1 YEAR WARRANTY

OMEGA™

# User's Guide



## CMDP Series
## Chilled Mirror Hygrometer

## CMDP Overview

The CMDP series is a family of low-cost dew point chilled mirror transmitter that can be configured as a duct, wall, pipe, or an OEM unit. The unit offers stable, accurate and repeatable measurements that are traceable to NIST. Available air temperature option for wall and OEM configurations. Settable service cycles for balancing and cleaning the mirror. The CMDP is a primary measurement using a fundamental principle to measure the dew point very accurately. Simple maintenance to cleaning the mirror requires using a wetted cotton swab to restore the transmitter to normal operation. Because of its construction, the customer can enjoy a long life of excellent performance.

## Features

- Precision accuracy
- Two 4-20mA outputs (configurable)
- Durable and fast responding
- Automatic balance function for the mirror, optical circuitry
- RS232 communication
- Simple maintenance-mirror cleaning

## Specifications

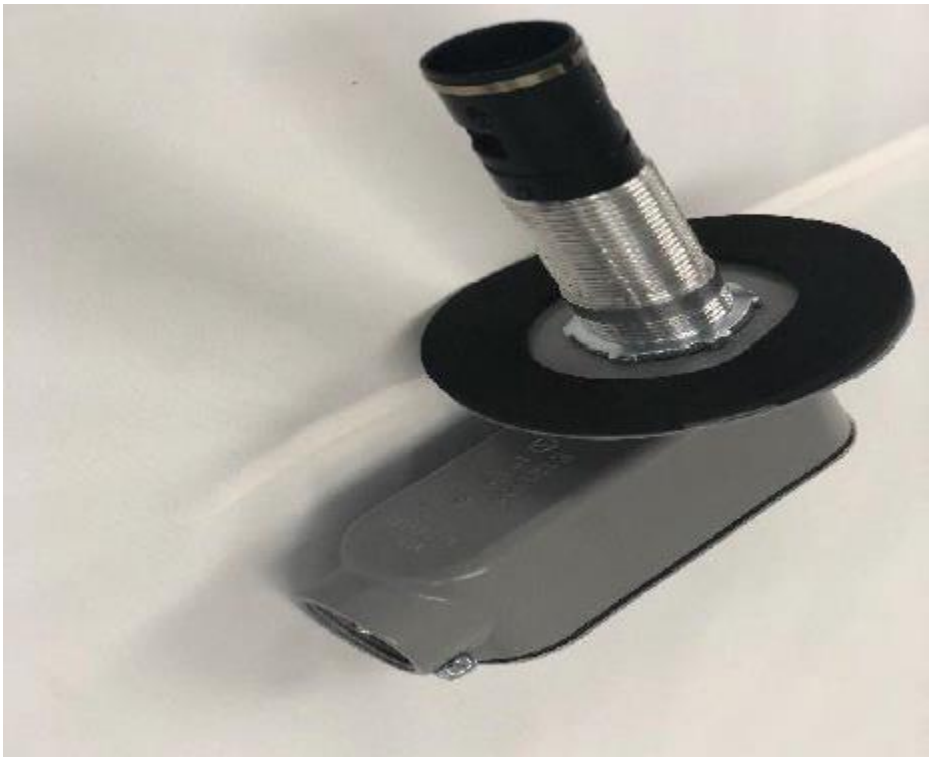
### Operating Limitations:

**Temperature:** -40°C to +70°C. High temperatures will damage the electronics
**Accuracy:** ± 0.5C of reading for both dew point and temperature
**Repeatability:** ± 0.05C
**Calibration:** NIST Traceable
**Measurement Range:**
Dew Point -20°C (@ 25°C) to 60°C (non-condensing)
Dew Point -40°C (@ 0°C)
Temperature probe (optional): -40°C to 120°C
**Output**:
(2) 4 to 20mA output at 24Vdc (configurable)
Default settings: -20C to 60C (unless specified on purchase order)
**Supply Voltage:** 24Vdc +/-3V @1.0A
**Weight:** 2lbs
**Wetted material**: Nickel, ultem and anodized aluminum
**Pressure rating**: 5 ATM. Thread size 1.25”-12 UNF
***WARNING:** Pressure more than allowable rating may cause the housing to burst and cause serious personal injury.*
**Air Velocity**: 50 to 900m/min
**Air Temperature probe dimensions (optional)**: Length 5”, O.D. 0.1875 (3/16”)
**Air temperature connection (optional)**: 4 Wire (flying leads)

