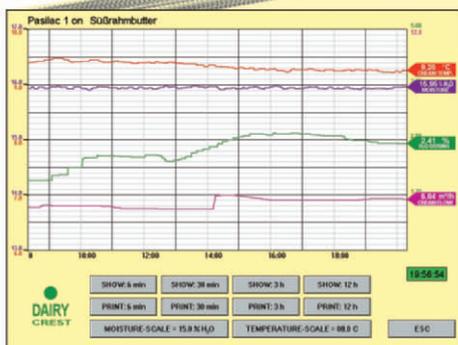
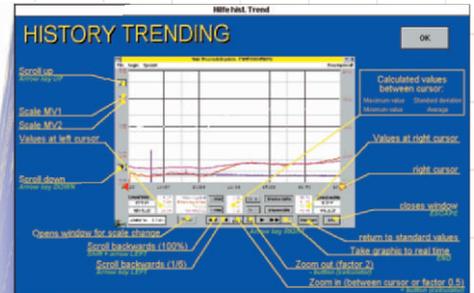
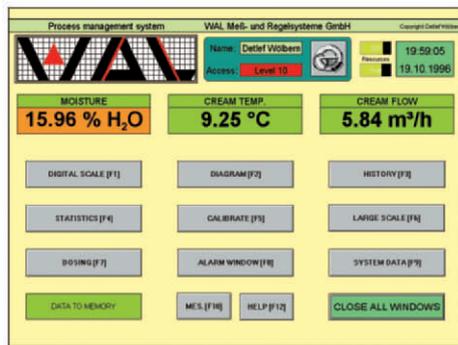


Process-Management-System

For online measuring and control of moisture on continuous butterchurns



Measurement:

- moisture content
- cream temperature
- cream amount
- recording of operational data (statistical functions)

Control:

- butter temperature
- buttermilk amount
- water dosing
- culture dosing
- salt dosing
- automatic calibration



GENERAL INFORMATION

The utilization of modern butterchurns with increasingly competitive national and export market conditions, today call for a continuously advancing optimization of the moisture and fat percentages in the butter. Furthermore, the parameters of solids not fat, minimum fat content, culture dosing and salt content are subject to increasingly stricter tolerances.

Today, it is no longer sufficient to effect laboratory examinations. It has rather become necessary to utilize a metering system directly collecting and adjusting all important process data during production.

The Process Management System is well suited to provide the man-machine interface for the purpose. All parameters and data essential for the process as, e.g., the moisture content, the butter temperature or the amount of cream, are being collected and/or controlled by the internal microprocessor system and then transmitted to the computer for further processing.

The system's accuracy now facilitates production within 0.1% H₂O below the legal limit without exceeding it. This constitutes a significant improvement compared to the possibilities that have been available till now. Given a daily output of 5t/h based on one-shift production, 0.1% butter fat not utilized, amounts to a profit loss of about 50.000 Euro per year. Therefore the financial returns are extremely attractive with paybacks often within a 12 month period.

There are additional cost savings due to reduced laboratory testing, that is fewer analyses being required. Similarly, automation of e.g. dosing pump control is continuously highly accurate compared to what the operator can achieve. Furthermore manual cleaning of the highly sensitive sensor is no longer necessary and it may be cleaned in the normal CIP cycle.

The time required to instruct operators will be short because of the user friendly process visualization operated with MS Windows®. The required entries and operations are described and displayed for the operator by means of clearly arranged screen menus.

The input required by the operator is significantly reduced through the inbuilt semi automatic calibration system which can be further enhanced through the option of direct connection of a laboratory scale or other systems to improve on the time required and to reduce errors.



Microprocessor system

A touch screen is offered to reduce operating time and eliminate any requirement for keyboard skills.

Utilizing a standard PC offers additional possibilities. For instance, a network connecting additional process visualization systems may be installed in the production or a remote-control system for maintenance and online support/assistance to reduce service call outs with the minimum of interruption to manufacture.

