BFI Industrie-Elektronik
GmbH + Co. KG

BFI ELEKTRONIK

B0/34

regulated high voltage power supply

technics - function - data

V1.7

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Content:

1 Function

The high voltage power supply B0/34 converts an AC Voltage of 230V/50Hz to two regulated DC voltages for ionizer and collector of an electrostatic air filtration system.
The device is open-circuit operation and sustained short-circuit proof.
All devices carry the CE mark and meet currently applicable regulations.
Devices are constructed to be connected to industrial electricity networks.
It is possible to adapt the standard version of the B0/34 to customer specifications. The symbol ☑ refers to such configuration options.

1.1 Adjusting high voltage

The ionizer voltage of the B0/34 standard device is 11kV, the collector voltage 5,5kV. The ionizer voltage can be adjusted by a 20-turn trimming potentiometer with a screwdriver between 8kV and 12kV. The collector voltage is the half of the ionizer voltage.

! The output voltage should only be changed by qualified personnel, because it has a significant stake in filtration performance !!!

☑ The ionizer voltage may be adjusted to a voltage from 8kV to 24kV.

☑ The adjustable voltage range may be changed.

☑ The ionizer to collector ratio may be changed from 1:2 to 1:3, 1:4, 2:3 or 3:4.

1.2 Overcurrent shutdown

The high voltage power supply supplies the connected filters always with the adjusted voltage. Exceeds the sum of ionizer and collector current a special limit, the high voltage power supply turns high voltage temporary down and increases afterwards the voltage gradual to the adjusted value ("smooth start-up").

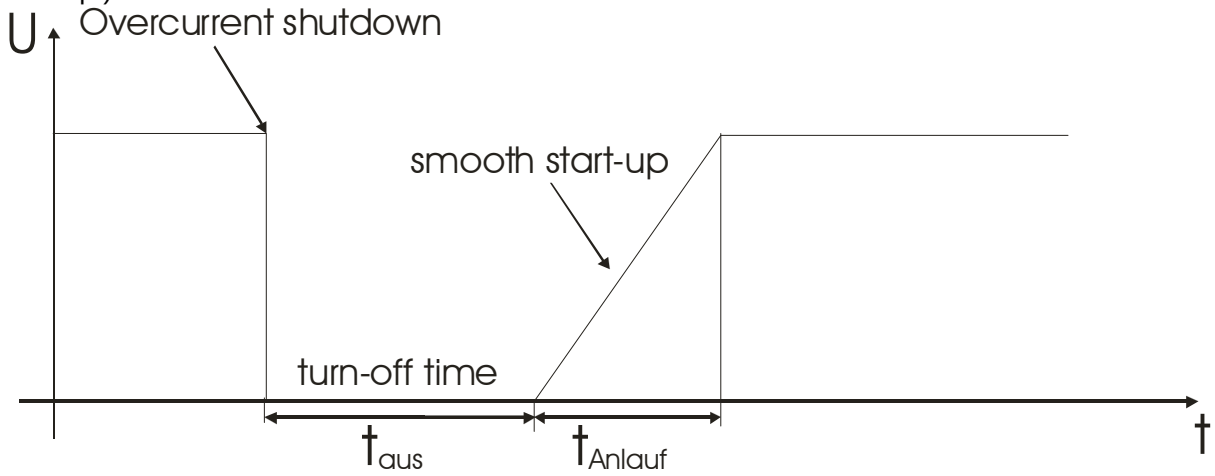


figure 1: Overcurrent shutdown

The standard device turns off by exceeding a sum current of 6mA. Turn-off time t_{aus} is 1s and smooth start-up time t_{Anlauf} 1s.

☑ Overcurrent may be adjusted. Maximum value is 12mA by an ionizer value of 12kV.

☑ Turn-off time t_{aus} may be adjusted.

☑ Smooth start-up time t_{Anlauf} may be adjusted.

1.3 Constant short circuit shutdown

Overcurrent shutdowns may occur by strongly filter pollution. In this case high voltage turns off and starts up multiple. This may cause an abatement of filter pollution. Does the problem, which causes overcurrent shutdown, still exist after several start-ups, the device supposes a constant short circuit and turns off high voltage finally.

! If the device has turned off high voltage, you have to turn off and turn on supply voltage to reactivate the high voltage power supply.

To detect a constant short circuit, the device counts the number of start-ups. Is this number greater than 80, the device supposes constant short circuit.
Occurs during a time span $t_{RESET\_Fehlerzähler}$ of 5s no overcurrent shutdown, the error counter will be reset to 0.

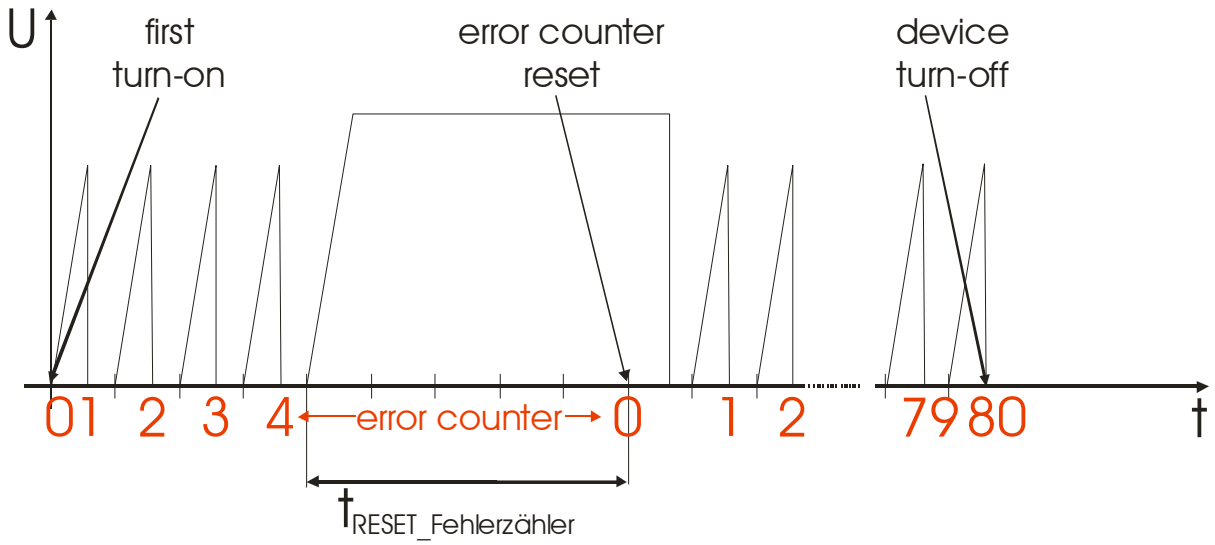


figure 2: Error counter reset / device turn-off

☑ The number of start-ups, which cause device turn-off may be adjusted up to 255.

