

## Sensor Information

|            |                            |
|------------|----------------------------|
| Model Name | Sony IMX304                |
| Type       | 1.1" progressive scan CMOS |
| Shutter    | Global Shutter             |
| Resolution | 4096 x 3000 pixels         |
| Scan Area  | 14.13 mm x 10.35 mm        |
| Pixel Size | 3.45 μm x 3.45 μm          |

## Data Quality

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

|                           |                        |
|---------------------------|------------------------|
| Dark Noise ( $\sigma$ )   | 2 e- typical           |
| Saturation                | 9500 e- typical        |
| Dynamic Range             | 71 dB typical          |
| SNR                       | 40 dB typical          |
| Quantum efficiency $\eta$ | 67,3% @ 536 nm typical |

## Acquisition

| Resolution  | 4096 px x 3000 px |             |   |
|---|-------------------|-------------|---|
| Interface Frame Rate<br>(depends on used interface performance) | Format            | Resolution  | max. Frame Rate<br>(@ Trigger Mode) <sup>2)</sup> |
|   | Full Frame        | 4096 x 3000 | 9 fps   |
|   | Binning 2x2       | 2048 x 1500 | 15 fps  |
|   | Binning 2x1       | 2048 x 3000 | 15 fps  |
|   | Binning 1x2       | 4096 x 1500 | 15 fps  |

Acquisition Frame Rate <sup>1)</sup> 15 fps |  $t_{\text{readout}} = 65.8 \text{ msec}$  (max. Res. Full Frame) @ 12 bit (Burst Mode)

|               |  |
|---------------|--|
| Pixel Formats | Mono8, Mono10, Mono12, Mono12p   |
| Partial Scan  | True Partial Scan with increasing Frame Rate on Y direction, Region of Interest (ROI) arbitrary<br>Width: minimum 16, increment 16<br>Height: minimum 1, increment 1 |

|                                   |  |
|-----------------------------------|--|
| Adjustable Acquisition Frame Rate | Off or 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                     |

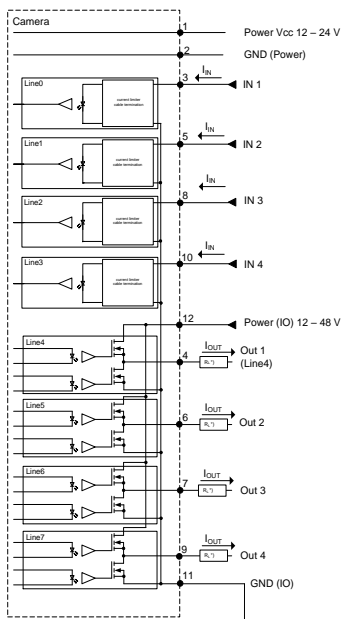
## Image Pre-Processing

|                   |   |
|-------------------|---|
| Analog Controls   | Exposure Time (1 μsec ... 60 sec   Step Size 1 μsec)<br>Gain (0...48 dB), Offset (0 ... 255 LSB   12 bit) |
| Auto Function     | ExposureAuto and GainAuto with BrightnessAutoPriority based on BrightnessAuto ROI                         |
| LUT               | Luminance (12 bit)  |
| Color Models      | Mono  |
| Color Processing  | -   |
| Color Adjustment  | -   |
| Color Enhancement | -   |
| Color Tolerance   | -   |

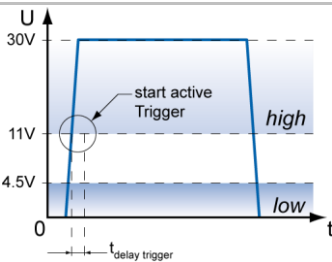
<sup>1)</sup> Sensor readout, different from pixel format

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

### Digital Input / Output: principle circuit diagram



### Trigger Mode: Start up time and valid Trigger



### Image Pre-Processing

|                              |  |
|------------------------------|--|
| Binning Horizontal           | 1 or 2   |
| Binning Vertical             | 1 or 2   |
| Image Flipping               | Horizontal, vertical                                   |
| Defect Pixel Correction      | via Defect Pixel List with up to 512 Pixel Coordinates |
| Fix Pattern Noise Correction | -  |

