

# **NOCTURN XL Monochrome Interface Control Document**

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**Document Revisions**

<b>Date</b>	<b>Version Number</b>	<b>Document Changes</b>
Sept. 4, 2012	A.01	Engineering release
Apr. 5, 2013	B.01	Update for spec, QE and CameraLink® output data
Dec. 2, 2013	C.01	Update to spec, QE and added external trigger connection information
Jan. 29, 2014	C.02	Updated J301 figure
July 12, 2014	C.03	Corrected typo on operating/storage temperature and minor typos

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## 1 Introduction

### 1.1 Scope

This document describes the electrical and mechanical interfaces to the NOCTURN XL camera module only. Operational instructions and additional support documentation are described in separate documents. Please contact PHOTONIS technical support if you require additional information.

## 2 Electrical and Mechanical Interfaces

### 2.1 Introduction

The NOCTURN product name identifies a family of low light level cameras developed around the PHOTONIS' 1280 × 1024 LYNX CMOS imaging sensor. The "XL" model indicates that the NOCTURN camera has an integrated interface board that can be used to output digital video over a Camera Link® compatible interface as well as NTSC/PAL composite video (see Figure 1). This section provides detailed information on the NOCTURN XL specifications, power requirements as well as the electrical and mechanical interface of the module.



Figure 1 Back Side View of the NOCTURN XL Camera

### 2.2 NOCTURN XL Specifications

The NOCTURN XL is a rugged low light camera module that features high-definition, high sensitivity and high dynamic range with low power consumption. It provides monochrome real-time imaging capabilities from daylight to bright starlight in the visible and near infrared spectrum. Its small size, weight and power (SWaP) makes this camera module ideal for integration into aerial, mobile and hand-held surveillance systems. Detailed specifications of the NOCTURN XL camera are given in Table 1.

Table 1 NOCTURN XL Specifications

Parameter	Specification
<b>Sensor Resolution</b>	1280 × 1024 Pixels
<b>Sensor Pixel Pitch</b>	9.7 μm × 9.7 μm
<b>Sensor Well Capacity</b>	> 25000 e-
<b>Sensor Dynamic Range</b>	> 60 dB
<b>Sensor Read Noise</b>	< 4 e- med. (60fps Mode)
<b>Sensor Quantum Efficiency</b>	> 60% at 600nm
<b>Frame Rate</b>	50, 60 or 100Hz with full field resolution (user adjustable)
<b>Sensor Image Lag</b>	< 0.1 %
<b>Sensor Shutter Mode</b>	Rolling
<b>Lens Mount</b>	CS
<b>Dimensions (W × H × D)</b>	34.1 mm × 36.6 mm × 37.4 mm
<b>Weight</b>	< 85 grams
<b>Digital Video Output</b>	10/8 bit Base CameraLink® compatible
<b>Analog Video Output</b>	NTSC/PAL (user configurable)
<b>Communication</b>	Serial via CameraLink® compatible interface or USB
<b>Image Correction</b>	Bad pixel replacement and 2 points non uniformity correction
<b>Contrast Enhancement</b>	Contrast stretching, equalization and adaptive equalization
<b>Gain Control</b>	Automatic gain and exposure control or manual
<b>Digital Zoom</b>	Up to 8X (0.001 increment resolution) <sup>1</sup>

<sup>1</sup> Option only available in 60 and 50Hz frame rate mode

Parameter	Specification
<b>Synchronization</b>	Frame start trigger (2 to 12V) Analog output strobe reference (2 to 12V)
<b>Windowing<sup>2</sup></b>	Full field of view down to 2 sensor lines
<b>OSD</b>	Full on screen display capability with text, standard geometrical shape and graphics
<b>Snapshots</b>	On board capture of *.JPG (8b) or *. PGM (8/10b)
<b>Camera/Imaging Start Up Time</b>	< 5 seconds
<b>Operating Temperature</b>	-40° to +60° C
<b>Storage Temperature</b>	-50° to +80° C
<b>Input Voltage</b>	USB powered or external +5 to +15 VDC
<b>Power (Typical)<sup>3</sup></b>	60/50Hz mode: 1.8W (typ.); 100Hz mode: <2.25W

### 2.3 Quantum Efficiency

The typical quantum efficiency as a function of wavelength for the LYNX CMOS for versions with and without micro-lenses is shown in *Figure 2*.

