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Digitalized concrete product production 4.0

The industrial revolution developed in significant steps. At first, the focus was on controlling and automating processes, followed by systems for data collection, such as the Mannesmann-Kienzle recorders implemented at the plants. Like the speedometer of a truck, all the relevant information was recorded as a graphic on a small piece of paper. The Hess Group had already started to replace these electromechanical recorders for data collection with more modern software systems by the end of the 1990s. The Hess production statistics automatically collected all production times and finished output of the plant. The collected information could be transferred to superordinate systems via printout. This was the first step in the transition to Industry 3.0 in concrete block production.

In 2014, Hess modernized and supplemented this data collection system to comprehensively record the data of a concrete block plant, such as the produced quantity and the operating times of the plant components. Over the years, further data such as the quality determination of equipment from other manufacturers, e.g., raw density measurement, weighing of the production boards with and without product, or block height measurement, was recorded step by step, even down to the single product. This is where quality is verifiable. Nowadays, this is generally known as Industry 4.0 and implies that the entire process is networked and monitored, and all data can be collected up to the individual product.

Industry 4.0 in 2022

The several components that Hess provides are as follows:
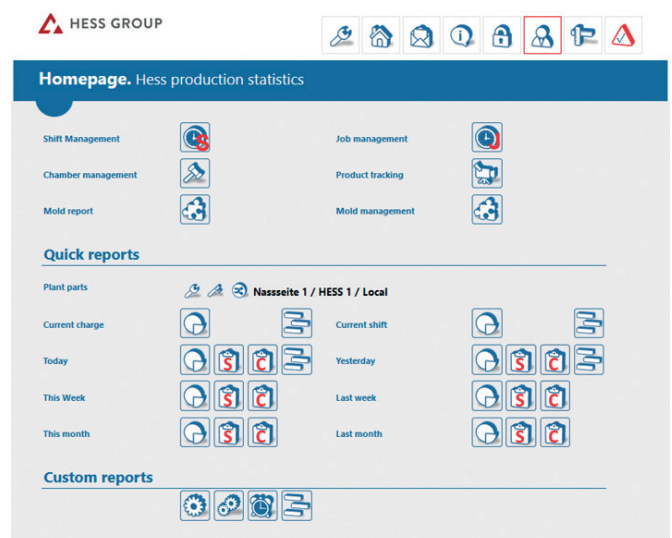
Hess Standard Software

Today we want to monitor and control all the manufacturing data of a concrete block plant. Even more critical: easily retrieve all the recorded data in the past. To use digitization effectively for the success of the customers, detailed documentation and subsequent control of the recorded information are necessary. With the correct data storage, the accessibility of the collected data is guaranteed for the long term.

During the first stage of data acquisition, daily (per 24 hours), the information is listed about which products the plant has manufactured in a certain amount of time. All the operating modes of the individual plant components are recorded, for example, the machine's status: Is it switched on, is it in automatic mode, or is it in operation? If production is not taking place, it can be determined whether back- or face mix con-

crete is available, whether production boards are missing, or, for example, the finger car is unavailable. The machine operator must specify the downtime reason if the plant is in manual mode. This could be, for example, a mechanical or hydraulic malfunction, a mold change, or a color change. The percentages of the waiting and downtime reasons, production time, and the availability of the production plant will be automatically recorded. This significantly simplifies the optimization of individual plant components.

There are several ways to visualize the collected data. For example, a list of all work shifts, or manufactured products, can be displayed in a listing mode or a pie chart with the complete data. A bar chart can show the chronological flow of an item production, a shift, or a defined period. A plant manager can then use all this data to run his plant most efficiently through preventive and effective maintenance, among other things.

