SENSOR INSIGHTS:

SONY® Pregius™ – CMOS Global Shutter

The state of the art in machine vision image sensors
THE LAUNCH OF THE SONY PREGIUS™ SERIES IN LATE 2013 MARKED A MILESTONE IN THE HISTORY OF IMAGE SENSORS. Its outstanding performance, success and large consumer capacity were among some of the triggers resulting in SONY’s decision to shut down their CCD sensor development and production, despite their technology and market leadership. The Pregius series combines the image quality from its Exmor technology with high readout speed, an electronic global shutter and the low noise EXview HAD II Technology from the CCD designs.

Thanks to latest advances in wafer production techniques and pixel design, today’s professional grade CMOS image sensors outperform CCD’s in both speed and image quality. Thereby, they are now also capable to start and stop the light exposure time for all pixels simultaneously, (known as global shutter). CMOS sensor technology has continued to evolve with unprecedented advances in resolution, frame rate, sensitivity, readout-noise, high dynamic range and control features that enable new applications in industrial imaging.

This series has evolved since then with the third generation. Each generation has a unique basic pixel size and design that is optimized for different resolutions and sensor sizes. Later generations provide a continuously expanding set of control and readout features. SONY has created a family of sensors that are pin compatible, allowing customers to create a full product offering with a single design. Furthermore, each sensor type is available as a fully featured version, or with a reduced feature set, and lower speed (resulting in a lower cost sensor). SONY also offers some models as special variants for sensing and video recording applications.
Understanding SONY’s Exmor™ Technology

Exmor™ is one of the secrets behind the outstanding performance of the CMOS global shutter sensors from SONY, branded as Pregius™.

One of the keys of the Exmor technology is the digitization of the pixel data early in the transfer process. This minimizes the amount of additional noise that is accumulated as the image data travels around within the sensor, even at high speed. To further improve the noise response of the sensor, correlated double sampling (CDS, from CCD technology) on either side of the ADC (analog to digital conversion) cancels out the noise in the signals and ensures the accuracy of the digitized data.

These sensors now feature a pixel architecture with high quantum efficiency (QE), i.e. the ratio of arriving photons which are converted into electron charges. More QE leads to a stronger electric signal and thus to better sensitivity.

Pixels of the Pregius sensors have an increased well depth, enabling them to capture and hold more electrons before saturating. This provides a higher dynamic range of achievable pixel values and it also increases the sensitivity at longer wavelengths of the NIR spectrum.

SONY has optimized the Exmor technology over many years and product generations. It features unrivaled image quality, even at very short exposure times and under low light conditions.

SONY Pregius Portfolio

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<th>IMX253</th>
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<td>128.20@12 (IMX174)</td>
<td>300@10 (IMX250)</td>
<td>60@10 (IMX252)</td>
<td>60@10 (IMX252)</td>
<td>60@10 (IMX255)</td>
<td>60@10 (IMX264)</td>
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<td>Sub LVDS, MIPI</td>
<td>LVDS, DDR</td>
<td>LVDS</td>
<td>LVDS</td>
<td>SLVS, SLVS-EC</td>
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<tr>
<td>Similar CCD models</td>
<td>ICX674, ICX817, ICX818</td>
<td>ICX424, ICX259, ICX415</td>
<td>ICX445</td>
<td>ICX808</td>
<td>ICX825, ICX855</td>
<td>ICX814, ICX815</td>
<td>ICX834</td>
</tr>
</tbody>
</table>

*only available as monochrome versions
The SONY Pregius series of Global Shutter CMOS sensors has evolved over several product generations. Each generation features basically the same architecture of the pixels and readout circuits. Every generation brought individual improvements over the previous one, but also came with different trade-offs between pixel size, saturation capacity and sensor size. Therefore, the application requirements will determine which Pregius generation is best suited.

### 1st Generation

The 1st generation Pregius sensor, the IMX174 with its 2.35 MP and 1/1.2” optical format, set an initial benchmark and enjoyed great response in the industrial imaging market. Thanks to a pixel area of 5.86 µm and a very high saturation level of 30,000e-, the dynamic range increased to 75 dB, even with its high readout noise of 5e-. Features like multiple Regions of Interest (multi-ROI), addressed the requirements of modern machine vision systems. With these sensors, it was possible to implement applications with an image quality and speed that was inconceivable with CCD technology.

