User Manual

Bobcat-640-GigE&CL Camera
&
Bobcat-320-GigE&CL Camera

ENG-2012-UMN020-R005

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Issue	Issue date	Changes	Modified by
001	21/03/2014	First released issue	CDU
002	31/03/2014	Second released issue	CDU
003	19/03/2015	3rd released issue	KNB
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005	19/01/2016	5th released issue	KNB

Change Details

This table lists all changes of this issue compared to the previous released one.

Chapter/Section	Changes	Modified by

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List of Abbreviations

ASY	Assembly
CC	Camera Control
CE	Conformité Européenne
CL	Cameralink
CLK	Clock
CTIA	Capacitive Trans Impedance Amplifier
FPA	Focal Plane Array
GigE	Gigabit Ethernet
GND	Ground
HG	High Gain
ICD	Interface Control Document
InGaAs	Indium Gallium Arsenide
ITR	Integrate Then Read
IWR	Integrate While Read
LG	Low Gain
NUC	Non-Uniformity Correction
OPT	Optics
RJ	Registered Jack
ROIC	Read-Out Integrated Circuit
SDK	Software Development Kit
SDR	Shrunk Delta Ribbon connector
SMA	Sub-Miniature version A connector
SW	Software
SWIR	Short Wave Infrared
TE1	Single Stage Thermo-Electric Cooler
TEC	Thermo-Electric Cooling
UMN	User Manual
VIS	Visible
VISNIR	Visible Near Infrared
XEN	Xenics Part Number
XFPA	Xenics Focal Plane Array
XSP	Xenics Serial Protocol
XSW	Xenics Short Wave Module

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1. Introduction

1.1. Scope

This User Manual describes the technical specifications, dimensions, image processing, basic and advanced parameters and related subjects for the following cameras:

Camera	Part number	Description
Bobcat-640-GigE Scientific	XEN-000296	High resolution SWIR imaging Camera with TE1 stabilization and GigE interface
Bobcat-640-GigE Industrial	XEN-000298	
Bobcat-640V-GigE Scientific	XEN-000099	High resolution VisNIR Imaging Camera with TE1 stabilization and GigE interface
Bobcat-640V-GigE Industrial	XEN-000139	
Bobcat-640-CL Industrial	XEN-000297	High resolution SWIR imaging Camera with TE1 stabilization and CL interface
Bobcat-640V-CL Industrial	XEN-000140	High resolution VisNIR Imaging Camera with TE1 stabilization and CL interface

Table 1-1 Camera overview - Bobcat-640V-GigE, Bobcat-640-GigE and CL

Camera	Part Number	General Description
Bobcat-320-GigE-100Hz	XEN-000583	Compact SWIR Imaging Camera with TE1 stabilization and GigE interface
Bobcat-320-GigE-400Hz	XEN-000524	
Bobcat-320-GigE-400Hz-Gated	XEN-000525	
Bobcat-320-CL-100Hz	XEN-000584	Compact SWIR Imaging Camera with TE1 stabilization and Cameralink interface
Bobcat-320-CL-400Hz	XEN-000526	
Bobcat-320-CL-400Hz-Gated	XEN-000585	

Table 1-2 Camera overview - Bobcat-320-GigE and CL

(*) planned

Target group: This technical manual is written for professional users.

i Please read this manual thoroughly before operating the camera!

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1.2. Manual Overview

This section provides a chapter overview:

- Chapter 1 gives an overview of the conventions used in this manual (styles and symbols), the safety warnings, conformity information about Xenics cameras and the contact information.
- Chapter 2 gives a mechanical (2D drawings) and electrical overview
- Chapter 3 describes how to get started
- Chapter 0 describes the optical interfaces
- Chapter 0 describes the electrical interfaces
- Chapter 0 provides the installation of the Xeneth and SDK software
- Chapter 7 lists the appendices.

Reference Documents

(Ref. 1)	Xenics Serial Protocol	ENG-2011-ICD003
(Ref. 2)	Mechanical Drawings GigE and CL	
(Ref. 3)	Auto Gain Control	ENG-2013-UMN006
(Ref. 4)	Auto Exposure Control	ENG-2012-UMN017
(Ref. 5)	XFPA-640 and XFPA-320 Control and Operation	ENG-2013-ICD007
(Ref. 6)	Network connection setup for GigE	ENG-2013-ICD003
(Ref. 7)	Frame Rate Calculator	ENG-2014-ICD001
(Ref. 8)	Histogram Equalization Control	ENG-2014-UMN002
(Ref. 9)	Real-Time Calibration Switching	ENG-2015-UMN002
(Ref. 10)	Xeneth Installation Manual (see Xeneth SW directory)	ENG-2013-UMN024

1.3. Conventions Used in This Manual

To give this manual an easily understood layout and to emphasize important information, the following typographical styles and symbols are used:

The styles used in this manual are:

- **Bold**: used for programs, inputs (commands or parameters) or highlighting important things
- `Courier New`: used for code listings and output.
- *Italics*: used for modes and fields.

The symbols used in this manual:

i Note: This symbol highlights important information.

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Warning: This symbol highlights important instructions. These instructions must be followed to avoid malfunctions!

1.4. Safety Warnings

The following safety warnings must be followed:

Supply voltage polarity: Use the correct polarity of the 12 V supply voltage.

Warranty: The warranty becomes void in case of unauthorized tampering or any manipulations not approved by the manufacturer.

Electrostatic discharge: The camera contains sensitive electronic components which can be destroyed by means of electrostatic discharge. Use sufficient grounding to minimize the risk of damage.

