

Operation Manual

# Model 4PHM

## Heated 4-Port Manifold



 **THUNDER SCIENTIFIC<sup>®</sup>**  
**CORPORATION**

# **Model 4PHM 4 Port Heated Manifold Accessory**

Document #OM4PHM - Edition 6.0

OPERATION MANUAL



**4 Port Heated Manifold**

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# 1 GETTING STARTED

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## 1.1 ABOUT

The Heated 4 Port Manifold is used to reduce sensor dry down time by heating the sensors/probes to an approximate default temperature of 50 °C or to the upper operating temperature range of the probe or sensor. The Heated 4 Port Manifold consists of the 316 stainless steel 4 Port manifold, heater, and heater controller, back pressure regulator, interconnecting fittings, and tubing.

## 1.2 NOTICE

The specifications listed and the information contained in this document is subject to change without notice. Screen shots shown in this document may differ slightly from the actual product and are given to show functionality of the examples, procedures and program. Thunder Scientific Corporation makes no warranties, either express or implied, regarding the examples, procedures and program, or the fitness of these examples, procedures or program for a particular purpose. The examples, procedures and program are made available solely on an "as is" basis and the entire risk as to their quality and performance rests with the user. Thunder Scientific Corporation shall not be liable for any incidental or consequential damages in connection with or arising out of the furnishing, use, or performance of the examples, procedures or program.

## 1.3 SAFETY INFORMATION

Important safety guidelines need to be observed when operating this equipment. Precautions are highly advisable so that no personal injury will occur during the operation and maintenance of the system. Observation of local and national regulations must be adhered to regarding safety standards.

### 1.3.1 Live Power Source

**Warning!** Make sure power source is OFF before making internal adjustments or replacing any component. Only authorized technicians should perform any maintenance or repairs to equipment.

### 1.3.2 Electrostatic Discharge

**Caution!** Electrostatic discharge (ESD) could possibly damage or destroy solid-state parts. Electrostatic discharge may not be seen, felt, or heard at levels less than 4,000 volts.

### 1.3.3 Safety Guidelines

All compressed gases, including air, can be dangerous. Know and follow all safety rules when using compressed air and especially when disconnecting and venting compressed air lines.

Always operate the Heated 4 Port Manifold in a clean, dry, well ventilated area, free of combustible materials, or solvent vapors. Operate the Heated 4 Port Manifold in an open area away from any obstruction that would restrict the flow of fresh air to the ventilation openings. Restricting any of the enclosure openings will cause serious overheating leading to probable failure.

Your Heated 4 Port Manifold system is powered by electricity. Like any other electrically powered device, if not used properly it may cause electric shock. Never operate in wet conditions and never operate with cover removed. Failure to provide adequate grounding could result in serious injury or death from electrocution. Make certain that the electrical circuit to which the Heated 4 Port Manifold is connected provides proper electrical grounding, correct voltage, and adequate fuse protection.

Attempting to operate the Heated 4 Port Manifold with protective cover removed can result in serious injury. Any repair required should be performed by authorized personnel. Repairs attempted by unqualified personnel can result in serious injury or death.

### 1.3.4 Safety Symbols

Symbols used in this manual for safety and other disciplines can be found in table 1-1.

Safety terminology used for identification of any safety conditions are as follows:

**Warning** indicates a potential hazard may exist and the user should be extremely careful.

**Caution!** identifies a condition or action that may cause damage to the system or the user.





Symbol	Description
	This symbol is shown from the WEEE directive and indicates do not dispose of this product in any municipal waste area.
	This symbol means Caution should be observed or important information.
	This symbol indicates a potential shock hazard may exist.
	This symbol means Earth Ground.

Table 1-1

## 1.4 TECHNICAL SUPPORT

If the user requires assistance with any aspect of the Heated 4 Port Manifold System, technical support can be obtained by contacting Thunder Scientific Corporation by any of the following means:

Web: [www.ThunderScientific.com](http://www.ThunderScientific.com)

Email: [support@thunderscientific.com](mailto:support@thunderscientific.com)

