



MV Lab

All About Machine Vision

Camera

Machine Vision Component



Camera

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Camera

About

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Camera
Interface

Resolution

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Sensor Size

Frame Per
Second

Sensor Type

Shutter



Camera Wavelength

Cameras



UV camera, Visible camera, NIR camera, SWIR Camera, MWIR Camera, LWIR Camera

Camera

Wavelength



Visible Camera - Hikrobot

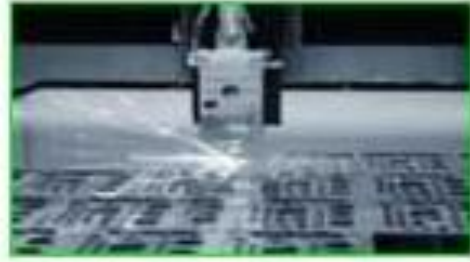
- Resolution from 0.3mp to 151mp
- Global Shutter and Rolling Shutter
- Suitable in most of industry including semicon, FNB, Medical, automation and etc
- Interface can be selected

Camera

Wavelength - Visible Camera



Color Checking



Alignment



Defect Detection



Dimensional Gauging



Code Inspection



Assembly Verification



OCR/OCV



Feature Presence

Camera Type

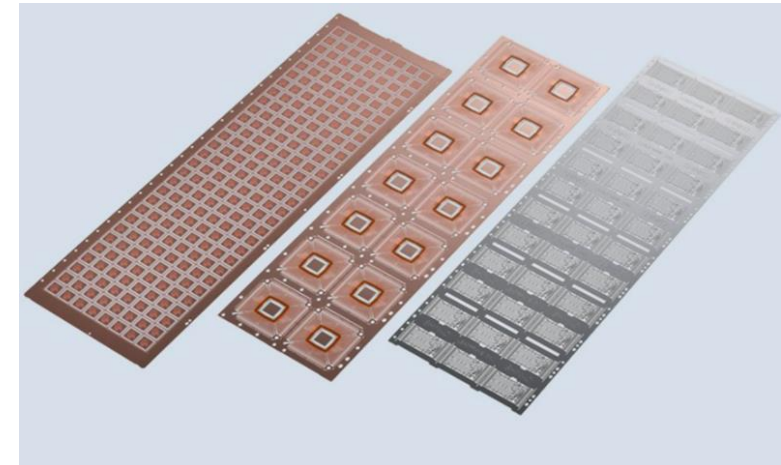
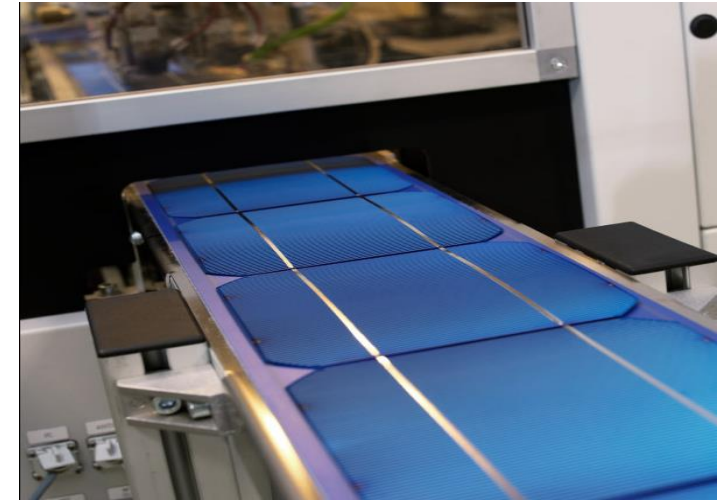


Line Scan Camera - Hikrobot

- resolution from 2k to 8k
- GigE and cameralink interface supported
- Supports exposure time and gain adjustment, PRNUC correction, LUT, Gamma correction, etc.
- Compact design and flexible installation.
- Compatible with GenICam Standard.

