

CMOH/CMLH Series

Hi-Temp Capacitance Manometers

User Guide

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1.1 PRODUCT INTRODUCTION

This manual covers the CMOH/CMLH Series Hi-Temp Capacitance Manometer as shown in Figure 1 below. Capacitance Manometers (CMs) are pressure measuring instruments that sense the deflection of a diaphragm by measuring a change in capacitance between an electrode, or electrodes, and a diaphragm which deflects under forces of pressure. Manometers are characterized by high precision, excellent stability, and a wide dynamic range. Included herein is general information, operating specifications, installation and removal instructions, and product warranty information.



Figure 1. CMOH/CMLH Hi-Temp Capacitance Manometer

1.2 INTENDED USE

Celerity capacitance manometers are typically used in conjunction with pressure controllers (such as a Celerity ACX series) or digital displays with power supplies to measure pressure. A typical system diagram is shown in Figure 2.

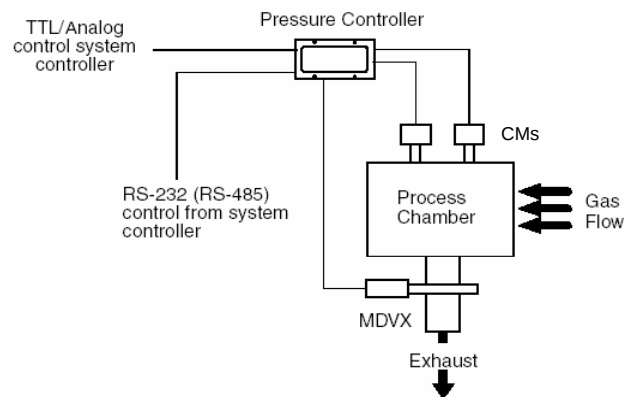


Figure 2. System Diagram

2.1 SAFETY NOTICES

This manual provides information for the installation and operation of the Celerity CMOH and CMLH Series capacitance manometers. It is imperative that this manual be reviewed prior to installation and operation of the device. Failure to comply with the warnings, cautions, and hazard notes will void the product's warranty. The use of these instruments in a manner other than those specified by Celerity may result in injury or death and will void the product's warranty. Celerity assumes no liability for any damage resulting from the improper use of its products.

The following safety symbols are used throughout the system documentation:

 CAUTION

Damage to equipment of software could result if stated or local procedures are not followed.

 WARNING

Injury to user or other personnel could result if stated or local procedures are not followed.

 DANGER

Severe injury or injury resulting in death could result if stated or local procedures are not followed.

 DANGER

SHOCK HAZARD. All devices must be properly grounded.

 DANGER

Do not use equipment in an explosive atmosphere.

 CAUTION

Do not substitute parts or modify equipment.

2.2 GROUNDING

All devices must be properly grounded to reduce the risk of an electrical shock.

2.3 EXPLOSIVE ATMOSPHERE

The CMOH/CMLH product family is NOT intended for use in explosive atmospheres.

2.4 PART SUBSTITUTIONS AND MODIFICATIONS

Modifying an instrument in any way not only voids the warranty but could cause a safety hazard and should be avoided. Repair work should be done at the factory or by a factory-authorized service center.

2.5 GENERAL SAFETY GUIDELINES

Always follow established industrial safety practices when operating any production equipment.

Safety is designed into every product. When followed, these minimum guidelines provide an acceptable level of safety for operating and maintaining your system. They are not, however, a substitute for determining your own internal safety procedures.

The use of controls, adjustments, or procedures other than those specified in this manual without consulting a competent safety professional may result in exposure to potential hazards. Always follow established industrial safety practices when operating production equipment.

⚠ CAUTION ⚠
The connection should be conducted with no power being present to the available connections.



Use of controls, adjustments, or procedures other than those specified in this manual without consulting a competent safety professional may result in exposure to potential hazards

2.5.1 Unsafe acts

- NEVER defeat a safety interlock unless you are certified to perform the procedure and have been specifically directed to defeat the interlock.
- NEVER operate or service this system without a thorough knowledge of the dangers involved and the precautions to be followed for safe and efficient operation.
- NEVER disregard instructions to lockout/tagout the system.
- NEVER permit unauthorized or untrained personnel to use the system.
- NEVER STAND IN WATER OR ON A WET SURFACE WHILE OPERATING ANY ELECTRICALLY POWERED EQUIPMENT.
- NEVER place your hands near moving parts or energized parts or sub-systems. Components can move rapidly.
- NEVER remove a warning label from the equipment.
- NEVER operate damaged equipment.
- NEVER permit unauthorized or untrained personnel access to the system.

