Apex Series

3-CMOS prism-based R-G-B area scan cameras
for advanced machine vision applications

When color precision counts… the Apex Series stands out as the ultimate choice!

- Exceptionally accurate color image data
- Higher spatial resolution and sensitivity than single-sensor cameras
- Best-in-class waveband separation with minimal crosstalk

Version 2

The Apex Series

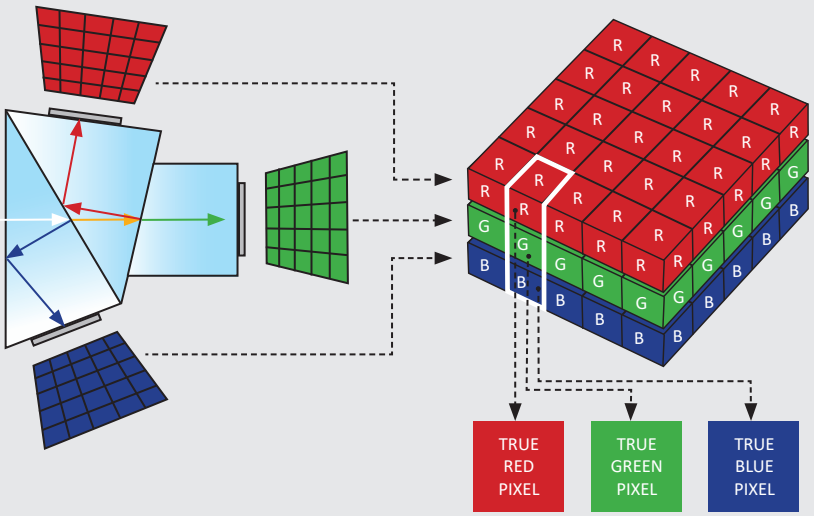
3-CMOS prism-based R-G-B area scan cameras
for advanced machine vision applications

The chameleon masters color with flawless control....
Just as nature excels, the Apex Series sets the standard in color vision systems.
Featuring advanced 3-CMOS, prism-based technology, Apex cameras deliver
unparalleled color accuracy and spatial precision.

Delivering exceptional color accuracy for your most demanding machine vision and inspection applications

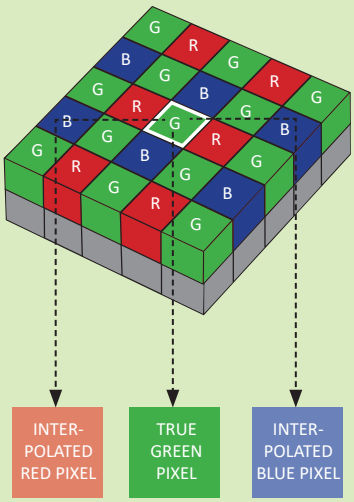
If you are developing a vision system that demands highly accurate color imaging, the JAI Apex Series is the ideal choice. Cameras in the Apex Series utilize prism-based imaging technology to separate incoming light into red, green, and blue wavelengths, directing the light to three precisely pixel-to-pixel aligned CMOS sensors. This advanced approach delivers significantly higher color fidelity and spatial precision than conventional Bayer mosaic-based color cameras.

Prism-based imaging versus Bayer Mosaic imaging



Prism-based imaging: True-to-life colors

The in-camera prism divides light into its red, green, and blue wavelengths, which are then captured by three precisely aligned CMOS sensors. The three images are combined into a single R-G-B image with more accurate per-pixel color values and better spatial precision, outperforming traditional color cameras that rely on the Bayer mosaic color interpolation technique.



Bayer Mosaic imaging: Interpolated colors

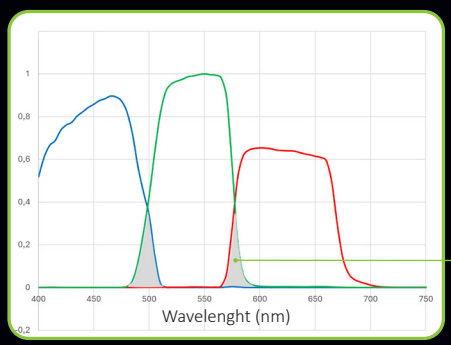
In the Bayer technique, each pixel is filtered to capture only one of the three primary colors. As a result, no single pixel can fully represent all red, green, and blue values. To create a full-color image, the Bayer technique interpolates the missing color information by referencing the surrounding pixels. This process estimates the red, green, and blue values for each pixel, based on its neighbors. The result of this interpolation technique is lower color accuracy and lower resolution compared with a prism-based camera.

