WidePIX

CHROMATIC Industry
CHROMATIC SenseEdge

former name: WIDE*PIX* P*O*E *G2* 2(1)x5 - MPX3
Model No.: WxPM3x-Xxx

Datasheet

ΛDVACAM
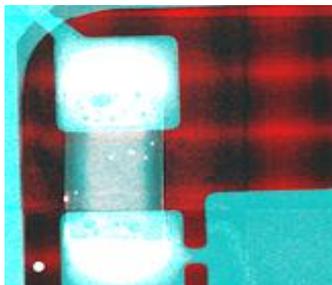Imaging the Unseen

General features

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

The large area imaging detector **WidePIX CHROMATIC Industry 10** (Double Row) with resolution of 512 x 1280 pixels i.e. 0.64 Mpx and **WidePIX CHROMATIC Industry 5** (Single Row) with resolution of 256 x 1280 pixels are composed of Medipix3 hybrid detectors electronics tiles. Each tile (256 x 256 pixels) is attached to a silicon or CdTe sensor. Therefore, the whole area of the **WidePIX CHROMATIC Industry** device is fully sensitive and there are no gaps between sensor tiles. **WidePIX CHROMATIC SenseEdge** shares this architecture but adds edgeless sensor technology, allowing measurements right up to the physical edge of the device for true gapless coverage in complex layouts. 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 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 CHROMATIC Industry 5** (Single Row) 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's spectral response and therefore also quality of spectra measured in individual pixels.

Main Features

- Readout chip type......................................Medipix3
- Pixel size[1]..55 × 55 μm^2
- Sensor resolution.......................................512 (256) × 1280 pixels
- Dynamic range in one frame[2].................12-bit / 24-bit
- Dark current..none
- Interface ....1 Gb/s Ethernet with PoE
- Maximum frame rate[2]...............................up to 90 (170) fps
- Dimensions ....228,5 × 92 x 42,5 mm
- Weight...1700 g

[1] 55 x 110 μm^2 at the edges and 110 x 110 μm^2 at the corners
[2] Depends on operation mode.

Device parameters

Operation conditions

Symbol	Parameter	Value	Units	Comment
T_a	Operating ambient temperature range[1]	10-55	°C	
Φ	Humidity	< 80	%	Not condensing
IP	IP rating	IP50		

[1] With temperature stabilization – see the paragraph below.

Water cooling interface

Temperature stabilization of the device required when in operation. **WidePIX CHROMATIC Industry** 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.

Device specification

T_a = 25 °C

Symbol	Parameter	CHROMATIC Industry (Single Row)	CHROMATIC Industry (Double Row)	Units	Comment
V_{CC}	Supply Voltage DC	48		V	
I_{CC}	Supply Current	0,4/0,8	0,5/1,0	A	Typ/Max
P	Power consumption	20/40	25/50	W	Typ/Max

Chip parameters

Symbol	Parameter	CHROMATIC Industry (Single Row)	CHROMATIC Industry (Double Row)	Units	Comment
A	Sensitive area	70,5 × 14,1	70,5 × 28,2	mm^2	
	Detector resolution	1280 × 256	1280 × 512	Pixels	
	Pixel size[1]	55 x 55	55 x 55	µm^2	
f	Frame rate[2]	170	90	fps	
T_{READ}	Readout time[3]	6	11	ms	

[1] 55 x 110 µm^2 at the edges and 110 x 110 µm^2 at the corners.

[2] Operating parameters: Shutter time = 1 ms, Mode = CSM or SPM-1CH 12bit resolution.

[3] During Readout time (or Dead time), no charge is collected from the sensor.

Sensor parameters

T_{dev} = 22 °C

Symbol	Parameter	Si		CdTe	Units	Comment
	Thickness	300	500	1000	μm	
V_{BIAS}	Bias voltage	150	150	−450	V	max
	Minimum energy threshold	5,0		8,0	keV	
	Typical detectable energy range for X-rays[1]	up to 60		up to 600	keV	See chart below
	Pixel size	55 × 55		55 × 55	μm^2	

[1] To get true detector response, detectable energy and quantum efficiency of sensor chip must be combined with energy range of readout chip.

