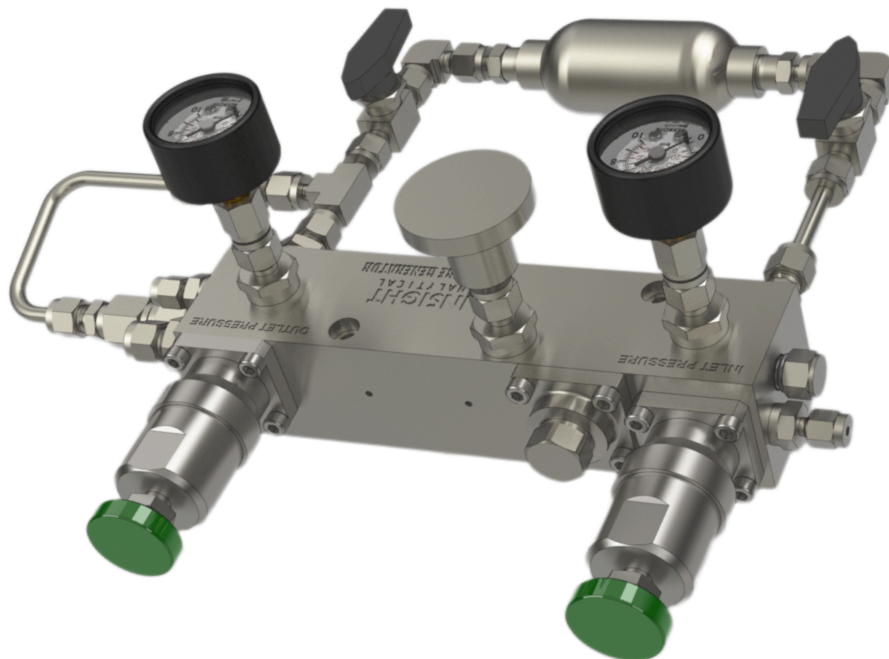
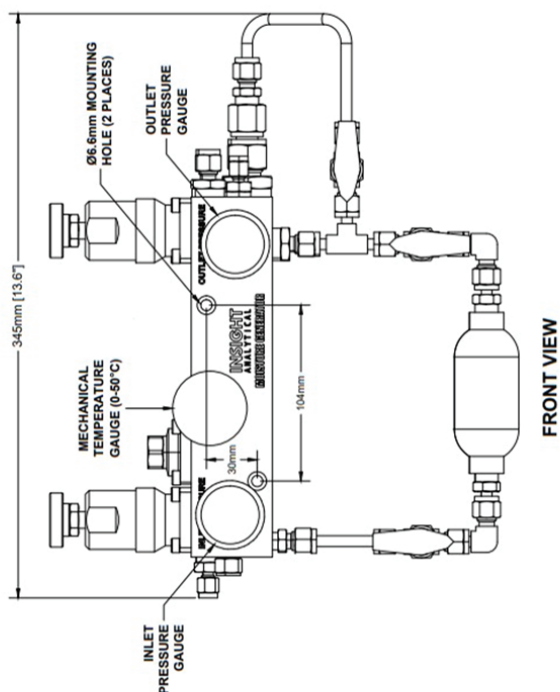




## Moisture Generator Block



The Insight Analytical Moisture Generator (Patent Pending) is a compact, portable, rugged device for adding a known amount of moisture to a gas sample for field validation of analyzers measuring water vapor concentration and requires no utilities except for a high-pressure gas supply. It has an adjustable water vapor concentration range from close to zero up to 190 ppm (8.7 lbs/mmscf or 140 mg/m<sup>3</sup>) over a range of delivery pressure and flow rate that makes it compatible with checking the calibration on a wide variety of analyzers measuring water content or water dew point temperature, for example in natural gas applications where the natural gas can be used as the high-pressure gas supply.

