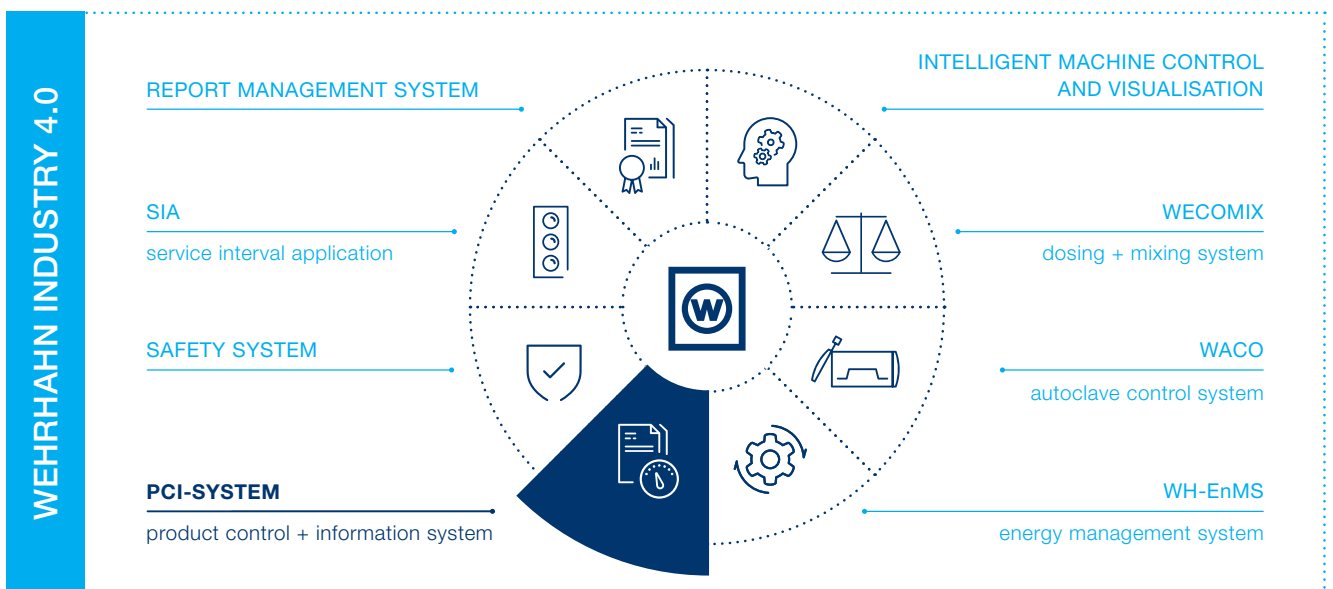# Intelligent automation modules in AAC production plants – part 3: Product Control and Information (PCI)-system

