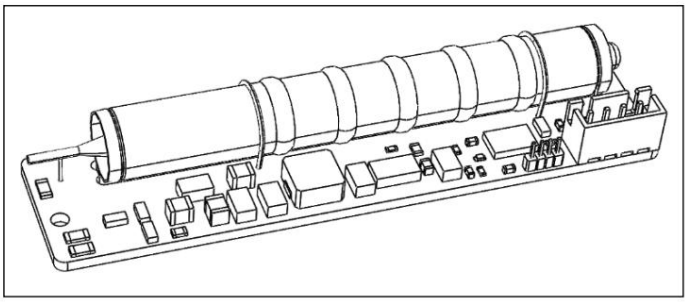
ClimateGuard

RadSens 1v6/2v6

Modular dosimeter-radiometer on a Geiger counter SBM20-1

Technical information



1 Main Features

• Functional:

- Universal I2C connection
- Support for two algorithms for calculating radiation intensity
- Dynamic adjustment of the counting time period
- Measuring the total number of pulses
- Software change of I2C address
- Autonomous use as radiation indicator

• Electrical:

- Low supply voltage 3.0…3.5 V
- Maximum current consumption at high radiation is no more than 50 mA

• Technical:

- Compact module dimensions 89mm x 21mm x 13.5mm
- Fixed (vibration-resistant) counter location
- The weight of the module is no more than 12 g
- Operating temperature range from -20°C to +60°C

2 Description

RadSens is a universal dosimeter-radiometer of modular form factor. The sensitive element in the module is a gas-discharge Geiger-Muller counter SBM20-1, used in most household and professional dosimeters.

The device supports measurement and calculation of radiation intensity using two algorithms: with a dynamic range of counting time for detecting local sources of pollution, and with a wide static time range for accurate measurement of the current radiation background 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 400 kHz
implemented on the STM32 microcontroller installed on the board. The module supports software address change and switching on/off the high-voltage converter to improve energy efficiency. It is also possible to adjust the sensitivity to ionizing radiation via I2C, which allows using other counters with similar anode supply voltage on this module.

counter To

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3 Device characteristics

3.1 Technical

Overall dimensions of the device with the installed counter: 89mm x 21mm x 13.5mm. 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	-	20	50	MA
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

The main element is the Geiger counter SBM20-1 manufactured by SF JSC "NIITFA", decimal number TDMK.433217.008, corresponding to the technical conditions OD0.339.544TU. Intensity calculation 60 min × 60 sec

radiation is performed according to the formula: $= \times \frac{}{Wed^{\times}}$, Where

ÿÿÿ – average sensitivity of the SBM20-1 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 400 kHz. In this case, the sensor operates in Slave mode with default address 0x66 (configured by software).

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.)	R	0 … 1 440 000	0.1*ÿR/h
0x06-0x08	Radiation intensity (measurement period T = 500 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	R/W	0x03-0x77	-
0x11	Generator HV	R/W	0/1	-
0x12-0x13	Counter sensitivity	R/W	0 - 65535	imp/ÿR

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 a time interval containing only relevant data. Allows the device to be used in local pollution search mode. Refresh rate – 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 500 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 HV generator

[address: 0x11, size: 8 bits, access: R/W]

High-voltage converter control register. By default, it is in the on state. To turn on the HV generator, it is necessary to write 1 to the register, to turn off 0. When trying to write other values, the command is ignored.

4.2.8 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.

4.3 Pulse output

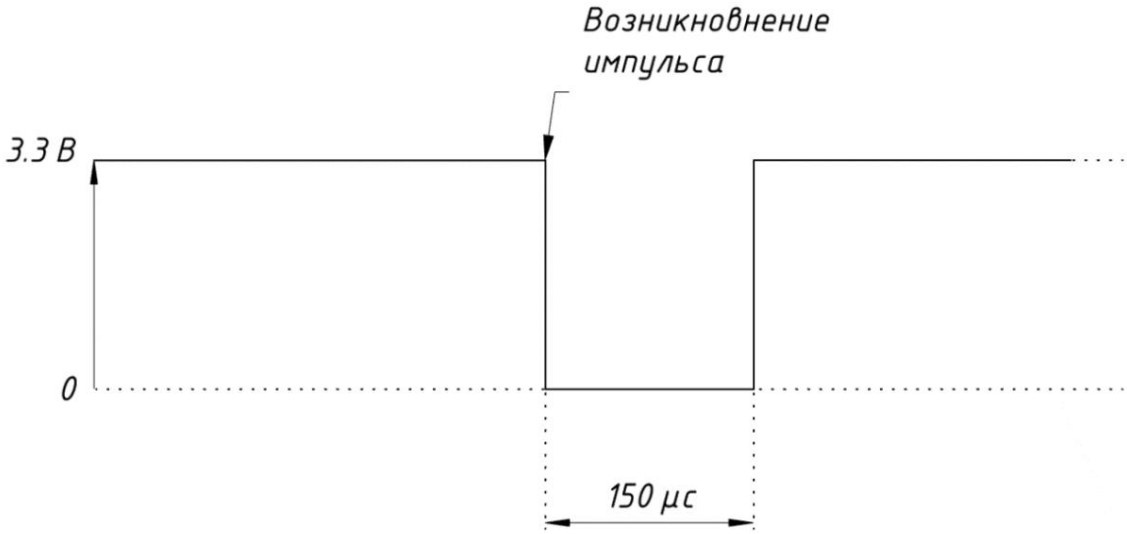
4.3.1 Description

The pulse output is designed to register pulses by an external device (controller) in real time.