Tel : 1-505-265-8701

FAX : 1-505-266-6203

## 1.5 WARRANTY

Thunder Scientific Corporation (TSC) warrants this product to be free of defects in material and workmanship under normal use and service when operated within the specified design limitations for a period of 1 year from date of shipment. TSC's obligation under this warranty shall be limited to the following: The Product is returned to TSC with transportation charges prepaid and that TSC's examination reveals the Product to be defective, TSC, at its option, shall repair or replace at TSC's plant, any part or parts of the Product



which is or are defective. This warranty shall not apply to any Product that has become damaged or inoperative because of ordinary wear, misuse, cold, heat, rain, excessive humidity, use of improper chemicals, negligence, accident, failure to operate the product in accordance with the instructions provided in the Owner's Manual(s) supplied with the product, improper maintenance, the use of accessories or attachments not recommended by TSC or unauthorized repair or alterations.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER WARRANTY, WHETHER EXPRESS OR IMPLIED, AND ALL OTHER LIABILITIES AND OBLIGATIONS ON THE PART OF TSC; TSC SHALL NOT BE LIABLE FOR ANY INCIDENTAL, INDIRECT OR CONSEQUENTIAL LOSS, DAMAGE, OR EXPENSE THAT MAY RESULT FROM ANY DEFECT, FAILURE OR MALFUNCTION OF THE PRODUCT.

All warranties express or implied, with respect to any device or component not manufactured by TSC but incorporated into its Product are the responsibility of the original manufacturer and shall not affect or apply to TSC.

## 1.6 COPYRIGHT

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Albuquerque, New Mexico 87123, USA

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## 1.7 TRADEMARK



®THUNDER SCIENTIFIC is the registered trademark of Thunder Scientific Corporation

## 1.8 SPECIFICATIONS <sup>1</sup>

SetPoint Manifold Temperature: ..... 20 to 60 °C +/- 1.0 °C  
Voltage/Frequency: ..... 100-240VAC, 50/60Hz  
Pressure Rating (MAWP): ..... 50 psiA  
Physical Dimensions (no regulator): ..... 6.25" L x 3.75" W x 4.00" H  
Weight: ..... 9.0 lbs.

## 1.9 ENVIRONMENTAL CONDITIONS

Ambient Temperature: ..... 18 to 26 °C  
Storage Temperature: ..... > 0 to 70 °C  
Humidity: ..... 5 to 90% Non-condensing

# 2 INSTALLATION

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## 2.1 UNPACKING

Unpack the Heated 4 Port Manifold carefully and inspect it for any damage that may have occurred during shipment. If there is shipping damage, notify the carrier immediately. Verify that the power cord, back-pressure regulator, fittings and manual are present. If possible, save shipping container for future use.

## 2.2 LOCATION

Locate the Heated 4 Port Manifold on the humidity generator countertop or other appropriate location. The ventilation openings must remain unrestricted to maintain proper operating temperature. A minimum of one inch (2.5 cm) airspace must be maintained around the sides and top. Be aware that the enclosure is connected to ground.

## 2.3 INITIAL SETUP

Uncap the manifold inlet and outlet. Connect the sample line using the Swagelok fittings between the humidity generator and the manifold inlet. If test pressure control is not required leave the manifold outlet unrestricted. If test pressure control is required connect the generator test pressure transducer to the test pressure port on the manifold. Connect the back-

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<sup>1</sup> Uncertainty of the manifold is designed for  $\pm 3.0$  °C sensors at -70 °C or lower frost points.

pressure regulator to the manifold outlet (rotate knob counterclockwise to be ensure no pressure control).

Refer to [6.6 pneumatic schematic](#)

## 2.4 POWER

The Heated 4 Port Manifold is equipped with a fused power receptacle. Connect to power source using power cord supplied. The plug must be used with an outlet that has been installed and grounded in accordance with all local codes and ordinances. The Power Entry Module allows power to be turned on or off at the manifold.

# 3 COMPONENTS AND CONTROLS

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## 3.1 PORT MANIFOLD AND TEMPERATURE CONTROLLER

The Heated 4 Port Manifold is a four-port calibration manifold, constructed of electro polished 316 stainless steel, and designed to accommodate from one to four moisture probes. The Heated 4 Port Manifold incorporates a temperature controller designed to operate on standard AC line power. The temperature controller manages the manifold temperature by using a closed-loop feedback from an internal temperature probe to operate a heater.

## 3.2 BACK-PRESSURE REGULATOR

The Back-Pressure Regulator controls the test pressure at the Heated 4 Port Manifold outlet which is the indicated test pressure on the humidity generator. Turn the adjustment knob slowly clockwise to increase test pressure and counterclockwise to decrease test pressure.

