

MiniPIX Sprinter

Miniaturized and low power radiation camera



Key features	
Readout chip type	Timepix2
Pixel size	55 x 55 μm (55 x 110 μm at the edges and 110 x 110 μm at the corners)
Sensor resolution	256 x 256 pixels
Counter bit depth	10/ 14/ 18 bit
Dark current	none
Interface	USB 2.0 (Full-Speed)
Maximum frame rate	up to 99 fps
Dimensions	80 x 21 x 14 mm
Weight	37 g

The MINIPIX_{SPRINTER} is a miniaturized and low-power radiation camera solution that incorporates a single Timepix2 detector with a sensor of customer preference (typically 300 μm thick silicon). The detector features 256 x 256 pixels with a pitch of 55 μm and is capable of single particle counting or high-energetic particle tracking for space applications¹. This energy-sensitive detector also brings a new dimension to radiographic images. The MINIPIX_{SPRINTER} device utilizes a USB 2.0 interface, allowing for reading of up to 99 frames per second. The signal-to-noise ratio exceeding 1000 enables crystal-clear X-ray images with low noise².

The MINIPIX_{SPRINTER} device controlled via a USB interface is compatible with major operating systems: MS Windows, Mac OS and Linux. The software Pixet Pro for detector operation, offering comprehensive functionality and ease of use, is supplied with the device. With its miniaturized size, low power consumption, and advanced Timepix2 detector technology, the MINIPIX_{SPRINTER} is an efficient and effective solution for various radiation detection applications (imaging, XRD, XRF, particle tracking, space radiation monitoring, electron microscopy, science, education, etc.).

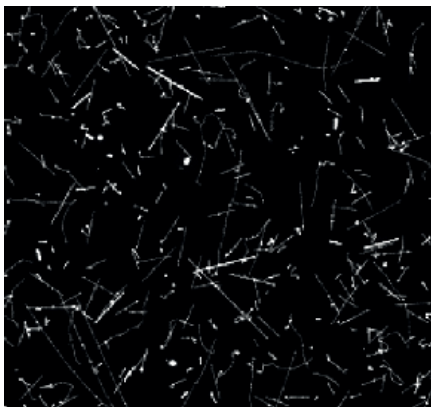


Illustration of single particle sensitivity of Timepix2 detector. The tracks of different particles of radiation background (mostly muons and few protons) were recorded in 5 minutes on board of an airplane. No noise (clean zero) is seen in the dark regions.

¹ The device is not certified dosimeter. It serves as the first level indicator and monitor of radiation fields allowing identification of a radiation type. Radiation protection of people cannot be based on measurements with this device.

² Dynamic range of final picture is theoretically unlimited; the only limiting factor is exposure time.

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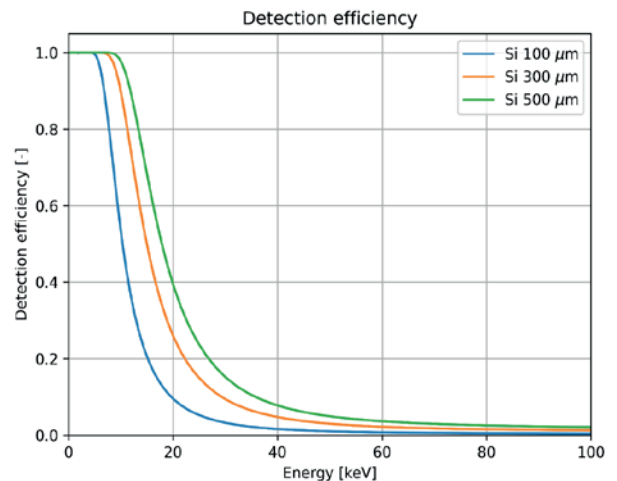
Device parameters

Operating conditions				
Symbol	Parameter	Value	Units	Comment
T_{def}	Operating temperature range *	10-55	°C	
Φ	Humidity	<80	%	Not condensing
IP	IP rating	IP40		

* The device shall be thermally stabilized during operation.
The device will automatically shut down after exceeding 55 °C.

