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WidePIX L<sup>®</sup><sub>2(1)x10 - MPX3</sub>  
Large area imaging detector



# WidePIX L<sup>®</sup><sub>2(1)x10 - MPX3</sub>

## Large area imaging detector



The large area imaging detector **WidePIX L<sub>2(1)x10 - MPX3</sub>** with resolution of 512 (256) x 2560 pixels is composed of Medipix3 hybrid detector electronics tiles. Each tile (256 x 256 pixels) is attached to a silicon or CdTe sensor. Therefore, the whole area of the **WidePIX L<sub>2(1)x10 - MPX3</sub>** device is fully sensitive and there are no gaps between sensor tiles. Each pixel has two integrated 12-bit digital counters and two energy discrimination thresholds. The counters store number of registered particles, e.g. X-ray photons, with energy above the appropriate threshold. Both counters can be joined to a single 24-bit counter providing enhanced dynamic range. The particle counting principle eliminates any additional noise generated by the sensor or electronic readout. It allows acquiring X-ray images with very high

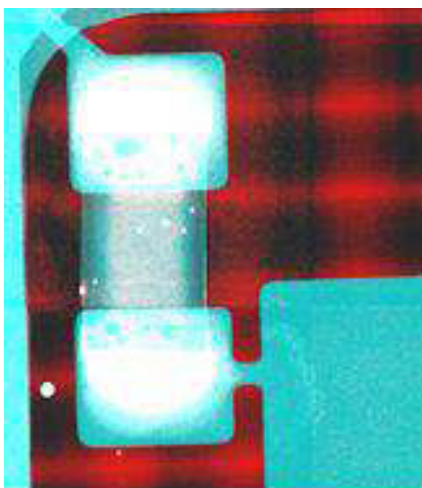


Illustration of multichannel "color" radiographs where different materials are identified and imaged in different colors

Key features	
Readout chip type	Medipix3
Pixel size <sup>1</sup>	55 x 55 µm
Sensor resolution	512 (256) x 2560 pixels
Dynamic range in one frame	12-bit / 24-bit <sup>1</sup>
Dark current	none
Interface	2x RJ45 1Gbit/s ethernet
Maximum frame rate <sup>2</sup>	up to 80 (170) fps
Dimensions	170 x 210 x 42 mm
Weight	3000 g
<sup>1</sup> 55 x 110 µm at the edges and 110 x 110 µm at the corners	
<sup>2</sup> Depends on operation mode.	

contrast and wide dynamic range. Therefore, even low contrast structures such as plastic or soft tissue are easily detectable in X-ray images.

Both devices are suitable for CT scanners, which can take advantage of large sensitive area without any gaps. The **WidePIX L<sub>1x10 - MPX3</sub>** variant moreover supports a hardware-based Time-Delayed-Integration mode for online (continuous) scanning applications.

The energy discrimination thresholds of Medipix3 technology allow spectral X-ray imaging. Different materials in an inspected sample could be then identified based on their spectral X-ray attenuation properties. Energy spectra could be measured typically from 5 keV upwards.

The Charge Summing Mode implemented in the pixel electronics provides hardware-based correction of signal cross talk between pixels. This further considerably improves the detector spectral response and therefore also quality of spectra measured in individual pixels.

The camera is connected to a computer via an ethernet cable.

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### Device parameters

Operating conditions				
Symbol	Parameter	Value	Units	Comment
T <sub>a</sub>	Operating ambient temperature range <sup>1</sup>	0-40	°C	
Φ	Humidity	< 60	%	Not condensing
IP	IP rating	IP50		

<sup>1</sup> With temperature stabilization – see the paragraph below.

### Water cooling interface

Temperature stabilization of the device required when in operation. WidePIX L<sub>2(1)x10 - MPX3</sub> uses water connectors that allow for quick disconnection/reconnection. Mating connector is included as standard accessories and must be attached to 4x6 mm plastic hose.



Temperature of the cooling water must be within range  $21 \pm 4$  °C.  
 Max. pressure in the water-cooling system: 1,2 bar.  
 The device will automatically shut down after chip or CPU temperature exceeds 55 °C.  
 Intended for dust free indoor use.

### Electrical specification

T<sub>a</sub> = 25 °C, V<sub>cc</sub> = 12 V

Symbol	Parameter	WidePIX L 1x10 - MPX3	WidePIX L 2x10 - MPX3	Units	Comment
V <sub>cc</sub>	Supply Voltage	12 ± 10 %		V	
I <sub>cc</sub>	Supply Current (V <sub>cc</sub> = 12 V)	1.4/2,68	3.2/6.4	A	Typ/Max
P	Power dissipation	18/36	32/64	W	Typ/Max
A	Sensor Area	141 x 14,1	141 x 28,2	mm	
	Detector Resolution	2560 x 256	2560 x 512	Pixels	
f	Frame Rate <sup>1</sup>	50	20	fps	
T <sub>READ</sub>	Readout Time <sup>2</sup>	20	50	ms	
m	Weight	3000	3200	g	

<sup>1</sup> Operating parameters: Shutter time= 1 ms, Mode = CSM or SPM-1Ch 12bit resolution.

