CD/CM Series

Capacitance Manometers

User Guide

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CELERITY.

1.0 SAFETY NOTICES

This manual provides information for the installation and operation of the Celerity CD and CM 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. 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.

1.1 SAFETY SYMBOLS

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.

1.2 GROUNDING

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

DANGER
Do not use equipment in an explosive atmosphere.

1.3 EXPLOSIVE ATMOSPHERE

The ACX family of products are NOT intended for use in explosive atmospheres.

⚠ **CAUTION** ⚠
Do not substitute parts or modify equipment.

1.4 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.

1.5 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.

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.

1.5.1 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 subsystems. 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.

1.5.2 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.

DANGER

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

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.

2.0 DESCRIPTION

2.1 WHAT IS A CAPACITANCE MANOMETER?

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. capacitance Manometers are characterized by:

- high precision
- excellent stability
- wide dynamic range

2.2 DESIGN OVERVIEW

Celerity capacitance manometers are typically used in conjunction with pressure controllers (such as the Celerity ACX series) or digital displays with power supplies to measure pressure. The use of heated capacitance manometers (CDH, CMH series) may require a power supply booster to provide the additional power necessary to operate the heater.

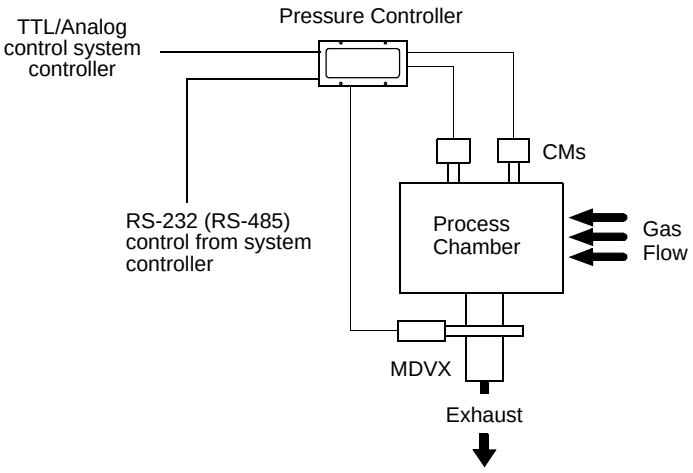


Figure 1. System Diagram

2.3 CAPACITANCE MANOMETER (CM) MODELS

Celerity provides a wide range of high-performance capacitance manometers. Consult your Celerity applications support engineer for specific recommendations for your application and environment.

Heated capacitance manometers are either heated to a constant temperature to prevent ambient temperature fluctuations from affecting the sensor output signal, or prevent the formation of condensable deposits on the sensor.

This manual describes how to install and operate the following capacitance manometers:

Model	Description
CDL	Non-heated, extremely accurate with exceptional performance over a wide pressure operating range. (Removable terminal strip)
CDLD	Non-heated, extremely accurate with exceptional performance over a wide pressure operating range with two independently adjustable relays that can be used for controlling external equipment. (15-pin D-sub male connector)
CDLS	Non-heated, extremely accurate with exceptional performance over a wide pressure operating range. (15-pin D-sub male connector)
CDH	Heated to 45°C or 80°C. (9-pin D-sub male connector)
CDHD	Heated to 45°C or 80°C (15-pin D-sub male connector)
CDHS	Heated to 45°C or 80°C (15-pin D-sub male connector) with two independently adjustable relays that can be used for controlling external equipment.
CMLA	Non-heated, general purpose. 10 to 100 Torr full scale range.
CMLB	Non-heated, general purpose. 10 to 1000 Torr full scale range.
CMH	Heated to 35°C. Full scale range of 1, 10 and 100 Torr.
CMH4	Heated to 45°C. Full scale range of 0.1 Torr.
CMHT	Heated to 75°C. Full scale range of 1 and 10 Torr.

