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Optronis CoaXPress Cameras
CamPerform CP80 / CP90 Series

User Manual
CP80-4-M/C-500
CP90-4-M/C-500

CoaXPress

Document Reference 1887-SU-01-J
Release Date 29/03/2018

About this manual

Thank you for using an Optronis product.

The purpose of this document is to provide a description of Optronis CP80-4-M/C-540, CP90-4-M/C-540 cameras.

Please read this manual thoroughly before operating your new camera for the first time. Please follow all instructions and observe warnings.

This document is subject to change without notice and corresponds to the last camera firmware version.

You can check product page download area to be sure you are using:

- Last Datasheet version
- Last Manual version
- Last Firmware version
- Last Firmware Update software version
- Last CAD data version

http://optronis.com/en/products/camperform-cp80-4-mc-500/

http://optronis.com/en/products/camperform-cp90-4-mc-500/

Support

We hope that this manual can answer your questions, but should you have any further questions or if you wish to claim a service or warranty case, please contact your local dealer or refer to the Optronis support. You can contact our support by using our website or by email at the following address: support@optronis.com . To process your request efficiently please prepare following information:

- Camera Model name: CPX0-XX-M/C-XX. (See label at the bottom side of the camera).
- Serial-Number: 1xxx-ST-XXX. (See label at the bottom side of the camera).
- Frame Grabber Model
- Cable type (BNC or Din 1.0/2.3, adapter types…)
- Operating System (Windows 7/10/32bit/64bit …)
- Short description of the problem

Contacts

To contact us, please use the information below.

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1 General

1.1 Declaration of Conformity

CE

Declaration of Conformity

In accordance with the EU directive 2014/30/EU (electromagnetical compatibility) of 26. February 2014

Hereby we explain that those corresponds to below designated products in its conception and design as well as in circulation the execution the fundamental safety and health requirements of the Community directive 2014/30/EU brought by us. In the case of a change of the product not co-ordinated with us this explanation loses its validity.

Manufacturer: Optronis GmbH
Ludwigstr. 2
D-77694 Kehl

Authorized person Dr. Patrick Summ
(Managing Director)

Description of the electrical equipment:

function: Machine Vision Kamera
type / modell: CP90-4-M-500
serial number: 1897-ST-010

The agreement with further valid guidelines / regulations following for the product is explained:

EMV Directive (2014/30/EU) of 26. February 2014

Reference to the harmonized standards:

DIN EN 61326-1:2006-10
Electrical equipment for measurement, control and laboratory use
– EMC requirements -
Part 1: General requirements

Date: 27. December 2016

Personal data of the signer: Dr. Patrick Summ

Signature:

1.2 RoHS Compliance

CamPerform CP80-4-M/C-540, CP90-4-M/C-540 cameras are Pb free manufactured.

1.3 Standards

The camera has been developed according to following standards:

- CoaXPress Standard Version 1.1.1 - JIIA CXP-001-2015
- GenICam SFNC 2.3
- GenICam PFNC 2.1

1.4 Remarks

The following signs are used in this user manual to highlight some information:

Remarks and additional information.

Attention, warnings.

1.5 Scope of Delivery

The camera is delivered together with:

- Brief Introduction

Available accessories are:

- Lens mount: C-Mount lens adapter
  F-Mount lens adapter
  G-Mount lens adapter
  M42x1 lens adapter
  M42x0.75 lens adapter
  Custom mounts on request

For CP80 cameras:

- Pigtail cable CP80
- Power supply CP80
- Programming cable CP80

For CP90 cameras:

- Pigtail cable CP70, CP90
- Power supply CP70, CP90
- Programming cable CP70, CP90

2 Getting Started

2.1 General Precautions

2.1.1 Environmental Conditions

Recommended environmental conditions are:

Temperature range during operation:	< + 40°C / ~ + 104°F (ambient temperature) > 0°C / ~ + 32°F (ambient temperature)
Humidity:	< 80%

Optronis does not guaranty camera operation beyond above conditions and camera lifetime might be reduced.

2.1.2 Camera Handling

Please be careful when using camera. Pay attention especially to:

Camera power	Please be careful when powering camera. Use power over Coaxpress (PoCXP) or delivered external power supply (option).
Temperature and Humidity	Please respect recommended conditions. You may use controlled airflow or heatsinks to keep camera in better temperature conditions.
Direct sun light	Please avoid direct-sun light, camera sensor may be damaged.
Dust and Cleaning	The camera is produced in a dust-controlled environment. Please be careful when changing lens, mount or accessing any part close to the sensor. Always unplug the camera before cleaning it. Do not use cleaning liquids or sprays. Instead, use a dry and soft duster.

Do not open the housing of the camera.
Warranty becomes void if the camera housing is opened.

2.2 Setting Up System

2.2.1 Typical System Configuration

A typical system with Optronis CoaXPress camera is composed of:

- An Optronis CoaXPress camera
- CoaXPress cables
- An acquisition and control system (a PCI CoaXPress Frame Grabber in a PC)
- A Control Software based on Frame Grabber features
- Optional features (External power supply, External synchronization system, etc…).

Here is an illustration of such a system:

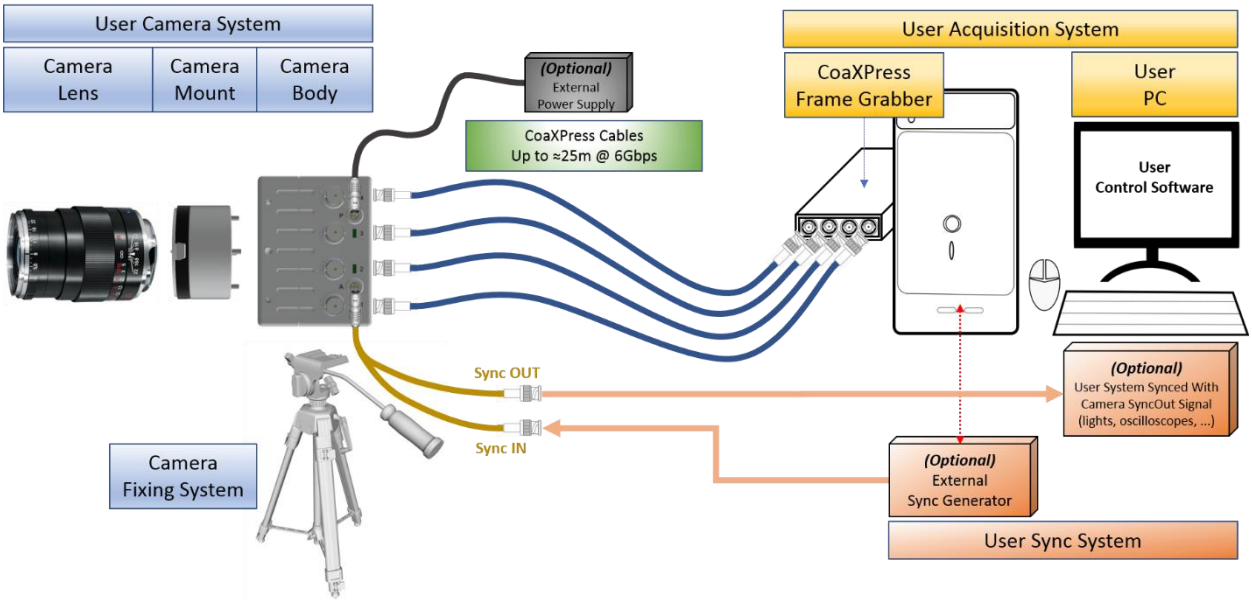


Figure 1: Typical System

2.2.2 Set Up Lenses

Please be careful when installing or removing camera lens. Depending on your lens mount type and lens, pay attention to following points:

- If your lens has a mounting mark, first align lens-holder and lens mounting marks and then rotate anti-clockwise to lock the lens. To remove the lens, unlock the lens-holder silver clip and rotate clockwise until marks are aligned. Then remove the lens.
- If your lens has a screw thread, rotate anti-clockwise to remove it and clockwise to installing it.
- If you are removing the lens from the camera, always use a cap on the camera to avoid dust infiltration.
  Use also caps on both lens sides for the same reason.
- Do not forget to remove the cap of your lens before using the camera.

2.2.3 Optical Considerations

A typical optical system can be represented as below.

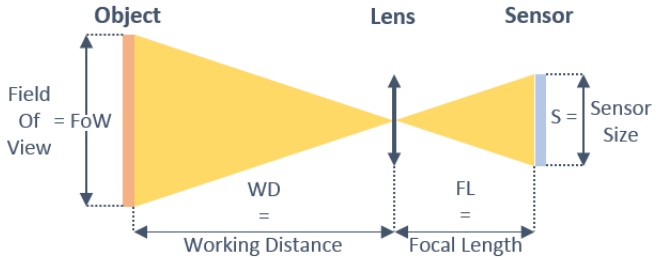


Figure 2: Field of View

Using above notations:

The sensor size depends on frame dimension:

$$\boldsymbol{Sensor\ Size = S = PixelSize \times \sqrt{Resolution\_X^2 + Resolution\_Y^2}}$$

To select a lens, you can use above formula:

$$\boldsymbol{Focal\ Length = FL = \frac{WD}{1+\frac{FoW}{S}}} \textit{(distances in millimeters, mm)}$$

Alternatively, if you already have a lens, you can compute working distance using above formula:

$$\boldsymbol{Working\ Distance = WD = FL \times \left(1 + \frac{FoW}{S}\right)} \textit{(distances in millimeters, mm)}$$

Examples:

- PixelSize = 0.008mm
- Full resolution 1696 x 1708
- FoW = Object size = 100 mm
- WD = 300 mm

$$S = 0{,}008 \times \sqrt{1696^2 + 1708^2} = 19{,}26$$

$$FL = \frac{300}{1 + \frac{100}{19{,}26}} \sim 48{,}5\ mm$$

⇨ Selected focal length = 50 mm.

Same example but using a 35mm lens.

$$WD = 35 \times \left(1 + \frac{100}{19{,}26}\right) \sim 217\ mm$$

⇨ Object must be set at least at WD = 217 mm.

