



Refrigerator
KE 360-1-2T
KE 370-1-2T

Service Manual: H8-T8-01

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Contents

1. Safety instructions	4
2. Repair instructions	5
3. KE 360-1-2	
Refrigerator/freezer combination	
with or without fan in the refrigeration compartment	6
3.1 Operating panel	6
3.2 Refrigeration system	6
3.2.1 Purpose of the control	6
3.2.2 Input parameters	6
3.2.3 Controlled outputs	6
3.3 Function	7
3.3.1 Defrosting	7
3.3.2 Function of the fan	7
3.3.3 Function intensive freezing (super)	7
3.3.4 Alarm	7
3.4 Function during faults	8
3.5 Table of time and temperature constants	9
3.6 Measuring points	9
3.6.1 NTC sensors	9
3.6.2 Table of the resistors of the NTC sensors	10
4. KE 370-1-2T	
Refrigerator/freezer combination with 3-way valve	11
4.1 Operating panel	11
4.2 Refrigeration system	12
4.2.1 Purpose of the control	12
4.2.2 Input parameters	12
4.2.3 Controlled outputs	12
4.3 Function	13
4.3.1 Defrosting	13
4.3.2 Function of the fan	13
4.4 Special functions	13
4.4.1 Intensive freezing (super)	13
4.4.2 Intensive refrigeration	13
4.4.3 Economy programme	13
4.4.4 Holiday programme	13
4.4.5 Rapid cooling of drinks in the freezer	14
4.4.6 Child protection	14
4.5 Alarms	14
4.6 Function during faults	14
4.7 Test programme	15
4.8 Table of time and temperature constants	16
4.9 Measuring points	17
4.9.1 Operating module	17
4.9.2 NTC sensors	17
4.9.3 Table of the resistors of the NTC sensors	18
5. Switch diagrams	19
5.1 KE 360-1-2T	19
5.2 KE 370-1-2T	20

1. Safety instructions



Danger!

Repairs may only be carried out by a qualified electrician!

Improper repairs can be extremely dangerous for the user.

It is essential that you observe the following instructions in order to prevent electric shocks:

- The casing and the frame may be live in the event of faults!
- Touching live components inside the appliance may cause dangerous currents to flow through your body!
- Disconnect the appliance from the mains prior to carrying out any repair work!
- When inspecting live parts, a residual current circuit breaker must always be used!
- Always ensure that an earthed conductor is properly connected! The ground wire resistance must not exceed that specified in the standard! It is of vital importance for ensuring the safety of people and the functioning of the appliance.
- On completion of repairs, an inspection must be carried out in accordance with VDE 0701 [Association of German Electrical Engineers] or the corresponding regulations for your country!
- Do not touch any of the components in the appliance. The modules are also live!
- Observe instructions on electrostatic hazards!
- Wear safety goggles and protective gloves when handling refrigerants. Rinse your eyes with a lot of water if refrigerant splashes into them.



Attention!

Make sure you observe the following instructions:

- The appliances must be disconnected from the mains prior to all repairs. If inspections must be carried out on live appliances, make sure you use a residual current operated device.



Sharp edges: Use protective gloves.



Components may be electrostatic!
Observe handling precautions!

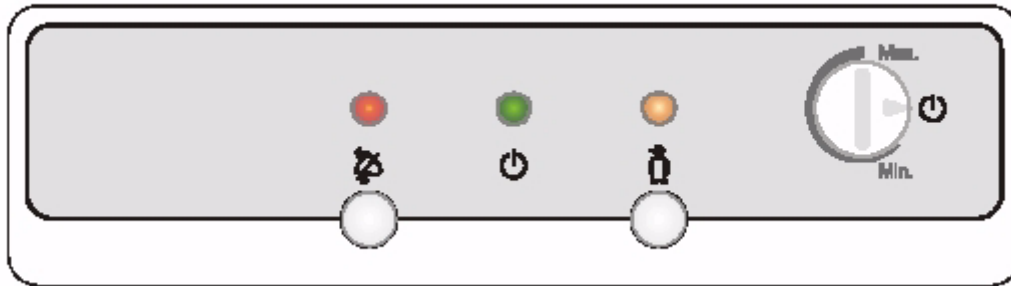
2. Repair instructions

- Never attempt to carry out repairs by “randomly replacing” components!
- Always proceed systematically and observe the technical documentation that goes with the appliance!
- Electronic circuit boards are generally not repaired; instead they are completely replaced with original spare parts. Exceptions are documented separately.
- Pipe connections in cooling circuits are not to be soldered. Lokring connections are to be used.
- Carry out a leak test and a functional test on the cooling circuit.
- The dehumidifier is to be replaced before evacuation and filling during any intervention in the cooling circuit.
- It is essential to replace the compressor and the dehumidifier when repair work resulting from suction leaks in the cooling circuit is carried out. Humidity which gets into the cooling circuit will cause irreparable damage to the oil in the compressor.