## Ordering Configuration

| | |
|---|---|
| CMDP-D | Duct mounted chilled mirror hygrometer (dew point only) |
| CMDP-W | Wall mounted chilled mirror hygrometer (dew point only) |
| CMDPT-W | Wall mount chilled mirror hygrometer (dew point/air temperature) |
| CMDP-P | Pipe mounted chilled mirror hygrometer (dew point only) |

CMDP Instructional Guide



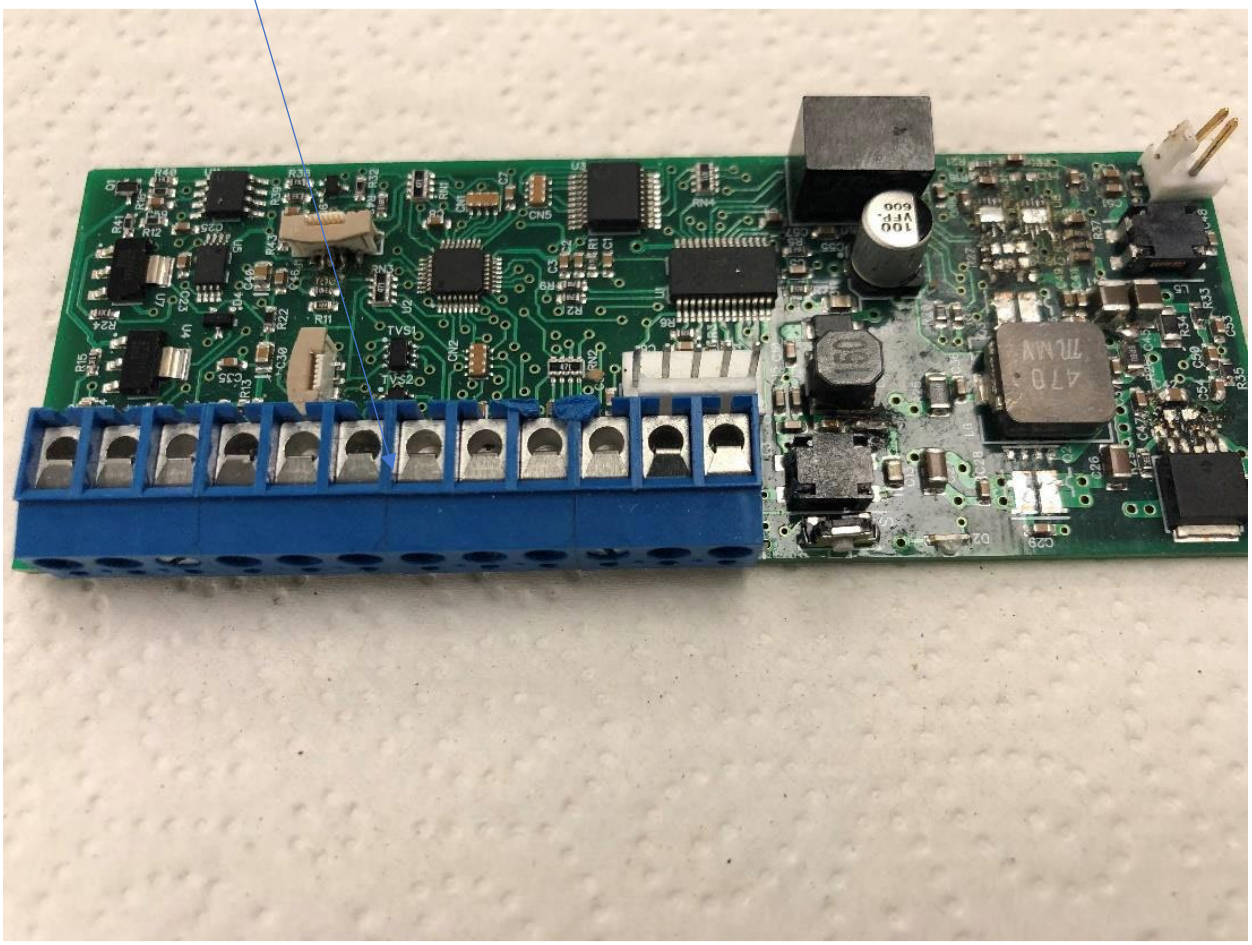
The CMDP is a single stage chilled mirror hygrometer configured for duct mount, wall mount and OEM application. For Pipe Mount applications please consult factory. The CMDP requires 24VDC @1 A for power. It has two 4-20mA outputs factory scaled for -40°C to 60°C. The unit also has a RS232 communication connection that can be accessed using either the Hyper terminal or Tera Term program which is available on most computers.

