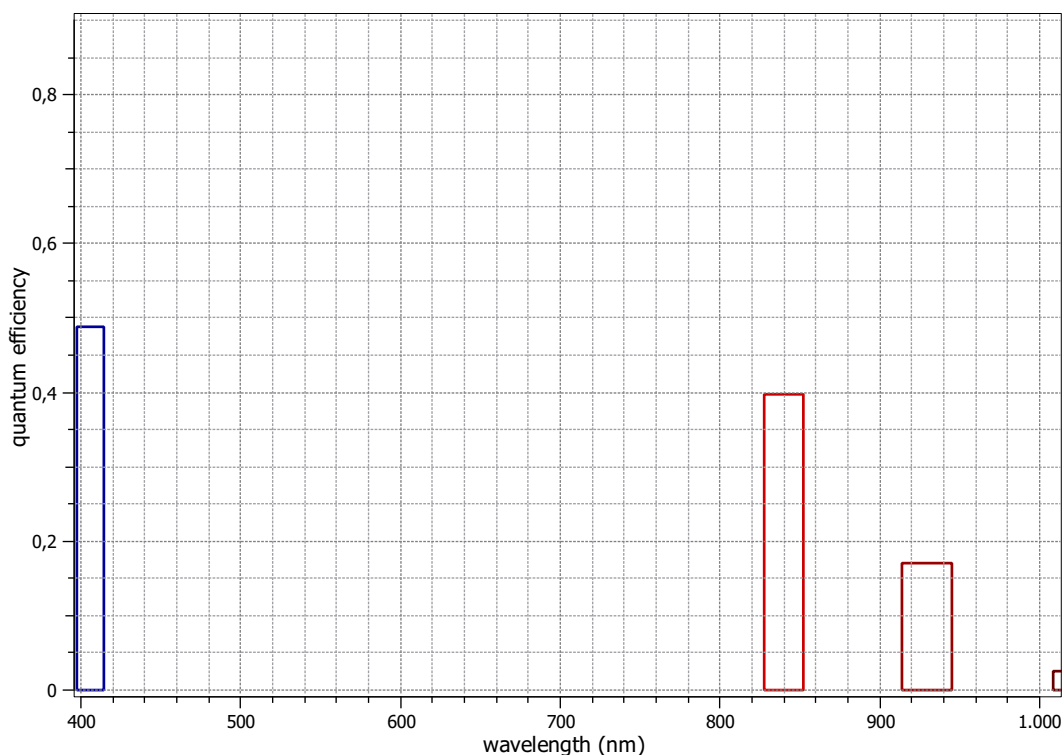


EMVA 1288 Summary Sheet

This datasheet describes the specification according to the standard 1288 release 3.1 for "Characterization and Presentation of Specification Data for Image Sensors and Cameras" issued on December 30, 2016 by the European Machine Vision Association (EMVA), published at www.standard1288.org and the *zenodo EMVA 1288 community* with proprietary extensions from AEON. The measurements were performed with the AEON ACC4, Release 3d, 06.10.2019, SN 0003(Baumer).

Measurements performed by Technical and Application Support Center, Baumer Optronic GmbH.

