

NOCTURN

Digital Low-Light CMOS Camera

Electro-Mechanical ICD

Nocturn Digital Low Light CMOS Camera
XL Camera Module



PHOTONIS USA, Inc.
6170 Research Road | Suite 208
Frisco, TX USA 75033
T: +1 (469) 713-6108
F: +1 (469) 713-2880
www.photonis.com

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Any questions regarding the use of the referenced product should be referred to:

Sales: Phone: +1 (770) 998-1975, Email: l.nowell@usa.photonis.com

Technical Support: Phone: +1 (972) 987-1463, Email: m.conti@usa.photonis.com

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-	July 23, 2012	Creation of document
A	September 04, 2012	Engineering release
A-1	September 17, 2012	Minor format updates
A-2	November 16, 2012	Updated Mechanical Figures and QE Curve
A-3	November 16, 2012	Corrected USB connector table
A-4	November 26, 2012	Corrected Camera Link Frame Grabber Config.
A-5	January 22, 2013	Updated phone numbers

Table of Contents

1. SCOPE	5
2. ELECTRICAL AND MECHANICAL INTERFACES	5
Introduction.....	5
NOCTURN XL Specifications.....	5
Electrical Interfaces.....	7
Mechanical Interface.....	10
Optical Interface	11
Input power Specifications.....	12
Communication Interface	12
3. INTERFACE TIMING	12
Digital Video Interface	12
Analog Video Interface	13
4. ELECTRICAL CONNECTORS	14
Power Input and I/O Connector: J301	14
Micro-USB Micro Connector: J304.....	14
Camera Link SDR Connector: S501	14
Analog Video Connector: J601	15

List of Tables

Table 1 NOCTURN XL Specifications	5
Table 2 Power Input and I/O Connector: J301	7
Table 3 USB Micro-Connector: J304	8
Table 4 Camera Link Compatible SDR Connector: S501	8
Table 5 Analog Video Connector: J601.....	9
Table 6 NOCTURN XL Input Power Specifications	12
Table 7 Frame Grabber Configuration Summary	12
Table 8 Analog Video Signal Specifications	13
Table 9 RS-170 Analog Video Output Specifications.....	13
Table 10 PAL Analog Video Output Specifications.....	14

List of Figures

Figure 1 Back Side View of the NOCTURN XL Camera.....	5
Figure 2 Typical Quantum Efficiency Curve.....	6
Figure 3 Power Input and I/O Connector: J301	7
Figure 4 USB Micro-Connector: J304.....	8
Figure 5 Pin Location on Camera Link [®] Compatible SDR	8
Figure 6 Pin location on Analog Video Connector: J601	9
Figure 7 Basic Mechanical Dimensions of the NOCTURN XL Camera (all dimensions in mm).....	10
Figure 8 Basic Mechanical Dimensions of Tripod Mount Adapter (dimensions in mm [in]).....	10
Figure 9 Tripod Mount Adapter 2-56 Mounting Location on side of NOCTURN XL (in mm).....	11
Figure 10 Tripod Mount Adapter 2-56 Mounting Location on top of NOCTURN XL (in mm)	11
Figure 11 Location of Setscrew to Loosen Lens Mounting Ring for Focus Adjustments	11
Figure 12 Basic Digital Video Interface Timing Diagram	13

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

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

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
Sensor Resolution	1280 × 1024 Pixels
Sensor Pixel Pitch	9.7 μm × 9.7 μm

Parameter	Specification
Sensor Well Capacity	> 25000 e-
Sensor Dynamic Range	> 60 dB (> 72 dB by using the HDR ¹ mode)
Sensor Read Noise	< 4 e- med. (at 60Hz frame rate)
Sensor Quantum Efficiency	> 50% at 600nm (see Figure 2)
Frame Rate	0.1 to 100Hz with full field resolution ² (user adjustable)
Sensor Image Lag	< 0.1 %
Sensor Shutter Mode	Rolling
Lens Mount	CS
Dimensions (Width x Height x Depth ³)	34.1 mm x 36.6 mm x 37.4 mm
Weight	85 grams
Digital Video Output	10 bit Camera Link® Compatible
Analog Video Output	NTSC/PAL (user configurable)
Communications	Serial via Camera Link Interface or USB interface
Image Correction	Bad pixel replacement and 2 points non uniformity correction
Synchronization	Analog output strobe reference
Camera/Imaging Start Up Time	< 5 seconds
Gain Control	Automatic (AGC) or manual
Digital Zoom	Up to 4 X
Contrast Enhancement	Contrast stretching and histogram equalization
Operating Temperature	-40° to +60° C
Storage Temperature	-50° to +80° C
Input Voltage	USB powered or external +5 to +15 VDC
Power	< 1.8 W (Typical)

