

**Digital Color Camera**

 System: **Gigabit Ethernet**

# Baumer EXG50c

Revision 1

**Art. No: 11012596**

- Gigabit Ethernet CMOS camera
- 2592 x 1944 pixel
- Up to 14 full frames per second
- GigE Vision™ standard compliant
- True partial scan function (ROI) for increased frame rates
- On board integrated color processor for high quality color calculation
- External synchronization via industrial compliant process interface (trigger / flash)
- Jumbo frames supported
- Integrated 32 MByte RAM for temporarily image data buffering
- Camera parameter programmable in real-time
- Ultra compact and lightweight aluminum housing



## 1. Overview

Model Name	EXG50c
Sensor	1/2.5" progressive scan CMOS technology
Shutter / readout mode	rolling curtain type shutter / progressive scan readout
Number of pixel	2592 x 1944
Scan area	5.70 mm x 4.28 mm
Pixel size	2.2 µm x 2.2 µm
Color filter	RGB Bayer mosaic
<b>Operation modes</b>	
Trigger mode	yes, global reset operation
Free running mode	yes, overlapped operation
<b>Signal processing</b>	real-time software programmable
Pixel clock	96 MHz fast scan
A/D converter	12 bit
Exposure control (t <sub>exp</sub> )	total: 4 µsec .. 1 sec step: 1 µsec
Gain control	0 .. 18 dB
Offset (black level)	permanent automatic offset correction, digital offset correction 0 .. 4095 LSB (12 bit)
Image data buffer	max. 2 image

Technical specifications subject to change

Image acquisition								
Camera image format modes		Format (pixel)	Gen↔Cam standard	Format ID	Pixel format	Pixel clock MHz	Frames per sec. *)	t <sub>readout</sub>
Full frame	Fast	2592 x 1944	yes	01	BayerRG8 **)	96	14	71,66ms
					BayerRG12			
					Mono8			
					YUV411 Packed			
Color Binning 2x2	Fast	1296 x 972	yes	03	BayerRG8 **)	96	33	30ms
					BayerRG12			
					Mono8			
					YUV411 Packed			
Color Binning 4x4	Fast	648 x 486	yes	08	BayerRG8 **)	96	52	20ms
					BayerRG12			
					Mono8			
					YUV411 Packed			
YUV422 Packed								
<b>Image size controls</b>								
Binning horizontal		yes, 1, 2 or 4						
Binning vertical		yes, 1, 2 or 4						
Pixel format		BayerRG8, BayerRG12, Mono8, YUV411 Packed, YUV422 Packed						
Test image selector		yes, in mode BayerRG Off, GreyHorizontalRamp, GreyVerticalRamp, HorizontalLineMoving, VerticalLineMoving HorizontalAndVerticalLineMoving						
Partial scan		yes, format freely programmable in all modes (minimal Size X: 304 Pixel)						
<b>Analog controls</b>								
Gain		yes						
Black Level (Off set)		yes						
Gamma		no						
Brightness correction (custom)		yes, in all binning modes brightness is permanent corrected in the camera						
<b>Acquisition and Trigger</b>								
Acquisition mode		Continuous						
Trigger source		HardwareTrigger (Line0), SoftwareTrigger, CommandTrigger (ActionCommand), All or Off						
Trigger delay		no						
Sequencer		no						
<b>Digital I/O</b>								
Lines		Line0 (Input), Line1 (Output)						
Line source (outputs only)		Line1: ExposureActive or UserOutput						
Line debouncer		no						
<b>Event Generation</b>								
Events		no						
Event Notification		no						
<b>Counters and Timers</b>								
Framecounter		yes, 2 <sup>32</sup> can be set by user						
<b>LUT Controls</b>								
LUT selector		no						
Defect pixel correction (custom)		Yes, ON / OFF						
Defect pixel list (custom)								
<b>GigEVisionTransportLayer</b>								
PayLoadsize		4 Byte .. 10.077.968 Byte						
<b>UserSets</b>								
User set selector		Default (factory settings / read only) UserSet1, UserSet2, UserSet3 (read and write)						
UserSetDefaultSelector		yes, define the start up "UserSet"						