☑ Time span $t_{RESET\_Fehlerzähler}$ may be adjusted.

1.4 Automatic output voltage adjusting (Stepping)

After a downtime of some hours condensed water or any other non-operating materials may be accumulated in the filter and cause many overcurrent shutdowns after start up the air cleaning system. To ensure unattended operation in this situation the high voltage power supplies can be equipped with a "Stepper", which adapts the output voltage automatically to the respective situation.
The "Stepper" contains an error counter, which works similar to the error counter for device turn-off.
Reaches this error counter the number of seven errors, the output voltage will be reduced by 100V. This procedure will be repeated until the lowest step is reached. Occures no error while a time span $t_{RESET\_StepperFehlerzähler}$ of 5s, the error counter will be reset to 0.

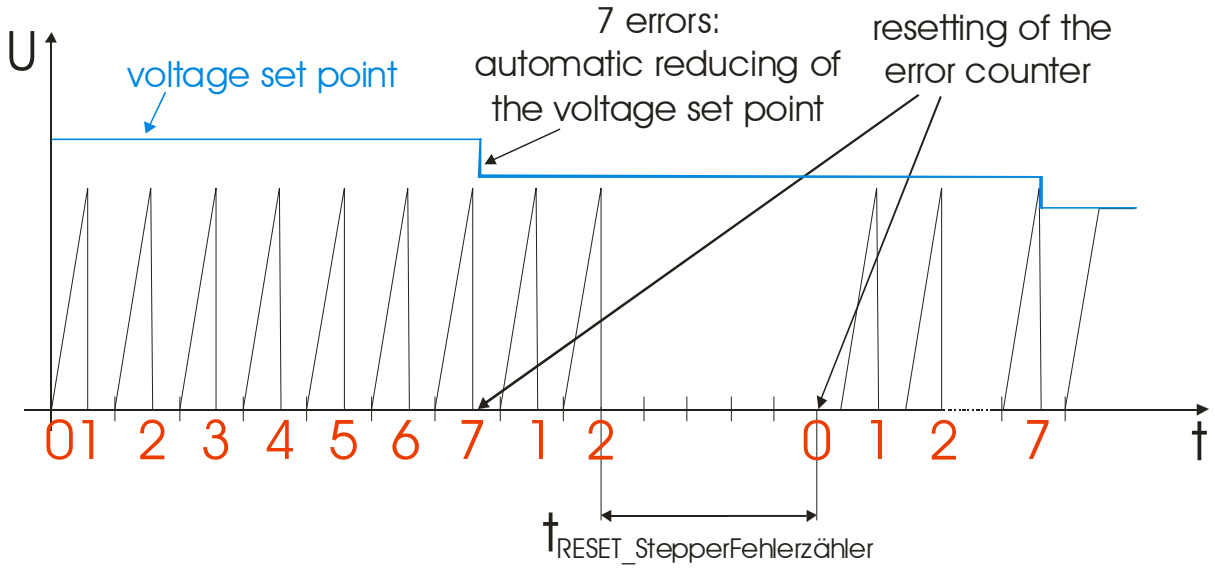


figure 3: automatic reducing of the voltage set point by stepping

Occurs no error while a time span t_{StepUp} of 20s, output voltage will be increased by 100V until the adjusted output voltage is reached.

