

NOCTURN MD MONOCHROME INTERFACE CONTROL DOCUMENT

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PHOTONIS USA, Inc.

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

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Document Revisions

Date	Version Number	Document Changes
Sept. 9, 2013	A.01	Engineering draft
Nov. 11, 2013	A.02	Typos and figures update
Jan. 29, 2014	B.01	Updated for the RevB and RevC hardware design
June 11, 2014	B.02	Updated (+VIN), (+VUSB), (+RTC_BAT), (+3.3V), (SW_POWER_ON_N), (POWER_LOCK_EN), (EXP_RXD_TO_FPGA), (EXP_TXD_FROM_FPGA) descriptions.

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1 Introduction

1.1 Scope

This document describes the electrical and mechanical interfaces to the NOCTURN MD imaging core 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 “MD” model indicates that the NOCTURN camera has an integrated interface board that can be used to output digital video to a high resolution micro-display as well as NTSC/PAL composite video (see Figure 1). This section provides detailed information on the NOCTURN MD specifications, power requirements as well as the electrical and mechanical interface of the module.



Figure 1 Front view of the NOCTURN MD imaging core

2.2 NOCTURN MD Specifications

The NOCTURN MD imaging core is a rugged low light imaging core that features high-definition resolution, high sensitivity and high dynamic range with low power consumption. Powered by PHOTONIS' 1 inch optical format 1280×1024 pixels Lynx CMOS sensor and Microoled 1746×1000 pixels black and white monochrome micro-display, the NOCTURN provides real-time imaging capabilities (from daylight to one quarter moon scene illumination) in the visible and near infrared spectrum. Its small size, weight and power (SwaP) make this core module ideal for integration into mobile and hand-held surveillance systems.

With its 9.7µm×9.7µm pixel pitch and 4e- median read noise, the NOCTURN provides unsurpassed signal to noise at low light with video rates up to 60 frames per second. Built on PHOTONIS expertise in night vision imaging, the NOCTURN electronics incorporates a

multitude of functions to enhance the low light level performance. The NOCTURN MD features automatic gain control (AGC), automatic exposure control (AEC), non-uniformity correction (NUC), on board image capture and advanced image enhancement, allowing the NOCTURN to provide continuous situational awareness without compromising mobility and SWaP.

A summary of the NOCTURN MD imaging core specifications are given in Table 1.

Table 1 NOCTURN MD Imaging Core Specifications

Parameter	Specification
Sensor Resolution	1280 × 1024 Pixels
Sensor Pixel Pitch	9.7 μm × 9.7 μm
Sensor Well Capacity	> 25000 e-
Sensor Dynamic Range	> 60 dB
Sensor Read Noise	< 4 e- med. (at 60Hz frame rate)
Sensor Quantum Efficiency	> 60% at 600nm
Sensor Frame Rate	Adjustable up to 60Hz
Sensor Image Lag	< 0.1 %
Sensor Shutter Mode	Rolling
Display Type	High Resolution Monochrome (B&W) OLED micro-display
Display Resolution Modes	1746×1000 or 1280×1000 Pixels
Display Pixel Pitch	5 μm × 5 μm
Display Maximum Luminance	250 cd/m ² , 75fL
Display Frame Rate	60 Hz
Imaging Startup Time	< 5 sec
On Screen Display	Full on screen display capability with text, standard geometrical shape and graphics
Dimensions (W × H × D)	34.1 mm × 36.6 mm × 25 mm
Weight	< 50 grams

Parameter	Specification
Analog Video Output	NTSC/PAL (user configurable)
External Communication	Industry Standard USB2.0 Full Speed USB2.0 Mass Storage Device For SD Card Support
User Interface	Logic Level RS-232 Serial Port
Image Correction	Bad pixel replacement and 2 points non uniformity correction
Contrast Enhancement	Contrast stretching, equalization and adaptive equalization
Gain Control	Automatic gain and exposure control or manual
Digital Zoom	Up to 8X (0.001 increment resolution)
Snapshots	On board capture of *.JPG (8b) or *.PGM (8/10b)
Operating Temperature	-40° to +60° C
Storage Temperature	-50° to +80° C
Input Voltage	USB powered or external +2.6 to +12 VDC
Power (Typical)¹	1.8W (typ.)

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*.

