

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

 System: **Gigabit Ethernet**

Baumer TXG14

Revision 2

Art. No: OD108072

- Gigabit Ethernet progressive scan CCD camera
- 1392 x 1040 pixel
- Up to 20 full frames per second
- GigE Vision™ standard compliant
- Outstanding image quality
- Ultra high sensitivity (Exview CCD technology) and high 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
- 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	TXG14
Sensor	2/3" interline progressive scan CCD Exview technology
Shutter / readout mode	global shutter / progressive scan readout
Number of pixel	1392 x 1040
Scan area	8.9 mm x 6.7 mm
Pixel size	6.45 μm x 6.45 μm
Color filter	-
Operation modes	
Trigger mode	yes, overlapped operation
Free running mode	yes, overlapped operation
Signal processing	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 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 _{readout}
Full frame HQ	slow	1392 x 1040	Vendor specific	00	Mono8 **)	20	10	100 msec
					Mono12			
					Mono12 Packed			
Full frame	fast	1392 x 1040	yes	01	Mono8 **)	40	20	50 msec
					Mono12			
					Mono12 Packed			
Binning 2x2 HQ	slow	696 x 520	Vendor specific	02	Mono8 **)	20	19	51 msec
					Mono12			
					Mono12 Packed			
Binning 2x2	fast	696 x 520	yes	03	Mono8 **)	40	39	26 msec
					Mono12			
					Mono12 Packed			
Binning 1x2 HQ	slow	1392 x 520	Vendor specific	04	Mono8 **)	20	19	51 msec
					Mono12			
					Mono12 Packed			
Binning 1x2	fast	1392 x 520	yes	05	Mono8 **)	40	39	26 msec
					Mono12			
					Mono12 Packed			
Binning 2x1 HQ	slow	696 x 1040	Vendor specific	06	Mono8 **)	20	10	100 msec
					Mono12			
					Mono12 Packed			
Binning 2x1	fast	696 x 1040	yes	07	Mono8 **)	40	20	50 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							

Technical specifications subject to change

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, 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 ... 2.895.632 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	
Readout noise	$\sigma < 0.5$ LSB (8 bit) typical
Dynamic range	typical > 54 dB
Optical interface	
Optical filter	C-Mount on request: CS-Mount 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" 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 = $t_{\text{exp}} + 94$ µsec fast mode = $t_{\text{exp}} + 47$ µsec
Software reset	yes, delay up to 102 msec
Asynchronous reset	Full frame / Binning 2x1 slow delay up to 21.3 msec fast 10.7 msec
	Binning 2x2 / Binning 1x2 slow delay up to 11.0 msec fast 5.5 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: 450 mA .. 135 mA
Power consumption	approx. 4 Watt
Digital input	Line 0: trigger signal, opto decoupled $U_{IN(low)} = 0 .. 4.5 \text{ VDC}$, $U_{IN(high)} = 11 .. 30 \text{ VDC}$ $I_{IN} = \text{max. } 10 \text{ mA}$ rising edge (invert = false) ****) min. trigger impulse length (t_{min}): 2 μsec trigger delay out of $t_{readout}$ ($t_{delay \text{ trigger}}$): 5 μsec max. trigger delay during $t_{readout}$ ($t_{delay \text{ trigger}}$): slow mode = 94 μsec fast mode = 47 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
Housing operating temperature	between +36 °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, UL, RoHS compliant
Housing	
Dimensions	36 x 36 x 48 mm ³
Weight	< 90 g
1000 Base-T interface	1000 Mbit / sec
Ethernet IP configuration	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 / 32 bit)

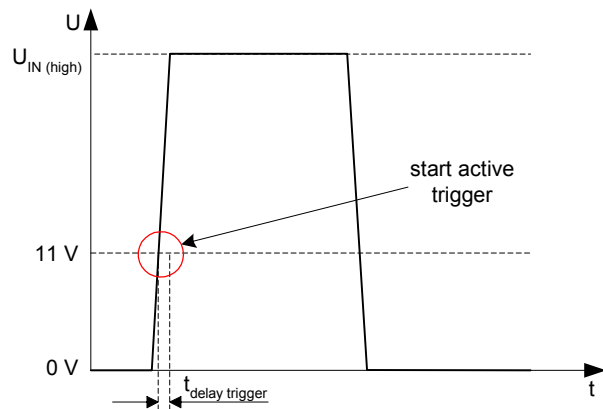
- *) maximum frame rate in free running mode, effective frame rate depending on camera image format mode settings and set exposure time ($t_{exp} < t_{readout}$)
- ***) default pixel format
- ****) the LUT function will be used for the gamma value and the calculation time of the internal used LUT need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