**Note:** *Test Pressure Transducer maximum pressure is 50 psiA. A generator shutdown will occur if the pressures exceeds 50 psiA.*

## 3.3 MANIFOLD TEMPERATURE

Insert the humidity generator's test temperature probe into the test temperature port on the side of the manifold. This allows the Manifold temperature to be indicated on the humidity generator's display as the Test Temperature.

## 4 GENERAL OPERATION

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### 4.1 MANIFOLD SETUP

- 1) Uncap manifold inlet and outlet. Connect sample tubing from generator outlet port to the manifold inlet port.
- 2) Connect generator test pressure transducer to manifold test pressure port.
- 3) Install generator test temperature probe into manifold temperature port.
- 4) If test pressure control is desired, connect back pressure regulator to outlet (ensure adjustment knob has been rotated counterclockwise for no pressure control).
- 5) Install probes and/or sensors to be calibrated into the threaded ports. Cap unused ports.
- 6) Insert the power cord into the Heated 4 Port Manifold power receptacle. With the Heated 4 Port Manifold power switch in the off position, plug the power cord into an AC mains outlet of the appropriate voltage, frequency, and current capacity as indicated by the equipment label.

*Refer to [6.6 pneumatic schematic](#)*

### 4.2 START-UP AND HEATED PROFILE

- 1) Prepare humidity generator per manual such as adding water, performing sat clears and purging the system.
- 2) Operate generator in generate mode at lowest desired humidity to start.
- 3) Set generator flow rate to 4 L/min (1.0 L/min per cell).

- 4) If connected, slowly adjust back pressure regulator to the desired test pressure as indicated on humidity generator.
- 5) Apply power to the Heated 4 Port Manifold using the On/Off power switch and manifold will begin to control to the default heat setpoint of 25 °C.
- 6) Press the (Fn) icon to start the default heating cycle profile. The manifold will ramp up the manifold temperature to 50 °C and then will hold point for 2 hours. After the 2 hours the manifold will reset the heat setpoint to 25 °C and the manifold will naturally cool to 25 °C.

**Note:** *If needed, press the (Fn) icon again to stop the profile. Refer to 5.2.2 if profile modification is required.*

- 7) If connected, readjust back pressure regulator to the desired test pressure, indicated on humidity generator.
- 8) When UUT readings are stable acquire a data point then ramp up the generator to the next humidity point.

## 5 TEMPERATURE CONTROLLER

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### 5.1 DESCRIPTION

The Heated 4 Port Manifold incorporates a temperature controller designed to operate on standard AC line power. The temperature controller manages the manifold temperature by using a closed-loop feedback from an internal temperature probe to operate a heater. This combination results in a precise temperature control of the manifold at a user entered setpoint above ambient temperature. The controller also incorporates a single push (Fn) action that starts a controlled profile that will run the manifold up to a predefined temperature to purge the sensors for a set time and then ramp back down to a near ambient temperature for the remainder of the calibration. This assures proper drying of the sensor and then any heat sensitivity the sensor might have is negated by calibrating the sensor at a single controlled temperature.

## 5.2 SETTINGS

The Heated 4 Port Manifold is factory configured to heat to 25 °C. This heat setpoint can be changed anytime the manifold is not running a profile by using the “+” or “-” icons on the front display.

### 5.2.1 How to make changes

If the user wishes to change the profile settings the controller must first be unlocked using the following steps.

1. Press the right arrow icon on the front display to access the Operations menu.  
Using the “+” or “-” icons to scroll up or down, scroll down to “Factory” and press the right arrow.
2. Scroll to “Unlock” and press the right arrow.
3. Use the slider to enter the User password 63.
4. Press the Home icon to exit the Unlock page.

### 5.2.2 Heated Profile

The Heated 4 Port Manifold’s heated profile is activated by pushing the (Fn) icon on the lower right of the display. The user can stop the profile at any time by pushing the (FN) icon again.

To access the profile first press the right arrow icon to access the Operations menu. Next, use the “-” icon to scroll down to “Profile” and press the right arrow.