2.4 PRODUCT SPECIFICATIONS

Table 1: CDH45 Series Specifications

	CDH	CDHD	CDHS
Range	0.1, 1, 2, 5, 10, 20, 100, 1000 Torr		
Usable Control Range[1]	0.1 to 100% of full scale		
Accuracy[2] 1000 Torr 100 Torr 20 Torr 10 Torr 5 Torr 2 Torr 1 Torr 0.1 Torr	 0.5% of reading 0.25% of reading 0.25% of reading 0.15% of reading 0.15% of reading 0.15% of reading 0.15% of reading 0.5% of reading		
Temperature Effects on Zero	0.005% of FS/°C		
Temperature Effects on Span	0.02% of FS/°C		
Response Time	20 msec		
Operating Temperature	15 - 35°C		
Exposed Materials[3]	Inconel and/or 316L Stainless Steel		
Volume	17cc		
Approximate Shipping Weight	1.40 lbs (726 grams)		
Overpressure Limit	17 PSIA or 125% of Full Scale, whichever is greater		
Power Input	±15 VDC (±5%) @ 300 mA		±15 VDC (±5%) @ 360 mA
Output	0 - 10 VDC (5k load) minimum		
Relay Contact Rating			1 A @ 30 VDC 0.3 A @ 110 VDC 0.5 A @ 125 VAC
Connector Type	9-pin D-sub male	15-pin D-sub male	

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.

Table 2: CDH80 Series Specifications

	CDH	CDHD	CDHS
Range	0.1, 1, 2, 5, 10, 20, 100, 1000 Torr		
Usable Control Range[1]	0.1 to 100% of full scale		
Accuracy[2] 1000 Torr 100 Torr 20 Torr 10 Torr 5 Torr 2 Torr 1 Torr 0.1 Torr	 0.5% of reading 0.25% of reading 0.25% of reading 0.25% of reading 0.25% of reading 0.25% of reading 0.25% of reading 0.5% of reading		
Temperature Effects on Zero	0.005% of FS/°C		
Temperature Effects on Span	0.02% of FS/°C		
Response Time	20 msec		
Operating Temperature	15 - 50°C		
Exposed Materials[3]	Inconel and/or 316L Stainless Steel		
Volume	17cc		
Approximate Shipping Weight	1.40 lbs (726 grams)		
Overpressure Limit	17 PSIA or 125% of Full Scale, whichever is greater		
Power Input	±15 VDC (±5%) @ 700 mA		±15 VDC (±5%) @ 760 mA
Output	0 - 10 VDC (5k load) minimum		
Relay Contact Rating			1 A @ 30 VDC 0.3 A @ 110 VDC 0.5 A @ 125 VAC
Connector Type	9-pin D-sub male	15-pin D-sub male	

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.

Table 3: CDL Series Specifications

	CDL Series	CDLD	CDLS
Range	1, 2, 5, 10, 20, 100, 1000 Torr		
Usable Control Range[1]	0.5 to 100% of full scale		
Accuracy[2]	0.25% of reading (0.50% of reading for 1000 Torr only)		
Temperature Effects on Zero	0.008% of FS/°C		
Temperature Effects on Span	0.04% of FS/°C		
Response Time	20 msec		
Ambient Operating Temperature Range	5 - 45°C		
Exposed Materials[3]	Inconel and/or 316L Stainless Steel		
Volume	17cc		
Approximate Shipping Weight	1.125 lbs (567 g)		
Overpressure Limit	17 PSIA or 125% of Full Scale, whichever is greater		
Power Input	±15 VDC (±5%) @ 35 mA		±15 VDC (±5%) @ 95 mA
Output	0 - 10 VDC (5k load) minimum		
Connector Type	Removable Terminal Strip	15-pin D connector	
Relay contact Rating	—	—	1 A @ 30 VDC 0.3 A @ 110 VDC 0.5 A @ 125 VAC

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.

Table 4: CMH Series Specifications

	CMH	CMHT	CMH4
Range (Torr)	1, 10, 100 Torr	1, 10 Torr	0.1 Torr
Usable Control Range[1]	0.1 to 100% of full scale		
Accuracy[2]	0.12% of reading	0.50% of reading	0.75% of reading
Temperature Effects on Zero	0.004% F.S./°C		0.02% of FS/°C
Temperature Effects on Span	0.002%F.S./°C		
Response Time	20 msec		
Ambient Operating Temperature Range	10-30°C (sensor @ 35°C)	10-50°C (sensor @ 75°C)	10-40°C (sensor @ 45°C)
Exposed Materials[3]	Inconel and/or 316L Stainless Steel		
Volume	17cc		
Approximate Shipping Weight	1.875 lbs (851 g)		
Overpressure Limit	17 PSIA or 125% of full scale, whichever is greater		
Power Input	±15 VDC (±5%) @ 200 mA	±15 VDC (±5%) @ 700 mA	±15 VDC (±5%) @ 450 mA
Output	0 - 10 VDC (5k load) minimum		
Connector Type	9-pin D connector (male)		

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.