Environmental conditions: Operate the camera in dry and dust free environment.
Regarding the signal quality of the camera it is an advantage to operate the camera under constant ambient air temperature (~20°C).
Beneath or above ambient temperature a sufficient heating or cooling may be necessary.

Warm-up Period: Depending on the prevailing environmental conditions, some time might pass after the camera start, until the image quality reaches its optimum.

1.5. Conformity

Xenics declares under its sole responsibility that all standard cameras of the Bobcat 640 family to which this declaration relates to, are conform with the following standard(s) or other normative document(s):

- CE, following the provisions of 2004/108/EG directive
- RoHS (2002/95/EC).

CE:
We declare, under our sole responsibility, that the previously described Bobcat cameras are conform to the CE directives.

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1.6. Contact Information

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- **Distributors worldwide**
  Xenics is a European based provider of infrared imaging products and has representatives and distributor locations around the world to service our many customers.

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2. Mechanical & Electrical Specifications

The mechanical drawings of Bobcat-GigE and CL can be found in Appendix Mechanical Drawings.

2.1. Bobcat-640 Detector Specifications

The detector specifications are summarized in Table 2-1.

Parameter	Specification	Unit
Sensor type	InGaAs FPA; ROIC with CTIA topology	
Spectral Band	0.9 to 1.7	µm
	Optional 0.4 to 1.7 (VisNIR)	µm
Array format	640x512	pixels
Pixel pitch	20	µm
Quantum Efficiency SWIR sensor (1)	80	%
Quantum Efficiency VisNIR sensor(2)	85	%
Dark Current (3)	0.19 x 10^6 at 200mV bias at 288K	electrons/s
	30 at 200mV bias at 288K	fA
ROIC Noise High Gain (3)	60	electrons
ROIC Noise Low Gain (3)	400	electrons
Integration Capacitor High Gain	6.7	fF
Integration Capacitor Low Gain	85	fF
Full Well High Gain	80 x 10^3	electrons
Full Well Low Gain	1.1 x 10^6	electrons
Pixel operability	>99	%
Cooling	TE1	

Table 2-1 Electro-optical detector specifications Bobcat-640

(1) Typical value @ 1600nm
(2) Typical value @ 950nm
(3) Typical value

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2.2. Bobcat-640-GigE & CL Camera Specifications

The camera specifications are listed in Table 2-2.

Feature	GigE	CL
Imaging performance		
Frame rate	100 Hz	
Window of interest	Yes (minimal window: 32x4)	
Exposure time range	1-40000 (1) µs	
Gain (in High Gain mode)	1.28 electron/ADU	
Gain (in Low Gain mode)	16.2 electron/ADU	
Camera Read Noise Low Gain (2)	400 electrons	
Camera Read Noise High Gain (2)	120 electrons	
Dynamic Range Low Gain	68 dB	
Dynamic Range High Gain	56 dB	
Readout mode	- Integrate Then Read (ITR) - Integrate While Read (IWR)	
On-board image processing	- Imaging correction (fixed NUC for Bobcat-GigE, TrueNUC for Bobcat-CL), - Auto-Gain and Offset - Auto-Exposure (Only for Bobcat CL) - Histogram Equalization (Only for Bobcat CL) - Trigger possibilities	
A to D conversion resolution	14 bit	
Interfaces		
Image acquisition and Camera control	GigE Vision	Camera Link
Trigger	In or out via SMA	In or out via SMA or CL-CC1
Trigger-in delay	3.1 µs rising edge (SMA trigger) (3) 3.3 µs falling edge (SMA trigger) (3)	1.3 µs rising and falling edge (CC1 trigger) 3.1 µs rising edge (SMA trigger) (3) 3.3 µs falling edge (SMA trigger) (3)
Trigger-in jitter	± 0.05 µs	

Table 2-2 Specifications Bobcat-640-GigE and CL

(1) At 25°C FPA temperature: the max. exposure time is dark current limited.
(2) Typical value, measured in the dark at t_{exp} = 0.1ms and 25°C FPA temperature.
(3) With trigger-in voltage = 5V.

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Feature	GigE	CL
Power Requirements		
Input Voltage	12±10% V	
Power consumption (1)	4 W	2.8 W
Physical characteristics		
Dimensions (2)	55x55x81.7 mm^3 without lens	55x55x72 mm^3 without lens
Camera weight	334 g without lens	285 g without lens
Environmental specifications		
Operating case temperature	-40 to 70 °C	
Storage temperature	-45 to 85 °C	
Vibration	5g (20 to 2000 Hz), according to MIL-STD810G	
Shock	40g, 11ms, according to MIL-STD810G	

Table 2-3 Specifications Bobcat-640-GigE and CL (2)

(1) Typical value, measured without TEC

2.3. Bobcat-320 Detector Specifications

The detector specifications are summarized in Table 2-4 Electro-optical detector specifications Bobcat-320

Parameter	Specification	Unit
Sensor type	InGaAs FPA; ROIC with CTIA topology	
Spectral Band	0.9 to 1.7	µm
Array format	320 x 256	pixels
Pixel pitch	20	µm
Quantum Efficiency SWIR sensor (1)	80	%
Dark Current (2)	0.19 x 10^6 at 200mV bias at 288K	electrons/s
	30 at 200mV bias at 288K	fA
ROIC Noise	To be defined	electrons
Integration Capacitor	10	fF
Full Well High Gain	125 x 10^3	electrons
Pixel operability	>99	%
Cooling	TE1	

