

AFFORDABLE. HIGH DEFINITION. SWIR VISION.

# Acuros<sup>TM</sup> SWIR Camera

SWIR Vision Systems<sup>™</sup> introduces the Acuros<sup>™</sup> family of high definition cameras featuring CQD<sup>™</sup> Colloidal Quantum Dot technology. Acuros cameras deliver broadband, visible-to-SWIR, high resolution images, at far superior cost points compared to InGaAs SWIR cameras. The cameras are classified as EAR99 products (no license required for globl export), and are intended for use in applications including industrial machine vision, silicon inspection, surveillance, hyperspectral imaging, and more.

# **Applications**

#### Industrial automation

- Machine vision
- Silicon inspection
- Process control
- Moisture detection
- Fill level inspection
- Plastics sorting

#### Surveillance and security

- Chemical sensing
- Gas leak detection
- Explosives detection
- IR surveillance

#### Agriculture

- Crop health monitoring
- Water, moisture monitoring
- Food sorting

# Innovation: CQD™ Sensor Technology

Tiny semiconductor 'Quantum Dot' crystals are deposited directly onto silicon CMOS circuitry. The result is higher resolution sensors, delivered at lower cost/megapixel than InGaAs sensors.



# **High Definition SWIR Cameras**

SWIR Vision Systems cameras are built with increasing resolution to provide the needed performance for specific applications.

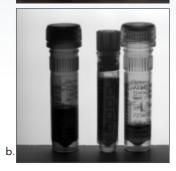
- Acuros<sup>™</sup> VGA SWIR Camera (640 x 512)
- Acuros<sup>™</sup> 1MP SWIR Camera (1280 x 1024)
- Acuros<sup>™</sup> HD SWIR Camera (1920 x 1080)



### **SWIR Application Images**

Pharmaceutical Vials Imaging





Imaging liquid fill level in pharmaceutical vials with (a) CMOS Camera Image (b) SWIR Camera Image

Food Sorting Imaging





Imaging sub-surface bruising of fruit: (c) CMOS Camera Image (d) SWIR Camera Image

Maritime Haze Imaging





Maritime imaging across misty inlet: (e) CMOS camera image (f) SWIR camera image

# For More Information

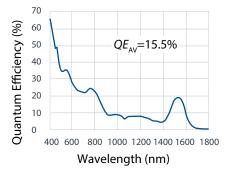
For sales inquiries and pricing information, and to explore co-development and partnership opportunities, contact us at:

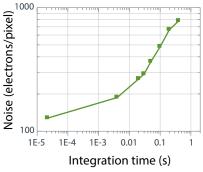
info@swirvisionsystems.com +1 919.248.0032



Ideal in daylight or artificially lit environments, Acuros cameras provide the superior image resolution needed in challenging image sensing environments. With inherently lower cost per megapixel than InGaAs detectors, Acuros SWIR cameras provide excellent value for system integrators.

