MIH® Laser Source

PPM-020C **Datasheet**

Key Features:

- 976 nm laser source
- Up to 20 W laser power out
- Adjustable power levels
- Overheating alarm
- Compact design and easy to integrate

Applications:

- Current Measurement (ECTs)
- Remote Sensors
- Power Electronics
- EMC Testing
- RF over Fiber & 5G

Product Description

The photonic power module (PPM) includes one diode laser, a driver control board and a TEC cooler, with one 10-pin connector and one 2-pin connector. The PPM provides up to 20 W of optical power output, which is launched into a 0.5 m multimode fiber (105/125 µm, NA 0.22) with FC/PC connector at nominally 976 nm wavelength. An extra heat sink for the PPM module is required to provide sufficient cooling when operating under different environmental conditions. This unit is designed only for use when connected to a photovoltaic power converter (PPC), purchased separately.

Mechanical Drawing

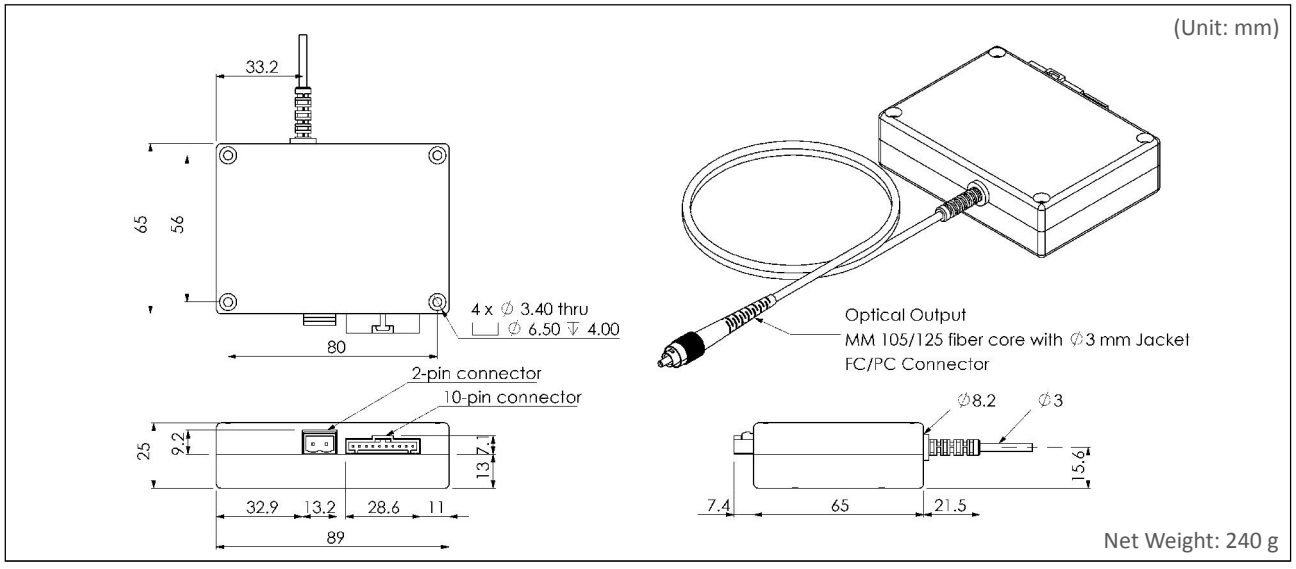


Figure 1. PPM Mechanical Drawing

Operation Principle

External power must be applied to the module in accordance with Table 1 for proper operation. The PPM accepts a supply voltage in the range of 11 V to 13 V.

The PPM is enabled when the **SDN** pin voltage is higher than 1.4 V, and disabled when it is lower than 0.95 V. The output optical power can be adjusted by applying a voltage between 0 V and 2.5 V to the **LIS** pin. The driving current increases linearly with the voltage applied to the **LIS** pin up to 2.5 V and can be monitored through the voltage level on the **LIO** pin.