Table 2-4 Electro-optical detector specifications Bobcat-320

(1) Typical value @ 1600nm
(2) Typical value

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2.4. Bobcat-320-GigE & CL Camera Specifications

Feature	GigE	CL
Imaging performance		
Frame rate	100Hz or 400Hz	
Window of interest	Yes (minimal window: 32x4) (only applicable for 400Hz camera)	
Exposure time range	1-40000 (1) µs gated: 0.1-40000 µs	
Gain (in High Gain mode)	1.5 electrons/ADU	
Camera Read Noise High Gain (2)	114 electrons	
Dynamic Range High Gain	60 dB (TBC)	
Readout mode	- Integrate Then Read (ITR) - Integrate While Read (IWR)	
On-board image processing	- Imaging correction (fixed NUC for Bobcat-GigE, TrueNUC for Bobcat-CL), - Auto-Gain and Offset - Auto-Exposure (Only for Bobcat CL) - Histogram Equalization (Only for Bobcat CL) - Trigger possibilities	
A to D conversion resolution	14 bit	
Interfaces		
Image acquisition and Camera control	GigE Vision	Camera Link
Trigger	In or out via SMA	In or out via SMA or CL-CC1
Trigger-in delay (3)	7.1 µs rising edge (SMA trigger) (3) 7.3 µs falling edge (SMA trigger) (3)	5.3 µs rising and falling edge (CC1 trigger) 7.1 µs rising edge (SMA trigger) (3) 7.3 µs falling edge (SMA trigger) (3)
Trigger-in jitter	± 0.05 µs	

Table 2-5 Specifications Bobcat-320-GigE and CL

(1) At 25°C FPA temperature: the max. exposure time is dark current limited.
(2) Typical value, measured in the dark at t_{exp} = 0.1ms and 25°C FPA temperature.
(3) With trigger-in voltage = 5V.

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Feature	GigE	CL
Power Requirements		
Input Voltage	12±10% V	
Power consumption (1)	4 W	2.8 W
Physical characteristics		
Dimensions	55x55x81.7 mm^3 without lens	55x55x72 mm^3 without lens
Camera weight	334 g without lens	285 g without lens
Environmental specifications		
Operating case temperature	-40 to 70 °C	
Storage temperature	-45 to 85 °C	
Vibration	5g (20 to 2000 Hz), according to MIL-STD810G	
Shock	40g, 11ms, according to MIL-STD810G	

Table 2-6 Specifications Bobcat-640-GigE and CL (2)

(1) Typical value, measured without TEC

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3. Getting Started

The steps to start the Bobcat camera easily are described in this section.

3.1. Connect to the Camera using Xeneth

Perform the following steps to connect the camera when using Xeneth:

- Connect all necessary cables to the camera. For details about the electrical interface and cables: see chap. 0.
- Install Xeneth on the PC. For more information see chap. 5.5.1 & (Ref. 9).
    - For the Bobcat CL, make sure that the frame grabber is installed properly.
    - For the Bobcat GigE, see also (Ref. 6) for more information related to the network connection.
- Start Xeneth by clicking the Xeneth shortcut on the desktop to start up Xeneth (see Figure 3-1). The connection dialog will become visible (see Figure 3-2). When the camera is not shown, click the refresh button on the dialog. Select the camera, together with the calibration data suited for it. For more details, consult the Xeneth User Manual, section Connection setup - Settings.
- Select the camera in the Connection Setup window (see Figure 3-2).
- Select the calibration pack to be loaded (see Figure 3-2).
    - To use a calibration pack in software, select the name of the calibration pack
    - To use the onboard calibration use: <Camera memory>.
    - Press <Connect> to connect to the camera.
- Press <Start Capturing> to start grabbing frames (see Figure 3-3).

Figure 3-1 Xeneth shortcut

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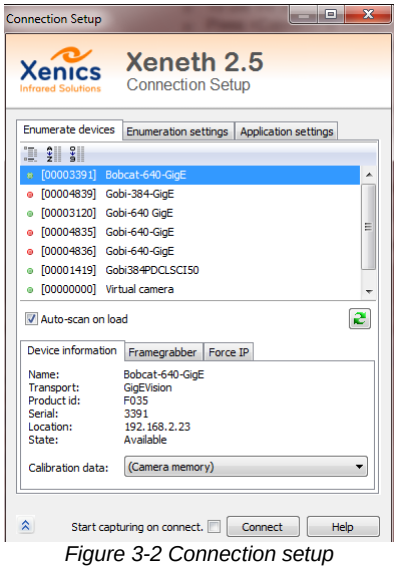

Figure 3-2 Connection setup

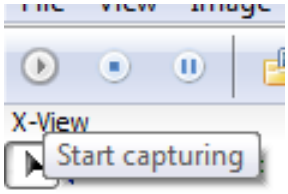

Figure 3-3 Start capturing

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3.2. Bobcat GigE: Camera Properties and Corrections

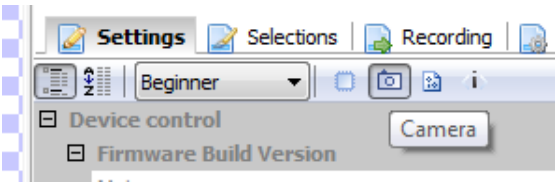

Figure 3-4 Access the camera properties

3.2.1. Change Camera Properties

Perform the following steps to change the camera properties:

- To change the camera properties, press the <Camera> icon (see Figure 3-4).
- When using the camera for the first time, use the Beginner mode (see Figure 3-4).
- In the beginner mode, the following properties can be modified by the user. For more information on the camera properties, see (Ref. 3), (Ref. 4), (Ref. 5) and (Ref. 8), or click on the property (Right-button-click) and select <Show property documentation>.