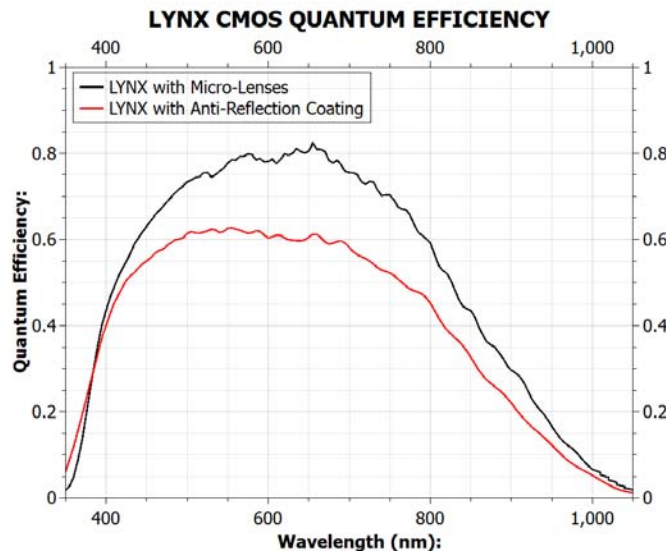


Figure 2 LYNX CMOS Quantum Efficiency Curve

<sup>2</sup> Feature only available on the digital video output interface with OSD disabled

<sup>3</sup> Excluding analog video power

2.4 Electrical Interfaces

2.4.1 Power Input and I/O Connector: J301

The external power input and I/O connector (J301) electrical interface is given in *Table 2*. The physical pin numbering convention is shown in *Figure 3*.

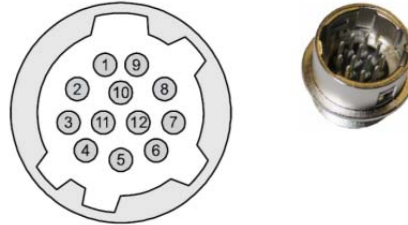


Figure 3 Power Input and I/O Connector: J301

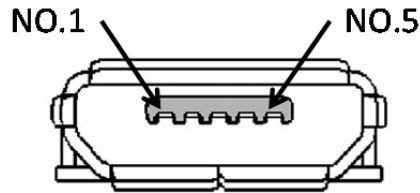
Table 2 Power Input and I/O Connector: J301

Pin	Signal Name	Function	Description
J301-1	ISO_EXT_TRIGGER_IN_N	Input	External Trigger Input N Bias with 2-12VDC12mA Max
J301-2	ISO_EXT_TRIGGER_IN_P	Input	External Trigger Input P Bias with 2-12VDC12mA Max
J301-3	ISO_EXT_TRIGGER_OUT_P	Output	External Trigger Output P Bias with 2-12VDC12mA Max
J301-4	ISO_EXT_TRIGGER_OUT_N	Output	External Trigger Output N Bias with 2-12VDC 12mA Max
J301-5	+VIN	Power	Primary Voltage Supply (5-15VDC)
J301-6	GND	Power	Primary Ground Return
J301-7	NC		
J301-8	I2C_SDA_3V3	I/O	I2C Interface SDA 3.3V L
J301-9	I2C_SCL_3V3	I/O	I2C Interface SCL 3.3V L
J301-10	GND	Power	Primary Ground Return
J301-11	+3.3VOUT	Power	+3.3V Power Output mA Max
J301-12	NC		



**2.4.2 Micro-USB Connector: J304**

The micro-USB connector (J304) electrical interface is given in Table 3 and physical pin number convention in Figure 4.