Sensor Technology         CQD™ Quantum Dot         CQD™ Quantum Dot         CQD™ Quantum Dot         CQD™ Quantum Dot           Format         640 x 512         1280 x 1024         1920 x 1080           Resolution         0.33         1.31         2.07           Sensor Size         12.3 mm         24.6 mm         33 mm           Spectral Band         400-1700 nm         400-1700 nm         400-1700 nm           Pixel pitch         15 μm         15 μm         15 μm           Integration Time         10 μsec-30 msec         10 μsec-30 msec         10 μsec-30 msec           Max frame rate         10 bit: 380 fps 14 bit: 190 fps         45 fps         60 fps 30 fps           Quantum Efficiency         15% average         15% average         15% average           Total Noise         280 electrons rms, 30 ms integration         30 ms integration         280 electrons rms, 30 ms integration         30 ms integration           Noise Equivalent Irradiance         6 x 10° photons/cm²/s (33 fps at 1550 nm)         >99%         >99%           Operability (typical)         >99%         >99%         >99%           Dynamic Range         >2100:1         >2100:1         >2100:1           TEC Cooler         yes         yes         yes           Non-Uniformity	SWIR Vision Systems™ Acuros Camera Performance	Acuros™ VGA	Acuros™ 1MP	Acuros™ HD
Resolution         0.33         1.31         2.07           Sensor Size         12.3 mm         24.6 mm         33 mm           Spectral Band         400-1700 nm         400-1700 nm         400-1700 nm           Pixel pitch         15 μm         15 μm         15 μm           Integration Time         10 μsec-30 msec         10 μsec-30 msec         10 μsec-30 msec           Max frame rate         10 bit: 380 fps 14 bit: 190 fps 95 fps 30 fps 45 fps 30 fps 30 fps 45 fps 30 fps 45 fps 30 fps 30 ms integration         280 electrons rms, 280 electrons rms, 280 electrons rms, 280 electrons rms, 280 electr	Sensor Technology	CQD™ Quantum Dot	CQD™ Quantum Dot	CQD™ Quantum Dot
Sensor Size         12.3 mm         24.6 mm         33 mm           Spectral Band         400-1700 nm         400-1700 nm         400-1700 nm           Pixel pitch         15 μm         15 μm         15 μm           Integration Time         10 μsec-30 msec         10 μsec-30 msec         10 μsec-30 msec           Max frame rate         10 bit: 380 fps 14 bit: 190 fps         95 fps 30 fps 30 fps 30 fps 45 fps         60 fps 30 fps 30 fps 30 fps 45 fps           Quantum Efficiency         15% average         15% average         15% average         15% average           Total Noise         280 electrons rms, 30 ms integration           Noise Equivalent Irradiance         6 x 10° photons/cm²/s (33 fps at 1550 nm)           Operability (typical)         >99%         >99%         >99%           Dynamic Range         >2100:1         >2100:1         >2100:1         >2100:1           IEC Cooler         yes         yes         yes           Non-Uniformity Correction         2-point, firmware	Format	640 x 512	1280 x 1024	1920 x 1080
Spectral Band         400-1700 nm         400-1700 nm         400-1700 nm           Pixel pitch         15 μm         15 μm         15 μm           Integration Time         10 μsec-30 msec         10 μsec-30 msec         10 μsec-30 msec           Max frame rate         10 bit: 380 fps 14 bit: 190 fps 45 fps 30 fps         60 fps 30 fps           Quantum Efficiency         15% average         15% average         15% average           Total Noise         280 electrons rms, 30 ms integration           Noise Equivalent Irradiance         6 x 10° photons/cm²/s (33 fps at 1550 nm)           Operability (typical)         >99%         >99%           Dynamic Range         >2100:1         >2100:1         >2100:1           TEC Cooler         yes         yes         yes           Non-Uniformity Correction         2-point, firmware         2-point, firmware         2-point, firmware           Binning Arrays         2x2, 4x4         2x2, 4x4         2x2, 4x4           Windowing/Region of Interest (ROI)         Max frame rate scales with ROI. Array centered.           External Trigger         Hirose 12-pin         Hirose 12-pin         Hirose 12-pin           Data interface	Resolution	0.33	1.31	2.07