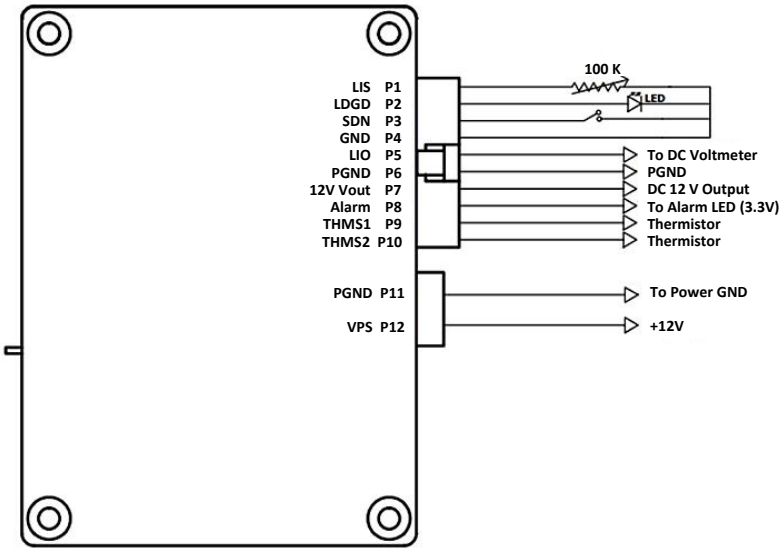


Figure 2. Stand-alone Application Schematic for PPM-020C

Table 1. Pin Function Descriptions

Pin #	Name	Type	Description
1	LIS	Analog Input	Laser current set-point voltage. There is an input variable resistor of 100 KΩ tied to **GND**. Setting it from 0 V to 2.5 V will set the output laser power from 0 A to 10 A linearly.
2	LDGD	Digital Output	Laser diode good indicator. ● When this pin is high, V_{LDGD} > 2 V, the laser diode is good, the control loop is working properly. ● When this pin is low, V_{LDGD} < 0.3 V, the laser diode is bad, or there is a short or open circuit at the laser diode.
3	SDN	Digital Input	Shut down control. When the shutdown control is open (by default), this pin is 3.3 V and the laser will be on. To turn off the laser, short this pin to **GND** by switching shut down control to close.
4	GND	Signal Ground	Signal ground pin.
5	LIO	Analog Output	Laser current indicator. The **LIO** can be used to monitor the laser current when the **LIS** is adjusted. 0 V to 2.5 V indicates the laser current from 0 A to 10 A linearly. I_{laser} [A] = 4 × V_{LIO} [V]
6	PGND	Power Ground	Power ground pin. Connect this pin directly to power supply return pass.
7	12V V_{out}	Power Output	12V power output. Can be used to power the voltage meter. An external capacitor (100 uF/ 25 V) is required for the external line. Connect 12V V_{out} to the positive terminal and **PGND** to the negative terminal.

Table 1. Pin Function Descriptions (continued)

Pin #	Name	Type	Description
8	Alarm	Digital Output	Warning indicator. When laser diode temperature is too high or laser driver malfunctions, this pin will output 3.3 V. ● When the laser temperature is higher than 35 °C, it will show 5 Hz PWM 3.3 V voltage level ● When the laser driver is abnormal, it will show a stable 3.3 V voltage level.
9	THMS1	Analog Output	Case temperature. The **THMS** is used to monitor case temperature based on the lookup table in Figure 4. Please keep case temperature below 40 °C during operation.
10	THMS2	Analog Output	
11	PGND	Power Ground	Power ground pin. Connect this pin directly to power supply return pass.
12	VPS	Power Input	Power supply voltage. The driver will work from **VPS** = 11 V to 13 V, and 12 V is recommended.

Equipped Connectors:

(a) 10-pin connector: Molex® SL 10-pin, 2.54 mm pitch, (P/N: 705530114)

(b) 2-pin connector: Molex® Terminal block, 2-pin, 5.08 mm pitch (P/N: 395321002)

Turning Laser On and Off

The PPM can be turned on and off by setting the **SDN** pin high and low respectively. It is recommended to turn the PPM on by the following sequence:

Turning on: Turn on the PPM by providing the voltage supply on the **VPS** pin, and raising the voltage of **SDN** pin.