A state-of-the-art factory has to save and store all relevant product data to ensure product traceability (especially in case of claims). Furthermore, it should continuously increase product quality and plant efficiency by a "continuous improvement process" according to the four steps "Plan - Do - Check - Act". Consequently, the production process should be automatically monitored and analysed. This part of the series of articles describes the automatic control of machine and process parameters as part of the entire PCI-system.
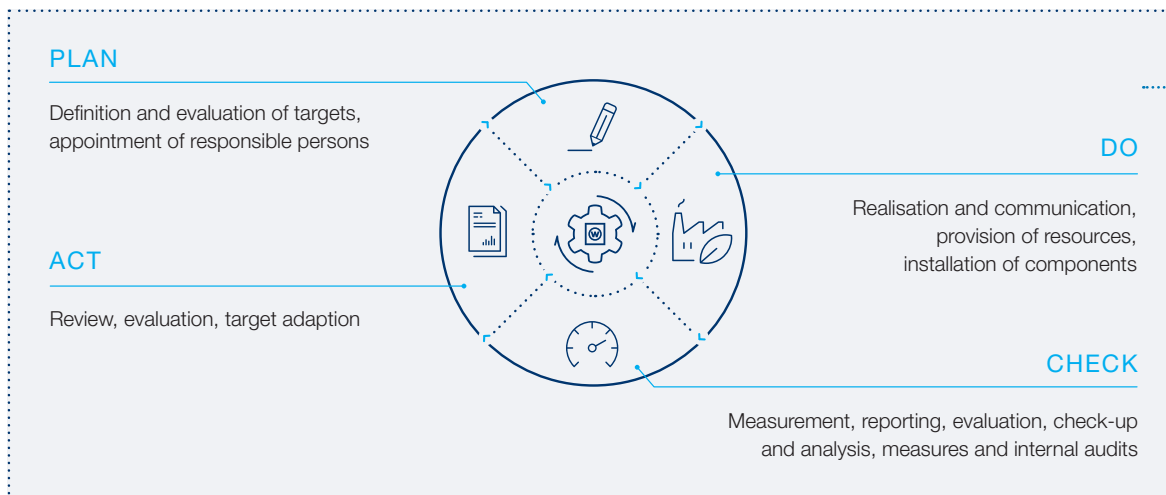
An efficient production plant provides a large number of measured values, product data and machine data which are of interest for the operators (for required machine adjustments), the ERP-system (information about the productivity and amount of products on stock), the management (product quality, output, plant performance) and the laboratory department (information about raw material consumption, production process and product quality) etc.

Data collection in the past

For decades, data handling in many plants was primarily manually done by taking notes. Information and notes were handwritten on paper by every single operator. Handling over paper notes from one division to the next, however, causes problems and it is rather difficult to follow up the production process.

WEHRHAHN INDUSTRY 4.0

REPORT MANAGEMENT SYSTEM

INTELLIGENT MACHINE CONTROL AND VISUALISATION

SIA
service interval application

WECOMIX
dosing + mixing system

SAFETY SYSTEM

WACO
autoclave control system

PCI-SYSTEM
product control + information system

WH-EnMS
energy management system

AAC - automation modules for a precisely coordinated Automation Control System.

PLAN

Definition and evaluation of targets, appointment of responsible persons

ACT

Review, evaluation, target adaption

DO

Realisation and communication, provision of resources, installation of components

CHECK

Measurement, reporting, evaluation, check-up and analysis, measures and internal audits

Plan-Do-Check-Act cycle for continuous improvement process.

Therefore, following up each individual cake was formerly almost impossible. It was common that the operators marked up numbers on the cake at the end of the cutting process to help operators in the packing area to identify the cake. But it is essential to track the AAC cake throughout the whole process and it is not possible to use the old style of paper notes collection and distribution.

How to evaluate the data economically?

The manually written product data are usually only partly evaluated and unfortunately mostly too late. Data are entered into an Excel file by somebody, a practice not only costly and time-consuming but also fault-prone. As a result, the causes of possible malfunctions and optimization potentials cannot be found quickly enough which negatively reflects in quality and quantity of production.

Moreover, online data evaluation in real time is not possible. Many plant managers may feel overloaded by the amount of data and wide data diversity. Therefore, it is hardly possible to profitably use the provided data.

The solution to improve

An automatic electronic measuring, recording, processing and analysis of the production data in real time would provide the management with all the important information quickly and reliably.
If this control system is used to track each individual cake in every position continuously, it would facilitate to adjust the machine parameters exactly to the requirements for a smoothly running plant and to gain maximum plant availability and reliability - and finally profit!

Mandatory features of such a system are

- Identification of the cake in each position of the production process
- Machine parameters of the different product types

- Self-adjustment of the machine parameters automatically
- Storage and analysis of all product data
- Provision of comprehensible information for operators, laboratory engineers and management in real time
- Transfer of data to connected analysing software and for evaluation.

Handwritten notes on cakes were customary in former times.

The solution is the Wehrhahn Product Control and Information system (PCI-system)

Product
… pursues the product through the whole process and saves all relevant production data automatically in a secured SQL-database, e.g. for merchandise or quality management systems.

