and remove them together with the washers
- Remove the fan, disconnect the earth wire and transfer it to the new fan
- Reassemble the device in reverse order

5.6.3 Replace the condenser fan

The condenser fan is made of the motor (414) and the fan wing (415)

- Open the door, pull out the mains plug and remove the housing (see 5.1.4)
- Unplug the leads of the condenser fan at the start relay (terminal **10 & 14**) in the terminal box and loosen the earth wire at the front plate
- Unscrew the 2 fastening screws of the bracket together with the locking rings and washers
- Unscrew the fastening screws of the condenser and turn the condenser to front side
- Remove the condenser fan together with the bracket to the side
- Transfer the bracket to the new motor (414) and install the (new) fan wing(415)
- Reassemble the device in reverse order and perform a test run

5.7 Imbalance switch

5.7.1 Replace the imbalance switch

The imbalance switch assembly consists of a contact plate (323), the rubber mounts (360) with bracket (350) and adjustable screw. The contact plate is isolated screw to the motor by using isolated spacers and washers. The bracket (350) with the adjustable screw is isolated mounted with rubber mounts (360) on the ground plate. The bracket and contact plate are connected each with 2 wires for detection of a broken imbalance signal line.

- Open the door, pull out the mains plug and remove the back panel and the rubber flange (see 5.1.1 and 5.1.5)
- Unplug the connectors at the contact plate and the bracket. After unscrew the mounting screws at the contact plate or the nuts at the bracket the single part of the switch assembly can removed to upside or back side
- Reassemble the device in reverse order and perform a test run

5.7.2 Adjustment of Imbalance Switch

The imbalance switch has the task to switch off the centrifuge by incorrect loading of the rotor before reaching the normal speed. The imbalance detector is a vibrating contact (kind of mechanical distance switch) and reacts by its resonance frequency at app. 1400 rpm during acceleration. The amplitude of the oscillation depends on weight and position of imbalance, rotor mass and damping property of the drive. For this reason no single weight can be specified to adjust the imbalance switch.

Tools and accessories:

Swing-out rotor #3450 with 4 buckets #3451/3452
Ohmmeter

Procedure:

- Remove plug XE from main board
- Connect Ohmmeter to plug **XE** of the imbalance switch
- Turn in the adjustment screw of the imbalance distance switch so far that the Ohmmeter starts to respond
- Then turn back the screw for 1 revolution
- Unplug the Ohmmeter from plug **XE**
- Reinsert plugs **XE** at the main board

5.7.3 Test Run Performance

- **Install** in table available **rotor(s)** in unloaded condition

Rotor / Bucket	Run through weight	Cut off weight
75003451 with 75003452	approx. 10g	approx. 50g

- Insert rotor dependent **cut-off weights** and position them at angles of 90° to each other, the centrifuge must stop 4 times indicating "bAL" message - in case of false correct the adjustment of the imbalance switch. Insert the **admissible imbalance weights** in the same manner, the centrifuge must run through 4 times to maximum rotor speed - in case of false correct the adjustment of the imbalance switch.

5.8 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, 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 4-13:

