

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

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



### Sensor Information

Model Name	Sony IMX421
Type	2/3" progressive scan CMOS
Shutter	Global Shutter
Resolution	1920 x 1464 pixels
Scan Area	8.71 mm x 6.59 mm
Pixel Size	4.5 µm x 4.5 µm

### Data Quality

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

Dark Noise ( $\sigma$ )	5.7 e- typical
Saturation	24500 e- typical
Dynamic Range	71.5 dB typical
SNR	44 dB typical
Quantum efficiency $\eta$	73% @ 536 nm typical

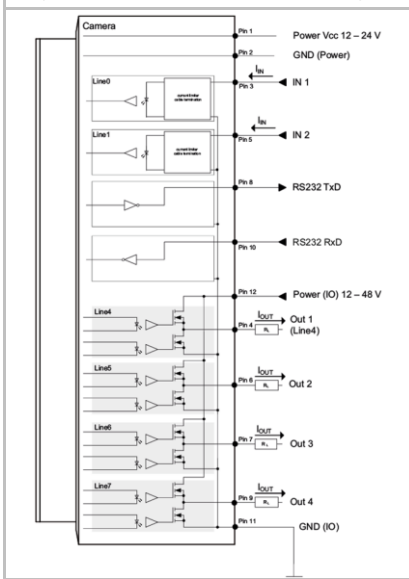
### Acquisition

Resolution	1920 px x 1464 px		
Interface Frame Rate (depends on used interface performance)	Format	Resolution	max. Frame Rate (@ Trigger Mode) <sup>2)</sup>
	Full Frame	1920 x 1464	411 fps
	Binning 2x2	960 x 732	791 fps
	Binning 2x1	960 x 1464	412 fps
	Binning 1x2	1920 x 732	412 fps
Acquisition Frame Rate <sup>1)</sup> (Burst Mode)	415 fps   $t_{\text{readout}} = 2.41$ msec (max. Res. Full Frame) @ 8 bit		
	377 fps   $t_{\text{readout}} = 2.65$ msec (max. Res. Full Frame) @ 10 bit		
	234 fps   $t_{\text{readout}} = 4.26$ msec (max. Res. Full Frame) @ 12 bit		
Pixel Formats	Mono8, Mono10, Mono12, Mono12p		
Partial Scan	True Partial Scan with increasing Frame Rate on Y direction, Region of Interest (ROI) arbitrary Width: minimum 64, increment 32 Height: minimum 1, increment 1		
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		

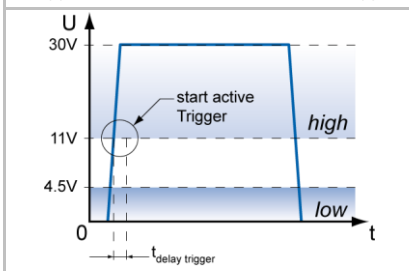
### Image Pre-Processing

Analog Controls	Exposure Time (1 µsec ... 60 sec   Step Size 1 µsec) 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
Color Processing	-
Color Enhancement	-
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	Yes, up to +12 dB, non-linear output with tone mapping
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 fixed Trigger Delay out of treadout: <sup>1)</sup> 29.9 µsec @ 8 bit 30.8 µsec @ 10 bit 37.1 µsec @ 12 bit max. Trigger Delay during treadout: <sup>1)</sup> 29.9 µsec @ 8 bit 30.8 µsec @ 10 bit 37.1 µsec @ 12 bit
Trigger Delay	0 ... 2 sec, Tracking and buffering of up to 256 triggers
External Flash Sync	via Exposure Active $t_{\text{delay flash}} \leq 1 \mu\text{sec}$ , $t_{\text{duration}} = t_{\text{exposure}}$
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 PWM Mode: Off, One Pulse, FixedFrequency PWM feature: PWMDuration, PWMDutyCycle Configuration Mode for lightning protection: MaxPWMDuration, MaxPWMDutyCycle
Line Debouncer	Low and high signal separately selectable Debouncing Time 0 ... 5 msec, Step Size: 1 µsec

## Memory

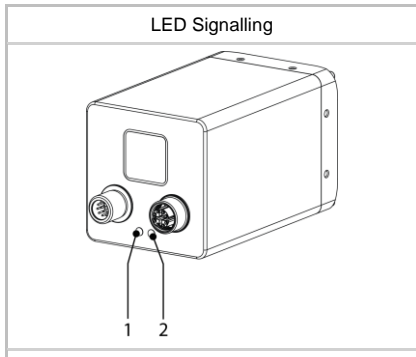
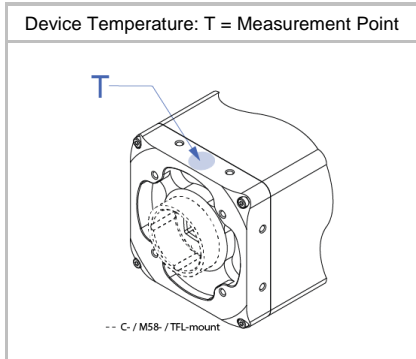
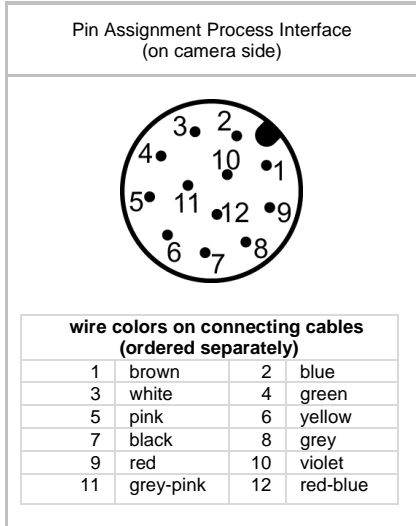
Image Buffer	1024 MB 370 Images (Trigger Mode) / 1 Image (Free Running Mode)
Non-volatile Memory	128 kb

