

**Digital Color
Progressive Scan Camera**

 System: **Gigabit Ethernet**
Baumer TXG50c

 Art. No: **OD108178**

- Gigabit Ethernet progressive scan CCD camera
- 2440 x 2042 pixel
- Up to 15 full frames per second
- GigE Vision™ standard compliant
- On board integrated color processor for high quality color calculation
- Outstanding image quality
- High sensitivity and dynamic range
- High quality slow scan mode for lowest readout noise
- True partial scan function (ROI) for increased frame rates
- External synchronization via industrial compliant process interface (trigger / flash)
- 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

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 µm x 3.45 µm
Color filter	RGB Bayer mosaic
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 µsec .. 2 sec step 1 µsec
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									
Data format	YUV , RGB , BGR , Mono8 or Raw image data from camera								
Camera image format modes	Format (pixel)	Gen-Cam standard	Format ID	Pixel format	Pixel clock MHz	Frames per sec. *)	t _{readout}		
Full frame HQ Raw	slow	2448 x 2050	Vendor specific	00	BayerRG8 **)	30	7.5	133 msec	
					BayerRG12				
Full frame Raw	fast	2448 x 2050	yes	01	BayerRG8 **)	60	15	67 msec	
									BayerRG12 ***)
Full frame HQ	slow	2440 x 2042	Vendor specific	02	Mono8	30	7.5	133 msec	
					YUV411 Packed				
					YUV422 Packed **)				
					YUV444 Packed				
					RGB8 Packed				
					BGR8 Packed				
Full frame	fast	2440 x 2042	yes	03	Mono8	60	15	67 msec	
					YUV411 Packed **)				
					YUV422 Packed ***)				
Stream channel packet size	576 Byte .. 16 kByte jumbo frames supported								
Partial scan function	yes, format freely programmable in all modes								
Look up table function	on request: user programmable (input 12 bit, output 12 bit / 8 bit) or Gamma								
Test pattern function	yes, in all modes								
Advanced features									
Time stamp function	yes								
Resend function	yes								
Asynchronous message channel	on request								
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	Hoya E-CM500S on request: super polished, dust protection, daylight filter or no filter								
Process interface functions									
Ethernet IP configuration	static IP / DHCP / LLA								
Async. Trigger	yes, trigger mode operation, software trigger and external trigger separately selectable external trigger in trigger mode 0 (overtriggered signals and trigger signals during the readout time will be notified in the received image header)								
External flash sync	yes, delay_value ≤ 4 μ sec, duration_value (t _{duration}) : slow mode = t _{exp} + 64 μ sec fast mode = t _{exp} + 32 μ sec								
Software reset	yes, delay up to 133 msec								
Asynchronous reset	Full frame	slow	delay up to 45 msec						
		fast	24 msec						
Image info header	yes								
User defined identifier	on request : user programmable permanent identifier								

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	1: trigger signal, opto decoupled $U_{IN(low)} = 0 \dots 4.5 \text{ VDC}$, $U_{IN(high)} = 11 \dots 30 \text{ VDC}$ $I_{IN} = 20 \text{ mA}$ (typical) rising edge (invert = false) ****) min. trigger impulse length (t_{min}): 2 μsec trigger delay out of $t_{readout}$ (t_{delay}): 3 μsec max. trigger delay during $t_{readout}$ ($t_{delay \text{ trigger}}$): slow mode = 64 μsec fast mode = 32 μsec
Digital output	1: flash sync signal, opto decoupled $U_{EXT} = 5 \dots 30 \text{ VDC} / 24 \text{ VDC}$ typical, $I_{OUT} = 16 \text{ mA}$ *****) high active (invert = false) *****) flash delay ($t_{delay \text{ flash}}$): $\leq 4 \mu\text{sec}$
LED	1: green: power on / yellow: data transmission active 2: green: Ethernet RX / yellow: Ethernet 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, RoHS
Housing	
Dimensions	36 x 36 x 48 mm ³
Weight	< 90 g
1000 Base-T interface	1000 Mbit / sec
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)

