

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

 System: **Gigabit Ethernet**

Baumer TXG50

Revision 2

Art. No: OD108068

- Gigabit Ethernet progressive scan CCD camera
- 2448 x 2050 pixel
- Up to 15 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	TXG50
Sensor	2/3" interline progressive scan CCD
Shutter / readout mode	global shutter / progressive scan readout
Number of pixel	2448 x 2050
Scan area	8.5 mm x 7.1 mm
Pixel size	3.45 μ m x 3.45 μ m
Color filter	-
Operation modes	
Trigger mode	yes, overlapped operation
Free running mode	yes, overlapped operation
Signal processing	real-time software programmable
Pixel clock	60 MHz fast scan / 30 MHz high quality (HQ) scan
A/D converter	14 bit
Exposure control (t_{exp})	total: 4 μ sec .. 2 sec step 1 μ sec
Gain control	0 .. 20 dB
Offset (black level)	0 .. 1023 LSB (14 bit)
Image data buffer	32 MByte

Technical specifications subject to change

Image acquisition								
Camera image format modes		Format (pixel)	GenCam standard	Format ID	Color coding	Pixel clock MHz	Frames per sec. *)	t _{readout}
Full frame HQ	slow	2448 x 2050	Vendor specific	00	Mono8 **)	30	7.5	133 msec
					Mono12			
					Mono12 Packed			
Full frame	fast	2448 x 2050	yes	01	Mono8 **)	60	15	67 msec
					Mono12 ***)			
					Mono12 Packed			
Binning 2x2 HQ	slow	1224 x 1025	Vendor specific	02	Mono8 **)	30	15	67 msec
					Mono12			
					Mono12 Packed			
Binning 2x2	fast	1224 x 1025	yes	03	Mono8 **)	60	30	34 msec
					Mono12			
					Mono12 Packed			
Binning 1x2 HQ	slow	2448 x 1025	Vendor specific	04	Mono8 **)	30	15	67 msec
					Mono12			
					Mono12 Packed			
Binning 1x2	fast	2448 x 1025	yes	05	Mono8 **)	60	30	34 msec
					Mono12			
					Mono12 Packed			
Binning 2x1 HQ	slow	1224 x 2050	Vendor specific	06	Mono8 **)	30	7.5	133 msec
					Mono12			
					Mono12 Packed			
Binning 2x1	fast	1224 x 2050	yes	07	Mono8 **)	60	15	67 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 and Off							
Trigger delay	0 .. 2 sec, 512 trigger can be tracked							
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: ExposureActive or UserOutput										
Line debouncer	yes, low and high signal separately selectable 0 .. 5 msec step: 1µsec										
Event Generation											
Events	GigEVisionError, EventLost, TemperatureExceeded, 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 .. 10.037.100 Byte										
UserSets											
User set selector	Default (factory settings) 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											
	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											
Ethernet IP configuration	static IP / DHCP / LLA										
Async. Trigger	yes, trigger mode operation, "Off", "software trigger", "hardware trigger", "command trigger" and "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 = $t_{\text{exp}} + 64$ µsec fast mode = $t_{\text{exp}} + 32$ µsec										
Software reset	yes, delay up to 133 msec										
Asynchronous reset	<table border="1"> <tr> <td rowspan="2">Full frame / Binning 2x1</td> <td>slow</td> <td rowspan="2">delay up to 45 msec</td> </tr> <tr> <td>fast</td> <td>24 msec</td> </tr> <tr> <td rowspan="2">Binning 2x2 / Binning 1x2</td> <td>slow</td> <td rowspan="2">delay up to 23 msec</td> </tr> <tr> <td>fast</td> <td>12 msec</td> </tr> </table>	Full frame / Binning 2x1	slow	delay up to 45 msec	fast	24 msec	Binning 2x2 / Binning 1x2	slow	delay up to 23 msec	fast	12 msec
Full frame / Binning 2x1	slow		delay up to 45 msec								
	fast	24 msec									
Binning 2x2 / Binning 1x2	slow	delay up to 23 msec									
	fast		12 msec								
Image info header	yes										

