

<sup>1)</sup> Sensor readout, different from pixel format

<sup>2)</sup> Depends on the used interface



## Sensor Information

|            |                              |
|------------|------------------------------|
| Model Name | Sony IMX537                  |
| Type       | 1/1.8" progressive scan CMOS |
| Shutter    | Global Shutter               |
| Resolution | 2464 x 2048 pixels           |
| Scan Area  | 6.7 mm x 5.6 mm              |
| Pixel Size | 2.74 µm x 2.74 µm            |

## Data Quality

@ 20 °C, gain = 1, exposure time = 4 msec

|                           |  |
|---------------------------|--|
| Dark Noise ( $\sigma$ )   | 2.2 e- typical                                   |
| Saturation                | 9000 e- typical                                  |
| Dynamic Range             | 72 dB typical                                    |
| SNR                       | 40 dB typical                                    |
| Quantum efficiency $\eta$ | 45% @ 465 nm, 52% @ 536 nm, 41% @ 631 nm typical |

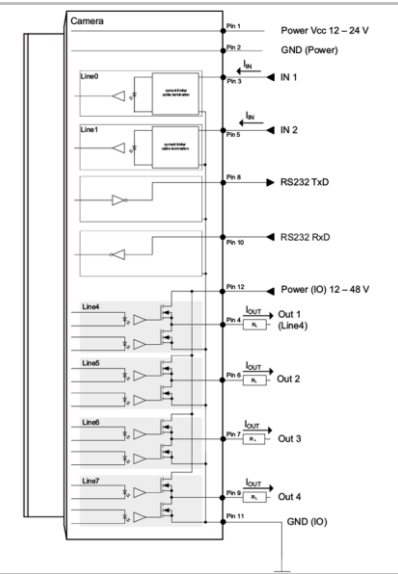
## Acquisition

|   |  |             |   |
|---|--|-------------|---|
| Resolution  | 2464 px x 2048 px  |             |   |
| Interface Frame Rate<br>(depends on used interface performance) | Format   | Resolution  | max. Frame Rate<br>(@ Trigger Mode) <sup>2)</sup> |
|   | Full Frame   | 2464 x 2048 | 243 fps   |
|   | Binning 2x2  | 1232 x 1024 | 259 fps   |
|   | Binning 2x1  | 1232 x 2048 | 259 fps   |
|   | Binning 1x2  | 2464 x 1024 | 259 fps   |
| Acquisition Frame Rate <sup>1)</sup><br>(Burst Mode)            | 259 fps   $t_{\text{readout}} = 3.86$ msec (max. Res. Full Frame) @ 8 bit  |             |   |
|   | 225 fps   $t_{\text{readout}} = 4.44$ msec (max. Res. Full Frame) @ 10 bit   |             |   |
|   | 174 fps   $t_{\text{readout}} = 5.75$ msec (max. Res. Full Frame) @ 12 bit   |             |   |
| Pixel Formats   | BayerRG8, BayerRG10, BayerRG12, BayerRG12p<br>Mono8, Mono10, Mono12, Mono12p, RGB8, BGR8   |             |   |
| Partial Scan  | True Partial Scan with increasing Frame Rate on Y direction, Region of Interest (ROI) arbitrary<br>Width: minimum 64, increment 32<br>Height: minimum 2, increment 2 |             |   |
| Multi ROI   | Up to 8 non-overlapping regions  |             |   |
| Ad. Acquisition Frame Rate                                      | Off or 0,01 ... 65535 Hz   |             |   |
| Acquisition Mode  | Continuous, Single Frame and Multi Frame   |             |   |
| Acquisition Status  | AcquisitionActive, AcquisitionTrigger Wait   |             |   |
| Exposure Mode   | Timed  |             |   |
| Readout Mode  | Overlapped, Sequential   |             |   |