2.5.2 Recommended Practices

- USE THE BUDDY SYSTEM: ALWAYS perform maintenance procedures in teams of two or more people; one to monitor the controls and indicators, and one to watch the system operation.
- ALWAYS observe all warning labels.
- ALWAYS avoid all unsafe acts.

The safety procedures described in this manual are minimum guidelines. It is believed that these guidelines will provide an acceptable level of safety. These guidelines, however, should not be considered a substitute for determining your own internal safety procedures in consultation with a competent safety professional.

3.1 PHYSICAL DIMENSIONS

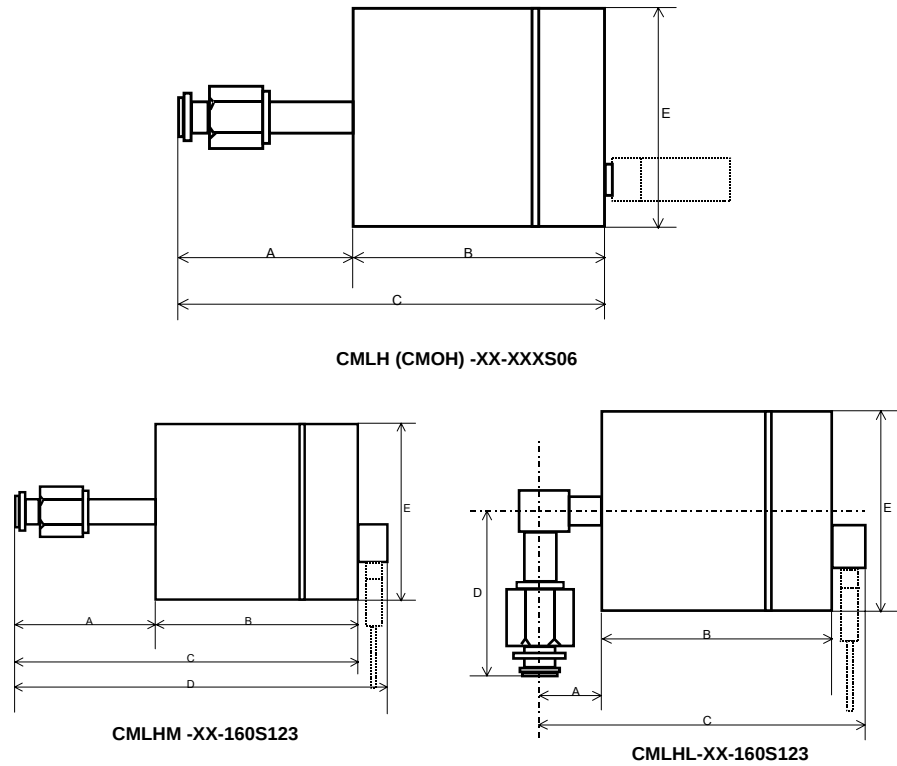


Figure 3. Dimensional Drawings

Table 1: Capacitance Manometer Fittings

Model Number	Fitting	A	B	C	D	E
CMLH (CMOH) -XX-XXXS06	Caion SS-8-VCR-3	63	93	156	-	76.5
CMLH-11-160S123	Fujikin UJR-9.52N	50	93	143	164	76.5
CMLHM-31-160S123	Fujikin UJR-9.52N	71	93	164	184	76.5
CMLHS-31-160S123	Fujikin UJR-9.52N	80	93	173	194	76.5
CMLHL-31-160S123	Fujikin UJR-9.52N	30	93	144	63	76.5

⚠ CAUTION ⚠
DO NOT mount the CM with the inlet tube facing up. Minimize vibration around the capacitance manometer. Mount the CM away from sunlight, heating/cooling ducts, and gas vents.

3.2 MOUNTING THE CAPACITANCE MANOMETER

The capacitance manometer (CM) can be mounted in any of the three positions shown in Figure 4. DO NOT mount the capacitance manometer with the inlet tube facing upward because the sensing diaphragm may become damaged by process contamination, which will adversely affect the operation, and thereby void the warranty.

Minimize vibration around the capacitance manometer to eliminate output electrical noise and to provide longer instrument life.

Mount the capacitance manometer away from direct sunlight, heating/cooling system ducts, gas vents, and other sources of temperature variation.