Electrical specification $T_{dev} = 25\text{ °C}$, USB voltage $V_{CC} = 4.8\text{ V}$						
Symbol	Parameter	Min	Typ	Max	Units	Comment
V_{CC}	Supply voltage	4.5	5.0	5.25	V	
I_{CC2}	Chip active		550	1000*	mA	* Tentative
P1	Power Dissipation		2.75	5	W	
V_{BIAS}	Bias Voltage for sensor diode	5	150	200	V	Depends on sensor thickness

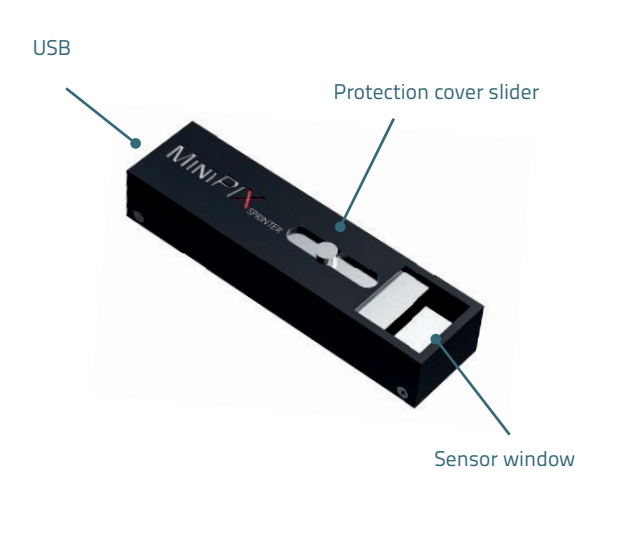
Sensor parameters $T_A = 25\text{ °C}$						
Symbol	Parameter	Si			Units	Comment
	Sensoe thickness	100	300	500	μm	
σ	Energy resolution of energy discrimination threshold ($\sigma @ 8\text{ keV}$)	0.4*			keV	* Typical values
	Minimum energy threshold	5			keV	
σ	Energy resolution in full spectral mode ($\sigma @ 8\text{ keV}$)	0.9*			keV	* Typical values
σ	Energy resolution in full spectral mode ($\sigma @ 23\text{ keV}$)	1.3*			keV	* Typical values
σ	Energy resolution in full spectral mode ($\sigma @ 60\text{ keV}$)	2.0*			keV	
	Typical detectable energy range for X-rays	5.0 - 60			keV	See chart below
	Pixel size	55			μm	



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Device description



USB connector

USB type Micro-B, Standard USB 2.0 High-Speed. The USB cable length should be less than 2m! For longer connections, a repeater or active cable is suggested.

Modes and types of readout chip operation

The detector is frame-based, i.e. the data from all the pixels are read out after the acquisition time is over.

- **Integral measurement**
During the acquisition, the recorded data is integrated and outputted as a single frame.
- **First hit measurement**
This mode disregards other events that take place in the same pixel during the acquisition, in order to minimize pileups.
- **Counter bit depth**
Different counter depths can be chosen for certain measurement modes. This enables tailoring the performance for higher frame rates, or better resolution.