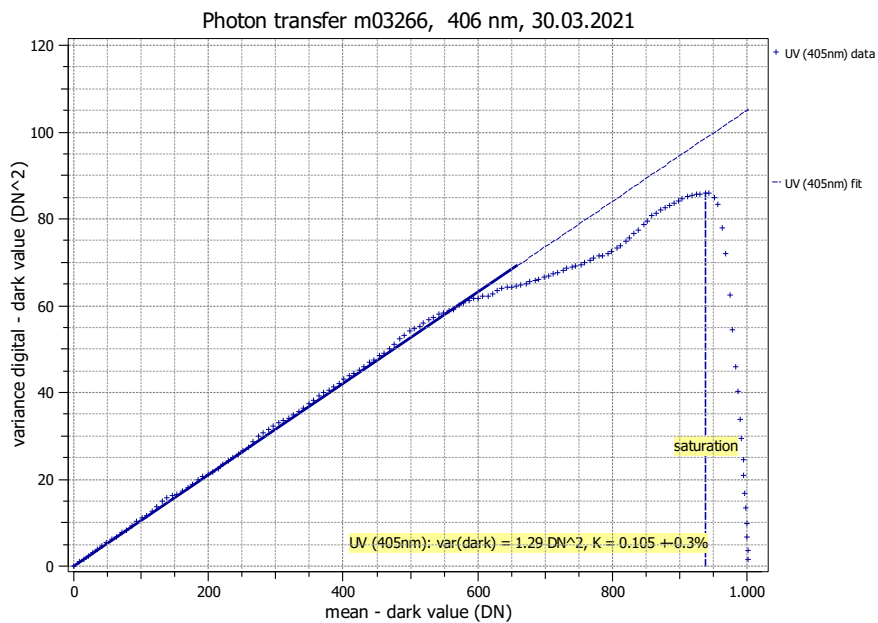
Vendor	Baumer	Type of data presented	Single	Optional data measured
Model	VCXG-53NIR	Operation point 1		None
Serial number	700006430923	Wavelength centroid	405.6 nm	
Sensor diagonal	15.86 mm	Wavelength FWHM	16.7 nm	
Lens category	C-Mount	Gain, black-level	1.0 / 18.0	
Resolution	2592 × 2048, 10 bit	Operation point 2		
Pixel size (h×v)	4.80 μm × 4.80 μm	Wavelength centroid	839.7 nm	
Sensor	OnSemi PYTHON5000	Wavelength FWHM	24.7 nm	
Sensor type	CMOS	Gain, black-level	1.0 / 18.0	
Shutter type	Global shutter	Operation point 3		
Overlap cap.	Overlapped	Wavelength centroid	929.6 nm	
Max. frame rate	0.0 Hz	Wavelength FWHM	31.3 nm	
Interface type	GEV	Gain, black-level	1.0 / 18.0	
		Operation point 4		
		Wavelength centroid	1041.2 nm	
		Wavelength FWHM	65.2 nm	
		Gain, black-level	1.0 / 18.0	



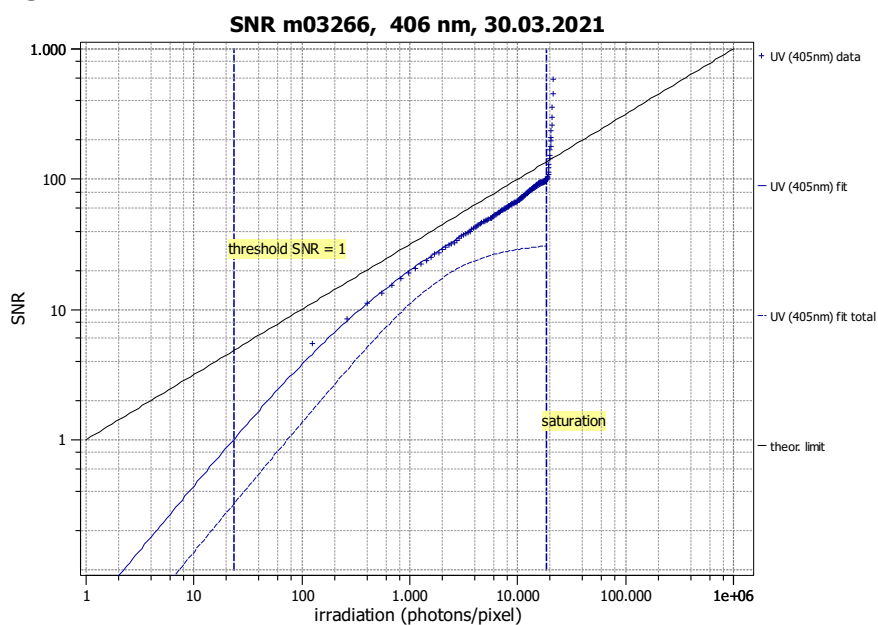
Summary Sheet for Operation Point 1 at a Wavelength of 406 nm

