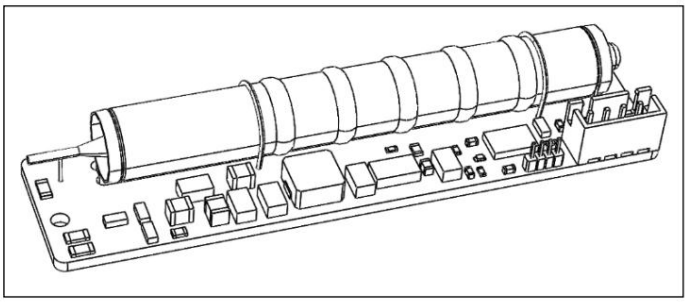
Climate Guard

RadSens-4v0

Modular dosimeter-radiometer for Geiger-Muller counters



1 Main Features

Functional:

ÿ Registration of pulse from the counter anode

ÿ Universal I2C connection

ÿ Support for two algorithms for calculating radiation intensity

ÿ Dynamic adjustment of the counting time period

ÿ Pulse measurement general quantities

ÿ Software change of I2C address ÿ Autonomous use as radiation indicator

ÿ Logical level 3.3v. Tolerant to level 5v (can be used without a converter)

ÿ Works with any counter with a working voltage ~400v **Electrical:**

ÿ Low supply voltage 3.0…3.5 V

ÿ Maximum current consumption at high radiation - no more than 100 µA

Technical:

ÿ Compact dimensions module 89mm x 21mm x 13.5mm

ÿ Fixed (vibration-resistant) counter location To

ÿ Module weight no more than 12 g

Range from -20°C working ÿ temperature to +60°C

Technical information

2 Description

RadSens is a universal dosimeter-radiometer of modular form factor. A gas-discharge or mica Geiger-Muller counter can be used as a sensitive element in the module.

The device supports measurement and calculation of radiation intensity using two algorithms: with a dynamic range of counting time for detecting local pollution sources, and with a wide

static time range for precise measurement of the current background radiation value. Also

it is possible to use

module without additional devices as a radiation “indicator”,
based on the blinking frequency of the LED installed on the board.

Pulse registration, calculation algorithms and data transmission via I2C with a bus frequency of up to 100 kHz
implemented on the STM32 microcontroller installed on the board. The module supports software address change. It is also possible to adjust via I2C

sensitivity to ionizing counter To radiation.

When starting up, the dosimeter blinks its LED - this means it is in operating mode.

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3 Device characteristics

3.1 Technical

Overall dimensions of the device with the installed meter: 89mm x 21mm x 13.5mm
for the RSb model and 120 x 21 x 20 for the RSb-h version. Module weight: 12 grams.

Parameter	Meaning			Size - not
	less than working	not more than		
Supply voltage	3,0	3,3	3,5	IN
Maximum current consumption	-	80	100	ÿA
Anode voltage on a gas-discharge counter	380	400	440	IN
Operating temperature range	-40	+20	+70	°C
Operating humidity range	0	60	98	%

Table 1 (technical specifications)

3.2 Metrological

By default, the sensitivity of the module is set to the more common Geiger counters SBM20-1 or SBM20 manufactured by SF JSC "NIITFA", decimal number TDMK.433217.008, corresponding to the technical specifications

OD0.339.544TU. The calculation of radiation intensity is performed using the formula: 60 min × 60 sec

$= \times \frac{}{\text{Wed}^{\times}}$, Where

ÿÿÿ – average sensitivity of the SBM20-1 (SBM20) counter to gamma radiation from the Ra226 source

dT – time interval for recording the number of pulses,

N – the number of pulses recorded during time dT,

RAD – the value of radiation activity in ÿR/h.

Parameter	Meaning			Size - not
	less than working	not more than		
Range of measured radiation	14,4	-	144 000,0	µR/h
Number of pulses between data readings	0	-	65 535	imp
Gamma Sensitivity Ra226 Relative Sensitivity Range	100	105	110	imp/ÿR
	-	-	±15	%

Table 2 (metrological characteristics)

4 Information interaction

4.1 Register Map

Data exchange (setting and transmission of measured values) is carried out via
I2C interface at a speed of up to 1000 kHz. The sensor operates in Slave mode.
with default address 0x66 (configured by software). Logical level 3.3v. Tolerant to 5v level (can be used with 5v devices without a converter).