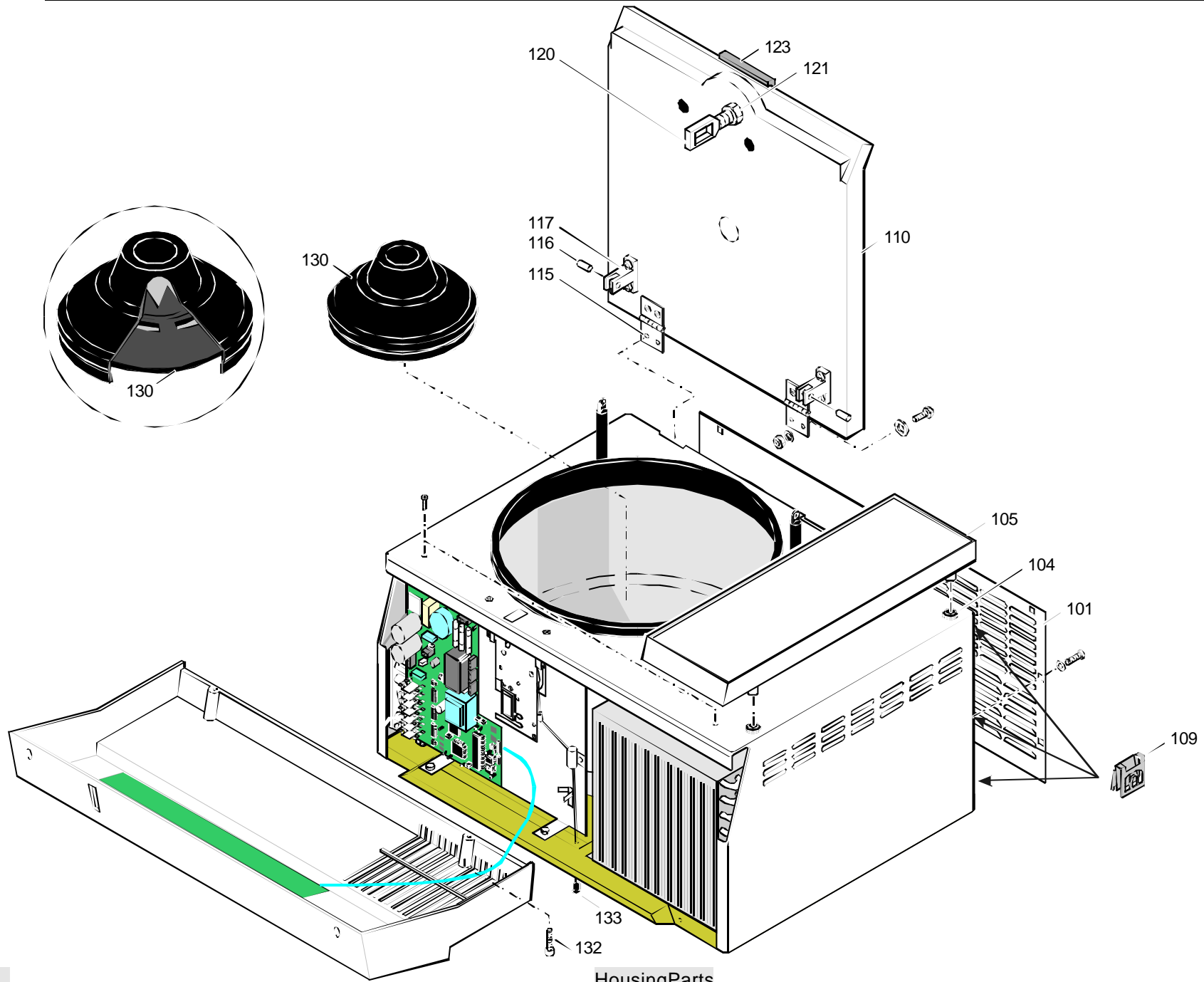
Pressure / temperature ranges are valid for continuous cooling at max. speed, ($\vartheta_U = 25^\circ\text{C}$)! Procedure for replacing defective components of the cooling cycle:

- Dismantle the casing -see 5.1.1 and mount pierce valves onto the service lines
- When gauging too little static pressure perform a leakage test (N₂ max. 25bars)
- Discharge the refrigerant with suction device into recycling bottle
- In case of compressor (400) fault, let the oil run out into a bowl to recycle it
- Unsolder defective component(s) and replace the dryer/collector assy (403), 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, re-solder the service lines tight after finishing work)
- Reassemble the device and perform a cooling power test run