Minimal color crosstalk for accurate color values and better spatial precision

Reveal the finest color details

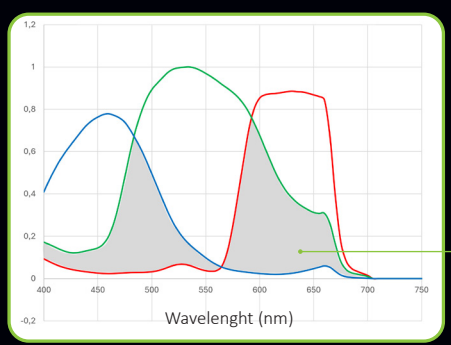
APEX prism-based RGB cameras use precision-engineered hard dichroic filters with steep spectral cutoffs to direct pure red, green, and blue wavelengths to dedicated sensors. This sharp spectral separation minimizes color crosstalk, delivering more accurate, vibrant colors while revealing even the most subtle visual differences.

In contrast, Bayer color cameras rely on color filter arrays with broader, less selective spectral response curves. The resulting overlap between the red, green, and blue channels increases color crosstalk, reducing color accuracy, and the ability to distinguish subtle color differences.



AP-5100T - Prism area scan camera with 3 x IMX548 monochrome sensors.

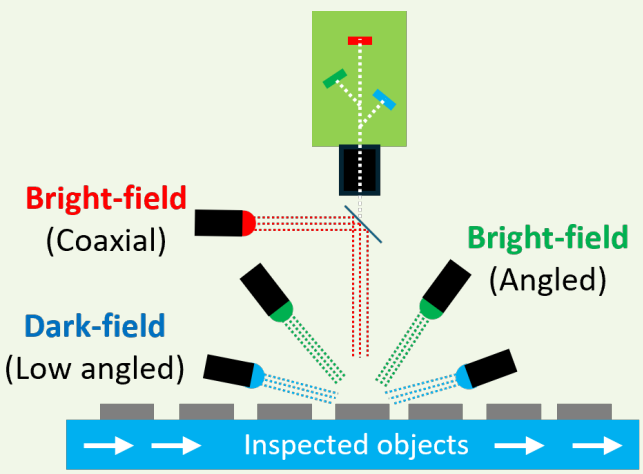
Minimal color crosstalk



GOX-5105C - Bayer area scan camera with 1 x IMX547 color sensor.

