

Datasheet

Features

- Cmos Monochrome Multi-Line Sensor :
 - 4096 RGB Pixels 5x5µm : 1, 2 or 4 Lines
 - 2048 RGB Pixels 10x10µm : 1 or 2 Lines
- Interface : NBASE-T™ (up to 5Gb/s)
- Line Rate : Up to 140 kl/s in 8bits
- Bit Depth : 8, 10 and 12bits
- Scan Direction
- Flat Field Correction
- Cycling Preset Modes and Memories
- Multi ROI
- Look up Table
- HDR Mode
- Metadata
- Rotary Encoder
- Mounts : F, C, M42 (embedded)



Description

To maintain their competitive advantage, industrial leaders in the machine vision market have a continuous requirement to improve defect detection accuracy and reduce the cost of imaging. The availability of the ELiXA+ cameras with an NBASE-T™ connection offers a straightforward solution, providing:

- High throughput - enabling high resolution and colour imaging without a frame grabber at speeds of up to 5 Gigabits per second (Gbps) over Category 5e standard Ethernet cable.
- Easy integration – compatible with GigE Vision protocol.
- Long-length (100 meters+), field terminable, inexpensive cabling - reduces costs and enables easier integration in imaging systems compared with optic fibre cabling

Applications

- Raw material surface inspection
- Parcel and postal sorting
- High resolution document scanning
- Print and paper inspection
- Industrial Inspection



Key Specifications

| Characteristics | Typical Value | | Unit |
|--|--------------------|----------|---------------------------|
| Sensor Characteristics at Maximum Pixel Rate | | | |
| Resolution | 4 x 4096 | 2 x 2048 | Pixels |
| pixel size (square) | 5 | 10 | μm |
| Max Line Rate (in 8 or 10Bits) | 140 | 140 | kHz |
| Radiometric Performance at Maximum Pixel Rate and minimum camera gain | | | |
| Bit depth | 8 / 10 / 12 | | Bits |
| Response non linearity | < 1 | | % |
| PRNU HF Max | 3 | | % |
| Dynamic range | 65 | | dB |
| Response (broadband) | 450 | | LSB/(nJ/cm ²) |
| Full Well Capacity | 18000 | | electrons |
| Dynamic range (1S / 2S / 4S mode) | 67,6 / 70,7 / 68,7 | | dB |

Test conditions :

- All values are given at Nominal Gain (0dB) : Preamp Gain x1, Amp Gain 0dB
- Figures in LSB are for a 12bits format
- Measured at exposure time = 400μs and line period = 400μs in Ext Trig Mode (Max Exposure Time)
- Maximum data rate

| Functionality (Programmable via GenICam Control Interface) | | |
|---|--|-------------------------|
| Analog Gain | Up to 12 (x4) | dB |
| Offset | -4096 to +4096 | LSB |
| Trigger Mode | Timed (Free run) and triggered (Ext Trig, Ext ITC) modes | |
| Sensor Modes | 4k Pixels 5μm : Multi-Lines 1, 2 or 4 2k Pixels 10μm : Binning 1 or 2 Lines | (1S/2S/4S) (1SB/2SB) |
| Mechanical and Electrical Interface | | |
| Size (w x h x l) | 60 x 60 x 55 | mm |
| Weight | 247/335 without/with Heat Sinks | g |
| Lens Mounts | C, F, M42 (embedded in the Front Face) | - |
| Sensor alignment | ±100 | μm |
| Sensor flatness | ±50 | μm |
| Power supply | 12 - 24 | V |
| Power dissipation | < 11 | W |
| General Features | | |
| Operating temperature | 0 to 60 (front face) or 85 (Internal) | °C |
| Storage temperature | -40 to 70 | °C |
| Regulatory | CE, FCC and RoHS compliant | |

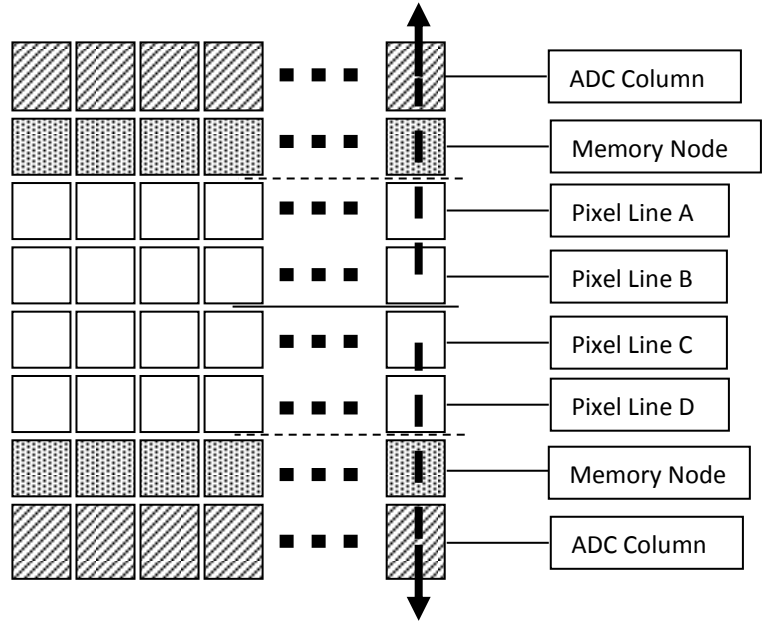
Image Sensor and Modes

Image Sensor

The Elixa+ 4k sensor is composed of two pairs of sensitive lines. Each pair of lines use the same Analog to Digital Column converter (ADC Column). An appropriate (embedded) Time delay in the exposure between each line allows combining two successive exposures in order to double the sensitivity of a single line.

