



Technical Details



# DMK 33G445 Technical Reference Manual



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## 1 Quick Facts

<b>General</b>	
Vision Standard	GigE Vision
Dynamic Range	8/12
Resolution	1280x960
Frame Rate	30
Pixel Formats	8-Bit Monochrome 12-Bit Packed Monochrome 16-Bit Monochrome

<b>Optical Interface</b>	
IR-Cut filter	No
Sensor Type	Sony ICX445ALA
Shutter Type	Global
Sensor Format	1/3 inch
Pixel Size	3.75 $\mu\text{m}$
Lens Mount	C/CS

<b>Electrical Interface</b>	
Interface	GigE
Supply voltage	11 VDC to 13 VDC or POE: 48 VDC to 56 VDC
Current consumption	approx 400 mA @ 12 VDC
I/O Connector	6-pin connector for power supply, trigger and strobe or general purpose input/output

<b>Mechanical Data</b>	
Dimensions	H: 29 mm, W: 29 mm, L: 57 mm
Mass	65 g



<b>Adjustments</b>	
Shutter	10 $\mu$ s to 30 s
Gain	0 dB to 3039 dB

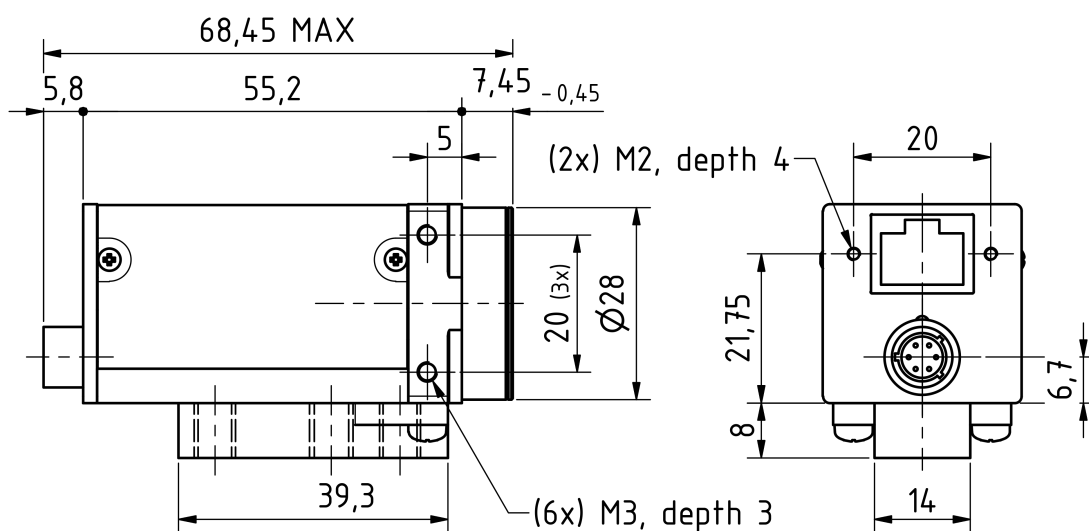
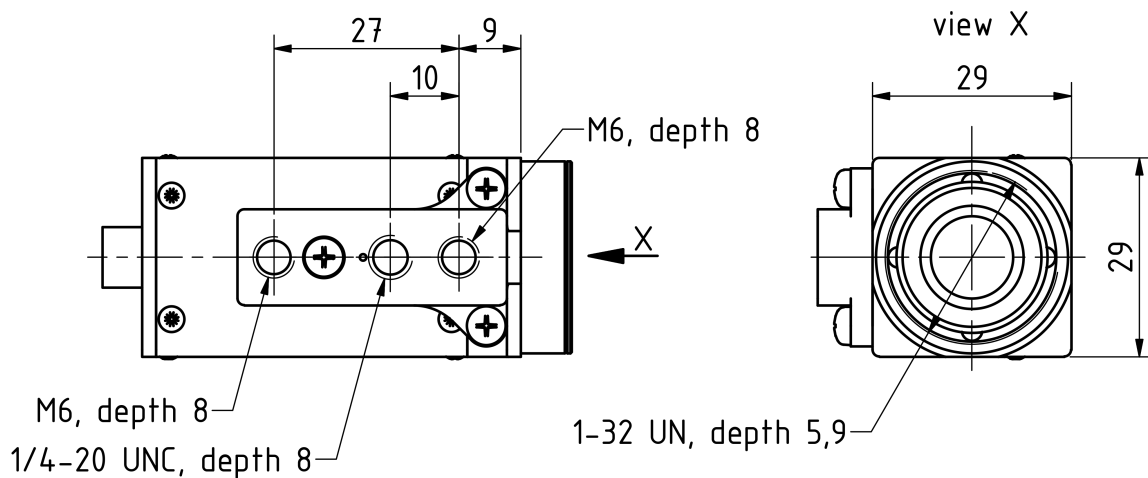
<b>Environmental</b>	
Temperature (operating)	-5 °C to 45 °C
Temperature (storage)	-20 °C to 60 °C
Humidity (operating)	20 % to 80 % (non-condensing)
Humidity (storage)	20 % to 95 % (non-condensing)



