

**Digital Color  
Progressive Scan Camera**

 System: **IEEE1394b**
**Baumer TXF03c**

 Art. No: **OD107788**

- FireWire™ – IEEE1394b (800 Mbit / sec) progressive scan CCD-camera
- 640 x 480 pixel
- Up to 90 full frames per second
- On board integrated color processor for high quality color calculation
- Outstanding image quality and color fidelity
- 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)
- Integrated 32 MByte RAM for temporarily image data buffering
- Camera parameter in real-time programmable
- 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 / Linux
- User-friendly Baumer TWAIN compatible image capture and camera control software



shown lens needs to be ordered separately

**1. Overview**

<b>Sensor</b>	1/3" interline progressive scan CCD HAD technology
Shutter / readout mode	global shutter / progressive scan readout
Number of pixel	656 x 494
Scan area	4.85 mm x 3.65 mm
Pixel size	7.4 µm x 7.4 µm
Color filter	RGB Bayer mosaic
<b>Operation modes</b>	
Trigger mode	yes, overlapped operation
Free running mode	yes, overlapped operation
<b>Signal processing</b>	real-time software programmable
Pixel clock	40 MHz fast scan / 20 MHz high quality (HQ) scan
A/D converter	12 bit
Exposure control (t <sub>exp</sub> )	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
<b>Image acquisition</b>	
Data format	YUV , RGB , Mono8 or Raw image data from camera

Technical specifications subject to change

Camera image format modes (see item 3)	Format (pixel)	Color Coding	Bit per pixel	Pixel clock MHz	Frames per sec. *)	t <sub>readout</sub>	
<b>Full frame Raw</b>	slow	656 x 494	Raw	12 / 8	46	22 msec	
	fast			12 **) / 8		40	11 msec
<b>Full frame Mono</b>	slow	640 x 480	Mono8	8	46	22 msec	
	fast					40	11 msec
<b>Full frame YUV</b>	slow	640 x 480	4:1:1 YUV	12	46	22 msec	
	fast		4:2:2 YUV	16		40	90
			4:4:4 YUV ***)	24			
<b>Full frame RGB</b>	slow	640 x 480	RGB8	24	20	46	22 msec
<b>Partial scan function</b>	yes, format freely programmable in all modes (binning on partial scan ok)						
<b>Look up table function</b>	on request: user programmable (input 12 bit, output 12 bit / 8 bit) or Gamma						
<b>Test pattern function</b>	yes, in all modes						
<b>Data quality</b>	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						
<b>Optical interface</b>	C-Mount on request: CS-Mount						
Optical filter	Hoya E-CM500S on request: super polished, dust protection, daylight filter or no filter						
<b>Process interface functions</b>							
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 $\leq 4$ $\mu$ sec duration_value (t <sub>duration</sub> ): slow mode = t <sub>exp</sub> + 41 $\mu$ sec fast mode = t <sub>exp</sub> + 21 $\mu$ sec						
Software reset	yes, delay up to 102 msec						
Asynchronous reset	Full frame	slow	delay up to 4.9 msec				
		fast	2.5 msec				
Image info header	yes						
User defined identifier	on request: user programmable permanent identifier						
<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 (invert value = true) ****) min. trigger impulse length (t <sub>min</sub> ): 2 $\mu$ sec trigger delay out of t <sub>readout</sub> (t <sub>delay trigger</sub> ): 3 $\mu$ sec max. trigger delay during t <sub>readout</sub> (t <sub>delay trigger</sub> ): slow mode = 41 $\mu$ sec fast mode = 21 $\mu$ sec						
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 (invert value = true) *****) flash delay (t <sub>delay flash</sub> ): $\leq 4$ $\mu$ sec						
LED	green: power on / yellow: data transmission active						
Power consumption	VCC: 8 .. 33 V I: 250 mA .. 90 mA approx. 2.5 Watt						
<b>Environmental</b>							
Storage temperature	-10 °C .. +70 °C						
Operating temperature	+5 °C .. +50 °C between +40 °C .. +50 °C, note the max. housing temperature						
Housing operating temperature	max. +50 °C *****) (measurement point, see item 5)						

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>	Baumer FCAM1394 driver / Baumer OHCI driver SDK for Windows 2000 / Windows XP / Windows Vista (32 bit) / Linux Kernel 2.4.>22, 2.6.xx supported .net platform Baumer TWAIN image capture and camera control software

