Digital Color
Progressive Scan Camera

System: **Gigabit Ethernet**

Baumer TXG50c-I7

Revision 2.1

Art. No: 11008688

- Gigabit Ethernet progressive scan CCD camera
- 2448 x 2050 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)
- 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
- IP67 camera housing design based on EHEDG recommendation
- Standard M12 industrial connector
- Baumer-GAPI: Flexible, generic software interface for Windows / Linux

shown tubes need to be ordered separately

1. Overview

Model Name	**TXG50c**
Sensor	2/3“ interline progressive scan CCD
Shutter / readout mode	global shutter / progressive scan readout
Number of pixel	2448 x 2050
Scan area	8.45 mm x 7.07 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	max. 1 image

Image acquisition								
Camera image format modes	**Format (pixel)**	**Gen<I>Cam standard**	**Format ID**	**Pixel format**	**Pixel clock MHz**	**Frames per sec. *)**	**$t_{readout}$**
Full frame HQ slow	2448 x 2050	Vendor specific	00	BayerRG8	30	7.5	133 msec
				BayerRG12			
				Mono8			
				YUV411 Packed			
				YUV422 Packed **)			
				YUV444 Packed			
				RGB8 Packed			
				BGR8 Packed			
Full frame fast	2448 x 2050	yes	01	BayerRG8	60	15	67 msec
				BayerRG12			
				Mono8			
				YUV411 Packed **)			
				YUV422 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 .. 47 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, TemperatureExceeded, 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 .. 15.055.472 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	σ < 0.5 LSB (8 bit) typical		
Dynamic range	typical > 54 dB		
Optical interface	C-Mount		
Optical filter	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 ($t_{delay\ flash}$) ≤ 4 µsec, duration_value ($t_{duration}$): slow mode = t_{exp} + 64 µsec fast mode = t_{exp} + 32 µsec		
User Output	yes, ON / OFF		
Timer	yes, Timer1		
Software reset	yes, delay up to 133 msec		
Asynchronous reset	Full frame	slow fast	delay up to 45 msec 24 msec
Image info header	yes		

Electrical interface	
Data / control	standard single cable 1000 Base-T with M12 connector, Cat6 recommended / minimum Cat5e
Power	VCC: 8 VDC .. 30 VDC I: 615 mA .. 190 mA
Power consumption	approx. 5.2 Watt
Digital input	Line 0: trigger signal, opto decoupled $U_{IN(low)}$ = 0 .. 4.5 VDC, $U_{IN(high)}$ = 11 .. 30 VDC I_{IN} = 6 .. 10 mA / 7 mA typical rising edge (invert = false) ****) min. impulse length (t_{min}): 2 µsec trigger delay out of $t_{readout}$ ($t_{delay\ trigger}$): 3 µsec max. trigger delay during $t_{readout}$ ($t_{delay\ trigger}$): slow mode = 64 µsec fast mode = 32 µsec
Digital output	Line 1: opto decoupled U_{EXT} = 5 .. 30 VDC / 24 VDC typical, I_{OUT} = max. 16 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 ****) between +25 °C .. +50 °C, note the max. housing tem perature see application note			
Housing operating temperature	max. +50 °C			
Humidity	10 % .. 90 % non condensing			
Conformity	CE, FCC Part 15 class B, RoHS compliant			
Housing	aluminum, IP67			
Dimensions	∅ 65 mm x 50 mm			
Weight Camera	< 380 g			
Weight Tubes	52 mm	62 mm	71 mm	94 mm
	< 120 g	< 140 g	< 150 g	< 200 g
1000 Base-T interface	1000BASE-T (1000 Mbit / sec)			
Ethernet IP configuration	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			

