

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

 System: **Gigabit Ethernet**
Baumer TXG20-I7

Revision 2.1

Art. No: 11008700

- Gigabit Ethernet progressive scan CCD camera
- 1624 x 1236 pixel
- Up to 16 full frames per second
- GigE Vision[®] standard compliant
- 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 supplementary function for flexible integration
- Sequence function up to 2³¹-1 frames per sequence
- 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	TXG20
Sensor	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	-
Operation modes	
Trigger mode	yes, overlapped operation
Free running mode	yes, overlapped operation
Signal processing	real-time 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	0 .. 20 dB
Offset (black level)	0 .. 255 LSB (12 bit)
Image data buffer	max. 7 images

Technical specifications subject to change

Image acquisition								
Camera image format modes		Format (pixel)	Gen\leftrightarrowCam standard	Format ID	Pixel format	Pixel clock MHz	Frames per sec. *)	t_{readout}
Full frame HQ	slow	1624 x 1236	Vendor specific	00	Mono8 (**)) (**))	20	8	125 msec
					Mono12			
					Mono12 Packed			
Full frame	fast	1624 x 1236	yes	01	Mono8 (**)) (**))	40	16	63 msec
					Mono12			
					Mono12 Packed			
Binning 2x2 HQ	slow	812 x 618	Vendor specific	02	Mono8 (**)) (**))	20	15	67 msec
					Mono12			
					Mono12 Packed			
Binning 2x2	fast	812 x 618	yes	03	Mono08 (**)) (**))	40	29	35 msec
					Mono12			
					Mono12 Packed			
Binning 1x2 HQ	slow	1624 x 618	Vendor specific	04	Mono08 (**)) (**))	20	15	67 msec
					Mono12			
					Mono12 Packed			
Binning 1x2	fast	1624 x 618	yes	05	Mono08 (**)) (**))	40	29	35 msec
					Mono12			
					Mono12 Packed			
Binning 2x1 HQ	slow	812 x 1236	Vendor specific	06	Mono08 (**)) (**))	20	8	125 msec
					Mono12			
					Mono12 Packed			
Binning 2x1	fast	812 x 1236	yes	07	Mono08 (**)) (**))	40	16	63 msec
					Mono12			
					Mono12 Packed			
Standard features								
Image size controls								
Binning horizontal	yes, 1 or 2							
Binning vertical	yes, 1 or 2							
Pixel format	Mono8, Mono12, Mono12Packed							
Test image selector	yes, in all modes Off, GreyHorizontalRamp, GreyVerticalRamp, HorizontalLineMoving, VerticalLineMoving HorizontalAndVerticalLineMoving							
Partial scan	yes, format freely programmable in all modes (binning on partial scan ok)							
Analog controls								
Gain	yes							
Black Level (Off set)	yes							
Gamma	yes, user programmable (***) (available if LUT is enable) ****) total: 0.001 .. 2							
Brightness correction (custom)	yes, in all binning modes							
Acquisition and Trigger								
Acquisition mode	Continuous							
Trigger source	HardwareTrigger (Line0), SoftwareTrigger, CommandTrigger (ActionCommand), All or Off							
Trigger delay	0 .. 2 sec, 512 trigger can be tracked, step: 1 μ sec							
Sequencer	Up to $2^{31}-1$ frames per sequence / one exposure time and gain value for each parameter set max. set of sequences: Up to $2^{31}-1$ frames x 256 parameter sets							