Camera

Type - Line Scan



Camera Type



Smart Camera - Hikrobot

- Adopts sensor platform for high-speed image processing.
- Open platform for users to develop their own programs.
- Multiple IO interfaces for input and output signals.
- Multiple LED indicators indicating real-time status to assist the configuration and debugging on site.
- Supports saving and exporting logs.
- Supports external extended module for meeting different application demands

Camera Resolution

Resolution is the details a camera can capture. Higher resolution, more details a camera can capture.

The more pixels a camera has, the more detail it can capture and the larger pictures can be without becoming blurry or pixelate.



Horizontal (Pixels)	Vertical (Pixels)	Total Pixels	Megapixel
640	480	307,200	0.3 MP
1280	960	1,228,800	1.2 MP
1920	1200	2,304,000	2.3 MP
2048	2048	4,194,304	4.1 MP
4000	3000	12,000,000	12 MP

Camera Resolution

The **more pixels** a camera has,
the **more detail** it can capture.



Camera Sensor Size

Refers to the physical size of the sensor, and is typically not noted on specification sheets. The best way to determine sensor size is to look at the **Pixel Size** on the sensor and multiply by the **Resolution (Number of Pixels)**.

Example:

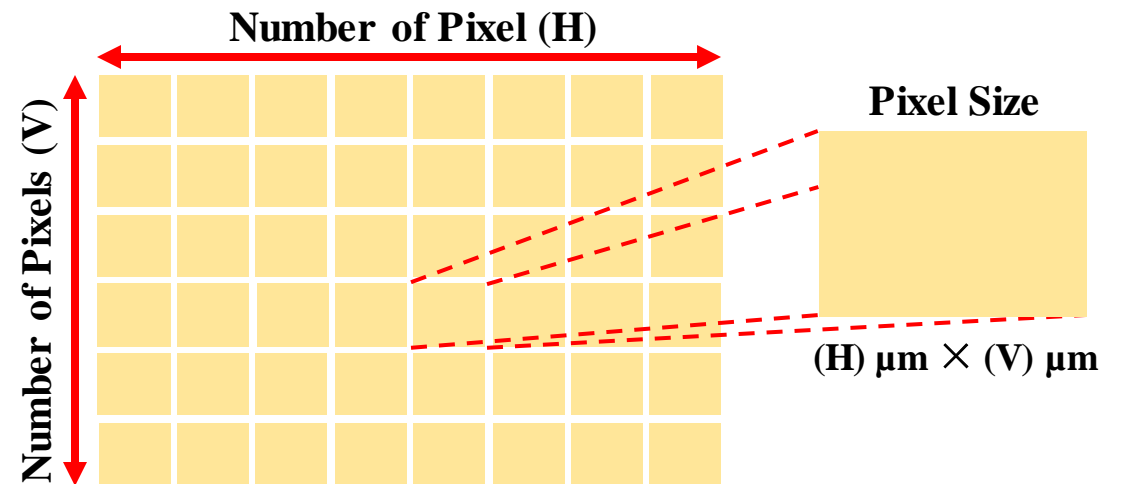
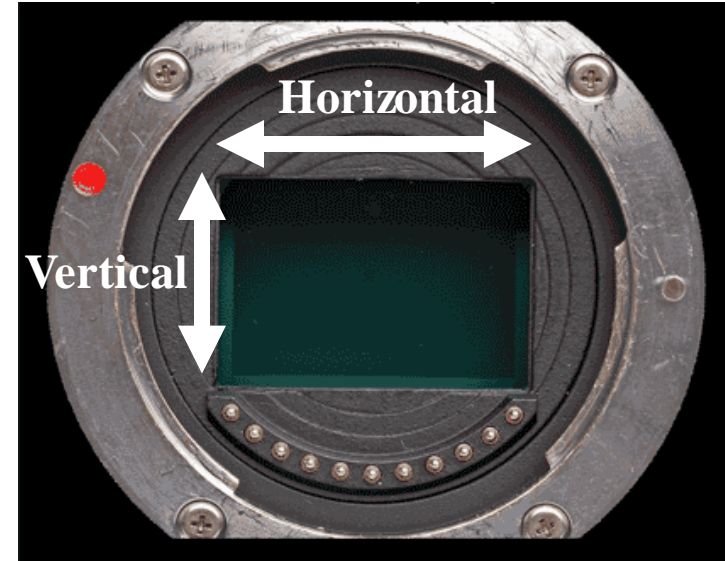
A camera has a pixel size of 3.75 x 3.75µm and the resolution is 1296 x 966 pixels.