### Field of Application:

Process moisture analyzers such as those using Tunable Diode Laser (TDLAS), Chilled Mirror, and Quartz Crystal Microbalance (QCM) technologies installed in the field on processes such as natural gas pipelines normally operate for long periods of time reading very low water vapor concentrations with little or no changes in their outputs. It is sometimes difficult to determine if these analyzers are working properly and that they will respond to a process upset when it occurs. It is desirable to "bump test" these analyzers periodically to validate their operation and verify that they will respond properly to an upset, but this is often not commonly done because it requires using moisture calibration cylinders that are expensive, large, and heavy along with additional equipment such as heated pressure regulators and heated cylinder blankets.



## Principle of Operation:

This device generates a known water vapor concentration for validating moisture or water dew point analyzers. An inlet pressure regulator on the gas supply is used to adjust the outlet water vapor content with the resulting water vapor concentration being roughly inversely proportional to this pressure setting (high-pressure settings give low water vapor concentrations and lower pressures result in higher water contents). After this pressure adjustment, the gas flow is split into two streams with one flowing into a saturation chamber where the gas becomes water-saturated at the supply pressure and block temperature, and the other flowing through a dryer containing mole sieve to remove most of the water vapor.

The flow of these two streams is controlled such that the mixing ratio of the dry and wet gas streams is always constant regardless of the inlet pressure regulator setting or supply gas composition. The dry gas and wet gas streams are mixed in a T-fitting and internal passages in the block before flowing through the outlet connection fitting.

The water vapor concentration in the outlet gas is calculated using a spreadsheet which uses the inlet pressure regulator setting and the temperature of the block to calculate water content. A back pressure regulator (BPR) at the block outlet is used to adjust the outlet pressure to match the inlet pressure requirements of the analyzer being validated and vents any excess gas flow that exceeds the analyzer flow requirements.

The general layout of the moisture generator is shown in Figure 1 and the range of water vapor concentration generated for a range of block temperatures and pressure settings is shown in Figures 2, 3 and 4 for concentration units of ppmv, lbs/mmscf, and mg/m<sup>3</sup> respectively.

## Advantages:

- It can be used as a portable moisture generator to “bump test” field moisture analyzers or permanently mounted in an analyzer sample system.
- It can use high pressure sample gas such as natural gas to create the moisture validation gas mixture so that the analyzers can be validated with the same gas composition that they are measuring – this helps to determine if the sample gas composition is affecting analyzer accuracy.
- It has no electrical components, so it is suitable to be used in explosive gas atmospheres, such as natural gas plants or metering stations without additional certifications.
- The dry and wet gas stream are combined at a constant mixing ratio which is stable over time and is unaffected by gas composition.
- Adjusts the moisture content by changing the saturation pressure rather than the saturation temperature, so it responds quickly to adjustments because pressure changes stabilize much faster than temperature changes.
- Small ruggedly built package that is light, portable, and resistant to damage and vibration.
- Can use any high-pressure gas supply including gas from cylinders or high-pressure natural gas as the validation gas media.
- Does not require external equipment such as pressure regulators, gas cylinders etc.
- Accuracy is not affected by the analyzer operating pressure regardless of whether it is high, low, or unsteady.
- Does not use expensive or high maintenance components like mass flow controllers, heaters, or coolers.

## Technical Specifications

Maximum Pressure Rating	1500 psig (10342 kPag)
Temperature Range	-6°C to 65°C
Delivery Pressure Range	0 to 250 psig (0 to 1724 kPag)
Flow Rate Range	3 scfh at 100 psig to 26 scfh at 1000 psig Saturation Pressure With Methane Based Gas Supply (1.4 LPM at 690 kPag to 12.3 LPM at 6895 kPag)
Outlet Water Content Range at 21°C Ambient Temperature	0 to 8.7 lbs/mmscf / 0 to 140 mg/m <sup>3</sup> / 0 to 190 ppmv  At 21°C Block Temperature and Saturation Pressures from 100 psig to 1000 psig (690 kPag to 6895 kPag). See Figures 3, 4 and 5 for more details
Inlet and Outlet Connection Size	1/8" Tube Swagelok Compression Fitting
Vent Connection Size	1/4" Tube Swagelok Compression Fitting
Wetted Materials	Electroless Nickel Plated Aluminum and 316 Stainless Steel
NACE compliance	NACE MR0175/ISO 15156 and MR0103 Compliant.