- \*) maximum frame rate in free running mode, effective frame rate depending on camera image format mode settings, set exposure time ( $t_{exp} < t_{readout}$ ) and used IEEE1394 interface
- \*\*\*) maximum frame rate only available with IEEE1394b (800 Mbit / sec) interface
- \*\*\*\*) only available in 20 MHz high quality (HQ) scan
- \*\*\*\*\*) 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
<b>Operation modes</b>	free running mode
<b>Signal processing</b>	
Exposure control	32 msec
Gain control	factor 1 = 0 dB
Offset (black level)	0
<b>Image acquisition</b>	
Camera image format mode	mode ID = 08: Full frame YUV (4:2:2) HQ (see item 3)
White balance	active, adjusted on light source value = 5000 K (D50)
Partial scan function	not active
<b>Electrical interface</b>	
Flash sync signal	disabled, digital output set to low status (high impedance) invert value = true
Async. Trigger	disabled invert value = true

### 3. Supported Image Formats via Baumer API (Baumer FCAM driver)

#### 3.1 Supported Image Format

Camera name		TXF03c			
Camera mode		SDK image mode			
	Bit per pixel	Mode ID	Image format	Description	Functions / State
Full Frame slow	8	00	656 x 494	Full Frame HQ Raw 8 bit	PS, T, F, Color
Full Frame slow	12	01	656 x 494	Full Frame HQ Raw 12 bit	PS, T, F, Color
Full Frame fast	8	02	656 x 494	Full Frame Raw 8 bit	PS, T, F, Color
Full Frame fast *)	12	03	656 x 494	Full Frame Raw 12 bit	PS, T, F, Color
Full frame Mono slow	8	04	640 x 480	Full Frame HQ Mono	PS, T, F, Mono
Full frame Mono fast	8	05	640 x 480	Full Frame Mono	PS, T, F, Mono
Full frame YUV (4:1:1) slow	12	06	640 x 480	Full Frame HQ YUV (4:1:1)	PS, T, F, Color
Full frame YUV (4:1:1) fast	12	07	640 x 480	Full Frame YUV (4:1:1)	PS, T, F, Color
Full frame YUV (4:2:2) slow	16	08	640 x 480	Full Frame HQ YUV (4:2:2)	PS, T, F, Color
Full frame YUV (4:2:2) fast	16	09	640 x 480	Full Frame YUV (4:2:2)	PS, T, F, Color
Full frame YUV (4:4:4) slow	24	10	640 x 480	Full Frame HQ YUV (4:4:4)	PS, T, F, Color
Full frame RGB slow	24	11	640 x 480	Full Frame HQ RGB	PS, T, F, Color

\*) maximum frame rate only available with IEEE1394b (800 Mbit / sec) interface

#### 3.2 Software supported / Calculated Color Coding

		Supported / calculated color coding via software							
Baumer-GAPI		Bayer RG8	Bayer RG12	BGR8 Packed	BGR12 Packed	RGB8 Planar	RGB12 Planar	Mono8	Mono12
API Fxlib		Bayer8	Bayer12	Color 3x8x1	Color 3x12x1	Color 1x8x3	Color 1x12x3	Mono8	Mono12
Pixel coding camera	Raw8	x *)		x		x		x	
	Raw12	x	x *)	x	x	x	x	x	x
	Mono8							x *)	
	YUV (4:1:1)			x		x		x	
	YUV (4:2:2)			x		x		x	
	YUV (4:4:4)			x		x		x	
	RGB8			x *)		x		x	

