FUNKE GERBER

Laboratory Equipment

for milk and food testing

Contents

Funke-Dr. N. Gerber Labortechnik GmbH
Partner of Dairy Industry since 1904

For 95 years Funke-Gerber has been an important partner both of German and foreigen diary industry. Laboratory equipment for the analysis of milk and foodstuff is one of our most important activities.
We are still mainly involved in manufacturing of centrifuges, butyrometers and other equipment for the determination of fat according to Dr. N. Gerber. In addition to this classical field, our company has been producing modern electronic equipment for milk analysis for 15 years.
The freezing point determination with the series "CryoStar" is highly appreciated due to its precision and reliability which is why many dairies and institutes have been using it for years.
The new device "LactoStar", that was developed to determine constituents of milk routinely has opened up a new era of routine analytics.
Our present expert knowledge and a continuous development of our products make Funke-Gerber an important partner for dairy industries.
There is a trusting cooperation with many business partners for decades. They are representing Funke-Gerber

in almost al countries of the world and assure the global presence that is necessary to guarantee supply of our products to our customers.
Funke-Gerber has been standing for quality, reliability and continuity since 1904.

Products:
The company develops, manufactures and sells the following equipment worldwide:
- ☐ Equipment and accessories for "Fat Determination according to Gerber": Centrifuges, water bathes, reading lamps, butyrometers
- ☐ Freezing point determination unit "CryoStar"
- ☐ Analyzer for milk constituents "LactoStar"
- ☐ General laboratory equipment

Activities:
Turnkey installation or design of complete laboratories in the special fields of:
- ☐ Milk processing industry
- ☐ Dairies, milk collecting centers
- ☐ Cheese and butter plants, factories for ice-cream, condensed milk and powdered milk

Company Profile
Founded: 1904

Managing director: Dipl.-Ing. Konrad Schäfer
Authorized signatory: Dipl. oec. Georg Hörnle

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Milk sampler

nickel-plated brass, with valve for automatic drainage

3000	1 ml
3001	2 ml
3003	5 ml
3004	10 ml
3007	20 ml
3008	40 ml
3010	50 ml
3011	100 ml

Milk stirrer

stainless steel, disk perforated,
Ø 160 mm, 750 mm long

3021	

Dipper

handle ca. 50 cm long

3030	125 ml aluminum with spout
3031	250 ml aluminum with spout

Dipper

3033	130 ml stainless steel, 300 mm long
3034	250 ml stainless steel, 400 mm long
3035	450 ml stainless steel, 400 mm long

Milk sample bottle

glass 50 ml, DIN 12835 with frosted-glass pane

3040	

Milk sample bottle

PP 50 ml for LactoStar (see 3560)

3041	
3042	Rubber sealing stopper for 3041

Rubber stopper
for 3040

3050	

Cleaning brush
for 3040/3041

3080	

Wire cradle
for 50 bottles, each 50 ml (3040/41),
plastic-coated wire

3091	

Cheese trier
chrome-nickel steel, with plastic handle

3120	110 x 9 x 13 mm
3121	125 x 14 x 19 mm
3122	140 x 17 x 21 mm

Low-cost cheese trier
120 x 11 x 14 mm, with metal handle

3124	

Milk-powder collector
for ca. 28 x 385 mm, ca. 230 ml, nickel-plated brass

3125	

Butter trier
chrome-nickel steel, with wooden handle

3130	240 mm bore length
3131	300 mm bore length

Laboratory blender

2 speeds and timer 1 – 60 Sec., 230 V/50 Hz

3135	with 1.2 l glass container
3136	mit 1 l stainless-steel container

Laboratory grinder

for preparing cheese samples etc.

3137	

BagMixer 400

capacity: 80 – 400 ml, 220 V/50 Hz,
17 kg, 40 x 22 x 24 cm

3140	

Disposable plastic bag

3141	400 ml, sterile, suitable for 3140
3142	Filter bags, 400 ml, sterile
3143	Bag clasps
3144	Stand for 12 bags

Butyrometric Determination of the Fat Content in Milk according to Gerber

Dipl.-Chem. Alfred Töpel

The butyrometric determination of the fat content in milk (the Gerber method) was developed in 1892 by Dr. N. Gerber and was incorporated into official regulations in 1935 as a sulphuric acid process. The rapid method of testing appears both in German standards (e.g. DIN 10310) and international standards (e.g. ISO 2446 or IDF 105).

The butyrometric determination of the fat content in milk according to Gerber is a quick method of testing and is still used today despite the introduction of automated methods of determining the fat content of milk in rapid-test dairy laboratories. The advantages of the Gerber method over the modern quick-test methods are:

- There is no need to calibrate the measuring gauge (which is time-consuming).
- The investment costs are relatively low, as are the costs of carrying out quick tests on individual samples.
- It can be used for all types of milk.

The disadvantages are in the use of the very aggressive concentrated sulphuric acid, which involves taking special precautionary measures, and the need to dispose of the sulphuric acid mixture later in an environmentally suitable way.

The Principles of the Method

The method involves separating off the fat into a special measuring vessel called butyrometer, determining its volume, and giving it as a percentage by mass. The fat is in the milk as small globules of various diameters from 0.1 to 10 micrometers. The globules of fat form a consistent emulsion with the milk liquid. The globules of fat are surrounded by a protective coating, a fat globule membrane of phospholipides, fat globule membrane coat protein and hydrate water. This protein coating around the fat globules coat prevents them from coalescing and stabilizes the emulsified state.

In order to separate off the fat completely we must destroy the protective coating on the fat globules. This is done with concentrated sulphuric acid of 90 to 91 mass %. The sulphuric acid oxidizes and hydrolyzes the organic components of the fat globule protective coating, the lactalbumin fractions and the lactose. A heat due to dilution is produced and also a strong heat die to the reaction. The butyrometer gets quite hot. The oxidation products turn the resulting solution brown. The fat thus released is then separated by centrifuging, whereby the addition of amyl alcohol makes the phase separated easier and a sharp delineation is produced between the fat and the acid solution. The fat content of the milk can be read off on the scale on the butyrometer as a mass content in %.

Application

The process can be used on raw milk and treated milk with a fat content of 0–16%, and for milk which contains a suitable preservative as well as for homogenized milk.

The Chemicals Needed

Sulphuric Acid, H_2SO_4
Requirements:
Density to 20 °C
(1.818 ± 0.003) g ml^{-1}
colorless or only slightly colored and free from any substances which might have an influence on the result

Danger Symbol	Degree of Danger
	C_2 R 35 S 2 - 26 - 30

Note:

The required density is the equivalent of a 90 to 91% mass. Stronger or weaker concentrations are to be avoided. At 65 °C any stronger concentrations of sulphuric acid attack amyl alcohol, cause dehydration and form olefine, and this influences the result. Weaker concentrations reduce the oxidation effect. The fat globule coat is not completely destroyed and this can lead to the formation of lumps.

Amyl Alcohol for the Determination of the Fat Content in Milk according to *Gerber*
Isomer Mixture of 2-Methylbutane 1-ol
and 3-Methylbutane 1-ol

Requirements:

Density at 20 °C, (1.811 ± 0.003) g ml^{-1}
Boiling points: 98% (volume part) has to be overdistilled at a temperature of between 128 °C and 132 °C at 1 bar. The amyl alcohol must not contain any substances which could influence the result.
Instead of amyl alcohol, a substitute can be used provided that it would bring about the same result as would be achieved using amyl alcohol.

Note:
Isomer amyl alcohols have different distillation points:
2-methylbutane-1ol 128 °C and
3-methylbutane-1-ol 132 °C.
Of the 8 known isomer amyl alcohols, only this mixture is appropriate for the Gerber method. Contamination with the other isomer amyl alcohols, particularly with tertiary amyl alcohol 2-methylbutane 2-ol produce false results. Too high a fat content is given.

Danger Symbol	Degree of Danger
	Xn R 10-20 S 24/25 VbF A II

Appliances Required
1. Calibrated butyrometer with suitable stopper
DIN 12836-A 4, DIN 12836-A 6, DIN 12836-A 8,
DIN 12836-A 5

2. Pipette DIN 10283-p for milk or pipette DIN 12837-A for milk

3. Pipette DIN 12837-B or measuring tap 10 ml for sulphuric acid (Fig. 3)

4. Pipette DIN 12837-C or measuring tap 1 ml calibrated for amyl alcohol

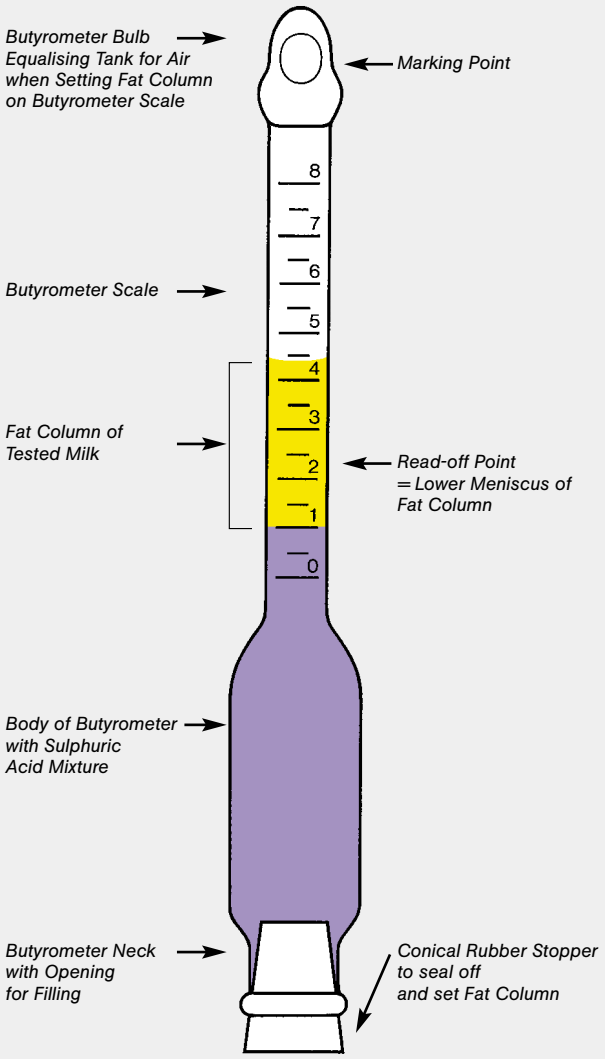
5. Centrifuge for determining the fat content with revolution counter, heatable (Fig. 1)

When used under full load this centrifuge must be capable of producing a centrifugal pressure of (350 ± 50) g on the inside of the butyrometer stopper after a maximum of two minutes. With a rotation radius of e.g. (26 ± 0.5) cm up to the inside of the butyrometer stopper, i.e. the distance between the point of torque and the butyrometer stopper, this centrifugal speed is reached at a rotor speed of (1100 ± 80) min^{-1}.

6. Tempering device for butyrometers, e.g. water bath (65 ± 2) °C

With a heated centrifuge you can use a bushing in the centrifuge to attach the butyrometer in the water bath. The temperature at the read-off must be (65 ± 2) °C.

Preparation of the Test Specimen
The milk in the specimen bottle is heated up to 20 °C and thoroughly mixed by giving it a careful shake. The idea is to bring about an even distribution of fat and to prevent any froth and any tendency of the milk to butter.



Butyrometer DIN 12836 for determining the fat content according to Gerber

Milk fat is lighter than water and creams if allowed to stand. A layer rich in fat accumulates on the surface. Stirring and careful shaking bring about the original distribution.
If the layer of cream cannot be evenly distributed in this way, the milk should be slowly heated up to 35 – 40 °C, during which it is carefully turned, until a homogenous distribution of fat has been obtained. The milk is then cooled to 20 °C before being drawn up into the pipette. *Froth breaks open the coating of the fat globules. The*

milk can begin to turn to butter when stirred and the fat is then no longer able to be evenly distributed.
At a temperature of 35 to 40 °C the fat liquefies and the process of distribution is speeded up.
After the temperature has been set, the milk is allowed to stand to three or four minutes so as to allow any pockets of air to disperse.

When filling with sulphuric acid make sure you wear goggles and rubber gloves.

The gauges to measure volume are set at 20 °C. Any variations in temperature will influence the volume. Air pockets reduce the density and therefore the mass of the quantity of milk thus measured.

Conducting a Test = How to Go about It
the same milk specimen must be tested twice.

1. Place two butyrometers in a clamp (butyrometer stand). With the measuring tap, put 10 ml sulphuric acid into the butyrometer without touching the neck of the butyrometer (see Fig. 3).