Notes: Even though the unit is scaled from -40°C to 60°C, the unit can only measure to -20°C dew point at ambient temperature conditions (25°C). If the dew point is lower than -20°C, the user will have to cool the body of the sensor to a lower temperature. The unit has depression capability of 45°C (meaning if at ambient (25°C), subtract 45° from 25°C and that will be your lowest dew point (-20°C). So, lowering the temperature of the sensor will get you to lower measurable dew points.

## CMDP Wiring Instructions

Terminal Block
All wiring is done to the 12-pin terminal block located on the PCB
Pin 1 Tx (RS232)
Pin 2 Rx (RS232)
Pin 3 (+) 4-20mA output
Pin 4 Ground
Pin 5 (+) 4-20mA output
Pin 6 (-) common for 4-20mA outputs
Pin 7 (-) Air temperature probe
Pin 8 (-) Air temperature probe
Pin 9 (+) Air temperature probe
Pin 10 (+) Air temperature probe
Pin 11 Return
Pin 12 24Vdc (@1A)

PCB blue connector:



## CMDP Protocol Setup

No special software is needed. User can use either the Tera Term program or the HyperTerminal program on their PC. Connect the RS232 connection from the Dew Tran and using a USB converter connect to your PC.

Protocol configuration: Baud rate 19.2K, 8 Bits, 1 stop Bit, No parity To access the menu, hit the "esc" The Cap lock key must be on when selecting commands.

### Calibrating Current Outputs:

There are 2 methods for calibrating the 4-20 mA outputs. Method 1 uses a digital ammeter, capable of 1 uA. Resolution. The second method uses high precision (.005%) Resistor(s), In range of 10 – 750 ohms. The factory Calibration is done using 100.00 ohm resistors. For output 1, connect Ammeter across BLACK Wire and RETURN.

