PHOTONIC SENSOR MONITOR

Tabletop Radiation Monitor and Controller

- With 2 Sensor Channels and Data Output -

The Photonic Sensor Monitor

The **Photonic Sensor Monitor** is a stand-alone measurement and control module based on approved Sensor Monitor 5.0 technology. It is designed for monitoring of photonic sensors like photodiodes or probes with diode- or pre-amplified output. The device displays radiation, dose and state information and provides it simultaneously via USB/RS232. Extensive programming options allow customized measurement and control functions. Three programmable relays (banana sockets on the back panel) allow an automated control of single- and multi-level irradiation processes. The Photonic Sensor Monitor is used in scientific research, biotechnology, solar measurements and various irradiation processes.

Standard Accessory

Sensor Connectors	Two sensor connectors with bare wires for individual configuration
Software	PC software with data monitoring and logging functions
Power Supply	15V AC Adapter with 2m cable
USB Converter	RS232 to USB Converter integrated into a 2m cable
Manual	CD with Photonic Sensor Monitor manual

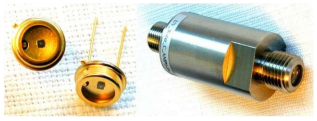
Specifications of the Photonic Sensor Monitor

Parameter	Value	Unit
Ports		
Number of probe inputs	2	-
Data output	USB/RS232	-
Number of relay outputs	3	-
Parameters of the housing		
Panel dimensions (BxH)	234x95	mm^2
Module depth	197	*mm*
Degree of protection	IP40	
Additional technical data		
Operating temperature	0….+70	℃
Storage temperature	-25… +85	℃
Power supply	12… 24	V_{DC}
Power consumption at 24 VDC	0,4	*W*
Weight	1,22	*kg*

Manufacturer: sglux GmbH; Agent: Boston Electronics, 91 Boylston St, Brookline MA 02445 USA
(800) 3475445 or (617) 5663821; fax (617) 7310935; uv@boselec.com ; www.boselec.com

Connections and Outputs

Sensor Input



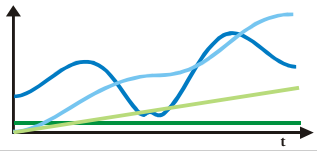
Both measurement inputs can be connected with pre-amplified probes or photodiodes.

Visualization of Values and State

Each row of the user configurable illuminated display shows the following information:

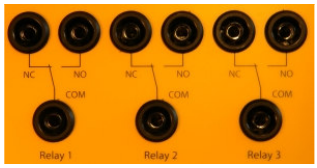
- Radiation or dose (in selectable units) and relay state
- Error messages like overrange

Data Output



The measurement data can be read out via USB or RS232 to a PC or PLC. The transfer is done with a CSV file which can be analyzed with a typical software like Origin or Excel.

Relay Functions



Three potential-free relays (banana sockets) can be used for process control.

- Activation when excessing or falling below a threshold intensity or reaching an irradiation dose (lamp switch and/or alarm)
- Logic combination, control of transport processes, switch conditions depending on dose, intensity and relative lamp output

Model Overview

Control cabinet units	
Sensor Monitor 5.0 (€ 390,-)	One channel, no data output
Sensor Monitor 5.0 Connect (€ 490,-)	One channel, USB & RS232 data output
Sensor Monitor 5.0 Double (€ 585,-)	Two channels, no data output
Sensor Monitor 5.0 Double Connect (€ 735,-)	Two channels, USB & RS232 data output
Stand-alone unit	
Photonic Sensor Monitor (€ 950,-)	**Two channels, USB & RS232 data output stand-alone version incl. power supply**

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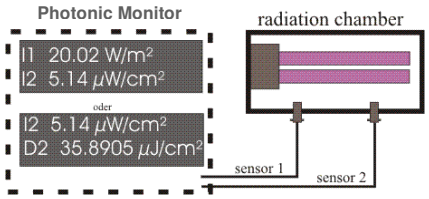
Basic Functions

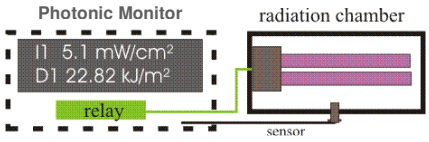
Radiation Measurement

Parallel measurements of two lamp outputs or radiation parts of one lamp can realized (e.g. UVA and UVB). In the first display example the intensity I1 at sensor 1 and the intensity I2 at sensor 2 is displayed. The second picture shows intensity and dose (time integration of the intensity).
If the data port is activated the complete relevant information (intensities, doses, error messages and state of relays and dose measurements) is transferred to a PC.