2. Turn the bottle with the specimen of milk carefully upside down three or four times and then immediately pipette 10.75 ml of milk into the butyrometer so that the milk does not touch the neck of the butyrometer, and so that the milk is not allowed to mix with the sulphuric acid. This is done by leaning the tip of the pipette laterally as deep as possible on the wall of the butyrometer and the milk is simply layered over to the sulphuric acid. (Fig. 4)
   When the Gerber method was first introduced, 11 ml of milk were used. By reducing this to 10.75 ml the fat content arrived at degrees more closely with the results of the reference method. If you wet the butyrometer neck with milk, some of it will stick to the side.
   The sign of a good layering is a clear dividing line between acid and milk without a brownish-colored edge.

3. 1 ml of amyl alcohol is pipetted on to the milk (or inserted by measuring tap).

   Thanks to the low density of the amyl alcohol, the two mixtures do not mix.

4. The butyrometer is closed with the stopper without mixing the two liquids.
   As a rule the lower end of the stopper comes into contact with the liquid.

5. The butyrometer is placed into a butyrometer casing with the bulb downwards. Shake the butyrometer quite vigorously until the two liquids are completely mixed. Keep your thumb firmly pressed down on the butyrometer stopper. Turning the butyrometer several times up and down allows the sulphuric acid still in the bulb to disperse.
   When the liquids are mixed, a considerable amount of heat is given off. The gas built up in this way can cause the stopper to shoot out or the butyrometer can even break.
   The butyrometer casing is merely a safety precaution. Instead of using a casing, the butyrometer can be wrapped in a cloth.
   To lax shaking of the butyrometer or unnecessarily holding it in a slewed position inhibits quick mixing and therefore also the rapid oxidization of the whole of the liquid and thus can ruin the careful work done trying to get the layering right.

6. Immediately after the mixture has been shaken and turned upside down a few times, the butyrometers, still hot and with the stopper pointing downwards, are placed into a casing inside in the heated Gerber centrifuge, whereby it is essential that the butyrometers are positioned exactly opposite to each other.

The butyrometer in the casing is shaken (goggles and rubber gloves must be worn).

Beforehand however, the stopper should be turned to set the column of fat at the height of the expected level of fat. After setting the time on the centrifuge, the process can now be started. After reaching a centrifugal pressure of (350 ± 50) g, usually after one minute, the corresponding number of revolutions (1100 ± 50) per minute should be maintained for four minutes.

The centrifuge must be fitted with a lid interlocking. After the centrifuging time has been reached, the brake for the rotor system automatically comes on.

7. The butyrometers are now removed from the centrifuge, taking care not to tip them, and placed in a water bath (heated up to 65 °C) with the stopper downwards, for a few minutes.
   It is important to maintain an exact temperature so as to obtain accurate results. Only a read-off at 65 °C will give you an exact result. If the temperature is too low, the volume of the column of fat is reduced and you get a fat content reading which is too low.

8. After the butyrometer is removed from the water bath it should be kept in a vertical position at a height where the meniscus of the column of fat is at eye level. With the help of the stopper position mark the demarcation line between residual mixture and fat at a whole line of the butyrometer scale and read off the height of the fat column at the lowest point of the meniscus. If too much time elapses before the reading is taken, the butyrometer must be placed in the water bath again.
   If your eye and the meniscus are not at the same level, you will get a wrong reading caused by parallaxis.

Result and Degree of Accuracy

The result should be read off to half a scale point, i.e. to 0.05 %. It is not possible to obtain a more exact result with whole milk butyrometers. If the meniscus is touching the graduation point, then the result is accepted as such (Fig. 7a). If the meniscus is between graduation points, then the lower value is taken (Fig. 7b).

The difference between the readings from both butyrometers must not be greater than 0.10 %, i.e. the reproducibility is 0.10 %.

When recording the result you must add the note “Fat content according to Gerber”. If the two specimens differ by 0.1%, then the mean value of both readings is taken.

Specimen 1: 4.2 %

Specimen 2: 4.3 %

correct result: 4.25 % fat content

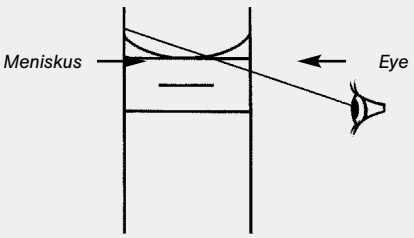
If however, the two readings are 4.20 % and 4.25 % fat, then the lower value 4.20 % is taken, on the principle that it is better to err on the side of caution.

The butyrometers are brought to the exact read-off temperature in the water bath.

The values can be read off accurately and exactly with the help of a safety lamp.

Determination of the Fat Content of Homogenized Milk according to Gerber

Treated milk is homogenized in order to prevent creaming. This involves reducing the globules of fat, which vary in size, to a fairly uniform diameter of 1 – 2 micrometers.



In the centrifuging process however, the separating effect is considerably lessened and therefore the specimen must stay longer in the centrifuge in order to completely separate the released fat.

Steps 1 – 8 are carried out as for the testing of non-homogenized milk and the results are recorded. The butyrometer is heated up to 65 °C again for at least five minutes in the water bath, then centrifuged again for five minutes and the results read off as described above.

If the value obtained after the second centrifuging is more than 0.05 % higher than the value after the first centrifuge, then the heating up and centrifuging is to be repeated another two times at the most.

If the recorded value is higher than 0.05 % or less compared with the initial result, then the highest recorded value is taken.

Example:

After the first centrifuging, the readings for the two specimens were 3.55 % and 3.60 % and after the second centrifuging they were 3.60 % and 3.65 %. The official result taken for the fat content of the homogenized milk is therefore 3.65 %.

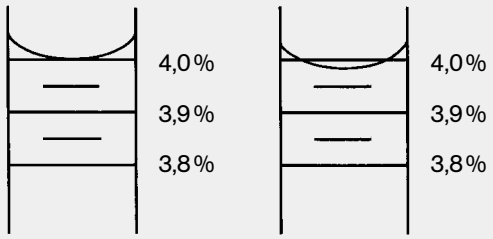


Fig. 7a: Correct reading 4.0 % *Fig. 7b: Correct reading 3.95 %*

If after the last two repeats, i.e. after the third and fourth centrifuging, there is still a difference of more than 0.05 %, then the result of the particular test is to be discarded.

Alfred Töpel, Dipl.-Chem. has been a lecturer at Halberstadt Dairy Academy since 1960.
Since 1992 he has been responsible for training at MLUA Oranienburg.
He is also the author of the text book "The Chemical and Physical Aspects of Milk".

Specific Products: Cream, Ice-Cream, Cheese, etc.

Preface: The butyrometric determination of the fat content in milk has been increasingly replaced by other routine analyses (like for instance LactoStar or infrared spectroscopes). But such devices can either measure milk products like cheese, ice-cream, etc. only after a costly preparation of samples or they cannot measures them at all. The butyrometric procedure is a good alternative for routine analyses of such products.

1. Application
Determination of the fat content in milk and various milk products.

2. Volumes
If not stated differently, use the following quantities of chemicals and test samples:

Sulphuric acid:	10.0 ml (20 °C + 2 °C)
Amyl alcohol:	1.0 ml (20 °C + 2 °C)
Milk or milk products:	10.75 ml (20 °C + 2 °C)

Short Description of the Method for the Butyrometric Determination of the Fat Content

3.1 ... in Milk (acc. to Gerber):
Perfectly cleaned milk butyrometers, particularly free from fat residues, are filled in the following sequence: sulphuric acid, milk, and amyl alcohol. Milk and amyl alcohol are filled in by overlaying. They must not mix before shaking. After closing the butyrometer, the content is mixed thoroughly by shaking and turning the butyrometer upside down a few times. Adjust the stopper carefully so that the scale is filled but that there is no liquid in the bulb. Centrifuge the butyrometer in the heated centrifuge, put into a water bath of 65 °C for 5 minutes, mark the demarcation line between sulphuric-acid mixture/fat column at a whole line, read off the upper end of the fat column at the lower meniscus.

3.2 ... in Homogenized Milk
See above but centrifuge three times for 5 minutes. Heat the butyrometers in a water bath of 65 °C for 5 minutes between the process of centrifuging.

3.3 ... in Skim Milk and Whey
Use skim-milk butyrometers with narrowed scale acc. to Sichler.
Centrifuge two times and place butyrometers in water bath of 65 °C for 5 minutes between centrifuging.

3.4 ... in Condensed Milk (sugar-free)
First heat the condensed milk to 50 °C, allow to cool and then mix with water in a ratio 1:1. This dilution is tested like milk acc. to Gerber. Fat content = read value x 2.

3.5 ... in Buttermilk
(modification acc. to Mohr and Baur)
Pipette 10 ml of buttermilk instead of 10.75 ml and 2.0 ml amyl alcohol. Shake butyrometer after closing and centrifuge immediately. This prevents the disturbing plug-up. Read off after the second centrifuge.
Fat content = read-off value x 1.075.

3.6 ... in Powdered Milk acc. to Teichert
Use powdered-milk butyrometers acc. to Teichert.
The butyrometer is charged with 10 ml sulphuric acid. Overlay 7.5 ml of water and 1 ml of amyl alcohol. Weigh 2.5 g of powdered milk in a weighing boat and transfer into the butyrometer through a funnel by using a fine brush. Close the butyrometer and shake thoroughly but put into the water bath of 65 °C a few times meanwhile. Centrifuge in a heated centrifuge 2 x 5 min. and read off the value after placing it into the water bath (5 min.).

3.7 ... in Cream acc. to Roeder (weighing method)
Use cream butyrometer acc. to Roeder.
5 g of cream are weighed in the beaker in the stopper and filled into the butyrometer. Fill sulphuric acid through the upper opening of the butyrometer exceeding the upper rim of the glass beaker. After closing the butyrometer, place it into a water bath of 70 °C, shake it from time to time until the protein is completely dissolved. Add sulphuric acid to the beginning of the scale numbering and add another 1 ml of amyl alcohol. Close the butyrometer, shake and place it another 5 minutes in the 70 °C water bath. Then centrifuge for 5 minutes and temper in a water bath of 65 °C. Read off at 65 °C, adjust fat column to the zero point, read off at the lower meniscus.

3.8 ... in Cream acc. to Schulz-Kley (weighing method)
Use cream butyrometer acc. to Schulz.
Fill into the butyrometer: first 10 ml sulphuric acid, then 5 ml water, ca. 5 g cream weighed by differential weigh-

ing using a syringe or weighing pipette fixed to the balance, 1 ml amyl alcohol. Mix the content of the butyrometer by shaking and turning it upside down.
Centrifuge the butyrometer in a heated centrifuge for 5 min. and read off after a tempering time of 5 minutes in a 65 °C water bath. Convert the read value to 5 g of weighed portion or correct according to the Cream Correction Table acc. to Schulz. Do not allow more than 15 minutes between overlaying of water and shaking due to a possible reduction of the reaction heat caused by this addition of water. The dissolution process must be completed under 60 sec.

3.9 ... in Cream acc. to Köhler (measuring method)
Use cream butyrometer acc. to Köhler.
Fill into the cream butyrometer: first 10 ml sulphuric acid d °1.820, then 5 ml cream, 5 ml water, 1 ml amyl alcohol. When you use a cream syringe, rinse it several times with water before you fill in the 5 ml of water. Close the butyrometer, shake and centrifuge for 5 minutes, read off after a tempering time of 3 minutes in a 65 °C water bath. Read off from the zero point.

3.10 ... in Cheese acc. to van Gulik
(See ISO 3433)
Use cheese butyrometer acc. to van Gulik.
First fill 15 ml sulphuric acid d °1.52 into the butyrometer acc. to van Gulik which must be closed at the end with the scale. Then fill 3 g of cheese by using a weighing boat and a fine brush and close the filling opening. Pasty cheese samples have to be weighed in glass beaker with holes that belongs to the van-Gulik butyrometer and then filled into the butyrometer. Place the closed butyrometer into a water bath of 70 °C – 80 °C. The scale must be upwards. Shake repeatedly until the cheese is completely dissolved. Then add 1 ml amyl alcohol through the scale opening and sulphuric acid approximately up to the 15% mark of the scale. Then close, mix, temper for 5 minutes in a 65 °C water bath, centrifuge for 5 minutes, place again in a 65 °C water bath, adjust fat column to zero point and read off absolute fat content. Reading is done at the lower end of the meniscus.

3.11 ... in Ice-Cream acc. to Köhler (measuring method)
Use ice-cream butyrometer acc. to Köhler.
Remove icing or other rough particles (e.g. fruit, etc.) if there are any. Mix the ice-cream thoroughly after it has room temperature. If there are any air pocket, they can be removed almost completely by evacuation.
Fill into the ice-cream butyrometer: first 10 ml sulphuric acid d °1.820, then 5 ml ice-cream, 5 ml water, 1 ml amyl alcohol. When you use a cream syringe, rinse it several times with water before you fill in the 5 ml of water. If the butyrometer is not sufficiently filled, add 2 ml of water. Close the butyrometer, shake and centrifuge for 5 minutes, read off after a tempering time of 5 minutes in a 65 °C water bath.