Type of data	Single	Gain, black-level	1.0 / 18.0
Exposure control	By irradiance	Environmental temperature	24.7°C
Exposure time	410.00 μ s	Camera body temperature	34.9°C
Frame rate	10.0 Hz	Internal temperature(s)	—
Data transfer mode	Mono10	Wavelength, centr., FWHM	406 nm, 16.7 nm

Photon Transfer



Signal-to-Noise Ratio



Quantum efficiency

 η 48.7%

Overall system gain

 K 0.105 DN/e⁻
 $1/K$ 9.518 e⁻/DN

Temporal dark noise

 σ_d 10.46 e⁻
 $\sigma_{y,\text{dark}}$ 1.14 DN

Signal-to-noise ratio

 SNR_{max} 95

39.6 dB

6.6 bit

 $1/\text{SNR}_{\text{max}}$ 1.05 %

Absolute sensitivity threshold

 $\mu_{p,\text{min}}$ 23.3 p

 $\mu_{p,\text{min,area}}$ 1.01 p/ μm^2
 $\mu_{e,\text{min}}$ 11.3 e⁻
 $\mu_{e,\text{min,area}}$ 0.49 e⁻/ μm^2

Saturation capacity

 $\mu_{p,\text{sat}}$ 18662 p

 $\mu_{p,\text{sat,area}}$ 810 p/ μm^2
 $\mu_{e,\text{sat}}$ 9093 e⁻
 $\mu_{e,\text{sat,area}}$ 395 e⁻/ μm^2