Address	Name	R/W	Range	Size-ness
0x00	Device ID	R	0x7D	-
0x01	Firmware Version	R	0-255	-
0x02	<reserved>	-	-	-
0x03-0x05	Radiation intensity (measurement period T < 123 sec.) Radiation intensity	R	0 ... 1 440 000	0.1*ÿR/h
0x06-0x08	(measurement period T = 220 sec.)	R	0 ... 1 440 000	0.1*ÿR/h
0x09-0x0A	Pulse counter (resets when read)	R	0 ... 65535	imp
0x0B-0x0F	<reserved>	-	-	-
0x10	Device address	W	0x03-0x77	-
0x12-0x13	Counter sensitivity	R/W	0-65535	imp/ÿR
0x14	Indicator diode control	R/W	0/1	-

Table 3 (map of information interaction registers)

4.2 Description of registers

4.2.1 Device ID *[address: 0x00, size: 8 bits, access: R]*

Control register containing the product identifier. Default value is 0x7D. Used to control the device connection.

4.2.2 Firmware version
[address: 0x01, size: 8 bits, access: R]

Register for storing the current firmware version. Used to control and update the software in a timely manner.

4.2.3 Radiation intensity (dynamic counting period)
[address: 0x03, size: 24 bits, access: R]

Contains the dynamic value of the intensity of ionizing gamma radiation. When detecting a sharp change in radiation intensity (either up or down), it dynamically adjusts the counting period

sliding window so that the range covers the time period,

containing only current data. Allows using the device in local pollution search mode. Update frequency – 1 sec.

4.2.4 Radiation intensity (static counting period)

[address: 0x06, size: 24 bits, access: R]

Contains the statistical value of the intensity of ionizing gamma radiation. The counting period of the sliding window is 220 sec. Allows
make precise measurements of the constant radiation background. Update frequency – 1 sec.

4.2.5 Pulse counter

[address: 0x09, size: 16 bits, access: R]

Contains the accumulated number of pulses registered by the module since the last reading of data via I2C. The value is reset each time it is read. Allows you to directly process the pulses from the Geiger counter and implement other algorithms. The value is updated at the moment of registration of each pulse.

4.2.6 Device Address

[address: 0x10, size: 8 bits, access: W]

This register is used to change the device address when it is necessary to connect several devices to one line at the same time. By default, it contains the value 0x66. After recording, the new value is saved in the non-volatile memory of the microcontroller.

4.2.7 Counter sensitivity

[address: 0x12, size: 16 bits, access: R/W]

Contains the value of the coefficient Psr (p. 3.2), used to calculate the radiation intensity. If necessary (for example, when installing a different type of counter), the required sensitivity value in imp/ÿR is entered into the register. The default value is 105 imp/ÿR. Upon completion of recording, the new value is saved in the non-volatile memory of the microcontroller.

4.2.8 Indicator diode control

[address: 0x14, size: 8 bits, access: R/W]

Indicator diode control register (the diode is located on the module board). By default, it is in the on state. To enable the indication, 1 must be written to the register, to disable, 0. When attempting to write other values, the command is ignored.

4.3 Pulse output

4.3.1 Description

Designed to register pulses by an external device (controller).

4.3.2 Operating procedure

The pulse output duplicates the interrupt of the Geiger counter. When the counter output line is set to low position for approximately 11.2 ms. The output operates in open collector mode. To register pulses, it is necessary to add an external pull-up to the positive supply. The delay after pulse registration by the counter until the signal is generated on the line is 15 ÿs.

5 Connection connector

The board has a connector "XH-4A", the mating part is "xh2.54-4p". The connector pinout is shown in the table below. The pinout does not indicate a separate contact - INT. The operation of this output is shown in paragraph 4.3.

Contact	Name	Purpose
1	VCC	Sensor power supply circuit
2	GND	General conclusion
3	I2C-SCL	I2C interface clock line
4	I2C-SDA	I2C interface data line

Table 4 (connector pinout)

