

Fredericia turns to brewmaxx

Carlsberg relies on a proven brewery automation solution

The brief for the new automation solution at the Carlsberg brewery in Denmark was quite simple: make the complex production processes more transparent and more product-safe, considerably improve user-friendliness and, naturally, implement it as quickly as possible – with a minimum amount of production downtime.

by **Martin Lutz** and **Thomas Prinz**
ProLeiT

There were a number of good reasons why brewmaxx from ProLeiT was eventually chosen. On the one hand, ProLeiT has already been responsible for putting numerous Carlsberg breweries around the world into operation. With over 25 years of experience to call on and brewmaxx being one of the most widely applied process control systems in the brewing industry, this recent Carlsberg project involved the re-automation of the entire beer production process – from malt delivery to the bottling line.

The Carlsberg brewery in Fredericia is one of the largest European breweries with an annual output of roughly 4.3mHl including more than 40 beer types and no less than 20 Trade mixed products. Being Carlsberg's only large site in Denmark, it was essential to complete the changeover to the new control system with a minimum of downtime. Exceptionally close co-operation was essential between ProLeiT and the brewery. Thorough process descriptions and technical specifications ensured that changeover and commissioning of brewmaxx went smoothly. The individual process areas were implemented one after the other in record time and were put into operation as planned with only a few brief interruptions.

Beer tree and CIP matrix

The primary goal at the Fredericia plant was to increase the plant's process and product safety while minimising costs and losses. The entire beer tree, which defines the recipes and which beer types can be processed through which vessels across the various production steps – from wort to bright beer tank – was thus stored in the process control system. Based on this beer tree, the system initially supports the operator in selecting compatible tanks for the chosen product with regard to material compatibility and technological status of the beer. These extensive tests



The Carlsberg brewery in Fredericia, Denmark.

optimise the process safety for tank allocation. After selecting the tanks, a cleaning matrix is then used to check the status information of the line route. Depending on the product type which previously occupied the lines, the system automatically decides whether the lines require cleaning for the new product or not. The operator is informed at once about product incompatibilities or an incorrect cleaning status. Operating errors are therefore excluded. Required cleaning in between transferring various products is selected, thus saving time and cutting cleaning costs.

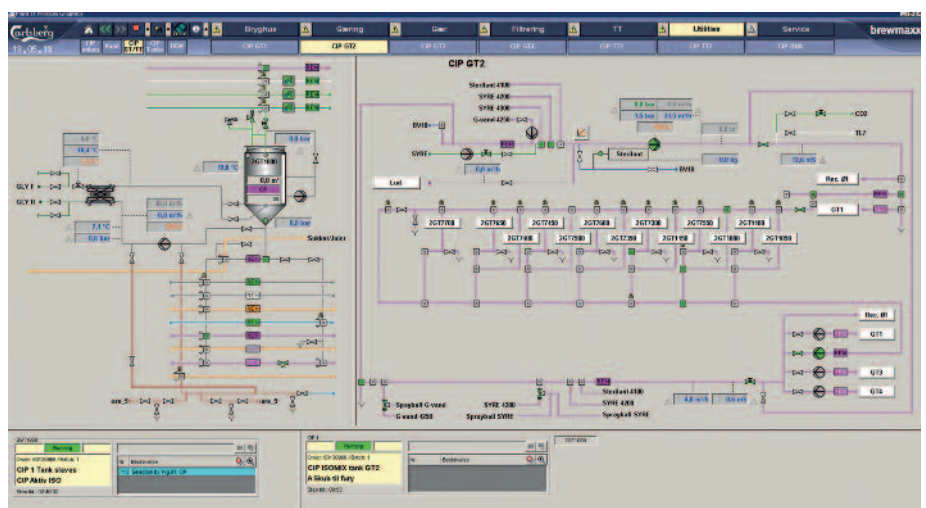
Mashing rhythm

The lautering duration of previous brews of the same product type is considered in the brew scheduler in order to optimise allocation in the brewhouse. The expected lautering time stored at the wort recipe is adjusted to the

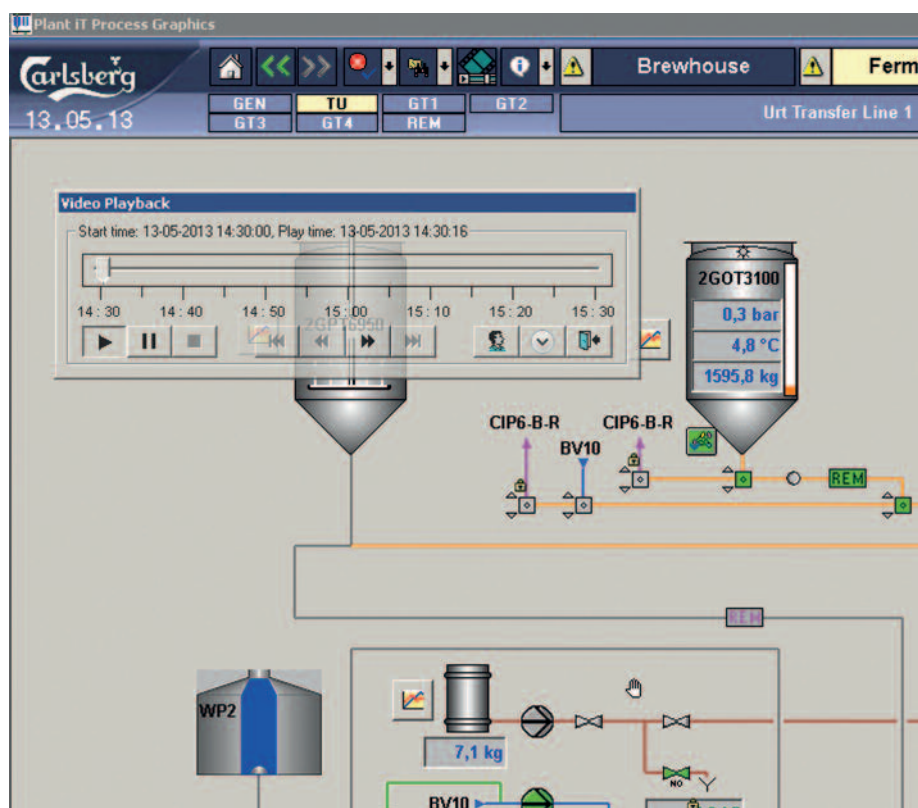
actual duration in order to react to the real lautering behaviour. Furthermore, the system automatically optimises malt outtake for the two brew lines. The main brew line is operated with higher priority to ensure constant utilisation.

