

**Digital Color
Progressive Scan Camera**

 System: **Gigabit Ethernet**

Baumer TXG14cf

Revision 2.1

Art. No: 11008760 (OD108702)

- Gigabit Ethernet progressive scan CCD camera
- 1384 x 1036 pixel
- Up to 30 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)
- Integrated supplementary function for flexible integration
- 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



1. Overview

Model Name	TXG14cf
Sensor	2/3" interline progressive scan CCD Exview technology
Shutter / readout mode	global shutter / progressive scan readout
Number of pixel	1384 x 1036
Scan area	8.93 mm x 6.68 mm
Pixel size	6.45 µm x 6.45 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 .. 60 sec step: 1 µsec
Gain control	0 .. 20 dB
Offset (black level)	0 .. 1023 LSB (14 bit)
Image data buffer	max. 3 images

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	1384 x 1036	Vendor specific	00	BayerRG8	30	15	67 msec
					BayerRG12			
					Mono8			
					YUV411 Packed			
					YUV422 Packed **)			
					YUV444 Packed			
					RGB8 Packed			
Full frame	fast	1384 x 1036	yes	01	BayerRG8	60	30	33.5 msec
					BayerRG12			
					Mono8			
					YUV411 Packed			
					YUV422 Packed **)			
					YUV444 Packed			
					RGB8 Packed			
BGR8 Packed								
Standard features								
Image size controls								
Pixel format	BayerRG8, BayerRG12, Mono8, YUV411 Packed, YUV422 Packed, YUV444 Packed, RGB8 Packed, BGR8 Packed							
Test image selector	yes, in all modes Off, GreyHorizontalRamp, GreyVerticalRamp, HorizontalLineMoving, VerticalLineMoving, HorizontalAndVerticalLineMoving							
Partial scan	yes, format freely programmable in all modes							
Analog controls								
Gain	yes							
Black Level (Off set)	yes							
Gamma	no							
Acquisition and Trigger								
Acquisition mode	Continuous							
Acquisition frame rate	yes, ON / OFF (only in freerunning mode) 0 .. 143 Hz, step: 0.01 Hz							
Trigger source	HardwareTrigger (Line0), SoftwareTrigger, CommandTrigger (ActionCommand), All or Off							
Trigger delay	0 .. 2 sec, 512 trigger can be tracked, step: 1 µsec							
Sequencer	no							
Digital I/O								
Lines	Input: Line0, Output: Line1							
Line source (outputs only)	Line1: Off, ExposureActive, Timer1, ReadoutActive, User0, TriggerReady, TriggerOverlapped, TriggerSkipped							
Line debouncer	yes, low and high signal separately selectable 0 .. 5 msec step: 1 µsec							
Event Generation								
Events	GigEVisionError, Heartbeattimeout, 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							
Timer	yes, TimerSelector: Timer1 TimerTriggerSource: Off, Input: Line0, SoftwareTrigger, CommandTrigger (ActionCommand), ExposureStart, ExposureEnd, FrameStart, FrameEnd, TriggerSkipped TimerDelay: 0 µsec .. 2 sec, step: 1 µsec TimerDuration: 10 µsec .. 2 sec, step: 1 µsec							

LUT Controls			
LUT selector	no		
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 .. 4.301.744 Byte		
TransmissionDelay (custom)	0 .. $2^{32}-1$ ticks		
UserSets			
User set selector	Default (factory settings / read only) 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		
DeviceTemperature	yes, internal camera temperature range: -25 °C .. +100 °C accuracy: ±1 K (temperature value is notified as asynchronous message event)		
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			
Optical filter	C-Mount on request: CS-Mount Hoya E-CM500S on request: dust protection, daylight filter or no filter		
Process interface functions			
Async. Trigger	yes, trigger mode operation, "Off", "software trigger", "hardware trigger", "command trigger" or "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 = $t_{\text{exp}} + 62$ µsec fast mode = $t_{\text{exp}} + 31$ µsec		
User Output	yes, ON / OFF		
Timer	yes, Timer1		
Software reset	yes, delay up to 102 msec		
Asynchronous reset	Full frame	slow fast	delay up to 14.2 msec 7.1 msec
Image info header	yes		