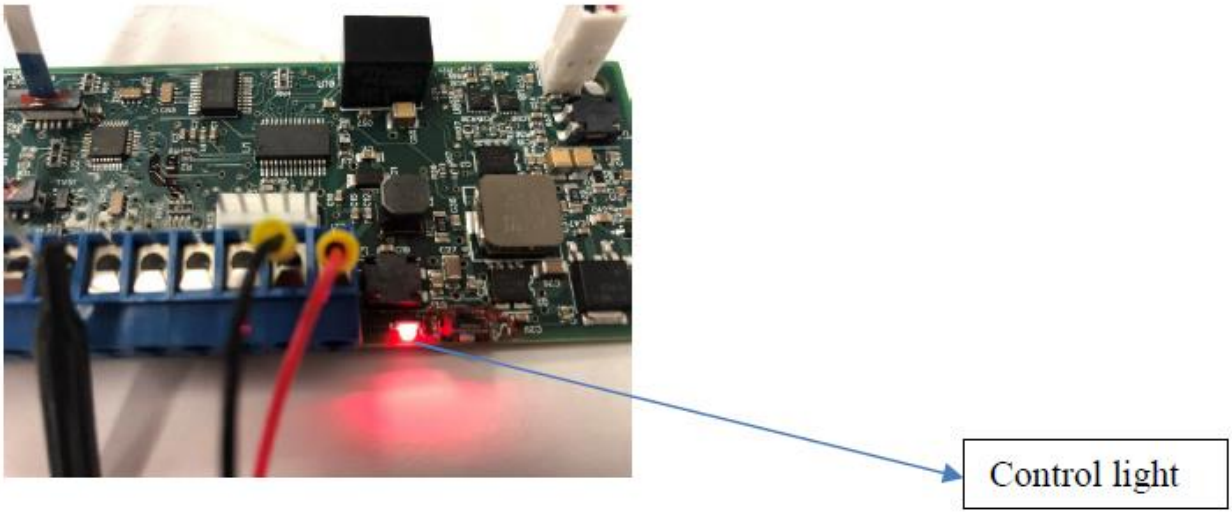
From normal operation, enter following keystrokes:
<ESC> <C>hange <O>utputs <C>alibrate <C>urrent at the "Sense Resistor Value (Y/N) OHMS?" Prompt, enter <N> Enter<1> for Current output 1.
The prompt "4 mA. = ?, enter the value displayed on Ammeter, as mA's Continue for the next 2 prompts (12 mA. and 20 mA.)
The prompt "4 mA. = 1XXXX" is displayed, check Ammeter for 4.00 mA. reading.
Press <CR> to sequence (8, 12, 16 ,20 mA.) Values, with corresponding Ammeter Readings. If calibrated values good, at "Save Calibration (Y/N)?, enter<Y>.

## Operations

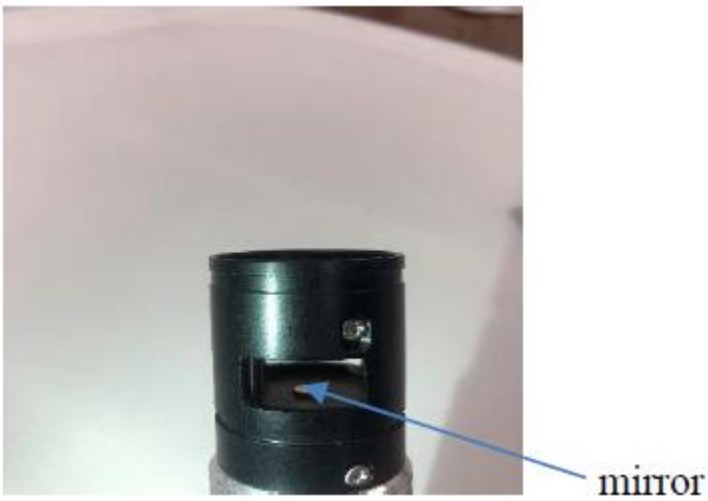
There are two ways to determine if the sensor is operating/properly functioning.

Reminder: When the unit is first powered on, the unit will take 3-5 minutes to control. Typically, the unit goes through what we call an ARC condition. Which is a balancing cycle, the unit initial heats up, then goes into an acquiring mode (hunting for the dew point) and then the control mode.

1) If you are using the RS232, output you can view the data via your computer to see if the unit is in control. The data will be streamlined on your PCs and you will see the word "control" at the end of each line.
2) Another method is by viewing the red light on the PCB. If the red light is in a steady state (always on), the unit is in control.
3) If the red light is blinking, the unit is most likely in one of these three states.
    a. The unit was just powered on and is going through its ARC cycle for 3-5 minutes.
    b. The mirror is dirty (has contaminants on it) and it needs to be cleaned. Refer to the clean mirror procedure.
    c. If the above 2 steps do not remove the blinking red light condition, the unit could be out of range to measure that dew point/frost point. (Ex: if your ambient condition is 25C and your dew points is below -20C, the unit can not measure that dew point (red light will blink). A way to correct that is to lower the body temperature of the sensor to a point where the dew point is measurable with this unit.



