## Introduction

For manufacturing of integrated circuits (IC) a wide range of chemistries are used. These chemistries are typically distributed by a distribution system centrally located in the gray room area of the FAB or in the Sub-Fab.

Tighter controls on the processes due to the higher levels of integration and increased productivity now require a greater control on the transfer of liquids from the distribution systems in the sub-fab (or gray area) to the processing tools in the clean room.

Fluctuating pressure from the facility supply may lead to unstable, non repeatable flow rates at the point of use (POU). As a consequence, processes can be non repeatable and medium consumption can be increased from needle valves being opened wider than required, along with other changing factors like temperature, viscosity and filter loading (requires manual retuning of valves to get the desired process results) etc.

Levitronix have developed a delivery system concept that eliminates this unsatisfactory situation. The following pictures detail the setup, with field data provided from two different central delivery systems to support the effectiveness of the concept.

## Redundant Pump Systems

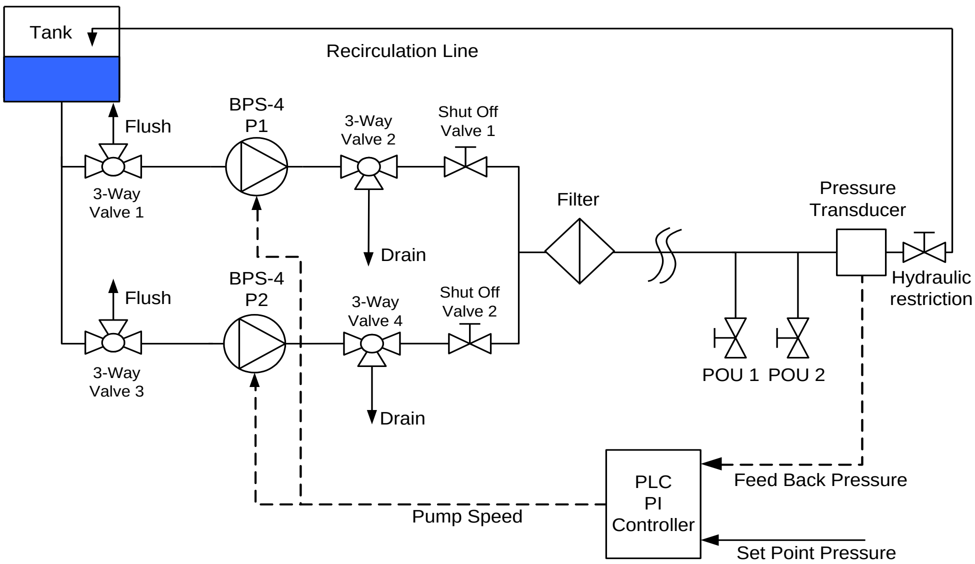


*Figure 1: Schematic of delivery system with redundant Levitronix pump systems*

## Advantages

- **Constant Pressure, independent of medium consumption or changes in viscosity, density and temperature of chemicals used**
- **Redundant pumps to prevent tool downtime and process failure**
- **Observation and reporting of filter loading or other pressure-decreasing factors**
- **Automatic adjustment of pump speed to maintain defined pressure**
- **Minimized medium consumption on processing tools based on precise controlled and stable facility pressure**

The hydrochloric acid (HCL) application has the following process parameters:

## Field Data with HCL

| | |
|---|---|
| Viscosity: | 1.9 cP at 25 °C |
| Density: | 1.18g/cm$^3$ |
| (POU) Pressure: | 2.1bar |
| Pressure fluctuation: | 0.08bar |
| Peak Consumption: | 1200ml/min |

***Behavior of System at Pump Switching***

*Figure 2* shows a constant POU pressure. The pressure is independent of the fluid medium consumption (flow rate), induced by changing chemistry demands at the POU. The controlled pressure in the system is consistently maintaining a pressure at 2.1bar. Even when there is a pump switch (“P1” to “P2”) the pressure remains stable. In addition,

