

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

 System: **IEEE1394b**
**Baumer TXD20**

 Art. No: **OD107727**

- FireWire™ – IEEE1394b (800 Mbit / sec) progressive scan CCD camera
- 1624 x 1236 pixel
- Up to 16 full frames per second
- 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 32 MByte RAM for temporarily image data buffering
- Ultra compact and lightweight aluminum housing
- Bilingual: FireWire™ – IEEE1394b and IEEE1394a compatible
- Screw-lock type industrial connector
- Baumer-GAPI: Flexible, generic software interface for Windows
- DCAM (IIDC V1.31) compatible Baumer driver / Baumer OHCI driver



shown lens needs to be ordered separately

**1. Overview**

<b>Sensor</b>	1/1.8" interline progressive scan CCD
Shutter / readout mode	global shutter / progressive scan readout
Number of pixel	1624 x 1236
Scan area	7.15 mm x 5.44 mm
Pixel size	4.4 µm x 4.4 µm
Color filter	-
<b>Operation modes</b>	
Trigger mode	yes, overlapped operation
Free running mode	yes, overlapped operation
<b>Signal processing</b>	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	manual control: 0 .. 20 dB
Offset (black level) / brightness control	manual control: 0 .. 255 LSB (12 bit)
Image data buffer	32 MByte
<b>Image acquisition</b>	
One / multi shot function	yes
Data format / color coding	Mono8, Mono16

Technical specifications subject to change

Camera image format modes	Resolution / description	Color coding	Bit per pixel	Pixel clock MHz	Frames per sec. *)	t <sub>readout</sub>
<b>Format 2 Mode 5</b>	1600 x 1200 center scan fast scan	Mono8	8	40	30 (16) **, 15, 7.5, 3.75, 1.875	61 msec
<b>Format 2 Mode 7</b>	1600 x 1200 center scan high quality scan	Mono16	16	20	15 (8.3) **, 7.5, 3.75, 1.875	121 msec
<b>Format 7 Mode 0</b>	1624 x 1236 full frame high quality scan	Mono8	8	20	8 block size 4 .. 4096 Byte	125 msec
		Mono16	16			
<b>Format 7 Mode 1</b>	1624 x 1236 full frame fast scan	Mono8	8	40	16 block size 4 .. 8192 Byte	63 msec
		Mono16	16			
<b>Format 7 Mode 2</b>	812 x 618 binning 2x2 high quality scan	Mono8	8	20	15 block size 4 .. 1888 Byte	67 msec
		Mono16	16			
<b>Format 7 Mode 3</b>	812 x 618 binning 2x2 fast scan	Mono8	8	40	29 block size 4 .. 3768 Byte	35 msec
		Mono16	16			
<b>Partial scan function</b>	yes, format freely programmable in all Format 7 modes					
<b>Advanced feature</b>						
Look up table	on request: user programmable (input 12 bit, output 12 bit / 8 bit) or Gamma					
Test pattern function	yes, in all modes					
Brightness correction	yes, optional in all binning modes					
Image info header	yes					
Start / stop camera	yes					
<b>Data quality</b>	at 20 °C, gain = 0 dB, exposure time = 32 msec, Format 7 Mode 0					
Readout noise	$\sigma < 0.5$ LSB (8 bit) typical					
Dynamic range	typical > 54 dB					
<b>Optical interface</b>	C-Mount option: CS-Mount					
Optical filter	dust protection option: super polished, IR cut filter, daylight filter or no filter					
<b>Process interface functions</b>						
Async. trigger	yes, trigger mode operation, software trigger and external trigger in trigger mode 0					
External flash sync / Strobe_0	yes delay_value ≤ 4 µsec, duration_value (t <sub>duration</sub> ): slow mode = t <sub>exp</sub> + 99 µsec fast mode = t <sub>exp</sub> + 50 µsec					
Software reset / initialize camera	yes, delay up to 125 msec					
<b>Electrical interface</b>						
Data / control / power	standard single cable IEEE1394b bilingual / 9 pins option: screw lock type connector					
Digital input	1: trigger signal, opto decoupled U <sub>IN(low)</sub> = 0 .. 4.5 VDC, U <sub>IN(high)</sub> = 11 .. 30 VDC I <sub>IN</sub> = 20 mA (typical) rising edge / polarity bit = "1" *** min. trigger impulse length (t <sub>min</sub> ): 2 µsec trigger delay out of t <sub>readout</sub> (t <sub>delay trigger</sub> ): 3 µsec max. trigger delay during t <sub>readout</sub> (t <sub>delay trigger</sub> ): slow mode = 106 µsec fast mode = 53 µsec					
Digital output	1: flash sync signal, opto decoupled U <sub>EXT</sub> = 5 .. 30 VDC / 24 VDC typical, I <sub>OUT</sub> = 16 mA **** high active / polarity bit = "1" *** flash delay (t <sub>delay flash</sub> ): ≤ 4 µsec					
LED	green: power on / yellow: data transmission active					
Power consumption	VCC: 8 .. 33 V I: 300 mA .. 100 mA approx. 3 Watt					