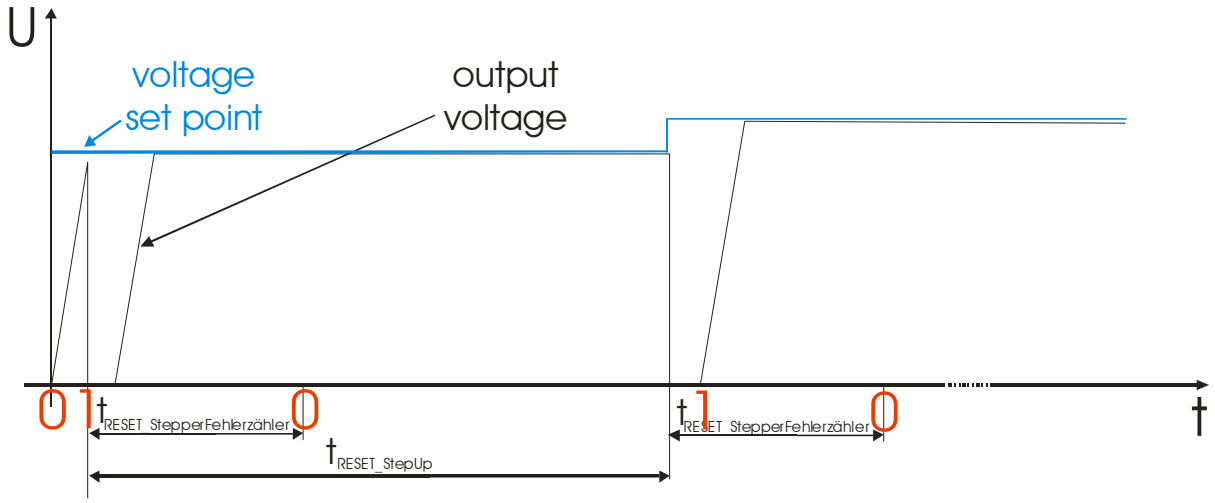
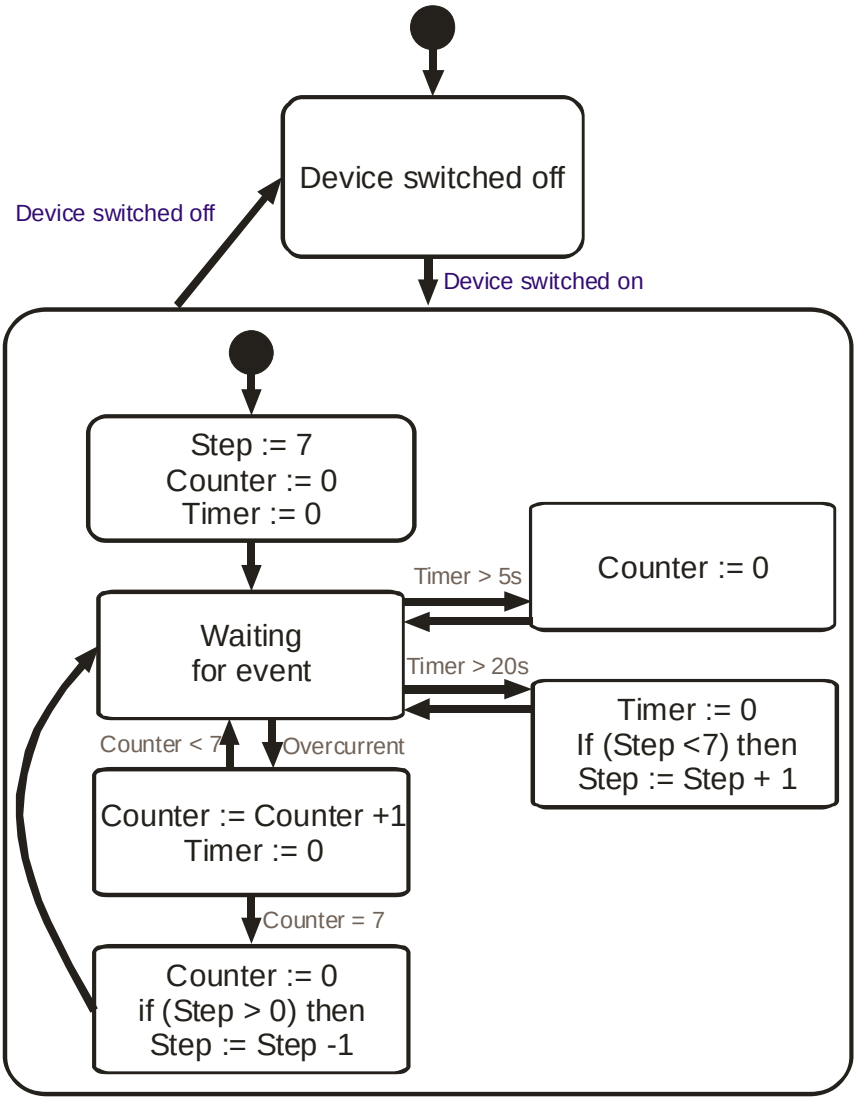


figure 4: automatic increasing of the voltage set point by stepping

The exact mode of operation is shown in the following figure.
The standard device has no "Stepper".



Step 7: maximum output voltage
Step 0: minimum output voltage

figure 5: stepper function

! Stepper function must at present not be used together with penny-filters.

☑ The number of errors, which causes a step-down of the output voltage, may be adjusted.

☑ Time span $t_{RESET\_StepperFehlerzähler}$ may be adjusted.

☑ Time span t_{StepUp} may be adjusted.

☑ The maximum number of steps may be 2, 4 or 8.

☑ The voltage difference between two steps may be adjusted.

1.5 Excess temperature shutdown

The device is designed to work in a temperature range from -10°C to +50°C. It contains a temperature control circuit, which monitors the temperature of the case bottom. Exceeds the temperature approximately 75°C, high voltage will be turned off. After temperature decreasing to approximately 65°C, high voltage will be turned on again automatically.
Excess temperature shutdown avoids damaging of the device. This function is only necessary if the devices are mounted inappropriate.

1.6 Pollution detection

Pollution of the filter causes higher current drain. The device may be equipped with a sensor, which uses this effect to detect filter pollution.
If current drain is longer than 10 seconds greater than 90% of the overcurrent value, the device reports filter pollution an the red LED changes to triple blinking.
If subsequent current drain is longer than 10 seconds smaller than 90% of the overcurrent value, triple blinking of the red LED will be turned off.
If the red LED is triple blinking, the filter should be cleaned.

☑ The device may be equipped with a sensor, which detects filter pollution.

☑ Time span during current drain must be greater than 90% of the overcurrent value to report filter pollution, may be changed.

☑ Time span during current drain must be smaller than 90% of the overcurrent value to leave filter pollution mode, may be changed.

☑ Current threshold to detect filter pollution may be changed.

☑ Filter pollution may be additionally reported by a logic output.

1.7 Logic outputs

The device contains two potential-free outputs K1 (clamps 24, 21, 22) and K2 (clamps 14, 11, 12) which are used to report the system state. The standard device uses two relays to communicate with a SPC or an indicator. A buzzer may also be connected to this outputs.
The relay outputs are change-over contacts for an AC voltage up to 230V and a current up to 5A.

☑ Output K1 may be configured to drive an usual LED. In this case the internal 5V-suplly voltage will be carried over resistors to the clamps 21 and 24. The maximum current to drive the LED is 10mA.

The outputs of the standard device indicate following device states:
- Output K1 is closed while smooth startup or while there is no undervoltage.
- Output K2 is closed if the device is switched off because of constant short circuit shutdown.

The exact behaviour of the output is described in the chapters 7.1 and 7.3.

☑ The conditions which cause output switching may be free chosen.

1.8 Current state LEDs

The device contains two or three LEDs to indicate its state:
- The green LED is on while smooth startup or while there is no undervoltage. This causes a pseudo-blinking of this LED while turning on an off of the device because of overcurrent shut-downs.
- The red LED is off while no error exists. If an error exists the LED blinks or glows permanently (see table).
- The optional yellow LED indicates activity of the stepper. If this LED is off, the device generates adjusted output voltage, else output voltage is reduced to avoid flashovers.

