

Sensor Information

| | |
|------------|-----------------------------|
| Model Name | ON Semiconductor PYTHON5000 |
| Type | 1" progressive scan CMOS |
| Shutter | Global Shutter |
| Resolution | 2592 x 2048 pixels |
| Scan Area | 12.44 mm x 9.83 mm |
| Pixel Size | 4.8 μm x 4.8 μm |

Data Quality

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

| | |
|---------------------------|----------------------|
| Dark Noise (σ) | 11.5 e- typical |
| Saturation | 8600 e- typical |
| Dynamic Range | 57 dB typical |
| SNR | 39.5 dB typical |
| Quantum efficiency η | 56% @ 536 nm typical |

Acquisition

| | | | |
|---|-------------------|------------|-----------------|
| Resolution | 2592 px x 2048 px | | |
| Interface Frame Rate | Format | Resolution | max. Frame Rate |
| (depends on used interface performance) | | | |

| | | |
|-------------|-------------|--------|
| Full Frame | 2592 x 2048 | 73 fps |
| Binning 2x2 | 1296 x 1024 | 73 fps |
| Binning 2x1 | 2592 x 1024 | 73 fps |
| Binning 1x2 | 1296 x 2048 | 73 fps |

Acquisition Frame Rate ¹⁾ 73 fps | $t_{\text{readout}} = 13.6 \text{ msec}$ (max. Res. Full Frame) @ 10 bit

| | |
|---------------|---|
| Pixel Formats | Mono8, Mono10 |
| Partial Scan | True Partial Scan with increasing Frame Rate on X and Y direction, Region of Interest (ROI) arbitrary |
| | Width: minimum 48, increment 16 |
| | Height: minimum 1, increment 1 |

Adjustable 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 |
| Shutter Mode | Global |
| Readout Mode | Overlapped, Sequential |

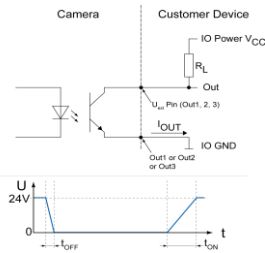
Image Pre-Processing

| | |
|----------------------|--|
| Analogue Controls | Exposure Time (20 μsec ... 1 sec Step Size 1 μsec) Gain (0...18 dB), Offset (0 ... 63 LSB 10 bit) |
| Auto Function | ExposureAuto and GainAuto with BrightnessAutoPriority based on BrightnessAuto ROI |
| Gamma Correction LUT | Gamma (0.1 ... 2 available if LUT is enabled) Luminance (12 bit) |
| Color Models | Mono |
| Color Processing | - |
| Color Enhancement | - |

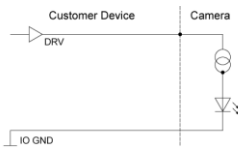
¹⁾ Sensor readout, different from pixel format