3. KE 360-1-2

Refrigerator/freezer combination with or without fan in the refrigeration compartment

3.1 Operating panel



3.2 Refrigeration system

The refrigeration system is a classical single compressor system. The coolant flows from the compressor-condenser capillary first into the freezer compartment then into the fridge and then through the return pipe back into the compressor.

3.2.1 Purpose of the control

- Guarantee of the refrigerator temperature (between 1°C and 9°C)
- Defrosting the refrigerator evaporator
- Direct maintenance of the temperature inside the freezer compartment (min -15°C)
- Maintaining the intensive freezing function

3.2.2 Input parameters

- Refrigerator sensor temperature
- Freezer sensor temperature
- Evaporator sensor temperature

3.2.3 Controlled outputs

- Compressor
- Fan (for models with fan)
- Heating element

3.3 Function

The control is based on the temperature measurements in the refrigeration compartment. The compressor switches on and off on the basis of the fixed temperature setting in the fridge. The temperature in the freezer is not controlled and is, on account of the design of the cooling system, coupled to the fridge settings and fulfils the requirements of the standard.

The minimum switched-on and minimum switched-off time of the compressor is 5 minutes.

Function when the ambient temperatures are low

The sensor in the freezer compartment controls the function of a heating element in the fridge. By switching on the heating element, the correct function of the appliance is also ensured at low ambient temperatures.

Provided the compressor is switched off, the heating element switches on at -15°C (if the fridge setting is 2-9°C) or at -18°C (if the fridge setting is 1°C) to increase the temperature inside the refrigerator compartment and as a consequence of this the sensor in the fridge switches on the compressor. The heating element switches off when the temperature threshold (-15°C or -18°C) in the freezer compartment is reached and the compressor is still working. The compressor switches off when the set temperature in the refrigerator has been reached.

3.3.1 Defrosting

If during the resting phase of the cooling system at the evaporator sensor temperatures are reached which mean that the evaporator has defrosted the appliance will not enter the obligatory defrosting state. In the opposite case, the appliance will, according to the programme, be switched to the obligatory defrosting state. The condition is fulfilled after the last cooling cycle when the total operating time of the compressor reaches or exceeds 120 minutes at the temperature setting 9°C (and 240 minutes at the temperature setting 1°C). When the temperature at the evaporator exceeds 3°C or at the latest after 3 hours of defrosting the defrosting process is ended.

3.3.2 Function of the fan

The fan (if one is installed in the appliance) works in conjunction with the compressor.

3.3.3 Function intensive freezing (super)

The intensive freezing function is carried out following a special algorithm providing the corresponding freezing capacity. The appliance switches from the intensive freezing to normal operation after 50 hours.

After a power cut the appliance will work with normal operation after a restart, the intensive freezing function is not retained.

3.3.4 Alarm

- The function is activated 24 hours after the appliance has been switched on or earlier once the set temperature has been reached.
- The alarm switches on if the temperature in the freezer compartment exceeds a value of -13°C. For a time of 5 minutes an uninterrupted whistling is sounded (15s ON, 15s OFF). This signal is repeated every hour. The red control lamp flashes continuously.

3.4 Function during faults

In the event of a sensor fault the green control lamp will start flashing after 5 seconds. The flashing frequency differs depending on which sensor has failed:

- Simultaneous fault with 2 or 3 sensors: 1 s ON / 1 s OFF
- Fault with the freezer or refrigerator sensor: 2 s ON / 2 s OFF
- Fault with the evaporator sensor: 4 s ON / 4 s OFF

In the event of a fault with the refrigerator sensor, a time algorithm has been provided for switching on and off the compressor: 15 minutes ON, 30 minutes OFF.

For the event of a fault with the freezer sensor, a time algorithm has been provided for switching on and off the compressor: 20 minutes ON, 10 minutes OFF.

In the event of a fault with the evaporator sensor, the defrosting process is initiated after the prescribed total compressor operation time; end of the defrosting process after 1 hour 30 minutes.