State	Chapter	LED green	LED red	LED yellow
system works (no failure)	1	ON	OFF	*
Filter-"Alarm" (Overcurrent counter > 80)	1.3	OFF	glows permanently	OFF
Undervoltage (internal error)		OFF	blinking twice	*
Filter pollution (>10s >90%)	1.6	ON	blinking triple	*
Overtemperature shutdown	1.5	OFF	blinking permanently	OFF
Device damaged (Fuse, etc.)		OFF	OFF	OFF

table 1: Meaning of the current state LEDs

State	LED yellow
Adjusted output voltage	OFF
Reduced output voltage to avoid flashovers	ON

Tabelle 1: Meaning of the yellow LED (Stepper-LED)

☑ Device may be equipped with a yellow LED to signal stepper state.

☑ Functions of the LEDs may be chosen.

☑ Colours of the LEDs may be chosen.

1.9 High voltage outputs

The device contains two 6,3mm flat-connectors to attach the ionizer and two 6,3mm flat-connectors to attach the collector. At output voltages greater than 14kV the device is equipped with two not shielded high voltage cables to lead out high voltage.
All other connectors are placed on the other side of the high voltage power supply. It is practicable to mount the device with high voltage connectors up.

figure 6: The high voltage outputs of the B0/34 at output voltages of maximal 14kV

1.10 Quality control

The high voltage power supplies are subject to very strongly quality and reliability controls. In a special testing facility every device is tested for about 4 hours by full load.

2 Installation and initial startup

! Installation and initial startup of high voltage power supplies must be executed by qualified personnel, which is familiar with switching power supplies and high voltage. Incorrect handling may cause injury to persons or material damage.

When the high voltage power supply is installed the general installation instructions (especially VDE0100) have to be taken into account.
An orderly grounding is extremely important.

Use clamps L, N, PE for mains connection of the high voltage power supply.

The high voltage generators are intended for installation in industrial enclosures. The B0/34 will be fixed on the mounting plate with four screws.

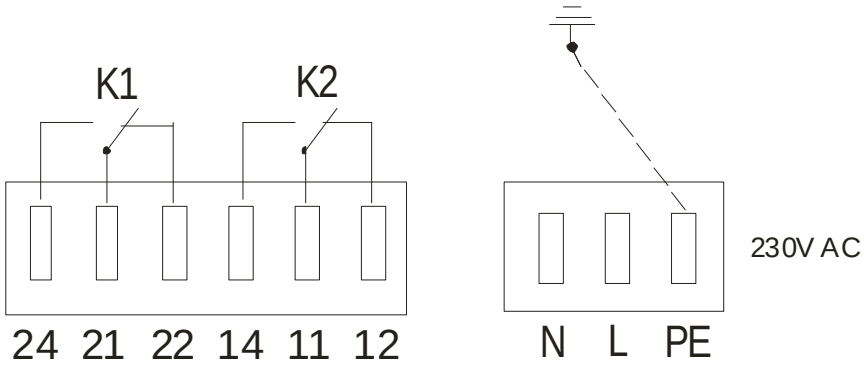


figure 7: Clamps

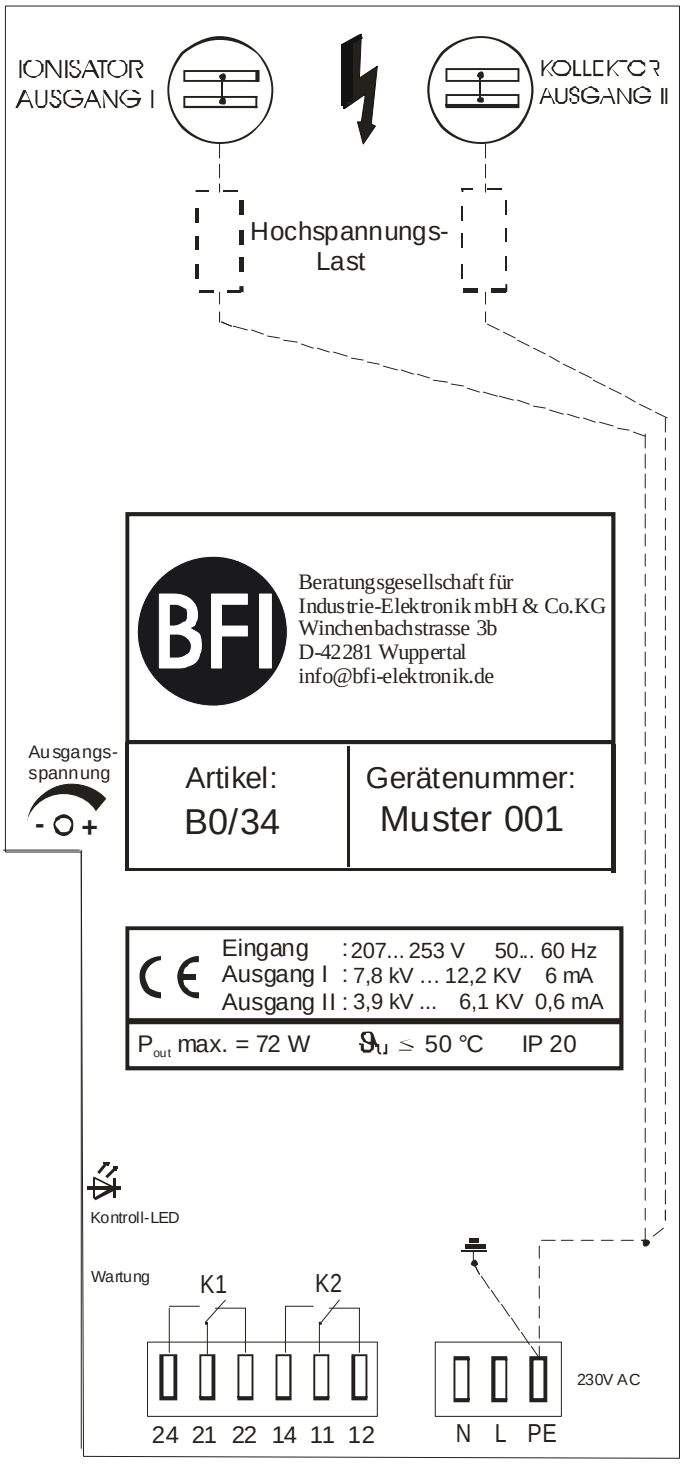
! It is forbidden to open the high voltage power supply !

! Disconnect the power before any work is done at the system !

