Best Practices in Moist and Wet Gas Flow

Considerations and Solutions for Applying FCI ST80 Series Thermal Mass Flow Meters in Wet Gas or Open Stack/Rain Down Installations

What is FCI's "Wet Gas" Sensor?

As a leading innovator in the design of thermal mass flow meter technology and best application practices, FCI continues to develop solutions that address the most challenging customer requirements. The latest of these developments is the Wet Gas MASSter for the ST80 Series flow meters. This mechanical design shunts moisture, condensation and water droplets away from the thermal sensor, thus maintaining an accurate gas flow measurement while minimizing errors that occur from a cooling effect on the sensor that could cause a spike or false high reading. The Wet Gas MASSter can be used in applications that either have moisture entrained in the gas (annular mist) or for protection against rain in larger, vertical stacks.

Why is it needed?

The Wet Gas MASSter sensor is for use in applications that have a high level of moisture or condensation present in the gas flow stream that cannot otherwise be removed.

The measuring principle of thermal mass flow meters involves heat transfer caused by gas flow. Any moisture or condensate in the gas stream that contacts the heated sensor can cause a sudden, momentary change in the heat transfer that can result in a spiked or fluctuating reading, creating inaccurate or unstable flow measurement. Thermal flow meters using the constant ΔT (CT) method are particularly reactive to moisture droplets, while constant power (CP) method meters, because their slightly heated sensor elevates the dew point, are less so.

For entrained moisture, eliminating the moisture from the gas stream is always the preferred, best practice. Common methods for this include:

- Installation of a gas dryer
- Installation of a knockout drum or knockout pot upstream from the flow meter installation point.*
- Insulate or heat wrap the pipe to prevent condensation.

However, if none of these moisture elimination practices are feasible, then there are two solutions to consider:

1) Use a standard thermal flow meter using constant power (CP) technology and optimize the installation itself to minimize or prevent condensation from contacting the sensor. Angle mount the flow meter in the pipe per *Figure 1* so that gravity moves the moisture away from the sensor.

* If using knockout pot, installation of the flow meter per *Figure 1* is also the recommended best practice.

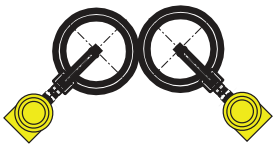

Figure 1. Angle mounted at 135° or 225° position

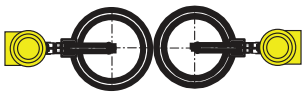

Figure 2. Side mounted at 90° or 270° position

2) Install a special purpose "wet gas" thermal flow meter. There are two types.

   a) One, and the preferred solution, is FCI's "wet gas" sensor head which mechanically shunts the condensate away and never allows it to reach the sensors. Because it is a mechanical solution, all safety approvals remain, there is no increase in energy consumption to power the instrument, and there is no impact on the sensors' service life. Further, there is no de-rating of the instrument's T-rating and the sensor is safe to touch. Recommended installation is side mounted in either 90° or 270° position per *Figure 2*.

   b) Another one is a ΔT (CT) method device that is extremely heated, to 300 °C [572 °F] to "flash off" any moisture. However, inserting such a high heat source into the flow stream may create an unsafe condition, consumes much more energy to operate, and may result in shortened operating life-cycle, accelerated aging, susceptibility to drift and/or premature failure of the sensors.

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What are the key specification and performance differences between FCI's standard "S" type sensor head (operating in CP method) and the "WG" wet gas sensor head?

	ST80 Series	
	"S" Sensor	"WG" Sensor
Application conditions	< 100% RH or flow velocity < 10 FPS [3 MPS] *No condensate droplets or rain drops will contact the sensor head*	> 100% RH or flow velocity > 10 FPS [3 MPS] *When condensate droplets or rain drops may contact the sensor head*
Minimum flow range	0.25 SFPS [0,07 NMPS]	1 SFPS [0,3 NMPS]
Maximum flow range	1000 SFPS [305 NMPS]	600 SFPS [183 NMPS]
Accuracy	±1% rdg, ±0.5% FS	±1% rdg, ±0.5% FS
Repeatability	±0.5% rdg	±0.5% rdg
Recommended mounting orientation	Angle mount at 135° or 225° position	Side mount at 90° or 270° position
Response time in constant power (CP) mode	7-9 sec	3 sec
Temperature service *Gas temperature maximum*	850 °F [454 °C]	Up to 350 °F [177 °C]
Pressure service	Same	
Agency approvals and certifications	Same	
Outputs and electronic functions	Same	
Process connection options	Same	

Frequently Asked Questions

Q1) When "WG" sensor is selected, how does FCI account for the wet gas in the calibration of the flow meter?

A1) The purpose and design of the WG (wet gas) sensor head is to shunt spurious moisture away from the sensors so they see and measure only the true dry gas. Therefore the ST80 flow meter will be calibrated for the "dry" gas composition.

Q2) Does the ST80 drive the "WG" sensor to run at a higher temperatures than other FCI thermal flow meters?

A2) No, it runs at same, low temperature as any ST80; all agency T-rating approvals apply.

Q3) If gas is also dirty, should I select "WG" or "S" head?

A3) Either will work and a decision should be based on the maintenance routine available. The "S" head is completely open and, for most situations, it is easier and quicker to simply wipe clean. The "WG" head has more surface area and draining slots which may require more frequent or detailed cleaning. The amount of dirt/particulate in a gas stream will vary from site to site.

Note: In either case, FCI recommends installing in the pipe through an isolation ball valve. The flow element is then easily retracted and removed from the process for cleaning.

How Do I Order ST80 with "Wet Gas" Sensors? *

Ordering is simple. In the instrument's ordering configuration, specify order Code "P" in Block 1.

	Flow Element (FE)									Flow Transmitter (FT)					Calibration					General
ST80 -	**P**	0							**-**					**-**					**-**	
Block No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**		**9**	**10**	**11**	**12**		**13**	**14**	**15**	**16**		**17**

If application is for entrained moisture, select appropriate "side-mount" Code from ordering guide and enter in Block 8.
If application is for "rain shield" in a vertical pipe, then select Code 3 in Block 8.

* *The "WG" sensor is also available in FCI's ST100 Series thermal mass flow meters as a special order. Contact FCI for instructions on how to specify it.*

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Locally Represented By:

Visit FCI online at www.FluidComponents.com | FCI is ISO 9001 and AS9100 Certified

FCI World Headquarters
1755 La Costa Meadows Drive | San Marcos, California 92078 USA | **Phone:** 760-744-6950 **Toll Free (US):** 800-854-1993

FCI Europe
Persephonestraat 3-01 | 5047 TT Tilburg, The Netherlands | **Phone:** 31-13-5159989 **Fax:** 31-13-5799036

FCI Measurement and Control Technology (Beijing) Co., LTD
Room 107, Xianfeng Building II, No.7 Kaituo Road, Shangdi IT Industry Base, Haidian District | Beijing 100085, P. R. China
Phone: 86-10-82782381