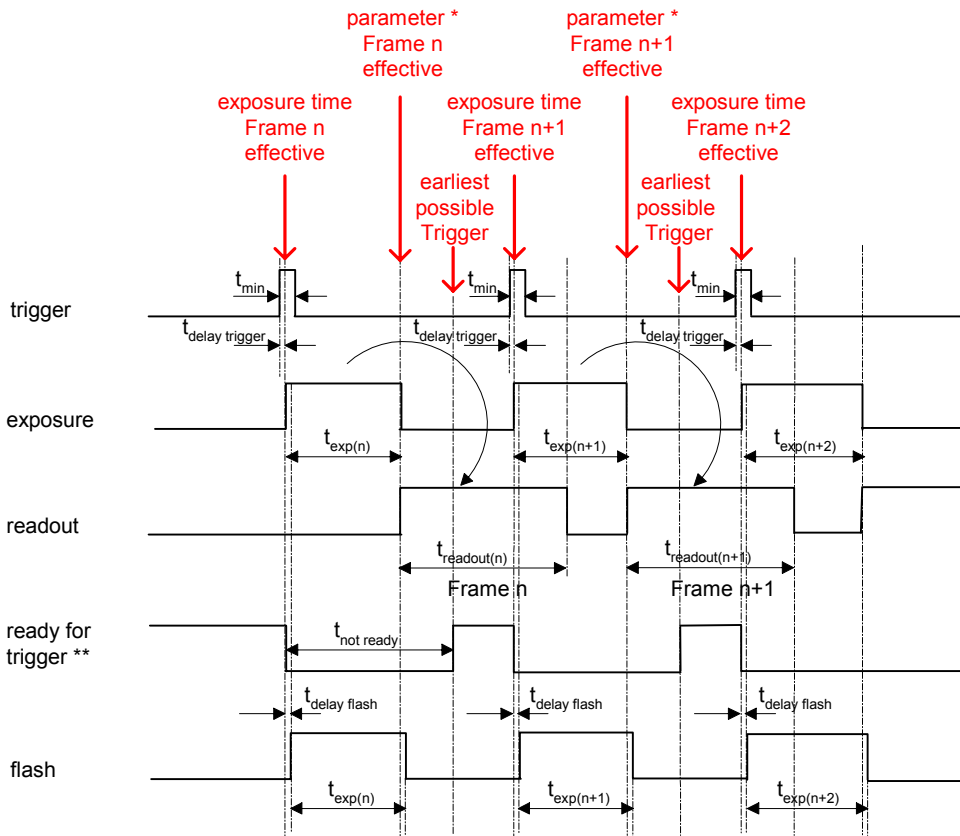
Camera factory settings after camera start-up	
Operation modes	free running mode
Signal processing	
Exposure control	32 msec
Gain control	factor 1 = 0 dB
Offset (black level)	0
Image acquisition	
Camera image format mode	mode id = 01, full frame / Mono8
Partial scan function	not active
Test image selector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