Bobcat-640-GigE	
Property name	**Description**
Device control:	Device gain (only for 640): High Gain or Low Gain to set the feedback capacitor value (6.7fF or 85fF) of the CTIA readout. See also (Ref. 5) Sensor mode (only for 320): CTIA mode is the default mode. When using exposure times between 0.1 and 1µs, switch to gated mode. Temperature: (read only): this value gives the temperature of the focal plane array.
Acquisition control	Exposure time: Sensor exposure time. Integration mode (only for 640): ITR (Integrate then read) or IWR (Integrate while read). Note that the ITR mode gives in general a better image quality. Only for long exposure times (>10000us), it is adviced to use IWR, in order to obtain a higher framerate.
Image processing control	Auto gain control: see also (Ref. 3) • Offset Control: automatic or manual offset control • Gain Control: automatic or manual gain control • Offset used: offset used by the auto-gain&offset algorithm • Gain used: gain used by the auto-gain&offset algorithm • Manual mode control: when the manual mode is selected, the gain and offset can be manually set.
GigE Vision Transport Layer.	

Table 3-1 Camera properties Bobcat-640-GigE

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3.2.2. Use of Correction Files

For the Bobcat-GigE, there following correction files are available:

Correction Files Bobcat-GigE (Fixed NUC and TrueNUC) [1]	
Bobcat-320-GigE-100Hz	Fixed NUC, CTIA mode: 500 µs, 1ms, 5 ms, 10ms
Bobcat-320-GigE-400Hz	Fixed NUC, CTIA mode: 500 µs, 1ms, 5 ms, 10ms TrueNUC, CTIA mode (only to be used in Xeneth software) - 1µs – 1ms - 100µs – 10ms
Bobcat-320-GigE-400Hz-gated	Fixed NUC, Gated Mode: 100ns Fixed NUC, CTIA mode: 500 µs, 1ms, 5 ms, 10ms TrueNUC, CTIA mode (only to be used in Xeneth software) - 1µs – 1ms - 100µs – 10ms
Bobcat-640-GigE	Fixed NUC - Low gain 500 µs - Low gain 5 ms - High gain 500 µs - High gain 5 ms TrueNUC (only to be used in Xeneth software) - Low Gain ITR 100 µs – 20 ms - High Gain ITR 100 µs – 10 ms

Table 3-2 Correction files Bobcat-GigE

Note that the **TrueNUC** files can **only be applied in Xeneth software.** The **Fixed NUC** files can be used **both with Xeneth software and onboard** of the camera.

Perform the following steps to use the non-uniformity correction (NUC) files:

- To apply a correction in Xeneth **software:** click the <Select> button and select a different correction file. Note that the fixed NUC files are only valid for a fixed exposure time (at the specified sensor temperature and integration mode). The TrueNUC files are valid for a range of exposure times (at the specified sensor temperature and integration mode). In this case, a new offset image is calculated whenever the exposure time is changed. In this way, the dark current variation with exposure time is taken into account.
- To **use** an onboard fixed NUC, perform the following steps:
    - In Xeneth go to the Settings tab / Storage icon (see Figure 3-5)
    - Set the user-set selector: every user set is directly linked with a fixed NUC correction (see Figure 3-6)
    - Press load command.
    - Xeneth will automatically reconnect and load the selected user-set and NUC

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- To **upload** (a different NUC) and use this NUC correction file onboard of the camera**,** perform the following steps **(only possible for fixed NUC correction files):**
    - In Xeneth: go to the Settings tab / Storage icon (see Figure 3-5)
    - Put the selector on the user set to which the calibration pack must be uploaded: Note that:
        - Do not save the Bobcat GigE TrueNUC calibration packs on board!
        - Do not save a calibration pack when the selector is set on default!
    - Upload the correction file:
        - Click on Correction file property and then on the green upload arrow on the right (see Figure 3-8). When uploading the correction file, verify each time that the correct selector is selected!
        - Select the new correction file and user set, do the upload and wait for the file transfer.
        - Wait till the file is transferred to the camera (= wait until Xenics logo disappears: see Figure 3-9). Wait at least 30 seconds extra to be sure that the data transfer is completed.
        - Select one of the 4 user sets as default selector.
    - Reconnect to the camera to activate the new correction file. While reconnecting, choose ‘camera memory’ calibration data (see Figure 3-10). It will start up with the correction of the default selector.
- The correction can be enabled and disabled using the **enable image correction button** (see Figure 3-11).

When the default selector is changed for a reason (from one to another user set), disconnect the camera from Xeneth and power cycle the camera. From now on, the camera will start up with the new chosen default user set correction.

