

# External Readout MFC Applications

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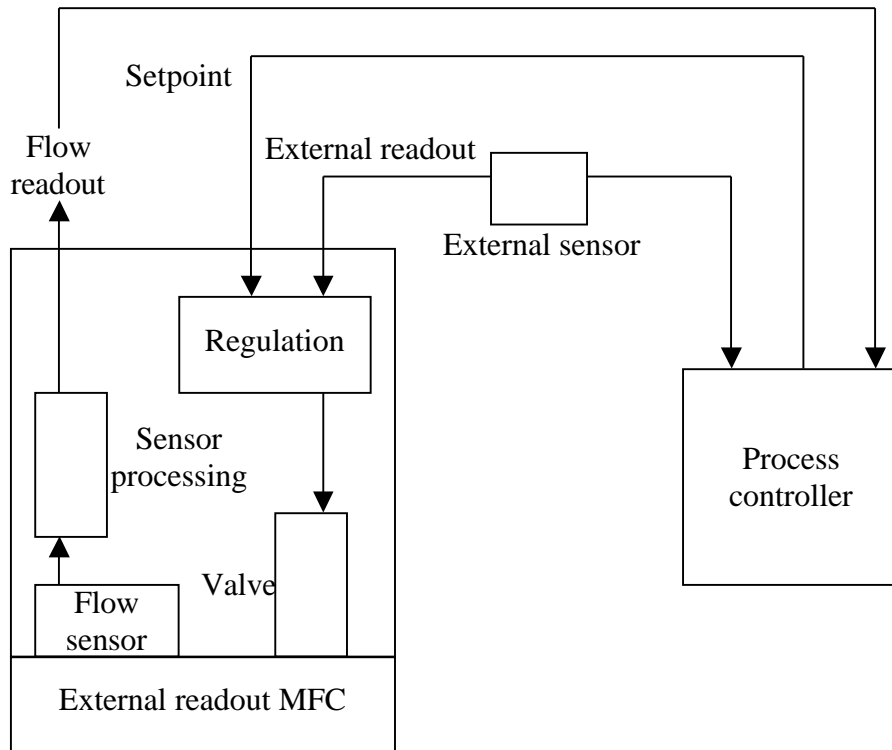
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## 1. Introduction

The MFC's external readout feature can be used in a variety of applications such as pressure control in a vacuum process chamber, pressure control for wafer's back side cooling, evaporation control in a gas bubbler, and burner flame temperature control using gas as a medium. This document describes some applications as mentioned above.

## 2. Principle



The flow measure of the MFC is not involved in the regulation, it is just an information which is given to the customer.

The regulation adjusts the valve command so that : **external readout (V) = setpoint (V)**

### Input/output format

- Flow readout :
  - 0V  $\hat{=}$  flow = 0 (digisoft display : 0V or 0 % Full Scale )
  - 5V  $\hat{=}$  flow = MFC flow Full Scale (digisoft display : 5V or 100% Full Scale )
- Setpoint :
  - between 0 and 5V (digisoft display : xV or x% FS with 5V  $\hat{=}$  100% FS)
- External readout :
  - between 0 and 5V or 10V (digisoft display: yV or y% FS with 5V  $\hat{=}$  100% FS or 10V  $\hat{=}$  100% FS)

Note 1 : A digital external readout MFC can be operated also in normal mode ! (selection with digisoft). And in normal mode, the same setpoint input (between 0 and 5V) is used for the regulation.

Note 2: - In normal mode: setpoint  $\Leftrightarrow$  flow (sccm or % FS)  
 - In External readout mode: setpoint  $\Leftrightarrow$  pressure, temperature, (Bars, Torrs, °C, °K, %FS)

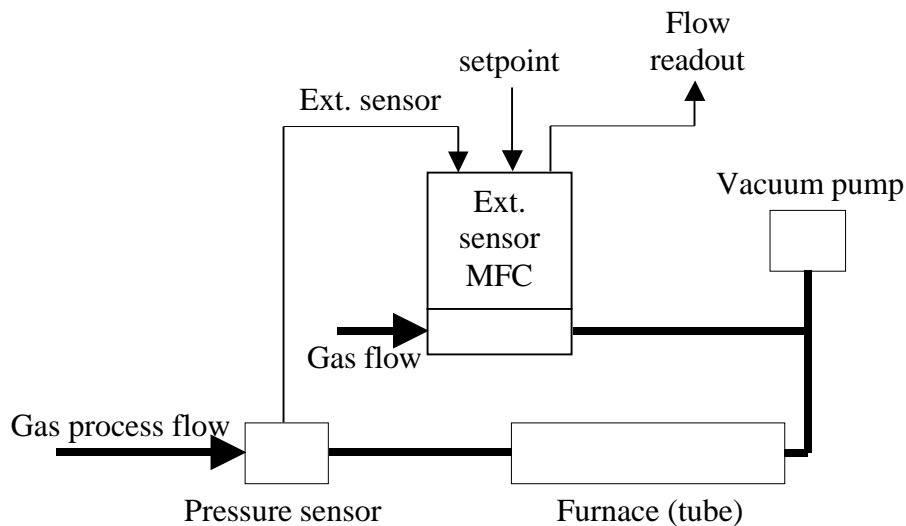
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### 3. Different cases of external readout MFC applications

We can distinguish several different cases for external sensor applications.