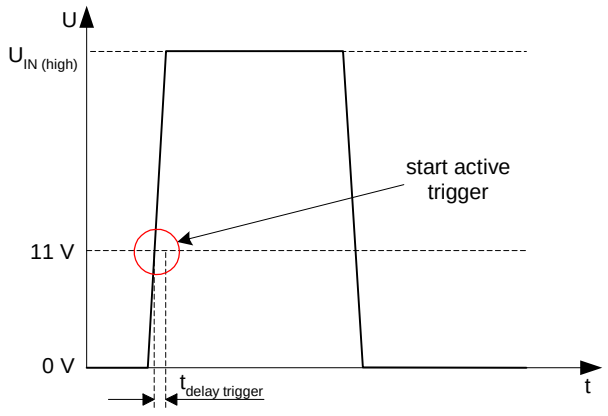
*) maximum frame rate in free running mode, effective frame rate depending on camera image format mode settings and set exposure time ($t_{exp} < t_{readout}$)
**) default pixel format
***) bandwidth of GigE interface is limiting frame rate
****) can be inverted via software

2. Camera Factory Settings after Camera Start-up

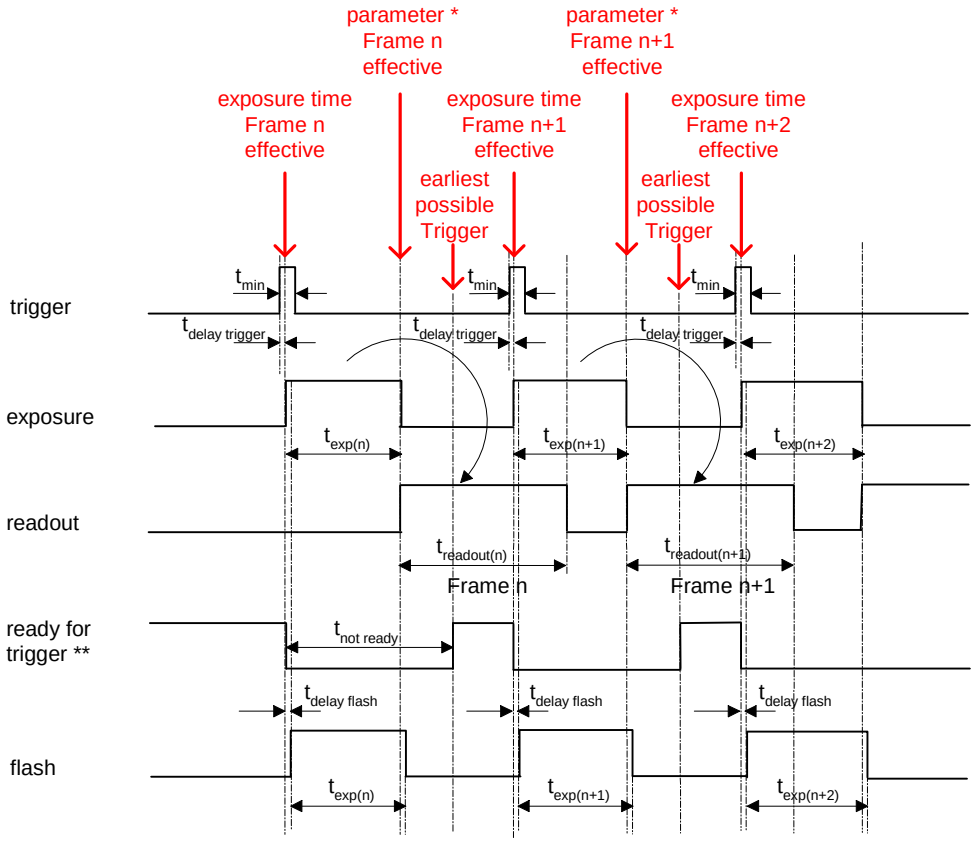
	Camera factory settings after camera start-up
Operation modes	free running mode
Signal processing	
Exposure control	32 msec
Gain control	factor 1 = 0 dB
Offset (black level)	0
Image acquisition	
Camera image format mode	mode id = 01, full frame YUV411 Packed
Partial scan function	not active
Acquisition 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