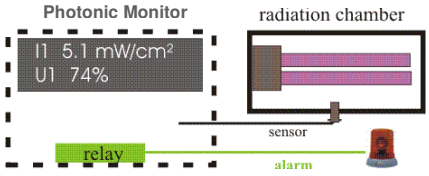
Measuerement and Lamp Control

At excessing or falling below a configurable intensity threshold or reaching an irradiation dose the lamp can be switched off or changed over to another lamp.



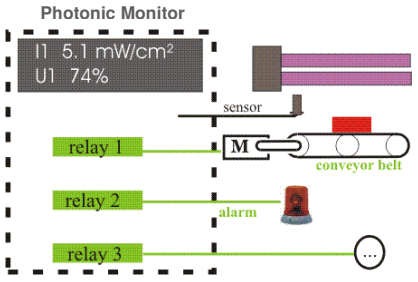
Measurement and Alarm

In the example an alarm is given if the percentaged lamp power falls below a configurable threshold. Further two relays can be used for other functions (switching of pumps, shutters etc.).



Transport Control of irradiated Goods

Measurement of the dose at irradiated goods and activation of the belt transport. The hold times of the relays are variable therefore the transport distance can be adjusted with the hold time. In the example a second relay is giving an alarm if the intensity falls below the threshold. The third relay can be used for information from a second sensor or for a logic combination with one of the other relays (e.g. transport if dose threshold is exceeded and intensity is higher than a minimum value at the same time).



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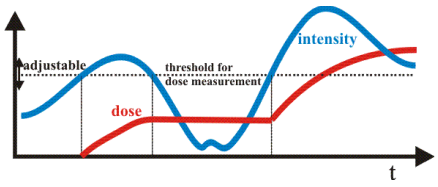
Advanced Use in Process Automation

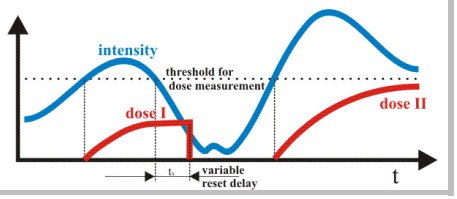
Automated Dose Measurement

The measurement of irradiation doses can be done manually or subjected to automation conditions.

In the first example the dose measurement is started at exceeding a critical intensity. If the intensity falls below the threshold the integration is interrupted and the dose stays constant. While exceeding the threshold again, the integration is continued.



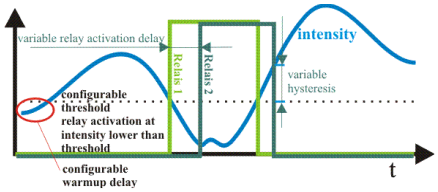
In the second example the dose measurement is finished with falling under the intensity threshold. The reset delay keeps the value on the display. At exceeding of the threshold a new dose is generated. The generation of single doses is used if the dose stop condition is activating a pump or a transport of a good (see below). For each irradiated good or segment a dose is calculated.



Relay Configuration

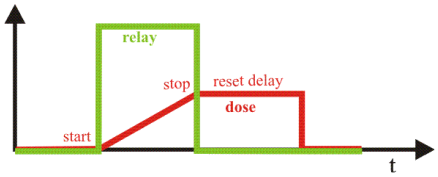
Three relays can be configured for controlling different functions activated by various configurable process conditions. In the simplest use the relays activate at falling under or exceeding a critical threshold of a selectable measure.

A warmup delay can be implemented to avoid false reports at the start-up process. Additionally it may be reasonable to ignore a short malfunction and only to consider a longer malfunction by using a relay activation delay. Hysteresis parameters can be set for values that are alternating around the threshold.



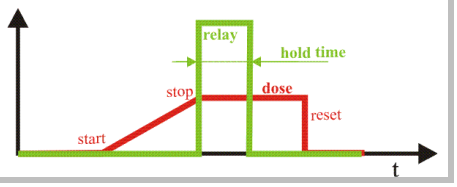
Dose Measurement Indication

Each relay can be associated with dose functions. Running dose measurements can be indicated by an activated relay. There is no difference if the dose measurement is operated manually or under automated conditions.