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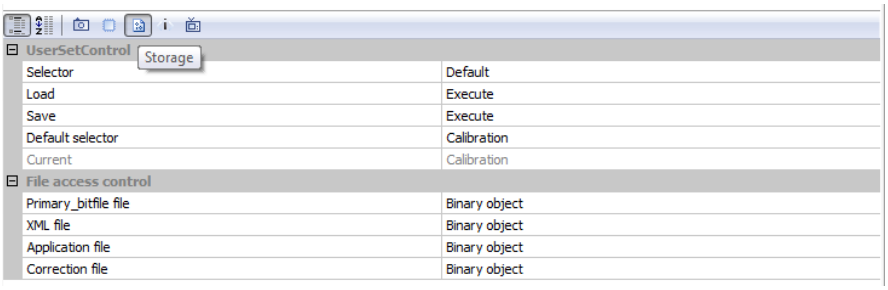

Figure 3-5 Userset / Correction pack: storage icon

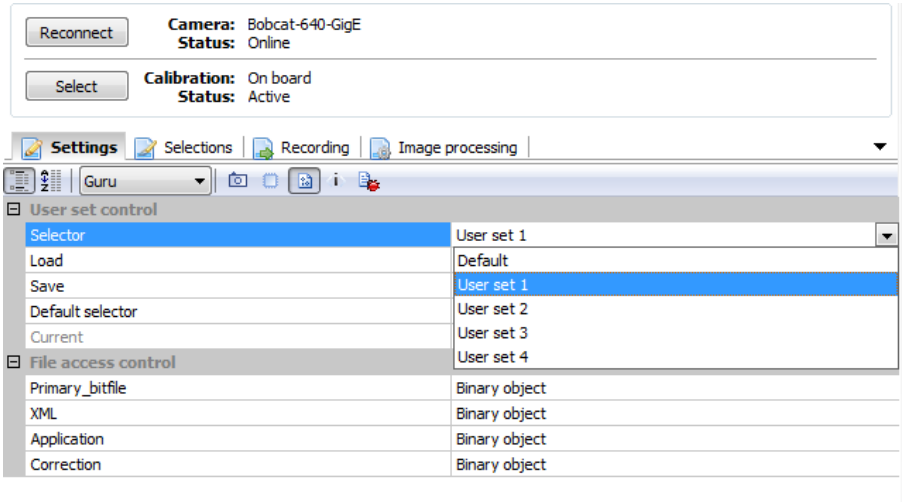

Figure 3-6 Load Correction pack upload: selector set

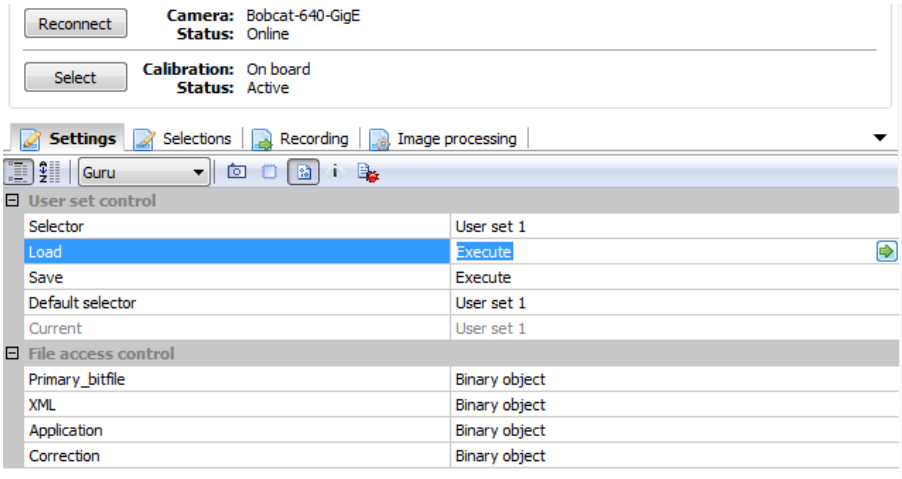

Figure 3-7 Load Correction pack upload: load command

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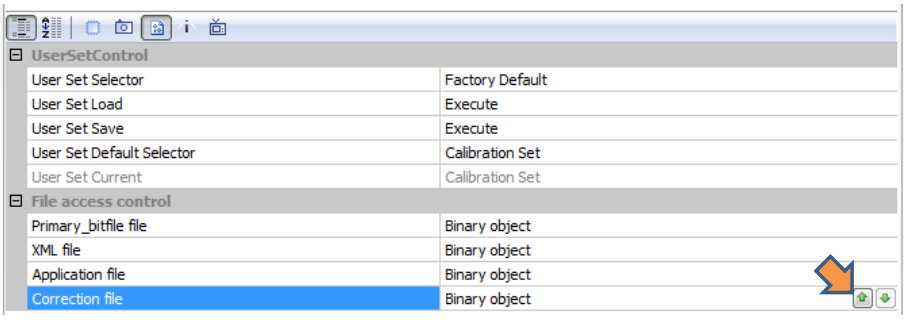

Figure 3-8 Correction file: upload onboard

Figure 3-9 Xenics logo while correction file upload

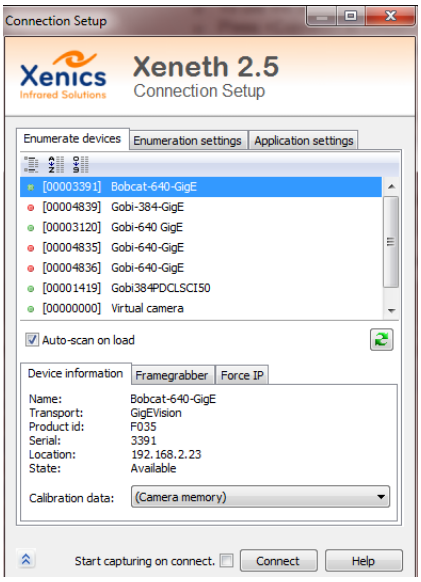

Figure 3-10 Reconnect to camera with onboard correction

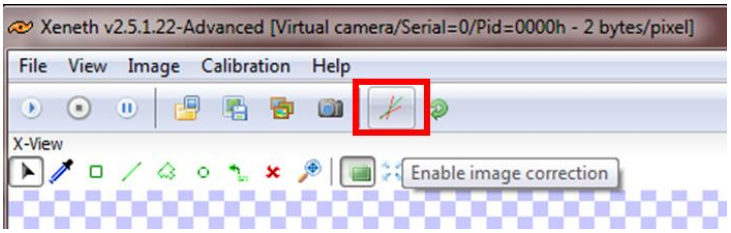

Figure 3-11 Enable image correction

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3.3. Bobcat-640 CL: Camera Properties and Corrections