What is the Camera's Sensor Size?

Horizontal: $3.75\mu\text{m} \times 1296 = 4.86\text{mm}$

Vertical: $3.75\mu\text{m} \times 966 = 3.62\text{mm}$

The Sensor Size is **4.86 x 3.62mm**

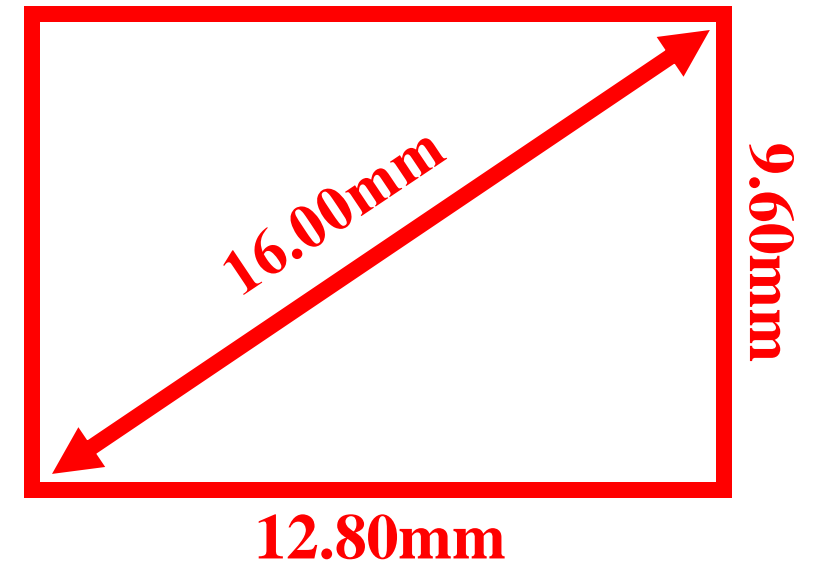
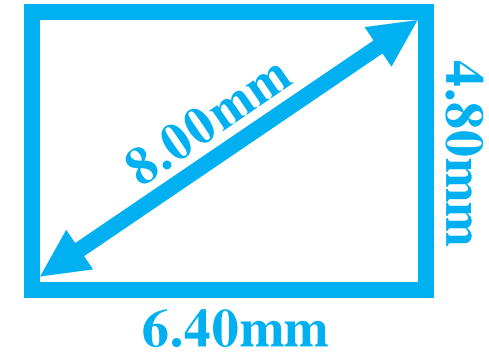


Camera

Sensor Format

Also refers to the physical size of the sensor but is not dependent on the pixel size. This specification is used to decide what lens the camera is compatible with.

Sensor Format	Diagonal (mm)	Width (mm)	Height (mm)
1/3"	6.00	4.80	3.60
1/2"	8.00	6.40	4.80
1/1.8"	8.93	7.18	5.32
2/3"	11.0	8.80	6.60
1"	16.0	12.80	9.60
4/3"	21.6	17.3	13.0

