

## 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 $\mu$ m x 3.45 $\mu$ m |

## 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 $\eta$ | 47 % @ 465 nm, 58 % @ 536 nm, 53 % @ 631 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> (Burst Mode) 15 fps |  $t_{\text{readout}} = 65.9$  msec (max. Res. Full Frame) @ 12 bit

Pixel Formats BayerRG8, BayerRG10, BayerRG12, BayerRG12p Mono8, Mono10, Mono12, Mono12p, RGB8, BGR8

Partial Scan True Partial Scan with increasing Frame Rate on Y direction, Region of Interest (ROI) arbitrary  
Width: minimum 16, increment 16  
Height: minimum 2, increment 2

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  $\mu$ sec ... 60 sec | Step Size 1  $\mu$ sec)  
Gain (0...48 dB), Offset (0 ... 255 LSB | 12 bit)

Auto Function ExposureAuto and GainAuto  
with BrightnessAutoPriority based on BrightnessAuto ROI  
BalanceWhiteAuto and ColorTransformationAuto based on BalanceWhiteAuto ROI

LUT Luminance (12 bit)

Color Models Mono, Raw Bayer, RGB and BGR

Color Processing Integrated color processor for high quality color calculation

Color Adjustment Manual White Balance  
Automatic White Balance (Once or Continuous) based on Region of Interest (ROI)

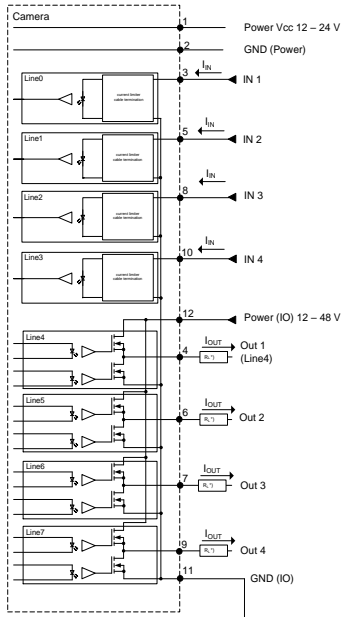
Color Enhancement Color Transformation to sRGB color space by optimized Matrix for 3000 K, 5000 K, 6500 K and 9500 K  
Lightsource or User defined Matrix

Color Tolerance -

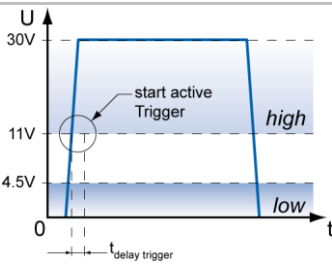
<sup>1)</sup> Sensor readout, different from pixel format

<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><br>97.7 µsec @ 12 bit<br>max. Trigger Delay during t <sub>readout</sub> : <sup>1)</sup><br>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:<br>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   |

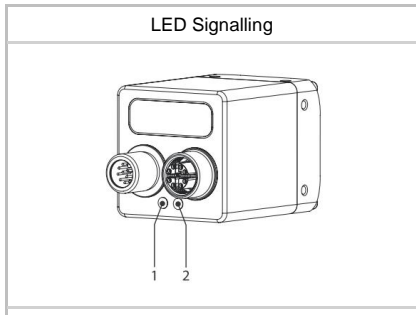
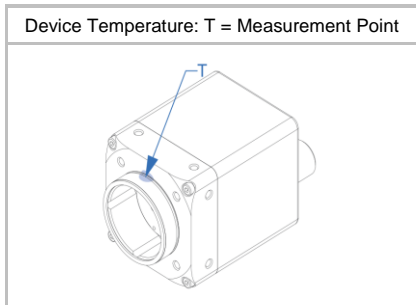
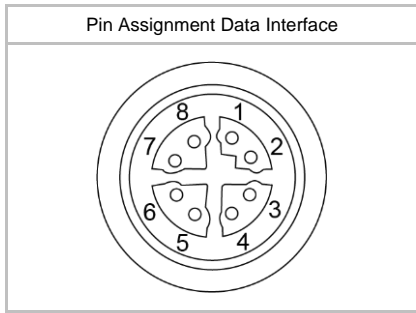
### Network Interface Data

|                           |  |
|---------------------------|--|
| 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 ... 36864224 Byte   |
| Timestamp   | 64 bit, resolution in nsec, increment = 8   |
| Packet Delay  | 0 .. 2 <sup>32</sup> - 1 nsec   |
| Packet Resend   | Resend Buffer: 71 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)  |

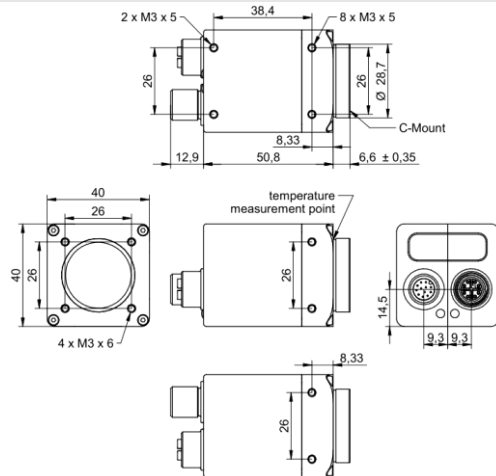
## Optical Data

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

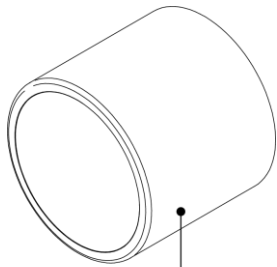
**Optional accessories for IP65/67 protection (ordered separately)**



tube adapter

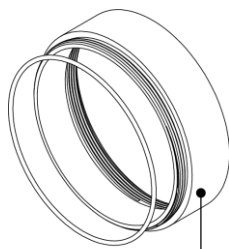
including seals and screws

| 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: 107 ... 215 mA  |
| Power over Ethernet | Class 1 device<br>VCC: 36 ... 57 V DC<br>I: 67 mA @ 48 VDC  |
| Power Consumption   | approx. 2.6 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 65.9 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                   | BayerRG8   |
| 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 | 42                   | 42                               |
| 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   | 133                  | 133                              |
| QVGA     | 320 x 240   | 155                  | 155                              |
| QCIF     | 176 x 144   | 229                  | 229                              |
| LineScan | 4096 x 2048 | 22                   | 14                               |
|          | 4096 x 1024 | 42                   | 29                               |
|          | 4096 x 512  | 81                   | 58                               |
|          | 4096 x 256  | 147                  | 117                              |
|          | 4096 x 128  | 248                  | 235                              |
|          | 4096 x 64   | 378                  | 378                              |
|          | 4096 x 32   | 511                  | 511                              |
|          | 4096 x 16   | 621                  | 621                              |
|          | 4096 x 8    | 695                  | 695                              |
|          | 4096 x 4    | 739                  | 739                              |
|          | 4096 x 2    | 764                  | 764                              |
|          | 4096 x 1    | -                    | -                                |

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