Technical specifications subject to change

<b>Environmental</b>	
Storage temperature	-10 °C .. +70 °C
Operating temperature	+5 °C .. +50 °C
Humidity	10 % .. 90 % non condensing
Conformity	CE, FCC Part 15 class B, RoHS
<b>Housing</b>	aluminum
Dimensions	36 x 36 x 48 mm <sup>3</sup>
Weight	< 90 g
<b>IEEE1394 interface</b>	800 / 400 / 200 / 100 Mbit / sec
<b>Software</b>	DCAM (IIDC V1.31) compatible Baumer FCAM1394 driver (Baumer OHCI driver) / Software Development Kit (SDK) for Windows 2000 / Windows XP / Windows Vista DCAM (IIDC V1.31) compatible IEEE1394 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, set block size and set exposure time ( $t_{exp} < t_{readout}$ )
- \*\*) possible frame rates which can be achieved in the selected mode, see item 2
- \*\*\*) can be inverted via software
- \*\*\*\*) necessary for optimal timing specification

## 2. Selectable Frame Rates depending on the used IEEE1394 Interface

Format	Mode	IEEE1394 interface	240 fps	120 fps	60 fps	30 fps	15 fps	7.5 fps	3.75 fps	1.875 fps
2	5	800 Mbit / sec				x (16) *)	x	x	x	x
		400 Mbit / sec					x	x	x	x
		200 Mbit / sec						x	x	x
		100 Mbit / sec							x	x
	7	800 Mbit / sec					x (8.3) *)	x	x	x
		400 Mbit / sec					x (8.3) *)	x	x	x
		200 Mbit / sec						x	x	x
		100 Mbit / sec							x	x

- \*) possible frame rates which can be achieved in the selected mode

## 3. Camera Factory Settings after Camera Start-up

	Camera factory settings after camera start-up
<b>Operation modes</b>	free running mode
<b>Signal processing</b>	
Exposure control	32 msec
Gain control	factor 1 = 0 dB
Offset (black level) / brightness control	0
<b>Image acquisition</b>	
Camera image format mode	Format 2 Mode 5 / 3.75 fps
Partial scan function	not active
<b>Electrical interface</b>	
Flash sync signal / Strobe_0	disabled, digital output set to low status polarity bit = "1"
Async. Trigger	disabled polarity bit = "1"

4. Supported Image Formats via fxlib.dll (Baumer FCAM driver)

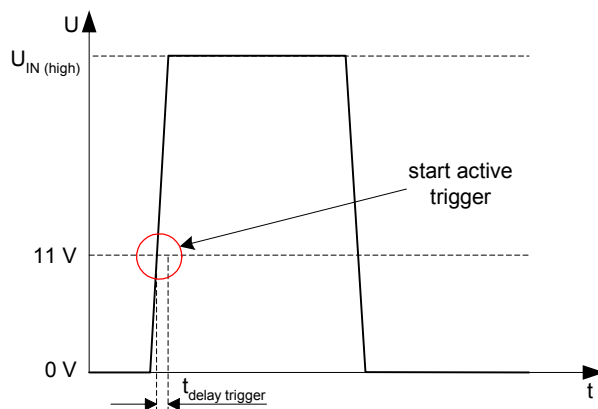
Camera name		TXD20				
Camera mode		SDK image mode				
	Color coding	Mode ID	Image format	Description	Color coding	Functions / State
Format 2 Mode 5	Mono8	25	1600 x 1200	center scan fast scan	RawMono8, Mono8	T, F
Format 2 Mode 7	Mono16	27	1600 x 1200	center scan high quality scan	RawMono8, Mono8, RawMono16, Mono16	T, F
Format 7 Mode 0	Mono8	070	1624 x 1236	full frame Mono8 high quality scan	RawMono8, Mono8	PS, T, F
	Mono16	570	1624 x 1236	full frame Mono16 high quality scan	RawMono8, Mono8, RawMono16, Mono16	PS, T, F
Format 7 Mode 1	Mono8	071	1624 x 1236	full frame Mono8 fast scan	RawMono8, Mono8	PS, T, F
	Mono16	571	1624 x 1236	full frame Mono16 fast scan	RawMono8, Mono8, RawMono16, Mono16	PS, T, F
Format 7 Mode 2	Mono8	072	812 x 618	binning 2x2 Mono8 high quality scan	RawMono8, Mono8	PS, T, F, BRC
	Mono16	572	812 x 618	binning 2x2 Mono16 high quality scan	RawMono8, Mono8, RawMono16, Mono16	PS, T, F, BRC
Format 7 Mode 3	Mono8	073	812 x 618	binning 2x2 Mono8 fast scan	RawMono8, Mono8	PS, T, F, BRC
	Mono16	573	812 x 618	binning 2x2 Mono16 fast scan	RawMono8, Mono8, RawMono16, Mono16	PS, T, F, BRC

