Karmin3 Stereo Camera

User Manual

(v1.0) November 6, 2019

Contents

1   Available Models

Karmin3 is available in two different baseline distances: 10 cm and 25 cm. The 10 cm model is intended for close-range measurements, while the 25 cm model is intended for long-range measurements. The covered measurement range also depends on the selected lenses and on the processed disparity range, which is the image overlap range that is searched during image processing.

Both baseline distances are available with either monochrome or color image sensors. When used in combination with SceneScan, the monochrome versions can achieve higher image resolutions and frame rates. Using the monochrome models is hence recommended if color information is not important for subsequent processing.

When using identical lenses and a constant disparity range, the 10 cm models will have a lower minimum depth when compared to the 25 cm models. The depth error increases approximately quadratically with the measured depth, starting at the minimum depth. Hence the 25 cm models will have a lower depth error for all points that fall within its measurement range. If the minimum depth of the 25 cm models is sufficient, then these models should be preferred over the 10 cm models. Detailed characteristics, including the minimum depth, are available on the Karmin3 product page[1] for the most common configurations.

2   Specifications

2.1   General Specifications

Sensor resolution	2048 × 1536 pixels
Sensor	Sony Pregius IMX265
Sensor format	1/1.8"
Lens mount	C/CS-mount
Chroma	mono / color
Shutter	global shutter
Interface	USB 3.0
Trigger-input	4-pin Binder M8 connector
Stereo baseline distance	10 cm / 25 cm
Mounting bottom side	4× M3 threaded hole
	1× 1/4" UNC threaded hole (tripod mount)
Mounting top side	2× M3 threaded hole
Weight without lenses	350 g for 10 cm baseline
	470 g for 25 cm baseline
Conformity	CE, FCC, RoHS

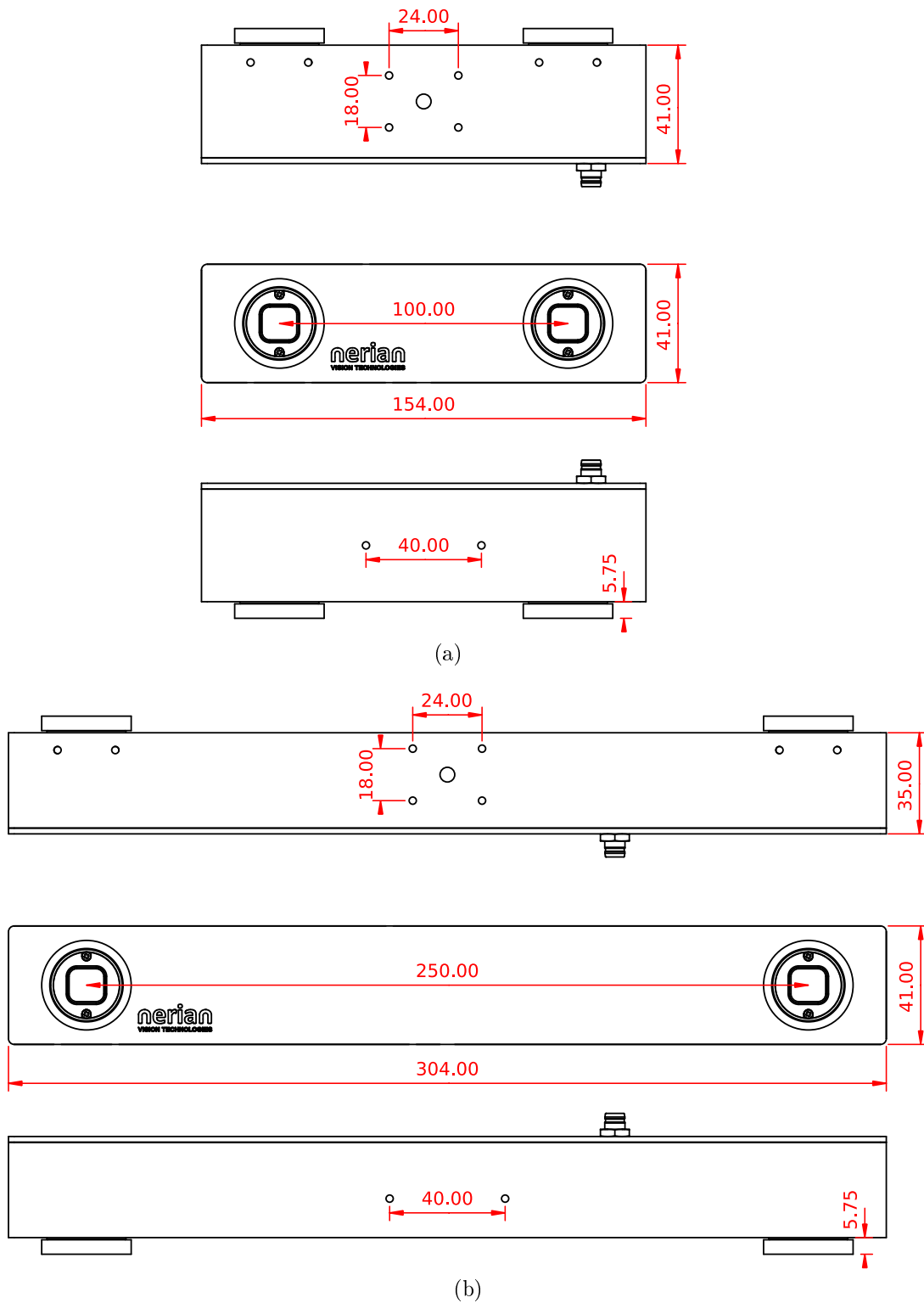[1]See: https://nerian.com/products/karmin3-3d-stereo-camera/