Technical specifications subject to change

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		
LUT Controls			
LUT selector	1 LUT: Luminance (12 bit) ON / OFF		
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 .. 4.014.800 Byte		
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		
Data quality			
Readout noise	at 20 °C, gain = 1, exposure time = 32 msec, full frame mode, slow scan $\sigma < 0.5$ LSB (8 bit) typical		
Dynamic range	typical > 54 dB		
Optical interface			
Optical filter	C-Mount dust protection on request: super polished, IR cut filter, 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 = $t_{\text{exp}} + 99$ µsec fast mode = $t_{\text{exp}} + 50$ µsec		
User Output	yes, ON / OFF		
Software reset	yes, delay up to 125 msec		
Asynchronous reset	Full frame / Binning 2x1	slow	delay up to 17.7 msec
		fast	9.5 msec
	Binning 2x2 / Binning 1x2	slow	delay up to 11.7 msec
		fast	6.2 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: 431.7 mA .. 123 mA								
Power consumption	approx. 4 Watt								
Digital input	Line 0: trigger signal, opto decoupled $U_{IN(low)} = 0 \dots 4.5 \text{ VDC}$, $U_{IN(high)} = 11 \dots 30 \text{ VDC}$ $I_{IN} = 6 \dots 10 \text{ mA}$ / 7 mA typical rising edge (invert = false) ****) min. impulse length (t_{min}): 2 μsec trigger delay out of $t_{readout}$ ($t_{delay \text{ trigger}}$): 3 μsec max. trigger delay during $t_{readout}$ ($t_{delay \text{ trigger}}$): slow mode = 106 μsec fast mode = 53 μsec								
Digital output	Line 1: opto decoupled $U_{EXT} = 5 \dots 30 \text{ VDC}$ / 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 °C .. +70 °C								
Operating temperature	+5 °C .. +50 °C								
Housing operating temperature	between +39 °C .. +50 °C, note the max. housing temperature max. +50 °C *****) (measurement point, see item 4)								
Humidity	10 % .. 90 % non condensing								
Conformity	CE, FCC Part 15 class B, RoHS compliant								
Housing									
aluminum, IP67									
Dimensions	$\varnothing 65 \text{ mm} \times 50 \text{ mm}$								
Weight camera	< 380 g								
Weight tube	<table border="1"> <tr> <td>52 mm</td> <td>62 mm</td> <td>71 mm</td> <td>94 mm</td> </tr> <tr> <td>< 120 g</td> <td>< 140 g</td> <td>< 150 g</td> <td>< 200 g</td> </tr> </table>	52 mm	62 mm	71 mm	94 mm	< 120 g	< 140 g	< 150 g	< 200 g
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								
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									

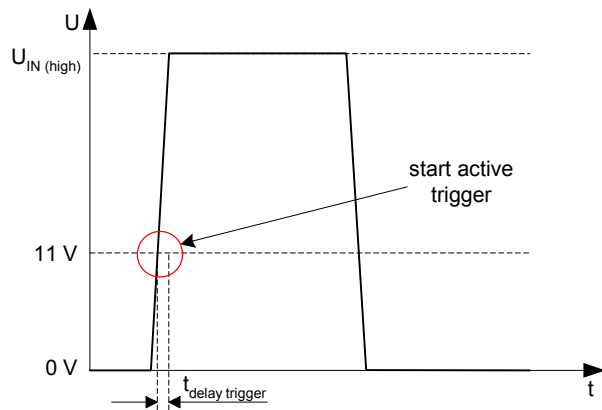
- *) maximum frame rate in free running mode, effective frame rate depending on camera image format mode settings and set exposure time ($t_{exp} < t_{readout}$)
- **) default pixel format
- ***) the LUT function will be used for the gamma value and the calculation time of the internal used LUT need app. 2 sec, if the gamma value changed
- ****) can be inverted via software
- *****) housing temperature is limited by CCD sensor specification