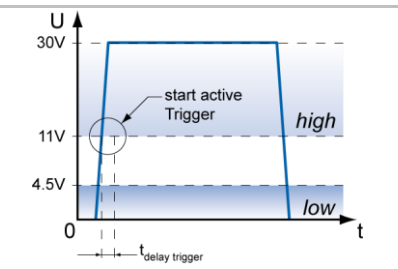
## Image Pre-Processing

|                         |  |
|-------------------------|--|
| Analog Controls         | Exposure Time (1 µsec ... 60 sec   Step Size 1 µsec)<br>Gain (0...48 dB), Offset (0 ... 255 LSB   12 bit)                          |
| Auto Functions          | ExposureAuto and GainAuto with BrightnessAutoPriority based on BrightnessAuto ROI  |
| Gamma Correction        | Gamma (0.1 ... 2   available if LUT is enabled)  |
| LUT                     | Luminance (12 bit)   |
| Color Models            | Mono, Raw Bayer, RGB and BGR   |
| Color Processing        | Integrated color processor with superb quality (5x5)   |
| Color Enhancement       | Color Transformation to sRGB color space by optimized Matrix for 3000 K, 5000 K, 6500 K, 9500 K Lightsource or User defined Matrix |
| Color Tolerance         | -  |
| Binning                 | Horizontal: 1 or 2, Vertical: 1 or 2   |
| Image Flipping          | Horizontal, vertical   |
| Defect Pixel Correction | via Defect Pixel List with up to 512 Pixel Coordinates   |
| Shading Correction      | Brightness correction per tile of 64x64 pixels   |
| Sharpening              | Edge sharpening and noise reduction  |
| HDR                     | -  |
| Image Compression       | -  |

Digital Input / Output: principle circuit diagram



Trigger Mode: Start up time and valid Trigger



## Process Synchronization

|  |   |
|--|---|
| Trigger Mode                           | Off (Free Running), On (Trigger)  |
| Trigger Overlap Type                   | Readout   |
| Trigger Sources                        | Hardware (Line0,1), Software, All, ActionCMD (Action 1) or Off<br>fixed Trigger Delay out of treadout: <sup>1)</sup><br>63,1 µsec @ 8 bit<br>70,1 µsec @ 10 bit<br>76,1 µsec @ 12 bit<br>max. Trigger Delay during treadout: <sup>1)</sup><br>63,1 µsec @ 8 bit<br>70,1 µsec @ 10 bit<br>76,1 µsec @ 12 bit |
| Trigger Delay                          | 0 ... 2 sec, Tracking and buffering of up to 256 triggers   |
| External Flash Sync                    | via Exposure Active<br>$t_{\text{delay flash}} \leq 1 \mu\text{sec}$ , $t_{\text{duration}} = t_{\text{exposure}}$  |
| Encoder Function                       | yes, via Counter and Trigger Source   |
| Precision Time Protocol (PTP) Function | IEEE1588-2008 clock synchronization, default profile 1.0, master and slave mode   |

## Digital I/Os

|                     |  |
|---------------------|--|
| Lines               | Input: Line 0 .. 1, Output: Line 4 .. 7, GPIO: no, RS232: Line 2 .. 3 (reserved for future use)  |
| Output Sources      | Off, ExposureActive, Timer1, ReadoutActive, UserOutput 1-3 and TriggerReady  |
| Output Line Mode    | yes, Tri-State, PushPull, OpenDrain, OpenSource  |
| Output PWM function | yes, Line 4 .. 7<br>PWM Mode: Off, One Pulse, FixedFrequency<br>PWM feature: PWMDuration, PWMDutyCycle<br>Configuration Mode for lightning protection: MaxPWMDuration, MaxPWMDutyCycle |
| Line Debouncer      | Low and high signal separately selectable<br>Debouncing Time 0 ... 5 msec, Step Size: 1 µsec   |

