Higher economy and consistent quality through on-line measurements of fat-, protein-, TS- and lactose content

HARRER KASSEN

Dairies and Creameries

Liquid Products
Milk
Evaporated Milk
Condensed Milk
Cream
Jogurt
Desserts
Whey Drinks
Mixed Drinks

Cream Cheese
Curd
Cream Cheese
Cottage Cheese

Mascarpone
Ricotta

Pasta Filata Cheese
Mozzarella
Burrata
Ragusano

Butter

Fermented Cheese
Soft Cheese
Semi hard Cheese
Hard Cheese

Measurement Dry-Solids with Microwave-Instruments

Processed Cheese

Milk Powder
Whole Milk Powder
Skimmed Milk Powder
Buttermilk Powder
Yogurt Powder
Cream Powder
Curd Powder

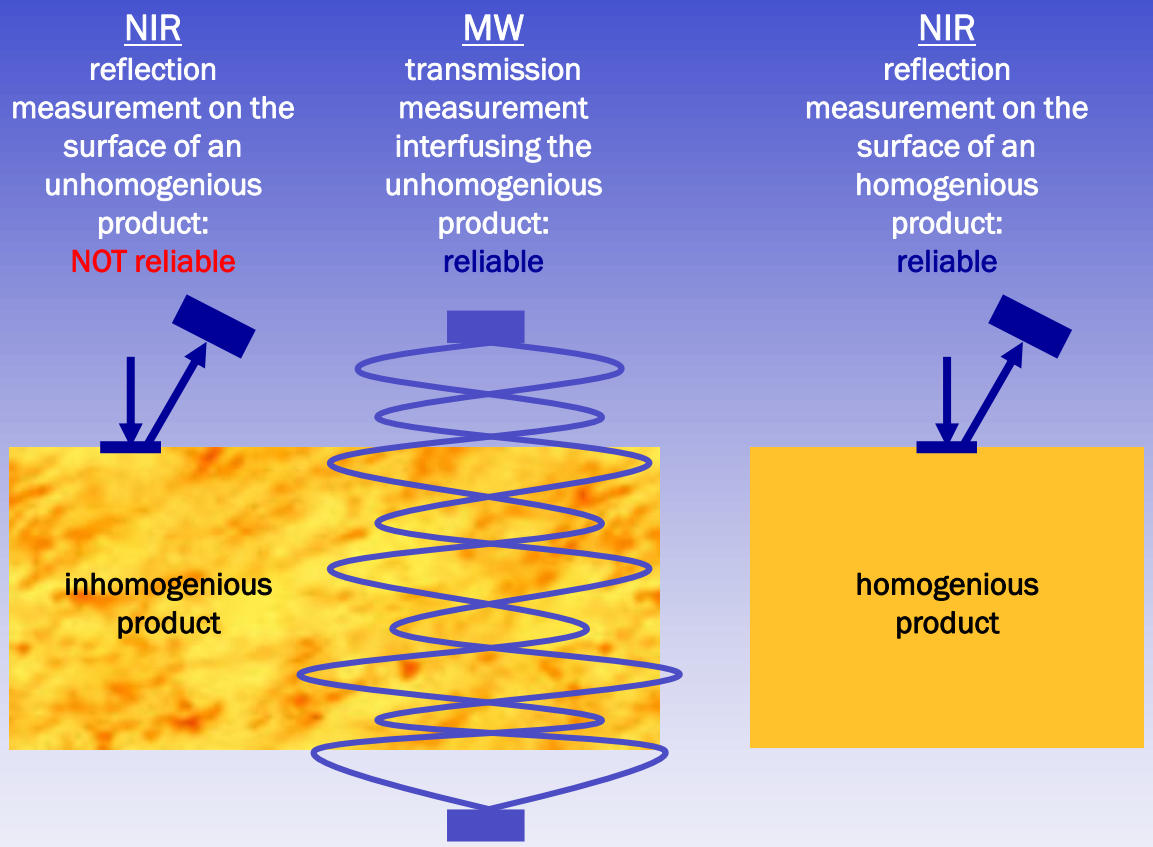
A steadily growing demand for online-measurements due to:

- further increasing quality requirements after ISO and EU standards,
- quality assurance,
- standardisation and online-trend observation.

Differences: Microwave - NIR

	Microwave	NIR
Constituents	1 / H_2O (Dry Solids, Watercontent)	4 / H_2O, Fat, Protein, Lactose, Salt, ...
Conditions	no NaCL (Salt), no metal, no air bubbles	homogeneous product, No air bubbles
Location	conveyor belt, rising pipe, tank	pipe, tank, blender
Principle	transmissive	reflective
Coverage	total product	product surface
Colour	no influence	no influence

Principles of Measurement

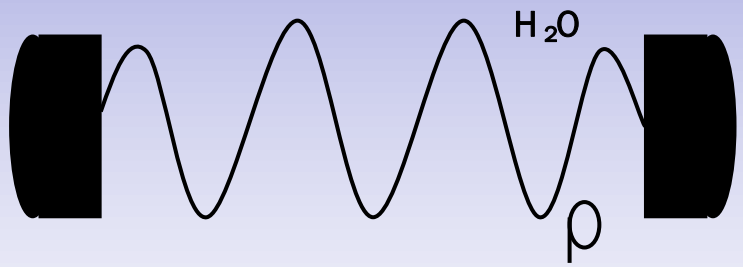


To achieve a realible detection of the total solids in cheese blanks, only the interfusing method comes into consideration.

Microwave - Technology

The microwave instrument generates an electromagnetic wave of low energy, which is irradiated the cheese **via an antenna** . The wave dispreads in dependance of its dielectric characteristics. A second antenna receives the wave. Energy and phasing of the received wave are indicators for water content or total solids.

Microwave measurements are distinguished for high stability and very fast responding properties.



Preconditions for very good measuring results:
Within the measuring section is neither salt (NaCl) nor metal!

Microwave - Applications

Measurement of Water Content / Dry-Solids

all measurements before add-on of salt

Milk
Fermented Cheese
Cream Cheese
Ricotta
Mozzarella
Pizza-Mozzarella
Butter
Evaporated Milk
Condensed Milk
Cream
Yogurt

Applications

MW-Technology HK1

Applications are all milkbased liquid-products with different consistency.
During processing the products are running through
pipes, tanks or flow hopper.