Pixel pitch         15 μm         15 μm         15 μm           Integration Time         10 μsec–30 msec         10 μsec–30 msec         10 μsec–30 msec           Max frame rate         10 bit: 380 fps 14 bit: 190 fps         95 fps 45 fps         30 fps           Quantum Efficiency         15% average         15% average         15% average           Total Noise         280 electrons rms, 30 ms integration         280 electrons rms, 30 ms integration         280 electrons rms, 30 ms integration           Noise Equivalent Irradiance         6 x 10° photons/cm²/s (33 fps at 1550 nm)           Operability (typical)         >99%         >99%           Operability (typical)         >99%         >99%           Dynamic Range         >2100:1         >2100:1         >2100:1           TEC Cooler         yes         yes         yes           Non-Uniformity Correction         2-point, firmware         2-point, firmware         2-point, firmware           Binning Arrays         2x2, 4x4         2x2, 4x4         2x2, 4x4           Windowing/Region of Interest (ROI)         Max frame rate scales with ROI. Array centered.           Exposure Control         Global Shutter         Global Shutter           External Trigger         Hirose 12-pin         Hirose 12-pin         Hirose 12-pin	Sensor Size	12.3 mm	24.6 mm	33 mm
Integration Time	Spectral Band	400-1700 nm	400-1700 nm	400-1700 nm
Max frame rate         10 bit: 380 fps 14 bit: 190 fps         95 fps 45 fps         60 fps 30 fps           Quantum Efficiency         15% average         15% average         15% average           Total Noise         280 electrons rms, 30 ms integration         280 electrons rms, 30 ms integration         280 electrons rms, 30 ms integration           Noise Equivalent Irradiance         6 x 10° photons/cm²/s (33 fps at 1550 nm)           Operability (typical)         >99%         >99%           Dynamic Range         >2100:1         >2100:1           TEC Cooler         yes         yes           Non-Uniformity Correction         2-point, firmware         2-point, firmware         2-point, firmware           Binning Arrays         2x2, 4x4         2x2, 4x4         2x2, 4x4           Windowing/Region of Interest (ROI)         Max frame rate scales with ROI. Array centered.           Exposure Control         Global Shutter         Global Shutter         Global Shutter           External Trigger         Hirose 12-pin         Hirose 12-pin         Hirose 12-pin           Data interface         USB3 Vision or GigE Vision         USB3 Vision or GigE Vision         GigE Vision           Lens mount         C-mount         C-mount, F-mount         F-mount           Supply Voltage         6-12 V         6-12 V	Pixel pitch	15 µm	15 µm	15 µm
Quantum Efficiency15% average15% average15% averageTotal Noise280 electrons rms, 30 ms integration280 electrons rms, 30 ms integration280 electrons rms, 30 ms integrationNoise Equivalent Irradiance6 x 10° photons/cm²/s (33 fps at 1550 nm)Operability (typical)>99%>99%Dynamic Range>2100:1>2100:1>2100:1TEC CooleryesyesyesNon-Uniformity Correction2-point, firmware2-point, firmware2-point, firmwareBinning Arrays2x2, 4x42x2, 4x42x2, 4x4Windowing/Region of Interest (ROI)Max frame rate scales with ROI. Array centered.Exposure ControlGlobal ShutterGlobal ShutterGlobal ShutterExternal TriggerHirose 12-pinHirose 12-pinHirose 12-pinData interfaceUSB3 Vision or GigE VisionUSB3 Vision or GigE VisionUSB3 Vision or GigE VisionLens mountC-mountC-mount, F-mountF-mountSupply Voltage6-12 V6-12 V6-12 VPower (typical)5:75W at 25C5:75W at 25C5:75W at 25CPhysical Dimensions(H) 6.1 cm (W) 6.1 cm (W) 6.1 cm (W) 6.1 cm (U) 9.9 cm or 13.0 cm (L) 13.0 cm	Integration Time	10 µsec–30 msec	10 µsec–30 msec	10 µsec–30 msec