3 Camera Overview

3.1 Model Description

3.1.1 Model Name and Options

CamPerform camera series decoding information are illustrated here after. Check camera label on the bottom side to get both:

- Ref.: Camera Model Name (see Figure 3)
- S/N.: Camera Serial Number (see Figure 4)

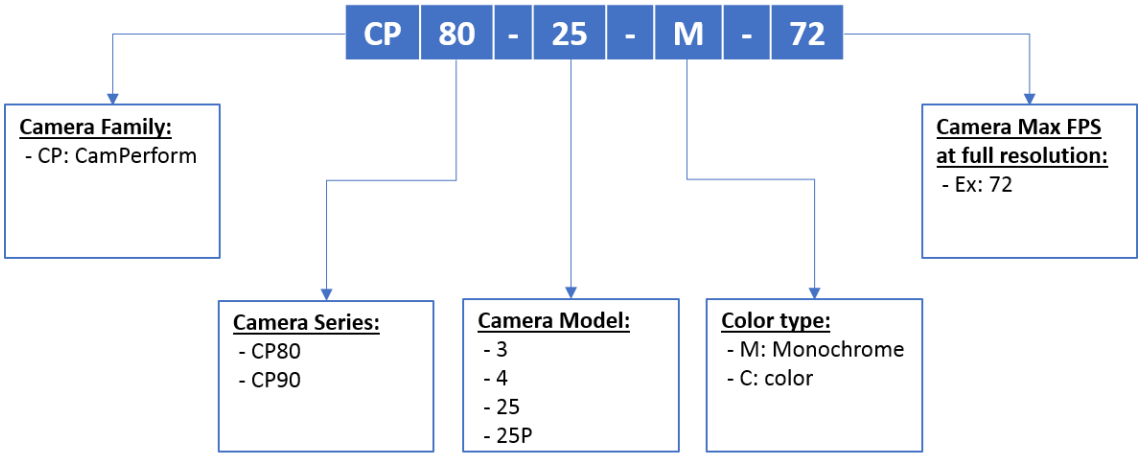


Figure 3: Camera Model Name Decoder

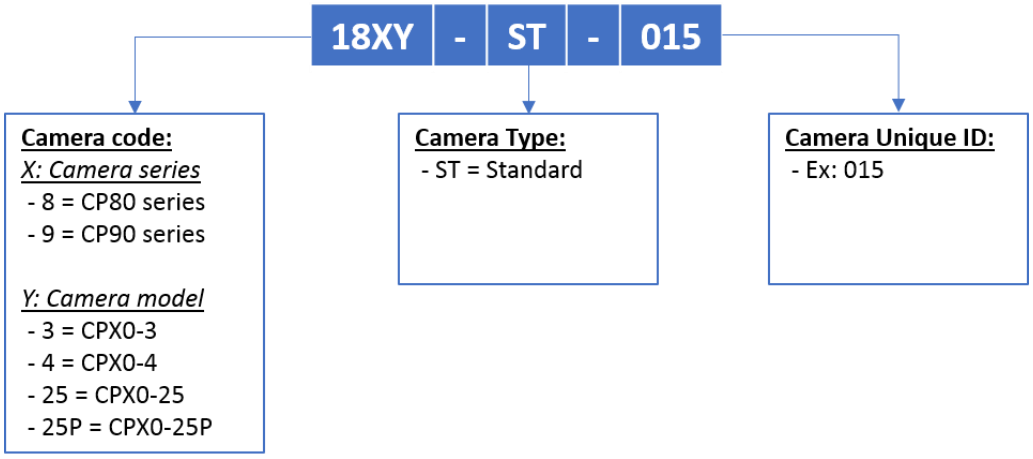


Figure 4: Camera Serial Number Decoder

3.1.1 CP80 / CP90 Series Differences

CP80 and CP90 series differ mainly by the user hardware interface:

- Connector types: Power and auxiliary, CoaXPress connectors (BNC or 1.0/2.3 DIN)
- LED positions
- CoaXPress connectors position: camera side (CP80), or camera rear (CP90)

The CP90 series also have a slightly better power efficiency.

Both series use the same firmware.

3.2 Technical Data

3.2.1 General Info

3.2.1.1 All Models General Info

Feature	Comments
Power Source	External power supply or Power over CoaXPress (PoCXP): + 24V +/- 5% DC < 200mV ripple
Sensor resolution	2304 x 1720
Frame rate @ max. sensor res	506 fps
Image sensor	AM41 global shutter CMOS
Exposure Time	2 µs - 1/Framerate
Active Area	16.13 mm x 12.04 mm
Sensor Diagonal Dimension	20.13 mm
Pixel Size	7 µm
A/D Conversion	8 Bit (LUT optional)
Dynamic	50 dB
Sensitivity	8 V/lux*s @525 nm
Saturation capacity (FWC)	20000 e-
SNR	43 dB
DSNU1288	170 e-
PRNU1288	1.5%
Non-linearity error	< 1%
Shutter efficiency	global electronic shutter
Trigger signal	TTL, 3.3 - 5 V, 10 mA, optically isolated
Trigger modes	internal free-run, external, CXP
Video Interface	CoaxPress CXP6, CXP5, CXP3 – 1, 2 or 4 links
Uplink	Over CoaxPress
Mounting Screws	4 x M4 (depth 6mm) in front 4 x M2.5 (depth 5mm) at camera rear 2 x M4 (depth 6mm) on each 4 sides (8 in total) 1 x ¼ - 20 UNC (depth 6mm) on center of each 4 sides (4 in total)

3.2.1.2 CP80 Version General Info

Feature	Comments
Power consumption	Approximately 10 Watt
CoaXPress connectors	CoaxPress 4 x BNC
Size	85 mm x 85 mm x 99,5 mm (F-Mount)
Weight	Approximately 400g without lens and mount

3.2.1.3 CP90 version General info

Feature	Comments
Power	Approximately 9 Watt
CoaXPress connectors	CoaxPress 4 x DIN 1.0/2.3
Size	85 mm x 85 mm x 97 mm (F-Mount)
Weight	Approximately 400g without lens and mount

3.2.2 Spectral Response

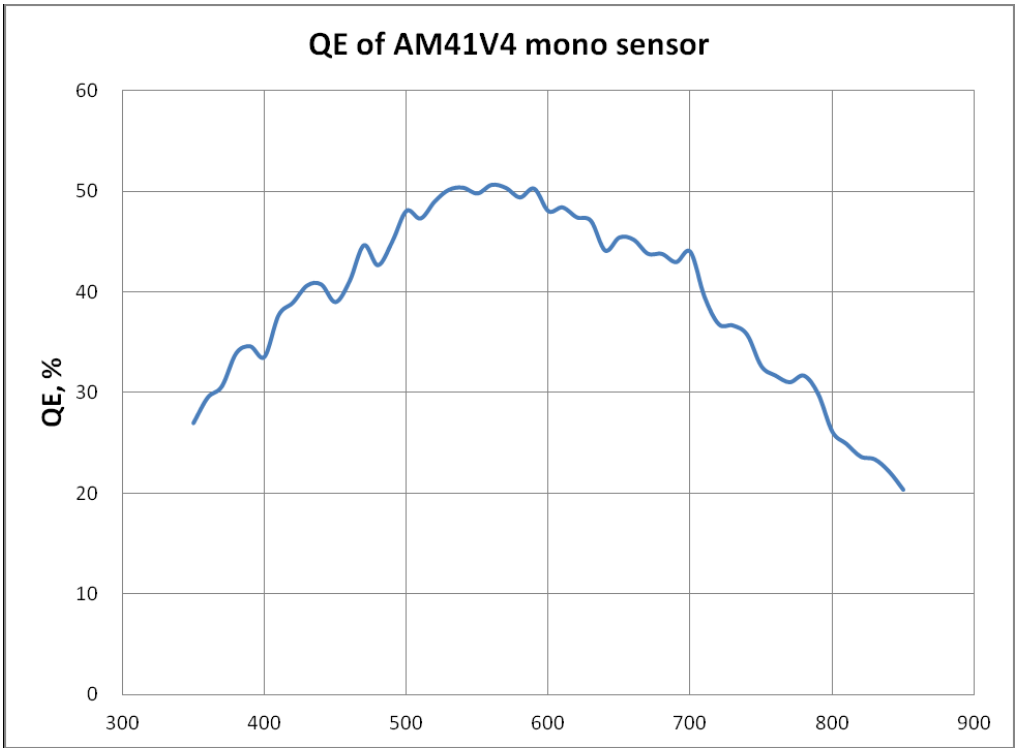


Figure 5: Monochrome Camera Spectral Response

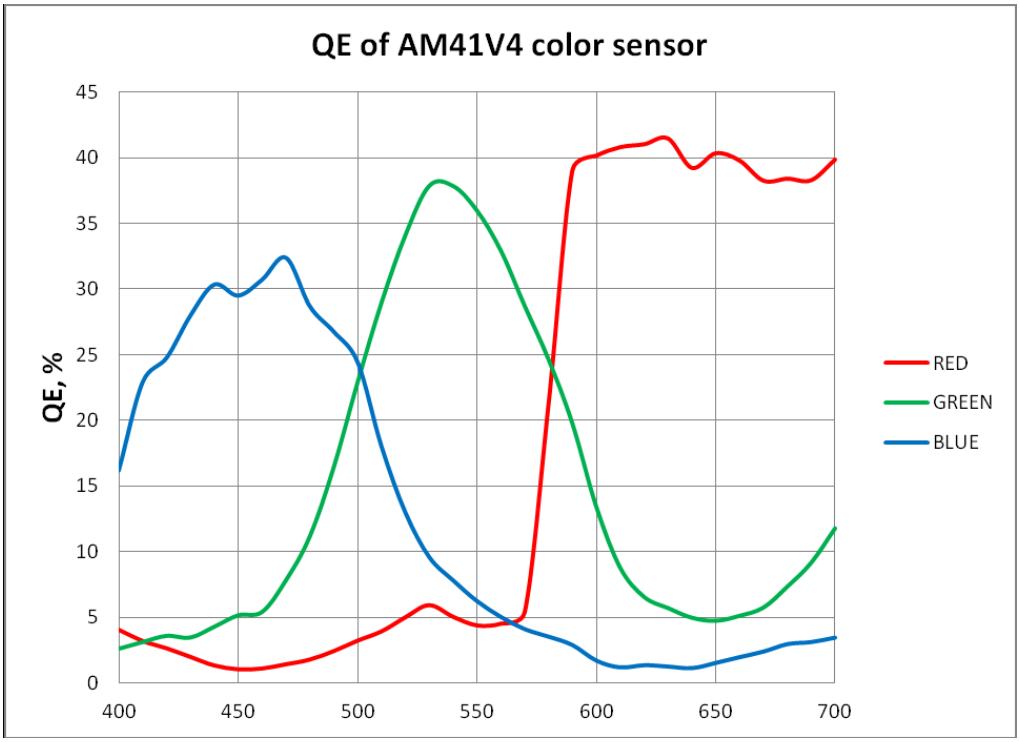


Figure 6: Color Camera Spectral Response

3.2.3 Glass Filter

Color cameras (CP80-4-C-500 and CP90-4-C-500 models) are delivered with an IR filter placed in front of the sensor. Its typical transmittance is illustrated on Figure 7.