Flow-cells
pressure ≤ 10bar
for pipes
DN50 – DN150

3A-spiralantennas
with process-connection

Flow-cells
pressure ≤ 20bar
for pipes, tanks or
flow-cells

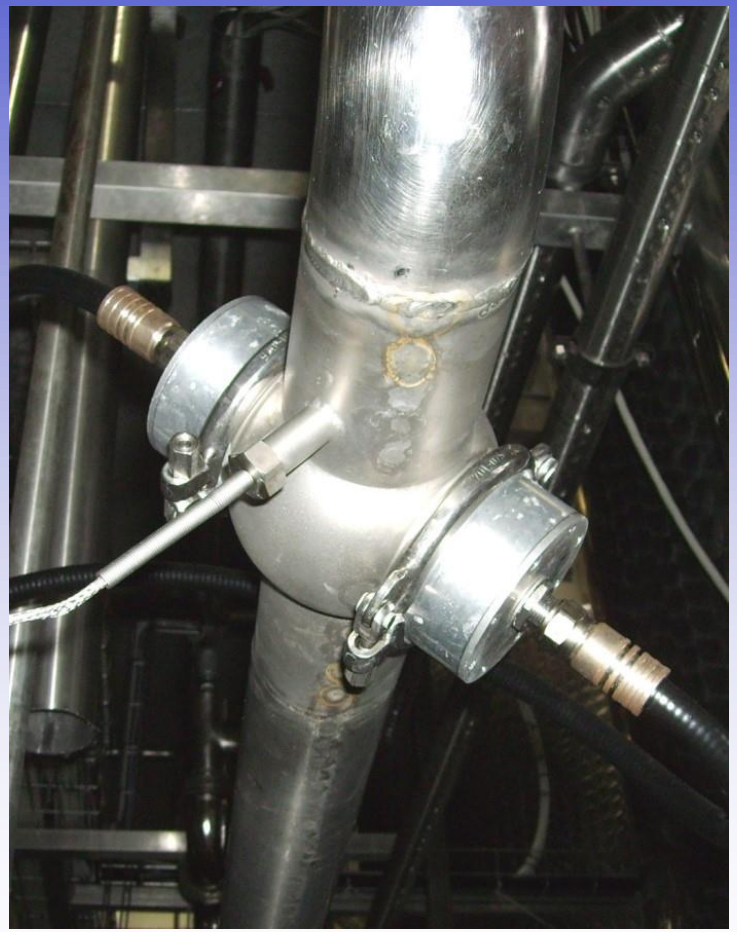
short 3A-pinantennas
with welding-sockets

Milk, Cream cheese, Ricotta, Pizza-mozzarella, Butter, Concentrate,
Condensed milk, Evaporated milk,
Curd, Cream, Yogurt.

Decentralised systemdesign

MW-Technology

Measurement of 1 constituent (H_2O: dry-solids / water content)



Functionality and design

MW-Technology HK1

-Stainless steel housing HK1
hxwxd : 300x500x170mm

-Antennas (stainless steel) with process connection for flow-cells

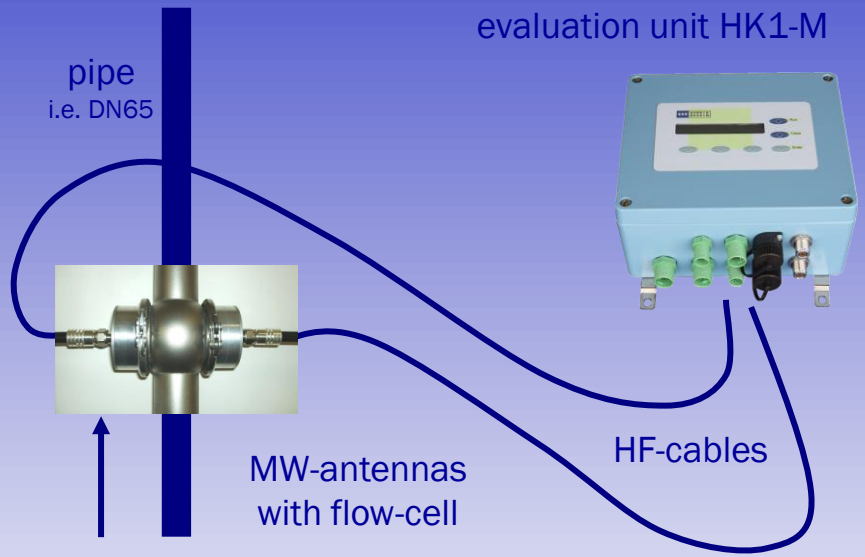
-2 Analogue signal 0/4 – 20mA

-Serial interfaces: RS232 or RS485

-Connection sensor system – evaluation unit:
2 x HF-cable / each 2m

-Sensor system: 2 x 3A-spiralantennas or
2 x short pinantennas

-Trend visualisation and data archiving

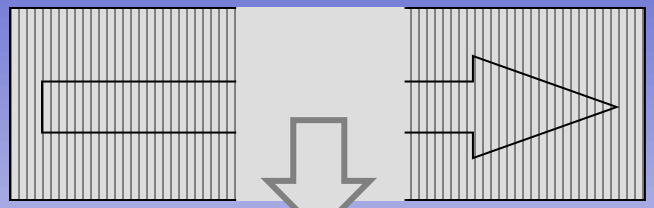


The measurement is contactless, the measured values of the water- or dry-solids content are available as digital and analogue values. The HK-instruments are applicable as continuous online-measurements in different industries and in different production lines for milk processing.

Because of further increasing quality requirements after ISO and EU standards, the industries have an enhanced demand for improved
quality assurance, standardisation and online-trend observation.

MW-Technology HK1

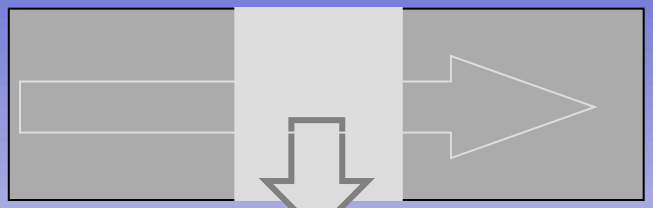
Production



Sample analysis HK1

+

Laboratory-reference



Laboratory values

input calibration

alignment of values

The sampling point is located close to the measurement point!

MW-Technology HK1

Display, Control, Archiving

Dairy liquid-products pipe

PCS

manual / auto

actuator

control value

Y

control deviation

Dry-solids%

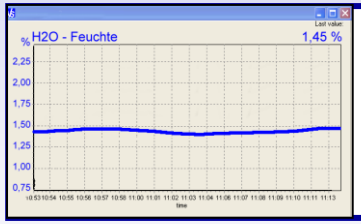
continuous average values

analogue signal (0/4-20mA)

digital

scope of supply Harrer&Kassen

Antennas



VisualSpecter

	current	total
Dry-solids	1,5	1,45

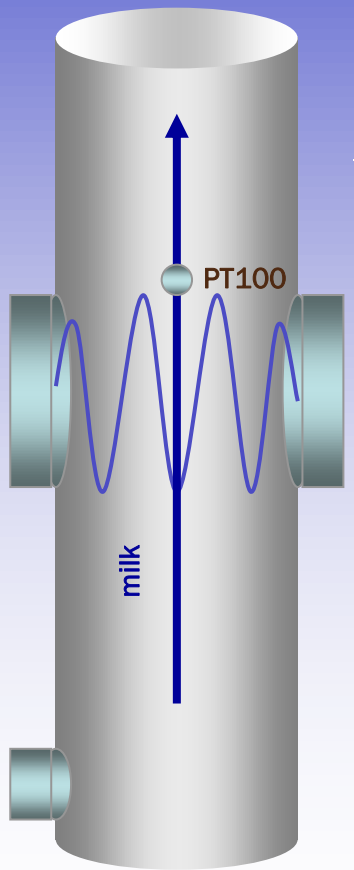
measured data / HF-cable

further processing

Applications

Milk, Cream Cheese, Curd, Ricotta, Jogurt, Cream,
Pizza-Mozzarella, Evaporated Milk, Condensed Milk, Butter