### Process Synchronization

|                      |  |
|----------------------|--|
| Trigger Mode         | Off (Free Running), On (Trigger)   |
| Trigger Overlap Type | Readout  |
| Trigger Sources      | Hardware (Line0, 1, 2, 3), Software, Action CMD (Action 1), All or Off<br>fixed Trigger Delay out of t <sub>readout</sub> : <sup>1)</sup> 97.7 µsec @ 12 bit<br>max. Trigger Delay during t <sub>readout</sub> : <sup>1)</sup> 114.1 µsec @ 12 bit |
| Trigger Delay        | 0 ... 2 sec, Tracking and buffering of up to 256 triggers  |
| External Flash Sync  | via Exposure Active<br>t <sub>delay flash</sub> ≤ 3 µsec, t <sub>duration</sub> = t <sub>exposure</sub>  |
| Encoder Function     | yes, via Counter and Trigger Source  |
| PTP Function         | -  |

### Digital I/Os

|                     |  |
|---------------------|--|
| Lines               | Input: Line 0 .. 3, Output: Line 4 .. 7, GPIO: no  |
| 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        | 36 MB<br>1 Images (Trigger Mode) / 1 Image (Free Running Mode) |
| Non-volatile Memory | 128 kb   |

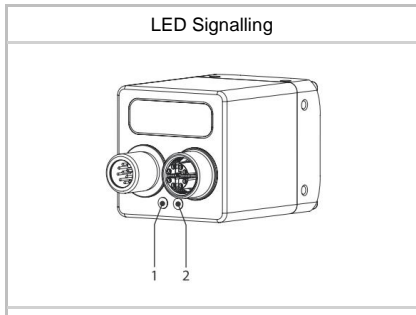
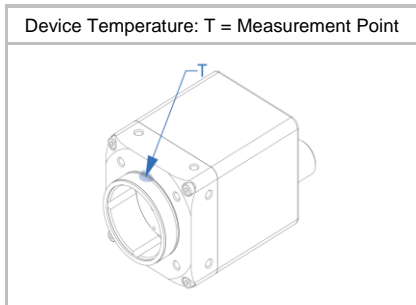
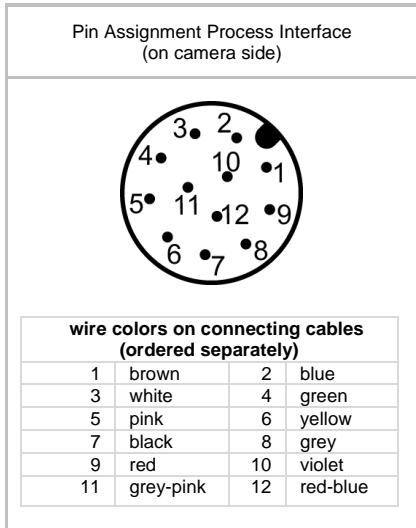
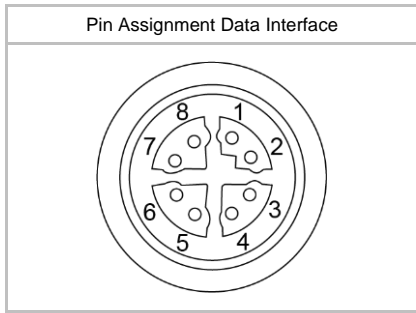
### Network Interface Data

|                           |  |
|---------------------------|--|
| Interface                 | Gigabit Ethernet 1000BASE-T 1000 Mbits/sec<br>Fast Ethernet 100 BASE-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, GigEVisionError, GigEVisionHeartbeatTimeOut, PrimaryApplicationSwitch, Line0..7 FallingEdge, Line0..7 RisingEdge, TransferBufferFull, TransferBufferReady, TriggerOverlapped, TriggerReady, TriggerSkipped |
| Action CMD  | yes, Action 1 for Trigger   |
| Frame Counter   | up to 2 <sup>32</sup>   |
| Payload Size  | 0 ... 24576224 Byte   |
| Timestamp   | 64 bit, resolution in nsec, increment = 8   |
| Packet Delay  | 0 .. 2 <sup>32</sup> - 1 nsec   |
| Packet Resend   | Resend Buffer: 47 MB (2 Images)   |
| GigE Vision   | v2.0 (v1.2 backward compatible)   |

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



## Interfaces and Connectors

|                          |                  |  |                  |
|--------------------------|------------------|--|------------------|
| Data and Power Interface | Gigabit Ethernet | Transfer Rate  | 1000 Mbits/sec   |
|                          | Fast Ethernet    | Transfer Rate  | 100 Mbits/sec    |
|                          | Connector:       | M12 / 8-pol x-coded<br>(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<br>(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 - IN3 (Line2)  |
|                          |                  | 9 - OUT4 (Line7)                                     | 10 - IN4 (Line3) |
|                          |                  | 11 - GND (IO)  | 12 - Power (IO)  |