Large color crosstalk

Optimizing multi-field vision inspection

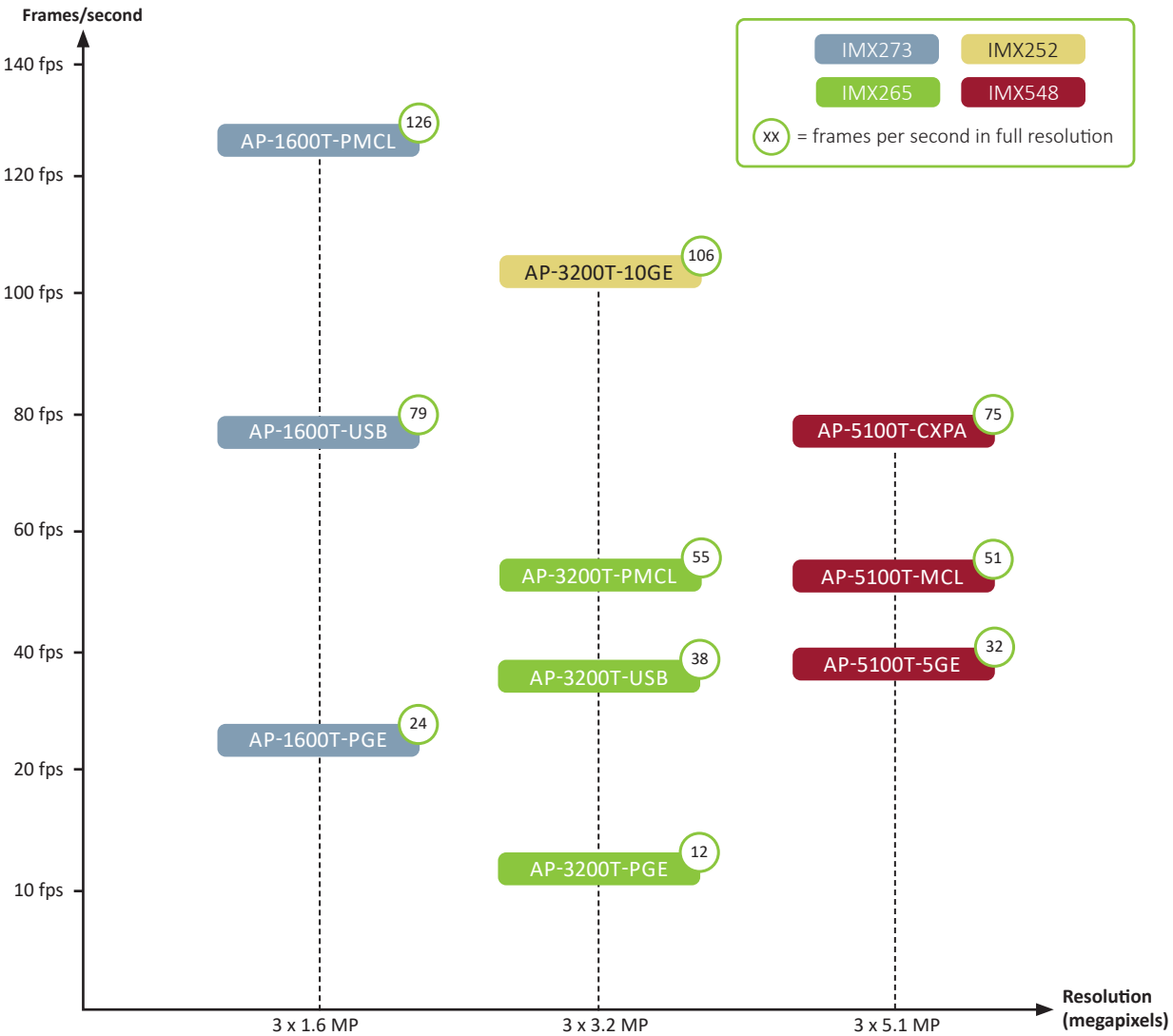


By combining multi-sensor prism camera technology with narrow-band LED illumination, it is possible to simultaneously acquire images of light scattered at different angles (coaxial, bright-field, and dark-field). The red, green, and blue LEDs can all be illuminated simultaneously because the camera prism uses dichroic filters to separate the different wavelength bands and direct them onto three pixel-aligned image sensors.

This machine vision configuration enables true parallel imaging at high conveyor speeds while eliminating the need for complex synchronization between the illumination and camera triggering. As a result, the system simultaneously acquires pixel-aligned images under coaxial, bright-field, and dark-field illumination in a single pass.

Choose from a wide range of resolutions, frame rates, and interfaces

The Apex Series models are equipped with Pregius™ and Pregius™ S image sensors, offering a variety of resolution options, including 3 x 1.6 megapixels, 3 x 3.2 megapixels, and 3 x 5.1 megapixels. Frame rates range from 12 to 126 frames per second, depending on the resolution and interface selected.



44 x 44 x 84 mm (H x W x D)

54 x 54 x 74 mm (H x W x D)

62 x 62 x 86.5 mm (H x W x D)

54 x 54 x 74 mm (H x W x D)

44 x 44 x 74 mm (H x W x D)

44 x 44 x 74 mm (H x W x D)

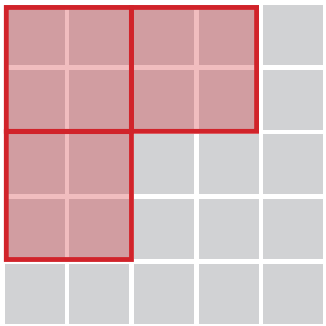
54 x 54 x 74 mm (H x W x D)

Pixel binning

For improved light sensitivity on sensors.