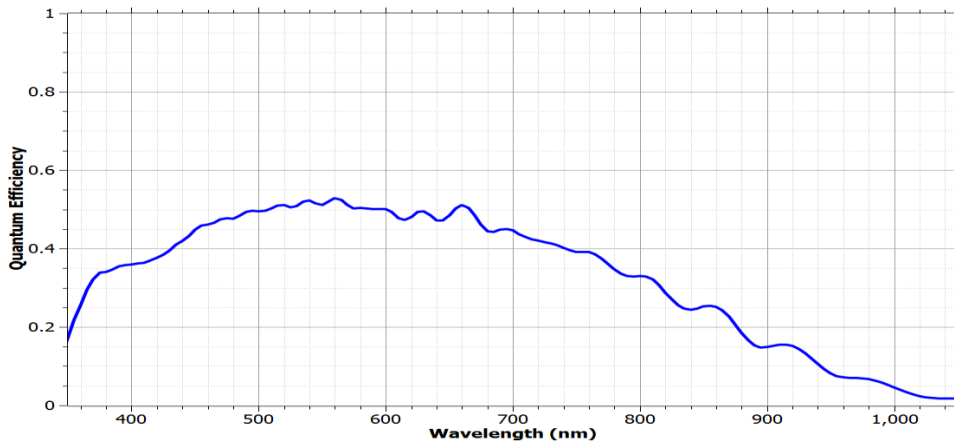


Figure 2 Typical Quantum Efficiency Curve

¹ HDR : High Dynamic Range

² Higher frame rates can be achieved by windowing the sensor

³ Excludes connectors protruding from main NOCTURN XL housing

Electrical Interfaces

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.

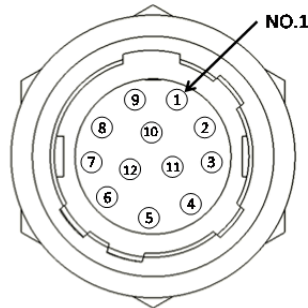


Figure 3 Power Input and I/O Connector: J301

Table 2 Power Input and I/O Connector: J301

Pin	Signal Name	Function	Description
J301-1	NA	Reserved	Do not connect
J301-2	NA	Reserved	Do not connect
J301-3	ISO_EXT_TRIGGER_OUT_P	Output	External Trigger Output P Bias with 2-12VDC 12mA 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		

Micro-USB Connector: J304

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

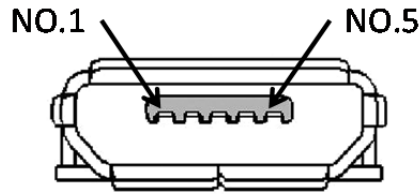


Figure 4 USB Micro-Connector: J304

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

Camera Link SDR Connector: S501

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

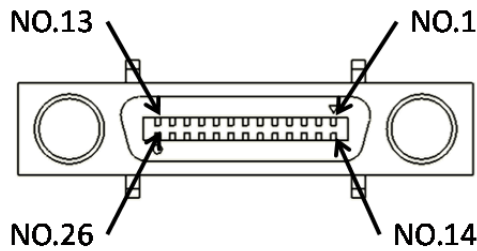


Figure 5 Pin Location on Camera Link® Compatible SDR

Table 4 Camera Link 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

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

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.

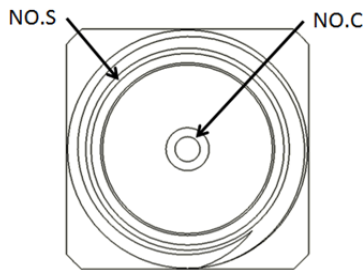


Figure 6 Pin location on Analog Video Connector: J601

Table 5 Analog Video Connector: J601

Pin	Signal Name	Function	Description
J601-S	GND	Ground	Ground Return

Pin	Signal Name	Function	Description
J601-C	VIDEO_OUT	Output	Analog Video Output

Mechanical Interface

Basic Mechanical Dimensions

The basic mechanical dimensions of the NOCTURN XL camera are provided in Figure 7. If further details are required please refer to the NOCTURN XL mechanical interface control document located on the companion CD-ROM delivered with your NOCTURN XL camera.

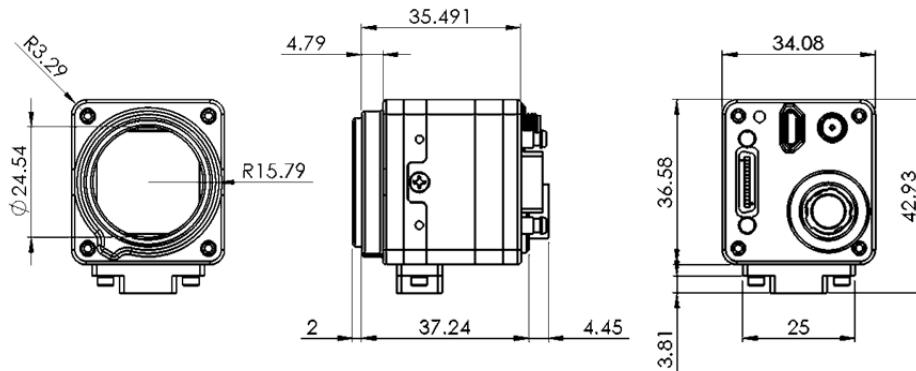


Figure 7 Basic Mechanical Dimensions of the NOCTURN XL Camera (all dimensions in mm)

