



Alfa Laval Octopus Plus

Autopilot for decanter centrifuges in sludge dewatering

Ground-breaking new technology

Alfa Laval Octopus Plus is a ground-breaking intelligent “autopilot” system for use in sludge dewatering with Alfa Laval decanter centrifuges. Alfa Laval Octopus Plus has one sole objective: to make the sludge dewatering process at wastewater treatment plants run at its absolute best - right round the clock.

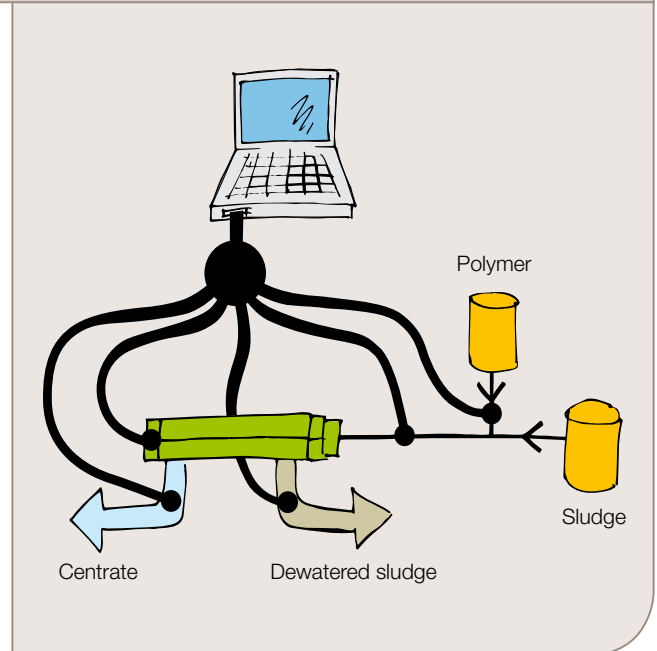
The Alfa Laval Octopus Plus system is based on advanced software that monitors and controls the sludge feed rate, polymer dosing and internal settings used in the decanter. It uses state-of-the-art infrared sensors to continuously analyze process performance, and then automatically makes the adjustments necessary to keep the dewatering process running at peak performance, 24 hours per day.

What makes Alfa Laval Octopus Plus such a breakthrough is its ability to monitor, control and optimize all aspects of the dewatering process, along with its proven reliability. This is because the system runs the dewatering process using the sum total of Alfa Laval wastewater decanter know-how. The result is a straightforward, highly effective way to save up to 20% on dewatering costs.

Benefits

The heart of Alfa Laval Octopus Plus is custom-written software, developed using more than 40 years of Alfa Laval process experience in sludge dewatering. Alfa Laval Octopus Plus provides real-time information about exactly what is going on in the dewatering process. It uses that information to detect and adjust for variations in the dewatering process, keeping it running at peak performance all the time. Alfa Laval Octopus Plus makes it possible to track operating costs in a highly efficient manner and provides benefits that include:

- consistent sludge cake dryness
- up to 25% cost savings on polymer consumption
- up to 2% drier dewatered sludge
- opportunities for boosting dewatering capacity by increasing operating hours (up to 24/7, if required)
- less downtime, because automatic, real-time reaction to changing conditions means fewer alarms and fewer shutdowns
- cleaner centrate - increasing the solids recovery means the recycle load is reduced



- on-screen, real-time access to the dewatering process, providing much better insight into upstream operations and the dewatering process

Working principle

The overall objective of the Alfa Laval Octopus Plus system is to minimize the cost of the dewatering process within any parameter limits defined by the user.

For example, minimum and maximum cake dryness can be set to meet local operational constraints, such as cake pumping capacity or disposal contract obligations. Alternatively, a minimum solids recovery can be set to ensure that the recycle load is kept within acceptable limits.

To achieve this, Alfa Laval Octopus Plus monitors and controls the following process parameters:

- suspended solids content and flow rate of the incoming sludge
- suspended solids content in the centrate
- polymer dosing rate
- differential speed and conveyor torque of the decanter.

Alfa Laval Octopus Plus optimization algorithms use these parameters in combination with the operational cost structure (factoring in the costs of polymer, disposal, power, water, etc.) to automatically vary the feed rate of sludge or polymer and the differential speed of the decanter, and thus minimize the overall cost.

The constituent parts of Alfa Laval Octopus Plus are described in more detail below:

- (1) hardware
- (2) communication
- (3) modes of operation
- (4) optimization algorithms.

Hardware

To control the process effectively, Alfa Laval Octopus Plus needs accurate, reliable measurements of the suspended solids content in both the feed and the centrate. To achieve such accuracy, Alfa Laval uses Solitax® sensors manufactured by the German company Hach Lange.