This Time Delay Exposure is used only in the 4S multi-line modes (4 Lines) and also in the three binning modes, as described below.

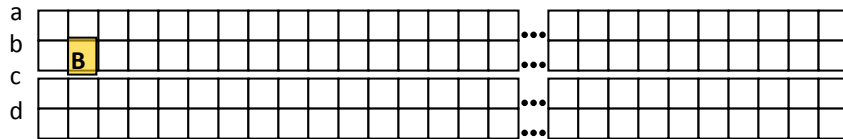
The 2048 Pixels of 10µm are achieved by the binning of 4 Pixels together.



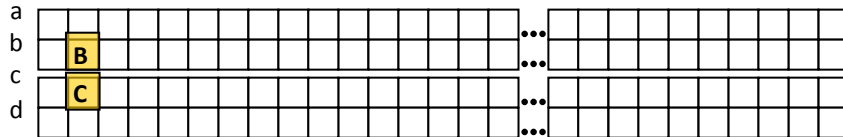
Sensor modes

4K Pixels 5µm

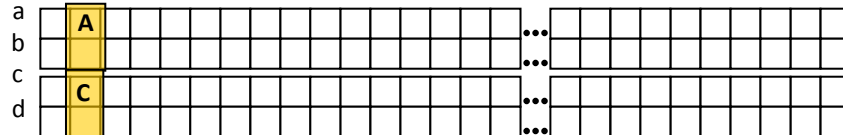
Mode 1S = B



Mode 2S = B+C (FPGA)