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

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

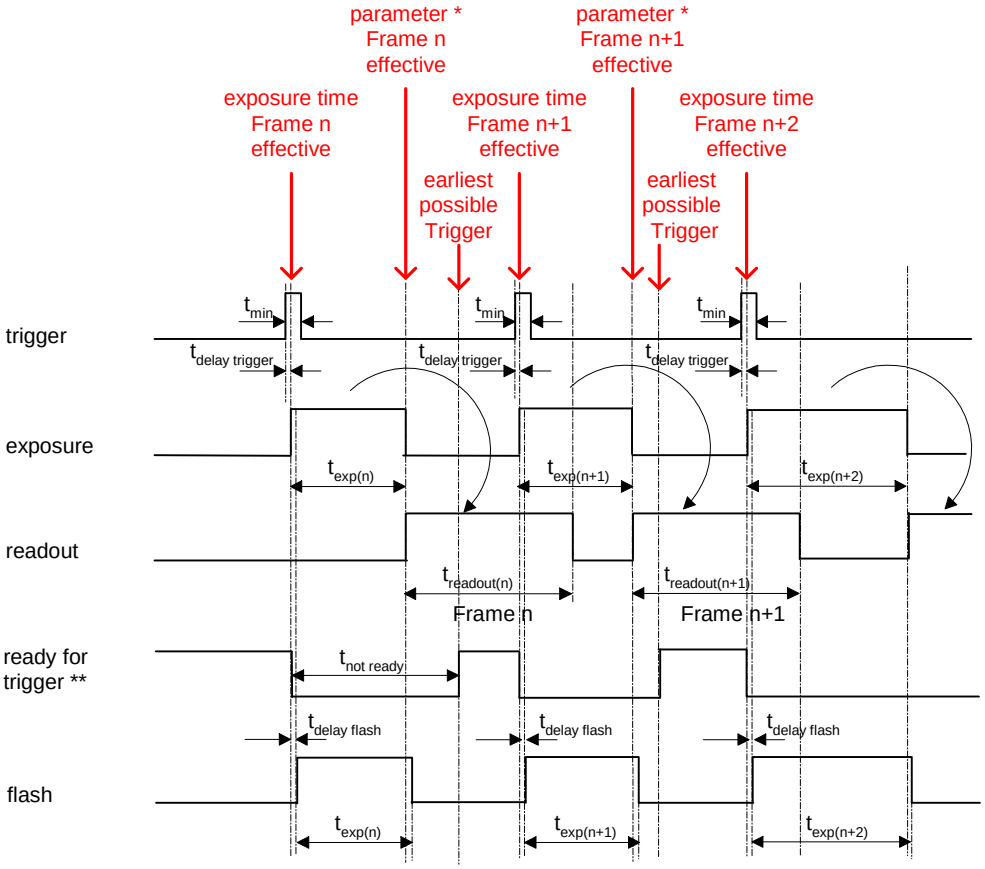
$t_{exp} < t_{readout}$: $t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$

