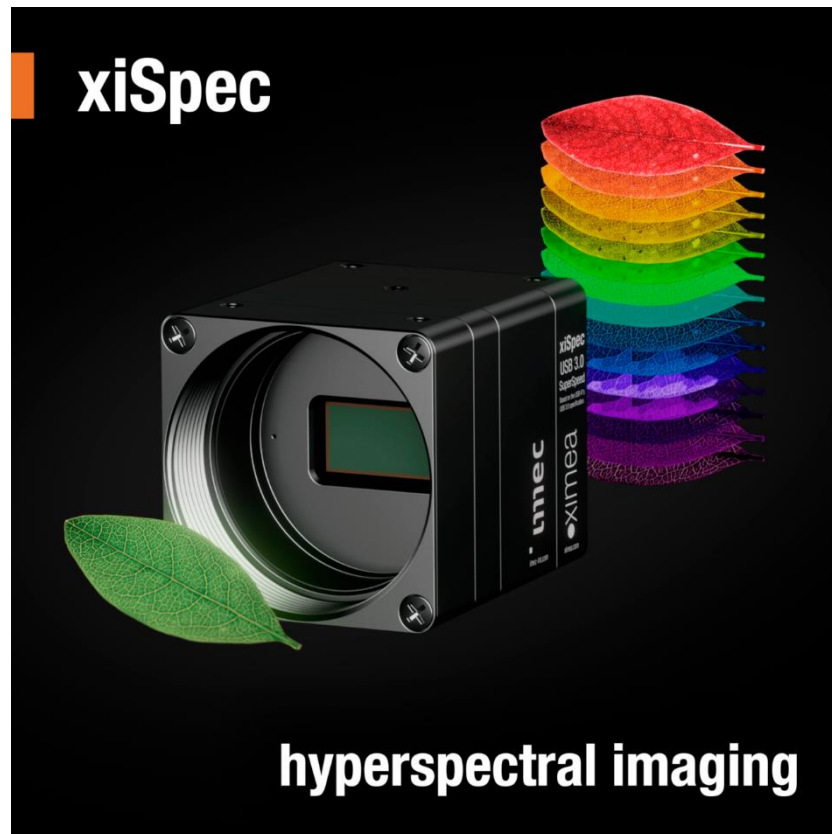# Very compact hyperspectral cameras xiSpec2.

(V 2.02)

xiSpec is an ultra-compact Industrial hyperspectral imaging (HSI) camera family with outstanding facts and features.

-   Cameras with 10 to 150 spectral bands
-   170 fps with USB3 interface, 340 fps with PCIe
-   Snapshot and line scan versions
-   Smallest and lightest hyperspectral cameras available
-   Low power consumption
-   Rugged, no moving parts
-   Flexible and programmable GPIO options

The camera housing and the bandpass filters are optimized to improve the spectral performance of the cameras including guaranteed spectral data quality. Each xiSpec2 camera is individually calibrated. The camera specific calibration file and spectral test report is part of the scope of delivery.

These snapshot mosaic HSI cameras have the unique capability of more than real time video-rate spectral data acquisition. Each image can be interpreted as a hyperspectral imaging cube immediately.

The standard xiSpec2 cameras come with a micro-B USB3 interface. For use in compact integration projects, models with USB3 flat-ribbon connection or PCIe (in a later phase) will also be available. The PCIe interface enables bandwidths of 10 Gbit/s with low power consumption and allows access to the maximum possible framerates from the installed sensors.

The dimensions of the cameras of only 26.4 x 26.4 x 32 mm and a flyweight of only 32g ideally support mobile applications.

Snapshot mosaic sensors:

Three different snapshot-mosaic sensors are available. 4x4 or 5x5 mosaic patterns are repeated continuously on the sensor surface:

Camera model (standard USB3)		Spectral range	Spectral bands
MQ022HG-IM-SM4X4-VIS3	Snapshot visible light	460 – 600	16
MQ022HG-IM-SM4X4-RN2	Snapshot Red-NIR	600 – 860	15
MQ022HG-IM-SM5X5-NIR2	Snapshot NIR	665 – 960	24

The 4x4 matrix has 16 interference filters and the 5x5 matrix 25 interference filters. The filter specific response curves may have some overlaps or are partially outside the active wavelength range. After processing with the IMEC API, the mathematical model reduces the spectrum to so called "virtual bands".

The spatial resolution is approx. 512x272 pixels (4x4 pattern) or 409x217 pixels (5x5 pattern). The original sensor resolution can be interpolated.

Line scan sensors

The different hyperspectral bands are realized in vertical direction. One standard sensor is available:

Camera model (standard USB3)		Spectral range	Spectral bands
MQ022HG-IM-LS150-VN2	Line scan 150 VIS-NIR	470 – 900	150

Each band has a size of 2048x5 pixels.

To use this camera a synchronized camera / object movement and image acquisition is required. Many (more than 150) images must be stitched together. Software for this task must be developed by the user himself.

The line scan cameras will be sold only to OEM customers after clarification of the project use.

Hardware

The sensor technology used in our HSI-cameras (HSI = Hyperspectral imaging) is based on standard CMOS area sensors with a native resolution of 2048*1088 pixels (AMS/CMOSIS CMV2000 mono).

Hyper spectral filters are added at wafer-level on top of the pixel structure of the sensor. The sensors are designed to work in specific spectral ranges (active range). The required bandpass filters are included with the camera.

The HSI sensors are integrated either in the standard USB3 camera series xiQ with up to 170 frames per second or in the standard PCIe 2 lane Gen 2 camera series xiX with up to 340 frames per second.

The technical manual for the xiQ camera series is available at:

http://www.ximea.com/downloads/usb3/manuals/xiq_technical_manual.pdf

The technical manual for the xiX camera series is available at:

http://www.ximea.com/downloads/cb/manuals/xix_technical_manual.pdf

The xiSpec cameras are based on the camera model MQ022MG-CM (xiQ), MQ022MG-CM-FL (xiQ flex cable) or MC022MG-CM-X2G2-Fx (xiX), but of course use imec's hyperspectral sensors. All standard camera parameters (structure, dimensions, interface, IO system, ...) can be found in the xiQ or xiX manual.

Starter kit

Camera, bandpass filter and lens form a unit, which are measured during a calibration.

For first system integrations we offer cameras with starter kit including cables and a Lite Diffuse Reflectance target to ensure a smooth startup.

The Starter Kit contains one of three broadband coated lenses (425-1000 nm) with different focal lengths.

16mm: FOV horizontal: 38.9°, vertical: 21.2°, WD: 100mm - ∞, weight: 74g
25mm: FOV horizontal: 25.5°, vertical: 13.7°, WD: 100mm - ∞, weight: 48g   (default lens)
35mm: FOV horizontal: 18.3°, vertical: 9.8°, WD: 165mm - ∞, weight: 75g

Software

A software solution must be used / developed that is able to acquire the RAW data from the camera and read and interpret the calibration data. XIMEAs API/SDK to acquire the RAW data and control the camera is available for free.

As a result of the intensified cooperation between imec and XIMEA, buyers of xiSpec2 snapshot mosaic cameras have access to imec's HSI-Mosaic software:

- HSI Mosaic: GUI based acquisition software
- HSI Camera API: connect, configure, and acquire raw data from a camera
- HSI Mosaic API: configure and use a processing pipeline for imec mosaic data

HSI Support

Registered xiSpec2 camera customers have direct access to imec's first line support for hyperspectral imaging matters, imec's manuals and sample data. Imec will provide tailored expert level technical support to help customers in making the right technical decisions and enable them to focus on their application.

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