**Note:** You must unlock the controller before you can modify the profile (refer to [5.2.1](#)).

Default profile settings are as follows:

Operations>Profile>Profile 1 Step

Profile 1>Step 1>Step Type = Time

Profile 1>Step 1>Target SetPt Loop 1 = 50.0

Profile 1>Step 1>Hours = 0

Profile 1>Step 1>Minutes = 30

Profile 1>Step 1>Seconds = 0

Profile 1>Step 2>Step Type = Soak

Profile 1>Step 2>Hours = 2

Profile 1>Step 2>Minutes = 0

Profile 1>Step 2>Seconds = 0

Profile 1>Step 3>Step Type = Time

Profile 1>Step 3>Target SetPt Loop 1 = 25.0

Profile 1>Step 3>Hours = 0

Profile 1>Step 3>Minutes = 0

Profile 1>Step 3>Seconds = 0

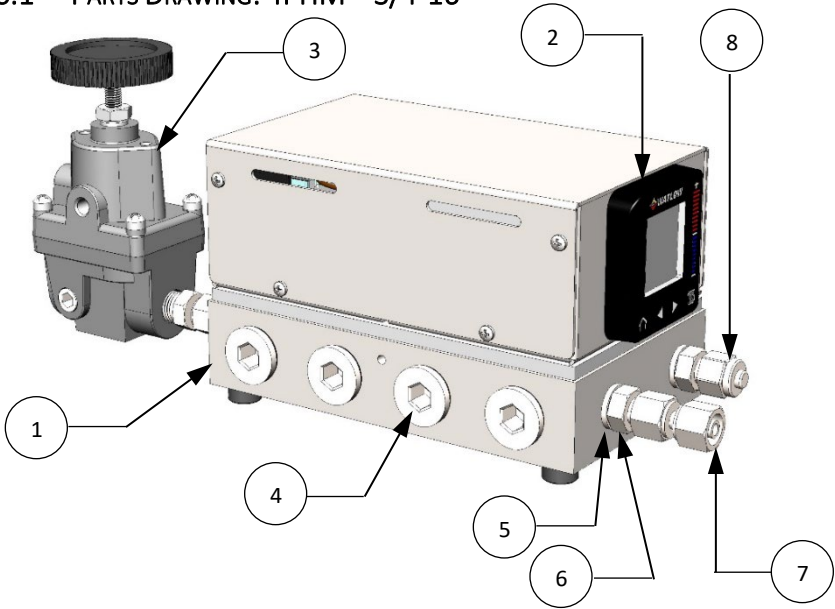
Profile 1>Step 4>Step Type = End

Profile 1>Step 4>End Type = Hold

## 6 HEATED 4 PORT MANIFOLD DRAWINGS

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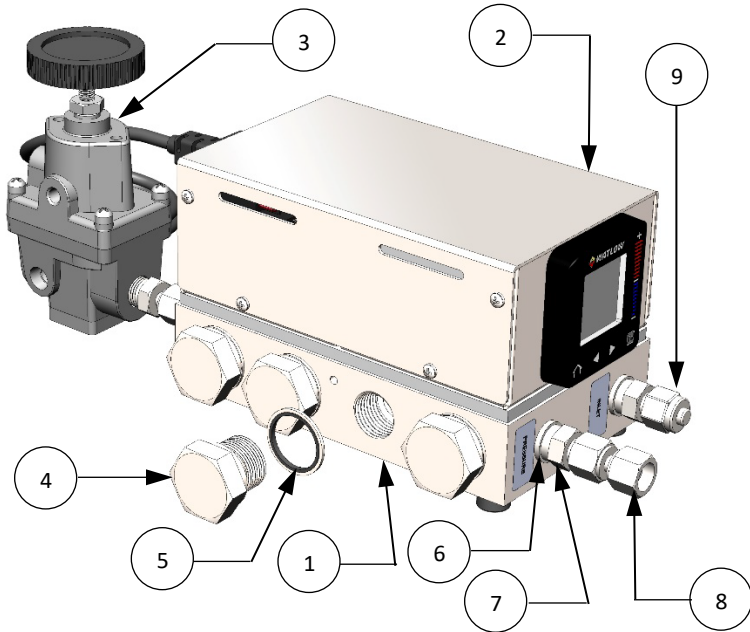
### 6.1 PARTS DRAWING: 4PHM – 3/4-16