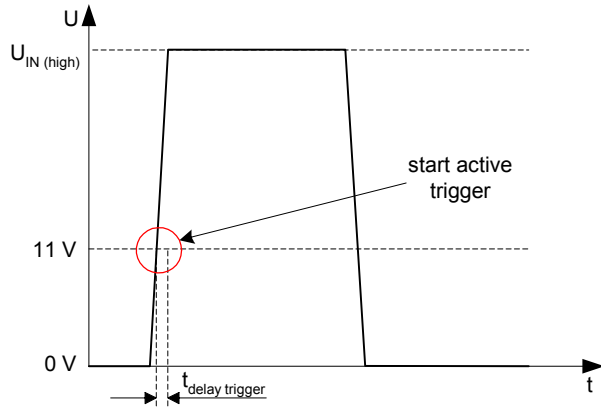
- *) maximum frame rate in free running mode, effective frame rate depending on camera image format mode settings and set exposure time ($t_{exp} < t_{readout}$)
- ***) default pixel format
- ****) bandwidth of GigE interface is limiting frame rate
- *****) can be inverted via software
- *****) necessary for optimal timing specification
- *****) housing temperature is limited by CCD sensor specification

2. Camera Factory Settings after Camera Start-up

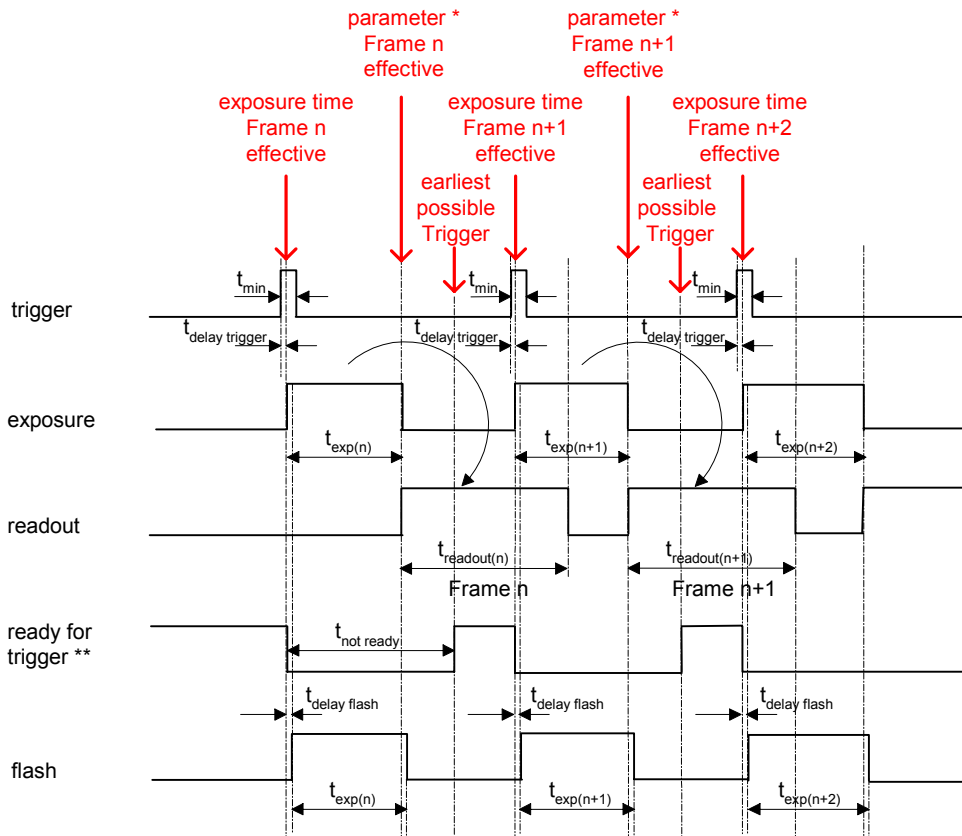
Camera factory settings after camera start-up	
Operation modes	free running mode
Signal processing	
Exposure control	32 msec
Gain control	factor 1 = 0 dB
Offset (black level)	0
Image acquisition	
Camera image format mode	mode id = 03, full frame YUV411 Packed
White balance	active, adjusted on light source value = 5000 K (D50)
Partial scan function	not active
Stream channel packet size	576 Byte
Electrical interface	
Flash sync signal	disabled, digital output set to low status (high impedance) invert = false
Async. Trigger	disabled invert = false