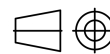
# Dimensional Diagrams

## 2 Dimensional Diagrams

### 2.1 DMK 33G445 C-Mount with Tripod Adapter

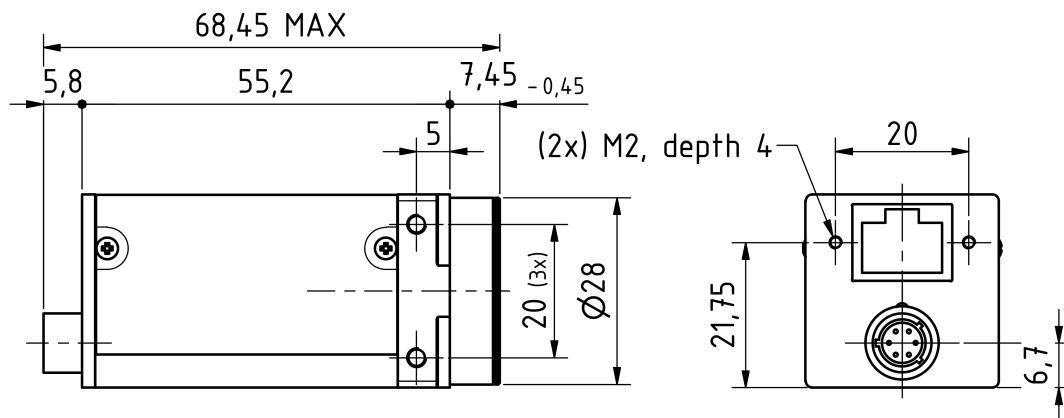
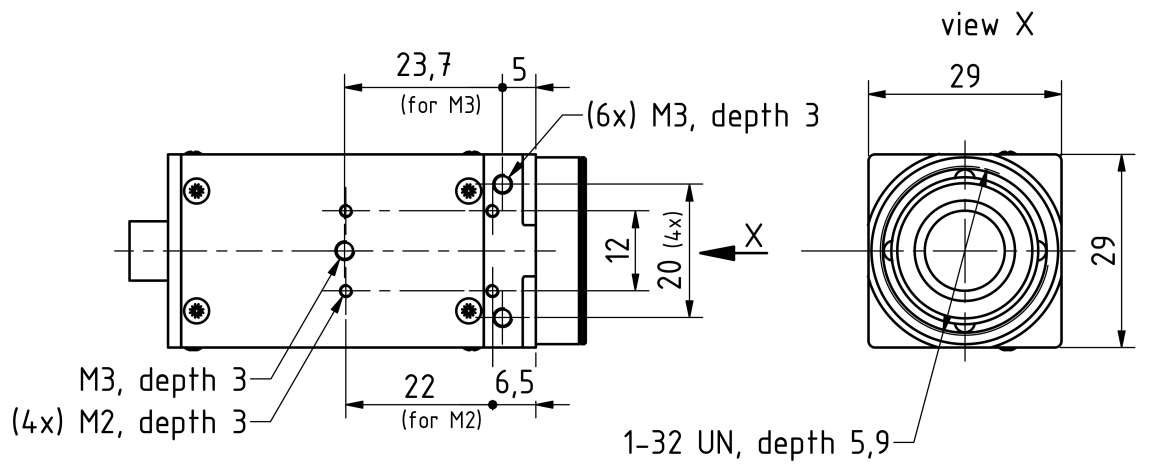


Dimensions: mm  
Tolerances: DIN ISO 2768m

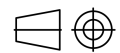




## 2.2 DMK 33G445 C-Mount without Tripod Adapter

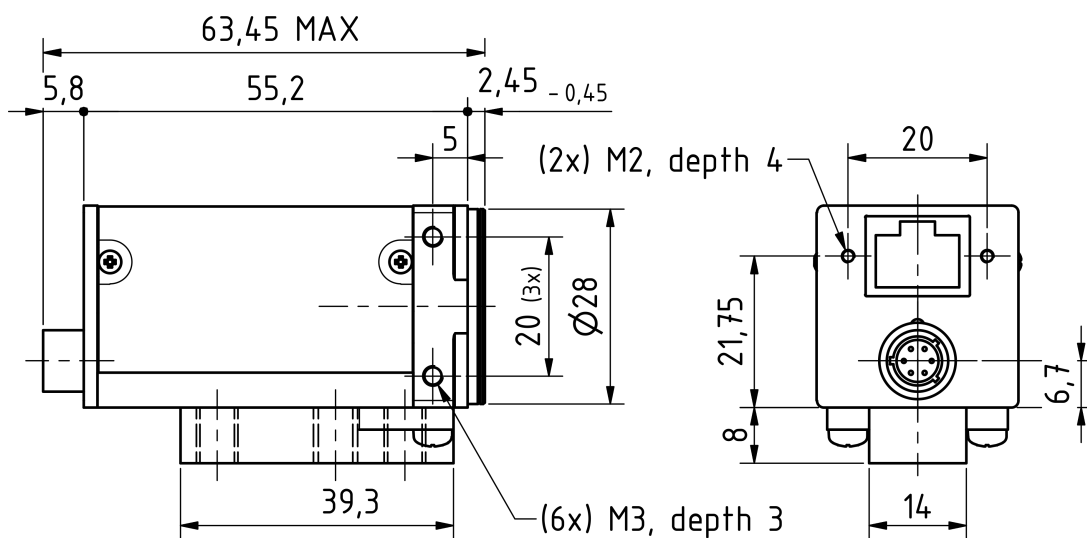
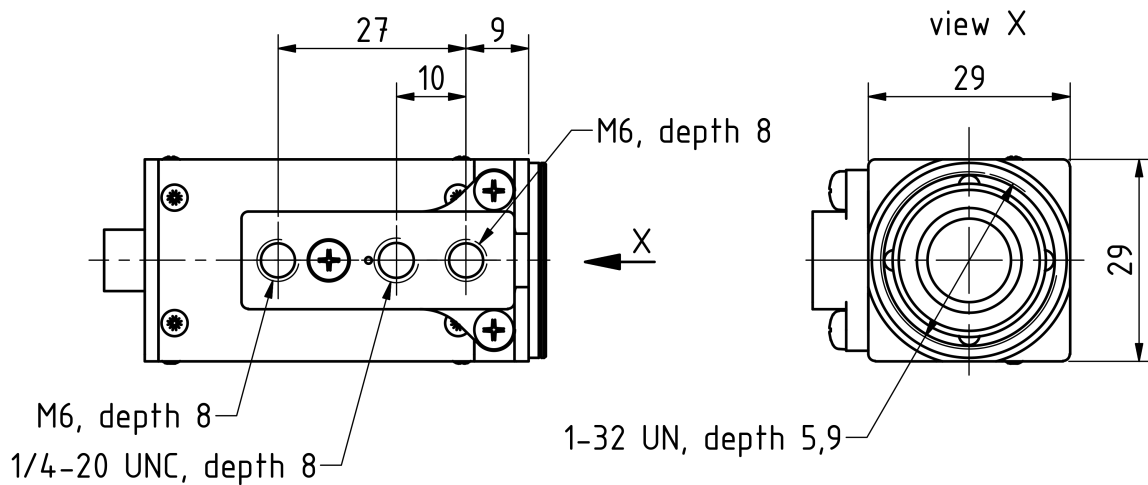