- SDK - Software Development Kit
- BRC - brightness correction
- PS - partial scan
- T - trigger
- F - flash

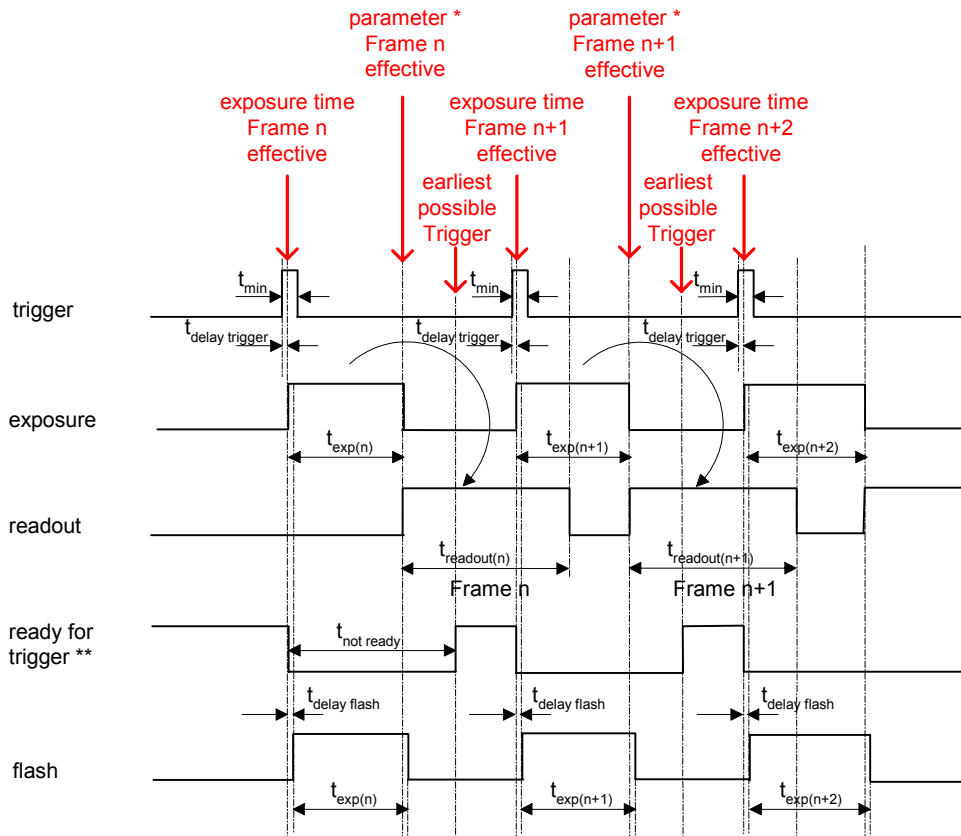
RawMono8 [16] - unmanipulated pixel data for monochrome camera modes in 8 [16] bit  
 Mono8 [16] 3 software corrected image data for monochrome camera modes in 8 [16] bit