Single row   Double row
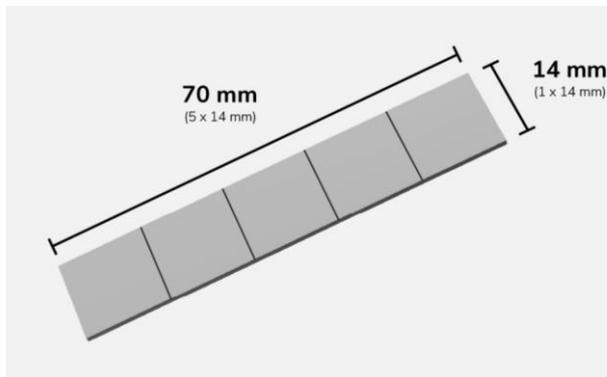

WidePIX CHROMATIC 5 (Single Row)   WidePIX CHROMATIC 10 (Double Row)
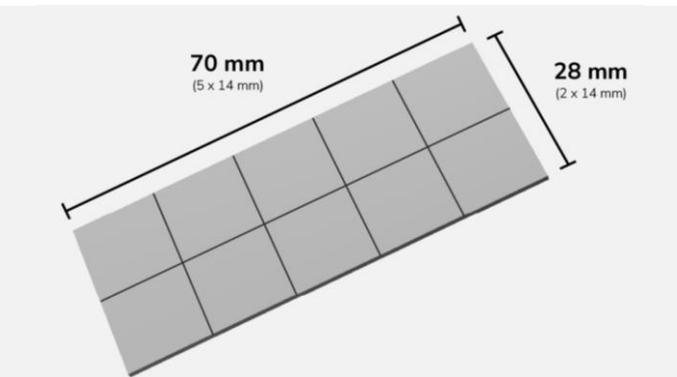
The detector is built from configurable arrays of 14 × 14 mm readout chips bump-bonded to the sensor layer:
Silicon sensors are monolithic up to 70 × 28 mm, which ensures a continuous, gapless detection area.
CdTe sensors are composed of individual 14 × 14 mm tiles assembled into the final area.

Detector efficiency
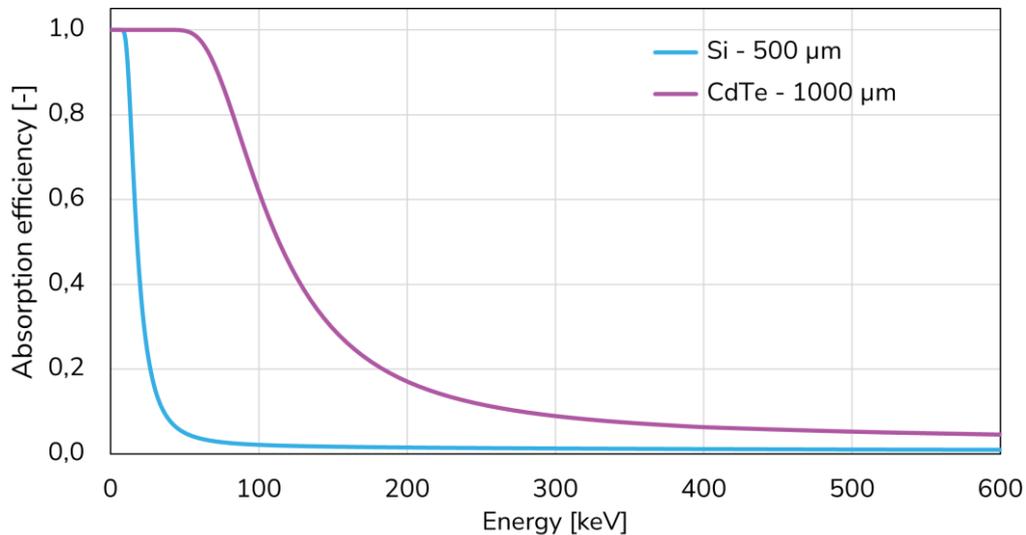
Threshold setting

Energy threshold is the minimum photon energy a pixel must receive in order to be counted as an event.

Typical values for 500 µm **silicon sensor**, T_a = 22 °C.