Electrical interface	
Data / control	standard single cable 1000 Base-T, Cat6 recommended / minimum Cat5e option: screw lock type connector
Power	VCC: 8 VDC .. 30 VDC I: 620 mA .. 165 mA
Power consumption	approx. 5 Watt
Digital input	Line 0: trigger signal, opto decoupled $U_{IN(low)} = 0 .. 4.5 \text{ VDC}$, $U_{IN(high)} = 11 .. 30 \text{ VDC}$ $I_{IN} = 6 .. 10 \text{ mA}$ / 7 mA typical rising edge (invert = false) *** min. 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 = 62 μsec fast mode = 31 μsec
Digital output	Line 1: opto decoupled $U_{EXT} = 5 .. 30 \text{ VDC}$ / 24 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 $^{\circ}\text{C}$.. +70 $^{\circ}\text{C}$
Operating temperature	+5 $^{\circ}\text{C}$.. +50 $^{\circ}\text{C}$ ****) between +40 $^{\circ}\text{C}$.. +50 $^{\circ}\text{C}$, note the max. housing temperature
Housing operating temperature	max. +50 $^{\circ}\text{C}$
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	< 100 g
1000 Base-T interface	
Ethernet IP configuration	1000BASE-T (1000 Mbit / sec) persistent IP / DHCP / LLA
Stream channel packet size	576 Byte (default) .. 65535 Byte jumbo frames supported
Interpacketgap	0 .. 2 ³² -1 ticks
Multicast function	yes
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 / 64 bit) / Windows 7 (32 bit / 64 bit) / Linux Kernel 2.6.xx (64 bit / 32 bit)	
GigE Vision [®] compatible 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 and set exposure time ($t_{exp} < t_{readout}$)

**) default pixel format

***) can be inverted via software

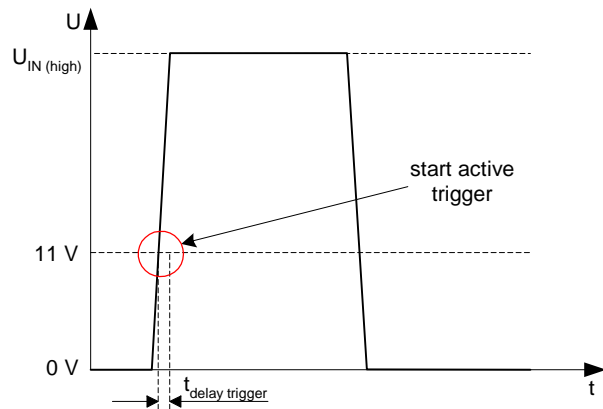
****) housing temperature is limited by CCD sensor specification