### 2nd Generation

With its 2nd generation, SONY focused more on the requirements of machine vision. These sensors provide an additional 8 bit ADC option for digitizing the pixels that reduces the needed output bit depth that was not present in the previous generation. At the same time, they have twice the number of data channels to transport the image data resulting in a doubling of the output speed to 9.5 Gbps. Extended functionalities such as additional trigger modes enable and simplify many imaging solutions. The smaller pixel size of 3.45 µm limits the saturation to 11,000e-, while the significantly lower readout noise of 2e- retains the high dynamic range of 74 dB.

Furthermore, thanks to this pixel size, the first sensor of this generation IMX250 with 5.07 MP and 2/3” optical format is a direct replacement of its CCD antecessors ICX625 and ICX655. Thus, a large variety of optics are already available and cameras with the new Pregius sensors can serve as drop-in replacement for previous CCD-based systems.

In the second generation, SONY also integrated the widely adopted I2C control interface as an additional option.

### 3rd Generation

The innovations of the 3rd generation deliver clear improvements, mainly in terms of image quality and speed. Based on these improvements, an increase in performance is seen through improved detection quality in applications with moving objects such as running production lines and robotics applications as well as in the ITS and automotive sectors. The increase in pixel size of 4.5µm produces a much higher saturation (25,000e-) than the second generation. Combined with the low readout noise of 2.5e-, the maximum dynamic range reaches a new peak with 80 dB, making improved light-dark detection feasible even in difficult lighting conditions.

Based on the different quality improvements, it will be no longer possible to transfer this increase in image data any faster using the existing standard interfaces. SONY has therefore developed the SLVS-EC standard with 8 channels, which with 19 Gbps doubles the maximum output speed compared to the 2nd generation.

<table>
<thead>
<tr>
<th></th>
<th>1st Generation</th>
<th>2nd Generation</th>
<th>3rd Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pixel size (µm)</td>
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<td>3.45 / 6.9</td>
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<td>Sub-LVDS 16ch</td>
<td>SLVS-EC 8lane &amp; SLVS 8ch</td>
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<tr>
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<td>8/10/12</td>
<td>8/10/12 +α</td>
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<td>Saturation (e-)</td>
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<td>Readout noise (e-)</td>
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<td>2.5</td>
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<tr>
<td>Dynamic range (dB)</td>
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<td>80</td>
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<tr>
<td>Max. output (Gbps)</td>
<td>4.7</td>
<td>9.5</td>
<td>18.4</td>
</tr>
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</table>
Different Sensor Variants for Different Requirements

All SONY Pregius Sensors of the same generation share similar architecture and thus provide comparable image quality. As some applications are less dependent on speed and control features, the SONY Pregius Series offers different sensor variants for each model. With most models, a high-speed variant for leading-edge machine vision applications and a low-speed variant with reduced feature set for standard machine vision and traffic applications are available. For some models, a global shutter video recording variant is offered with features required for high-end video captures in research, monitoring, or broadcast.

High-Speed Applications

These flagship sensors combine the outstanding image quality of the pixel architecture and readout circuits with leading edge speed and features.

- Analog-digital conversion with 8, 10, or 12 bit
- Various trigger modes:
  - Exposure time control: external trigger pulses can define the time of light accumulation
  - Trigger output: indicates sensor status during shutter operation for synchronization with peripheral circuits.
  - Fast trigger mode: reduced delay between trigger and exposure
  - Multi-exposure mode: single trigger pulses initiate a sequence of image captures
- Sequencer: Series of 2/4 frames can be captured after single trigger, for each frame the user can define different exposure time, gain, and ROIs with different positions and sizes.
- Regions of Interest: The image capture can be cropped to 16 / 64 regions of interest, even with overlapping areas.