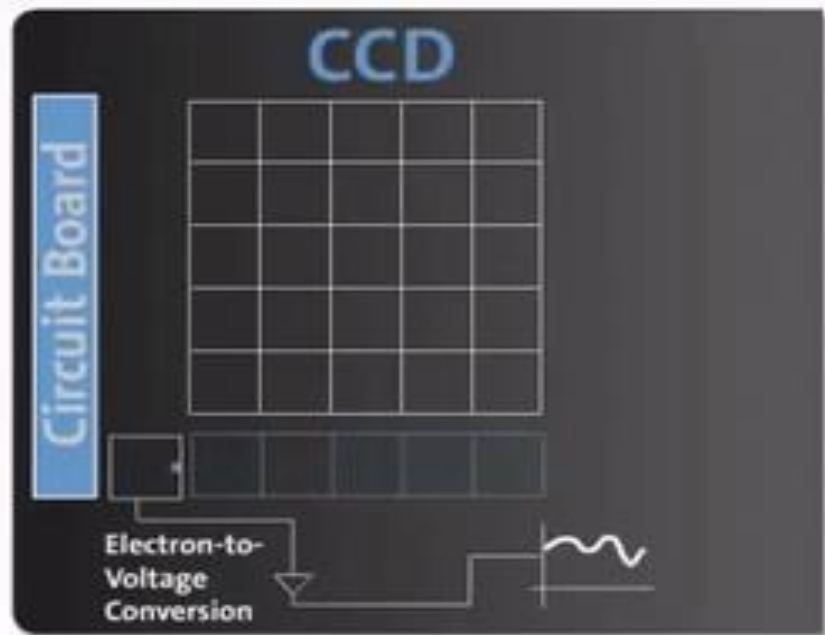


Camera Sensor Type

CCD

(Charge-Couple Device)

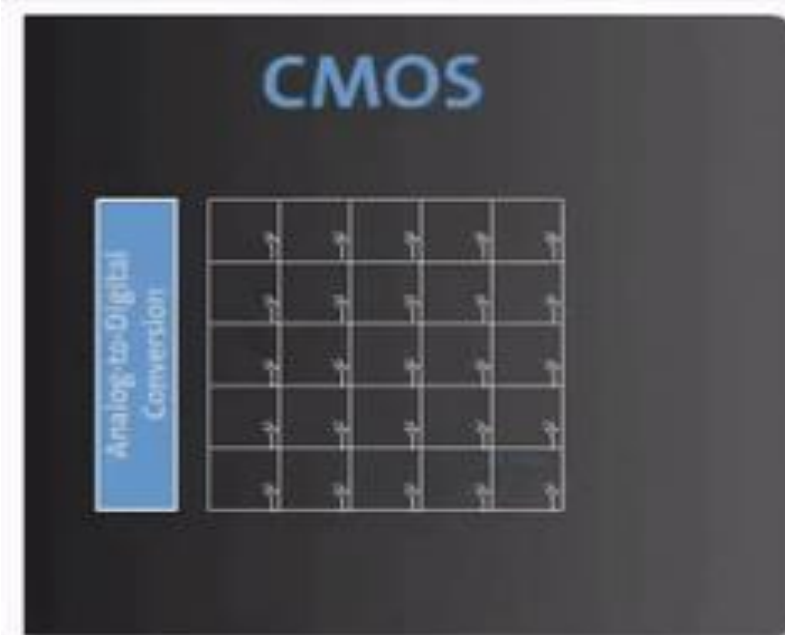
The charge is actually transported across the chip and read at one corner of the array. An analog-to-digital converter turns each pixel's value into a digital value.



CMOS

(Complementary Metal-Oxide Semiconductor)

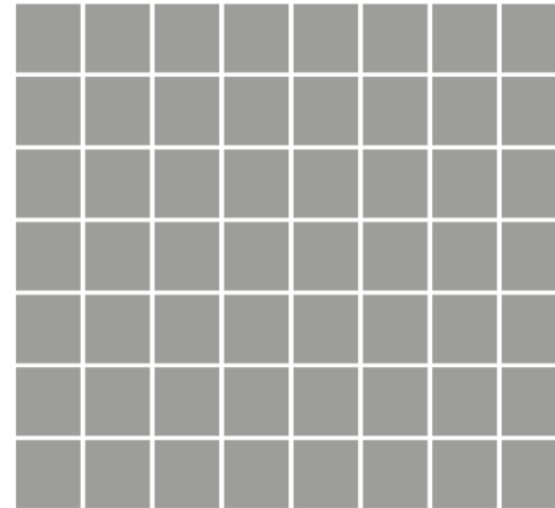
There are several transistors at each pixel that amplify and move the charge using more traditional wires. The CMOS approach is more flexible because each pixel can be read individually.