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

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



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

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

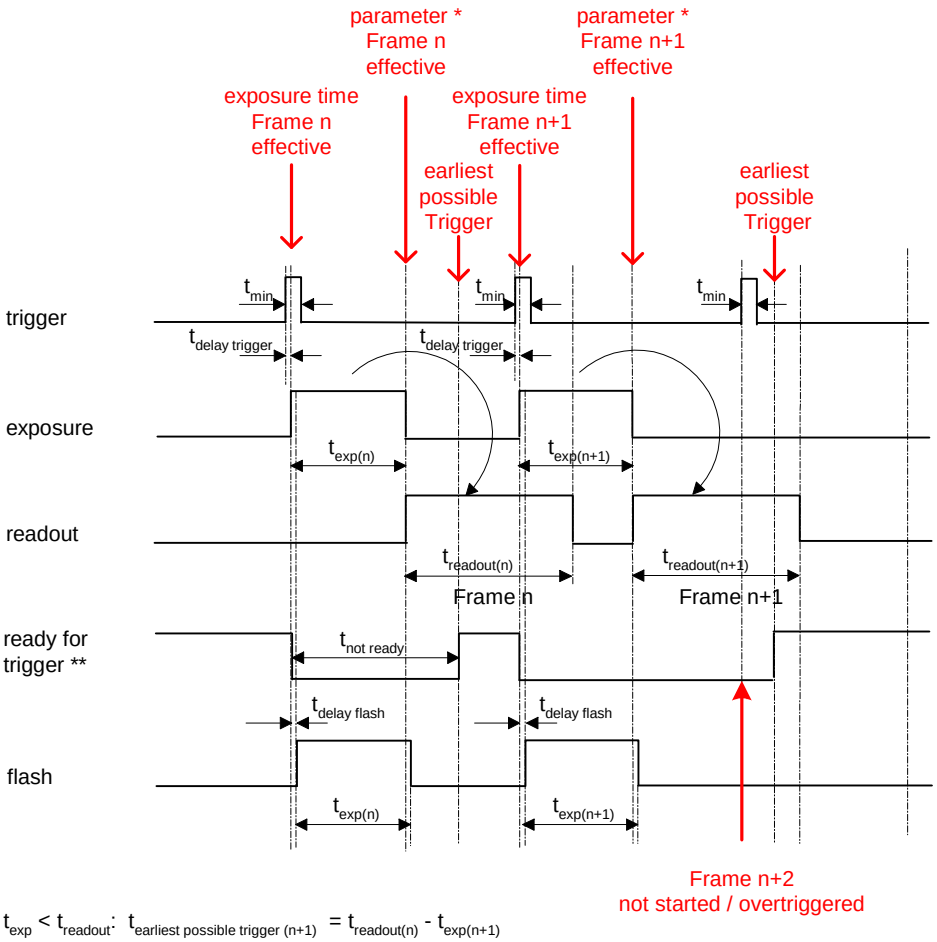
$t_{exp} < t_{readout}$: $t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$

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

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



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

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

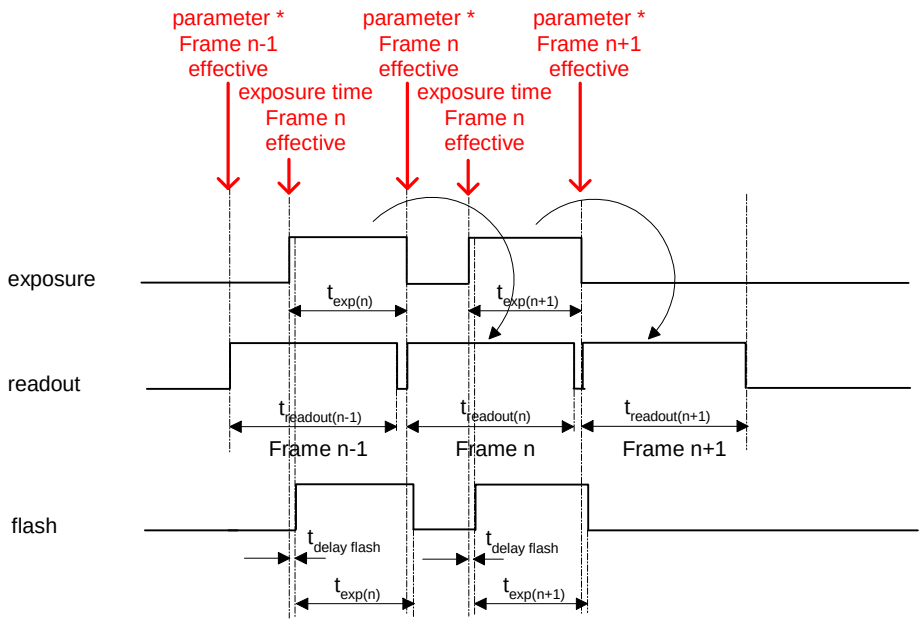
$t_{exp} < t_{readout}$: $t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$