## Network Interface Data

Interface	10 Gigabit Ethernet 10GBASE-T 10.000 Mbits/sec 5 Gigabit Ethernet 5GBASE-T 5.000 Mbits/sec 2.5 Gigabit Ethernet 2.5GBASE-T 2.500 Mbits/sec Gigabit Ethernet 1000BASE-T 1.000 Mbits/sec 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 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 ... 5622000 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

Interface	Connector	Transfer Rate
10 Gigabit Ethernet	M12 / 8-pol x-coded (SACC-CI-M12FS-8CON-L180-10G)	10.000 Mbits/sec
5 Gigabit Ethernet		5.000 Mbits/sec
2.5 Gigabit Ethernet		2.500 Mbits/sec
Gigabit Ethernet		1.000 Mbits/sec
Fast Ethernet		100 Mbits/sec

Assignment:

1 - MX1+	2 - MX1-
3 - MX2+	4 - MX2-
5 - MX4+	6 - MX4-
7 - MX3-	8 - MX3+

Interface	Connector	Assignment												
Process Interface	M12/12-pin a-coded (SACC-CI-M12MS-12CON-L180)	<table border="1"> <tbody> <tr> <td>1 - Power Vcc</td> <td>2 - GND (Power)</td> </tr> <tr> <td>3 - IN1 (Line0)</td> <td>4 - OUT1 (Line4)</td> </tr> <tr> <td>5 - IN2 (Line1)</td> <td>6 - OUT2 (Line5)</td> </tr> <tr> <td>7 - OUT3 (Line6)</td> <td>8 - RS232 TxD (Line2)</td> </tr> <tr> <td>9 - OUT4 (Line7)</td> <td>10 - RS232 RxD (Line3)</td> </tr> <tr> <td>11 - GND (IO)</td> <td>12 - Power (IO)</td> </tr> </tbody> </table>	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)
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)													

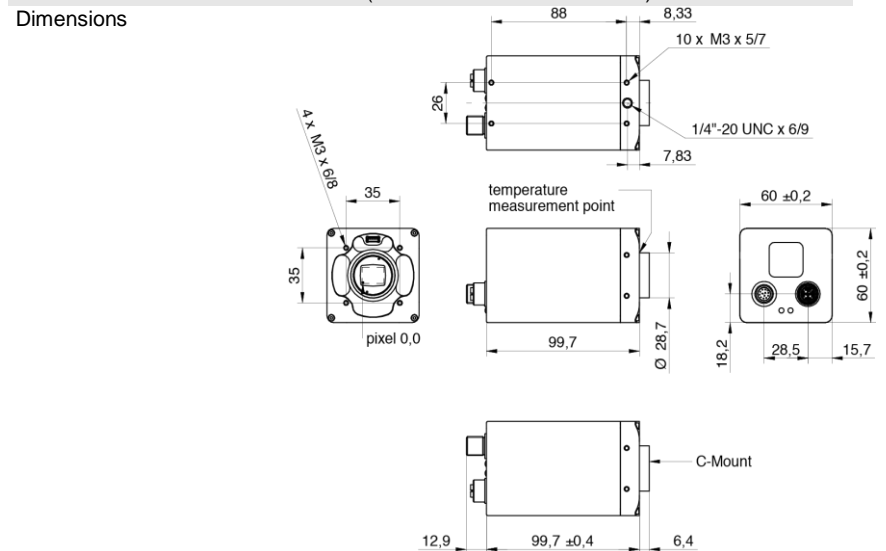
Interface	Connector	Assignment						
Lens Control Interface (located within support, reserved for future use)	6 pin (JST BM06B-SRSS-TB)	<table border="1"> <tbody> <tr> <td>1 - Power (lens)</td> <td>2 - GND (lens)</td> </tr> <tr> <td>2 - UART RxD</td> <td>4 - UART TxD</td> </tr> <tr> <td>5 - NC</td> <td>6 - NC</td> </tr> </tbody> </table>	1 - Power (lens)	2 - GND (lens)	2 - UART RxD	4 - UART TxD	5 - NC	6 - NC
1 - Power (lens)	2 - GND (lens)							
2 - UART RxD	4 - UART TxD							
5 - NC	6 - NC							