2. Camera Factory Settings after Camera Start-up

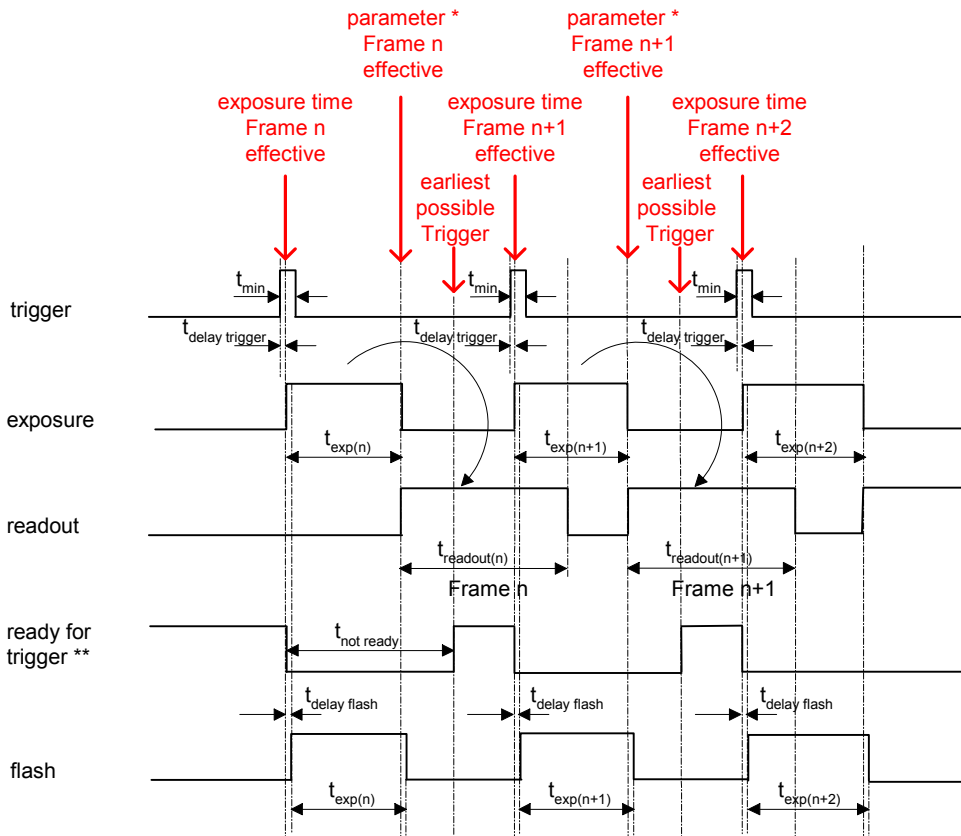
Camera factory settings after camera start-up	
Operation modes	free running mode
Signal processing	
Exposure control	32 msec
Gain control	factor 1 = 0 dB
Offset (black level)	0
Image acquisition	
Camera image format mode	mode id = 01, full frame Mono8
Partial scan function	not active
Test image selector	Off
Defect pixel correction	On
Electrical interface	
Exposure Active (External flash sync)	disabled, digital output set to low status (high impedance) invert = false line source = Exposure Active
Async. Trigger	disabled invert = false trigger source = Line0