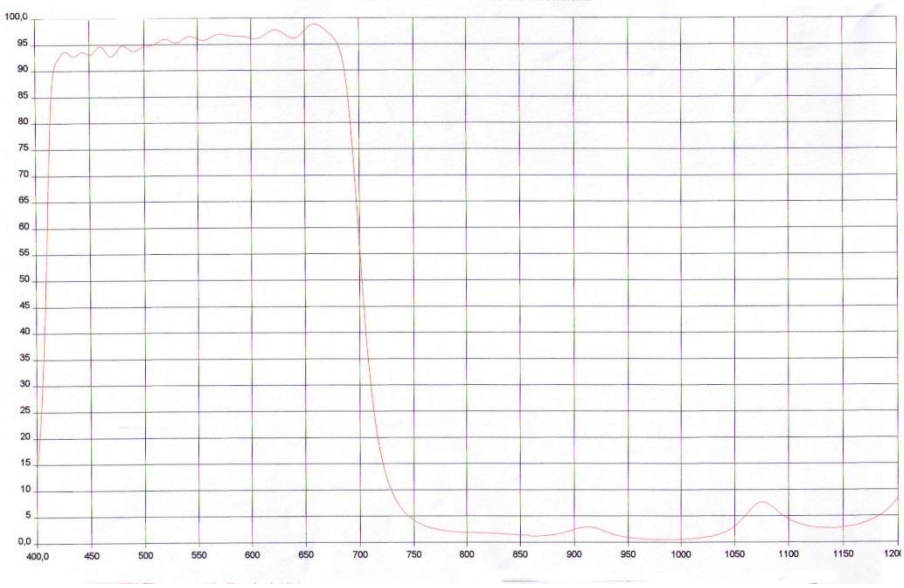


Figure 7: Glass Filter typical transmittance (1830-SS-10 IR Filter)

3.2.4 Mechanical Drawings - Dimensions and Mounting Points

3.2.4.1 CP80 Mechanical Dimensions (with F-Mount - /FM option)

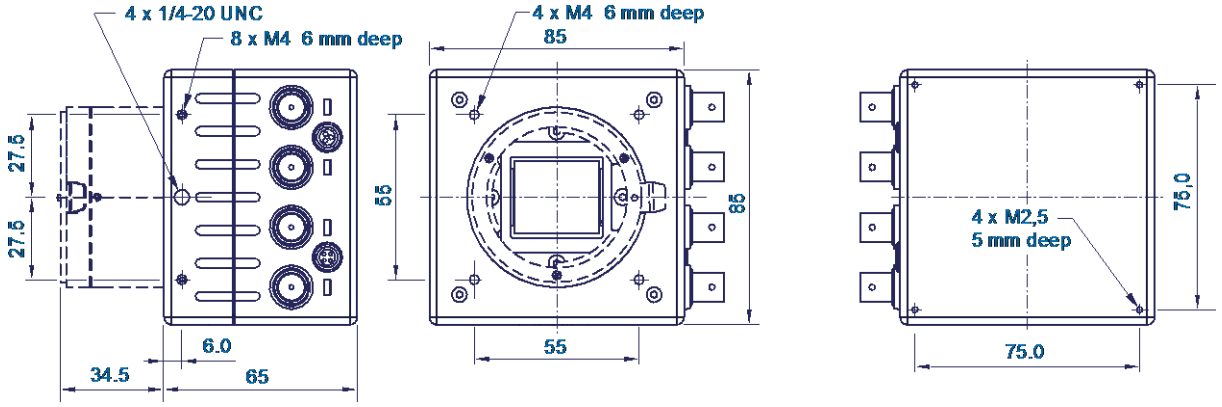


Figure 8: CP80 Dimensions (with F-Mount option)

3.2.4.2 CP90 Mechanical Dimensions (with F-Mount - /FM option)

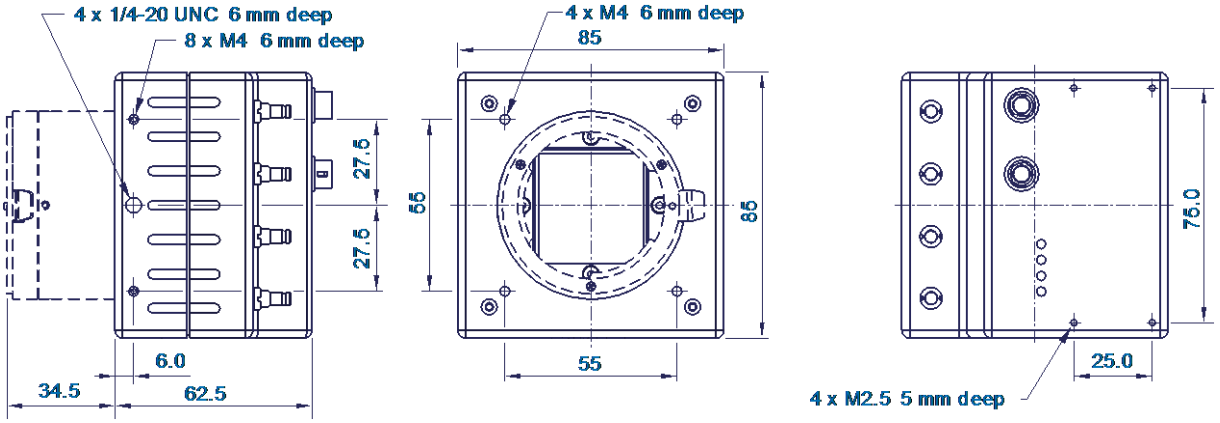


Figure 9: CP90 Dimensions (with F-Mount option)

4 Camera Main Features

This paragraph describes camera main features and how they can be used. It focuses on principles and overall understanding of these features. The camera control interface and specific values used to access these features are detailed in later paragraph"*6.2. XML Main Entries - Features Description, page 36"*.

As explained later, these features are controlled by an XML file divided in "entries". *XML entries* are using this special text font for better identification in this paragraph.

Please check also"*6.2. XML Main Entries - Features Description, page 36"* paragraph to have a precise description of allowed values for each entry.

4.1 Frame Format

4.1.1 Supported Pixel Formats

The camera supports the following pixel formats:

- Mono 8
- Bayer RG8 (Color cameras only)

Pixel format is controlled by XML entry:

- *PixelFormat*

4.1.2 Single ROI

The full frame resolution of the camera is:

- 2304 x 1720

The resolution can be reduced in both directions. Resolution is controlled by XML entries:

- *Width* / *WidthMax*
- *Height* / *HeightMax*

When reducing the resolution, the ROI is centered in both directions by default. ROI position is controlled by XML entries:

- *OffsetX*
- *OffsetY*

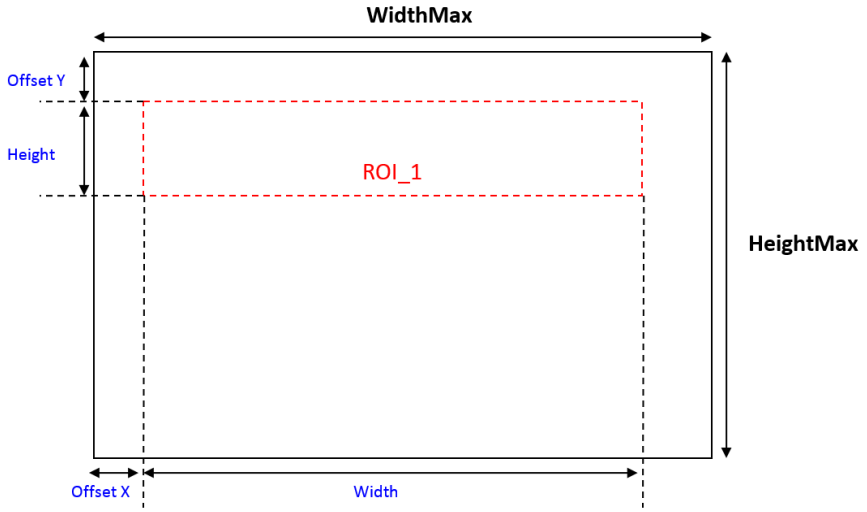


Figure 10: Camera Single ROI Control

4.1.3 Dual ROI

4.1.3.1 Dual ROI control

Dual ROI mode is controlled by XML entries:

- *DualROIMode*
- *Width / OffsetX*
- *Height_ROI1 / ROI1_OffsetY*
- *Height_ROI2 / ROI2_OffsetY*
- *(Height = Height_ROI1 + Height_ROI2, automatically computed, refresh XML interface if it is not automatic)*

The figure here after (Figure 11) shows how to use these entries.