²⁾ depends on the used interface

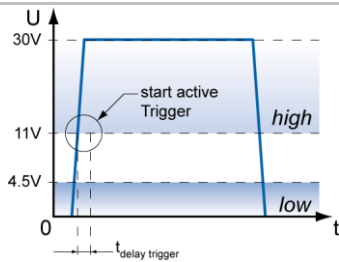
Digital Output: Low Active



Digital Input



Trigger Mode: Start up time and valid Trigger



GPIO

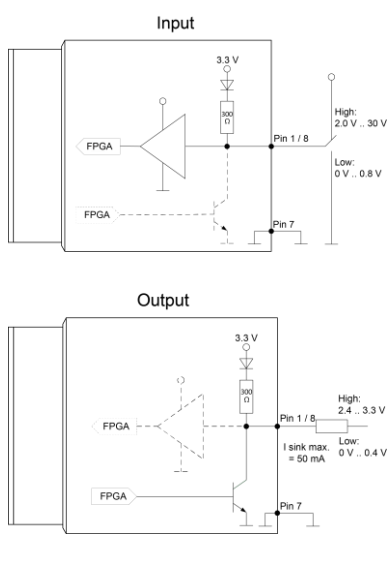


Image Pre-Processing

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

Process Synchronization

| | |
|----------------------|--|
| Trigger Mode | Off (Free Running), On (Trigger) |
| Trigger Overlap Type | Readout |
| Trigger Sources | Hardware (Line0, 1, 2), Software, Counter 1, 2 End, All or Off fixed Trigger Delay out of treadout: ¹⁾ 3 µsec @ 10 bit max. Trigger Delay during treadout: ¹⁾ 10 µsec @ 10 bit |
| Trigger Delay | 0 ... 2 sec, Tracking and buffering of up to 256 triggers |
| External Flash Sync | via Exposure Active $t_{\text{delay flash}} \leq 3 \mu\text{sec}$, $t_{\text{duration}} = t_{\text{exposure}}$ |
| Encoder Function | yes, via Counter and Trigger Source |
| PTP Function | - |

Digital I/Os

| | |
|----------------|--|
| Lines | Input: Line 0, Output: Line3, GPIO: Line 1, Line 2 |
| Output Sources | Off, ExposureActive, Timer1, ReadoutActive, UserOutput 1-3 and TriggerReady |
| Line Debouncer | Low and high signal separately selectable Debouncing Time 0 ... 5 msec, Step Size: 1 µsec |

Memory

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|---------------------|--|
| Image Buffer | 471 MB 31 Images (Trigger Mode) / 1 Image (Free Running Mode) |
| Non-volatile Memory | 128 kb |

Interface Data

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|----------------------------|-------------------------|
| Interface | USB3.0 (5000 Mbits/sec) |
| USB Vendor ID / Product ID | 0x2825 / 0x12E |

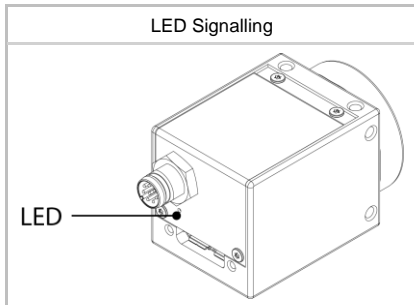
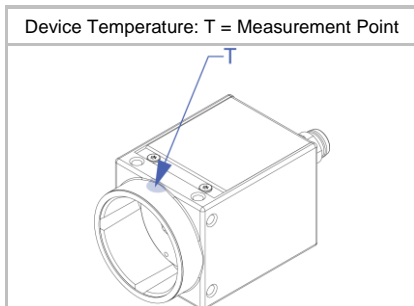
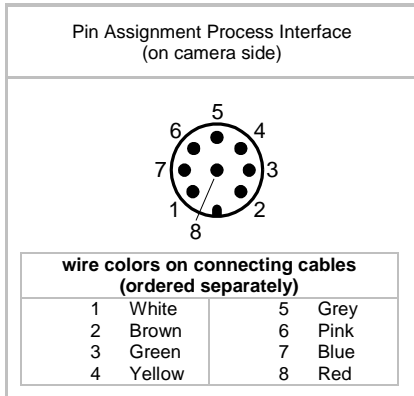
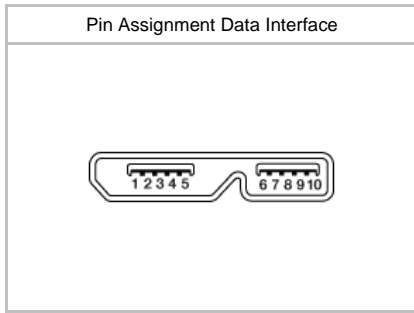
USB 3 Vision® Features

| | |
|---|--|
| Events | DeviceTemperatureStatusChanged, EventLost, ExposureEnd, ExposureStart, FrameEnd, FrameStart, FrameTransferSkipped, Line0..2 FallingEdge, Line0..2 RisingEdge, TransferBufferFull, TransferBufferReady, TriggerOverlapped, TriggerReady, TriggerSkipped up to 2 ³² |
| Transmission via Asynchronous Message Channel | |
| Frame Counter | up to 2 ³² |
| Payload Size | 0 ... 10617056 Byte |
| Timestamp | 64 bit, resolution in nsec, increment = 10 |
| USB Vision | v1.0.1 |

