

## Overview



**Figure 1:** CRIUS®4.0 controller with HaloSense.

Accurate monitoring and recording of chlorine disinfectant levels in food washing processes is critical to ensure that the required levels of safety and compliance are maintained. Failure to meet these strict requirements results in food and beverage companies risking consumer health and incurring large fines. Prior to working with Process Instruments (Pi), Whitby Seafoods dedicated hours of labour to manually testing and recording the free chlorine levels of their onsite borehole water post treatment. Due to large variations in flow rate and subsequent reactive manual dosing, Whitby Seafoods often needed to switch to municipal water to ensure compliance with the required residual free chlorine levels, significantly increasing the cost of their water bills. Through installation of the HaloSense residual free chlorine sensor and CRIUS®4.0 controller from Pi, Whitby Seafoods upgraded their borehole disinfection system and saw reliable chlorine dosing of their onsite water supply, regardless of flow rate, which ensured constant and consistent compliance with food safety legislation. Additionally, significant money was saved through reduced reliance on municipal water, more efficient use of onsite manual labour and accurate dosing of expensive disinfectant.

Damon Wright

Senior Engineer Whitby Seafoods

*'Since the installation of the Process Instruments controller, we have had great success in accurately maintaining a healthy free chlorine level in our treated borehole water. This along with the added online monitoring and email alarm system, has given us excellent peace of mind over the years.'*

# HaloSense/CRIUS<sup>®</sup> 4.0 and Whitby Seafoods

A supplier to supermarkets across the UK, Whitby Seafoods is recognised as one of the largest UK manufacturers of high-quality scampi produce. On their main produce processing site, plans were in place for the water utilised for washing to be drawn from their onsite borehole treatment plant.



**Figure 4:** Whitby Seafoods.

However, the absence of automatic monitoring, alongside frequent manual testing and fixed speed dosing pumps, limited their borehole water utilisation. Concerns over water quality compliance often resulted in the requirement to switch to the use of municipal water, which led to high water costs. Therefore, driven by food and water quality concerns and mounting water usage costs, Whitby Seafoods contacted Pi for a solution.



**Figure 5:** Whitby Seafoods plant room.



**Figure 6:** Whitby Seafoods CRIUS<sup>®</sup> 4.0 with HaloSense.

The initial project sought to automate the hours of manual labour spent on residual free chlorine level checks and recording to ensure compliance with food and water quality standards. However, inspired by the functionality and modular capability of the CRIUS<sup>®</sup> 4.0 controller, the project scope expanded to include not only HaloSense free chlorine sensors but new variable speed drive dosing pumps using flow proportional PID control.

# HaloSense and CRIUS<sup>®</sup>4.0

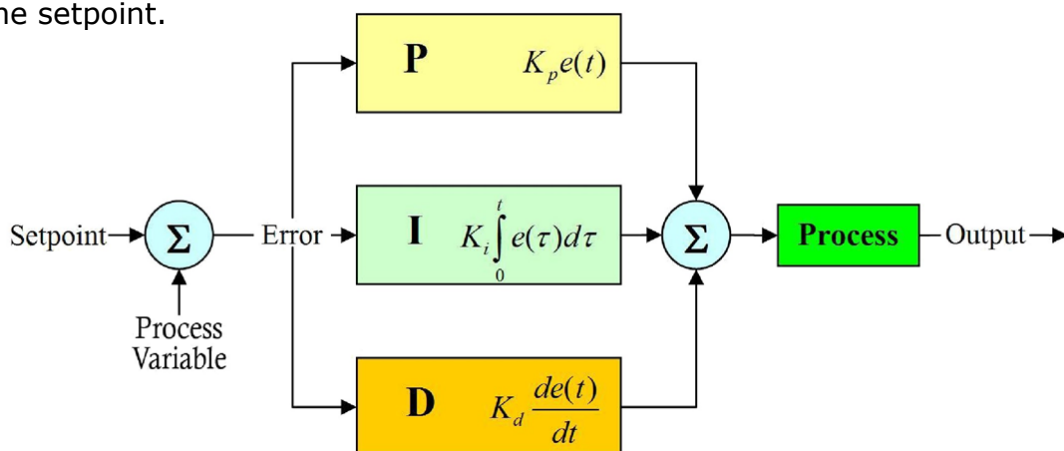


**Figure 2:** CRIUS<sup>®</sup>4.0 controller with HaloSense.

HaloSense is Pi's range of free and total chlorine amperometric sensors. HaloSense sensors are membrane electrochemical sensors, containing an internal electrolyte and buffer rendering them insensitive to changes in pH. This allows them to remain extremely stable, which results in reduced maintenance and whole life costs. The continuous real time signal sent from the HaloSense sensor in response to the free chlorine concentration can feed into a PID (Proportional, Integral, Differential) algorithm. By automatically adjusting the PID output, and therefore dosing pump speeds, in response to changes in free chlorine level, sites are able to reliably maintain a user defined residual setpoint. Additionally, automatic data logging within the CRIUS<sup>®</sup>4.0 ensures consistent recording of vital water quality and free chlorine level analytics, making food safety compliance easy to both maintain and provide evidence for.