Table 5: CMLA/CMLB Series Specifications

	CMLA	CMLB
Range	10, 100 Torr	10, 100, 1000 Torr
Usable Control Range[1]	0.5 to 100% of full scale	
Accuracy[2]	0.5% of reading	1.0% of reading
Temperature Effects on Zero	0.01% of FS/°C	
Temperature Effects on Span	0.04% of FS/°C	
Response Time	10 msec	
Ambient Operating Temperature Range	5 - 45°C	
Exposed Materials[3]	Inconel and/or 316L Stainless Steel	
Volume	17cc	
Approximate Shipping Weight	1.125 lbs (567 g)	
Overpressure Limit	17 PSIA or 125% of Full Scale, whichever is greater	
Power Input	±15 VDC (±5%) @ 30 mA	
Output	0 - 10 VDC (5k load) minimum	
Connector Types	CMLA: 5-post terminal CMLAM: Removable terminal strip CMLAMD: 15-pin D connector	5-post terminal

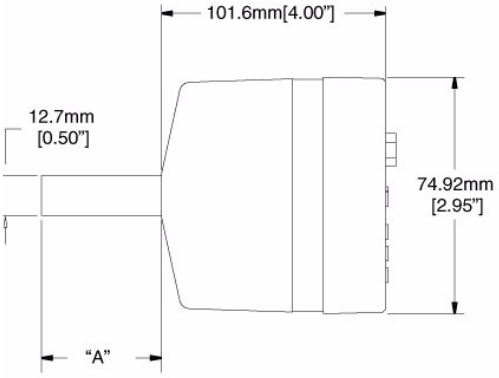
Specification Notes

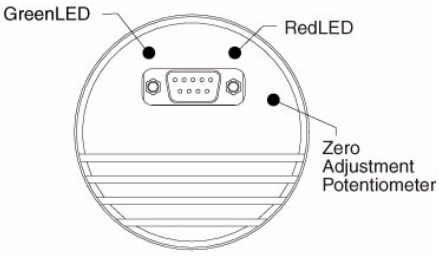
[1]This is based on a 50 mVolt control signal and is a conservative number.
[2]Includes hysteresis, linearity, and repeatability.
[3] Device fitting not included.
All specifications subject to change without notice.

3.0 INSTALLATION

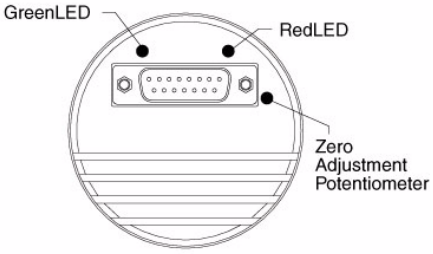
3.1 PHYSICAL DIMENSIONS

3.1.1 CDH/CDHD Series Dimensions





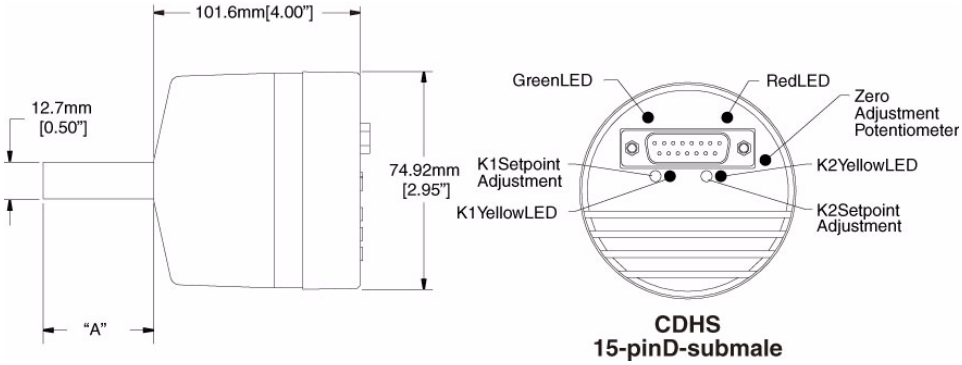
CDH
9-pinD-submale



CDHD
15-pinD-submale

Fitting	Model	"A" Dimension
0.5" OD Tube	-	25.40 mm [1.00"]
KF-10 flange	02	38.10 mm [1.50"]
1.33" ConFlat® flange or compatible flange	03	25.40 mm [1.00"]
8 VCO® or compatible fitting (female)	05	36.06 mm [1.42"]
8 VCR® or compatible fitting (female)	06	53.59 mm [2.11"]
2.75" ConFlat flange or compatible flange	07	26.41 mm [1.04"]
KF-16 flange	12	38.10 mm [1.50"]
KF-25 flange	20	29.21 mm [1.15"]