Features:
- Analog-digital conversion with 12 bit
- Regions of Interest: 1
- Sequencer with 2 / 4 frames with different exposure times and gains
- Trigger modes

Low-Speed Applications

Applications, which do not require the speed and features set of the high-speed machine vision models, can benefit from these cost-effective models, yet providing the exact same image quality.

Features:
- Analog-digital conversion with 12 bit
- Regions of Interest: 1
- Sequencer with 2 / 4 frames with different exposure times and gains
- Trigger modes

Global Shutter Video Recording

Where recording of fast moving objects is required, users of these sensor models benefit from their global shutter functionality and obtain blur-free image captures. While the recording speed is limited as with low-speed machine vision sensor variants, it still allows for detailed slow-motion analysis or continuous display.

Features:
- Vertical inversion of pixel scan
- 2-frame set output mode: Recording of two consecutive frames at different exposure times, merged to one picture to enable wide dynamic range.
- Regions of Interest: All-pixel scan or Full-HD

CURRENTLY AVAILABLE MODELS:

- IMX287 0.4 MP
- IMX273 1.6 MP
- IMX174 2.35 MP
- IMX252 3.19 MP
- IMX250 5.07 MP
- IMX255 8.95 MP
- IMX253 12.37 MP

CURRENTLY AVAILABLE MODELS:

- IMX297 0.4 MP
- IMX296 1.6 MP
- IMX249 2.35 MP
- IMX265 3.19 MP
- IMX264 5.07 MP
- IMX267 8.95 MP
- IMX304 12.37 MP

CURRENTLY AVAILABLE MODEL:

- IMX302 2.4 MP
- IMX305 8.9 MP
These second generation Pregius sensors share the same pixel architecture based on a 3.45 µm pitch. They were designed for small sensor formats with low readout noise of just 2.1 electrons. Despite the factor of four difference in resolution, both sensors share the same optical format of about 1/3". This is achieved by maintaining the schematic pixel layout but doubling the pixel pitch and thus quadrupling the pixel area of the 0.4-megapixel IMX287 and IMX297. This leads to a massive pixel size of 6.9 µm, and a correspondingly increased full-well capacity and quantum efficiency. Thanks to this engineering trick, the low-speed model IMX297 already features at least a doubling in speed from its CCD predecessors, while the high-speed machine vision version IMX287 outperforms competing models from other brands in speed and resolution, alongside its outstanding image quality.

With 226 fps, the IMX273 allows for high-speed imaging at a resolution of 1.6 megapixels. The low readout-noise, typical for the 2nd Pregius generation, ensures crisp greyscale images as well as accurate color reproduction. Even the low-speed and low-cost IMX296 delivers more than double the framerate of the widely adopted SONY ICX445 1.25MP CCD, using the same optical format. Most lenses designed for this old CCD sensor will be suitable as well for IMX273/IMX296-based cameras, although their pixel pitch is smaller by 0.3 µm.

The IMX297 is the only sensor of this category which can reach its full speed on a GigE interface platform. The IMX296 slightly exceeds the effective bandwidth of GigE and calls for dual-GigE or NBaseT at 2.5 Gbps data interface; as does the IMX287. With 3.58 Gbps, IMX273 will likely not reach its full speed on standard USB 3.0 platforms without some data compression. Camera Link, CoaXPress, or NBaseT at 5 Gpbs would be the likely interface candidates to best leverage the throughput of this sensor.

Despite the trend towards higher resolutions, for many applications, like in logistics and factory automation, these 0.4 or 1.6 megapixel sensors are still the perfect choice. In presence detection, code reading, geometric measurement and quality inspection of small areas with close-up captures, these sensors fulfill the requirements at an attractive price. Thanks to the enormously high frame rates and great image quality at short exposure times, IMX287 and IMX273 open up new opportunities in terms of production line throughput and captures at high object velocities.