1. 4 Port Manifold, D19M3920250
2. Watlow Heat Controller Assembly, PM6R1KH-AAAAPWN
3. Back Pressure Regulator, F30242BP
4. 3/4-16 SAE Hollow Hex Plug, S8-HPST
5. 1/8" RS Fitting Steel Gasket, S2RS2V
6. 1/4" Tube x 1/8" ISO Parallel Thread Adapter, S4-1-2RS
7. 1/4" Male NPT x 1/4" Port Adapter, S4-TA-4
8. 1/4" Tube Plug, S4-P

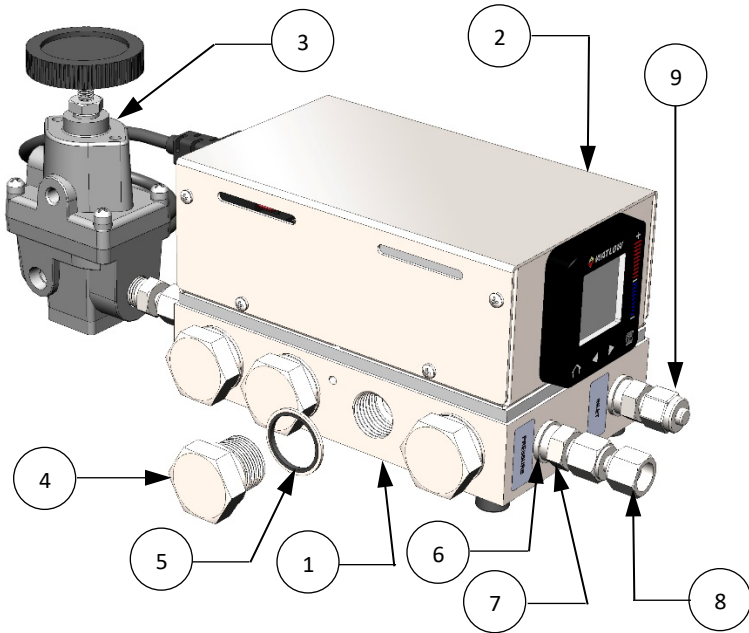


## 6.2 PARTS DRAWING: 4PHM – ISO G1/2



1. 4 Port Manifold, D21M3920252
2. Watlow Heat Controller Assembly, PM6R1KH-AAAAPWN
3. Back Pressure Regulator, F30242BP
4. ISO G1/2 Hex Plug, SS-8-P-RS
5. Gasket, SS-8-RSD-2V
6. 1/8" RS Fitting Gasket, SS-2-RSD-2V
7. 1/4" Tube x 1/8" ISO Parallel Thread Adapter, S4-1-2RS
8. 1/4" Male NPT x 1/4" Port Adapter, S4-TA-4
9. 1/4" Tube Plug, S4-P

### 6.3 PARTS DRAWING: 4PHM – 5/8-18

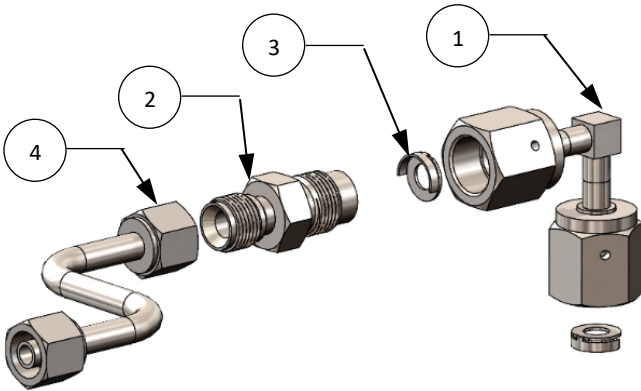


1. 4 Port Manifold, D24M3920259
2. Watlow Heat Controller Assembly, PM6R1KH-AAAAPWN
3. Back Pressure Regulator, F30242BP
4. 5/8-18 UNF Hex Plug, 25M3920172
5. Gasket, SS-9500-6
6. 1/8" RS Fitting Gasket, SS-2-RSD-2V
7. 1/4" Tube x 1/8" ISO Parallel Thread Adapter, S4-1-2RS
8. 1/4" Male NPT x 1/4" Port Adapter, S4-TA-4
9. 1/4" Tube Plug, S4-P

