

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

 System: **Gigabit Ethernet**
Baumer TXG04-P

Revision 2

Art. No: OD108708

- Gigabit Ethernet progressive scan CCD camera
- 656 x 494 pixel
- Up to 56 full frames per second
- GigE Vision™ standard compliant
- Supported Power over Ethernet
- Outstanding image quality
- High sensitivity and dynamic range
- High quality 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
- 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	TXG04
Sensor	1/2" interline progressive scan CCD
Shutter / readout mode	global shutter / progressive scan readout
Number of pixel	656 x 494
Scan area	6.5 mm x 4.9 mm
Pixel size	9.9 µm x 9.9 µm
Color filter	-
Operation modes	
Trigger mode	yes, overlapped operation
Free running mode	yes, overlapped operation
Signal processing	real-time software programmable
Pixel clock	24 MHz
A/D converter	14 bit
Exposure control (t _{exp})	total: 4 µsec .. 60 sec step: 1 µsec
Gain control	0 .. 20 dB
Offset (black level)	0 .. 1023 LSB (14 bit)
Image data buffer	max. 31 images

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 _{readout}
Full frame	656 x 494	yes	01	Mono8 **)	24	56	17.9 msec
				Mono12			
				Mono12 Packed			
Binning 2x2	328 x 247	yes	03	Mono8 **)	24	105	9.5 msec
				Mono12			
				Mono12 Packed			
Binning 1x2	656 x 247	yes	05	Mono8 **)	24	105	9.5 msec
				Mono12			
				Mono12 Packed			
Binning 2x1	328 x 494	yes	07	Mono8 **)	24	56	17.9 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 µsec						
Sequencer	Up to 2 ³¹ -1 frames per sequence / one exposure time and gain values for each sequence max. set of sequences: Up to 2 ³¹ -1 frames x 256 exposure times and gain values						

Digital I/O		
Lines	Line0 (Input), Line1 (Output)	
Line source (outputs only)	Line1: Off, ExposureActive or UserOutput	
Line debouncer	yes, low and high signal separately selectable 0 .. 5 msec step: 1µsec	
Event Generation		
Events	GigEVisionError, 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 .. 648.400 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		
Readout noise	$\sigma < 5$ LSB (12 bit) typical	
Dynamic range	typical > 58 dB	
Optical interface		
	C-Mount on request: CS-Mount	
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}): $t_{\text{exp}} + 33$ µsec	
User Output	yes, ON / OFF	
Software reset	yes, delay up to 65 msec	
Asynchronous reset	Full frame / Binning 2x1	delay up to 4.4 msec
	Binning 2x2 / Binning 1x2	delay up to 2.25 msec
Image info header	yes	

Electrical interface	
Data / control	standard single cable 1000 Base-T, Cat6 recommended / minimum Cat5e option: screw lock type connector
Power	VCC: Power over Ethernet (PoE), Class 0 device (via 1000 Base-T cable) VCC: 20 VDC .. 57 VDC I: 205 mA .. 64 mA
Power consumption	approx. 3.9 Watt
Digital input	Line 0: trigger signal, opto decoupled $U_{IN(low)} = 0 \dots 4.5 \text{ VDC}$, $U_{IN(high)} = 11 \dots 30 \text{ VDC}$ $I_{IN} = \text{max. } 10 \text{ mA}$ 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 $t_{readout}$ ($t_{delay \text{ trigger}}$): 33 μsec
Digital output	Line 1: opto decoupled $U_{EXT} = 5 \dots 30 \text{ VDC} / 24 \text{ VDC typical}$, $I_{OUT} = \text{max. } 16 \text{ mA}$ high active (invert = false) ****)
LED	1: green: Power on yellow: Readout active 2: green: Link active green flash: Receiving 3: red: Transmitting
Environmental	
Storage temperature	-10 °C .. +70 °C
Operating temperature	+5 °C .. +50 °C between +39 °C .. +50 °C, note the max. housing temperature
Housing operating 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	
Dimensions	36 x 36 x 58 mm ³
Weight	< 110 g
1000 Base-T interface	
1000 Mbit / sec	
Ethernet IP configuration	persistent IP / DHCP / LLA
Stream channel packet size	576 Byte (default) .. 16 kByte 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 / 64bit) 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	