The integrated DDE interface facilitates the exchange of data with other programs operated with Windows® like, e.g., Excel®, Word® or Access®. Production data once acquired may thus be further processed by existing application programs and do not require changing to a different program.



MOISTURE CONTENT

A CIP capable sensor installed at the outlet of the butter churn continuously measures the moisture content of the butter and transmits the measured value to the Process Management System.

The sensor which is manufactured to a high standard to take into account the exacting requirements of today's food production sites, was developed by the WAL company. The fitting length of the device corresponds to the plants that were common up to now, thus reducing conversion costs.

One of the sensor's most important features is its temperature consistency up to 120 °C ensuring CIP capability.



Sensor and temperature probe in the process line

The inline cleaning of the sensor economizes on time and therefore costs with the operator free to perform other tasks.

Window for choosing PRODUCT TYPE	
selected product =	Salted Sweet Butter
zero point H ₂ O =	5.33 % H ₂ O
amplification H ₂ O =	1.00
middle value of H ₂ O-scale =	15.00 % H ₂ O
middle value of creamtemp-scale =	10.00 °C
setpoint moisture =	15.90 % H ₂ O
1.culture FR19 =	1.00 % culture 1
2.culture 4/25 =	1.25 % culture 2
setpoint saltcontent =	0.00 % salt
correction factor =	1.00
<i>please choose:</i>	
<input type="radio"/> Salted Sweet Butter <input type="radio"/> Unsalted Lactic <input type="radio"/> Salted Sweet Butter <input type="radio"/> Salted Lactic	<input type="button" value="load product"/> <input type="button" value="save product"/> <input type="button" value="delete product"/> <input type="button" value="ESC"/>

„Type“ window

Provided that the moisture is well and evenly distributed, this measured value will be indicated with an accuracy of $\pm 0.05\% \text{ H}_2\text{O}$. The normal setting for the measuring range is 13.0 to 17.0 % H₂O, however, it may be adjusted to the customer's request.

Due to the measuring accuracy, a moisture content of 15.9 to 16.0 % H₂O may be targeted to achieve maximum efficiency. This still ensures that the legal limits will not be exceeded.

The system is designed for the accurate moisture content measuring of sweet and sour cream, slightly lactic butter, NIZO butter as well as salted butter and spreads through the use of pre-selected setpoints which the operator chooses from for that day's particular manufacture.

This way, only a single input of the desired parameters is required. These subsequently constitute a data record allocated to the respective product. Time-consuming and repeated modifications of, e.g. the set values are completely eliminated saving time and avoiding mistakes. Please also refer to the section "water dosing".

CALIBRATION and AUTOMATIC CALIBRATION

Samples which are subsequently analyzed in the laboratory, are taken from the ongoing production process.

As soon as the actual sample for laboratory reference is taken it is “marked in the calibration window” ensuring the current time and corresponding measured value is registered. A minimum of 3 calibration sample are recommended for each run/cream vat.

The operator enters the laboratory result after verification.

The system is automatically calibrated by selection of a single key.

Accurately taken and tested samples improves the performance of the Process Management System to a high level.

CALIBRATION ButterZuor10				
TIME:	VALUE:	LAB RESULT:	DIFF.:	SELECTION:
09:53:28	15.80 %	15.80 % [A]	0.00 %	✓
09:53:28	15.80 %	15.95 % [B]	-0.15 %	✓
10:02:11	15.80 %	0.00 % [C]		✗
10:02:12	15.80 %	0.00 % [D]		✗
Zero point :		9.18 %		
HELP [F1]				
SAMPLE [S]		CALIBRATE [Z]		ESC