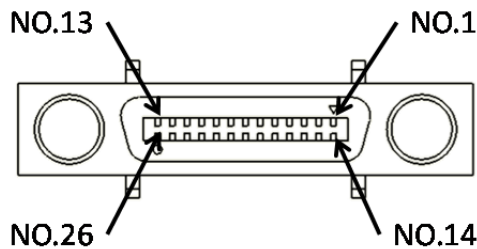
**Figure 4 USB Micro-Connector: J304**

**Table 3 USB Micro-Connector: J304**

Pin	Signal Name	Function	Description
J304-1	+VBUS	Power	USB Power
J304-2	USB_DN	I/O	USB DATA N
J304-3	USB_DP	I/O	USB DATA P
J304-4	NC		
J304-5	GND	Power	Primary Ground Return

**2.4.3 CameraLink® Compatible SDR Connector: S501**

The CameraLink® compatible SDR (S501) connector electrical interface is given in Table 4 and physical pin number convention in Figure 5.



**Figure 5 Pin Location on the CameraLink(r) Compatible SDR Connector: S501**

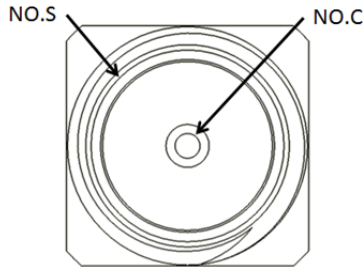
Table 4 CameraLink® Compatible SDR Connector: S501

Pin	Signal Name	Function	Description
S501-1	GND	Power	Primary Ground Return
S501-2	TX_OUT0_N	Output	CL Data0 N
S501-3	TX_OUT1_N	Output	CL Data1 N
S501-4	TX_OUT2_N	Output	CL Data 2 N
S501-5	TX_CLK_N	Output	CL CLK N
S501-6	TX_OUT3_N	Output	CL Data3 N
S501-7	COM_RXD_TO_CAMERA_P	Input	UART RX Data P 3.3V Level
S501-8	COM_TXD_TO_FG_N	Output	UART TX Data N 3.3V Level
S501-9	CL_CC1_n	NC	
S501-10	CL_CC2_p	NC	
S501-11	CL_CC3_n	NC	
S501-12	CL_CC4_p	NC	
S501-13	GND	Power	Primary Ground Return
S501-14	GND	Power	Primary Ground Return
S501-15	TX_OUT0_P	Output	CL Data0 P
S501-16	TX_OUT1_P	Output	CL Data 1 P
S501-17	TX_OUT2_P	Output	CL Data 2 P
S501-18	TX_CLK_P	Output	CL CLK P
S501-19	TX_OUT3_P	Output	CL Data3 P
S501-20	COM_RXD_TO_CAMERA_N	Input	UART RX Data N 3.3V Level
S501-21	COM_TXD_TO_FG_P	Output	UART TX Data P 3.3V level
S501-22	CL_CC1_p	NC	
S501-23	CL_CC2_n	NC	

Pin	Signal Name	Function	Description
<b>S501-24</b>	CL_CC3_p	NC	
<b>S501-25</b>	CL_CC4_n	NC	
<b>S501-26</b>	GND	Power	Primary Ground Return
<b>S501-S1</b>	GNDE	Shield	Isolated Ground
<b>S501-S2</b>	GNDE	Shield	Isolated Ground

**2.4.4 Analog Video Connector: J601**

The analog video connector (J601) electrical interface is given in Table 5. A top view of the physical layout of the connector is provided in Figure 6.



**Figure 6 Analog Video Connector: J601**

**Table 5 Analog Video Connector: J601**

Pin	Signal Name	Function	Description
<b>J601-S</b>	GND	Ground	Ground Return
<b>J601-C</b>	VIDEO_OUT	Output	Analog Video Output

**2.5 Mechanical Interface**

**2.5.1 Basic Mechanical Dimensions**

The basic mechanical dimensions of the NOCTURN XL camera are provided in Figure 7. A more detailed drawing can be requested from PHOTONIS.