Furthermore, the production data of each produced product is recorded, as well as the availability of the equipment and the number of production cycles for this product. The machine operator can also indicate whether a produced layer is 2nd choice or whether a product layer is to be disposed of directly by a dumping device. At the end of a production day, such data collection allows evaluation of the operating times and the number and quality of the produced products of a particular product.
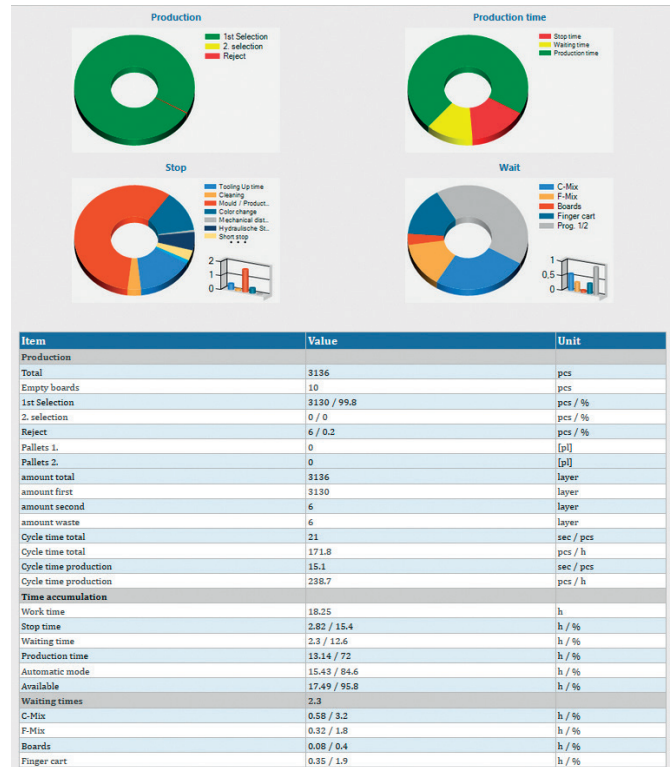

The main menu of the Hess Standard software with the overview and management of the various parameters

Many concrete block plants have internal administration tools for collecting production data and controlling production, the produced quantity, and running times of the plant as simple as possible. An Excel file export of the current data view is already included in the standard version to support these tools. It allows transferring lists with analyses to Excel to support internal processes optimally and enable necessary calculations.

A great benefit of the Hess data collection system is that all information can be accessed directly at the plant, administration, and any location in the world through a mobile device. The Hess router delivered with the plant only needs to be integrated into the customers' existing network so that all authorized devices in the customer's network can display the recorded data via a secure connection.

Even with several plants in the factory, a visualization of the previous and the current production is available at any time, e.g., for the plant manager or owner.

Item	Value	Unit
Production		
Total	3136	pcs
Empty boards	10	pcs
1st Selection	3130 / 99.8	pcs / %
2. selection	0 / 0	pcs / %
Reject	6 / 0.2	pcs / %
Pallets 1.	0	[pl]
Pallets 2.	0	[pl]
amount total	3136	layer
amount first	3130	layer
amount second	6	layer
amount waste	6	layer
Cycle time total	21	sec / pcs
Cycle time total	171.8	pcs / h
Cycle time production	15.1	sec / pcs
Cycle time production	238.7	pcs / h
Time accumulation		
Work time	18.25	h
Stop time	2.82 / 15.4	h / %
Waiting time	2.3 / 12.6	h / %
Production time	13.14 / 72	h / %
Automatic mode	15.43 / 84.6	h / %
Available	17.49 / 95.8	h / %
Waiting times	2.3	
C-Mix	0.58 / 3.2	h / %
F-Mix	0.32 / 1.8	h / %
Boards	0.08 / 0.4	h / %
Finger cart	0.35 / 1.9	h / %

Some ways to visualize the collected data: presented as a list of shifts or a pie chart of all produced items

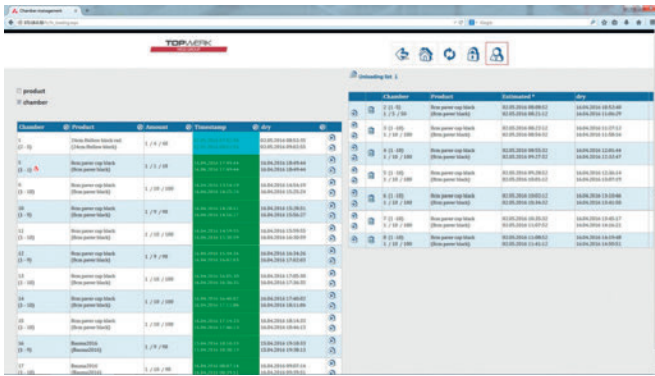The curing chamber data management of Hess Group

The order management in the Professional module enables the plant operator to record the planned products, the times, and the produced quantities according to the order.

Curing chamber management in the standard version

Hess also installs a detailed, dedicated visualization system if the delivery scope includes a finger car. The products that need to be stored in the chamber are recorded per elevator with a product description and a timestamp; this data will then be forwarded to the dry side. This enables, for example, an automatic change of the system parameters in case of a product change from the wet to the dry side without any operator intervention. The minimum and maximum curing time in the chamber can be managed, in order, to deliver the products for surface processing at the right time. In the visual chamber overview, the operator can always find the relevant information about the products in the chamber system. The operator can manually influence the time of clearing list removal or choose the fully automatic mode of chamber clearing according to the oldest production time. Furthermore, a wide range of options is available so that the operator can select all production of a particular product for taking them out of the curing chamber with a single mouse click.