Dimensions: mm  
Tolerances: DIN ISO 2768m





## 2.3 DMK 33G445 CS-Mount with Tripod Adapter



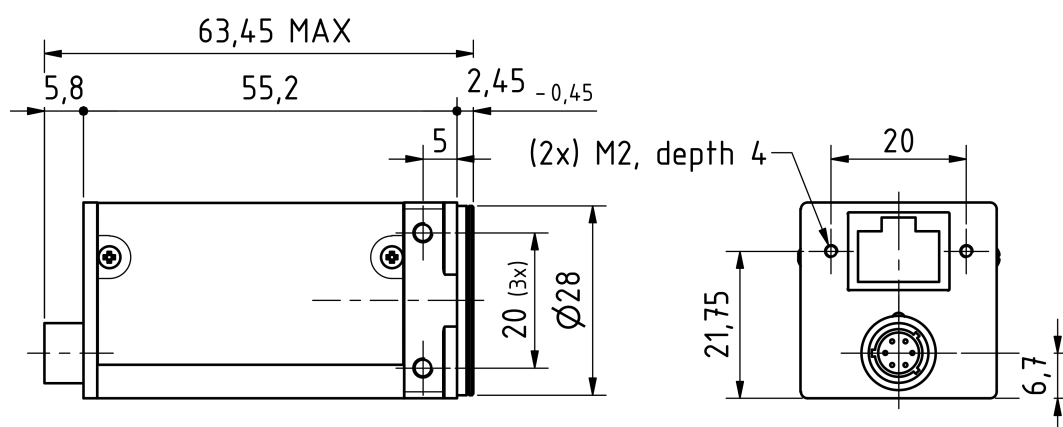
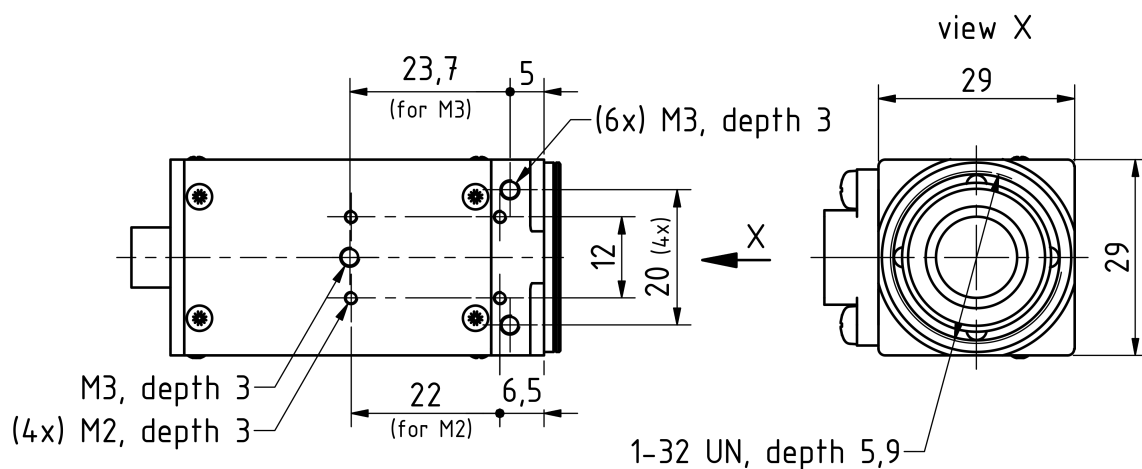
Dimensions: mm  
Tolerances: DIN ISO 2768m