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

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

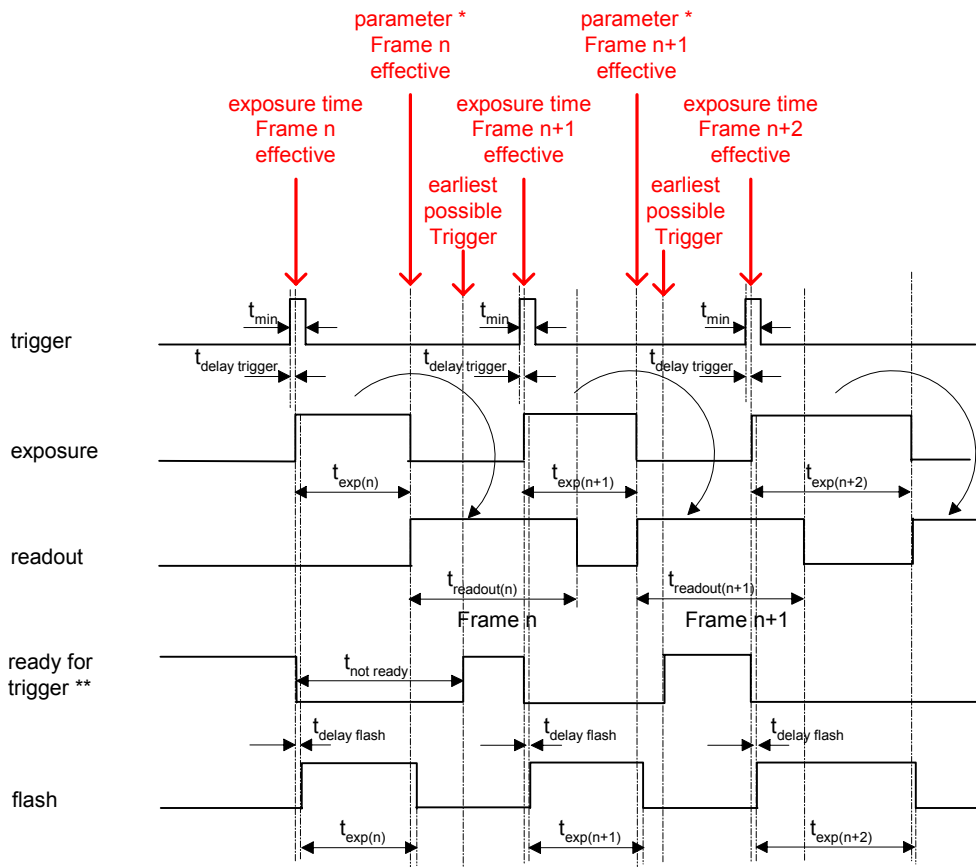
$$t_{exp} < t_{readout}: t_{\text{not ready (n+1)}} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

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



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

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

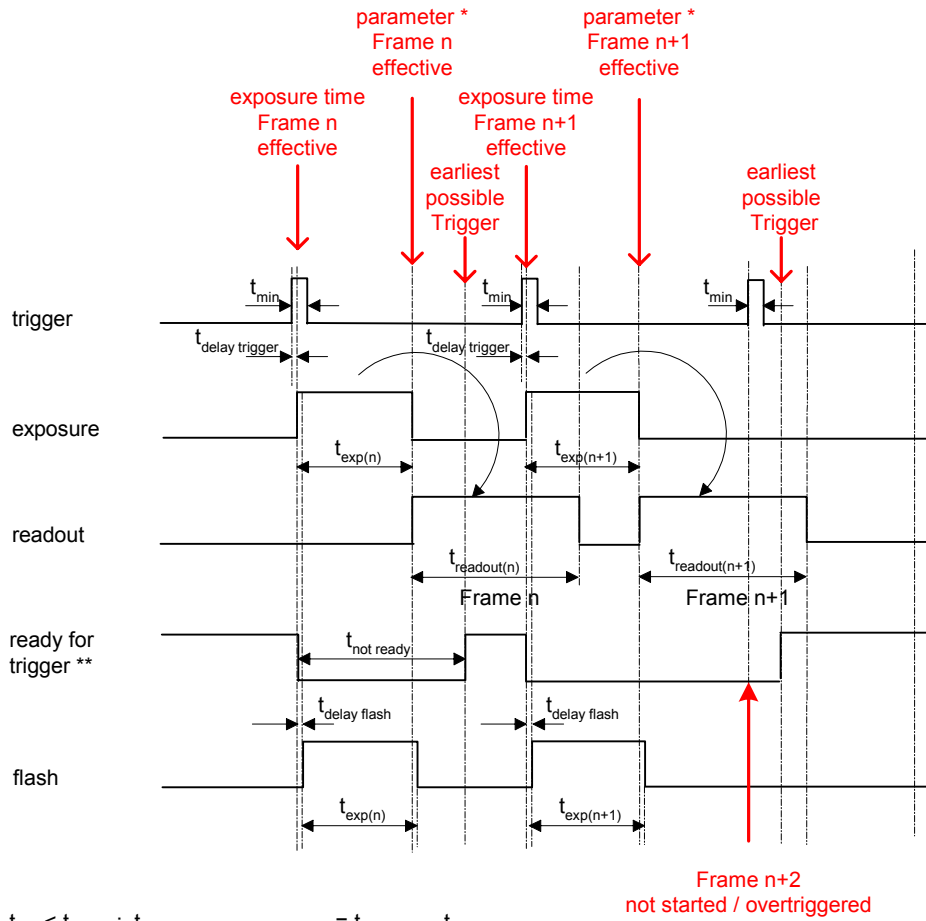
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