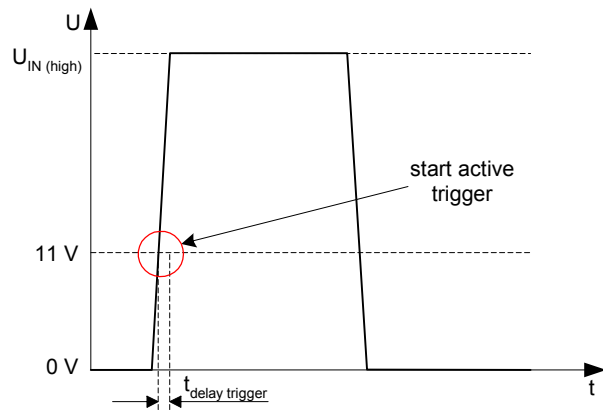
- *) maximum frame rate in free running mode, effective frame rate depending on camera image format mode settings and set exposure time ($t_{exp} < t_{readout}$)
- **) default pixel format
- ***) between 38 VDC and 57 VDC IEEE802.3 clause 33 conform
- ****) the LUT function will be used for the gamma 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

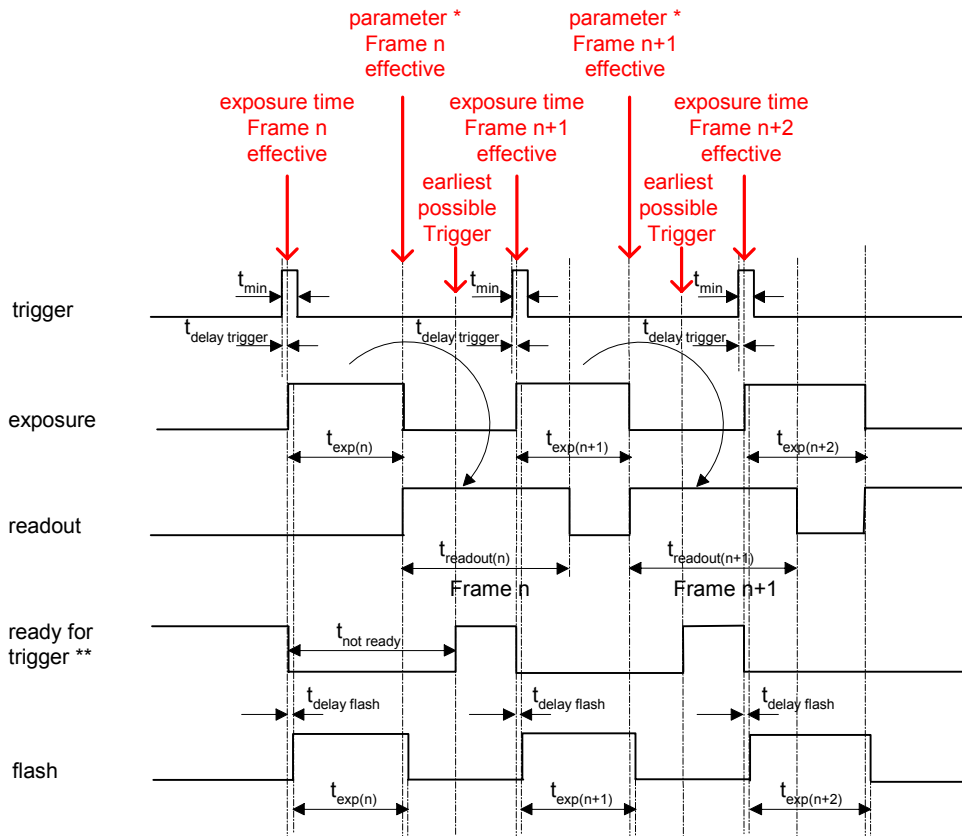
Camera factory settings after camera start-up	
Operation modes	free running mode
Signal processing	
Exposure control	32 msec
Gain control	factor 1 = 0 dB
Offset (black level)	0
Image acquisition	
Camera image format mode	mode id = 01, full frame Mono8
Partial scan function	not active
Test image selector	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