Range		Mode	Energy threshold [keV]
Super Narrow[2]	Very narrow range, low-energy optimized.	SPM	5,0 up to ~ 60
		CSM	Not supported
Narrow	Standard calibration mode	SPM	5,0 up to ~ 120
		CSM	5,0 up to ~ 300

Typical values for 1000 µm **CdTe sensor**, T_a = 22 °C

Range		Mode	Energy threshold [keV]
Super Narrow[2]	Very narrow range, low-energy optimized.	SPM	8,0 up to ~ 60
		CSM	8,0 up to ~ 60
Narrow	Standard calibration mode	SPM	8,0 up to ~ 150
		CSM	8,0 up to ~ 300
Broad[2]	Used for higher-energy photons; wider usable range.	SPM	8,0 up to ~ 250
		CSM	8,0 up to ~ 500

[2] The detector is calibrated for Narrow Gain Mode by default; other gain modes are available on request

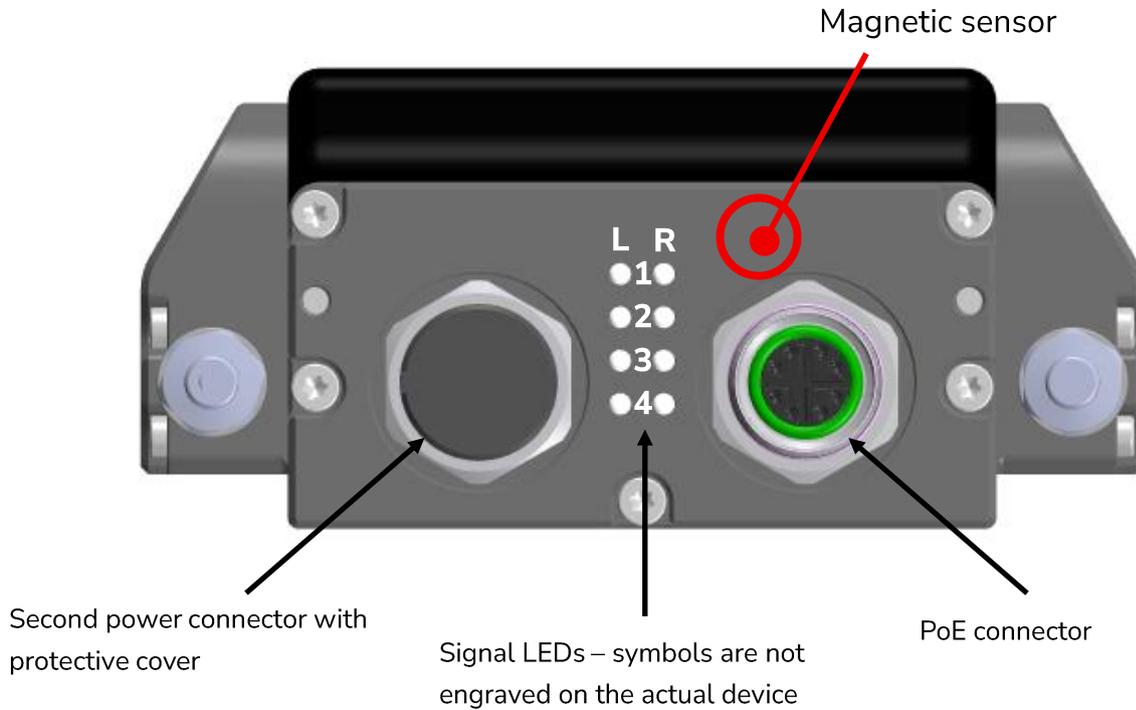# Basic principles, measurement types and operational modes

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 (Except Broad range and combination of Super narrow mode with CSM with silicon detectors).

Device description

Magnetic sensor

L R
1
2
3
4

Second power connector with
protective cover

Signal LEDs – symbols are not
engraved on the actual device

PoE connector

PoE connector

An Ethernet cable supporting Power over Ethernet (PoE), with an M12 X-coded connector on one end and an RJ45 modular connector on the other, is included as a standard accessory. Ethernet cable is connected to an external PoE injector or PoE-enabled switch. The injector or switch must support IEEE 802.3bt Type 3 (PoE++) and deliver at least 60 W of power. Both the power delivery and the data transfer are provided by the Ethernet cable. For more information see **WidePIX CHROMATIC Industry** manual.