3.12 ... in Ice-Cream acc. to Roeder (weighing method)
Use ice-cream butyrometer acc. to Roeder.
Weigh in 5 g of thoroughly mixed ice-cream into the glass beaker in the stopper and fill then into the butyrometer. Fill sulphuric acid d °1.53 through the upper opening of the butyrometer exceeding the upper rim of the glass beaker. After closing the butyrometer, place it into a water bath of 70 °C, shake it from time to time until the protein is completely dissolved. Add 1 m amyl alcohol and sulphuric acid up to the 10 % mark. Close the butyrometer, shake and place it another 10 minutes in the 70 °C water bath. Shake regularly during this time. Then centrifuge (7 min.!) and temper in a water bath of 65 °C. Read off at 65 °C, adjust fat column to the zero point, read off at the lower meniscus.

3.13 ... in Butter acc. to Roeder (weighing method)
Use butter butyrometer acc. to Roeder.
Weigh in 5 g of butter into the glass beaker in the stopper and fill into the butyrometer. Fill sulphuric acid through the upper opening of the butyrometer exceeding the upper rim of the glass beaker. After closing the butyrometer, place it into a water bath of 70 °C, shake it from time to time until the protein is completely dissolved. Add sulphuric acid to the beginning of the scale numbering and add another 1 ml of amyl alcohol. Close the butyrometer, shake and place it another 5 minutes in the 70 °C water bath. Then centrifuge for 5 minutes and temper in a water bath of 65 °C (approx. 5 min.). Read off at 65 °C, read off at the lower meniscus.

Appliances and Accessories for the Determination of the Fat Content of Milk according to Dr. N. Gerber

The basic implement for the GERBER process is the butyrometer. The ORIGINAL FUNKE-GERBER Butyrometers manufactured by us are well-known all over the world as reliable precision instruments. since Dr. N.

Gerber brought out the butyrometer named after him in 1892, we have systematically improved on it until it has reached its current flat design. We now manufacture high-quality flat butyrometers and make sure that we subject them to very strict standards of quality control. The exactness of the scale and the content of the body guarantees very accurate test results.
Funke-Gerber butyrometers are high-precision instruments with a flattened scale part, and are made out of acid-resistant glass in accordance with German and international standards (DIN, BS, IDF, ISO, etc.). Our experience of producing butyrometers stretches back over 95 years and enables us to produce high-quality instruments at reasonable prices. We produce butyrometers for milk and for all milk products, too.
In Germany and in some other countries butyrometers must be officially calibrated. They are then marked "(E)

10,75 ml of milk are pipetted into the butyrometer.

officially calibrated". Other butyrometers are not officially calibrated, but they are produced in exactly the same way and correspond to the same high standards of quality.
All butyrometers come in standard packs of 10. When ordering therefore, please order in units of 10.

Precision butyrometer

for liquid milk and vat milk, frosted wall behind scale,
tolerance 0.025 %, 0 – 4 %: 0.05

3150	

Butyrometer for milk

3151	0 – 5 %: 0.1
3152	0 – 6 %: 0.1
3153	0 – 7 %: 0.1
3154	0 – 8 %: 0.1
3155	0 – 9 %: 0.1
3156	0 – 10 %: 0.1
3157	0 – 12 %: 0.1
3158	0 – 16 %: 0.2

Skim-milk butyrometer

according to *Sichler*, round scale, with open bulb
0 – 1 %: 0.01

3160	

Skim-milk butyrometer

according to *Kehe*

3161	0 – 4 %: 0.05
3162	0 – 5 %: 0.05

Skim-milk butyrometer

according to *Siegfeld*

3164	0 – 0.5 %: 0.02

Milk-power butyrometer

according to *Teichert*

3170	0 – 35 %: 0.5, without accessory (3310)
3171	0 – 70 %: 1.0, without accessory (3310)

Ice-cream and condensed milk butyrometer

weighing method acc. to *Roeder*

3180	0 – 6 – 12 %: 0.1, including 3290, 3300, 3320
3181	0 – 15 %: 0.2, including 3290, 3300, 3320

Cream butyrometer

(measuring method), for ice-cream

3189	0 – 15 %: 0.2
3190	0 – 20 %: 0.2

Cream butyrometer

weighing method acc. to *Roeder*

3200	0 – 5 – 40 %: 0.5, including 3290, 3300, 3320
3201	0 – 30 – 55 %: 0.5, including 3290, 3300, 3320
3202	0 – 50 – 75 %: 0.5, including 3290, 3300, 3320
3203	0 – 5 – 70 %: 1.0, including 3290, 3300, 3320

Cream butyrometer

weighing method acc. to *Schulz-Kley*, with closed bulb
0 – 5 – 40 %: 0.5

3208	

Cream butyrometer

acc. to *Köhler* (measuring method)

3210	0 – 40 %: 0.5
3211	0 – 50 %: 1.0
3212	0 – 60 %: 1.0
3213	0 – 70 %: 1.0

Butter butyrometer

acc. to *Roeder* (weighing method)
0 – 70 – 90 %: 0.5 %, including 3290, 3300, 3323

3220	

Cheese butyrometer

acc. to *van Gulik* (weighing method)

3230	0 – 40 %: 0.5, including 3290, 3300, 3321

Curd butyrometer

weighing method
0 – 20 %: 0.2, including 3290, 3330, 3321

3240	

Food butyrometer

acc. to *Roeder* (weighing method)
0 – 100 %: 1.0, including 3290, 3300, 3320

3250

Free-fat butyrometer

for determining free fat in milk and cream,
srew-capped, scale 0.002 g.

3252

Babcock bottle

0 – 8 % for milk

3254

Babcock bottle

0 – 20% for cream

3256

Babcock bottle

0 – 60 % for cream and cheese

3258

Patent closure FIBU

for all measuring butyrometers

3260 FIBU without key

Patent closure GERBAL

for all measuring butyrometers

3261

Patent closure NOVO

for all measuring butyrometers

3262

Key
for patent closure FIBU

3270

Key
for patent closure GERBAL

3271

Key
for patent closure NOVO

3272

Rubber stopper, conical
for all measuring butyrometers, 11 x 16 x 43 mm

3280

Rubber stopper
for sealing the bulb of all types of weighing butyrometers,
9 x 13 x 20 mm

3290

Rubber stopper, with hole
for all weighing butyrometers, 17 x 22 x 30 mm

3300

Rubber stopper, without hole
for milk-powder butyrometers, 17 x 22 x 30 mm

3310

Glass nail
for milk-powder butyrometers

3315

Weighing beaker for cream
for ice-cream and condensed milk butyrometers
and cream butyrometers acc. to *Roeder*

3320

Weighing beaker for cheese, with holes
for *Van Gulik* butyrometers

3321

Weighing boat for butter
for butyrometers acc. to *Roeder*

3322

Butter beaker with 2 holes

3323

Cleaning brush
for butyrometer body

3324

Cleaning brush
for graduated stem of butyrometer

3325

Butyrometer rack

3330 for 36 samples (PP)

3331 for 12 samples (PP)

Shaking rack

3332 for 12 samples (PP)

Protective shaking hood

3340 for 36 samples (PP)

3341 for 12 samples (PP)

Pour plate

Plastic

3350	for 36 samples
3351	for 12 samples

Automatic dispenser, Permanent

with ground-in measuring chamber and stopper, single, DIN 10282

3390	10 m sulphuric acid
3391	1 ml amyl alcohol

Stand for permanent automatic dispenser

consisting of positioning board, stem and rataining ring with stem and retaining ring with sleeve

3400	10 ml for 1 permanent automatic dispenser
3401	1 ml for 1 permanent automatic dispenser
3402	10 + 1 ml for 2 permanent automatic dispensers

Automatic tilt measure, Superior

with rubber stopper and dispensing bottle, 500/250 ml

3420	10 ml sulphuric acid
3421	1 ml amyl alcohol

Volumetric pipette

with one ring mark

3430	10 ml sulphuric acid
3431	10.75 ml milk

3432	11 ml milk
3433	1 ml amyl alcohol
3434	5.05 ml cream
3435	5 ml water
3436	5 ml ream
3437	50 ml short type
3438	25 ml short type

Syringes

nickel-plated brass

3440	10.75 ml milk
3441	10.75 ml milk rep. exch.
3442	5.05 ml cream
3443	5.05 ml cream rep. exch.
3450	11 ml milk
3451	Replacement cylinder 10.75 und 11 ml
3452	5 ml cream
3453	Replacement cylinder 5 ml

Pipette stand

PVC, for pipettes of various sizes

3460	

Cleaning brush
for pipettes

3470

Laboratory goggles

3480

Agitated water bath
stainless steel with 18 tubes, 8 kg, dimension: 45 x 21 x 31 cm

3550

LactoStar
See detailed description on page 35

3560

Accessories:
thermal printer: Art.-Nr. 7151
milk sample bottle: Art.-Nr. 3041

Replacement part:
3560-023 pump head

Butyrometer bucket
pressure-casted light metal, see SuperVario-N 3680

3631	1 piece
3631-12	set with 12 buckets
3631-24	set with 24 buckets
3631-36	set with 36 buckets

Babcock bucket
see SuperVario-N 3680

3632

Bucket for ADMI-tubes
see SuperVario-N 3680

3633

Solubility index tube

see SuperVario-N 3680
ADMI, 50 ml, glass, graduated
from 0 to 20 ml and mark at 50 ml

3634

Stand

for 6 buckets 3634

3636

Special solubility index tube

fitting in butyrometers tubes for
table centrifuge “Nova Safety”

3637

Centrifuge tube

acc. to *Friese* with 2 stoppers

3638

Replacement butyrometer tube

for Nova Safety
brass with flanged-edge brim,
can be also used for water-bath insert,
see item no. 3670, 3717

3641

Nova Safety

Reliabel and tested bench centrifuge with angular rotor
for determination of fat according to Dr. N. Gerber.

Properties:
Automatic lid interlocking
Automatic break (breaking time <8 s)
Timer for centrifugation time (digital)
Heating, thermostatically controlled to 65 °C
Filling capacity: max. 8 butyrometers

3670

Milk-laboratory centrifuges

Centrifuges for butyrometric fat determination according to Dr. N. Gerber

There are a number of characteristics that distinguish these special centrifuges from other laboratory centrifuges. Please pay attention to the following points when you want to buy and operate a centrifuge for fat determination according to Dr. N. Gerber:

1. Quiet running

The centrifuge is equipped with butyrometers. These are sensitive glass tubes with a long and narrow neck. It is important that a centrifuge runs with as little vibration as possible to avoid braking of glass and to increase the service life of the butyrometers. Basically we make a difference between the following types of centrifuges:

Centrifuge with flat lying butyrometers:

This type of positioning the butyrometer guarantees a gentle centrifugation for the butyrometers. Anyhow, it is important to discharge this type of centrifuge quickly. Otherwise the separated phases could intermix after centrifugation.

Centrifuge with angular rotor:

The angular rotor keeps the butyrometers in a fixed angle. Unfortunately, this position stresses the long and thin neck of the butyrometer. This type is mainly used in inexpensive small centrifuges.

Centrifuge with swing-out butyrometer buckets:

The flexibly mounted butyrometer buckets enable the butyrometers to swing out horizontally. The butyrometers are only stressed in their longitudinal axis. This is why you should prefer a centrifuge of this type to others.

1.3 Unbalance

The centrifuge should be equipped with an automatic unbalance switch-off. In case of broken glass (a broken butyrometer) or another unbalance, the centrifuge switches off automatically.

1.4 Lid interlocking

For reasons of safety, a lid interlocking is stipulated for bigger centrifuges in most European countries. But also small centrifuges are increasingly equipped with a lid interlocking.

1.5 Heating

On principle, it is possible to work with an unheated centrifuge. A heated centrifuge, however, prevents a cooling down of the butyrometers. This reduces the subsequent temperature-regulating time in a water bath and the analysis is more reliable. The temperature in the hydro-extracting vessel should be at least 50 °C.

1.5 Rotor speed

The determination of fat acc. to Gerber specifies a "RCA" (**R**elative **C**entrifugal **A**cceleration) of 350 g with a maximum deviation of ± 50 g. Die RCA does not only depend on the rotor speed but also on the effective radius. The effective radius is defined as the distance between the center point of the rotor and the outer end of the butyrometer. This is why the rotor speed the various types of centrifuges differs according to their radiuses. However, it is important that the rotor speed is constant or only changes insignificantly (within the range of tolerance, see above), depending on whether the centrifuge is fully or only partially loaded.
The RCA is calculated in the following way:

$$RCA = 1{,}12 \times 10^{-6} \times R \times N^2$$

$$N = \sqrt{\frac{RCA}{1{,}12 \times 10^{-6} \times R}}$$

R = effective horizontal radius, in millimeter;
N = rotor speed in revolutions per minute [min^{-1}].