#### 3.1. Pressure Control in Vacuum Process Chamber

This application uses a pressure sensor as an external signal to the mfc to control the pressure inside a vacuum chamber. The setpoint remains the same as normal MFC application. The internal thermal sensor is used for initial calibration in manufacturing. Feed back for control is based on the external sensor.

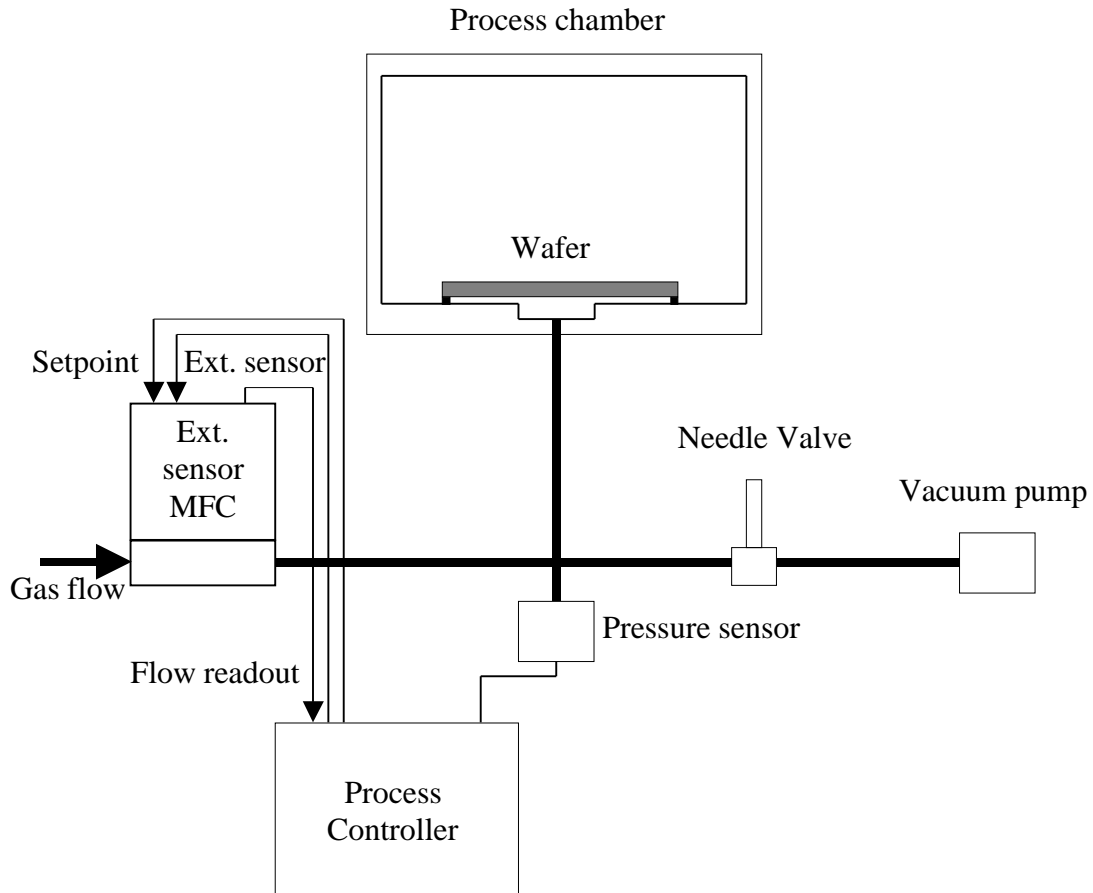


For this application, the customer can choose the external sensor rate according to his process point.  
 For instance; process pressure regulation: **200 mbars**, external sensor range possibility: 0-1000 mbars  $\Leftrightarrow$  **0-5 V**

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3.2. Wafer backside pressure control

This application uses a pressure sensor as an external signal to the MFC to control the wafer backside pressure.