Dynamic range

DR 802

58.1 dB

9.6 bit

Spatial nonuniformities

 DSNU_{1288} 33.69 e⁻

3.54 DN

 PRNU_{1288} 3.06 %

Linearity error

 LE_{min} -1.28%

 LE_{max} 0.65%

Dark current

 $\mu_{c,\text{mean}}$ 1245 \pm 15 e⁻/s

130.8 DN/s

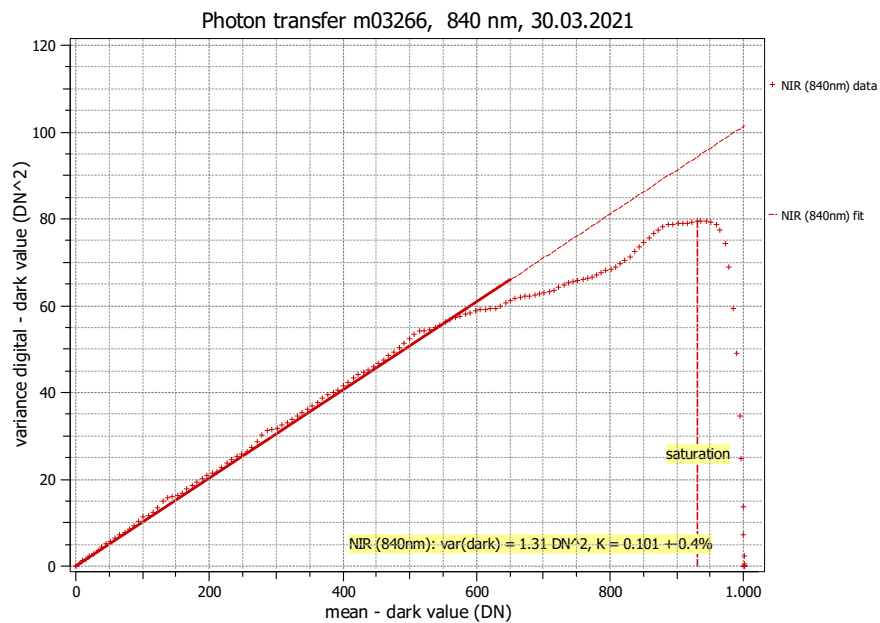
 $\mu_{c,\text{var}}$ 1300 \pm 13 e⁻/s

 T_d — °C

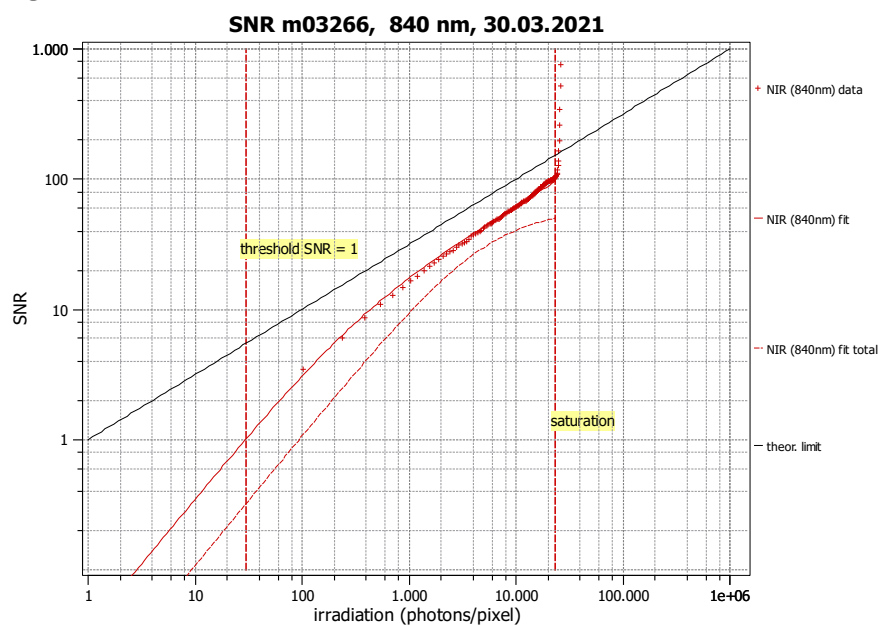
Summary Sheet for Operation Point 2 at a Wavelength of 840 nm

Type of data	Single	Gain, black-level	1.0 / 18.0
Exposure control	By irradiance	Environmental temperature	25.1 °C
Exposure time	410.00 μ s	Camera body temperature	35.9 °C
Frame rate	10.0 Hz	Internal temperature(s)	—
Data transfer mode	Mono10	Wavelength, centr., FWHM	840 nm, 24.7 nm

Photon Transfer



Signal-to-Noise Ratio



Quantum efficiency

 η 39.8%

Overall system gain

 K 0.101 DN/e⁻
 $1/K$ 9.864 e⁻/DN

Temporal dark noise

 σ_d 10.92 e⁻
 $\sigma_{y,\text{dark}}$ 1.14 DN

Signal-to-noise ratio

 SNR_{max} 96

39.7 dB

6.6 bit

 $1/\text{SNR}_{\text{max}}$ 1.04 %

Absolute sensitivity threshold

 $\mu_{p,\text{min}}$ 29.6 p

 $\mu_{p,\text{min},\text{area}}$ 1.29 p/ μm^2
 $\mu_{e,\text{min}}$ 11.8 e⁻
 $\mu_{e,\text{min},\text{area}}$ 0.51 e⁻/ μm^2

Saturation capacity

 $\mu_{p,\text{sat}}$ 23317 p

 $\mu_{p,\text{sat},\text{area}}$ 1012 p/ μm^2
 $\mu_{e,\text{sat}}$ 9286 e⁻
 $\mu_{e,\text{sat},\text{area}}$ 403 e⁻/ μm^2