Example:
A centrifuge with an effective radius of 260 mm needs a rotor speed of 1100 rpm to be able to reach the specified RCA of 350 g.

2. Mounting

Place the centrifuge on a plane and solid surface. (e.g. solid table or platform). There should be a low degree of air humidity if possible. The ambient temperature should not exceed 30 °C.

3. Routine operation/maintenance

Charge the centrifuge in good balance if possible. Pay attention to position the butyrometers evenly.
Clean the centrifuge in case of broken glass immediately after it has stopped. This prevents unnecessary corrosion and guarantees a long service life.

Dipl.-Ing. K. Schäfer

SuperVario-N

Multi-purpose centrifuge for the dairy industry

A centrifuge known particulary for its extremely quiet running. Absence of vibration and swing-out butyrometers hangers positively influence the operating time of your butyrometers. This guarantees correspondingly good results (repeatability and comparability). This is why SuperVario-N is often used as a pilot centrifuge for calibration.
SuperVario-N can be used for the following tests due to its flexibility (rotor speed, temperature and time are programmable):

	Type of test	Rotor speed/RCA
1.	Gerber fat determination	1100 / 350 g
2.	Babcock fat determination	750 / 165 g
3.	Determination of solubility (ADMI)	900 / 172 g
4.	Fat determination acc. to Röse-Gottlieb*	600 / 77 g

** operation only when complying with the respectively valid safety regulations*

Properties:

- ☐ Stainless-steel housing
- ☐ Programmable rotor speed from 600 rpm to 1130 rpm in steps of 10 rpm *(corresponding to g-value of 77 to 372 g)*
- ☐ Programmable heating up to 68 °C to 1 °C steps
- ☐ Automatic centrifugation time from 1 to 99 minutes
- ☐ Automatic safety interlocking of the lid
- ☐ Automatic switching-off of unbalance
- ☐ Automatic brake

Technical data:

Connected load:	230 V/50 ... 60 Hz/1200 VA
Weight, empty:	26 kg
Total height incl. lid:	460 mm
Filling height:	370 mm
Rotor speed range:	600 bis 1130 rpm**
Temperature range:	ambient temperature up to 68 °C

*** The fat determination acc. to Gerber specifies a g-value of 350 g ± 50 g. Having a **R**elative **C**entrifugal **A**cceleration (RCA) of 371 g unloaded (no-load-running) and 323 g fully loaded SuperVario-N complies exemplary with the standard specifications.*

SuperVario-N

Multi-purpose centrifuge for all butyrometers.
See detailed description on page 29

3680

Head A

Centrifugal head for 36 butyrometers
or 18 Babcock bottles max.

3685

Butyrometer hangers, pressure-casted light metal, page 26
3631 1 piece
3631-12 12 pieces
3631-24 24 pieces
3631-36 36 pieces
Babcock hangers: Item no. 3632 page 26

Head B

Centrifugal head B (protection vessel for 8 Mojonnier tubes)

3686

Mojonnier tubes: Item no. 3870, 3871, page 33

Head C

Centrifugal head C (6 solubility buckets max.)

3687

Bucket for solubility index tube: Item no. 3633 page 26
Solubility index tube, ADMI: Item no. 3634 page 27

WB 436-D universal water bath (digital)

Digital temperatur display (actual value), digital nominal temperatur control, PT 100 sensor (platinum sensors), Stop watch (1 to 99 min. with acoustic signal)

3707

Description for WB 436-D
Stainless steel interior housing, exterior housing made of powder-coated sheet steel, external heating – no interfering heating elements, overheating protection (also in case of empty container). Operation with distilled water possible.

Technical data:
Temperature rage: up to 100 °C
Connected load: 230 V/50 Hz ... 60 Hz/1000 W
Dimensions: 396 mm x 331 mm x 265 mm (L x B x D)
Volume: 15.3 l
Weight: 8.8 kg

WB 436-A Universal water bath (analogue)

See 3707, but with analogue temperature adjustment (turning knob), temperature display with thermometer (included in scope of supply), thermostatic heat controller.

3708

Description for WB 436-A
Stainless steel interior housing, exterior housing made of powder-coated sheet steel, external heating – no interfering heating elements, overheating protection (also in case of empty container). Operation with distilled water possible.

Technical data:
Temperature rage: to 100 °C
Connected load: 230 V/50 Hz ... 60 Hz/1000 W
Dimensions: 396 mm x 331 mm x 265 mm (L x B x H)
Volume: 15.3 l
Weight: 8.8 kg

Butyrometer stand for WB-436

Stainless steel, for 36 butyrometers

3717

Mojonnier stand
stainless steel, for 10 Mojonnier tubes

3718

Universal shelf
Stainless steel

3727

Reductase insert
for 99 samples

3737

Lid for reductase

3747

Insert for “Delvotest”

3754

Butyrometer tubes
closed, brass, for butyrometer stand

3766-G

Butyrometer tubes
open, brass, for butyrometer stand

3766-O

Safety reading lamp

for safe reading of the butyrometers, antiglare light, lens with protective Plexiglas cover, adjustable height and lens distance, cord-operated switch, 230 V/50 ... 60 Hz

3800

Shaking machine

For even, vigorous and reproducible mixing of the content of 4 extraction tubes acc. to *Mojonnier*
230 V/50 ... 60 Hz

3850 for 4 Mojonnier tubes

3851 for 6 Mojonnier tubes

Extraction tube

acc. to *Mojonnier*
with cork stopper with round bulb

3870

Extraction tube

acc. to *Mojonnier*
with cork stopper with flat-topped bulb

3871

Wooden stand

for 8 extraction tubes

3875

LactoStar

A new standard for routine analytics

Dipl.-Ing. K. Schäfer, Dipl.-Phys. W. Spindler

LactoStar – a quick and reliable method to determine the constituents of milk.

Constituents	Dissolution	Repeatability
Fat:	0.01%	± 0.02%
Protein:	0.01%	± 0.03%
Lactose:	0.01%	± 0.03%
SNF: (fat-free dry matter)	0.,01%	± 0.04%
Freezing point:	−0.001 °C	± 0.002 °C

Types of products:

20 different types of products (e.g. cow milk, raw milk, skim milk, sheep's milk, cream, etc.) can be calibrated and stored.

Operation:

Operation is easy and clear because it is menu-assisted.

Calibration:

Two-point calibration: The unit is calibrated with two reference milks. Calibration takes place automatically.

Measuring principle:

The measurement is based on a combined thermo-optical procedure, i.e. the milk sample (12 ml to 20 ml, adjustable) is pumped in two different measuring cells. It is then analyzed with the help of these two measuring units, an opto-unit (BlueBox) and a thermal unit (RedBox). This means that the milk samples are analyzed by using to completely different measuring methods. These measuring methods are:

1.1 Optical measuring method (BlueBox)

It is a turbidity measurement. The undissolved (visible) substances are regitered in this measuring unit, i.e. it measures the sum of fat and protein.

1.2 Thermal measuring method (RedBox)

By making use of termal effects, the fat content and the fat-free dry matter are determined at different measuring temperatures.

Technical data:

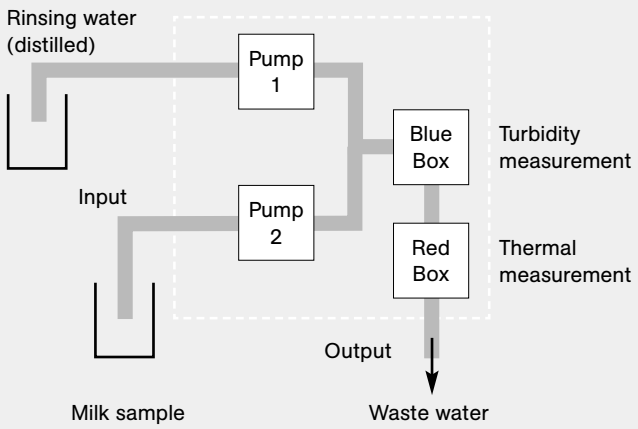
Connected load:	230 V/180 VA 50 – 60 Hz 12 V DC
Sample throughput:	Up to 30 samples/h
PC-connection:	serial interface, 9.200 Baud, software included in scope of delivery
Printer:	parallel interface
Dimensions:	40 cm x 20 cm x 26 cm (W x H x D)
Weight:	ca. 15 kg

1.3 Computational analysis

You determine the content of protein by calculating the difference between: Result of tubidity measurement (fat + protein) minis result of thermal measurement (fat)
P = T - F
The freezing point is calculated according to the following pattern: SNF - Protein = FP (sum of all dissolved substances)

Summary:

Combining two physically completely different measuring methods and completing it by a corresponding computing algorithm forms the basis of this instrument concept.



2.0 Construction

The instrument consists of the following functional units:

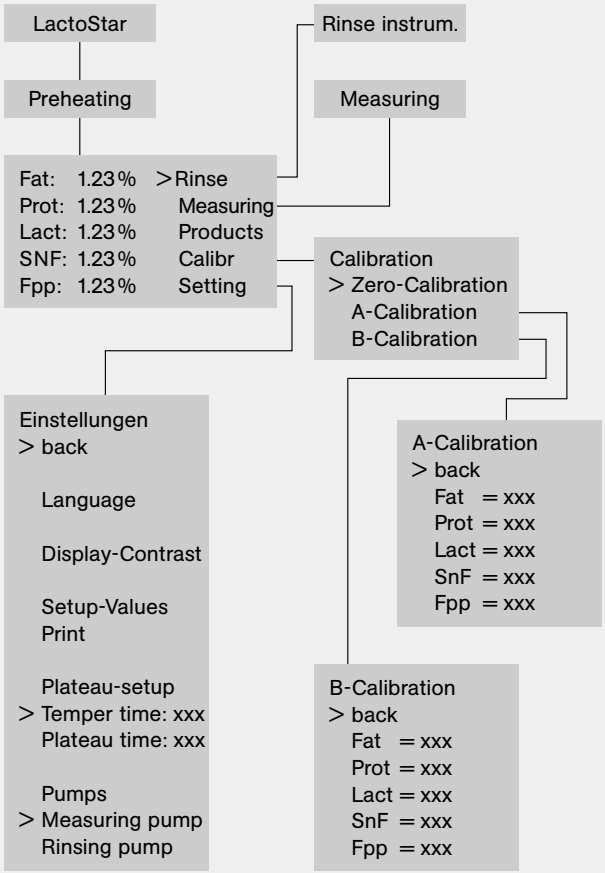
2.1 Two pumps
2.1.1 rinsing pump
2.1.2 sample pump
2.2 Optical measuring unit (BlueBox)
2.3 Thermal measuring unit (Red Box)
2.4 Printed circuit board/ CPU (Central Processing Unit)
2.5 Display
2.5.1 LCD, 4 lines with 20 characters each
2.5.2 Keyboard with just 3 buttons
2.6 Power supply

Menu tree/operation

You operate the instrument with just three buttons and is menu-assisted.

The most important menu items:

☐ Rinsing: Rinse measuring tract
☐ Measuring: You start measuring with it.
☐ Zero-calibration: You start an automatic zero-calibration of the complete device (4 measuring routines of 12 ml each). The actual calibration for the constituents starts afterwards.
☐ Calibration A: You start an A-calibration with the set current A-values
☐ Calibration B. You start a B-calibration with the set current B-values.



Setting of the LactoStar

There is a control panel on the front of the device which has an LCD-display with four lines and three buttons. The display always shows the present position in the menu tree. You use the upper and the lower button to activate the indicated menu item (e.g. if you want to change a value). All menu items that are related to input of numbers show a question mark "?" instead of the equals sign "=". Then you can alter the indicated value. Example: You want to change the plateau time of 30 seconds to 25 seconds:

☐ First press the lower button until the display shows the checkmark in front of "Menu".
☐ Then press the middle button to get into the menu.

Note: The sensitive area "Menu" is protected. You have to press "Enter" for approx. 3 sec. to get into it. The same is true for the area "Calibration".

Then press the lower button again until you “Plateau setup” appears on the display and you have a checkmark in front of “Plateau = ...”.

☐ Press the middle button. You see “Plateau ? 30 s” on the display.
☐ Now you can increase or decrease the value with the left or right button until you see the value you want (e.g. 25 s).
☐ Press the middle button again. The question mark disappears and the new value is stored.

The LactoStar is pre-calibrated with a raw milk ex works and is delivered with standard settings. It has to be adjusted to the particular values of its concrete field of application and those valid for the respective laboratory. The LactoStar stores 20 different calibration data sets for various kinds of products. This enables you to switch from one kind of product to another without a new calibration (after corresponding calibration), e.g. from skim milk to cream and back. There are 12 different data sets for milks 4 data sets for whey and 4 data sets for cream.