3 Technical data (standard device)

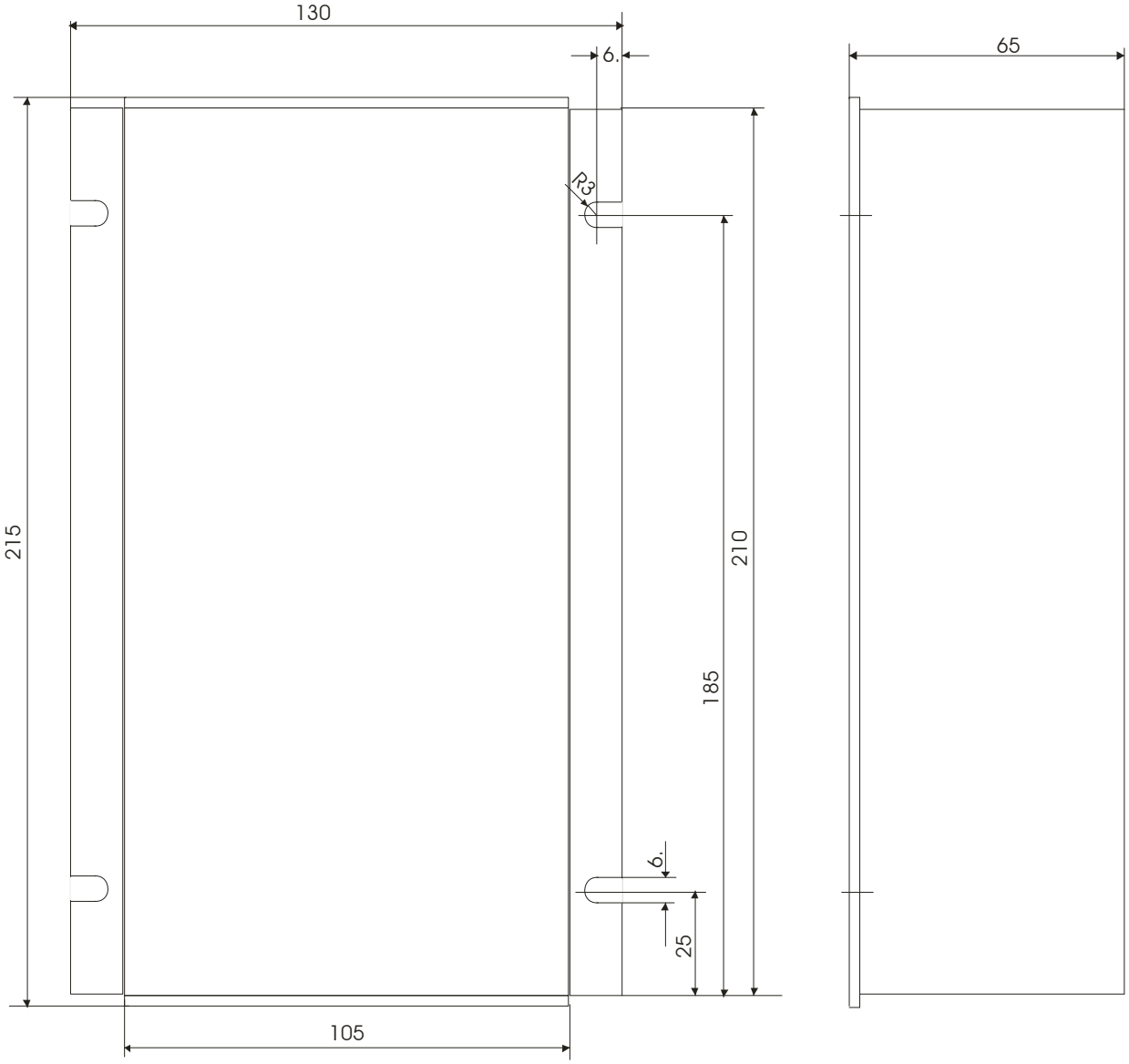
case:	Aluminiumcase
protection class:	IP20,
working temperature:	–10°...+50°C
input voltage:	230V~
input voltage range:	207V~ ... 253V~
frequency:	50Hz ... 60Hz
output voltage I (ionizer)	11 KV
output voltage II (collector)	5,5 KV
adjustment range (output voltage):	ionizer: 7,8KV ... 12KV
	collector: 3,9KV ... 6KV
output current I (ionizer):	0 ... +6mA
output current II (collector):	0 ... +0,6mA
max. output current I+II	6mA
max. output power	72W
efficiency	0,86
dimensions:	215 x 105 x 65 mm (LxBxH)
width of fasting plate	130mm
weight	approx. 1,7 kg

