APPLICATION NOTE A043-FP01

REACTOR SYSTEMS

In Research and Development laboratories of (petro-) chemical companies as well as pharmaceutical companies or life science companies, chemical reactors are used for many different processes.

Bronkhorst has developed a specialised combination of electronic pressure and thermal mass flow controllers for automated pressure control of reactor vessels. This standard solution can be applied for low flow lab reactor systems as well as for high flow industrial applications as for instance in hydrogenation processes in the food and pharma industry or at chemical plants, at either low or (very) high pressure (up to 400 bar).

Compact lab reactor system for low and high pressure reactions, with interchangeable glass and steel pressure vessels (Picture: Büchi AG)

Application requirements

To optimize a chemical reaction, chemists must find the best combination of compounds and insert these in the optimal proportions into the reaction chamber. This reactor may be kept at a certain pressure and temperature and a catalyst may be added to accellerate the reaction.

The input of the reaction gases must be accurately measured at all times, also while pressurizing the reactor. An overshoot in flow (outside the scale of the mass flow meter) should be avoided, because this will introduce inaccuracy.

Important topics

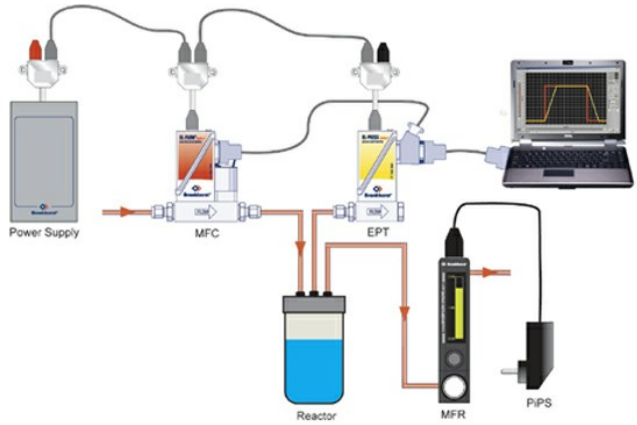
- Accurate measurement of gases reaction and process pressure
- Programmable pressure profile
- Batch control

Process solution

Combined Mass Flow - Pressure Control for safe and automated reactor pressure control.

The proposed set-up may slightly vary per application, since the concept can be applied to both analog or digital systems. Furthermore the instruments used may be in ‘laboratory style’ or with rugged industrial housing, IP65 protected and optionally with ATEX Zone 2 approval. To illustrate the solution, uniquely offered by Bronkhorst, please see the adjacent schematic.

At the inlet of the reactor, a mass flow controller (MFC) takes care of the process gas delivery, whilst an electronic pressure transmitter (EPT) measures the reactor pressure. At the outlet of the system there is a flow restriction which could simply be a (needle) valve or, as shown in the illustration, a mass flow regulator (MFR) with local display. The reactor pressure is controlled by giving a setpoint to the pressure transmitter. In the illustration this is done via RS232 by a script programmed into a PC. The integrated PID-controller of this pressure meter (Master) controls the valve position of the mass flow controller's control valve (Slave). When building up the pressure in the reactor, the maximum inlet flow is restricted by the mass flow controller, thus preventing a flow peak. By using the ‘slave factor’ option, the maximum flow can be adjusted.



A schematic technical diagram showing our product included in the customer’s process

Recommended Products

EL-FLOW SELECT F-201CV

Min. flow 0,16…8 mln/min
Max. flow 0,5…25 ln/min
Pressure rating 64 bar
Compact design
High accuracy and repeatability

EL-PRESS P-502C

Min. pressure 2...100 mbar
Max. pressure 1,28...64 bar
Absolute or gauge pressure
High accuracy

MASS-VIEW® MV-301

Min. flow 10...50 mln/min
Max. flow 10...200 mln/min
Pressure rating 10 bar
Bright, graphical OLED display
High quality needle valve

IN-FLOW F-112AI

Min. flow 0,8…40 ln/min
Max. flow 1,4…250 ln/min
Pressure rating 100 bar
Compact IP65 design
High accuracy

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