## PID Control

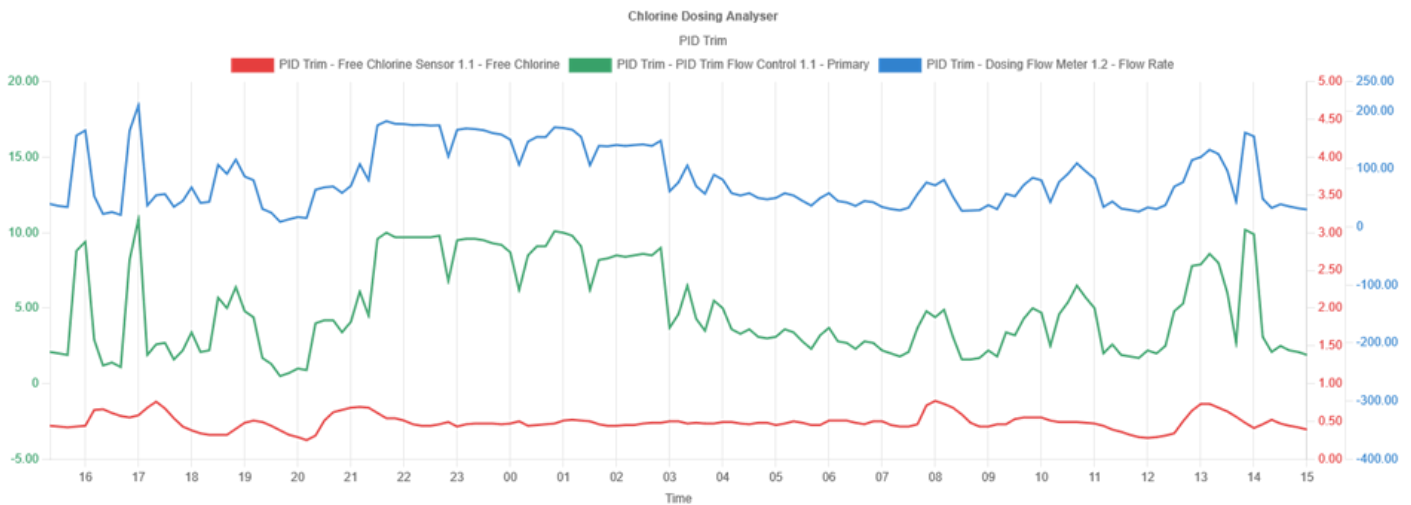
PID algorithms can control processes by calculating an 'error' value derived from the difference between a measured process variable, such as residual free chlorine level, and the user defined setpoint. The controller then adjusts equipment such as a dosing pump to minimise the 'error'. P, I and D are different calculations the controller can use to minimise the 'error' value. Most processes can manage with just P, but can be combined with I (and very rarely D) to produce an output signal in response to the 'error' value, such as increasing the speed of a disinfectant dosing pump if the detected residual free chlorine level is below the setpoint.



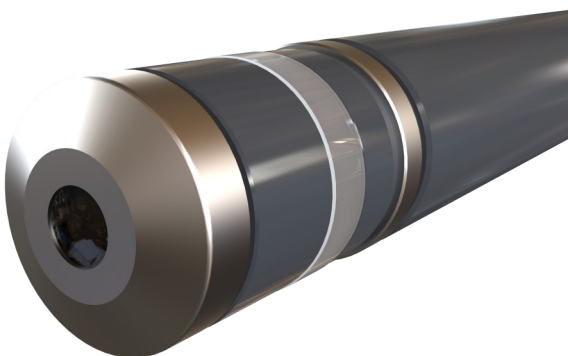
**Figure 3:** Diagram of Proportional/Integral/Derivative (PID) control.

