EMVA 1288 Data Sheet m0797

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

Measurements performed by T.Renner, Matrix Vision GmbH

<table>
<thead>
<tr>
<th>Vendor</th>
<th>MATRIX VISION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>mvBlueCOUGAR-X107bC</td>
</tr>
<tr>
<td>Serial number</td>
<td>GX028072</td>
</tr>
<tr>
<td>Sensor diagonal</td>
<td>17.55 mm</td>
</tr>
<tr>
<td>Lens category</td>
<td>C-Mount</td>
</tr>
<tr>
<td>Resolution</td>
<td>3216 × 2208, 12 bit</td>
</tr>
<tr>
<td>Pixel size (h×v)</td>
<td>4.50 µm × 4.50 µm</td>
</tr>
<tr>
<td>Sensor</td>
<td>IMX428</td>
</tr>
<tr>
<td>Sensor type</td>
<td>CMOS</td>
</tr>
<tr>
<td>Shutter type</td>
<td>Global</td>
</tr>
<tr>
<td>Overlap cap.</td>
<td>Overlapping</td>
</tr>
<tr>
<td>Max. frame rate</td>
<td>8.4 Hz</td>
</tr>
<tr>
<td>Interface type</td>
<td>GigE Vision</td>
</tr>
</tbody>
</table>

Type of data presented Single

**Operation point 1 (page 5)**
- Wavelength centroid 468.0 nm
- Wavelength FWHM 20.0 nm
- Gain, black-level 0dB, 0.1

**Operation point 2 (page 20)**
- Wavelength centroid 535.0 nm
- Wavelength FWHM 31.0 nm
- Gain, black-level 0dB, 0.1

**Operation point 3 (page 35)**
- Wavelength centroid 630.0 nm
- Wavelength FWHM 13.0 nm
- Gain, black-level 0dB, 0.1

Optional data measured None
Summary Sheet for Operation Point 1 at a Wavelength of 468 nm

<table>
<thead>
<tr>
<th>Type of data</th>
<th>Single</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain, black-level</td>
<td>0 dB, 0.1</td>
</tr>
<tr>
<td>Environmental temperature</td>
<td>23.9°C</td>
</tr>
<tr>
<td>Camera body temperature</td>
<td>34.0°C</td>
</tr>
<tr>
<td>Internal temperature(s)</td>
<td>—</td>
</tr>
<tr>
<td>Wavelength, centr., FWHM</td>
<td>468 nm, 20.0 nm</td>
</tr>
</tbody>
</table>

**Photor Transfer**

Photon transfer m0797, 468 nm, 02.05.2019

**Signal-to-Noise Ratio**

SNR m0797, 468 nm, 02.05.2019

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**Quantum efficiency**

\[ \eta = 49.3\% \]

**Overall system gain**

\[ K = 0.161 \text{ DN/e}^- \]

\[ 1/K = 6.209 \text{ e}^-/\text{DN} \]

**Temporal dark noise**

\[ \sigma_d = 5.56 \text{ e}^- \]

\[ \sigma_{y,dark} = 0.94 \text{ DN} \]

**Signal-to-noise ratio**

\[ \text{SNR}_{\text{max}} = 157 \]

43.9 dB

7.3 bit

\[ 1/\text{SNR}_{\text{max}} = 0.64\% \]

**Absolute sensitivity threshold**

\[ \mu_{p,\text{min}} = 12.90 \text{ p} \]

\[ \mu_{p,\text{min,area}} = 0.637 \text{ p/\mu m}^2 \]

\[ \mu_{e,\text{min}} = 6.37 \text{ e}^- \]

\[ \mu_{e,\text{min,area}} = 0.314 \text{ e}^-/\text{\mu m}^2 \]

**Saturation capacity**

\[ \mu_{p,\text{sat}} = 49919 \text{ p} \]

\[ \mu_{p,\text{sat,area}} = 2465 \text{ p/\mu m}^2 \]

\[ \mu_{e,\text{sat}} = 24630 \text{ e}^- \]

\[ \mu_{e,\text{sat,area}} = 1216 \text{ e}^-/\text{\mu m}^2 \]

**Dynamic range**

\[ \text{DR} = 3869 \]

71.8 dB

11.9 bit

**Spatial nonuniformities**

\[ \text{DSNU}_{1288} = 1.42 \text{ e}^- \]

0.23 DN

\[ \text{PRNU}_{1288} = 0.77\% \]

**Linearity error**

\[ \text{LE}_{\text{min}} = -0.48\% \]

\[ \text{LE}_{\text{max}} = 0.40\% \]

**Dark current**

\[ \mu_{c,\text{mean}} = \pm 19 \pm 5 \text{ e}^-/\text{s} \]

\[ \mu_{c,\text{var}} = \pm 31 \pm 40 \text{ e}^-/\text{s} \]

\[ T_d = \deg C \]
**Summary Sheet for Operation Point 2 at a Wavelength of 535 nm**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of data</td>
<td>Single</td>
</tr>
<tr>
<td>Exposure control</td>
<td>By irradiance</td>
</tr>
<tr>
<td>Exposure time</td>
<td>18.00 ms</td>
</tr>
<tr>
<td>Frame rate</td>
<td>8.0 Hz</td>
</tr>
<tr>
<td>Data transfer mode</td>
<td>BayerRG12</td>
</tr>
<tr>
<td>Gain, black-level</td>
<td>0dB, 0.1</td>
</tr>
<tr>
<td>Environmental temperature</td>
<td>24.0°C</td>
</tr>
<tr>
<td>Camera body temperature</td>
<td>36.5°C</td>
</tr>
<tr>
<td>Internal temperature(s)</td>
<td>—</td>
</tr>
<tr>
<td>Wavelength, centr., FWHM</td>
<td>535 nm, 31.0 nm</td>
</tr>
</tbody>
</table>