Technical specifications subject to change

<b>Advanced features</b>	
Time stamp function	yes, 64 bit tick = 32 nsec
Asynchronous message channel	No
Concatenation function	no
User defined identifier	yes, user programmable permanent identifier
ActionCommand	yes, ID 0 = Trigger
<b>Data quality</b>	at 20 °C, gain = 1, exposure time = 32 msec, full frame mode, slow scan
Readout noise	$\sigma < 0.5$ (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: dust protection, daylight filter or no filter
<b>Process interface functions</b>	
Async. Trigger	yes, trigger mode operation, "Off", "software trigger", "hardware trigger", "command trigger" or "all" separately selectable
Exposure Active (External flash sync)	yes
User Output	yes, ON / OFF
Software reset	yes
Asynchronous reset	No
Image info header	yes
<b>Electrical interface</b>	
Data / control	standard single cable 1000 Base-T, Cat6 recommended / minimum Cat5e option: screw lock type connector
Power	VCC: 8 VDC .. 30 VDC I: 330mA .. 90mA
Power consumption	2,7W
Digital input	Line 0: trigger signal, opto decoupled $U_{IN(low)} = 0 .. 4.5$ VDC, $U_{IN(high)} = 11 .. 30$ VDC $I_{IN} = \text{max. } 10$ mA rising edge (invert = false) *** min. impulse length ( $t_{min}$ ): 2 $\mu$ sec trigger delay out of $t_{readout}$ ( $t_{delay}$ trigger): 2 $\mu$ sec
Digital output	Line 1: opto decoupled $U_{EXT} = 5 .. 30$ VDC / 24 VDC typical, $I_{OUT} = \text{max. } 16$ 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
<b>Environmental</b>	
Storage temperature	-10 °C .. +70 °C
Operating temperature	+5 °C .. +48 °C ****) between +24 °C .. +50 °C, note the max. housing temperature
Humidity	10 % .. 90 % non condensing
Conformity	CE, FCC Part 15 class B, UL, RoHS compliant

Technical specifications subject to change

<b>Housing</b>	aluminum
Dimensions	36 x 36 x (43 ... 56) mm <sup>3</sup>
Weight	86 g
<b>1000 Base-T interface</b>	1000 Mbit / sec
Ethernet IP configuration	persistent IP / DHCP / LLA
Stream channel packet size	576 Byte (default) .. 16 kByte jumbo frames supported
Interpacketgap	0 .. 2 <sup>32</sup> -1 ticks
Resend function	yes
<b>Software</b>	Baumer-GAPI SDK with supported OS socket driver and Baumer filter driver / SDK for Windows XP (32 bit) / Windows Vista (32 bit / 64bit) 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

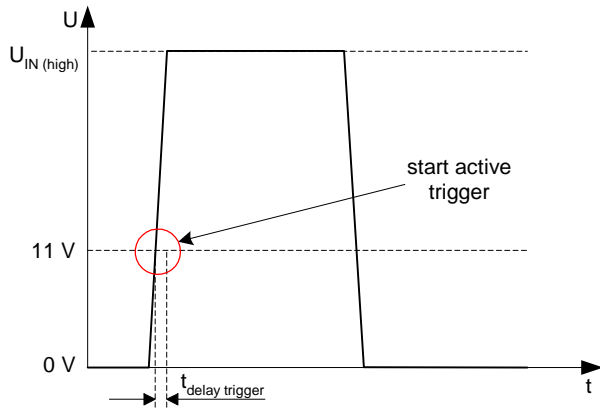
- \*) maximum frame rate in free running mode, effective frame rate depending on camera image format mode settings and set exposure time ( $t_{exp} < t_{readout}$ )
- \*\*) Default pixel format
- \*\*\*) can be inverted via software
- \*\*\*\*) housing temperature is limited by CMOS sensor specification