4 Top Cover Print

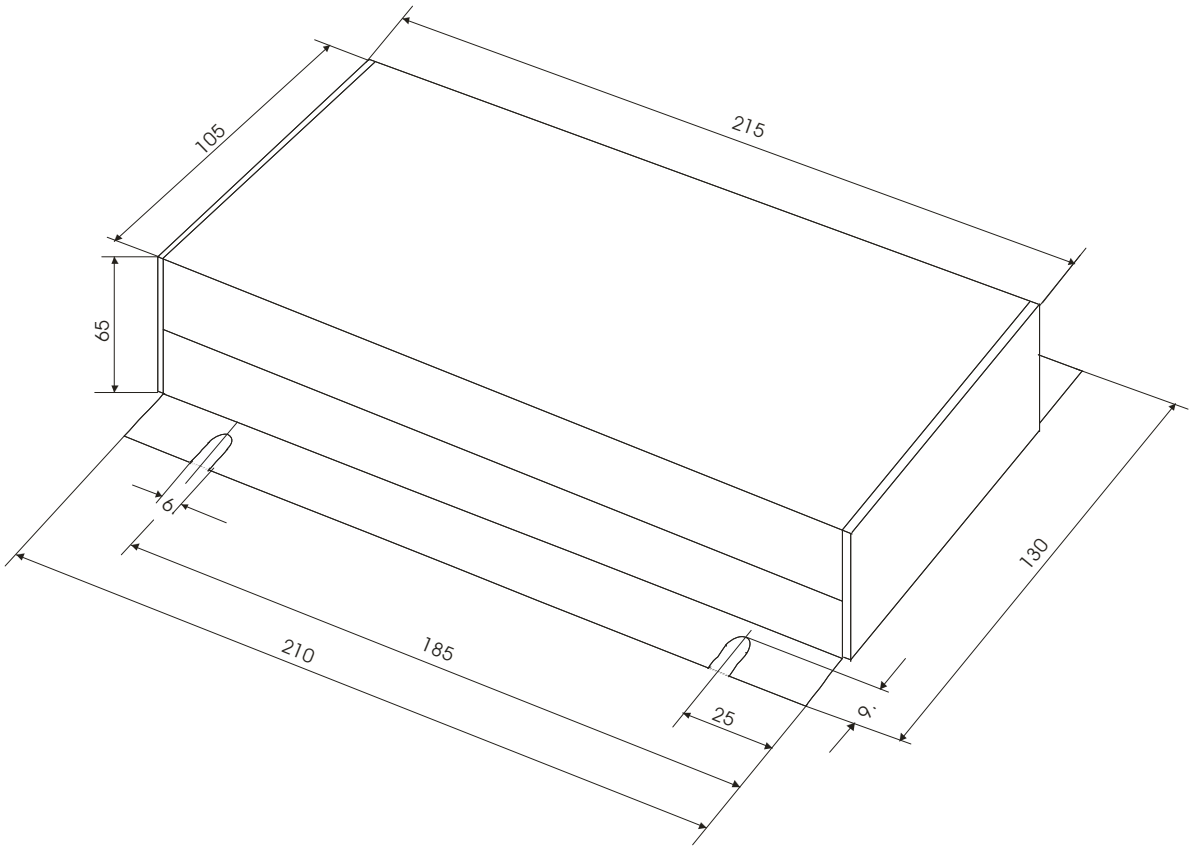


☑ Top cover can be imprinted with a special label.

5 Dimensions



Werkstoff	2003	Datum	Name		BFI-elektronik 42281 Wuppertal
	Bearb.	27.2.	Fr.		
	Gepr.		Berges.		
	Norm				
	Maßstab	Hochspannungserzeuger Gehäuse Bemaßung		Z. Nr.	B0/34/M006



Werkstoff	2003	Datum	Name		BFI-elektronik 42281 Wuppertal
	Bearb.	27.2.	Fr.		
	Gepr.		Berges		
	Norm				
	Maßstab	Hochspannungserzeuger Gehäuse Perspektive		Z. Nr.	B0/34/M007

6 Error handling

Assess the state of the device by controlling the LEDs:

State	Chapter	LED green	LED red	LED yellow
Filter-"Alarm" (Overcurrent counter > 80)	6.1	OFF	glows permanently	OFF
Undervoltage (internal error)	6.4	OFF	blinking twice	*
Filter pollution (>10s >90%)		ON	blinking triple	*
Overtemperature shutdown	6.2	OFF	blinking permanently	OFF
Device damaged (Fuse, etc.)	6.4	OFF	OFF	OFF

! If high voltage turns on and off repeatedly because of overcurrent shutdowns, the green LED seems to blink. After ten overcurrent shutdowns the red LED starts blinking twice, after 80 overcurrent shutdowns device turns off.

6.1 Filter-„Alarm“

Filter current exceeds permanently I_{max}.

1. Disconnect high voltage power supply from line voltage.
2. Discharge the filter by short-ciruiting with ground.
3. Check pollution degree of the filter and clean it if necessary.
4. Connect high voltage power supply to line voltage again.
5. If error occurs furthermore, disconnect high voltage power supply from line voltage again, discharge filter by short-circuiting to ground and disconnect high voltage lead for ionizer and collector from the device.
6. Connect high voltage power supply to line voltage and check its function. If the green LED glows constant the system is the source of fault. Disconnect the high voltage power supply for line voltage and test the filter, the isolators and the high voltage leads for short-circuit or mechanical deformations, which can cause high voltage flashovers.
7. Exchange filter if necessary.
8. Connect the high voltage power supply to ionizer and collector again.
9. Connect the high voltage power supply to line voltage again.

6.2 Overtemperature shutdown

The high voltage power supply has turned off because ist temperature exceeded the allowed limit of 75°C. As soon as the device has reached a temperature of 65°C again, it will turn on automatically.
If this error occurs frequently, check the following environmental conditions:

1. The ambient temperature must not exceed 50°C.
2. The cubicle must be amply dimensioned.
3. The enclosure must be aerated sufficiently.
4. Line voltage should be nearly 230V AC. Permanent considerable lower voltage causes higher power consumption and hence higher device temperature.

6.3 Filter pollution

The device reports filter pollution because current drain was greater than 90% of the overcurrent value for more than 10 seconds.

1. Disconnect high voltage power supply from line voltage.
2. Discharge the filter by short-ciruiting with ground.
3. Check pollution degree of the filter and clean it if necessary.
4. Connect high voltage power supply to line voltage again.