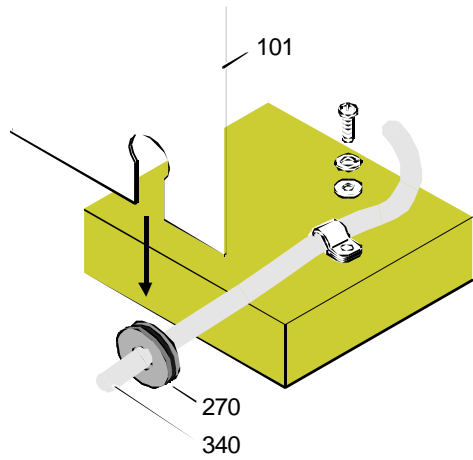
Charging information 120V/230V version

Refrigerant: R 134a
Amount: 350 grams

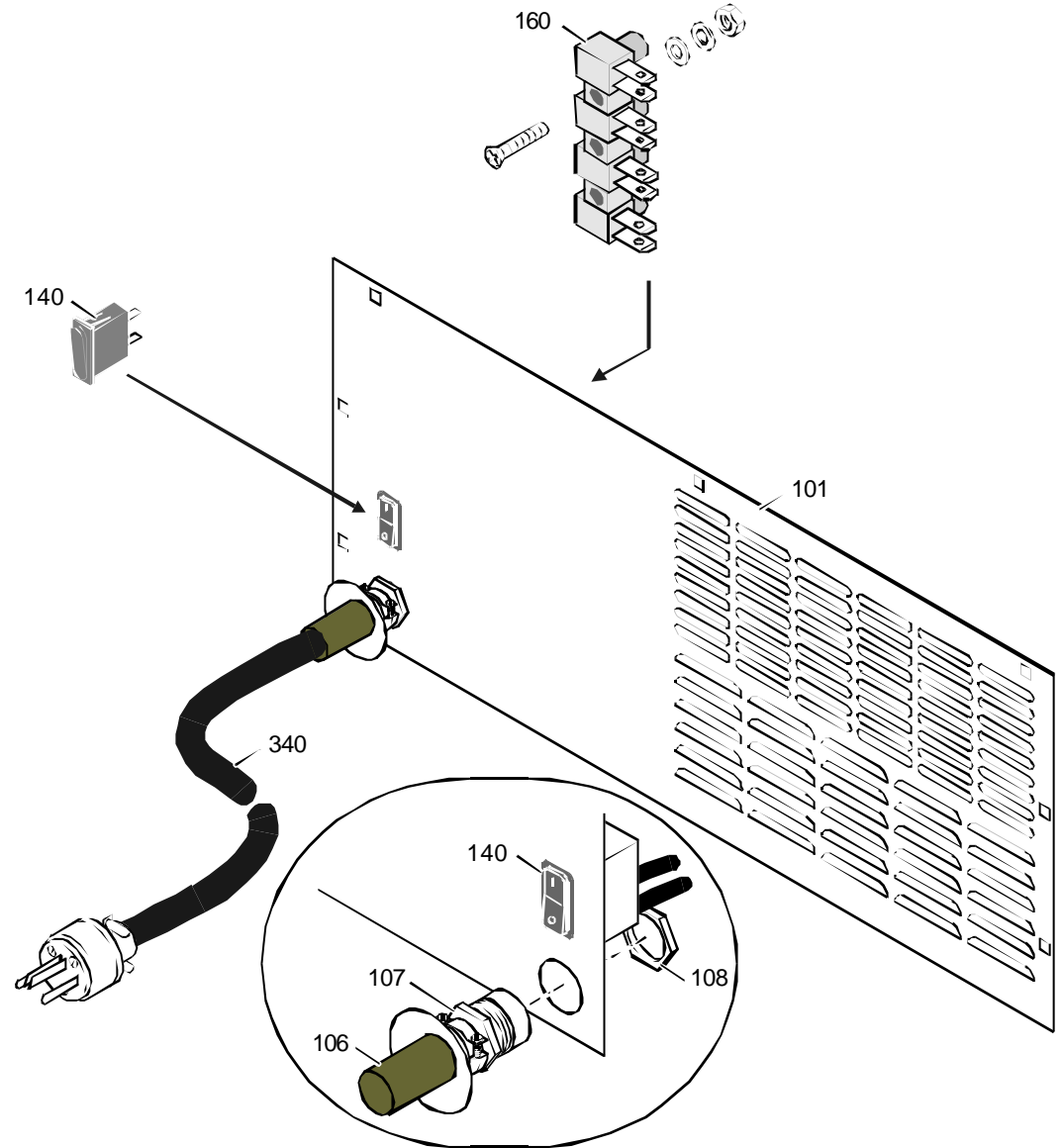
Operating pressure with rotor #3450 / buckets #3451
Speed: 4000 rpm
Ambient: 25 °C
Time: 3 hours
Suction: about 2,5 – 3,0 bars