## 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	16 msec
Gain control	factor 1 = 0 dB
Offset (black level)	0
<b>Image acquisition</b>	
Camera image format mode	mode id = 01, full frame BayerRG8
Partial scan function	not active
Test image selector	Off
Defect pixel correction	On
<b>Electrical interface</b>	
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

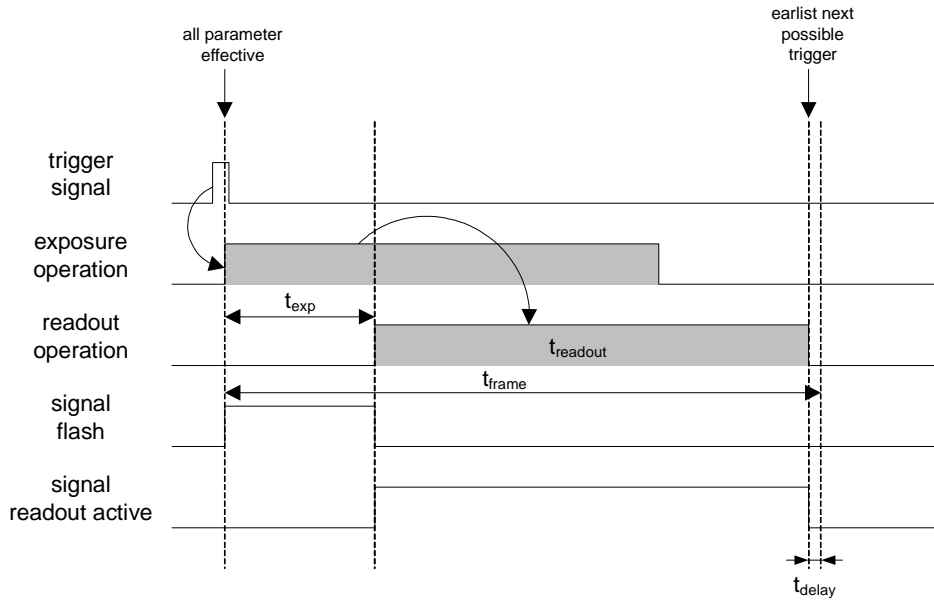
### 3. Timing Operation Modes

Trigger Mode: start up time



### 3.1 Trigger Mode

#### 3.1.1 Global Reset



$$t_{frame} = t_{exp} + t_{readout} + t_{delay}$$

$$\begin{aligned} t_{exp} < t_{readout}: & \quad t_{delay} = t_{readout} \\ t_{exp} > t_{readout}: & \quad t_{delay} = t_{exp} \end{aligned}$$

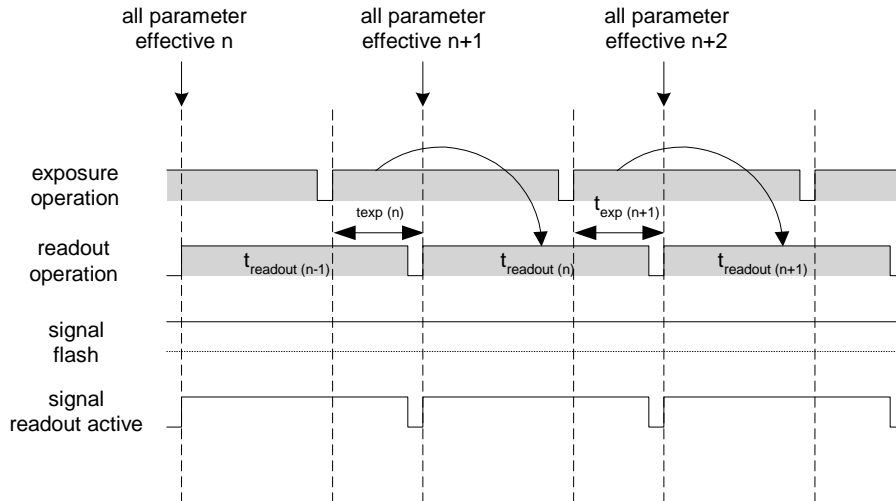
Maximum trigger frequency:

