

Introduction

Levitronix® provides a closed-loop flow control system for POU (point of use), blending, dosing and spiking applications. The system mainly consists of an Integrated *Bearingless Pump System with an* ultrasonic flowmeter (BPS-iF30, BPS-iF100). The reverse flow control concept allows accurate flow control capabilities with pre-pressure, supplied from facilities or tool internal pressure sources.

Concept overview

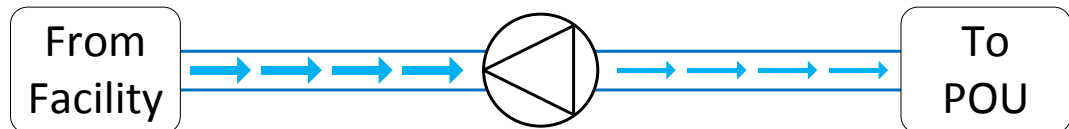


Figure 1: Pump used to reduce pressure

To regulate flow in a situation in which a supply pressure exists in the line, the BPS-iF30 and BPS-iF100 can be used as a pressure reducer. In this reverse flow control mode the pump is installed against the fluid flow and controls the flow by reducing the pressure rather than increasing the pressure like in standard pump applications.

Why Reverse Control?

- **Wide flow range and high turn down ratio:**
Reverse flow control allows high flow rates as well as very small flows. Even a complete no flow condition (0 ml/min) is possible, which results in an infinitely high turndown ratio.
- **No local pressure minimum:**
Since the pressure doesn't have to be lowered below the pressure needed for the application, there is no local pressure minimum. This prevents outgassing and ensures a steady flow.
- **High resolution at small flow rates:**
A high flow resolution can be achieved over the whole flow range. Even at small flows the resolution remains precise.

Other Advantages

- High accuracy and resolution of flow control
- High dynamic
- Robust against pressure fluctuations
- No particle generation and wear-out
- No change of actuator-characteristic over time
- High-End Ultrasonic Flowmeter without drift
- Linear flow vs. pump speed characteristic over wide range
- Possibility to combine volume dosing and flow control
- Small foot print

System Overview

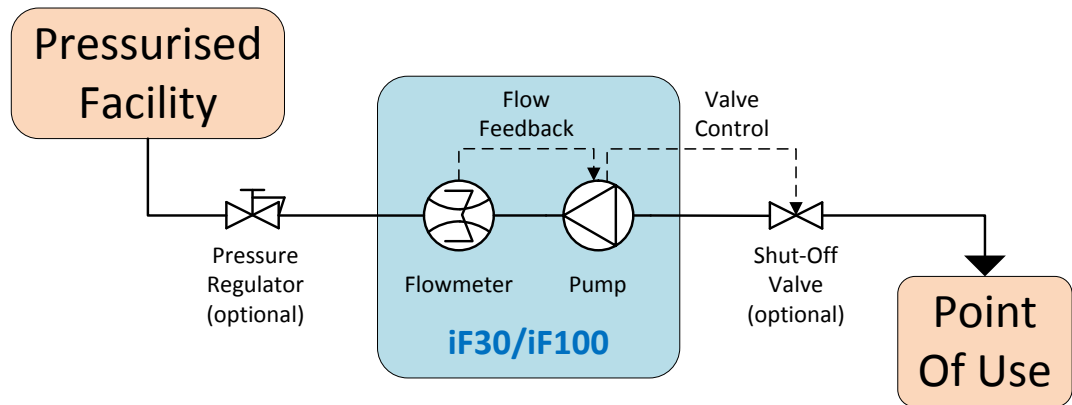


Figure 2: Detailed Concept of the Flow Controlled Loop

A reverse flow control System for pressurized applications consists of a *Levitronix*[®] BPS-iF30/iF100 unit, a pressure regulator and a shut-off valve. The shut-off valve and the pressure regulator are optional components and can be omitted if the specific application allows it.

Electrical Interfacing

The *Levitronix*[®] reverse flow control System can be operated by a single analog signal. All available signals are described in the following tables.

Required Signals		
Type	Levels	Description
Analog Input	4..20 mA OR 0..10 V = 0..100%	Reference Value (configurable)

Table 1: Signals which must be provided by the customer

Optional Signals		
Type	Levels	Description
2 Digital Inputs	5-24 V → active 0 V → not active	There are two digital inputs available to the customer. These inputs can be configured to serve different functions. These functions include: enabling/resetting of the pump and performing a zero adjustment.
2 Digital Outputs	closed/open circuit	One digital output is used to automatically control the shut-off valve. The other digital output is available to the customer. This signal can be configured to display one of a variety of available errors or warnings. If no shut-off valve is used both digital outputs are available.
Analog Output	0..10 V = 0..100%	Actual flow value (configurable)

Table 2: Overview of available signals

Modbus communication can be used as an alternative control method.