Interfaces and Connectors

| | | | |
|--------------------------|----------------|-----------------|-----------------|
| Data and Power Interface | USB 3.0 | Transfer Rate | 5000 Mbits/sec |
| | USB 2.0 | Transfer Rate | 480 Mbits/sec |
| | Connector: | | USB 3.0 Micro B |
| Pin Assignment: | 1 - VBUS | 2 - D- | |
| | 3 - D+ | 4 - ID | |
| | 5 - GND | 6 - MicB_SSTX- | |
| | 7 - MicB_SSTX+ | 8 - GND_DRAIN | |
| | 9 - MicB_SSRX- | 10 - MicB_SSRX+ | |

¹⁾ Sensor readout, different from pixel format



Interfaces and Connectors

| | | |
|-------------------|-------------|--|
| Process Interface | Connector: | M8/8-pin (SACC-DSI-M8MS-8CON-M8-L180) |
| | Assignment: | 1 - GPIO (Line2) 2 - not connected 3 - IN1 (Line0) 4 - GND IN1 5 - Power VCC 6 - OUT1 (Line3) OUT1 8 - GPIO (Line1) 7 - GND GPIO |

Caution



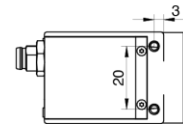
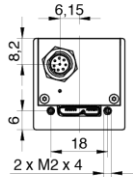
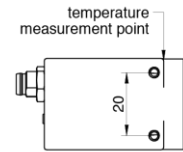
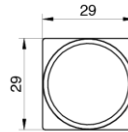
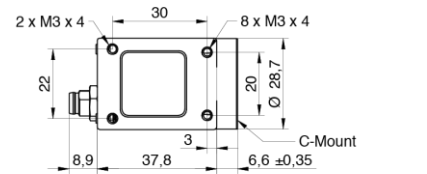
* Note GPIOs: Ground loops are to be avoided and can lead to destruction of the device.

Optical Data

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

Mechanical Data

| | |
|------------------|--|
| Housing | Zinc die casting, baked varnish (until 02-2020 nickel-chrome-plated) |
| Protection Class | IP40 (with mounted lens and USB 3.0 cable) |
| Weight | 90 g |
| Dimensions | |




Environmental Data

| | |
|-------------------------|--|
| Storage Temperature | -10 °C ... + 70 °C |
| Operating Temperature | 0 °C ... +65 °C @ T = Measurement Point or 0 °C ... +75 °C @ internal Temperature Sensor Ambient temperature above 28 °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 |

LED Signalling

| | | |
|-----|-------------|------------------------------|
| LED | Green flash | Power on, no link active |
| | Green | Link active USB 3.0 |
| | Red | Error or Link active USB 2.0 |
| | Yellow | Sensor Readout activity |
| | Red flash | Update |

Electrical Data

| | |
|---|---|
| Power Supply | bus powered via USB3.0 interface |
| Power Consumption | approx. 3.9 W @ 73 fps (Factory Setting "Default") |
| Digital Input | Optocoupler $U_{IN(low)}$: 0.0 ... 4.5 VDC $U_{IN(high)}$: 11.0 ... 30.0 VDC I_{IN} : 3.0 ... 10.0 mA min. Impulse Length: 2.0 μ sec |
| Digital Output | Optocoupler U_{EXT} : 5 ... 30 V DC I_{OUT} : max. 50 mA t_{ON} = typ. 3 μ sec t_{OFF} = typ. 40 μ sec |
| GPIO | direct, without optocoupler |
| GPIO used as Input: | $U_{IN(low)}$: 0.0 ... 0.8 VDC $U_{IN(high)}$: 2.0 ... 30.0 VDC min. Impulse Length: 2.0 μ sec |
| GPIO used as Output: | $U_{Out(low)}$: 0.0 ... 0.4 VDC ($I_{sink\ max}$: 50 mA) $U_{Out(high)}$: 2.4 ... 3.3VDC (I_{max} : 1 mA) |
| Caution  | * The General Purpose I/Os (GPIOs) are not potential-free and do not have an overrun cut-off. Incorrect wiring (overvoltage, undervoltage or voltage reversal) can lead to defects in the electronic system. Ground loops are to be avoided and can lead to destruction of the device. |