Control

… adjusts machine parameters automatically depending on the individual product type preventing operator errors in the machine settings and reducing product damages (cutting speed, separating pressure, etc.)

Information

… includes an analysis software where data can be selected to evaluate productivity and detect or locate production disturbances.

The cake is "born"

In the dosing and mixing process the precise amount of raw materials is dosed into a high speed mixer. The different recipes define the properties of the AAC to be produced, e.g. strength classes, raw densities, thermal conductivity, etc. The physical characteristic

of the final product is determined and significantly influenced in this section.

Each cake automatically gets an individual identification number (cake-ID) from the dosing and mixing control system Wecomix. This cake-ID will be tracked during the whole process. When the cake is "born" (the mix is filled into the mould) all data from the mixing process like raw material amounts, temperatures, densities, mixing times, correction values, CaO, water/solid-ratio as well as process values like operator name, automatic mode, cycle time, fault messages, etc. and mould number will be stored in the database under the unique cake-ID.

How can the cake-ID be tracked throughout the process?

Two different identification steps are required:
1. The cake-ID is created after the mixture is poured into the mould. The cake tracking process is started.

2. The cake leaves the mould and is placed onto a cutting pallet before it is cut and finally, after cutting, onto an autoclave grid/pallet.

Mould identification in the dosing and precuring area

The optimum result can be reached with RFID-chips (Radio-frequency identification). The RFID tag is a very thin radio transponder which transmits digital data to a RFID reader when triggered by an electromagnetic interrogation pulse. There are two types of transponders (passive and active tags). While passive tags will be energized by interrogating radio waves of the RFID reader, the active tags are powered by a battery which allows a distance to the reader of up to hundred meters. Usually the passive tags are sufficient since they need less maintenance.

Although the climatic conditions in the precuring area are quite demanding (the system needs to overcome and resist high temperatures, humidity, dust and soiling), the identification is working absolutely reliable.

The optimal precuring process

In the precuring section the machines are automatically adjusted to the requirements of the product inside the mould. Transportation speeds are precisely adjusted to transport in the shortest possible time without stressing the cake too much. The precuring time is adjusted to the recipe to cut the cake in the best moment. Additional measuring devices like cake tester (cake hardness, temperature and height) just before the cutting line as well as a sensor unit in the precuring chamber (cake height and temperature rising measuring, chamber temperature and humidity) help to find the optimal cutting time. All these data are stored in the cake database under the cake-ID.
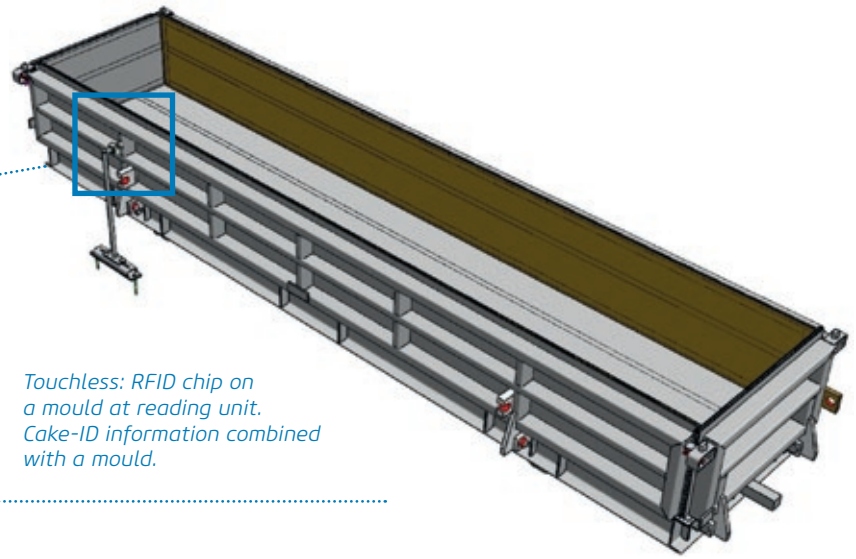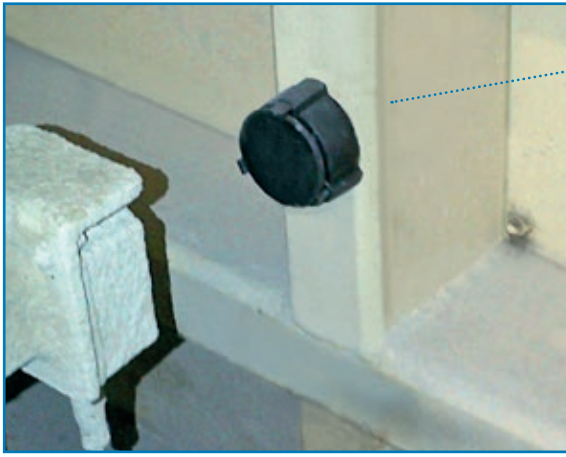