## Memory

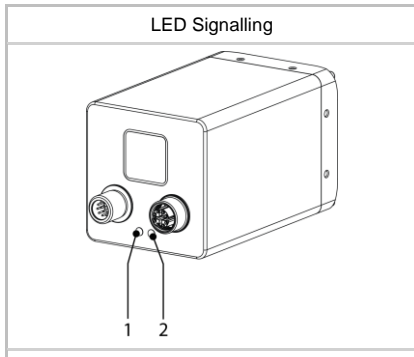
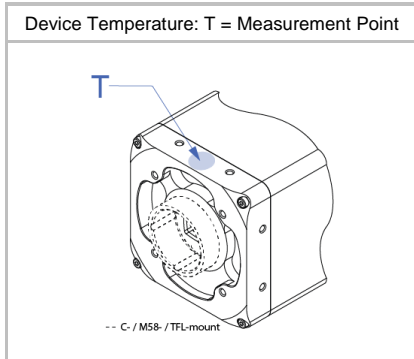
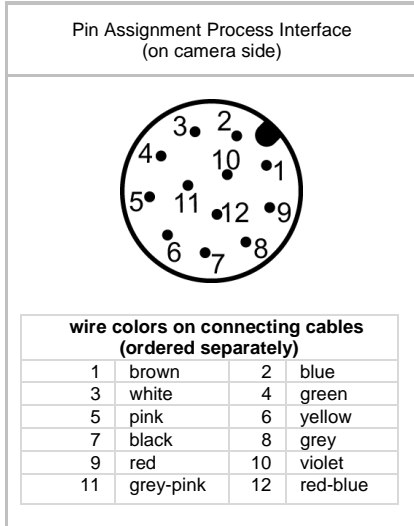
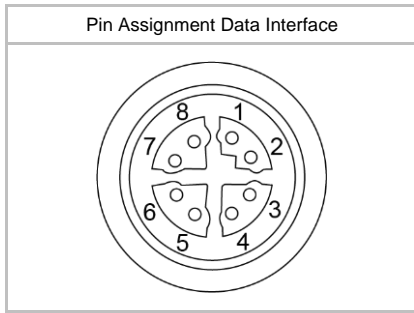
|                     |  |
|---------------------|--|
| Image Buffer        | 1024 MB<br>206 Images (Trigger Mode) / 1 Image (Free Running Mode) |
| Non-volatile Memory | 128 kb   |

## Network Interface Data

|                           |  |
|---------------------------|--|
| Interface                 | 10 Gigabit Ethernet 10GBASE-T 10.000 Mbits/sec<br>5 Gigabit Ethernet 5GBASE-T 5.000 Mbits/sec<br>2.5 Gigabit Ethernet 2.5GBASE-T 2.500 Mbits/sec<br>Gigabit Ethernet 1000BASE-T 1.000 Mbits/sec<br>Fast Ethernet 100BASE-T 100 Mbits/sec |
| Ethernet IP Configuration | Persistent IP, DHCP, LLA   |
| Packet Size               | 576 ... 9000 Byte, Jumbo Frames supported  |

## GigE Vision® Features

|   |   |
|---|---|
| Events<br>Transmission via Asynchronous Message Channel | DeviceTemperatureStatusChanged, EventLost, ExposureEnd, ExposureStart, FrameEnd, FrameStart, FrameTransferSkipped, Error, GigEVisionHeartbeatTimeout, Line0..3 FallingEdge, Line0..3 RisingEdge, PrimaryApplicationSwitch, TransferBufferFull, TransferBufferReady, TriggerOverlapped, TriggerReady, TriggerSkipped |
| Action CMD  | yes, Action 1 for Trigger   |
| Frame Counter   | up to 2 <sup>32</sup>   |
| Payload Size  | 0 ... 15139056 Byte   |
| Timestamp   | 64 bit, resolution in nsec, increment = 8   |
| Packet Delay  | 0 .. 2 <sup>32</sup> - 1 nsec   |
| Packet Resend   |   |
| GigE Vision   | v2.0  |



