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OWL 640T

Model: OW1.7-VS-CL-640-T

USER MANUAL





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1. INTRODUCTION

1.1 Scope

This manual covers the Owl 1280 digital camera and all applicable components. Raptor recommends that this manual be used to optimize camera operation.

1.2 Camera Care

Raptor cameras require no regular maintenance except occasional external cleaning of the sensor window (the glass window between the camera sensor and the microscope or lens). Should any other issues occur please contact your local agent.

To clean the sensor window: gently wipe the face of the sensor window with a small amount of optical grade isopropyl alcohol and lens paper. Apply forced air again to remove any loose particles.

CAUTION — The camera's sensor, and circuits are sensitive to static discharge. Ensure you are using a static strap or are completely grounded at all times to release any static energy before you clean the window.

CAUTION — Do not use acetone.

1.3 CameraLink Cable

If using a CameraLink cable not supplied direct from Raptor, for CE compliance we recommend using a screened CameraLink cable with ferrite (100 ohms at 100MHz) fitted as close to the camera as possible.

2. SPECIFICATION

2.1 Camera Specification

The OWL 640T digital camera is designed for applications requiring visible to SWIR imaging (600-1700nm). The OWL 640T camera uses an InGaAS sensor with a resolution of 640 x 512 in a 12-bit digital output. High-speed low-noise electronics provide linear response and sensitivity for rapid image capture.

The Camera Link digital interface provides the most stable platform for data transfer and the camera will work on any Camera Link standard card.

٨	Software Develo	nmont Kit (SUK)	is available.	for interfacing	with custom	coftware
А	Soltware Develo	ршенскіс (JUN)	IS available	ior interracing	with custom	Soltware.

SPECIFICATION					
Sensor Type	InGaAs PIN-Photodiode				
Active Pixel	640 x 512				
Pixel Pitch	10μm x 10μm				
Active Area	6.4mm x 5.12mm				
Spectral response ¹	0.6µm to 1.7µm				
Readout Noise (RMS) LG = Low Gain HG = High Gain	LG: <190 electrons (160 electrons typical) HG: <50 electrons (47 electrons typical)				
Quantum Efficiency	>80% @ 1.55μm				
Full Well Capacity	LG: 450ke- HG: 10ke-				
Pixel Operability	>99%				
Digital Output Format	12 bit Camera Link (Base Configuration)				
Dark Current (e/p/s)	<19,000 @ 15°C				
Exposure time	LG: 300µs to 92.5ms HG: 600µs to 86.5ms				
Frame Rate	10 to 60Hz				
Dynamic Range	LG: 69dB, HG: 47dB				
Optical Interface	C-mount (selection of SWIR lenses available) or M42				
Trigger interface	Trigger IN and OUT – TLL compatible				
Power supply	12V DC ± 0.5V				
TE Cooling	Active				
Image Correction	3 point NUC (offset, gain & dark current) + pixel correction				
Functions Controlled by Serial Communication	Exposure, Intelligent AGC, Non-Uniformity Correction, Gamma, Pk/Av, ROI				
Camera Power Consumption ²	<3W with TEC OFF, NUC ON <5W with TEC ON, NUC ON				
Operating Case Temperature ³	-20°C to +55°C				
Storage Temperature	-30°C to +60°C				
Dimensions (L*W*H) ⁴	50mm x 67.60mm x 50mm				
Weight	247g				

Note 1: Optional filters available: Shortpass, Longpass or Bandpass Note 2: Measured in ambient of 25°C with adequate heat sinking Note 3: Extended operating temperature range on request

2.2 Mechanical Outline



3D drawings (STEP) are available upon request.

3. GETTING STARTED

3.1 System Overview



- 1. NOT IN USE
- 2. 3M CameraLink connector (TxOUT +comms) Part #: 12226-1150-00FR
- 3. SMA connector: Trigger Out. Single ended, source impedance = 51Ω , capable of sinking and sourcing 32mA and will have an output voltage of 3.3v i.e. TTL compatible.
- 4. SMA connector: Trigger In. Single ended, termination impedance = 510 Ω , capacitive load = 200 pF, TTL compatible.
- 5. 4 Pin Hirose connector Part #: HR10A-7R-4PB(73)

3.2 Mounting to Microscope

The OWL 640T has a standard C-Mount that should easily screw onto any microscope port.