Milk



pressure
≥ 1,5 bar

sampling

cleaning, pasteurise

coagulation
add on of lactobacilli

curd cutting

centrifuge

heating
washing

separation of whey

filtering
cooling

cooling

optionally add on
of cream

bottling

cream cheese

farmers
cheese

cottage cheese

whey
heating
80° C

coagulation
heating

separation
acid-
whey

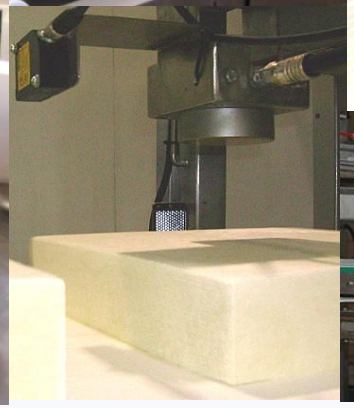
moulding

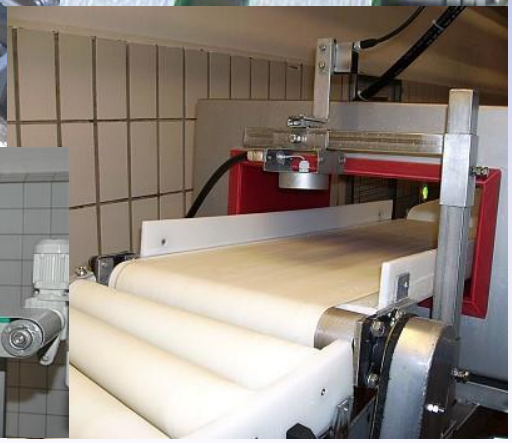
ricotta

Application Fermented Cheese



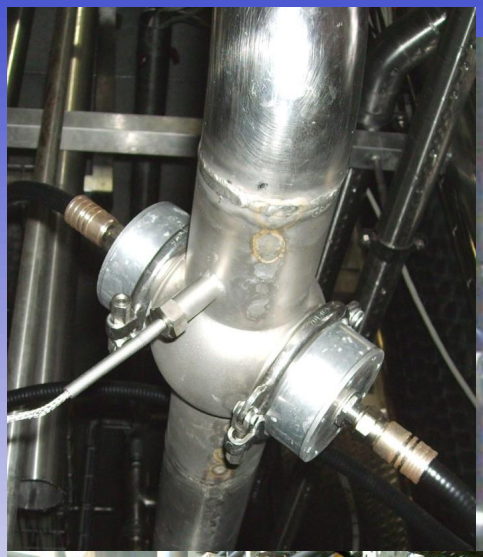






Applications

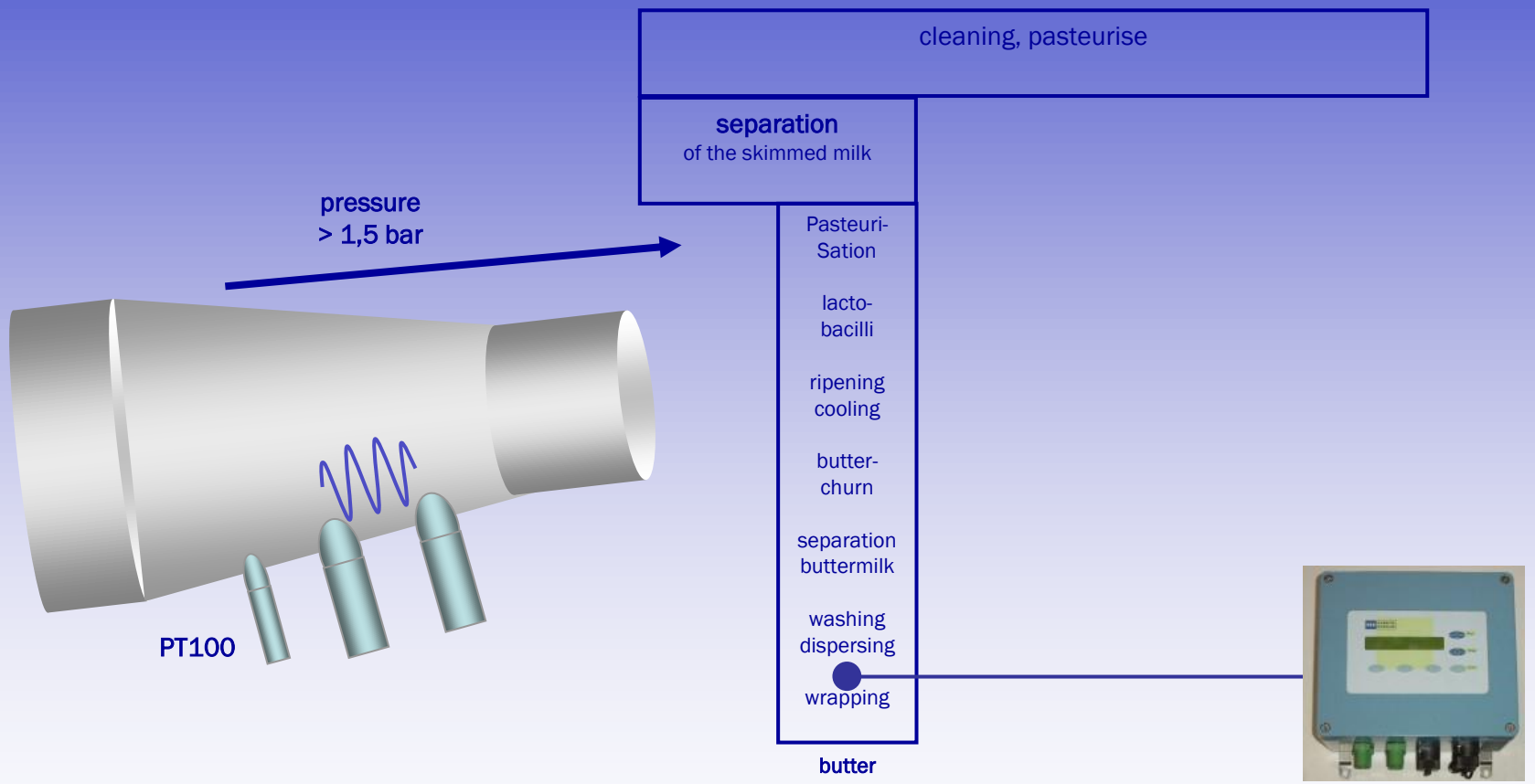
Milk, Cream Cheese, Curd, Ricotta, Jogurt, Cream
Pizza-Mozzarella, Evaporated Milk, Condensed Milk, Butter