The Solitax® sensors measure the turbidity and the suspended solids by scattering infrared light into the target stream and measuring the reflected



light via two light sensors. One of these measures turbidity, while for colour-independent measurement of solids content, both detectors are used. This is called the infrared-duo scattered light method, and it can measure turbidity in the range of 0.001-1000 FNU, and solids content from 0.001 to 50g/l (TS line) and 0.001 to 150g/l (high line).

The Hach Lange system also provides easy, one-point calibration, and has a built-in wiper to clean the lens at preset intervals.

One important feature of the Alfa Laval Octopus Plus system is the specially designed tank, which helps to reliably measure the suspended solids content in the centrate. This tank was specially designed by Alfa Laval, with the following features:

- accurate measurements of the centrate flow, which is de-aerated to ensure that air bubbles do not distort the turbidity measurement.
- the positioning of the sensor and the automatic flushing routine prevent distortion of the reading by solids build-up in the vessel.
- to keep the lens surface as clean as possible, the system periodically doses diluted acid onto the lens surface to ensure that there is no build-up of struvite, which would distort the sensor's measurement.
- the tank and the centrate pipe supplying the feed to the tank are automatically flushed at regular intervals.

The feed sensor is installed in the sludge line, using the special mounting device supplied.

The software itself is delivered installed in an industrial PC mounted in a panel. This panel is supplied pre-fitted with all the necessary communication components, as well as a modem that allows remote access to update the software or for support services.



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Communication

Alfa Laval Octopus Plus is designed to provide flexible communication to existing plant equipment (polymer pump, feed pump and decanter controller) as well as to supplied equipment (sensors and centrate tank).

Depending on user requirements, this communication can be set up in three different ways:

- hard-wired, where all instruments are connected directly to the Octopus Plus panel, bypassing any local control system (e.g. PLC or SCADA).
- partly hard-wired, where existing plant equipment (feed and polymer pumps) are controlled via the local control system and the sensors and centrate tank are hard-wired to the Alfa Laval Octopus Plus panel.
- all equipment is connected to and controlled via the local control system.

To facilitate communication with the local control systems, an OPC server is provided.

Safety control in the form of a watchdog function is built into the communication routines so that control reverts to the local control system if communication with Alfa Laval Octopus Plus is interrupted.

Modes of operation

The Alfa Laval Octopus Plus system can be run in one of four modes:

Monitoring mode

Control of the dewatering operation remains with the plant personnel (using the existing control system). Alfa Laval Octopus Plus merely logs all relevant process parameters. This mode can be described as standby mode.

Set-point mode

Control of the process is taken over by Alfa Laval Octopus Plus, but the set points for the key parameters are manually entered by the user. Operation is similar to manual operation.

Optimization mode

Full control of set points is taken over by

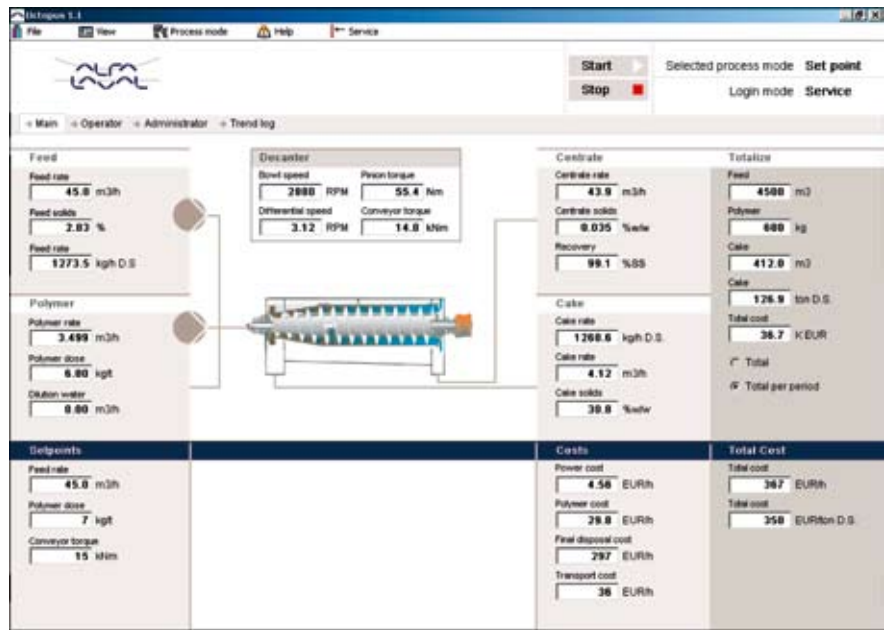
Alfa Laval Octopus Plus, which automatically sets values for feed rate, polymer dosing and differential speed based on a real-time process analysis performed by the optimization algorithms.