3.3 Mounting to a tripod or optical table

The camera has a $\frac{1}{20}$ BSW (Whitworth), threaded hole to mount to a tripod or an optical table. The image below shows an optical table mount with the $\frac{1}{20}$ BSW thread.



3.4 3rd PARTY SOFTWARE

Raptor supports a range of 3rd party software packages as per the matrix below.

	XCAP	XCLIB	NI Labview	Micromanager
Hawk 252				
Falcon III				\checkmark
Eagle			\square	$\overline{\checkmark}$
Owl 320 High Speed				
Owl 640M			V	\checkmark
Owl 640 II			V	\checkmark
Owl 640T				
Ninox 640 II			V	\checkmark
Owl 1280			\square	
Ninox 1280			V	

✓ - Software tested by Raptor Photonics

☑ - Software tested by other companies

Blank - The camera has not been tested or is not supported by this software

In this guide, there is a quick overview of XCAP (<u>http://www.epixinc.com/support/files.php</u>) and Micro-Manager (<u>https://micro-manager.org</u>). Should you have other software support specific needs, please do not hesitate to contact our sales team on <u>sales@www.raptorphotonics.com</u>.

3.5 Connecting your camera to a computer

- Boot up the computer.
- Insert EPIX software key dongle into a USB port of your PC (the red light on the dongle should light up).
- Use the Camera Link cable to connect the camera to the computer. Be sure to use the Camera Link port closest to the trigger and power connectors on the camera. The 2nd port is not in use.
- Carefully thread the C-mount lens onto the camera's lens ring, rotating the lens in a clockwise direction until it is securely fastened. Use the lens controls to adjust focus. We suggest that the camera be mounted on a tri-pod or an optical bench.
- Connect the 12V power supply to the camera.

The Owl 640T camera is compatible with all types of Camera Link frame grabber. However, our cameras are extensively tested using Epix Inc equipment's XCAP, for this reason we recommend XCAP software.

If using a CameraLink cable not supplied direct from Raptor, for CE compliance we recommend using a screened CameraLink cable with ferrite (100 ohms at 100MHz) fitted as close to the camera as possible.

4. EPIX XCAP

For minimum computer system requirements, please contact Epix for the latest information.

4.1 Download and Install XCAP

Using the following link, <u>http://www.epixinc.com/support/files.php</u>, please select the appropriate version of XCAP for your computer. Please ensure you are downloading from the section labelled. *Pre-release version with support for the latest cameras and latest PIXCI® imaging boards*. Open the downloaded file when complete and follow the onscreen instructions. Be sure to accept the board driver installation.

4.2 Operating your camera using XCAP

1. Open XCAP from within your operating system enabling administrative privileges.

2. Select PIXCI dropdown menu and select PIXCI Open Close, Figure 1 should appear.

1 PIXCI® Open/Clo	PIXCI® Open/Close					
Options						
Multiple Devices	Advanced					
Camera & Format	Driver Assistant					
Open Close C	Cancel Board Info					

Figure 1: Open / Close

3. Select Close, and then Click on the Camera & Format button.

4. Using the dropdown menu scroll down and select Raptor Photonics OWL 640T from the list (Figure

2). Selecting OK when done.

