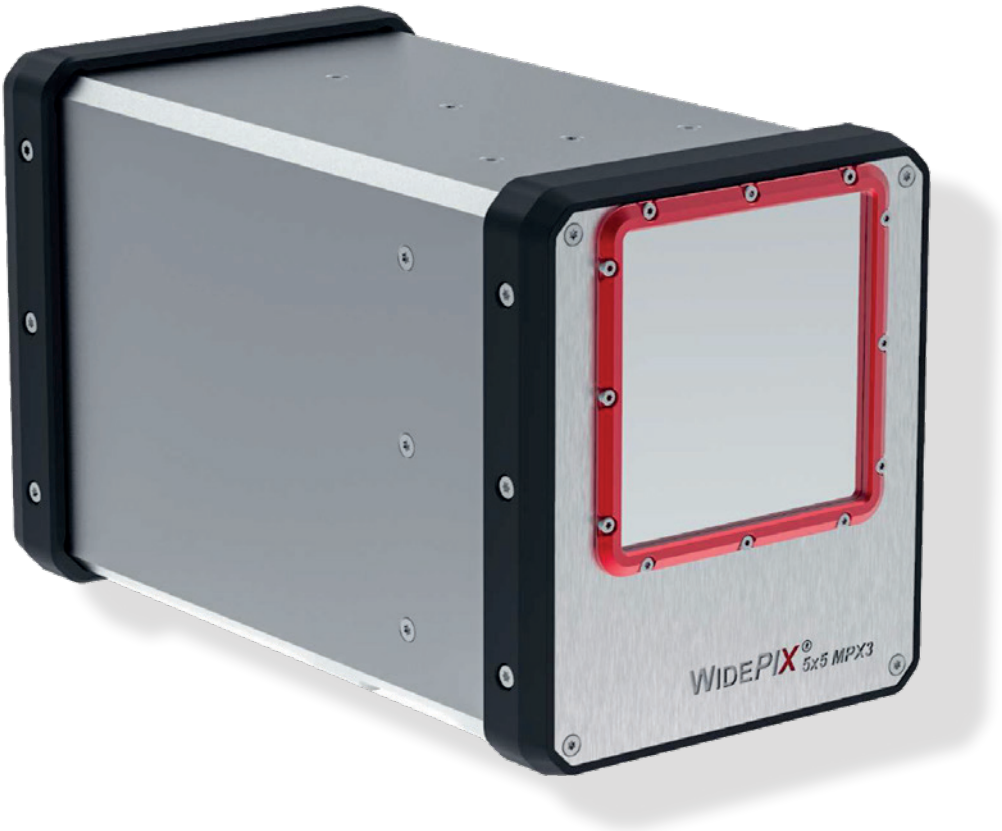
WidePIX® 5X5 - MPX3
Large area imaging detector



Quantum Design

Quantum Design
1 avenue de l'Atlantique
Bâtiment Fuji-Yama
91940 Les Ulis - France

Tél. : +33 1 69 19 49 49
france@qd-europe.com
www.qd-europe.com

ADVACAM
Imaging the Unseen

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Large area imaging detector

Key features	
Readout chip type	Medipix3
Pixel size[2]	(55 x 55) µm²
Sensor resolution	1280 x 1280 pixels
Dynamic range in one frame	12-bit / 24-bit[1]
Dark current	none
Interface	5x RJ45 1Gbps ethernet
Maximum frame rate[3]	up to 170 fps
Dimensions	139,5 x 119 x 227,2 mm
Weight	4910 g

The large area imaging detector **WidePIX** $_{5x5 - MPX3}$ with resolution of 1280 x 1280 pixels is composed of Medipix3 hybrid detector electronics tiles. Each tile (256 x 256 pixels) is attached to a CdTe sensor. The whole area of the **WidePIX** $_{5x5 - MPX3}$ device is fully sensitive and there are only small gaps between sensor tiles[1]. 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 Xray images with very high contrast and wide dynamic range.

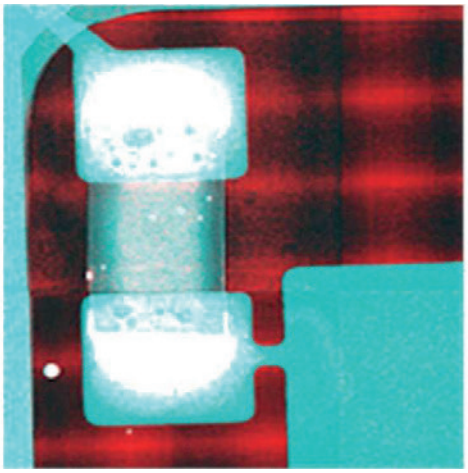

Illustration of multichannel 'color" radiographs, where different materials are identified and imaged in different colors

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

The device is suitable for CT scanners, which can take advantage of large sensitive area.

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 8 keV upwards.