**Figure 1 – Moisture Generation Block General Arrangement Drawing**

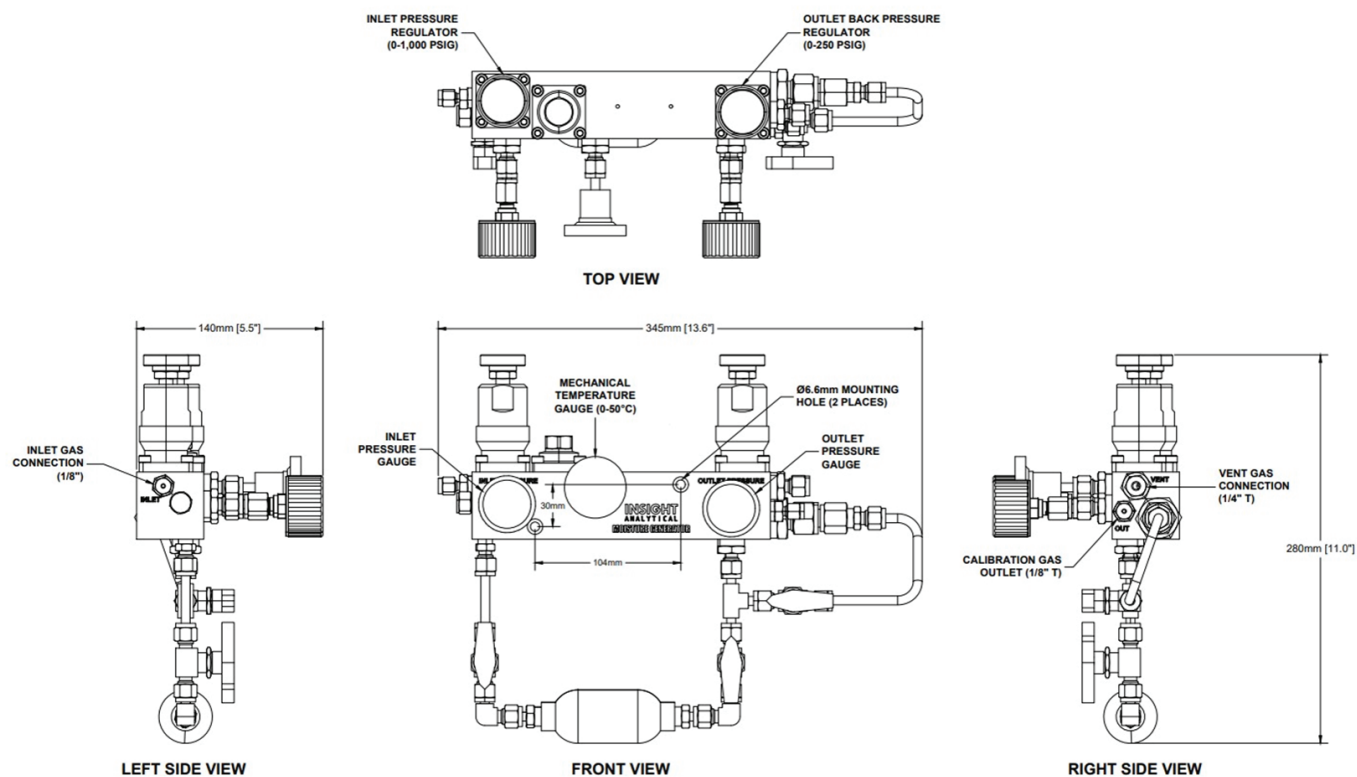


Figure 2 – Water Vapor Concentrations in ppmv Generated Over a Range of Block Temperatures and Pressure Settings