Traditional pixel binning can be applied to improve light sensitivity and can boost the signal-to-noise ratio, making it ideal when prioritizing image quality over maximum resolution. Multiple binning options are available:
2x1 (horizontal), 1x2 (vertical) or 2x2 (horizontal and vertical).

2 x 2



Traditional 2x2 binning.

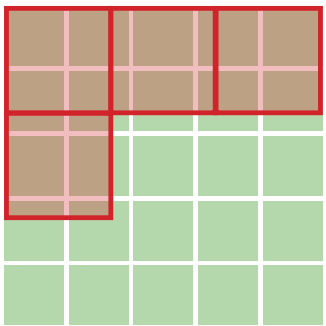
Xscale function

Sub-pixel scaling to meet your pixel size, sensitivity, and resolution requirements.

The Xscale function offers significantly greater flexibility than traditional pixel binning when adjusting pixel size, resolution, sensitivity, and signal-to-noise ratio. While conventional binning is restricted to whole-pixel groupings—such as 1x2, 2×1 or 2×2 — Xscale supports floating-point values. This means you can combine whole and fractional pixels to form “virtual” pixels of precisely the size you need.

Note: The Xscale feature is only available in the Apex 5.1-megapixel models.

1.666 x 1.666

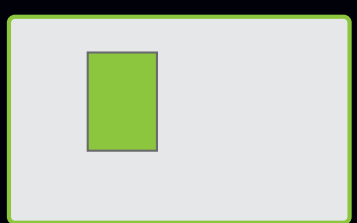


Xscale sub-pixel scaling example.

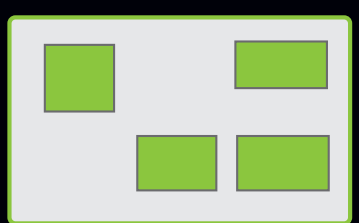
Single and multi-region-of-interest (ROI)

For enhanced frame rates and image processing efficiency.

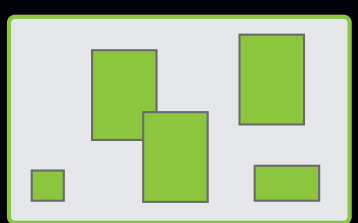
The cameras support both single and multi-region-of-interest (ROI) configurations, enabling image capture of specific square or rectangular areas within the scene. By restricting processing to these defined ROIs, the cameras achieve higher frame rates and reduce image processing load—resulting in faster and more efficient inspection routines.



Single ROI.



Multi-ROI, grid based.



Multi-ROI, with overlaps.

Note: Multi-ROI and Multi-ROI with overlaps are available on select models.

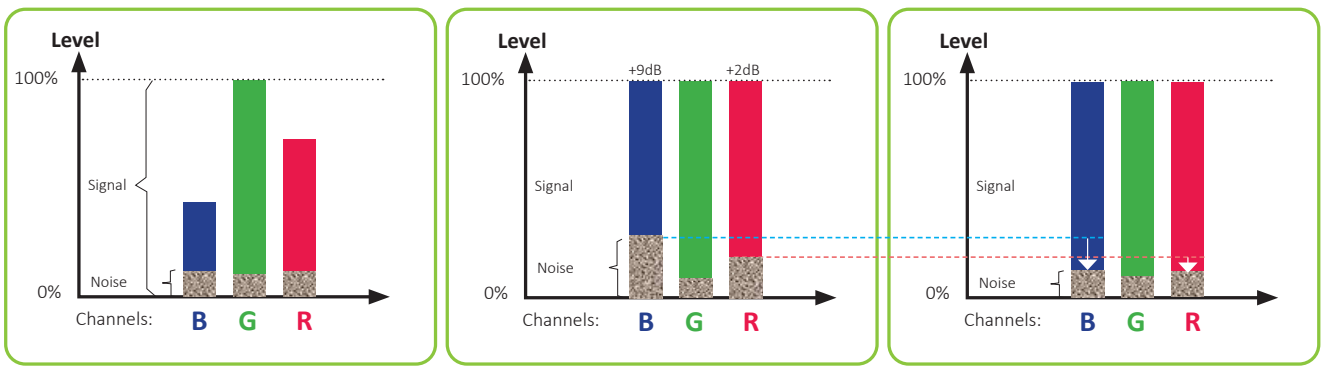
Shading correction on ROI. (only AP-5100T models)