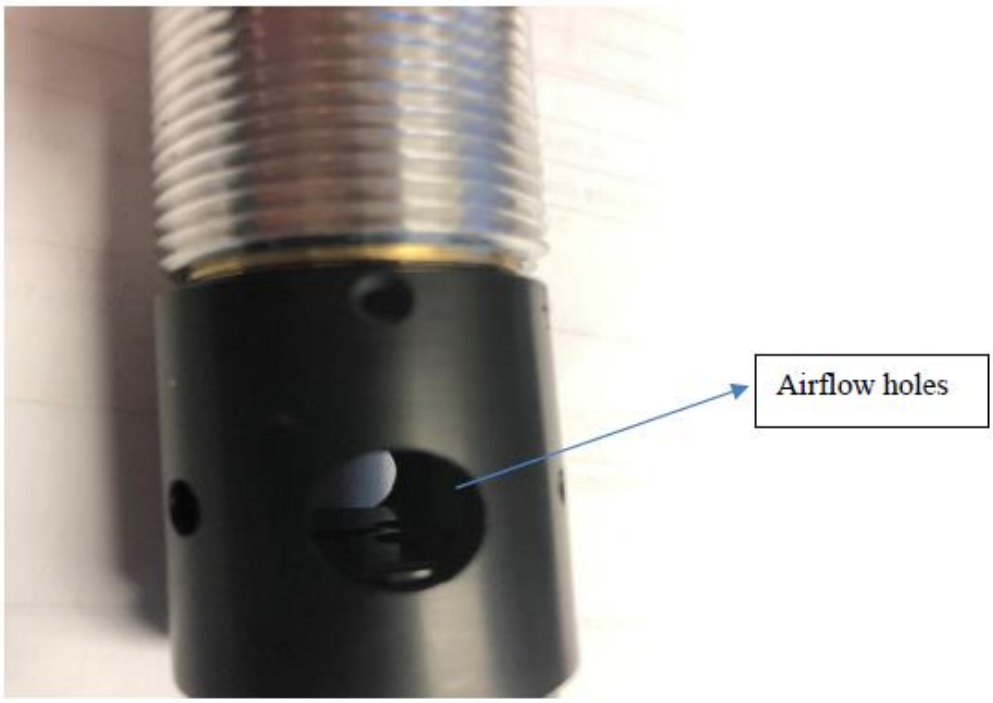

## Clean Mirror

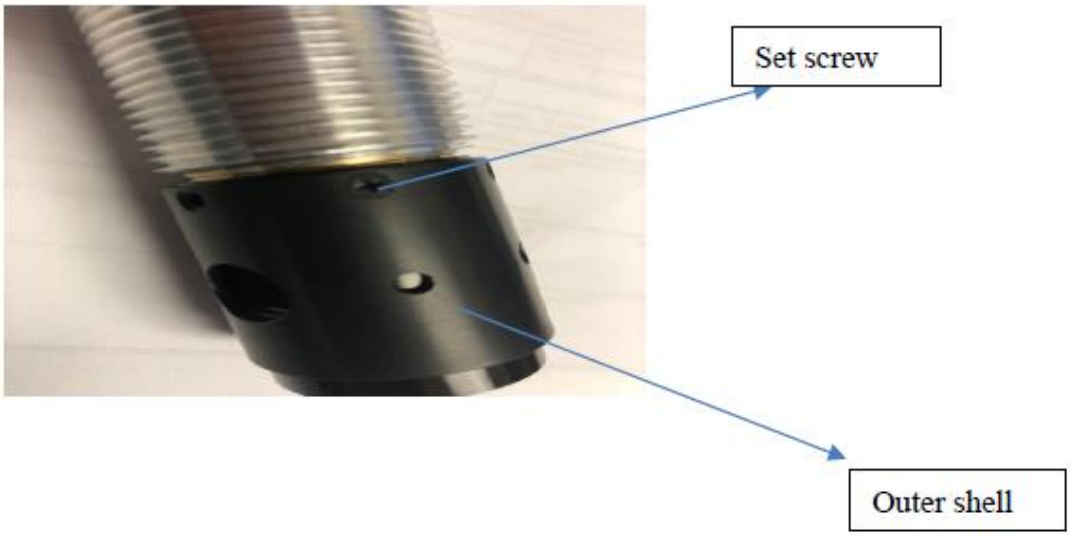



1) Power down
2) Gain access to the mirror
3) Clean mirror with a wetted (using isopropyl alcohol) cotton swab.
4) Dry the mirror surface with a dry cotton swab.
5) Reinstall sensor shield if applicable.
6) Power the CMDP on
7) Also, the mirror can be cleaned during the ARC (when red light is blinking) by following the above steps 2- 5

## Airflow Adjustments

There are 6 air holes in the middle of the outer shell: 2 large holes, 2 medium, and 2 small. The holes allow the airflow to the mirror (where the measurement is made).



