

maxipix



MAXIPIX technical data

ESRF/ISDD

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Contents

1. Application areas..... 3

2. Specification 4

3. Description 5

4. Detector head 6

 Fixture interface (bottom side) 7

5. Computer 8

6. References 9

1. Application areas

MAXIPIX [1] is a high spatial resolution (small pixels), high frame rate, photon-counting pixel detector developed by ESRF for synchrotron beamlines. MAXIPIX is based on MEDIPIX2/TIMEPIX [2] [3] readout ASICs developed by CERN and the MEDIPIX2 collaboration [4].

MAXIPIX is best suited for experiments requiring :

- noiseless detection (photon-counting)
- high dynamic range
- spatial resolutions in the 50-100 μm range
- frame rates up to 1.4 kHz
- beam energies between 5 keV and 25 keV

This covers applications such as :

- coherent diffraction
- surface diffraction
- grazing incidence scattering
- small-angle scattering in particular with microfocus beam
- inelastic scattering

with possibilities for stroboscopic and time-resolved experiments in each of these areas. Imaging applications can also be considered in certain cases (low energy, moderate X-ray intensity).

Due to the photon-counting detection process MAXIPIX is not suited for applications using intense beams (upper limit in the 10^8 photons/second/ mm^2 range).

The energy range is at present limited by the absorption of the silicon sensor. New versions implementing high-Z material pixel sensors are being developed, in order to extend the energy range up to 50 or possibly 100 keV.

2. Specification

Currently available MAXIPIX versions :

Update 06/04/2011

Model	TAA11PC	TAA22PC	TAA51PC
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Electrical & physical (detector head)			
Power supply	220 VAC/50 Hz		
Power consumption	~30 W		
Dimensions (L x W x H)	222 x 145 x 140 mm		
Weight	4.7 kg		
Temperature range	10-30 °C recommended		

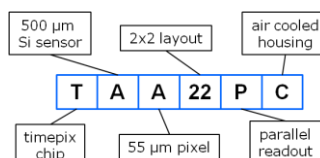
Imaging			
Sensor	Silicon 500 µm thick		
Readout chip	Timepix *		
Pixel pitch	55 x 55 µm ²		
Image dimensions	256 x 256	516 x 516	1296 x 256
Detection area (mm ²)	14.1 x 14.1	28.4 x 28.4	71.3 x 14.1
Maximum count rate	200 000 cps/pixel		
Pixel counter depth	11 180 counts		
Absorption efficiencies	100% (8keV), 68% (15 keV), 37% (20 keV)		
Dark noise	~1 count/pixel/day (cosmic background)		
Minimum adjustable threshold	3.5 keV typ. (noise floor)		
Exposure time range	1 µs - 1023 s		
Readout dead time (@100MHz clock)	0.29 ms		
Max. frame rate	1400 Hz	350 Hz	285 Hz
Data output time	0.7 ms	2.8 ms	3.5 ms
Image file format	edf (ESRF data format)		

Trigger modes	
software	acquisition sequence start by software command
single trigger	acquisition sequence start by external trigger
multiple trigger	start of each frame in a sequence by external trigger
frame gating	frame exposure time defined by external gate signal
exposure gating	counting enabled/disabled by external gate signal

Main software features
automatic or triggered acquisition
accumulation mode (unlimited dynamic range)
online image display
threshold settings and threshold scans in DAC or in keV units

* The Timepix readout chip is developed by CERN and the Medipix2 collaboration

Model identification :



3. Description

Update 25/08/2011

Detector case

Metal housing with air cooling fans, black kapton input window, front lead shield
ESRF "PRIAM B" readout interface
High voltage bias supply
AC/DC power supply (220 V input)
5 Lemo analog connectors (trig in, trig out, gate in, shutter out, DAC out)
1 dual optical input/output port 2Gbit/s
Power on/off switch
Forced air cooling
1 dual fiberoptic cable 30 m (other lengths possible up to 100 m)
Detector module holder