Applications

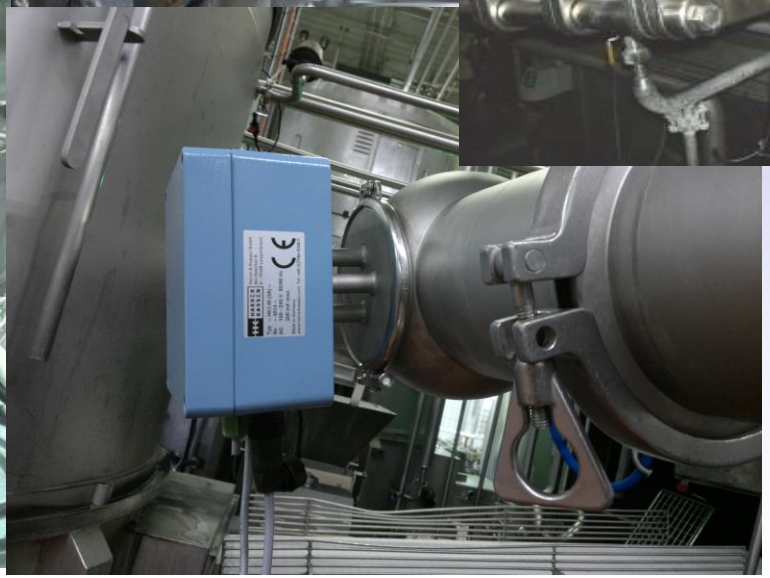
Butter, Pizza-Mozzarella

Milk



Applications

Butter



Technical Data

MW-Technology HK1

Environmental temperature	-20° C to +85° C
Product temperature	0° C to +130° C
Product pressure 3A-spiralantennas	≤ 10bar
Product pressure short 3A-pinantennas	≤ 20bar
Principle	Microwave measurement
Measure value / Constituents	1 constituent / water
Analogue outputs	2 x 0/4 – 20mA
Stainless steel housing evaluation unit	300 x 500 x 170mm
MW-sensor / 3A spiralantennas	with process connection for pipes
MW-sensor / short 3A-pinantennas	With process connection for tanks andflow funnels
PC-interfaces	serial RS232 or RS485
Ambient light	no influence
Product colour	no influence
Power supply	85 – 270 VAC / 24V DC/DC
Protection class	IP67

NIR- Spectrometer

Dairy liquid-products

Continuous on-line-measurement
water-, fat-, protein- and lactose content

Range of application

NIR- Spectrometer

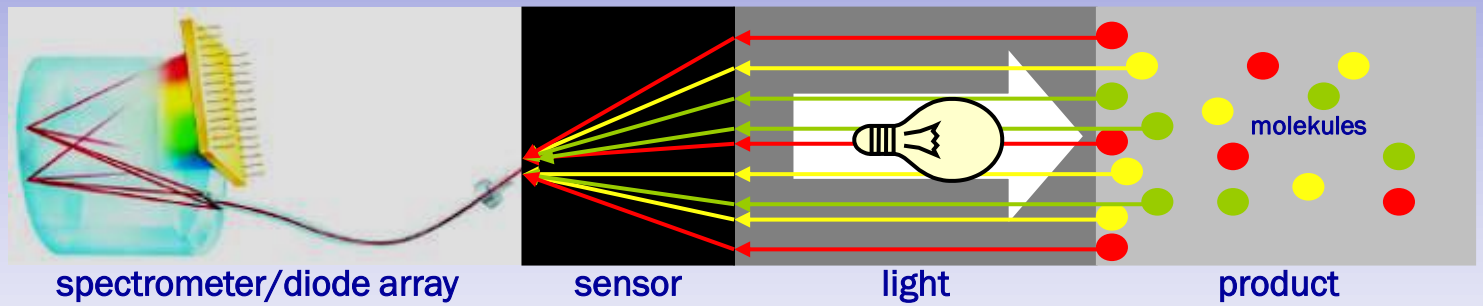
Infrared-Measurement in the NIR-range for the detection of water-, fat-, protein- and lactose of milk based liquid-products in pipes, tanks and flow funnels.

Milk, cream cheese, ricotta, pizza- mozzarella, butter, concentrate, condensed milk, evaporated milk, mascarpone, processed cheese, curd, cream, yogurt.

NIR - Spectroscopy

In the NIR-measurement technology the surface of the product is illuminated by white halogen light. An optical fiber sensor transfers the data, measured after the transmissive or reflective principle, to the diode array. The evaluation with a diode array realize the measurement of every organic constituent with an absorption line in the detected spectrum.
Mainly this are molecules of the CH-, OH- and NH-compounds.

The measurement is not influenced by colour variation



Preconditions for very good measuring results:

- The place for measurment should be selected carefully
- During measurement the sensor system always should be covered with product.

Applications

NIR- Spectrometer

Applications are all milk based liquid- products with different consistencies. During processing the products are running through pipes, tanks or flow hopper.

Flow- cell

pressure
≤ 10bar

for pipes
DN50 – DN150

Tank- cell

pressure
≤ 10bar

For tanks and flow hopper

Milk, Cream cheese, Ricotta, Pizza-mozzarella, Butter, Concentrate, Condensed milk, Evaporated milk, Mascarpone, Processed cheese, Curd, Cream, Yogurt

