

**Digital Monochrome (b/w)  
Progressive Scan Camera**

 System: **Gigabit Ethernet**

# Baumer TXG06

Revision 2

**Art. No: OD108078**

- Gigabit Ethernet progressive scan CCD camera
- 776 x 582 pixel
- Up to 64 full frames per second
- GigE Vision™ standard compliant
- Outstanding image quality
- High sensitivity and dynamic range
- High quality slow scan mode for lowest readout noise
- Binning and true partial scan function (ROI) for increased frame rates
- External synchronization via industrial compliant process interface (trigger / flash)
- integrated supplementary function for flexible integration
- Sequence function up to  $2^{31} - 1$  frames per sequence
- Supported jumbo frames
- Integrated 32 MByte RAM for temporarily image data buffering
- Camera parameter programmable in real-time
- Ultra compact and lightweight aluminum housing
- Standard RJ45 connector
- Screw-lock type industrial connector
- Baumer-GAPI: Flexible, generic software interface for Windows / Linux



shown lens needs to be ordered separately

## 1. Overview

| Model Name                     | TXG06  |
|--------------------------------|--|
| <b>Sensor</b>                  | 1/2" interline progressive scan CCD              |
| Shutter / readout mode         | global shutter / progressive scan readout        |
| Number of pixel                | 776 x 582  |
| Scan area                      | 6.47 mm x 4.83 mm                                |
| Pixel size                     | 8.3 μm x 8.3 μm                                  |
| Color filter                   | -  |
| <b>Operation modes</b>         |  |
| Trigger mode                   | yes, overlapped operation                        |
| Free running mode              | yes, overlapped operation                        |
| <b>Signal processing</b>       | real-time software programmable                  |
| Pixel clock                    | 40 MHz fast scan / 20 MHz high quality (HQ) scan |
| A/D converter                  | 12 bit   |
| Exposure control ( $t_{exp}$ ) | total: 4 μsec .. 60 sec<br>step 1 μsec           |
| Gain control                   | 0 .. 20 dB                                       |
| Offset (black level)           | 0 .. 255 LSB (12 bit)                            |
| Image data buffer              | 32 MByte   |

Technical specifications subject to change

| Image acquisition              |   |                |                 |           |               |                 |                    |                      |
|--------------------------------|---|----------------|-----------------|-----------|---------------|-----------------|--------------------|----------------------|
| Camera image format modes      |   | Format (pixel) | GenCam standard | Format ID | Pixel format  | Pixel clock MHz | Frames per sec. *) | t <sub>readout</sub> |
| Full frame HQ                  | slow  | 776 x 582      | Vendor specific | 00        | Mono8 **)     | 20              | 32                 | 31 msec              |
|                                |   |                |                 |           | Mono12        |                 |                    |                      |
|                                |   |                |                 |           | Mono12 Packed |                 |                    |                      |
| Full frame                     | fast  | 776 x 582      | yes             | 01        | Mono8 **)     | 40              | 64                 | 15.5 msec            |
|                                |   |                |                 |           | Mono12        |                 |                    |                      |
|                                |   |                |                 |           | Mono12 Packed |                 |                    |                      |
| Binning 2x2 HQ                 | slow  | 388 x 291      | Vendor specific | 02        | Mono8 **)     | 20              | 64                 | 15.5 msec            |
|                                |   |                |                 |           | Mono12        |                 |                    |                      |
|                                |   |                |                 |           | Mono12 Packed |                 |                    |                      |
| Binning 2x2                    | fast  | 388 x 291      | yes             | 03        | Mono8 **)     | 40              | 127                | 8 msec               |
|                                |   |                |                 |           | Mono12        |                 |                    |                      |
|                                |   |                |                 |           | Mono12 Packed |                 |                    |                      |
| Binning 1x2 HQ                 | slow  | 776 x 291      | Vendor specific | 04        | Mono8 **)     | 20              | 64                 | 15.5 msec            |
|                                |   |                |                 |           | Mono12        |                 |                    |                      |
|                                |   |                |                 |           | Mono12 Packed |                 |                    |                      |
| Binning 1x2                    | fast  | 776 x 291      | yes             | 05        | Mono8 **)     | 40              | 127                | 8 msec               |
|                                |   |                |                 |           | Mono12        |                 |                    |                      |
|                                |   |                |                 |           | Mono12 Packed |                 |                    |                      |
| Binning 2x1 HQ                 | slow  | 388 x 582      | Vendor specific | 06        | Mono8 **)     | 20              | 32                 | 31 msec              |
|                                |   |                |                 |           | Mono12        |                 |                    |                      |
|                                |   |                |                 |           | Mono12 Packed |                 |                    |                      |
| Binning 2x1                    | fast  | 388 x 582      | yes             | 07        | Mono8 **)     | 40              | 64                 | 15.5 msec            |
|                                |   |                |                 |           | Mono12        |                 |                    |                      |
|                                |   |                |                 |           | Mono12 Packed |                 |                    |                      |
| <b>Standard features</b>       |   |                |                 |           |               |                 |                    |                      |
| <b>Image size controls</b>     |   |                |                 |           |               |                 |                    |                      |
| Binning horizontal             | yes, 1 or 2   |                |                 |           |               |                 |                    |                      |
| Binning vertical               | yes, 1 or 2   |                |                 |           |               |                 |                    |                      |
| Pixel format                   | Mono8, Mono12, Mono12Packed   |                |                 |           |               |                 |                    |                      |
| Test image selector            | yes, in all modes<br>Off, GreyHorizontalRamp, GreyVerticalRamp,<br>HorizontalLineMoving, VerticalLineMoving<br>HorizontalAndVerticalLineMoving  |                |                 |           |               |                 |                    |                      |
| Partial scan                   | yes, format freely programmable in all modes<br>(binning on partial scan ok)  |                |                 |           |               |                 |                    |                      |
| <b>Analog controls</b>         |   |                |                 |           |               |                 |                    |                      |
| Gain                           | yes   |                |                 |           |               |                 |                    |                      |
| Black Level (Off set)          | yes   |                |                 |           |               |                 |                    |                      |
| Gamma                          | yes, user programmable (available if LUT is enable) ***)<br>total: 0.001 .. 2   |                |                 |           |               |                 |                    |                      |
| Brightness correction (custom) | yes, in all binning modes   |                |                 |           |               |                 |                    |                      |
| <b>Acquisition and Trigger</b> |   |                |                 |           |               |                 |                    |                      |
| Acquisition mode               | Continuous  |                |                 |           |               |                 |                    |                      |
| Trigger source                 | HardwareTrigger (Line0), SoftwareTrigger, CommandTrigger (ActionCommand), All and Off   |                |                 |           |               |                 |                    |                      |
| Trigger delay                  | 0 .. 2 sec, 512 trigger can be tracked  |                |                 |           |               |                 |                    |                      |
| Sequencer                      | Up to 2 <sup>31</sup> -1 frames per sequence / one exposure time and gain values for each sequence<br>max. set of sequences: Up to 2 <sup>31</sup> -1 frames x 256 exposure times and gain values |                |                 |           |               |                 |                    |                      |