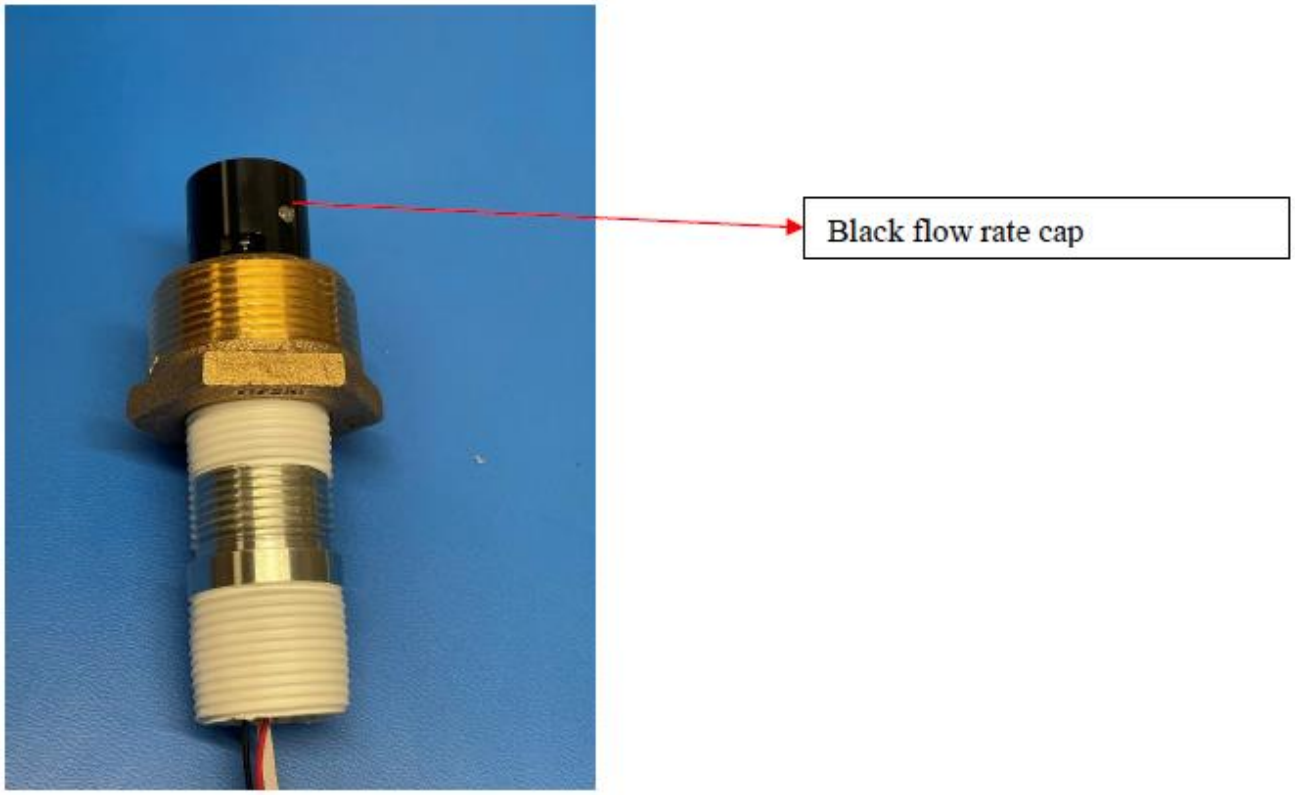




To adjust the airflow to the mirror, the Phillip set screw must be removed. Once removed, twist the outer shell to the correct hole for airflow and then re-install the set screw to hold the outer shell in place.

Example: if the larger airflow hole has been selected and your signal is constantly oscillating after the red light is in a steady state. You might want to select a smaller hole to slow down the airflow to the mirror. If that doesn't work, try to clean the mirror.

