

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

 System: **Gigabit Ethernet**
Baumer TXG08-I7

Revision 2.1

Art. No: 11003946

- Gigabit Ethernet progressive scan CCD camera
- 1032 x 776 pixel
- Up to 28 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 2³¹-1 frames per sequence
- Jumbo frames supported
- Integrated 32 MByte RAM for temporarily image data buffering
- Camera parameter programmable in real-time
- Ultra compact and lightweight aluminum housing
- IP67 camera housing design based on EHEDG recommendation
- Standard M12 industrial connector
- Baumer-GAPI: Flexible, generic software interface for Windows / Linux



shown tubes need to be ordered separately

1. Overview

| Model Name | TXG08 |
|--------------------------------------|--|
| Sensor | 1/3" interline progressive scan CCD |
| Shutter / readout mode | global shutter / progressive scan readout |
| Number of pixel | 1032 x 776 |
| Scan area | 4.80 mm x 3.61 mm |
| Pixel size | 4.65 µm x 4.65 µm |
| Color filter | - |
| Operation modes | |
| Trigger mode | yes, overlapped operation |
| Free running mode | yes, overlapped operation |
| Signal processing | real-time software programmable |
| Pixel clock | 29.75 MHz fast scan / 14.87 MHz high quality (HQ) scan |
| A/D converter | 12 bit |
| Exposure control (t _{exp}) | total: 4 µsec .. 60 sec step: 1 µsec |
| Gain control | 0 .. 20 dB |
| Offset (black level) | 0 .. 255 LSB (12 bit) |
| Image data buffer | max. 7 images |

Technical specifications subject to change

| Image acquisition | | | | | | | | |
|--------------------------------|---|----------------|------------------------------------|-----------|--------------------|-----------------|--------------------|----------------------|
| Camera image format modes | | Format (pixel) | Gen\timesCam standard | Format ID | Pixel format | Pixel clock MHz | Frames per sec. *) | t_{readout} |
| Full frame HQ | slow | 1032 x 776 | Vendor specific | 00 | Mono8 (**)) (**)) | 14.87 | 14 | 71 msec |
| | | | | | Mono12 | | | |
| | | | | | Mono12 Packed | | | |
| Full frame | fast | 1032 x 776 | yes | 01 | Mono8 (**)) (**)) | 29.75 | 28 | 36 msec |
| | | | | | Mono12 | | | |
| | | | | | Mono12 Packed | | | |
| Binning 2x2 HQ | slow | 516 x 388 | Vendor specific | 02 | Mono8 (**)) (**)) | 14.87 | 24 | 42 msec |
| | | | | | Mono12 | | | |
| | | | | | Mono12 Packed | | | |
| Binning 2x2 | fast | 516 x 388 | yes | 03 | Mono08 (**)) (**)) | 29.75 | 49 | 20 msec |
| | | | | | Mono12 | | | |
| | | | | | Mono12 Packed | | | |
| Binning 1x2 HQ | slow | 1032 x 388 | Vendor specific | 04 | Mono08 (**)) (**)) | 14.87 | 24 | 42 msec |
| | | | | | Mono12 | | | |
| | | | | | Mono12 Packed | | | |
| Binning 1x2 | fast | 1032 x 388 | yes | 05 | Mono08 (**)) (**)) | 29.75 | 49 | 20 msec |
| | | | | | Mono12 | | | |
| | | | | | Mono12 Packed | | | |
| Binning 2x1 HQ | slow | 516 x 776 | Vendor specific | 06 | Mono08 (**)) (**)) | 14.87 | 14 | 71 msec |
| | | | | | Mono12 | | | |
| | | | | | Mono12 Packed | | | |
| Binning 2x1 | fast | 516 x 776 | yes | 07 | Mono08 (**)) (**)) | 29.75 | 28 | 36 msec |
| | | | | | Mono12 | | | |
| | | | | | Mono12 Packed | | | |
| Standard features | | | | | | | | |
| Image size controls | | | | | | | | |
| Binning horizontal | yes, 1 or 2 | | | | | | | |
| Binning vertical | yes, 1 or 2 | | | | | | | |
| Pixel format | Mono8, Mono12, Mono12Packed | | | | | | | |
| Test image selector | yes, in all modes Off, GreyHorizontalRamp, GreyVerticalRamp, HorizontalLineMoving, VerticalLineMoving HorizontalAndVerticalLineMoving | | | | | | | |
| Partial scan | yes, format freely programmable in all modes (binning on partial scan ok) | | | | | | | |
| Analog controls | | | | | | | | |
| Gain | yes | | | | | | | |
| Black Level (Off set) | yes | | | | | | | |
| Gamma | yes, user programmable (**)) (available if LUT is enable) (**)) total: 0.001 .. 2 | | | | | | | |
| Brightness correction (custom) | yes, in all binning modes | | | | | | | |
| Acquisition and Trigger | | | | | | | | |
| Acquisition mode | Continuous | | | | | | | |
| Trigger source | HardwareTrigger (Line0), SoftwareTrigger, CommandTrigger (ActionCommand), All or Off | | | | | | | |
| Trigger delay | 0 .. 2 sec, 512 trigger can be tracked, step: 1 μ sec | | | | | | | |
| Sequencer | Up to $2^{31}-1$ frames per sequence / one exposure time and gain value for each parameter set max. set of sequences: Up to $2^{31}-1$ frames x 256 parameter sets | | | | | | | |