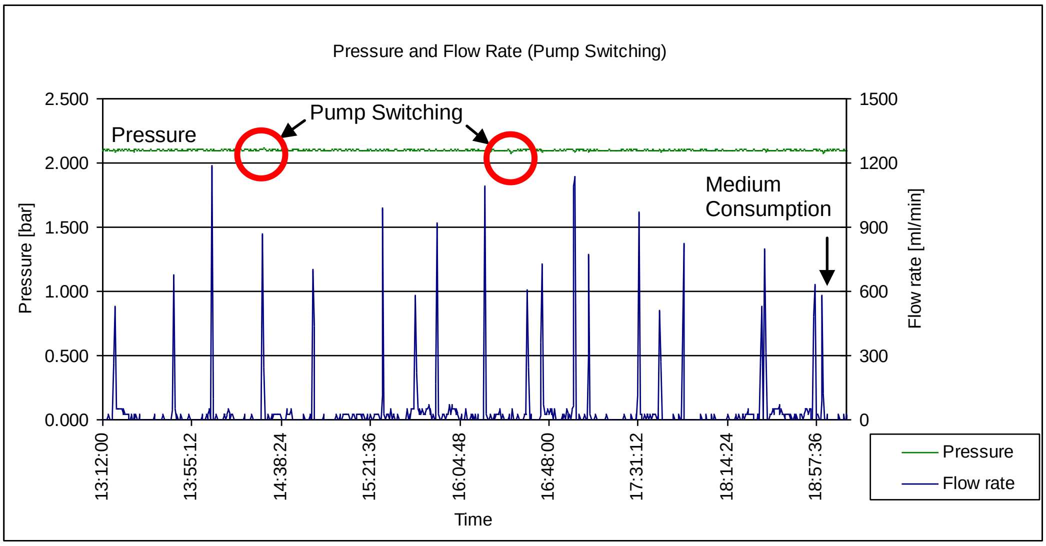


***Figure 2: Pressure and Flow at different flow demands and during pump switch***

*Figure 3* shows the pump speed during a switch from pump “P1” to pump “P2” and then back to pump “P1”.

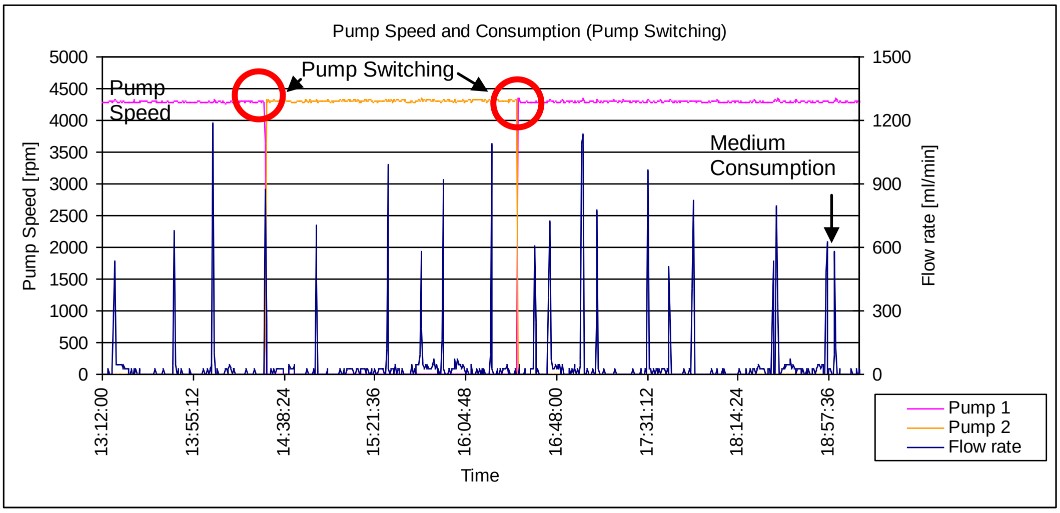


***Figure 3: Pump speed at different flow demand situations during pump switch***

### *Behavior of System at High Consumption Peaks*

*Figure 4* shows several active process tools demanding fluid. The fluid medium consumption is increased to 2400ml/min and the controlled pressure remains stable at 2.1bar.

