

Technical Note 02

Analyser to Pump -

How Controllers can Interact with and Control Pumps

INTRODUCTION

Pumps are almost ubiquitous in water processes; whether the pump is the main driver for water flow, is dosing chemicals, or is moving water around a sample line, there is (nearly) always a pump somewhere in the process. Often there are multiple pumps of varying sizes and specifications, making managing all of them a challenge for any operator.

In pools and spas, controllers will generally interact with pumps for 2 main reasons:

1. **Controlling chemical dosing** - controlling a pump to dose a chemical into a system based on one or more measurements (e.g. chlorine residual and flow rate).
2. **Recirculation control** - controlling a pump to manage the water recirculation. The cost of running a recirculation pump can be high - see technical note 03.

This technical note provides a summary of some of the different kind of signals that can be used to interact with pumps, some of the common applications they are used in, and their advantages and disadvantages.

POWER SWITCHING RELAY BASED CONTROL

Description: Power On/Off provides power to pumps when the analyser needs the pump to be on, this can be 13-230V. Pumps are off and have no power when they are not pumping.

Advantages: Cheapest and most universal method of control.

Disadvantages: High pump and relay wear.

Commonly used for: Small cheap dosing pumps.

VOLT FREE CONTACT (VFC) CONTROL

Description: The pump is powered separately to the analyser, and only begins to pump when a low voltage circuit is closed. VFC can be used with thresholds or with PID and can be used as on/off control or pulse width/frequency.

This means that the analyser can mimic a flow meter's 'Pulse Control'.

Advantages: Very commonly accepted by pumps and protects both the relay and the pump from high voltage surges.

Disadvantages: Not as precise as analogue control, especially for non-recirculating systems.

Commonly used for: Better quality small to medium dosing pumps.

ANALOGUE CONTROL

Description: Either a 4-20mA or a 0-10V output is scaled to match the pump output and is then used to control the pump rate.

Advantages: Very precise control. The pump is on all the time eliminating power surges and start-up fatigue.

Disadvantages: Can only be used on pumps that accept analogue outputs.

Commonly used for : Larger pools and spas



SMART AND DIGITAL CONTROL

Description: Some pumps can now be controlled using digital communications such as Modbus or Profibus. These are designed to be used directly from PLCs and they give operators distinct advantages over more traditional methods. A digital signal has longer range, has a signal cable for 2-way communication, and is able to transmit far more detailed information than a simple on/off alarm or analogue signal.

An example of a pump with SMART and DIGITAL communication is the Grundfos DDA dosing pump with e-box add-on. The e-box provides a Modbus or Profibus connection for 2-way communication.

The AutoPool® 4.0 pool controller from Pi is the only pool controller capable of utilizing the full range of information available from the DDA pump. Information such as: total pump run time, pump pressures, volume pumped, and many more are now available to the analyser.

Error alerts can now be specific, telling operators exactly what needs to be done with their pump. This wealth of information can be useful in coordinating maintenance and increasing uptime for the pump and the system as a whole. All of this information can be stored, and data-logged, making the system very auditable.

Normally all of this information would only be available to operators with access to a PLC, and a PLC engineer able to integrate the two systems, but the AutoPool® 4.0 is a customizable controller that doesn't need a PLC engineer to configure.

Control with the DDA e-box can also be extremely precise, with the pump more able to correct the pump output to very closely match the scale used by the analyser. A pump being controlled by a 4-20mA scale, asking for 60% of the pump's output, was more than a litre off the real value of 60% of the pump's scale. This means that on a 0-30l/h pump, a pump controlled by a 4-20mA signal calling for 60% of the pump's output would actually be pumping 19l/h, whereas a Modbus controlled pump would be pumping 18l/h. This difference is small but measurable, and over a pump's lifetime would add up to a remarkable discrepancy in chemical. It's likely that with longer cable lengths, on a real site, this discrepancy would increase.

Advantages: The most precise control, excellent maintenance information, more uptime for processes.

Disadvantages: Currently only available with Grundfos DDA pumps and Pi analysers.

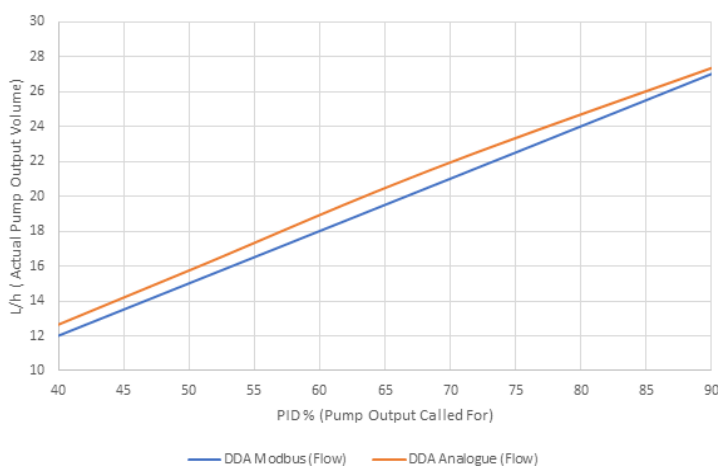
Commonly used for: Large, prestigious pools.

CONCLUSIONS

There are many ways for analysers to interact with pumps, and no single way is a 'one size fits all' solution. Whether you are retrofitting to an existing system, or designing a new plant with the latest in SMART and DIGITAL communications, Pi's pool controllers will be able to communicate with your pump of choice.



Graph to show discrepancy between Modbus and Analogue control on a DDA pump



Graph to show discrepancy between analogue control and Modbus control on a DDA pump - the difference is very small but is measurable. This was measured on a real DDA pump in-house by Pi engineers.