Mechanical & Hydraulic Interfacing

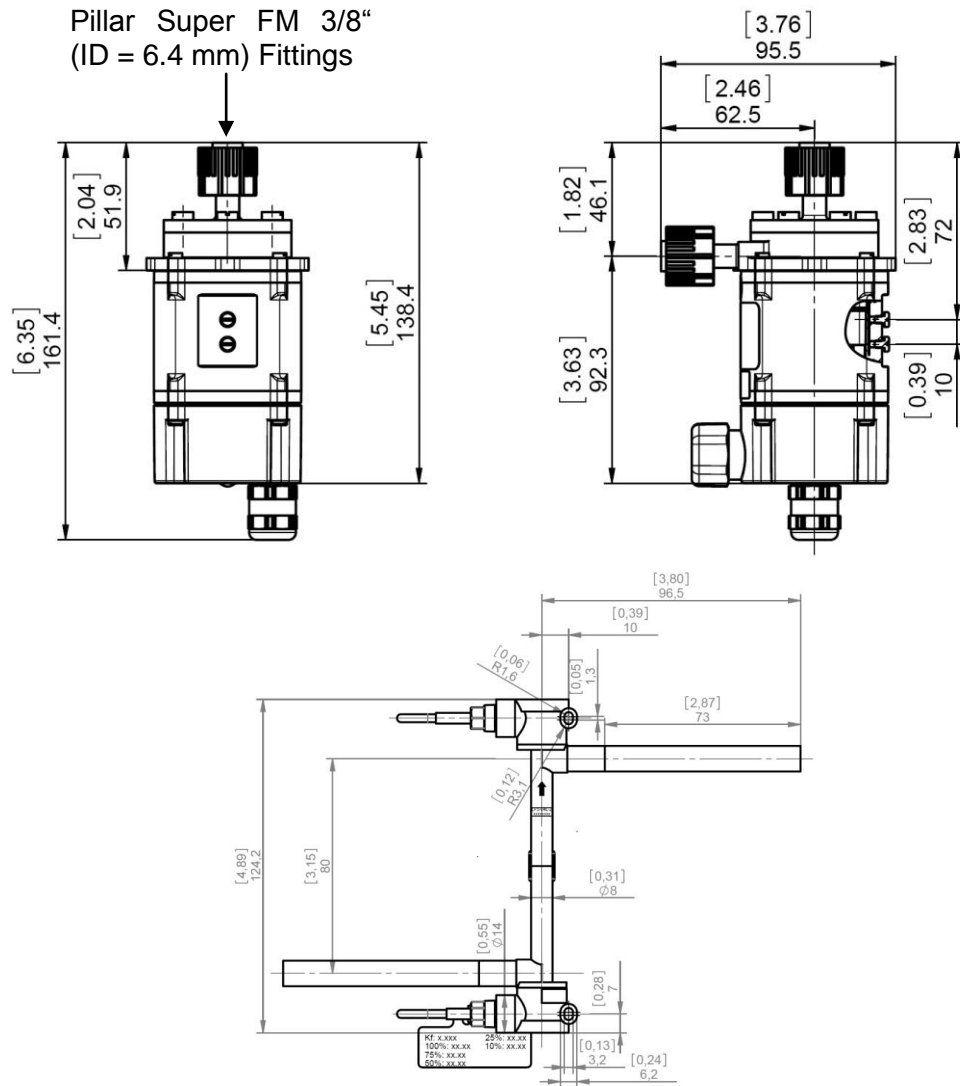


Figure 3: Flowmeter and pump dimensions

Automatic flow controller optimization

The *Levitronix*[®] BPS-iF30 and BPS-iF100 Systems are able to automatically adapt to a user's hydraulic system and to optimize controlling parameters to achieve a quick system response and small rise times.

Flow Alarm and Trend Warning

The system provides an actual flow signal and a Flow Alarm, whenever the actual and set point flow doesn't correspond with each other. Therefore low flow conditions are detected when caused by, for example, line clogging. In addition, a Trend Warning is provided, which enables failure prediction and scheduling of preventive maintenance.