|  |   |
|--|---|
| <b>Digital I/O</b>                       |   |
| Lines                                    | Line0 (Input), Line1 (Output)   |
| Line source (outputs only)               | Line1: ExposureActive or UserOutput   |
| Line debouncer                           | yes, low and high signal separately selectable<br>0 .. 5 msec<br>step: 1µsec  |
| <b>Event Generation</b>                  |   |
| Events                                   | GigEVisionError, EventLost, Line0RisingEdge, Line0FallingEdge, Line1RisingEdge, Line1FallingEdge, ExposureStart, ExposureEnd, FrameStart, FrameEnd, TriggerReady, TriggerOverlapped, TriggerSkipped   |
| Event Notification                       | yes, ON / OFF   |
| <b>Counters and Timers</b>               |   |
| Framecounter                             | yes, 2 <sup>32</sup><br>can be set by user  |
| <b>LUT Controls</b>                      |   |
| LUT selector                             | 1 LUT: Luminance (12 bit)<br>ON / OFF   |
| Defect pixel correction (custom)         | yes, ON / OFF   |
| Defect pixel list (custom)               | yes, max. 256 pixel coordinates (x, y) can be stored  |
| <b>GigEVisionTransportLayer</b>          |   |
| PayLoadsize                              | 4 Byte .. 903.536 Byte  |
| <b>UserSets</b>                          |   |
| User set selector                        | Default (factory settings)<br>UserSet1, UserSet2, UserSet3 (read and write)   |
| UserSetDefaultSelector                   | yes, define the start up "UserSet"  |
| <b>Advanced features</b>                 |   |
| Time stamp function                      | yes, 64 bit<br>tick = 32 nsec   |
| Asynchronous message channel             | yes   |
| Concatenation function                   | yes   |
| User defined identifier                  | yes, user programmable permanent identifier   |
| ActionCommand                            | yes, ID 0 = Trigger   |
| <b>Data quality</b>                      |   |
|  | at 20 °C, gain = 1, exposure time = 32 msec,<br>full frame mode, slow scan  |
| Readout noise                            | $\sigma < 0.5$ LSB (8 bit) typical  |
| Dynamic range                            | typical > 54 dB   |
| <b>Optical interface</b>                 |   |
|  | C-Mount<br>on request: CS-Mount   |
| Optical filter                           | dust protection<br>on request: super polished, IR cut filter, daylight filter or no filter  |
| <b>Process interface functions</b>       |   |
| Async. Trigger                           | yes, trigger mode operation,<br>"Off", "software trigger", "hardware trigger", "command trigger" and "all" separately selectable<br>(overtriggered signals and trigger signals during the readout time will be notified in the received image header) |
| Exposure Active<br>(External flash sync) | yes,<br>delay_value ( $t_{\text{delay flash}}$ ) $\leq 4$ µsec,<br>duration_value ( $t_{\text{duration}}$ ): slow mode = $t_{\text{exp}} + 49$ µsec<br>fast mode = $t_{\text{exp}} + 25$ µsec   |
| Software reset                           | yes, delay up to 102 msec   |
| Asynchronous reset                       | Full frame / Binning 2x1    slow    delay up to 6.8 msec<br>fast                                    3.5 msec  |
|  | Binning 2x2 / Binning 1x2    slow    delay up to 3.5 msec<br>fast                                    1.8 msec   |
| Image info header                        | yes   |
| <b>Electrical interface</b>              |   |
| Data / control                           | standard single cable 1000 Base-T, Cat6<br>option: screw lock type connector  |
| Power                                    | VCC: 8 VDC .. 30 VDC<br>I: 450 mA .. 135 mA   |
| Power consumption                        | approx. 4 Watt  |