3.5 Table of time and temperature constants

Setting range of the refrigerator	from 1°C to 9°C
Limitation to the uninterrupted compressor operation	6 hours
Function during a fault with the refrigerator sensor	15 minutes ON / 30 minutes OFF (compressor)
Minimum switch-off time for the compressor	5 minutes
Minimum switch-on time for the compressor	5 minutes
Limiting temperature of the freezer compartment for switching on the heating element	-15°C (when the fridge temperature setting is 2-9°C) -18°C (when the fridge temperature setting is 1°C)
Threshold of the temperature alarm for the freezer compartment	> -13°C
Function during a freezer sensor fault	20 minutes ON / 10 minutes OFF (compressor)
Superfrost timer	50 hours
Alarm sound at excess temperature	5 minutes, whistling 15s ON/ 15s OFF Repeating after 55 minutes
Blocking of the temperature alarm when the appliance is switched on	24 hours or once the appliance has reached the set values

3.6 Measuring points

3.6.1 NTC sensors



Connection between 1 and 2 – freezer sensor (conductor colour - black)

Connection between 3 and 4 – refrigerator evaporator sensor (conductor colour - white)

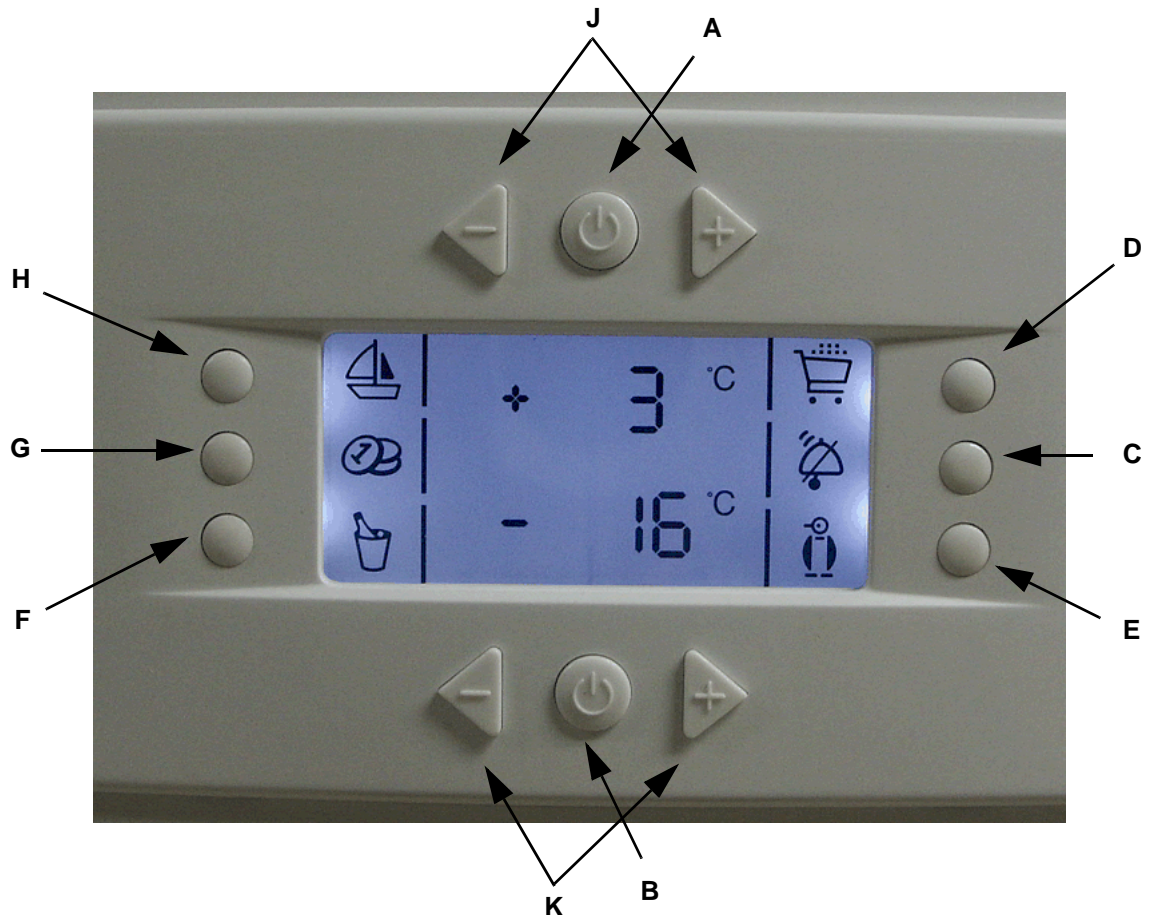
Connection between 5 and 6 – refrigerator sensor (conductor colour - blue)

3.6.2 Table of the resistors of the NTC sensors

T (°C)	R (kΩ)	T (°C)	R (kΩ)	T (°C)	R (kΩ)	T (°C)	R (kΩ)
-35	122.80	-17	40.96	1	15.52	19	6.52
-34	115.10	-16	38.69	2	14.75	20	6.23
-33	108.00	-15	36.56	3	14.02	21	5.95
-32	101.20	-14	34.56	4	13.33	22	5.69
-31	95.03	-13	32.68	5	12.69	23	5.44
-30	89.24	-12	30.92	6	12.07	24	5.21
-29	83.83	-11	29.25	7	11.49	25	4.98
-28	78.79	-10	27.70	8	10.94	26	4.77
-27	74.09	-9	26.24	9	10.43	27	4.57
-26	69.70	-8	24.85	10	9.93	28	4.38
-25	65.58	-7	23.55	11	9.47	29	4.19
-24	61.75	-6	22.33	12	9.03	30	4.02
-23	58.32	-5	21.18	13	8.61	31	3.85
-22	54.81	-4	20.09	14	8.21	32	3.69
-21	51.66	-3	19.07	15	7.84	33	3.54
-20	48.72	-2	18.10	16	7.48	34	3.39
-19	45.97	-1	17.19	17	7.14	35	3.26
-18	43.39	0	16.33	18	6.82		