If the illumination does not cover the full sensor area, shading correction can be applied to just the region of interest. This allows you to use partial-field lighting without compromising correction accuracy in the active imaging area.

Per-channel exposure control

For cleaner, more accurate colors.

Apex cameras offer independent exposure control for each of the red, green, and blue sensors. By individually adjusting the shutter time for each channel, the camera increases the true signal without artificially amplifying the noise. This results in cleaner, higher-quality images with accurate color and consistent contrast, even in multi-spectral or mixed-illumination setups.



Typical CMOS image.

*Different gray levels on the 3 channels if **Gain** and **Exposure** are identical. Level adjustment needed.*

*Bayer cameras can only balance levels via **GAIN**.*

Image noise increases proportionally.

*Apex cameras can control the **EXPOSURE** time on each sensor individually.*

Image noise stays at a minimum.

The increment of noise with exposure time is nearly negligible (within standard exposure time ranges).

In-camera chromatic aberration correction

Sharper Images.

To ensure perfect spatial alignment across all color channels, the Apex 5.1-megapixel models include advanced lateral chromatic aberration correction, enabling the adjustment of magnification for each channel independently. This compensates for optical dispersion effects caused by lenses, delivering sharper, more accurate images — especially critical for precise measurement, defect detection, and multi-spectral analysis.

Note: AP-3200T and AP-1600T models provide standard aberration correction.

Automatic Level Control (ALC)

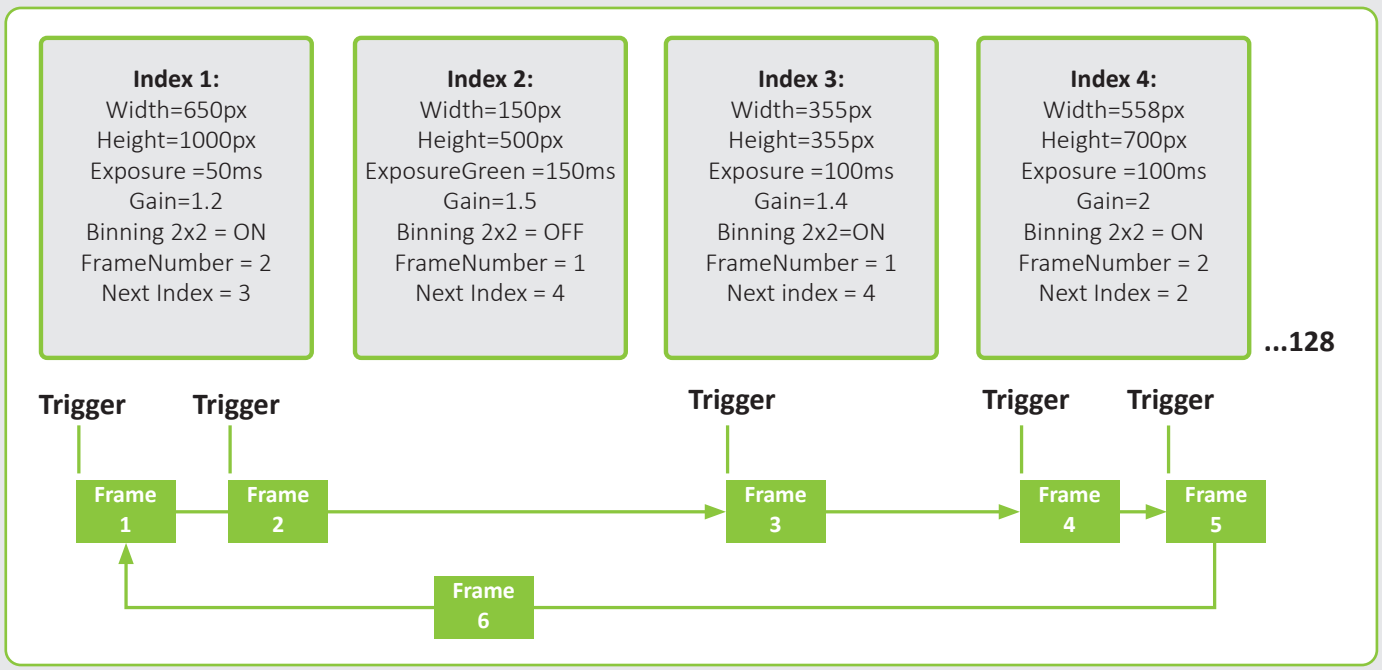
Maintaining consistent image brightness.