2. Camera Factory Settings after Camera Start-up

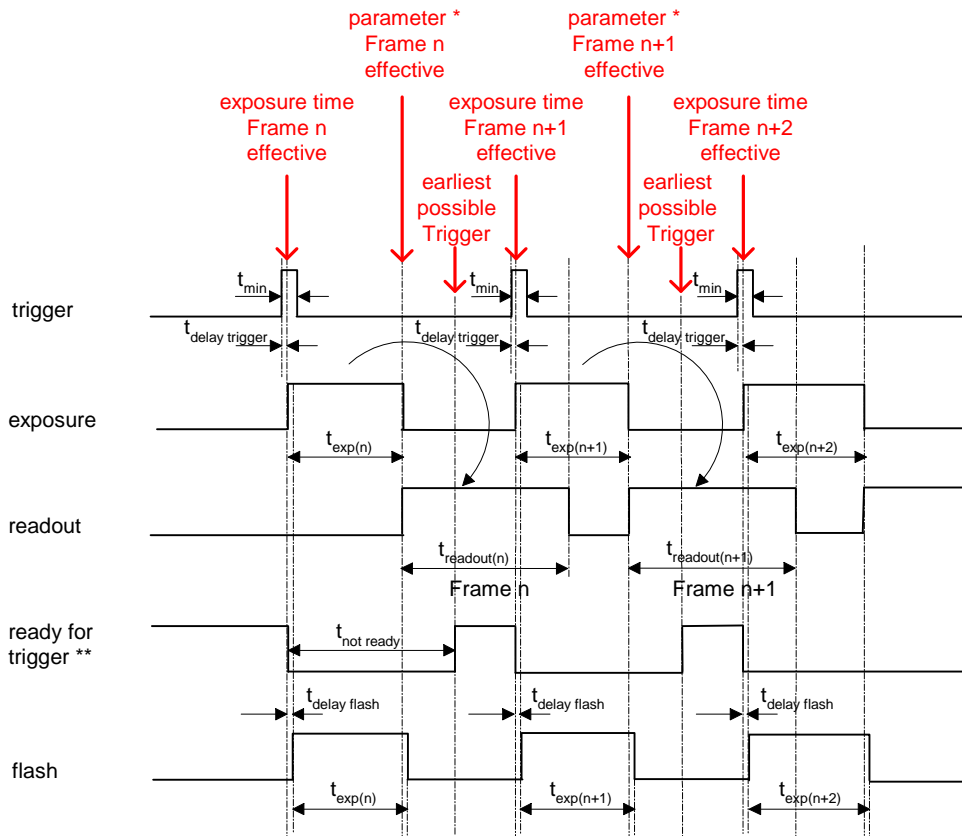
Camera factory settings after camera start-up	
Operation modes	free running mode
Signal processing	
Exposure control	32 msec
Gain control	factor 1 = 0 dB
Offset (black level)	0
Image acquisition	
Camera image format mode	mode id = 01, full frame YUV422 Packed
Partial scan function	not active
Acquisition frame rate	Off
Timer	Off
Transmission delay	0 ticks
Test image selector	Off
Defect pixel correction	On
Electrical interface	
Digital input	1: Line0 disabled, digital output set to low status (high impedance) invert = false line source = Exposure Active
Digital output	1: Line1 disabled invert = false trigger source = Line0

3. Timing Operation Modes

Trigger Mode: start up time



Trigger Mode: trigger mode 0, overlapped trigger



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

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

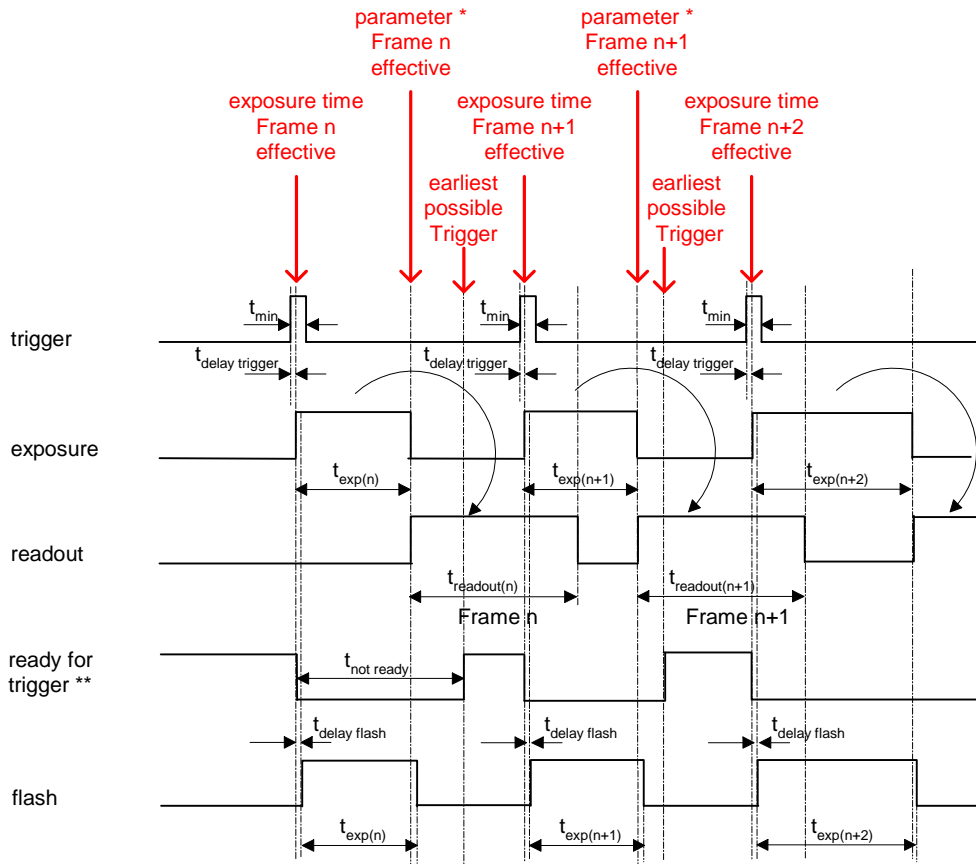
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