Technical specifications subject to change

|                               |   |
|-------------------------------|---|
| Digital input                 | <p>Line 0: trigger signal, opto decoupled<br/> <math>U_{IN(low)} = 0 \dots 4.5 \text{ VDC}</math>, <math>U_{IN(high)} = 11 \dots 30 \text{ VDC}</math><br/> <math>I_{IN} = \text{max. } 10 \text{ mA}</math><br/>                     rising edge (invert = false) ****)<br/>                     min. trigger impulse length (<math>t_{min}</math>): 2 <math>\mu\text{sec}</math><br/>                     trigger delay out of <math>t_{readout}</math> (<math>t_{delay \text{ trigger}}</math>): 4 <math>\mu\text{sec}</math><br/>                     max. trigger delay during <math>t_{readout}</math> (<math>t_{delay \text{ trigger}}</math>): slow mode = 49 <math>\mu\text{sec}</math><br/>                     fast mode = 24 <math>\mu\text{sec}</math></p> |
| Digital output                | <p>Line 1: opto decoupled<br/> <math>U_{EXT} = 5 \dots 30 \text{ VDC} / 24 \text{ VDC typical}</math>, <math>I_{OUT} = \text{max. } 16 \text{ mA}</math><br/>                     high active (invert = false) ****)</p>  |
| LED                           | <p>1: green: Power on<br/>                     yellow: Readout active<br/>                     2: green: Link Phy (1 GBit)<br/>                     green flash: Ethernet RX<br/>                     yellow: Ethernet TX<br/>                     yellow/red flash: Ethernet RX/TX</p>   |
| <b>Environmental</b>          |   |
| Storage temperature           | -10 °C .. +70 °C  |
| Operating temperature         | +5 °C .. +50 °C<br>between +39 °C .. +50 °C, note the max. housing temperature  |
| Housing operating temperature | max. +50 °C ****)<br>(measurement point, see item 4)  |
| Humidity                      | 10 % .. 90 % non condensing   |
| Conformity                    | CE, FCC Part 15 class B, UL, RoHS compliant   |
| <b>Housing</b>                | aluminum  |
| Dimensions                    | 36 x 36 x 48 mm <sup>3</sup>  |
| Weight                        | < 90 g  |
| <b>1000 Base-T interface</b>  | 1000 Mbit / sec   |
| Ethernet IP configuration     | static IP / DHCP / LLA  |
| Stream channel packet size    | 576 Byte (default) .. 16 kByte<br>jumbo frames supported  |
| Interpacketgap                | 0 .. 2 <sup>32</sup> -1 ticks   |
| Resend function               | yes   |
| <b>Software</b>               | Baumer-GAPI SDK with supported OS socket driver and Baumer filter driver /<br>SDK for Windows XP (32 bit) / Windows Vista (32 bit / 64bit)<br>Linux Kernel 2.6.xx (64 bit / 32 bit)   |

- \*) maximum frame rate in free running mode, effective frame rate depending on camera image format mode settings and set exposure time ( $t_{exp} < t_{readout}$ )
- \*\*) default pixel format
- \*\*\*) the LUT function will be used for the gamma value and the calculation time of the internal used LUT need app. 2 sec, if the gamma value changed
- \*\*\*\*) can be inverted via software
- \*\*\*\*\*) housing temperature is limited by CCD sensor specification