Automatic Level Control (ALC) is an intelligent imaging feature of the camera that dynamically adjusts both gain and shutter speed (within user-defined thresholds) to maintain consistent brightness and image quality (without introducing motion blur), even under fluctuating lighting conditions. It is particularly useful for real-time outdoor imaging systems that must operate reliably across diverse and changing environments.

Sequencer control function

Capturing multiple exposures with different camera settings.

All Apex models are equipped with a sequencer control function allowing users to define multiple combinations (indexes) of exposure time, gain, ROI, and other camera settings which can be stepped through each time the camera receives a trigger signal. This is particularly useful for quickly capturing multiple exposures of objects under inspection to adjust for areas or components with significantly different levels of reflectance or contrast, thereby improving vision inspection efficiency. Users can specify up to 128 indexes and define the order in which indexes are to be executed.



In-camera color space conversion to match your application

Apex cameras offer advanced on-board color space conversion, enabling flexible adaptation to application-specific requirements such as print inspection and flat panel display inspection.

Supported conversions include:
R-G-B to HSI, R-G-B to CIE XYZ, R-G-B to sR-G-B and R-G-B to Adobe R-G-B.

In addition, a user-defined color correction matrix allows for custom R-G-B profile configuration, providing enhanced control over color reproduction.

Flexible opto I/O for complex triggering scenarios

With up to four opto inputs and four opto outputs, Apex cameras integrate easily into sophisticated inspection systems. This flexibility allows complex triggering schemes to be set up for coordinating multiple light sources, cameras, or motion control devices — ensuring precise timing for each illumination step in multi-spectral workflows.

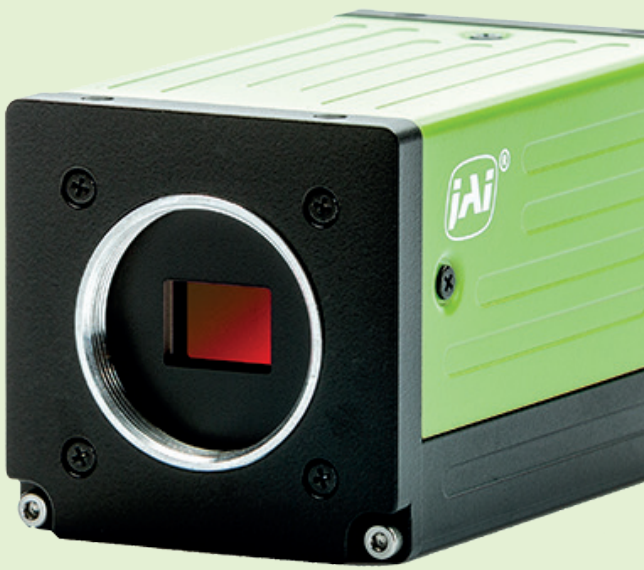
Robust design for reliable operation

Engineered for demanding industrial applications, the cameras feature a rugged construction with high shock (50G) and vibration (3G) tolerance ensuring reliable performance even in harsh and high-temperature environments (ambient temperature range: -5°C to +45°C).