3.1.2 CDHS Series Dimensions



Fitting	Model	"A" Dimension
0.5" OD Tube	-	25.40 mm [1.00"]
KF-10 flange	02	38.10 mm [1.50"]
1.33" ConFlat flange or compatible flange	03	25.40 mm [1.00"]
8 VCO or compatible fitting (female)	05	36.06 mm [1.42"]
8 VCR or compatible fitting (female)	06	53.59 mm [2.11"]
2.75" ConFlat flange or compatible flange	07	26.41 mm [1.04"]
KF-16 flange	12	38.10 mm [1.50"]
KF-25 flange	20	29.21 mm [1.15"]

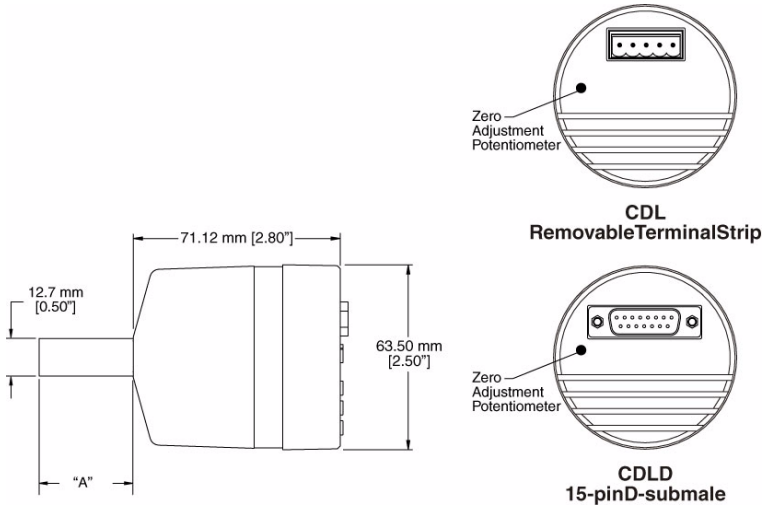
Table 6: Logic Table for CDHS

Measured Pressure Setpoint	Relay State	YELLOW LED	Relay Normally OPEN	Relay Normally CLOSED
Below Trip Point	Energized	ON	CLOSED	OPEN
Above Trip Point	De-energized	OFF	OPEN	CLOSED

Table 7: CDHS LED Operational Definitions

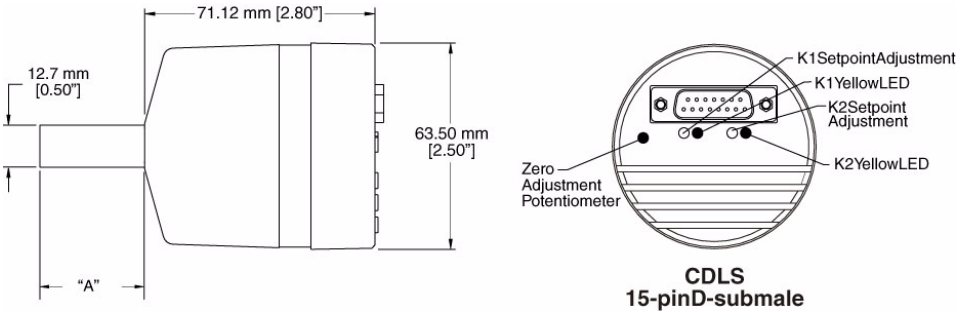
LED	Under-Temperature	At-Temperature	Over-Temperature	No Power
RED	ON	OFF	ON	OFF
GREEN	OFF	ON	ON	OFF

3.1.3 CDL/CDLD Series Dimensions



Fitting	Model	"A" Dimension
0.5" OD Tube	-	32.77 mm [1.29"]
KF-10 flange	02	45.72 mm [1.80"]
1.33" ConFlat flange or compatible flange	03	33.02 mm [1.30"]
8 VCO or compatible fitting (female)	05	43.69 mm [1.72"]
8 VCR or compatible fitting (female)	06	61.21 mm [2.41"]
2.75" ConFlat flange or compatible flange	07	34.07 mm [1.34"]
KF-16 flange	12	45.72 mm [1.80"]
KF-25 flange	20	36.58 mm [1.44"]