6.4 Undervoltage or device damaged

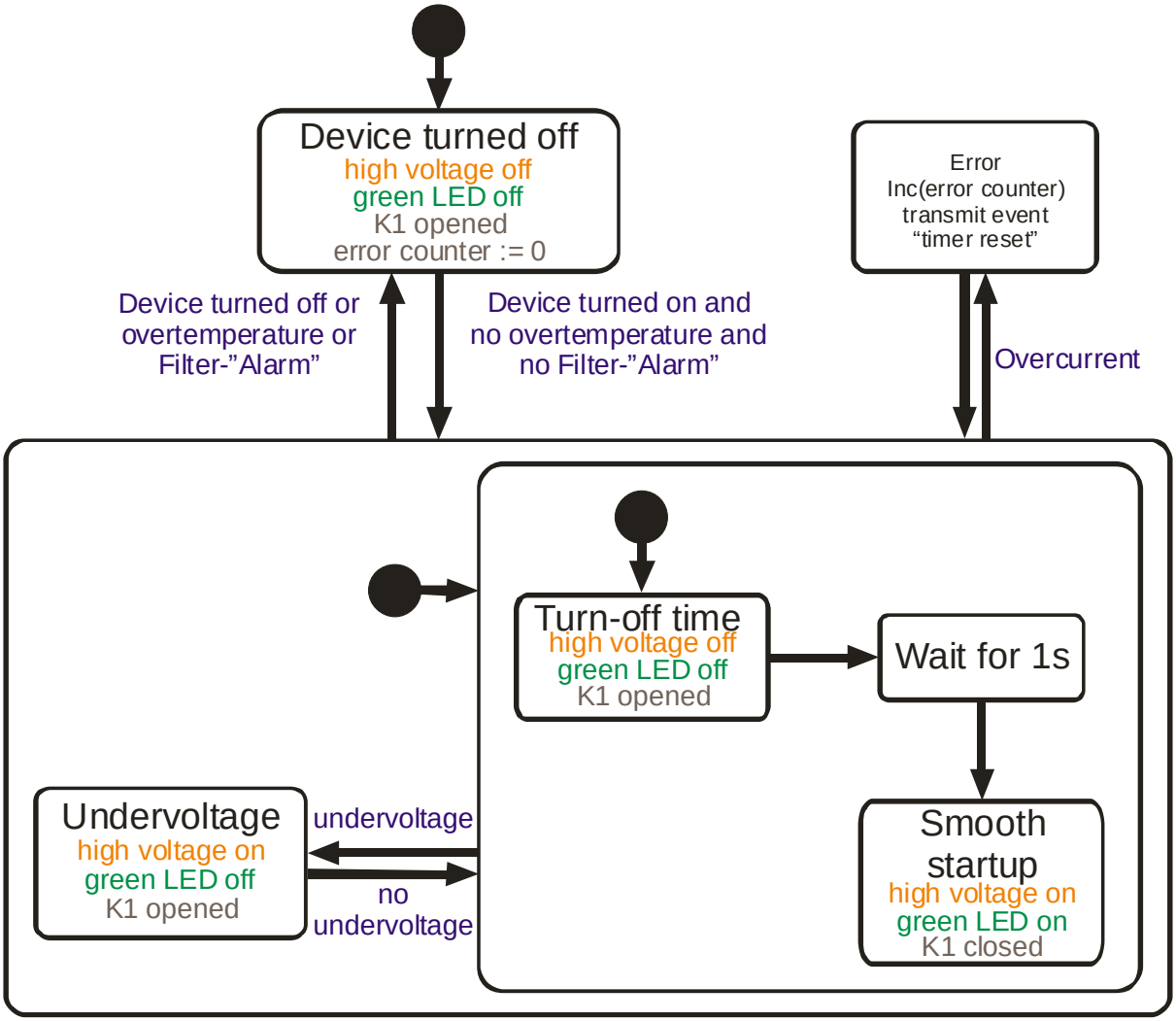
The source of fault is the high voltage power supply:

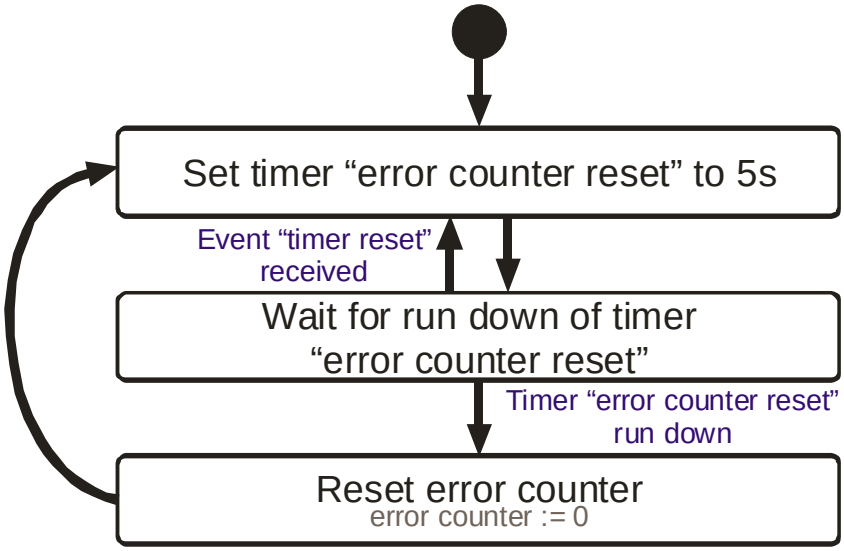
1. Disconnect high voltage power supply from line voltage.
2. Discharge the filter by short-ciruiting with ground.
3. Substitute the device by another.
4. Connect the high voltage power supply to line voltage.