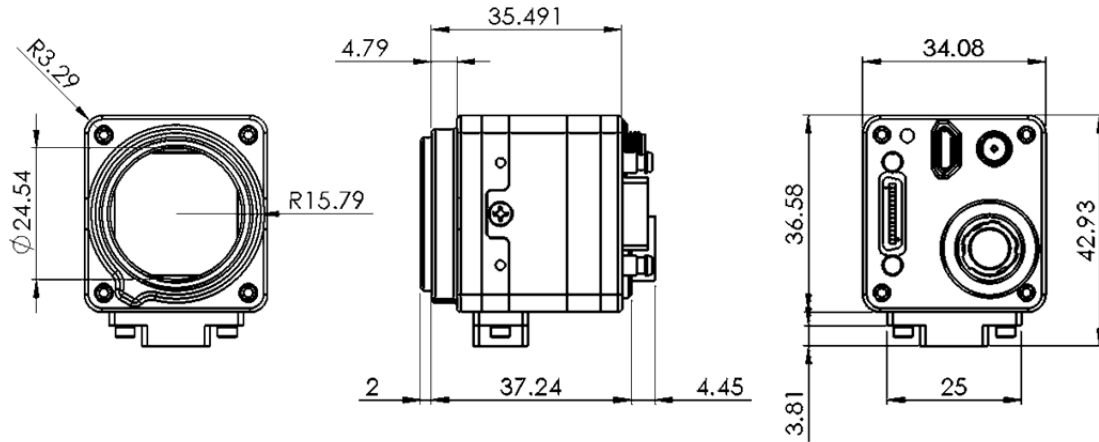


Figure 7 Basic Mechanical Dimensions of the NOCTURN XL Camera (all dimensions are in mm)

2.5.2 Mount Interfaces

The NOCTURN XL cameras are delivered with a ¼"-20 tripod mount adapter (see Figure 8). This tripod mount adapter can be attached to the camera using two 2-56 (3/16" long) thread socket head cap screws on all four sides of the module parallel to the optical axis. Figure 9 and Figure 10 show the mounting 2-56 hole locations on the side and top of the NOCTURN XL camera respectively for the tripod mount adapter.

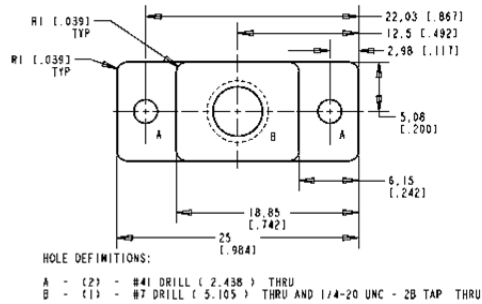
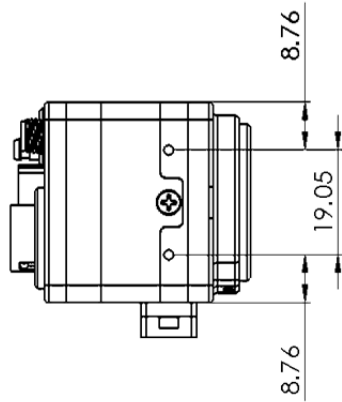
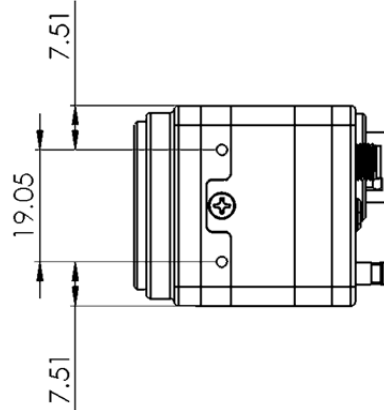


Figure 8 Basic Mechanical Dimensions of the Tripod Mount adapter (all dimensions are in mm [in])