3.1.4 CDLS Series Dimensions



Fitting	Model	"A" Dimension
0.5" OD Tube	-	32.77 mm [1.29"]
KF-10 flange	02	45.72 mm [1.80"]
1.33" ConFlat flange or compatible flange	03	33.02 mm [1.30"]
8 VCO or compatible fitting (female)	05	43.69 mm [1.72"]
8 VCR or compatible fitting (female)	06	61.21 mm [2.41"]
2.75" ConFlat flange or compatible flange	07	34.07 mm [1.34"]
KF-16 flange	12	45.72 mm [1.80"]
KF-25 flange	20	36.58 mm [1.44"]

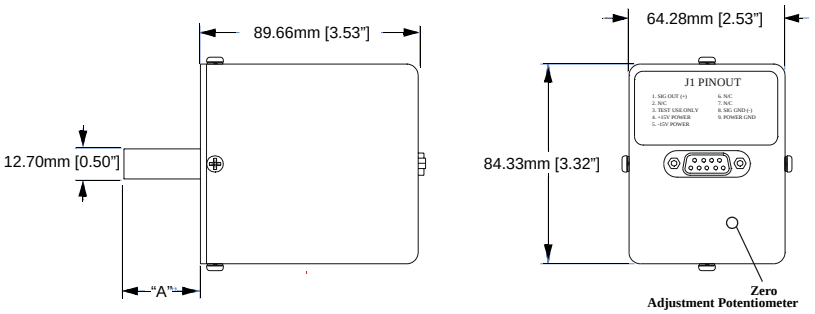
Table 8: Table 8 Logic Table for CDLS

Measured Pressure Setpoint	Relay State	YELLOW LED	Relay Normally OPEN	Relay Normally CLOSED
Below Trip Point	Energized	ON	CLOSED	OPEN
Above Trip Point	De-energized	OFF	OPEN	CLOSED

Table 9: CDLS LED Operation Definitions

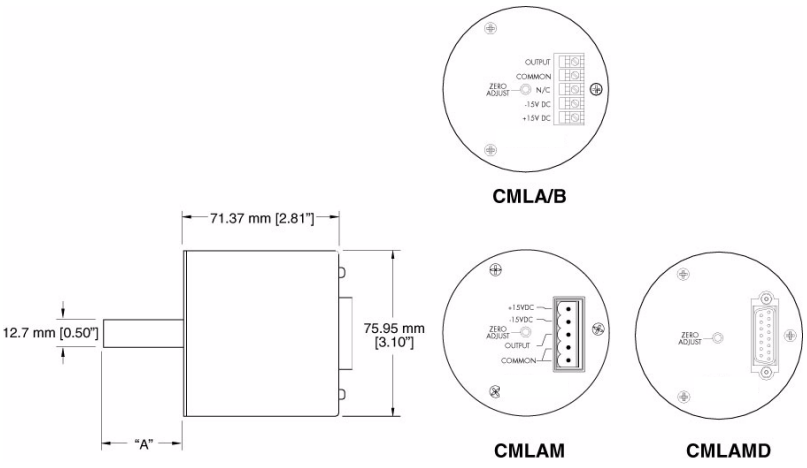
LED	Under-Temperature	At-Temperature	Over-Temperature	No Power
RED	ON	OFF	ON	OFF
GREEN	OFF	ON	ON	OFF

3.1.5 CMH Series Dimensions



Fitting	Model	"A" Dimension
0.5" OD Tube	-	31.75 mm [1.25"]
KF-10 flange	02	44.70 mm [1.76"]
1.33" ConFlat flange or compatible flange	03	32.00 mm [1.26"]
8 VCO or compatible fitting (female)	05	42.93 mm [1.69"]
8 VCR or compatible fitting (female)	06	59.69 mm [2.35"]
2.75" ConFlat flange or compatible flange	07	36.07 mm [1.42"]
KF-16 flange	12	44.70 mm [1.76"]
KF-25 flange	20	35.81 mm [1.41"]