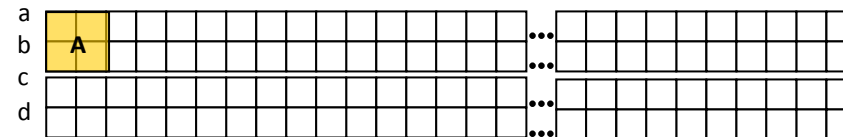


Mode 4S = (A.B)+(C.D)
 Note : (A.B) = summation in the sensor

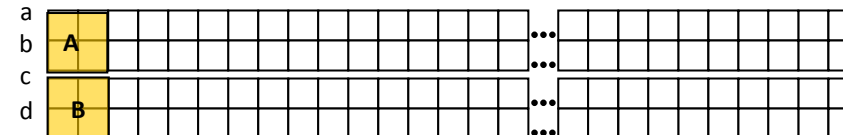


2k Pixels 10µm

Mode 1SB = A

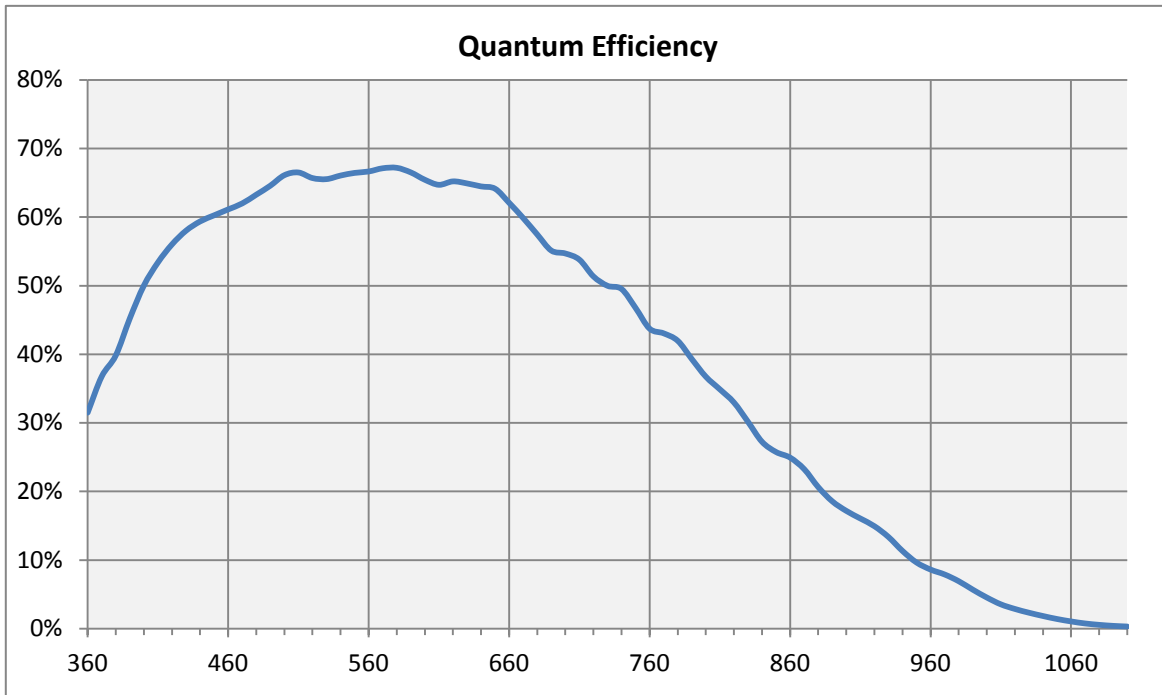


Mode 2SB = (A+B)