Model	
Frame Grabber Model	
PIXCI E8	
PIXCI® E8	
Camera selection is preset, as pre-pr	ogrammed
into the DIVCIE ES. You may choose a	n alternate
The the PIACIS Ec. Tou may choose a	naliemate
camera, or choose 'Generic Came	ra Link'.
camera, or choose 'Generic Came	ra Link'.
camera, or choose 'Generic Came	ra Link'.
camera, or choose 'Generic Came Frame Grabber Preset Camera & Format Generic Camera Link	ra Link'.
camera, or choose 'Generic Came Frame Grabber Preset Camera & Formal Generic Camera Link Configure Software for Camera & Forma	ra Link'.
camera, or choose 'Generic Came Frame Grabber Preset Camera & Format Generic Camera Link Configure Software for Camera & Forma Raptor Photonics Owl 640 T	ra Link'.
camera, or choose 'Generic Came Frame Grabber Preset Camera & Formal Generic Camera Link Configure Software for Camera & Forma Raptor Photonics Owl 640 T	ra Link'.
camera, or choose 'Generic Came Frame Grabber Preset Camera & Format Generic Camera Link Configure Software for Camera & Forma Raptor Photonics Owl 640 T	ra Link'. at Search
camera, or choose 'Generic Came Frame Grabber Preset Camera & Format Generic Camera Link Configure Software for Camera & Forma Raptor Photonics Owl 640 T	ra Link'. at Search Setup
camera, or choose 'Generic Came Frame Grabber Preset Camera & Format Generic Camera Link Configure Software for Camera & Forma Raptor Photonics Owl 640 T Open w. Last used Video Open w. Default Video Set	ra Link'. st Setup up

Figure 2: Camera Selection

5. Select Open and the viewing and control screens, Figure 3, will now open. Two windows should open, a viewing window (Left) and a control window (Right).



Figure 3: XCAP Camera Control Screen

6. The camera controls are pre-configured in EPIX.

7. The control window on the right should reflect your chosen camera. For example, for the Owl 640T, it should read - EPIX PIXCI EL8: Raptor Photonics OWL 640T. If not, you need to select a different camera.

8. Check that the camera is communicating, see animated icon (Figure 4) on bottom right of control screen.



Figure 4: Active Communication

9. You are now configured and connected, ready to acquire an image.

10. Check the Serial Connect box (to establish serial communication to the camera). This should contain a tick (as circled in Figure 5).

11. Check the live button (as circled in Figure 5).

PIXCI® E8	Raptor Photonics Owl 840 T
Capt Preset Norm	NUC TEC Misc Info
Buf Res Trig	Communication
	Serial Mode Min. Up/Dnload 👻
Current Buffer	Serial Retries 2
	Serial Checksum Disabled 👻
Frame Buffers	Serial Log None 💌
Field Count	Export Sommeride
9915	
Clear Buffers	
• Live Shap	

Figure 5: Image Capture

12. You should now see an image. On the bottom of the screen, you should see something similar to the following: *Frame: O Size: 640x512 Resize 0.7x0.7 Video: 25.0fps Capture: 25.0 fps Display: 25.0fps*.



Figure 6: Live Image Capture Window

4.3 Changing the settings on XCAP

You have the ability to change several settings to control the camera through the tabs in the control window of the EPIX software.

4.4 Exposure

Click on the Gain Tab.

There is an option for Auto Level Control (ALC). When Auto Level Control is unchecked, you can manually adjust the exposure and digital gain using the sliders or entering a specific value in the field. It is recommended to start with auto gain on to get an image, then turning it off to fine-tune your image.

PIXCI® E8	Raptor Photonics Owl 640 T
Capt Preset Norm	NUC TEC Misc Info
Buf Res Trig Capture - Buffers	Port Gain Trigger Auto Auto ROI
	Analog Gain Low
Current Buffer	Auto Analog Gain Control
0	Digital Gain 0.778 (dB)
Frame Buffers	0 20 dB 4
Field Count	
16528	
	Exposure & Rate
Clear Buffers	Frame Period 40.000 (msec.)
	Exposure 4.473 (msec.)
	0 10 msec. 20 3
Live Snap	Auto Level Control 🔽 Dnioad Settin
Unlive Reset a	

Figure 7: Gain Tab

4.5 Trigger

Use this tab to select the Readout Mode, and a Fixed Frame Rate value.