3.1.1 CML Series Dimensions



Fitting	Model	"A" Dimension
0.5" OD Tube	-	36.83 mm [1.45"]
KF-10 flange	02	49.53 mm [1.95"]
1.33" ConFlat flange or compatible flange	03	36.83 mm [1.45"]
8 VCO or compatible fitting (female)	05	47.75 mm [1.88"]
8 VCR or compatible fitting (female)	06	65.28 mm [2.57"]
2.75" ConFlat flange or compatible flange	07	40.89 mm [1.61"]
KF-16 flange	12	49.53 mm [1.95"]
KF-25 flange	20	40.64 mm [1.60"]

3.2 MOUNTING THE CAPACITANCE MANOMETER

⚠ CAUTION ⚠
DO NOT mount the CM with the inlet tube port facing upward (see Figure 2). The sensing diaphragm may be damaged by process contamination, which will adversely affect the operation and will void the warranty.

⚠ CAUTION ⚠
Minimize vibration around the CM to eliminate output electrical noise and provide a longer instrument life. Mount the CM away from direct sunlight, heating/cooling system ducts, gas vents, and other sources of temperature variation.

⚠ CAUTION ⚠
For a 0.1 Torr CM, the specific mounting orientation for the device is specified for optimal performance. Model number containing "V" in it stands for vertical mounting. Without letter "V" in model number implies a horizontal mounting.

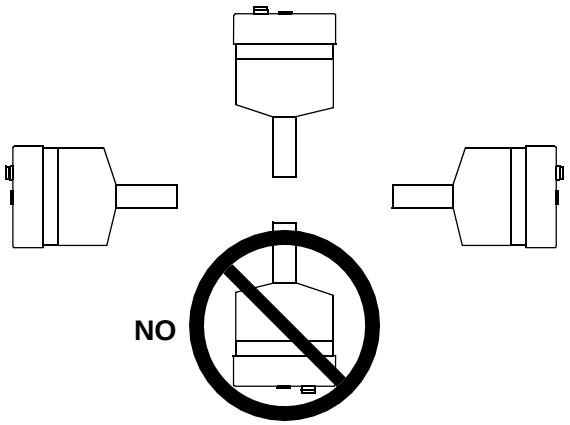


Figure 2. Mounting Orientation

3.2.1 PLUMBING CONSIDERATIONS

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

3.2.1.1 Tubing Size

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

3.2.1.2 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.

3.2.1.3 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 re-stabilize 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 capacitance manometers with less than a 10 Torr full scale range.

⚠ CAUTION ⚠
The CM 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.

3.2.1.4 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 this deposition.

⚠ CAUTION ⚠
Reversing the power supply connections may damage the CM.

⚠ CAUTION ⚠
Combining the chassis ground, signal common, and power common will severely compromise the pressure signal output.

3.2.1 ELECTRICAL CONNECTIONS

All capacitance manometers produced by Celerity are designed to be powered by a ±15 VDC (±5%) power supply. Temperature-controlled capacitance manometers require more power than unheated devices. Refer to Specification Tables beginning on page 4.

Electrical Signal Descriptions

Table 10: Electrical Signal Descriptions

Signal	Description	Notes
+ 15 VDC	Positive power supply input for the CM.	Wire size should be selected to minimize the voltage drop between the power source and the CM.
-15 VDC	Negative power supply input for the CM.	
Chassis Ground (CHASSIS)	This pin connects to a systems' chassis ground when the CM is mounted.	The shield in the cable should be connected to this pin to eliminate the possibility of radio frequency interference (RFI) affecting the output signal from the device.
Signal Common SIG GND (CMH) COMMON (CML) (SIG COM)	Pressure output reference return signal.	This should be used as the reference signal to avoid any ground return potentials developed in the Power Supply Common, described below.
Signal Output Output (CML) (SIG OUT)	A differential voltage developed between the Signal Out pin and the Signal Common pin.	This signal voltage has a maximum differential output of +10 VDC at the rated full scale pressure range of the CM. The output signal voltage is linearly proportional to pressure. Cable used for this signal should be shielded, and the shield should be connected to the chassis ground.
Power Common PWR GND (CMH) (PWR COM)	Power supply ground return line.	Wire size should be selected to minimize the voltage drop between the power source and the CM. This is the common reference point for the Trip Point control voltage levels. (See Specifications for power requirements.)
Temperature Status (TEMP STATUS)	Reports the status of the internal heater by remaining high (+5 VDC) until the CM reaches the control temperature, at which time the signal goes to zero or Signal Common.	Heated CMs.
NC	No connection.	Refers to CMLA/CMLB only.

