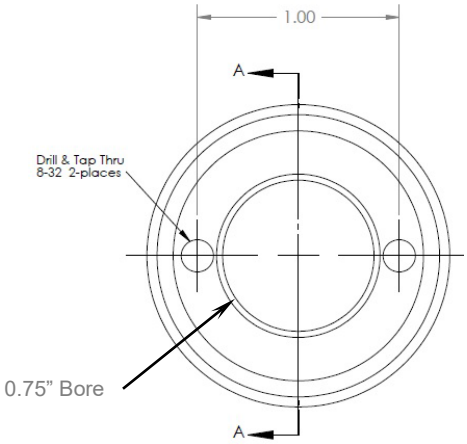
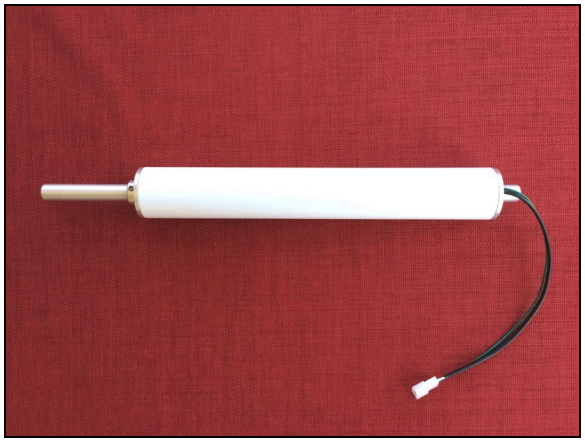
Alaric 10090 10W DC Heated Inlet Instructions

The Alaric Electromechanics Model 10090 Heated Inlet Assembly is OEM designed to meet the RH control inlet heater requirements for 2 L/min or similar low flow particulate matter (PM) sensors or nephelometer modules. The heater assembly is insulated, weatherproof, and is designed to be installed on the top of a user-supplied instrument enclosure. There are two versions of the assembly with different mounting methods for your enclosure.





10090 Standard Base With Dimensions for Required Enclosure Mounting Holes (Inches)

10090-2 M30x2 Threaded Base Version For User-Supplied Threaded Socket

Specifications:

Heater Voltage:	12V DC standard. (24V DC version optional)
Heater Wattage:	10 Watts typical. 12W max.
Heater Current:	0.85 Amps typical
Heater Element Resistance:	13-16 Ohms typical at room temperature.
Internal Operating Temperature:	150-160ºF (65-71 C) Typical, at internal tube with zero air flow.
Inlet Tube Length:	13.75 Inches (35 cm) long.
Inlet Tube Diameters:	0.499 Inch (12.68 mm) max OD. 0.26 Inch (6.6 mm) Inside Diameter.
Airflow Rate:	1-5 L/min Typical
Heat Control:	Self-regulating resistive heater element. No thermostat or temperature sensing hardware required. See notes.

Installation:

Model 10090 standard base version: See drawing above. The 10090 heater assembly is easily adapted to an existing enclosure, but may be more difficult to remove if needed depending on your enclosure layout. It requires a 0.75 inch (19 mm) diameter round hole to be cut in the roof of the enclosure for the inlet tube and wire harness to pass through. This hole must be located directly above the particulate sensor inlet socket. Two 0.17 inch (4.5 mm) diameter holes with 1.00 inch (25.4 mm) spacing for two mounting screws are also required. The 10090 heater assembly is supplied with an AS568A-026 size o-ring which should be installed into the groove on the bottom of the heater base for a waterproof seal against the enclosure roof. The heater includes two 8-32 mounting screws with split washers, which install upward through your enclosure roof to mount the heater.

Model 10090-2 M30 threaded base version: See photos above. The 10090-2 version has a 17mm long M30 x 2 metric male threaded boss on the bottom of the heater shell assembly. This version threads into a mating socket (not included) on the top of your enclosure for easier inlet installation and removal if called for by the application. A 26mm ID x 2.5 o-ring seals the joint. This version requires the instrument manufacturer or system integrator to make a suitable mating threaded socket for the top of the enclosure. Alaric can manufacture custom M30 sockets to your specifications if needed, for an additional cost.