Dynamic range

DR 787

57.9 dB

9.6 bit

Spatial nonuniformities

 DSNU_{1288} 35.12 e⁻

3.56 DN

 PRNU_{1288} 1.66 %

Linearity error

 LE_{min} -1.03%

 LE_{max} 1.47%

Dark current

 $\mu_{c,\text{mean}}$ 1291 ± 16 e⁻/s

130.8 DN/s

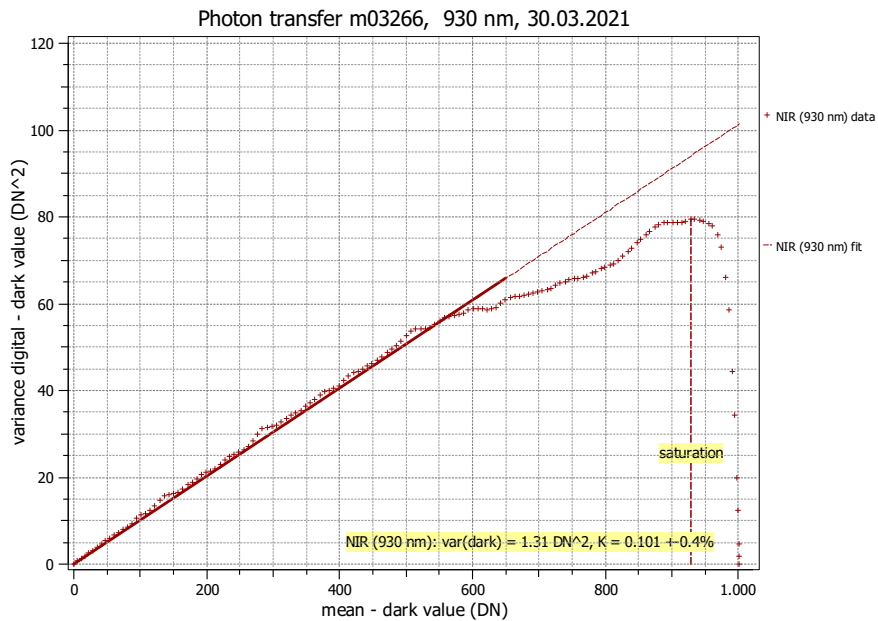
 $\mu_{c,\text{var}}$ 1396 ± 14 e⁻/s

 T_d — °C

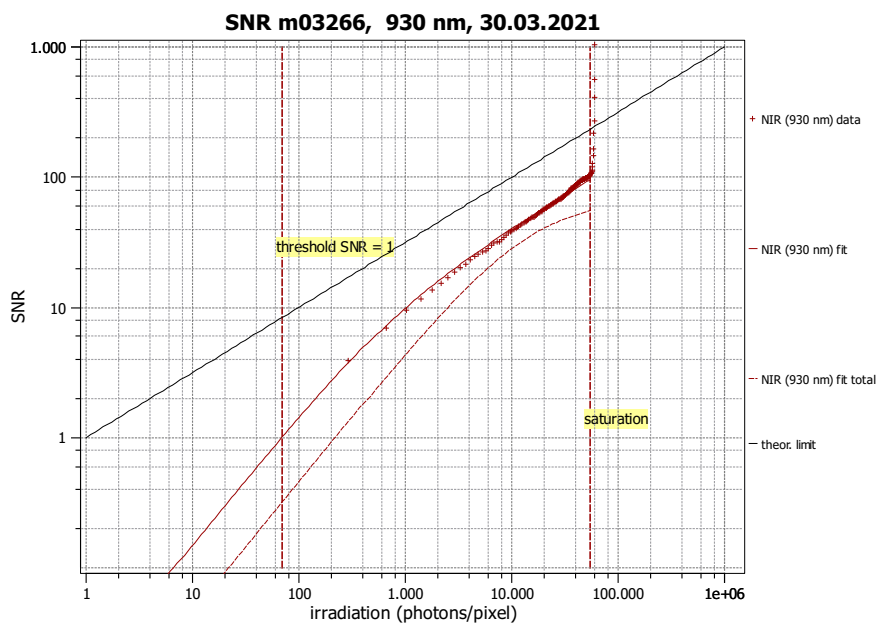
Summary Sheet for Operation Point 3 at a Wavelength of 930 nm