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



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

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

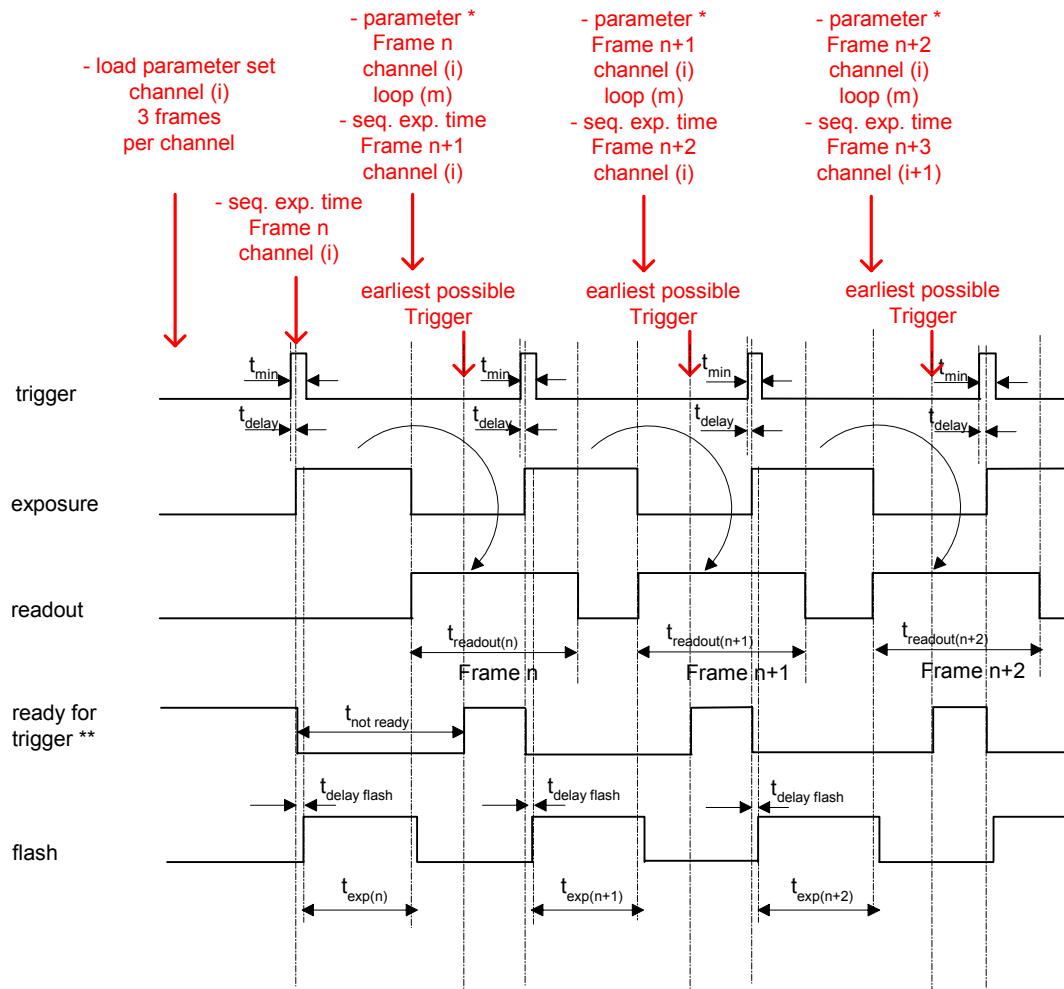
$$t_{exp} < t_{readout} : t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