## Interfaces and Connectors

|                          |                      |   |   |                |
|--------------------------|----------------------|---|---|----------------|
| Data and Power Interface | 10 Gigabit Ethernet  | Transfer Rate                                     | 10.000 Mbits/sec                              |                |
|                          | 5 Gigabit Ethernet   | Transfer Rate                                     | 5.000 Mbits/sec                               |                |
|                          | 2.5 Gigabit Ethernet | Transfer Rate                                     | 2.500 Mbits/sec                               |                |
|                          | Gigabit Ethernet     | Transfer Rate                                     | 1.000 Mbits/sec                               |                |
|                          | Fast Ethernet        | Transfer Rate                                     | 100 Mbits/sec                                 |                |
|                          | Connector:           | M12 / 8-pol x-coded (SACC-CI-M12FS-8CON-L180-10G) |   |                |
| Assignment:              | 1 - MX1+             | 2 - MX1-  |   |                |
|                          | 3 - MX2+             | 4 - MX2-  |   |                |
|                          | 5 - MX4+             | 6 - MX4-  |   |                |
|                          | 7 - MX3-             | 8 - MX3+  |   |                |
|                          | Process Interface    | Connector:  | M12/12-pin a-coded (SACC-CI-M12MS-12CON-L180) |                |
|                          | Assignment:          | 1 - Power Vcc                                     | 2 - GND (Power)                               |                |
|                          |                      | 3 - IN1 (Line0)                                   | 4 - OUT1 (Line4)                              |                |
|                          |                      | 5 - IN2 (Line1)                                   | 6 - OUT2 (Line5)                              |                |
| 7 - OUT3 (Line6)         |                      | 8 - RS232 TxD (Line2)                             |   |                |
| 9 - OUT4 (Line7)         |                      | 10 - RS232 RxD (Line3)                            |   |                |
| 11 - GND (IO)            |                      | 12 - Power (IO)                                   |   |                |
| Lens Control Interface   |                      | Connector:  | 6 pin (JST BM06B-SRSS-TB)                     |                |
| (located within support) |                      | Assignment:                                       | 1 - Power (lens)                              | 2 - GND (lens) |
|                          |                      |   | 2 - UART RxD                                  | 4 - UART TxD   |
|                          |                      |   | 5 - NC  | 6 - NC         |
|                          |                      |   |   |                |
|                          |                      |   |   |                |

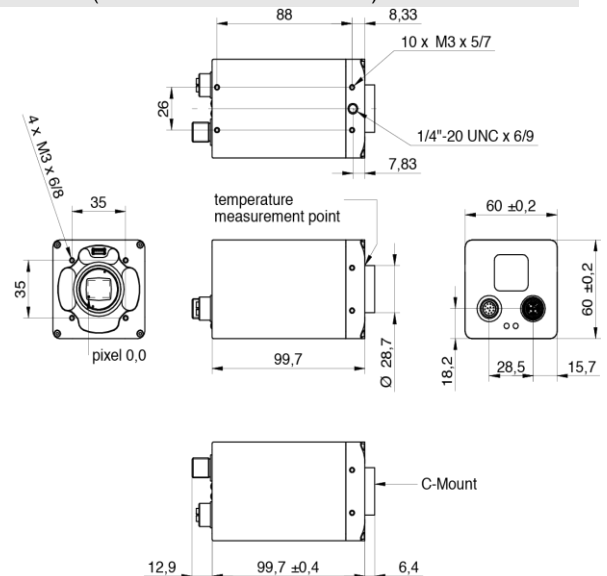
## Optical Data

|                |               |
|----------------|---------------|
| Lens Mount     | C-Mount       |
| Optical Filter | IR cut filter |

## Mechanical Data

|         |   |
|---------|---|
| Housing | aluminum, hard anodized, IP40 (with mounted lens and 10 GigE cable) IP65/67 (with mounted tube and cable) |
|---------|---|

### Dimensions



|        |       |
|--------|-------|
| Weight | 485 g |
|--------|-------|

## Environmental Data

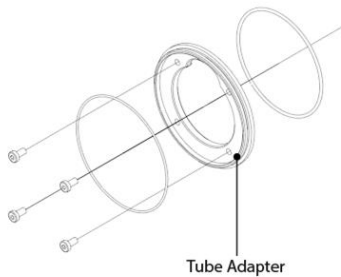
|                             |   |
|-----------------------------|---|
| Storage Temperature         | -10 °C ... + 70 °C  |
| Operating Temperature<br>*) | 0 °C ... +60 °C @ T = Measurement Point or<br>0 °C ... +69 °C @ internal Temperature Sensor<br>Ambient temperature above 26 °C requires heat<br>dissipation measures. |
| Int. Temperature<br>Sensor  | yes, accuracy:<br>±2 °C (typ) -40 °C ... 0 °C<br>±1 °C (typ) 0 °C ... +85 °C  |
| Humidity                    | 10 % ... 90 % non-condensing  |

\*) the maximum temperature for Sony sensor characteristics (sensor performance) are guaranteed up to 50°C @ Measurement Point or 55°C @ internal temperature sensor