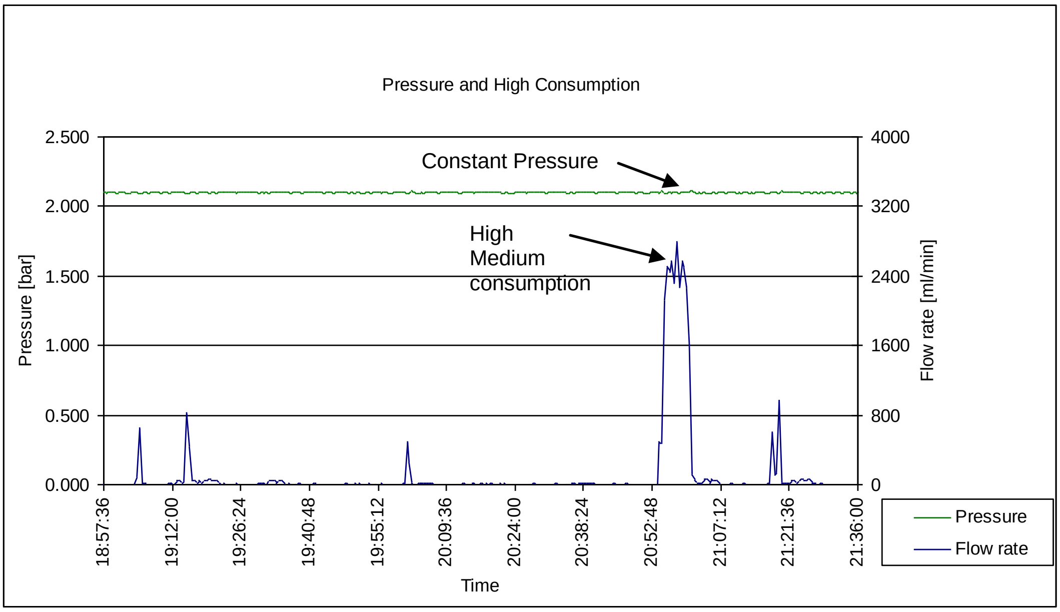


***Figure 4: Pressure and Flow at increased medium consumption at POU***

*Figure 5* shows an adjustment to the pump speed during the changing flow demand which results in a pump speed increase from 4290 rpm to 4375 rpm.

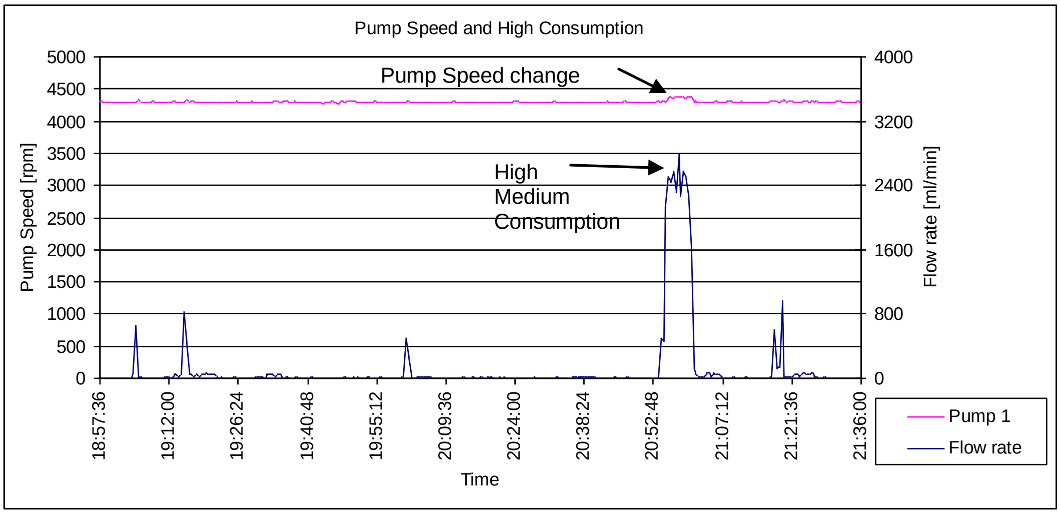


***Figure 5: Pump speed and pressure at increased medium consumption at POU***

The phosphoric acid (H3PO4) application has the following process parameters

## Field Data with H3PO4

| | |
|---|---|
| Viscosity: | 3.86cP |
| Density: | 1,685 g/cm$^3$ (85%) |
| Pressure: | 2bar |
| Pressure fluctuation: | 0.09bar |
| Peak Consumption: | 2800ml/min |

***Behavior of System at Pump Switching***

*Figure 6* shows a constant POU pressure. The pressure is independent of the fluid medium consumption (flow rate), induced by changing chemistry demands at the POU. The controlled pressure in the system is consistently maintaining a pressure at 2bar. Even when there is a pump switch (“P1” to “P2”) the pressure remains stable.

