

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

 System: **Gigabit Ethernet**

Baumer EXG50

Revision 1

Art. No: 11012594

- 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
- 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	EXG50
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	-
Operation modes	
Trigger mode	yes, global reset operation
Free running mode	yes, overlapped operation
Signal processing	real-time software programmable
Pixel clock	96 MHz fast scan
A/D converter	12 bit
Exposure control (t _{exp})	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)	GenCam standard	Format ID	Pixel format	Pixel clock MHz	Frames per sec. *)	t _{readout}	
Full frame fast	2592 x 1944	yes	01	Mono8 **)	96	13,9	71 msec	
				Mono12				
				Mono12 Packed				
Binning 2x2 fast	1296 x 972	yes	03	Mono8 **)	96	33,6	30 msec	
				Mono12				
				Mono12 Packed				
Binning 4x4 fast	648 x 486	yes	08	Mono8 **)	96	52,3	20 msec	
				Mono12				
				Mono12 Packed				
Standard features								
Image size controls								
Binning horizontal	yes, 1, 2 or 4							
Binning vertical	yes, 1, 2 or 4							
Pixel format	Mono8, Mono12, Mono12 Packed							
Test image selector	yes, in all modes Off, GreyHorizontalRamp, GreyVerticalRamp, HorizontalLineMoving, VerticalLineMoving HorizontalAndVerticalLineMoving							
Partial scan	yes, format freely programmable in all modes (minimal Size X: 304 Pixel)							
Analog controls								
Gain	yes							
Black Level (Off set)	yes							
Gamma	no							
Brightness correction (custom)	yes, in all binning modes brightness is permanent corrected in the camera							
Acquisition and Trigger								
Acquisition mode	Continuous							
Trigger source	HardwareTrigger (Line0), SoftwareTrigger, CommandTrigger (ActionCommand), All or Off							
Trigger delay	no							
Sequencer	no							
Digital I/O								
Lines	Line0 (Input), Line1 (Output)							
Line source (outputs only)	Line1: ExposureActive or UserOutput							
Line debouncer	no							
Event Generation								
Events	no							
Event Notification	no							
Counters and Timers								
Framecounter	yes, 2 ³² can be set by user							
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 .. 10.077.968 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	no
Concatenation function	no
User defined identifier	yes, user programmable permanent identifier
ActionCommand	yes, ID 0 = Trigger
Data quality	at 20 °C, gain = 1, exposure time = 32 msec, full frame mode
Readout noise	$\sigma < 0.5$ (8 bit) typical
Dynamic range	typical > 54 dB
Optical interface	C-Mount on request: CS-Mount
Optical filter	no on request: dust protection, daylight filter or IR cut filter
Process interface functions	
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
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: 0,3A .. 0,09A
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 μ sec trigger delay out of $t_{readout}$ ($t_{delay \text{ trigger}}$): 2 μ 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
Environmental	
Storage temperature	-10 °C .. +70 °C
Operating temperature	+5 °C .. +50 °C ****) between +25 °C .. +50 °C, note the max. housing temperature
Humidity	10 % .. 90 % non condensing
Conformity	CE, FCC Part 15 class B, RoHS compliant

Technical specifications subject to change

Housing	aluminum
Dimensions	36 x 36 x 43 mm ³
Weight	< 90 g
1000 Base-T interface	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 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 / 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

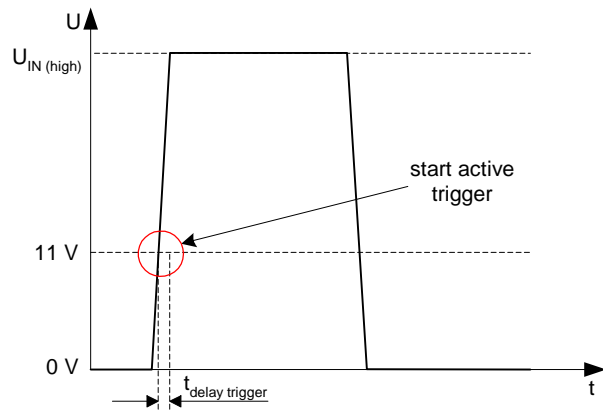
- *) maximum frame rate in free running mode, effective frame rate depending on camera image format mode settings and set exposure time ($t_{exp} < t_{readout}$)
- **) default pixel format
- ***) can be inverted via software
- ****) housing temperature is limited by C-MOS sensor specification

2. Camera Factory Settings after Camera Start-up

	Camera factory settings after camera start-up
Operation modes	free running mode
Signal processing	
Exposure control	16 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