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

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

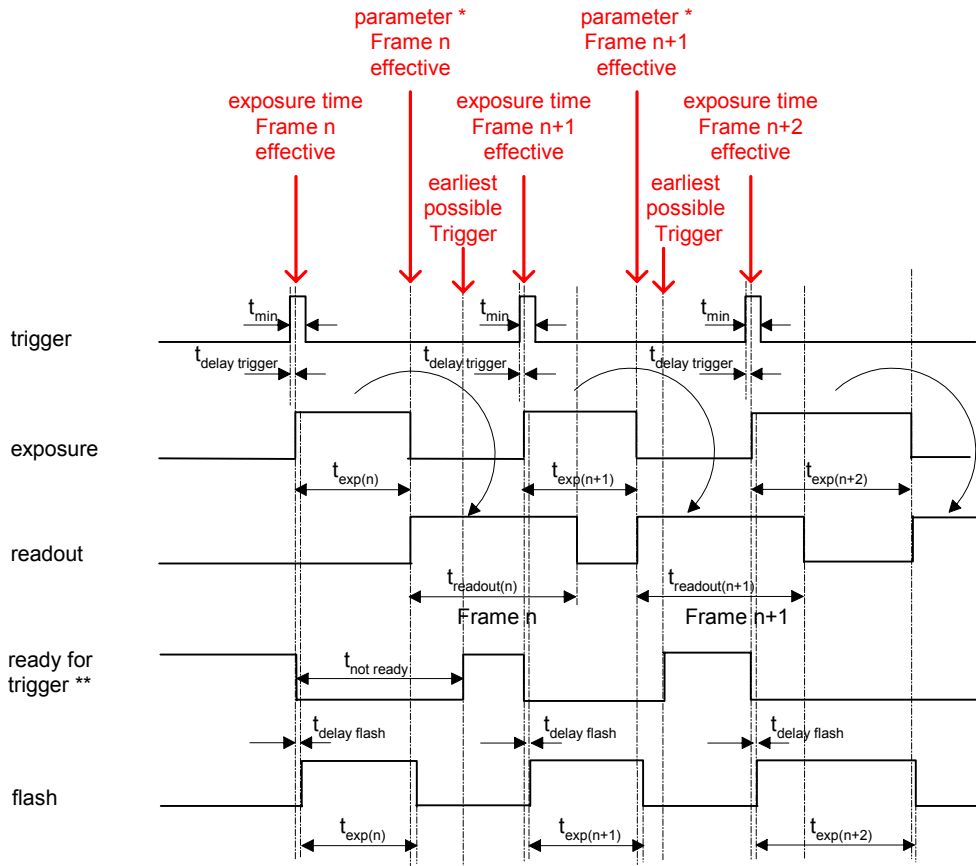
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

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



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

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

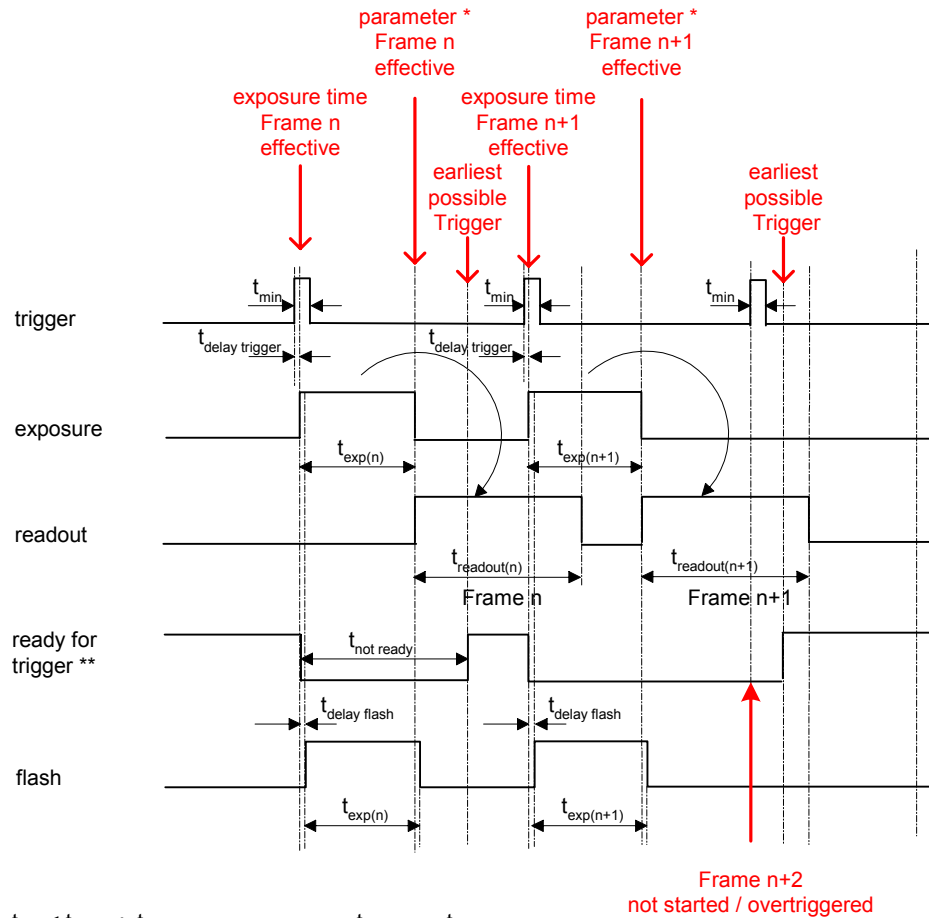
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