¹ With analog video output disable, advanced image processing turned-off and display at nominal brightness

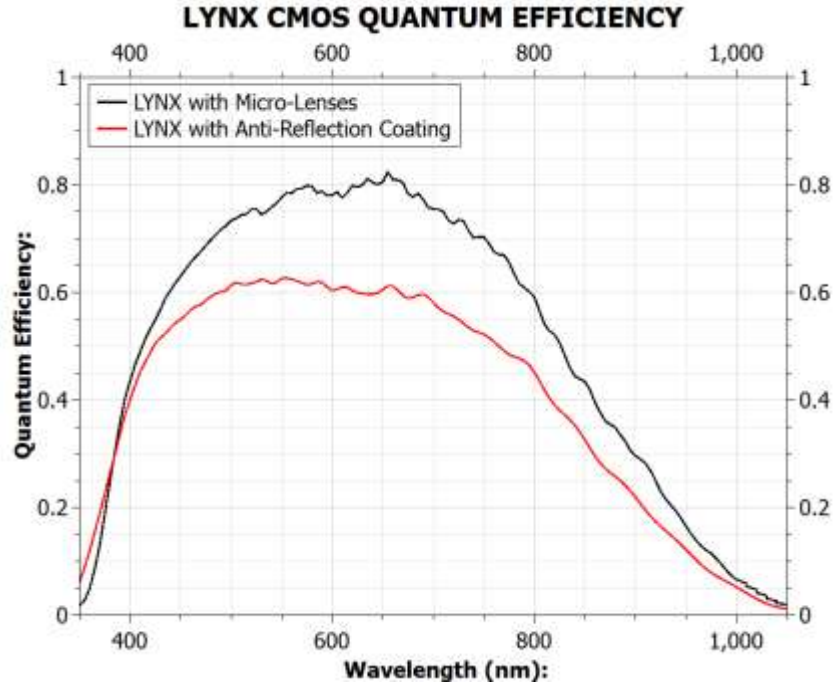


Figure 2 LYNX CMOS Quantum Efficiency Curve

2.4 Electrical Interfaces

The NOCTURN MD imaging modules has four user accessible connectors (see NOCTURN MD mechanical reference drawing for location):

- J303- Expansion I/O Flex Connector
- J304- Power Input and I/O Connector
- J801- Micro-Display Flex Connector
- J202- Debug Flex Connector (reserved for PHOTONIS)

2.4.1 Expansion I/O Flex Connector: J303

The expansion I/O flex connector (J303) electrical interface is given in Table 2. The physical pin numbering convention is shown in Figure 3.

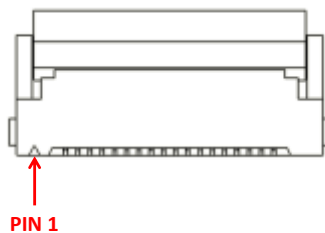


Figure 3 Expansion I/O Flex Connector: J303

Table 2 Expansion I/O Flex Connector: J303

Pin	Signal Name	Function	Description
J303-1	+3.3V	Power	+3.3V Output (60mA supply)
J303-2	SW_SD_CARD_SCK	Signal	SD Card Clock
J303-3	GND	Power	Primary Ground Return
J303-4	SW_SD_CARD_CMD	Signal	SD Card Command/Response
J303-5	SW_SD_CARD_DETECT_N	Signal	SD Card Detection
J303-6	SW_SD_CARD_DAT0	Signal	SD Card Data Line 0
J303-7	SW_SD_CARD_DAT1	Signal	SD Card Data Line 1
J303-8	SW_SD_CARD_DAT2	Signal	SD Card Data Line 2
J303-9	SW_SD_CARD_DAT3	Signal	SD Card Data Line 3
J303-10	GND	Power	Primary Ground Return
J303-11	SD_CARD_ACTIVITY_LED_N	Signal	SD Card Activity LED
J303-12	EXP_RXD_TO_FPGA	I/O	RS232 RXD (3.3V LL)
J303-13	EXP_TXD_FROM_FPGA	I/O	RS232 TXD (3.3V LL)
J303-14	+RTC_BAT	Input	Real Time Clock Battery (1.3V-5.5V)
J303-15	GND	Power	Primary Ground Return
J303-16	+VIN	Power	+VIN Output (500mA Max)
J303-17	SW_POWER_ON_N	Input	Aux Power On Control (Active Low) connected to J304 pin 4.
J303-18	POWER_LOCK_EN	Input	Aux Power On Lock (Active High) Used To Maintain Power ON When SW_POWER_ON_N Is Momentary. Run Threshold (VIN=2.7V-15V).

2.4.2 Power Input and I/O Connector: J304

The power input I/O connector (J304) electrical interface is given in Table 3. The physical pin numbering convention is shown in Figure 4.