## 2.4 DMK 33G445 CS-Mount without Tripod Adapter



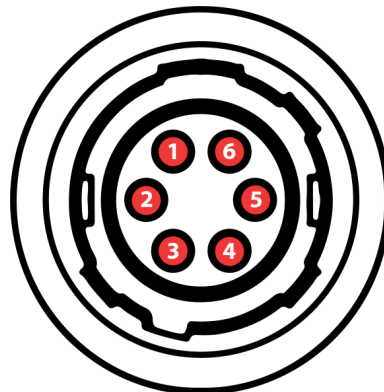
Dimensions: mm  
Tolerances: DIN ISO 2768m





## 3 I/O Connector

### 3.1 6-pin I/O Connector



Rear view of camera

Pin	Signal	I/O	Remarks	Characteristics			
				Min	Typ	Max	Unit
1	GigE Power Supply	P <sup>3</sup>		11.0	12.0	13.0	V
2	TRIGGER_IN (+)	I <sup>3</sup>	Optocoupler signal	3.3 <sup>2</sup>	-	24.0 <sup>2</sup>	V
3	TRIGGER_IN (-)	I <sup>3</sup>	Optocoupler ground	-	-	-	-
4	STROBE_OUT	O <sup>3</sup>	Open drain	-	-	24.0 <sup>1</sup>	V
5	GND_I/O	G <sup>3</sup>	External Ground (Open Drain)	-	-	-	-
6	GND_DC	G <sup>3</sup>	External Ground (Power Supply)	-	-	-	-

<sup>1</sup> max. 0.2A (ID) for open drain MOSFET!

<sup>2</sup> min. 3.5 mA driver strength required!

<sup>3</sup> G: Ground O: Output I: Input

The part number of this Hirose connector is HR10A-7R-6P(73). To create an I/O cable you need a Hirose connector HR10A-7P-6S(73).

#### 3.1.1 TRIGGER\_IN

The *TRIGGER\_IN* line can be used to synchronize the start of the exposure time with external events. The [Trigger](#) section describes in detail how the image sensor's behavior can be controlled.



The current input signal can also be read directly through the [General Purpose Input](#) feature.

### 3.1.2 STROBE\_OUT

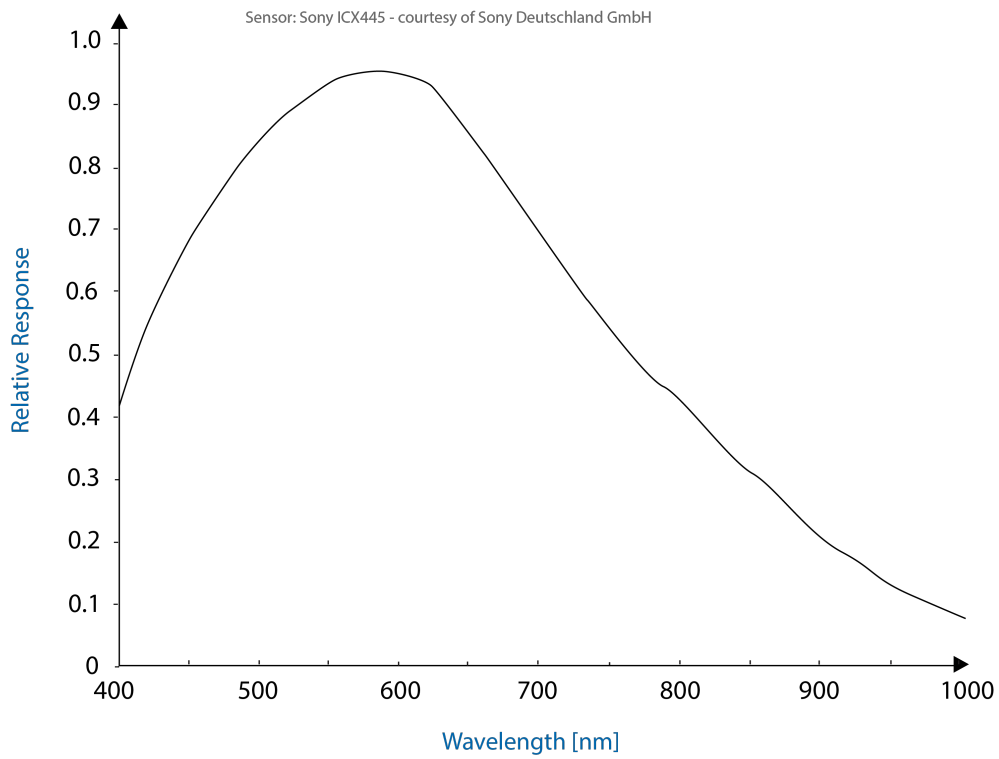
The *STROBE\_OUT* line's main usage is to indicate the integration time of the image sensor which allows flashes, strobos or other light sources to be synchronized with camera operation. The line's behavior can be controlled through the [Strobe](#) controls.

The output signal can also be directly controlled through the [General Purpose Output](#) feature.



## 4 Spectral Characteristics

### 4.1 Spectral Sensitivity - ICX445ALA





## 5 Camera Controls

This section describes the parameters available for the DMK 33G445 camera.

The actual name of the parameter depends on the driver technology used to access the camera. Parameter names are listed for the most common ways to access the cameras:

- *GigE Vision* (cross platform, via 3rd party driver)
- *IC Imaging Control* (on Windows, via *Device Driver for The Imaging Source GigE Cameras*)

### 5.1 Sensor Readout Control

#### 5.1.1 Pixel Format

The pixel format defines the data type of the pixels transmitted to the computer. The bits per pixel needed for a particular pixel format influence the required bandwidth.