4. KE 370-1-2T Refrigerator/freezer combination with 3-way valve

4.1 Operating panel



- A. On/off button for refrigerator
- B. On/off button for freezer
- C. Alarm button
- D. Intensive refrigeration button
- E. Intensive freezing button
- F. Rapid cooling of drinks in the freezer button
- G. Economy programme button
- H. Holiday programme button
- I. Refrigerator temperature setting
- J. Freezer temperature setting

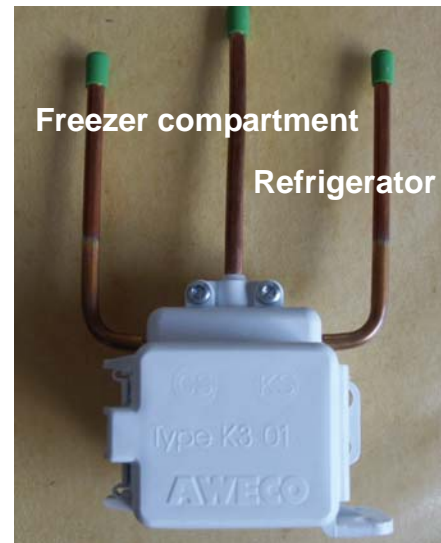
For appliances with a compressor the appliances can be switched on or off by button B.
When the appliance is switched on the refrigerator can be switched on or off by button A.

4.2 Refrigeration system

The cooling system is a single compressor system with a three-way valve. The coolant flows from the compressor condenser

- a) into the refrigerator capillary and then into the refrigerator evaporator, into the freezer evaporator and through the return pipe into the compressor when the refrigerator compartment needs cooling;
- b) into the freezer capillary and then into the freezer evaporator and through the return pipe into the compressor when the freezer compartment needs cooling.

The path of the coolant is determined by the three-way valve according to the needs of the refrigeration compartments. The coolant always flows through the freezer compartment, which means that only the refrigeration compartment can be switched off. In the event of problems with the freezer compartment (temperature increase in the freezer compartment) only the freezer is cooled, the refrigerator is "sacrificed".



4.2.1 Purpose of the control

- Maintaining the temperature in the refrigerator
- Defrosting the refrigerator evaporator
- Maintaining the temperature in the freezer compartment
- Maintaining of the intensive freezing function
- Additional functions

4.2.2 Input parameters

- Refrigerator sensor temperature
- Freezer (fridge) sensor temperature
- Evaporator sensor temperature

4.2.3 Controlled outputs

- Compressor
- Fan
- Three-way valve

4.3 Function

The control is based on the temperature measurements in the refrigeration and freezer compartment. Based on the temperature settings in the refrigerator or the freezer, the compressor is switched on or off (the compressor can switch on both because of the refrigerator and the freezer). The path of the coolant is determined by the three-way valve on account of the temperature inside the refrigerator. When cooling the refrigerator is necessary, the path of the coolant through the refrigerator is opened. Once the set temperature has been reached, the three-way valve switches to the freezer setting and the coolant flows through the freezer. When the temperature in both compartments has reached the set temperature, the compressor switches off. The refrigerator can be switched off (the three-way valve is in the freezer position) only the freezer compartment operates.

For the compressor operation two restrictions have been added which apply irrespective on the demands from the sensors:

- a) Minimum compressor operation time 5 minutes
- b) Minimum compressor time of standstill 8 minutes

4.3.1 Defrosting

The electronics ensures defrosting of the appliance in the refrigerator compartment. If the compressor during the usual cycles has not been fully defrosted (this is noticed by the evaporator sensor) the appliance will be set to the obligatory defrosting mode.

During obligatory defrosting, the path of the coolant through the refrigerator is blocked and the appliance is defrosted. During this time the freezer continues working normally.

4.3.2 Function of the fan

The fan operates when the path for the coolant through the refrigerator is open and the door of the refrigerator is closed, in other cases the fan will not work.

4.4 Special functions

4.4.1 Intensive freezing (super)

The intensive freezing function is carried out following a special algorithm providing the corresponding freezing capacity. The appliance switches from the intensive freezing to normal operation after 50 hours.

4.4.2 Intensive refrigeration

The refrigerator control is set to +3°C over 6 hours, afterwards it return to the previous setting.