Total Noise  280 electrons rms, 30 ms integration  A x 10° photons/cm²/s (33 fps at 1550 nm)  Operability (typical)  >99%  >99%  >99%  >99%  >99%  >99%  >99%  Pynamic Range  >2100:1  **TEC Cooler**  yes  yes  Non-Uniformity Correction  Binning Arrays  2x2, 4x4  **Windowing/Region of Interest (ROI)  Exposure Control  Global Shutter  Global Shutter  External Trigger  Hirose 12-pin  Hirose 12-pin  Data interface  USB3 Vision or GigE Vision  GigE Vision  C-mount  C-mount  C-mount, F-mount  Supply Voltage  6-12 V  6-12 V  Power (typical)  280 electrons rms, 30 ms integration  80 ms integration  99%  \$	Max frame rate	The state of the s		
Noise Equivalent Irradiance  \[ \begin{array}{cccccccccccccccccccccccccccccccccccc	Quantum Efficiency	15% average	15% average	15% average
Operability (typical)>99%>99%Dynamic Range>2100:1>2100:1>2100:1TEC CooleryesyesyesNon-Uniformity Correction2-point, firmware2-point, firmware2-point, firmwareBinning Arrays2x2, 4x42x2, 4x42x2, 4x4Windowing/Region of Interest (ROI)Max frame rate scales with ROI. Array centered.Exposure ControlGlobal ShutterGlobal ShutterGlobal ShutterExternal TriggerHirose 12-pinHirose 12-pinHirose 12-pinData interfaceUSB3 Vision or GigE Vision or GigE VisionUSB3 Vision or GigE VisionLens mountC-mountC-mount, F-mountF-mountSupply Voltage6-12 V6-12 V6-12 VPower (typical)5:75W at 25C5:75W at 25C5:75W at 25CPhysical Dimensions(H) 6.1 cm (W) 6.1 cm (W) 6.1 cm (W) 6.1 cm (W) 6.1 cm (U) 9.9 cm or 13.0 cm (L) 13.0 cm	Total Noise			
Dynamic Range>2100:1>2100:1>2100:1TEC CooleryesyesyesNon-Uniformity Correction2-point, firmware2-point, firmware2-point, firmwareBinning Arrays2x2, 4x42x2, 4x42x2, 4x4Windowing/Region of Interest (ROI)Max frame rate scales with ROI. Array centered.Exposure ControlGlobal ShutterGlobal ShutterGlobal ShutterExternal TriggerHirose 12-pinHirose 12-pinHirose 12-pinData interfaceUSB3 Vision or GigE VisionUSB3 Vision or GigE VisionLens mountC-mountC-mount, F-mountF-mountSupply Voltage6-12 V6-12 V6-12 VPower (typical)5:75W at 25C5:75W at 25C5:75W at 25CPhysical Dimensions(H) 6.1 cm (W) 6.1 cm (W) 6.1 cm (W) 6.1 cm (W) 6.1 cm (U) 9.9 cm or 13.0 cm (L) 13.0 cm	Noise Equivalent Irradiance	6 x 10° photons/cm²/s (33 fps at 1550 nm)		
TEC Cooler  yes  yes  yes  yes  Non-Uniformity Correction  2-point, firmware  2-point, firmuare  4-10.	Operability (typical)	>99%	>99%	>99%
Non-Uniformity Correction2-point, firmware2-point, firmware2-point, firmwareBinning Arrays2x2, 4x42x2, 4x42x2, 4x4Windowing/Region of Interest (ROI)Max frame rate scales with ROI. Array centered.Exposure ControlGlobal ShutterGlobal ShutterGlobal ShutterExternal TriggerHirose 12-pinHirose 12-pinHirose 12-pinData interfaceUSB3 Vision or GigE Vision or GigE VisionUSB3 Vision or GigE VisionUSB3 Vision or GigE VisionLens mountC-mountC-mount, F-mountF-mountSupply Voltage6-12 V6-12 V6-12 VPower (typical)5:75W at 25C5:75W at 25C5:75W at 25CPhysical Dimensions(H) 6.1 cm (W) 6.1 cm (W) 6.1 cm (W) 6.1 cm (U) 9.9 cm or 13.0 cm (L) 13.0 cm	Dynamic Range	>2100:1	>2100:1	>2100:1
Binning Arrays  2x2, 4x4  4x 2x2, 4x4  6loch  6lobal Shutter  Global Shutter  Glob	TEC Cooler	yes	yes	yes
Windowing/Region of Interest (ROI)Max frame rate scales with ROI. Array centered.Exposure ControlGlobal ShutterGlobal ShutterGlobal ShutterExternal TriggerHirose 12-pinHirose 12-pinHirose 12-pinData interfaceUSB3 Vision or GigE Vision or GigE VisionUSB3 Vision or GigE VisionLens mountC-mountC-mount, F-mountF-mountSupply Voltage6-12 V6-12 V6-12 VPower (typical)5:75W at 25C5:75W at 25C5:75W at 25CPhysical Dimensions(H) 6.1 cm (W) 6.1 cm (L) 9.9 cm(H) 6.1 cm (W) 6.1 cm (L) 9.9 cm or 13.0 cm(H) 6.1 cm (W) 6.1 cm (L) 13.0 cm	Non-Uniformity Correction	2-point, firmware	2-point, firmware	2-point, firmware