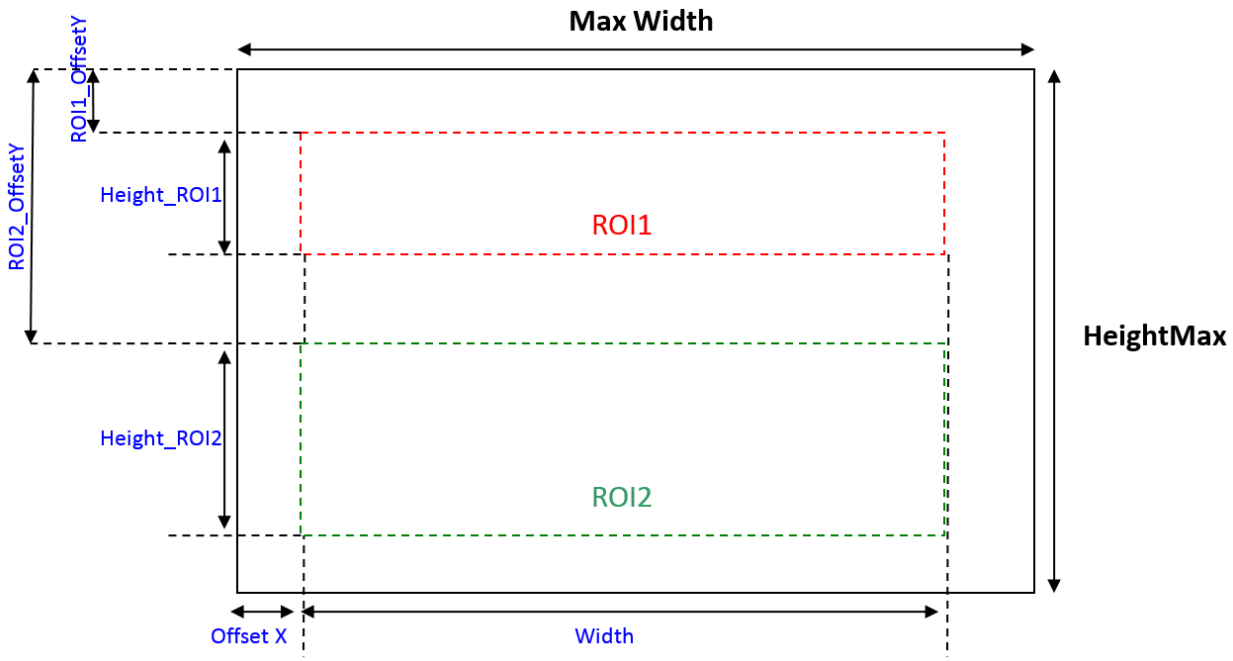


Figure 11: Camera Dual ROI control

4.1.3.2 Enabling and Configuring dual ROI

To enable and use dual ROI:

- Stop Acquisition
- Set *Width / OffsetX* according your needs. Both ROI share the same *Width / OffsetX.*
- Set *DualROIMode to "On"*
- Set ROIs parameters *Height_ROI1 / ROI1_OffsetY* and *Height_ROI2 / ROI2_OffsetY* following these rules
  - ⇨ (Width + Offset X) ≤ WidthMax
  - ⇨ (*Height_ROI1 + ROI1_OffsetY*) < *ROI2_OffsetY*
  - ⇨ (*Height_ROI1 + ROI1_OffsetY*) + (*Height_ROI1 + ROI1_OffsetY*) ≤ HeightMax
- Refresh interface to get updated *Height = Height_ROI1 + Height_ROI2.*

- To disable Dual ROI mode, Set *DualROIMode to "Off"*

4.1.3.3 Dual ROI output Image

When using the Dual ROI mode, the output image send to the Frame Grabber is one image composed by the 2 ROIs with:

Output width = *Width*.

Output height = *Height = Height_ROI1 + Height_ROI2*.

It is up to Frame Grabber application to separate ROIs according dual ROI parameters.

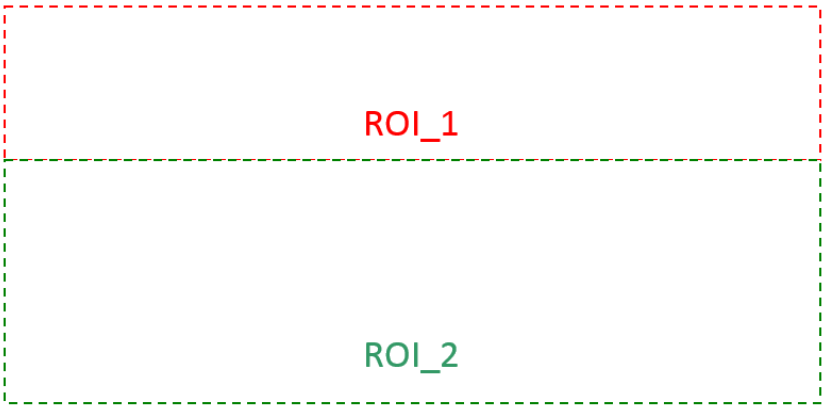


Figure 12: Camera output image when using dual ROI

4.1.4 ROI Subsampling

Subsampling feature allows to transfer only the even lines of the ROI1 (Single ROI) or both ROI1 and ROI2 (Dual ROI). ROIs parameters are controlled as explained in earlier paragraph *4.1.3 Dual ROI*.

ROI subsampling can be enabled or disabled independently for both ROI.

ROI subsampling feature is controlled by XML entries:

- *SubSamplingROI1*
- *SubSamplingROI2*

4.1.4.1 Single ROI Subsampling Configuration

- Stop Acquisition
- Set DualROIMode = “Off”
- Set SubSamplingROI1 = “On”
- Set ROI1 parameters:
  - Height_ROI1
  - ROI1_OffsetY
- Height is automatically set to Height_ROI1 / 2

4.1.4.2 Dual ROI Subsampling Configuration

- Stop Acquisition
- Set DualROIMode = “On”
- Set SubSamplingROI1 = “On”
- Set SubSamplingROI2 = “On”
- Set ROI1 parameters
  - Height_ROI1
  - ROI1_OffsetY
- Set ROI2 parameters:
  - Height_ROI2
  - ROI2_OffsetY
- Height is automatically set to Height_ROI1 / 2 + Height_ROI2 / 2

4.1.5 Frame Y Revert

This feature reverts both Y axis reference for frame vertical parameters (*Height_ROI1 / ROI1_OffsetY*) and image line readout order.

If the ROI is centered, enabling this feature mirrors vertically the image. If ROI is not centered, enabling this feature generates another ROI (see below figure) with a reverse line readout.

Y reversion is controlled by XML entry:

- *ReverseY*

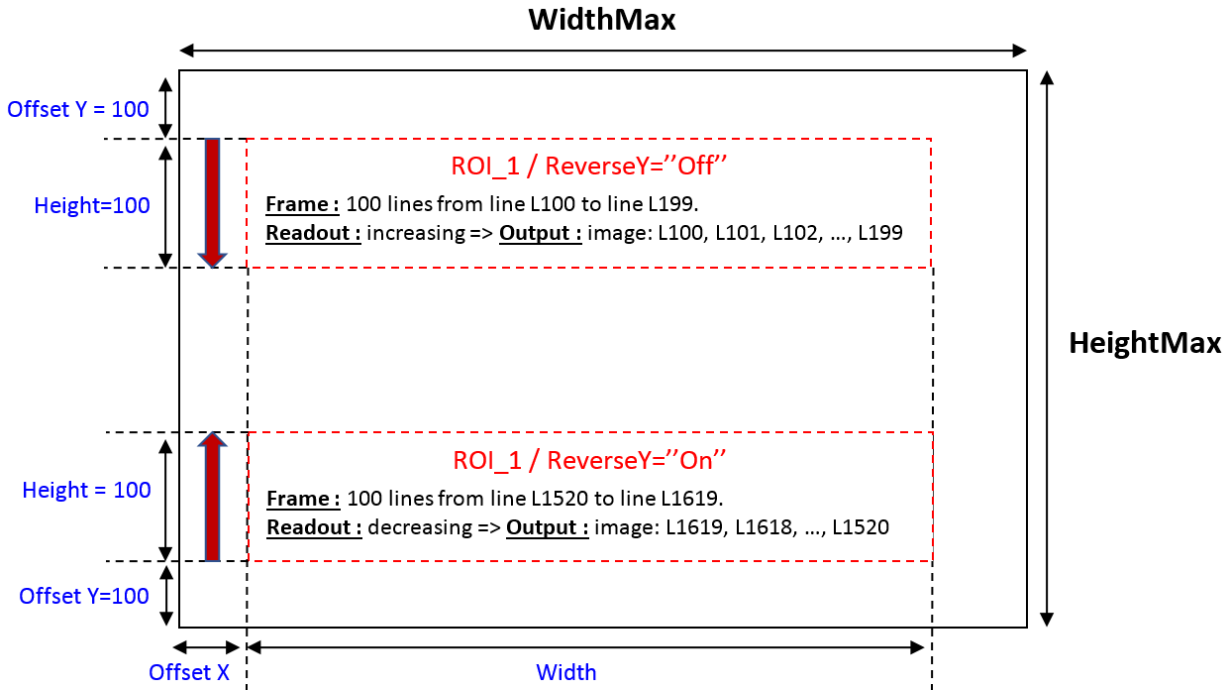


Figure 13: Output ROI example depending on ReverseY value

4.2 Available CXP Configurations

The CoaXPress standard allows a lot of different configurations (number of cables, transfer rates, …). You may want to change it to fit your system needs.

This camera is compatible with:

- *CXP3_X1 = 1 links at 3Gbbps*
- *CXP3_X2 = 2 links at 3Gbbps*
- *CXP3_X4 = 4 links at 3Gbbps*
- *CXP5_X1 = 1 links at 5Gbbps*
- *CXP5_X2 = 2 links at 5Gbbps*
- *CXP5_X4 = 4 links at 5Gbbps*
- *CXP6_X1 = 1 links at 6Gbbps*
- *CXP6_X2 = 2 links at 6Gbbps*
- ***CXP6_X4 = 4 links at 6Gbbps (default configuration)***

CXP configuration is controlled by XML entry:

- *ConnectionConfig*

Using a lower transfer rate allows longer cable length.

4.3 Acquisition Control - Frame Generation and Synchronization

The camera frame acquisition is controlled by using camera XML AcquisitionStart and AcquisitionStop commands.

The camera frame acquisition can be synchronized by 3 different ways:

- **Camera Internal Generator:** (*AcquisitionMode* = “Continuous”)
  In this mode, the camera uses its own sync generator and generates frames continuously when acquisition is started. Frames are generated according to *AcquisitionFrameRate* value.
  Please check next paragraph *“4.4. Frame Rate and Exposure, page 21”* for more information about frame rate and exposure control.

- **External Synchronization Generator:** (*AcquisitionMode* = “Single Frame”)
  In this mode, the camera uses an external signal to generate frames. You must apply a TTL signal the Sync In input of the camera. Please respect signal limits (current and voltage) and use the Aux. to BNC adapter or respect Aux. connector pinout (Hardware information in *“5.1.4. Auxiliary Connector, page 31”* paragraph).
  Please check next paragraph *“4.4. Frame Rate and Exposure, page 21”* for more information about frame rate and exposure control.

- **Synchronization over CoaXPress by Frame Grabber:** (*AcquisitionMode* = “CoaxPress”)
  CoaXPress standard allows Frame Grabber synchronizing camera frame generation using specific packets called *trigger packets* sent on “CoaXPress uplink”.
  The frame grabber sends 2 kind of trigger packets: rising_edge and falling_edge trigger packets. It allows the camera to build a square synchronization signal:
  - Its period is the period of the rising_edge trigger packets.
  - Its pulse width is the time difference between falling_edge trigger packets and rising_edge trigger packets.