Turning off: Turn off the PPM by lowering the voltage of **SDN** pin, and stopping the voltage supply on the **VPS** pin.

Adjusting the Laser Power

The output laser power can be adjusted by setting the laser driving current through **LIS** pin. The driving current is set by adjusting the 100 KΩ variable resistor between **LIS** and **GND**, which sets input voltages of **LIS**. The driving current will be 4 × V_{LIS} [A]. The voltage settings to generate specific laser power output levels are illustrated in Table 2. Actual voltage settings may vary per PPM, and exact settings will be included with the PPM.

Table 2. Laser Power and Setting Voltage Chart

Laser Power [W]	Setting Voltage [V]	Driving Current [A]	Resistance [KΩ]
2	0.34	1.34	1.44
4	0.54	2.14	2.50
6	0.70	2.78	3.76
8	0.90	3.58	5.33
10	1.10	4.38	7.38
12	1.30	5.18	9.92
14	1.46	5.82	13.25
16	1.66	6.62	17.91
18	1.86	7.42	25.72
20	2.02	8.06	38.36

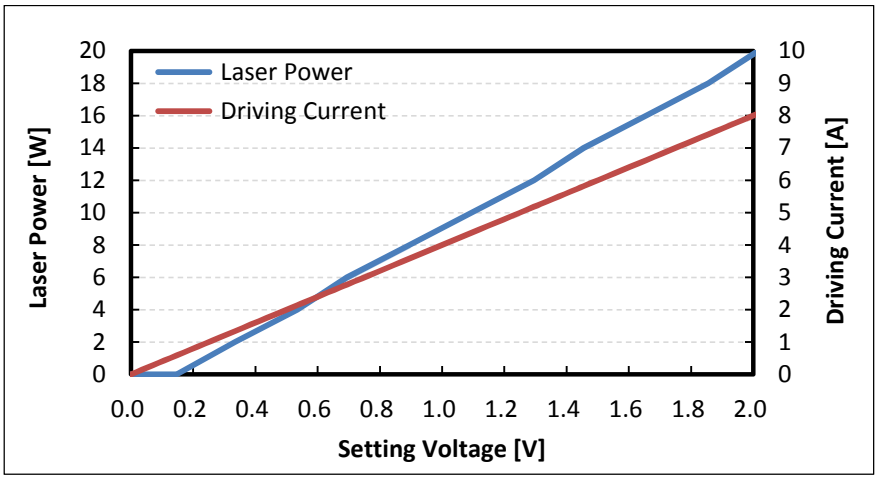


Figure 3. Laser Power & Driving Current under Different Voltage Settings

Monitoring the Laser Power

The PPM output power can be monitored by measuring the voltage V_{LIO} on the **LIO** pin, which indicates the laser driving current I_{laser} level. This feature is very useful for a micro-driver based system where the ADC is available and monitoring the driving current in real time is required. This pin provides a very low noise voltage signal which is proportional to the driving current:

$$I_{laser}\ [A] = 4 \times V_{LIO}\ [V]$$

For example, when the output signal equals to 1 V, the driving current is 4 A. The **LIO** pin can be used to drive an ADC directly, and also be measured by a multi-meter during debugging process.

Monitoring the Case Temperature

The case temperature can be monitored using the resistance between **THMS1** and **THMS2**. The resistance of the thermistor is 10 KΩ at 25 °C. Based on the R/T characteristics table in Figure 4, the resistance will go up as the temperature drops, and the resistance will go down as the temperature increases.

For example, when the resistance reading (R2) is 29,200 Ω, the case temperature will be between 0 °C ~ 5 °C, determined by looking up values in the table below. Using 0 °C (T1) as the reference point, we know that R1 = 32,650 Ω and α1 = 0.051. Putting the values into the following formula, the case temperature = 2.25 °C.

$$\text{Case temperature} = T1 - \frac{\ln(\frac{R2}{R1})}{\ln(1+\alpha 1)} = 0 - \frac{\ln(\frac{29200}{32650})}{\ln(1+0.051)} = 2.25\ °C$$

Please keep the case temperature below 40 °C, which is needed to keep the resistance above 3,603 Ω. The maximum power that can be applied to this thermistor is 150 mW; exceeding this power level could cause damage to the thermistor.