## Optical Data

Lens Mount	C-Mount
Optical Filter	-

## Mechanical Data

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



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

## Environmental Data

Storage Temperature	-10 °C ... + 70 °C
Operating Temperature *)	0 °C ... +60 °C @ T = Measurement Point or 0 °C ... +69 °C @ internal Temperature Sensor Ambient temperature above 26 °C requires heat dissipation measures.
Int. Temperature Sensor	yes, accuracy: ±2 °C (typ) -40 °C ... 0 °C ±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

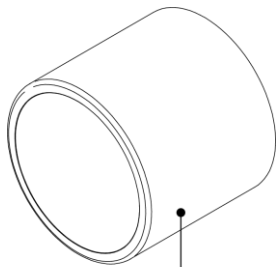
**Optional accessories for IP65/67 protection (ordered separately)**



Tube Adapter

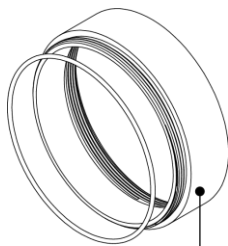
including seals and screws

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% I: 483 mA
Power over Ethernet	NA
Power Consumption	approx. 11.6 W @ 24VDC and 411 fps (Factory Setting "Default")
Digital Input	Isolated, short circuit protection U <sub>IN(low)</sub> : 0.0 ... 4.5 VDC U <sub>IN(high)</sub> : 11.0 ... 30.0 VDC I <sub>IN</sub> : 3.0 ... 10.0 mA min. Impulse Length: 2.0 µsec
Digital Output	Isolated, short circuit protected U <sub>EXT</sub> : 12 ... 48 V DC [Power (IO)] I <sub>OUT</sub> : Continuously: max. 1.5 A PWM t <sub>ON</sub> max 1s / Duration max 40%: max. 2.5 A (Max. current for each output itself or summery of all outputs) t <sub>ON</sub> = < 0.2 µsec      t <sub>OFF</sub> = < 0.2 µsec max. Frequency: 500 kHz
GPIO	NA
RS232 (reserved for future use)	RS232 compatible, not optically isolated Baud Rate: up to 115200, data bits: 8, stop bits: 1, Parity: none, flow control: none
Liquid lens control	Support for Varioptic Caspian C-39N0 series (C-C-39N0-160-R33, C-C-39N0-250-R33, up to 2/3") VCC: 5 V DC ± 20% , I: 100 mA, UART 3.3 V

**Conformity**

Conformity	CE, RoHS, REACH, EAC
KC Registration No. / Date	- / -
MTBF	26 years @ T = 45 °C / 17 years @ T = 60 °C T = Measurement Point

**GenICam™ Features**

Short Exposure Range	yes, ShortExposureTimeEnable Short Exposure Range 1 µsec ... 60 sec Default Exposure Range 8 µsec ... 60 sec
Timer	Timer Selector: Timer 1 TimerTriggerSource: Line0, SoftwareTrigger, ExposureStart, ExposureEnd, FrameTransferSkipped, TriggerSkipped, Action 1 and Off TimerDelay: 0 µsec ... 2 sec, Step Size: 1 µsec TimerDuration: 4 µsec ... 2 sec, Step Size: 1 µsec
Counter	Counter Selector: Counter 1, Counter 2 CounterValue: 0 ... 65535 Counter Event Source: Counter1End or Counter2End, ExposureActive, FrameTransferSkipped, FrameTrigger, TriggerSkipped and Off Counter Reset Source: Counter1End, Counter2End, Line0 and Off
Sequencer	Sequencer Characteristics: up to 128 sets, up to 4 possible paths for triggered set transitions, 6 trigger sources: Counter1End, Counter2End, ExposureActive, Line0, ReadoutActive, Timer1End Sequencer Parameters for Exposure, Gain, Trigger, ROI and Output: ExposureTime, CounterDuration, CounterEventActivation, CounterEventSource, CounterResetSource, ExposureMode, ExposureTime, Gain, Height, OffsetX, OffsetY, TriggerMode, UserOutputValue, UserOutputValueAll, Width

## GenICam™ Features

User Sets	Factory Settings: UserSet0 (read only) Freely Programmable: UserSet1, UserSet2, UserSet3 Parameters: any user definable Parameter
Acquisition Abort	Delay up to 4.3 msec
Chunk Data	yes, Chunk Selector: Binning, Black Level, DeviceTemperature, ExposureTime, FrameID, Gain, Height, Image, ImageControl, LineStatusAll
Device Temperature	InHouse Event generation for Normal to High, High to Exceeded and Exceeded to Normal 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	Mono8
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	545	545
SXGA	1280 x 1024	572	572
XGA	1024 x 768	740	740
SVGA	800 x 600	916	916
VGA	640 x 480	1105	1105
CIF	352 x 288	1644	1644
QCIF	176 x 144	-	-
Full Line	1920 x 1024	572	572
	1920 x 512	1046	1046
	1920 x 256	1788	1788
	1920 x 128	2767	2767
	1920 x 64	3813	3813
	1920 x 32	4712	4712
	1920 x 16	5318	5318
	1920 x 8	5713	5713
	1920 x 4	5713	5713
	1920 x 2	5713	5713
	1920 x 1	-	-

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