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

* image parameter: offset
global gain
mode
partial scan

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

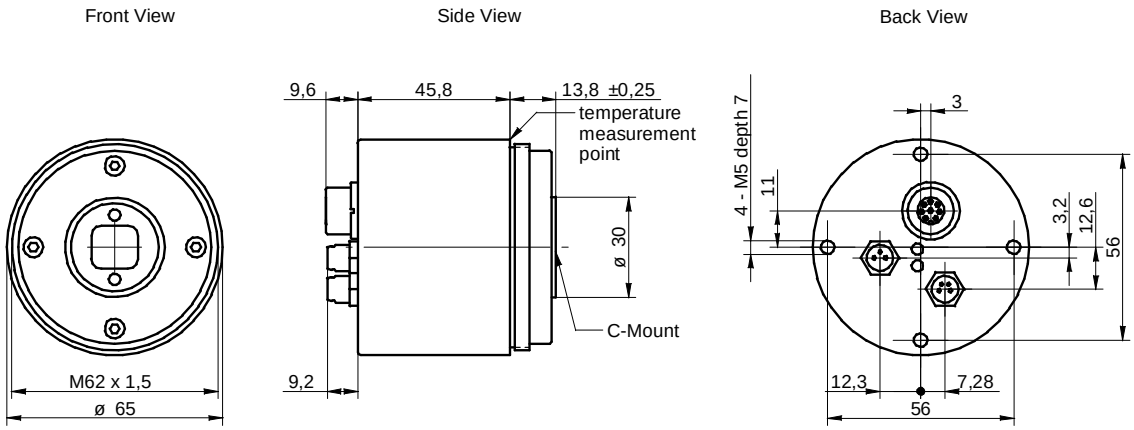
Free Running Mode: overlapped operation



* image parameter: offset
global gain
mode
partial scan

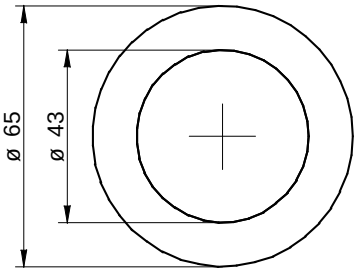
4. Housing

4.1 Camera

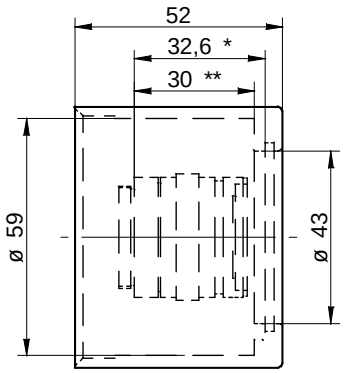


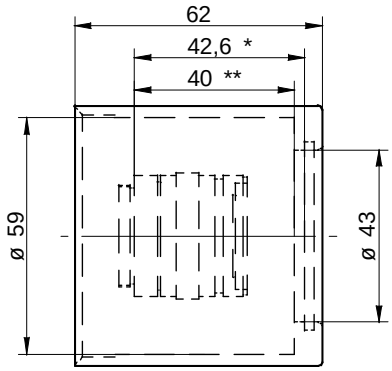
4.2 Tubes

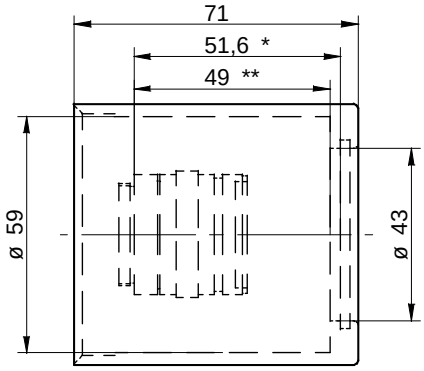
Front View

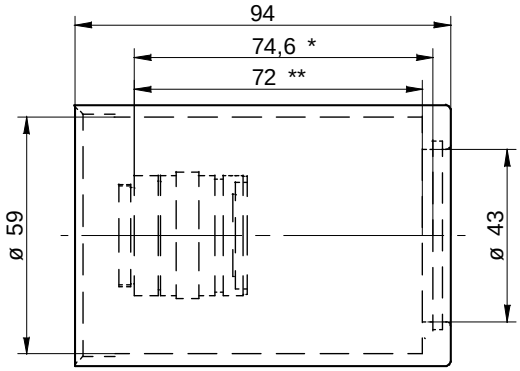


Side View





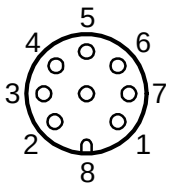


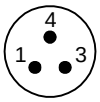


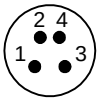
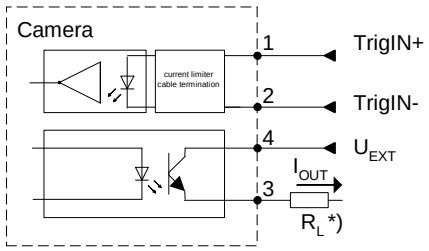
* max. installation space between C-mount and glass
** max. installation space between C-mount and cylinder bottom

5. Connectors / Electrical Interfaces

5.1 Pin assignment:

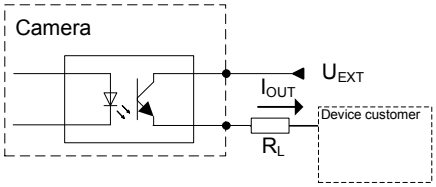
Data / Control 1000 Base-T	Type: female M12 / 8 pin A cod.
	1: MX3- 2: MX4+ 3: MX4- 4: MX1- 5: MX2+ 6: MX1+ 7: MX3+ 8: MX2-