Turn-key Solution

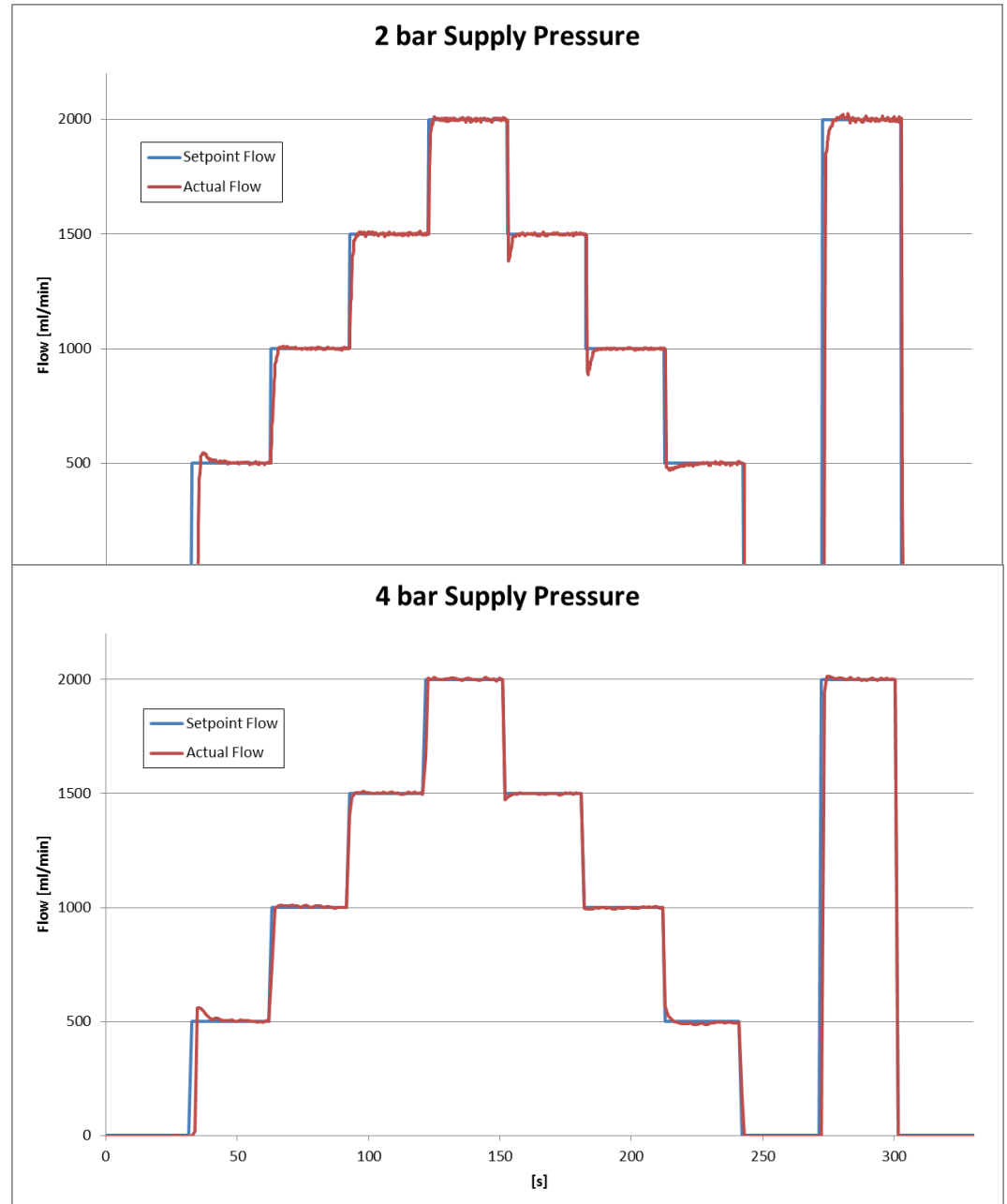
Turn-key solution for replacing valve based flow controllers or peristaltic pumps

The *Levitronix*[®] reverse flow control system can be operated by a single analog signal to turn on/off the pump system and set the requested set point flow rate. This allows for replacements of old style valve based flow controllers or peristaltic pumps without any electrical or software changes on the tool side.