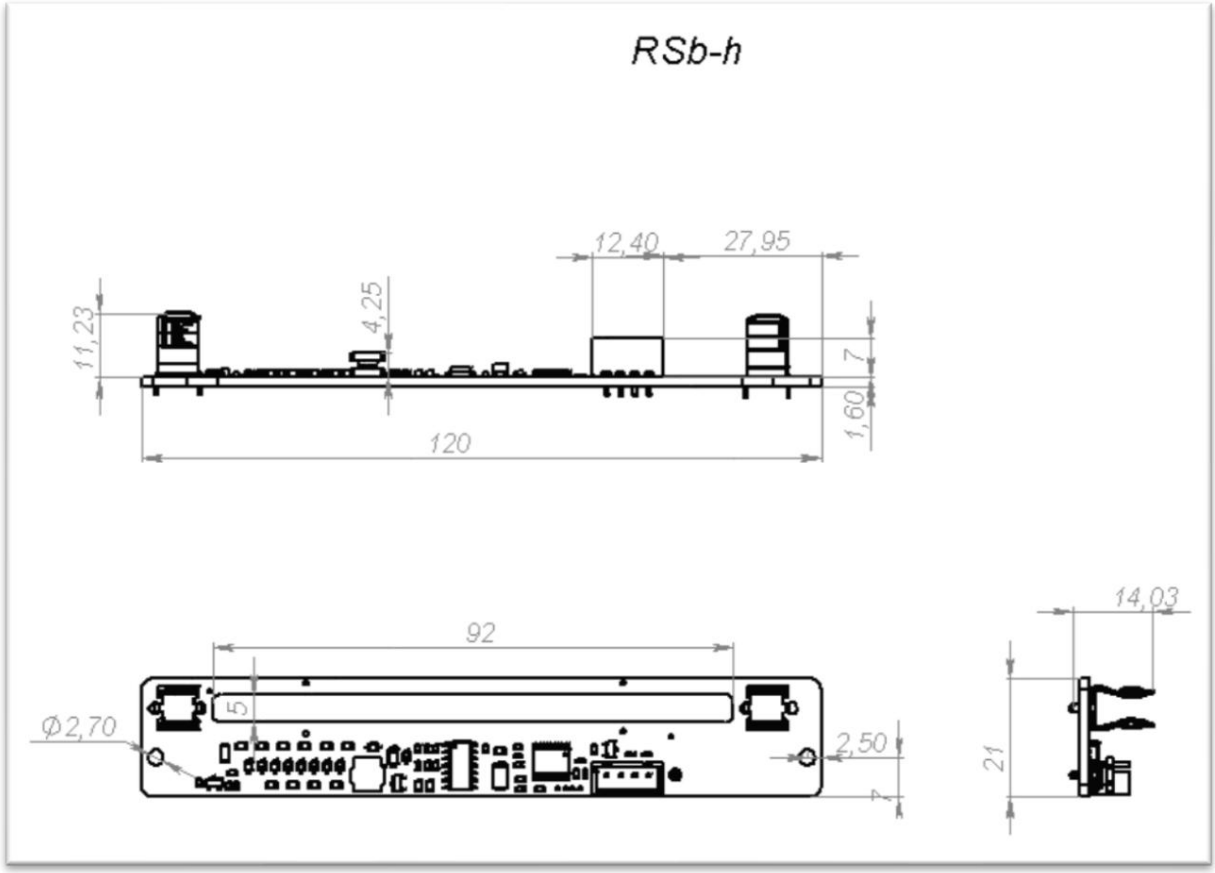
6 Model range

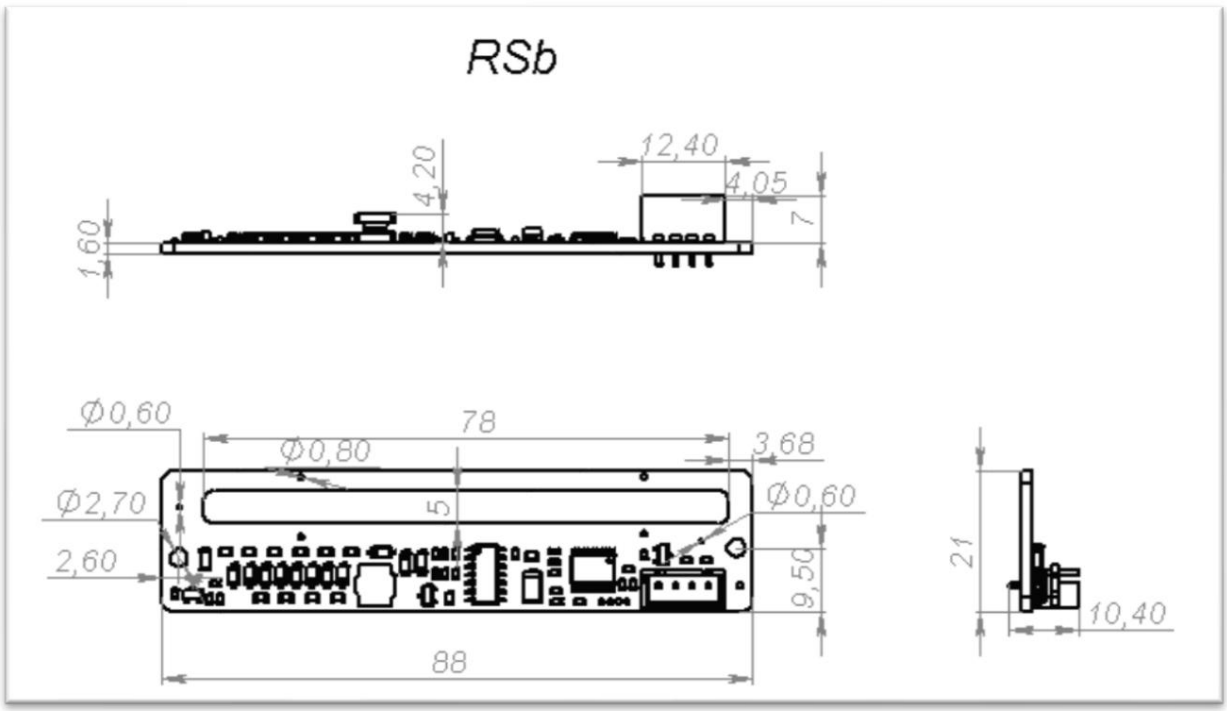
The dosimeter is produced in 4 versions. The description of the versions is given in the table below.