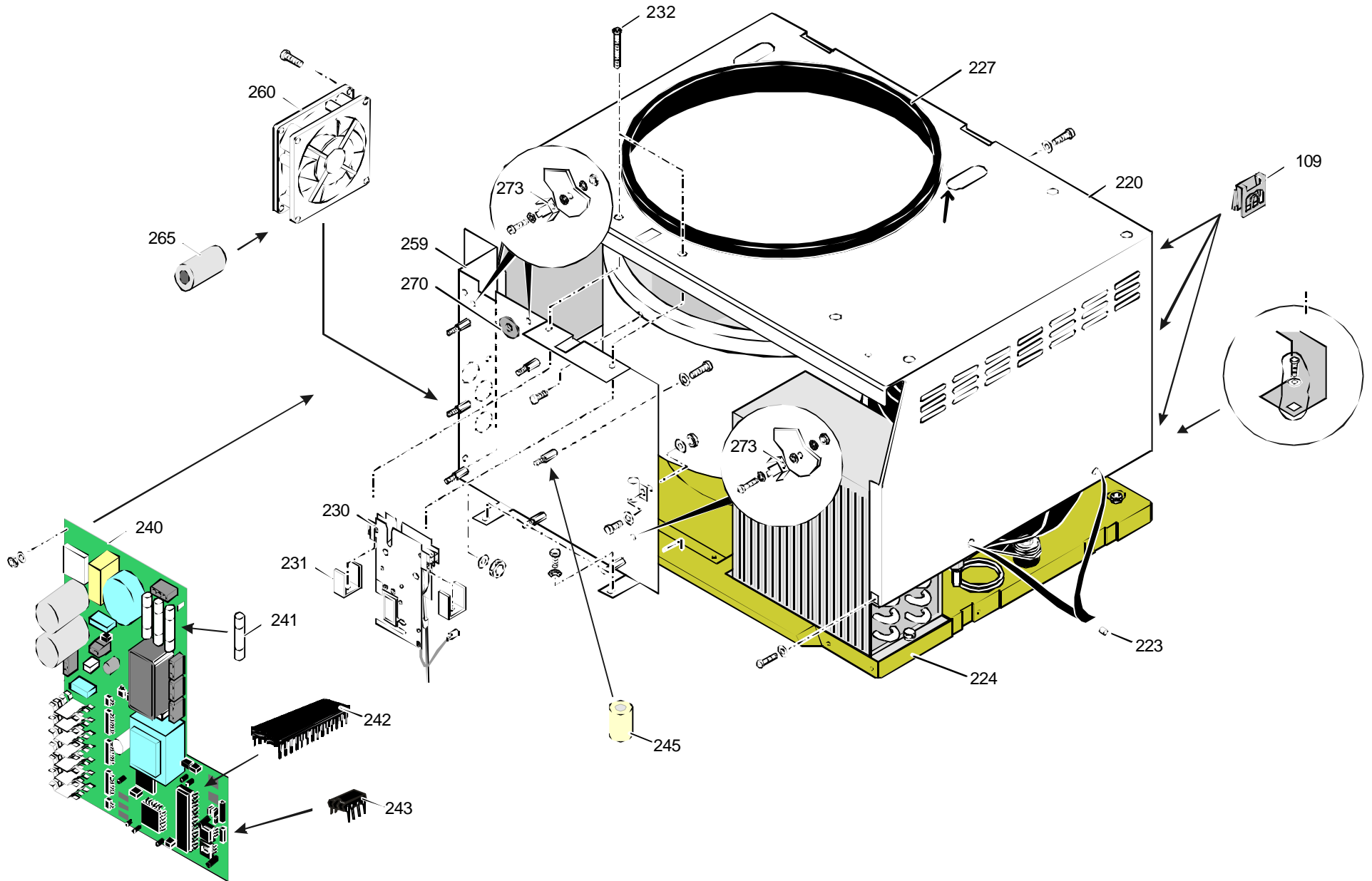


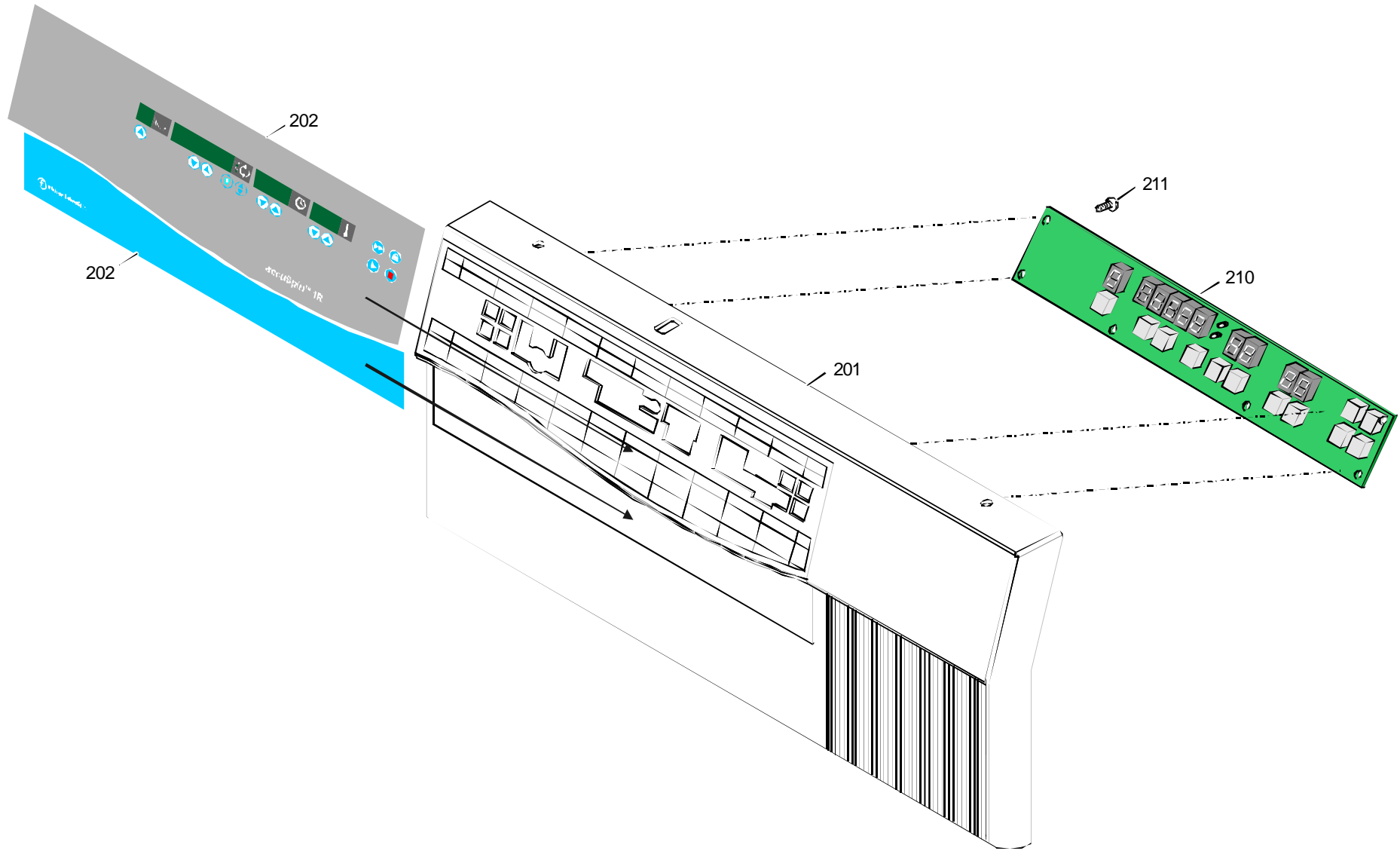
Mains input230Vunits