  So, it is very similar as using an external generator but controlled by user acquisition system (usually a PC + a CoaXPress frame grabber).

Please check next paragraph *"4.4. Frame Rate and Exposure, page 21"* for more information about frame rate and exposure control.

Please check your Frame Grabber manual to use its trigger over CoaXPress mode.

Acquisition is controlled by XML entries:

- *AcquisitionStart*
- *AcquisitionStop*
- *AcquisitionMode*

4.4 Frame Rate and Exposure

- **Camera Internal generator:** (*AcquisitionMode* = "Continuous")
  Frame rate: In this mode, frame rate is defined by camera register and can be modified using camera XML control interface.
  Exposure: In this mode, the exposure is defined by camera register and can be modified using camera XML control interface.

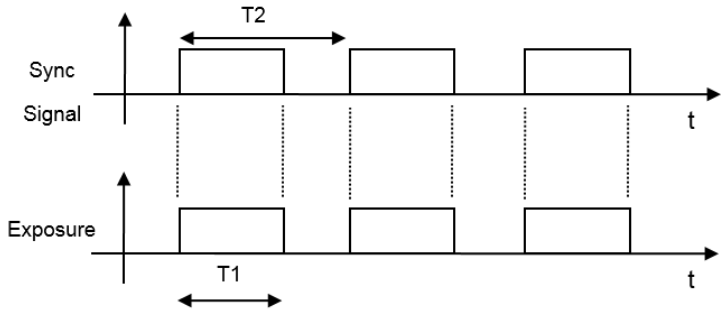
- **External Synchronization generator:** (*AcquisitionMode* = "Single Frame")
  Frame rate: In this mode, the frame rate is defined by the external TTL signal period. The allowed frame rate range is the same as in Internal Synchronization.
  Exposure: In this mode, the exposure can be controlled by 2 different sources. The XML "Granularity" feature allows you to select the control source:
  - *Granularity* = "On": Same as in the "Continuous" mode, camera register controls the exposure and can be modified using camera XML control interface.
  - *Granularity* = "Off": The exposure is controlled by the external TTL signal pulse width.

- **Synchronization over CoaXPress by Frame Grabber:** (*AcquisitionMode* = "CoaxPress")
  Frame rate: In this mode, the frame rate is defined by Frame Grabber "Trigger packets" period. The allowed frame rate range is the same as in Internal Synchronization.
  Exposure: In this mode, the exposure can be controlled by 2 different sources. The XML *Granularity* feature allows you to select the control source:
  - *Granularity* = "On": Same as in the "Continuous" mode, camera register controls the exposure and can be modified using camera XML control interface.
  - *Granularity* = "Off": The exposure is controlled by the CoaXPress TTL signal pulse width.

Frame rate and exposure are controlled by XML entries:

- *AcquisitionFrameRate*
- *ExposureTime*
- *Granularity*

4.4.1 Synchronization timings



T1: Exposure time T2: Frame Interval = (1 / Fps)	T2min = Frame Interval min = (1 / fps_min) T2max = Frame Interval max = (1 / fps_max) T1max = T2 - T1min T1min = see "Max & Min Exposure Time" paragraph

Figure 14: Sync Timings

4.4.1.1 @ Internal Synchronization

Timings are controlled by camera. Using XML interface range ensures that timings are respected.

4.4.1.2 @ External Synchronization

- If *Granularity* is enabled ("On"):
  - T2 is controlled by user external generator signal period
  - T1 is controlled by camera
- If *Granularity* is disabled ("Off"):
  - T2 is controlled by user external generator signal period
  - T1 is controlled by user external generator pulse width

  In both cases, timings must be respected.

4.4.1.3 @Synchronization over CoaXPress

- If *Granularity* is enabled ("On"):
  - T2 is controlled by CoaXPress frame grabber "signal" period
  - T1 is controlled by camera
- If *Granularity* is disabled ("Off"):
  - T2 is controlled by CoaXPress frame grabber "signal" period
  - T1 is controlled by CoaXPress frame grabber "signal" pulse width

  In both cases, timings must be respected.

4.4.2 Max & Min FPS

Camera maximum FPS can be reached at default CoaXPress configuration. If you reduce CoaXPress speed (ex: CXP6 to CXP5) and/or topology (4 links to 2 links), the maximum FPS is reduced.

$$\boldsymbol{Max_{FPS}} = A\ frame\ rate\ calculator\ will\ be\ soon\ online\ on\ our\ Website.$$

$$You\ can\ contact\ Optronis\ support\ to\ get\ a\ Windows\ version\ of\ this\ frame\ rate\ calculator.$$

$$\boldsymbol{Min\_FPS = 50}$$

Maximum Frame Rate Examples (at default CoaXPress configuration):

CoaXPress cabling configuration	PixelResolution_X	PixelResolution_Y	Max Frame rate
CXP6_x4	2304	1720	506
	1920	1080	804
	1920	1024	848
	512	512	1687
	256	256	3336
	128	128	6523
	128	4	87417
CXP5_x4	2304	1720	452
	1920	1080	719
	1920	1024	758
	512	512	1507
	256	256	2981
	128	128	5828
	128	4	78106
CXP3_x4	2304	1720	253
	1920	1080	402
	1920	1024	424
	512	512	843
	256	256	1668
	128	128	3261
	128	4	43708

4.4.3 Max & Min Exposure Time

The maximum exposure time depends on current frame rate and can be calculated using this formula:

$$\boldsymbol{Min\_Exposure = 2\mu s}$$

$$\boldsymbol{Max\_Exposure = \frac{1}{Framerate} - Min\_Exposure}$$

4.5 Sync Out Output

The camera output Sync Out delivers a TTL signal reflecting camera frame acquisition. External synchronization may be operated in level detection mode. Please see the external synchronization timing for more information about resulting frame rates and exposure times.

The Sync Out output can be used to synchronize other devices as e.g. additional cameras or external light flashes.

Using camera accessory “Pigtail cable” (BNC adapter) is the easiest way to use Sync Out signal.

Note that:

- Sync Out signal period is the real effective frame delivered by the camera.
- Sync Out signal high time is the effective exposure time done by the camera.

4.6 Image Enhancement

4.6.1 Gamma Correction

User can apply a gamma correction with coefficient between 0.5 and 4.0 with 0.1 increments.

Gamma correction is controlled by XML entry:

- *GammaCoeff*

This entry uses values between 5 and 40 and with increment of 1. It is translated by the camera and corresponds to a gamma coefficient between 0.5 and 4.0 with 0.1 increments.

4.6.2 FPN/PRNU Corrections

Several corrections can be applied to the frame: FPN, PRNU, FPN+PRNU… These corrections are available only for firmwares versions ≥ 12.0.

These corrections are controlled by XML entries:

- *Correction*
- *Correction_Coeff_X*
- *Correction_Coeff_V*
- *Correction_UserGD*
- *Correction_DMean*
- *FFCSaveToFlash*

All corrections can be disabled by setting *Correction* to “None”. They are enabled by setting *Correction* to “FFC”.

As explain in paragraphs here after, these corrections are camera specific and based on reference frames. So before enabling any correction, you must generate theses reference frames for your camera(s). Several different corrections can be enabled:

- FPN Correction Only
- FPN and PRNU Correction

4.6.2.1 Generating Reference Frames and Correction Formula

- Disable all corrections (*Correction=" None"*).
- Set frame full resolution (X and Y)
- Grab a sequence of 100 "dark" frames (set camera cap, ensure that sensor is not lighted at all)
- Build an average frame D with these 100 frames and build its DP:
    - For each x (column), DP(x)=[D(x,0)+...+D(x,H-1)]/H
- Grab a sequence of 100 "grey" frames. Set lighting system/lens aperture to have a uniform light and a histogram centered at 70% of saturation (~178LSB in Mono8 pixel format).
- Build an average frame g with these 100 frames and build its GP:
    - For each x (column), GP(x)=[G(x,0)+...+G(x,H-1)]/H

The formula used for FPN and PRNU corrections is:

$$CORR(x,y) = UserGG(x)*(Uncorr(x,y)-DP(x)) + Avg(DP) + UserGD,$$

Where:

- UserGG(x) : factory initialized to ([Avg(GP)-Avg(DP)] / [GP(x) - DP(x)])
- CORR(x,y) : data of a pixel after a calibration
- UNCORR(x,y) : data of a pixel before carrying out a calibration
- DP(x) : black calibration data of the column x
- GP(x) : grey calibration data of the column x
- UserGD : user global dark offset fine adjustment between 0 and 127

4.6.2.2 Computing and Applying FPN Correction Only

- Proceed to the dark frame acquisition as described previously.
- Launch UCXP_Flash Optronis software to start the camera upload program with the USB cable connected to the camera.
- Click on "CP80-4 Calcul Offset Only" button and select frame D (average dark frame).
  The software will calculate the offset coefficients and store the parameters to the file 'offset.txt':

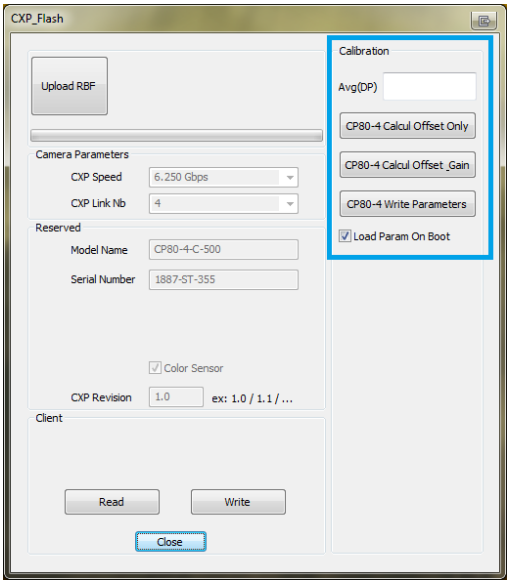


Figure 15: UCXP_flash software

- Tick "Load Param On Boot" button to load the correction at next camera power up.
- Then click on "CP80-4 Write Parameters" to write result into the camera.
- Power Cycle camera and enable could be used at next power up.