**Short spec**

<table>
<thead>
<tr>
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<th>IMX287</th>
<th>IMX297*</th>
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<tbody>
<tr>
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<td>2nd</td>
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<td>Horizontal [px]</td>
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<td>1456</td>
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<tr>
<td>Vertical [px]</td>
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<td>1088</td>
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<tr>
<td>Optical format</td>
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<td>1/2.9*</td>
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<td>Pixel pitch [µm]</td>
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<td>Data rate (Gbps at 10 bit)</td>
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<td>Sub LVDS, MIPI</td>
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<tr>
<td>Similar CCD models</td>
<td>ICX424, ICX259, ICX415</td>
<td>ICX445</td>
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*only available as monochrome versions
While this sensor was introduced in 2013, it is still leading edge in performance and already constitutes a milestone in the history of Machine Vision. The IMX174 features Full-HD capable 1936 x 1216 resolution, up to 164.5 fps at 10 bit, very large 5.86 µm pixel pitch and 1/1.2" format, with multiple regions of interest. This sensor and its low-speed companion IMX249 fulfill the needs of a large variety of machine vision applications where previously similar slow megapixel CCD-sensors had been applied.

The large pixel size in combination with micro-lenses on the sensor surface leads to high quantum efficiency and an outstanding saturation level of 30,000 electrons.

The maximum data rate of the IMX174 is at 4,752 Gbps which exploits the video bandwidth of USB 3.0. On the other hand, for various machine vision applications this sensor can also be designed into platforms with a GigE or dual-GigE interfaces, by reducing the sensor's throughput to a quarter or respectively half of the frame rate in continuous recording mode to support the bandwidth available with these interfaces. Captures at full speed can still be enabled for short sequences on these interfaces by buffering frames to memory inside the camera and subsequent transmission at lower data rates. With a maximum frame rate of 30 fps at 12 bit, the IMX249 delivers 1188 Mbps and is therefore ideally suited for continuous recording on Gigabit Ethernet platforms.

Thanks to the high sensitivity and saturation capacity, pixels looking at darker areas of a scene can equally resolve the light intensity as pixels looking at the bright ones. This wide dynamic range is beneficial, for example in fast and precise localization of laser lines in 3D profilometry or the inspection of shiny surfaces with glare and specular surfaces. Traffic applications with challenging lighting conditions caused by headlights at night or sun reflections are perfect applications for these sensors as they deliver sufficiently high contrast, which is also needed for number plate recognition in automatic tolling, car access control or traffic law enforcement.

Short spec

<table>
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<tr>
<th>High-speed</th>
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<tr>
<td>Low speed</td>
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<table>
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<td>Vertical [px]</td>
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<td>30/18 (IMX249)</td>
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The first sensors of the second Pregius generation are a direct replacement to their CCD equivalents. Especially the 5 megapixel IMX250 and IMX264 which feature the same optical format, resolution, and pixel size as the widely used ICX625 and ICX655 CCD sensors. This allows for the use of the large portfolio of lenses from various manufacturers, which were designed for the equivalent CCD models, leading to lower costs for an imaging system. One of the major advantages of the new Pregius sensors lies in their speed. While the 2-tap ICX625 delivered just 15 fps, the IMX250 captures up to 163 fps at 8-bit encoding. Furthermore, the non-linear and temperature dependent balancing of the CCD readout taps is not required anymore with CMOS.

Using the same pixel architecture as the IMX250 and IMX264, the 3.19 MP sensors IMX252 and IMX265 address high-speed imaging systems with moderate requirements on resolution.

With a maximum data rate of 9.504Gbps (IMX252) and 9.504 Gbps (IMX250) these sensors demand high-speed camera interfaces like Camera Link Full, CoaXPress x2, or 10 GbE. As IMX265 and IMX264 deliver maximum data rates of below 1.8 Gbps they can reach their maximum performance already with dual-GigE interfaces.

While the full-well capacity is just slightly more than 1/3 of the first generation Pregius sensors, the readout noise lies at just 2.1 electrons. This low readout noise will produce very clear monochrome pictures, and has outstanding color reproduction. This is especially helpful in the analysis of color prints and pharmaceuticals along with inspection systems for fruit, vegetables, and pastries of all kinds in automated food production facilities. Furthermore, demanding applications like panel inspection and surface inspection benefit significantly from higher throughput and accuracy thanks to the speed and resolution of these image sensors.
The IMX420 and IMX428 are the first sensors of the 3rd Pregius generation. The new pixel size of 4.5 x 4.5 µm perfectly balances high quantum efficiency, saturation capacity and compactness. Thanks to its low readout noise of 2.5 electrons and a full pixel well of 25,000 electrons these sensors achieve an unprecedented maximum dynamic range of 80 dB.