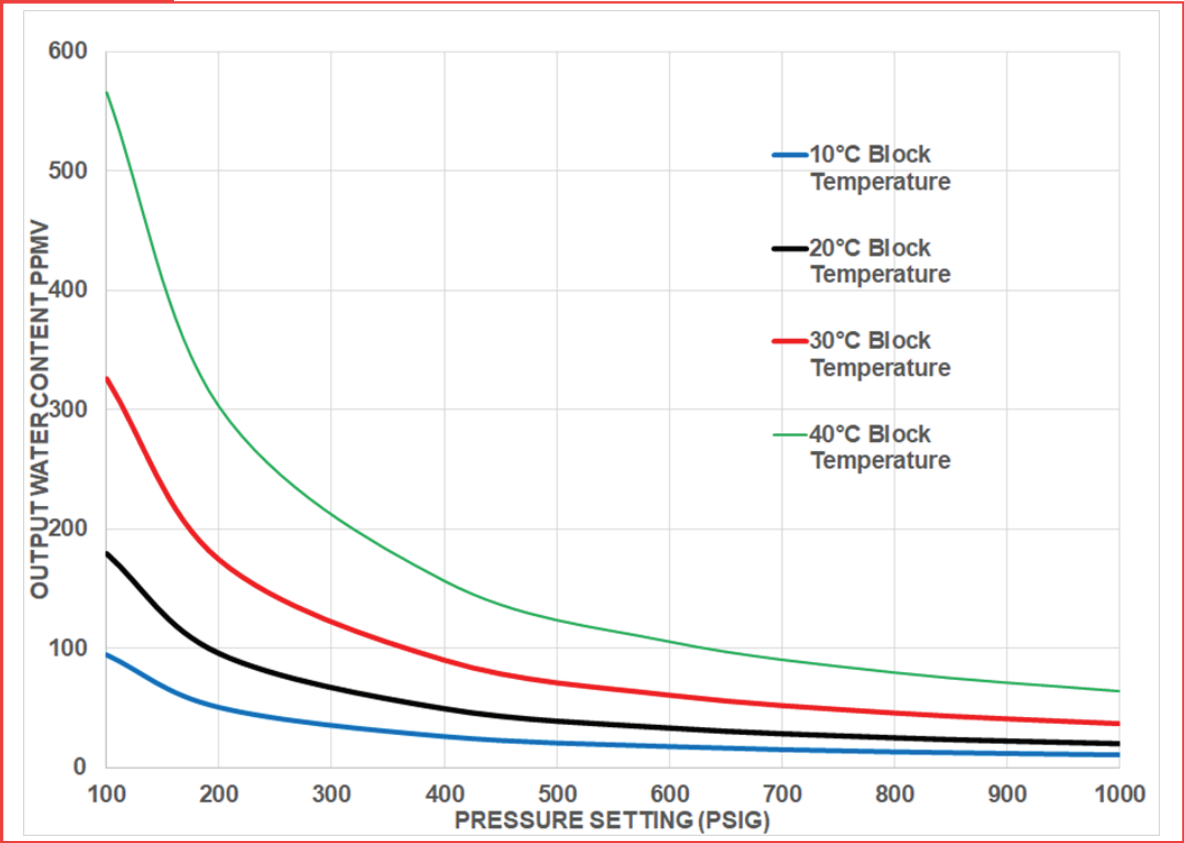


Figure 3 – Water Vapor Concentrations in lbs/mmSCF Generated Over a Range of Block Temperatures and Pressure Settings