4.6.2.3 Computing and Applying FPN and PRNU Corrections

- Proceed to the dark frame acquisition as described previously.
- Launch UCXP_Flash Optronis software to start the camera upload program with the USB cable connected to the camera.
- Click on “CP80-4 Calcul Offset_Gain” button and select frame D (average dark frame) and then frame G (average grey frame).
  The software will calculate the offset coefficients and store the parameters to the file ‘offset_gain.txt’:

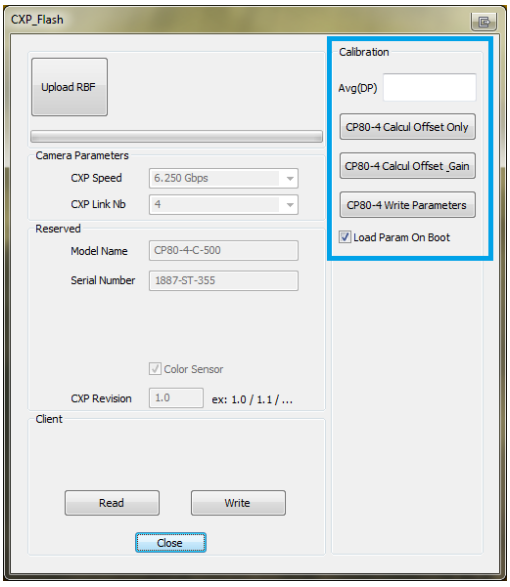


Figure 16: UCXP_flash software

- Tick “Load Param On Boot” button to load the correction at next camera power up.
- Then click on “CP80-4 Write Parameters” to write result into the camera.
- Power Cycle camera and enable could be used at next power up.

4.6.2.4 FPN/PRNU parameters reading/writing (camera RAM memory)

To read UserGG(x) and DP(x):

- Set the GenICam entry ‘Correction_Coeff_X’ to the desired x-coordinate between 0 and 2303.
- Then read the GenICam entry ‘Correction_Coeff_V’ that returns a 16-bits value:

Bits 8..0 : UserGG(x) between 0 and 511. This is the decimal value. The ‘real’ gain value is UserGG(x)/128.

Bits 15..9 : DP(x) between 0 and 127

4.6.2.5 FPN/PRNU Global gain fine adjustment

To modify UserGG(x):

- Set the GenICam entry ‘Correction_Coeff_X’ to the desired x-coordinate between 0 and 2303.
- Then read the GenICam entry ‘Correction_Coeff_V’ that returns a 16-bits value
- Modify only bits 8..0 (as bits from 15 to 9 contains DP(x)). This is a decimal value between 0 and 511. The ‘real’ gain value taken into account by the camera algorithm is UserGG(x)/128.

4.6.2.6 FPN/PRNU Global dark offset fine adjustment

To modify UserGD, set the GenICam entry ‘Correction_UserGD’ to the desired value between 0 and 127. Negative values are not allowed.

4.6.2.7 FPN/PRNU parameters save to flash

To save all the corrections applied to the camera and have them at the next power cycle you need to save its paremeters to flash by using *FFCSaveToFlash* XML command.

If you don't use *FFCSaveToFlash* command, you will need to rewrite all parameters at next power cycle.

4.6.3 Maximum framerate calculation method

Maximal framerate can be returned based on exposure time or based on sensor size.

Maximal framerate calculation method is controlled by XML entry:

- *MaxFrameRateExtended*

If set to "Default", the calculation of the maximal frame rate is based on sensor size.

If set to "Extended", the calculation of the maximal frame rate is based on exposure time (approximately 1/exposure time)

4.6.4 Offset and Gain Control

4.6.4.1 Predefined Setups

User can use 3 predefined gain setups or define its own user offset and gain setup.

Predefined gain setups are controlled by XML entry:

- *SensorOffsetGain*

Predefined values are: **"x1", "x1.5"** and **"x2"**. If **"User"** value is used instead, then gain is controlled by user (see here after paragraph).

4.6.4.2 User Setup

Predefined gain setups are controlled by XML entries:

- *SensorOffsetGain (must be set to "User")*
- *UserOffset*
- *UserGain*

UserOffset is an integer value between 0 and 1600 corresponding to an analog voltage applied to the sensor's ADC black level reference between 0 and 1.6V. Address is 0x6150.

UserGain is an integer value between 0 and 2000 corresponding to an analog voltage applied to the sensor's ADC gain reference between 0v and 2.0V. Address is 0x6154.

4.7 Counter Information

An optional counter information can be enabled.

When enabled, this counter information is integrated in the first pixels of every transferred frame and replace the first 96 bits (i.e. 12 pixels in Mono8 pixel format). This 96bits counter is built as follow:

- 16 first bits contain an image counter (incrementing with every frame transferred)
- 16 next bits for image gain (*SensorOffsetGain* = “x1”, “x1.5” or “x2”)
- 32 next bits for image horizontal offset (*OffsetX*)
- 32 next bits for image horizontal offset (*OffsetY*)

When disabled, no information is integrated in the transferred frames and all bits are pixel data.

Counter Information is controlled by XML entry:

- *AddCounterInformation*

4.8 Send Pattern Frame

Camera can enable a pattern which replace sensor data in camera output frame. See paragraph *4.1 Frame Format* to understand how to control frame parameters (X, Y, etc…).

When enabled, this pattern consists in a rolling 8bit counter starting at 0 on the 1st pixel of the 1st line. It is shifted by +1 on every line.

Example:

Line_1 0, 1, 2, 3, … , 255, 0, 1, 2, 3, …
Line_2 1, 2, 3, 4, …, 255, 0, 1, 2, 3, 4, …
…
Line_N-2 255, 0, 1, 2, 3, …, 255, 0, 1, 2, 3…
Line_N-1 0, 1, 2, 3, 4, …, 255, 0, 1, 2, 3
Line_N 1, 2, 3, 4, …, 255, 0, 1, 2, 3, 4
…

Pattern frame feature controlled by XML entry:

- *SendPatternFrame*

4.9 Save User Settings to Flash

The camera can boot using a specific user setup.

Using command save to flash save current camera configuration (frame resolution, fps, etc…). This configuration will be used after next power cycle.

Save to flash feature is controlled by XML entry:

- *SaveToFlash*

5 Camera Hardware Interface

5.1 Connectors and LED

5.1.1 Identify Connectors and LED Positions

5.1.1.1 CP80 series

Figure 17: CP80 HW Identification

5.1.1.2 CP90 series

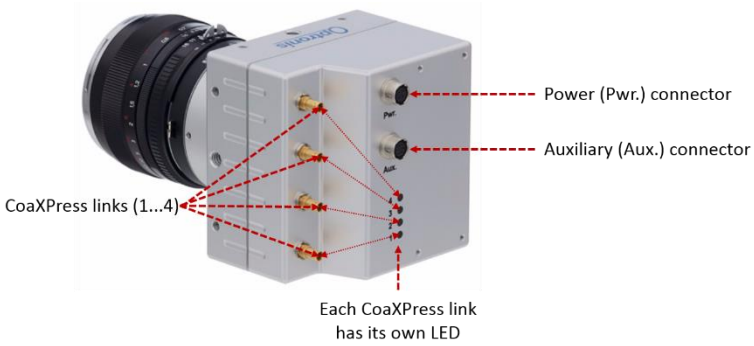


Figure 18: CP90 HW Identification

5.1.2 Powering Camera

Camera can be powered either by Power over Coaxpress (PoCXP) or using its external power connector.

5.1.2.1 Using PoCXP

When using PoCXP, the power is supplied by the Frame Grabber through CXP cable on cable n°1. Other cables are used only for data transfer.

Please refer to your Frame Grabber documentation for more information.

5.1.2.2 External Power Supply

Power connector is used to power camera when using an external power supply instead of power over CoaXPress feature (PoCXP).

The connector is labelled “P” for CP80 and “Pwr” for CP90.

Optronis Camera accessory “Power supply” is recommended when using an external power supply. Alternatively, your power supply must respect bellow characteristics:

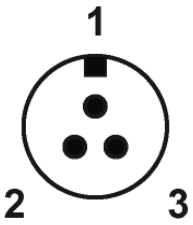
<table>
<tr><th>CP80 Series</th><th colspan="2">CP90 Series</th></tr>
<tr><td>Connector info:
Camera (P) connector type:
• Lemo EGG.0B.303CLL
Cable Connector:
• Lemo FGG0B303.CLAD56Z</td><td colspan="2">Connector info:
Camera (Pwr.) connector type:
• Hirose HR10A-7R-4S
Cable Connector:
• Hirose HR10A-7R-4P</td></tr>
<tr><td>Connector View:
 

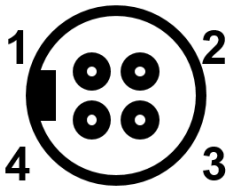
Figure 19: CP80 Power Connector</td><td colspan="2">Connector View:
 

Figure 20: CP90 Power Connector</td></tr>
<tr><td>Connector Pinout:</td><td colspan="2">Connector Pinout:</td></tr>
<tr><td>Pin 1: VCC</td><td>+24Volt +/-5% (Ripple < 200mV)
Inrush Current ~0,6A</td><td>Pin 1: VCC</td><td rowspan="2">+24Volt +/-5% (Ripple < 200mV)
Inrush Current ~0,6A</td></tr>
<tr><td>Pin 2: GND</td><td>Power Ground</td><td>Pin 2: VCC</td></tr>
<tr><td>Pin 3: Reserved</td><td></td><td>Pin 3: GND</td><td rowspan="2">Power Ground</td></tr>
<tr><td></td><td></td><td>Pin 4: GND</td></tr>
</table>

5.1.3 CoaXPress Connectors

CP80 Series	CP90 Series
Connector info: 4 x 75 Ω BNC connector. Compliant with IEC 61169-8 annex A, as required by CoaXPress specification.	Connector info: 4 x 75 Ω 1.0 / 2.3 DIN connector Compliant with IEC 61169-29 standard, as required by CoaXPress specification.
Remark: Connectors are labelled from 1 to 4	Remark: Connectors are labelled from 1 to 4

5.1.4 Auxiliary Connector

Auxiliary connector is used to access camera Sync In and Sync Out IOs and for firmware updates.

The connector is labelled “A” for CP80 and “Aux” for CP90.

Camera accessory “Pigtail cable” gives user 2 x 50 ohm BNC connectors to access Sync IN and Sync Out signals.

Camera accessory “Programming cable” allows an USB connection to a PC for firmware updates.