4.4.3 Economy programme

The refrigerator control is automatically set to +5°C and the freezer control to -18°C; this function is switched off manually.

4.4.4 Holiday programme

The refrigerator control is automatically set to +8°C and the freezer control to -18°C; this function is switched off manually.

4.4.5 Rapid cooling of drinks in the freezer

After a cooling time of 45 minutes an acoustic alarm is activated (1s ON, 1s OFF). When the alarm is switched off the function is also switched off.

Caution: the bottles must have a content of at least 0.75 l because otherwise there exists the danger of freezing.

4.4.6 Child protection

Child protection is activated by pressing and holding the alarm OFF button for 3 seconds. In the bottom line the word "LOC" will appear which disappears again after 3 seconds.

Child protection is switched off by pressing and holding the alarm OFF button for 3 seconds again. In the bottom line the word "LOC" will appear which disappears again after 3 seconds.

In the blocked mode only the alarm OFF button is active.

4.5 Alarms

- Open-door alarm for the refrigerator; after 1 minute an uninterrupted whistling is sounded and the alarm symbol glows. The whistling can be switched off by means of the alarm OFF button. The open-door alarm is switched off by closing the appliance door.
- Excessively high temperature in the refrigerator or freezer; if the temperature exceeds +11°C (in the refrigerator) or -13°C (in the freezer) an interrupted whistling is sounded for 5 minutes at the beginning of every full hour (15s ON, 15s OFF). The whistling can be switched off by pressing the alarm off switch; the display of the alarm temperature and the alarm symbol remain active until the alarm has been acknowledged. During activation of the alarm on account of a power failure, the highest temperature reached will be displayed. If 24 hours after switching off the whistling the set temperature has not been reached, the alarm is activated once again.
After switching on the appliance from stand-by the alarm function is blocked for 24 hours. When the appliance has reached the set values before the 24 hour block has come to an end, the alarm block is lifted.

4.6 Function during faults

During faults with the connection between the operating unit and the power supply unit, the device will continue functioning with the last settings. In the first line of the LCD display the text "EE" will appear. The other information shown on the display depends on the time of the fault:

- If the fault has occurred during operation, the display of the other information is not changed.
- If the fault has occurred when the appliance is connected to the power supply, all symbols are switched off and in the second line of the display the symbol "- -" is displayed (as for a switched-off appliance).

During a fault with the sensor in the refrigerator, the symbol "E" is shown on the display. The requirement for the switching ON and OFF of the refrigerator (switching on compressor, three-way valve in the refrigerator position) and the fan is activated cyclically: 15 minutes ON, 40 minutes OFF.

During a fault with the sensor in the freezer, the symbol "E" is shown on the display. The requirement for the switching on or off of the freezer (switching on of the compressor, three-way valve in the freezer position) is activated: 15 minutes ON, 40 minutes OFF.

4.7 Test programme

The test programme is activated by pressing and holding a particular button combination: press first of all the switch-on button of the refrigerator and then the holiday programme button. After 3 seconds in the upper display line "oP" appears. By activating the test programme, the status of the output remains unchanged. In the test programme the outputs can be toggled as desired.

A time protection is integrated which limits this operating status to a maximum of 5 minutes unless it is blocked earlier than that.

Blocking/releasing the test programme

Press and hold the following button combination: first of all press the switch-on freezer button and then the intensive freezing button. After 3 seconds in the upper display line the status of the test programme appears: blocked "-P", released "oP".

By pressing the individual buttons, the functions listed in the table below can be reached:

Button	Description	Display
J (-)	Temperature display in the refrigerator	In the second line
A (on)	Display of the evaporator temperature (refrigerator)	In the second line
J (+)	Temperature display in the freezer	In the second line
H	Switching on and off of the compressor	Symbol "Holiday programme"
G	Switching on and off of the three-way valve	Symbol "economy programme"
F	Switching on and off of the fan	Symbol "rapid cooling of drinks"
E	Switching on and off of the illumination	Symbol "intensive freezing"
B (on)	Display of the software version of the control module	In the second line "LC:vv"

The test programme is activated by pressing and holding the button combination below: press first of all the switch-on button of the refrigerator and then the holiday programme button.

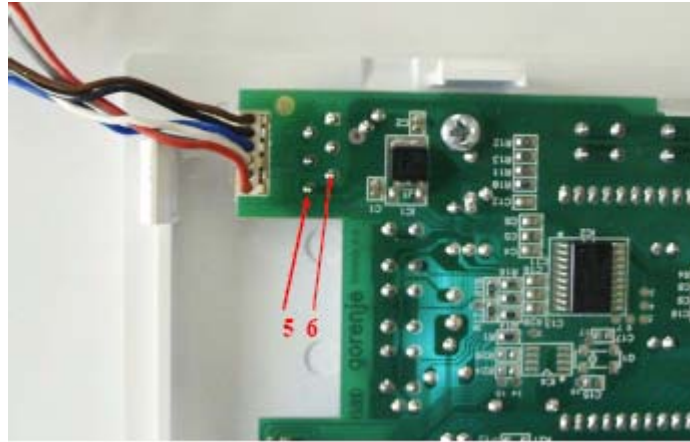
When leaving the test programme, the appliance switches, depending on the required algorithm, to standard operation.