Dose Limit Indication

At the dose limit indication the relay is activated if the dose measurement is finished. With the hold time the time of the relay activation is set.



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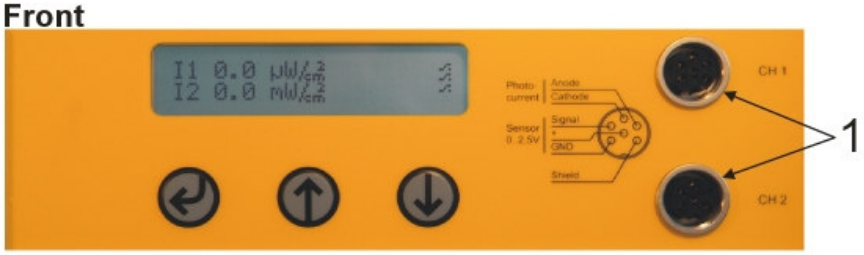
1 Photonic Sensor Monitor

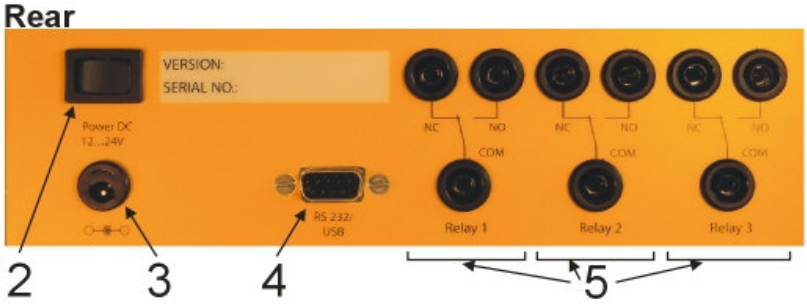
Contents

1.1 Connections

Front



Rear



1	**Two Inputs.** Each one can be used with a pre-amplified probe or a photodiode Connection of photodiodes (CH1 and/or CH2): anode of the photodiode — Anode cathode of the photodiode — Cathode if shield existent — Shield <u>Connection of pre-amplified probes with 0...2.5V (Probe 1 and/or Probe 2):</u> V+ of the probe — + ground of the probe (G) — GND Signal of the probe — Signal if shield existent — Shield
2	**Connection of the data output** The data output can be directly used as a RS232 port or as a USB output with the provided converter. The connection settings on your computer are provided on the enclosed connection sheet.
3	**Power supply** Please use the provided power supply or a power supply between 12 and 24V with polarity according to the connection icon.
4	**The Relays** are used in a standard way to switch electric circuits. If connecting to COM and NO, a relay activation will close the open circuit. If connected to COM and NC it switches vice versa.

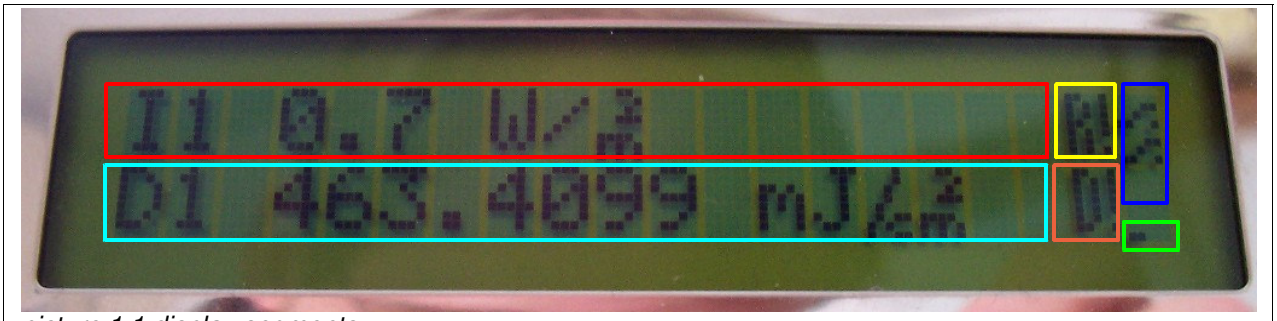
1.2 Operation

The operation is done via three buttons (enter, up and down). Each button can have three active states: pressed short, pressed long and held. The reaction of these states is depending on the operating condition. The Photonic Sensor Monitor uses three operating conditions which are explained in the following.