Technical specifications subject to change

| | |
|--|--|
| Digital I/O | |
| Lines | Input: Line0, Output: Line1 |
| Line source (outputs only) | Line1: Off, ExposureActive, Timer1, ReadoutActive, User0, TriggerReady, TriggerOverlapped, TriggerSkipped |
| Line debouncer | yes, low and high signal separately selectable 0 .. 5 msec step: 1 µsec |
| Event Generation | |
| Events | GigEVisionError, Heartbeattimeout, EventLost, Line0RisingEdge, Line0FallingEdge, Line1RisingEdge, Line1FallingEdge, ExposureStart, ExposureEnd, FrameStart, FrameEnd, TriggerReady, TriggerOverlapped, TriggerSkipped |
| Event Notification | yes, ON / OFF |
| Counters and Timers | |
| Framecounter | yes, 2 ³² can be set by user |
| LUT Controls | |
| LUT selector | 1 LUT: Luminance (12 bit) ON / OFF |
| Defect pixel correction (custom) | yes, ON / OFF |
| Defect pixel list (custom) | yes, max. 256 pixel coordinates (x, y) can be stored |
| GigEVisionTransportLayer | |
| PayLoadsize | 4 Byte .. 1.601.936 Byte |
| UserSets | |
| User set selector | Default (factory settings / read only) UserSet1, UserSet2, UserSet3 (read and write) |
| UserSetDefaultSelector | yes, define the start up "UserSet" |
| Advanced features | |
| Time stamp function | yes, 64 bit tick = 32 nsec |
| Asynchronous message channel | yes |
| Concatenation function | yes |
| User defined identifier | yes, user programmable permanent identifier |
| ActionCommand | yes, ID 0 = Trigger |
| Data quality | |
| | at 20 °C, gain = 1, exposure time = 32 msec, full frame mode, slow scan |
| Readout noise | $\sigma < 0.5$ LSB (8 bit) typical |
| Dynamic range | typical > 54 dB |
| Optical interface | |
| Optical filter | dust protection on request: super polished, IR cut filter, daylight filter or no filter |
| Process interface functions | |
| Async. Trigger | yes, trigger mode operation, "Off", "software trigger", "hardware trigger", "command trigger" or "all" separately selectable (overtriggered signals and trigger signals during the readout time will be notified in the received image header) |
| Exposure Active (External flash sync) | yes, delay_value ($t_{\text{delay flash}}$) ≤ 4 µsec, duration_value (t_{duration}): slow mode = $t_{\text{exp}} + 100$ µsec fast mode = $t_{\text{exp}} + 50$ µsec |
| User Output | yes, ON / OFF |
| Software reset | yes, delay up to 102 msec |
| Asynchronous reset | Full frame / Binning 2x1 slow delay up to 13.9 msec fast 7.2 msec |
| | Binning 2x2 / Binning 1x2 slow delay up to 11.6 msec fast 5.8 msec |
| Image info header | yes |