Electrical interface	
Data / control	standard single cable 1000 Base-T, Cat6 option: screw lock type connector
Power	VCC: 8 VDC .. 30 VDC I: 615 mA .. 190 mA
Power consumption	approx. 6 Watt
Digital input	Line 0: trigger signal, opto decoupled $U_{IN(low)} = 0 .. 4.5 \text{ VDC}$, $U_{IN(high)} = 11 .. 30 \text{ VDC}$ $I_{IN} = \text{max. } 10 \text{ mA}$ rising edge (invert = false) ***** min. trigger impulse length (t_{min}): 2 μsec trigger delay out of $t_{readout}$ ($t_{delay \text{ trigger}}$): 3 μsec max. trigger delay during $t_{readout}$ ($t_{delay \text{ trigger}}$): slow mode = 64 μsec fast mode = 32 μsec
Digital output	Line 1: opto decoupled $U_{EXT} = 5 .. 30 \text{ VDC} / 24 \text{ VDC typical}$, $I_{OUT} = \text{max. } 16 \text{ mA}$ high active (invert = false) *****
LED	1: green: Power on yellow: Readout active 2: green: Link 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 between +25 °C .. +50 °C, note the max. housing temperature (see application note)
Housing operating temperature	max. +50 °C ***** (measurement point, see item 4)
Humidity	10 % .. 90 % non condensing
Conformity	CE, FCC Part 15 class B, UL, RoHS compliant
Housing	
Dimensions	aluminum 36 x 36 x 48 mm ³
Weight	< 90 g
1000 Base-T interface	
Ethernet IP configuration	1000 Mbit / sec static 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 / on request: 32 bit)

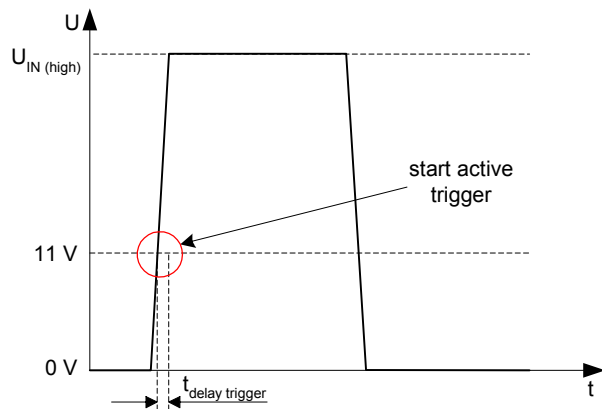
- *) maximum frame rate in free running mode, effective frame rate depending on camera image format mode settings and set exposure time ($t_{exp} < t_{readout}$)
- **) default pixel format
- ***) bandwidth of GigE interface is limiting frame rate
- ****) the LUT function will be used for the gamma value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

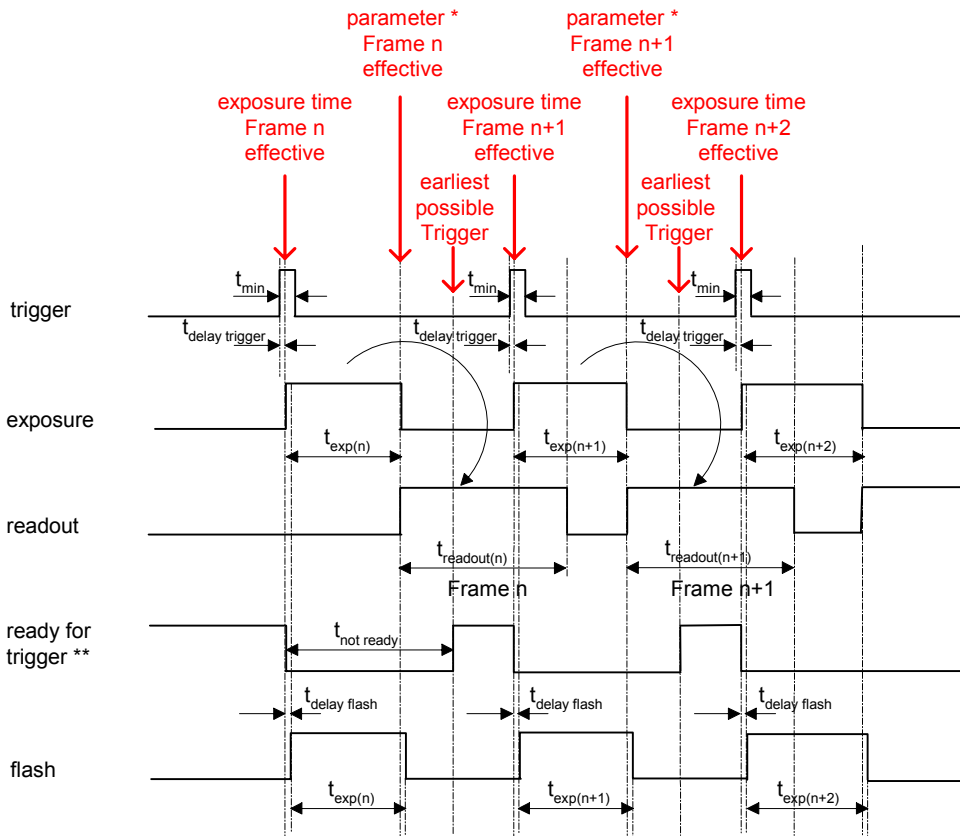
Camera factory settings after camera start-up	
Operation modes	free running mode
Signal processing	
Exposure control	32 msec
Gain control	factor 1 = 0 dB
Offset (black level)	0
Image acquisition	
Camera image format mode	mode id = 01, full frame Mono8
Partial scan function	not active
Test image selector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