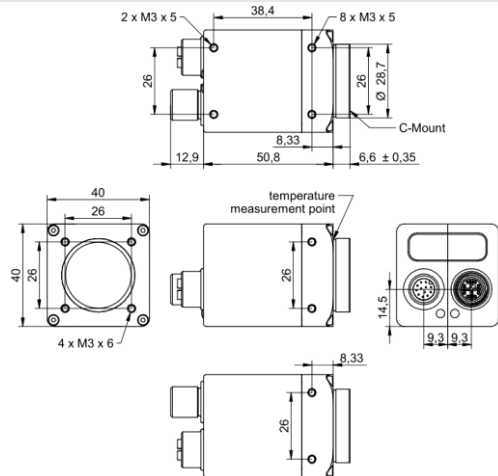
## Optical Data

|                |         |
|----------------|---------|
| Lens Mount     | C-Mount |
| Optical Filter | -       |

## Mechanical Data

|                  |  |
|------------------|--|
| Housing          | aluminum, hard anodized  |
| Protection Class | IP40 (with mounted lens and GigE cable)<br>IP54 (with mounted lens and GigE cable)<br>IP65/67 (with mounted tube and cable)<br>IP69k (with stainless steel housing system) |
| Weight           | 137 g  |

### Dimensions



## Environmental Data

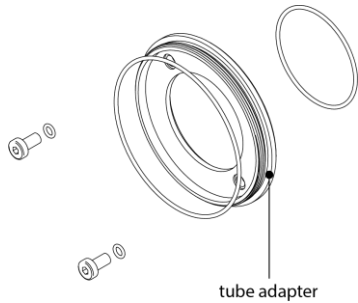
|                            |   |
|----------------------------|---|
| Storage Temperature        | -40 °C ... + 70 °C  |
| Operating Temperature      | -40 °C ... + °C @ T = Measurement Point or<br>)<br>-40 °C ... + °C @ internal Temperature Sensor<br>Ambient temperature above 0 °C requires heat<br>dissipation 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 °C @ Measurement Point or °C @ internal temperature sensor

## LED Signalling

|       |       |               |           |
|-------|-------|---------------|-----------|
| LED   | LED 1 | Yellow static | Error     |
|       |       | Yellow flash  | TX active |
| LED 2 | LED 2 | Green static  | Link ON   |
|       |       | Green flash   | RX active |

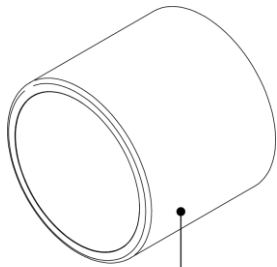
**Optional accessories for IP65/67 protection (ordered separately)**



tube adapter

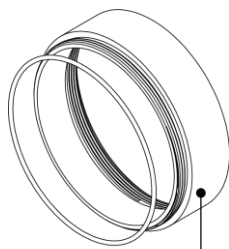
including seals and screws

| Article Number | Diameter  | Length  |
|----------------|-----------|---------|
| 11185373       | Ø 49,5 mm | 5,25 mm |
| 11185377       | Ø 65 mm   | 5,25 mm |



tube

| Article Number | Diameter  | Cover Glass                     | Length |
|----------------|-----------|---------------------------------|--------|
| 11185370       | Ø 49,5 mm | Acryl                           | 44 mm  |
| 11185374       | Ø 65 mm   |                                 | 58 mm  |
| 11195425       | Ø 49,5 mm | Tempered laminated safety glass | 44 mm  |
| 11195426       | Ø 65 mm   |                                 | 58 mm  |



distance ring

including seal

| Article Number | Diameter  | Length |
|----------------|-----------|--------|
| 11185372       | Ø 49,5 mm | 6 mm   |
| 11185371       | Ø 49,5 mm | 12 mm  |
| 11211571       | Ø 49,5 mm | 36 mm  |
| 11185376       | Ø 65 mm   | 6 mm   |
| 11185375       | Ø 65 mm   | 12 mm  |
| 11198906       | Ø 65 mm   | 36 mm  |