## LED Signaling

|     |              |           |
|-----|--------------|-----------|
| LED | Green flash  | RX active |
|     | Green        | Link ON   |
|     | Yellow       | Error     |
|     | Yellow flash | TX active |

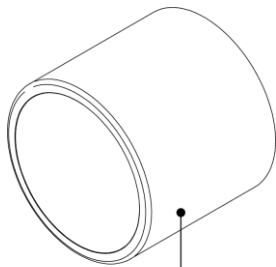
**Optional accessories for IP65/67 protection (ordered separately)**



Tube Adapter

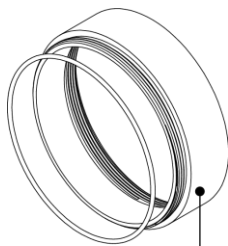
including seals and screws

| Article Number | Diameter | Length |
|----------------|----------|--------|
| 11193125       | Ø 65 mm  | 2 mm   |



tube

| Article Number | Diameter | Cover Glass                     | Length |
|----------------|----------|---------------------------------|--------|
| 11185374       | Ø 65 mm  | Acryl                           | 58 mm  |
| 11195426       | Ø 65 mm  | Tempered laminated safety glass | 58 mm  |



distance ring

including seal

| Article Number | Diameter | Length |
|----------------|----------|--------|
| 11185376       | Ø 65 mm  | 6 mm   |
| 11185375       | Ø 65 mm  | 12 mm  |
| 11198906       | Ø 65 mm  | 36 mm  |

**Electrical Data**

|                                    |  |
|------------------------------------|--|
| Power Supply (ext.)                | VCC: 24 V DC ± 20%<br>I: 504 mA  |
| Power over Ethernet                | NA   |
| Power Consumption                  | approx. 12.1 W @ 24VDC and 243 fps<br>(Factory Setting "Default")  |
| Digital Input                      | Isolated, short circuit protection<br>U <sub>IN(low)</sub> : 0.0 ... 4.5 VDC<br>U <sub>IN(high)</sub> : 11.0 ... 30.0 VDC<br>I <sub>IN</sub> : 3.0 ... 10.0 mA<br>min. Impulse Length: 2.0 µsec  |
| Digital Output                     | Isolated, short circuit protected<br>U <sub>EXT</sub> : 12 ... 48 V DC [Power (IO)]<br>I <sub>OUT</sub> : Continuously: max. 1.5 A<br>PWM t <sub>ON</sub> max 1s /<br>Duration max 40%: max. 2.5 A<br>(Max. current for each output itself or sumery of all outputs)<br>t <sub>ON</sub> = < 0.2 µsec      t <sub>OFF</sub> = < 0.2 µsec<br>max. Frequency: 500 kHz |
| GPIO                               | NA   |
| RS232<br>(reserved for future use) | RS232 compatible, not optically isolated<br>Baud Rate: up to 115200, data bits: 8, stop bits: 1,<br>Parity: none, flow control: none   |
| Liquid lens control                | Support for Corning (Varioptic) Caspian C-39N0 series<br>(C-C-39N0-160-R33, C-C-39N0-250-R33, up to 2/3")<br>VCC: 5 V DC ± 20% , I: 100 mA, UART 3.3 V   |

**Conformity**

|                            |  |
|----------------------------|--|
| Conformity                 | CE, RoHS, REACH, UL recognized                                       |
| KC Registration No. / Date | - / -  |
| MTBF                       | 26 years @ T = 45 °C / 17 years @ T = 60 °C<br>T = Measurement Point |