Automatic mode

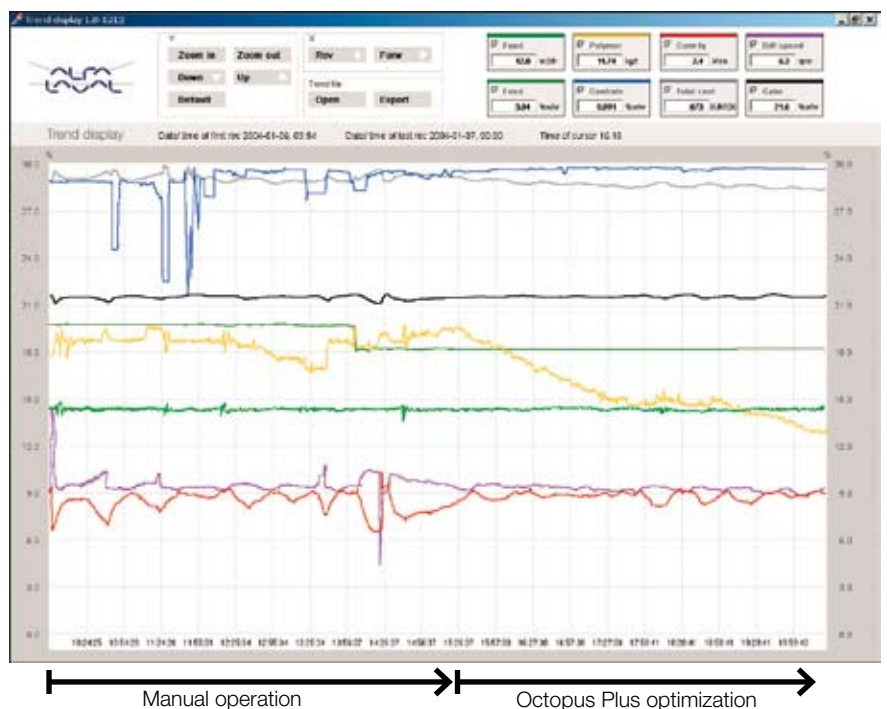
Used for starting up, where the process is run for a preset length of time in

set-point mode before switching to optimization mode.

The user interface depends on the level of access: operator level shows basic process values, and administrator mode shows process values and real-time costs.



The full user interface



A trend log shows a visualisation of the last day's operation, showing all key parameters. This is a screen capture from an Alfa Laval Octopus Plus installation. In the first half of the graph, the process was running manually, while in the second half (after 15:00), Alfa Laval Octopus Plus was optimizing the process automatically. Note the reduction in the polymer consumption (yellow line) and the stabilization of the cake dryness (black line) and solids recovery (blue line).

Optimization algorithms

The optimization algorithms are advanced software routines specially developed by Alfa Laval. They incorporate the considerable process and decanter knowledge and experience built up by Alfa Laval over many years.

The way these algorithms work can be likened to the actions taken by a highly experienced operator, combined with the benefits of continuous availability and early reaction to changes in the process. This is important as it avoids any deterioration before action is taken. It also means that only small steps are required to compensate for process variation. The result is a much smoother-running process.

Under stable operating conditions, Alfa Laval Octopus Plus always seeks to reduce the overall dewatering cost by saving polymer, increasing the dryness of the final cake, or both, depending on the cost structure at the plant. For example, increasing the polymer dosage enables the system to deliver drier cake and cleaner centrate - although this will be at the cost of additional chemicals. Alfa Laval Octopus Plus analyzes the relevant costs and benefits, and takes the action necessary to ensure the greatest possible savings.

Any actions are always subject to the limitations set by the user. For example, should the plant have a contract for

disposal of sludge which stipulates a minimum cake dryness, Alfa Laval Octopus Plus will respect that limit, even though it may be cheaper to sacrifice dryness in exchange for saving in polymer consumption.

Should the process conditions change in such a way that any of the limitations are overstepped, Alfa Laval Octopus Plus takes action to bring the process back within acceptable limits. For example, a sudden increase in feed solids may result in a deterioration of centrate quality beyond acceptable limits. Alfa Laval Octopus Plus takes corrective action, either by increasing polymer or by increasing differential speed. As both solutions incur additional costs, Alfa Laval Octopus Plus chooses the less expensive solution. When the situation returns to normal, Alfa Laval Octopus Plus resumes its hunt for a lower final dewatering cost.

In summary, under normal operating conditions, Alfa Laval Octopus Plus will continuously search for ways to save money by varying feed rate, polymer and decanter settings. When a process limit has been violated, the system will pause the search for cost minimization and will only resume it once corrective action has been successfully taken. The end result is a smoother-running process, peace of mind for the operators and lower cost.

How to contact Alfa Laval

Up-to-date Alfa Laval contact details for all countries are always available on our website at www.alfalaval.com.