50G	3G	-5°C to +45°C	> 100K hours
Shock	Vibration	Temp. range	MTBF

Plus, a lot more features to help you get the job done:

- Automatic white balance
- Color temperature preset function
- Gamma/lookup tables
- Blemish compensation
- Shading correction
- Precision Time Protocol (PTP). Note 1
- Color enhancer function
- Edge enhancer function
- Video process bypass mode
- Pulse generator
- Counter function
- RCT mode (select models)
- Particle Image Velocimetry (PIV) mode. Note 2
- Power over Ethernet (PoE)- AP-1600T-PGE and AP-3200T-PGE
- Power over Camera Link (PoCL)- AP-1600T-PMCL and AP-3200T-PMCL
- Power over CoaXPress (PoCXP)- AP-5100T-CXPA



Note 1: Supported in all models with GigE Vision interface.
Note 2: The PIV mode is available in the AP-5100T models.

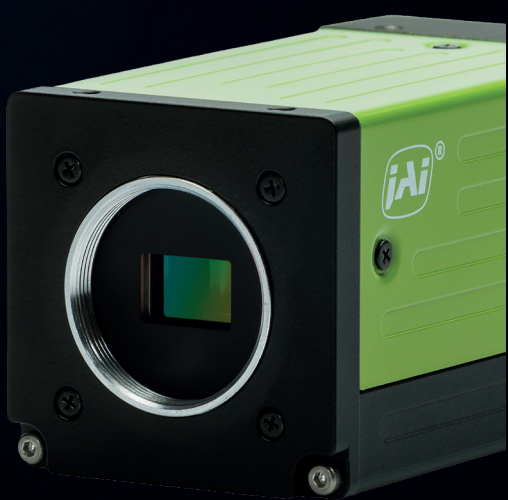
Find the right Apex model for your next color inspection system:

Model	Front view	Resolution megapixels (MP) (horizontal x vertical pixels)	Frames/ second (fps)	Sensor format	Pixel size (µm)	Data output (bit)	Sensor name	Interface
Models with 3 x 1.6 megapixels:								
AP-1600T-PGE		3 x 1.6 MP 1456 x 1088	24 fps	1/2.9″ CMOS	3.45 x 3.45 µm	8/10/12	IMX273 (Pregius)	GigE Vision
AP-1600T-USB [1]		3 x 1.6 MP 1456 x 1088	79 fps	1/2.9″ CMOS	3.45 x 3.45 µm	8/10/12	IMX273 (Pregius)	USB Vision
AP-1600T-PMCL		3 x 1.6 MP 1456 x 1088	126 fps	1/2.9″ CMOS	3.45 x 3.45 µm	8/10/12	IMX273 (Pregius)	Mini CL
Models with 3 x 3.2 megapixels:								
AP-3200T-PGE		3 x 3.2 MP 2064 x 1544	12 fps	1/1.8″ CMOS	3.45 x 3.45 µm	8/10/12	IMX265 (Pregius)	GigE Vision
AP-3200T-USB [1]		3 x 3.2 MP 2064 x 1544	38 fps	1/1.8″ CMOS	3.45 x 3.45 µm	8/10/12	IMX265 (Pregius)	USB Vision
AP-3200T-PMCL		3 x 3.2 MP 2064 x 1544	55 fps	1/1.8″ CMOS	3.45 x 3.45 µm	8/10/12	IMX265 (Pregius)	Mini CL
AP-3200T-10GE [2]		3 x 3.2 MP 2064 x 1544	106 fps	1/1.8″ CMOS	3.45 x 3.45 µm	8/10/12	IMX252 (Pregius)	GigE Vision (10GBASE-T)
Models with 3 x 5.1 megapixels:								
AP-5100T-CXPA **NEW**		3 x 5.1 MP 2472 x 2064	75 fps	1/1.8″ CMOS	2.74 x 2.74 µm	8/10/12	IMX548 (Pregius S)	CoaXPress (CXP-12) 1-connector
AP-5100T-5GE [3] **NEW**		3 x 5.1 MP 2472 x 2064	32 fps	1/1.8″ CMOS	2.74 x 2.74 µm	8/10/12	IMX548 (Pregius S)	GigE Vision (5GBASE-T)
AP-5100T-MCL **NEW**		3 x 5.1 MP 2472 x 2064	51 fps	1/1.8″ CMOS	2.74 x 2.74 µm	8/10/12	IMX548 (Pregius S)	Mini CL

Note 1: Models can be delivered with or without IR-cut filter. Models without IR-cut filter provide higher red channel sensitivity and NIR sensitivity.