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



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

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

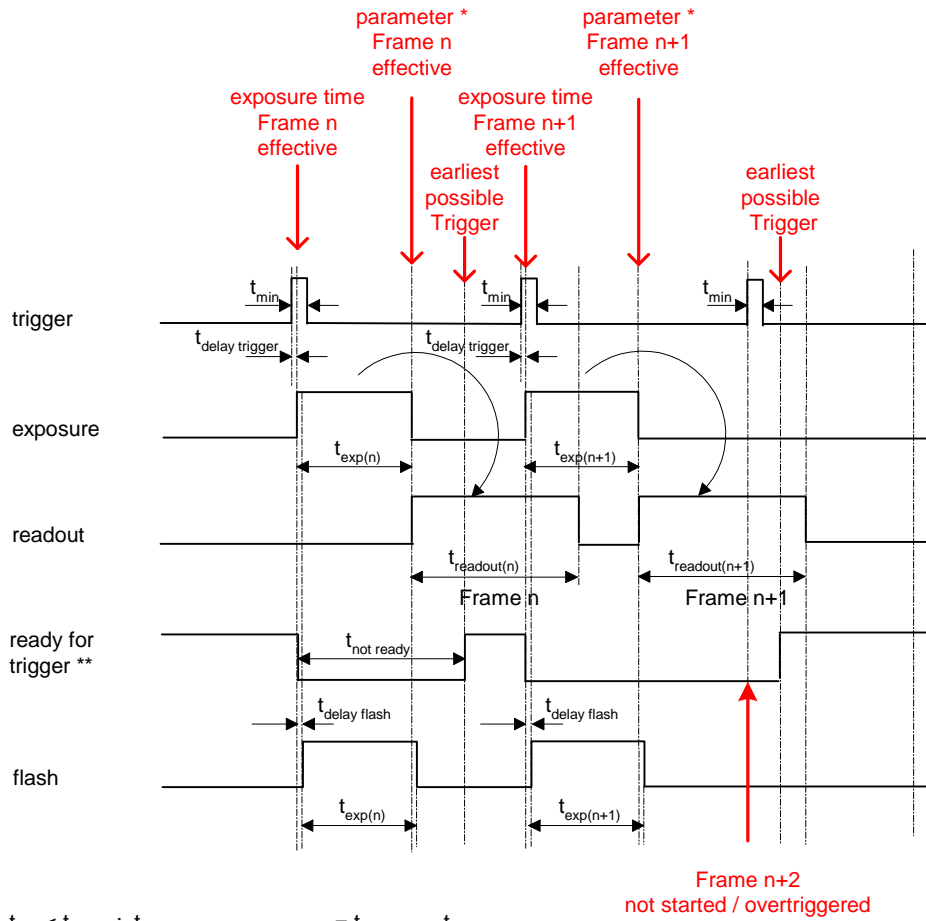
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