1.2.1 Display

After switching on the Photonic Sensor Monitor the measurement display is active and shows the preset measures. The measurements ara running immediately, the dose measurements and relays are working immediately or later, depending on the configuration.

The display is devided into 6 segments (picture 1.1).



picture 1.1 display segments

red: measure above yellow: error measure above
turquoise: measure below orange: error measure above
blue: relay state (relay 1 ... 2(3) from top to bottom)
green: condition of dose measurements 1 (left bar) und 2 (right bar)

The following button functions are active:

- UP/long => change of measure in the above rowe
- DOWN/long => change of measure in the below row
- ENTER/long => change into the menu
- UP/short => only at dose measurement in the above row: start/stop/reset of the shown dose measurement, if configured manually.
- DOWN/short=> only at dose measurement in the below row: start/stop/reset of the shown dose measurement, if configured manually.

1.2.2 Menue Navigation and Entering of Values

If changed from the measurements into the menu, the following button functions are active:

- UP/DOWN short => change to the next/previous menu item
- ENTER/short => editing a parameter or change into a submenu
- ENTER/long => leaving submenu/menu

If a parameter was opened for editing via ENTER, the ENTER button has for all types of parameters the following function:

- ENTER/short => exit editing, value is saved
- ENTER/lang => cancel editing, value is refused

The buttons UP/DOWN have different functions depending on the type of parameter:

1.2.2.1 Selection Parameter (Enumerator)

- UP/DOWN => changes to the next/previous parameter

1.2.2.2 Integer

- UP/short => increments the active value „0...9“
- DOWN/short => changes to the next value

1.2.2.3 Floating Point Number

- UP/short => increments the active value „0...9-.E“
- UP/long => jumps to the first special character („-.E)
- DOWN/short => changes to the next value

1.3 Menu Structure

Main Menue	type
Input 1 config.	submenu
Input 2 config.	submenu
Dosage 1 config.	submenu
Dosage 2 config.	submenu
Relay 1 config.	submenu
Relay 2 config.	submenu
Relay 3 config.	submenu
Device setup	submenu

table 1.2

Input-Menü	Typ
i? input signal	selection *
i? raw value unit	selection
i? irradiance unit	selection
i? customized unit	selection
i? number format	selection
i? cal. raw value	floating
i? cal. irradiance	floating
i? cal. customized	floating

table 1.1

Dosage-Menü	Typ
d? input channel	selection *
d? dosage unit	selection
d? cal. dosage	floating
d? start condition	selection
d? start delay	integer *
d? trigger level	floating
d? stop condition	selection
d? dosage limit	floating
d? reset condition	selection
d? reset delay	integer

table 1.3

Device-Menü	Typ
line frequency	selection *
logging interval	integer
default mode line 1	selection *
default mode line 2	selection *
factory setup	submenu

table 1.4

Relay-Menü	Typ
r? function	selection
r? signal channel	selection
r? warmup delay	Ganzzahl *
r? trigger point	floating
r1? threshold delay	integer
r? hysteresis	floating
r? on time	integer

Tabelle 1.5

Factory-Menü	Typ
CP PARAMETER	selection *
IP PARAMETER	selection *

table 1.6

Note: changes of parameters marked with* are active after a restart!

2 Standard Measurements

2.1 Overview

The Photonic Sensor Monitor has two measurement channels, which can be set on any input channels (also both on the same input).

Each measurement channel provides 3 measures: raw value, irradiation value and user value.

- The raw value is used for the first calibration and sensor fitting.
- The radiation value is the basis for the dose measurement. If the dose measurement is used this value must be calibrated first.
- The user value provides further units

2.2 List of Parameters

Parameter	Selections and valuation
i? input signal	"current 1 ", "current 2 " "voltage 1", "voltage 2"
i? raw value unit	"%" , "nA" , "{005}A" , "mA" , "mV" , "V"
i? irradiance unit	[µW, mW, W, kW, MW] pro [cm², m²]
i? customized unit	"nA" , "µA" , "mA" , "A" "µV" , "mV" , "V", "UVI" , "%" , "‰", "W", "W/sr", "W/m²sr", "mW/cm²sr", "lx", "klx", "cd"
i? number format	"0.###" (3 decimal places) "#.##" "##.#" "####" (no decimal place) This does not effect the dose measurement!
i? cal. raw value	$1 \cdot 10^{\pm 15}$
i? cal. irradiance	$1 \cdot 10^{\pm 15}$
i? cal. customized	$1 \cdot 10^{\pm 15}$

table 2.1

3 Dose Measurement

3.1 Overview

The Photonic Sensor Monitor has two dose measurement channels, which can be set on any input channels (also both on the same input).

