

# Multi-Chamber PID Pressure Control

## Controlling the pressure of a reaction chamber using off-the-shelf ICs

### Application Challenge

High accuracy pressure control is a common requirement for many physical processes in biochemical, semiconductor and process control industries. OEM machine designers need an off-the-shelf and cost-effective solution for single as well as multiple chambers that provides accurate PID (Proportional, Integral, Derivative) control and flexible pressure control profiles.

### Application Considerations

Feature/Function	Units
Pressure Control Range	800 – 25, 000 millibar
Pressure Control Accuracy	10 millibar
Pressure Control Resolution	2.5 millibar
# of Chambers	3



### Control Solution

Figure 1 below shows the major elements of the proposed solution: a linear pressure sensor that outputs an analog voltage, signal conditioning and A/D circuitry, a Magellan PID controller IC, output signal conditioning and a voltage-controlled flow valve. A host PC or microprocessor communicates to the PID controller IC and provides overall sequencing and control of all three reactions chambers.

We will use a PMD Magellan IC to provide the pressure control profile generation and PID pressure control. This chip is more commonly used to control motors, but will serve just as well to control pressure.

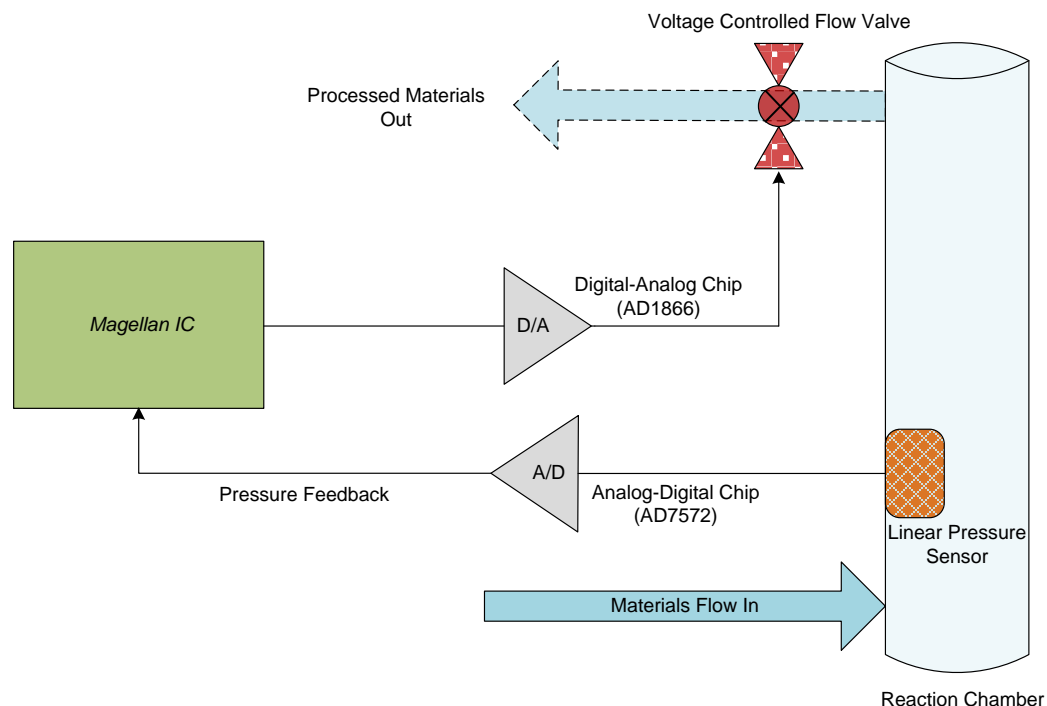


Figure 1

The Magellan receives its parallel-word input by the analog voltage after it is converted to a digital signal. The Magellan's SPI output mode is used to create a command voltage to the valve using an SPI-input drive chip. There are several different types of valve control signals, such as 4-20ma signal and the +/- 10v dc signal, which will dictate the SPI drive chip to be used. This application will use a 4-20ma signal.

Components	Specification	Description
Analog-Digital Chip	AD7572	Input feedback signal A/D converter
Digital-Analog Chip	AD1866 (SPI)	The AD1866 uses SPI input and output voltage signals
Controller	PMD 58000 Magellan IC	Off the shelf Controller IC

Figure 2 shows the block diagram for the pressure profiling and PID controller. The Magellan's flexible architecture can be used to set a desired pressure, create pressure profiles with linear or parabolic ramps and set breakpoint conditions such as 'automatically change to a new target profile after a specified pressure set-point is reached'.

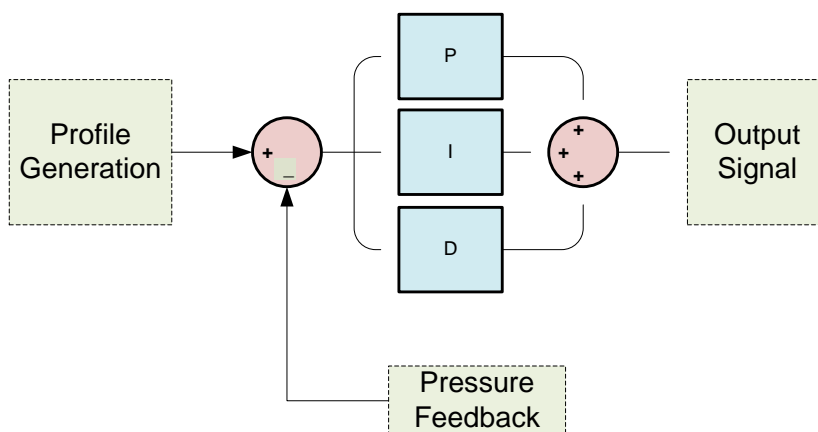


Figure 2

The PID sample/output rate should be set to match the system response. For typical pressure controllers, this means setting the PID loop sample time to between 10 mSec and 1 sec.

### Going Further

The Magellan IC can also be used to control temperature. In fact, it is common to control both pressure and temperature in a single reaction chamber. This would take up two 'axes' of the Magellan control IC. The principle of control is the same; the input sensor provides the current temperature and the output from the PID drives a heater/cooler.

The Magellan® Family of Motion Control ICs provides high performance chip-based motion control for multiple motor types. Magellan motion control ICs are available in 1, 2, 3, and 4-axis versions. They are designed for demanding and precise applications such as this pressure valve application and other automation and instrumentation challenges.



Contact our customer support team at +1 781 674 9860 for more information including details on Developer's Kits and application support. We would like to assist you in improving your motion system.