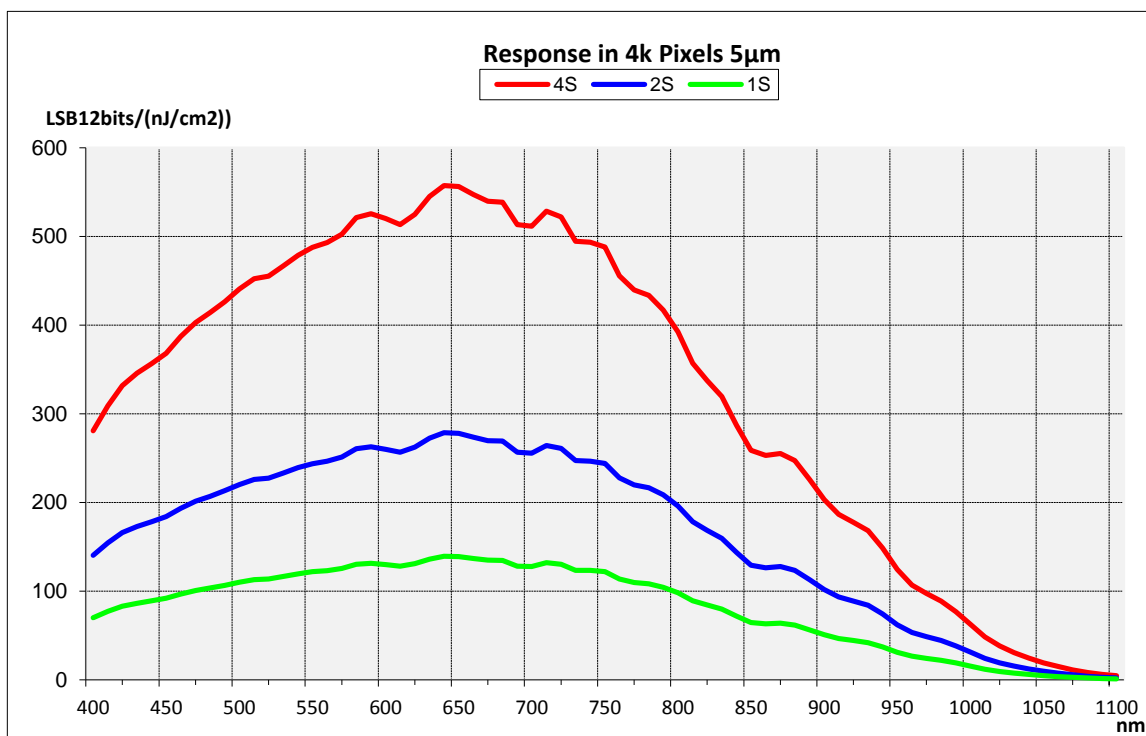
Response & QE curves

Quantum Efficiency

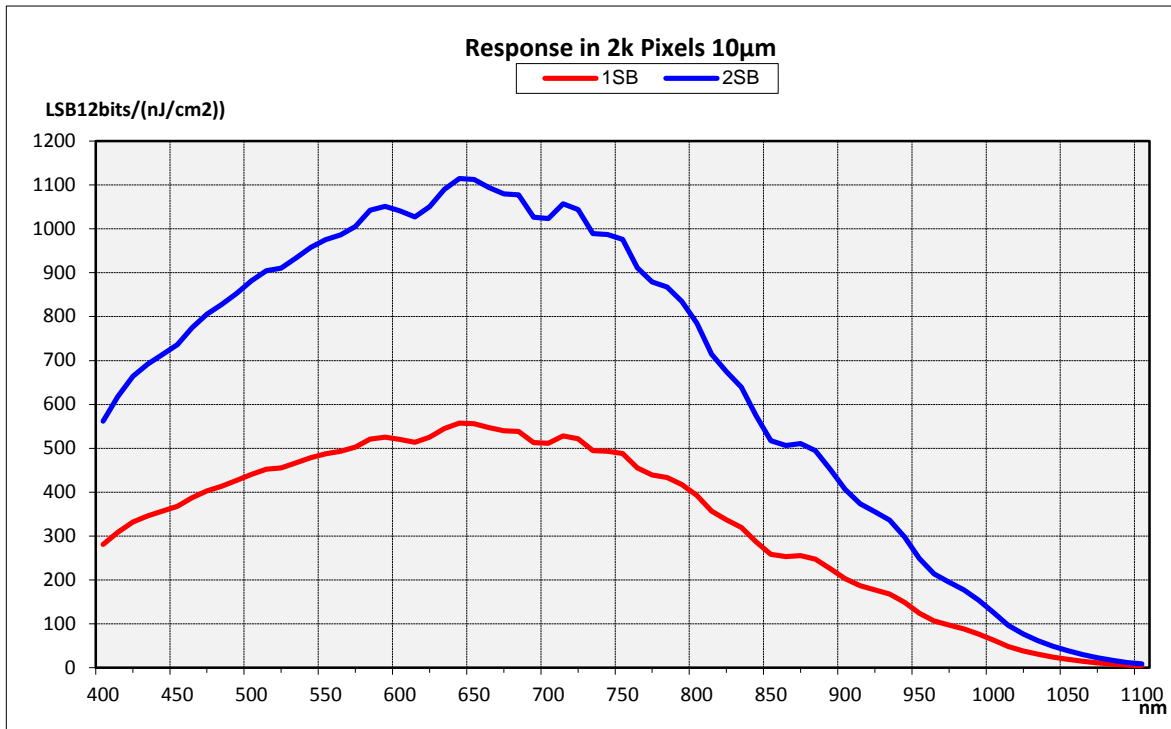


Spectral Responses

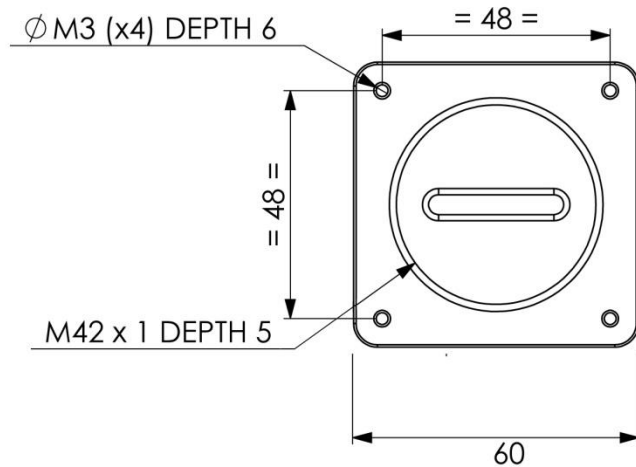
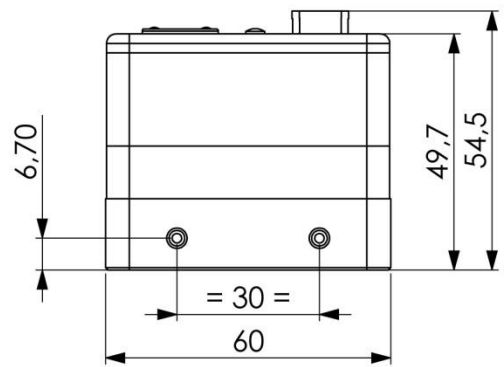
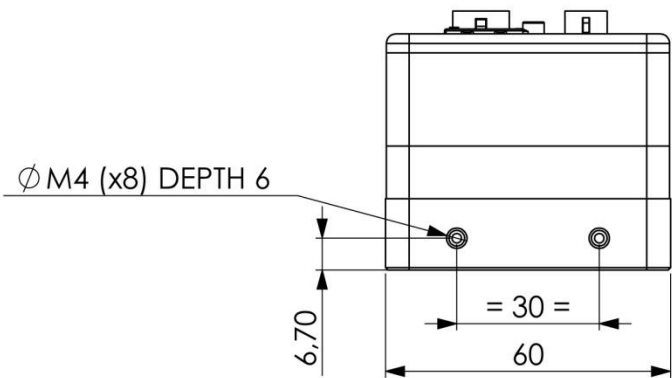
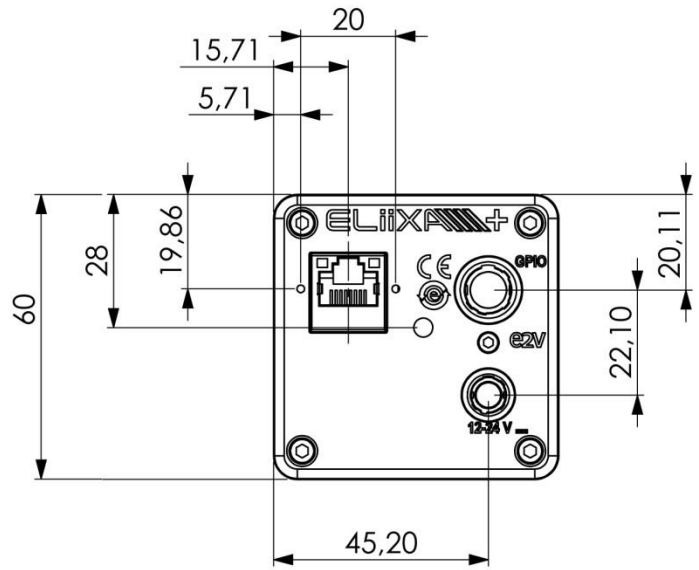
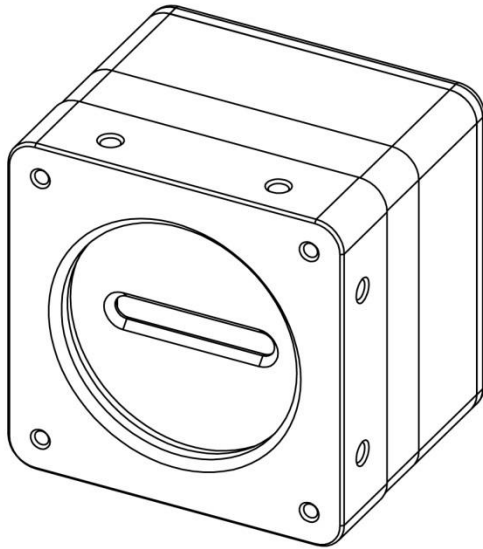
Single Modes : 1S, 2S, 4S