| | | | | | | | | | |
|--|---|---------|---------|-------|-------|---------|---------|---------|---------|
| Electrical interface | | | | | | | | | |
| Data / control | standard single cable 1000 Base-T with M12 connector, Cat6 recommended / minimum Cat5e | | | | | | | | |
| Power | VCC: 8 VDC .. 30 VDC I: 450 mA .. 135 mA | | | | | | | | |
| Power consumption | approx. 4 Watt | | | | | | | | |
| Digital input | Line 0: trigger signal, opto decoupled $U_{IN(low)} = 0 .. 4.5 \text{ VDC}$, $U_{IN(high)} = 11 .. 30 \text{ VDC}$ $I_{IN} = 6 .. 10 \text{ mA}$ / 7 mA typical rising edge (invert = false) ****) min. impulse length (t_{min}): 2 μsec trigger delay out of $t_{readout}$ ($t_{delay \text{ trigger}}$): 4 μsec max. trigger delay during $t_{readout}$ ($t_{delay \text{ trigger}}$): slow mode = 100 μsec fast mode = 50 μsec | | | | | | | | |
| Digital output | Line 1: opto decoupled $U_{EXT} = 5 .. 30 \text{ VDC}$ / 24 VDC typical, $I_{OUT} = \text{max. } 16 \text{ mA}$ high active (invert = false) ****) | | | | | | | | |
| LED | 1: green: Power on yellow: Readout active 2: green: Link Phy (1 GBit) green flash: Ethernet RX yellow: Ethernet TX yellow/red flash: Ethernet RX/TX | | | | | | | | |
| Environmental | | | | | | | | | |
| Storage temperature | -10 °C .. +70 °C | | | | | | | | |
| Operating temperature | +5 °C .. +50 °C | | | | | | | | |
| Housing operating temperature | between +39 °C .. +50 °C, note the max. housing temperature max. +50 °C *****) (measurement point, see item 4) | | | | | | | | |
| Humidity | 10 % .. 90 % non condensing | | | | | | | | |
| Conformity | CE, FCC Part 15 class B, RoHS compliant | | | | | | | | |
| Housing | | | | | | | | | |
| aluminum, IP67 | | | | | | | | | |
| Dimensions | $\varnothing 65 \text{ mm} \times 50 \text{ mm}$ | | | | | | | | |
| Weight camera | < 380 g | | | | | | | | |
| Weight tube | <table border="1"> <tr> <td>52 mm</td> <td>62 mm</td> <td>71 mm</td> <td>94 mm</td> </tr> <tr> <td>< 120 g</td> <td>< 140 g</td> <td>< 150 g</td> <td>< 200 g</td> </tr> </table> | 52 mm | 62 mm | 71 mm | 94 mm | < 120 g | < 140 g | < 150 g | < 200 g |
| 52 mm | 62 mm | 71 mm | 94 mm | | | | | | |
| < 120 g | < 140 g | < 150 g | < 200 g | | | | | | |
| 1000 Base-T interface | | | | | | | | | |
| 1000BASE-T (1000 Mbit / sec) | | | | | | | | | |
| Ethernet IP configuration | persistent IP / DHCP / LLA | | | | | | | | |
| Stream channel packet size | 576 Byte (default) .. 65535 Byte jumbo frames supported | | | | | | | | |
| Interpacketgap | 0 .. $2^{32}-1$ ticks | | | | | | | | |
| Resend function | yes | | | | | | | | |
| Software | | | | | | | | | |
| Baumer-GAPI SDK with supported OS socket driver and Baumer filter driver / SDK for Windows XP (32 bit) / Windows Vista (32 bit / 64 bit) / Windows 7 (32 bit / 64 bit) / Linux Kernel 2.6.xx (64 bit / 32 bit) | | | | | | | | | |
| GigE Vision® compatible programs and image processing libraries supported Windows / Linux depending on the actually driver software is used | | | | | | | | | |

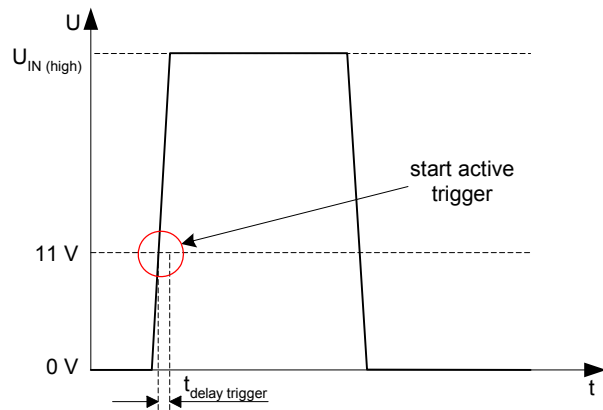
- *) maximum frame rate in free running mode, effective frame rate depending on camera image format mode settings and set exposure time ($t_{exp} < t_{readout}$)
- **) default pixel format
- ***) the LUT function will be used for the gamma value and the calculation time of the internal used LUT need 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

