



PFA-DT Sensor Datasheet



2023

PFA-DT Sensor Description

The PFA-DT 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-DT Sensor Types

Type	Part Number
Sensor (PFA-DT-660)	974100
Sensor (PFA-DT-785)	974110
Sensor (PFA-DT-850)	974120
Sensor (PFA-DT-785-OA)	974150
Sensor (PFA-DT-850-OA)	974130

Product Specifications

Table 2 PFA-DT Sensor Features

Feature	Description
Structured Light Pattern	Single Dot
Laser Wavelengths Available	660 nm, 785 nm, 850 nm
Laser Classification	Class 1M for 660 nm and 785 nm, Class 1 for 850 nm
Sampling Rate	Up to 8 KHz
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	200 mm
Specimen Reflectivity	1% - 99%

Table 3 PFA-DT 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	± 1400	± 4000
10X	0.28	± 3.5	± 350	± 4000
20X	0.42	± 1.6	± 160	± 1200
50X	0.55	± 0.9	± 65	± 200

- 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 $\pm 0.53 \mu\text{m}$).
- 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 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 ($R \sim 4\%$).

Electrical Connections

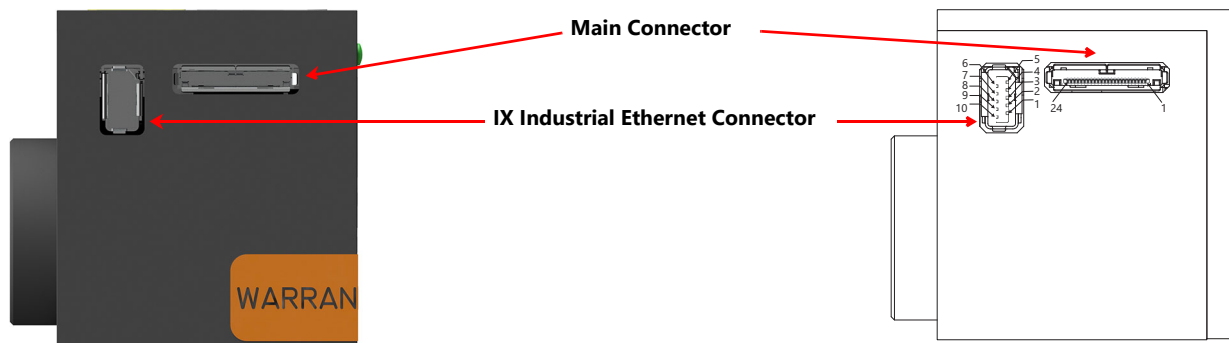


Figure 1 PFA-DT Sensor Connectors

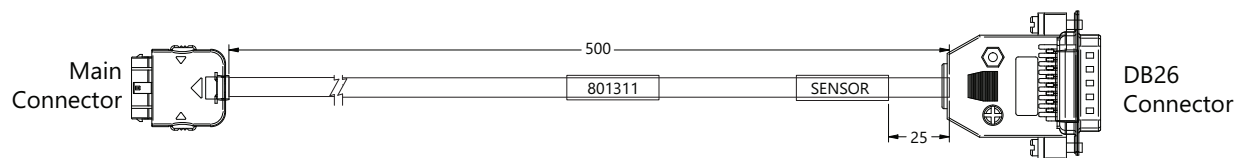


Figure 2 PFA-DT Sensor Cable

Table 4 PFA-DT Sensor Cable Assembly Pin Outs

DB26 Pin #	Signal Name	Description
1	+24V	+24V Power Supply.
3	GND	Power Supply Return + CAN Return.
5	CANL	CAN Low Level Line.
6	CANH	CAN High Level Line.
8	GND	Motor control return.

