



PFA-LN Sensor Datasheet



PFA-LN Sensor Description

The PFA-LN Sensor is an automated focus tracking sensor that provides focusing servo systems with fast feedback signals to quickly and accurately focus almost any type of infinity-corrected microscope. The sensor determines the direction toward focus and measures the distance to the best focus position. The sensor outputs this information to the microscope system which moves either the sample, or the objective, to the best focus location.

Ordering Info

Table 1 PFA-LN Sensor Types

Type	Part Number
Sensor (PFA-LN-450)	974180
Sensor (PFA-LN-660)	974140
Sensor (PFA-LN-785)	974160
Sensor (PFA-LN-850)	974220
Sensor (PFA-LN-660 HIAW)	974190
Sensor (PFA-LN-660 HIAB)	974200
Sensor (PFA-LN-785 HIAW)	974210
Sensor (PFA-LN-785 HIAW OA)	974230

NOTE: All sensors in *Table 1* may be ordered as PN 974XXX-1, with the "-1" indicating a 1800 mm cable variant.

Product Specifications

Table 2 PFA-LN Sensor Specifications

Feature	Description
Structured Light Pattern	Line
Laser Wavelengths Available	450 nm, 660 nm, 785 nm, 850 nm
Laser Classification	Class 3R
Sampling Rate	Up to 3 kHz (5kHz SWIFT Mode)
Static Autofocus Accuracy	±0.25 Objective DOF or better
Tracking Autofocus Accuracy	±0.33 Objective DOF or better
PC Communication	Gigabit Ethernet, RS485
Maximum Standoff Distance	300 mm
IEC Certification	61326-1, 61010-1 and 60825-1

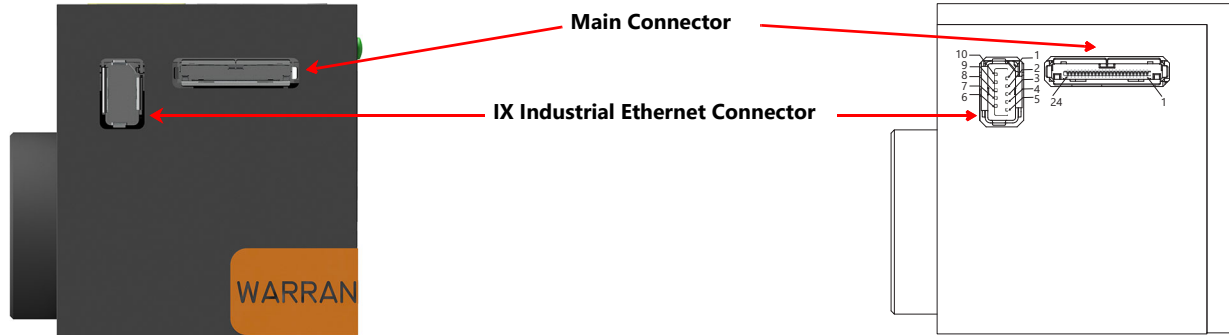
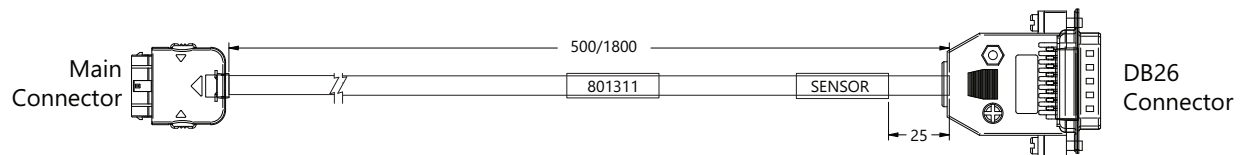
Table 3 PFA-LN Sensor Performance Data for 660 nm

Objective Lens ^a	Numerical Aperture	DOF ^b [μm]	Linear Range ^c [μm]	Capture Range ^d [μm]
5X	0.14	±14	±600	More than ±4500
10X	0.28	±3.5	±170	More than ±4500
20X	0.42	±1.6	±100	±4300
50X	0.55	±0.9	±25	±1000

- a. All specifications in this table are for Mitutoyo M PLAN APO objectives.
- b. Focus repeatability is normally 1/3 DOF or better (e.g., focus repeatability for a 20X lens is ±0.53 μm).
- c. The Linear Range is the maximum distance from which both the approximate distance and direction to focus is known. The Linear Range is restricted digitally by the sensor controller. The Linear Range Bias setting has been found to be optimal for sensor speed and resolution. Extending linear range reduces resolution.
- d. The specified Capture Range is the maximum distance from which the direction to focus is known. It is valid only if WDI's coupling filter (or a filter with similar specifications) is used and no additional filters are placed between the sensor and the objective lens. Additional filters reduce light transmitted and received by the sensor and adversely affect the Capture Range. Capture Range is affected by substrate reflectivity; the values above were obtained with glass (R~4%).