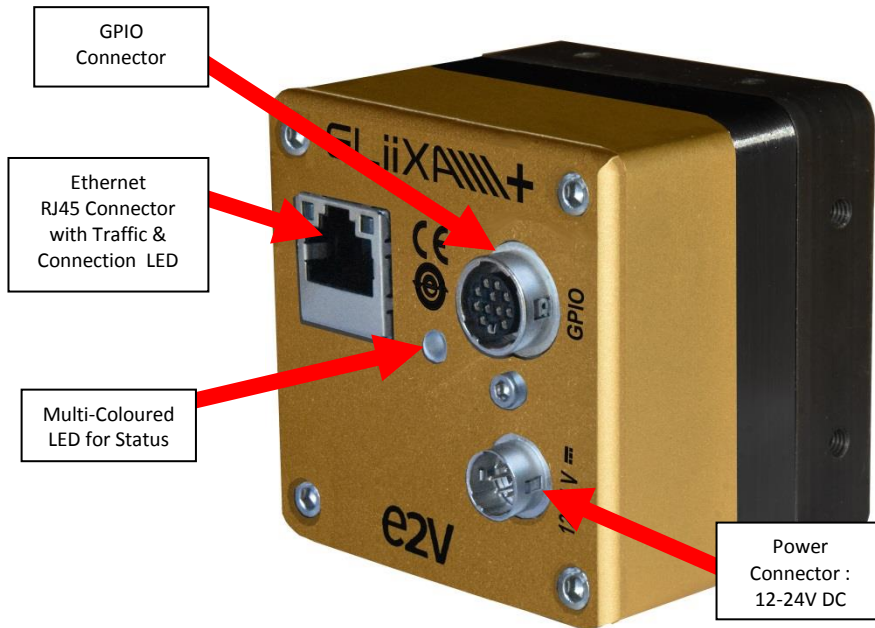
Binning Modes : 1SB, 2SB



Camera Hardware Interface



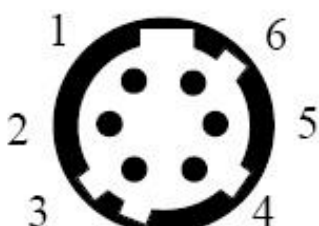
Input/output Connectors and LED



Power Connector

Camera connector type: Hirose HR10A-7R-6PB (male)

Cable connector type: Hirose HR10A-7P-6S (female)

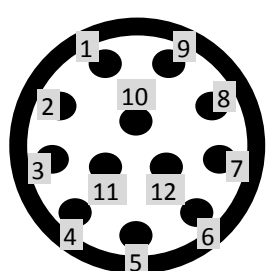
|  Camera side description | | Signal | Pin | Signal | Pin |
|--|--|--------|-----|--------|-----|
| | | PWR | 1 | GND | 4 |
| | | PWR | 2 | GND | 5 |
| | | PWR | 3 | GND | 6 |
| Power supply from 12 to 24v Power 11W max with an typical inrush current peak of 1A during power up | | | | | |