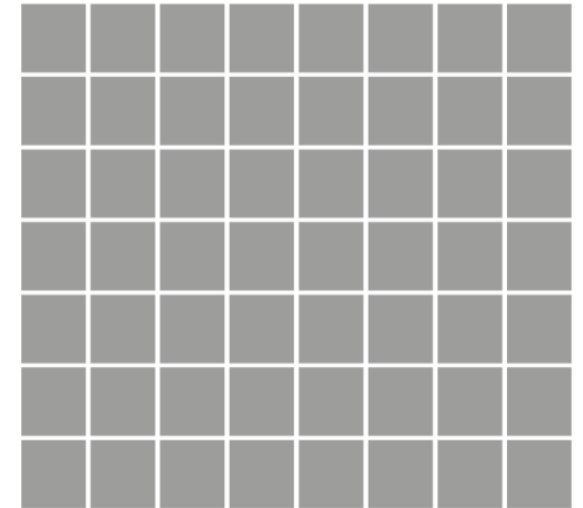
Camera Shutter

- **Global Shutter** is referring to sensors that scan the entire area of the image simultaneously.
- **Rolling Shutter** is referring to images is scanned sequentially, from one side of the sensor (usually the top) to the other, line by line.

Rolling shutter



Global shutter



【Global Shutter】



【Rolling Shutter】



Camera

Frame Rate

- Frame rate is the frequency (rate) at which consecutive images called frames appear on a display.
- Frame rate may also be called the frame frequency and be expressed in hertz.

Model	Sensor	Resolution	Frame Rate	Data Interface	Mono/Color
MV-CA003-21UM	PYTHON 300	640x480	814fps	USB 3.0	Mono
MV-CA003-21UC	PYTHON 300	640x480	814fps	USB 3.0	Color
MV-CA013-21UM	PYTHON 1300	1280x1024	170fps	USB 3.0	Mono
MV-CA013-21UC	PYTHON 1300	1280x1024	90fps	USB 3.0	Color
MV-CA016-10UM	IMX273	1440x1080	165.9fps	USB 3.0	Mono
MV-CA016-10UC	IMX273	1440x1080	165.9fps	USB 3.0	Color
MV-CA023-10UM	IMX249	1920x1200	41fps	USB 3.0	Mono

Camera Lens Mount

T-Mount



- Referred as M42 Mount. Or M58x0.75 and M72x1 mount are used as alternative to F Mount for **Line Scan Camera** or **High Resolution Sensors** as it considered more robust.

S-Mount



- Extreme small lens mount system. Normally used for **board level cameras** and **micro head cameras**. These lenses only allow minimum of adjustment.

C-Mount



- Most common type of lens mount used in machine vision application.
- C Mount connector can be used on a camera with a CS-Mount connector is a CS-Mount adapter inserted between the lens and the camera.
- C-Mount connector is **NOT suitable** for larger sensors such as in high resolution camera or line scan camera.

CS-Mount



- Same as C-Mount but with 5mm shorter flange focal length. Less common in machine vision.
- It is **NOT possible** to use a CS-Mount Lens on a C-Mount camera, even with adapter.

F-Mount



- Lens connector used in imaging and machine vision particularly for **high resolution camera** or **line scan camera**.
- F Mount is the name for Nikon's SLR camera lens mount system.

Camera

Camera Interface



GigE camera, 5MP, 24FPS



USB3.0 camera, 5MP, 35FPS



Cameralink camera 4K, 100FPS



10 GigE camera 25MP, 40FPS



CoaXPress camera, 31MP, 17FPS