3. Timing Operation Modes

Trigger Mode: start up time



Trigger Mode: trigger mode 0, overlapped trigger



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

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

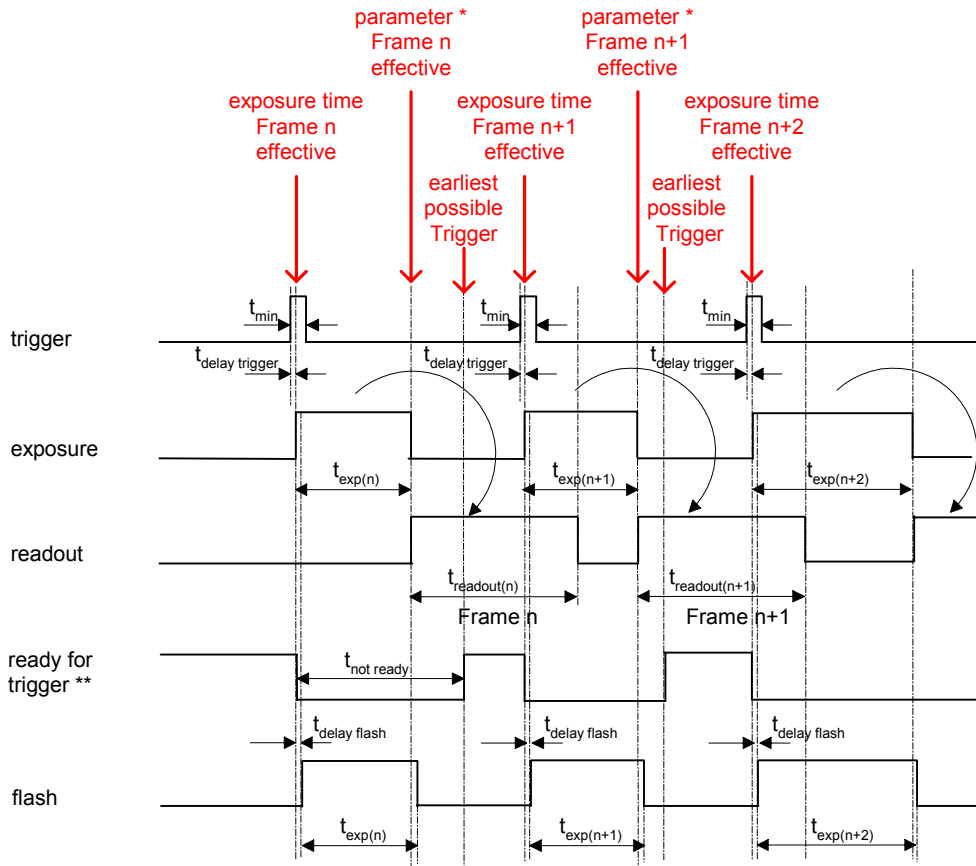
$$t_{exp} < t_{readout}: t_{\text{not ready (n+1)}} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

* image parameter: offset
 global gain
 mode
 partial scan

** signal is not available as digital output

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



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

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

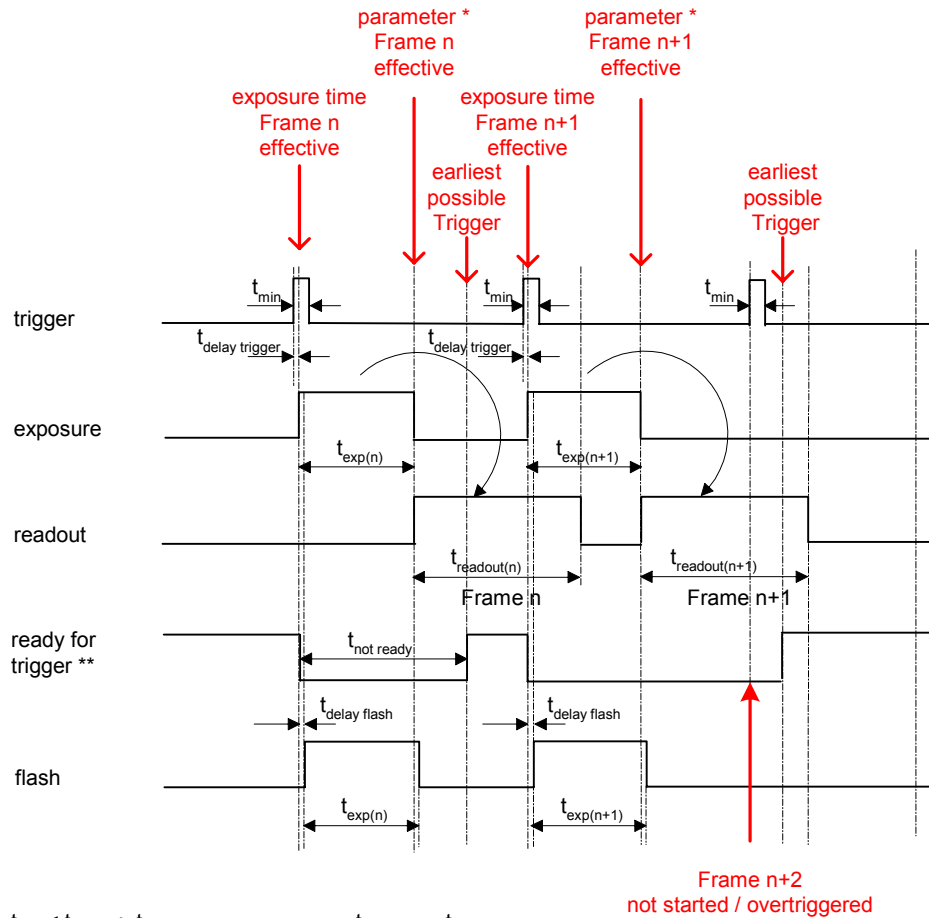
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