GPIO Connector

Camera Connector type: Hirose HR10A-10R-12SB

Cable Connector type: Hirose HR10A-10R-12P

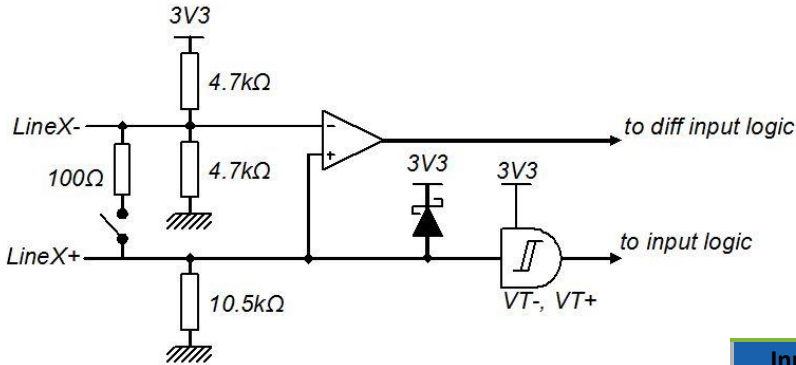
Cable type: cable immune from interference and with twisted pairs

|  Camera side description | | Signal | Pin | Signal | Pin |
|--|--|---------|-----|---------|-----|
| | | Line 0+ | 1 | Line 3+ | 7 |
| | | Line 0- | 2 | Line 4+ | 8 |
| | | Line 1+ | 3 | Line 5+ | 9 |
| | | Line 1- | 4 | Line 6+ | 10 |
| | | Line 2+ | 5 | GND | 11 |
| | | Line 2- | 6 | GND | 12 |

Lines 0, 1 and 2

The GPIO Connector allows the following connections :

- **Line 0, 1 or 2** : Dedicated inputs for Line Triggers and Frame Trigger. Differential (RS422 with or without termination) or TTL (Single End) in 3.3V, 5V, 12V or 24V.

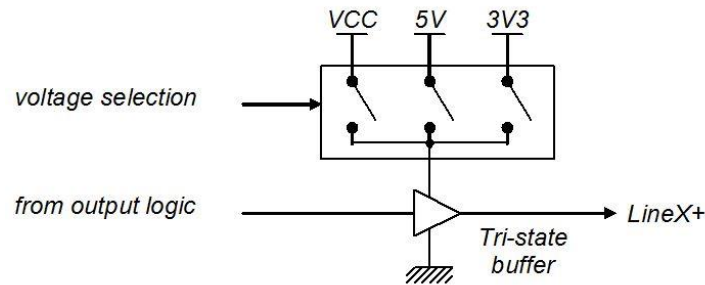


| Input Thresholds | VT- Min | VT+ Max | Unit |
|------------------|---------|---------|------|
| 24V | 5.5 | 10.7 | V |
| 12V | 2.9 | 5.5 | V |
| 3.3 / 5V | 0.8 | 1.5 | V |

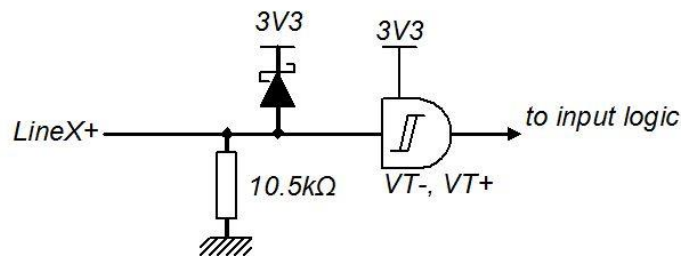
Lines 3, 4, 5 and 6

- **Line 3, 4, 5 and 6** : Configurable Inputs or Outputs in TTL only :
 - Input Configuration : Single End in 3.3V, 5V, 12V or 24V
 - Output configuration : Single End or Open Collector in 3.3V, 5V, or Camera power Supply

INPUT Configuration



OUTPUT Configuration



Camera Interface : NBASE-T™

What is the NBASE-T™ Technology ?

NBASE-T™ technology defines a new type of Ethernet signaling that boosts the speed of installed based twisted-pair cabling well beyond the cable's designed limit of 1 Gigabit per second (Gbps) for distances up to 100 meters. Capable of reaching 2.5 and 5 Gbps using the large installed base of Cat5e and Cat6 cabling, NBASE-T™ solutions enable users to accelerate their networks in the most cost-effective, least disruptive manner.

Flexible silicon solutions can auto-negotiate the optimal network speed, be it the new NBASE-T™ rates, slower 2.5 Gbps and 5 Gbps rates, or—if the network infrastructure supports it—10 Gbps

To introduce these new cameras, e2v has partnered with Pleora Technologies, the world's leading supplier of high-performance video interfaces, the first company from the machine vision industry to join the NBASE-T™ Alliance, a consortium collaborating on new technologies that extend the bandwidth capabilities of twisted-pair copper cabling using standard Ethernet technology.