The way the pixel format is controlled varies significantly among the driver technology used to access the camera:

- When using *GigE Vision*, the pixel format is controlled through the `PixelFormatGenICam` feature.
- When using *IC Imaging Control*, the pixel format is part of the video format - a parameter which combines pixel format, resolution and readout mode. For more information, refer to the *IC Imaging Control* documentation sections on `VideoFormat` and `VideoFormatDesc`.

The DMK 33G445 monochrome camera supports multiple pixel formats with variable bits-per-pixel settings. The names of the pixel formats and the way to select them depends on the driver used to control the camera. The following table contains a short overview of all possible formats followed by a more detailed description.

Pixel Format	Bits Per Pixel	GigE Vision	TIS GigE Driver
8-Bit Monochrome	8	Mono8	Y800
12-Bit Packed Monochrome	12	Mono12Packed	Y16
16-Bit Packed Monochrome	16	Mono16	Y16

##### 5.1.1.1 8-Bit Monochrome

This format transmits data using one byte for each pixel.

*GigE Vision* drivers see this pixel format as `Mono8`.

The *Device Driver for The Imaging Source GigE Cameras* offers this pixel format as the `Y800` video format.



## 5.1.1.2 12-Bit Packed Monochrome

This format transmits data using 3 bytes for each pair of 2 consecutive pixels.

*GigE Vision* drivers see this pixel format as `Mono12Packed`.

The *Device Driver for The Imaging Source GigE Cameras* offers this pixel format as the `Y16` video format. Since the DMK 33G445 camera offers both 12-bit packed and 16-bit monochrome pixel formats, the driver will use the 12-bit packed format when the `Y16` video format is selected.

## 5.1.1.3 16-Bit Monochrome

The sensor of the DMK 33G445 camera is not capable of providing 16-bit data output. Instead, the pixel data is transmitted in the most significant bits which allows application programs to ignore the sensor-specific data type, and treat the data as if the sensor outputs 16 bits.

*GigE Vision* drivers see this pixel format as `Mono16`.

The *Device Driver for The Imaging Source GigE Cameras* offers this pixel format as the `Y16` video format.

## 5.1.2 Frame Rate

The frame rate is specified in frames per second and determines the camera's operating speed.

The way the frame rate is controlled depends greatly upon which driver technology is used to access the camera:

- When using *GigEVision*, the frame rate is controlled through the *GenICam* feature `AcquisitionFrameRate`.
- When using IC Imaging Control, the frame rate is selected from a list of available frame rates through APIs such as `Grabber::setFPS` or `ICImagingControl.DeviceFrameRate`.

The range of available frame rates depends upon other camera settings such as well, pixel format, resolution and readout modes.

Parameter	Frame Rate
Minimum	Depending on Pixel Format, Resolution, and Readout Mode
Maximum	Depending on Pixel Format, Resolution, and Readout Mode
GigE Vision: GenICam	<code>AcquisitionFrameRate</code>

The following tables show the maximum frame rate for some combinations of pixel format and resolution.



## 8-Bit Monochrome

Width	Height	Maximum Frame Rate
1280	960	30

## 12-Bit Packed Monochrome

Width	Height	Maximum Frame Rate
1280	960	30

## 16-Bit Monochrome

Width	Height	Maximum Frame Rate
1280	960	30

## 5.2 Image Sensor Control

### 5.2.1 Exposure Time

The *Exposure Time* parameter defines the time the camera opens its (electronic) shutter when it is taking an image.

Parameter	Exposure Time
Minimum	10 $\mu$ s
Maximum	30 s
Default	auto
GigE Vision: GenICam	ExposureTime
VCD Property	VCDID_Exposure\VCDElement_Value

### 5.2.2 Gain

The *Gain* parameter defines the amplification that is applied to the image at sensor level.

Parameter	Gain
Minimum	0 dB
Maximum	3039 dB
Default	auto
GigE Vision: GenICam	Gain
VCD Property	VCDID_Gain\VCDElement_Value



## 5.3 Automatic Exposure and Gain Control

The DMK 33G445 camera can automatically control gain and exposure time. These automatic functions are enabled by default.

In order to optimize image parameters, a region of interest can be specified for automatic functions. Specifying a region of interest enables fine-grained control over the image area for which the image parameters are optimized. A selection of pre-defined area presets is available, but the user can also specify the coordinates of a custom rectangle.

In certain situations, it is desirable to limit the range of the auto-controlled parameters. For example, one might want to avoid high gain settings in order to keep noise levels low. Other applications require limiting the maximum exposure time so that movements do not get blurred. Therefore, the ranges of the gain and exposure parameter can be limited.

If both auto exposure and auto gain are active, the camera tries to lower the gain value in order to reduce noise and improve the image quality.

### 5.3.1 Auto Exposure

Parameter	Auto Exposure
Continuous	Enable Auto Exposure
True	
Off	Disable Auto Exposure
False	
GigE Vision: GenICam	ExposureAuto
VCD Property	VCDID_Exposure\VCDElement_Auto

### 5.3.2 Auto Gain

Parameter	Auto Gain
Continuous	Enable Auto Gain
True	
Off	Disable Auto Gain
False	
GigE Vision: GenICam	GainAuto
VCD Property	VCDID_Gain\VCDElement_Auto





### 5.3.3 Auto Reference Value

The *Auto Reference Value* parameter specifies the target brightness for both auto exposure and auto gain.