Figure 1: Dimensions and spacing of mounting holes for (a) 10 cm and (b) 25 cm versions of Karmin3. All measurements are provided in millimeters.

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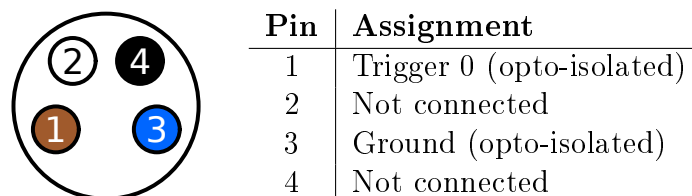| Pin	Assignment
1	Trigger 0 (opto-isolated)
2	Not connected
3	Ground (opto-isolated)
4	Not connected

Figure 2: Pin assignment of trigger connector.

2.2 Dimensions and Mounting Holes

Dimensions of the available models are shown in Figures 1a and 1b. The figures also include the spacing of the available mounting holes. All measurements are provided in millimeters.

The top side features two threaded mounting holes with M3 metric threads. The bottom side features four additional mounting holes with M3 threads, and one mounting hole with a 1/4" UNC thread for use with tripods. The drill depth of all mounting holes is 6 mm.

3 Trigger Port

The camera features a trigger port on the backside, which uses a male 4 pin Binder 718/768 series connector. This connector matches the female trigger connector on SceneScan and SceneScan Pro.

The following manufacturer part numbers correspond to matching connectors, and should be used for custom trigger cables:

99 3376   00 04   Matching connector with solder termination, not shielded.
99 3376 100 04   Matching connector with screw termination, not shielded.
99 3376 500 04   Matching connector with cutting clamps termination, not shielded.
99 3362   00 04   Matching connector with solder termination for 3.5 - 5 mm^2 cable cross section, shielded.
99 3362   25 04   Matching connector with solder termination for 2 - 3.5 mm^2 cable cross section, shielded.
99 3362 100 04   Matching connector with screw termination for 3.5 - 5 mm^2 cable cross section, shielded.
99 3362 100 04   Matching connector with screw termination for 6 - 8 mm^2 cable cross section, shielded.

The pin assignment of the trigger port is shown in Figure 2. There is one opto-isolated trigger line named Trigger 0, which correspond to the equally named trigger signal provided by SceneScan.

By default, Karmin3 is configured such that image acquisition only happens upon a positive edge of Trigger 0. It is thus necessary to connect Karmin3 to

Table 1: Operating voltages for trigger port.

Voltage	Description
−70 – +40 VDC	Absolute maximum voltage
0 – +30 VDC	Safe operating range

Table 2: Maximum allowed lens intrusion.

Mount type	Maximum intrusion
CS-mount	5.2 mm
C-mount	10.2 mm (with 5 mm spacer ring)

SceneScan's trigger port or to an equivalent trigger source. The trigger signal will ensure that image acquisition of both cameras is synchronized, which is necessary for processing the acquired image data.

The relevant voltage ratings for the trigger line are listed in Table 1. The absolute maximum voltage must not be exceeded in order to avoid damages to the device.

4   Lenses

On the front-side, Karmin3 features two lens mounts for its two image sensors. The lens mounts are compatible to the CS-mount standard. By using a 5 mm spacer ring, it is possible to connect a C-mount lens. Karmin3 is shipped with two spacer rings pre-mounted.

When mounting a lens, it is important that the lens doesn't intrude farther than the maximum allowed lens intrusion. If the lens intrudes farther, it can scratch the dust protection window. The maximum allowed intrusions for C-mount and CS-mount lenses are listed in Table 2.

5   Camera Configuration

5.1   Pixel Binning and Bayer Pattern Downsampling

For many applications a high frame rate is more important than a high image resolution. To cover such use cases, the monochrome Karmin3 models can be configured to use a 2×2 pixel binning. In this setting, four sensor pixels are combined to form one image pixel. Using pixel binning allows the cameras to operate at a higher frame rate. When used with SceneScan Pro, a maximum frame rate of 38 fps is possible.