<sup>2</sup> During Readout time (or Dead time), no charge is collected from the sensor.

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### Energy range and resolution

Typical values for 300 $\mu\text{m}$ Silicon sensor, $T_a = 20^\circ\text{C}$ .		
Range	Mode	Min. energy threshold [keV]
Super Narrow	SPM	-
	CSM	-
Narrow <sup>1</sup>	SPM	6.0
	CSM	6.0
Broad	SPM	-
	CSM	-

<sup>1</sup> By default the detector will be calibrated for the Narrow Gain Mode. Additional gain modes can be added upon request.

Typical values for 1000 $\mu\text{m}$ CdTe sensor, $T_a = 20^\circ\text{C}$ .		
Range	Mode	Min. energy threshold [keV]
Super Narrow	SPM	-
	CSM	-
Narrow <sup>1</sup>	SPM	8.0
	CSM	8.0
Broad	SPM	-
	CSM	-

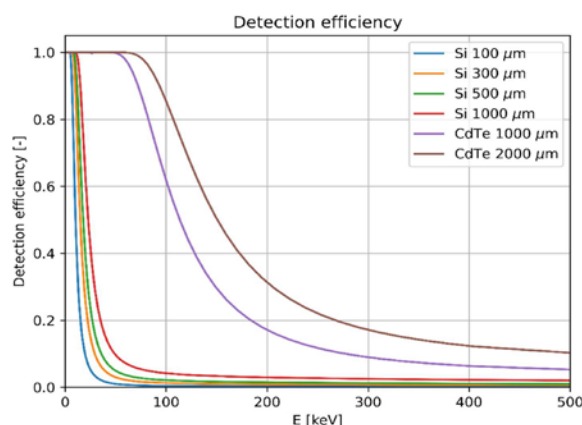
<sup>1</sup> By default the detector will be calibrated for the Narrow Gain Mode. Additional gain modes can be added upon request.

### Sensor parameters

$T_{\text{dev}} = 22^\circ\text{C}$					
Parameter	Si		CdTe	Units	Comment
Thickness	300	500	1000	$\mu\text{m}$	
Bias Voltage	200	300	-450	V	Max
Typical detectable energy range for X-rays <sup>1</sup>	up to 60		up to 600	keV	See chart below
Pixel size	55 x 55			$\mu\text{m}^2$	

<sup>1</sup> to get true detector response, detectable energy and quantum efficiency of sensor chip must be combined with energy range of readout chip (see chapter "Energy range and resolution").

<sup>2</sup> 55 x 110  $\mu\text{m}$  at the edges and 110 x 110  $\mu\text{m}$  at the corners.



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## Large area imaging detector

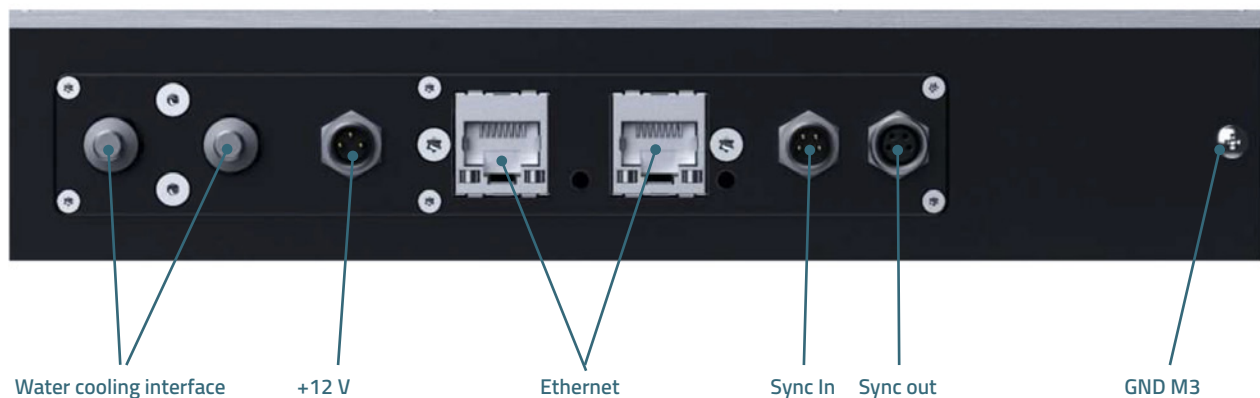
### Basic principles, measurement types and operational modes

The ionizing radiation particle interacts with the sensor material creating an electric charge. This charge is collected by electric field and brought to pixel preamplifier where it is amplified and shaped forming triangular voltage pulse. The amplitude and duration of this pulse is proportional to energy deposited by particle within the pixel. The situation when the voltage pulse amplitude in particular pixel exceeds preselected threshold value is called 'event' or 'hit'. Each pixel contains two digital counters (12 and 12 bits). These counters are used differently according to measurement type and mode. List of operational modes and their description is provided in the table below.