Options

Water cooling	detector module holder with swagelock fluid connectors
Remote detector head	requires PRIAM B SP version (serial/parallel readout)

Detector module (mounted in detector case)

ESRF chipboard PCB
Detector assembly 500 μm thick Si pixel sensor bonded on readout chip(s)
Flex connections to PRIAM interface
1 HV bias miniconnector
1 power supply connector

Options (depending on availabilities)

Chipboard format	1x1 (single), 2x2 (quad), 5x1 (ladder)
Readout chip	MPIX2MXR20 ("Medipix 2") or TIMEPIX

Acquisition station

Rack PC Trenton - CPU Xeon quad core 2.33 GHz/64 bit
8 GB RAM
4 SAS hard disks
RAID controller
ESPIA serial interface : PCI 64 bit, full duplex 2.15 Gbaud on fiberoptic port
Keyboard, mouse
20" LCD screen

Software

ESRF Linux 2.1A (Redhat enterprise 5, Linux 2.6.18 64 bits)
ESRF "LIMA" library
ESRF MAXIPIX device server
ESRF "Oxidix" image viewer
TANGO
SPEC runtime with ESRF macros (user interface)

4. Detector head

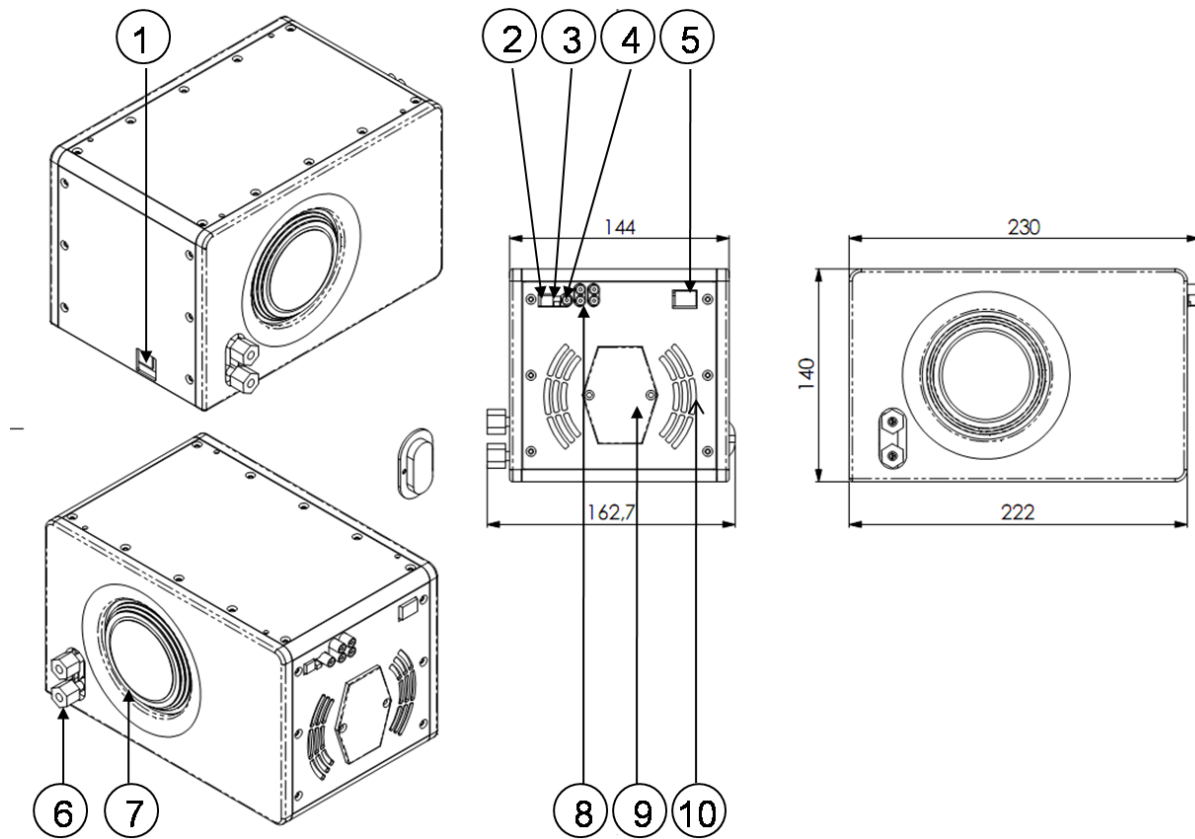


Fig. 1: detector case dimensions

1	Input window (1x1 version)
2	External DC supply (not used)
3	power on LED
4	DAC out connector
5	Fiberoptic connector
6	Water cooling ports (option)
7	Air cooling outlet
8	Trigger and shutter signals
9	Main power supply and main power switch
10	Air cooling intake

Fixture interface (bottom side)

The bottom side is fitted with M4 threadings for direct mounting of Microcontrolle X48 rail carriers.