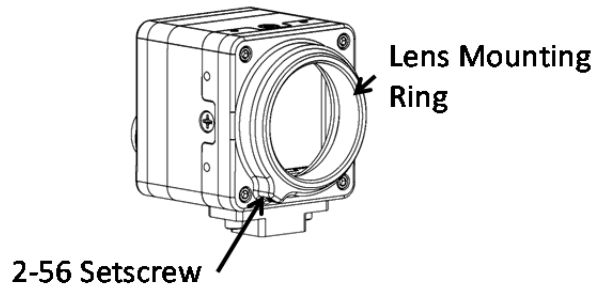
**Figure 9 Tripod Mount Adapter 2-56 Mounting Location on side of NOCTURN XL (in mm)**



**Figure 10 Tripod Mount Adapter 2-56 Mounting Location on top of the NOCTURN XL (in mm)**

**2.5.3 Focus Adjustments**

In the event that focus cannot be achieved through normal lens operation, the lens mount ring (see Figure 11) can be adjusted to compensate for small variation in the back focal flange distance of the lens. This is done by loosening the lens mount 2-56 setscrew and performing a flange back adjustment. Please refer to the NOCTURN XL mechanical drawing for actual focal plane location with respect to the lens mount.



**Figure 11 Location of Setscrew to Loosen Lens Mounting Ring for Focus Adjustments**

**2.6 Optical Interface**

The NOCTURN XL is designed to work with 1" optical format cs mount lens<sup>4</sup>. C mount lens with 1" optical format can be utilized as well as long as a 5mm cs to c mount adapter is inserted between the lens back flange and the NOCTURN XL lens mounting ring.

<sup>4</sup> A lens extender can be purchase separately from PHOTONIS to utilized lenses designed for 2/3" and 1/2" format imagers

## 2.7 Input Power Specifications

The NOCTURN XL can be powered either via the USB interface from a personal computer (must be able to provide 500 mA over the USB port) or through the J301 connector. For the latter, the voltage input must be within a range of +5.0 to +15.0 VDC (see Table 6).

Table 6 NOCTURN XL Input power Specifications

Parameter	Description	Min	Typ	Max	Units
<b>Vin</b>	Input Voltage	5	--	15	V
<b>Icc</b>	Input Current <sup>5</sup>	--	350 <sup>6</sup>	--	mA

## 2.8 Communication Interface

Control of the camera can be done either using the serial communication protocol over Camera Link or through the micro USB interfaces via serial message using printable ASCII characters. The serial port settings should be 8 bits data, no parity, 1 stop bit and no flow control with a default baud rate of 115200 bits per second. The user should refer to the NOCTURN XL manual for a list of valid commands.

## 3 Interface Timing

Timing for the NOCTURN XL video outputs are described in this section.

### 3.1 Digital Video Interface

The digital video interface is provided via a Camera Link® compatible serialized protocol. The video interface supports 4 LVDS data pairs, the LVDS output clock and serial based communication. The parameters needed to configure the frame grabber are given in **Error! Reference source not found.** and the timing diagram is shown in **Error! Reference source not found.**. Furthermore, it should be noted that the port and bit assignments of the S501 connector (see Table 4) are compliant with the Camera Link® standard.

Table 7 Frame Grabber Configuration Summary

Parameter	Value	Unit
<b>Pixel Clock per Tap (30/50/60fps Mode)</b>	48	MHz
<b>Pixel Clock per Tap (100fps Mode)</b>	72	MHz
<b>Number of Taps</b>	2 Interlaced Vertically	NA

<sup>5</sup> Digital video output only without image processing enabled

<sup>6</sup> Measured with 5VDC input

Parameter	Value	Unit
Grayscale Resolution	10	Bits
Data Width pre Valid	8	Pixels
Data Height pre Valid	1	Line
Data Width Valid	1280	Pixels
Data Height Valid	1024	Pixels
Data Width post Valid	0	Pixels
Data Height post Valid	0	Pixels