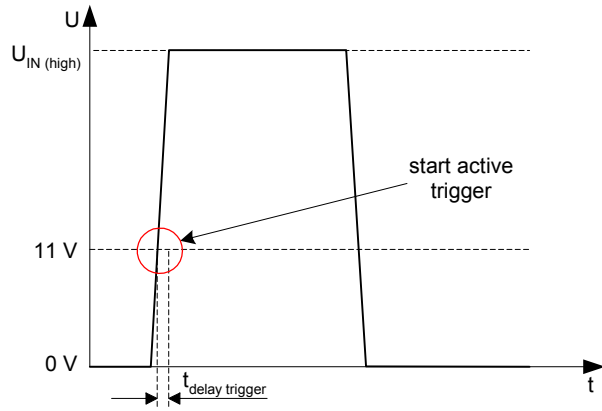
## 2. Camera Factory Settings after Camera Start-up

|                                       | Camera factory settings after camera start-up  |
|---------------------------------------|--|
| <b>Operation modes</b>                | free running mode  |
| <b>Signal processing</b>              |  |
| Exposure control                      | 32 msec  |
| Gain control                          | factor 1 = 0 dB  |
| Offset (black level)                  | 0  |
| <b>Image acquisition</b>              |  |
| Camera image format mode              | mode id = 01, full frame Mono8   |
| Partial scan function                 | not active   |
| Test image selector                   | Off  |
| Defect pixel correction               | On   |
| <b>Electrical interface</b>           |  |
| Exposure Active (External flash sync) | disabled, digital output set to low status (high impedance)<br>invert = false<br>line source = Exposure Active |
| Async. Trigger                        | disabled<br>invert = false<br>trigger source = Line0   |

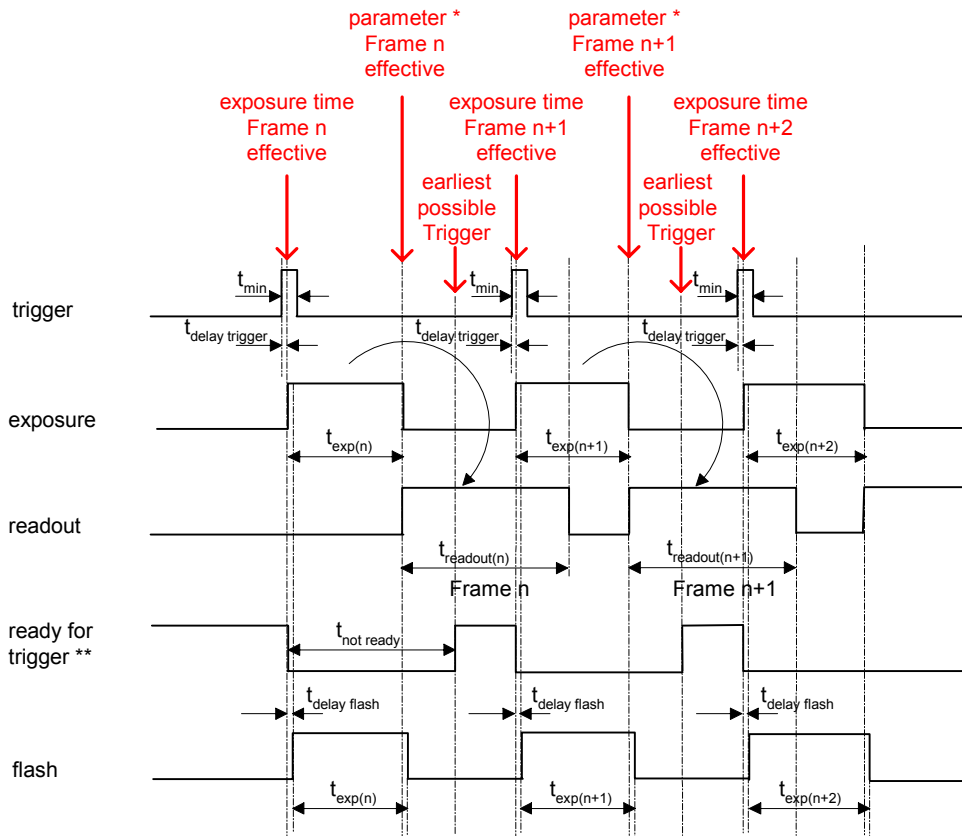
Technical specifications subject to change

### 3. Timing Operation Modes

Trigger Mode: start up time



Trigger Mode: trigger mode 0, overlapped trigger



$$t_{exp} < t_{readout}: t_{\text{earliest possible trigger (n+1)}} = t_{readout(n)} - t_{exp(n+1)}$$

$$t_{exp} > t_{readout}: t_{\text{earliest possible trigger (n+1)}} = t_{exp(n)}$$