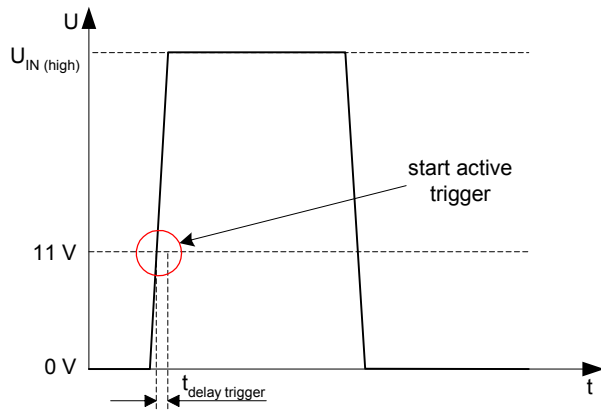
\*) original camera format

### 3.3 Abbreviation / Description

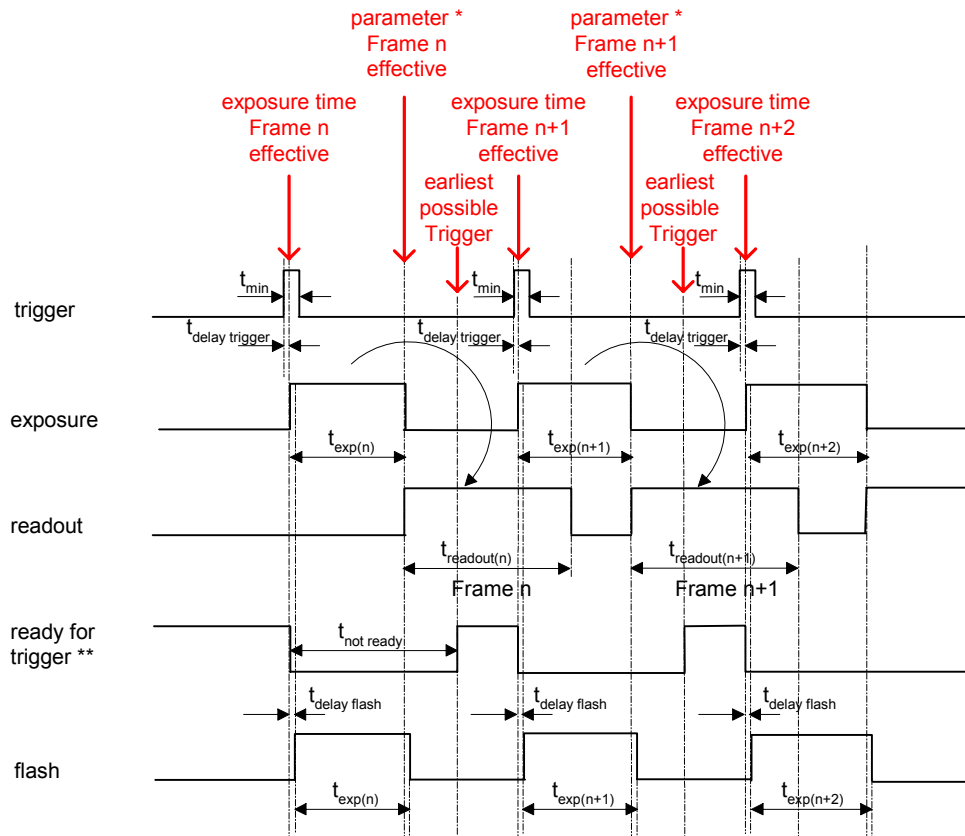
SDK	- Software Development Kit
PS	- partial scan
T	- trigger
F	- flash
Mono	- monochrome mode
Color	- color mode
Raw8[12] / Bayer8[12] / BayerRG8[12]	- unmanipulated pixel data in Bayer filter pattern in 8 [12] bit
Color3x8[12] / RGB8[12] Packed	- software corrected image data for color camera modes in the color data arrangement BGR in 24[36] bit
Color1x8[12]x3 / RGB8[12] Planar	- software corrected image data for color camera modes in the color data arrangement RRR...GGG...BBB in 3x8[12] bit
RGB8	- camera calculated image data for color camera modes in the color data arrangement RGB in 24 bit
YUV (4:1:1)	- camera calculated image data for color camera modes in the color data arrangement YUV (4:1:1) in 12 bit
YUV (4:2:2)	- camera calculated image data for color camera modes in the color data arrangement YUV (4:2:2) in 16 bit
YUV (4:4:4)	- camera calculated image data for color camera modes in the color data arrangement YUV (4:4:4) in 24 bit
Mono8[12]	- camera or software calculated image data for monochrome camera modes in 8[12] bit