These sensors come with a variety of new and highly innovative features including High Conversion Gain for better image quality under low light conditions and the Low Conversion Gain for bright scenes. With Dual ADC, each pixel can be read out with different gains. By combining the two images with different gains off-the-sensor a high dynamic range image can be obtained. As with 1st and 2nd generation Pregius sensors, the high-speed models provide captures with multiple ROIs. The new Dual Triggering allows for different exposure times and gains in different regions of interest, while a Self-Triggering feature detects changes above a certain threshold in a predefined “sensing area” and acquires an image automatically.

The new SLVS-EC interface of the 3rd generation sensors allows for a maximum output of 19 Gbps over 8 lanes. With 172 frames at 10 bit the IMX420 generates a data rate of 19 Gbps, which requires either high speed interfaces like 3x CoaXPress or Camera Link HS. The low speed IMX428 offers 51.4 fps which makes it a perfect fit for USB 3.0 based platforms.

High resolution, high frame rate, effective global shutter and a host of new features qualifies the IMX420 for demanding system setups in quality assurance of fast moving objects and precision control in robotic applications. The IMX428 is optimized for ITS and delivers 12-bit images with just one ROI. Yet, any applications with lower requirements on throughput can still benefit from the high resolution, image quality and reduced price of this model.

The IMX420 and IMX428, as the first sensor models featuring SONY’s 3rd generation CMOS Global Shutter mode, clearly show how the combination of high resolution and high frame rates, along with Global Shutter read-out technology boosts imaging quality and speed into new spheres. Mass production is scheduled around spring 2018.

### Short spec

<p>| High-speed | IMX420 |</p>
<table>
<thead>
<tr>
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<td>Vertical [px]</td>
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<tr>
<td>Frame rate [fps]</td>
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<td>Data rate [Gbps]</td>
<td>19.0 4.752</td>
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<td>ICX694, ICX695</td>
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As all members of the 2nd Pregius generation, the IMX253 and its little brother IMX255 are based on comparably small pixels of 3.45 x 3.45 µm with reduced full-well capacity compared to first generation sensors and very low readout noise of 2.1 electrons. Their diagonal remains within a small 1" and 1.1" optical format respectively despite their high resolution of 8.95 and 12.37 megapixels while still being compatible with C-mount lenses.

Maximum data rates greater than 9.504 Gbps drive interfaces like 10 GigE or USB 3.1 Gen2 just beyond their effective bandwidth. Camera Link Deca, CoaXPress x2 or interfaces with higher bandwidth can reliably transmit the generated data rates at full speed.

The 1.1" IMX253 with a traditional 4:3 aspect ratio is designed for high-resolution analysis of displays or solar panels, or built into multi-camera 3D model creation systems for Virtual Reality.

The IMX255 features the same horizontal pixel count with less vertical lines when compared against the IMX253. This results in a 17:9 cinematography format of the IMX255, making it suitable for high-speed recordings with 4K TV (a.k.a. Ultra HD) resolution. In applications where high resolution in the horizontal but less in the vertical direction are required, the Region of Interest-feature of the SONY Pregius series makes the IMX255 a real high-speed sensor with high frame rates at a resolution of 4112 x 2176.

The low readout noise of both sensors contributes to crisp and clear images for reliable 3D captures and inspection results.
Typical Applications

High-end Manufacturing Automation and Logistics

Production managers are under constant pressure to increase the output quality and productivity of their facilities while at the same time reducing the total costs of manufacturing lines. Furthermore, the new Industry 4.0 revolution calls for utmost flexibility in production and logistics. The high speed, resolution, image quality and the rich feature set of SONY Pregius sensors provides unprecedented opportunities to build very flexible machine vision systems with high accuracy and throughput at moderate costs.

Features and benefits:

- **High resolution** allows for more detailed inspection, especially in the semiconductor industry at the inspection of display panels, solar panels, wafers, etc. as well as in food and glass production where smallest defects can be detected.