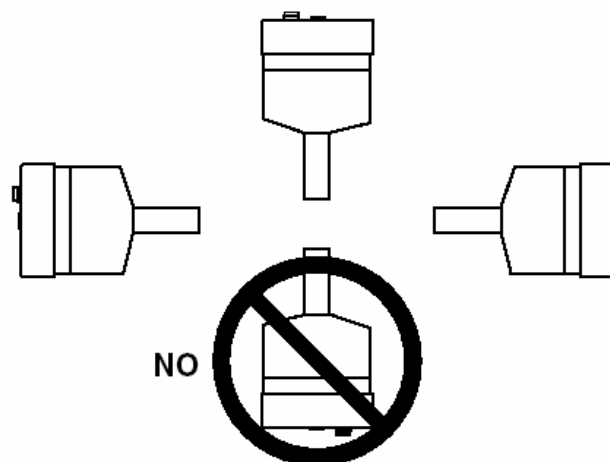


Figure 4. Mounting Orientation

3.3 PLUMBING CONSIDERATIONS

When connecting any capacitance manometer to the system chamber, the following should be carefully considered:

3.3.1 Tubing Size

The tubing between the capacitance manometer and the system chamber must be of equal or greater internal diameter than the manometer inlet tube. Using smaller tubing will degrade the response characteristics when using the capacitance manometer in a dynamic control system. Minimize restrictions between the capacitance manometer and chamber to maximize the molecular conductance path.

3.3.2 Tubing Length

The tubing between the capacitance manometer and the system chamber must be as short as possible, with the maximum length no longer than 152 mm [6"]. Longer tubing may degrade the response characteristics when used in a dynamic control system.

3.3.3 Use of an Isolation Valve

A capacitance manometer will take several hours to reach a stable operating temperature. The use of an isolation valve will reduce the need to wait for the device to restabilize after each vent to atmosphere. Although not required to protect the capacitance manometer, it is strongly recommended that you use an isolation valve for all manometers with less than a 10 Torr full scale range.



Use of controls, adjustments, or procedures other than those specified in this manual without consulting a competent safety professional may result in exposure to potential hazards

⚠ CAUTION ⚠

The connection should be conducted with no power being present to the available connections.

3.3.4 Material Exposure

The process gas needs to be compatible with Inconel and/or 316L stainless steel. If the process generates by-products that could deposit inside the capacitance manometer, a heated device should be used to reduce the deposition. The capacitance manometer may not be used in any application where it may be exposed to conditions or materials that could cause damage to the unit or injury to the operator.

3.4 ELECTRICAL CONNECTIONS

Electrical connections are made at the 15 pin D connector. Refer to Table 2 for pinout details.

Table 2: Electrical Pinout Connections

Pin	Description
1	Temperature sensor resistance A
2	Pressure output 0-10V
3	Temperature sensor resistance B
4	No connection
5	Power common
6	-15 Vdc
7	+15 Vdc
8	No connection
9	Temperature sensor resistance B'
10	Heater power input 1
11	Heater power input 2
12	Signal common
13	No connection
14	No connection
15	Chassis ground

Note: Measurement of sensor resistance can be performed between temperature resistance A and B (or B').

4.1 OPERATING SPECIFICATIONS

Specification	CMOH Series	CMLH Series
Range	1, 2 Torr	10, 100, 1000 Torr
Usable Control Range ¹	0.5 to 100% of full scale	
Accuracy ²	0.5% of reading (1.0% reading for 1000 Torr only)	
Temperature Effects on Zero	0.01% of FS/°C	
Temperature Effects on Span	0.04% of FS/°C	
Response Time	10 msec.	
Operating Temperature	0 - 50°C	
Exposed Materials ³	Inconel and/or 316L Stainless Steel	
Volume	17cc	
Approximate Shipping Weight	2.1 pounds (950 grams)	
Overpressure Limit	17 PSIA or 125% of Full Scale, whichever is greater	
Power Input	±15 VDC (±5%) @ 930 mA	
Output	0 - 10 VDC (5k load) minimum	
Connector Type	15-pin D Connector	

Specification Notes

¹ This is based on a 50 mVolt control signal and is a conservative number.

² Includes hysteresis, linearity, and repeatability.

³ Device fitting not included.

All specifications subject to change without notice.