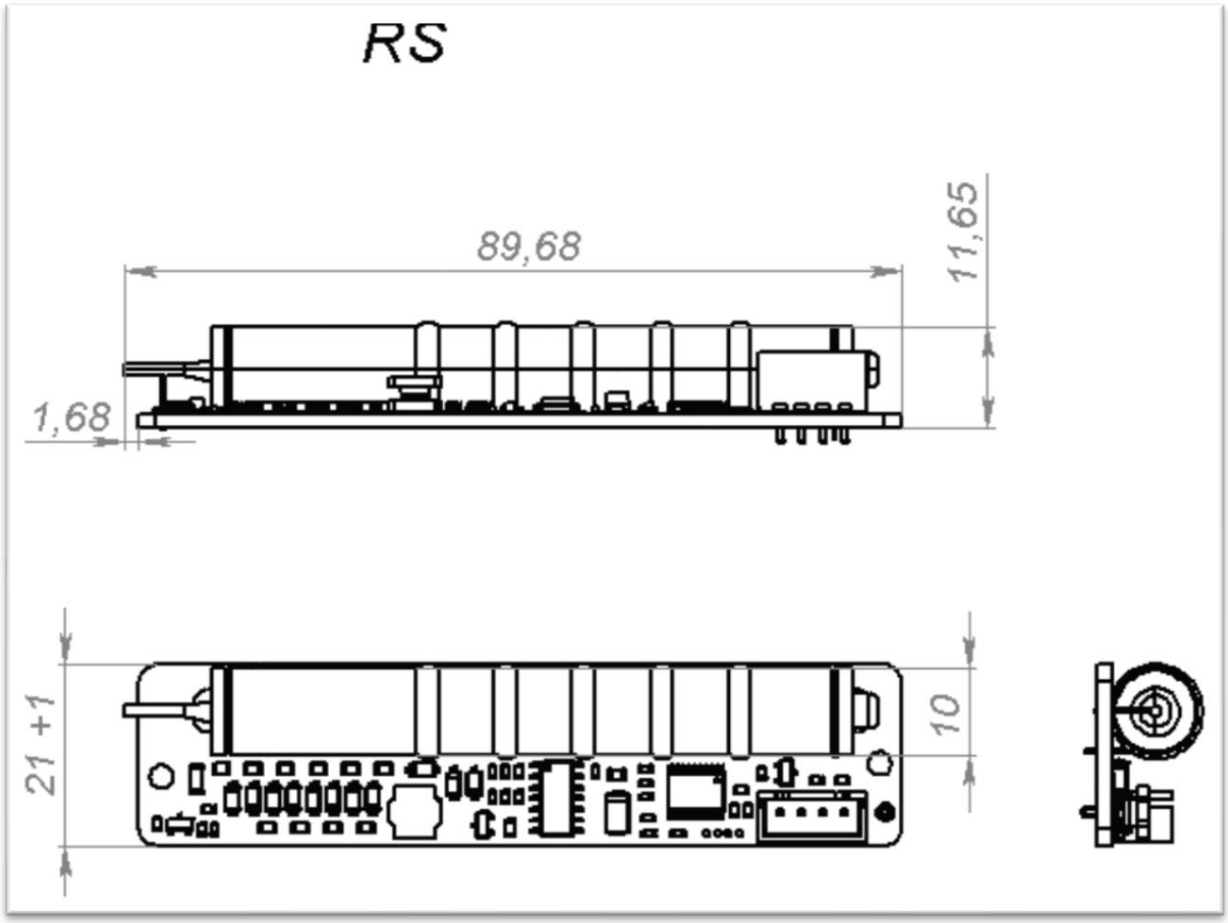
Part number/ item	Description
RS	Compact version of the module with the installed sbm20-1 counter. The counter connection method is soldering.
RSb	Compact version of the module, not supplied with a meter. Installing the meter "by soldering"
RSh	An enlarged version of the module, equipped with a sbm20 meter. The meter is fixed in special "quick-release" holders.
RSbh	An enlarged version of the module, without a counter installed. It has 2 special holders for gas discharge tubes, as well as 2 holes for soldering.