* image parameter: offset
 global gain
 mode
 partial scan

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

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



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

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

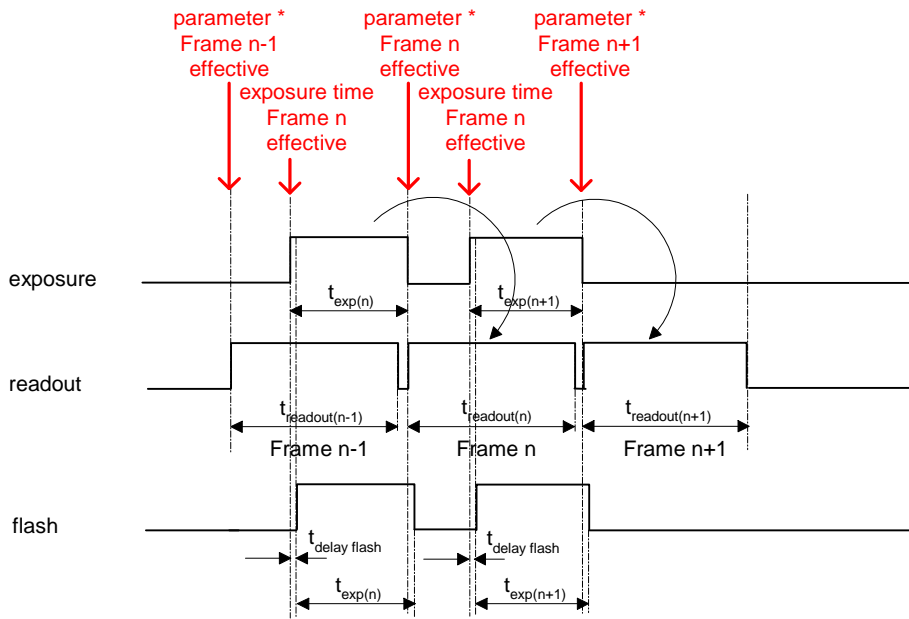
$$t_{exp} < t_{readout} : t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

* image parameter: offset
global gain
mode
partial scan

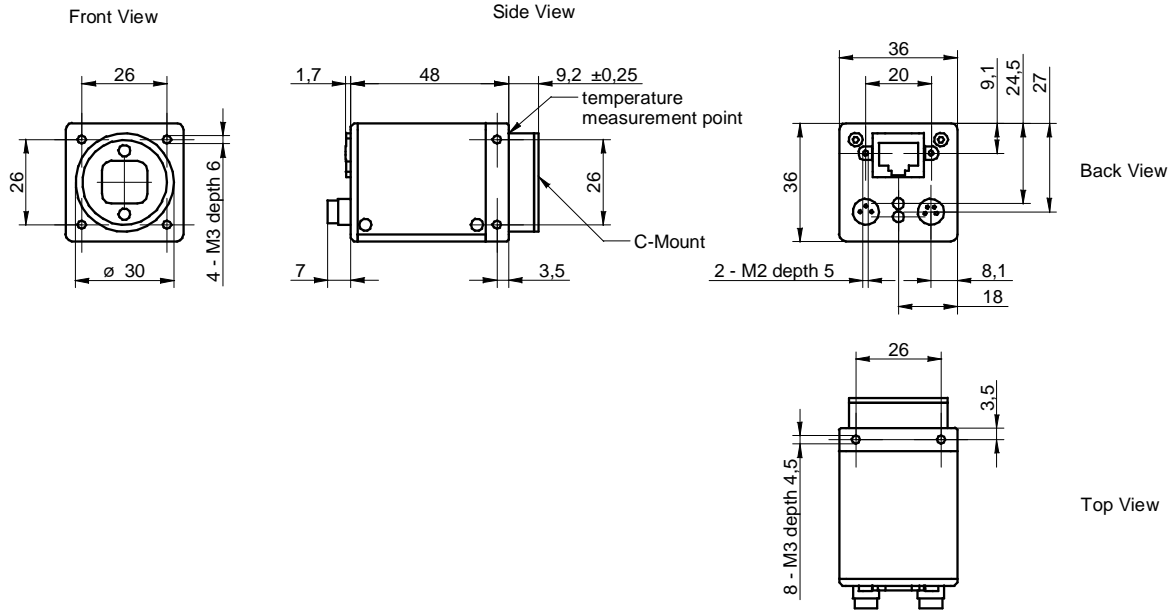
** signal will be notified as event "TriggerReady" and is not available as digital output