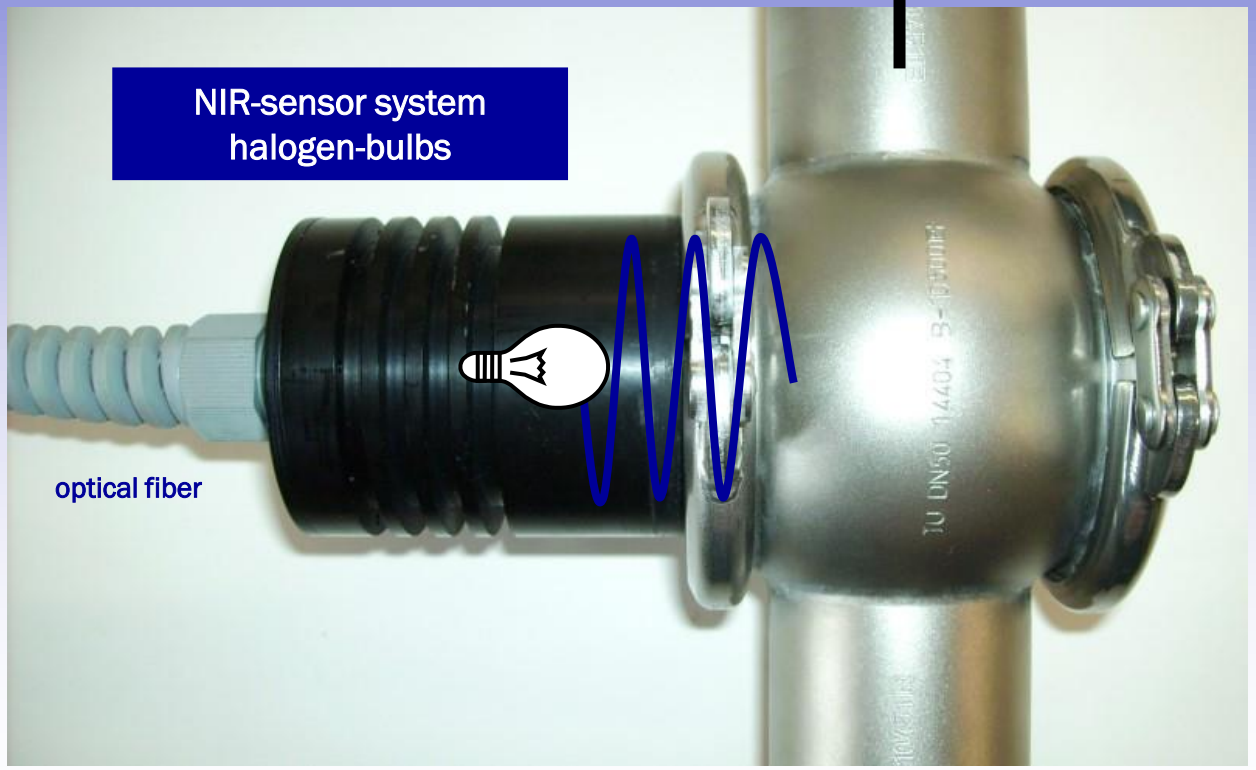
Applications

Milk, Cream Cheese, Curd, Ricotta, Mascarpone, Jogurt, Cream,
Pizza-Mozzarella, Evaporated Milk, Condensed Milk, Butter, Powder

tank-cell:
application in blenders

≤ 10bar

product
salted



flow cell

bulb housing
NIR-sensor system

Decentralized system design

NIR- Spectrometer

HK4-2: Measurement of up to 4 constituents

Functionality and design

NIR- Spectrometer

-Stainless steel housing HK4
hxwxd: 300x500x167mm

-Sensor system (stainless steel) with process connection for flow- an tank- cells

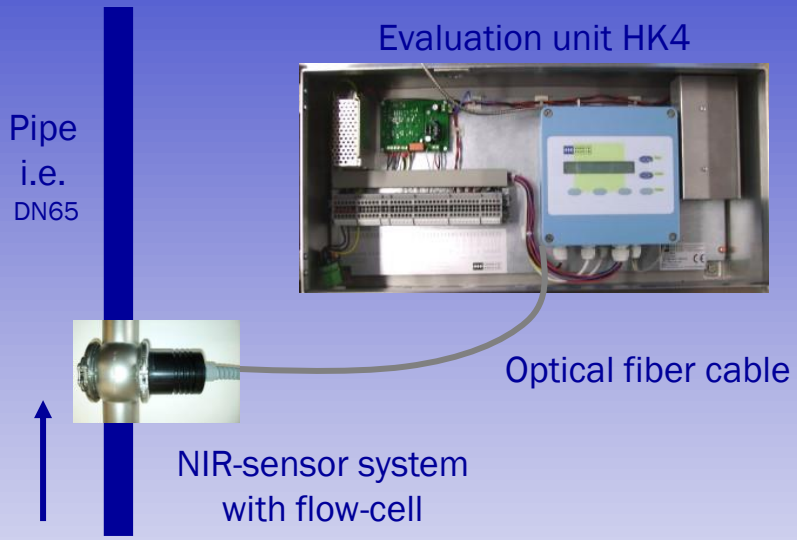
-4 Analogue signals 0/4 – 20mA

-Serial interfaces: RS232 or RS485

-Connection sensor system – evaluation unit: optical fiber cable ≤100m

-Sensor system : 4 halogen bulbs

-Trend visualization and data archiving



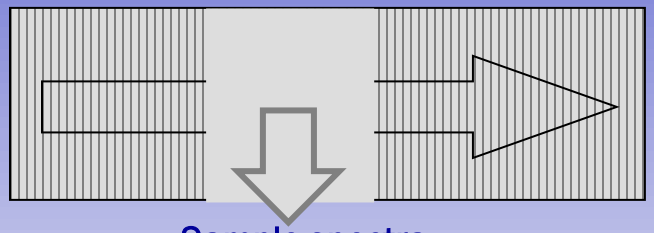
Continuous NIR reflection measurement with diode array.
The NIR- Spectrometer consists of the evaluation unit and the sensor system, connected via optical fiber cable.
The measurement is contactless, the sensor system and the product are separated through a borosilicate or sapphire glass.
The measured values of the H^2O-, fat- protein- and lactose content are available
As digital and analogue values.

Calibration

NIR- Spectrometer

The Samples must be cover the whole measuring range.

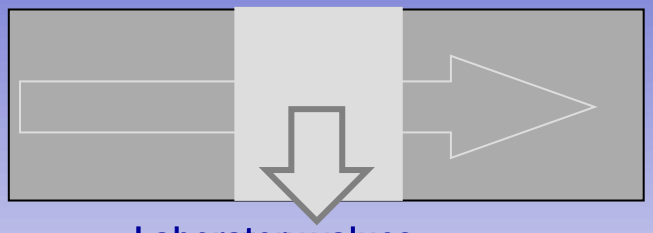
Production



Sample spectra

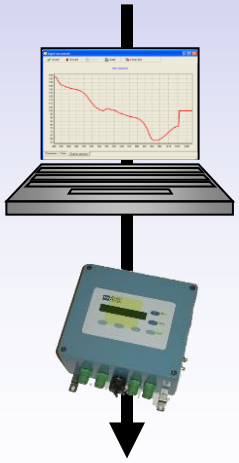
+

Laboratory - reference



Laboratory values

regression



The sampling point is located close to the measurement point!

