PowerMax Water-Cooled & OEM Detector Application Note

Caution

While working with the water connections, avoid getting any water on the surface of the detector. Water will corrode the coating on the detector surface and cause damage during use. If water does come in contact with the detector surface, the best way to quickly remove the water is to use a blow dryer or heat gun to evaporate the water and keep it from soaking into the coating.

Fittings

All PM1K, PM3K, PM5K, and pM10K water-cooled detectors come with brass fittings, while all other water-cooled detectors lower than 1 kW come with plastic fittings. All are 1/8 NPT (National Pipe Thread.) The brass fittings on the kW detectors have been *glued to the water jacket inlet and outlet permanently.* **REMOVAL OF FITTINGS FROM THE KW DETECTORS WILL CHANGE THE COOLING PROPERTIES OF THE DETECTOR AND WILL VOID THE WARRANTY ON THE PRODUCT.**

Coolant

1. Tap or distilled water is recommended.
2. Do not use Dl water, as it will dissolve aluminum and brass.
3. Ethylene Glycol is okay up to a 10% maximum in the mixture.
4. Allow sufficient time for the water flow and detector head to reach equilibrium. The water flow should run through the detector for a couple minutes before zeroing the meter and beginning the measurement.
5. Maximum input water temperature fluctuation should be 1 degree C per minute. It should be much slower than the time constant of the head. Any rapid temperature variation will give erroneous readings.
6. It is recommended that the water supplied to the detector is not in series with water supplied to other equipment (such as a laser.) In certain applications, laser systems will adjust the water flow rate based on the needs of the laser. This can change the flow rate in the detector and cause erroneous measurements. Adding a detector head to a laser cooling supply can also cause problems with thermal strain on the cooling system.

Water Flow

The following table lists some of the minimum flow rates for the water-cooled power detectors. The water-cooling requirements are basically the same for the high power and OEM detectors, although they can vary depending on the exact detector being used.

Laser Power	Flow Rate
100 W	0.2 GPM
500 W	0.2 GPM
1000 W	0.4 GPM
2500 W	1.0 GPM
5000 W	2.0 GPM
7500 W	3.0 GPM
10000 W	4.0 GPM

Note! These are minimums. This allows the water discharge temperature to increase 15 degrees F, which is the maximum recommended for safe operation. The flow rate for any measurement under 500 W should not drop below 0.2 GPM.

A simplified method for calculating the minimum water flow is given by the following approximate formula.

At a flow rate of 1 GPM, the outgoing water temperature will rise 1 degree F for every 150 W of power on the detector surface. To avoid damage to the sensor, the rise in outgoing water temperature should be limited to 15 degrees F. Based on these numbers, the minimum water flow should be 1 GPM per 2500 W. This leads to the following equation:

$$\text{Water Flow} = \frac{\text{Power}}{2500\text{W/GPM}}$$

Example: Model PM5K-200 is measuring a 4000 W laser. Using 15 degrees F as the maximum temperature change of the outgoing water, the minimum water flow should be:

$$\frac{4000\text{ W}}{2500\text{W/GPM}} = 1.6\text{ GPM}$$

This applies to all Molectron water-cooled detectors, including OEM detectors. This does have its limitations and assumes that the water is not near boiling! The water temperature affects the damage threshold of the absorber surface. As the temperature of the water increases the damage threshold goes down. We have not done any specific studies and don't know if it is a linear function or not. If maximum damage threshold is being considered or high power is being applied, maximize the water flow.

Pressure vs Water Flow

The following table shows flow rate versus pressure, using our fittings and a 3/8 inch hose that connects to the supplied fittings. If the fittings or hoses are changed, the flow rate will change. This applies to our PMIK, PM3K, PM5K, and PM10K detectors, and does not include the PM10-xxx, PM150-xxx, or PMIK-36B GEM detectors. Water flow is measured at the input of the detector.

Pressure	Flow Rate
3 PSI	0.5 GPM
6 PSI	1.0 GPM
11 PSI	1.5 GPM
18 PSI	2.0 GPM
25 PSI	2.5 GPM
32 PSI	3.0 GPM
42 PSI	3.5 GPM

OEM Detectors

PMIO-I9B, PMI50-I9B, PMIK-36B

Output impedance is close to 2.5 kohm. The output needs to run into a high impedance of at least 1 Mohm.

The center conductor is positive. It is electrically floating above ground except for capacitance value to ground. Maximum elevated voltage above ground is 25 V.

PMIO-19A, PMI50-I9A

Current draw for a 15 V supply is approximately 8 mA at -15 V, and approximately 18 mA at +15 v.