

# Liquid Dosing Systems

Using flow meter controlled pumps

## > Introduction

Bronkhorst High-Tech B.V. manufactures the largest variety of thermal Mass Flow Meters and Controllers for gases and liquids. The L10/L20/L30 Series Mass Flow Meters of the LIQUI-FLOW® Series are compact, modular instruments for capacities from 0,1...5 g/h up to 0,4...20 kg/h. The CORI-FLOW® product range offers a range from 200 g/h up to 600 kg/h. Both LIQUI-FLOW® and CORI-FLOW® instruments can be combined with integrated or separate control valves. This leaflet describes an alternative way of liquid flow control, i.e. by using a close-coupled pump.

## > Control valve or controlled pump ?

The concept of using a straight forward Mass Flow Controller is simple and economical. It requires a certain head pressure, which can be achieved by pressurising a vessel filled with liquid, for instance by using an inert gas blanket. In some applications this method is not possible or not recommended. The alternative of using a pump for fluid transfer seems logical, but was not always advisable because of the pulsating flow pattern of most low-flow pumps.

## > Liquid Dosing Systems

Bronkhorst offers Liquid Dosing Systems to cover their liquid flow range of 20 mg/h up to 600 kg/h. Each Liquid Dosing System consists of a flow sensor of the LIQUI-FLOW® or CORI-FLOW® series with controlling function, a gear pump, a filter, a check valve and all interconnecting material. Furthermore, Bronkhorst will take care of electrical and mechanical connection, testing and optimization including the PID-integrated controller. In addition to the Bronkhorst LIQUI-FLOW® Pump for small flow ranges, a complete series of pumps is available for those applications which require higher flow rates, higher pressures, wide control ranges or aggressive fluids. Further to operation in analog mode, the system can also be used digitally with RS232 or with an on-board interface to Profibus-DP®, DeviceNet™, Modbus-RTU or FLOW-BUS.



## > Low Flow Liquid Pump

The new Bronkhorst LIQUI-FLOW® Pump unit has a rotary positive-displacement pump, which is virtually pulsation-free. It can easily be applied for low-viscosity fluids in a control loop with a LIQUI-FLOW® Mass Flow Meter, using the standard controller function on its pc-board. Currently the LIQUI-FLOW® pumps can be offered in the ranges of 10...500 g/h, 20...1000 g/h and 80...4000 g/h.

## > Features

- ◆ Simple and compact assembly; easy to use
- ◆ No need to pressurise liquid source
- ◆ Pump controlled by mass flow instrument with adjustable PID-controller via voltage output signal
- ◆ Direct mass flow measurement/control (not volumetric)
- ◆ High accuracy and stability (nearly pulse free)
- ◆ Desired flow to be set via: analog 0...5(10) V / 0(4)...20 mA or digital communication by RS232 or fieldbus

## > Applications

Liquid Dosing Systems offer precise, automated mass flow control of reactants, additives or catalysts in:

- ◆ Analytical laboratories and systems
- ◆ Chemical industry
- ◆ Petrochemical and Offshore industry
- ◆ Food and Pharmaceutical industry
- ◆ Energy (fuel cells)

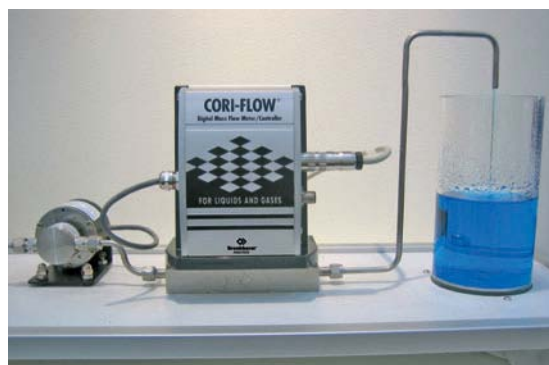


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## Application example:

### > CORI-FLOW® used as a batch counter

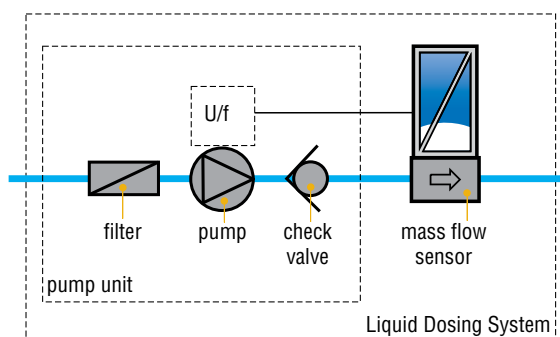
The CORI-FLOW® instrument measures the flow rate and the integrated PID-controller drives the pump using its analog actuator output signal. The pump with integrated U/f converter translates the PID-controller output voltages into more or less rpm's to reach the desired flow rate. This flow rate setpoint can be provided using the CORI-FLOW's analog input or via digital communication interfaces (RS232 or fieldbus). The desired batch can be programmed into the integrated counter limit value. After each batch, the CORI-FLOW® can be reset using the button on the instrument or via the digital interface. Each time when the counter limit (batch) has been reached, the CORI-FLOW® will automatically stop the pump until the next reset. These integrated digital features, available in all Bronkhorst digital instruments, enable the user to define a highly accurate, fast, repeatable and compact dosing system. Using the special ratio control modes, complete master/slave systems with other flow instruments can easily be supplied.



### > Liquid Dosing System components

Bronkhorst Liquid Dosing Systems will be delivered as complete working and tested set of components. This set will contain (from inlet to outlet):

- ◆ Liquid filter with the correct mesh type and size for the required flow rate and pump type to protect the gear pump against damage due to particles in the flow;
- ◆ Gear pump with integrated (or separate) U/f converter and all connection material;
- ◆ Check valve to avoid backflow when the pump has stopped and to enable fast start-up from zero;
- ◆ LIQUI-FLOW® or CORI-FLOW® mass flow sensor with integrated PID-controller and (batch)counter.



### > Safety

To guarantee safe use and long durability of the pumps in the liquid dosing systems, the LIQUI-FLOW® or CORI-FLOW® mass flow instrument will have its "response alarm" enabled. This is an alarm condition related to the actual flow versus set-point which will stop the pump when the flow is not within a preset band around the set-point within a certain time. This might be the case when the vessel containing the fluid is emptied; the response alarm will therefore protect the pump against damage due to running dry.

Another possible safety-issue is over-pressure created by the pump due to blocking of the downstream flow. This could be solved by using a relief valve with the return flow routed to the vessel, however, the response alarm will also take care of this. As the downstream flow becomes blocked, the response alarm will occur after the preset time, the pump will be stopped and the user will be signalled via LED's and the digital communication (RS232 or fieldbus). After a reset (using button or via interface) the dosing system will continue to control at its last known setpoint. Additionally, some pump series also benefit from drives with over-voltage protection and will shut-off automatically when the downstream flow has been blocked.

Bronkhorst Liquid Dosing Systems are equipped with either FKM (Viton) or FFKM (Kalrez) seals. In most cases SS316 is used as pump and instrument material. As options, several other materials for instruments, pumps and seals are available. Your local distributor can advise you on the many materials that are available.