NOTE: These are target specifications. Final specifications subject to change.

Electrical Connections

**Figure 1** PFA-LN Sensor Connectors**Figure 2** PFA-LN Sensor Cable**Table 4 PFA-LN Sensor Cable Assembly Pin Outs**

DB26 Pin #	Signal Name	Description
1	+24V	+24V Power Supply.
3	GND	Power Supply Return + CAN Return.

Table 4 PFA-LN Sensor Cable Assembly Pin Outs (continued)

DB26 Pin #	Signal Name	Description
5	CANL	CAN Low Level Line.
6	CANH	CAN High Level Line.
8	GND	Motor control return.
9	AO	Analog Output.
10	PULSE	Motor Step pulse. Open Drain with internal 1K Ω pull up to +5V.
11	DIR	Motor Direction. Open Drain with internal 1K Ω pull up to +5V.
12	CWLIM	CW Limit Switch Input. Drive high-switch not tripped, floating or low-switch tripped.
13	CCWLIM	CW Limit Switch Input. Drive high-switch not tripped, floating or low-switch tripped.
14	5V	5V for motor driver brick optocouplers (max 50-100mA).
16	RS485-	Inverting RS485 Receiver Input and Driver Output.
17	RS485+	Non Inverting RS485 Receiver Input and Driver Output.
18	GND	Serial Comm / IO Return.
19	INF	In Focus. Open Drain with internal 1K Ω pull up to +5V.
20	MIV	Material In View (In Range). Open Drain with internal 1K Ω pull up to +5V.
22	ESTOP	Emergency Stop (Laser Enable), normally wired to supply voltage through a mushroom button. Actively drive high to enable laser diode.
23	CSYNC	Camera Sync Input, immediately disables the laser for the duration of the pulse. Active high.
Shell		The cable braided shield connects to the connectors metallic shell at both ends.

Electrical Specifications

Table 5 PFA-LN Sensor Electrical Specifications

Description	Value
Power Supply Voltage	10.8 VDC to 26.4 VDC
Power Consumption	12W maximum, 7W nominal
Ethernet Supported Speeds	10/100/1000 Mbps

Table 6 PFA-LN Sensor IO Electrical Specifications

Parameter	Condition	Min	Typ	Max	Units
Digital Inputs (IN1/CCWLIM, IN5/CWLIM, ESTOP, CSYNC)					
Input Voltage High (VIH)		2.8		28	V
Input Voltage Low (VIL)		-0.5		1	V
Input Resistance		21.4			k Ω
Digital Outputs (DIR/INF, PULSE/MIV)					
Maximum Drain Current	Output active (low)			100	mA
Maximum Output (Pull-Up) Voltage	Output inactive (high)		5	5.5	V
Output Voltage Low (VOL)	Output active (low)	0	0.35	0.5	V
Internal Pull Up Resistor Value			1		k Ω
Analog Output					
Output Voltage Range		-10		10	V

Table 6 PFA-LN Sensor IO Electrical Specifications (continued)

Parameter	Condition	Min	Typ	Max	Units
Maximum Output Current				±10	mA
Output Resistance			20		Ω

Environmental Specifications

Table 7 PFA-LN Sensor Environmental Specifications

Description	Value
Operating Ambient Temperature	20°C to 30°C
Transport Temperature (sealed container)	-20°C to 50°C
Storage Temperature	10°C to 40°C
Humidity Temperature	25% to 75% non-condensing

Optical Specifications

Table 8 Laser Characteristics

	450 nm version	660 nm version	785 nm version	850 nm version
Wavelength	450 (-10/+10) nm	660 (-8/+4) nm	785 (-10/+10) nm	850 (-10/+10) nm
Typical output power ^a	1.1 mW	1.1 mW	0.9 mW	1.1 mW
Beam divergence	Collimated along the length of the sensor housing, and less than 40 mrad in the perpendicular direction ^b			
Laser pulse frequency	5 kHz max			
Duty cycle	0-100%			
Laser pulse width	0.45 μs – 20 ms			

- a. The typical power values are measured with a 2 μs exposure time in 50X far mode, corresponding to a 40% duty cycle.
- b. For PFA-LN 785nm OA and PFA-LN 850nm OA sensors, adjusting the position of the OA lens, located at the output aperture, slightly changes the output beam divergence.