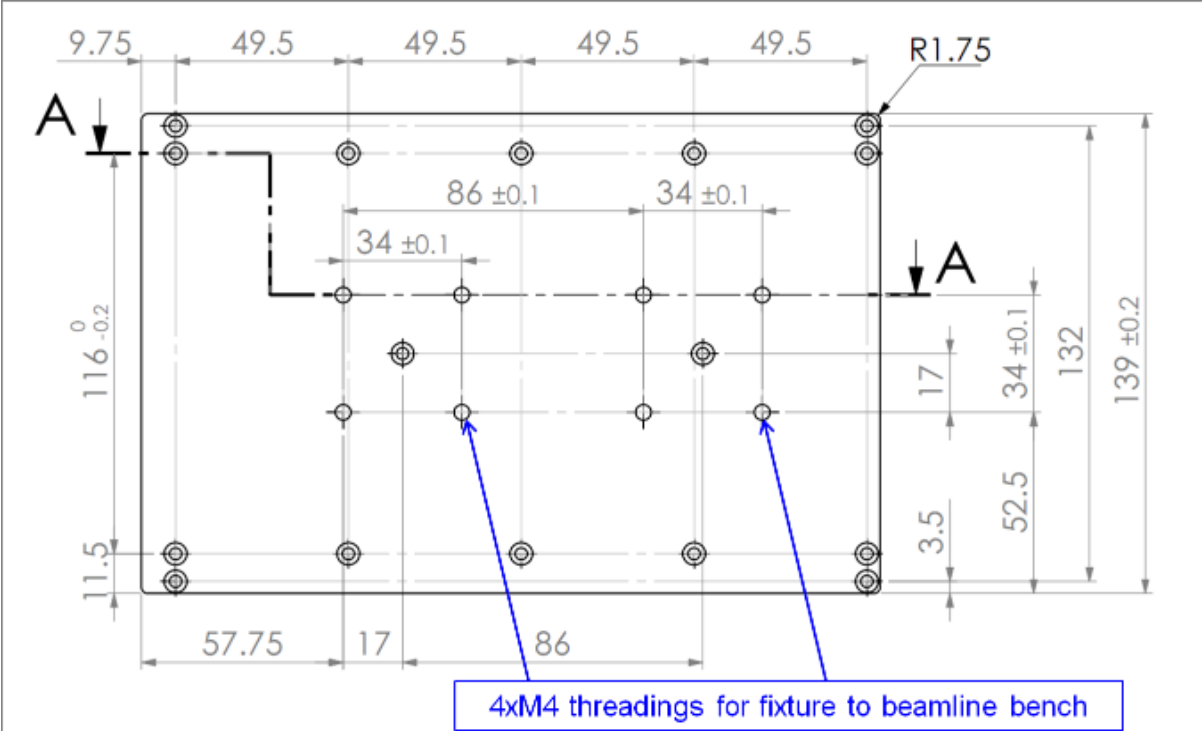


Fig. 2: Detector bottom side

5. Computer

Units: mm

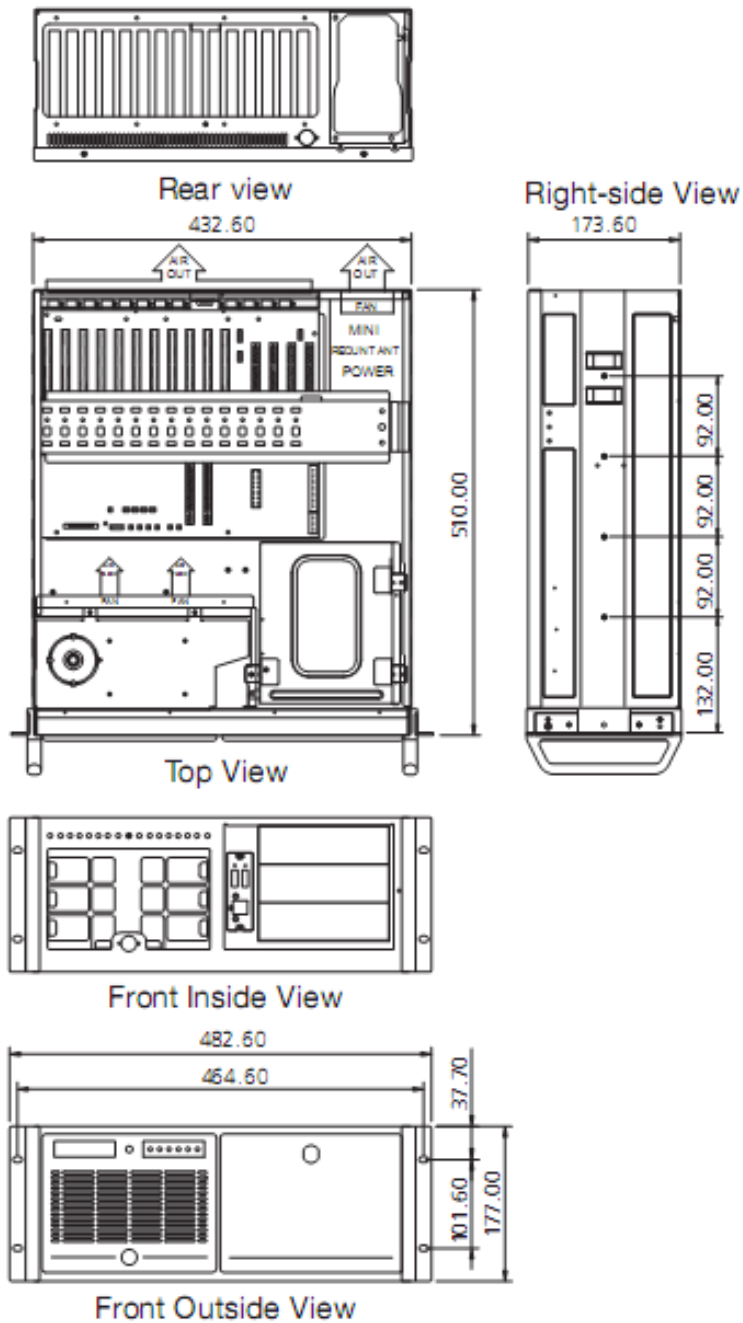


Fig. 3: Computer rack dimensions

6. References

- [1] Ponchut C. et al., *MAXIPIX, a fast readout photon-counting X-ray area detector for synchrotron applications*. J. Inst., 2011. **6**: p. C01069.
- [2] Llopart X. et al., *Medipix2: a 64-k pixel readout chip with 55 μm square elements working in single photon counting mode*. IEEE Trans. Nucl. Sci., 2002. **49**(5): p. 2279-2283.
- [3] Llopart X. et al., *Timepix, a 65k programmable pixel readout chip for arrival time, energy and/or photon counting measurements*. Nucl. Instr. and Meth. A, 2007. **581**: p. 485-494.
- [4] *MEDIPIX collaboration*. <http://medipix.web.cern.ch/MEDIPIX/>.