Display, control, archiving

NIR-Spectrometer

Dairy liquid- products pipe

PCS

Manual / auto

set point W

Control value

actuator

Regelabweichung

Y

Dry solid%
fat %
protein %
lactose %

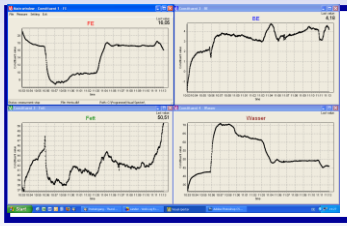
continuous
Average values

Analogue signals (0/4-20mA)

digital

Scope of supply
Harrer&Kassen

Sensor



VisualSpecter

	current	total
dry solids	11,1	11,7
fat	1,9	2,2
protein	3,3	3,8
lactose	-	-

HK4

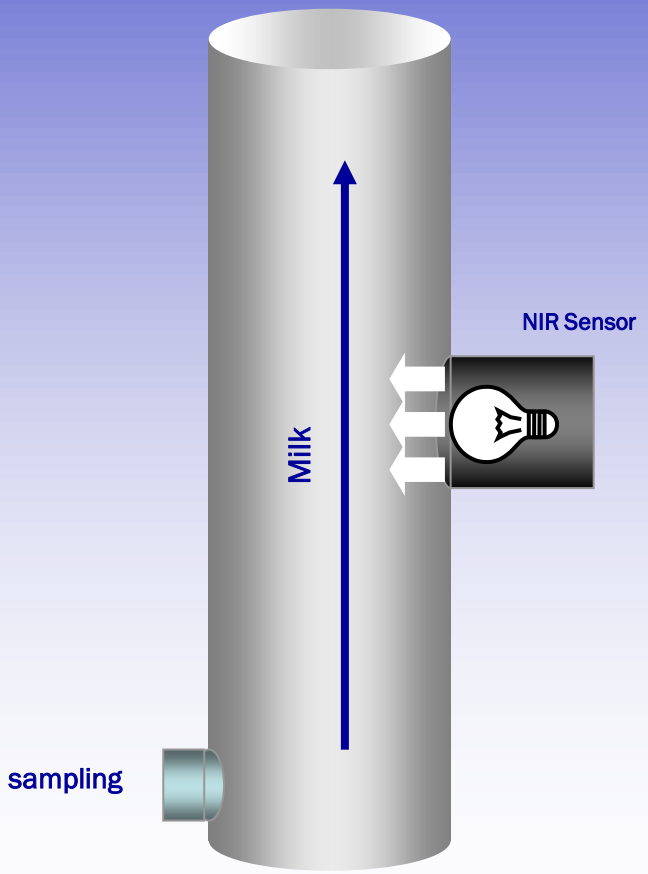
Measured data / optical fiber cable

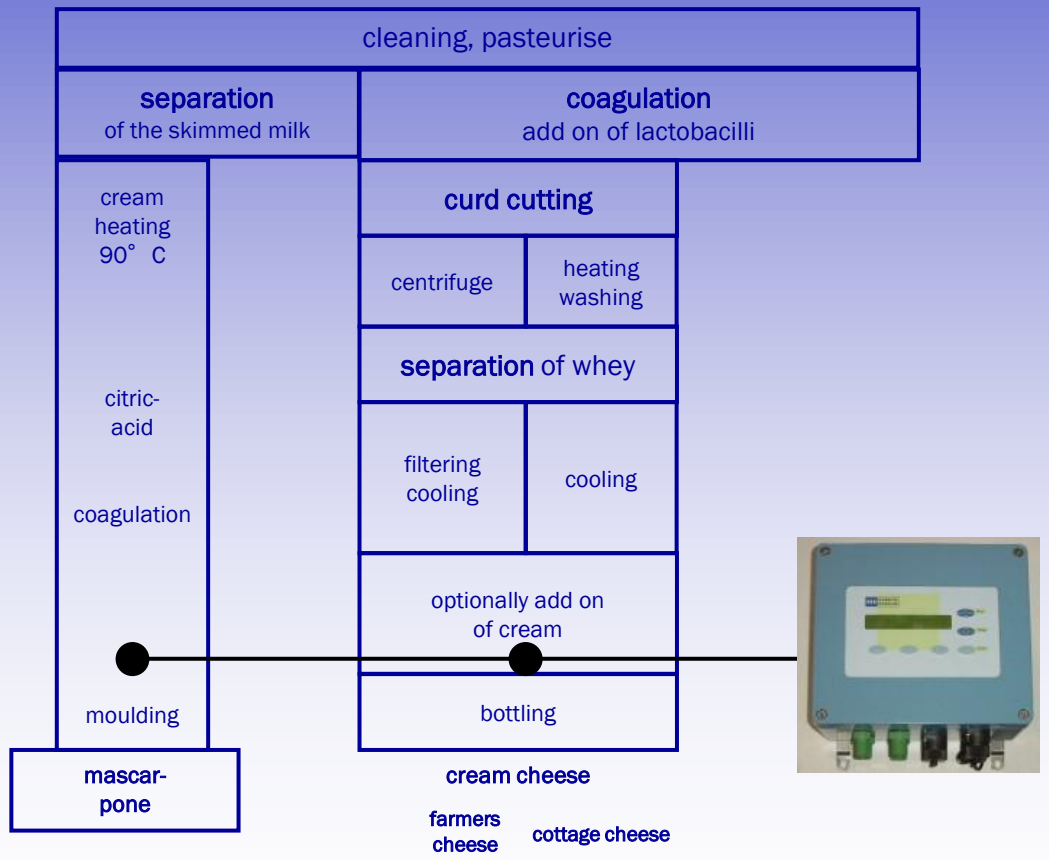
Further processing

Applications

Cream Cheese, Curd, Ricotta, Mascarpone, Jogurt, Cream, Milk,
Pizza-Mozzarella, Evaporated Milk, Condensed Milk, Butter