The Charge Summing Mode implemented in the pixel electronics provides hardwarebased 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 5 ethernet cables.

[1] 4 pixels between chips in a row, approx. 2 pixels between the rows

[2] 55 x 110 µm² at the edges and 110 x 110 µm² at the corners

[3] Depends on operation mode, settings and OS. 170 fps reached on Linux Ubuntu, settings: Frames, 1000x 1ms, SPM1CH, 12-bit

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Device parameters

Operating conditions				
Symbol	Parameter	Value	Units	Comment
T_a	Operating ambient temperature range [1]	10-35	°C	
Φ	Humidity	0-85	%	Not condensing
IP	IP rating	IP20		
[1] With temperature stabilization – see the paragraph below.				

Water cooling interface

Temperature stabilization of the device required when in operation. WidePIX 5x5 - MPX3 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 ± 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_a = 25 °C, V_{CC} = 12 V

Symbol	Parameter	WidePIX 5x5 - MPX3	Units	Comment
V_{CC}	Supply voltage	12 ±10%	V	
I_{CC}	Supply Current (V_{CC} = 12V)	16,6	A	Typ/Max
P	Power dissipation	90/200	W	Typ/Max
A	Sensor Area	70 x 70	mm	
	Detector Resolution	1280 x 1280	Pixels	
F	Frame Rate[1]	170	fps	
T_{READ}	Readout Time[1,2]	6	ms	
m	Weight	4910	g	
[1] Operating parameters: Shutter time=1 ms, Mode = CSM or SPM-1Ch 12bit resolution.				
[2] During Readout time (or Dead time), no charge is collected from the sensor.				

Energy range and resolution

Typical values for 1000 µm CdTe sensor, Ta = 20 °C		
Range	Mode	Min. energy threshold [keV]
Super Narrow	SPM	-
	CSM	-
Narrow[1]	SPM	8.0
	CSM	8.0
Broad	SPM	-
	CSM	-
[1] By default the detector will be calibrated for the Narrow range mode (High gain mode). Additional modes can be added upon request.		

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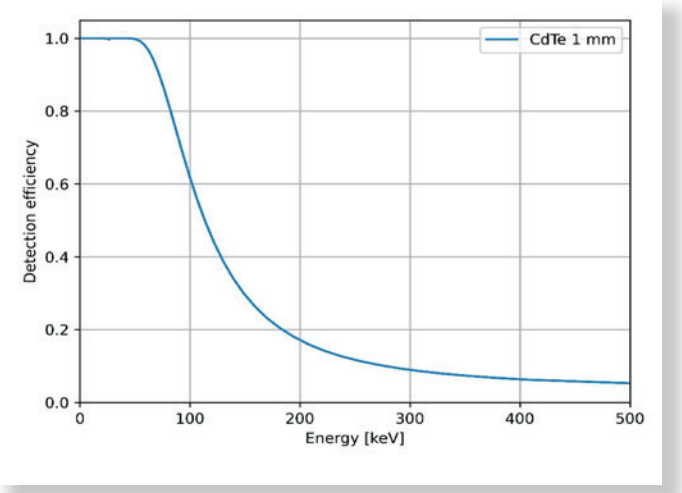
Sensor parameters

T_{dev} = 22°C			
Parameter	**CdTe**	**Units**	**Comment**
Thickness	1000	µm	
Bias Voltage	-400	V	Typ.
Typical detectable energy range for X-rays[1]	up to 600	keV	See chart below
Pixel size[2]	55 x 55	µm²	
[1] to get true detector response, detectable energy and quantum efficiency of sensor chip must be combined with energy range of readout chip.			
[2] 55 x 110 µm² at the edges and 110 x 110 µm² at the corners.			



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 in three ranges: Broad / Narrow / Super Narrow. By default, the detector will be calibrated for the Narrow range mode (High gain mode). Additional modes can be added upon request.

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Device description

1. **Signal LED panel.** Left to right:
   OVERTEMP: signals overheating of the device
   PGOOD1-5: power in segment 1-5 OK
   PGOOD6: development use
   READY IN: external triggering purposes
   TRIGGER IN: external triggering purposes
   READY OUT: external triggering purposes
2. **Power connector:** 12V, DC 16A
3. **Synchronization connector:** IN
4. **Synchronization connector:** OUT
5. **External bias connector**
6. **Water cooling interface.** Max. pressure: 1,2 m bar
7. **Ethernet connectors.** The white arrow is pointing at an IP reset hole. For more information, please refer to our **WidePIX MPX3 Ethernet manual**

Ethernet connectors
5 x RJ45 1Gbit/s ethernet connectors. For details about the Ethernet connection, see our **WidePIX MPX3 Ethernet manual.**

+12 V DC connector
Main power supply, use only the power source supplied with your device.

Synchronization interface

Two 4-pin M8 connectors (female for outputs and male for input) serve as synchronization interface, allowing to synchronize WidePIX L 5x5 - MPX3 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**.	