3. Timing Operation Modes

Trigger Mode: start up time



Trigger Mode: trigger mode 0, overlapped trigger



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

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

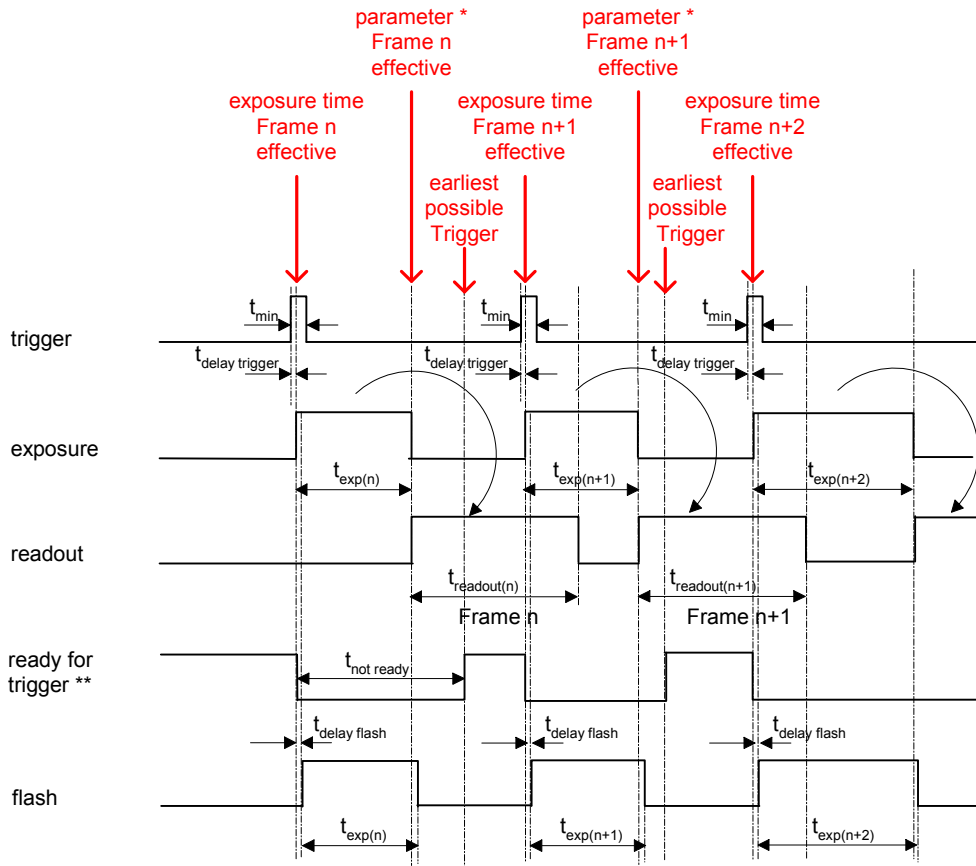
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

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



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

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

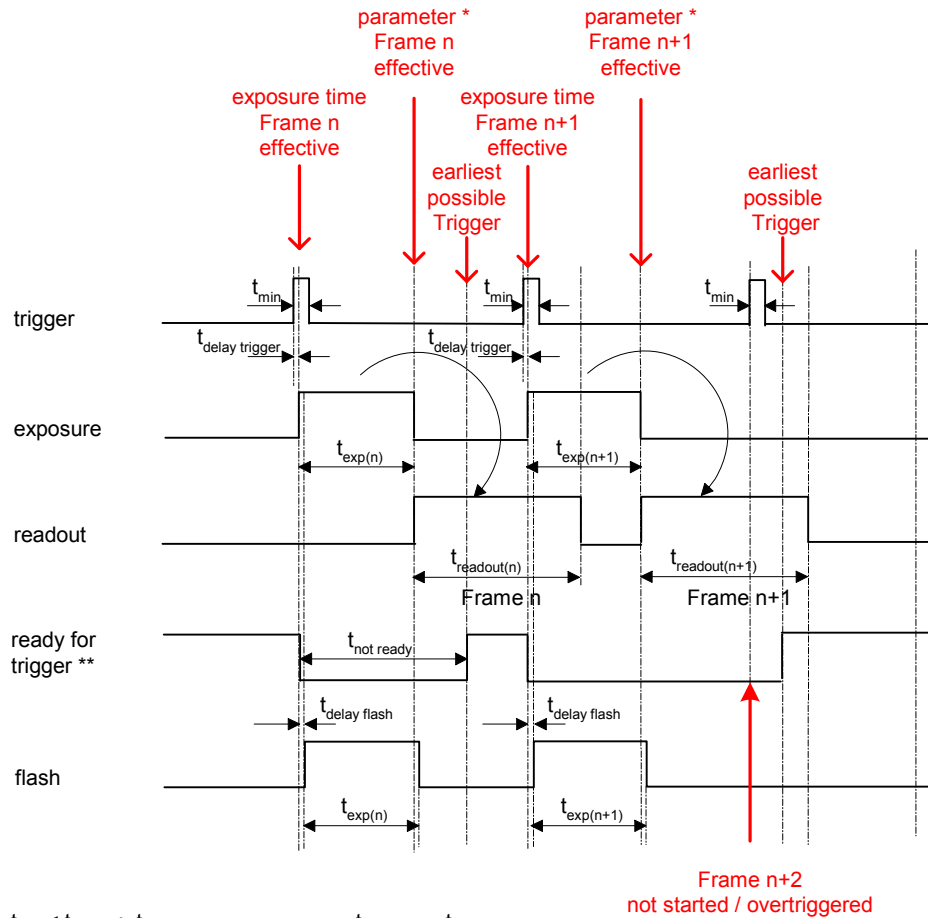
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