5. Timing Operation Modes

Trigger Mode: start up time



Trigger Mode: trigger mode 0, overlapped trigger



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

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

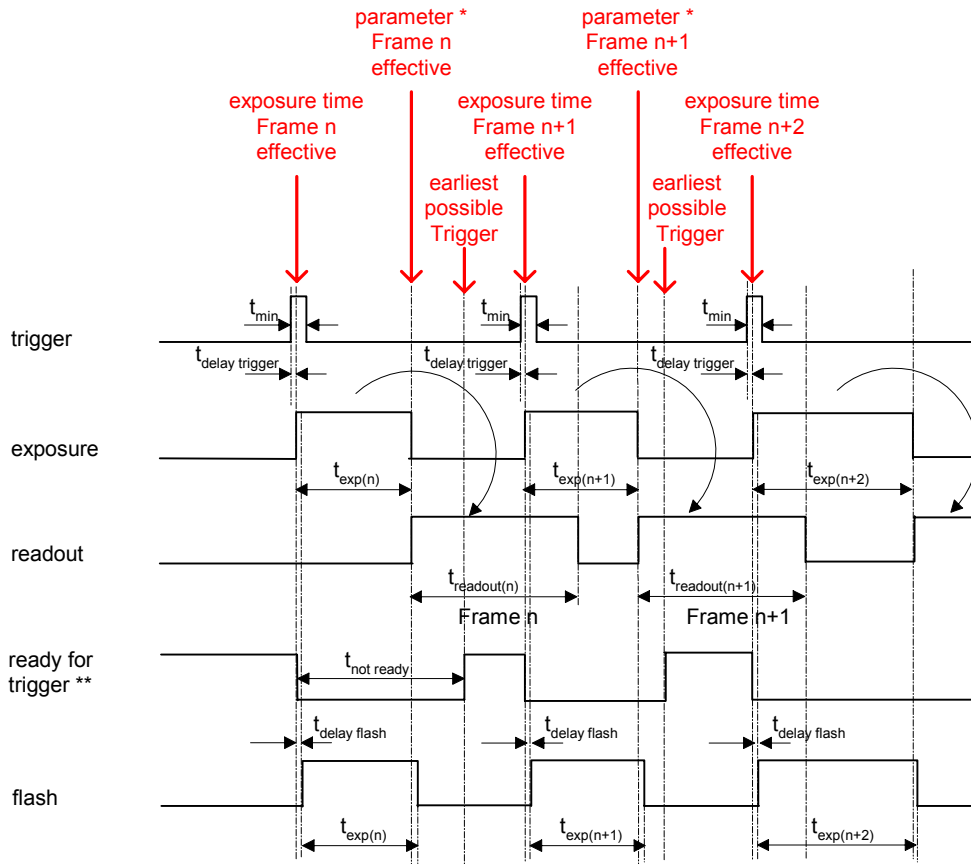
$$t_{exp} < t_{readout}: t_{\text{not ready (n+1)}} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

\* image parameter: offset  
global gain  
mode  
partial scan

\*\* signal is not available as digital output

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



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

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

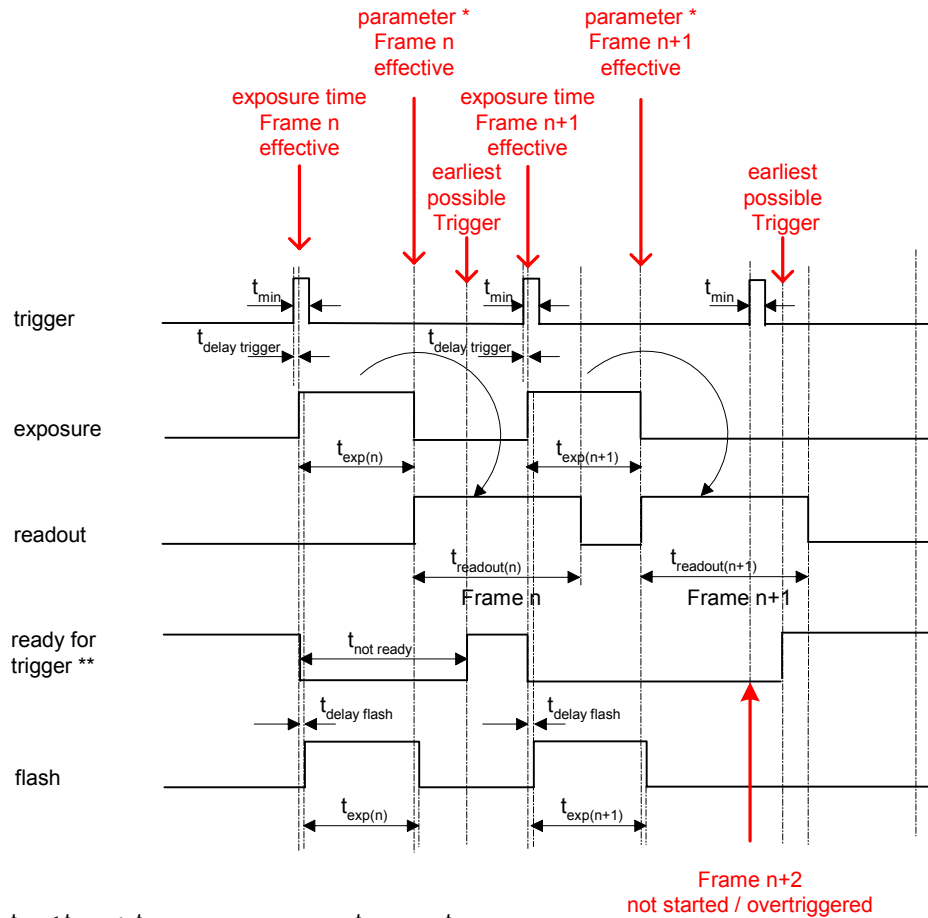
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