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

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

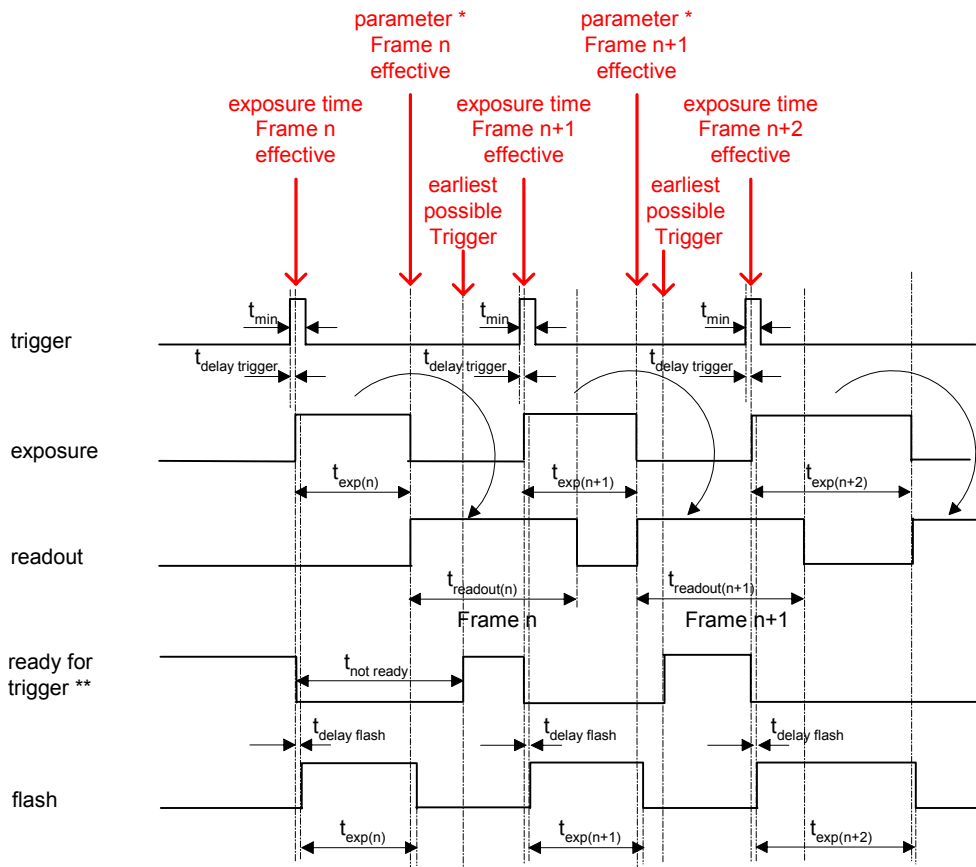
$$t_{exp} < t_{readout}: t_{\text{not ready (n+1)}} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