**Photon Transfer**

- Photon transfer m0797, 535 nm, 02.05.2019

**Signal-to-Noise Ratio**

- SNR m0797, 535 nm, 02.05.2019

**Quantum efficiency**

\[ \eta = 60.9\% \]

**Overall system gain**

\[ K = 0.161 \text{DN/e}^- \]
\[ 1/K = 6.197 \text{e}^-/\text{DN} \]

**Temporal dark noise**

\[ \sigma_d = 5.60 \text{e}^- \]
\[ \sigma_y, \text{dark} = 0.95 \text{DN} \]

**Signal-to-noise ratio**

- SNR\(_{\text{max}}\) = 157
- 43.9 dB
- 7.3 bit
- 1/SNR\(_{\text{max}}\) = 0.64%

**Absolute sensitivity threshold**

\[ \mu_{p, \text{min}} = 10.52 \text{p} \]
\[ \mu_{p, \text{min}. \text{area}} = 0.519 \text{p/}\mu\text{m}^2 \]
\[ \mu_{e, \text{min}} = 6.40 \text{e}^- \]
\[ \mu_{e, \text{min}. \text{area}} = 0.316 \text{e}^-/\mu\text{m}^2 \]

**Saturation capacity**

\[ \mu_{p, \text{sat}} = 40522 \text{p} \]
\[ \mu_{p, \text{sat}. \text{area}} = 2001 \text{p/}\mu\text{m}^2 \]
\[ \mu_{e, \text{sat}} = 24659 \text{e}^- \]
\[ \mu_{e, \text{sat}. \text{area}} = 1218 \text{e}^-/\mu\text{m}^2 \]

**Dynamic range**

- DR = 3853
- 71.7 dB
- 11.9 bit

**Spatial nonuniformities**

- DSNU\(_{1288}\) = 1.73 \text{DN}
- 0.28 DN
- PRNU\(_{1288}\) = 0.74%

**Linearity error**

- \( LE_{\text{min}} = -0.39\% \)
- \( LE_{\text{max}} = 0.36\% \)

**Dark current**

- \( \mu_{c, \text{mean}} = -19 \pm 5 \text{e}^-/\text{s} \)
- \( -3.1 \text{DN/s} \)
- \( \mu_{c, \text{var}} = 31 \pm 40 \text{e}^-/\text{s} \)
- \( T_d = -\circ\text{C} \)
Summary Sheet for Operation Point 3 at a Wavelength of 630 nm

Type of data: Single
Exposure control: By irradiance
Exposure time: 18.00 ms
Frame rate: 8.0 Hz
Data transfer mode: BayerRG12

Gain, black-level: 0dB, 0.1
Environmental temperature: 24.1°C
Camera body temperature: 37.8°C
Internal temperature(s): —

Photon Transfer

Quantum efficiency: \( \eta = 53.8\% \)
Overall system gain: \( K = 0.161 \text{DN/e}^- \)
\( 1/K = 6.225 \text{e}^-/\text{DN} \)

Temporal dark noise:
\( \sigma_d = 5.64 \text{e}^- \)
\( \sigma_y,\text{dark} = 0.95 \text{DN} \)

Signal-to-noise ratio
\( \text{SNR}_{\text{max}} = 158 \)
44.0 dB
7.3 bit
\( 1/\text{SNR}_{\text{max}} = 0.63\% \)

Absolute sensitivity threshold
\( \mu_{p,\text{min}} = 11.98 \text{p} \)
\( \mu_{p,\text{min}.\text{area}} = 0.592 \text{p/\mu m}^2 \)
\( \mu_{e,\text{min}} = 6.44 \text{e}^- \)
\( \mu_{e,\text{min}.\text{area}} = 0.318 \text{e}^-/\text{\mu m}^2 \)

Saturation capacity
\( \mu_{p,\text{sat}} = 46346 \text{p} \)
\( \mu_{p,\text{sat}.\text{area}} = 2289 \text{p/\mu m}^2 \)
\( \mu_{e,\text{sat}} = 24925 \text{e}^- \)
\( \mu_{e,\text{sat}.\text{area}} = 1231 \text{e}^-/\text{\mu m}^2 \)

Dynamic range
\( \text{DR} = 3868 \)
71.7 dB
11.9 bit

Spatial nonuniformities
\( \text{DSNU}_{1288} = 1.39 \text{e}^- \)
\( \text{PRNU}_{1288} = 0.22 \text{DN} \)

Linearity error
\( \text{LE}_{\text{min}} = -0.86\% \)
\( \text{LE}_{\text{max}} = 0.50\% \)

Dark current
\( \mu_{c,\text{mean}} = -19 \pm 5 \text{e}^-/\text{s} \)
\( -3.1 \text{DN/s} \)
\( \mu_{c,\text{var}} = 31 \pm 40 \text{e}^-/\text{s} \)
\( T_d = -\text{°C} \)