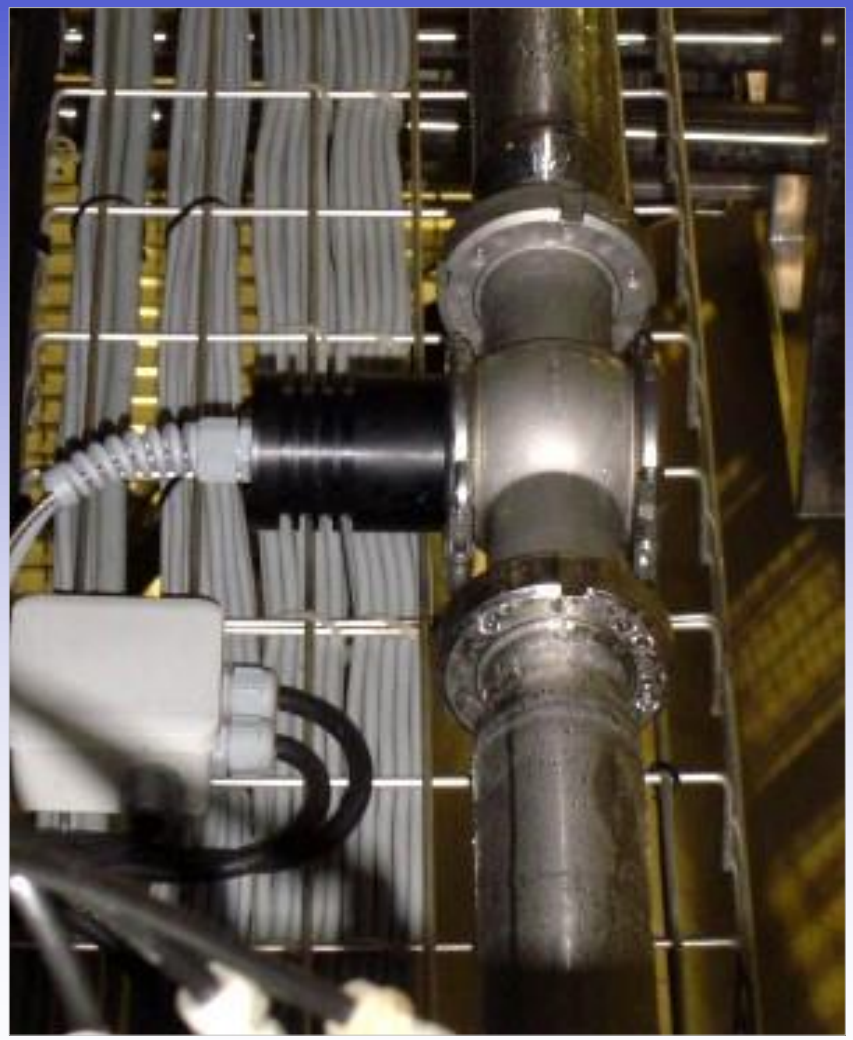
Milk





Applications

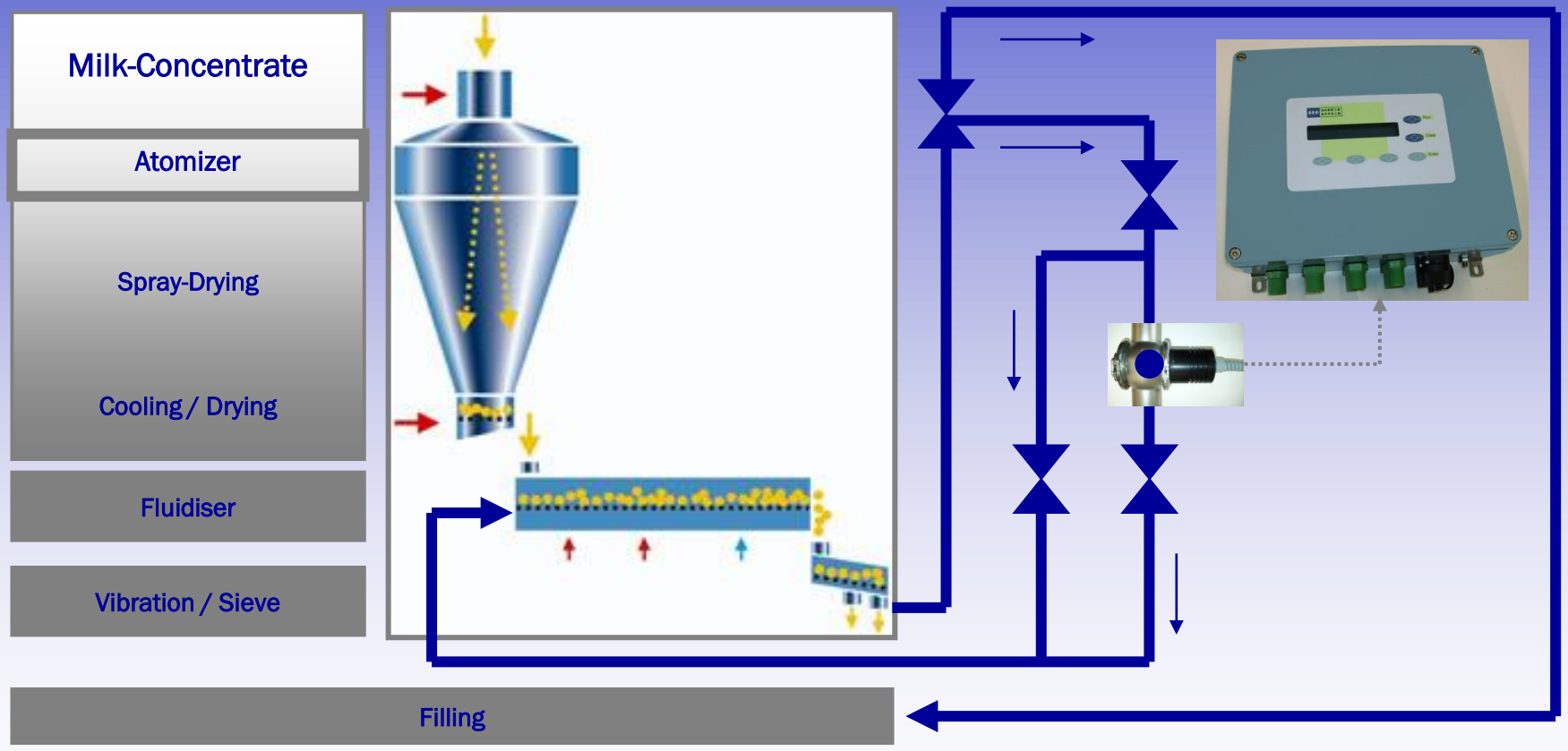
Milk, Cream Cheese, Curd, Ricotta, Mascarpone, Jogurt, Cream,
Pizza-Mozzarella, Evaporated Milk, Condensed Milk, Butter



Applications

Milk Powder

Whole Milk Powder, Skimmed Milk Powder, Curd Powder,
Jogurt Powder, Buttermilk Powder, Cream Powder