#### 4. Timing Operation Modes

Trigger Mode: start up time



Trigger Mode: trigger mode 0, overlapped trigger



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

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

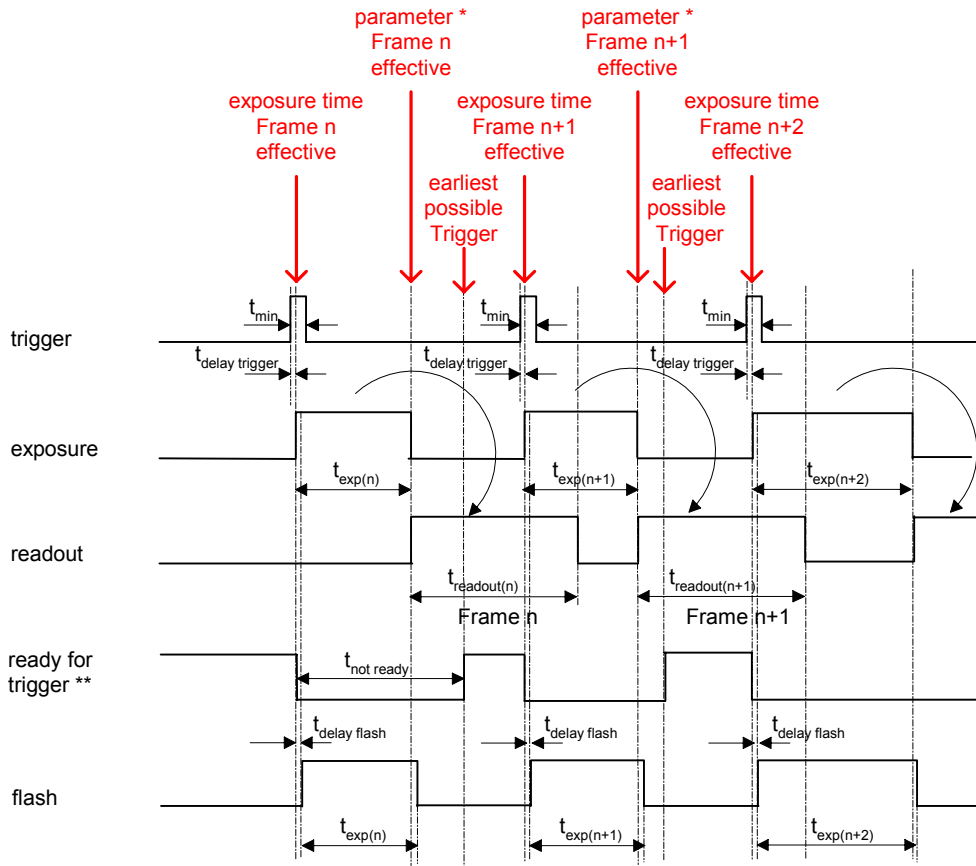
$$t_{exp} < t_{readout} : t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

\* image parameter:    offset  
                               global gain  
                               mode  
                               partial scan

\*\* signal is not available as digital output

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



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

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

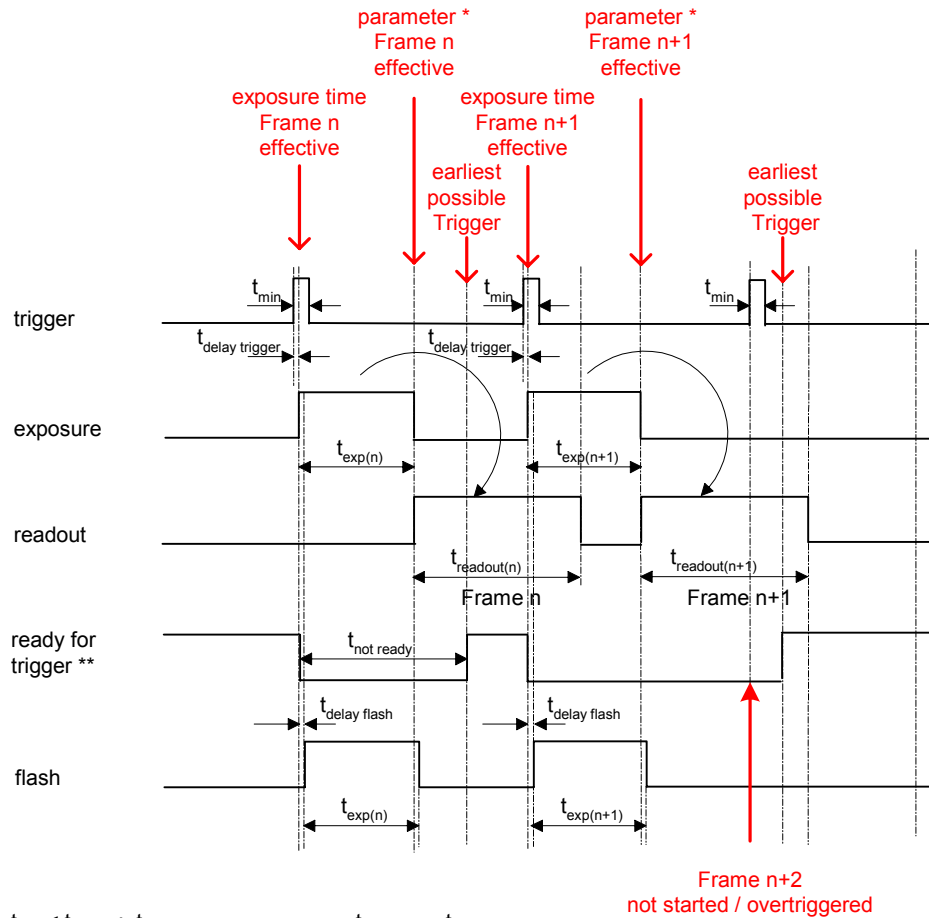
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