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



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

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

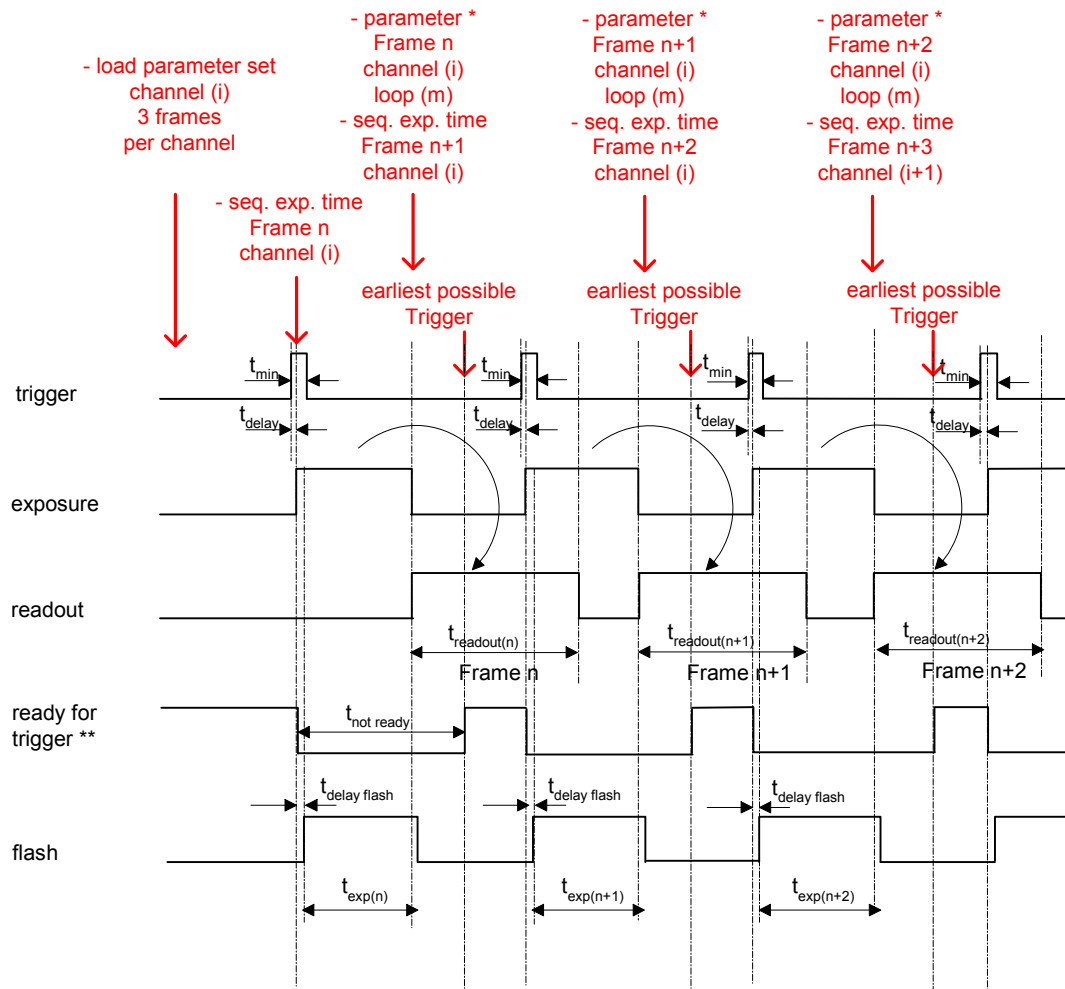
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