Conformity

| | |
|----------------------------|--|
| Conformity | CE, RoHS, REACH, KC, EAC |
| KC Registration No. / Date | R-R-BkR-VCXU-53M / 08.12.2020 |
| MTBF | 67 years @ T = 45 °C / 44 years @ T = 60 °C T = Measurement Point |

GeniCam™ Features

| | |
|----------------------|---|
| Short Exposure Range | - |
| Timer | Timer Selector: Timer Selector: Timer 1 TimerTriggerSource: Line0, SoftwareTrigger, ExposureStart, ExposureEnd, FrameTransferSkipped, TriggerSkipped, Off TimerDelay: 0 μ sec ... 2 sec, Step Size: 1 μ sec TimerDuration: 4 μ sec ... 2 sec, Step Size: 1 μ sec |
| Counter | Counter Selector: Counter 1, Counter 2 CounterValue: 0 ... 65535 Counter Event Source: Counter1End or Counter2End, ExposureActive, FrameTransferSkipped, FrameTrigger, TriggerSkipped, Line0..2 and Off Counter Reset Source: Counter1End, Counter2End, Line0..2 and Off |
| Sequencer | Sequencer Characteristics: up to 128 sets, up to 4 possible pathes for triggered set transitions, 6 trigger sources: Counter1End, Counter2End, ExposureActive, Line0..2, 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 13.6 msec |
| Chunk Data | yes, Chunk Selector: Binning, BlackLevel, CounterValue, DeviceTemperature, ExposureTime, FrameID, Gain, Height, Image, ImageControl, LineStatusAll, OffsetX, OffsetY, PixelFormat, SequencerSetActive, Timestamp, Width |
| 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 with CustomDataKonfiguration Mode |
| 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 | ON |
| Digital Input | Line0, invert = false |
| Digital Output | Line3, invert = false, line source = Off |
| GPIO 1/2 | Line1, Line2, invert = false, LineMode = Input |
| TriggerSource | All |

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

| | Resolution | max. fps acquisition | max. fps interface ²⁾ |
|----------|-------------|----------------------|----------------------------------|
| Full HD | 1920 x 1080 | 185 | 185 |
| SXGA | 1280 x 1024 | 286 | 286 |
| HD720 | 1280 x 720 | 401 | 401 |
| XGA | 1024 x 768 | 463 | 463 |
| SVGA | 800 x 600 | 726 | 726 |
| VGA | 640 x 480 | 918 | 918 |
| CIF | 352 x 288 | 1417 | 1417 |
| QVGA | 320 x 240 | 1640 | 1640 |
| QCIF | 176 x 144 | 2393 | 2393 |
| LineScan | 2592 x 2048 | 73 | 73 |
| | 2592 x 1024 | 146 | 146 |
| | 2592 x 512 | 286 | 286 |
| | 2592 x 256 | 552 | 552 |
| | 2592 x 128 | 1030 | 1030 |
| | 2592 x 64 | 1816 | 1816 |
| | 2592 x 32 | 2936 | 2936 |
| | 2592 x 16 | 4244 | 4244 |
| | 2592 x 8 | 5460 | 5460 |
| | 2592 x 4 | 6373 | 6373 |
| | 2592 x 2 | 6955 | 6955 |
| | 2592 x 1 | 7288 | 7288 |

²⁾ depends on the used interface