PIXCI® E8	Raptor Photonics	Owl 640 T			
Capt Preset Norm	NUC TEC Misc	Info			
Buf Res Trig Capture - Buffers	Port Gain Irigger	Auto Auto ROI			
	Readout Mode	Live 💌			
Current Buffer	Trigger Polarity	Rising Edge 👻			
0	Trigger Delay	0.000 (µsec.)			
Frame Buffers	Frame Rate 25.00 Hz 🔹				
Field Count					
1.000					
Clear Buffers	Frame Per	riod 40.000 (msec.)			
	Expos	ure 4.473 (msec.)			
	0 10 mseo.	20			
Live Snap	Auto Level Control	Dnload Settin			

Figure 8: Trigger Tab

4.6 Auto

On this Tab, you can select the parameters for the Automatic Level Control, Including the speed, and spread of signal. In this mode, the FPGA of the camera will automatically adapt the exposure time and digital gain within the given frame rate to optimise the image quality.

PIXCI® E8	Raptor Photonics	Owl 640 T			
Capt Preset Norm	NUC TEC Misc Info				
Buf Res Trig Capture - Buffers	Port Gain Trigger	Auto Auto I	२०।		
	ALC from Peak	20 (%)	-		
Current Puffer	ALC from Mean	80 (%)	4		
	ALC Level	ALC Level 700			
Frame Buffers	ALC Speed	ALC Speed 7			
68	AGC Speed	7	*		
Field Count 22215					
Class Budday	-Exposure & Rate-		100		
Clear Durrers	Frame Per	iod 40.000 (m	sec.)		
	Expos	ure 26.460 (m	sec.)		
	0 10 mseo. <u>L i i i i i i</u>	20 1 1 1 1	1.1.3		
		223 No.			

Figure 9: Auto Tab

4.7 Auto ROI

Use this tab to set the Region of Interest (ROI) used for the Auto Level Control; ROI gain will set an overlay onto the image, so you can track its position. By default, this will be set to account for the

whole image. Edit the values of Offset, Width and Height to place the Auto Level Control ROI over the image.

IXCI® E8	Raptor Photonics Owl 840 T
Capt Preset Norm	NUC TEC Misc Info
Buf Res Trig apture - Buffers	Port Gain Trigger Auto Auto ROI ALC Region of Interest
	ROI Highlight None 👻
	ROI X Offset 🜡 🚬 🚑
Current Buffer	ROI X Width 624
0	ROI Y Offset 🛃 🚛
Frame Buffers	ROI Y Height 496
Field Count	/America
24294	
	Exposure & Rate
Clear Buffers	Frame Period 40.000 (msec.)
	Exposure 26.460 (msec.)
	0 10 mseo. 20 <u>1 i i i i i i i i i i i i i i i i i i i</u>
Live Snap	Auto Level Control 🔽 Daload Setti

Figure 10: Auto ROI Tab

🛅 EPIX	® PIXCI®: Vie	ew #1					A DESCRIPTION OF TAXABLE PARTY.		A DESCRIPTION OF TAXABLE PARTY.	
File V	iew Examine	Modify	Measure Draw	Aoi Capture	Help			_		
4		1					-			
		ř.							🖞 EPIX® PIXCI® ECB2: Rapto	or Photonics Owl-CL-640: Capture
⇒									PIXCI® ECB2 Capt Preset Norm	Raptor Photonics Owl-CL-840
$\overline{}$									Buf Res Trig	Port Gain Trigger Auto Auto ROI
M								Ш	-Capture - Resolution-	POLICity of the POLICity
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<u> </u>		Ť.					Same Statestation		Image Orientation	ROI X Width 148
		and the				1			Bottom R-L	ROI Y Offset 340
		1							Max Video Window	[Max ROI]
Σ				and and in	Antibio			0	Set Video Window	-Exposure
			1.00				and the second			Exposure 4.165 (msec.)
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									Live Snap	Auto Level Control 🔽 Doload Setting
									C Unlive Reset >	
		e	4			5 8 - 1				

Figure 11: Active ROI Dark Area

In Figure 11, the ROI is contained within the small white box, and as such when centred on the black case we can see the minor scratches but the sun light on the carpet has saturated the image.