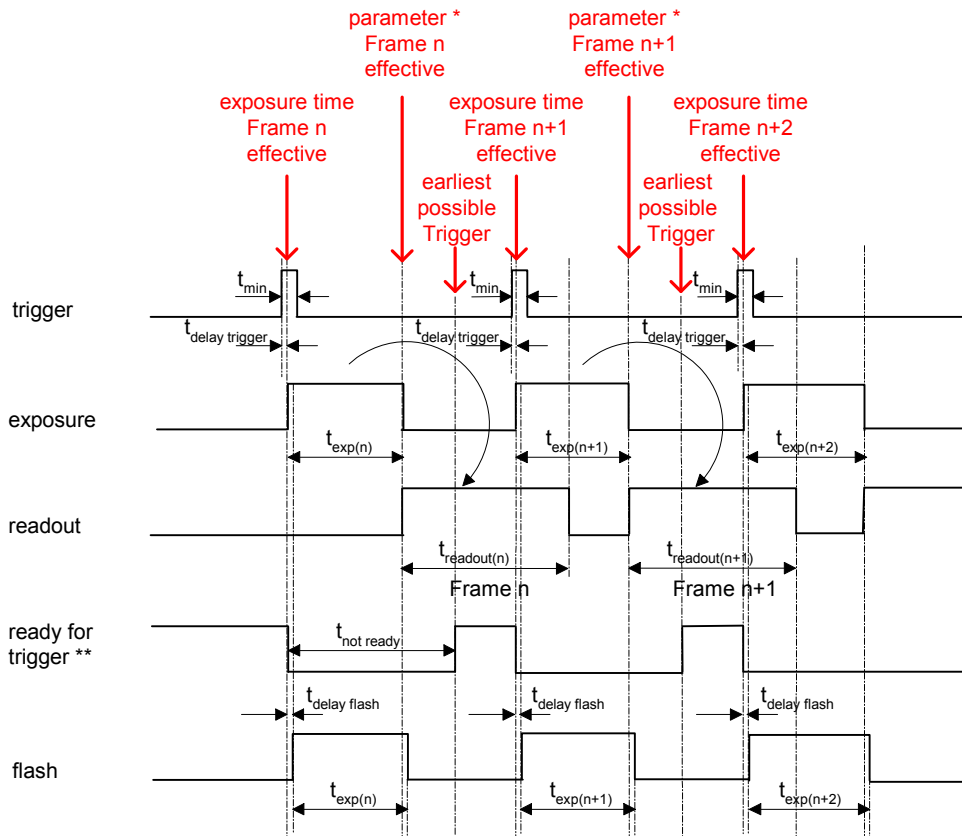
| Camera factory settings after camera start-up | |
|---|--|
| Operation modes | free running mode |
| Signal processing | |
| Exposure control | 32 msec |
| Gain control | factor 1 = 0 dB |
| Offset (black level) | 0 |
| Image acquisition | |
| Camera image format mode | mode id = 01, full frame Mono8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

3. Timing Operation Modes

Trigger Mode: start up time



Trigger Mode: trigger mode 0, overlapped trigger



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

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

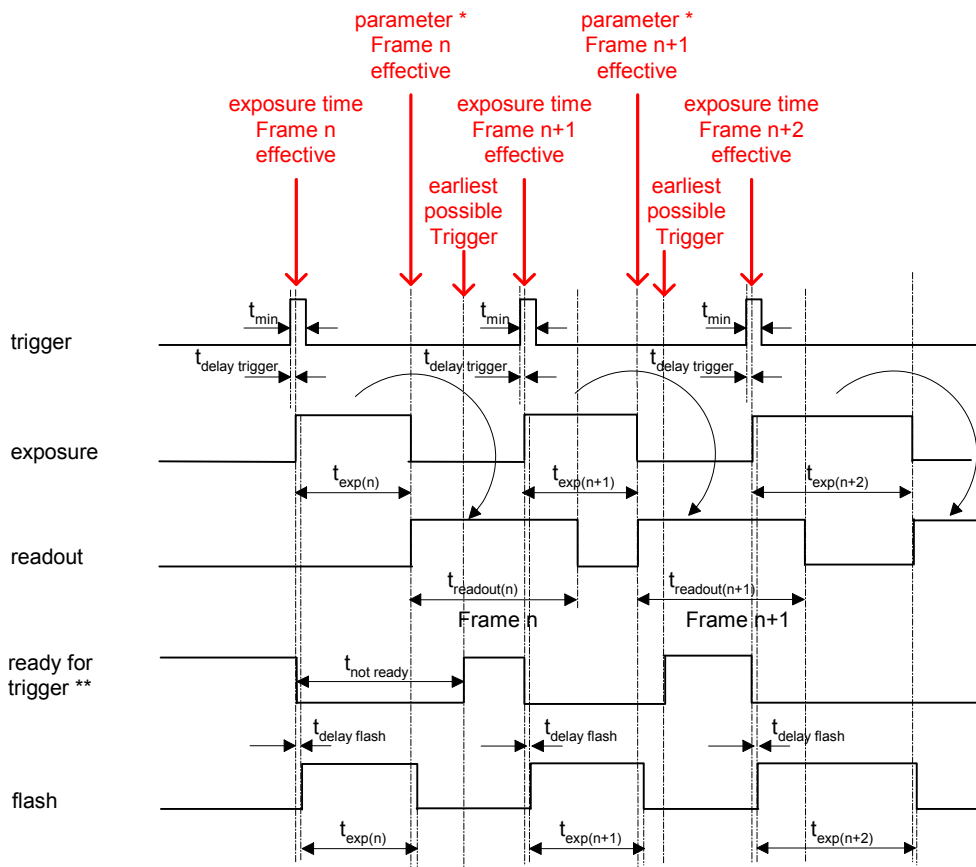
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