Second power connector: +48 V DC connector – without PoE

Alternative power supply via standard M12 connector. +48V DC power adapter is connected to the device's power connector. In this configuration, the Ethernet cable is used only for data transfer and should be connected directly to your computer. **Warning:** Do **NOT** combine PoE with the power adapter. For more information see WidePIX CHROMATIC Industry manual.
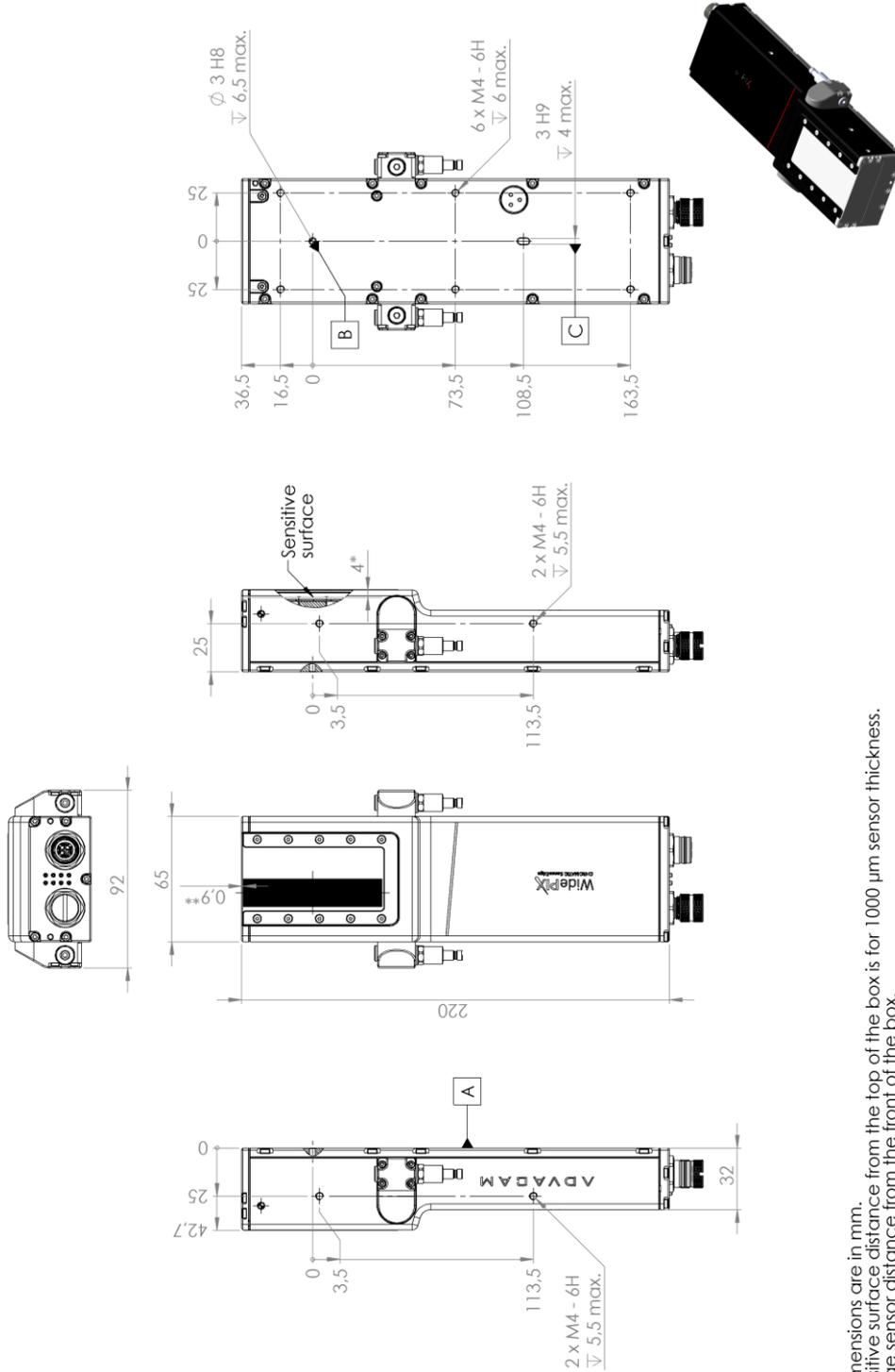
Mechanical dimensions

The following drawings illustrate the standard connection setup.