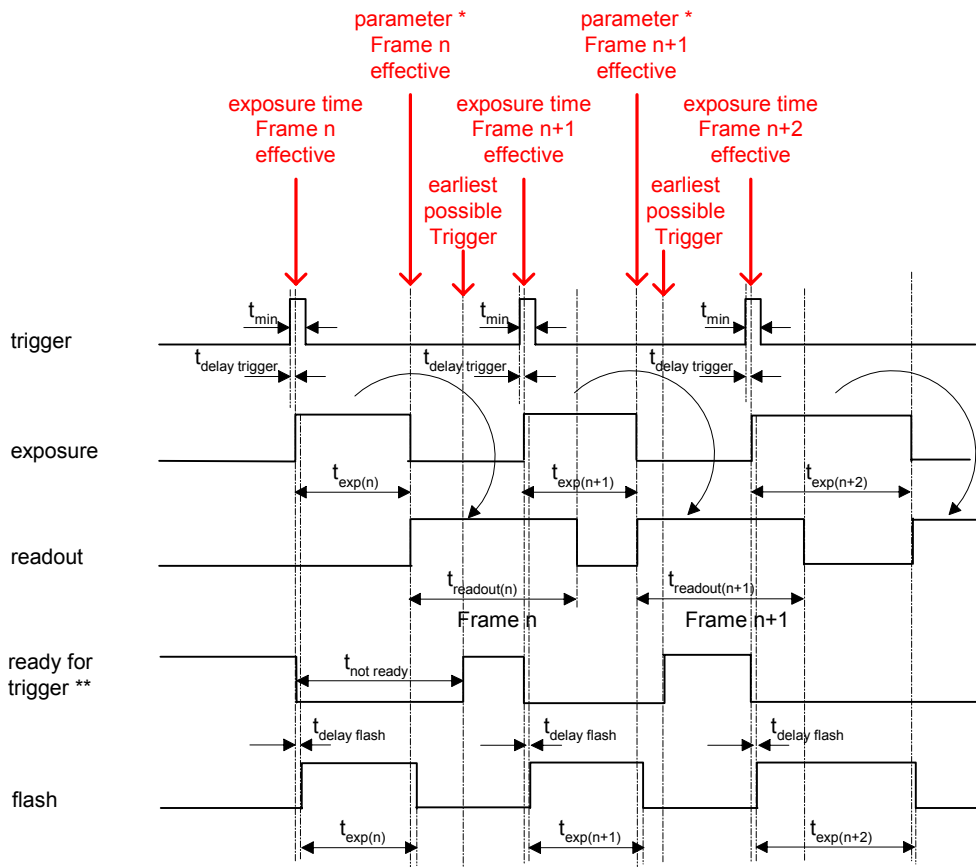
$$t_{exp} < t_{readout}: t_{\text{not ready (n+1)}} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

$$t_{exp} > t_{readout}: t_{\text{not ready (n+1)}} = t_{exp(n)}$$

\* image parameter: offset  
global gain  
mode  
partial scan

\*\* signal will be notified as event "TriggerReady" and is not available as digital output

Trigger Mode: trigger mode 0, overlapped trigger , when  $t_{exp(n+2)} > t_{exp(n+1)}$



$$t_{exp} < t_{readout}: t_{earliest\ possible\ trigger\ (n+1)} = t_{readout(n)} - t_{exp(n+1)}$$

$$t_{exp} > t_{readout}: t_{earliest\ possible\ trigger\ (n+1)} = t_{exp(n)}$$

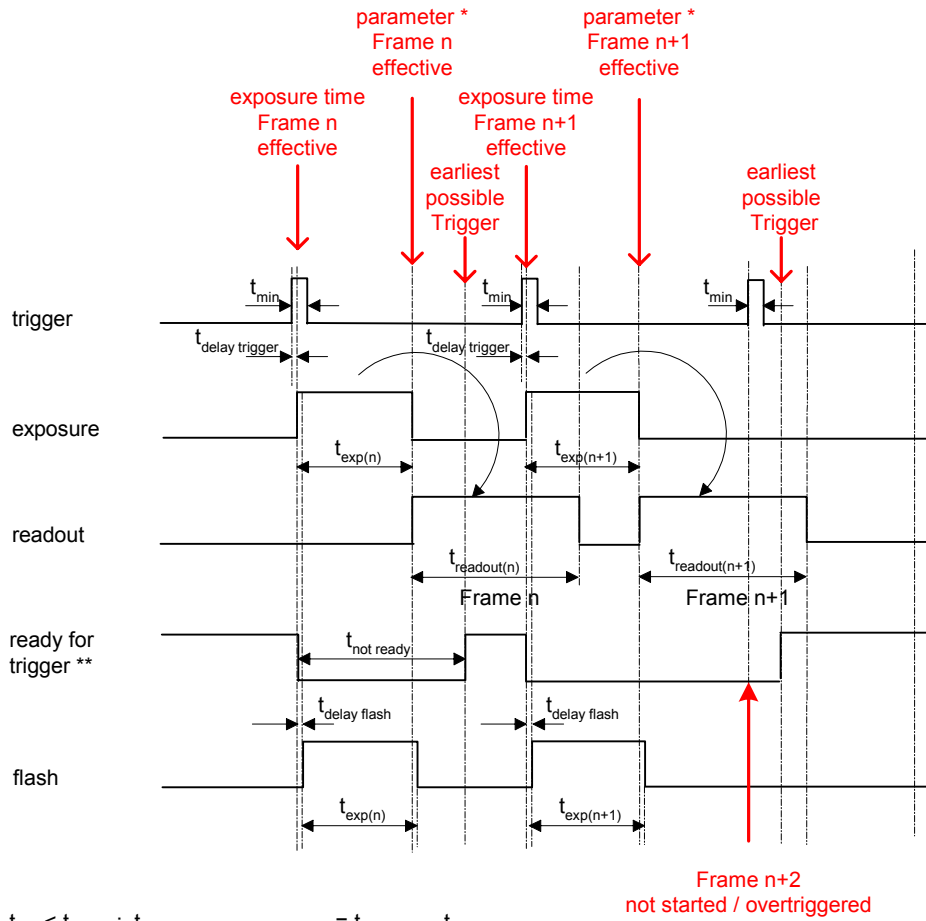
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