Hess Software Module Professional

All options of the standard version are, of course, available in the professional version. In addition, the recording is not only limited to 24h but can also be recorded shift by shift. This is advantageous because production-free periods are not included in the evaluation; the shifts can be recorded, tracked, and compared individually. Identifying which employees were involved in tasks during the work shift is also possible. An order management system is also integrated into the module. The customer can not only inform the plant operators which products are to be manufactured but also record the times and produced quantities for each order, using the corresponding order number. By defining the orders that need to be completed, the plant supervisor can ensure that the plant is operated in a planned and trouble-free manner. With this, a fully comprehensive "paperless" production becomes possible.

One of the most valuable functions in the Professional version is the 'Master Recipe' function. This function allows to save
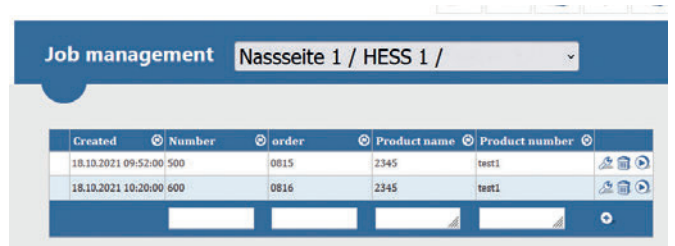
and secure specific settings of the machine (recipe/parameter set). Everyone can use this parameter set, but it is password protected for changing or even deleting. The recipes that the Hess process engineers create during the commissioning can therefore be saved as "standard recipes." This allows free access to the basic parameters at any time, as these programs are 'read-only.'

Hess Software Modul Ultimate

The Ultimate version is the most detailed software module. All production-specific parameters of a particular product can be recorded with this feature. All plant components are connected, and the product tracking is done on the production board level. As soon as a board has been produced, it receives a unique number in the Hess data acquisition system. Therefore, RFID chips in the production pallets are not required, reducing the initial investment costs and administration. The corresponding production parameters such as the vibrating force and vibration time, the tamper head pressure, and the product height measured by the machine
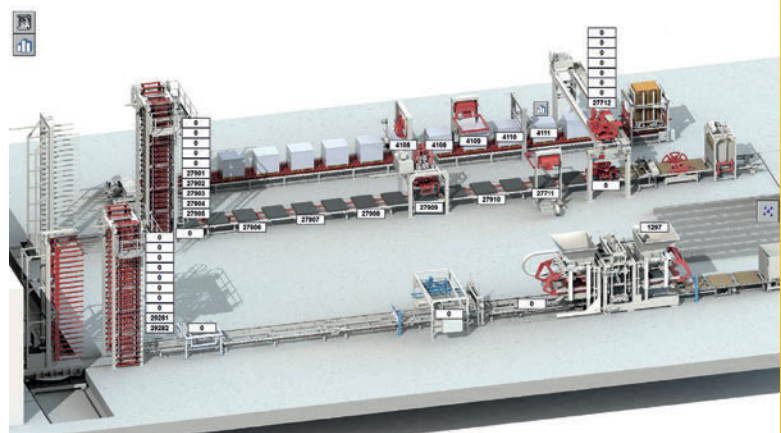
The complete manufacturing process is interconnected and monitored in the Ultimate Module. All data up to the finished product can be collected.

systems are specifically assigned to the single product board. Also, the data of the complete batching - and concrete mixing process can be recorded and assigned to the single Layer produced.

After production with the Hess machine, even more, quality-relevant information such as product weight, block heights possibly measured by laser, density data, etc., can be assigned to every production board. The timestamp for infeed and clearing is also recorded for the chamber system and the curing time for each board. Subsequently, on the Dry Side, the stacking time is recorded. If applicable, changed quality data on the dry side due to an inline Value Adding System (shot blasting or similar) are also recorded. A new block stack gets a specific stack number with a timestamp of the stacking and the assigned product information. With this stack number, necessary information, like layer data with details on shift, personnel, drying, quality, production, and mixture, can be recalled. This allows complete control of the whole manufacturing without any significant effort.