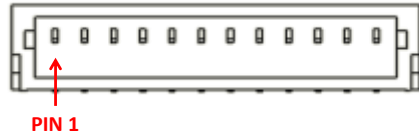


Figure 4 Power Input and I/O Connector: J304

Table 3 Power Input and I/O Connector: J304

Pin	Signal Name	Function	Description
J304-1	RS170_VIDEO_OUT	Output	Analog Video Output
J304-2	GND_R	Power	Analog Video Return
J304-3	SD_CARD_READER_MODE_N	Signal	SD CARD MODE Control
J304-4	SW_POWER_ON_N	Signal	Power On Control (Maintained Active Low)
J304-5	+VUSB	Power	USB Voltage Supply (4.5-5.5VDC) (Noble Diode Switched Alternative to +VIN_EXT To Power System).
J304-6	USB_DN	I/O	USB Data N
J304-7	USB_DP	I/O	USB Data P
J304-8	GND	Power	Primary Ground Return
J304-9	+VIN_EXT_PIN	Power	Ext Power Input (2.6-12.0VDC)
J304-10	+VIN_EXT_PIN	Power	Ext Power Input (2.6-12.0VDC)
J304-11	GND	Power	Primary Ground Return
J304-12	GND	Power	Primary Ground Return

2.4.3 Micro-Display Flex Connector: J801

The micro-display connector (J801) electrical interface is given in Table 3. The physical pin numbering convention is shown in Figure 5.

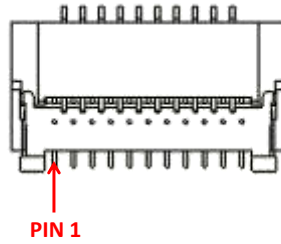


Figure 5 Micro-Display Flex Connector

Table 4 Micro-Display Flex Connector

Pin	Signal Name	Function	Description
J801-1	MD_I2C_SCL_3V3	Clock	I2C Clock
J801-2	MD_ENDI	Signal	Enable Data Interface
J801-3	MD_UD	Signal	Vertical Shift Register Direction
J801-4	MD_LR	Signal	Horizontal Shift Register Direction
J801-5	MD_PWR_DN_N	Signal	MicroDisplay Power Down (Active Low)
J801-6	MD_VSYNC	Signal	MicroDisplay Vertical Sync
J801-7	MD_HSYNC	Signal	MicroDisplay Horizontal Sync
J801-8	MD_PCLK	Clock	MicroDisplay Pixel CLK
J801-9	GND	Power	Primary Ground Return
J801-10	+2.85V FLT	Power	+2.85V (Filtered)
J801-11	MD_DAC_4A	Signal	Lower Right Pixel
J801-12	MD_DAC_3A	Signal	Upper Left Pixel
J801-13	MD_DAC_2A	Signal	Upper Right Pixel
J801-14	MD_DAC_1A	Signal	Lower Left Pixel
J801-15	NC		
J801-16	NC		

Pin	Signal Name	Function	Description
J801-17	MD_I2C_SDA_3V3	Signal	I2C Data
J801-18	+2.5V_FLT	Power	+2.5V (Filtered)
J801-19	GND	Power	Primary Ground Return
J801-20	+3.3V_FLT	Power	+3.3V (Filtered)
J801-21	-VCATH_FLT	Power	Cathode Voltage (Filtered)

2.5 Mechanical Interface

The basic mechanical dimensions of the NOCTURN MD imaging core are provided in . Please contact PHOTONIS if further technical details are required.

2.6 Input Power Specifications

The NOCTURN MD can be powered either via the USB interface from a personal computer (must be able to provide 500 mA over the USB port) or via battery power. Both power interfaces are available on the J304 connector. For the battery power (external power input on J304 connector), the voltage input must be within a range of +2.6 to +12.0 VDC (see Table 5).

Table 5 NOCTURN MD Input Power Specifications

Parameter	Description	Min	Typ	Max	Units
V _{in}	Input Voltage	2.6	--	12	V
I _{cc}	Input Current ²	--	360 ³	--	mA

2.7 Communication Interface

Control of the imaging core can be done using serial communication protocol over the USB serial bridge interface or the user interface RS-232 interface 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 (user selectable). The user should refer to the NOCTURN MD user guide for a list of valid commands.