Type of data	Single	Gain, black-level	1.0 / 18.0
Exposure control	By irradiance	Environmental temperature	25.4 °C
Exposure time	801.00 μ s	Camera body temperature	36.6 °C
Frame rate	10.0 Hz	Internal temperature(s)	—
Data transfer mode	Mono10	Wavelength, centr., FWHM	930 nm, 31.3 nm

Photon Transfer



Signal-to-Noise Ratio



Quantum efficiency

 η 17.1%

Overall system gain

 K 0.101 DN/e⁻
 $1/K$ 9.877 e⁻/DN

Temporal dark noise

 σ_d 10.96 e⁻
 $\sigma_{y,\text{dark}}$ 1.15 DN

Signal-to-noise ratio

 SNR_{max} 96

39.7 dB

6.6 bit

 $1/\text{SNR}_{\text{max}}$ 1.04 %

Absolute sensitivity threshold

 $\mu_{p,\text{min}}$ 69.2 p

 $\mu_{p,\text{min,area}}$ 3.00 p/ μm^2
 $\mu_{e,\text{min}}$ 11.8 e⁻
 $\mu_{e,\text{min,area}}$ 0.51 e⁻/ μm^2

Saturation capacity

 $\mu_{p,\text{sat}}$ 54156 p

 $\mu_{p,\text{sat,area}}$ 2351 p/ μm^2
 $\mu_{e,\text{sat}}$ 9268 e⁻
 $\mu_{e,\text{sat,area}}$ 402 e⁻/ μm^2