PCI helps to improve production in all areas

„Our Wehrhahn plant is operating with Wecomix, the basic level of the Wehrhahn PCI-system in the 'dosing and mixing' section. All data for both areas have always been saved and could be used for retracing the process. However, for the areas 'precuring', 'cutting' and 'packing' we had only handwritten records. A long way for the evaluation. After installing the PCI we are now able to evaluate all required production data and to analyse quality directly.

Today we have very reliable production data. This helps us to optimise our production process. So we can provide consistent good quality to our customers.

When changing the block dimensions or density then PCI automatically adjusts the machine parameters. The required type of AAC block parameters are set once at the 'dosing and mixing' control. All subsequent production sections adjust their plant parameters automatically. The operator only has to supervise the process on the monitor. Operator errors are minimised close to zero."

Stefan Wolf,
Production Manager of Rodgauer Baustoffwerke, Germany

Touchless: RFID chip on a mould at reading unit. Cake-ID information combined with a mould.

Precise cutting at the right time ensures the high quality

When the cake is ready to be cut it leaves the mould and it is transferred onto a cutting pallet and finally onto an autoclave pallet/grid after cutting. The cake on the autoclave pallet is placed onto an autoclave trolley to be transported into the autoclave.

Before the cutting process starts, the machine parameters are automatically adjusted, i.e. cutting speeds, handholds, cutting wire positions, etc. and are stored in the database together with cycle time, fault messages, etc.
In case of irregularities the operator can prepare comments which are stored in the database, too. This supports the finding of reasons for any disturbances in the production process during data evaluation.

Autoclave pallet identification

The steel pallet or grid stays in an autoclave with 12 bar at around 190 °C for 12 hours which makes it difficult to use electronic identification tags like RFID for cake detection.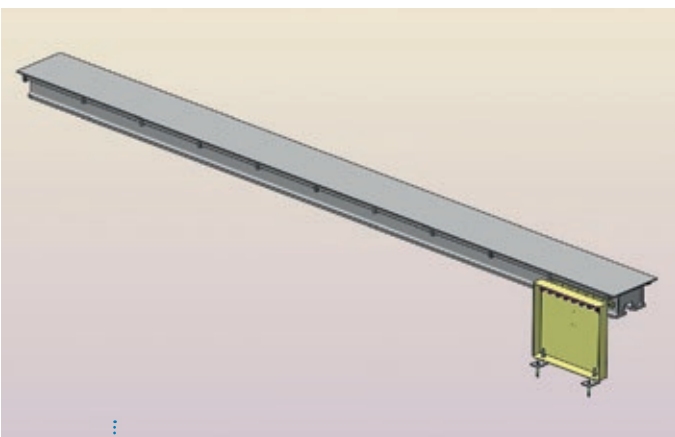 Even there are some RFID-chips available on the market which resist temperatures over 250 °C, but lifetime is limited to less than six months. The exchange of RFID-chips of around 200 pallets every six months is unacceptable.