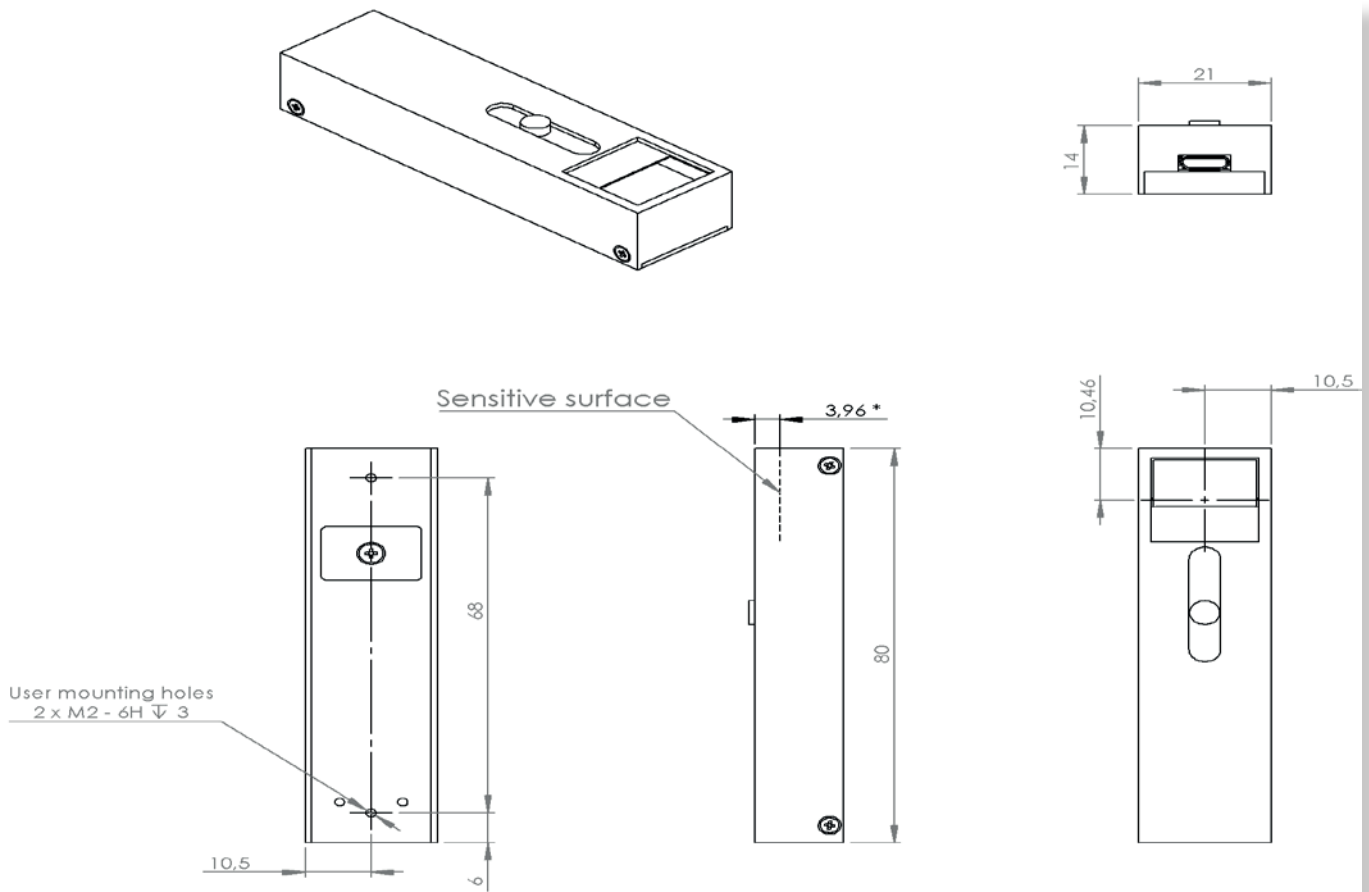
An overview of operation modes and measurement modalities (default cases are highlighted) together with maximum achievable frame rates is presented in the table below. Actual frame rate might decrease due to detected particle flux, software or processing being run simultaneously with the measurement, performance of the computer itself.

Operation modes and measurement modalities			
Mode	Counter Depth	Energy measurement modality	Maximum frame rate
Counts	14 bits	N/A	64 fps
	10 bits - high frame rate		99 fps
Energy	14 bits	Integrated energy	65 fps
		Energy of 1st hit	
Time	14 bits	N/A	65 fps
	10 bits - high frame rate		98 fps
Counts + Energy	10 bits (Energy) / 4 bits (Counts)	Integrated energy	61 fps
		Energy of 1st hit	
Energy + Time	14 bits (Energy) / 14 bits (Time)	Integrated energy	32 fps
		Energy of 1st hit	
	10 bits (Energy) / 18 bits (Time)	Integrated energy	34 fps
		Energy of 1st hit	

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Mechanical dimensions



All dimensions are in mm.

* Sensitive surface distance from top of the box is for 300 μ m sensor thickness.

Do not touch sensor surface!



Disposal



Do not dispose these instruments as unsorted municipal waste. Please use separate collection facility to contact the supplier from which the instrument was purchased. Please make sure discarded electrical waste is properly recycled to reduce environment impact.

Instructions for safe use

To avoid malfunction or damage to your MINIPIX_{SPRINTER} please observe the following:

- Do not expose the device to water or moisture.
- Do not disassemble. Wire-bonding connection may be irreversibly damaged.
- Do not insert any object into the sensor window.
- The maximum USB cable length is 2m.
- The protection provided by this product may be impaired if it is used in a manner not described in this document.
- Thermal stabilization of the device is necessary.

Extreme care must be taken when removing protecting cover and handling the MINIPIX_{SPRINTER} without the protecting cover. The warranty does not apply to mechanical damage of the sensor and wirebonds.