„Calibration“ window

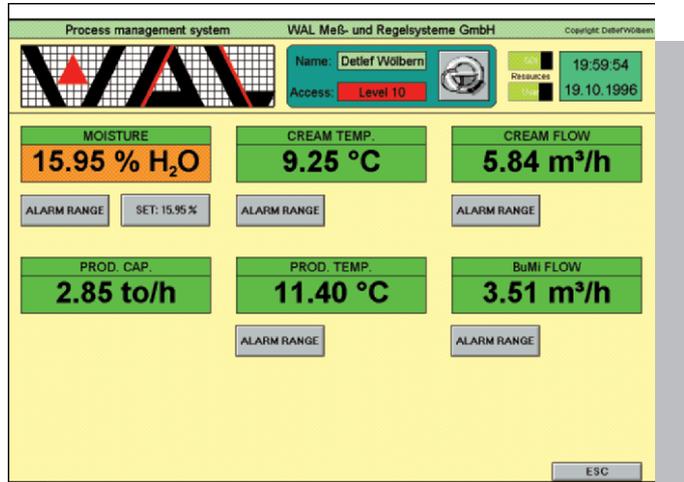
(OPTION: XOPHT2OWAF)

For calibration purposes, a laboratory scale, linked directly to the system is available to reduce potential errors. This system is based on a halogen drier and does the evaporation and calculation automatically (without user assistance). Therefore the repeatability is better than 0,05%.

CREAM TEMPERATURE

In order to monitor the quality of the incoming cream, a fast response and highly sensitive temperature sensor (Pt100) is inserted into the

supply line continuously recording the cream temperature within a measuring range from 0 to 15 °C. Stability of cream temperature is closely linked to minimal moisture variations in production. This measured value is therefore an important production factor.



Window displaying the measured values

To allow the operator to input to the overall quality assurance of production, continuous display of temperature parameters are shown on the screen.

BUTTER TEMPERATURE (OPTION: XOPHT2OBTE)

Another temperature sensor (Pt100) is inserted at the outlet of the butterchurn. It provides continuous recording of the butter temperature within a measuring range from 0 to 15 °C thus allowing for additional control of the production process. This parameter is important in order to ensure good consistency and in order to ensure good consistency and spreadability of the butter.

The combined parameters described provide a simple and reliable production analysis to ensure quality consistence of the butter produced.

PRODUCTION OUTPUT (OPTION: XOPHT2ORME/RMA)

Moisture, salt and culture contents are indicated as % of butter throughput, therefore the



system requires continuously, the amount of cream entering the churn.

This measured value is given to the system by a magnetic inductive flow meter or massflow meter (coriolis) which is installed in the cream supply line.

Using entered data such as cream fat results from the laboratory together with dosing and measured amounts the system accurately calculates the butter amount being produced.

WATER DOSING (OPTION: XOPH2OWDA)

CULTURE AND SALT DOSING (OPTION: XOPH2OKDA)

Moisture as well as the culture and salt contents have to be adjusted in accordance with the current measured values to ensure optimal production with the quality remaining consistent. For this purpose, the Process Management System contains an “intelligent” dosing system which may control up to 6 pumps.

The entries needed to effect the adjustment are performed by the operator via a single window in which the desired set values for the moisture content, the salt content and the culture are displayed and controlled, including inputs such as cream fat percentage.

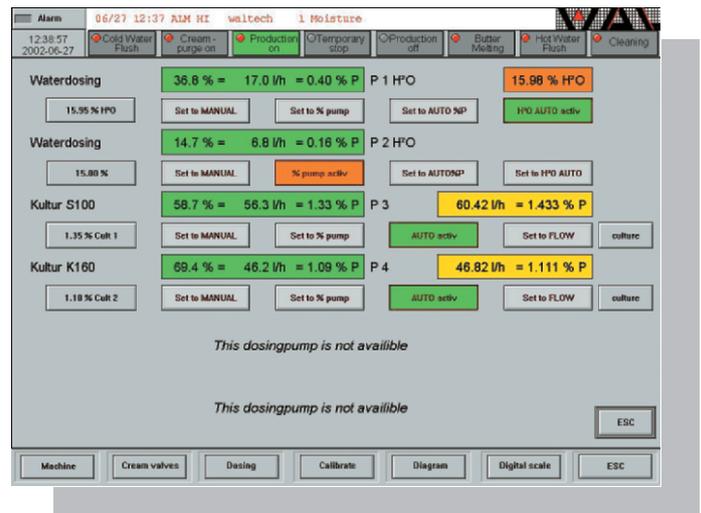
The set values are given automatically, provided a product type for which the corresponding data already exists is selected. - Please also refer to the section “Moisture content”.