Figure 12: Active ROI

However, when we move the ROI box to the carpet, Figure 12, where the sun is shining the camera adjusts the exposure, but the box becomes too dark to see any detail. This is an extreme example used with our Owl 640 camera to illustrate this feature.

4.8 NUC

On this tab, you can select the parameters for the on-board Non Uniformity Correction (NUC); select the 3point NUC Offset, Gain & Dark shown in Figure 13. Figure 14 and Figure 15 show the effect of the NUC off and on.



Figure 13: Controlling the NUC Status



Figure 14: NUC Off

Figure 15: NUC On

4.9 TEC

Thermoelectric Cooling (TEC). Use this tab to set and read back the sensor temperature. The optimum temperature should be set on start-up, for the OWL 1280 should be 15°C.



Figure 16: TEC Control

4.10 Miscellaneous

There are two features here, Video invert and Active Image Enhancement. Output video can be digitally inverted such that dark areas in the image will appear bright by checking the video invert box.

PIXCI® E8	Raptor Photonics Owl 840 T		
Capt Preset Norm	Port Gain Trigger Auto Auto ROI		
Buf Res Trig	NUC TEC Misc. Info		
Capture - Buffers	- Miscellaneous		
	Bad Pixel Replace		
Current Buffer	Horizontal Flip		
0	Vertical Flip		
Frame Buffers			
68	Micro Reset		
Field Count			
32138			
Clear Buffers	Frame Period 40.000 (msec.)		
	Exposure 26.460 (msec.)		
	0 10 mseo. 20		
Laura South	Auto Level Control V Doload Sett		

Figure 17: Camera Information

Output video can be digitally processed to provide image sharpening by checking the Active image enhancement box as shown in Figure 17.

The Info tab can be used to view the cameras manufacturer data, for example Build date and serial number.

PIXCI® E8	Raptor Photonics Owl 840 T		
Capt Preset Norm	Port Gain Trigger Auto Auto ROI		
Buf Res Trig Capture - Buffers	NUC TEC Misc Info		
	Build Date 11/05/20	^	
	Build Code 00781		
Current Buffer	ADC Calibration 1610/968		
0	DAC Calibration 2647/3923		
Frame Buffers	CCD Temperature 15.0 (°C)		
68	PCB Temperature 42.5 (°C)		
Field Count	Update Status	~	
01200	Exposure & Rate		
Clear Buffers	Frame Period 40.000 (msec.)		
	Exposure 26.460 (msec.)		
	0 10 msec. 20 	31	
Live Sinap	Auto Level Control 🔽 Dhload Se	etting	

Figure 18: Information Tab

4.11 Adjusting the image display (With XCAP Std only)

The Viewing Pallet is not automatically adjusted in the XCAP software.

This needs manually Configured to give the best display of the RAW image data from the camera.

1. Go to the Modify/Contrast Modification menu, Figure 19.

2. Select "Stretch Contrast, Histogram Percentile Endpoints" and "Preview" Figure 20: Stretch Contrast.

3. Adjust the "Low Percentile Endpoint" and "High Percentile Endpoint" to optimize the image display, defaults should be acceptable for most applications.



Figure 19: Contrast Modification

Operations	Parameters		-
C Histogram Modification	Histogram Linear		
	C Histogram Exponential		
	C Histogram: Exponential Transposed		
	 Histogram: Logarithmic 		
Stretch Contrast, Pixel Value Endpoints	G Histogram Logarithmic Transposed		
	O Histogram User-Defined		
Stretch Contrast, Histogram Percentile Endpoints	Histogram Shape f(Z)	sin(2*pi*z/255.0)	
	Neighborhood Size	3	
	Low Pixel Endpoint	984	
C Invert Contrast	High Pixel Endpoint	1416	
	Low Percentile Endpoint	1 (%)	
201	High Percentile Endpoint	99 (%)	100
1X© PIXCI® Buffer 0: ((0,0),(658,496)), Grey Level	Report Endpoints Use		

Figure 20: Stretch Contrast







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