Type	Mode	Bit depth	Description
Frame (reading all pixels)	SPM-1CH	12/24 bit/frame	Single Pixel Mode using one counter: Every pixel works independently of its neighbors. One energy threshold (energy channel) is available. 1 output image: Number of events per pixel
	SPM-2CH	12 bit/frame	Single Pixel Mode using both counters: Every pixel works independently of its neighbors. Two energy thresholds (energy channels) are available. 2 output images: Number of events per pixel
	CSM	12/24 bit/frame	Charge Summing Mode: The charge from 4 adjacent pixels is summed and is assigned to the pixel with the largest charge deposition. The event is counted only if the sum of signals exceeds the second energy threshold. 1 output image: Number of events per pixel

All modes can be operated at three ranges: Broad / Narrow / Super Narrow<sup>1</sup>  
<sup>1</sup> Except CSM mode Silicon sensor.

### Device description



#### Ethernet connectors

2 x RJ45 1Gbit/s ethernet connectors.

#### +12 V DC connector

Main power supply (via standard M8 connector with 3 female contacts) Connect after plugging ethernet cable.



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### Synchronization interface (optional)

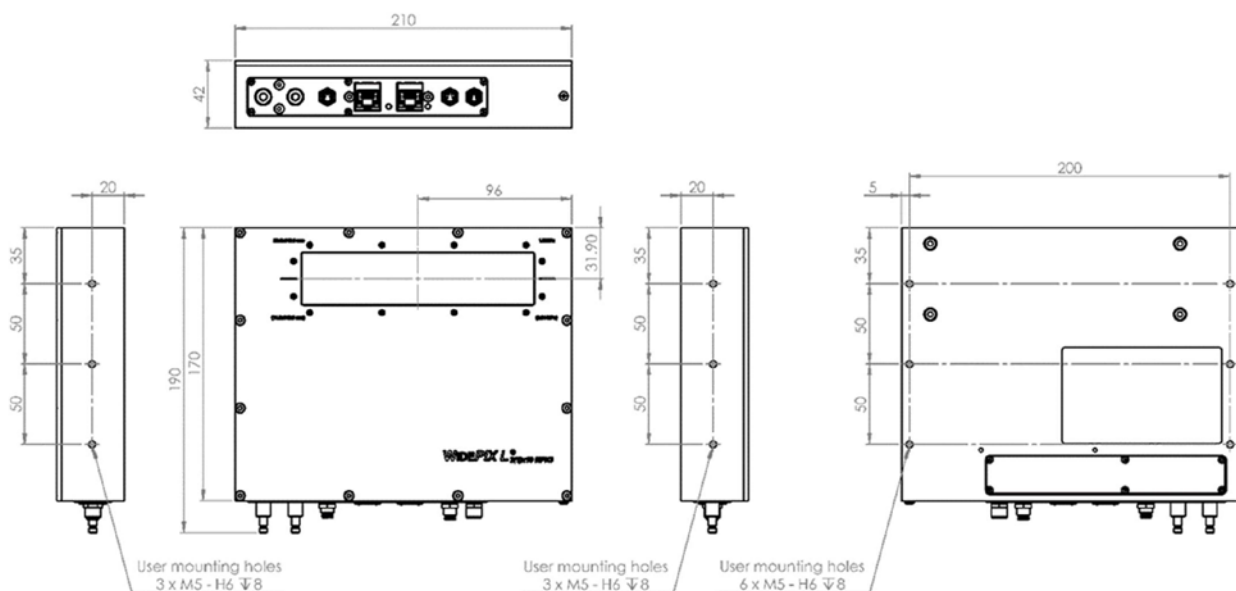
Two 4-pin M8 connectors (female for outputs and male for input) serve as synchronization interface, allowing to synchronize WidePIX L<sub>2(1)x10 - MPX3</sub> detector with external processes. Four signals are available:

Ready in	measurement is not possible, when signal at logical zero
Trigger in	logical zero starts shutter (measurement)
Ready out	logical one if device is ready to for new shutter
Trigger out	mirrors shutter (logical zero when shutter is active)

All signals are TTL compatible and 5V tolerant. For detailed description see Synchronization Guide for WidePIX.