Laser Beam Shape and Size

The image in this section is the shape of the laser light as it exits the PFA-LN Sensor. The following properties can be observed:

- The laser light profile is that of an elongated rectangle.
- The laser exits from only one half of the sensor's exit aperture.
- As the laser light is observed at longer distances the shape changes. The width of the line remains the same while the height of the line decreases.

- At a distance of about 150mm the beam turns into a line and then starts to diverge.

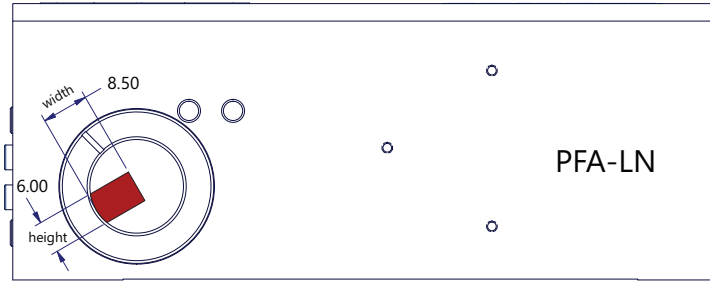
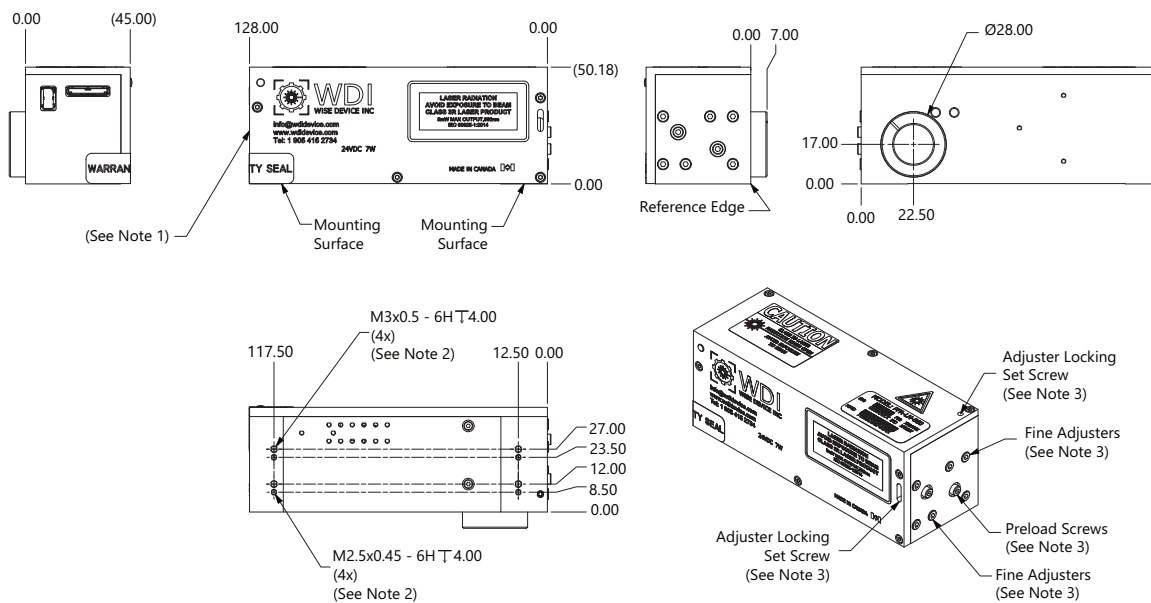


Figure 3 Sensor Beam Shape and Size

Mechanical Dimensions



NOTES:

- Allow an extra 70 mm for cable bend radius and connector unplugging.
- Mounting screws must not protrude into the body more than 4 mm to avoid any interference with internal components.
- The Preload Screw, Fine Adjusters, and Adjuster Locking Set Screws must be accessible after installation for the final, in field, calibration of the sensor.
- Weight of the sensor is 0.44 Kg.