Product tracking. Single pallet

Item	Value		Unit
Plant	HESS 1		
Location	Local		
Plant part	Trockenseite 1		
Common data			
Job			
Product name	Uni 10 cm		
Product number	1102002		
Charge dry line	03.12.2021 06:00:00 - 06.12.2021 02:56:00		
Charge number dry line	83104		
Shift number dry line	1		
Shift dry line	03.12.2021 06:00:00 - 06.12.2021 06:00:00		
Production steps			
Number	290591		
Timestamp	03.12.2021 10:47:53		
Modified	---		
Production values			
Layer count	8		pcs
Amount (1.08)	8.64		m²
Count 1. Quality	8		
Count 2. Quality	0		
Count waste	0		
Count unknown Quality	0		
Product tracking			
Layer 1	2659283		
Layer 2	2659284		
Layer 3	2659281		
Layer 4	2659282		
Layer 5	2659279		
Layer 6	2659280		
Layer 7	2659277		
Layer 8	2659278		

Product tracking. Single layer

Item	Value		Unit
Plant data			
Plant	HESS 1		
Location	Local		
Plant part	Nassseite 1		
Plant part	Trockenseite 1		
Common data			
Job			
Product name	Uni 10 cm		
Product number	1102002		
Charge wet line	01.12.2021 06:00:00 - 02.12.2021 06:00:00		
Charge number wet line	83092		
Shift number wet line	1		
Shift wet line	01.12.2021 06:00:00 - 02.12.2021 06:00:00		
Job dry line			
Product name dry line	Uni 10 cm		
Product number line	1102002		
Charge dry line	03.12.2021 06:00:00 - 06.12.2021 02:56:00		
Charge number dry line	83104		
Shift number dry line	1		
Shift dry line	03.12.2021 06:00:00 - 06.12.2021 06:00:00		
Production steps			
Number	2659283		
Timestamp	01.12.2021 06:00:19		
To chamber	01.12.2021 06:06:24		
From chamber	03.12.2021 10:10:28		
Dry time	52.07		
Dtacked	03.12.2021 10:47:53		
Modified	---		
Production values			
Quality			
Amount	1.08		m²
Previbration time	0.20		sec
Mainvibration time	3.00		sec
Previbration speed	2600.00		rpm
Mainvibration speed	2850.00		rpm

Product tracking. Single batch

Item	Value		Unit
Plant data			
Plant	HESS 1		
Location	Local		
Plant part	Nassseite 1		
Common data			
Timestamp	01.12.2021 05:58:42		
Job			
Product name	Uni 10 cm		
Product number	1102002		
Charge wet line	30.11.2021 15:01:00 - 01.12.2021 06:00:00		
Shift number wet line	1		
Shift wet line	30.11.2021 06:00:00 - 01.12.2021 06:00:00		
Number	289215		
Batch number *	141142		
Charge number wet line	83086		
Production values			
Manual intervention	No		
Typ	C-Mix		
Dry mix time	620		sec
Wet mix time	0		sec
Humidity	0		liter
Calculated values			
Total weight	6300.75		kg
Weight aggregates	3273		kg
Weight cements	3025		kg
Weight colors	2.75		kg
Aggregate			
Kies 8/16 ()	331		kg
Kies 2/8 ()	1229		kg
Sand 0/2 ()	1713		kg
Cement			
CEM 42.5 Grauzement_ ()	3025		kg
Color			
Schwarz 355 ()	2.75		kg
Product tracking			

Acquisition of quality-relevant data per one pallet, layer, and stack

Extension module label printer

Optional the Ultimate software module can be extended for transferring the information to a label printer. In this case, a label with all the item information that the customer requires, the production parameters, and the stack number can be applied to the product cube. This stack number can then be printed as a bar code or QR code and thus enables easy access to the previously mentioned product data of the complete production and therefore serves as control whether this product was manufactured according to specification.

Additional software modules

In addition to the three versions Standard, Professional and Ultimate, further software modules are available, which can be implemented independently.

Integration with an ERP system

A company's business and operating information are currently collected with an ERP system, such as Softbauware, Navision, SAP, or similar. To have continuous documentation in the company, including the concrete production plant, Hess offers the option of providing all data relevant to the production, such as quantities and running times, to the ERP system for each specific product.

An exchange of information is straightforward due to the standardized SQL connections. It can be reported to the ERP system starting from the raw materials used, like sand, gravel, or cement, and ending with the manufactured goods in pieces, square meters, product stacks, and so on. Furthermore, the ERP system can report all automatic waiting and downtimes. Even an order-specific production is possible as the order numbers are entirely recorded by the production system and supplied to the ERP system with the relevant information.