Measuring start
First press the two external buttons until the checkmark appears in front of “Measurement” on the display. Put the sample bottle into the bottle holder in such a way that the suction pipe dips deep enough into the sample. The sample must not be foamy because air bubbles disturb the measurement considerably. The device needs about 12 ml of sample. Then press the middle button and the measuring process starts. After the measurement is finished you see the results for fat, protein, lactose and SNF on the display. If you press the down-button, you will see protein, lactose, SNF and the freezing point.

Calibration
It is necessary to calibrate the LactoStar to get accurate results.

Zero calibration
It is recommended to do a zero calibration once a week. It is necessary for a calibration of the entire hardware, i.e. it is necessary to compensate changes that were caused by wear-out of components, long-time drift and other effects.

A zero calibration is done as follows:
☐ Repeated rinsing: Repeat rinsing until the water in the discharge hose is clear.
☐ Put a milk sample bottle with 50 ml distilled water into the bottle holder.
Select the menu item: ‘Zero Calibration’.
☐ Start zero calibration.

Note:
Zero calibration is a necessary hardware calibration. It is ***not*** *a calibration of the constituents. This is done by A- and B-calibration. This is why you cannot expect that the measuring results for distilled water are set to 0.00% by zero calibration. Depending on the type of product a measurement with water does not necessarily indicate 0.00% for the respective constituents . but that there are be considerable deviations (<0.1%). This effect is the smallest in whole milk. It is adequately higher in other types of products like skim milk, cream, etc.* ***This does not influence the measuring accuracy for the respective type of product!***

Calibration
The actual calibration for constituents consists of two calibrations: A-calibration with a milk that is poor in constituents in all its parameters (A-milk), and the B-calibration with a milk that is rich in all constituents (B-milk). The A-milk can be extracted from the B-milk by diluting the B-milk with water (e.g. by 50% = 1:1 or $33^{1}/_{3}\%$ = 1:2 or $66^{2}/_{3}\%$ = 2:1, etc.).It is important that this dilution is done with an exact balance and is mixed well to avoid mistakes in calibration.

The device sets certain requirements to the B-milk. The essential constituents of this milk have to be similar to the milks that are measured, or it must have a similar matrix. The differences between the constituents of A-milk and B-milk should amount at least to 1%.

Attention: You have to calibrate for each type of milk (type of product).

Examples for calibration:
The unit is to be calibrated for instance for:
Milk 1: raw milk measurements
Milk 2: homogenized milk
Milk 3: skim milk
Milk 4: sheep’s milk

First it is calibrated for the raw-milk measurement. You need about 200 ml of reference milk for a calibration (A- and B-calibration). Either you know the values of the respective constituents or you must determine them by reference analysis.

The LactoStar needs milk for 3 measurements for A- and B-calibration each. Therefore, take always a full sample bottle (50 ml) for calibration.

1. Selection of product
Set the instrument on “Milk 1”. You can do this in the menu under “Products” (see “Menu tree” and “Setting of the LactoStar”).

2.0 Preparation of A-milk
Prepare approx. 100 ml A-milk by diluting 50 ml of reference raw milk with for instance 20 % distilled water. (percentage by weight – use balance!). Mix thoroughly. It is possible to use also other mixing ratios which change the reference values for A-milk correspondingly. (It is particularly positive if the values for the constituents of the A-milk are not calculated but determined by the respective procedure (e.g. Gerber, Kjelhdahl, freezing point, etc.)

3.0 Entering values
3.1. Enter A-value
Select menu item ‘A-calibration’
☐ Enter value of constituent

3.2 Entering B-value
Select menu item ‘B-calibration’
☐ Enter value of constituent

4.0 A-milk
4.1 Carry out two measurements with A-milk. This is a rinsing cycle with a A-reference milk. The measured values are of no significance.

4.2 A-calibration:
☐ Put the milk sample bottle with A-milk (50 ml) into the bottle holder.
☐ Start A-calibration. 3 measurements are taken, i.e. the process takes about 6 minutes.

5.0 B-milk
5.1. Carry out two measurements with B-milk. This is a rinsing cycle with a B-reference milk. The measured values are of no significance.

5.2 B-calibration:
☐ Put the milk sample bottle with B-milk (50ml) into the bottle holder.
☐ Start B-calibration. 3 measurements are taken, i.e. the process takes about 6 minutes.

Calibration for milk 1 is completed. Carry out calibration for the other types of products (milk 2, milk 3, milk 4) in the same way.
Then the unit is ready for measuring various milks. Obviously you have to select the “correct” type of product before measurement.

Attention: Avoid any passive dispersal of calibration liquids. Work speedily and without any breaks between the calibration steps.
Do not mix up the calibration solutions. Do **A-calibration with A-milk** first and then **B-calibration with B-milk**. Any mistakes result definitely in completely wrong calibrations of the device.

Note: Do **not** calibrate right after you cleaned the device with a cleansing solvent or another cleansing agent. Such agents extremely adulterate the measuring results. You have to rinse thoroughly after you used them because they strongly wet the surface of the measuring cells.

Properties of the unit

1.0 Products
The LactoStar can store 20 different data sets. There are 12 data sets for different types of milk, 4 for whey, 4 for cream. so you can switch from one product to another (e.g. from milk to cream, etc.) without doing a new calibration.

2.0 Interfaces

2.1 Parallel interface
The LactoStar has a parallel interface to connect standard printers. You may also connect a small thermal recording printer. The 6-V-port is in the rear of the unit.

2.2 Serial interface
You can connect a PC to the serial interface. This enables you to record the measuring results and to add other information (date, time, delivering vehicle, specific supplier’s number, etc.). The recorded data can be used in other programs (e.g. spreadsheet or company software, etc.). You can also store and edit the calibration data. it is also possible to transfer the calibration profile from one unit to another one or to read the data from the unit and to store it. The necessary software is included in the scope of delivery.

Kjeldahl digestion apparatus

series heaters with modul-shaped tubular heating units and glass exhaust manifold to be connect to water jet pump or TURBOSOG exhaust terminal.

4200	for 4 digestions with Kjeldahl flasks 500 ml (10 kg – 650 x 250 x 300 mm)
4201	for 6 digestions with Kjeldahl flasks 500 ml (15 kg – 900 x 250 x 300 mm)
4202	with water jet pump for glass exhaust manifold
4203	TURBOSOG exhaust terminal

Kjeldahl distillation apparatus

series heaters with mould-shaped tubular heating units, Kjeldahl flask, Teitmair distillation tubes, cooling tubes, outlet pipes, Erlenmeyer flasks and stand equipment.

4210	for 4 distillations, 500 ml (25 kg – 650 x 380 x 950 mm)
4211	for 6 distillations, 500 ml (35 kg – 950 x 380 x 950 mm)

Kjeldahl digestion units

semi-automatic system
aluminum digestion block, support in tiers, insert rack, exhaust equipment and digestion tubes, without controller

4220	for 8 digestions 250 ml (16 kg – 380 x 380 x 650 mm)
4221	for 20 digestions 250 ml (39 kg – 460 x 500 x 740 mm)
4225	Thermostat 0 – 420 °C

Steam-heated distillation apparatus

for small number of samples with simple program flow: automatic NaOH dosing

4230	(25 kg – 440 x 690 x 340 mm)

for medium number of samples with varied program flow: automatic dosing of H_2O and NaOH and exhaust of distilled sample residues

4231	(27kg – 460 x 500 x 740 mm)

Laboratory pH meter

Electrodes are not in scope of supply

	Knick 766 comfortable measuring instrument for pH, mV und °C: adjustment and control of the electrode, self-diagnostic, automatic temperature compensation,
4310	recorder connection, calibrated-data memory
	Knick 765
4311	plus Rs 232 interface for computer and printer

Battery/pocket pH meter

Electrodes are not in scope of supply

	Knick 911 highly developed dust, water and impact protected measuring instrument for pH, mV and °C with mounting clip for tables: automatic calibration, identification of buffer solution
4315	and temperature compensation, self diagnostics.
4316	**Knick 912** plus measurement data storage
	Knick 913 plus data memory and interface
4217	for computer and printer
4319	Pt 1000-temperature sensor for pH 911, 912 and 913

Laboratory pH meter

	WTW Level 1 routine laboratory pH/mV meter with automatic temperature compensation, calibration system,
4320	battery and mains operated
	WTW Level 2
4321	precision pH/mV meter plus RS 232-interface for computer and printer

Pocket pH meter

4330	**WTW 330** robust and water-proof pH/mVmeter with data memory, automatic calibration, automatic temperature compensation.
4331	**WTW 330-SET** measuring instrument in professional suitcase with integrated measuring set, holding clip, buffer solution pH 4, pH 7, pH 10 and KCL solution, without electrode
4334	**WTW 340** measuring instrument with additional analogue and digital outlets RS 232
4335	temperature sensor with clip for WTW 330 und 340

Combined electrode for milk

Inlab 408, suitable for milk and other liquids,
fixed cable with DIN-plug

4350	

Electrodes

4360	for puncture measurements Inlab 427 with plug head and DIN-plug-cable
4361	Inlab 427 without cable
4370	SE 104 for stick-in-measurements in cheese, meat and meat-products, fixed cable with DIN-plug

Combined electrode with temperature sensor

SE 102 combined electrode with integrated Pt 1000 temperature sensor, fixed cable with DIN-plug

4380	

Buffer solution

250 ml in PE bottle

4390	pH 4.00
4391	pH 7.00
4392	pH 9.00

KCL-solution, 250 ml in PE bottle

4400	3 mol/l+AGCl

Electrode stand

4410	for two electrodes, plastic

Cleaner for combined electrodes

250 ml in PE bottles

4420	AG-Cl-diaphragma cleaner, Thiourea solution
4421	Protein solvent, pepsin-hydrochloric acid

Reactivation solution

250 ml in PE bottle, hydrofluoric acid

4422	

Acidity Determination
Titration equipment STANDARD

complete with storage bottle, rubber stopper, burette with automatic zero adjustment, sodalime tower with ascending tube, rubber pressure bulb, burette tip with pinchcock, one pipette 1 and 25 ml, Erlenmeyer flask 200 ml

4500	for milk: 0 – 20° SH
4501	for cream: 0 – 40° SH
4510	for curd: 0 – 250° SH with porcelain mortar and pestle, pipette 2 ml (without pipettes 1 and 25 ml and Erlenmeyer flask)

Acidity Determination
Titration equipment SIMPLEX

for milk and cream, complete with polyethylene bottle on a platic base, burette with automatic zero adjustment precision titration by button control, one pipette 1 ml and 25 ml, Erlenmeyer flask 200 ml

4520	for milk: 0 – 25° SH
4521	for cream: 0 – 40° SH

Titration equipment SIMPLEX

for general titration purposes,
see above but without accessoires

4530	with burette 0 – 10 ml : 0.05
4540	with burette 0 – 25 ml : 0.1
4550	with burette 0 – 50 ml : 0.1

Protein titre apparatus

with storage bottle, for use with 25 ml milk, special burette with automatic zero adjustment, sodalime tower with ascending tube, rubber bulb, outlet tip, pinchcock, one transfer pipette 1 ml, 5 ml and 25 ml, 2 beakers, short type, 250 ml, 2 measuring pipettes 1 ml : 0.01

4660	0 – 6 ET: 0.02

Rapid burette

acc. to *Dr. Schilling*, Schellbach stripes, complete with storage bottle and base

4680	10 ml: 1/20
4681	25 ml: 1/10
4682	50 ml: 1/10

Milk tester SALUT

with 2 tubes, for alcohol coagulation test/alizarol test at delivery platform, for determining the freshness of raw milk

4700	
4701	Replacement tube with hole

Salt test for butter and cheese

see no. 4530 and no. 4540, but with brown storage bottle

4760	for butter: 10 ml: 0.05
4770	for cheese: 25 ml: 0.1

Sediment tester SEDILAB

manual sediment tester for easy use, with clamp for tables, solid metal design, for 500 ml milk

4800	

Sediment tester REVAMAT

for serial testing at reception speed, throughput:
approx. 800 samples/hour, sharply defined sediment images,
for 500 ml milk, 220 V/50 Hz

4900

Sediment tester ASPILAC

pump type for direct suction from milk can,
Plexiglas housing, for original filter papers,
for 500 ml milk

4905

Filter papers

4910 with record surface, 1000 pieces

Filter, round

4911 32 mm, 1000 pieces

Reference table

4920 with 3 purity grades, German standard

Reductase test tubes

with ring mark

5040 10 ml and 21 ml

5041 10 ml

Rubber stopper

for reductase test tubes

5060

Pipetting syringes

for determinig nutrient and dye solutions,
self-priming, can be sterilized

5110	adjustable to 1 ml
5111	adjustable to 2 ml
5112	adjustable to 5 ml (for 10 ml see no. 8170)