- **High frame rates** allow for more throughput/productivity while the ROI and multi-ROI features provide even higher readout-speeds. Vision guided robots and 3D captures based on structured light, such as laser lines, benefit from these fast frame rates.

- **Sensitivity** enables very short exposure times which allow for blur-free captures of fast moving objects, e.g. on a conveyor belt.

- **Full-well capacity** leads to high dynamic range captures ensuring detailed pictures of shiny or specular surfaces minimizing the impacts of speckles and glare.

- **Features** like various trigger modes, sequencing, fast trigger response, trigger controlled exposure times, etc. reduce the need for external control peripherals and allow new innovated solutions for demanding applications possible.

- **Low cost** variants of the sensors ensure positive business cases even for cost-sensitive, large volume applications.
Medical Devices

From ophthalmology to dermatology, surgery room equipment and bio-chemical analyses, imaging enables multiple applications in the medical field by contributing to more secure and faster diagnostics, guidance of surgeons and surgery robots, to name a few.

Features and benefits:

- **Color fidelity:** Thanks to the high full-well capacity and the low readout noise, the RGB-color sensors of the SONY Pregius series offer vibrant color images with precise reproduction of the real color. In skin cancer diagnosis, or tissue and liquid analysis, the high color fidelity ensures accurate color reproduction for experts as well as for automatic image processing algorithms.

- **High resolution:** Vision applications for the spatial analysis of organic materials can operate at an even higher level of accuracy with higher resolution sensors. When it comes to the guidance of surgery tools, camera based 3D tracking systems are required as their accuracy is directly dependent on the resolution of the cameras used.

- **Sensitivity:** In fluorescence imaging, where low light intensities need to be captured, the SONY Pregius series rivals the performance of CCD image sensors. Where machine vision is used alongside patients or doctors, the artificial light intensity must be kept below hazardous limits requiring the image sensor to deliver clear images with the available light. Having sensors that are very sensitive can still capture high quality, high dynamic images under these low light conditions.

Security

Access control, passport check, and optical inspection of personal identification devices are few of the various imaging applications in the security sector. The better the images, the more reliable are the verifications of retinas, finger and palm prints, ID cards, or bank notes.

Features and benefits:

- **Sensitivity and low noise:** Especially for retina scans, the light intensity is very limited, and exposure times must be short to cope with continuous eye movements. For these reasons, the first and third generation Pregius sensors are ideally suited for this application.

- **Wide dynamic range:** At automatic passport inspection machines, the ambient light cannot always be controlled. This means that light sources in the background and speckles from glasses affect the details of the facial image being captured. Also, the optical inspection of reflective security features, e.g. holograms, requires detailed texture resolution in bright as well as in dark regions, making this feature a requirement.

Typical Applications
Sports and Entertainment
This broad application field of machine vision has rapidly evolved over the last few years. From basketball, soccer and baseball, to hockey, players and equipment they are continuously tracked for real-time analysis and rule enforcement. Slow motion videos of fast movements can be equally fascinating and insightful for the viewer especially when combined with Virtual Reality offerings that provide a more detailed 3D scan of athletes and the balls, pucks, birdies, javelins, etc.

Features and benefits:
- **High frame rates** enable accurate analyses of physical processes as well as the movements from athletes or horses. Slow motion replays are more intriguing where the original recording is faster. SONY Pregius sensors can reach greater than 1000 frames per second, especially with regions of interest.
- **High resolution** offers more spatial detail with less numbers of cameras covering the entire field of view. With up to 12 megapixels, large sections of playing fields can be monitored in detail. Also, 3D scans of objects for digitization in Virtual Reality applications benefit from higher level of detail that these sensors provide.
- **Wide dynamic range** is key in all outdoor applications in stadiums where half of the playing field is shadowed and the other is in bright sunlight.
- **Triggering and sequencing** is especially beneficial for the synchronized capture of moving objects with stereo cameras or 3D virtualization systems, or for even extended wide dynamic range by multiple captures with different exposure times and gains.