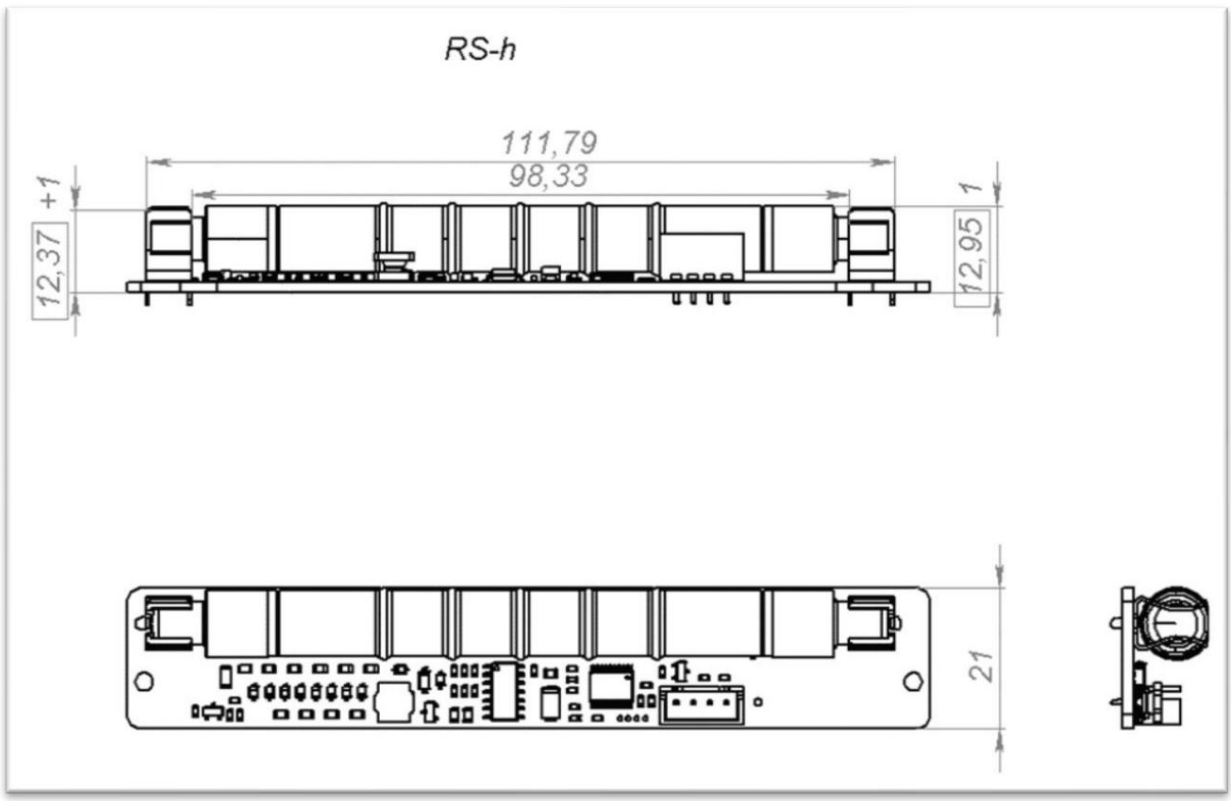
Table 5 (RadSens versions)

7 Module drawing









8 Additional Resources

Contact information and details on how to use the module are provided in the table below.

Description	Link
Manufacturer's website http://climateguard.ru/	
Library for working with the module https://github.com/climateguard/RadSens	

Table 6 (useful resources)