4.8 Table of time and temperature constants

Setting range of the refrigerator	from 1 °C to 9 °C
Range of display for the refrigerator temperature	from 1 °C to 30 °C
Limitation of uninterrupted three-way valve operation in the refrigerator	6 hours
Timed switch-off of the refrigerator illumination when the appliance door is left open	10 minutes
Threshold of the temperature alarm for the refrigerator compartment	> 11 °C
Threshold for the recall of the refrigerator temperature alarm	≤ 9 °C
Threshold for the recall of the 24-hours delay for the refrigerator temperature alarm	≤ 9 °C
Function during a fault with the refrigerator sensor	15 minutes ON / 40 minutes OFF (fan)
Setting range for the freezer	from -24 °C to -16 °C
Display range for the freezer temperature	from -24 °C to 30 °C
Threshold of the temperature alarm for the freezer compartment	> -13 °C
Threshold for the recall of the freezer temperature alarm	≤ - 16 °C
Threshold for the recall of the 24-hour delay for the freezer temperature alarm	≤ - 16 °C
Function during a freezer sensor fault	15 minutes ON / 40 minutes OFF (compressor)
Intensive refrigeration	3 °C automatically switched off after 6 hours
Intensive freezing	- 35 °C automatically switched off after 50 hours
Minimum switch-off time for the compressor	8 minutes
Minimum switch-on time for the compressor	5 minutes
Economy programme	5 °C / -18 °C
Holiday programme	9 °C / -18 °C
Rapid cooling for drinks in the freezer compartment	after 45 minutes an acoustic alarm is activated (1s ON, 1s OFF), after opening the appliance door the whistling is repeated
Open door alarm	After 1 minute, uninterrupted whistling
Alarm sound at excess temperature	5 minutes, whistling 15s ON/ 15s OFF; Repeating after 55 minutes
Blocking of the temperature alarm when the appliance is switched on	24 hours or once the appliance has reached the set values

4.9 Measuring points

4.9.1 Operating module

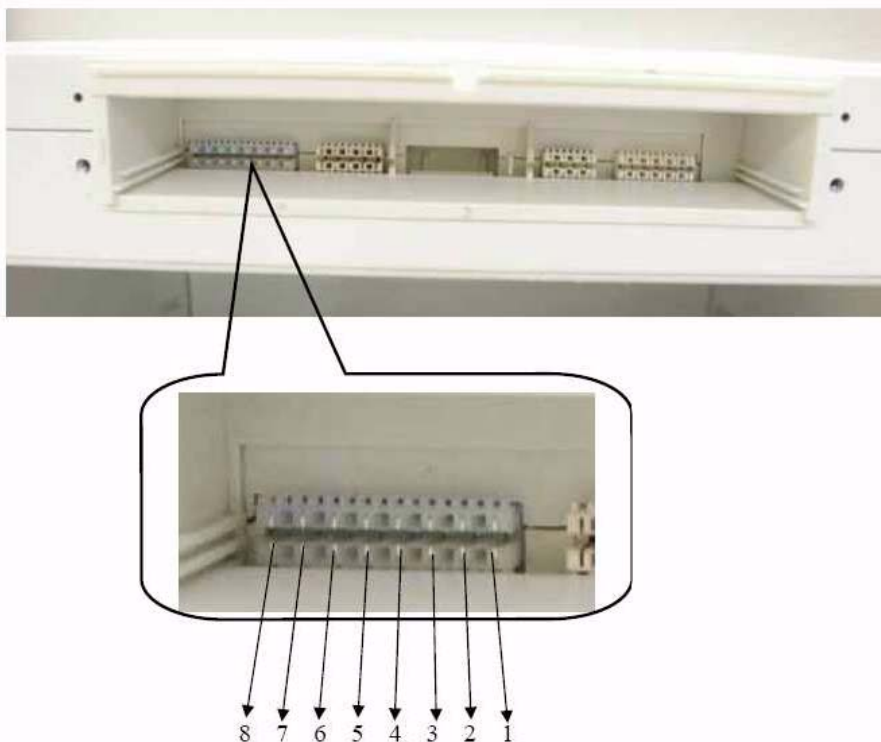


Inspection of the connection 5 - 6

If between terminals 5 and 6 no 12V voltage is applied, the supply module (power board) has to be replaced.

If between terminals 5 and 6 no 12V voltage is applied, the control module (control board) has to be replaced.