Table 11: Relay Electrical Signal Descriptions (CDLS/CDHS Series Only)

Switched Device	Description
Relay 1, Normally OPEN (K1-NO)	This is the normally OPEN contact of trip point Relay 1. It is disconnected from the Relay 1 common contact when the setpoint pressure has been reached, or when power is removed from the device. It is connected to the Relay 1 Common signal when the Pressure Output voltage is below the Trip Point 1 pressure.
Relay 1, Common (K1-COM)	Common terminal for relay K-1.
Relay 1, Normally CLOSED (K1-NC)	Normally closed contact of trip point Relay 1. It is connected to the Relay 1 common contact when the setpoint pressure has been reached, or when power is removed from the device. It is connected to the Relay 1 common signal when the Pressure Output voltage is below the Trip Point 1 voltage.
Relay 2, Normally OPEN (K2-NO)	Normally open contact of trip point Relay 2. It is disconnected from the Relay 2 common connector when the setpoint pressure has been reached, or when power is removed from the device. It is connected to the Relay 2 common signal when the Pressure Output voltage is below the Trip Point 2 voltage.
Relay 2 Common (K2-COM)	Common terminal for relay K-2.
Relay 2, Normally CLOSED (K2-NC)	Normally closed contact of trip point Relay 2. It is connected to the Relay 2 common contact when the setpoint pressure is above the Trip Point 2 voltage measure at the connector, or when power is removed from the device. It is disconnected from the Relay 2 common signal when the Pressure Output voltage is below the Trip Point 2 voltage.
Trip Point 1 Voltage (TP1 OUT)	This is the analog voltage that is compared to the Pressure Output signal to determine the state of the Trip Point 1 relay.
Trip Point 2 Voltage (TP2 OUT)	This is the analog voltage that is compared to the Pressure Output signal to determine the state of the Trip Point 2 relay.

Each CDHS/CDLS contains two relays for controlling external devices. Each relay's trip point is adjustable, and is set by adjusting the corresponding potentiometer. A yellow LED displays the status of each relay and its trip point.

Table 12: Electrical Pinouts

Pin	CDH	CDHD	CDHS	CDL	CDLD	CDLS	CMH	CMLA CMLB	CMLAM	CMLAMD
1	SIG OUT	TEMP STAT		+15 VDC			SIG OUT	SIG OUT	+ 15 VDC	
2		SIG OUT		-15 VDC	SIG OUT			SIG COM	- 15 VDC	SIG OUT
3	TEMP STAT		TP2 OUT	SIG OUT		TP2 OUT		NC	SIG OUT	
4	+ 15 VDC		TP1 OUT	SIG COM		TP1 OUT	+ 15 VDC	- 15 VDC	SIG COM	
5	- 15 VDC	PWR COM					- 15 VDC	+ 15 VDC	PWR COM	
6	CHASSIS	- 15 VDC			-15 VDC					- 15 VDC
7		+ 15 VDC			+ 15 VDC					+ 15 VDC
8	SIG COM		K1-NO			K1-NO	SIG COM			
9	PWR COM		K1-COM			K1-COM	PWR COM			
10			K1-NC			K1-NC				
11			K2-NO			K2-NO				
12		SIG COM			SIG COM					SIG COM
13			K2-COM			K2-COM				
14			K2-NC			K2-NC				
15		CHASSIS			CHASSIS					

⚠ CAUTION ⚠
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.

⚠ CAUTION ⚠
Never exceed the ambient temperature operating limits. These limits are listed in the Specifications Tables 1 - 5, beginning on page 7. Devices which are designed for a specific operation range may be damaged by excessive temperature and may not function correctly.

⚠ CAUTION ⚠
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.

4.0 OPERATION

4.1 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 operating precautions must be followed:.

4.2 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.

4.3 POWERING THE CAPACITANCE MANOMETER

Refer to Specifications Tables 1 - 5, beginning on page 4.

The power may be supplied from a variety of Celerity controllers or directly from a secondary power supply that is regulated to within ±5%.

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.