$$\text{Frames per second}_{max} = \frac{1}{t_{exp} + t_{readout} + t_{delay}}$$

\* image parameter: exposure time  
mode  
color gain  
partial scan

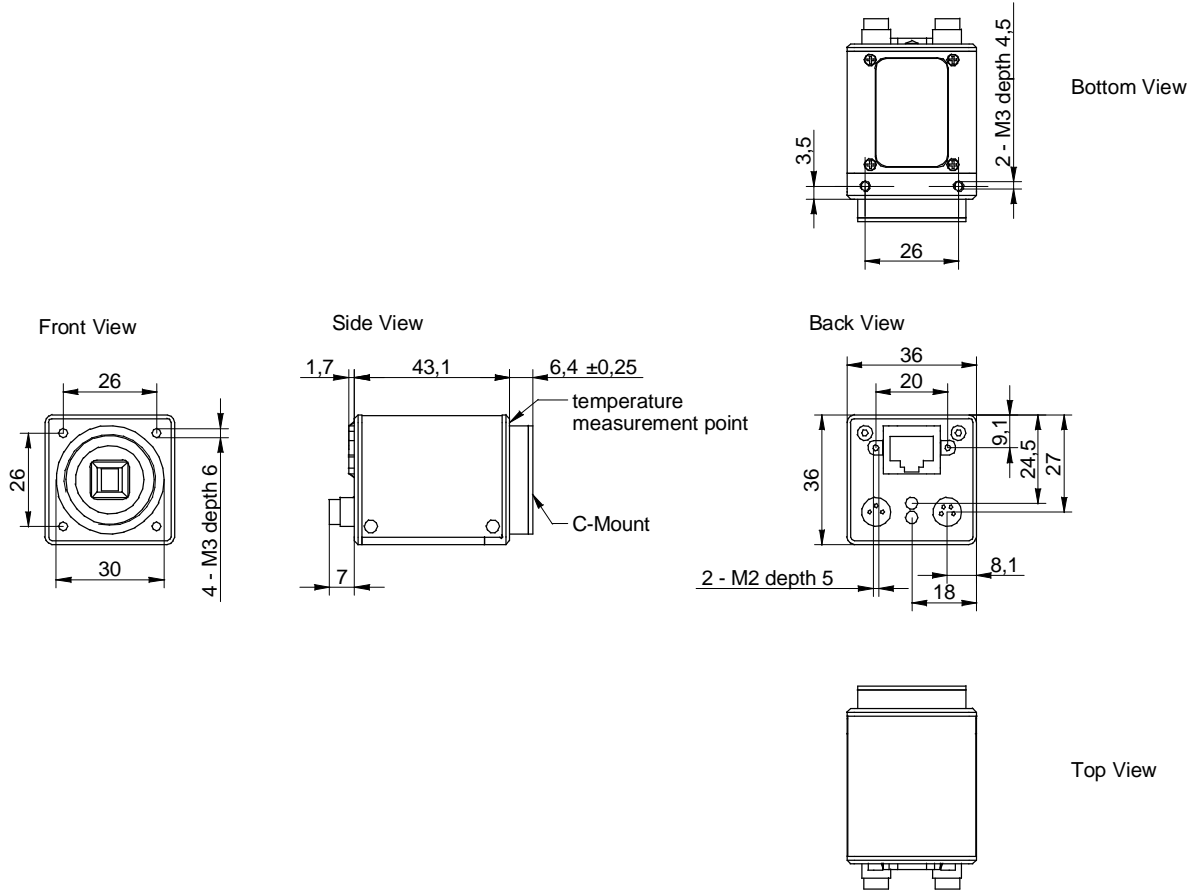
### 3.2 Free Running Mode

#### 3.2.1 Rolling Shutter



\* image parameter: exposure time  
mode  
color gain  
partial scan

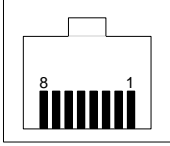
4. Housing





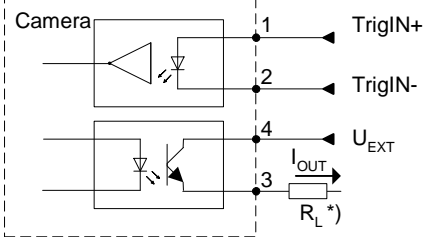


5. Connectors / Electrical Interfaces

5.1 Pin assignment:

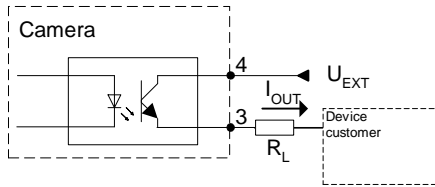
<b>Data / Control 1000 Base-T</b>	Type: RJ45 8P8C mod jack
	1: MX1+ 2: MX1- 3: MX2+ 4: MX3+ 5: MX3- 6: MX2- 7: MX4+ 8: MX4-

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

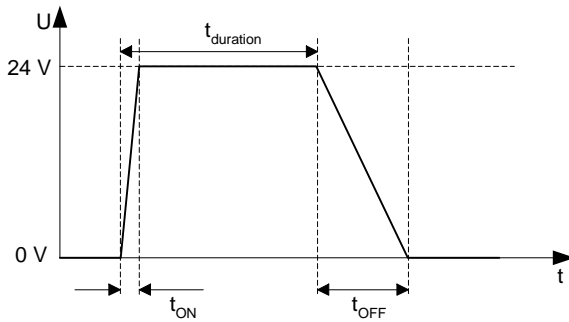
<b>Trigger Flash</b>	Type: Lumberg RSMESD 4pin.
	