Power	Type: Lumberg RSMESD / 3 pin
	1: Power VCC+ 3: GND 4: not used
	Power cable wires color: 1 = brown 3 = blue 4 = black

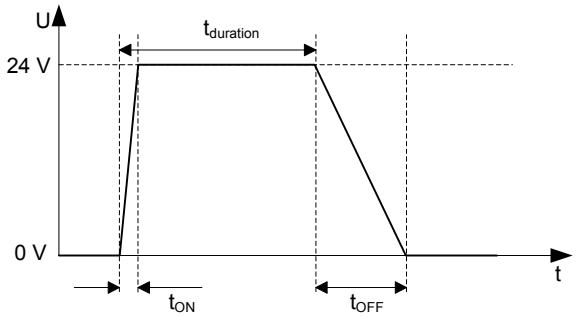
Trigger / Flash	Type: Lumberg RSMESD 4pin.
	 *) resistor must be used, I_{OUT} = 16 mA by U_{EXT} = 24 VDC recommended, drawing shown above example for using high active signal
	Trigger / Flash cable wires color *): 1 = brown 2 = white 3 = blue 4 = black

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

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



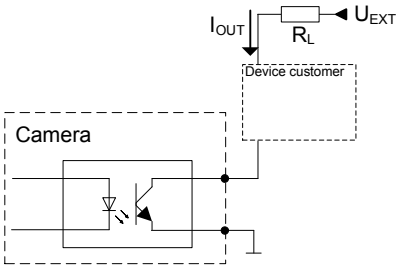
Timing example:
measurement condition U_{EXT} = 24 VDC / I_{OUT} = 16 mA
R_L = 1.5 kOhm



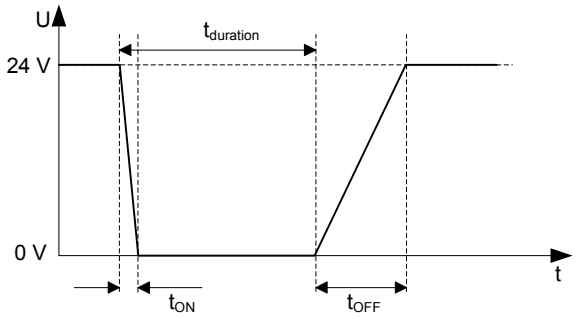
t_{ON} time = typ. 2 µsec

t_{OFF} time = typ. 40 µsec

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



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



t_{ON} time = typ. 2 µsec

t_{OFF} time = typ. 40 µsec

6. Application Note

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- 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