* image parameter: offset
 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 $t_{exp(n+2)} > t_{exp(n+1)}$



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

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

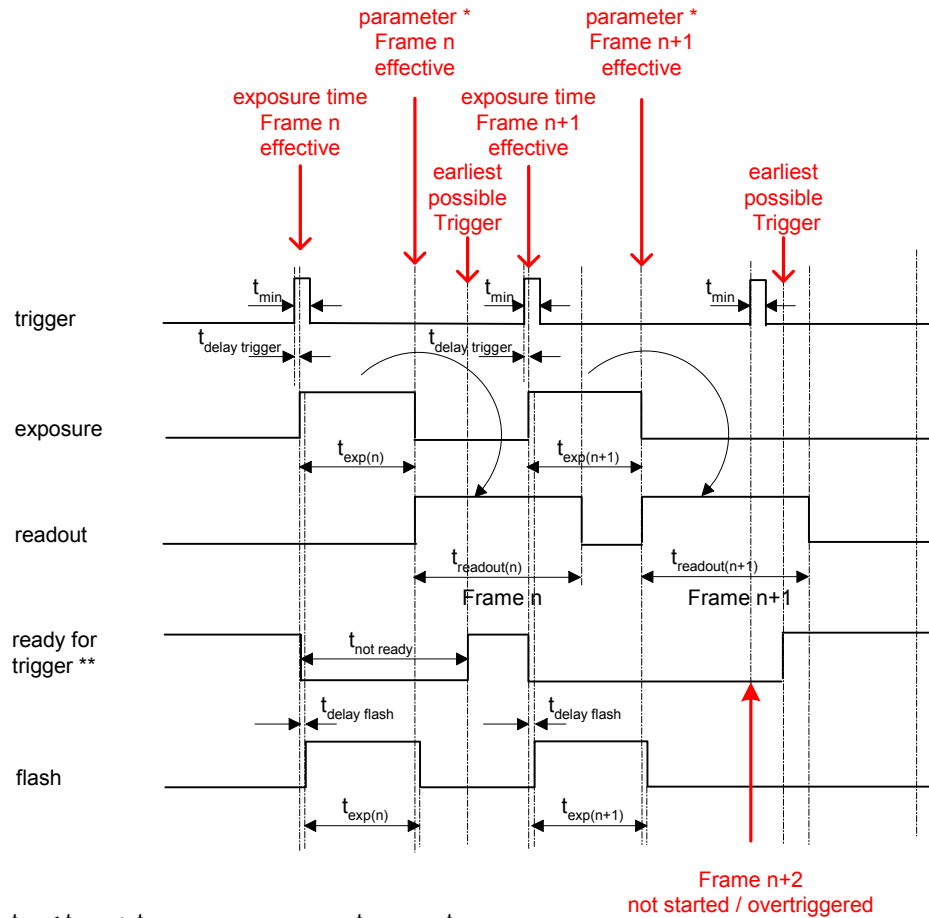
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

* 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 $t_{exp(n+2)} < t_{exp(n+1)}$