Methylene blue tablets

5140	50 pieces

Resazurine tablets

5150	for LOVIBOND comparator, 100 pieces

LOVIBOND comparator 2000

for resazurine tests, housing for 2 test tubes for comparison
with color disc

5160	

Color disc

5161	for resazurine 4/9 with 7 standard reference colors

Test tube

5162	set of 4 pieces

Dry-matter calculator

nacc. to *Ackermann*, for milk

5360	

Butter-melting beaker

5400 aluminum, 30 g

5401 aluminum, 50 g

Tongs

5420

Glass stirrer

pestle-type, 140/6 mm

5430

Double-ended spatula

pure nickel, 150 mm

5440

Butter test spoon

Plexiglas

5450

Crystal quartz sand

5460 washed, 1 kg, calcined

5461 washed, 3 kg, shipping costs on request

Aluminum foil

150 x 190 mm, 1000 pieces

5470

Weighing dish

aluminum, Ø 75 x 30 mm with lid (numbered on request)

5490

Bunsen burner

for propane (other types of gas on request)

5550

Infrared burner, up to 750 °C

suitable for fast, contact-less heating
(0.9 kg – 100 x 100 x 100 mm)

5571

5572 Power regulator

Spirit lamp

5580 glass

5581 metal

Water paper

for determination of moisture distribution in butter
40 x 78 mm, 1 box = 50 stripes

5600

Butter cutter

gauge 0.5 mm

5605

Pocket refractometer

for measuring the degree of evapoation of milk and determining concentration in various spheres of application, incl. case. The internationally valid Brix scale allows direct determination of percentage of dry matter in weight

5610	0 – 32 % Brix: 0.2%, for milk, fruit juice, soft drinks
5612	28 – 62 % Brix: 0.2%, for juice concentrate
5613	45 – 82 % Brix: 0.5%, for honey

Digital hand refractometer

0 – 45%: 0.1 % Brix, 1.3300 – 1.4100 nD: 0.0001 nD
0 – 60 °C: 0.1 °C
temperature compensation automatically 0 – 40 °C
(0.3 kg – 180 x 80 x 35 mm)

5614	

Digital Abbe refractometer

1.3000 – 1.7200 nD: 0.0001 nD, 0 – 95 %: 0.1 % Brix
0 – 99 °C: 0.1 °C, LED display 590 nm,
serial interface RS-232 and RS 422,
115/230 V, 50/60 Hz (5 kg – 140 x 275 x 300 mm)

5620	

Bath/circulation thermostat E-5 JULABO

for internal and external tempering
temperature range: 20 °C to 100 °C (depending on ambient temperature), dip opening 150 x 150/150 mm,
(6 kg 170 x 330 x 350 mm)

5630	

Moisture tester MA 30

fully automatic determination of moisture or dry matter.
30 g: 0,01%, data interface RS 232 C
(5,5 kg – 217 x 283 x 165)

5710	
5711	Foil press
5712	Aluminum round foil, 130 x 0.03 mm, 1000 pieces
5713	Glass-fiber filter for determining liquid, pasty and fat-containing samples, 80 pieces

Analytical balance

GLP/ISO protocol option, piece counting, formulation memory, percentage determination, RS 232 C interface, underfloor weighing, dust and splash-proof, including calibration weight.

5810	120 g : 0.1 mg
5811	220 g : 0.1 mg

Precision balance

piece counting, formulation memory, percentage determination, RS 232 C interface, plash-proof, including calibration weight.

5820	310 g: 0.01 g
5821	510 g: 0.01 g
5830	210 g: 0.001 g

FUNKE GERBER

Universal Ovens

Equipment	Typ	Ext. dimensions (W/H/D) [mm]	Int. dimensions (W/H/D) [mm]	Volume [Liter]	Support rips for shelves/ Shelves supplied with oven	Watt/Volt	Kg (Net)	Order-Num
Universal-oven "UM" Thermostatic temperature control, digital temperature display, passive through circulation	**UM 100**	470/520/325	320/240/175	14	2/1	600/230	20	**6000**
	UM 200	550/600/400	400/329/250	32	3/1	1100/230	28	**6001**
	UM 300	630/600/400	480/320/250	39	3/1	1200/230	30	**6002**
	UM 400	550/680/480	400/400/330	53	4/2	1400/230	35	**6003**
	UM 500	710/760/550	560/480/400	108	5/2	2000/230	50	**6004**
	UM 600	950/920/650	800/640/500	256	7/2	2400/230	87	**6005**
	UM 700	1190/1080/650	1040/800/500	416	9/2	4000/400	121	**6006**
	UM 800	1190/1605/750	1040/1200/600	749	14/2	4800/400	170	**6007**
Universal-oven "ULM" Thermostatic temperature control, digital temperature display, electrical blower	**ULM 400**	550/680/480	400/400/330	53	4/2	1400/230	35	**6008**
	ULM 500	710/760/550	560/480/400	108	5/2	2000/230	50	**8009**
	ULM 600	950/920/650	800/640/500	256	7/2	2400/230	87	**6010**
	ULM 700	1190/1080/650	1040/800/500	416	9/2	4000/400	121	**6011**
	ULM 800	1190/1605/750	1040/1200/600	749	14/2	4800/400	170	**6012**
Universal-oven "UE" Electronic temperature control (PID), digital watch, serial interface, passive through circulation	**UE 200**	550/600/400	400/329/250	32	3/1	1100/230	28	**6013**
	UE 300	630/600/400	480/320/250	39	3/1	1200/230	30	**6014**
	UE 400	550/680/480	400/400/330	53	4/2	1400/230	35	**6015**
	UE 500	710/760/550	560/480/400	108	5/2	2000/230	50	**6016**
	UE 600	950/920/650	800/640/500	256	7/2	2400/230	87	**6017**
	UE 700	1190/1080/650	1040/800/500	416	9/2	4000/400	121	**6018**
	UE 800	1190/1605/750	1040/1200/600	749	14/2	4800/400	170	**6019**
Universal-oven "ULE" Electronic temperature control (PID), digital watch, serial interface, electrical blower	**ULE 400**	550/680/480	400/400/330	53	4/2	1400/230	35	**6020**
	ULE 500	710/760/550	560/480/400	108	5/2	2000/230	50	**6021**
	ULE 600	950/920/650	800/640/500	256	7/2	2400/230	87	**6022**
	ULE 700	1190/1080/650	1040/800/500	416	9/2	4000/400	121	**6023**
	ULE 800	1190/1605/750	1040/1200/600	749	14/2	4800/400	170	**6024**
Universal-oven "UP" Electronic temperature control with process controller (PID), programmable, serial and parallel interfaces, passive through circulation	**UP 400**	550/680/480	400/400/330	53	4/2	1400/230	35	**6025**
	UP 500	710/760/550	560/480/400	108	5/2	2000/230	50	**6026**
	UP 600	950/920/650	800/640/500	256	7/2	2400/230	87	**6027**
	UP 700	1190/1080/650	1040/800/500	416	9/2	4000/400	121	**6028**
	UP 800	1190/1605/750	1040/1200/600	749	14/2	4800/400	170	**6029**
Universal-oven "ULP" Electronic temperature control with process controller (PID), programmable, serial and parallel interfaces, electrical blower	**ULP 400**	550/680/480	400/400/330	53	4/2	1400/230	35	**6030**
	ULP 500	710/760/550	560/480/400	108	5/2	2000/230	50	**6031**
	ULP 600	950/920/650	800/640/500	256	7/2	2400/230	87	**6032**
	ULP 700	1190/1080/650	1040/800/500	416	9/2	4000/400	121	**6033**
	ULP 800	1190/1605/750	1040/1200/600	749	14/2	4800/400	170	**6034**

Incubators/Sterilizers

Equipment	Typ	Ext. dimensions (W/H/D) [mm]	Int. dimensions (W/H/D) [mm]	Volume [Liter]	Support rips for shelves/ Shelves supplied with oven	Watt/Volt	Kg (Net)	Order-Num
Incubator "BE" Electronic temperature control (PID), digital watch, serial interface, passive through circulation	**BE 200**	550/600/400	400/329/250	32	3/1	440/230	28	**6035**
	BE 300	630/600/400	480/320/250	39	3/1	500/230	30	**6036**
	BE 400	550/680/480	400/400/330	53	4/2	800/230	35	**6037**
	BE 500	710/760/550	560/480/400	108	5/2	900/230	50	**6038**
	BE 600	950/920/650	800/640/500	256	7/2	1600/230	87	**6039**
	BE 700	1190/1080/650	1040/800/500	416	9/2	1800/230	121	**6040**
	BE 800	1190/1605/750	1040/1200/600	749	14/2	2000/230	170	**6041**
Incubator "BP" Electronic temperature control with process controller (PID), programmable, serial and parallel interfaces, passive through circulation	**BP 400**	550/680/480	400/400/330	53	4/2	800/230	35	**6042**
	BP 500	710/760/550	560/480/400	108	5/2	900/230	50	**6043**
	BP 600	950/920/650	800/640/500	256	7/2	1600/230	87	**6044**
	BP 700	1190/1080/650	1040/800/500	416	9/2	1800/230	121	**6045**
	BP 800	1190/1605/750	1040/1200/600	749	14/2	2000/230	170	**6046**
Sterilizer "SM" Thermostatic temperature control, digital temperature display, passive through circulation	**SM 100**	470/520/325	320/240/175	14	2/1	600/230	20	**6047**
	SM 200	550/600/400	400/329/250	32	3/1	1100/230	28	**6048**
	SM 300	630/600/400	480/320/250	39	3/1	1200/230	30	**6049**
	SM 400	550/680/480	400/400/330	53	4/2	1400/230	35	**6050**
Sterilizer "SLM" Thermostatic temperature control, digital temperature display, electrical blower	**SLM 400**	550/680/480	400/400/330	53	4/2	1400/230	35	**6051**
	SLM 500	710/760/550	560/480/400	108	5/2	2000/230	50	**6052**
	SLM 600	950/920/650	800/640/500	256	7/2	2400/230	87	**6053**
	SLM 700	1190/1080/650	1040/800/500	416	9/2	4000/400	121	**6054**
	SLM 800	1190/1605/750	1040/1200/600	749	14/2	4800/400	170	**6055**
Sterilizer "SE" Electronic temperature control (PID), digital watch, serial interface, passive through circulation	**SE 200**	550/600/400	400/329/250	32	3/2	1100/230	28	**6056**
	SE 300	630/600/400	480/320/250	39	3/2	1200/230	30	**6057**
	SE 400	550/680/480	400/400/330	53	4/2	1400/230	35	**6058**
								6059
Sterilizer "SLE" Electronic temperature control (PID), digital watch, serial interface, electrical blower	**SLE 400**	550/680/480	400/400/330	53	4/2	1400/230	35	**6060**
	SLE 500	710/760/550	560/480/400	108	5/2	2000/230	50	**6061**
	SLE 600	950/920/650	800/640/500	256	7/2	2400/230	87	**6062**
	SLE 700	1190/1080/650	1040/800/500	416	9/2	4000/400	121	**6063**
	SLE 800	1190/1605/750	1040/1200/600	749	14/2	4800/400	170	**6064**
Sterilizer "SLP" Electronic temperature control with process controller (PID), programmable, serial and parallel interfaces, electrical blower	**SLP 400**	550/680/480	400/400/330	53	4/2	1400/230	35	**6065**
	SLP 500	710/760/550	560/480/400	108	5/2	2000/230	50	**6066**
	SLP 600	950/920/650	800/640/500	256	7/2	2400/230	87	**6067**
	SLP 700	1190/1080/650	1040/800/500	416	9/2	4000/400	121	**6068**
	SLP 800	1190/1605/750	1040/1200/600	749	14/2	4800/400	170	**6069**
Cooling incubator "ICP" process controller (PID) from 0 to +60 °C, programmable, serial and parallel interfaces, electrical blower	**ICP 400**	558/967/486	400/400/330	53	4/2	500/230	68	**6070**
	ICP 500	718/1047/556	560/480/400	108	5/2	500/230	87	**6071**
	ICP 600	958/1335/656	800/640/500	256	7/2	700/230	144	**6072**
	ICP 700	1198/1495/656	1040/800/500	416	9/2	750/230	178	**6073**
	ICP 800	1198/1895/756	1040/1200/600	749	14/2	1200/230	227	**6074**

Laboratory ovens

Heating and incineration up to 1100 °C, furnace casing of stainless steel high-grade insulation, short heating-up period, 230 V/50 Hz

6220	Internal dimensions: 160 x 140 x 100 mm, 1.2 kW (18 kg – 340 x 340 x 420 mm)
6222	Internal dimensions: 240 x 250 x 170 mm, 3.0 kW (39 kg – 430 x 530 x 570 mm)

Discharge viscometer

This easy-to-use viscometer proved its value in internal viscosity measurements of yogurt, sour milk, sour cream, kefir and other products. The time needed to discharge is taken for the measure of viscosity.