4.9.2 NTC sensors



Connection between 1 and 2 – refrigerator sensor

Connection between 3 and 4 – evaporator sensor (refrigerator)

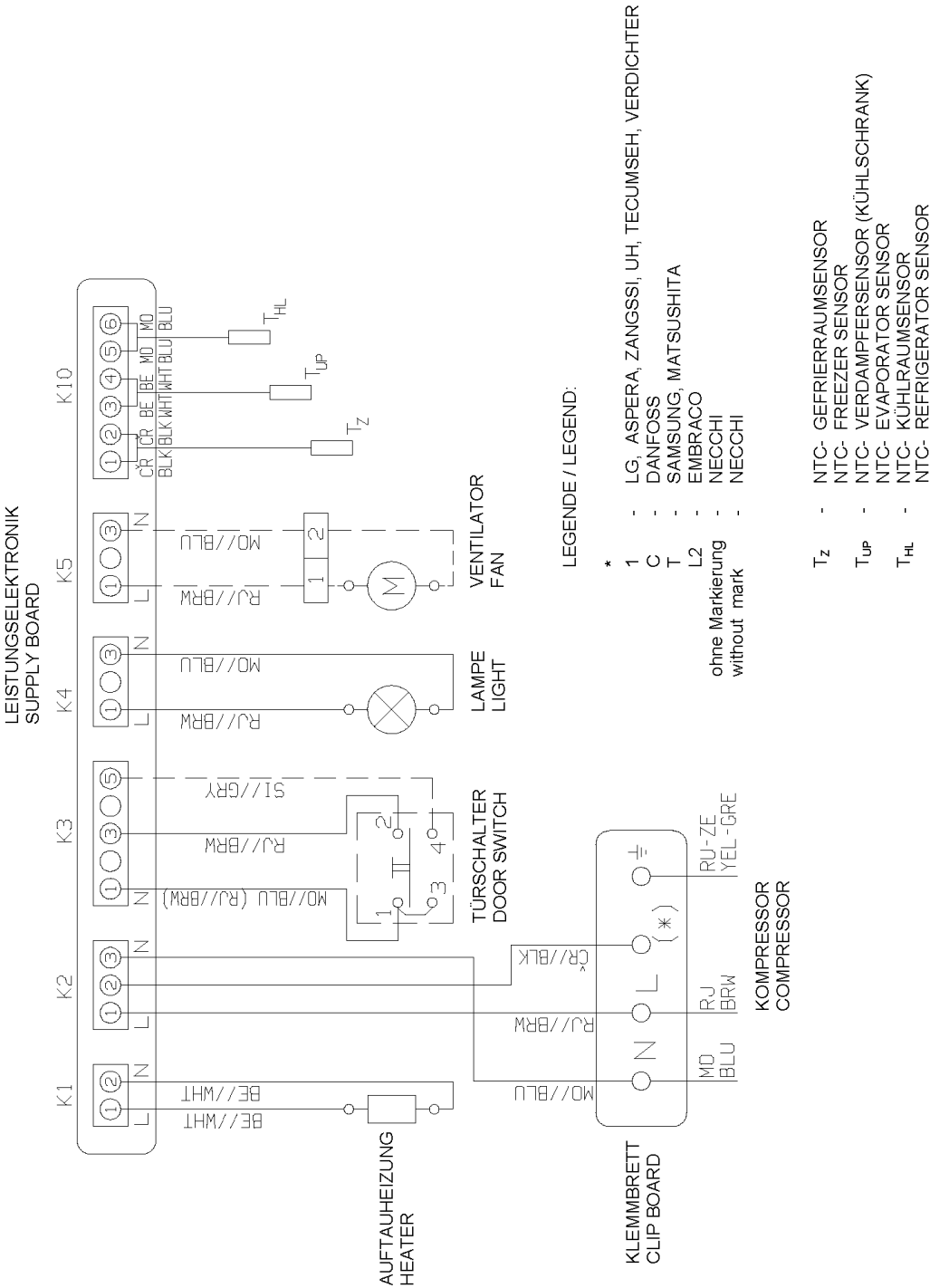
Connection between 5 and 6 – freezer sensor