**GenICam™ Features**

|                      |   |
|----------------------|---|
| Short Exposure Range | yes, ShortExposureTimeEnable<br>Short Exposure Range 1 µsec ... 60 sec<br>Default Exposure Range 5 µsec ... 60 sec  |
| Timer                | Timer Selector: Timer 1<br>TimerTriggerSource:<br>Line0, SoftwareTrigger, ExposureStart, ExposureEnd,<br>FrameTransferSkipped, TriggerSkipped, Action 1 and Off<br>TimerDelay: 0 µsec ... 2 sec, Step Size: 1 µsec<br>TimerDuration: 4 µsec ... 2 sec, Step Size: 1 µsec  |
| Counter              | Counter Selector: Counter 1, Counter 2<br>CounterValue: 0 ... 65535<br>Counter Event Source: Counter1End or Counter2End,<br>ExposureActive, FrameTransferSkipped, FrameTrigger,<br>TriggerSkipped and Off<br>Counter Reset Source: Counter1End, Counter2End, Line0<br>and Off   |
| Sequencer            | Sequencer Characteristics:<br>up to 128 sets,<br>up to 4 possible paths for triggered set transitions,<br>6 trigger sources: Counter1End, Counter2End,<br>ExposureActive, Line0, ReadoutActive, Timer1End<br>Sequencer Parameters for Exposure, Gain, Trigger, ROI<br>and Output:<br>ExposureTime, CounterDuration, CounterEventActivation,<br>CounterEventSource, CounterResetSource,<br>ExposureMode, ExposureTime, Gain, Height, OffsetX,<br>OffsetY, TriggerMode, UserOutputValue,<br>UserOutputValueAll, Width |

## GenICam™ Features

|                              |   |
|------------------------------|---|
| User Sets                    | Factory Settings: UserSet0 (read only)<br>Freely Programmable: UserSet1, UserSet2, UserSet3<br>Parameters: any user definable Parameter                           |
| Acquisition Abort            | Delay up to 5.8 msec  |
| Chunk Data                   | yes,<br>Chunk Selector: Binning, Black Level, DeviceTemperature, ExposureTime, FrameID, Gain, Height, Image, ImageControl, LineStatusAll                          |
| Device Temperature           | InHouse<br>Event generation for Normal to High, High to Exceeded and Exceeded to Normal<br>Exceeded (no image transfer) = max. internal temperature sensor + 1 °C |
| Device Link Throughput Limit | yes, up to max. Device Link Speed   |
| Custom Data                  | yes, 128 Byte   |
| SFNC Version                 | v2.4.0  |

## Factory Settings after Start-Up

|                                |  |
|--------------------------------|--|
| Trigger Mode                   | Off (Free Running)   |
| Analog Controls                | Exposure Time: 4 msec, Gain: 0 dB, Offset: 0                             |
| Pixel Format                   | BayerRG8   |
| Partial Scan                   | Off  |
| Acquisition Frame Rate         | Off  |
| Timer/Counter/Sequencer        | Off  |
| Defect Pixel Correction        | ON   |
| Fixed Pattern Noise Correction | -  |
| Digital Input                  | Line0 .. 1, invert = false, line format = Tri State                      |
| Digital Output                 | Line4 .. 7, invert = false, line source = Off, line format = Open Source |
| GPIO                           | NA   |
| TriggerSource                  | All  |

## ROI Frame Rates, min Exposure, 8 bit sensor readout, Mono8 or BayerRG8

|           | Resolution  | max. fps acquisition | max. fps interface <sup>2)</sup> |
|-----------|-------------|----------------------|----------------------------------|
| Full HD   | 1920 x 1080 | 440                  | 440                              |
| SXGA      | 1280 x 1024 | 459                  | 459                              |
| XGA       | 1024 x 768  | 568                  | 568                              |
| SVGA      | 800 x 600   | 677                  | 677                              |
| VGA       | 640 x 480   | 784                  | 784                              |
| CIF       | 352 x 288   | 1057                 | 1057                             |
| QCIF      | 176 x 144   | 1412                 | 1412                             |
| Full Line | 2464 x 2048 | 259                  | 244                              |
|           | 2464 x 1024 | 459                  | 459                              |
|           | 2464 x 512  | 753                  | 753                              |
|           | 2464 x 256  | 1119                 | 1119                             |
|           | 2464 x 128  | 1466                 | 1466                             |
|           | 2464 x 64   | 1736                 | 1736                             |
|           | 2464 x 32   | 1912                 | 1912                             |
|           | 2464 x 16   | 2016                 | 2016                             |
|           | 2464 x 8    | 2016                 | 2016                             |
|           | 2464 x 4    | 2016                 | 2016                             |
|           | 2464 x 2    | 2016                 | 2016                             |
|           | 2464 x 1    | -                    | -                                |

<sup>2)</sup> depends on the used interface speed