Mold and tamper head management

Every concrete factory manufactures a wide range of different products and designs. Each product implies a different mold. Sometimes a mold can have different tamper heads, and even a small concrete product factory can easily have more than 20 different molds. This module is beneficial for the correct management of the various molds. A scanner can read the mold/tamper head marked with a barcode or QR code during the mold change. This allows the machine to adjust its parameter sets easily, and the data acquisition can assign all manufacturing cycles to this mold.

The software application allows allocating limiting Parameters to the mold as well as remarks of repairs in the system. This simple representation of the molds makes an overview of the lifetime and preliminary planning simple and possible.
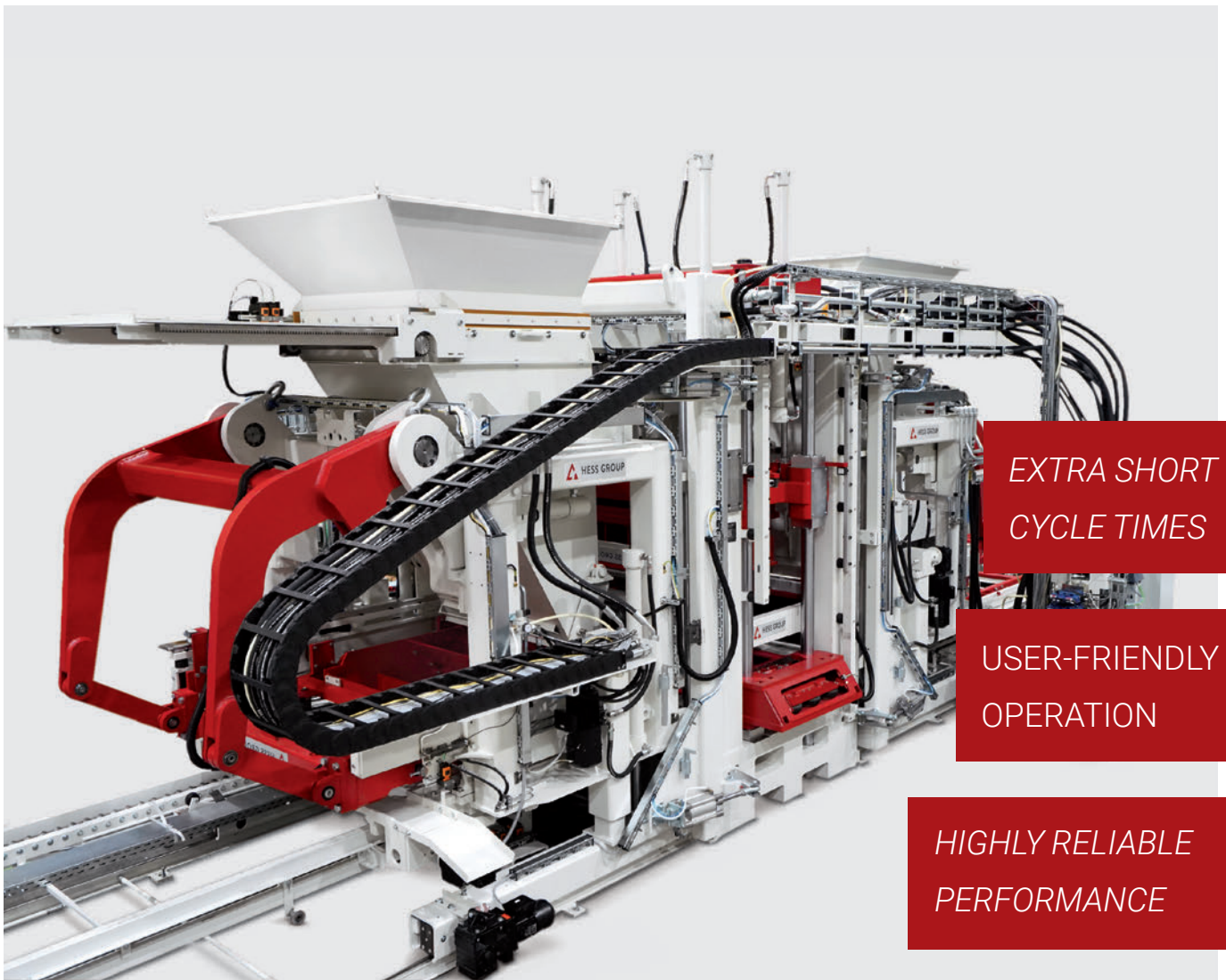
Parameter comparing