Figure 4 PFA-LN Sensor Dimensions

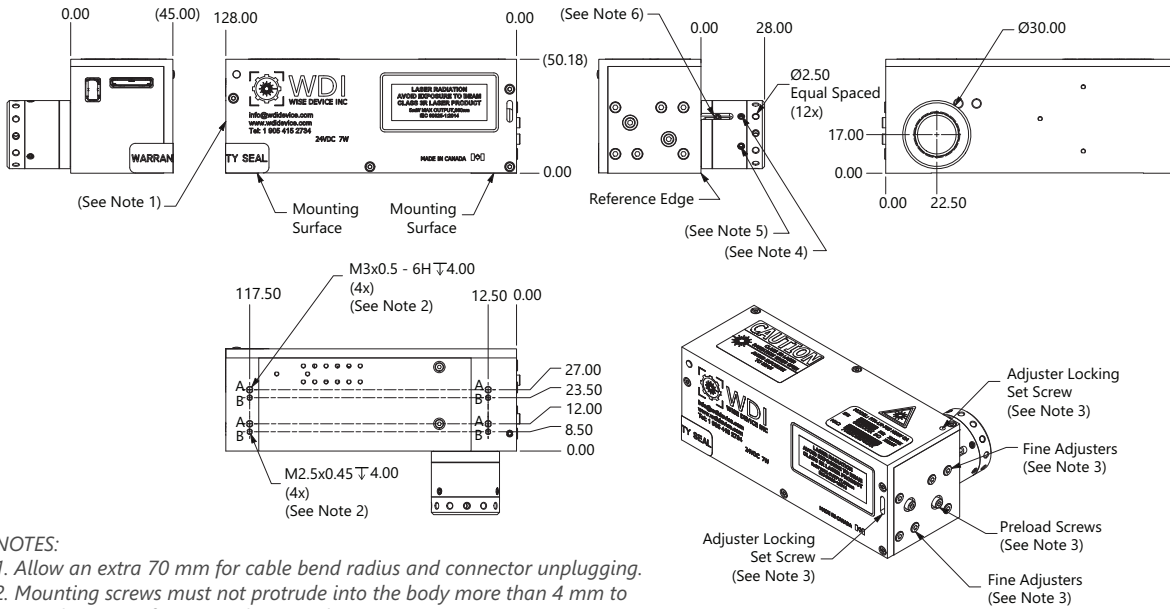


Figure 5 PFA-LN Sensor Dimensions – OA

Accessories

Table 9 PFA-LN Sensor Accessories

Accessory	Part Number	Remarks
PFA-DT/LN Distribution Box	970140	Includes Distribution Box and a connector kit for stand-alone configuration.
PFA-DT/LN DOF-5 Distribution Box Plus	970150	Includes Distribution Box Plus cable to connect to a Dover Motion DOF-5, and a connector kit.
Cable (Cat6A, IX-RJ45, 3m, Black)	301904	Ethernet cable, 3000 mm length.

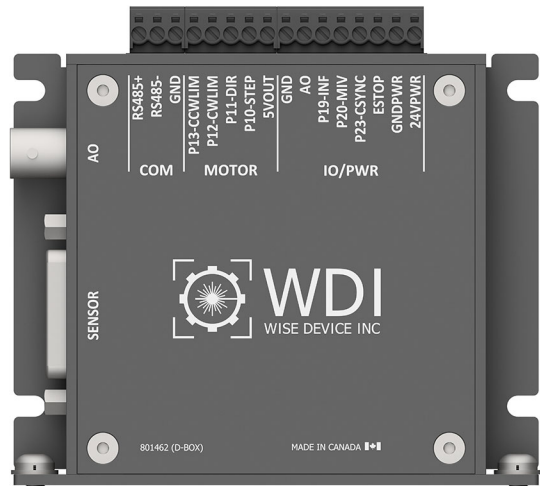


Figure 6 PFA-DT/LN Distribution Box

NOTE: This drawing shows the PFA-DT/LN Distribution Box (part number 970140). The customer connections on other version may differ. See the PFA-DT and PFA-LN Sensor Distribution Box Datasheet for more information.