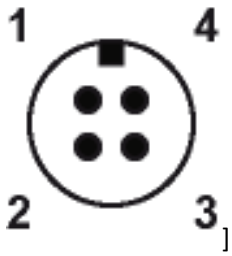
<table>
<tr><th colspan="2">CP80 Series</th><th colspan="2">CP90 Series</th></tr>
<tr><td colspan="2">Connector info:
Camera (A) connector type:
• LEMO EGG.0B.304CLL
Cable Connector:
• LEMO FGG.0B.304.CLAD56Z</td><td colspan="2">Connector info:
Camera (Aux.) connector type:
• Hirose HR10A-7R-6S
Cable Connector:
• Hirose HR10A-7R-6P</td></tr>
<tr><td colspan="2">Connector View:
 

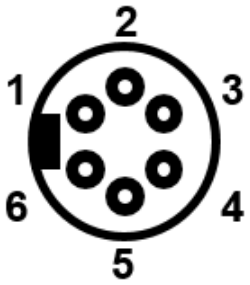
Figure 21: CP80 Auxiliary Connector</td><td colspan="2">Connector View:
 

Figure 22: CP90 Auxiliary Connector</td></tr>
<tr><td colspan="2">Connector Pinout:</td><td colspan="2">Connector Pinout:</td></tr>
<tr><td>Pin 1: Sync IN</td><td>External Synchronization Input.
TTL level:
< 0,8 Volt (low)
> 2 Volt (high)</td><td>Pin 1: Sync IN</td><td>External Synchronization Input.
TTL level:
< 0,8 Volt (low)
> 2 Volt (high)</td></tr>
<tr><td>Pin 2: Reserved</td><td></td><td>Pin 2: Reserved</td><td></td></tr>
<tr><td>Pin 3: GND</td><td>Ground</td><td>Pin 3: Sync Out</td><td>External Synchronization Output.
TTL level @ high impedance,
0 to 2 Volt @ 50 Ohm.</td></tr>
<tr><td>Pin 4: Sync Out</td><td>External Synchronization Output.
TTL level @ high impedance,
0 to 2 Volt @ 50 Ohm.</td><td>Pin 4, 5, 6: GND</td><td>Ground</td></tr>
</table>

5.1.4.1 Sync In

The Sync In camera input is TTL adapted (high impedance). To adapt to 50 Ohm, please add an external 50 Ohm termination. The input principle is described by Figure 23.

To operate Sync In correctly, a Sync In driver has to be used with a minimum sink current (TTL low level) of 5mA.

Source Current (TTL High Level) of the Sync In Driver is negligible (0mA)

Sync In input voltage limits are: [-5V ⇔ +30V].
Voltages beyond these limits may damage camera.

Easiest driver circuit is a transistor working in open collector configuration.

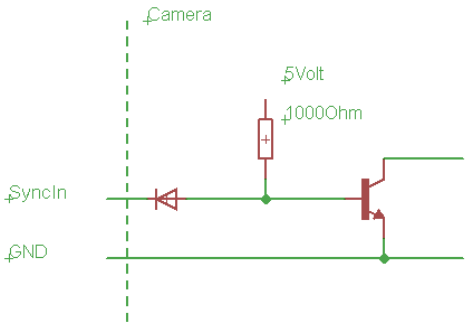


Figure 23: Sync In Input Schematics

5.1.4.2 Sync Out

Sync Out has a built in 50 Ohm driver. The output principle is described by Figure 24.

At 50 Ohm termination, the driver voltage is between 0 (low level) to ≈2 Volts (high level).

At high impedance termination, the driver voltage is in between 0 (low level) to ~4 Volts (high level).

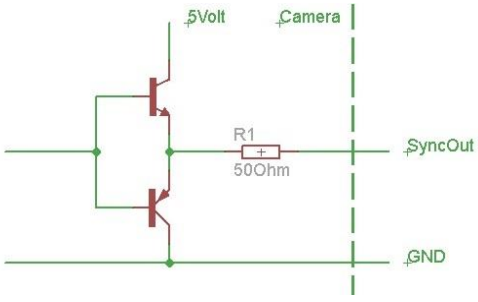


Figure 24: Sync Out Output Schematics

5.1.5 CoaXPress Status LEDs

LED colors and states are defined by CoaXPress standard. The table here after is listed all possibilities.

Camera LEDs Colors	Camera LED States
Red	Off
Orange	Solid
Green	Fast Flash 12.5Hz (20ms on, 60ms off)
	Slow Flash 0.5Hz (1s on, 1s off)
	Slow pulse 1Hz (200ms on, 800ms off)

Each 4 CoaXPress links / connector has its dedicated LED indicating its status. The table here after describes camera link status for every possible LED state.

Camera Link State	LED state	
No power		Off
System booting		Solid orange or Led Chaser
Powered, but nothing connected (only for power over power connector)		Slow pulse red
Link detection in progress, PoCXP active		Fast flash green
Link detection in progress, PoCXP not in use		Fast flash orange
Camera / Grabber incompatible, PoCXP active		Slow flash alternate red / green
Camera / Grabber incompatible, PoCXP not in use		Slow flash alternate red / orange
Camera connected, but no data being transferred		Slow pulse green
Camera connected, waiting for event (e.g. trigger, exposure pulse)		Slow pulse orange
Camera connected, transferring frames		Solid green
Error during data transfer		500ms red pulse
System error		Fast flash red
Firmware Update		Solid red

6 Camera Control Interface

6.1 GenICam XML Interface

6.1.1 CoaXPress GenICam Compliant Interface

The camera control is based on camera registers accesses (read and/or write). Some of these registers are defined by CoaXPress standard and others are Optronis specific and are used to controlled camera specific features.

The camera firmware contains a GenICam / CoaXPress compliant XML file which gives access to all required camera registers and thus allows a simplified control of the camera by any CoaXPress compliant Frame Grabber.

This XML file consists in entries. Each of these entries correspond to a camera feature and use its own access type, values, ranges, etc… Paragraphs here after are explaining more in details how to use this XML file.

6.1.2 XML Entry Access Mode

Each XML entry have a specific access mode:

- RO: Read Only
  This entry can be only read, any write access will be ignored.
- RW: Read and Write
  This entry can be read and write.
- WO: Write Only
  This entry is supposed to be write only.

6.1.3 XML Entry Types Description

Each XML entry use a specific type of data.

- String
- Integer
- Float
- Command: (for example, AcquisitionStart() or AcquisitionStop())
- Enumeration: list of allowed value. (for example, “On”, “Off”)
- IntSwissKnife: A formula computing an Integer using some other XML entries.

6.1.4 XML Entry Allowed Values

Some XML entries have a limited range of possible values depending on their type.

6.1.4.1 Numbers (Integer, Float, …)

For numbers (integer, float, etc…), limits are defined by:

- All these entries consist in a 4bytes register access.
- Masked = If a bit mask must be applied when accessing this value
- Min = Minimum possible value
- Max = Maximum possible value
- Inc = Increment

A value X is defined by formula $X = MinValue + N\ x\ Inc$
This value must respect $Min \leq X \leq Max$

6.1.4.2 Strings

For Strings, the limit is the length **"L"** (number of characters).

6.1.4.3 Command

A command consists in writing a fixed value = command value **"CV"** in a camera register. All these entries consist in a 4bytes register access.

6.1.4.4 Enumeration

XML gives a list of values. Only listed values are valid. All these entries consist in a 4bytes register access.

6.1.5 XML Masked Values

Some XML entries are sharing the same camera registers or use only a limited number of bits. They use bit masking to access the dedicated bits.

These entries use XML parameters "LSB" and "MSB" to identify the right bits.

Example:

If an XML entry has a *"Mask: LSB:31-MSB:16"*, it means that the you access a 32bit register and only the upper 16 bits are used by this entry.

6.1.6 Acquisition/Live Stop Required

Some XML features require to stop image acquisition to be modified. Please be careful and stop camera image acquisition when it is required.

In XML entries description paragraph, such entries are greyed out as shown in above example to ease their identification.

Example of greyed out XML entry:

Width @ 0x6000	RW	Integer	Min: 128 Max: WidthMax Inc: 128	This feature represents the actual image width expelled by the camera (in pixels).

If you modify a feature requiring acquisition to be stopped without stopping acquisition, camera behavior may become unstable and a power cycle may be required.

6.2 XML Main Entries - Features Description

Main XML entries are described in below tables. For more information and full XML content, you can retrieve full camera full XML file using your frame grabber XML tools.

Xml entry Name Address	Access Mode	Type	Valid Values	Description
DeviceControl category				
DeviceVendorName @ 0x2000	RO	String	L = 32	Name of the manufacturer of the device.
DeviceModelName @ 0x2020	RO	String	L = 32	This feature provides the model of the device.
DeviceFirmwareVersion @ 0x2090	RO	String	L = 32	Version of the firmware in the device.
DeviceID @ 0x6028	RO	String	L = 16	This feature stores a camera identifier.
ImageFormatControl category				
WidthMax @ 0x6000	RO	Integer	Mask: LSB:15-MSB:0	Maximum width (in pixels) of the image. The dimension is calculated after horizontal binning, decimation or any other function changing the horizontal dimension of the image.
HeightMax @ 0x6004	RO	Integer	Mask: LSB:15-MSB:0	Maximum height (in pixels) of the image. This dimension is calculated after vertical binning, decimation or any other function changing the vertical dimension of the image.
Width @ 0x6000	RW	Integer	Mask: LSB:31 - MSB:16 Min: 128 Max: WidthMax Inc: 128	This feature represents the actual image width expelled by the camera (in pixels).
Height @ 0x6004	RW	Integer	Mask: LSB:31-MSB:16 Min: 4 Max: HeightMax Inc: 4	This feature represents the actual image height expelled by the camera (in pixels).
OffsetX @ 0x60D0	RW	Integer	Min: 0 Max: OffsetXMax Inc: 16	Horizontal offset from the origin to the area of interest (in pixels).
OffsetY @ 0x60D4	RW	Integer	Min: 0 Max: OffsetYMax Inc: 1	Vertical offset from the origin to the area of interest (in pixels).
PixelFormat @ 0x60F0	RW	Enumeration	List: “Mono8” “BayerBG8”	This feature indicates the format of the pixel to use during the acquisition.