The behaviour of the dose measurement in the states start, stop, reset can be a combination of manual and automatic reactions. If a relay activation is needed according to the dose measurement state, the configuration is don in the relay functions.

A dose increment is calculated 20 times per second and added. Integer arithmetics is used to reduce accumulated rounding errors.

3.2 Use of Parameters

Some parameters are needed only under special dose measurement conditions. They only need to be configured when they are used.

	Start			Stop			Reset	
Name of parameter	**manual**	**auto delay**	**auto thresh.**	**manual**	**auto limit**	**auto thresh.**	**manual**	**auto delay**
d? input channel	X	X	X	X	X	X	X	X
d? dosage unit	X	X	X	X	X	X	X	X
d? cal. dosage	X	X	X	X	X	X	X	X
d? start condition	X	X	X					
d? start delay		X						
d? trigger level			X			X		
d? stop condition				X	X	X		
d? dosage limit					X			
d? reset condition							X	X
d? reset delay								X

table 3.1

3.3 List of Parameters

Parameter	Selections and valuation
d? input channel	"i1 irradiance" "i2 irradiance"
d? dosage unit	[µJ, mJ, J, kJ, MJ, GJ, Wh, kWh] / [cm², m²] "J", "J/sr", "J/m²sr", "mJ/cm²sr", "lxs", "klxs", "cds"
d? cal. dosage	$1 \cdot 10^{\pm 15}$
d? start condition	"manual" "@ power on delayed" "auto > trigg.level"
d? start delay	0 ... 30000 cs (centiseconds, = 3000 s, = 50 min)
d? trigger level	$1 \cdot 10^{\pm 15}$
d? stop condition	"manual" "auto @ dosage limit" "auto < trigg.level"
d? dosage limit	$1 \cdot 10^{-6}$ ... $(1 \cdot 10^{+8} - 1)$ = 99'999'999
d? reset condition	"manual" "auto delayed"
d? reset delay	0 ... 30000 cs (centiseconds, = 3000 s, = 50 min)

table 3.2

3.4 Dose Measurement in Detail

3.4.1 Signal Selection, Unit and Calibration Value

- The dose measurement references on one of the irradiation channels (d? input channel)
- The measurement is always running with the preset units
- The calibration value of the dose measurement must contain all conversion factors given by the units of irradiation and dose channel as well as the desired valuation of the measure.

3.4.2 Start Conditions

There are two different possibilities to start a dose measurement:

- manual: a dose measurement showed in the above/below row can be started by a short pressing on button up/down
- automatic at system start, with delay if needed

- automatic at exceeding an irradiation threshold

3.4.3 Stop Conditions

The dose measurement can be stopped in the following ways:

- manual: a dose measurement showed in the above/below row can be stopped by a short pressing on button up/down
- automatic: at reaching a dose threshold
- automatic: at falling below an intensity threshold (same value as set in the start conditions)

3.4.4 Reset Conditions

After the dose measurement is stopped, it needs to be reset before a new measurement cycle can be started. Therefore the following options exist:

- manual: a dose measurement showed in the above/below row can be reset by a short pressing on button up/down
- automatic, if needed with delay: after the reset delay the dose measurement is reset

4 Relay Functions

4.1 Overview

The Photonic Sensor Monitor has 3 independent a free configurable relays. Tey can work threshold depending or according to the dose measurement. The threshold functions allow a warmup bridging. All functions provide a aconfiguration of the pulse length which means that a minimum activation time can be set.

4.2 Use of Parameters

	ON above threshold	ON below threshold	ON dosage 1 @ limit	ON dosage 2 @ limit	ON dosage 1 running	ON dosage 2 running
r? function	X	X	X	X	X	X
r? signal channel	X	X				
r? delay *(warmup delay)*	X	X				
r? trigger point *(theshold)*	X	X				
r1? threshold delay	X	X				
r? hysteresis	X	X				
r? on time	X	X	X	X		