Dynamic range

DR 783

57.9 dB

9.6 bit

Spatial nonuniformities

 DSNU_{1288} 35.37 e⁻

3.58 DN

 PRNU_{1288} 1.42 %

Linearity error

 LE_{min} -0.93%

 LE_{max} 1.56%

Dark current

 $\mu_{c,\text{mean}}$ 1292 ± 16 e⁻/s

130.8 DN/s

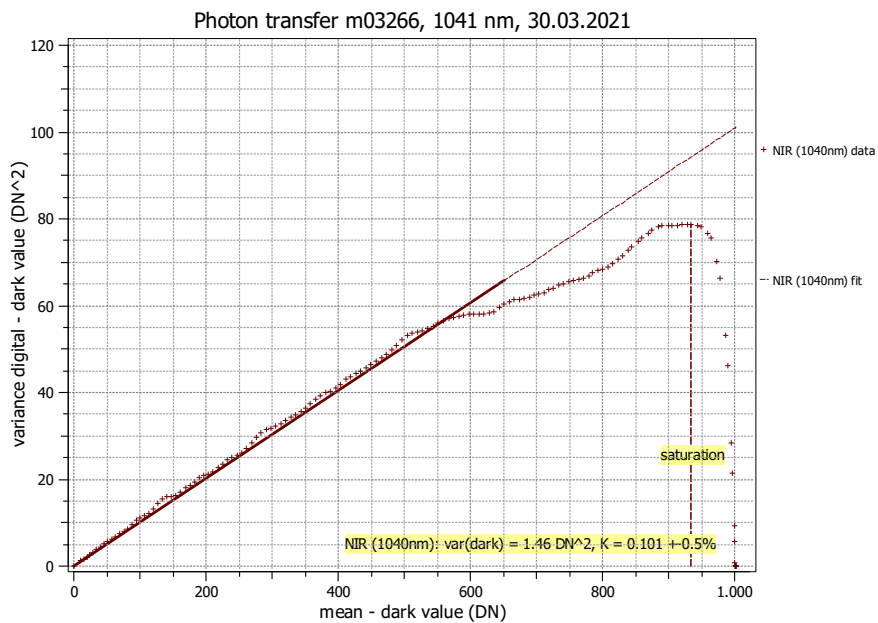
 $\mu_{c,\text{var}}$ 1400 ± 14 e⁻/s

 T_d — °C

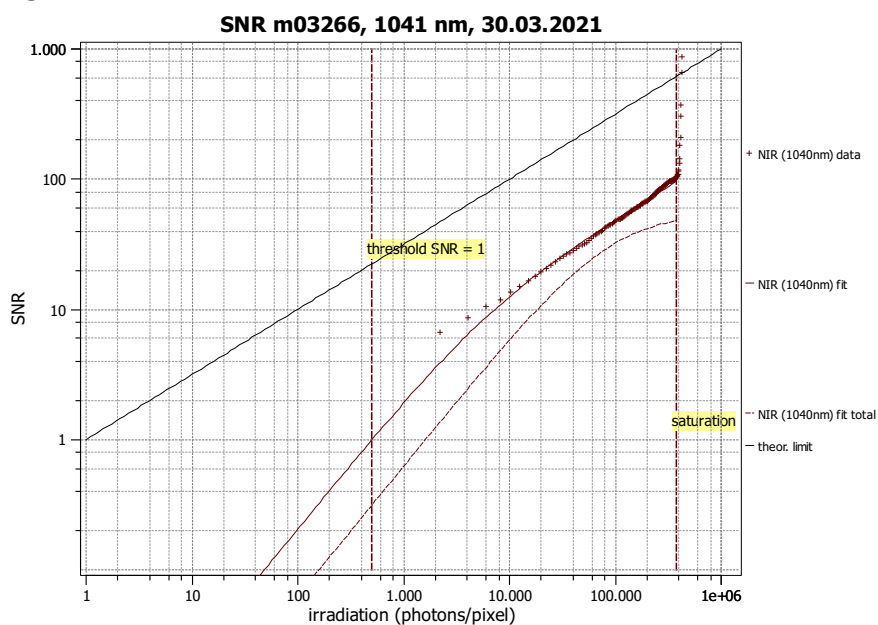
Summary Sheet for Operation Point 4 at a Wavelength of 1041 nm

Type of data	Single	Gain, black-level	1.0 / 18.0
Exposure control	By irradiance	Environmental temperature	25.7°C
Exposure time	12.52 ms	Camera body temperature	37.0°C
Frame rate	10.0 Hz	Internal temperature(s)	—
Data transfer mode	Mono10	Wavelength, centr., FWHM	1041 nm, 65.2 nm

Photon Transfer



Signal-to-Noise Ratio



Quantum efficiency

 η 2.5%

Overall system gain

 K 0.101 DN/e⁻
 $1/K$ 9.902 e⁻/DN

Temporal dark noise

 σ_d 11.60 e⁻
 $\sigma_{y,\text{dark}}$ 1.21 DN

Signal-to-noise ratio

 SNR_{max} 97

39.7 dB

6.6 bit

 $1/\text{SNR}_{\text{max}}$ 1.03 %

Absolute sensitivity threshold

 $\mu_{p,\text{min}}$ 504.3 p

 $\mu_{p,\text{min},\text{area}}$ 21.89 p/μm²
 $\mu_{e,\text{min}}$ 12.5 e⁻
 $\mu_{e,\text{min},\text{area}}$ 0.54 e⁻/μm²

Saturation capacity

 $\mu_{p,\text{sat}}$ 381198 p

 $\mu_{p,\text{sat},\text{area}}$ 16545 p/μm²
 $\mu_{e,\text{sat}}$ 9418 e⁻
 $\mu_{e,\text{sat},\text{area}}$ 409 e⁻/μm²

Dynamic range

DR 756

57.6 dB

9.6 bit

Spatial nonuniformities

 DSNU_{1288} 37.45 e⁻

3.78 DN

 PRNU_{1288} 1.75 %

Linearity error

 LE_{min} -1.06%

 LE_{max} 1.62%

Dark current

 $\mu_{c,\text{mean}}$ 1295 ± 16 e⁻/s

130.8 DN/s

 $\mu_{c,\text{var}}$ 1407 ± 14 e⁻/s

 T_d — °C