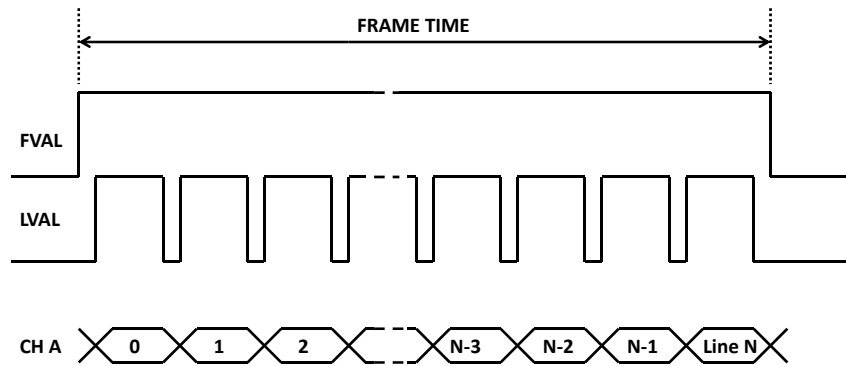


Figure 12 Basic Digital Video Interface Timing Diagram

### 3.2 Analog Video Interface

The NOCTURN XL is capable of providing a 1.4V (peak-to-peak, including sync) analog video signal output that can be set to RS-170 or PAL formats through serial commands. The nominal output voltages are provided in Table 8. The analog video timing specifications are provided in Table 9 for the NTSC format and Table 10 for the PAL format.

Table 8 Analog Video Signal Specifications

Parameter	Value	Unit
Peak-to-Peak	1.400	V
White Level	+1.000	V
Black Level	+0.075	V
Blank Level	0.000 (reference)	V

Parameter	Value	Unit
Sync Tip	-0.400	V

Table 9 RS-170 Analog Video Output Specifications

Parameter	Value	Unit
Pixel Rate	13.5	MHz
Total Number of Lines	525	Lines
Line Rate	15734.26	KHz
Line Blanking	138	Pixels
Line Active Video	720	Pixels
Field Rate	29.97	Hz
Field Lines (F0/F1)	263/262	Lines
Field Vertical Blanking	19	Lines
Field Active Video (F0/F1)	240/240, (244/243)	Lines
Frame Rate	59.94	Hz
Frame Active Video	480 (487)	Lines

Table 10 PAL Analog Video Output Specifications

Parameter	Value	Unit
Pixel Rate	13.5	MHz
Total Number of Lines	625	Lines
Line Rate	15.625	KHz
Line Blanking	144	Pixels
Line Active Video	720	Pixels
Field Rate	25	Hz



Parameter	Value	Unit
Field Lines (F0/F1)	312/313	Lines
Field Vertical Blanking	24	Lines
Field Active Video	288	Lines
Frame Rate	50	Hz
Frame Active Video	576	Lines

## 4 Electrical Connectors

This section provides the part number of all the user accessible connectors and suggested mating connector when applicable.

### 4.1 Power Input and I/O Connector: J301

#### **Camera Connector:**

Manufacturer: HIROSE ELECTRIC CO LTD

Description: CONN RECEPT 12POS MALE DIP

Manufacturer part number: HR10A-10R-12PB(71)

#### **Mating Connector:**

Manufacturer: HIROSE ELECTRIC CO LTD

Description: CONN HR10A PLUG 12POS FEMALE

Manufacturer Part Number: HR10A-10P-12S(73)

### 4.2 Micro-USB Micro Connector: J304

#### **Camera Connector:**

Manufacturer: HIROSE ELECTRIC CO LTD

Description: CONN RCPT MICRO USB B PCB VERT

Manufacturer Part Number: ZX80-B-5P

**4.3 Camera Link SDR Connector: S501*****Camera Connector:***

Manufacturer: 3M

Description: CONN SDR 26POS VERT RECEPT

Manufacturer Part Number: 12226-1150-00FR

**4.4 Analog Video Connector: J601*****Camera Connector***

Manufacturer: SAMTEC INC

Description: JACK PANEL MOUNT SMA

Manufacturer Part Number: SMA-J-P-H-ST-TH1