\* image parameter:    offset  
                               global gain  
                               mode  
                               partial scan

\*\* signal is not available as digital output

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



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

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

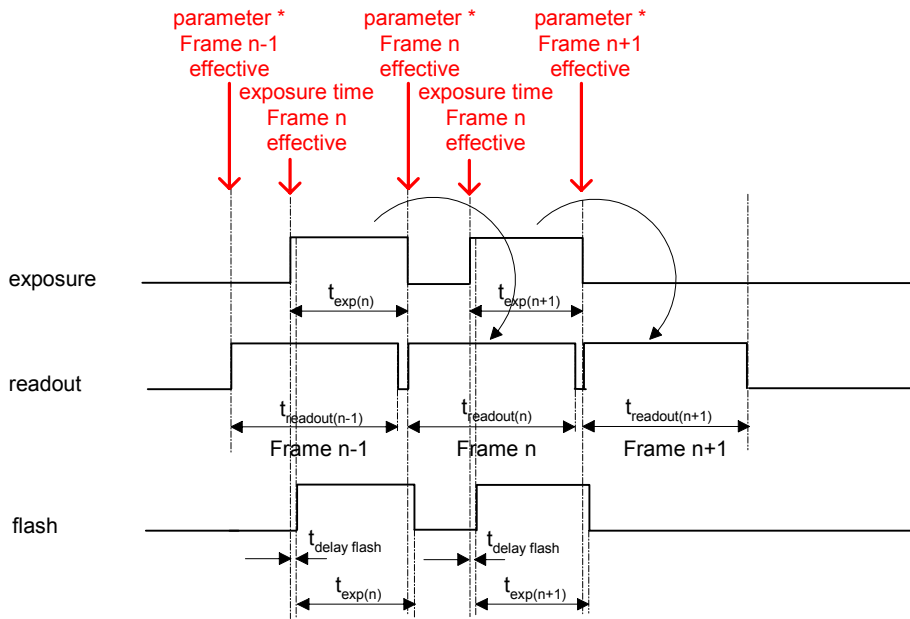
$$t_{exp} < t_{readout} : t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