² Digital video output only without image processing enabled

³ Measured with 5VDC input

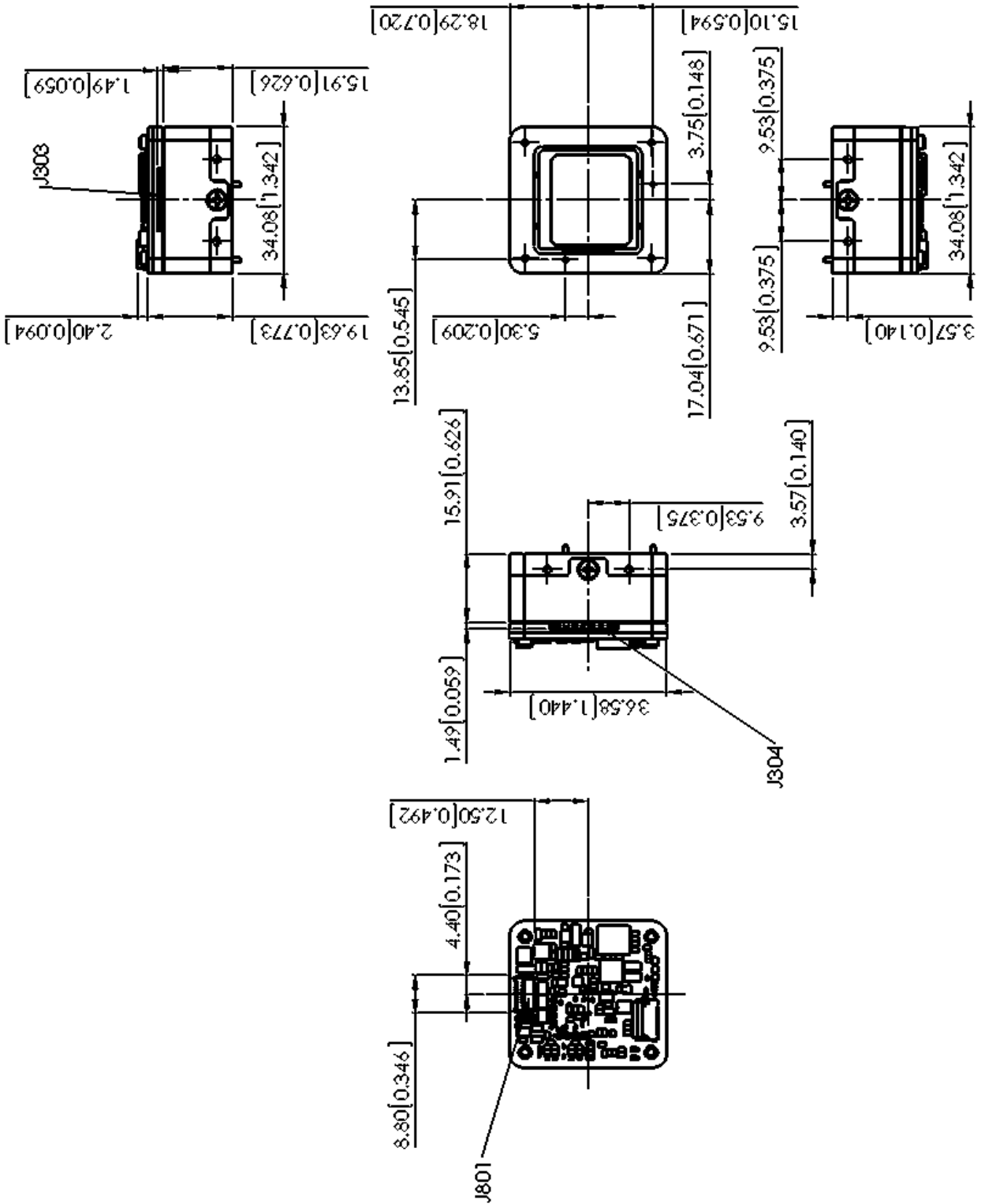


Figure 6 NOCTURN MD Mechanical Dimensions (in mm [in])

3 Analog Video Interface

The NOCTURN MD 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 6. The analog video timing specifications are provided in Table 7 for the NTSC format and Table 8 for the PAL format.

Table 6 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 7 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 8 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 USB Serial Bridge and USB Mass Storage Interface

When an SD card is connected on the J303 connector, the USB interface can be toggled between a serial bridge mode (to program and access the NOCTURN MD field programmable gate array) and a mass storage mode to retrieve snapshots captured with the NOCTURN MD. Enabling the mass storage mode is accomplished by turning off power to the imaging core pulling pin 3 on J304 to ground and re-applying power to the imaging core.

5 Electrical Connectors

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

5.1 Expansion I/O Flex Connector: J303

Camera Connector:

Manufacturer: OMRON ELECTRONICS INC.

Description: CONN FPC 18POS 0.5MM PITCH SMD

Manufacturer Part Number: XF2M-1815-1A

5.2 Power Input and I/O Connector: J304

Camera Connector:

Manufacturer: JST SALES AMERICA INC.

Description: CONN HEADER SH 12POS SIDE 1MM TIN

Manufacturer part number: SM12B-SRSS-TB(LF)(SN)

Mating Connector:

Manufacturer: JST SALES AMERICA INC.

Description: CONN HOUSING SH 12POS 1MM WHITE

Manufacturer Part Number: SHR-12V-S

Crimp Terminal: SSH-003T-P0.2

5.3 Micro-Display Flex Connector: J801

Camera Connector:

Manufacturer: HIROSE ELECTRIC Co LTD.

Description: CONN FPC 21POS .3MM GOLD SMD.

Manufacturer part number: FH23-21S-0.3SHAW(05).