* image parameter: offset
global gain
mode
partial scan

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

Trigger Mode: overlapped trigger sequence (example for 3 frames per channel with hardware trigger)



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

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

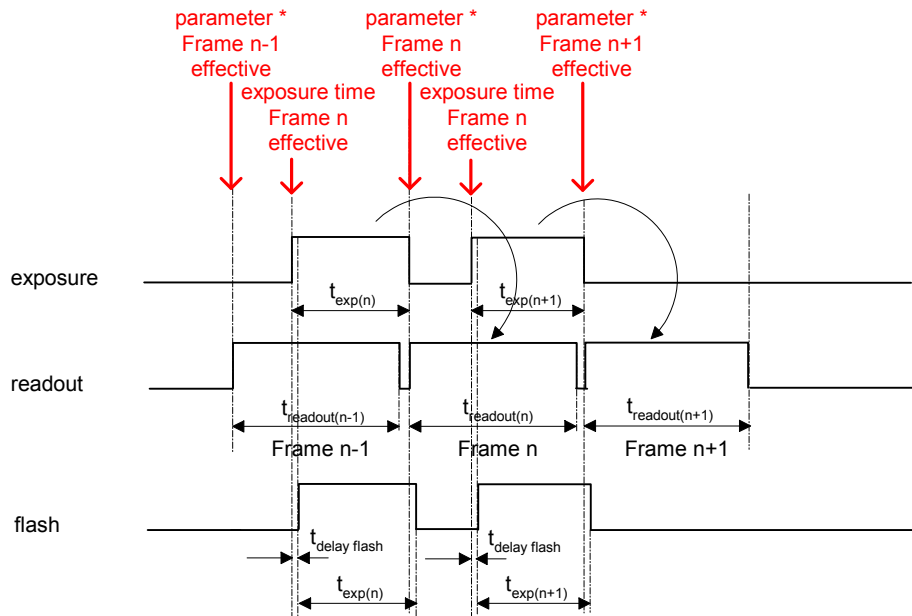
$$t_{exp} < t_{readout}: t_{not\ ready\ (n+1)} = t_{exp(n)} + t_{readout(n)} - t_{exp(n+1)}$$