Xml entry Name Address	Access Mode	Type	Valid Values	Description
AcquisitionControl category				
AcquisitionMode @ 0x6018	RW	Enumeration	List: "Continuous" "SingleFrame" "CoaxPress"	This feature controls the acquisition mode of the device. • Continuous: Camera internal trig • SingleFrame: Camera ext. IO trig • CoaxPress: trig over CXP
AcquisitionStart @0x601C	RW	Command	CV = '1' Mask: LSB:31-MSB:24	This feature starts the Acquisition of the device.
AcquisitionStop @0x601C	RW	Command	CV = '0' Mask: LSB:31-MSB:24	This feature stops the Acquisition of the device at the end of the current Frame.
AcquisitionFrameRate @ 0x60C0	RW	Float	Min: 50 Max: dynamic, depends on other parameters Max available at address 0x60C4	Frame rate in Hz.
ExposureTime @0x60C8	RW	Float	Min: 2 Max: dynamic, depends on other parameters Max available at address 0x60CC	Sets the Exposure time (in microseconds) when ExposureMode is Timed. This controls the duration where the photosensitive cells are exposed to light.
Granularity @ 0x6018	RW	Enumeration	List: "On" "Off"	Granularity mode. If "On", the exposure is controlled by "ExposureTime" entry. If "Off", exposure is controlled by Sync In pulse width (External or CoaXPress trig modes only).
TransportLayerControl category				
PayloadSize	RO	IntSwissKnife		Provides the number of bytes transferred for each image or chunk on the stream channel. This includes any end-of-line, end-of-frame statistics or other stamp data. This is the total size of data payload for a data block.
Support category				
Standard @ 0x0000	RO	Integer		CXP Bootstrap register Standard.
Revision @ 0x0004	RO	Integer		CXP Bootstrap register Revision.

Xml entry Name Address	Access Mode	Type	Valid Values	Description
CXP category				
ConnectionReset @ 0x4000	RW	Integer		CXP Bootstrap register ConnectionReset.
DeviceConnectionID @ 0x4004	RO	Integer		CXP Bootstrap register DeviceConnectionID.
MasterHostConnectionID @ 0x4008	RO	Integer		CXP Bootstrap register MasterHostConnectionID.
ControlPacketDataSize @ 0x400C	RO	Integer		CXP Bootstrap register ControlPacketDataSize.
StreamPacketDataSize @ 0x4010	RW	Integer		CXP Bootstrap register StreamPacketDataSize.
ConnectionConfig @ 0x4014	RW	Enumeration	List: “CXP3_X1” “CXP3_X2” “CXP3_X4” “CXP5_X1” “CXP5_X2” “CXP5_X4” “CXP6_X1” “CXP6_X2” “CXP6_X4”	CXP Bootstrap register ConnectionConfig.
ConnectionConfigDefault @ 0x4018	RO	Integer		CXP Bootstrap register ConnectionConfigDefault.
TapGeometry	RO	Enumeration	List: “X1Y1”	TapGeometry
Optronis category…				
IndicatorLamps @ 0x601C	RW	Enumeration	List: “On” “Off” Mask: LSB:8-MSB:15	Switch ON/OFF indicator lamps.
SendPatternFrame @ 0x601C	RW	Enumeration	List: “On” “Off” Mask: LSB:16-MSB:23	Send pattern frame.
ColorSensor @ 0x6038	RO	Integer	Min: 0 Max: 1 Inc: 1	Indicates if camera has camera a color sensor. ‘0’ means mono sensor. ‘1’ means color sensor.
MaxFrameRateExtended @ 0x60E4	RW	Enumeration	List: “Default” “Extended”	Maximum frame rate calulation method.
DualROIMode @ 0x60D8	RW	Enumeration	List: “On” “Off” Mask: LSB:0-MSB:7	Dual ROI mode control.

Xml entry Name Address	Access Mode	Type	Valid Values	Description
…Optronis category				
SubSamplingROI1 @ 0x60D8	RW	Enumeration	List: “On” “Off” Mask: LSB:8-MSB:15	ROI 1 subsampling mode control.
SubSamplingROI2 @ 0x60D8	RW	Enumeration	List: “On” “Off” Mask: LSB:16-MSB:23	ROI 2 subsampling mode control. Requires dual ROI mode to be enabled.
Height_ROI1 @ 0x60DC	RW	Integer	Min: Max: IMAGE_HEIGHT_MAX-HEIGHT_ROI2 Inc: 1 Mask: LSB:15-MSB:0	ROI 1 vertical size (line number) control.
Height_ROI2 @ 0x60DC	RW	Integer	Min: 0 Max: 1 Inc: 1 Mask: LSB:31-MSB:16	ROI 2 vertical size (line number) control. Requires dual ROI mode to be enabled.
ROI1_OffsetY @ 0x60E0	RW	Integer	Min: 0 Max: OFFSET_Y_ROI2- HEIGHT_ROI1 Inc: 1 Mask: LSB:15-MSB:0	ROI 1 vertical offset control.
ROI2_OffsetY @ 0x60E0	RW	Integer	Min: OFFSET_Y_ROI1 + HEIGHT_ROI1 Max: HEIGHT_MAX - HEIGHT_ROI2 Inc: 1 Mask: LSB:31-MSB:16	ROI 2 vertical offset control. Requires dual ROI mode to be enabled.

Xml entry Name Address	Access Mode	Type	Valid Values	Description
…Optronis category				
SensorOffsetGain @ 0x6138	RW	Enumeration	List: “1” “1.5” “2” “User”	Offset and Gain control. See paragraph 4.6.4
UserOffset @ 0x6150	RW	Integer	Min: 0 Max: 1600 Inc: 1	Offset and Gain control when using “User” own setup. See paragraph 4.6.4
UserGain @ 0x6154	RW	Integer	Min: 0 Max: 2000 Inc: 1	Offset and Gain control when using “User” own setup. See paragraph 4.6.4
GammaCoeff @ 0x6158	RW	Integer	Min: 5 Max: 40 Inc: 1	Gamma correction coefficient.
AddCounterInformation @ 0x6266	RW	Enumeration	List: “Yes” “no” Mask: LSB:23-MSB:16	AddCounterInformation
Correction @ 0x6266	RW	Enumeration	List: “None” “FFC” Mask: LSB:31-MSB:24	FPN/PRNU correction control. See paragraph 4.6.2
Correction_Coeff_X @ 0x6140	RW	Integer	Min: 0 Max: 2303 Inc: 1	FPN/PRNU correction control. See paragraph 4.6.2
Correction_Coeff_V @ 0x6144	RW	Integer		FPN/PRNU correction control. See paragraph 4.6.2
Correction_UserGD @ 0x6211	RW	Integer	Min: 0 Max: 127 Inc: 1	FPN/PRNU correction control. See paragraph 4.6.2
Correction_DMean @ 0x6254	RW	Integer	Min: 0 Max: 127 Inc: 1	FPN/PRNU correction control. See paragraph 4.6.2
FFCSaveToFlash @ 0x6148	RW	Command	CV = ‘1’ Mask: LSB:31-MSB:24	Save FPN / PRNU corrections parameters to flash. See paragraph 4.6.2
SaveToFlash @ 0x6024	RW	Command	CV = ‘1’ Mask: LSB:31-MSB:24	Save user configuration in flash.
ReverseY @ 0x6298	RW	Enumeration	List: “Yes” “no” Mask: LSB:23-MSB:16	Invert both Y axis reference and line readout order. See paragraph 4.1.5.

7 Firmware Update

Camera firmware update is available through camera Aux connector by using the camera accessory "Programming cable". This cable allows an USB connection to a PC and must be used together with Optronis Windows update software "UCXP_flash.exe".

Before updating camera firmware, please check product website page (download tab) to be sure that you have:

- The Last Firmware Version
- The Last Firmware Update Software Version (Setup_UCXP_Flash_vx.y.z.exe)

Update process is described in "ReadMe.pdf" file generated when installing UCXP Flash.exe. Please check this file to get the last up to date firmware update process description. Default folder is:

C:\Program Files (x86)\Optronis\UCXP_Flash_vx.x.x\Documentation

Please find below a quick description of the updating process:

1) If your software is out of date or if this is the first use:
   Execute last version of "Setup_UCXP_Flash_vx.y.z.exe" to install Firmware Update Software and Programming cable Drivers.
   Restart computer.
2) Connect USB cable to PC and camera Aux input.
   Use PC rear USB ports as front ports are often not working.
3) Power cycle the camera.
4) Start UCXP_Flash.exe
5) Select your camera series

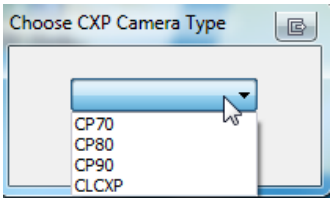


Figure 25: Camera Series Selection

6) When UCXP_flash.exe is connected to the camera, camera LEDs become solid RED.
   Click on "Upload RBF" button and select the new firmware (.rbf file)

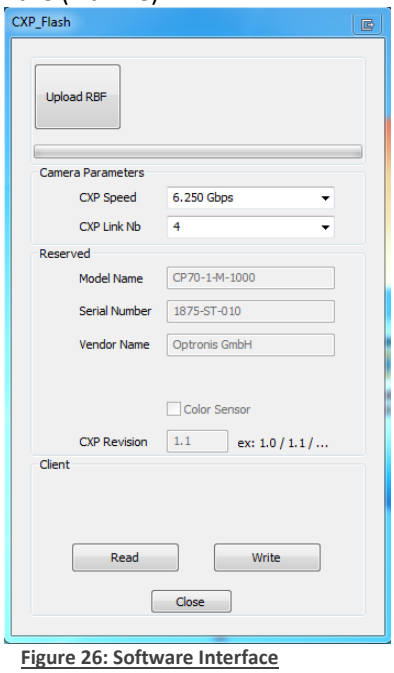


Figure 26: Software Interface

7) Wait end of process (10 to 20 minutes, depending on camera and firmware size)
   Power cycle camera when programming is finished.

If remaining time is higher than 20min, it often means that the cable is not well detected. Close software and end "UCXP_flash" process if it is still running.
Choose another USB port, power cycle camera and restart software.

8 Revisions

8.1 Manual Revision

Manual Revision	Date	Description
J	29/03/2018	• Update content
I	29/01/2018	• Update content • New presentation and layout • Synchronized content with datasheet v10/2016 • Add Gamma Correction feature • Update User Offset & Gain features • Add Analog Offset & Gain features • Add User Setup Flash Saving feature

8.2 Firmware Revision

Firmware Revision	Date	Description
v13.1.4	18/01/2018	• Minor corrections • Add Gamma Correction feature • Update User Offset & Gain features • Add Analog Offset & Gain features • Add User Setup Flash Saving feature
V13.0.3	20/11/2017	• Minor corrections • Correct Bayer Format XML value (color cameras)