$$t_{exp} > t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)}$$

\* image parameter:    offset  
                               global gain  
                               mode  
                               partial scan

\*\* signal will be notified as event "TriggerReady" and is not available as digital output

Trigger Mode: trigger mode 0, overlapped trigger , when  $t_{exp(n+2)} < t_{exp(n+1)}$



$$t_{exp} < t_{readout} : t_{earliest\ possible\ trigger\ (n+1)} = t_{readout(n)} - t_{exp(n+1)}$$

$$t_{exp} > t_{readout} : t_{earliest\ possible\ trigger\ (n+1)} = t_{exp(n)}$$

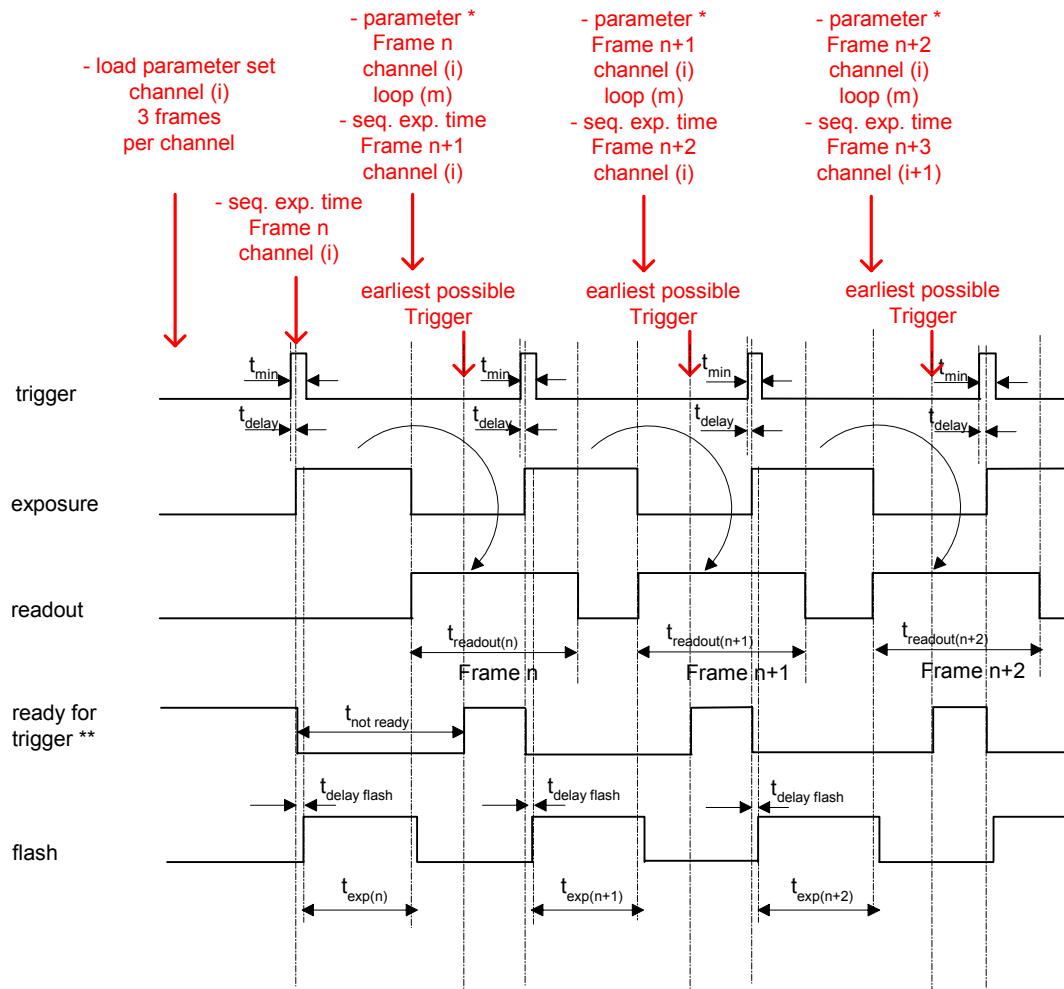
$$t_{exp} < t_{readout} : t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

$$t_{exp} > t_{readout} : t_{not\ ready\ (n+1)} = t_{exp(n)}$$

\* image parameter: offset  
global gain  
mode  
partial scan

\*\* signal will be notified as event "TriggerReady" and is not available as digital output