* image parameter: offset
 global gain
 mode
 partial scan

** signal is not available as digital output

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



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

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

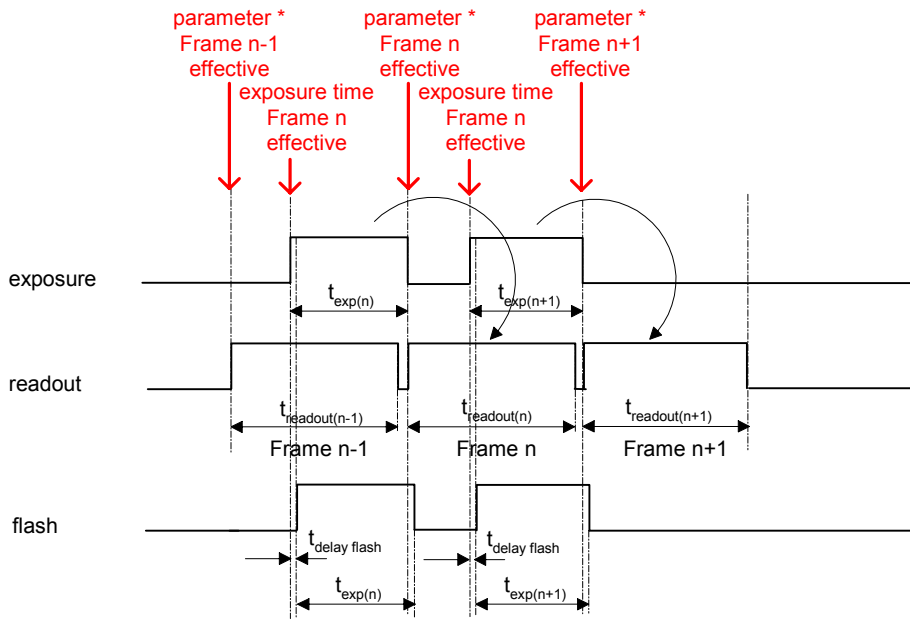
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

* image parameter: offset
global gain
mode
partial scan

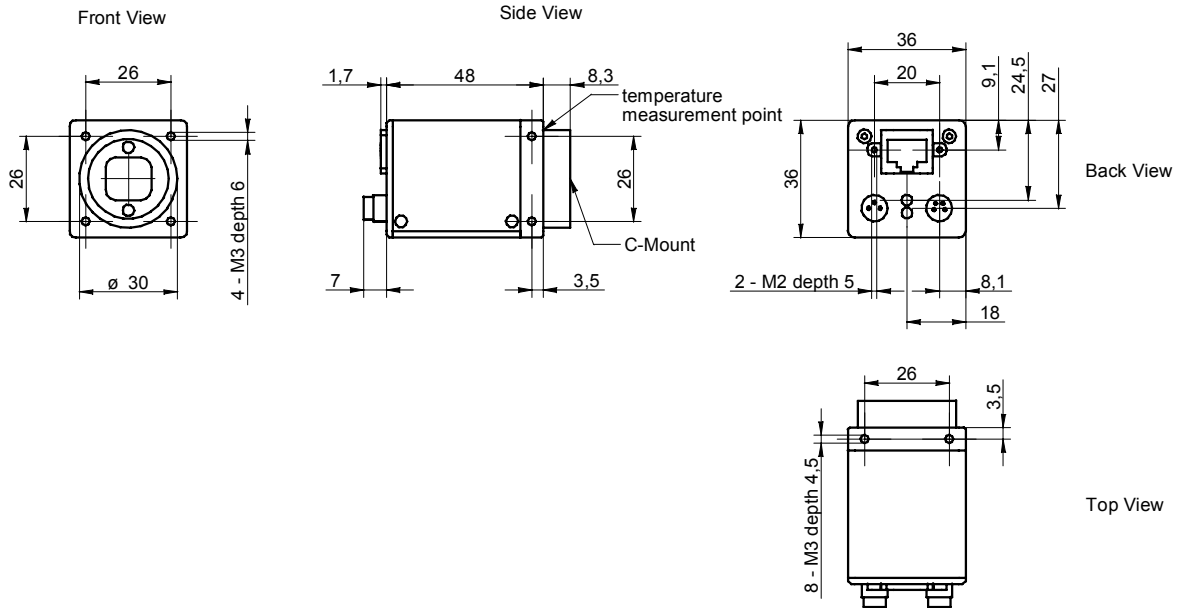
** signal is not available as digital output