Parameter	Auto Reference Value
Minimum	0
Maximum	255
Default	128
GigE Vision: GenICam	ExposureAutoReference
VCD Property	VCDID_Exposure\VCDElement_AutoReference

### 5.3.4 Highlight Reduction

Enabling *Highlight Reduction* lets the auto exposure and auto gain functions reduce overexposed areas in the output image. This feature is particularly useful when using 10/12/16-bit output images and a tone mapping algorithm in post-processing when using higher bit depths as the dark areas still contain a lot of useful information.

Parameter	Highlight Reduction
True	Try to reduce overexposed areas
False	Ignore overexposed areas and focus on matching the image brightness to the selected <a href="#">Auto Reference Value</a> .
GigE Vision: GenICam	ExposureAutoHighlightReduction
VCD Property	VCDID_HighlightReduction\VCDElement_Value

### 5.3.5 Auto Exposure Limits

The *Auto Exposure Lower Limit* parameter determines the minimum possible value that can be set by the auto exposure algorithm.

Parameter	Auto Exposure Lower Limit
Minimum	10 $\mu$ s
Maximum	1 s
GigE Vision: GenICam	ExposureAutoLowerLimit

The *Auto Exposure Upper Limit* parameter determines the maximum possible value that can be set by the auto exposure algorithm.



Parameter	Auto Exposure Upper Limit
Minimum	10 $\mu$ s
Maximum	1 s
GigE Vision: GenICam	ExposureAutoUpperLimit
VCD Property	VCDID_Exposure\VCDElement_AutoMaxValue

If the *Auto Exposure Upper Limit Auto* parameter is enabled, the value of *Auto Exposure Upper Limit* is automatically kept at the maximum possible value for the current frame rate.

Parameter	Auto Exposure Upper Limit Auto
On	Select <i>Auto Exposure Upper Limit</i> automatically
Off	Let the user control <i>Auto Exposure Upper Limit</i>
GigE Vision: GenICam	ExposureAutoUpperLimitAuto
VCD Property	VCDID_Exposure\VCDElement_AutoMaxValueAuto

### 5.3.6 Auto Gain Limits

The *Auto Gain Lower Limit* parameter determines the minimum possible value that can be set by the auto gain algorithm.

Parameter	Auto Gain Lower Limit
Minimum	0 dB
Maximum	3039 dB
GigE Vision: GenICam	GainAutoLowerLimit

The *Auto Gain Upper Limit* parameter determines the maximum possible value that can be set by the auto gain algorithm.

Parameter	Auto Gain Upper Limit
Minimum	0 dB
Maximum	3039 dB
GigE Vision: GenICam	GainAutoUpperLimit

## 5.4 Trigger

The trigger mode can be used to take images at very specific points in time which are specified by an electrical signal connected to the [TRIGGER\\_IN](#) pin of the I/O connector



of the camera.

## 5.4.1 Trigger Mode

The *Trigger Mode* parameter enables the trigger mode.

Parameter	Trigger Mode
On	Enable Trigger Mode
True	
Off	Disable Trigger Mode
False	
GigE Vision: GenICam	TriggerMode
VCD Property	VCDID_Trigger\VCDElement_Value

## 5.4.2 Trigger Polarity

The *Trigger Polarity* parameter controls whether a trigger event is accepted on the rising or falling edge of the signal connected to the TRIGGER\_IN line.

Parameter	Trigger Polarity
RisingEdge	Accept rising edge as trigger signal
True	
FallingEdge	Accept falling edge as trigger signal
False	
GigE Vision: GenICam	TriggerActivation
VCD Property	VCDID_Trigger\VCDElement_Polarity

## 5.4.3 Software Trigger

The *Software Trigger* function can be used to simulate a trigger pulse, in turn causing one image to be exposed and delivered to the host computer.

Parameter	Software Trigger
Execute	Simulate one trigger pulse
GigE Vision: GenICam	TriggerSoftware
VCD Property	VCDID_Trigger\VCDElement_SoftwareTrigger



## 5.4.4 Trigger Burst Count

The *Trigger Burst Count* parameter allows the camera to be configured to take more than one image per trigger pulse. By default, this parameter is set to 1 so that exactly one image is acquired. The images are taken as rapidly as possible given current settings (i.e. as limited by the current exposure time and frame rate settings).

Parameter	Trigger Burst Count
Minimum	1
Maximum	1000
Default	1
GigE Vision: GenICam	AcquisitionBurstFrameCount
VCD Property	VCDID_Trigger\VCDElement_TriggerBurstCount

## 5.4.5 Trigger Source

The *Trigger Source* parameter allows the camera to be configured to only accept trigger signals from a specified source, e.g. only software trigger.

Parameter	Trigger Source
Any	Allow trigger signals from any source
Line1	Allow only hardware trigger
Software	Allow only software trigger
GigE Vision: GenICam	TriggerSource

## 5.4.6 Trigger Overlap

The *Trigger Overlap* feature gives information on when a new trigger pulse is accepted in the trigger -> exposure -> readout sequence.