3.3.1. Change Camera Properties

Perform the following steps to change the camera properties:

- To change the camera properties, press the <Camera> icon (see Figure 3-4).
- When using the camera for the first time, use the Beginner mode (see Figure 3-4).
- In the beginner mode, the following properties can be modified by the user. For more information on the camera properties, see (Ref. 3), (Ref. 4), (Ref. 5) and (Ref. 8), or click on the property (Right-button-click) and select <Show property documentation>.

Bobcat-640-CL	
Property name	**Description**
Device control:	Device gain (only for 640):: High Gain or Low Gain to set the feedback capacitor value (6.7fF or 85fF) of the CTIA readout. See also (Ref. 5) Sensor mode (only for 320): CTIA mode is the default mode. When using exposure times between 0.1 and 1µs, switch to gated mode. Temperature: (read only): this value gives the temperature of the focal plane array.
Acquisition control	Exposure time: Sensor exposure time. Note that the sensor exposure time register is only active when the auto-exposure algorithm is disabled. Integration mode (only for 640): ITR (Integrate then read) or IWR (Integrate while read). Note that the ITR mode gives in general a better image quality. Only for long exposure times (>10000us), it is adviced to use IWR, in order to obtain a higher framerate.
Image correction control	True nuc control: when enabled, the onboard true nucs will be used (together with the dedicated bias settings) for image correction, at the specified integration mode and exposure time.
Image processing control	Auto gain control: see also (Ref. 3) • Offset Control: automatic or manual offset control • Gain Control: automatic or manual gain control • Offset used: offset used by the auto-gain&offset algorithm • Gain used: gain used by the auto-gain&offset algorithm • Manual mode control: when the manual mode is selected, the gain and offset can be manually set. Histogram equalization control: to enable or disable the histogram equalization algorithm: See also (Ref. 8). Auto exposure control: to enable or disable the auto-exposure algorithm: See also (Ref. 4). When enabled, the actual exposure time used, the integration mode and gain can be found in the auto exposure status control registers.

Table 3-3 Camera properties Bobcat-640-CL

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3.3.2. Use of Correction Files

For the Bobcat-CL, there following correction files are available:

Correction Files Bobcat-CL (Fixed NUC and TrueNUC) (1)	
Bobcat-320-CL-100Hz	Fixed NUC, CTIA mode: 500 µs, 1ms, 5 ms, 10ms
Bobcat-320-CL-400Hz	Fixed NUC, CTIA mode: 500 µs, 1ms, 5 ms, 10ms TrueNUC, CTIA mode: - 1µs – 1ms - 100µs – 40ms
Bobcat-320-CL-400Hz-gated	Fixed NUC, Gated Mode: 100ns Fixed NUC, CTIA mode: 500 µs, 1ms, 5 ms, 10ms TrueNUC, CTIA mode: - 1µs – 1ms - 100µs – 40ms TrueNUC, gated mode (only available onboard): - 100ns – 1µs
Bobcat-640-CL	Fixed NUC - Low gain 500 µs - Low gain 5 ms - High gain 500 µs - High gain 5 ms TrueNUC - Low Gain ITR 100 µs – 20 ms - High Gain ITR 100 µs – 10 ms - High Gain IWR 10 ms – 40 ms

Table 3-4 Correction files Bobcat-CL

Perform the following to use the non-uniformity correction (NUC) files:

- To apply a correction in Xeneth **software:** press the <Select> button and select a different correction file. Note that the fixed NUC files are only valid for a fixed exposure time (at the specified sensor temperature and integration mode). The TrueNUC files are valid for a range of exposure times (at the at the specified sensor temperature and integration mode). In this case, a new offset image is calculated whenever the exposure time is changed. In this way, the dark current variation with exposure time is taken into account.

- The Bobcat-CL has also the TrueNUC correction files onboard. To use a **TrueNUC correction files onboard** of the camera**,** perform the following steps**:**
    - Reconnect to the camera to activate the onboard correction. While reconnecting, choose ‘camera memory’ calibration data (see Figure 3-10).
    - Make sure that the **TrueNUC control register** is enabled
    - The correction can be enabled and disabled using the **enable image correction button** (see Figure 3-11).

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- Select the desired integration mode and exposure time, or use the auto-exposure mode.

3.3.3. Real-time NUC switching

When this capability is enabled (only for Bobcat-320-CL-400Hz-gated), the user can easily and fast switch between different NUCs. For more information: see (Ref. 5) and (Ref. 9).

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4. Optical Interface

The optical interface of the camera consists of three parts: the front panel, a lens insert and the lens itself.