Performance

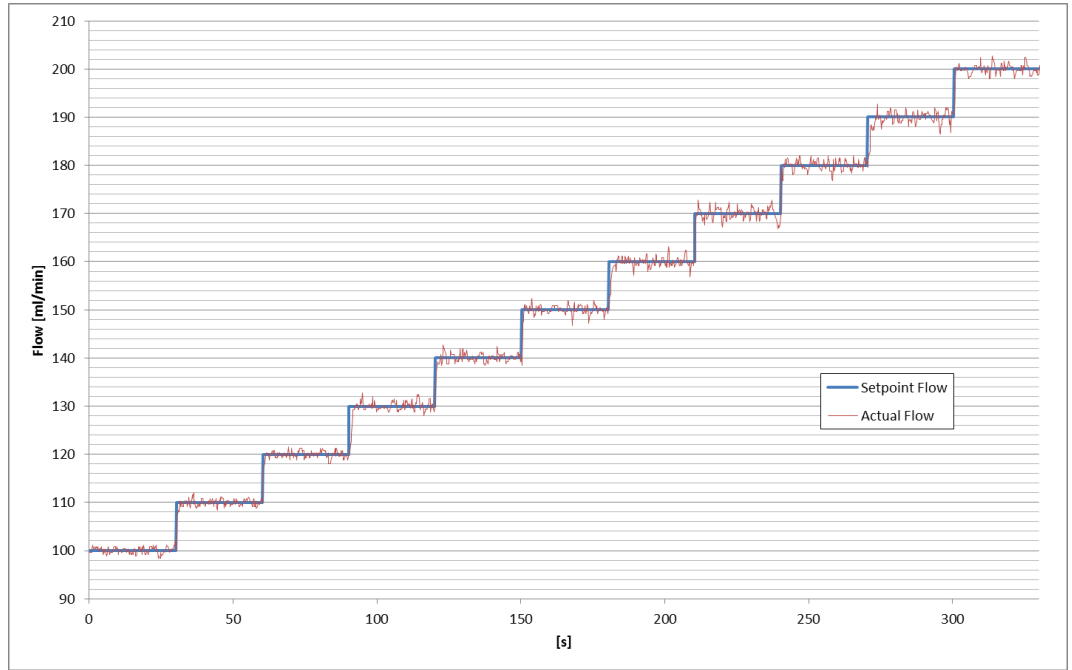
Wide Flow Range

The *Levitronix*[®] reverse flow control System can achieve flow rates of 0 to 2000 ml/min at supply pressures of 1.5 to 4 bar.