Sync. Outputs (M8-4Female)		Sync. Inputs (M8-4Male)	
Pin	Signal	PIN	Signal
1	Gnd	1	Gnd
2	Trigger Out	2	Trigger In
3	Ready Out	3	Ready In
4	Reserved	4	Reserved

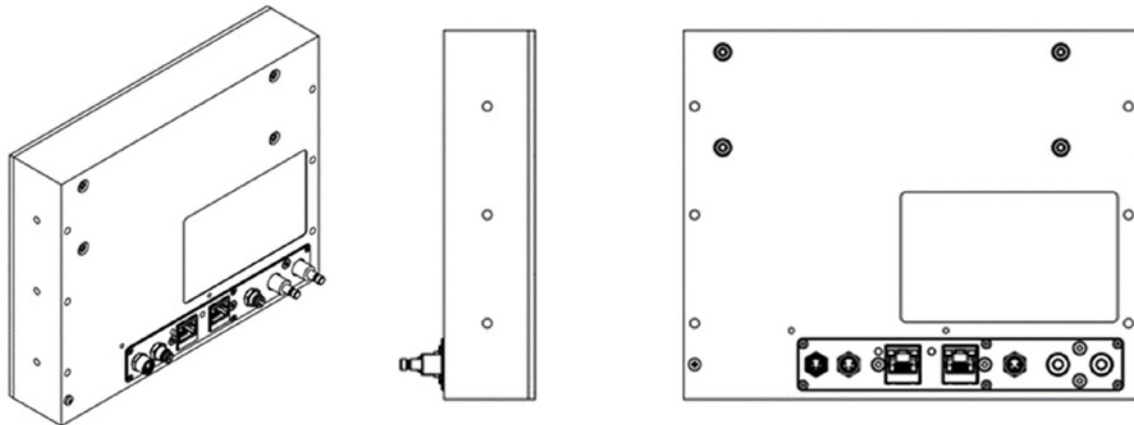
### Mechanical dimensions



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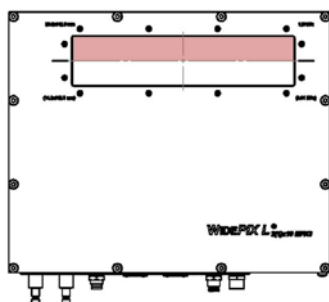
Following drawings are for rear connections



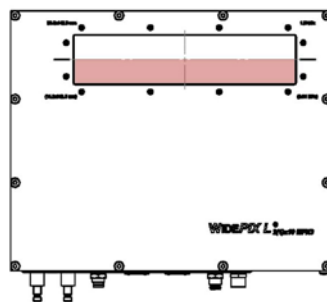
All dimensions are in mm.

\* Sensitive surface distance from top of the box may vary depending on actual sensor thickness.

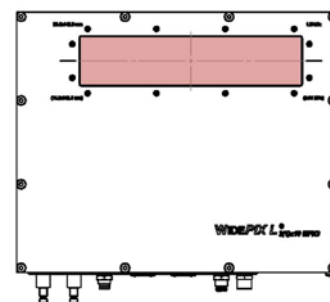
### Sensitive area



Sensitive area for models  
WUBM3B-XxxYYMMDD  
(single upper row)



Sensitive area for models  
WLBM3B-XxxYYMMDD  
(single lower row)



Sensitive area for models  
W2BM3B-XxxYYMMDD  
(two rows)

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### Instructions for safe use



Do not touch sensor surface!



To avoid malfunction or damage to your WidePIX L<sub>2(1)x10 - MPX3</sub> please observe the following:

- Do not expose to water or moisture WidePIX L<sub>2(1)x10 - MPX3</sub> is dust protected only.
- Do not open WidePIX L<sub>2(1)x10 - MPX3</sub> case. Detector wire-bonding connections may be irreversibly damaged.
- Do not operate detector when not properly water cooled. Otherwise, detector temperature may rise above the specified range. Recommended temperature is 22 °C.
- The protection provided by this product may be impaired if it is used in a manner not described in this document.

### 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.

### Model number codes (Example)

W2B	M3B	X	C	A	XXXXXXXX
Device name: W2B – WidePIX L 2x10 WUB – WidePIX L 1x10 – upper row WLB – WidePIX L 1x10 – lower row	Device modification: M3B – Medipix3 chips bottom connectors M3R – Medipix3 chips rear connectors		Sensor type: M – Silicon Monolithic C – CdTe	Sensor thickness: 3 – 300 µm 5 – 500 µm A – 1000 µm	Device build version:

### Release history

Date	Changes	Changed by
19/07/28	Preliminary version	
21/06/26	ETH version	
23/03/14	New drawings and corrected versions	
08/08/23	Supply Voltage changed from 24V to 12V	
05/09/23	Default gain mode added	
24/02/15	Datasheet revision	J. Baborák
24/06/28	Water cooling details added	J. Baborák
24/07/02	New graphic style of the document	P. Bloudek
24/07/23	Minor format changes	J. Baborák