WidePIX CHROMATIC Industry (Single Row)
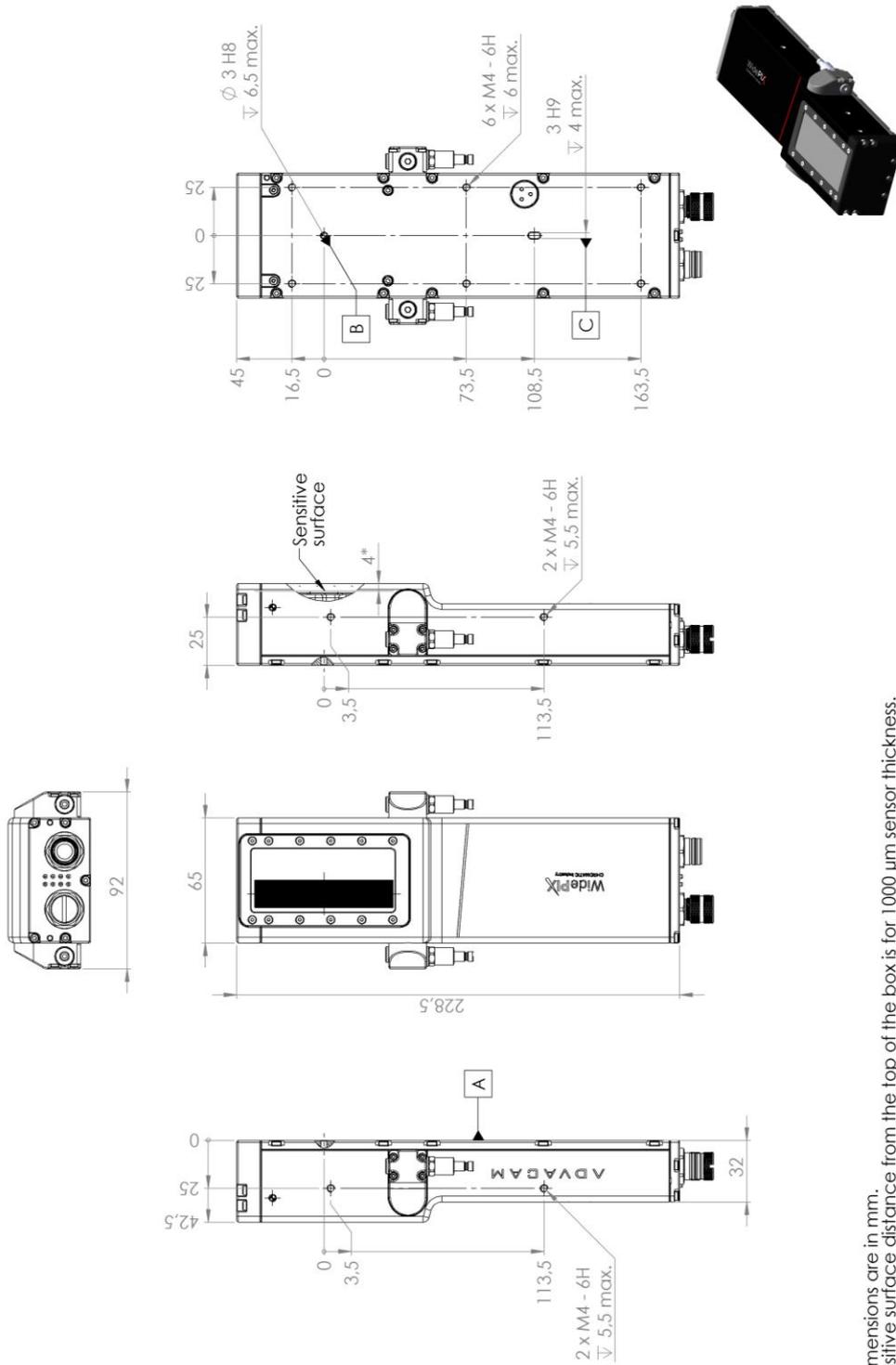
All dimensions are in mm.
* Sensitive surface distance from the top of the box is for 1000 µm sensor thickness.

WidePIX CHROMATIC SenseEdge (Single Row)

All dimensions are in mm.
* Sensitive surface distance from the top of the box is for 1000 μm sensor thickness.
** Edge sensor distance from the front of the box.

Instructions for safe use

⚠️	**Do not touch sensor surface!**

To avoid malfunction or damage to your **WidePIX CHROMATIC** please obey the following:

- Do not expose to water or moisture **WidePIX CHROMATIC** is dust protected only.
- Do not open **WidePIX CHROMATIC** 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 or contact the supplier from which the instrument was purchased. Please make sure discarded electrical waste is properly recycled to reduce environmental impact.

Release history

Date (YY/MM/DD)	Changes	Changed by
25/01/17	Preliminary version (W1PM35-Xxx)	D. Doubravová, J. Baborák
25/08/01	Release	J. Baborák
25/09/15	Version update	J. Baborák
26/01/21	New graphic style of the document, rebranding and revision	P. Bloudek, S. Valtera
26/02/24	Version update, layout	S. Valtera