	*) resistor must be used, $I_{OUT} = 16 \text{ mA}$ by $U_{EXT} = 24 \text{ VDC}$ recommended, drawing shown above example for using high active signal
	Trigger / Flash cable wires color *): 1 = brown 2 = white 3 = blue 4 = black

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

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

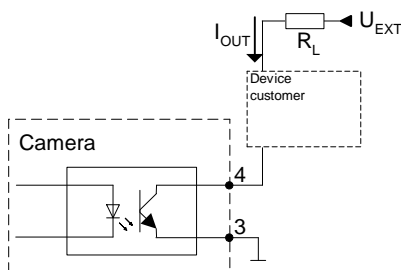


Timing example:  
 measurement condition  $U_{EXT} = 24\text{ VDC} / I_{OUT} = 16\text{ mA}$   
 $R_L = 1.5\text{ kOhm}$

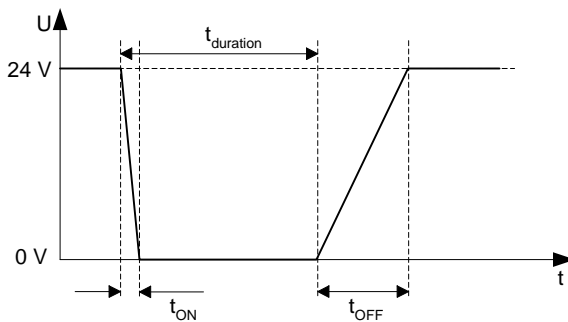


$t_{ON}$  time = typ.  $2\ \mu\text{sec}$   
 $t_{OFF}$  time = typ.  $40\ \mu\text{sec}$

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

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Technical specifications subject to change