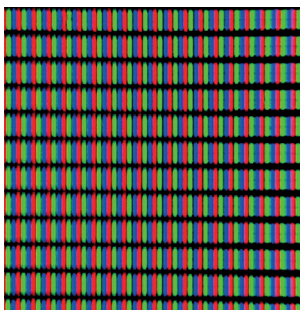
Note 2: Can auto-negotiate to 5GBASE-T, 2.5GBASE-T and 1000BASE-T.

Note 3: Can auto-negotiate to 2.5GBASE-T and 1000BASE-T.



Application examples

The Apex Series is the ideal choice for industrial imaging applications where accurate color data are paramount:



Display inspection

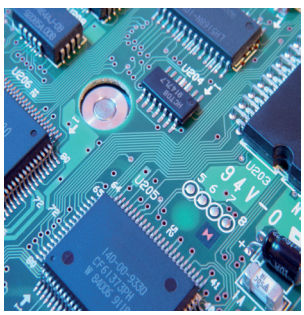
The R-G-B channel separation enables simultaneous inspection of red, green, and blue subpixels for brightness, uniformity, and dead pixel detection, with no leakage between channels avoiding critical measurement errors.

Pharmaceutical quality inspection

Low crosstalk imaging isolates true color differences in ampoules, capsules, and multi-layer tablets, improving detection of coating variations or contamination where Bayer sensors can be misled by color bleed.

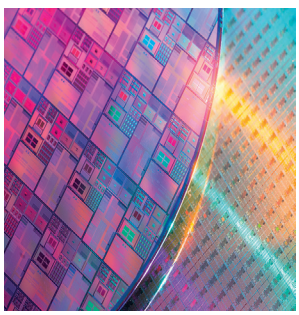
Electrical component and PCB inspection

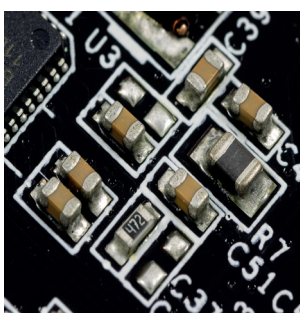
Capture multiple inspection images — such as solder joint integrity, silkscreen alignment, and component presence — in a single pass using different lighting per channel, increasing throughput while reducing camera count and saving system space.



Semiconductor and wafer inspection

Minimal spectral overlap allows the use of multiple illumination types — such as dark field, bright field, and backlight — or different wavelengths at the same time without channel contamination, enabling more detailed and efficient defect detection in wafers and microstructures.





MLCC inspection

MLCCs are fragile and highly susceptible to mechanical and thermal stress. Even a tiny surface crack can propagate and lead to short circuits during service. The high spatial resolution in the Apex cameras can help to identify tiny cracks and other defects in MLCCs before they are mounted on PCBs.

Print inspection

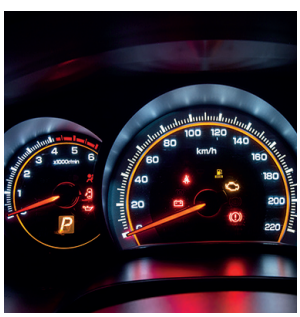
Resolve ink separations with exceptional precision for raster offset detection and accurate sampling of registration marks or color control patches, ensuring print quality and consistency.

Food sorting and grading

Prism-based separation eliminates color crosstalk, allowing precise grading of subtle ripeness and defect colors in fruits, vegetables, eggs, and meat — even under mixed illumination where Bayer sensors lose contrast.

Automotive inspection

By capturing pure R-G-B channels, prism sensors accurately measure paint shades and LED colors without contamination from nearby wavelengths, ensuring reliable results under diverse lighting conditions.



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