4.9.3 Table of the resistors of the NTC sensors

T (°C)	R (kΩ)	T (°C)	R (kΩ)	T (°C)	R (kΩ)	T (°C)	R (kΩ)
-35	122.80	-17	40.96	1	15.52	19	6.52
-34	115.10	-16	38.69	2	14.75	20	6.23
-33	108.00	-15	36.56	3	14.02	21	5.95
-32	101.20	-14	34.56	4	13.33	22	5.69
-31	95.03	-13	32.68	5	12.69	23	5.44
-30	89.24	-12	30.92	6	12.07	24	5.21
-29	83.83	-11	29.25	7	11.49	25	4.98
-28	78.79	-10	27.70	8	10.94	26	4.77
-27	74.09	-9	26.24	9	10.43	27	4.57
-26	69.70	-8	24.85	10	9.93	28	4.38
-25	65.58	-7	23.55	11	9.47	29	4.19
-24	61.75	-6	22.33	12	9.03	30	4.02
-23	58.32	-5	21.18	13	8.61	31	3.85
-22	54.81	-4	20.09	14	8.21	32	3.69
-21	51.66	-3	19.07	15	7.84	33	3.54
-20	48.72	-2	18.10	16	7.48	34	3.39
-19	45.97	-1	17.19	17	7.14	35	3.26
-18	43.39	0	16.33	18	6.82		

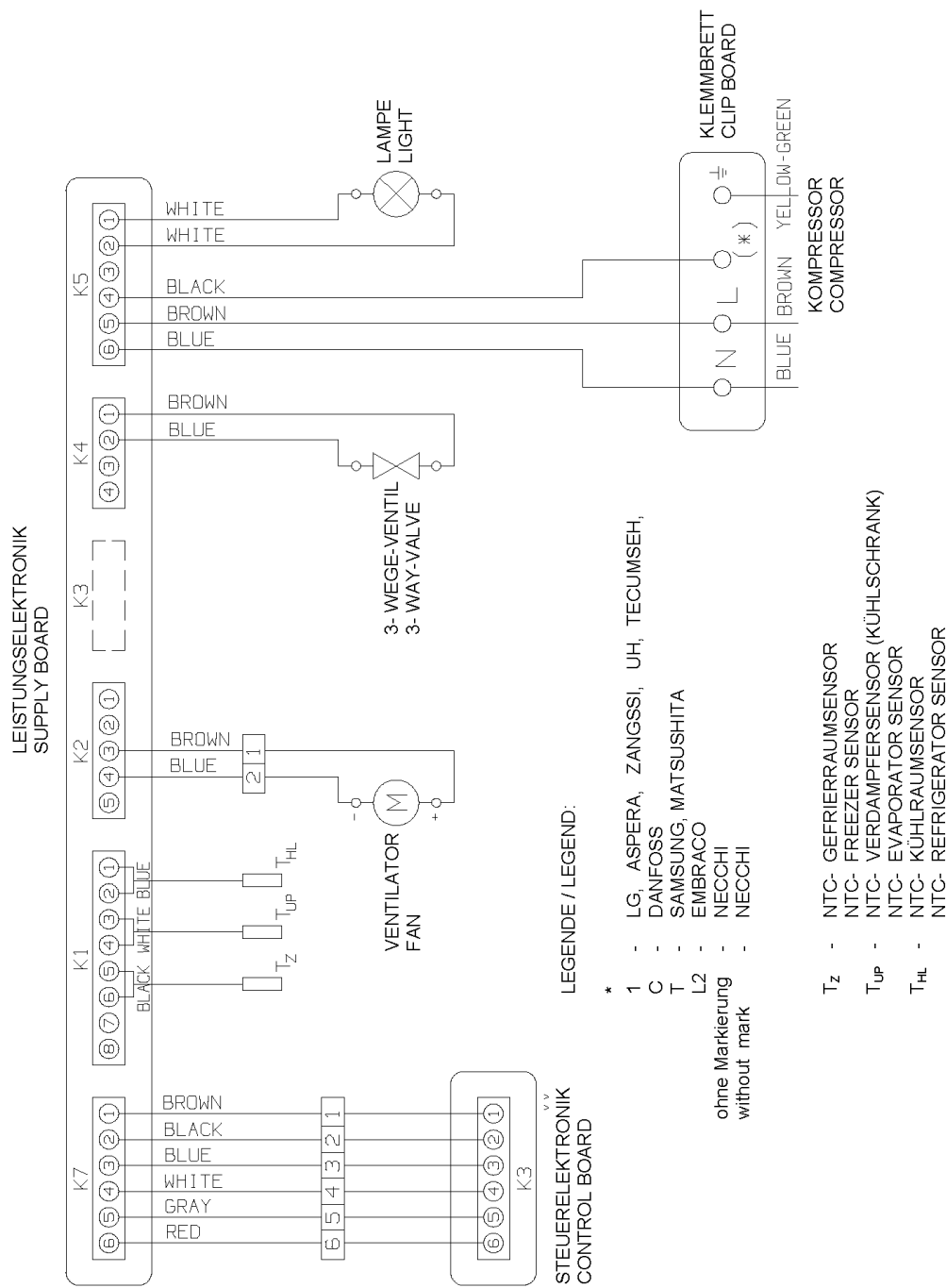
5. Switch diagrams

5.1 KE 360-1-2T



S161804-0050

5.2 KE 370-1-2T



S161804-0056