Intelligent Traffic Systems (ITS) and Transportation
Vision systems play a pivotal role in the ever increasing traffic volumes and the growing complexity in transportation and traffic safety. In cities with scarce parking or where there is a need to monitor public transport, image processing can help.

Features and benefits:
- **High resolution:** With up to 12 megapixels of the IMX253 and IMX304 a single camera can monitor larger areas, such as multiple lanes on a highway. This reduces costs and system complexity.
- **Image quality:** Thanks to the high sensitivity, high full-well capacity, and wide dynamic range these sensors provide, the images of drivers and license plates for tolling or law enforcement reliably provide clear images, even under challenging light conditions that include reflections, shadows and sun light.
- **NIR sensitivity:** The deep pixel wells of the Pregius architectures provide an increased sensitivity in the NIR spectrum, making them especially interesting for outdoor applications at night, especially when combined with NIR light sources.
How We Can Support Your Application

FRAMOS supports industrial customers, OEMs, system integrators, and researchers overcome imaging challenges. We partner with our clients to provide a complete vision solution from requirements gathering, to decision making, and delivery of the finished product.

We provide:
- Requirements Analysis
- Product Selection Support
- Measurements and Testing
- Evaluation Tools
- Rapid Prototyping
- Experienced Design-in Support
- Application Specific Hardware, Software, and IP Solutions

With our practical industry and project experience, FRAMOS serves our clients as a technical consultant, development partner and external supplier enabling our customers to develop cutting-edge imaging solutions while shortening their times-to-market.

Requirements Analysis

At FRAMOS, our goal is to enable our customers to leverage imaging and vision technology, to be ahead of the competition and to create cutting-edge business solutions in their field. This means working to find the best solution for our customers, is our number one
priority. As the experts in the industry, we listen to you, understand your requirements, and find a solution that fits your needs. Our experts are available to assist in selecting the components that meet the requirements for your vision system. We also offer a needs assessment to determine the requirements for the sensor, optics, data processing, data communication, interface, camera’s size and power consumption, and the software or SDK.

**Product Selection Support**

After a requirements assessment, our vision experts will work together with our customers to determine how to fulfill their requirements. To support single sensors to complete systems, we leverage our engineering team, strong partner network and diverse supplier network. When providing a solution, we may tap into our supplier network to determine which hardware suits the customer best. This may be components like sensors, optics or off-the-shelf cameras. If more customization is needed, we work with our partner network of specialized vision solution experts. This network enables us to provide vision technology for customer applications across the whole value chain.

**Experienced Design-in Support**

To fully understand the design of the sensor, we provide our clients with all necessary data, test measurements and development tools needed to create your vision system. Evaluation boards as well as EMVA 1288 measurements are available to ensure a full analysis and review can be completed to allow for the selection of the best component.

With our FRAMOS Engineering Services, we help industrial customers, OEMs, system integrators, and researchers overcome challenges with image processing. We can assist from requirements gathering, to decision making, and to delivery of the finished product. We work with you to determine your needs and are at your service as a technical consultant, development partner, and external supplier.

**Measurements and Testing**

FRAMOS provides a comprehensive range of testing and measurement services to evaluate sensors and compare apples to apples in terms of sensor models, functionality and manufactures. Using ISO and EMBA1288 standards we can offer our customers objective measurements of image sensors and cameras; and under conditions that are specific to the customer and application.

The ISO standard tests cover the entire imaging system and are used to identify the best combination of sensor, camera and lens for a customer application. These tests can also be used to evaluate information that includes the dynamic range, signal-to-noise ratio and modulation transfer function (MTF)/resolution.

The EMVA1288 standard requires sensor or cameras demo kits to be measured without a lens, which means that the sensor is illuminated directly with homogeneous light. The FRAMOS EMVA1288 measuring device records the properties on four wavelengths: 465nm, 532nm, 630nm and 848nm. The layout and structure of the EMVA1288 report is pre-defined and the values are generally measured uniformly in electrons or photons. The measurements provide a highly detailed, clear standardized comparison between different image sensors.

FRAMOS also offers in-house training with the FRAMOS Imaging Experts Academy to introduce them to the test methods and how they are used.