Production planning

Production specifications for brewhouse and filtration are activated on the basis of brewmaxx order planning. The filling of the fermenting tanks is basically planned in brew groups with the operator being able to carry out the necessary settings for the entire group or for individual brews when planning the order: malt silos, fermenting tanks, yeast dosing as well as special features, such as the diversion of wort to yeast propagation. The master brewer is able to define any target value as an order parameter in the recipe and to enter it in the order list for brew-specific changes.



User interface for the CIP overview in Danish.



The brewmaxx Visu-Recorder – recording and output of the process visualisation.

This is a tried-and-tested method, particularly when adapting dosing quantities for the compensation of variations during production. Blend ratios and target quantities are additionally specified for each order in the filtration planning. This ensures that Carlsberg can dispatch production specifications from the ERP system (SAP) directly to the order planning.

First project phase

The first project phase involved the re-automation of the whole cellar, consisting of four fermenting cellars with 54 fermenting tanks and two filtration lines with 40 downstream bright tanks and several tanker stations. The project was implemented for this entire cold block in one large step which took just nine days until all the areas of the fermenting cellar were up and running again with brewmaxx. Together with the Carlsberg experts it was possible to restart over 300 different programs within a very strict time limit. The tank cooling systems were re-activated after just one day. This was followed by a few days of electrical and mechanical engineering work on the plant before all six beer bottling lines were eventually put back into operation at two-day intervals. The first filter commenced production after five days, the second filter followed six days later. With the wort intake added, all areas of the cellar were running fully automatically with brewmaxx, an impressive achievement by both the Carlsberg and the ProLeiT teams, especially as the scope was extended to include the re-automation of the two Profi filter lines and beer supply a new canning

line, interfacing to a new Oenoflow filter and integration of a new yeast separation plant.

Second project phase

Wort preparation was adapted to brewmaxx during the second project phase. The brewhouse was actually out of service for just six days. To ensure the plant teams had sufficient time to familiarise themselves with brewmaxx, Carlsberg planned 20 brews for the first week after the changeover. In fact no less than 46 brews were actually carried out. Thanks to the high level of user-friendliness, Carlsberg's staff became well acquainted with the new automation system brewmaxx in next to no time.

Integrated materials management

Due to the large variety of products at Fredericia, raw materials stock control and recipe-controlled production processes was a key requirement which the new control system had to meet. Production output and materials consumption are thus recorded to allow full inventory management. Moreover, full traceability is guaranteed from the bright tank back to the malt silo. Using the brewmaxx materials management solution it is also possible to link a single process sequence, including the material parameters of various beer types, to different recipes.

This is highly recommended for technologically less advanced vessels, such as the bright tanks, which have an identical process sequence for all beer types. As the process sequence is already defined, only the material parameters need to be specified for

new beer types. This option means various process areas have easier access to the same material parameters. If these parameters require modification, they only have to be corrected once and are subsequently available in the updated form throughout the brewery's entire control system.

Everything under control

To ensure that Carlsberg always remains in control of the over 60 products involving roughly 200 materials and produced through a plant boasting approximately 6000 automatic valves, 1000 manual valves and 1000 pumps/motors, ProLeiT designed specific dynamic overview screens. These screens enable immediate intervention in every main process from each of the operating stations. The respective tanks and line sections appear dynamically according to the relevant selection. In other words, operators only see the plant components relevant for the respective process. The resulting user-friendliness of the system enhances staff response time and guarantees simpler, more transparent and safer working processes. To achieve a new level of user-friendliness, Carlsberg also requested that all the control system interfaces be made available in Danish.

Process sequences ensured

Carlsberg also uses the brewmaxx Visu-Recorder which documents every operating and process step – which means it is possible to display who intervened in which process or which route each product has taken through the plant. This can provide the basis for effective process optimisation and troubleshooting. Its intuitive and simple handling has led Carlsberg to also use the Visu-Recorder for staff training purposes.

The future

The latest project in Fredericia is to replace the current reporting system. This involves extending brewmaxx with additional MES functions, such as complete process validation, detailed reports, key figures derived from production processes and finally order confirmation to Carlsberg's SAP system. ■

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