Trigger Mode: overlapped trigger sequence (example for 3 frames per channel with hardware trigger)



$$t_{exp} < t_{readout}: t_{earliest\ possible\ trigger\ (n+1)} = t_{readout(n)} - t_{exp(n+1)}$$

$$t_{exp} > t_{readout}: t_{earliest\ possible\ trigger\ (n+1)} = t_{exp(n)}$$

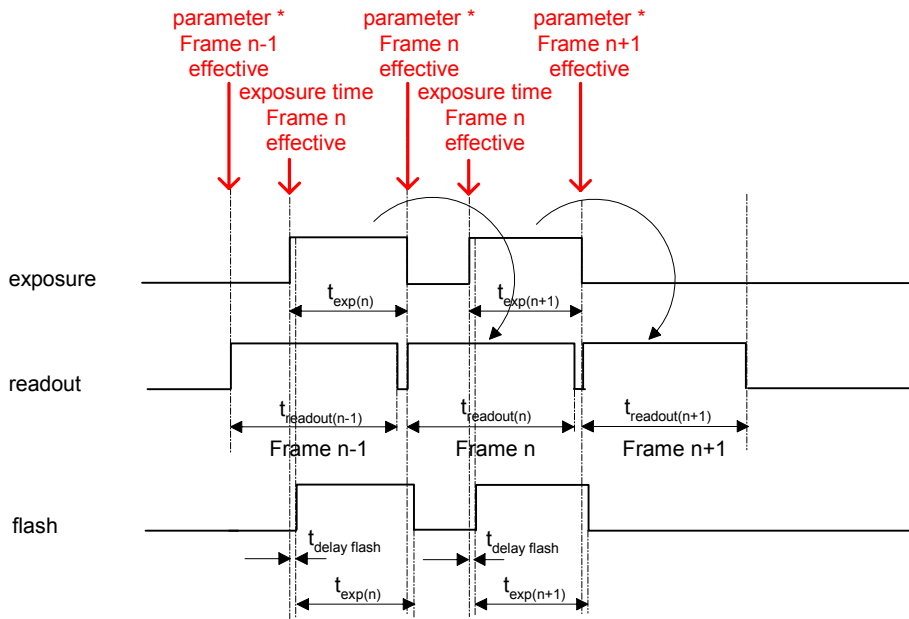
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

$$t_{exp} > t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)}$$

\* image parameter: offset  
sequence global gain  
mode

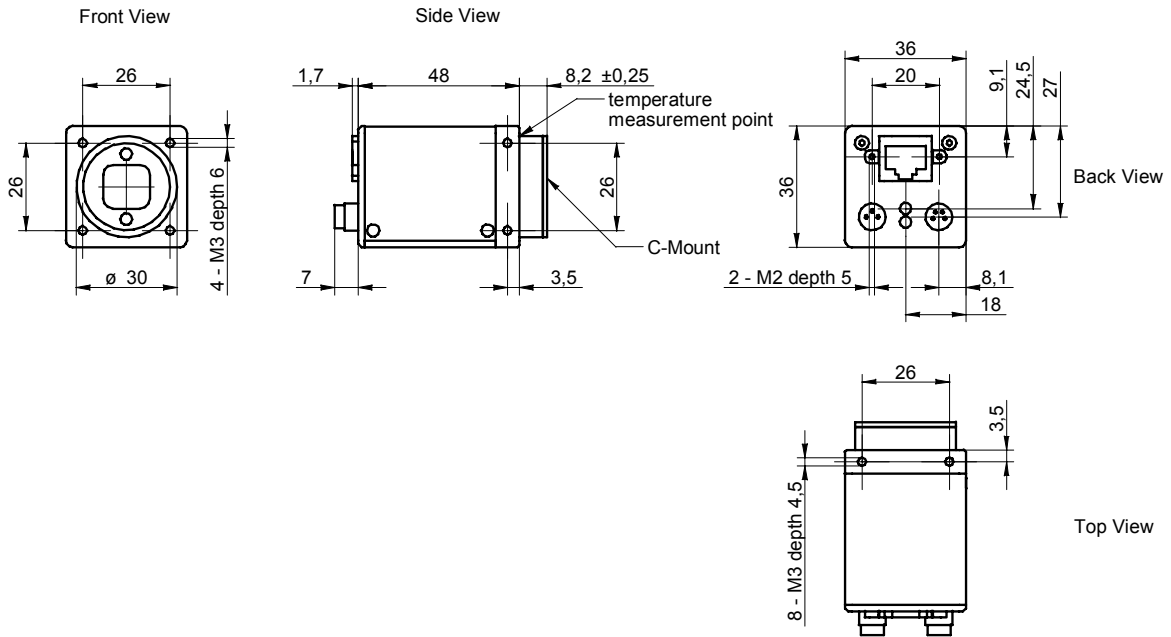
\*\* signal will be notified as event "TriggerReady" and is not available as digital output