EXPLOSION HAZARD. *Never over pressurize the manometer. Never exceed the ambient temperature operating limits. Avoid venting a heated or low-range manometer to atmosphere.*

4.2 OPERATING PRECAUTIONS

It is important to operate the capacitance manometer within the designed mechanical specifications in order to reduce the possibility of erroneous readings. The following operating precautions must be followed:

- **Never over-pressurize the Capacitance Manometer.** The capacitance manometer is designed to withstand a positive over pressure of 17 PSIA or 125% of rated full scale, whichever is greater, within the pressure port. Pressures greater than this may damage the pressure sensitive diaphragm and cause a failure of the capacitance manometer.
- **Never exceed the ambient temperature operating limits.** These limits are listed in the Specifications. Devices which are designed for a specific operation range may be damaged by excessive temperature and may not function correctly.
- **Avoid venting a heated or low-range capacitance manometer to atmosphere.** While this action will not damage the capacitance manometer, it will cause temperature and signal instabilities, which in turn may require an additional warm-up or recovery period. Although not required to protect the capacitance manometer from damage, it is strongly recommended that both heated and unheated capacitance manometers with less than a 10 Torr full scale range be used with a properly sized isolation valve.

4.3 OPERATING RANGES

The capacitance manometer has two types of operating ranges: measurement and control. The full scale range is the absolute maximum operating pressure in which the capacitance manometer may be used for accurate pressure measurements. The usable control range is the range where the capacitance manometer can be used effectively for pressure control.

4.4 DEVICE WARM-UP

Once a heated capacitance manometer has been installed and powered up on a system or tool, the signal output will be variable for a period of time. This variability is primarily the result of the temperature gradients inherent in the device. In general, this variability is on the order of 1 volt, which represents 10% of the full scale output of the device. Once the temperature profile of the device reaches a steady-state condition, the variability in the signal output will be negligible.

The following terms are defined:

Warm-Up: On a curve (voltage output vs. time), a device has *warmed up* when the first order derivative, or slope, of the curve is zero.

Settled: On a curve (voltage output vs. time), a device has *settled* when the second order derivative of the curve is zero.

The recommended warm-up time is 12 hours

4.5 ZEROING THE CAPACITANCE MANOMETER

Zero the capacitance manometer as follows:

1. Pump the system down to a pressure that is at least 5 decades below the full scale range of the device. Refer to the Zero Pressure Chart below.

Table 3: Zero Pressure Chart

Full Scale Range	Highest Pressure for Proper Zero Adjustment
1 Torr	1×10^{-5} Torr
2 Torr	2×10^{-5} Torr
10 Torr	1×10^{-4} Torr
100 Torr	1×10^{-3} Torr
1000 Torr	1×10^{-2} Torr

2. Allow the device to warm-up. (Refer to paragraph 4.4 for details.)
3. Adjust the ZERO potentiometer, clockwise to increase or counterclockwise to decrease the reading, until the pressure output signal is ZERO.

5.1 CALIBRATION

Celerity capacitance manometers are calibrated to conform with ANSI Z540 Standards. Capacitance manometers should be calibrated every 6-12 months depending on the application and actual usage. The following factors may affect calibration and may require calibration at more frequent intervals:

- Sensor diaphragm has become contaminated with process material
- Improper handling (dropping, misuse, etc.)

If the capacitance manometer is suspected to have calibration errors, return the unit to Celerity for repair/calibration.

5.2 CLEANING

Cleaning is NOT recommended by anyone other than authorized Celerity service personnel because it may cause damage to the device and may void the warranty.

5.3 TROUBLESHOOTING GUIDE

Table 4: Capacitance Manometer Troubleshooting Guide

SYMPTOM	POSSIBLE CAUSE	ACTION
No output signal	No power	Check electrical connection
		Check cable continuity
		Verify power supply outputs
		Check for dents in the enclosure
Fluctuating zero	Temperature fluctuations	Check for varying temperature sources
	Power supply fluctuations	Check power supply regulation
Fluctuating output signal	Electrical noise	Check power supply regulation
		Verify cable grounding and shields
	Pressure control system	Check pressure control system
	Excessive vibration	Reduce vibration
Pressure reading too low or too high	Zero offset	Verify electrical zero at zero pressure
	Power input is wrong	Verify power voltage levels
	Grounds	Check signal and power grounds
Positive output drift	Chamber outgassing	Re-pump system to base pressure
	Leak in chamber	Eliminate chamber leak
Negative drift	Chamber pumping down	Re-zero sensor after pump-down
	Leaky sensor	Return device for repair
Can not zero	Not at base pressure	Verify chamber is at base pressure
	Improper ground	Check signal and power grounds
	Pot limit reached	Return device for repair

6.0

Product warranty information can be found on our Celerity website at www.Celerity.net. This information provides general warranty information, limitations, disclaimers, and applicable warranty periods according to product group.



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