Parameter	Trigger Overlap
Off	The next trigger pulse is only accepted once the previous frame has been read out from the sensor
Readout	The next trigger pulse is accepted during readout as long as the remaining readout time is shorter than the exposure time
GigE Vision: GenICam	TriggerOverlap
VCD Property	VCDID_Trigger\VCDElement_TriggerOverlap



## 5.5 Trigger Timing Parameters

The 33G series camera series offers several options for dealing with bad trigger signals. By using the *Debounce Time*, *Denoise Time* and *Mask Time* parameters, the camera can be configured to ignore pulses on its [TRIGGER\\_IN](#) line under certain conditions.

Useful values for these parameters are application-specific. They depend on the expected trigger frequency, the exposure time and assumptions about the input signal quality.

The default values for all these parameters is 0  $\mu$ s, assuming perfect signal quality.

### 5.5.1 Trigger Delay

The *Trigger Delay* parameter specifies a time for which the camera waits between receiving a trigger signal and starting the exposure of an image. Simulated trigger pulses generated through the *Software Trigger* function are not delayed by this parameter.

Parameter	Trigger Delay
Minimum	0 s
Maximum	1 s
Default	0 s
GigE Vision: GenICam	TriggerDelay
VCD Property	VCDID_Trigger\VCDElement_TriggerDelay

### 5.5.2 Trigger Debounce Time

The *Trigger Debounce Time* parameter specifies the time for which the trigger input has to be low in order for the next trigger signal to be accepted.

Parameter	Trigger Debounce Time
Minimum	0 s
Maximum	1 s
Default	0 s
GigE Vision: GenICam	TriggerDebouncer
VCD Property	VCDID_Trigger\VCDElement_TriggerDebouncer

### 5.5.3 Trigger Mask Time

The *Trigger Mask Time* parameter specifies the time for which trigger pulses are ignored after accepting a trigger signal.



Parameter	Trigger Mask Time
Minimum	0 s
Maximum	1 s
Default	0 s
GigE Vision: GenICam	TriggerMask
VCD Property	VCDID_Trigger\VCDElement_TriggerMask

## 5.5.4 Trigger Noise Suppression Time

The *Trigger Noise Suppression Time* parameter specifies the time for which trigger input has to be active in order to be accepted as a trigger signal.

Parameter	Trigger Noise Suppression Time
Minimum	0 s
Maximum	1 s
Default	0 s
GigE Vision: GenICam	TriggerDenoise
VCD Property	VCDID_Trigger\VCDElement_TriggerDenoise

## 5.6 Digital I/O

The 33G series has one digital input and one digital output. The digital input can be used as a [Trigger](#) input but the current status can also be examined directly.

The digital output can be configured as a [Strobe](#) output to signal the exact moment when the image sensor is sensitive to light so that external light sources can be synchronized to its operation cycle.

### 5.6.1 General Purpose Input

The *General Purpose Input* parameter allows the current status of the [TRIGGER\\_IN](#) pin.



Parameter	General Purpose Input
True	TRIGGER_IN line status is low
1	
False	TRIGGER_IN line status is high
0	
GigE Vision: GenICam	GPIIn
VCD Property	VCDID_GPIO\VCDElement_GPIORead VCDID_GPIO\VCDElement_GPIOIn

## 5.6.2 General Purpose Output

The *General Purpose Output* parameter controls the status of the [STROBE\\_OUT](#) pin.

Parameter	General Purpose Output
True	Drive the STROBE_OUT line high
1	
False	Drive the STROBE_OUT line low
0	
GigE Vision: GenICam	GPOut
VCD Property	VCDID_GPIO\VCDElement_GPIOWrite VCDID_GPIO\VCDElement_GPIOOut

## 5.7 Strobe

The strobe function controls the automatic generation of output pulses on the [STROBE\\_OUT](#) pin which is synchronized to the image sensor's exposure time.

### 5.7.1 Strobe Enable

The *Strobe Enable* parameter enables the automatic generation of strobe pulses.

Parameter	Strobe Enable
On	Strobe enabled
True	
Off	Strobe disabled
False	
GigE Vision: GenICam	StrobeEnable
VCD Property	VCDID_Strobe\VCDElement_Value



## 5.7.2 Strobe Polarity

The *Strobe Polarity* parameter can be used to invert the strobe pulse output.

Parameter	Strobe Polarity
ActiveHigh	The STROBE_OUT pin is logically high during the exposure time
True	
ActiveLow	The STROBE_OUT pin is logically low during the exposure time
False	
GigE Vision: GenICam	StrobePolarity
VCD Property	VCDID_Strobe\VCDElement_StrobePolarity

## 5.7.3 Strobe Operation

The *Strobe Operation* parameter specifies how the length of the strobe pulses are controlled.

Parameter	Strobe Operation
Exposure	Output pulse duration is equal to the current exposure time
True	
FixedDuration	Output pulse duration is specified by <i>Strobe Duration</i>
False	
GigE Vision: GenICam	StrobeOperation
VCD Property	VCDID_Strobe\VCDElement_StrobeMode

## 5.7.4 Strobe Duration

The *Strobe Duration* parameter controls the length of the strobe pulses if *Strobe Operation* is set to use the fixed duration mode.

Parameter	Strobe Duration
Minimum	0 $\mu$ s
Maximum	10000 $\mu$ s
GigE Vision: GenICam	StrobeDuration
VCD Property	VCDID_Strobe\VCDElement_StrobeDuration





## 5.7.5 Strobe Delay

The *Strobe Delay* parameter can be used to add a small delay between the start of exposure and the strobe output pulse.