\* image parameter: offset  
global gain  
mode  
partial scan

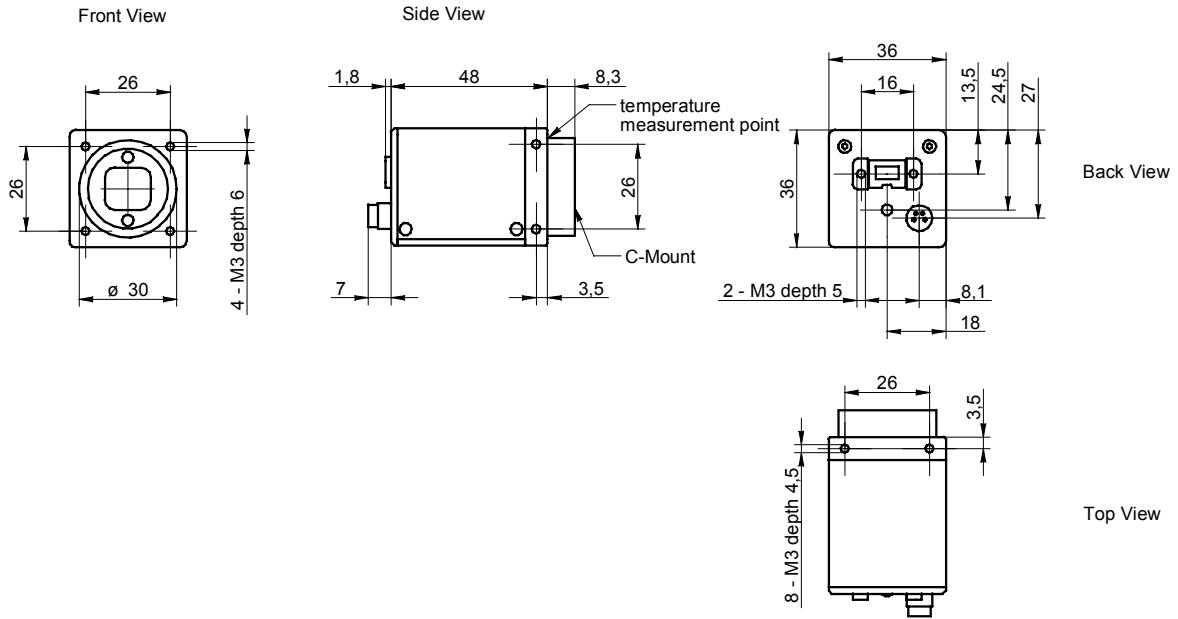
\*\* signal is not available as digital output

Free Running Mode: overlapped operation



\* image parameter: offset  
 global gain  
 mode  
 partial scan

5. Housing



6. Connectors / Electrical Interfaces

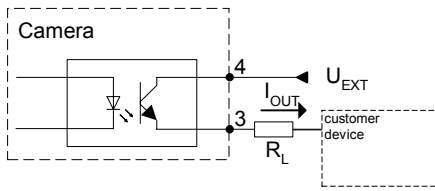
6.1 Pin assignment:

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

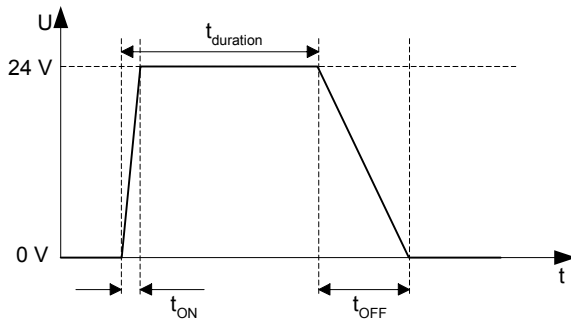
Trigger Flash	Type: Lumberg RSMESD 4pin.
	<p>*) resistor must be used, <math>I_{OUT} = 16 \text{ mA}</math> by <math>U_{EXT} = 24 \text{ VDC}</math> recommended, drawing shown above example for using high active signal</p> <p>Trigger / Flash cable wires color *):            1 = brown            2 = white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

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

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

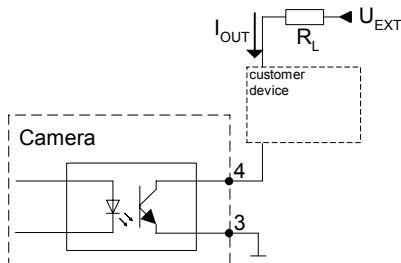


Timing example:  
 measurement condition  $U_{EXT} = 24 \text{ VDC} / I_{OUT} = 16 \text{ mA}$

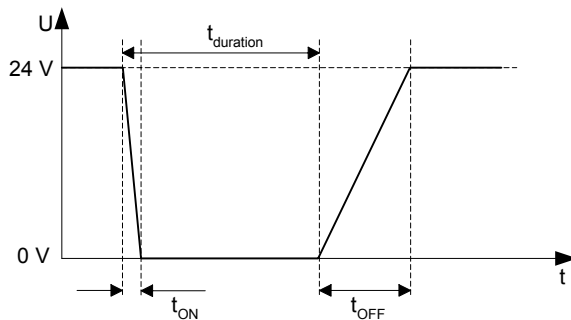


$t_{ON}$  time = typ. 2  $\mu\text{sec}$   
 $t_{OFF}$  time = typ. 40  $\mu\text{sec}$

6.3 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