## 6.4 INLET TUBE ASSEMBLIES

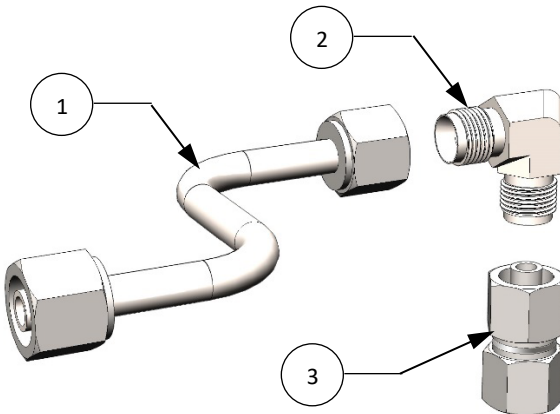
### 6.4.1 3920 Tube Inlet Assembly – Dwg 21A3920096

1. 1/4" VCR Female Elbow, 6LV-4-WVCR-9-DF
2. 1/4" VCR x 1/4" Tube Adapter, S4VCR-6-4
3. 1/4" SS VCR Face Seal Gasket, SS-4-VCR-2-ZC-VS
4. 1/4" SS Manifold Inlet Tube Assy, D21A3920097

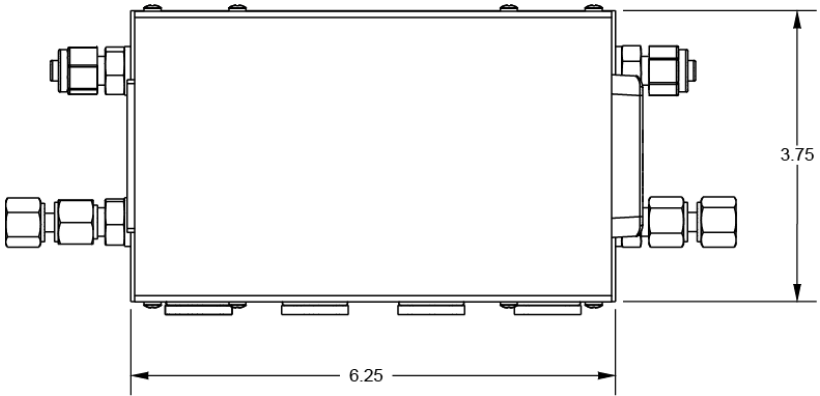


### 6.4.2 3900 Tube Inlet Assembly – Dwg 21A39070

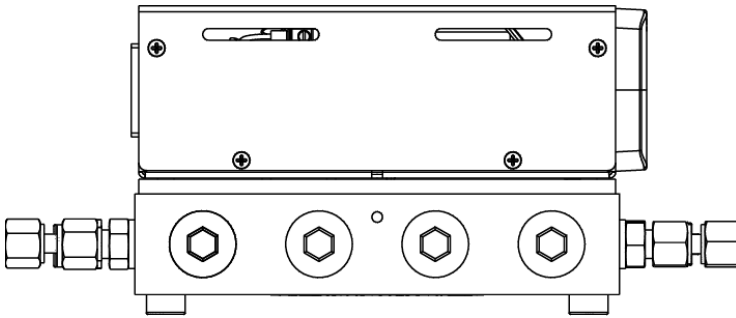
1. 1/4" SS Manifold Inlet Tube Assy, D21A3920097
2. 1/4" Union Elbow 316 Stainless Steel, S4-9
3. 1/4" Swagelok Port Connector 316 SS, S401-PC