Every machine operator knows this problem: A product should be produced of the highest possible quality, but a quality difference can be recognized! The operator is convinced that everything was adjusted precisely the same way compared to the product, which is almost identical. However, the quality still does not match the requirements. The solution to this problem is the Parameter Comparison

The Ultimate software module can retrieve all required product data via QR code.
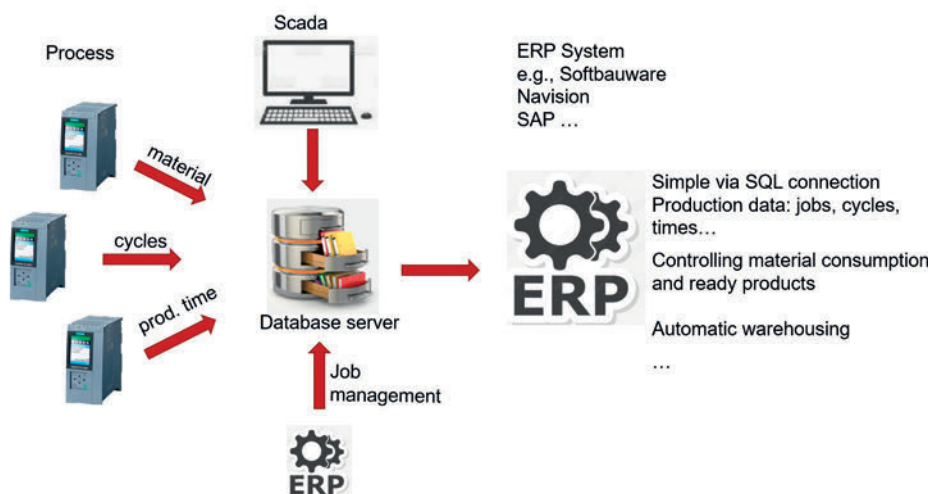
Hess can provide all production-relevant data such as quantities and runtimes to the company's ERP system on a product-specific basis.
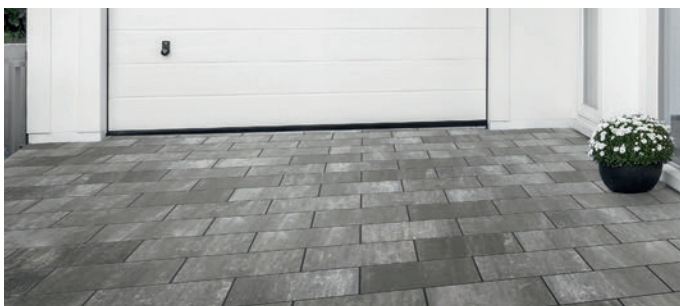
Module for mold and tamper head management

module. It provides the convenience of loading an "offline" program (green fields) in addition to the running machine parameters (blue fields) in the visualization and comparing these parameters directly frame by frame. A quick comparison is easily possible, and the quality can be improved again.

The trend towards collecting and analyzing data from production has also made its way into the world of concrete product plants. The implementation of Industry 4.0 in the concrete products industry offers great potential. Among other things, it is possible to increase the productivity of the concrete plant

and improve the quality of the final products. For this purpose, HESS GROUP offers an innovative collection of production data to implement these and other advantages of digitalization in the company and optimize the corresponding manufacturing processes, if necessary.

At bauma in Munich, the Hess Group will be providing information at its booth (B1.127 and B1.321) on how to achieve additional benefits with the Hess manufacturing statistics software. ◾
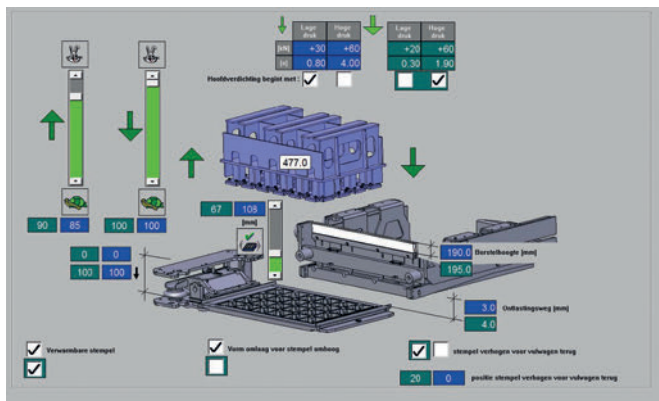
The parameter matching module provides a quick comparison between 2 identical products and enables a high & repeatable quality of the final products.

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