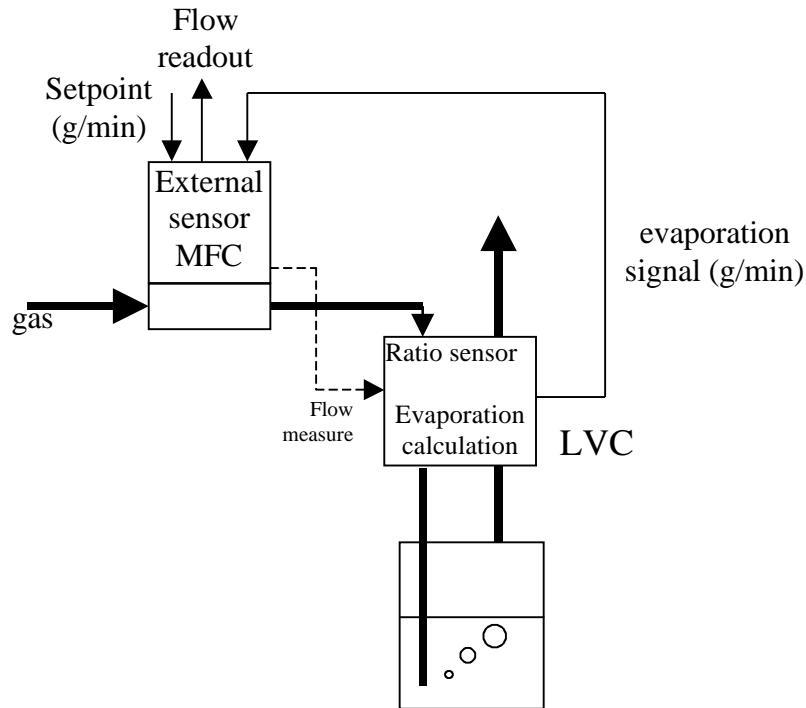


For example, this application can require a pressure regulation going from **3 Torr**s to **25 Torr**s.  
 External sensor range possibility: 0-50 Torr  $\Leftrightarrow$  **0-10 V**

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3.3. Bubbler Control

It s the case of the Qualiflow MCVD gas cabinet application



This is a typical mod low system, which includes an external sensor MFC. There is an evaporation full scale which is defined (if setpoint is 5V, the evaporation should be the full scale value).

The evaporation signal (ext sensor) is typically representing the evaporation value from 0 to ~1.5 times the full scale. It is physically impossible to have a negative evaporation.

The external readout MFC receives a signal which can represent overshoots. It is very important for the external sensor MFC to take in account these overshoots to get a good regulation. Therefore, in our application, we need an external sensor MFC which can read the external sensor value slightly over the setpoint full scale (~1.5 times FS).

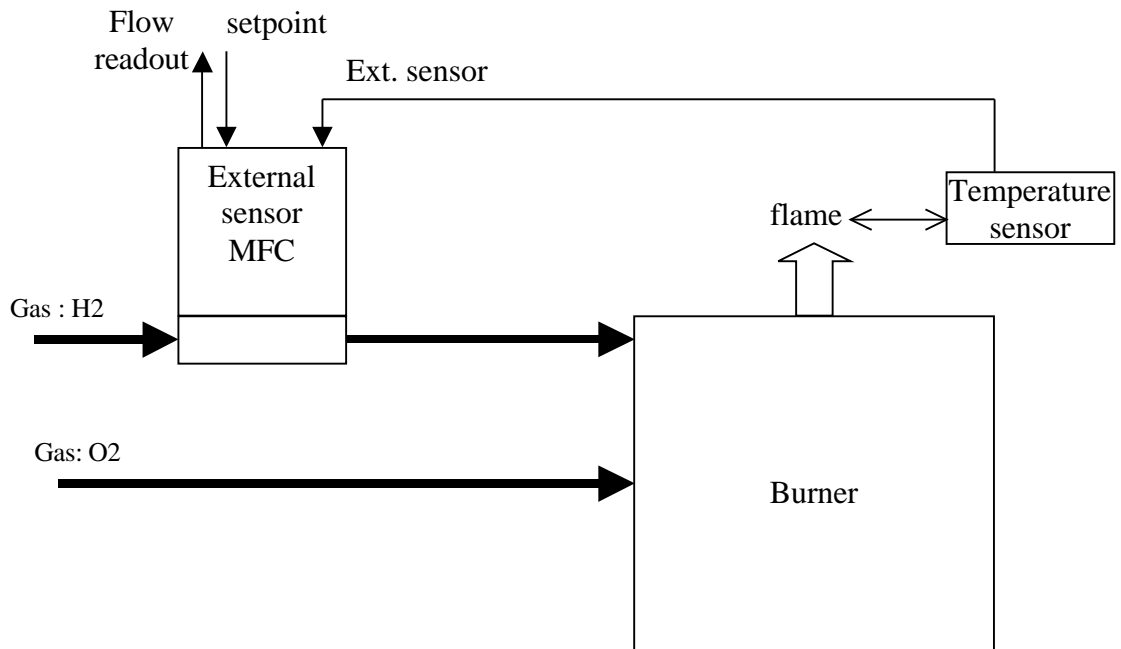
Example:

Evaporation F.S. (Setpoint F.S.): 0-5 V

Evaporation signal (External Readout): 0-7.5 V (1.5 x setpoint F.S.)

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3.4. Temperature Control



In this application, the customer wants to regulate the flame temperature around 1000°C - 1500°C. For example, the temperature sensor range could be 0-2000°C.

Note: This application is used to regulate lathe for optical fibre manufacturing.

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