* 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)

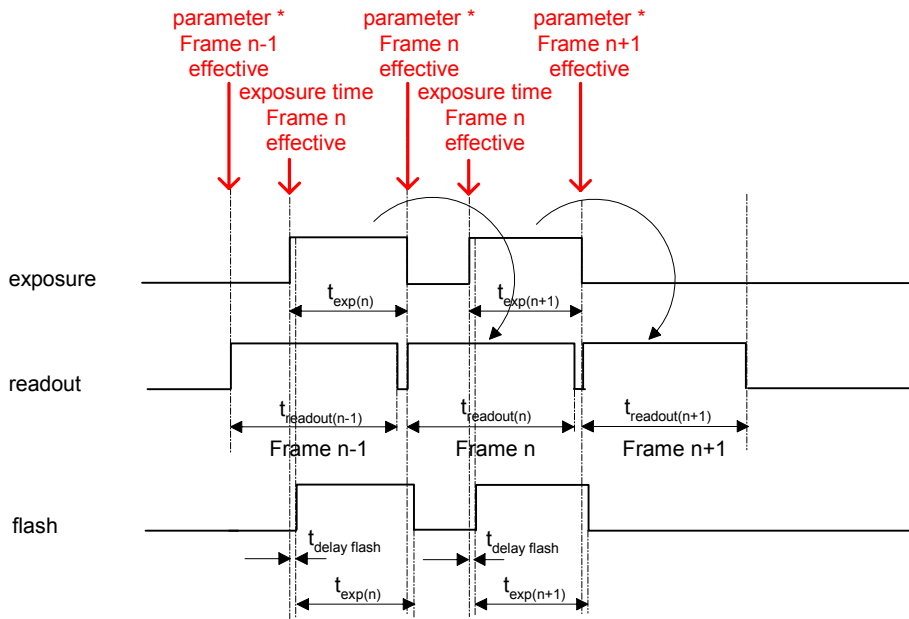


$$\begin{aligned}
 t_{exp} < t_{readout}: t_{earliest\ possible\ trigger\ (n+1)} &= t_{readout(n)} - t_{exp(n+1)} \\
 t_{exp} > t_{readout}: t_{earliest\ possible\ trigger\ (n+1)} &= t_{exp(n)} \\
 t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} &= t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)} \\
 t_{exp} > t_{readout}: t_{not\ ready\ (n+1)} &= t_{exp(n)}
 \end{aligned}$$

* image parameter: offset
sequence global gain
mode

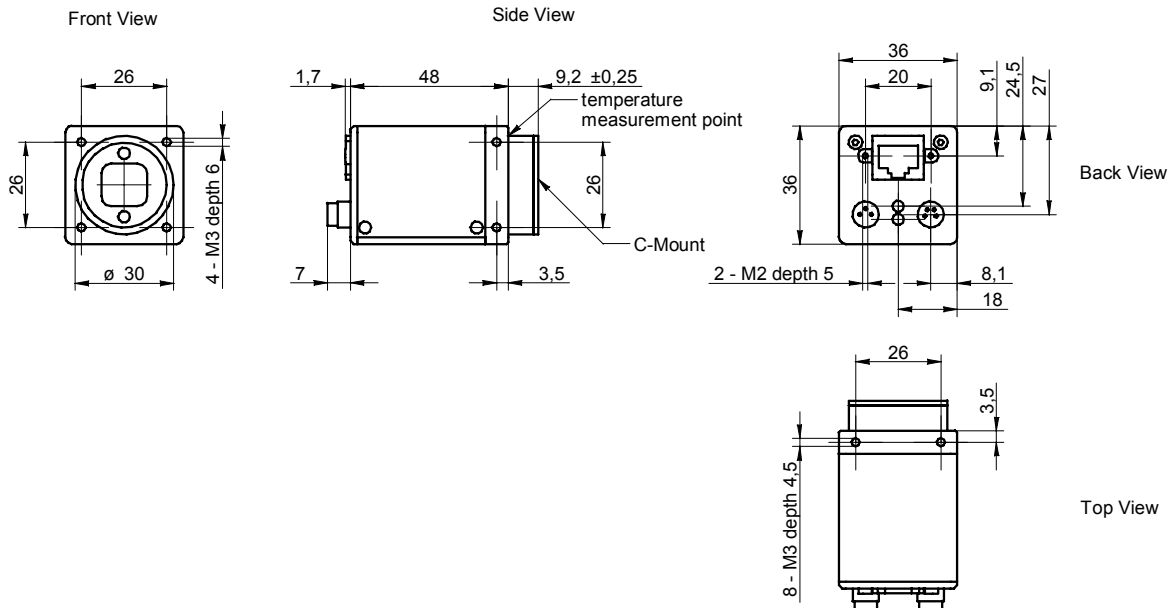
** signal will be notified as event "TriggerReady" and is not available as digital output