Free Running Mode: overlapped operation



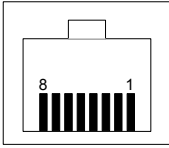
* image parameter: offset
 global gain
 mode
 partial scan


4. Housing


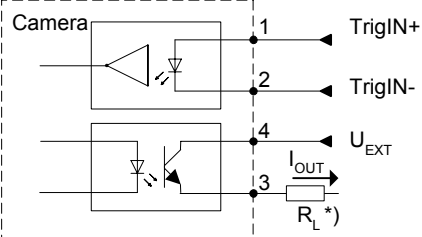


5. Connectors / Electrical Interfaces

5.1 Pin assignment:

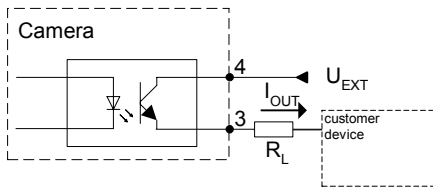
Data / Control 1000 Base-T	Type: RJ45 8P8S mod jack
	<ul style="list-style-type: none"> 1: MX1+ 2: MX1- 3: MX2+ 4: MX3+ 5: MX3- 6: MX2- 7: MX4+ 8: MX4-

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

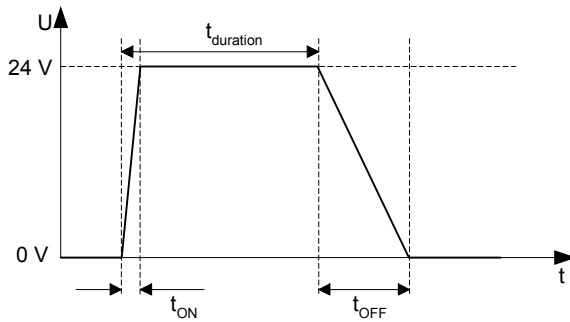
Trigger / Flash	Type: Lumberg RSME5D 4pin.
	
	*) resistor must be used, $I_{OUT} = 16 \text{ mA}$ by $U_{EXT} = 24 \text{ VDC}$ recommended, drawing shown above example for using high active signal
	Trigger / Flash cable wires color *): 1 = brown 2 = white 3 = blue 4 = black

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

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

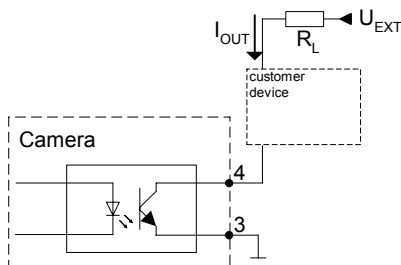


Timing example:
measurement condition $U_{EXT} = 24\text{ VDC} / I_{OUT} = 16\text{ mA}$

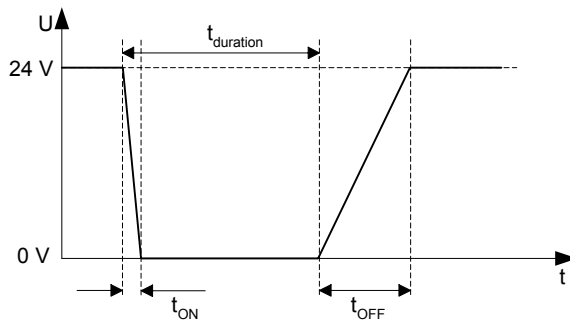


t_{ON} time = typ. 2 μsec
 t_{OFF} time = typ. 40 μsec

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



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



t_{ON} time = typ. 2 μsec
 t_{OFF} time = typ. 40 μsec

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.

End of Document