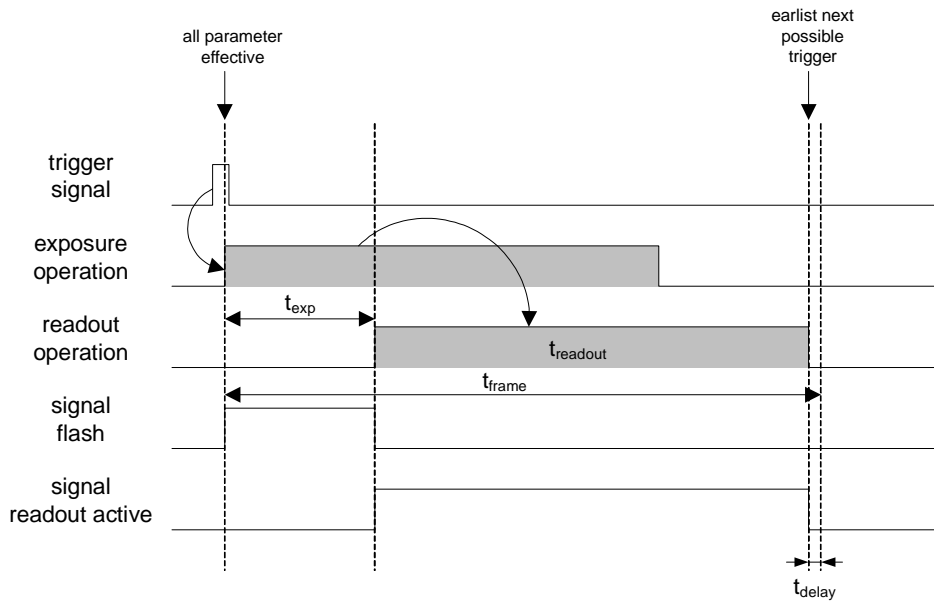
3. Timing Operation Modes

Trigger Mode: start up time



3.1 Trigger Mode

3.1.1 Global Reset



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

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

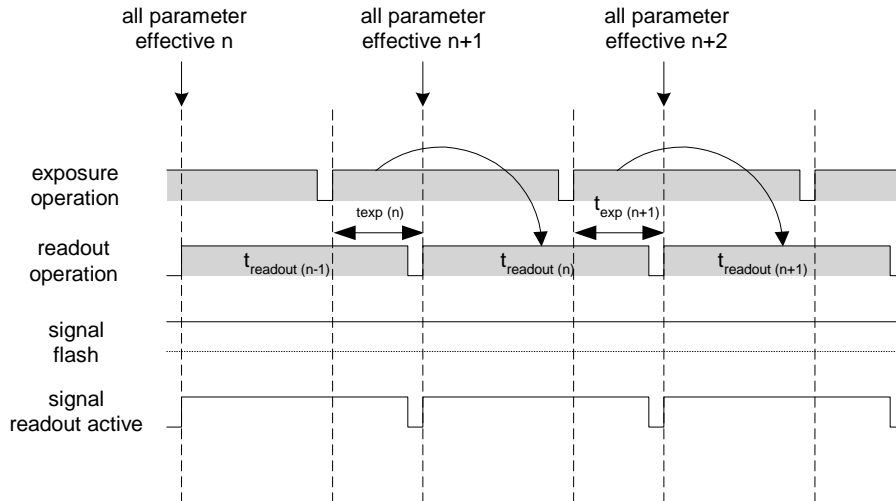
Maximum trigger frequency:

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

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

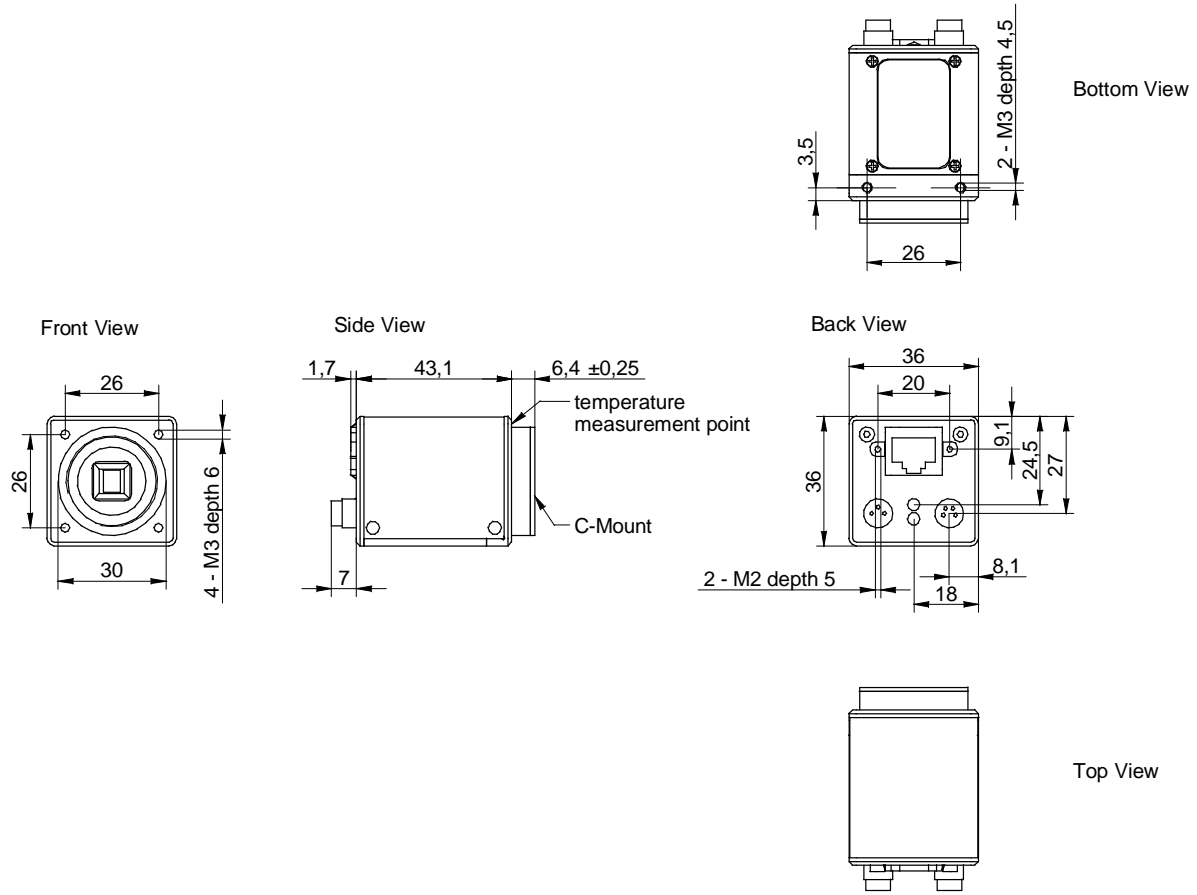
3.2 Free Running Mode

3.2.1 Rolling Shutter



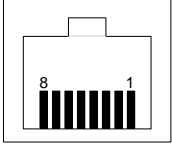
* image parameter: exposure time
mode
color gain
partial scan


4. Housing


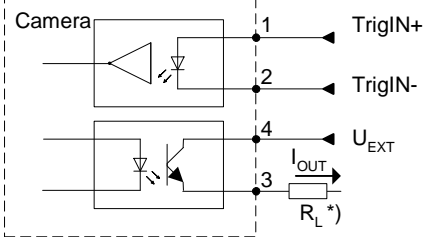


5. Connectors / Electrical Interfaces

5.1 Pin assignment:

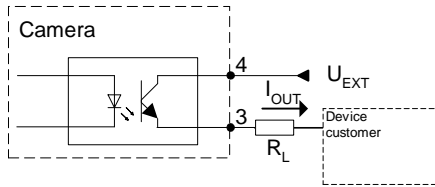
Data / Control 1000 Base-T	Type: RJ45 8P8C mod jack
	1: MX1+ 2: MX1- 3: MX2+ 4: MX3+ 5: MX3- 6: MX2- 7: MX4+ 8: MX4-

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

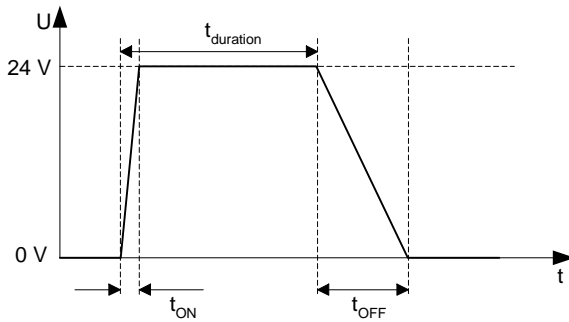
Trigger Flash	Type: Lumberg RSMESD 4pin.
	
	*) resistor must be used, $I_{OUT} = 16 \text{ mA}$ by $U_{EXT} = 24 \text{ VDC}$ recommended, drawing shown above example for using high active signal
	Trigger / Flash cable wires color *): 1 = brown 2 = white 3 = blue 4 = black

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

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

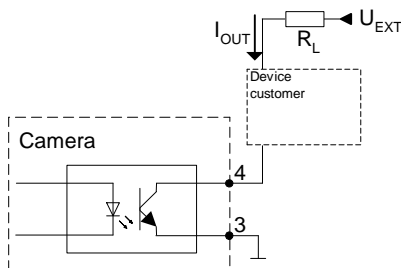


Timing example:
 measurement condition $U_{EXT} = 24\text{ VDC} / I_{OUT} = 16\text{ mA}$
 $R_L = 1.5\text{ kOhm}$

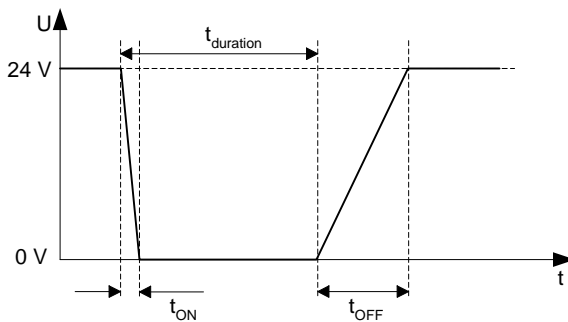


t_{ON} time = typ. $2\ \mu\text{sec}$
 t_{OFF} time = typ. $40\ \mu\text{sec}$

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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