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FLUID CONTROL SYSTEMS

BEST PRACTICE | THE CENTRE FOR SOLAR BIOTECHNOLOGY - UQ

Gas dosing control for Microalgae Biotechnology Platform

Assisting solar biotechnology research at University of Queensland

The Centre for Solar Biotechnology at University of Queensland (UQ) – part of the Institute for Molecular Bioscience (IMB) – was established in 2016 by Professor Ben Hankamer, and has since expanded to connect around 30 international research teams across Europe, the USA, Asia, Australia and New Zealand and its industry partners. Its purpose is to accelerate the innovation and commercialisation of new solar-powered technologies and industries, many of which are based on photosynthetic green algae.

Algae Technologies

The algae technologies tap into the huge energy resource of the sun and absorb CO2 to provide economic solar-driven solutions that will help supply the world's growing energy, food and water needs, and a path for CO2 utilisation. The technologies also open up a range of high value opportunities in the nutraceutical and pharmaceutical sectors. In the process, the Centre's work actively supports the development of new job opportunities, sustainable regional development, export industries and a clean, green and renewable future.

The Centre for Solar Biotechnology operates both indoor and outdoor pilot scale production facilities for micro- and macro-algae, which are equipped to operate high rate ponds, flat panel, tubular and airlift systems. This includes the testing of various bioreactor designs and process parameters, as well as testing and characterisation of production strains.

Extensive infrastructure is already in place, including CO2 and compressed air with associated piping and automation technologies for the operation of the bioreactors.

Updating an ageing bioreactor control system

The existing control system for the outdoor bioreactors had been built almost 15 years ago, and the Centre faced and expensive upgrade option available to the Centre from other providers. As a result, the University commissioned DSI-Tec to upgrade their plant with a new control system. Together they designed a new control and monitoring system for the bioreactors, which includes pH-controlled CO2 dosing and remote sensor calibration capabilities. The new automation system was first to be implemented for the indoor production facilities before being rolled out to the outdoor facilities.

DSI-Tec explored a number of options and providers for mass flow meters and controllers, and other necessary equipment, but kept coming back to Bürkert.

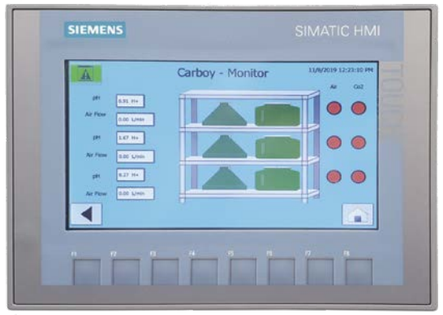
With the decision made, and to get the project underway, Bürkert invited David Horton, Principal of DSI-Tec, to their Sydney Systemhaus to discuss the project in detail. Specific valves and instrumentation were required for the control system, and the laboratory wanted a customised design that needed to communicate with a Siemens S7-1200 platform, using a Profinet network already onsite. The control system also required future-proofing and the design needed to allow for future upgrades with additional devices.

The first requirement was to provide a transmitter for eight raw pH probes. For this task, Bürkert supplied two Bürkert MultiCELL, Type 8691, each with Profinet and four pH modules. The pH reading, as well as other diagnostic data, is sent directly to the Profinet network for monitoring and control.

The second requirement was to provide five Multifunction Controllers (MFCs) to dose air, with the capacity for an additional 20 MFCs to be connected in the future.

To accommodate future expansion, Bürkert supplied five of its MFCs on its Efficient Device Integration Platform (EDIP) platform. This offers a modular design to allow the addition of devices according to application requirements. Bürkert's ME43 gateway device configured for Profinet provides an interface to the control system.

Data such as flow rate, totalisation and medium temperature is provided as standard and additional data such as run hours, sensor calibration data and sensor health can be extracted from each MFC as required. Future MFCs will plug into the network with configuration via Bürkert's Communicator software.



Custom manifolds and enclosures meet the requirement

The third requirement was to provide solenoid valves for CO2 dosing. To this end Bürkert supplied a stainless-steel manifold and valve system. The manifold was designed locally and built in-house by Bürkert Australia, and mounted on a stainless-steel top-hat, which supports easy mounting and serviceability. The five valves are controlled directly from the Siemens PLC digital outputs.

“The challenge for Bürkert was to accommodate the tight allocated installation space on-site,” said Dean Bryant, National Segment Manager, Micro Fluidics & Gas Handling for Bürkert Fluid Control Systems. “We therefore provided a narrow, free-standing enclosure to accommodate all of the MFCs and valves.”

Bürkert readily provides control panels and cabinets as part of their solutions for ease of setting up systems in various locations.

“The completed system included a Siemens S7-1200 PLC/HMI combination, which contained the Profinet Master that communicated with the other devices through Bürkert’s ME43 gateway device,” added Bryant.

A pre-commissioning factory acceptance test (FAT) was performed in the Sydney Systemhaus and included sequence and leak testing. Bürkert invited the University and DSI-Tec back onsite to witness all the tests for themselves. Extra pneumatic bulkheads were also fitted and plugged, ready for future MFC and valve installations.

Dean Bryant // National Segment Manager, Micro Fluidics & Gas Handling for Bürkert Fluid Control Systems.

Taking UQ’s research to the next level

The close collaboration between UQ, Bürkert and DSI-Tec – from the conceptual design right through to installation – ensured that the project was delivered exactly as required – on time and on budget.

“The automation upgrade for the indoor production facility now enables a precise and remote control of microalgae cultures to produce high quality biomass that is then used to develop bio-inspired green medicines, foods and nanomaterials,” said Dr Juliane Wolf, Research Officer and Project Manager. “Once we scale up the automation implementation further, to include our outdoor production facility, we can drive down the cost of production and expand the green developments to the production of fuels and eco-system services.”

“Our indoor and outdoor pilot plants are critical to our work and we thank DSI-Tec and Bürkert for working so professionally and constructively to provide us with the automated control systems that we require,” said Professor Hankamer. “The system will take our R&D work to the next level of systems design and scale-up, so that we can provide the renewable products and jobs of the future, through a solar-driven manufacturing base.”

The bioreactor project at UQ demonstrates how well Bürkert can integrate a solution in alignment with industry 4.0. Bürkert’s ability to adapt to existing systems, requirements and predetermined platforms gives them an added advantage compared to others in the market. With their local Australian Systemhaus in Sydney, Bürkert can provide customers hands-on consultations and testing environment, as well as direct access to Bürkert product solution experts, technical and design team.

Dr Juliane Wolf // Research Officer and Project Manager

We learn from you every day

Including when we think outside the box

When it comes to dealing with liquids and gases, Bürkert is a sought-after partner all over the world. Why? Probably because we have been learning for, and from, our customers for more than 70 years. This enables us to always think that crucial step ahead – or even sideways.

We make ideas flow.

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