Mount Interfaces

The NOCTURN XL cameras are delivered with a 1/4"-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 screw on all four side 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

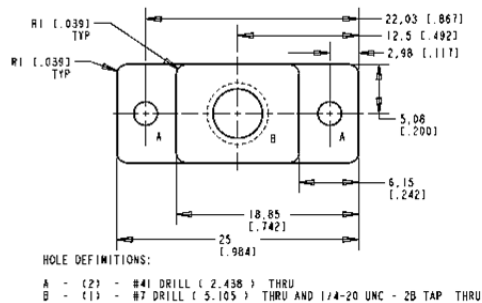


Figure 8 Basic Mechanical Dimensions of Tripod Mount Adapter (dimensions in mm [in])

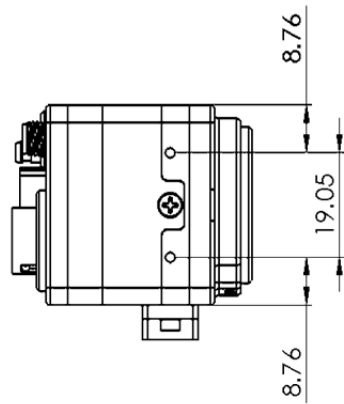


Figure 9 Tripod Mount Adapter 2-56 Mounting Location on side of NOCTURN XL (in mm)

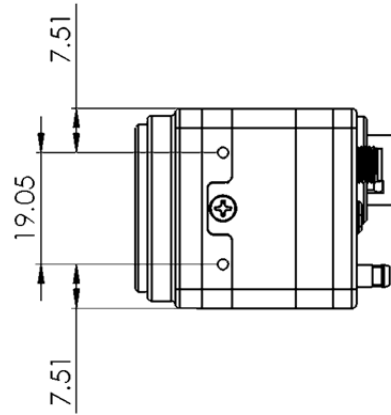


Figure 10 Tripod Mount Adapter 2-56 Mounting Location on top of NOCTURN XL (in mm)

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.

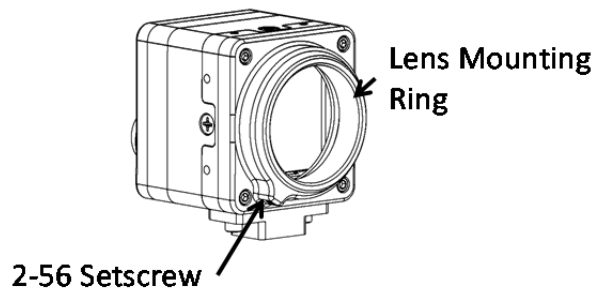


Figure 11 Location of Setscrew to Loosen Lens Mounting Ring for Focus Adjustments

Optical Interface

The NOCTURN XL is designed to work with 1" optical format cs mount lens⁴. 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.

⁴ A lens extender can be purchase separately from PHOTONIS to utilized lenses designed for 2/3" and 1/2" format imagers
[NVT 200-LC-0102](#)
 Revision: A-5
 Page 11 of 15

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
Vin	Input Voltage	5.0		15	V
Icc	Input Current ⁵		350 ⁶	415	mA

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.

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 Table 7 and the timing diagram is shown in Figure 12. 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
Pixel Clock per Tap (with 60fps operation mode)	48	MHz
Number of Taps	2 Interlaced Vertically	NA
Grayscale Resolution	10	bits
Data Width pre Valid	0	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

⁵ Measured with Vin at +5.0 VDC

⁶ Exclude analog video output power

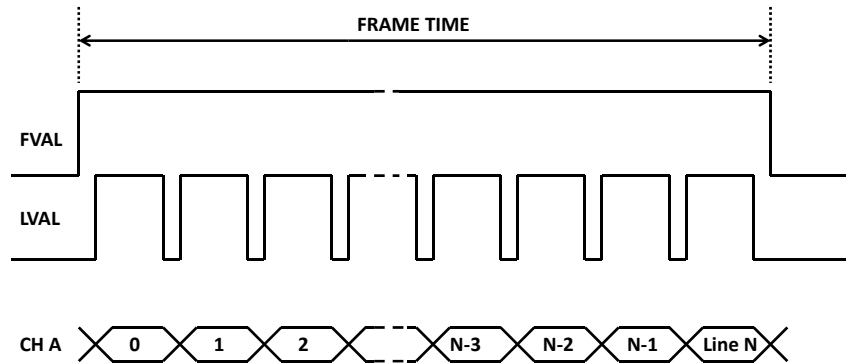


Figure 12 Basic Digital Video Interface Timing Diagram

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
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
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.

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)

Micro-USB Connector: J304

Camera Connector:

Manufacturer: HIROSE ELECTRIC CO LTD
 Description: CONN RCPT MICRO USB B PCB VERT
 Manufacturer Part Number: ZX80-B-5P

Camera Link SDR Connector: S501

Camera Connector:

Manufacturer: 3M
 Description: CONN SDR 26POS VERT RECEPT
 Manufacturer Part Number: 12226-1150-00FR

Analog Video Connector: J601

Camera Connector

Manufacturer: SAMTEC INC

Description: JACK PANEL MOUNT SMA

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