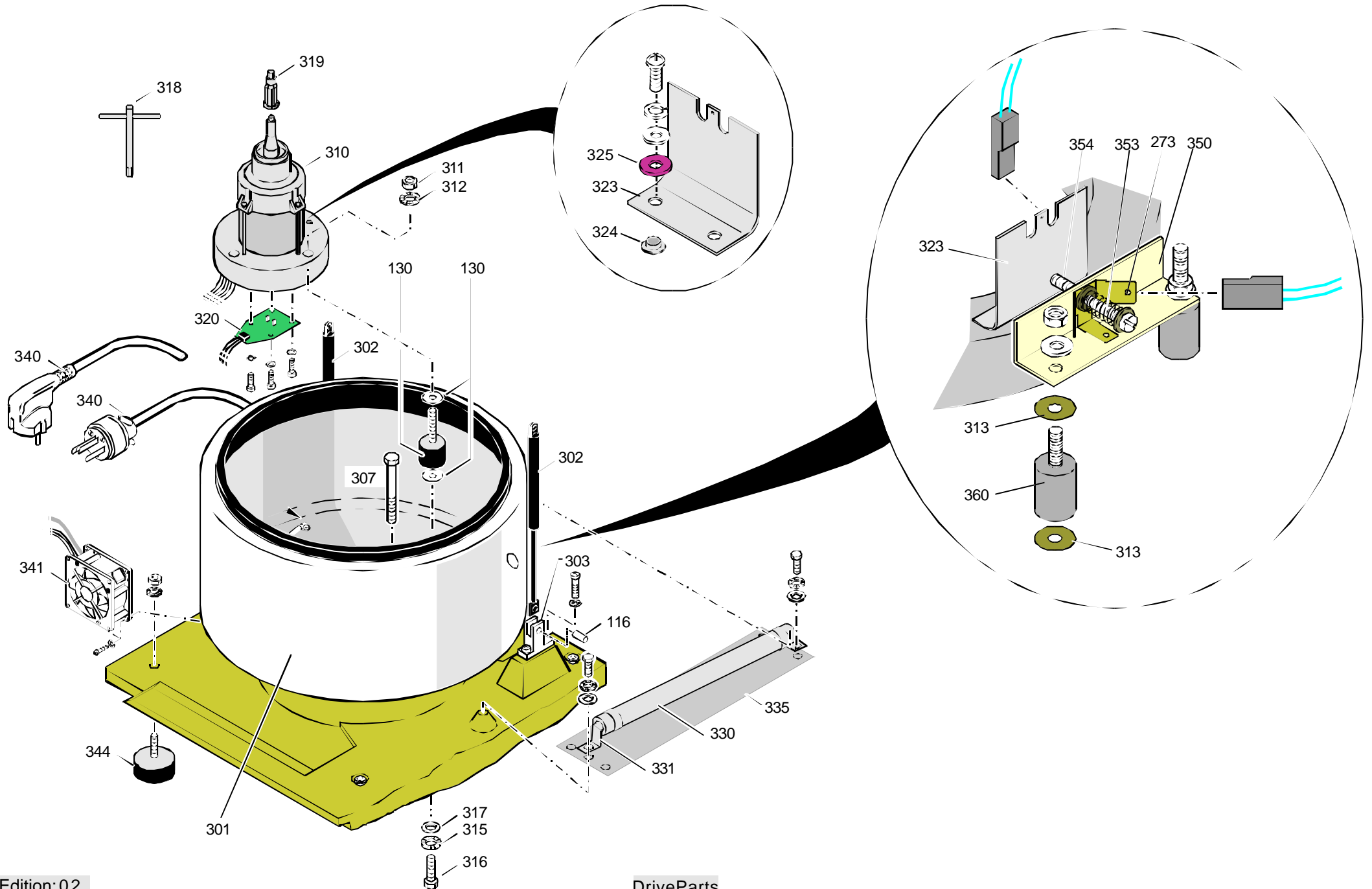


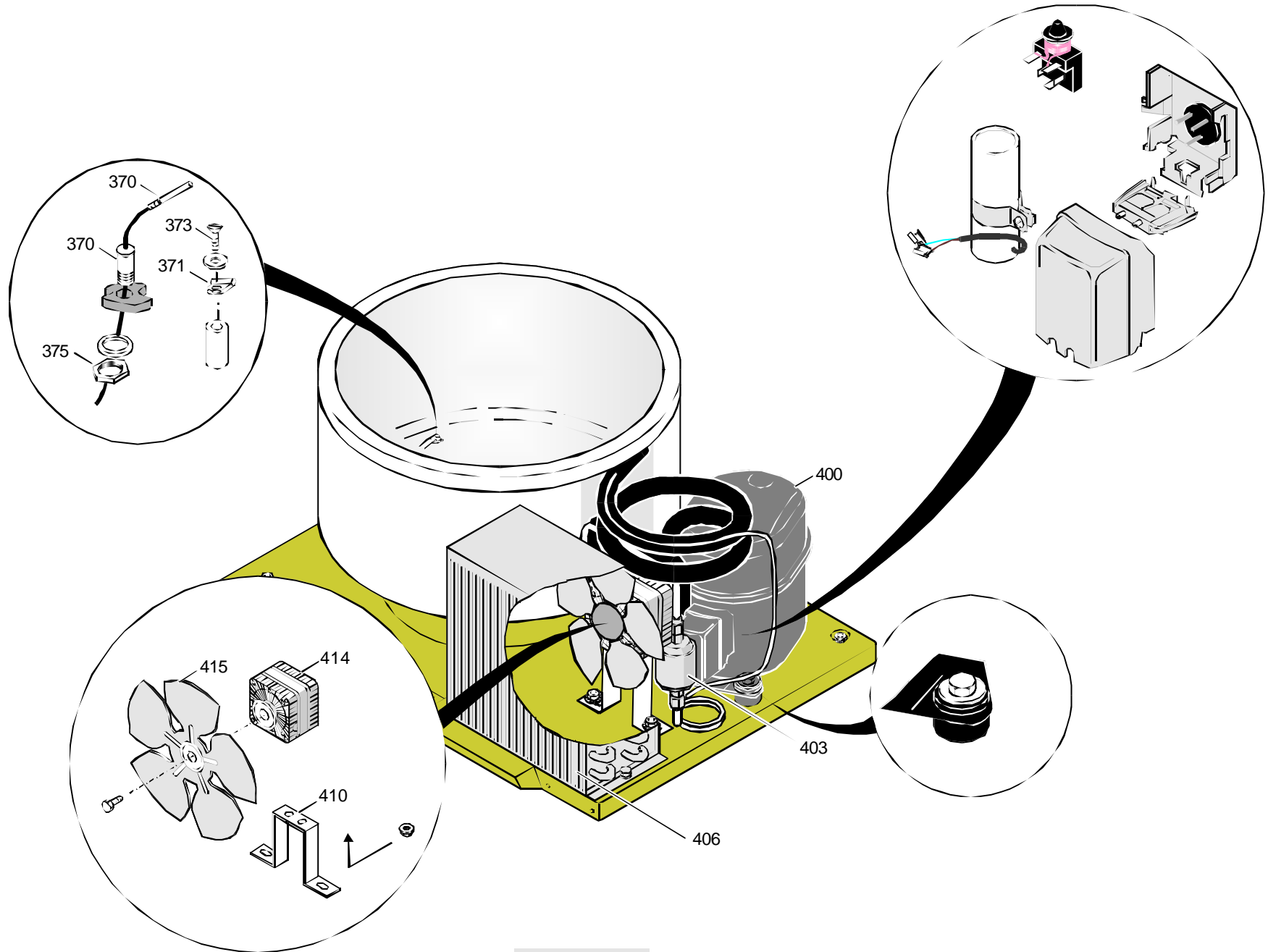
Mains input120Vunits











Spare-Part-List**Kendro Laboratory Products**

Plant Osterode

75003449.01**FISHER ACCUSPIN 1R 120V / 60 HZ**

from Serial-No.

to Serial-No.