The set values and the amount of butter are relevant for controlling the culture and salt pumps. Modifications made to these are immediately compensated for, by a precise water dosing adjustment, so that the measured value of moisture content is not effected.

The moisture content is then adjusted depending on the set value, the cream fat percentage and the amount of butter.

Whether production is currently ongoing with the adjustment system activated or the cleaning process is underway, is determined via switch selection or automatically with signals from the butterchurn. This way, e.g. the dosing pumps

are automatically set to an output of 100% in the CIP mode to ensure optimal cleaning.



„Dosing“ window

CONTROL OF DOSINGPUMPS (OPTION: XOPH2OKDR)

with an inductive flowmeter per pump for culture or salt including necessary hard- and software.

With this system the accuracy of dosing can be further increased. Additionally an alarm is possible if the dosingvalue is out of range. (Option RME or RMA, WDA and KDA are necessary)

CONTROL OF SALTDOSING (OPTION: XOPH2OMDR)

with a mass-flowmeter and densitometer including necessary hard- and software.

With this system the accuracy of salt dosing can be further increased. Additionally an alarm is possible if the dosingvalue is out of range. The system checks the concentration of salt solution by measuring the density. If the concentration fluctuates, the system corrects the salt dosing quantity depending on the salt percentage of the slurry.

Herewith the standard deviation of salt in butter is better than, 0,01%. (Option RME or RMA and KDA are necessary)



RECORDING OF OPERATIONAL DATA

In order to document the current process data, all measured values are recorded in a graph window. The visible range may be changed in four steps showing any period from 6 minutes to 12 hours. All views may be printed out with the color printer, included in the scope of delivery, information recorded and filed for review at a later date.



„Graph memory“ window

In addition, the graph window or a print-out may be referred to for error analysis in case irregularities occur during the production process. For ensuring uniform documentation of all acquired operational data, inclusive quality assurance, ISO 9000 (and following standards), GLP certifications a memory graph is integrated into the Process Management System providing operators and management with a simple but effective tool.

In order to allow for reviewing the process data at a later date, all data is stored on hard disk for minimum 1/2 year, meaning that it is possible to review and analyze data from a production of, let's say, 3 weeks ago, in detail.

(OPTION: XOPHT2OBDE)

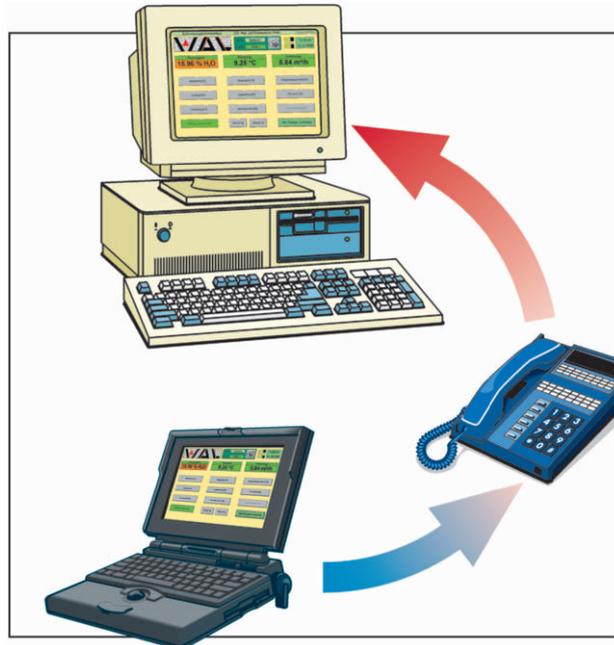
A complete analysis of the butter production requires the amount of buttermilk produced as an additional value to be measured. A second magnetic-inductive flow meter inserted into the buttermilk outlet line provides this.