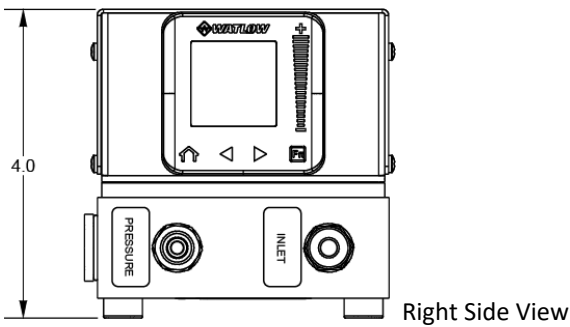
## 6.5 DIMENSIONAL DRAWING



Top View



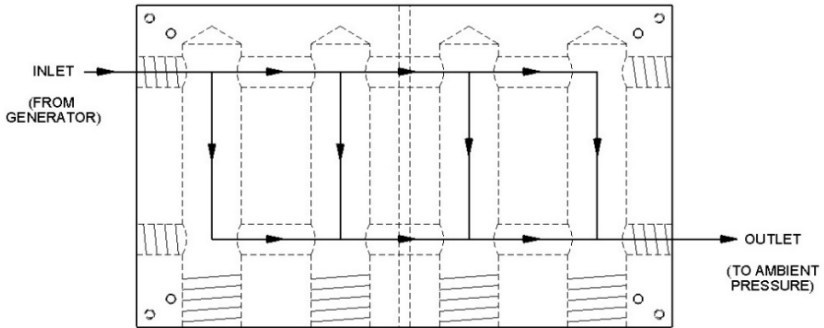
Front View



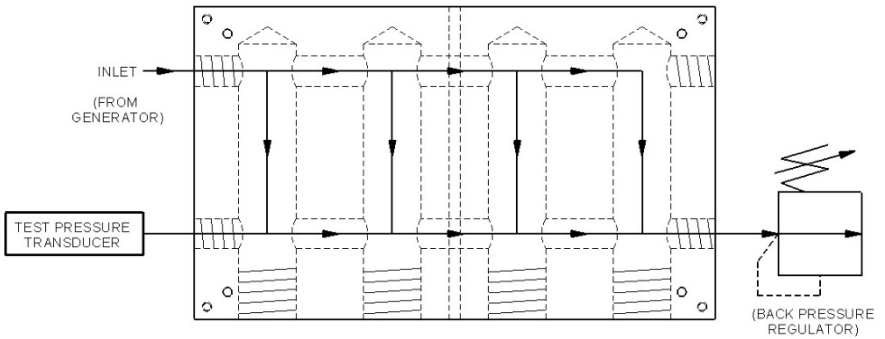
Right Side View

## 6.6 PNEUMATIC SCHEMATIC

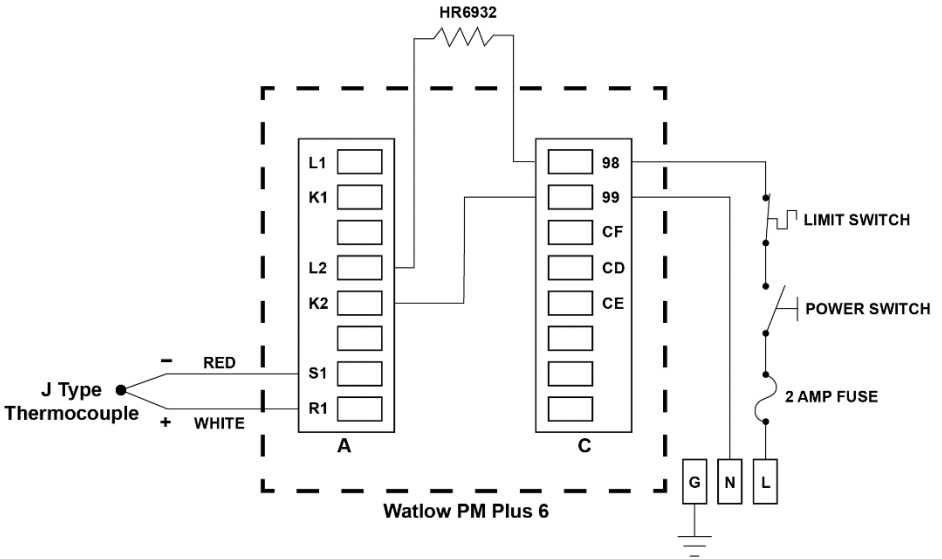
### 6.6.1 Without Pressure Control



### 6.6.2 With Pressure Control



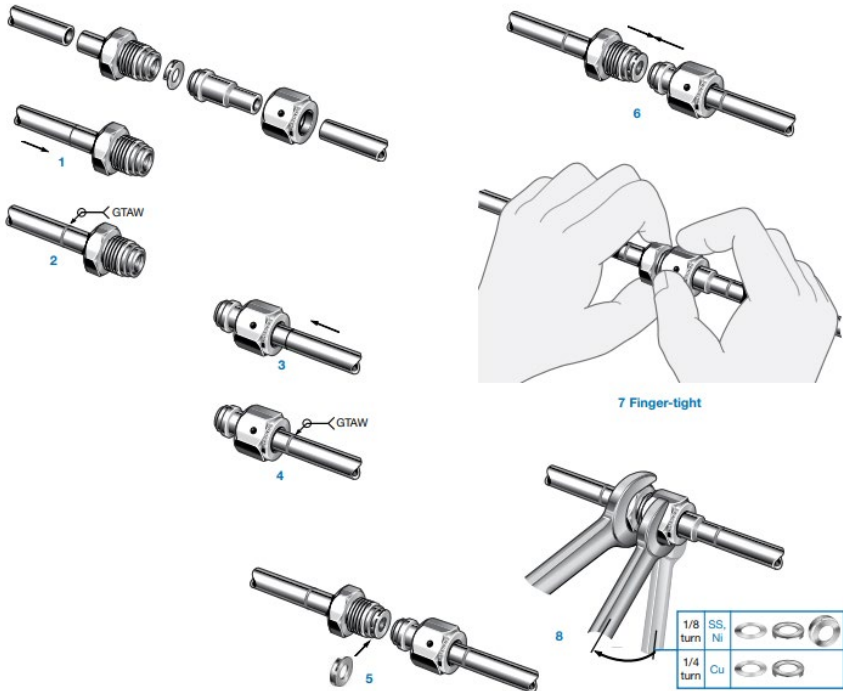
## 6.7 Electrical Schematic



## 6.8 Fitting Instructions

The Heated Four Port Manifold uses a Swagelok VCR® type fittings. Please follow the below Swagelok® instructions when connecting the manifold.

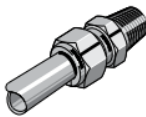
### VCR Fitting Installation Instructions



### Reassembly—All Sizes

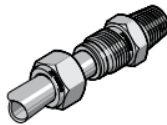
You may disassemble and reassemble Swagelok tube fittings many times.

**⚠ Always depressurize the system before disassembling a Swagelok tube fitting.**



Prior to disassembly, mark the tube at the back of the nut; mark a line along the nut and fitting body flats.