7 State charts

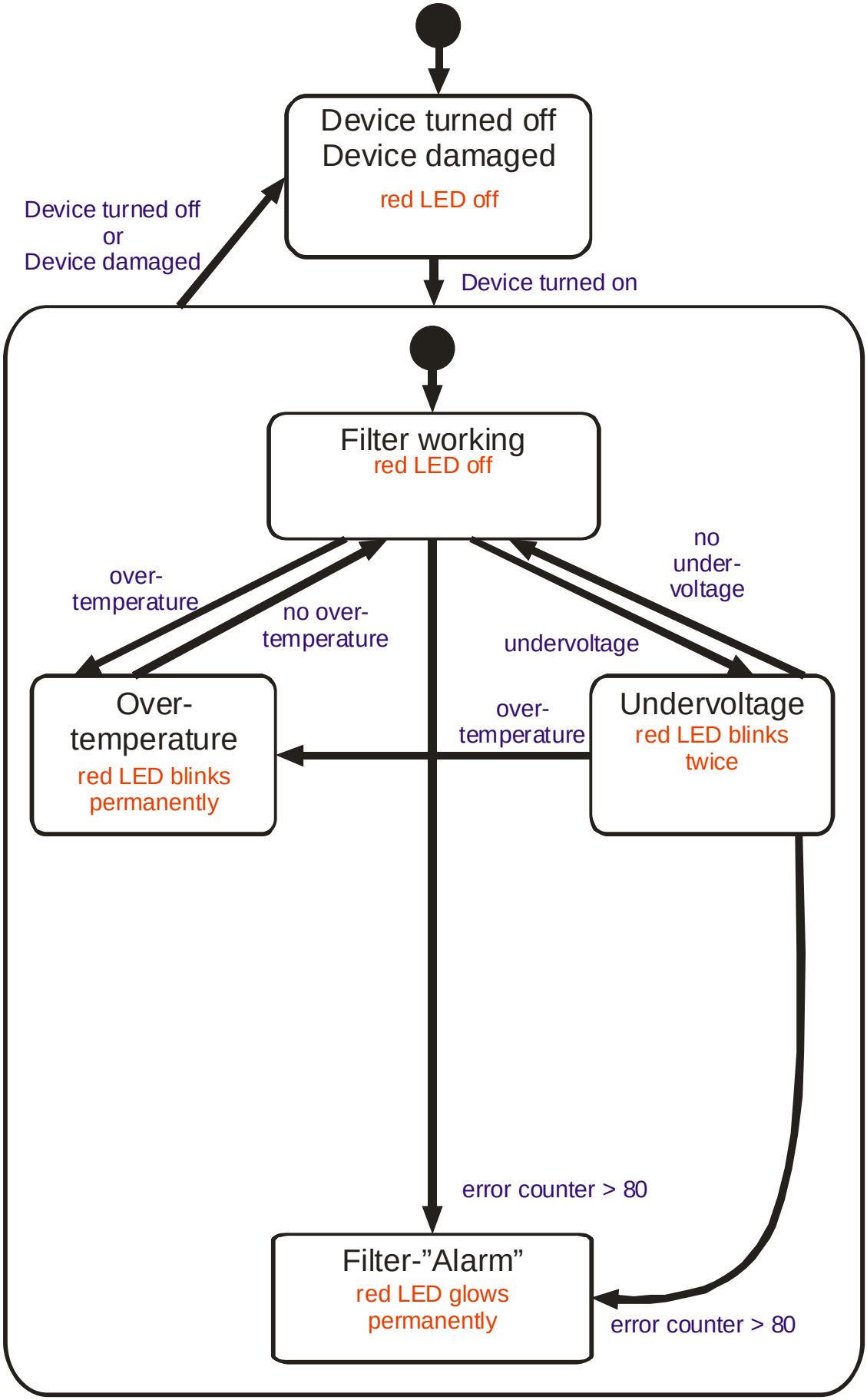
In this chapter the behavior of the high voltage power supply will be described by state charts.

7.1 Behaviour of the error counter, the green LED and logic output K1

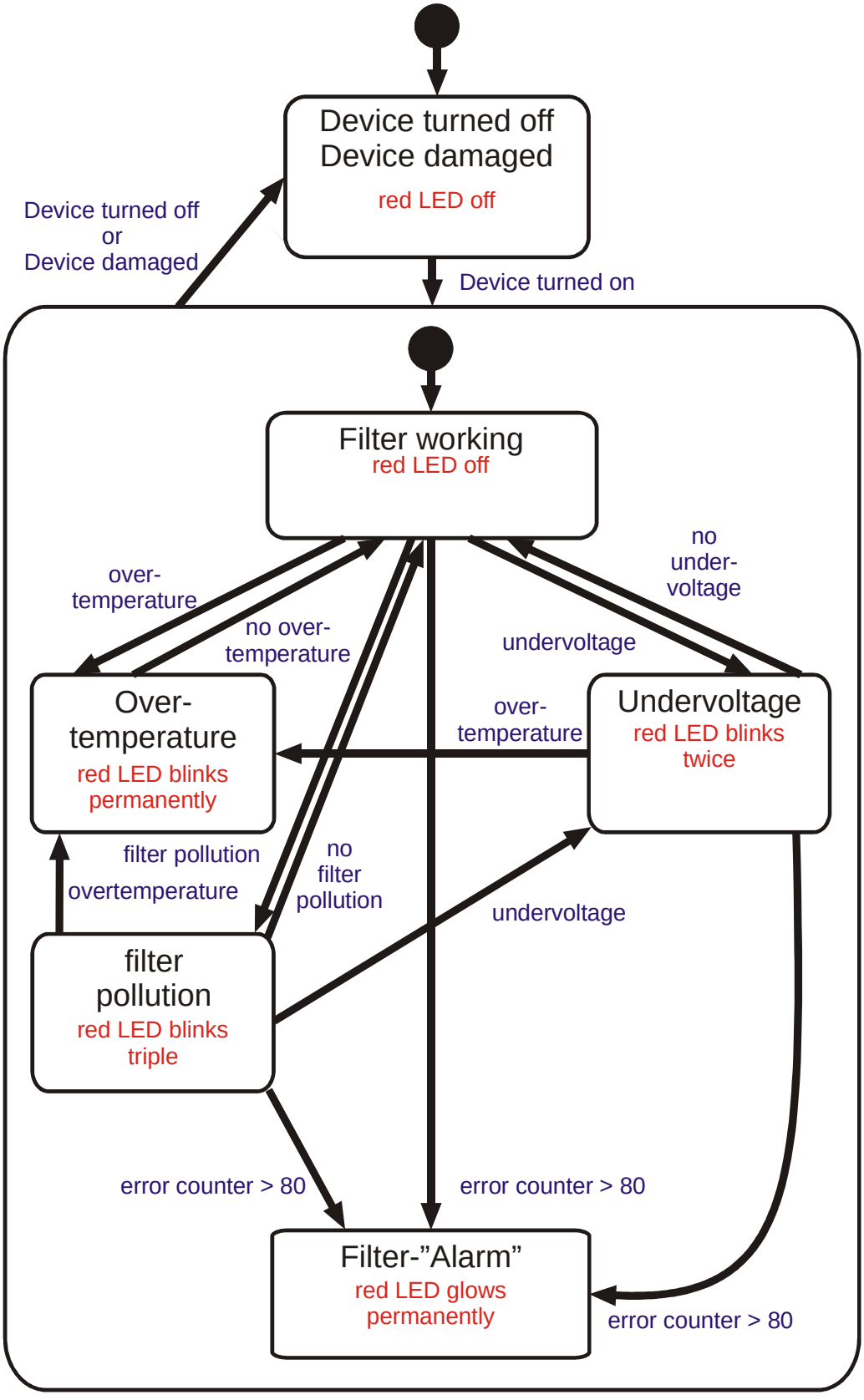




7.2 Behaviour of the red LED without pollution detection



7.3 Behaviour of the red LED with pollution detection



7.4 Behaviour of logic output K2