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



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

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

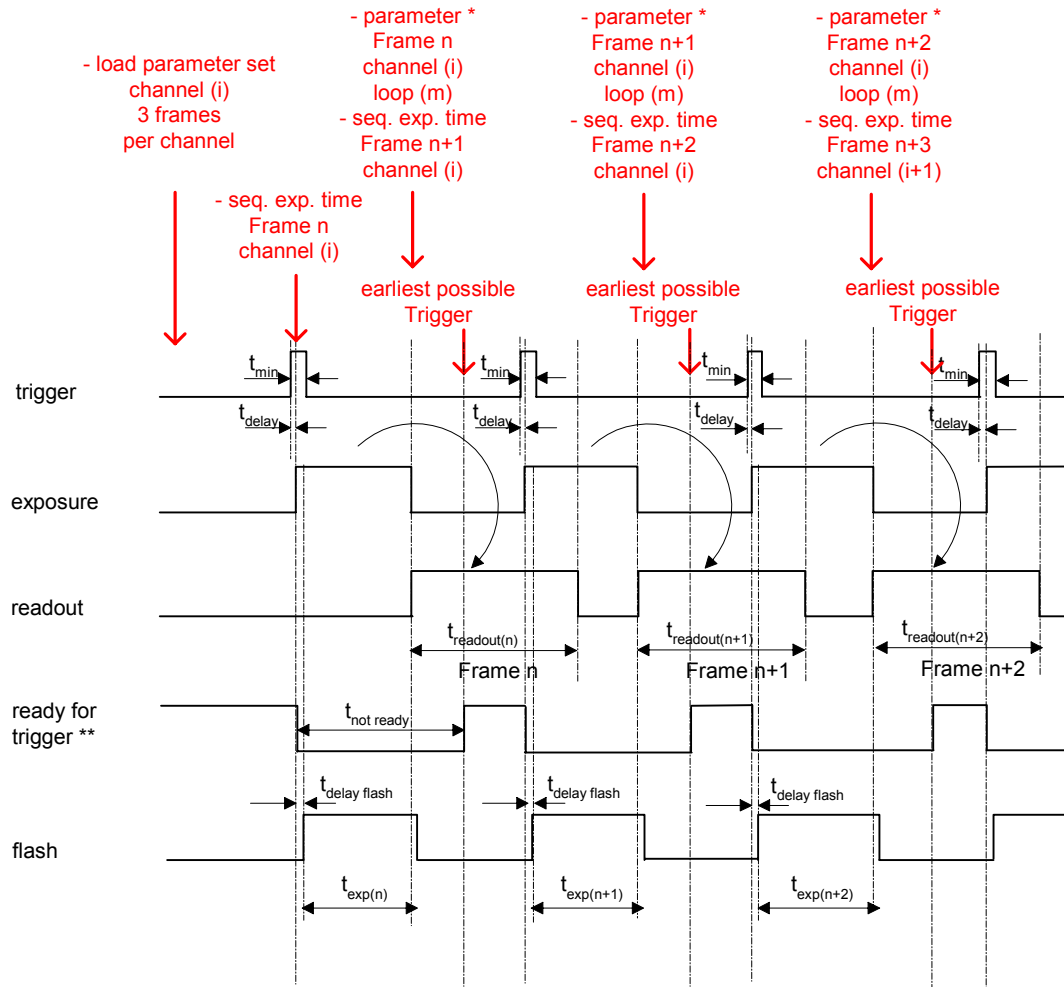
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