Index	Partno.	Text
00101	70022666	BACK PANEL
00104	20290187	CABLE ENTRY
00105	20022401	DEPOSITE
00106	20290320	CABLE ENTRY
00107	20220107	CORD GRIP
00108	20220106	NUT
00109	20420026	NUT
00110	20002695	LID WITH WINDOW
00115	20052364	HINGE
00116	20490287	PIN
00117	20023748	HINGE BRACKET
00120	20052842	LID HOOK
00121	20420151	NUT M10 X 1.25
00123	70060554	Handle
00130	70904577	Parts f maintenance Megafuge 1.0R/2.0R
00132	20510052	SCREW M4 X 10
00133	20310316	CLIP
00133	20310316	CLIP
00134	70904577	Parts f maintenance Megafuge 1.0R/2.0R
00140	20180589	SWITCH
00160	20220490	TERMINAL CLAMP
00201	20058191	Frontpanel
00202	20058204	R OVERLAY Mega 1.0 R FISHER
00210	20150227	PCB Display
00211	20460137	Z SCREW 3X8
00215	70902555	WIRING
00220	70055370	HOUSING
00223	20310264	CAP
00224	20022578	R BOTTOM PLATE Mega1.0/2.0R, AccuSpin1.0
00227	20290516	SEAL
00230	70003724	LID LOCK
00231	70022477	FIXING CLAMP
00232	20440306	SCREW M5X40
00240	20151092	Mainboard 120V
00241	20230172	FUSE 15 A
00242	70000498	PROCESSOR
00243	70904599	NV RAM accuSpin 1R
00259	70055369	FRONTPANEL

Spare-Part-List

Kendro Laboratory Products

Plant Osterode

75003449.01

FISHER ACCUSPIN 1R 120V / 60 HZ

from Serial-No.

to Serial-No.

Index	Partno.	Text
00260	20210341	FAN
00265	20170330	FERROXCUBE
00270	20290534	NOZZLE
00273	20180138	CONNECTOR
00301	70904031	EVAPORATOR
00302	20310309	GAS LID STAY
00303	20023748	HINGE BRACKET
00310	20210332	MOTOR red Leakage current
00311	20420070	NUT M 6
00312	20480251	SECURING WASHER
00313	70904577	Parts f maintenance Megafuge 1.0R/2.0R
00314	70904577	Parts f maintenance Megafuge 1.0R/2.0R
00315	70904577	Parts f maintenance Megafuge 1.0R/2.0R
00316	20430220	SCREW M6X25
00317	20480193	WASHER
00318	20360047	BOX SPANNER
00319	70003100	COLLET CHUCK
00320	20151028	Speed detection JST
00323	70022632	BRACKET
00324	20250071	WASHER
00325	20220484	SPACER
00330	20160685	RESISTOR 150R 150W
00331	20220483	ANGLE
00335	70038969	INSULATING SHEET
00340	70002287	POWER SUPPLY CABLE
00341	20210325	FAN
00344	20300059	FOOT
00350	70023955	BRACKEL
00353	20028940	SPRING
00354	20470081	SCREW M4 X 30
00360	20020732	ANTI VIBRATION MOUNT
00370	70062547	Temperature sensor
00371	20220286	GRIP 6,5
00373	20440309	SCREW M4 X 35
00375	20220100	NUT PG 9
00400	20240465	COMPRESSOR
00403	20240453	FILTERDRYER
00406	20022579	CONDENSOR

Spare-Part-List**Kendro Laboratory Products**

Plant Osterode

75003449.01**FISHER ACCUSPIN 1R 120V / 60 HZ**

from Serial-No.

to Serial-No.

Index**Partno.****Text**

00410

20210377

ANGLE

00414

20210376

FAN

Spare-Part-List**Kendro Laboratory Products**

Plant Osterode

75003447.01**FISHER ACCUSPIN 1R, 230 V**

from Serial-No.

to Serial-No.

Index	Partno.	Text
00101	70022666	BACK PANEL
00104	20290187	CABLE ENTRY
00105	20022401	DEPOSITE
00106	20290320	CABLE ENTRY
00107	20220107	CORD GRIP
00108	20220106	NUT
00109	20420026	NUT
00110	20002695	LID WITH WINDOW
00115	20052364	HINGE
00116	20490287	PIN
00117	20023748	HINGE BRACKET
00120	20052842	LID HOOK
00121	20420151	NUT M10 X 1.25
00123	70060554	Handle
00130	70904577	Parts f maintenance Megafuge 1.0R/2.0R
00132	20510052	SCREW M4 X 10
00133	20310316	CLIP
00134	70904577	Parts f maintenance Megafuge 1.0R/2.0R
00140	20180589	SWITCH
00160	20220490	TERMINAL CLAMP
00201	20058191	Frontpanel
00202	20058204	R OVERLAY Mega 1.0 R FISHER
00210	20150227	PCB Display
00211	20460137	SCREW 3X8
00220	70055370	HOUSING
00223	20310264	CAP
00224	20022578	R BOTTOM PLATE Mega1.0/2.0R, AccuSpin1.0
00227	20290516	SEAL
00230	70003700	LID LOCK ASSY
00231	70022477	FIXING CLAMP
00232	20440306	SCREW M5X40
00240	20151091	Mainboard
00241	20230122	FUSE 16 AT
00242	70000498	PROCESSOR
00243	70904599	NV RAM accuSpin 1R
00259	70055369	FRONTPANEL
00260	20210340	FAN
00265	20170330	FERROXCUBE

Spare-Part-List

Kendro Laboratory Products

Plant Osterode

75003447.01

FISHER ACCUSPIN 1R, 230 V

from Serial-No.

to Serial-No.