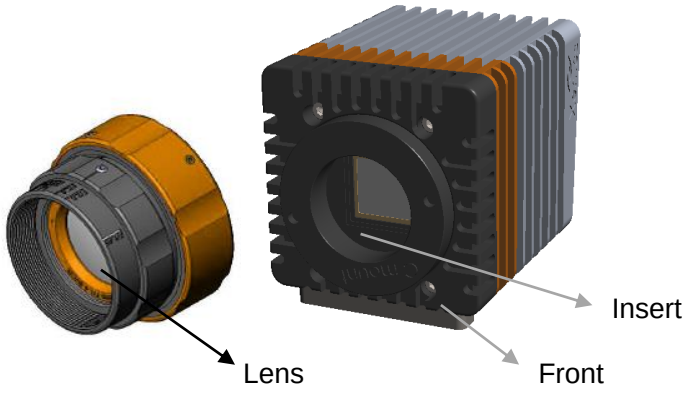

Figure 4-1 Optical components: lens - insert - front

A list of all possible VIS or SWIR lenses is available on http://www.xenics.com/LSG

A list of all possible accessories is shown in Table 4-1.

Lens configuration		Bobcat-640 GigE & CL	Bobcat-320 GigE & CL
C-mount Extension rings	OPT-000119	V	

Table 4-1 Lens accessories Bobcat-640 and Bobcat-320

It is possible to use the following different solvents to clean a lens:

- Ethanol: removal of fingerprints and other contaminants
- Alcohol: final cleaning before use.

Perform the following steps to clean a lens:

1. Immerse lens tissue in Alcohol / Propanol or Ethanol (reagent grade).
2. Wipe the lens in "S" motion in such way that each lens area will not be wiped more than once!
3. Repeat stage 2 until the lens is clean. Use a new lens tissue each time!

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5. Electrical Interface

5.1. General Overview Connectors and Specifications

Interface	Connector	Specification	Camera Protocol
Bobcat-GigE			
Input power (12V DC)	Hirose HR10-7R-4SA(73)	12V ±10%	
Trigger (either Trigger-in or Trigger-out!)	SMA	Trigger in: $V_{IN,L}$ = 0.8V Max. $V_{IN,H}$ = 2V Min. $V_{IN,MAX}$ = 30V Internal Pull-down: R = 10kΩ	
		Trigger out: V_{HIGH} = 3.3V ±10% V_{LOW} = 0V	
Ethernet	RJ45 connector	GigE standard	GigE Vision
		PoE (IEEE802.3 af specification (support for mode A and mode B))	
Bobcat -CL			
Input power (12V DC)	Hirose HR10-7R-4P(73)	12V ±10%	
Trigger (either Trigger-in or Trigger-out!)	SMA	Trigger in: $V_{IN,L}$ = 0.8V Max. $V_{IN,H}$ = 2V Min. $V_{IN,MAX}$ = 30V Internal Pull-down: R = 10kΩ	
		Trigger out: V_{HIGH} = 3.3V ±10% V_{LOW} = 0V	
Mini-camera link	CONN SDR 26POS VERT RECEPT	Serial control: 115200 baud, 8n1 Levels: RS-644	XSP Protocol (see (Ref. 1))
		Image acquisition: CL	CL Base protocol/ 1 TAP for image acquisition

Table 5-1 Electrical interface specifications for Bobcat-GigE and CL interface

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5.2. Power Interface

The power cable must be connected to the backside of the camera (see (Ref. 2) for its location). Figure 5-1 lists the connector pins overview. Table 5-2 shows schematically the pin location.

For a Bobcat-GigE, the power cable does not need to be connected to the camera in case Power over Ethernet (PoE) is used.

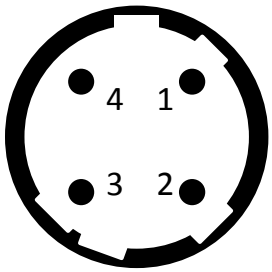

Figure 5-1 Camera power connector

Pin	Signal
1	+ 12V
2	+ 12V
3	Gnd
4	Gnd

Table 5-2 Camera power connector $12V_{DC}$

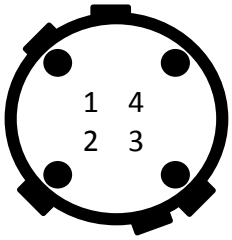

Figure 5-2 Cable connector

Pin	Signal
1	+ 12V
2	+ 12V
3	Gnd
4	Gnd

Table 5-3 Cable connector $12V_{DC}$

The power cable (ASY-001268) must be connected to the backside of the camera. Table 5-3 lists the connector pins overview. Figure 5-2 shows schematically the pin location of the cable connector (Hirose HR10-7P-4P(73)).

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5.3. Trigger Interface

Do not apply voltages to the trigger connector when it is configured in Trigger-OUT mode, because this will damage the camera!

For the trigger interface, a SMA connector is foreseen.

The trigger interface can be configured either as **Trigger-IN** or **Trigger-OUT**. The following settings can be customized:

- Trigger OUT
  - Polarity:
    - High
    - Low.
  - Width
  - Delay.
- Trigger-IN
  - Sensitivity
    - Level
    - Edge.
  - Polarity:
    - Low level / falling edge
    - High level / rising edge.
  - Delay
  - Trigger skip-count.

For more information on the trigger configuration see chap. (Ref. 5).

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5.4. GigE Interface

GigE Vision® is a camera interface standard that uses the Gigabit Ethernet (GigE) communication protocol. It provides a framework for transmitting high-speed video and related control data over Ethernet networks.

To realize the GigE communication the Bobcat-GigE cameras are equipped with a 1000Base-T Ethernet interface (RJ-45 connector). The data connection between camera and PC can be established via a standard CAT5e cable.