T (℃)	$B_{25/100}$ = 3988 K		T (℃)	$B_{25/100}$ = 3988 K	
	R_T / R_{25}	α (%K)		R_T / R_{25}	α (%K)
-55.0	96.30	7.4	45.0	0.4369	3.9
-50.0	67.01	7.2	50.0	0.3603	3.8
-45.0	47.17	6.9	55.0	0.2986	3.7
-40.0	33.66	6.7	60.0	0.2488	3.6
-35.0	24.26	6.4	65.0	0.2083	3.5
-30.0	17.70	6.2	70.0	0.1752	3.4
-25.0	13.04	6.0	75.0	0.1481	3.3
-20.0	9.707	5.8	80.0	0.1258	3.2
-15.0	7.293	5.6	85.0	0.1072	3.2
-10.0	5.533	5.5	90.0	0.09177	3.1
-5.0	4.232	5.3	95.0	0.07885	3.0
0.0	3.265	5.1	100.0	0.06800	2.9
5.0	2.539	5.0	105.0	0.05886	2.9
10.0	1.990	4.8	110.0	0.05112	2.8
15.0	1.571	4.7	115.0	0.04454	2.7
20.0	1.249	4.5	120.0	0.03893	2.6
25.0	1.0000	4.4	125.0	0.03417	2.6
30.0	0.8057	4.3	130.0	0.03009	2.5
35.0	0.6531	4.1	135.0	0.02654	2.5
40.0	0.5327	4.0	140.0	0.02348	2.4

Figure 4. R/T Characteristics of Thermistor

Recommended Mating Connector

- 10-pin connector: Molex® P/N: 50579410
  2-pin connector: Molex® P/N: 395300002

Please refer to Molex's official website (https://www.molex.com) for detailed schematics and drawings.

Fiber Handling

Follow proper fiber-handling procedures to avoid catastrophic damage in high-power lasers:

- Do not expose fiber to temperatures higher than 85 °C
- Always wear gloves or finger cots when handling the fiber to avoid fiber contamination
- Whenever possible, handle fiber in loops to prevent fiber damage
- Do not drag fiber over equipment, edges or sharp objects
- Never use the fiber to pick up or support the weight of the PPM. Always handle the PPM with two hands, one holding the PPM and the other handling the fiber coil to avoid fiber damage or breakage.
- Do not allow kinks or knots to develop in the fiber. Carefully work out any tangles without pulling on the fiber as this can cause any kinks or curls to tighten and exceed the minimum bend radius.
- Do not bend a fiber with a radius smaller than specified as minimum bending radius 30 mm

Fiber Contamination and Cleaning

Fiber contamination is a key consideration for high-power laser modules. Dirt or contamination will cause a local temperature increase as it absorbs the dissipated cladding modes.

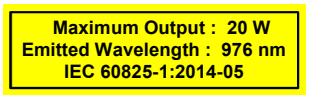
- Wear gloves when handling fiber
- Avoid any contamination of fiber tip

Fiber cleaning materials and procedures shown here are for informational purposes only and are not meant to recommend, endorse, or discredit any existing procedures. It is recommended that users evaluate any procedure or product before using it in applications where damage or failure could result. As always, safety precautions must be exercised at all times when using glass, chemicals, and lasers.

Safety Precaution

PPM-020C can provide up to 20 W optical power in the infrared region. Please follow the standard safety protocol for eye and skin for Class 4 IR lasers. Proper electrical interlocks should also be included as required for Class 4 laser systems.

This product is sold in component form and does not conform to **CDRH 21, CFR 1040.1 or 21 CFR 1040.11** or **IEC 60825-1** as applicable to complete laser systems.



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