Internal Inlet Tube Vertical Adjustment:

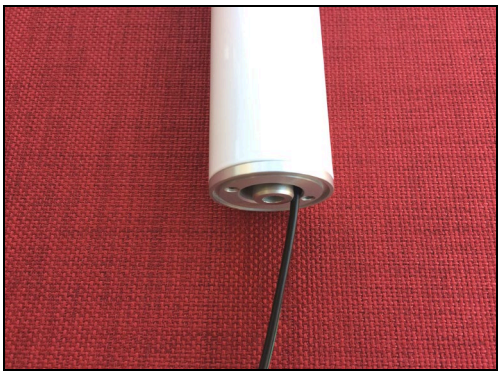
The top cap of the heater shell assembly has an internal AS568A-014 size o-ring which seals around the top of the internal inlet tube. This has been factory lubricated during assembly.

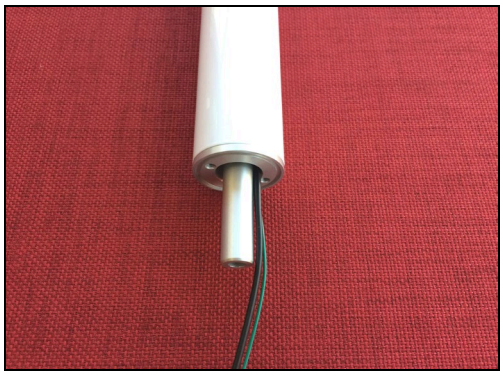
The internal ½ inch diameter inlet tube has a vertical adjustment range within the external heater shell. See photos below. This allows for some variability in the vertical position of the PM sensor in the enclosure, and also allows the inlet tube to be raised up out of the PM sensor for sensor removal if necessary. Removing the internal inlet tube heater core from the insulated heater shell assembly is not recommended, as there are no serviceable parts inside.

Note: The heater shell top cap has an 8-32 set screw which must be loosened with a 5/64” hex wrench before the inlet tube is raised or lowered. This set screw should be tightened after the inlet tube is in the final installed position, in order to prevent inlet tube movement or rotation.

With the inlet tube in its highest vertical position, the bottom of the tube will protrude about 0.1 inches (2 mm) from the bottom of the heater shell. With the inlet tube in its lowest vertical position, the bottom of the tube will protrude about 1.5 inches (40 mm) from the bottom of the heater shell. The top of the inlet tube must protrude from the heater body top cap far enough to properly accept a cyclone or TSP inlet as required. Note: The bottom protrusion length of the 10090-2 threaded base version varies slightly.

Note: It is recommended that the PM sensor be installed as close as possible to the inside of the enclosure roof. It is often necessary to raise the inlet tube before the PM sensor can be removed from the enclosure, depending on the design of the sensor mounting inside the enclosure.





Electrical Connections and Heater Control Methods:

The wire harness from the heater assembly must be connected to a 12V DC power source. The harness has a 3-pin Molex connector which can be removed and replaced with a different type if necessary. Mating connectors or the Molex parts ordering information are available from Alaric.

There are no thermostats, temperature sensors, or RH sensors located inside the heater assembly. These can be added to the downstream instrument flow path if required for the planned control method. The heater element is self-regulating and does not overheat or engage in thermal runaway. However, full wattage operation may not be optimal for your application.

The simplest control method is to wire the heater to 12 VDC so that it is powered on permanently. However, a preferred method is to power the heater on only when the instrument vacuum pump is running, and air is flowing through the tube. The warm-up time is approximately 5 minutes from room temperature. The maximum sample air stream temperature increase caused by the heater (Delta T) will vary depending on the flow rate of the instrument. Lab testing should be done during the integration of the heater module to measure the downstream temperature and/or RH of the air stream, and to ensure that the desired effects are occurring.