Free Running Mode: overlapped operation



* image parameter: offset
 global gain
 mode
 partial scan

4. Housing



5. Connectors / Electrical Interfaces

5.1 Pin assignment:

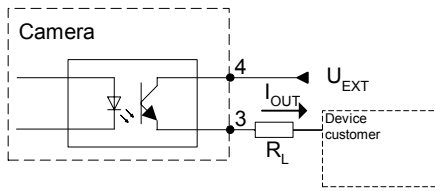
Data / Control 1000 Base-T	Type: RJ45 8P8C mod jack
	<ul style="list-style-type: none"> 1: MX1+ 2: MX1- 3: MX2+ 4: MX3+ 5: MX3- 6: MX2- 7: MX4+ 8: MX4-

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

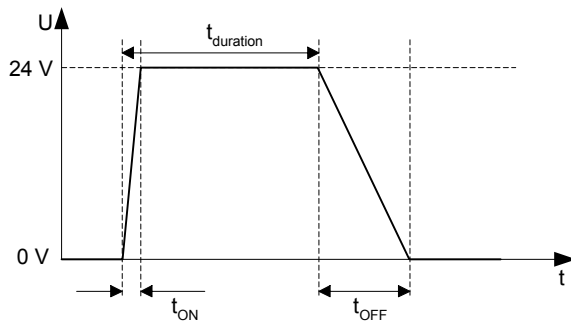
Trigger / Flash	Type: Lumberg RSME5D 4pin.
	*) resistor must be used, $I_{OUT} = 16 \text{ mA}$ by $U_{EXT} = 24 \text{ VDC}$ recommended, drawing shown above example for using high active signal
	Trigger / Flash cable wires color *): 1 = brown 2 = white 3 = blue 4 = black

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

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

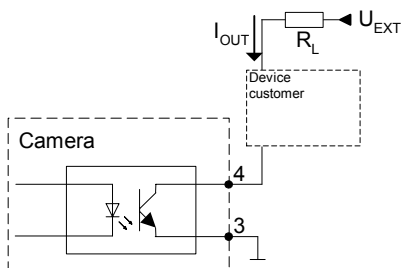


Timing example:
 measurement condition $U_{EXT} = 24\text{ VDC} / I_{OUT} = 16\text{ mA}$
 $R_L = 1.5\text{ kOhm}$

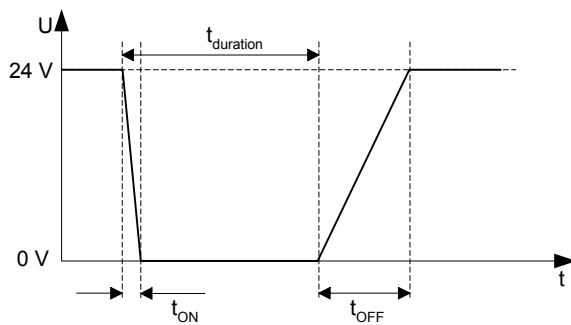


t_{ON} time = typ. $2\ \mu\text{sec}$
 t_{OFF} time = typ. $40\ \mu\text{sec}$

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. $40\ \mu\text{sec}$

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