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



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

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

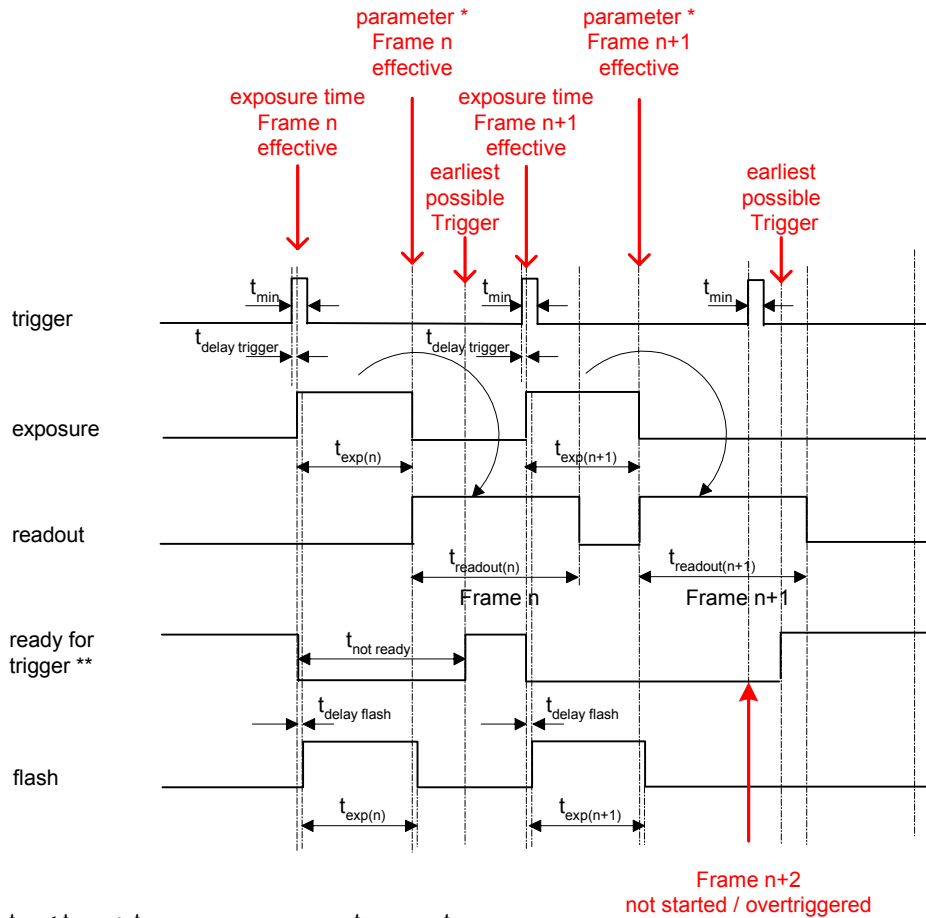
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

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



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

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

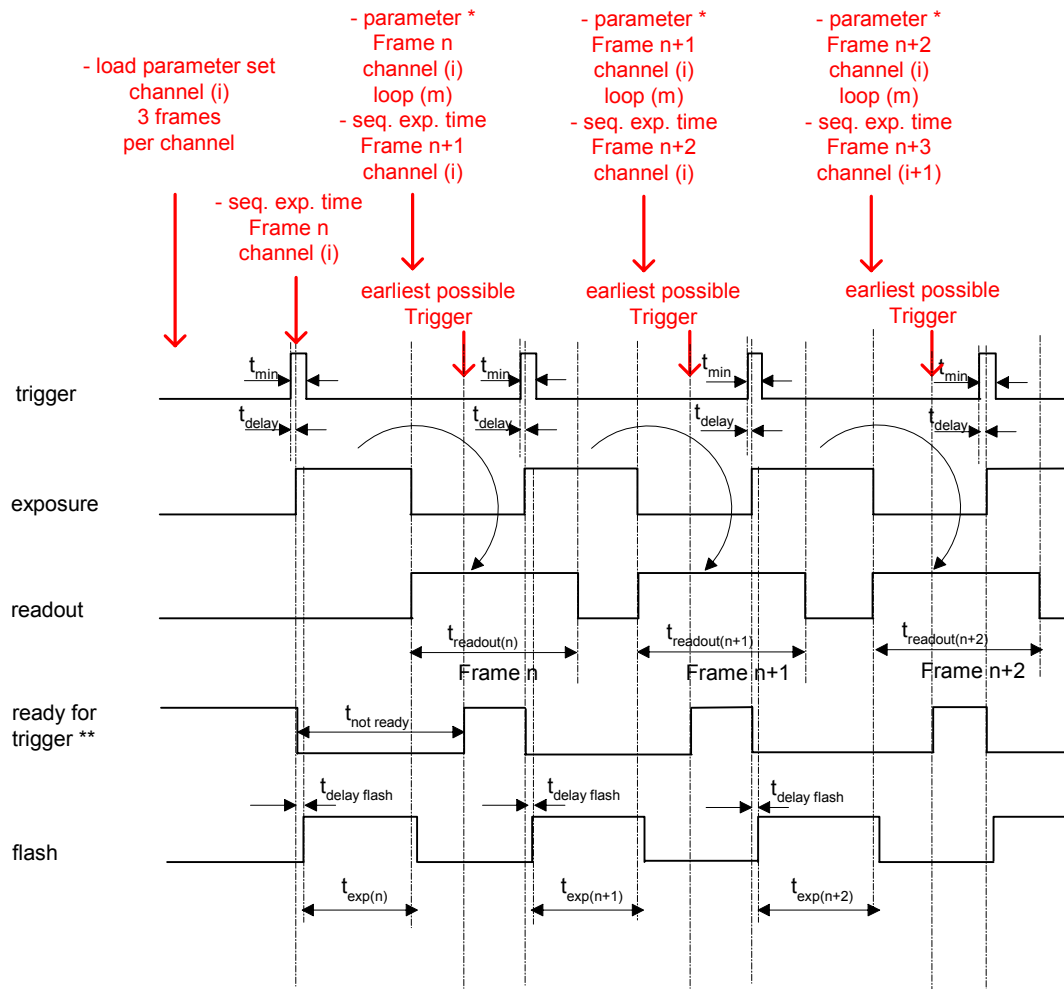
$$t_{exp} < t_{readout} : t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