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

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

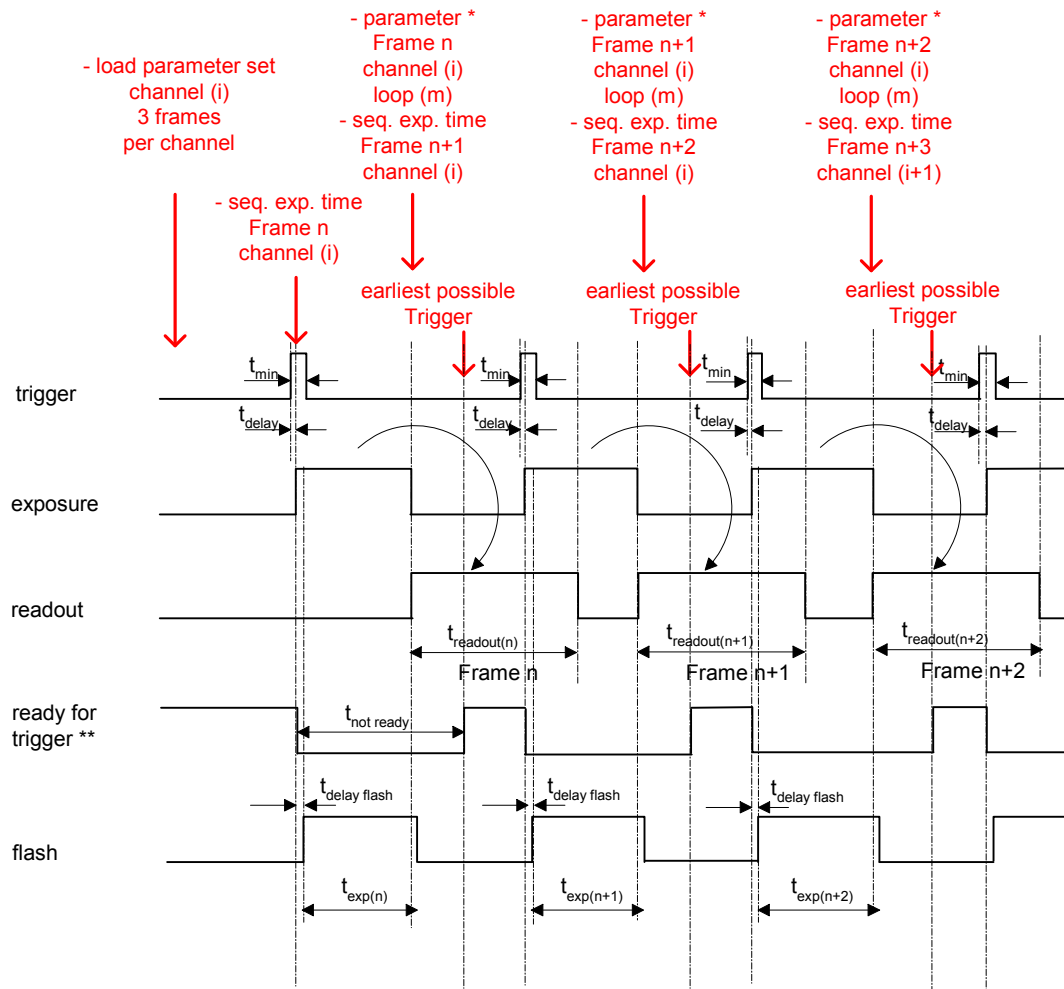
$$t_{exp} < t_{readout} : t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

* 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)



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

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

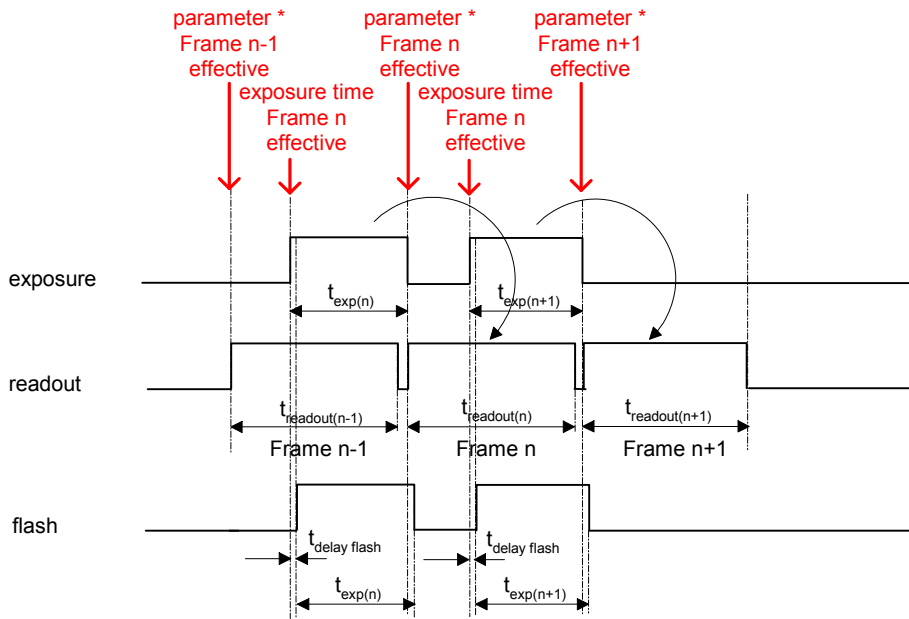
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