Free Running Mode: overlapped operation



* image parameter: offset
global gain
mode
partial scan

4. Housing



5. Connectors / Electrical Interfaces

5.1 Pin assignment:

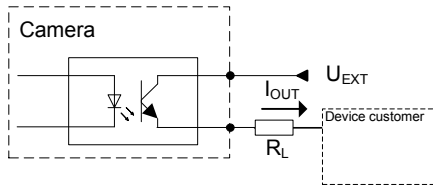
Data / Control 1000 Base-T	Type: RJ45 8P8C mod jack
	<ul style="list-style-type: none"> 1: MX1+ 2: MX1- 3: MX2+ 4: MX3+ 5: MX3- 6: MX2- 7: MX4+ 8: MX4-

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

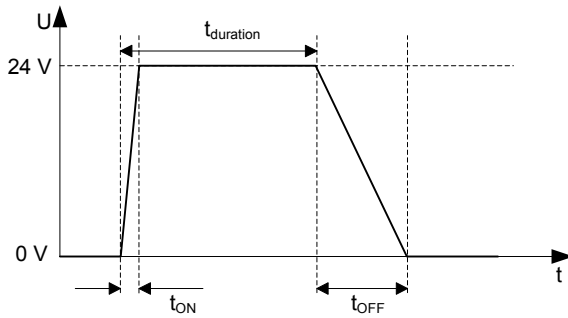
Trigger / Flash	Type: Lumberg RSMESD 4pin.
	*) resistor must be used, $I_{OUT} = 16 \text{ mA}$ by $U_{EXT} = 24 \text{ VDC}$ recommended, drawing shown above example for using high active signal
	Trigger / Flash cable wires color *): 1 = brown 2 = white 3 = blue 4 = black

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

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

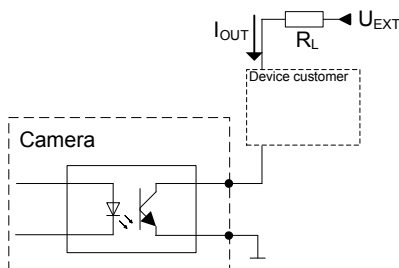


Timing example:
 measurement condition $U_{EXT} = 24 \text{ VDC} / I_{OUT} = 16 \text{ mA}$
 $R_L = 1.5 \text{ kOhm}$

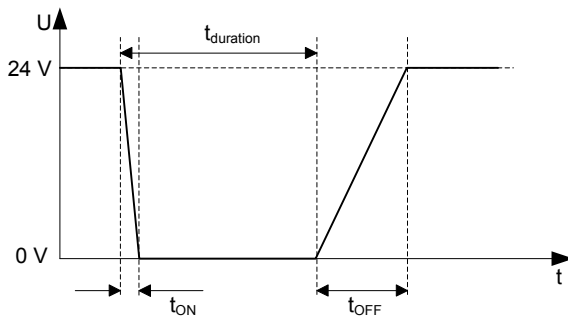


t_{ON} time = typ. 2 μsec
 t_{OFF} time = typ. 40 μsec

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



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



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