An additional statistics window offers a complete overview of production data like, e.g., the average moisture content and standard deviations, cream processed, the average cream temperature, the production time or the amount of butter produced.

The data shown in this window is automatically printed out every day at the same time in order to provide comparative values of the production data. Nevertheless, the print-out may also be requested manually and can be specifically tailored to management requirement.

ON-LINE ASSISTANCE REMOTE CONTROL (OPTION: XOPHT2OLLW)

Working with the Process Management System is facilitated by extensive on-line assistance and instruction windows. At the same time, ensuring only a short period is required by operators and management to become familiar with and use the system fully.



Remote control system

This way, the risk error is almost eliminated, ensuring a smooth production process.

In case further assistance will be required, support may be obtained directly from the ma-



nufacturer by utilizing a remote control system, thus avoiding potential periods of production downtime. The plant computer will then be controlled via the regular telephone line by means of a modem. Software updates may also be transmitted in this way.

ALARMS AND WARNINGS

The alarm function calling the operator's attention to potential production errors, constitutes an important function of all automatic plants.

Prior to enabling an alarm signal to be given, limit values have to be entered.

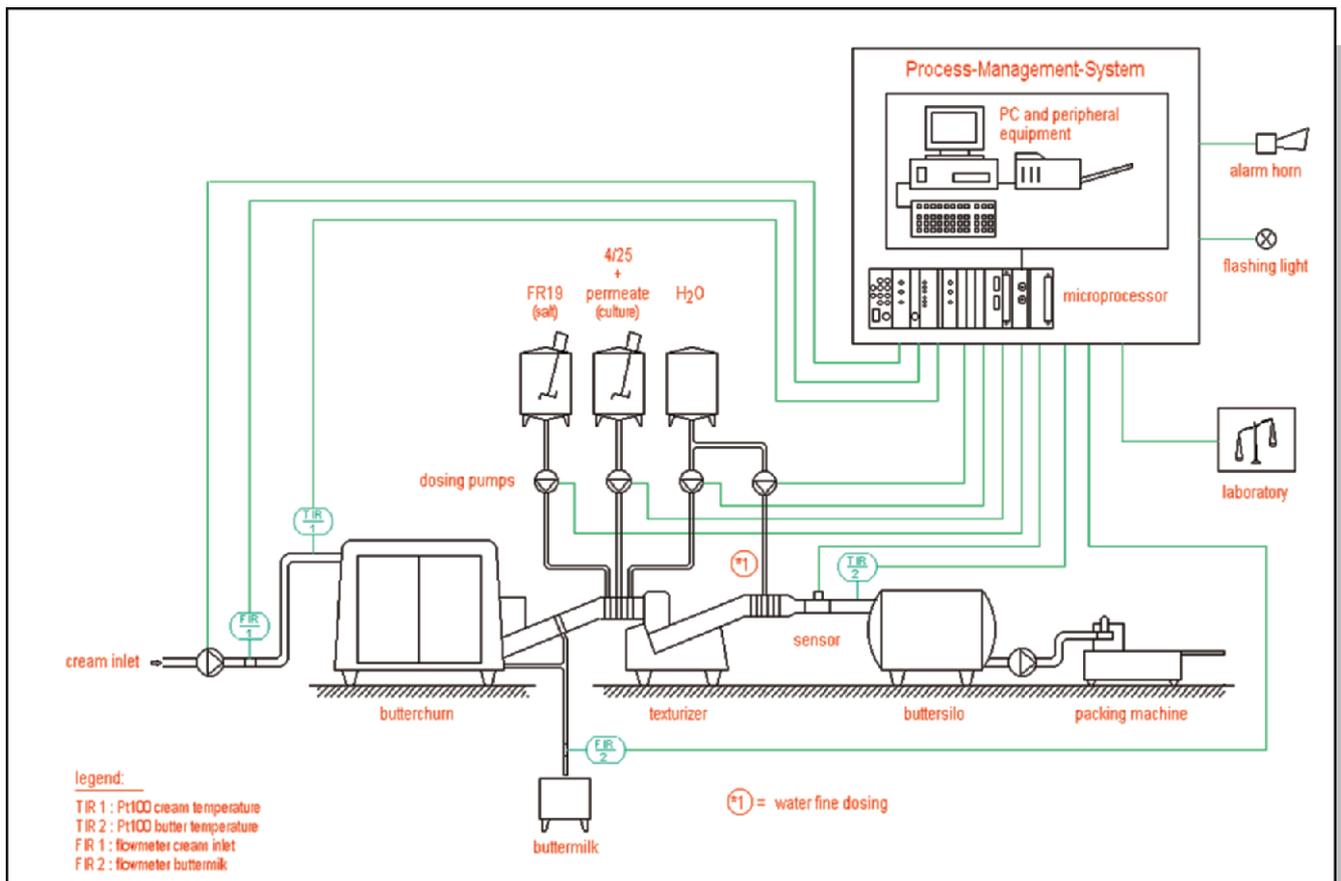
This is effected via limit value windows which may be used for all recorded parameters in one single display screen. These are set up and appear in an analogue form for recognition and checking.