**Evaluation Tools**

Evaluation Boards help camera manufacturers and OEMs in the development, selection and integration of sensors into their image processing applications and vision systems. An EVB is an excellent development tool that can be used through all stages of product design. The SONY EVB kits allow for detailed test and measurement with access to ‘truly raw data’ from the sensor, as well as its configuration and status information. It serves as a test tool to help you evaluate whether a particular sensor has the required image quality and performance for your application.

The EVB provides direct access to the output data for the image sensors running in any mode. This raw pixel data ensures you are seeing the true performance of the sensor. The purity of this data allows designers to get a head start on the image pipeline and downstream image processing. With the use of an EVB, designers have complete control of the sensor enabling you to evaluate it to see if it will perform exactly as you need it to.

With the use of an evaluation board, the development of the image pipeline can be started at an early stage, and provides the ability to test several lenses under your operating conditions. Costs are significantly reduced with the use of an EVB as it allows you to fully analyze and assess the true performance of the sensor under your operating conditions which will reduce development time. To assist schematic designers, complete reference design kits including the layout data (Gerber layout files), schematics, and Bill of Materials (BOM) for the EVB are available on request.
Rapid Prototyping
With our engineering know-how and our laboratories in Europe and North America, we can simulate customer applications and environments. We can change different components and vary system parameters to meet requirements. For example, a setup could consist of strobed lighting, cameras and the use of specific software. We can also test long-term reliability and the temperature resistance of the system. With this setup FRAMOS can prototype and document a solution to any customer application.

Commercial Flexibility
To provide you the flexibility you need, FRAMOS offers frame contracts allowing products to be in-stock and available as you need them. This ensures the sensors you need are always available and delivery delays or product discontinuations will not affect availability. Using consignment stock opportunities helps with long production cycles to ensure you get the products when you need them.

Quality Management
On-time delivery, highest quality and warehousing, mark FRAMOS as a reliable partner in logistic services. Our clean room warehouses are in accordance with DIN EN ISO 14644, Clean Room Class 5. The ESD certification ensures ESD-compliant clothing, conductive shelves and floors and special packaging regulations for conductive packaging reduce electrostatic charging. Moisture and temperature control, as well as ionization fans ensure high quality ambient conditions. Our FRAMOS warehouses are monitored and certified by SONY with the Canadian ESD room being the only certified room in North America external to SONY itself.

FRAMOS product and business processes, development and logistics are ISO 9001-certified. This certification ensures that everything that leaves our warehouses consistently adhere to the highest standards of quality. FRAMOS continuously monitors quality metrics and always strives to improve on industry’s best practices.

Application Specific Hardware, Software Solutions & IP Solutions
FRAMOS can assist with customers who have solutions requiring customized hardware and/or software. Applications range from embedded cameras to cameras with protective housing to special software features such as laser-line detection or image compression. We have a dedicated engineering team focusing on creating customized hardware and software solutions.

Our engineers can also help with customized IP Solutions. We have helped many organizations in building IP solutions, some of these solutions include sorting and object recognition based on machine learning algorithms, quality inspection of objects, packaging and space optimization and volume dimensioning. Our FRAMOS team is always available to discuss project and how we might help to create a custom solution that fits your needs.

ABOUT FRAMOS | At FRAMOS, we make machines to see and think. Imaging and Vision technologies are our passion and play a key role in automation, robotics and the IoT-connected factory—it controls modern production lines, autonomous cars, robots and drones, by now on the edge into cognitive systems and to vision based artificial intelligence. As a leading global supplier of imaging products, custom vision solutions and OEM services and as a modern family business, we assist our customers since 1981 in the development of visual future technologies. From the sensor to the finished system, we offer a powerful portfolio of vision services and components with a range of capabilities to suit every budget. Strong brands combined with excellent technical support allow our customers to shorten their time-to-market ranging from image sensor selection through camera customization to full turn-key designs. Our team of more than 100 employees is working worldwide to find the fastest, most professional and most efficient imaging solution for our customers.

For further questions please contact our Marketing Team at marketing@framos.com, they will lead you to the right expert!