**Electrical Data**

|                     |   |
|---------------------|---|
| Power Supply (ext.) | VCC: 12 ... 24 V DC ± 20%<br>I: 103 ... 207 mA  |
| Power over Ethernet | Class 1 device<br>VCC: 36 ... 57 V DC<br>I: 67 mA @ 48 VDC  |
| Power Consumption   | approx. 2.5 W @ 12VDC and 9 fps<br>approx. 3.2 W @ 48 VDC (PoE) and 9 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 summery of all outputs)<br>t <sub>ON</sub> = < 0.2 µsec      t <sub>OFF</sub> = < 0.2 µsec<br>max. Frequency: 500 kHz |
| GPIO                | no  |

**Conformity**

|                            |  |
|----------------------------|--|
| Conformity                 | CE, RoHS, REACH, EAC   |
| KC Registration No. / Date | - / -  |
| MTBF                       | 44 years @ T = 45 °C / 29 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 15 µsec ... 60 sec  |
| Timer                | Timer Selector: Timer 1<br>TimerTriggerSource:<br>Line0, SoftwareTrigger, ExposureStart, ExposureEnd, 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, ExposureActive, FrameTransferSkipped, FrameTrigger, TriggerSkipped, Line0..3 and Off<br>Counter Reset Source: Counter1End, Counter2End, Line0..3  |
| Sequencer            | Sequencer Characteristics:<br>up to 128 sets,<br>up to 4 possible paths for triggered set transitions,<br>6 trigger sources: Counter1End, Counter2End, ExposureActive, Line0..3, ReadoutActive, Timer1End<br>Sequencer Parameters for Exposure, Gain, Trigger, ROI and Output:<br>ExposureTime, CounterDuration, CounterEventActivation, CounterEventSource, CounterResetSource, ExposureMode, ExposureTime, Gain, Height, OffsetX, OffsetY, TriggerMode, UserOutputValue, 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 65.8 msec  |
| Chunk Data                   | yes,<br>Chunk Selector: Binning, BlackLevel, CounterValue, DeviceTemperature, ExposureTime, FrameID, Gain, Height, Image, ImageControl, LineStatusAll, OffsetX, OffsetY, PixelFormat, SequencerSetActive, Timestamp, Width |
| 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   |

## Factory Settings after Start-Up

|                                |  |
|--------------------------------|--|
| Trigger Mode                   | Off (Free Running)   |
| Analog Controls                | Exposure Time: 4 msec, Gain: 0 dB, Offset: 0                             |
| Pixel Format                   | Mono8  |
| Partial Scan                   | Off  |
| Acquisition Frame Rate         | Off  |
| Timer/Counter/Sequencer        | Off  |
| Defect Pixel Correction        | ON   |
| Fixed Pattern Noise Correction | -  |
| Digital Input                  | Line0 .. 3, invert = false, line format = Tri State                      |
| Digital Output                 | Line4 .. 7, invert = false, line source = Off, line format = Open Source |
| GPIO 1/2                       | no   |
| TriggerSource                  | All  |

## Partial Scan @ FullFrame, min Exposure, Mono8 (monochrome camera) or BayerRG8 (color camera)

|          | Resolution  | max. fps acquisition | max. fps interface <sup>2)</sup> |
|----------|-------------|----------------------|----------------------------------|
| UHD (4K) | 3840 x 2160 | 20                   | 14                               |
| Full HD  | 1920 x 1080 | 40                   | 40                               |
| SXGA     | 1280 x 1024 | 43                   | 43                               |
| HD720    | 1280 x 720  | 59                   | 59                               |
| XGA      | 1024 x 768  | 56                   | 56                               |
| SVGA     | 800 x 600   | 70                   | 70                               |
| VGA      | 640 x 480   | 86                   | 86                               |
| CIF      | 352 x 288   | 135                  | 135                              |
| QVGA     | 320 x 240   | 157                  | 157                              |
| QCIF     | 176 x 144   | 232                  | 232                              |
| LineScan | 4096 x 2048 | 22                   | 14                               |
|          | 4096 x 1024 | 43                   | 29                               |
|          | 4096 x 512  | 81                   | 58                               |
|          | 4096 x 256  | 149                  | 117                              |
|          | 4096 x 128  | 252                  | 235                              |
|          | 4096 x 64   | 387                  | 387                              |
|          | 4096 x 32   | 529                  | 529                              |
|          | 4096 x 16   | 646                  | 646                              |
|          | 4096 x 8    | 728                  | 728                              |
|          | 4096 x 4    | 776                  | 776                              |
|          | 4096 x 2    | 803                  | 803                              |
|          | 4096 x 1    | 817                  | 817                              |

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