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

DB26 Pin #	Signal Name	Description
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

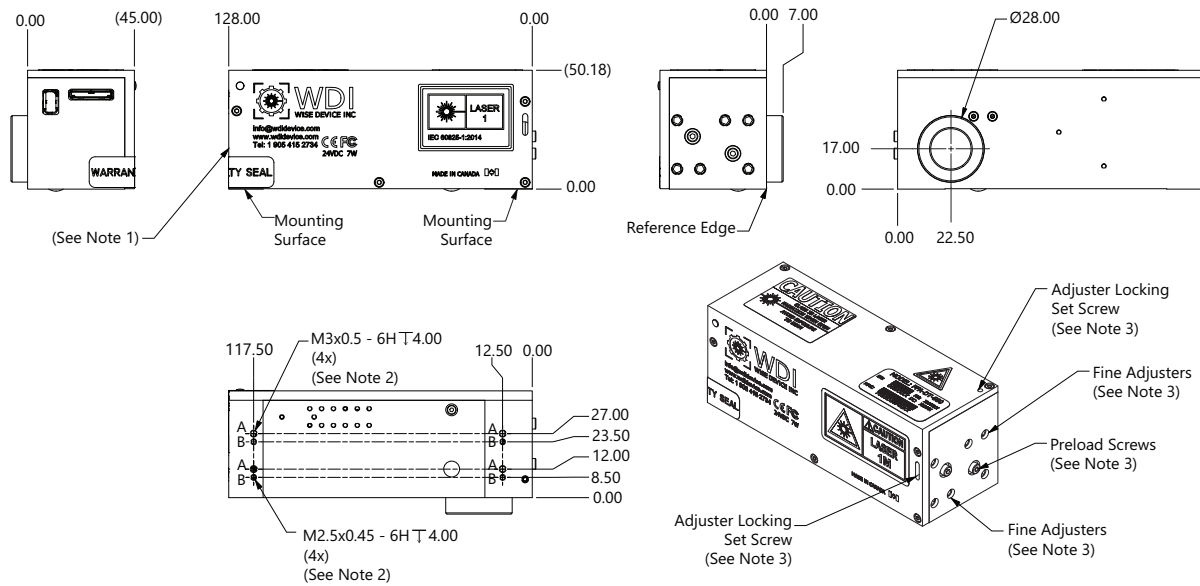
Table 5 PFA-DT Sensor Electrical Specifications

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-DT 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
Maximum Output Current				± 10	mA
Output Resistance		20			Ω

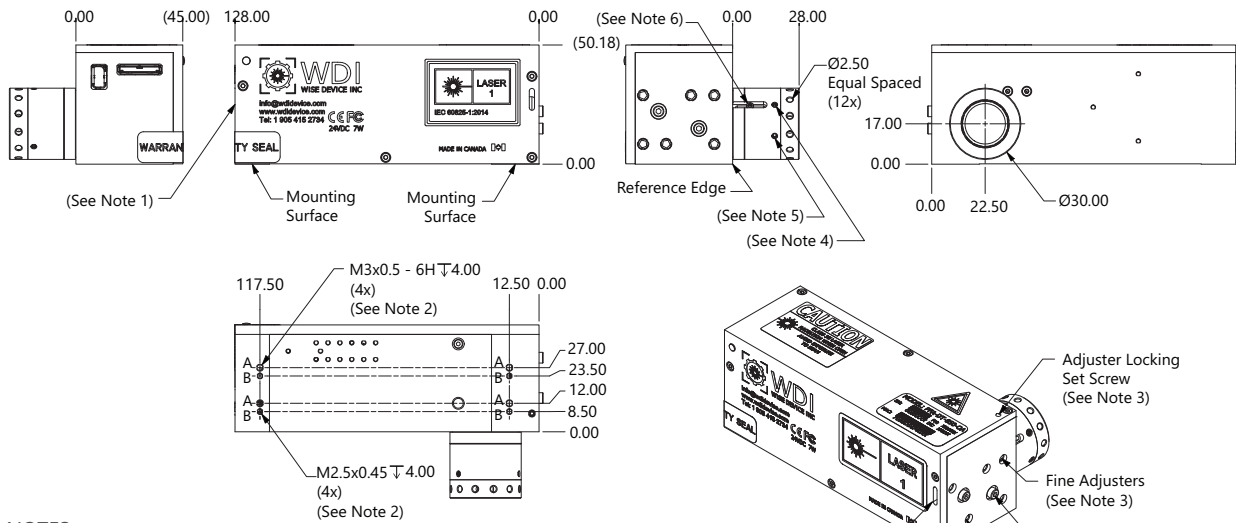
Mechanical Dimensions



NOTES:

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

Figure 3 PFA-DT Sensor Dimensions



NOTES:

1. Allow an extra 70 mm for cable bend radius and connector unplugging.
2. Mounting screws must not protrude into the body more than 4 mm to avoid any interference with internal components.
3. The Preload Screws, Fine Adjusters, and Adjuster Locking Set Screws must be accessible after installation for the final, in field, calibration of the sensor.
4. This "shiny" locking set screw must be accessible after installation for the final, in field calibration of the sensor, to lock the position of the offset adjuster lens.
5. These 3x "black" set screws **should not** be adjusted in field. adjusting these black set screws will compromise the performance of the offset adjuster.
6. This guiding screw **should not** be adjusted in field. adjusting this screw will compromise the performance of the offset adjuster.
7. Weight of the sensor is 0.455 Kg.