4.3.2 Operating procedure

The pulse output duplicates the interrupt of the Geiger counter. When the counter is broken, the output line is set to a low position for about 150 µs. The output operates in the open collector mode. To register pulses, it is necessary to add an external pull-up to the plus

nutrition.



Scheme 1 (pulse output operation)

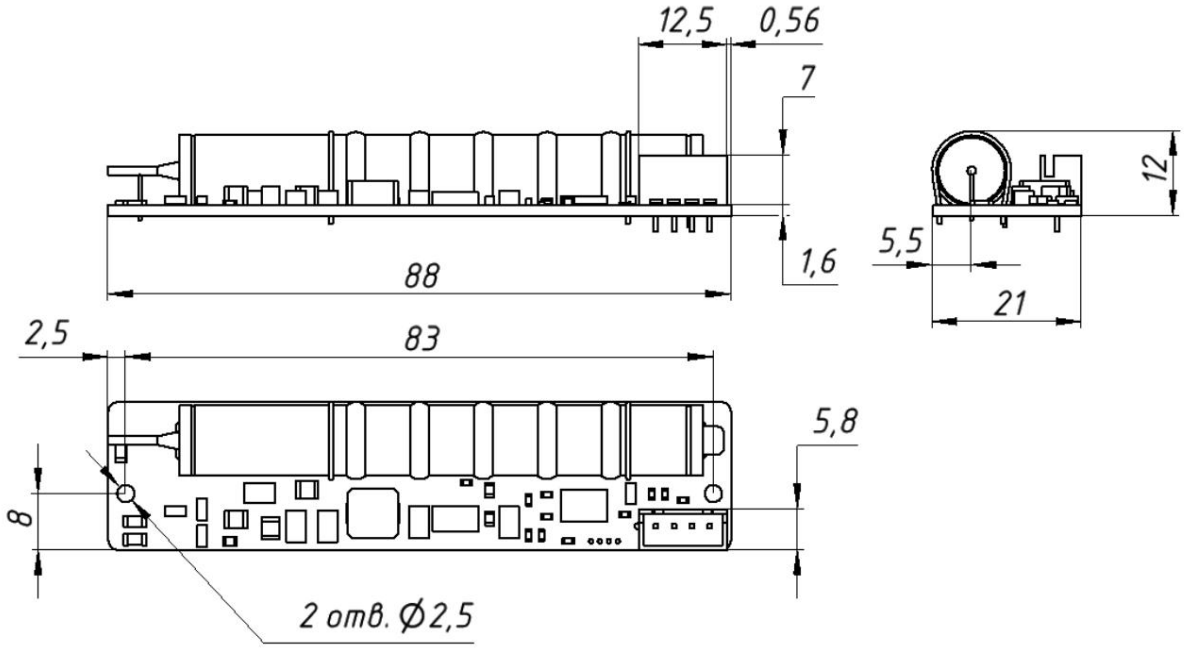
5 Connection connector

The board has an XH-2.54 4P connector. The connector pinout is shown in the table below.

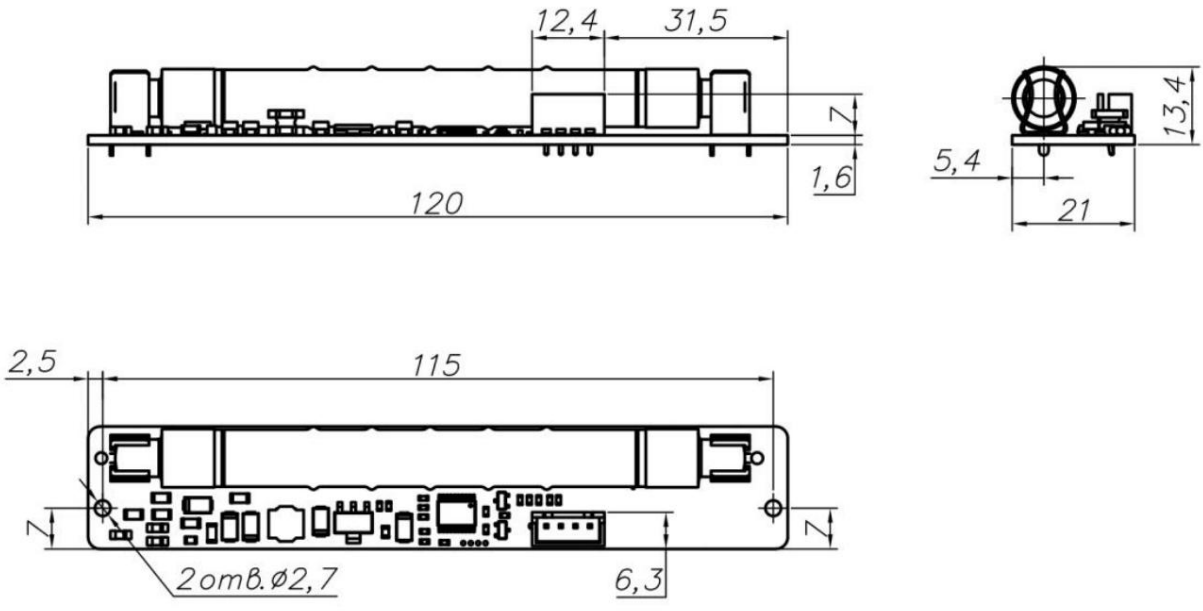
Contact	Name	Purpose
1	VCC	Sensor power supply circuit
2	GND	Earth
3	I2C-SCL	I2C interface clock line
4	I2C-SDA	I2C interface data line
5	INT	Pulse output

Table 4 (connector pinout)

6 Module drawing



Drawing 1. RadSens 1v6



Drawing 2. RadSens 2v6

7 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	
Telegram community https://t.me/climateguard_community	

Table 5 (useful resources)