* image parameter: offset
sequence global gain
mode

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

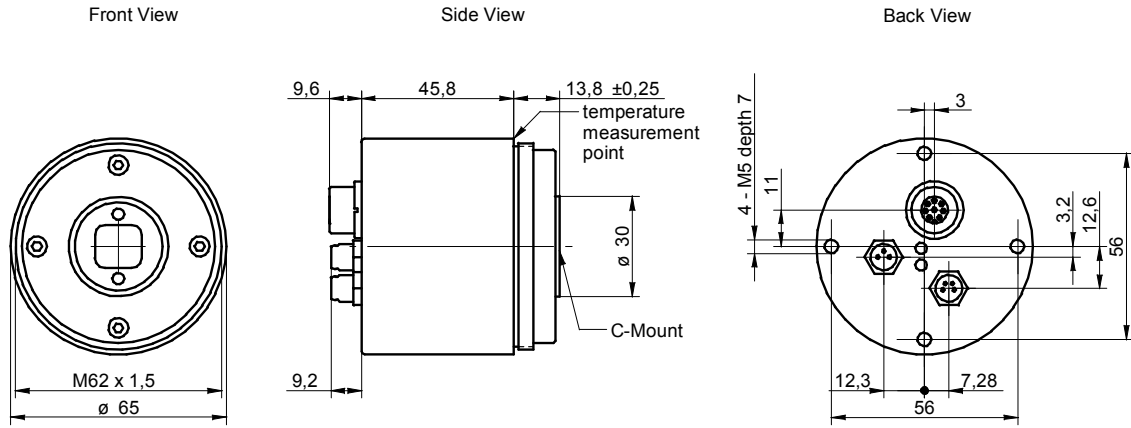
Free Running Mode: overlapped operation



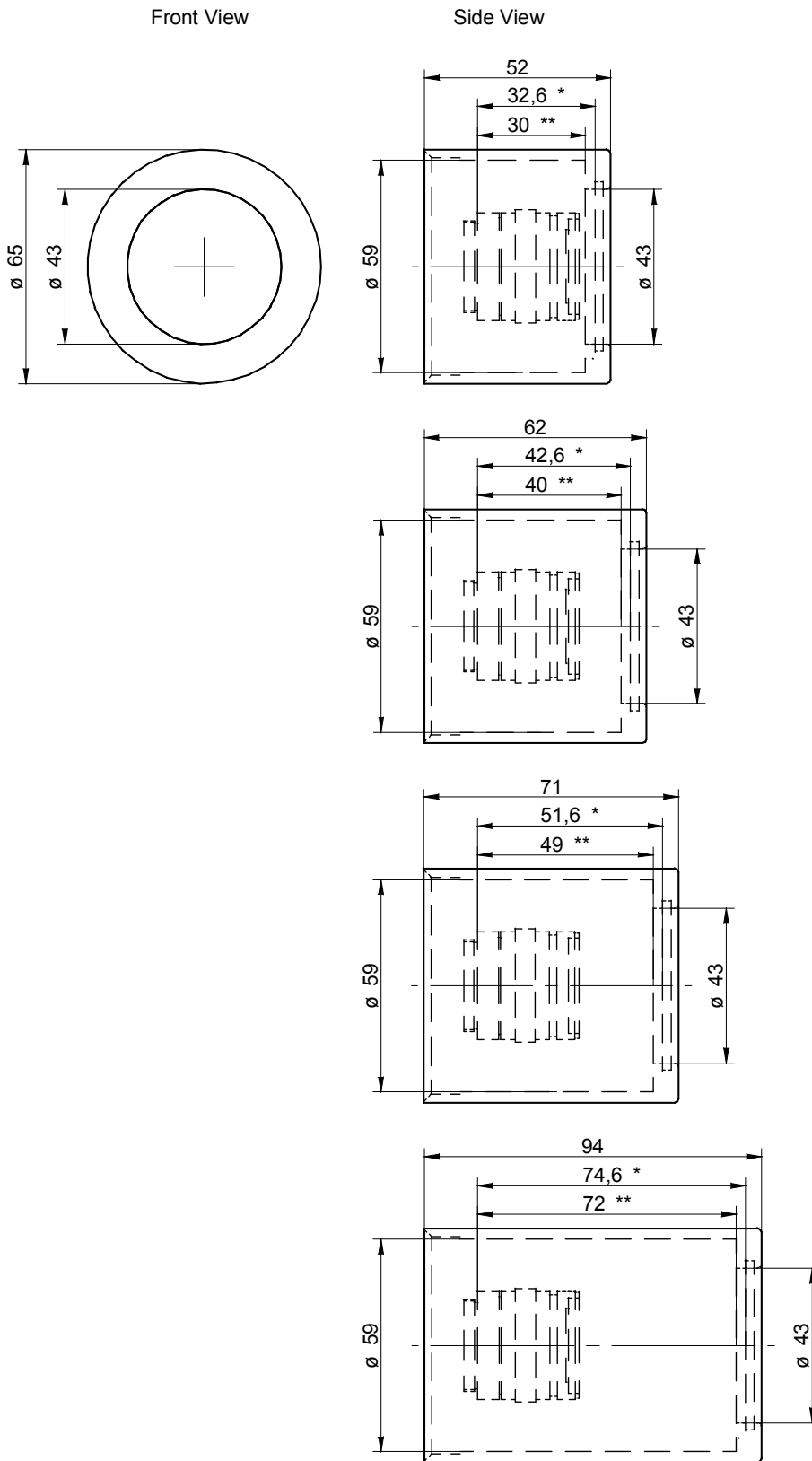
* image parameter: offset
 global gain
 mode
 partial scan