Figure 4 PFA-DT Sensor Dimensions – OA

Environmental Specifications

Table 7 PFA-DT 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	10% to 80% non-condensing

Optical Specifications

Table 8 PFA-DT Sensor Wavelength Specifications

Wavelength	Min	Typical	Max
PFA-DT 660	645 nm	660 nm	665 nm
PFA-DT 785	775 nm	785 nm	795 nm
PFA-DT 850	845 nm	850 nm	855 nm

Table 9 PFA-DT Sensor Typical Power

Wavelength	Typical power
PFA-DT 660	0.26 mW
PFA-DT 785	0.72 mW
PFA-DT 850	0.15 mW

Laser Beam Shape and Size

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

- The laser light profile is that of a half circle.
- The laser exits from only one half of the sensor's exit aperture.
- As the laser light is observed at longer distances the shape remains the same.

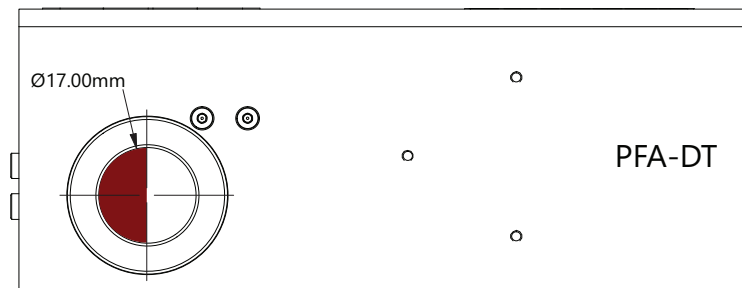


Figure 5 Sensor Beam Shape and Size

Available Accessories

Table 10 PFA-DT Sensor Accessories

KIT Accessories	Part Number	Remarks
PFA-DT/LN Stand-alone Accessory	970140	Includes Distribution Box-SA. For stand-alone configuration.
PFA-DT/LN MMS PBI-ZAA Accessory	970110	Includes Distribution Box-MMS and Cable (CAB-DB-PFABUS ZAA), 300 mm. For MMS with PFABUS(PB) ZAA configuration.
PFA-DT/LN MMS PBI-ZAA-LLC Accessory	970120	Includes Distribution Box-MMS and Cable (CAB-DB-PFABUS ZAA-LLC), 300 mm. For MMS with PFABUS(PB) ZAA & LLC configuration.
PFA-DT/LN DOF5 Accessory	970150	Includes Distribution Box-DOF5 and Cable (CAB-DB-DOF), 300 mm. For DOF5 configuration.

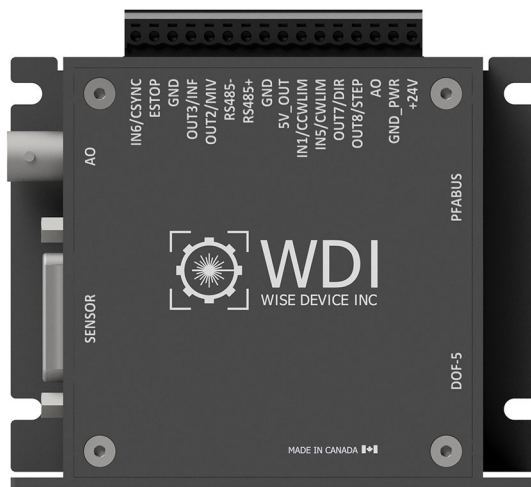


Figure 6 PFA-DT Sensor Distribution Box – DOF5

NOTE: This drawing shows the distribution box for DT/LN DOF5 Accessory (part number 970150). The customer connections on other versions may differ. See the PFA-DT Sensor Distribution Box Datasheet for more information.