*Use these marks to ensure that you return the nut to the previously pulled-up position.*



Insert the tube with preswaged ferrules into the fitting until the front ferrule seats against the fitting body.

**Over 1 in./25 mm sizes:** *If needed, reapply lubricant lightly to the body threads and the rear surface of the back ferrule.*



While holding the fitting body steady, rotate the nut with a wrench to the previously pulled-up position, as indicated by the marks on the tube and flats. At this point, you will feel a significant increase in resistance. Tighten the nut slightly.

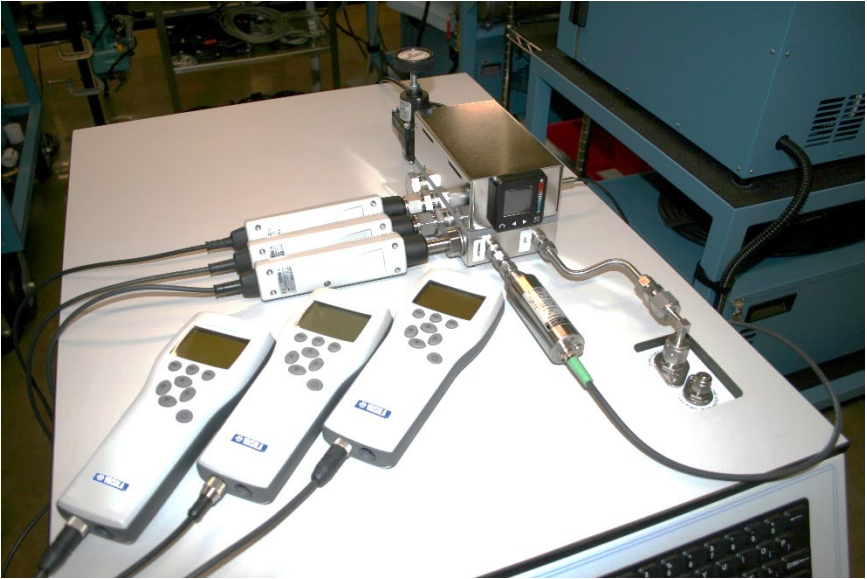
## 6.9 TYPICAL MANIFOLD SETUP

Typical Setup with fittings and components provided.





6.10 VIEW OF MANIFOLD WITH PROBES BEING CALIBRATED.





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