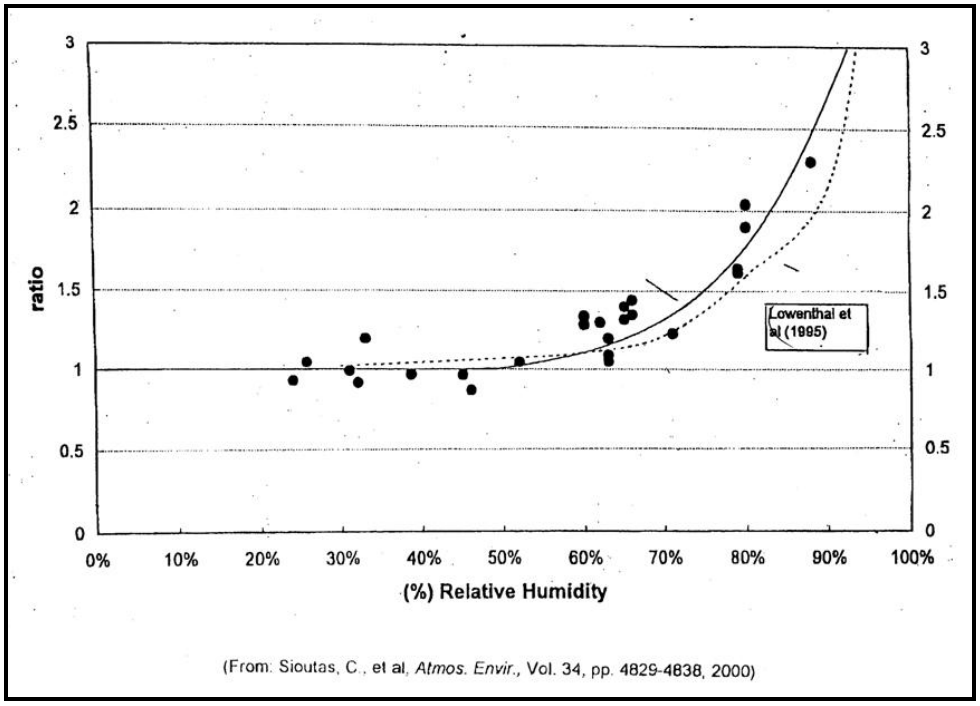
Although the exact airflow rate through the tube is not critical, the 10W element is typically sufficient for an airflow rate of 1-2 L/min in most ambient conditions. If the airflow rate is significantly higher, then testing should be done to ensure that enough heat is being generated to control the sample RH.

The heater may be configured to be actively controlled by the air sampling instrument electronics, a PLC, or other device to automatically power the inlet heater on or off as needed to regulate the temperature or relative humidity of the sample air to a desired setpoint. Pulse-width modulation or proportional control can be used for more sophisticated control methods. An air temperature sensor and/or RH sensor will be required in the flow path for these advanced heater control methods.

For most optical particulate monitoring applications, the sample air relative humidity must be maintained **below 50% RH** in order to minimize positive PM measurement bias (measuring too high) caused by particle swelling and aggregation. This effect can be very large, and there are several whitepaper research documents on the topic. The graph below from the journal *Atmospheric Environment* (volume 34, pp 4829-4838, 2000) shows RH drastically affecting the concentration measurement. The following article references also contain related information:

Volume 35, Issue 30, Oct 2001:
-Aerosol Light Scattering Measurements as a Function of Relative Humidity. (Malm, Day).
-Diurnal and Seasonal Patterns in Light Scattering, Extinction, and Relative Humidity. (Malm, Gebhart, Copeland).

Volume 35, Issue 16, June 2001:
-Estimates of Aerosol Species Scattering Characteristics as a Function of Relative Humidity. (Malm, Day).



(From: Sioutas, C., et al, *Atmos. Envir.*, Vol. 34, pp. 4829-4838, 2000)

Wiring and Testing:

The heater can be tested with a multimeter. The total resistance of the heater element should measure approximately 14.5 Ohms ±2 Ω between pin 1 (12V+) and pin 2 (12V-, common) of the connector, at room temperature. The heater element has no required polarity for pins 1 and 2. Because the heater element is self-regulating, the measured resistance will vary at different room temperatures. The resistance will also increase as the heater temperature increases, reducing the current flow. Allow the heater to cool completely before testing the resistance.

The extra wire on pin 3 is a chassis ground wire connected to the internal ½ inch diameter aluminum inlet tube. This should be connected to an instrument ground/common to prevent static electricity or EMI noise from coupling onto the inlet tube. There should be no conductivity between pin 3 and the other two pins.