* 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)



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

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

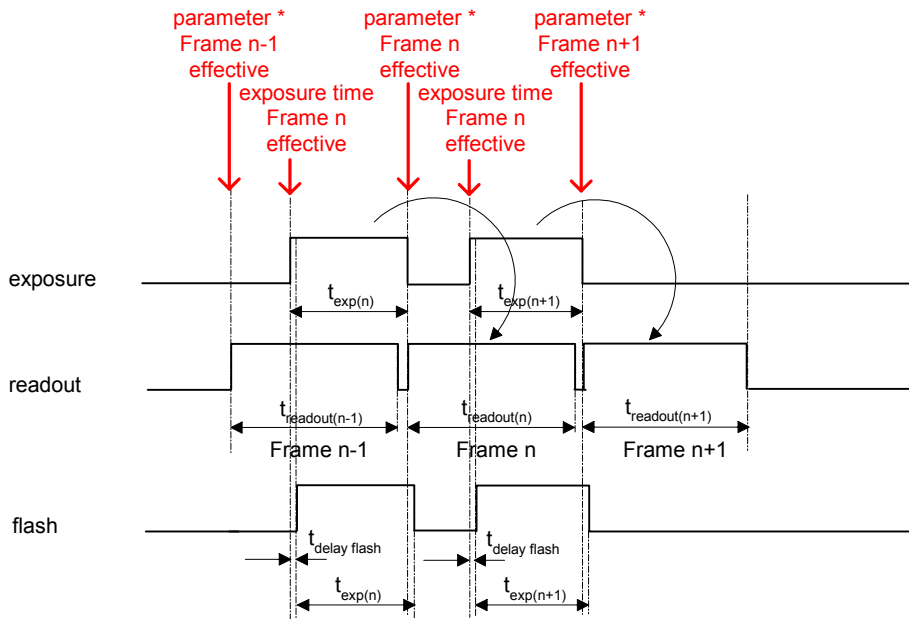
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

* image parameter: offset
sequence global gain
mode

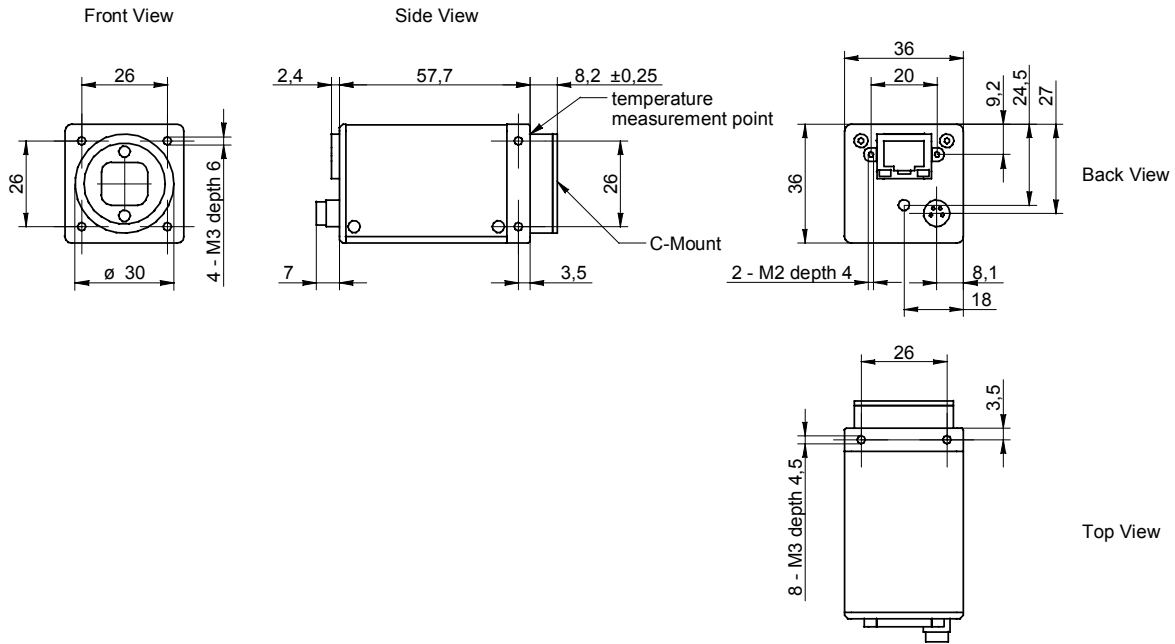
** signal will be notified as event "TriggerReady" and is not available as digital output