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

* image parameter: offset
sequence global gain
mode

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

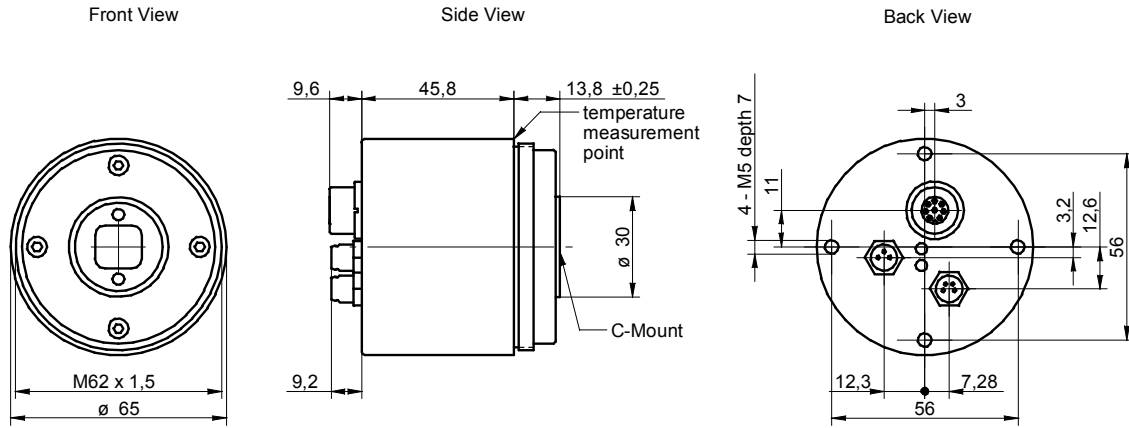
Free Running Mode: overlapped operation



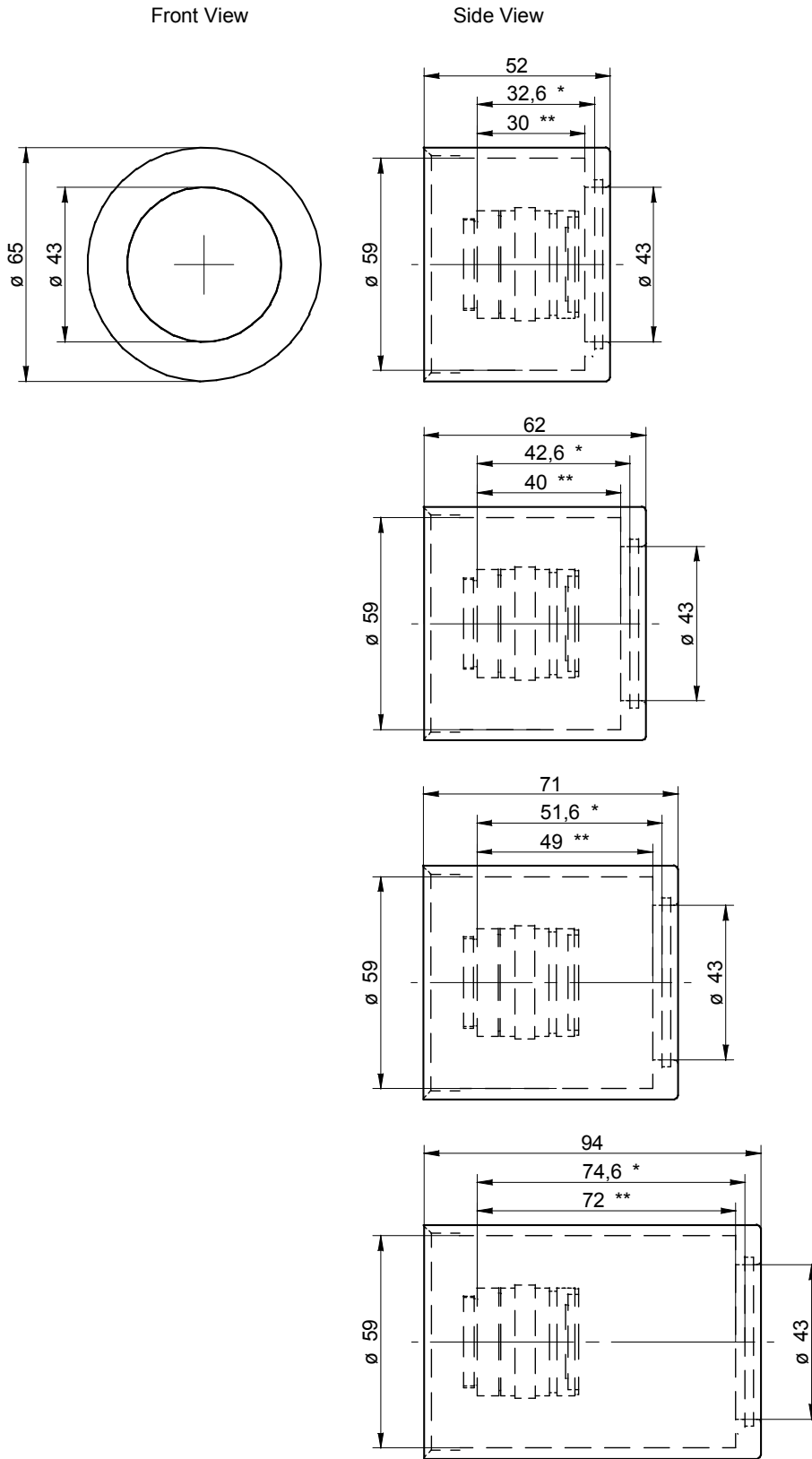
* image parameter: offset
 global gain
 mode
 partial scan