Interest (ROI)  Max frame rate scales with ROI. Array centered.  Exposure Control  Global Shutter  Global Shutter  Global Shutter  Hirose 12-pin  Hirose 12-pin  Data interface  USB3 Vision or GigE Vision  GigE Vision  C-mount  C-mount, F-mount  F-mount  Supply Voltage  6-12 V  6-12 V  6-12 V  Power (typical)  5:75W at 25C  5:75W at 25C  Physical Dimensions  (H) 6.1 cm (W) 6.1 cm (W) 6.1 cm (L) 9.9 cm (L) 9.9 cm or 13.0 cm (C) Global Shutter	Binning Arrays	2x2, 4x4	2x2, 4x4	2x2, 4x4
External Trigger         Hirose 12-pin         Hirose 12-pin         Hirose 12-pin           Data interface         USB3 Vision or GigE Vision         USB3 Vision or GigE Vision         USB3 Vision or GigE Vision           Lens mount         C-mount         C-mount, F-mount         F-mount           Supply Voltage         6-12 V         6-12 V         6-12 V           Power (typical)         5:75W at 25C         5:75W at 25C         5:75W at 25C           Physical Dimensions         (H) 6.1 cm (W) 6.1 cm (W) 6.1 cm (W) 6.1 cm (U) 9.9 cm or 13.0 cm (L) 13.0 cm         (L) 13.0 cm		Max frame rate scales with ROI. Array centered.		
Data interface         USB3 Vision or GigE Vision         USB3 Vision or GigE Vision         USB3 Vision or GigE Vision           Lens mount         C-mount         C-mount, F-mount         F-mount           Supply Voltage         6-12 V         6-12 V         6-12 V           Power (typical)         5:75W at 25C         5:75W at 25C         5:75W at 25C           Physical Dimensions         (H) 6.1 cm (W) 6.1 cm (W) 6.1 cm (L) 9.9 cm         (H) 6.1 cm (W) 6.1 cm (L) 9.9 cm or 13.0 cm         (H) 6.1 cm (W) 6.1 cm (L) 13.0 cm	<b>Exposure Control</b>	Global Shutter	Global Shutter	Global Shutter
GigE Vision         GigE Vision         GigE Vision           Lens mount         C-mount         C-mount, F-mount         F-mount           Supply Voltage         6-12 V         6-12 V         6-12 V           Power (typical)         5:75W at 25C         5:75W at 25C         5:75W at 25C           Physical Dimensions         (H) 6.1 cm (W) 6.1 cm (L) 9.9 cm         (H) 6.1 cm (W) 6.1 cm (L) 9.9 cm or 13.0 cm         (W) 6.1 cm (L) 13.0 cm	External Trigger	Hirose 12-pin	Hirose 12-pin	Hirose 12-pin
Supply Voltage         6-12 V         6-12 V         6-12 V           Power (typical)         5:75W at 25C         5:75W at 25C         5:75W at 25C           Physical Dimensions         (H) 6.1 cm (W) 6.1 cm (L) 9.9 cm         (H) 6.1 cm (W) 6.1 cm (L) 9.9 cm or 13.0 cm         (H) 6.1 cm (W) 6.1 cm (L) 13.0 cm	Data interface			
Power (typical)         5:75W at 25C         5:75W at 25C         5:75W at 25C           Physical Dimensions         (H) 6.1 cm (W) 6.1 cm (L) 9.9 cm         (H) 6.1 cm (W) 6.1 cm (L) 9.9 cm or 13.0 cm         (H) 6.1 cm (W) 6.1 cm (L) 13.0 cm	Lens mount	C-mount	C-mount, F-mount	F-mount
Physical Dimensions       (H) 6.1 cm       (H) 6.1 cm       (H) 6.1 cm         (W) 6.1 cm       (W) 6.1 cm       (W) 6.1 cm         (L) 9.9 cm       (L) 9.9 cm or 13.0 cm       (L) 13.0 cm	Supply Voltage	6-12 V	6–12 V	6–12 V
(W) 6.1 cm (W) 6.1 cm (W) 6.1 cm (L) 9.9 cm (L) 9.9 cm or 13.0 cm (L) 13.0 cm	Power (typical)	5:75W at 25C	5:75W at 25C	5:75W at 25C
Software Development Kit         Pleora SDK         Pleora SDK         Pleora SDK	Physical Dimensions	(W) 6.1 cm	(W) 6.1 cm	(W) 6.1 cm
	Software Development Kit	Pleora SDK	Pleora SDK	Pleora SDK





(Left) Plot of the FPA spectral QE. QE shown is the mean response for the array under monochromatic illumination. The FPA exhibited an average QE of 15% across the spectral range shown. (Right) Total per pixel RMS noise electrons as a function of integration time.