\* image parameter:    offset  
                               global gain  
                               mode  
                               partial scan

\*\* signal is not available as digital output

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



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

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

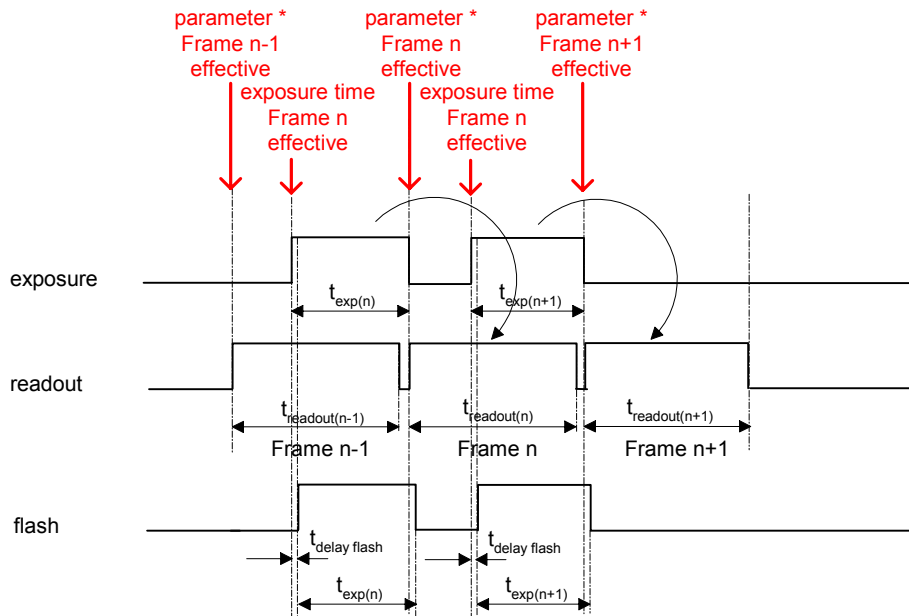
$$t_{exp} < t_{readout} : t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