6520	Including stand and two different slice nozzles
6521	**Glass plate**
6522	**Timer for** 6520

ViscoTester VT6R Haake

rotary viscometer for measurements pursuant to ISO 2555 and ASTM (Brookfield method)

– measuring range 20 ... 13.000.000 mPas (cP)
– acoustic warning for measuring range
– RS 232C interface
– set with 6 spindles, stand and carrying

6530	stand and carrying case are incl. in scope of delivery

Inhibitor Detection, Delvotest SP

6570	1 set for 100 samples

Delvotest plate test SP

6571	5 plates for 96 tests each

Lactodensimeter

Lactodensimeter are often used officially calibrated or officially calibrated with certificate. Please refer to our price list or contact us.

Lactodensimeter

for milk acc. to *Gerber*, large model, negative scale, 1.020 – 1.040: 0.0005 g/ml, with thermometer 10 – 40 °C in stem, T = 20 °C, 10 – 40 °C, approx. 300 x 28 mm

6600	standard model
6602-E	officially calibrated, thermometer 10 – 30 °C
6603-ES	officially calibrated, with certificate, thermometer 10 – 30 °C

Lactodensimeter

for milk acc. to *Gerber*, small model, negative scale 1,020 – 1,035: 0,0005 g/ml, T = 20 °C, with thermometer in body 0 – 40 °C, approx. 210 x 17 mm

6610	standard model
6612-E	officially calibrated, thermometer 10 – 30 °C
6613-ES	officially calibrated, with certificate, thermometer 10 – 30 °C

Hydrometer

for milk pursuant to former DIN 10290 without thermometer, 1.020 – 1.045: 0.0005 g/ml, T = 20 °C, approx. 350 x 25 mm

6620	standard model
6621-E	officially calibrated
6622-ES	officially calibrated, with certificate

Lactodensimeter

for milk acc. to Quevenne, 15 – 40: 1.0, with colored triple scale, T = 20 °C, with thermometer 0 – 40 °C, approx. 290 x 22 mm

6630	
6631	without thermometer, approx. 210 x 22 mm

Hydrometer for buttermilk serum

DIN 10293, 1.014 – 1.030: 0.0002 g/ml, T = 20 °C, without thermometer, approx. 240 x 21 mm

6640	standard model
6641-E	officially calibrated
6641-ES	officially calibrated, with certificate

Buttermilk tester

acc. to *Dr. Roeder*, 10 – 30: 1.0, with thermometer in stem, T = 20 °C, approx. 210 x 25 mm

6650	

Hydrometer for condensed milk

without thermometer, T = 20 °C

6660	1.000 – 1.240: 0.002 g/ml, approx. 310 x 19 mm
6661	1.040 – 1.080: 0.001 g/ml, approx. 230 x 21 mm

Hydrometer for yogurt and chocolate milk

with thermometer in body, T = 20 °C, approx. 220 x 16 mm

6670	

Hydrometer for brine/Beaumé

0 – 30 Bé: T = 15 °C, approx. 240 x 17 mm

6680	without thermometer
6681	with thermometer, 0 – 40 °C

Hydrometer for boiler water

DIN 12791, M 100, T = 20 °C, without thermometer, 1.000 – 1.100: 0.002 g/ml, approx. 250 x 20 mm

6690	

Hydrometer for boiler feed water

acc. to Dr. Ammer, −1.2 bis +2: 1/10 °Bé, approx. 300 x 22 mm

6700	

Alcoholmeter

with thermometer, 0 – 100 Vol.%: 1.0,
T = 20 °C, approx. 290 x 16 mm

6710

Hydrometer for amyl alcohol

DIN 12791, without thermometer, T = 20 °C, M 50,
approx. 260 x 24 mm, 0.800 – 0.850: 0.001 g/ml

6720

Hydrometer for amyl alcohol

DIN 12791, without thermometer, T = 20 °C, M 50,
approx. 270 x 24 mm

6730 1.800 1.850: 0.001 g/ml

6731 1.500 1.550: 0.001 g/ml

Hydrometer

DIN 12791, for various liquids,
M 50, without thermometer, T = 20 °C, approx. 270 x 24 mm

6740 1.000 1.050: 0.001 g/ml

6741 1.050 1.100: 0.001 g/ml

6742 1.100 1.150: 0.001 g/ml

6743 1.150 1.200: 0.001 g/ml

Jar

for lactodensimeters, 265 x 35 mm Ø (inside)

6800

Stand

with cardanic suspension, hanging cylinder,
210/22 mm for lactodensimeters no. 6610 – 6613

6810

Stand

with cardanic suspension, hanging cylinder with overflow, suitable for all lactodensimeters and hydrometers, incl. drip tray, tubes and pinchcock

6830

Dairy thermometer

with loop, 0 – 100 °C: 0.1, mercury filling, blue

7000

Dairy thermometer

with loop, 0 – 100 °C: 0.1, spirit filling, red

7001

Dairy thermometer

in plastic case, with loop, boiling and impact resistant, floatable, 0 – 100 °C: 0.1, mercury filling, blue

7030

Dairy thermometer

in plastic case, with loop, boiling and impact resistant, floatable, 0 – 100 °C: 0.1, spirit filling, red

7031

Dairy thermometer

mercury filling, blue, as replacement for no. 7030

7040

Dairy thermometer

spirit filling, red, as replacement for no. 7031

7041

Universal thermometer

−10 – 100 °C: 1.0, mercury filling

7045

Universal thermometer

−10 – 100 °C : 1.0, spirit filling, red

7046

Refrigerator thermometer

−50 to +50 °C: 1,0, spirit filling, blue, in plastic case,
with loop and hook

7060

Control thermometer

0 to +100 °C: 1.0, mercury filling, blue, 305 x 9 mm
officially calibrated with certificate

7070

7071 uncalibrated

Low-temperature laboratory thermometer

−38 to +50 °C: 1.0, mercury filling, 280 x 8 x 9 mm

7081

Maximum-minimum rod thermometer

mercury filling, blue, 220 mm long

7095 −35 to −50 °C: 1.0

7096 −10 to −100 °C: 1.0

Psychrometer

acc. to *Fleischmann*, complete with 2 special thermometers, water holder, diagram for reading off RH

7100

Special thermometer

as replacement for no. 7100

7101

Polymeter

(hair hygrometer) for measuring RH and temperature, measuring range 0 – 100 % RH, 0 – 30 °C, with scale for saturation vapor

7110

Digital thermometer 926

(Fig. with-stick/dipping sensor 7122)
for daily measurements of temperature in food industry, measuring range –50 to + 350 °C: 0.1 °C (1 °C from 200 °C), high precision, ISO-calibration certificate against extra charge

7120

Stick-in/dipping sensors

7122	robust precision sensor, dia. 4 mm x 110 mm
7123	Stainless steel sensor for food, dia. 4 mm x 125 mm
7124	Needle sensor for fast measurements without visible pinhole, dia. 1.4 mm x 150 mm
7125	Sensor for frozen goods, screwing in without pedrilling, dia. 8 mm x 110 mm

TopSafe

protective cover against pollution, water, impact

7127

Freezing-Point Determination

a subject of priority for
Funke-Dr. N. Gerber Labortechnik GmbH
K. Schäfer, Dipl.-Ing., and W. Spindler, Dipl.-Phys.

History

The German chemist Beckmann, known for the thermometer that was named after him, began to determine the freezing point of milk as early as 1895. He used this determination to identify alien water in milk. The American Hortvet applied this method very intensively in 1920 and improved essential features of it. The first thermistor-cryoscopes were introduced on the market in the sixties. However, they had to be operated completely manually. The first automatic thermistor-cryoscopes were available at the beginning of the seventies. With this development it was possible to determine the freezing point automatically – by touching a button.

A decisive improvement of thermistor-cryoscopy was made at the trade fair "FoodTec 1984": Funke-Gerber presented the first device with automatic calibration. Resulting from successful and intensive research and development work, another highlight could be presented at the "FoodTec 1988". Funke-Gerber introduced a fully automatic freezing-determination unit that had a capacity of 220 samples/ h.

By introducing indirect measuring of the freezing point (e.g. LactoStar) in routine analytics interest was mainly focused on reference devices that measured the freezing point according to the reference-analytical regulations. These devices have to meet strict requirements regarding measuring accuracy because they are used to calibrate routine devices. This is why Funke-Gerber has developed a freely programmable cryoscope with a resolution of 0,1 m°C. This device has already proven its precision and reliability in hundreds of laboratories all over the world.

Freezing Point:

The freezing point of pure water is the temperature at which ice and water are in equilibrium.

If soluble components are added to this liquid, the freezing point decreases (it is colder) because this reduces the ability of the water molecule to escape from the surface. Fat does not influence the freezing point because it is not soluble in water.

Measuring Principle:

Cool down milk to −3°C (subcool) and induce crystallization by mechanical impulses. As a consequence of this freezing process, the temperature rises quickly due the released lattice energy. It stabilizes at a certain plateau which corresponds to the freezing point.

Measuring Procedure:

The freezing point of liquids is not just any kind of temperature but it is exactly the temperature at which a part of the sample is in a liquid state and another part of the sample is in a frozen state while both parts are in an equilibrium.

This is why the sample has to be exactly in this specific state to be able to measure the freezing point. This needs a certain procedure that runs as follows:

First cool down the sample below ist freezing point and then trigger the freezing.

Triggering is necessary due to three reasons:

- ☐ The sample is kept in motion and it cannot freeze by itself.
- ☐ The sample is mixed well and all parts of it have the same temperature.
- ☐ The heat in the sample is transported to the outside where it is eliminated by the cooling device.

If a liquid is colder than its freezing point, this state is not stable. We call this state 'metastable'. Even very little actions like knocking at the glass wall with a hard object causes freezing. This continues avalanche-like until the heat of fusion, that is released during the freezing process, increases the temperature of the sample until it reaches the freezing point. Then the frozen parts of the sample and the parts that are not yet frozen are in equilibrium.

This means that a cryoscope has to induce freezing when the sample is sufficiently colder than its actual freezing point. What does 'sufficiently colder' mean? The aim is create that much ice during the freezing process that there are crystals in the whole sample which are of a normal size of ice-crystals. On the other hand, the sample must not be too much frozen. In milk, it turned out to be ideal if freezing was initiated at −2°C to −3°C.

After freezing was initiated the temperature of the sample rises because fusion heat is released during the freezing process. It stabilizes at a certain value, which is called 'plateau'. The cooling bath withdraws more and more heat from the sample. Additional parts of the sample freeze to the same extent as this happens, and release their heat of fusion. Thus temperature remains the same, at least as long as there are still liquid parts in the sample. This plateau lasts for some minutes. The cryoscope determines the freezing point from the measured temperature values of the plateau. They are specified in regulations.

Possible Sources of Error during the Measuring Process

Similar to the determination of the freezing point, measuring has to be performed according to a certain procedure whereby mistakes can occur at each step of this procedure.

Errors at cooling down:

If the withdrawal of heat from the sample is too low, cooling down takes too long. This is either caused by the cooling bath or the stirring rod. The cooling bath has to be at least −6 °C and must have a good circulation to withdraw the heat from the sample. The stirring rod has to rotate evenly with an amplitude of about 3 – 4 mm. If there are any errors during the process of cooling, measure the temperature of the cooling bath first. Then take an empty sample flask and check the circulation of the cooling bath. Then check whether the stirring rod can swing freely and does not knock or rub against something. Afterwards, check the amplitude of the stirring rod. CryoStar I features a special menu to do this. The guiding value is not any number of the display. This is just an approximate value. But you have to observe the tip of the swinging stirring rod and adjust it in such a way that the points of regression are about 3..4 mm from each other. Then fill 2.5 ml of water into a sample flask, hold it to the thermistor from below so that the stirring rod stirs the water, and then check whether the rod swings properly in the water.

After you have checked and adjusted all these things, take a test measurement with water and watch the value of temperature on the display. The time needed by the device to cool down the sample from room temperature (20 °C … 25 °C) to −2 °C should be almost exactly 1 minute. This means that cooling bath and stirring rod are adequately adjusted.

If the cooling period takes less than 45 seconds, the cooling bath is too cold or the stirring rood is too powerful.

If the cooling period takes more than 75 seconds, the cooling bath is too warm or circulates improperly or the stirring rod is low-powered.

If there is an “error during the cooling period” after cooling bath and stirring rod have been checked for their correct functioning, then it is necessary to check the thermistor or the calibration of the device. If the device is miscalibrated, it does not find its temperature scale and, as a result, cannot measure the correct temperature.