* 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)



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

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

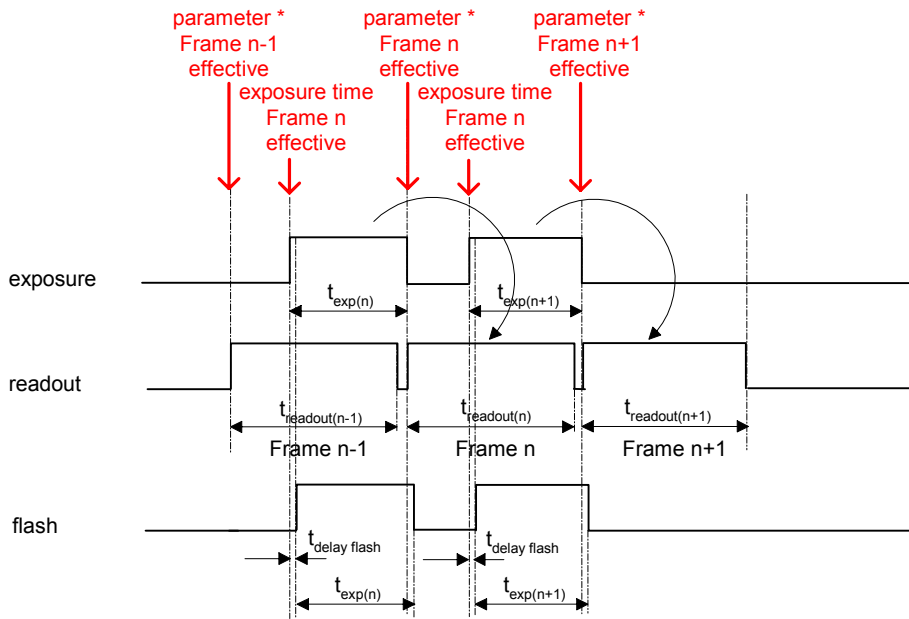
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

* image parameter: offset
sequence global gain
mode

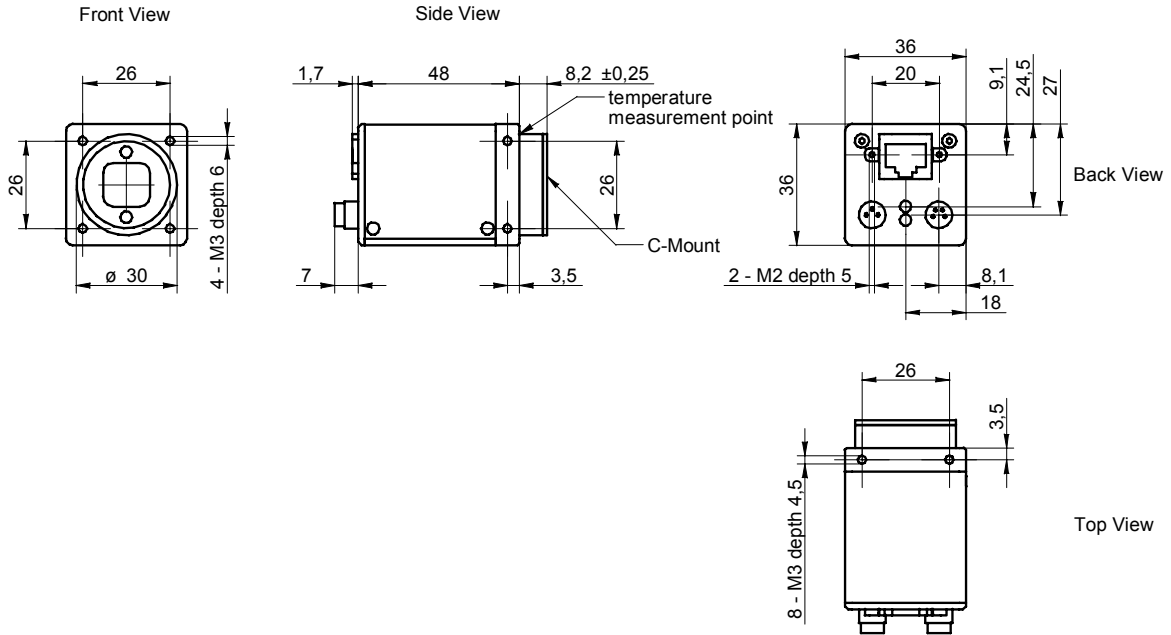
** signal will be notified as event "TriggerReady" and is not available as digital output