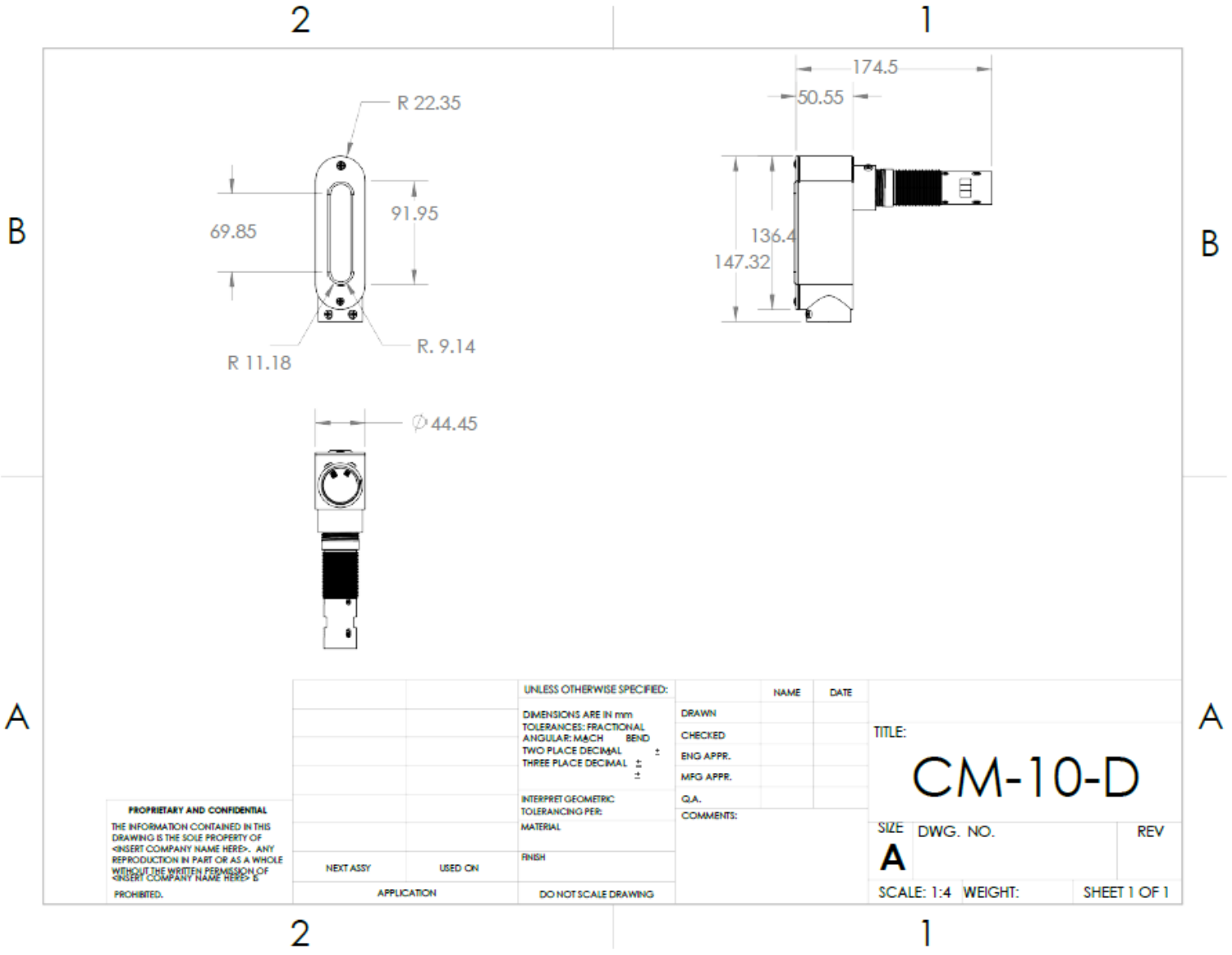
## Pipe Mount Configurations

Roscid supplies a Hex Bushing: Red Brass, 1 1/2 in x 1 in Fitting Pipe Size, Male NPT x Female NPT, Class 125.




The sensor head (black flow rate cap) should be installed at least 1” into the process gas.
If the reading is oscillating, you might need to adjust the black flow rate cap, slowing the flow rate down.

Fundamental First Principal Measurement for Dew Point



Chilled mirror hygrometers (CMH) use a primary fundamental principal measurement which is a change in resistance. This principle works when a sample of process gas flows across a special polished coated mirror. The mirror temperature is lowered by thermal electric coolers (located beneath the mirror block/mirror) until the water vapor of gas condenses out on to the mirror in the form of either dew or frost. There is an optical circuit which constantly monitors the mirror surface and looks for equilibrium between the optical LED detectors (a reference and the dew detector). The temperature of the mirror surface is measure by a highly accurate Platinum Resistance Thermometer (PRT) which is embedded and sealed in the mirror block which is thermally connected to the mirror. The PRT resistance measurement is what makes this a fundamental dew point measurement.

In more detail, a fundamental measurement is such that the parameter being measured, is the same as the Standard International definition of that parameter. In the case of the Chilled Mirror Hygrometer, that measurement is the temperature of the mirror surface covered by a water layer that is in equilibrium between the liquid and gaseous phases of water. If that temperature measurement is accomplished by a platinum resistance thermometer, the measurement is equivalent to the definition of dew point. Tables constructed by NIST, notably by Wexler and Greenspan, establish the equivalence