# Flow Proportional PID Using HaloSense/CRIUS<sup>®</sup> 4.0

Issues surrounding residual free chlorine levels in the borehole water were often raised by Whitby Seafoods due to the extreme variability of water flow through the washing system, from 10 L/min to as high as 250 L/min. Installation of ten third-party flow sensors into the adaptable CRIUS<sup>®</sup>4.0 controller and three expansion boxes allowed for total flow monitoring across the water disinfection system. The HaloSense free chlorine sensor online continuous monitoring of the free chlorine residual levels in tandem with flow rate, allowed a flow proportional PID output to be provided.



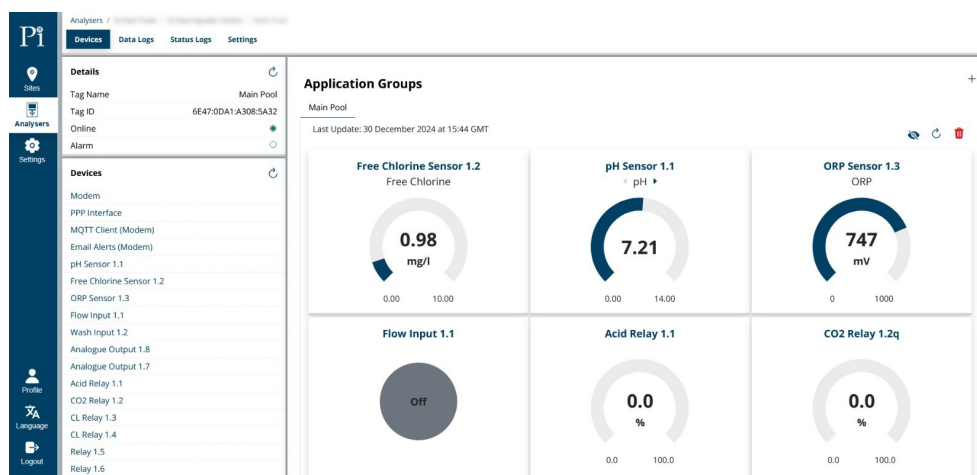
**Figure 7:** Change in residual free chlorine level around the user defined 0.5 ppm setpoint as water flow rate varies.



**Figure 8:** HaloSense free chlorine sensor.

As flow rate increased, feedback from the flow sensors to the CRIUS<sup>®</sup>4.0 controller allowed for a proportionally increased rate of dosing from the chlorine dosing pumps, i.e. if flow rate doubled, the PID output % to the dosing pump would double. However, precise control of the residual free chlorine level around the user defined setpoint was achieved through continuous feedback from the HaloSense free chlorine sensor to trim the PID response through additional signal communication with the CRIUS<sup>®</sup>4.0 controller. Overall, this setup provided excellent control of residual free chlorine around the setpoint, regardless of changes in water flow rate.

# Control InSite



**Figure 9:** Example screen of parameters monitored from a CRIUS<sup>®</sup> 4.0 through Control InSite.

In addition to the PLC-like functionality of the CRIUS<sup>®</sup> 4.0 controller, Whitby Seafoods has also benefited from controller remote access through Pi's online monitoring control portal, Control InSite. Laborious manual recording of data to ensure compliance was replaced with continuous automatic data logging at user defined time intervals, accessible on any device connected to the internet. Real time alarms, and email notifications when levels deviated outside of compliance limits, allowed for effort to be used to solve issues only when required rather than incurring labour costs searching for problems. Confidence in the reliability of the CRIUS<sup>®</sup> 4.0 reporting capabilities has simplified the identification of onsite issues and their causes, and online access through Control InSite reduced service costs, as anything that required access to the controller could be input using the online portal.

## Conclusion

Through utilisation of the PLC-like functionality of Pi's CRIUS<sup>®</sup> 4.0 controller and the HaloSense free chlorine sensor, Whitby Seafoods now experiences controlled and compliant residual chlorine levels in their onsite borehole water. Dedicated labour costs for constant site checks have been replaced with reliably automated chlorine dosing and automatically generated compliance reports, accessible from any internet connected device. CRIUS<sup>®</sup> 4.0 and Halosense have enabled Whitby seafoods to save on municipal and chemical costs, while ensuring responsive chlorine dosing, resulting in consistently compliant quality water.

Steve Barker

Manufacturing Engineer Manager Whitby Seafoods

*"We have come a long way, would have to log everything manually, daily paper checks were extremely labour intensive/time consuming. We still only do one check just as a visual check across the plant. Now we have confidence in the instrumentation, we now only check the whole plant (chemical levels, sensors etc) once a week. So overall, huge labour benefit which you cannot put a price to!"*