4. Housing

4.1 Camera



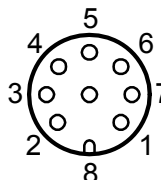
4.2 Tube

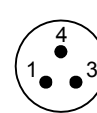



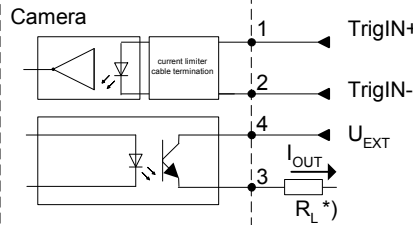
* max. installation space between C-mount and glass
 ** max. installation space between C-mount and cylinder bottom

5. Connectors / Electrical Interfaces

5.1 Pin assignment:

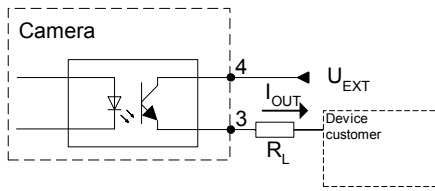
Data / Control 1000 Base-T	Type: female M12 / 8 pin A cod.
	1: MX3- 2: MX4+ 3: MX4- 4: MX1- 5: MX2+ 6: MX1+ 7: MX3+ 8: MX2-

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

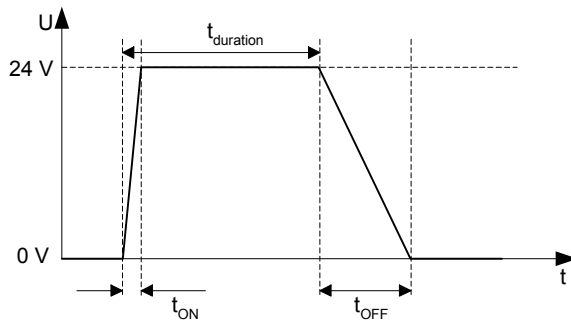
Trigger Flash	Type: Lumberg RSMEED 4pin.
	 <p>*) resistor must be used, $I_{OUT} = 16 \text{ mA}$ by $U_{EXT} = 24 \text{ VDC}$ recommended, drawing shown above example for using high active signal</p>
	Trigger / Flash cable wires color *): 1 = brown 2 = white 3 = blue 4 = black

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

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

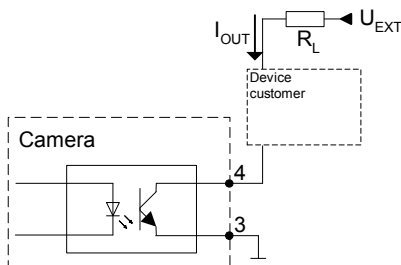


Timing example:
 measurement condition $U_{EXT} = 24$ VDC / $I_{OUT} = 16$ mA
 $R_L = 1.5$ kOhm

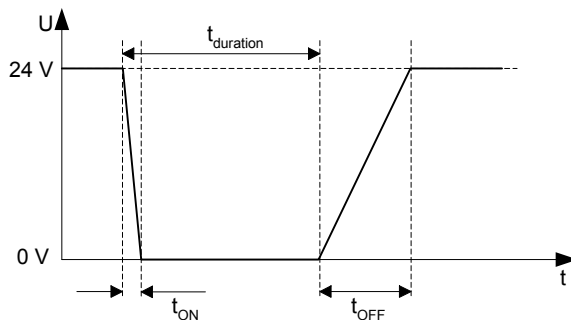


t_{ON} time = typ. 2 μ sec
 t_{OFF} time = typ. 40 μ sec

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 μ sec
 t_{OFF} time = typ. 40 μ sec

End of Document

Technical specifications subject to change