4. Housing

4.1 Camera



4.2 Tube



* max. installation space between C-mount and glass
 ** max. installation space between C-mount and cylinder bottom

5. Connectors / Electrical Interfaces

5.1 Pin assignment:

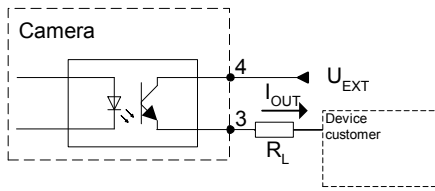
| Data / Control 1000 Base-T | Type: female M12 / 8 pin A cod. |
|-------------------------------|--|
| | 1: MX3- 2: MX4+ 3: MX4- 4: MX1- 5: MX2+ 6: MX1+ 7: MX3+ 8: MX2- |

| Power | Type: Lumberg RSMEED / 3 pin |
|-------|---|
| | 1: Power VCC+ 3: GND 4: not used |
| | Power cable wires color: 1 = brown 3 = blue 4 = black |

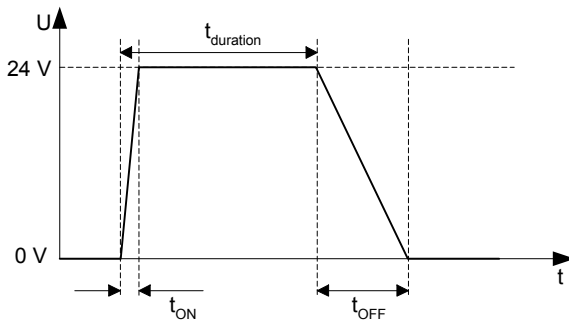
| Trigger Flash | Type: Lumberg RSMEED 4pin. |
|------------------|--|
| | |
| | *) resistor must be used, $I_{OUT} = 16 \text{ mA}$ by $U_{EXT} = 24 \text{ VDC}$ recommended, drawing shown above example for using high active signal |
| | Trigger / Flash cable wires color *): 1 = brown 2 = white 3 =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

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

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

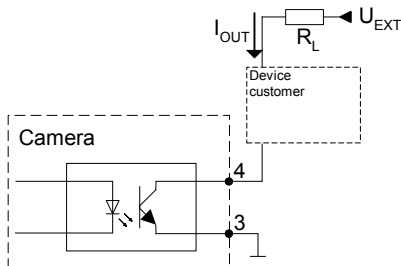


Timing example:
 measurement condition $U_{EXT} = 24\text{ VDC} / I_{OUT} = 16\text{ mA}$
 $R_L = 1.5\text{ kOhm}$

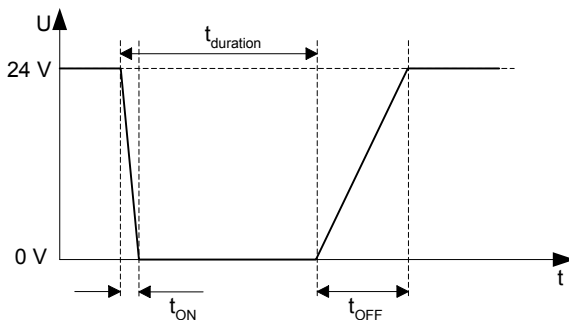


t_{ON} time = typ. $2\ \mu\text{sec}$
 t_{OFF} time = typ. $40\ \mu\text{sec}$

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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