Index	Partno.	Text
00270	20290534	NOZZLE
00273	20180138	CONNECTOR
00301	70904031	EVAPORATOR
00302	20310309	GAS LID STAY
00303	20023748	HINGE BRACKET
00310	20210353	MOTOR
00311	20420070	NUT M 6
00312	20480251	SECURING WASHER
00313	70904577	Parts f maintenance Megafuge 1.0R/2.0R
00314	70904577	Parts f maintenance Megafuge 1.0R/2.0R
00315	70904577	Parts f maintenance Megafuge 1.0R/2.0R
00316	20430220	SCREW M6X25
00317	20480193	WASHER
00318	20360047	BOX SPANNER
00319	70003100	COLLET CHUCK
00320	20151028	Speed detection JST
00323	70022632	BRACKET
00324	20250071	WASHER
00325	20220484	SPACER
00330	20160685	RESISTOR 150R 150W
00331	20220483	ANGLE
00335	70038969	INSULATING SHEET
00340	20190169	MAINS CABLE
00341	20210285	FAN
00344	20300059	FOOT
00350	70023955	BRACKEL
00353	20028940	SPRING
00354	20470081	SCREW M4 X 30
00360	20020732	ANTI VIBRATION MOUNT
00370	70062547	Temperature sensor
00371	20220286	GRIP 6,5
00373	20440309	SCREW M4 X 35
00375	20220100	NUT PG 9
00400	20240464	A COMPRESSOR
00403	20240453	FILTERDRYER
00406	20022579	CONDENSOR
00410	20210377	ANGLE
00414	20210375	FANMOTOR

Spare-Part-List**Kendro Laboratory Products**

Plant Osterode

75003447.01**FISHER ACCUSPIN 1R, 230 V**

from Serial-No.

to Serial-No.

Index**Partno.****Text**

00415

20210308

FAN BLADE

Fisher Centrifuges

PREVENTIVE MAINTENANCE CHECKLIST

accuSpinä 1R
Type
S/N

Rotor Inspection

- Check for corrosion and wear
- Inspect rotor lid locking screw
- Serial numbers:
 - 75003450 _____
 - 75003454 _____
 - 75003455 _____

Preliminary Checks

- Rotor chamber (defrost)
- Inst. Environment (level & clearance)
- Clean instrument & condense

Pre-run Checks

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

Mechanical

- Motor bearings
- Refrigerant leaks

Performance Checks

- Acceleration time _____ seconds
- Instrument top speed _____ rpm
- Deceleration time _____ seconds
- Time (10 minute set) ____ actual min:sec
- Temperature (2°C set) _____ actual (°C)

Imbalance

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

Safety Test

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

Comments:

S.R. Signature _____
Date of Service _____

Calibration Certification Procedure accuSpin™ 1R

Revised - 11/11/2003

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 the specifications.

2. Equipment Required

- Digital Multimeter
- Temperature Meter w/probe
- Stopwatch
- Photo Tachometer
- Safety Tester
- accuSpin™ 1R 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 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 (or wanted) 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

accuSpin™ 1R

- **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.



Fisher Scientific

Calibration Certification

accuSpinä
1R
Page 1

Preventive Maintenance Checklist Complete

Repair and Calibration Recertification

Account Name:

Account Address:

Instrument Model:

Serial Number:

Report Number:

Date:

Performance Certification

SPEED

Standard Test			Rotor Used:			
Set Speed (rpm)	Tolerance	Displayed Speed (rpm)	Measured Speed (rpm)	Meets Spec. (y/n)		Passed (Initials)
3000	+/-5%					
15000	+/-5%					
Custom Test			Rotor Used:			
	+/-5%					
	+/-5%					

TEMPERATURE

Standard Test			Rotor Used:			
Calibration Temp. (°C)	Tolerance (K)	Displayed Temp. (°C)	Measured Temp. (°C)	Meets Spec. (y/n)		Passed (Initials)
+2	+/- 2					
+20	+/- 2					
Custom Test			Rotor Used:			
	+/- 2					
	+/- 2					
	+/- 2					

TIME

Standard Test		Rotor Used:			
Timer Set (min.)	Tolerance (sec.)	Measured Time (m/s)	Meets Spec. (y/n)		Passed (Initials)
10	+/- 30				
Custom Test		Rotor Used:			
	+/- 30				
	+/- 30				
	+/- 30				

TEST EQUIPMENT

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

SAFETY TEST

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

Revised 15/04/03

Certified By: _____ Reviewed By: _____ Expiration Date _____

Signature

Date

Customer Signature

Date