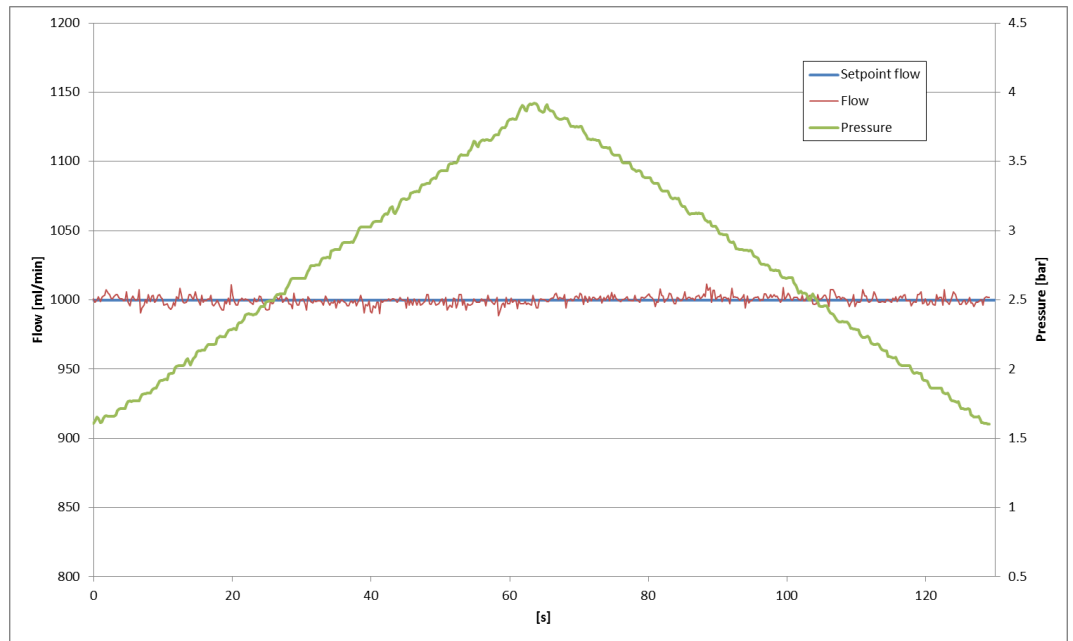
High Flow Resolution

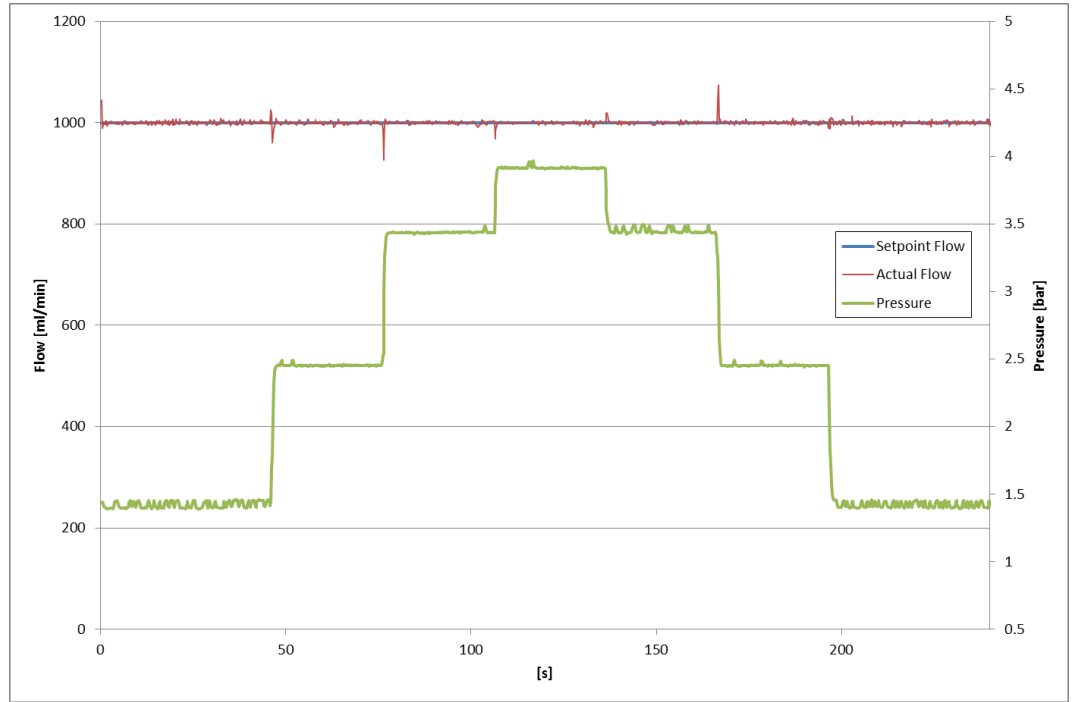
Precise and dynamic flow control over the entire available flow range.



Robust against pressure changes

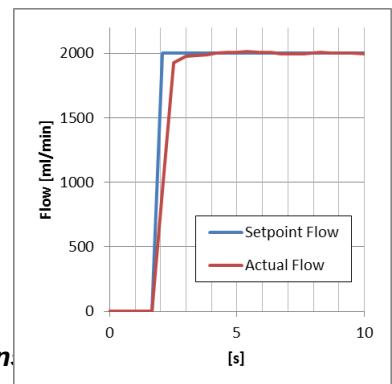
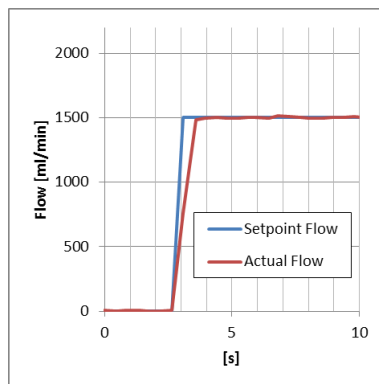
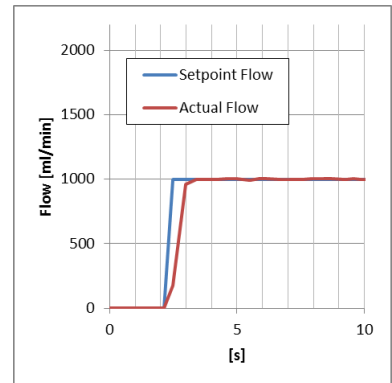
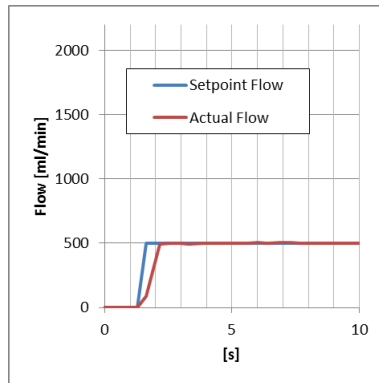
Flow rates remain stable at changing supply pressure and recovers quickly after a sudden decrease or increase in pressure.





Short Rise Times

Using the automatic flow controller, optimizing small rise times (10% to 90% < 1 second) can be achieved.



Step response

**Technical
Support**

For troubleshooting, support and detailed technical information contact *Levitronix®*
Technical Service Department.

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