\* image parameter: offset  
global gain  
mode  
partial scan

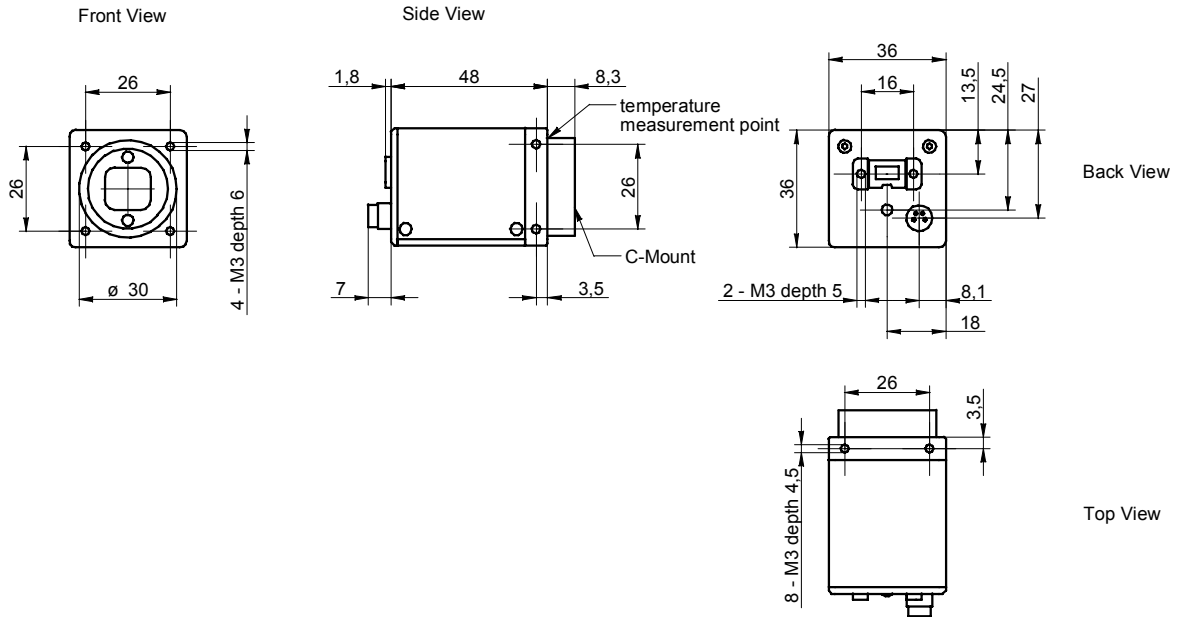
\*\* signal is not available as digital output

Free Running Mode: overlapped operation



\* image parameter: offset  
 global gain  
 mode  
 partial scan

### 6. Housing



### 7. Connectors / Electrical Interfaces

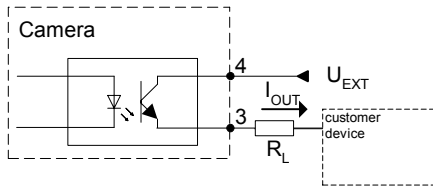
#### 7.1 Pin assignment:

IEEE1394b	Pin
	1: TPB- 2: TPB+ 3: TPA- 4: TPA+ 5: GND A 6: GND Power 7: not used 8: Voltage Power 9: GND B

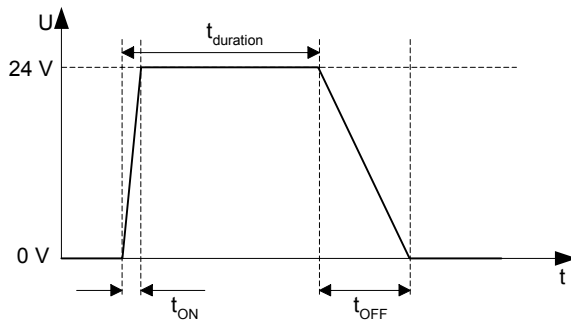
Trigger Flash	Type: Lumberg RSMESD 4pin.
	<p>*) resistor must be used, <math>I_{OUT} = 16 \text{ mA}</math> by <math>U_{EXT} = 24 \text{ VDC}</math> recommended, drawing shown above example for using high active signal</p>
	Trigger / Flash cable wires color *): 1 = brown 2 = white 3 = blue 4 = black

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

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



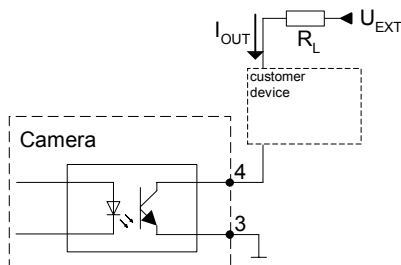
Timing example:  
measurement condition  $U_{EXT} = 24\text{ VDC} / I_{OUT} = 16\text{ mA}$



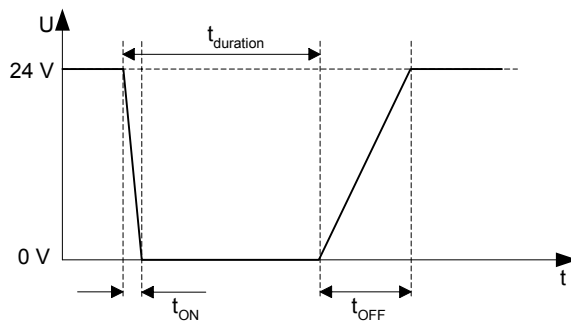
$t_{ON}$  time = typ. 2  $\mu\text{sec}$

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

7.3 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  $\mu\text{sec}$

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

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Technical specifications subject to change