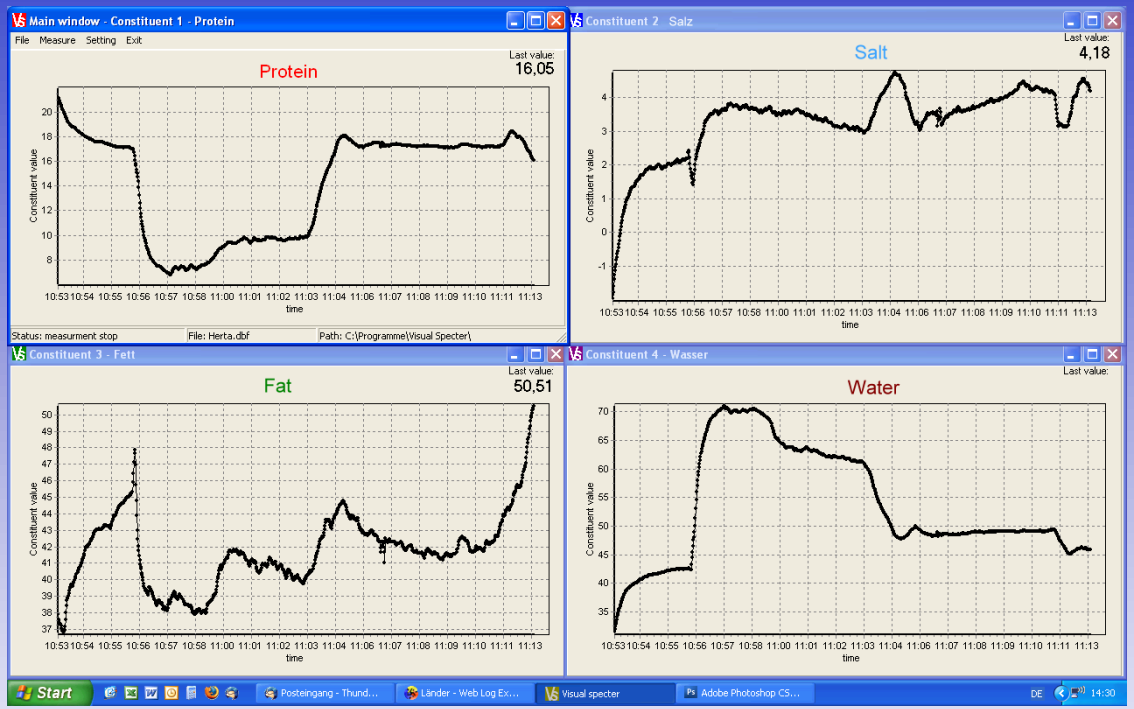
Applications

Milk Powder

Whole Milk Powder, Skimmed Milk Powder, Curd Powder,
Jogurt Powder, Buttermilk Powder, Cream Powder

Display of measurement trends

Milk, Cream Cheese, Curd, Ricotta, Mascarpone, Jogurt, Cream,
Pizza-Mozzarella, Evaporated Milk, Condensed Milk, Butter, Powder



Preconditions for very good measuring results:

- The product is homogenious,
- The measuring point is located in a rising pipe
- Pressure of ≥ 1,5bar

On-line-average values

In the volume flow rate for up to 4 organic constituents.
The salt content can be defined indirectly.

Applications

Milk, Cream Cheese, Curd, Ricotta, Mascarpone, Jogurt, Cream,
Pizza-Mozzarella, Evaporated Milk, Condensed Milk, Butter, Powder

4 constituents / analogue outputs
high availability through 4 halogen bulbs
MTBF-halogen bulbs: 1,5 years
change of lamps: no new calibration
Measurement also in case of blackout of 3 from 4 halogen bulbs

USP's HK NIR measuring devices

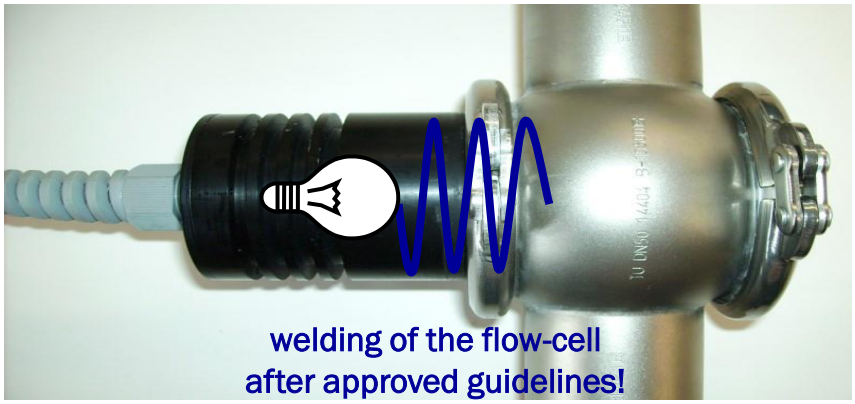
- colour differences / -variations have no influence to the measurement!

- lamp ageing will be compensated!

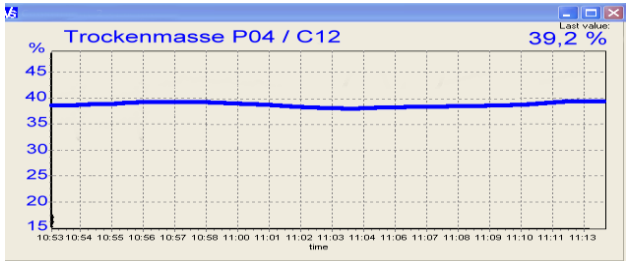
Non-contacting online-analysis of dairy products!
No sampling required through online-measurement!

max. 16 product-constituent combinations:
Calibrations for
- water, protein, lactose, fat, salt

installation by client



welding of the flow-cell
after approved guidelines!



data communication

RS232	RS485
appr. 100m	appr. 10km
data transfer PC SW-integration	network ethernet/intranet

Advantages HK NIR measuring devices

1) No drift of the measured values through lamp aging.
   - low follow-up costs
   - high device availability

2) Colour variations / -differences have no influence to the measurement.
   - low calibration cost
   - high device availability

3) We achieved on-line accuracies of proven laboratory devices.

4) Rapid and cost-effective assistane due to remote service
   - also after calibration

5) International references from leadind manufacturers of the food industry

Technical Data

NIR- Spectrometer

Environmental temperature	-20° C to +35° C
Product temperature	0° C to +130° C
Product pressure	≤ 10bar
Principle	NIR-/ Reflection measurement
Lifetime halogen bulbs / MTBF	2 years
Measure value / Constituents	1-4 constituents (water, fat, protein, lactose)
Analogue outputs	4 x 0/4 – 20mA
Stainless steel housing evaluation unit	300 x 500 x 167mm
NIR-sensor system	Stainless steel / optical fiber to evaluation unit
Calibration	Specter (chemo metrical Calibration-SW)
PC- interfaces	Serial RS232 or RS485
Ambient light	No influence
Product color	No influence
Protection supply	85 – 270 VAC
Protection class	IP67

Customer`s Benefit

NIR- Spectrometer

Reliable trend indication of water, fat, protein and lactose for every product all over the whole production.

Reliable recording of the “actual values” for every product all over the daily production.

Analysis of water, fat, protein and lactose in real-time and not after hours or days.

Definite results enable a more efficient control.

Establishment of audit approved statistics orientated to brands, products and clients.

Compensation of the daily laboratory analysis for production control.

Savings through prevention of spill- over production.

Thank you

for your attention !

Harrer & Kassen GmbH
Geschäftsführer Dr. Dipl. Ing. Horst Harrer
Am Heschen 4-6
75328 Langenbrand
Germany
Tel.: +49 (0)7084/9248-0
Fax: +49 (0)7084/924829

HARRER KASSEN