Recommended Warm-up Times

Device Type	From Cold Condition (in hours)	From Pre-Warmed Condition (in hours)
CMH4-M11	12	3
CMHT-11		1
CDH45-M11	3	2
CDH80-M11	5	2
CDH80-11 / 12	3	1

NOTE: The CDH-series warms up and settles in about 55-60% of the time required of the equivalent CMH-series devices.
NOTE: 10 and 20 Torr devices, regardless of make or model, warm up and settle in 40-50% of the time required by 0.1 Torr devices, or in 1.5 hours versus 3.5+ hours.
NOTE: Pre-warming any capacitance manometer cuts the time to stability by as much as 80-90%. Pre-warmed 0.1 Torr devices settle in about 1 hour, whereas pre-warmed 10 and 20 Torr devices settle in as little as 15 minutes.

4.5 ZEROING THE CAPACITANCE MANOMETER

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

Table 13: ZERO Pressure Chart

Full Scale Range	Highest Pressure for Proper Zero Adjustment
0.1 Torr	1×10^{-6} Torr
1 Torr	1×10^{-5} Torr
2 Torr	2×10^{-5} Torr
5 Torr	5×10^{-5} Torr
10 Torr	1×10^{-4} Torr
20 Torr	2×10^{-4} Torr
100 Torr	1×10^{-3} Torr
1000 Torr	1×10^{-2} Torr

2. Allow the device to warm-up. See “DEVICE WARM-UP” on page 16.
3. Adjust the ZERO potentiometer, clockwise to increase or counter-clockwise to decrease the reading, until the pressure output signal is ZERO.

4.6 SETTING RELAY TRIP POINT VOLTAGES

The Trip Point voltage levels are read at the power/signal connector. To statically adjust the Trip Point:

1. Calculate the Trip Point Voltage using the formula given below:

$$\frac{\text{10 Volts X Setpoint Pressure}}{\text{Full Scale range of CM}} = \text{Trip Point Voltage}$$

Example:
To calculate the trip point voltage for a 10 Torr CM at a pressure setpoint of 2 Torr:

$$\frac{\text{10 Volts X 2 Torr}}{\text{10 Torr}} = \text{Trip Point Voltage}$$

2. Power-up the capacitance manometer and attach a voltmeter to the desired signal, see Table 10 on page 14. Voltage should be measured relative to the PWR COM of this connector.
3. Adjust the setpoint adjustment potentiometer to the desired Trip Point voltage, as calculated above. Turn the pot clockwise to increase the Trip Point level, or counter-clockwise to decrease the level.
4. To adjust the Trip Point when the capacitance manometer is under pressure:
5. Bring the system to the desired pressure.
6. Adjust the desired Trip Point pot to the point where the LED just turns OFF. Turning the pot clockwise increases the Trip Point level.
7. Decrease, then increase the pressure to assure that the LED turns OFF at the correct pressure reading. Adjust the pot if necessary.

5.0 MAINTENANCE AND TROUBLESHOOTING

5.1 CALIBRATION

Celerity capacitance manometers are calibrated to conform with ANSI Z540 Standard. 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 as this may cause damage to the device and may void the warranty.

5.3 TROUBLESHOOTING

Table 14: Troubleshooting Guide

Symptom	Possible Cause	Action
No output signal	No power	Check electrical connection.
		Check cable continuity.
		Verify power supply outputs.
		Check for dents to 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 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.
Cannot zero capacitance manometer	Not at base pressure	Verify chamber is at base pressure.
	Improper ground	Check signal and power grounds.
	Pot limit reached	Return device for repair.
No switch operation (CDHS)	PCB exposed to +30 VDC	Return device for repair.

⚠ CAUTION ⚠

For a 0.1 Torr CM, the specific mounting orientation for the device is specified for optimal performance. Model number containing "V" in it stands for vertical mounting. Without letter "V" in model number implies a horizontal mounting.

6.0 GAS UNIT CONVERSIONS

Multiply	By	To Obtain
atm.	14.6960 760.00 407.2 101.3 1.013	psi Torr in. of H_2O (15° C) kPascal bar
psi	0.06805 51.7149 27.71 6.895 0.068947	atm. Torr in. of H_2O (15° C) kPascal bar
Torr	0.001316 0.01934 0.5358 0.1333 0.001333	atm. psi in. of H_2O (15° C) kPascal bar
in of H_2O (15° C)	0.002456 0.03609 1.866 0.2488 0.002489	atm. psi Torr kPascal bar
kPascal	0.009872 0.1450 7.501 4.019 0.0100	atm. psi Torr in. of H_2O (15° C) bar
bar	0.9869 14.50 750.06 401.8 100.0	atm. psi Torr in. of H_2O (15° C) kPascal

7.0

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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