There is also the option to enter pre-alarm limits when determining the limit values. If this is done, the system may warn the operator of errors at an early stage, thus allowing parameters are influenced.

All current alarms are indicated along with the dates, times and names of the operators in a separate window. Thus, uniform documentation of the production process for quality assurance is provided.

Alarm signals have to be acknowledged on a separate screen, thus providing a degree of corrective action and "checkability".

INSTALLATION SCHEME



TECHNICAL DATA

Control cabinet (option: XOPHT2OPUL):

desk-type cabinet from stainless steel
AISI 304 (1.4301)
1500 mm x 1170 mm x 600 mm (W x H x D)

Power supply:

230 V AC / 50-60 Hz / max. 1000 W

PC:

standard PC, IBM compatible
Intel processor of latest generation
operating system: MS Windows®

TFT-Monitor:

17", 1280 x 1024 resolution

Keyboard:

front panel build-in keyboard, A6 type
IBM XT/AT and MF 2 compatible

Touch screen:

17" touch panel
4096 x 4096 points per axis

Printer:

inkjet color printer
min. 1200 x 1200 dpi, colored

Data storage:

minimum 1/2 year onto hard disk
unrestricted access possible

Microprocessor:

1 moisture content sensor,
16 analog inputs
16 digital inputs
16 digital outputs
2 RS 232 interface

Moisture content measuring:

Measuring principle: electronic analysis of dielectric constant
Measuring range: 13 - 17 % H₂O (other measuring ranges are optional)
Measuring accuracy: ± 0.05 % H₂O absolute
Repeatability: 0.02 % H₂O

Moisture content sensor:

Material: parts that come in contact with product are made from stainless steel AISI 316Ti (1.4571)
Temperature: max. 120 °C
Fitting length: 280 mm
Nominal diameters: DN 100, DN 125, DN 150 DN 200 (different sizes on request)
Connections: milk pipe thread DIN 11851

Cream temperature measuring:

Measuring principle: Pt 100
Measuring range: 0 - 50 °C
Measuring accuracy: 0.15 K
Repeatability: 0.02 K
Reaction time: $\tau_{50} = 1.2$ s

Butter temperature measuring:

Measuring principle: Pt 100
Measuring range: 0 - 50 °C
Measuring accuracy: 0.3 K
Reaction time: $\tau_{50} = 3.2$ s

Cream amount measuring:

Measuring principle: magnetic-inductive flow meter
Measuring range: 0 - 20 m³/h
Measuring accuracy: 0.25 %
Repeatability: 0.1 %

Buttermilk amount measuring:

Measuring principle: magnetic-inductive flow meter
Measuring range: 0 - 20 m³/h
Measuring accuracy: 0.25 %
Repeatability: 0.1 %

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