table 4.1

4.3 List of Parameters

Parameter	Selections and valuation
r? function	"ON above threshold" , "ON below threshold" "ON dosage 1 @ limit" , "ON dosage 2 @ limit" "ON dosage 1 running" , "ON dosage 2 running"
r? signal channel *(source value)*	"i1 raw value" , "i2 raw value" "i1 irradiance" , "i2 irradiance" "i1 customized" , "i2 customized" "d1 dosage" , "d2 dosage"
r? delay *(warmup delay)*	0 ... 30000 cs (centiseconds, = 3000 s, = 50 min)
r? trigger point	$1 \cdot 10^{\pm 15}$
r1? threshold delay	0 ... 30000 cs (centiseconds, = 3000 s, = 50 min)
r? hysteresis	$1 \cdot 10^{\pm 15}$
r? on time	0 ... 30000 cs (centiseconds, = 3000 s, = 50 min)

table 4.2

4.4 The Relay Functions in Detail

4.4.1 Exceeding a Threshold

- At a warmup delay >0 the relay stays inactive for this time. The warmup time is went threw once after thestart of the device.
- If the source value>threshold, the relay gets activated immediately if the value is pending long enough (threshold delay). If the value falls under the threshold within that time, the delay is started again.
- At threshold delay=0 the relay activates immediately
- At source value < (threshold – hysteresis), the relay turns back into the standard state (if on time is expired).
- If the source value after the on time is not below (threshold – hysteresis), the relay stays activated until this condition is given (now the relay falls immediately into the standard state).

4.4.2 Falling below a Threshold

- At a warmup delay >0 the relay stays inactive for this time. The warmup time is went threw once after thestart of the device.
- If the source value<threshold, the relay gets activated immediately if the value is pending long enough (threshold delay). If the value exceeds threshold within that time, the delay is started again.
- At threshold delay=0 the relay activates immediately
- At source value > (threshold – hysteresis), the relay turns back into the standard state (if on time is expired).
- IIf the source value after the on time is not higher than (threshold + hysteresis), the relay stays activated until this condition is given (now the relay falls immediately into the standard state).

4.4.3 Dose Limit

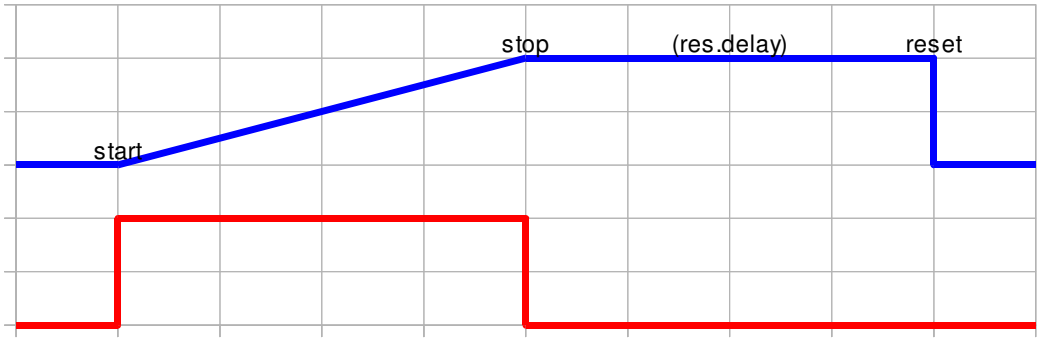
- The relay activates immediately after reaching the dose limit of the respective dose channel. das Relais zieht sofort an, wenn das Dosislimit der Dosismessung des jeweiligen Dosiskanals erreicht wurde
- the relay inactivates immediately after the on time is expired
- after a reset of the dose the process can run again

blue: dose measurement, red: relay

The on time of the relay can be shorter or longer than the reset delay. In the ladder the on time must exceed for reaching the dose threshold again.

4.4.4 Dose Run

- The relay is activated as long as the dose measurement is running



blue: dose measurement, red: relay

5 Device

5.1 List of Parameters

Parameter	Selections and valuation
line frequency *(Net frequency)*	"50 Hz" , "60 Hz"
interval *(logging intervall)*	1 ... 86400 s (= 24h)
default mode line 1 *(start display row 1)*	"i1 raw value" , "i1 irradiance" , "i1 customized" , "d1 dosage" "i2 raw value" , "i2 irradiance" , "i2 customized" , "d2 dosage"
default mode line 2 *(start display row 2)*	"i1 raw value" , "i1 irradiance" , "i1 customized" , "d1 dosage" "i2 raw value" , "i2 irradiance" , "i2 customized" , "d2 dosage"
factory setup	Submenu

table 5.1