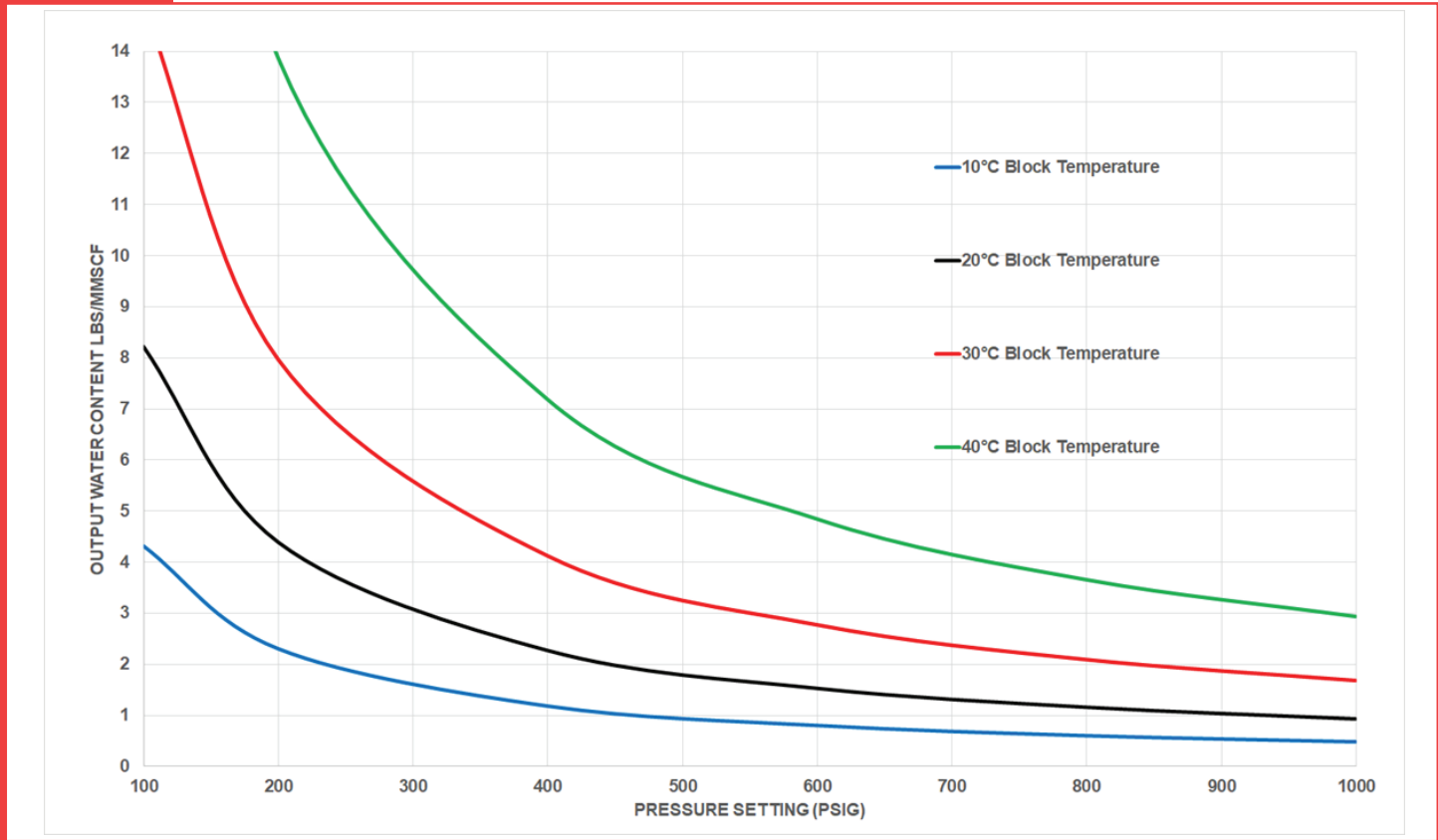


Figure 4 – Water Vapor Concentrations in mg/m<sup>3</sup> Generated Over a Range of Block Temperatures and Pressure Settings