For the color models, SceneScan can perform a combined demosaicing and down-sampling, which also results in the image width and height being halved. This is the default operation mode when a color Karmin3 camera is connected

to SceneScan, or when a Bayer pattern pixel format is selected. The combined demosaicing and down-sampling reduces artifacts from the Bayer pattern, which improves the image processing quality.

Switching the camera configuration between full resolution and pixel binning / down-sampling mode will also affect the covered depth range, if the disparity range is kept constant. A constant disparity range will cover a larger percentage of an image that was acquired with active pixel binning, compared to an image acquired at the native camera resolution. Hence, the disparity range should be adjusted when changing the pixel binning configuration.

5.2 Other Camera Settings

The cameras provide a multitude of different settings that can be configured when connected to SceneScan or SceneScan Pro. For a full documentation of all settings we recommend to consulting the GenAPI standard[2]. The most common camera settings are described in the following.

5.2.1 Analog Control

Gain:	Gain factor for the image sensor.
Gain auto:	Sets the mode for automatic gain control.
Black level:	Controls the analog black level as an absolute physical value.
Gamma:	Controls the gamma correction of pixel intensity.

5.2.2 Image Format Control

Width:	Width in pixels of the selected Region-Of-Interest (ROI).
Height:	Height in pixels of the selected ROI.
Offset X:	Horizontal image coordinate of the top-left corner of the selected ROI. When configured through SceneScan, this coordinate is measured relatively to the image center.
Offset Y:	Vertical image coordinate of the top-left corner of the selected ROI. When configured through SceneScan, this coordinate is measured relatively to the image center.
Binning horizontal:	Number of horizontal photosensitive cells that are combined for one image pixel.
Binning vertical:	Number of vertical photosensitive cells that are combined for one image pixel. There is a conditional dependency to the *binning horizontal* parameter, which has to be adjusted first.

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[2]See https://www.emva.org/standards-technology/genicam/genicam-downloads/

Pixel format: Desired pixel encoding mode.

5.2.3   Acquisition Control

Exposure time: Sets the exposure time.
Exposure auto: Sets the mode for automatic exposure control.
Trigger selector: Selects the trigger that shall be configured.
Trigger mode: Controls if the selected trigger is active.
Trigger source: Specifies the internal signal or physical input line to use as the trigger source.
Trigger activation: Specifies the activation mode of the trigger.
Exposure mode: Sets the operation mode of the exposure.

6   Interfacing Karmin3

6.1   Connecting to SceneScan

Karmin3 is intended for use with the SceneScan or SceneScan Pro image processing systems. Karmin3 should be connected with a Micro USB 3.0 cable to one of SceneScan's USB ports. It is highly recommended to secure the Micro-USB-connector with lock screws. This requires a locking USB3 cable.

In addition to the USB connection, Karmin3 also requires a connection to SceneScan's trigger port. A suitable trigger cable can be obtained from Nerian. It is alternatively possible to use a trigger source other than SceneScan. In this case please make sure that SceneScan is configured appropriately and that the trigger source obeys to the voltage levels listed in Section 3. Figure 3 shows Karmin3 connected to SceneScan Pro with a USB and trigger cable.

The trigger signal must provide an appropriate trigger frequency that can be matched by the cameras and the selected SceneScan model. The possible frequencies for different system configurations are listed in Table 3. In low-light situations the desired frame rate might not be achieved if the sensor exposure time is too high. In these cases, an appropriate exposure time upper limit should be configured in the SceneScan settings.

Figure 3: Karmin3 connected to SceneScan Pro.

Table 3: Supported trigger frequencies / frame rates.

Binning / Demosaicing	SceneScan model	Disparity range	Max. feq.
2 × 2 monochrome binning	SceneScan	128	16 Hz
2 × 2 monochrome binning	SceneScan Pro	256	33 Hz
Demosaicing (color)	SceneScan Pro	256	15 Hz
Full resolution monochrome	SceneScan Pro	256	7 Hz

SceneScan will load a suitable camera configuration for Karmin3 after the initial connection. Please refer to the SceneScan / SceneScan Pro user manual for information on the possible configuration options.

6.2 Connecting to a PC

When connected to a PC, Karmin3 will appear as two individual USB3 Vision cameras. Using Karmin3 with a PC is not officially supported. This is why an official API or example programs are not available. However, Karmin3 is compatible to machine vision software that supports the USB3 Vision standard.

7 Support

If you require support or if you have other inquiries that are related to this product, please contact:

Nerian Vision GmbH
Zettachring 2
70567 Stuttgart
Germany
Phone: +49 711 2195 9414
E-mail: service@nerian.com

Website: www.nerian.com

8 Warranty Information

The device is provided with a 2-year warranty according to German federal law (BGB). Warranty is lost if the housing is opened by others than official Nerian Vision Technologies service staff. In case of warranty please contact our support staff.

Revision History

Revision	Date	Author(s)	Description
v1.0	November 6, 2019	KS	Initial revision