Free Running Mode: overlapped operation



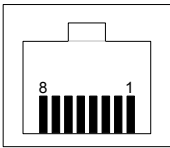
\* image parameter: offset  
 global gain  
 mode  
 partial scan


### 4. Housing


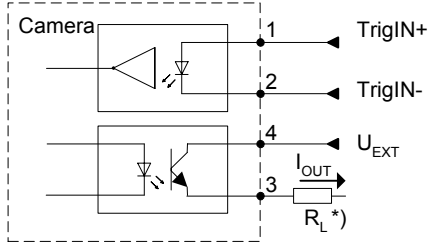


### 5. Connectors / Electrical Interfaces

#### 5.1 Pin assignment:

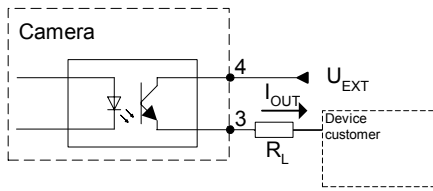
|   |  |
|---|--|
| <b>Data / Control</b><br>1000 Base-T  | Type: RJ45 8P8C mod jack   |
|  | <ul style="list-style-type: none"> <li>1: MX1+</li> <li>2: MX1-</li> <li>3: MX2+</li> <li>4: MX3+</li> <li>5: MX3-</li> <li>6: MX2-</li> <li>7: MX4+</li> <li>8: MX4-</li> </ul> |

|   |  |
|---|--|
| <b>Power</b>  | Type: Lumberg RSME5D / 3 pin   |
|  | <ul style="list-style-type: none"> <li>1: Power VCC+</li> <li>3: GND</li> <li>4: not used</li> </ul> |
|   | Power cable wires color:<br>1 = brown<br>3 = blue<br>4 = black                                       |

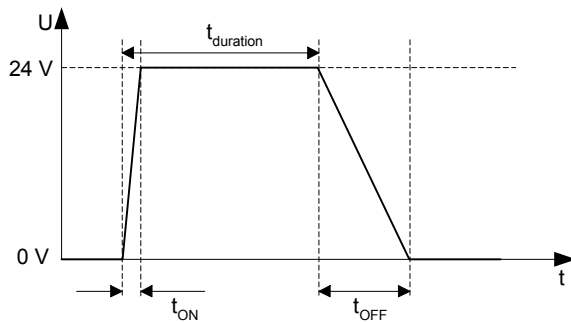
|   |   |
|---|---|
| <b>Trigger / Flash</b>  | Type: Lumberg RSME5D 4pin.  |
|  |    |
|   | *) resistor must be used, $I_{OUT} = 16 \text{ mA}$ by $U_{EXT} = 24 \text{ VDC}$ recommended, drawing shown above example for using high active signal |
|   | Trigger / Flash cable wires color *):<br>1 = brown<br>2 = white<br>3 = blue<br>4 = black  |

\*) shielded trigger / flash cable should be used and ordered separately

5.2 Flash sync sample  $U_{EXT} = 24\text{ VDC}$  high active:

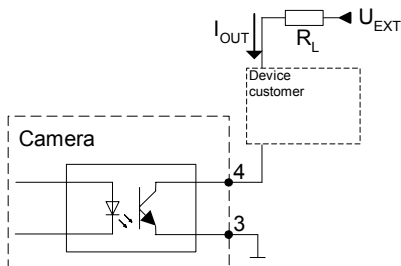


Timing example:  
 measurement condition  $U_{EXT} = 24\text{ VDC} / I_{OUT} = 16\text{ mA}$   
 $R_L = 1.5\text{ kOhm}$

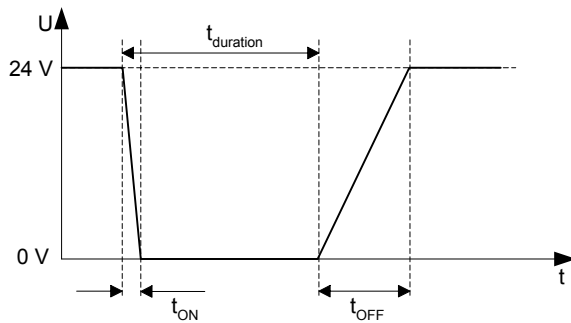


$t_{ON}$  time = typ.  $2\ \mu\text{sec}$   
 $t_{OFF}$  time = typ.  $40\ \mu\text{sec}$

5.3 Flash sync sample  $U_{EXT} = 24\text{ VDC}$  low active:



Timing example:  
 measurement condition  $U_{EXT} = 24\text{ VDC} / I_{OUT} = 16\text{ mA}$   
 $R_L = 1.5\text{ kOhm}$



$t_{ON}$  time = typ.  $2\ \mu\text{sec}$   
 $t_{OFF}$  time = typ.  $40\ \mu\text{sec}$

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