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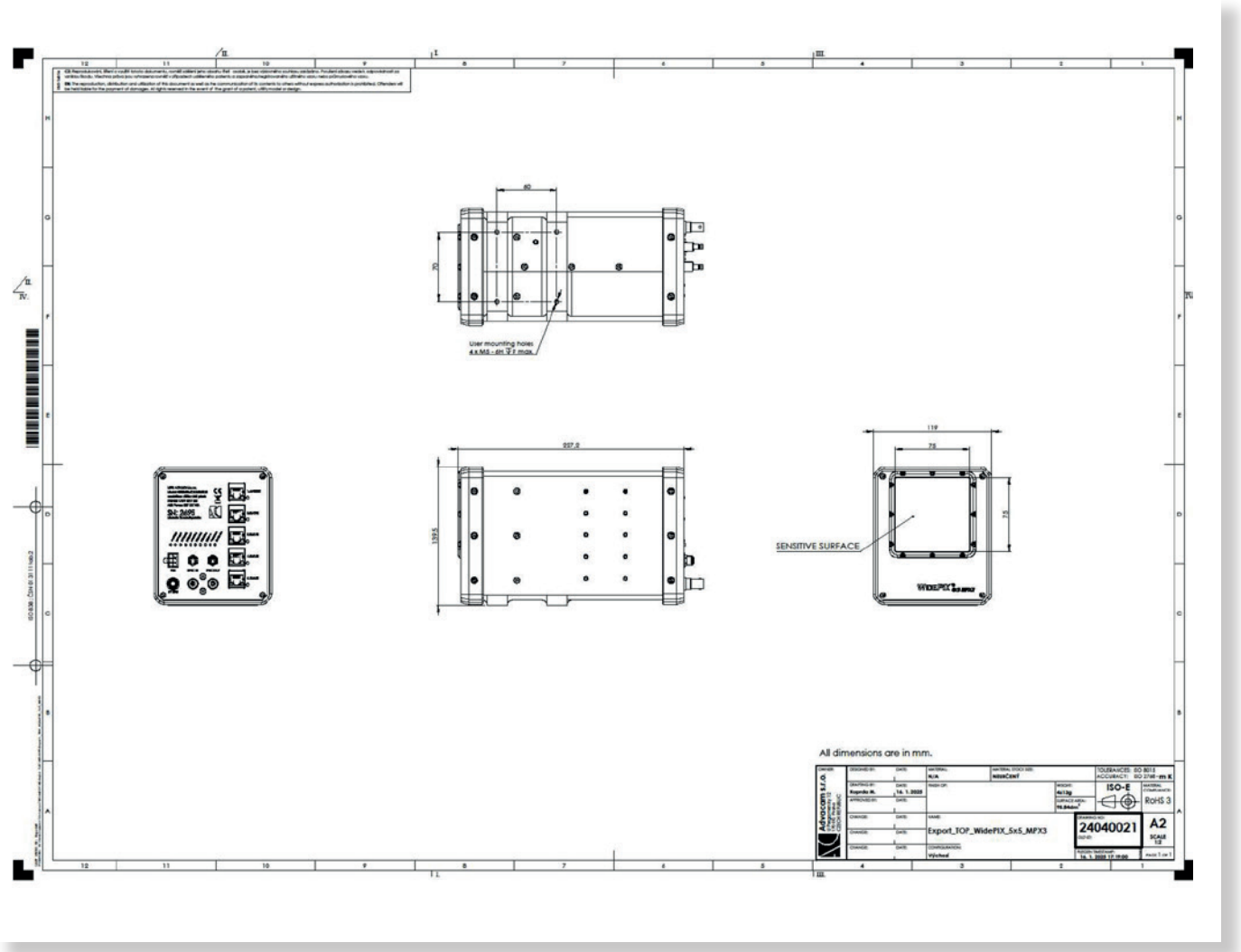
Sync. Outputs (M8-4Female)		Sync. Inputs (M8-4Male)	
Pin	Signal	Pin	Signal
1	Gnd	1	Gnd
2	Trigger Out	2	Trigger In
3	Ready Out	3	Ready In
4	Reserved	4	Reserved

Mechanical dimensions



All dimensions are in mm.

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Instructions for safe use

Do not touch sensor surface!

To avoid malfunction or damage to your WidePIX 5x5 - MPX3 please obey the following:

- Do not expose to water or moisture WidePIX 5x5 - MPX3 is dust protected only.
- Do not open WidePIX 5x5 - MPX3 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. The 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):

W55	MX3	X	C	A	XXXXXXXX
Device name: W55 – WidePIX 5x5	Device modification: MX3 - Medipix3 chips, back connectors		Sensor type: C – CdTe	Sensor thickness: A – 1000 µm	Device build version:

Release history

Date (YY/MM/DD)	Changes	Changed by
25/03/10	Release	J. Baborák

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