of dew point and the vapor pressure of water. Using this equivalence and a second, fundamental, temperature measurement, realizes the definition of Relative humidity: Vapor pressure of water/saturation vapor pressure (temperature) of the gas being measured, X100(%) i.e. %RH =100*PH2Ov/PSAT. Addition of a 3rd measurement, the pressure of the gas being sampled, allows measurement of almost every other humidity parameter.

Some further unit examples: absolute Humidity (gH2Ov/m3), mixing ratio (gH2Ov /kgDRY), Parts per million (PH2Ov/(PTot- PH20)), enthalpy(h), to name a few.

Chilled mirrors hygrometers are used where accuracy, typically +-0.2°C or better, repeatability, stability and no drift are paramount. CMH are the preferred reference standard in most calibration labs. Also, CMH work well due to their ruggedness, their inertness, their simple maintenance and ability to accurately measure sample gasses remotely from process, i.e. ovens, dryers, furnaces, etc. Dew points above ambient can be measured by heating the chilled mirror and associated components. Chilled mirrors can be, and are, constructed as an insertion probe, provided the temperature of the process is < ~95 °C.

In closing, the upside of the chilled mirror hygrometer is that it uses a fundamental principal, it can be designed to be inert to many corrosive gases, it is a repeatable in its measurement, there is no measurable hysteresis, it is very accurate and has a very long operating life. The downside is that it is expensive and is typically slower in response time when compared to other secondary principal humidity measurements.

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## WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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## RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

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