Parameter	Strobe Delay
Minimum	-10000 $\mu$ s
Maximum	10000 $\mu$ s
GigE Vision: GenICam	StrobeDelay
VCD Property	VCDID_Strobe\VCDElement_StrobeDelay

## 5.8 Region of Interest for Auto Functions

The 33G series cameras allow for the setting of a region of interest that is used while controlling the [Auto Exposure](#), [Auto Gain](#) and Auto White Balance functions.

### 5.8.1 Auto Functions ROI Enable

The *Auto Functions ROI Enable* parameter allows for the use of a region of interest for auto functions.

Parameter	Auto Functions ROI Enable
True	Auto functions only take a specified part of the image into account
False	Auto functions look at the whole image
GigE Vision: GenICam	AutoFunctionsROIEnable
VCD Property	VCDID_AutoRoi\VCDElement_Value

### 5.8.2 Auto Functions ROI Preset

The *Auto Functions ROI Preset* parameter lets the user select from a list of ROI presets.



Parameter	Auto Functions ROI Preset
Full Sensor	Select the full output image
Center 50%	Select a rectangular area in the center of the output image
Center 25%	Select a small rectangular area in the center of the output image
Bottom Half	Select the bottom half of the output image
Top Half	Select the top half of the output image
Custom Rectangle	Select a custom rectangle for fine-grained control
GigE Vision: GenICam	AutoFunctionsROI_Preset
VCD Property	VCDID_AutoRoi\VCDElement_AutoRoiPreset

### 5.8.3 Auto Functions ROI Custom Rectangle

When *Auto Functions ROI Preset* is set to *Custom Rectangle*, the user can manually set the position and size of the region of interest. The coordinates are relative to the origin of the current video format as specified by *Partial Scan Offset*.

Parameter	Auto Functions ROI Left
Minimum	0
Maximum	1264
GigE Vision: GenICam	AutoFunctionsROI_Left
VCD Property	VCDID_AutoRoi \VCDElement_AutoRoiLeftRelative

Parameter	Auto Functions ROI Top
Minimum	0
Maximum	944
GigE Vision: GenICam	AutoFunctionsROI_Top
VCD Property	VCDID_AutoRoi \VCDElement_AutoRoiTopRelative



Parameter	Auto Functions ROI Width
Minimum	16
Maximum	1280
GigE Vision: GenICam	AutoFunctionsROIWidth
VCD Property	VCDID_AutoRoi \VCDElement_AutoRoiWidthRelative

Parameter	Auto Functions ROI Height
Minimum	16
Maximum	960
GigE Vision: GenICam	AutoFunctionsROIHeight
VCD Property	VCDID_AutoRoi \VCDElement_AutoRoiHeightRelative

## 5.9 User Sets

The 33G series cameras can store their complete configuration into built-in non-volatile memory. The camera configuration can be saved into and restored from one of two available memory slots upon user's request. Additionally, the camera can be configured to load one of the user's camera configurations at startup.

### 5.9.1 User Set Selector

The *User Set Selector* parameter selects the memory slot on which consecutive load and save commands are executed.

Parameter	User Set Selector
UserSet1	First of the two memory slots for user configurations
UserSet2	Second of the two memory slots for user configurations
Default	A special memory slot that always contains the camera's factory default configuration. It cannot be overwritten
GigE Vision: GenICam	UserSetSelector

### 5.9.2 Load User Set

By using the *Load User Set* command, the user can restore the camera configuration from the memory slot selected by *User Set Selector*.



Parameter	Load User Set
Execute	Restore the camera configuration from the memory slot specified by <i>User Set Selector</i>
GigE Vision: GenICam	UserSetLoad

### 5.9.3 Save User Set

By using the *Save User Set* command, the user can save the camera configuration into the memory slot selected by *User Set Selector*.

Parameter	Save User Set
Execute	Save the current camera configuration into the memory slot specified by <i>User Set Selector</i>
GigE Vision: GenICam	UserSetSave

### 5.9.4 Default User Set

The *Default User Set* parameter controls the camera's startup behavior. It selects which memory slot is used for device initialization when the camera is powered up.

Parameter	Default User Set
UserSet1	Load configuration from the first memory slot
UserSet2	Load configuration from the second memory slot
Default	Load factory default configuration
GigE Vision: GenICam	UserSetDefault



## 6 Revision History

Date	Version	Description
2018/05/28		Initial release of this document



## DMK 33G445 Technical Reference Manual

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Last update: June 2018

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All weights and dimensions are approximate. Unless otherwise specified, the lenses shown in the context of cameras are not shipped with these cameras.

### **Headquarters:**

*The Imaging Source Europe GmbH  
Überseetor 18, D-28217 Bremen, Germany  
Phone: +49 421 33591-0*

### **North & South America:**

*The Imaging Source, LLC  
6926 Shannon Willow Rd, S 400, Charlotte, NC 28226, USA  
Phone: +1 704-370-0110*

### **Asia Pacific:**

*The Imaging Source Asia Co., Ltd.  
2F., No.8, Xinhu 1st Road  
Taipei City 114, Neihu District, Taiwan  
Phone: +886 2-2792-3153*

[www.theimagingsource.com](http://www.theimagingsource.com)