Free Running Mode: overlapped operation



* image parameter: offset
 global gain
 mode
 partial scan

4. Housing



5. Connectors / Electrical Interfaces

5.1 Pin assignment:

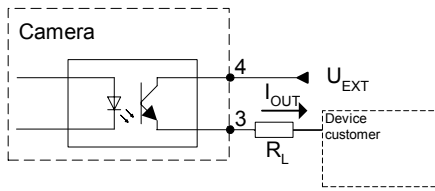
Data / Control 1000 Base-T	Type: RJ45 8P8C mod jack
	<ul style="list-style-type: none"> 1: MX1+ 2: MX1- 3: MX2+ 4: MX3+ 5: MX3- 6: MX2- 7: MX4+ 8: MX4-

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

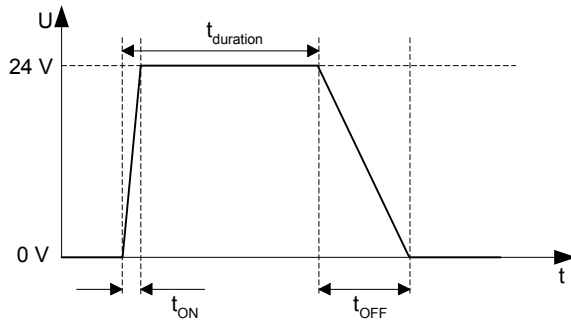
Trigger Flash	Type: Lumberg RSME5D 4pin.
	*) resistor must be used, $I_{OUT} = 16 \text{ mA}$ by $U_{EXT} = 24 \text{ VDC}$ recommended, drawing shown above example for using high active signal
	Trigger / Flash cable wires color *): 1 = brown 2 = white 3 = blue 4 = black

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

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

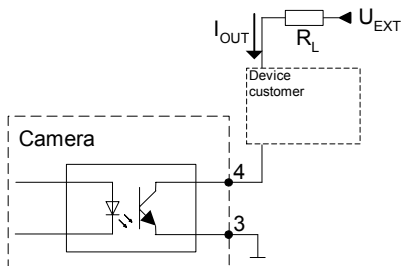


Timing example:
 measurement condition $U_{EXT} = 24 \text{ VDC} / I_{OUT} = 16 \text{ mA}$
 $R_L = 1.5 \text{ kOhm}$

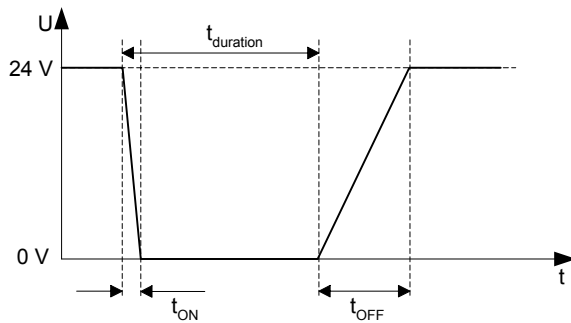


t_{ON} time = typ. $2 \mu\text{sec}$
 t_{OFF} time = typ. $40 \mu\text{sec}$

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. $40 \mu\text{sec}$

6. Application Note

- Baumer recommends that the camera should not be used unmounted.
- The camera should be mounted on a metal rack for using in warm environment. It is necessary to note the max. housing temperature of the camera.

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