The GigE Vision standard defines how compliant products interact to deliver video and control information over Ethernet networks. It has the following four main elements:

- **Device discovery**: defines the sequence of events required for compliant devices to obtain valid Internet Protocol addresses, and for control applications to discover compliant devices.
- **GigE Vision control protocol (GVCP)**: defines how to specify video stream channels and control and configure compliant devices.
- **GigE Vision stream protocol (GVSP)**: defines how images are packetized and provides mechanisms for cameras or other types of video transmission systems to send image data and other information to compliant receivers.
- **An extensible mark-up language (XML) description file**: provides the equivalent of a computer-readable data sheet of features in compliant devices. This file must be based on standard defined by the European Machine Vision Association'sGenICam™.

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5.5. Camera Link Interface

Camera Link is an interface for the transfer of digital video data. The standard defines data transfer on a physical base and determines connectors, cables and components for transmission and reception. Different configurations are available, distinguishing between the numbers of parallel transferred data bits.

For the Bobcat-CL camera, the **BASE configuration with 1 TAP** is used. The pin assignment and pin lay-out of the Camera Link connector on the Bobcat-CL module are shown in Figure 5-3 and Table 5-4.

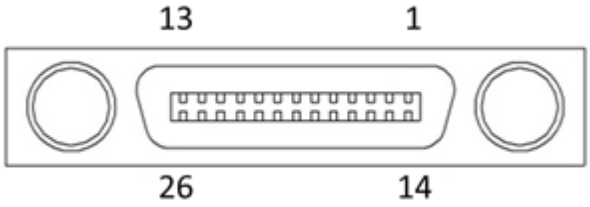

Figure 5-3 Pin out of camera link connector on the XSW-CL module

Pin	Signal	Pin	Signal
1	GND	14	GND
2	X0	15	X0+
3	X1	16	X1+
4	X2	17	X2+
5	XCLK	18	XCLK+
6	X3	19	X3+
7	SerTC+	20	SerTC-
8	SerTFG-	21	SerTFG+ P
9	CC1	22	CC1+
10	CC2+	23	CC2
11	CC3	24	CC3+
12	CC4+	25	CC4
13	GND	26	GND

Table 5-4 Camera link connector (base) pin assignment

CC1 can be configured as trigger input.

CC2 to CC4 in Table 5-4 are not supported by the module. The clock rate is 40 MHz with one tap & 16 bit/pixel.

i More info about the timing diagram can be found in (Ref. 5).

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5.5.1. Footer Information

The footer is appended as last line of the frame when the footer information bit is switched on. The first 16 pixels contain valid footer information; all other pixels have zero values. All multi-byte information is represented in little endian.

Pixel number	Value (16 bit)	Digital Video signal
1	PID	PID of the module
2	Trigger info	Not used, value = 0
3	Exposure time low	Bits 15 .. 0 of integration time in usecs
4	Exposure time high	Bits 31 .. 16 of integration time in usecs
5	Time stamp 1	64 bit time stamp in usecs since startup of module
6	Time stamp 2	
7	Time stamp 3	
8	Time stamp 4	
9	Module temperature	Temperature in centi Kelvin
10	RFU	Not used, value = 0
11	RFU	Not used, value = 0
12	Fixed Offset low	Manual applied fixed offset of image
13	Fixed Offset high	
14	Fixed Gain	Manual applied fixed gain of image
15	RFU	Not used, value = 0
16	RFU	Not used, value = 0

Table 5-5 Footer contents

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6. Software Installation

Before being able to start the camera, the Xeneth imaging suite (at least version 2.4) and its graphical user interface must be installed, so that the data coming from a wide variety of Xenics detectors and cameras can be easily operated on and analyzed.

6.1. Xeneth Installation

It is a good practice to first uninstall a previous Xeneth version when installing a new one.

Refer to the Xeneth Installation Manual (Ref. 9) that is delivered on the CD together with the camera to install Xeneth.

When using camera link cameras, it is also necessary to pre-install the frame grabber before installing Xeneth! Refer to the frame grabber manual for installation instructions.

6.2. SDK Installation

The optional SDK installation is delivered on the CD together with the camera. Install the SDK software using this file.

After the SDK installation, the SDK manual, together with the samples and header files can be found in the C:\Program Files\Xeneth\SDK directory.

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7. Appendices

7.1. Appendix Xenics Serial Protocol

A detailed description of the Xenics Serial Protocol can be found in (Ref. 1)

7.2. Appendix Mechanical Drawings

The complete mechanical drawing of the Bobcat-GigE and CL can be found in (Ref. 2)

7.3. Appendix Auto Gain Control

More detailed information on the Auto Gain Control functionality is provided in (Ref. 3)

7.4. Appendix Auto Exposure Control

More detailed information on the Auto Exposure Control functionality is provided in (Ref. 4)

7.5. Appendix Control & Operation

The command and control register set and the camera functions and features for the Bobcat-GigE/CL are described in more detail in (Ref. 5).

7.6. Appendix Network Connection Setup for GigE

The network connection set-up and the camera functions and features for the Bobcat-GigE are described in more detail in (Ref. 6).

7.7. Appendix Frame Rate Calculator

The achievable frame rate and the minimal required frame time can be calculated using the Frame rate calculator in (Ref. 7).

7.8. Appendix Histogram Equalization Control

The contrast of the image can be changed using the histogram equalization algorithm as described in (Ref. 8).

7.9. Appendix Real-Time Calibration Switching

Fast switching between different NUCs is further described in (Ref. 9).

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