Then all NBASE-T™ ELiXA+ are licensed for Pleora eBus SDK and PureGeV Software that you can download on Pleora website (<http://www.pleora.com/our-products/ebus-sdk>)

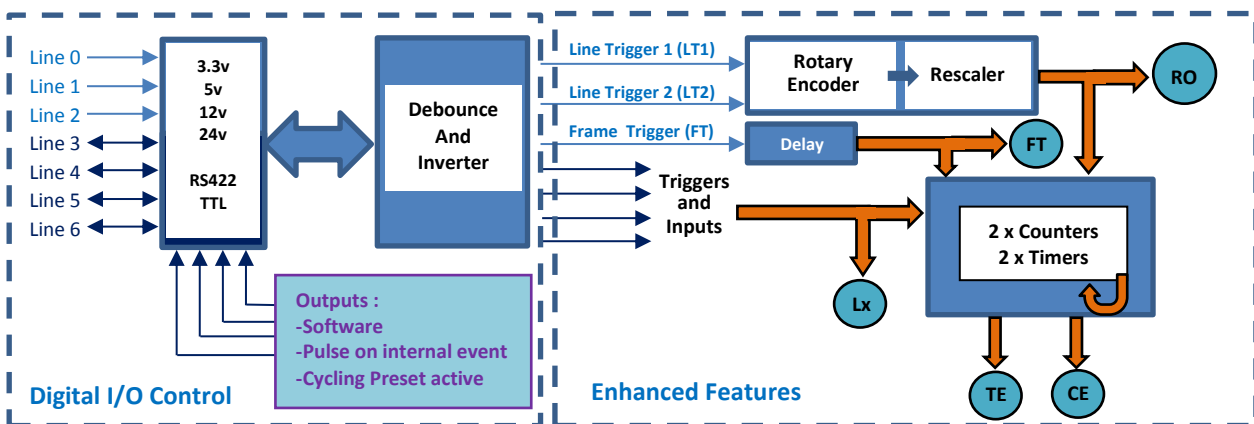
Camera Interface : GPIO

The GPIO Modules allows the connection of 7 external Lines :

- 3 dedicated inputs : 2 Line Triggers (LT1 and LT2) and one Frame Trigger (FT)
- 4 convertible generic Inputs / Outputs

A flexible in/Out block in RS422 or TTL with different detection levels (3.3v, 5v, 12v, 24v/Camera Power Supply) with a lot of features :

- Debounce filter and Inverter on each Input
- A delay dedicated to the Frame Trigger only (FT)
- A Full Rotary Encoder management (Quadratic with or without reverse miscount)
- A Rescaler following the Rotary Encoder module (available also if Rotary Encoder is bypassed)
- 2x Counters and 2x Timers
- 4x Outputs which can be set on Software, Start Frame or each individual Cycling Preset mode used.



GenICam Triggers

Four GenICam Triggers can be configured :

Four GenICam Triggers can be configured :

- Line Start Trigger : Start the Line on an Edge variation of the Source
- Exposure Active Trigger : Exposure active on a certain Level of the Source
- Frame Start Trigger : Start the Frame on an Edge variation of the Source
- Frame Active Trigger : Frame active on a certain Level of the Source

Each Trigger has these 5 following parameters :

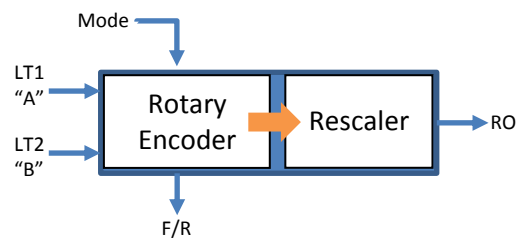
- Trigger Mode : Activates the Trigger. Only on Line and Frame Trigger activated in the same time.
- Trigger Source : Defines the Signal which is the Source of the Trigger (see table below)
- Trigger activation : Defines how the Source activate the Trigger (on edge for Line Start and Frame Start or level for Exposure Active and Frame Active)
- TriggerMaskSource : Defines the signal that can be set to enable/disable the Trigger
- TriggerMaskActivation : Defines on which level the TriggerMaskSource is activated.

Rotary Encoder

The Embedded Rotary Encoder is managed by the two inputs Lines :

- Line Trigger 1 taken as “A” quadrature input
- Line Trigger 2 taken as “B” quadrature input

The Encoder takes in account the Forward/Reverse indication given to the camera (by software or external input) to determine the forward or Reverse position of the A and B quadrature inputs. Its “Forward/Reverse” outputs is just an indication of its working mode as soon as it is not disabled but has no action on the camera scanning direction.



The Output of the Rotary Encoder enters a Rescaler (Multiplier / Divider) that can be also bypassed (neutral).

The Rotary encoder has two working modes :

- Quadratic without miscount : The Encoder is sending only forward lines. Any reverse line is not sent and not counted.
- Quadratic with miscount : The Encoder is sending only forward lines but reverse lines are miscount in an internal counter. The Encoder will restart sending Line triggers as soon as each reverse Line miscounted has been recounted forward.

The Rotary Encoder can be bypassed. Then the “B” input is disabled and the Line Trigger 1 (LT1) connected on input “A” is passing through the Rotary encoder to enter the Rescaler

The Rotary encoder can’t be used by changing the camera operation (Forward/Reverse) “on the fly” as some sensor modes require some reset and some time to change the scanning direction.

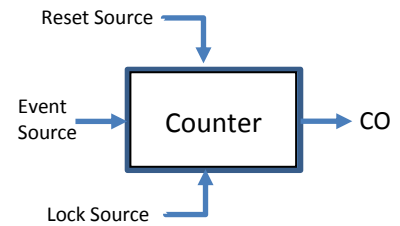
Counters

The Counter counts the Event Source Edges.