The solution is the combination of special inductive proximity switches or camera systems and a precise evaluation algorithm in the control system to reliably detect the pallets/grids.
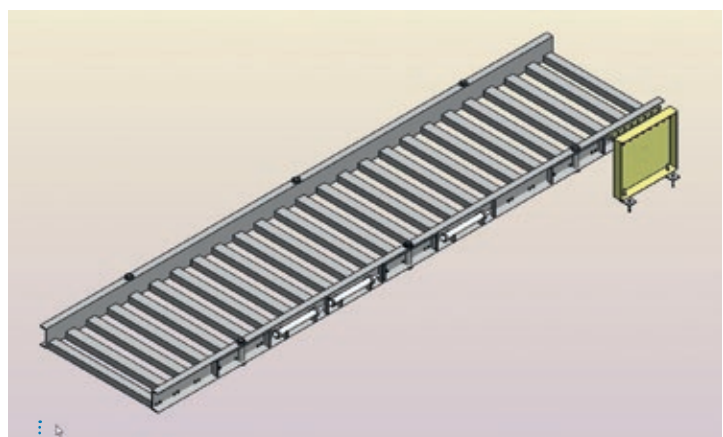
Wehrhahn has developed pallet detection systems with inductive sensors and special QR-code similar tags for AAC plants as well as for sand lime brick plants.

Automatic autoclaving process

As soon as a complete set of autoclave trolleys is ready to be loaded into an autoclave the applicable autoclave curve has to be chosen. Here the automatic data transfer, read from the autoclave pallet / grid, can enable an autoclave control system like WACO to automatically select the required autoclave curve and to autonomously carry out all autoclaving process steps.

Cake data transfer and identification of an autoclave pallet.

Cake data transfer and identification of an autoclave grid.

When the autoclaving process is finished successfully, the autoclave trolleys with the white cakes are transported automatically to the packing section.

Blocks or panels will be sorted and packed automatically

The autoclave pallet detection helps to identify the product in the packing line via the cake-ID. Also here all machine parameters are automatically adjusted, without any manual actions taken by the operator. The freshly produced AAC blocks or panels are placed onto wooden pallets. The background communication from the packing control system to the label printer guarantees the correct labelling of the packed product, including QR-code or barcode.

Daily reports provide all information of product types, productivity and reject rates to the ERP-system and/or to the quality management system.

Benefits with Wehrhahn PCI-system

To identify optimisation potential and to implement it precisely it is necessary to combine all production databases and to bring the individual data in correlation to each other. Therefore, all production data from the different kind of control systems are stored in a Wehrhahn created SQL-database which is part of the Wehrhahn Master Control Server system (MCS-system).

See here a video about Wehrhahn automation. Scan the QR-code with your smartphone.

PCI helps to:

- Increase productivity by shorter set-up times
- Increase product quality by less errors and faults due to automatic set-up
- Reduce production costs by optimising raw material consumption

The MCS-system will be described in one of the next issues of the Industry 4.0 series in AAC wordwide.

●

Frank Pottin studied automation engineering in Bremen. Immediately after completing his studies, he began with the electrical design, programming and commissioning of Wehrhahn AAC production plants. Today he has over 27 years' experience in AAC production. As Director Electric and Automation, with his team of more than 30 automation specialists, he continually develops new innovations for AAC production.

pottin@wehrhahn.de

Klaus Boderke studied process engineering in Clausthal-Zellerfeld. After being plant manager in several plants and meanwhile having 30 years experience in AAC plants he now supports plants worldwide for quality and output increase, cost reduction, change and project management, safety and environmental assessments with profound skillness in staff training and leadership.

boderke@wehrhahn.de

SINCE 1892
WEHRHAHN

Wehrhahn GmbH
Muehlenstr. 15, 27753 Delmenhorst, Germany
T +49 4221 12710, F +49 4221 127180
mail@wehrhahn.de, www.wehrhahn.de

AAC WORLDWIDE

Autoclaved Aerated Concrete

» Facebook: www.facebook.com/aac.worldwide/

» LinkedIn: www.linkedin.com/company/aac-worldwide/

» Twitter: https://twitter.com/aac_worldwide