

nanodac™ Recorder/Controller

MODEL

Purpose of this note

This application note describes how the nanodac recorder/controller can be used to control the dosing level of a liquid or gas using the Feedforward feature of the PID algorithm to achieve an output proportional to the flow rate of the fluid.

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Additive Dosing Control using the nanodac Recorder/Controller Application Note

Product

The nanodac recorder/controller provides combined recording and control in a single ¼ DIN package.

It is ideal for use on any application requiring up to four real universal inputs. An additional fourteen inputs can also be written to over communications effectively making an eighteen channel data logger. It also contains two PID control loops which can be configured to control process variables such as flow, level, pressure, temperature, etc.,. In addition to the features listed above, the nanodac recorder provides powerful logging and secure archiving of the data. It can store information in either open CSV format or in a secure (UHH), check summed format to protect data integrity.

In addition to live trending, a simple menu allows any selected portion of the recorder history to be archived, either to a 'memory stick' plugged into the USB port at the rear of the recorder (Local Archiving) or to a computer or server, by means of the FTP protocol (Remote Archiving). The archived data remains in the flash (50MB) memory of the instrument and can be reviewed directly on the instrument display.

The archive period can be chosen between the last hour, last day, last week, last month, archive everything in the recorders history or archive all files created since or updated since the last archive.

The status of the archive is displayed on the nanodac recorder/controller which shows when data is being transferred or is complete.

The archive data includes actual values from real or communications channels (PV), Alarm Messages, and Operator Input Messages all of which are accurately dated and time stamped from the on-board real time clock.

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Additive Dosing Control

Introduction

Dosing or residual control, as it is also known, is the name given to the technique for controlling the addition of a substance to a flowing liquid or gas. Typically a dosing system is designed so that the required dosing level can be achieved by maintaining the control signal as a proportion of the fluid flow rate. The dosing (or residual) level is used by the control algorithm to trim the output signal by the

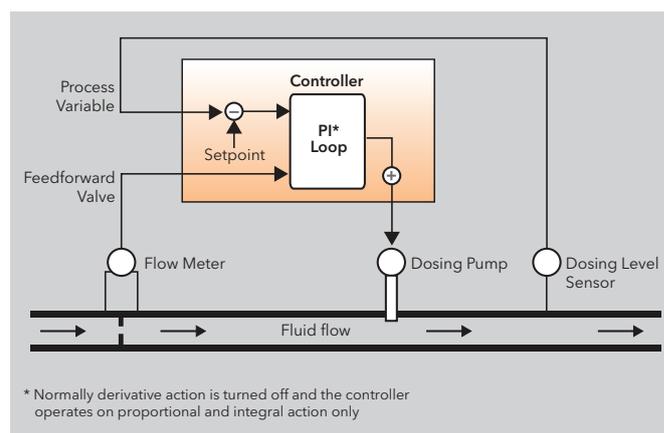
required amount. Any industry that mixes substances into flowing fluids potentially has the requirement for this type of control. These include the water, brewing, distilling, china clay, concrete, paper and soft drinks industries or any process requiring disinfection in cooling towers, food and beverage, drinking water, wastewater and swimming pools.

Application Example

The figure opposite shows the general arrangement of the dosing control system which in this example uses chlorine as the dosing additive. The main fluid flow is measured upstream from the dosing pump and the chlorine level is measured downstream. The feedforward feature in the control loop is used to achieve an output proportional to the fluid flow rate. This means that the dosing rate immediately tracks any changes in the flow rate and so avoids over or under dosing.

The dosing concentration, measured downstream, can be used to provide closed loop PID control to trim the feed forward output. As the flow rate varies so will the transport delay of the control loop. To compensate for this, the integral time of the controller should be increased as the fluid flow rate reduces. This is achieved by using the Gain Scheduling feature of the nanodac recorder/controller. Three sets of control parameters are available, the active set selected according to the flow rate.

In some cases the dosing level to be controlled is well downstream from the dosing pump, maybe by as much as 30 minutes at normal flow rates. In these cases, providing the dosing level can also be measured much closer to the pump, then the second loop in the nanodac recorder/controller can be used in cascade. The master loop controls the dosing level at the point further downstream. Process feedforward can still be used to compensate for flow rate changes.



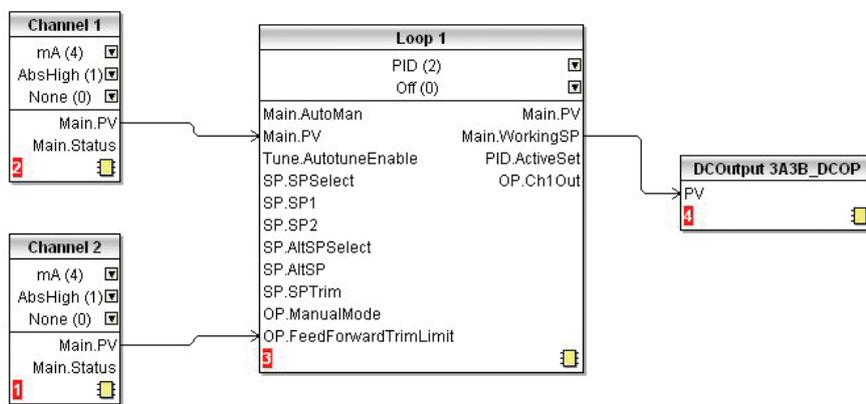
Dosing Control Example

Internal 'Soft' Wiring

In this example, dosing level is measured using channel 1 configured for 4-20mA input. This is connected to the main PV input of the control loop.

The flow rate is measured upstream using channel 2 configured for 4-20mA input. This is connected to the Feedforward input of the control loop.

The Control output is connected via Output Module 3. This is assumed to be 4-20mA in this example but other outputs (such as on/off) may be used to match the type of pump in use.

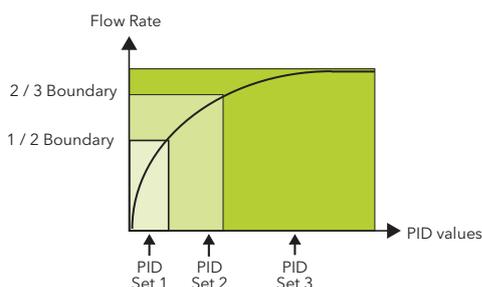


Graphical View of 'Soft' Wiring using iTools

To Apply Gain Scheduling (if required)

Gain scheduling allows a number of PID values to be stored and provides automatic transfer of control between one set of PID values and another. In the example below the number of sets is three which means that two boundaries are provided to select when the next PID set is used. When a boundary is exceeded the next PID set is selected bumplessly. Hysteresis is used to stop scheduling oscillation at the boundaries.

Gain scheduling is basically a look up table which can be selected using different strategies or types.



Gain Scheduling over a wide range of flow rates

In the Loop 1 PID list set 'Scheduler Type' = PV (The transfer between one set and the next depends on the value of the PV)

Set 'Number of Sets' up to 3 in the nanodac recorder/controller.

Set the control parameter values (particularly 'Integral Time') to compensate for the delay in the system

Set the 'Boundary' parameters to switch in the different control parameter values at defined flow rates

Further information may be downloaded
from www.eurotherm.co.uk

nanodac Recorder/Controller

User Guide HA030554
Brochure HA030685
Specification sheet HA030686

iTools Configuration & Monitoring Software

Help Manual HA028838

Eurotherm Review PC Based Software Package

Brochure HA028081

Dream Report Software

Brochure HA029515
User Friendly Reporting Software

Data Security with Store & Forward

Brochure HA029878

Environmental Quality Monitoring System

Brochure HA030142

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