The counter Duration is set and when the counted value reaches the duration, the Output of the counter rises to 1. If the reset input of the counter is not set (Off), the counter resets immediately : The end count value is set in the “Value at Reset”, the output is reset and Counter restarts counting on the same event.

The Reset input can be set on an external source and also can maintain the reset of the counter (on level)

As soon as the Reset input is set but not active, the counter counts. If it reaches the duration before any reset, the output rises to 1 and the counter carries on counting. Then if the Reset arises, the “Value at Reset” is set with the current value (even higher than the duration), the output is set to 0 and the counter can restart counting on the same even as soon as the reset input switches down to 0.



If the Reset arises before the counter has reached the duration, the “Value at Reset” is set with the current value (even lower than the duration), the output is set to 0 and the counter can restart counting on the same even as soon as the reset input switches down to 0.

The Counter can also be locked by an external source : As soon as the lock input is active, the counter value doesn't increment on an Event Source edge but can be reset if the reset signal arises.

Timers

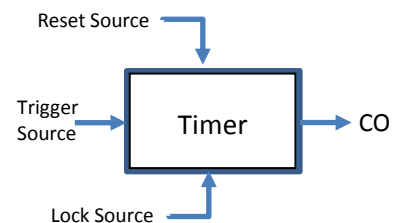
The Timer starts on its Trigger Source Edge

The Timer Duration is set and when this value is reached, the Timer output rises to 1. If the Reset source is not set (Off) then the Timer resets immediately : The output is reset and Timer restarts after the same event edge.

As soon as the Reset input is set but not active, the timer Output remains to 1.

When the Reset arises, the output is set to 0 and the Timer can restart as soon as the reset input switches down to 0. If the reset arises before the end of the Timer duration, the Timer is reset without switching to 1 and can restart as soon as the reset input switches down to 0.

The Timer can also be locked by an external source : As soon as the lock input is active, the Timer stops at its current timing value and can be reset if the reset signal arises. The Timer restarts form its current timing position when the reset input is released.

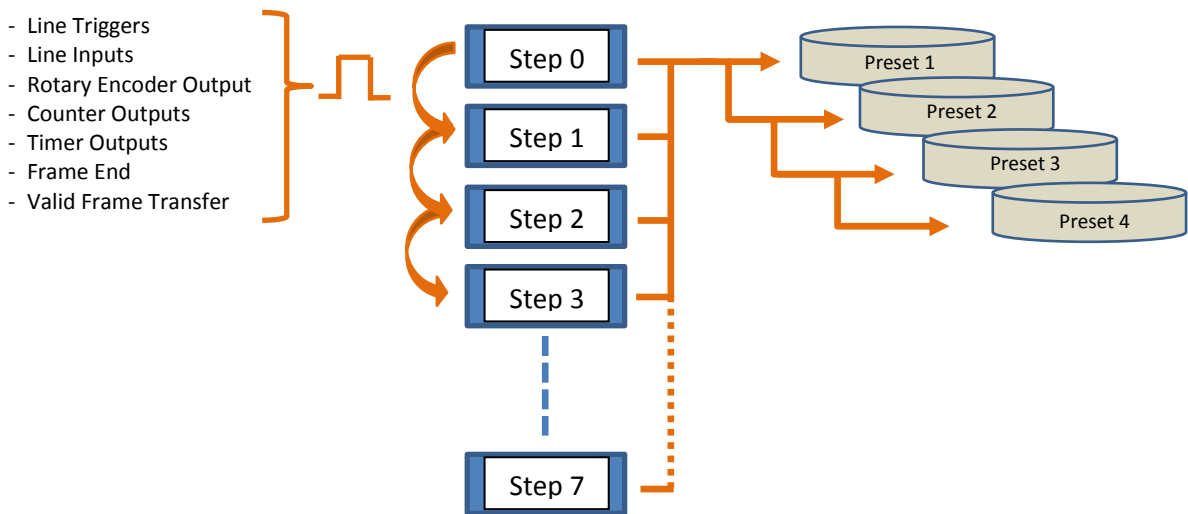


Cycling Preset modes and configuration

The Cycling Preset mode is the possibility for the camera to switch at least for each line between 4x sets of pre-defined parameters including :

- Exposure Time and Exposure Delay
- Flat Field Correction
- Gain (Amplification Gain)
- White Balance Gains
- RGB Colour Correction Matrix

The Cycling Preset mode configuration allows up to 8 different steps for switching between this choice of 4 sets of parameters and thus with the arising of different possible events (Line Input, Line Trigger, Frame Trigger, end of Counter and/or Timer ...) :



Models

| Part Number | Definition | Max Speed | Details |
|--------------------|------------|-----------|-------------------------------------|
| EV71YC4MNT4005-BA0 | 4k x 5µm | 140kHz | Delivered with a pair of Heat Sinks |
| EV71YC4MNT2010-BA0 | 2k x 10µm | 140kHz | |