Free Running Mode: overlapped operation



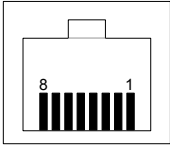
* image parameter: offset
 global gain
 mode
 partial scan


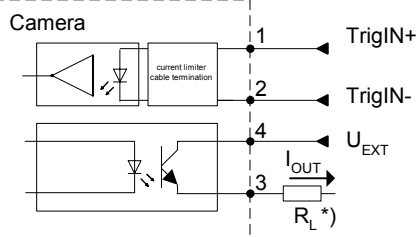
4. Housing



5. Connectors / Electrical Interfaces

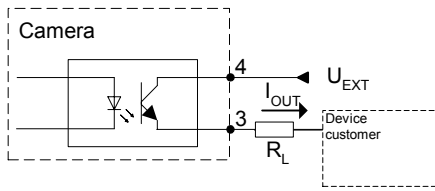
5.1 Pin assignment:

Data / Control 1000 Base-T	Type: RJ45 8P8C mod jack
	1: MX1+ (negative / positive V_{port}) 2: MX1- (negative / positive V_{port}) 3: MX2+ (positive / negative V_{port}) 4: MX3+ 5: MX3- 6: MX2- (positive / negative V_{port}) 7: MX4+ 8: MX4-

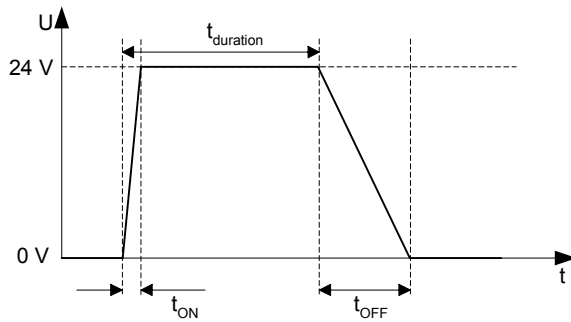
Trigger Flash	Type: Lumberg RSMESD 4pin.
	 <p>*) resistor must be used, $I_{OUT} = 16 \text{ mA}$ by $U_{EXT} = 24 \text{ VDC}$ recommended, drawing shown above example for using high active signal</p>
	Trigger / Flash cable wires color *): 1 = brown 2 = white 3 = blue 4 = black

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

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

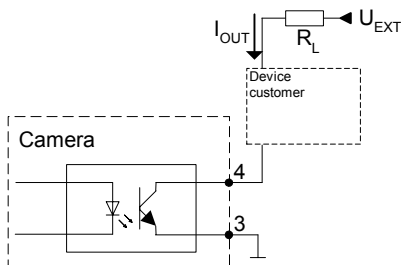


Timing example:
 measurement condition $U_{EXT} = 24\text{ VDC} / I_{OUT} = 16\text{ mA}$
 $R_L = 1.5\text{ kOhm}$

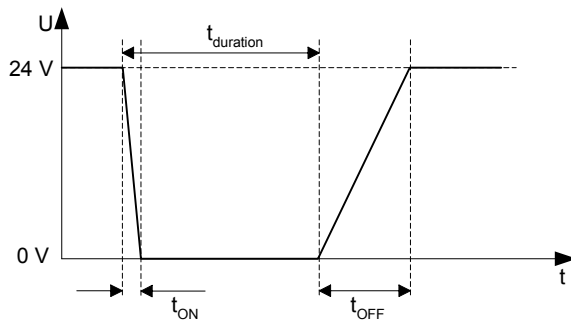


t_{ON} time = typ. $2\ \mu\text{sec}$
 t_{OFF} time = typ. $40\ \mu\text{sec}$

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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