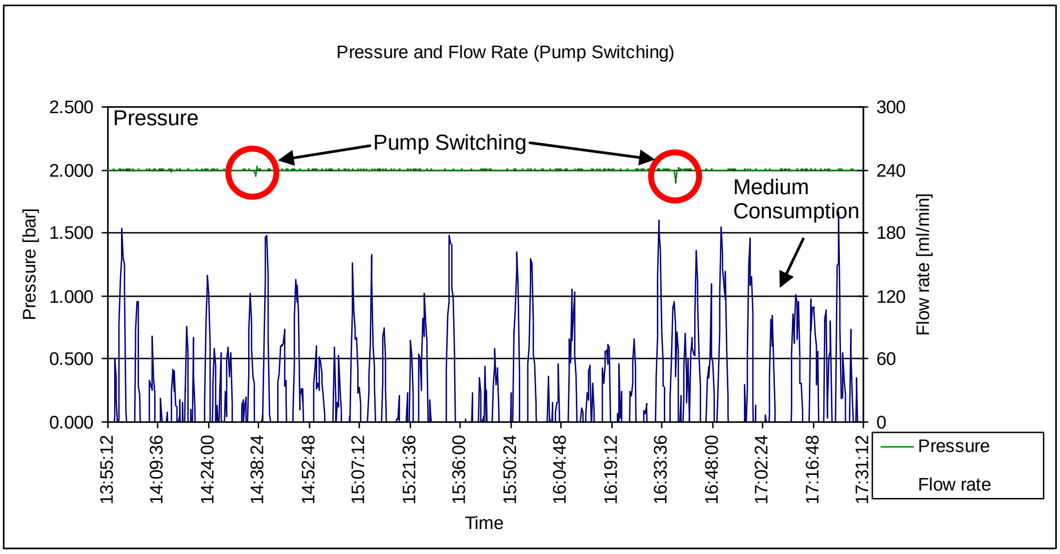


***Figure 6: Pressure and Flow at different flow demands and during pump switch***

*Figure 7* shows the pump speed during a switch from pump “P1” to pump “P2” and then back to pump “P1”.

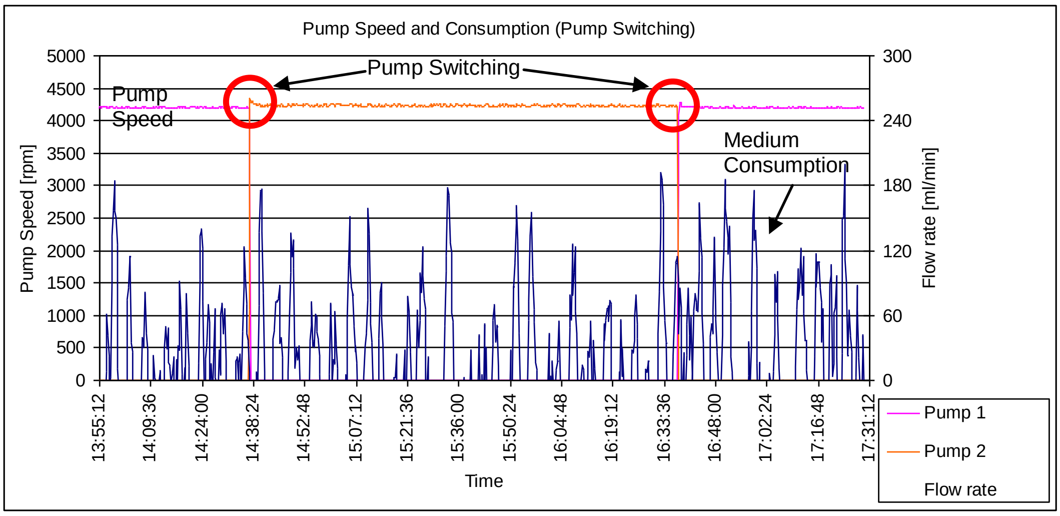


***Figure 7: Pump speed at different flow demand situations during pump switch***

***Behavior of System at High Fluid Consumption Peaks***

*Figure 8* shows several active process tools demanding fluid. The fluid medium consumption is increased to 2800ml/min The controlled pressure stays stable at 2bar.

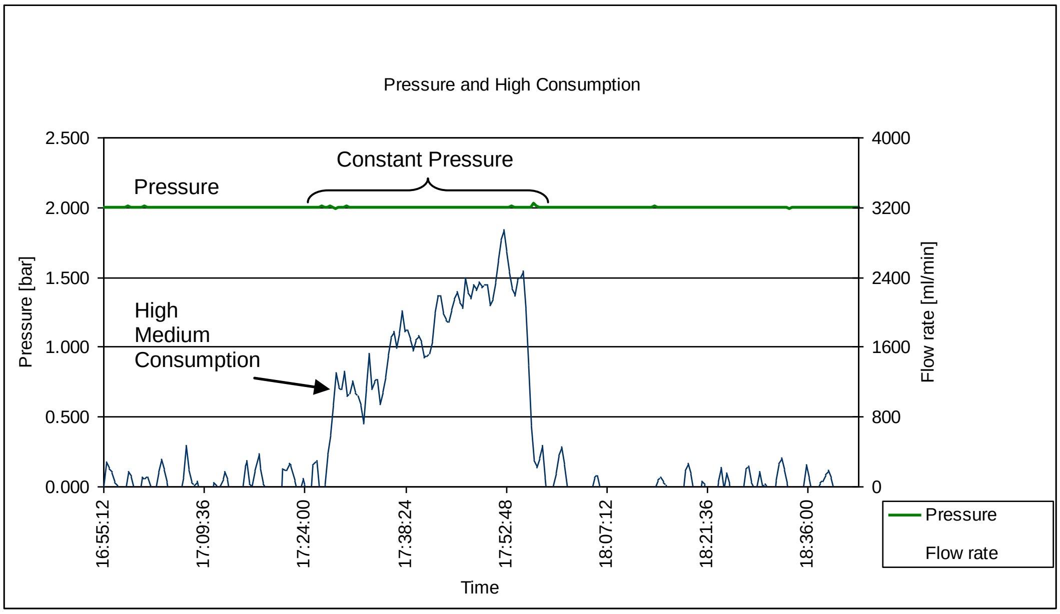


***Figure 8: Pressure and Flow at increased medium consumption at POU***

*Figure 9* shows an adjustment to the pump speed during the changing flow demand which results in a pump speed increase from 4210 rpm to 4350 rpm.

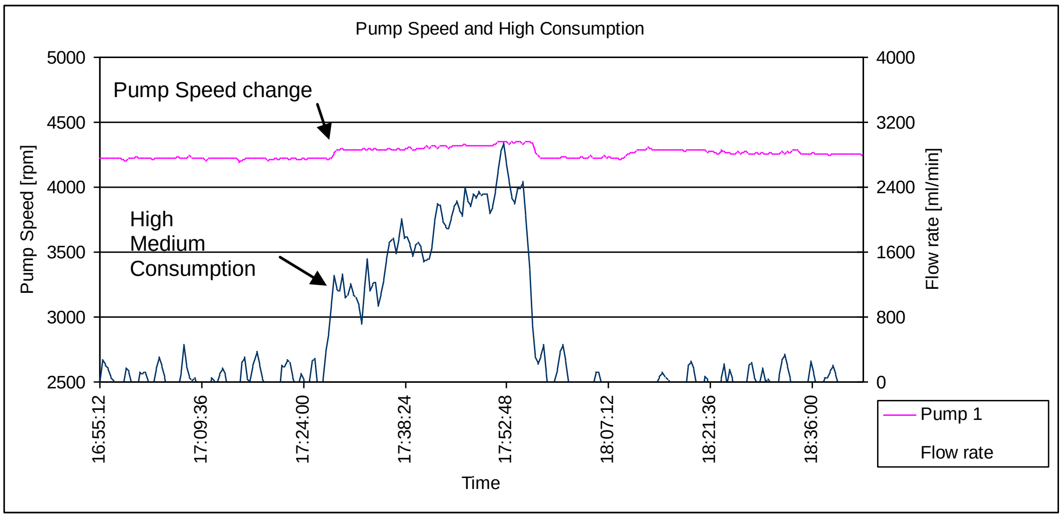


***Figure 9: Pump speed and pressure at increased medium consumption at POU***

## Technical Support

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

**Levitronix Technical Service Department**
**Technoparkstr. 1**
**CH-8005 Zurich**
**Switzerland**
**Phone: +41-44-445 19 13**
**E-Mail: TechSupport@levitronix.com**