Frozen too early:

The state of the sample is not stable if it is colder than its freezing point. Therefore it might happen that a sample freezes by itself or due to unintentional influences before the device initiates the freezing process. There are different reasons for this: There could be vibrations and freezing might be initiated if the stirrer works too strongly or the stirring rod rubs somewhere. The longer the cooling takes the more time the sample has to freeze by itself. This is why cooling has to be done as fast as possible. If there are contaminants in the sample, they might bring about the freezing.

Not frozen:

As soon as the set temperature for subcooling is reached (’trigger temperature‘), the device beats against the glass wall of the sample flask to initiate freezing. The temperature has to rise now. A criterion for a successful crystallization is a temperature increase of at least 0.1 °C. This always happens in water or in calibration solutions if the stirring rod is adjusted in such a way that it beats at the glass wall powerfully This is not always true for milks. There are milks that freeze badly. If this occurs just occasionally in individual samples of milk, then heat the respective milk up to about 40 °C again, allow to cool and measure again. But if this error happens quite often, it is better to decrease the “trigger temperature” and to cool down the samples a bit more and freeze more easily. If this error also occurs in calibration solutions, the calibration of the device is wrong or cooling liquid mixed with the sample.

Plateau not found:

This error can only happen if the plateau is “searched” by using the reference method for determination of the freezing point (ISO/DIS 5764). The plateau of the temperature value has to be in a fixed range for a certain period of time. It may happen that a certain type of milk does not fulfill this criterion. Then you have to measure a second sample of this milk. If the same error occurs again although the device works otherwise correctly, the problem lies either with the thermistor or external interferences.

Uncalibrated or defective thermistor:

The device tests the current value of the thermistor when starting a measurement or calibration. Its electrical resistance is a function of the temperature. This electrical resistance is translated into a figure by a ADC (Analogue-Digital-Converter), which is further processed by the device. If there is a short circuit or an

interruption in the thermistor, its resistance is zero or infinite. Both is impossible in a proper working thermistor. The device does not start measuring in such a case. If the temperature resulting from the current value of the thermistor and the calibration constants stored by the device is lower than +1 °C (which cannot happen when the thermistor is in a new, i.e. warm sample.), the device does not start measuring.

Identifying errors by the operator

Most errors that happen in devices for determination of the freezing point result from faulty calibrations. The calibration of a cryoscope is an essential condition for its use. It is necessary to use a thermistor for measuring the temperature of the sample due to the measurement technique. Thermistors have a very strong temperature effect which is necessary for the resolution of more than 1 m°K. Unfortunately, the variation of the resistance value in such components is that high due to manufacturing technique that the zero temperature (0 °C) has usually to be determined by pre-calibration before the device can be calibrated with a new thermistor.

We have to assume that an A-calibration cannot be done successfully after the thermistor was exchanged. First the device has to reach the knocking temperature and has to identify a higher temperature after knocking (as an indication that the freezing process started). This is not possible because the values of the new thermistor results in wrong temperatures because it calculates with the calibration constants of the old thermistor. This is why a so-called pre-calibration is necessary when the device ignores the temperatures and follows a merely time-controlled measuring process. Then the calibration constants are adjusted to the characteristics of the new thermistor, which means that A-calibration and B-calibration can be performed successfully.

However, it often happens that sample flasks with the calibration solutions are mixed up or that the wrong item on the menu is selected.

Confusing A-solution with B-solution:

First A-calibration works without problems. When doing the B-calibration the device indicates the error “uncalibrated or defective thermistor” and it remains uncalibrated. With older versions of firmware the device retains the wrong values and is not ready for a measurement from this point of time. You should do a new pre-calibration and a proper calibration in any case.

Confusing A-calibration with B-calibration

The entire temperature scale of the device is subsequently displaced. When remeasuring the calibration solutions you will get reversed values and a reversed sign. Example:

Calibration A with 0.000
Calibration A with 0.000
Calibration B with –0.557
Calibration A with –0.557 (faulty operation)
Remeasured B-solution: results in 0.000
Remeasured A-solution: results in + 0.557

Defective thermistor

This is the most common mistake. There are two possibilities:

1. The thermistor is (was) broken: You can identify this because the display shows constantly a negative value without any changes.
2. The bonding of the thermistor is porous: This results in extremely instable measuring. Repeatability is very poor, e.g. variations of about +0,1 °C.

The thermistor has to be exchanged in both cases.

Defect at stirring rod

The stirring rod does not swing freely. The stirring rod has to move freely in the designed slot. It must not touch the thermistor in any place. Pay special attention to this when exchanging the thermistor.

☐ The stirring rod amplitude is not high enough:
The cooling procedure is not continious and it needs more than 1 minute to get - 2 °C. In case of perfectly adjusted stir the time of cooling down procedure needs quite exactly 1 minute. The stirring rod amplitude should be adjusted at 3 – 4 mm.
Please adjust the stir once again in case of wrong adjustmend.

☐ The stirring rod is too high:
Prefreezing happens quite frequently.

Special applications/measuring of cream

We recommend to increase the sample volume for cream to 3 ml because cream that has a fat content of about 40 % has only a 60 % sample volume of liquid that is relevant for the freezing point.

CryoStar I

Automatic Freezing Point Determination
Reference measurement pursuant to ISO/DIS 5764

Some important features:

Flexible and safe for the future:
Fixed-time measurement, plateau and maximum search are available, all relevant parameters can be freely programmed. They are, of course also recorded. This makes CryoStar I adjustable to all national and international parameters (also future ones).

Comfortable:
Operation is menu-assisted in a language of your choice. At present the following languages are available: German, English, French, Greek, Italian, Polish, Spanish, Turkish and Hungarian.

Efficient:
A new cooling system (application for patent submitted) provides fast operating conditions even if the ambient temperature is higher (ca. 32 °C).

Fast:
Up to 40 samples per hour can be measured depending on the setting.

Multifunctional:
CryoStar I is featuring a parallel connection (for standard printers) and a serial interface to connect it to a PC. Thus it is possible to display and store the freezing-point curve during the measuring process. A powerful zoom function completes the comprehensive design. The respective software is included in the scope of delivery.

Compact:
The CryoStar is small, light and is easy to use. The percentage of water admixture is immediately indicated and printed out. It is equipped with automatic calibration. All settings and calibration values are saved permanently by a non-volatile memory.

Technical data:

Mains supply:	230 V/115 V AC (50 ... 60 Hz) 180 W, and 12 V DC
Measurement resolution:	0.0001 °C
Repeatability:	± 0.002 °C
Measuring range:	0.000 °C bis −1.500 °C
Sample volume:	2.0 ml to 2.5 ml
Recommended value:	2.2 ml
Sample throughput:	up to 40/h typical 30/h
Interfaces:	1 x parallel, 1 x serial (RS232)
Dimensions:	29 x 19 x 38 cm (W x H x D)
Measuring head:	24 cm (H)
Weight:	12 kg (net)

CryoStar I

automatic freezing point determination
reference method pursuant to ISO/DIS 5764
see detailed description on page 65

7150

Thermal printer

recording printer (6 V DC) for direct connection to CryoStar I and LactoStar, matching rolls of thermopaper see 7157

7151

Spare thermistor,

for CryoStar I pursuant to ISO/DIS 5764, PVC, white

7152

Software

for CryoStar I (included in scope of supply)

7156

Roll of thermopaper

for thermal printer 7151

7157

Connection cable (12 V DC)

for CryoStar 12-Volt-connection

7159

Calibration standard “A”

0.000 °C, 250 ml in PE bottle

7165

Calibration standard “B”
−0.557 °C, 250 ml in PE bottle

7166

Sample tube
with marking at 2.0 ml, 50 pieces

7167

Rack
material: PPH, for 27 sample tubes

7168

Cooling-bath liquid
500 ml in PE-bottle

7169

Sampling pipette
adjustable between 1.0 ml and 5.0 ml

7174

Pipette tips
for 7174

7175

Spare thermistor
(for CyroStar I please order with no. 7152)

7184 for CyroStar II-LC, III, IV and V

Calibration standard A
−0.408 °C, 250 ml in PE bottle

7186

Calibration standard B

−0.600 °C, 250 ml in PE bottle

7187

Control standard C

−0.512 °C, 250 ml in PE bottle

7188

Lactometer

Easy to use hand refractometer for internal determination of SNF.

7500

Solubility index mixer

acc. to ADMI- and DLG regulations, with special motor, glass mixing bowl, stainless-steel impeller, timer, continuous operation switch

7610

7620 Replacement glass mixing bowl

7621 Replacement impeller

7622 Replacement drive belt

Refernce table

ADMI “Scorched Particle Standards of Dry Milks”

7650

Jolting volumeter

Type STAV 2003 for determination of jolting volume of powdered milk, plastic case white, high polish, for determination of jolting volume of powdered milk, plastic casing white high-gloss with single-phase AC-motor 220 V/50 Hz with worm drive and capacitor, jolting mechanism with taper lock for measuring cylinder, 5-digit electronic pre-selection counter, On/Off switch with control lamp, operation panel red, silk-mat. The measuring cylinder (250 ml) are standardized by weight and graduation acc. to DIN 53194.

7660

Replacement measuring cylinder

for no. 7660

7661

HTST pasteurization
Determination of alkaline phosphatase

7820	Lactognost original pack with reference table for 100 samples
7821	Lactognost refill pack with reagents I, II and III for 100 samples
7822	Phosphatesmo MI test paper, 50 stripes per pack

Bucket for udder control

plastic

7910

California Mastitis Test (Schalm Test)

for rapid determination of an increased cell content in milk enabling identification of possible mastitis infection.
2 test trays with 4 dishes, 1 injection flask 250 ml

7920

CMT test liquid

7930 1 litre

7931 5 litre

LOVIBOND Comparator 2000

for determination of chlorine nitrate and nitrite DB 410

8010

Test tube

thick-walled, 160 x 15 x 16 mm, 100 pieces

8100

Rubber stopper

with glass tube and cotton wool

8110

Coli tube

20 x 10 mm, 100 pieces

8120

Durham tube

40 x 8 mm, 100 pieces

8130

Coli test rack

stainless steel, sterilizable

8140

Metering syringe

self suction, 10 ml, for nutrient solutions, sterilizable,
see also 5110, 5111, 5112

8170

Sterilization box, stainless steel

8190	300 x 65 mm, for pipettes
8191	420 x 65 mm

CAP-O-TEST seal

various colors

8200	

Kapsenberg cap

various colors

8201	

Coli strips

8220	1.0 ml, white
8221	0.1 ml, white
8222	1.0 ml, green

Dilution flask

borosilicate glass 3.3, 250 ml, with glass rod and silicon stopper, sterilizable

8290	
8291	Flask only

Dilution pipettes

8300	1.1 : 0.1 ml
8301	1.0 + 1.1 ml, acc. to Demeter with 2 ring marks
8302	1.0+2.0+2.1+2.2 ml, acc. to Demeter with 4 ring marks
8303	1.0 + 1.1 + 1.2 ml, acc. to Demeter with 3 ring marks

Petri dish

glass, 100 x 20 mm

8310	

Petri dish

plastic (disposable), sterile packing

8312	Ø 60 x 15 mm, 600 pieces, with vent cams
8313	Ø 94 x 16 mm, 1000 pieces,
8314	Ø 94 x 16 mm, 100 pieces, without vent cams
8315	Ø 145 x 20 mm, 165 pieces, with vent cams

Sterilizing box

with insert, stainless steel, for glass Petri dishes

8320	

Wire cages

for sterilization

8330	100 x 100 x 100 mm
8331	140 x 140 x 140 mm
8332	200 x 200 x 200 mm

Smear needle

rectangular bend

8340	

Spatula, Drigalsky type

glass

8350	

Inoculation wire

stainless steel, 1 m

8370	

Burri loop
platinum, calibrated

8380 0.001 ml

8381 0.01 ml

Needle holder
for inoculation-wire loop

8382

Slide
76 x 26 mm, half-white, cut edges 50 pieces

8400

Cover glass
18 x 18 mm

8401

Tweezers for slides

8410

Staining stand
acc. to *Bongert*

8420

Staining cuvette
rectangular

8430

Wire mesh

8440 with ceramic center

8441 without ceramic center

Tripod

for Bunsen burner

8450	

Bacterial colony counter ColonyStar

easy to clean plastic casing, adjustable in height with directly or indirectly illuminated area of 145 mm Ø, glare-free, frosted glass and clear glass plate with cm^2- and 1/9-cm^2 graduation, electric counting and marking felt pen. Petri dishes up to 145 mm Ø can be used. Smaller Petri dishes can be used together with the supplied reducing insert. 220 V/50 Hz, 25 x 23 x 7.5 cm, 1.7 kg ColonyStar inclusive all accessories (8501, 8503, 8504, 8505)

8500	
8501	Magnifying glass with base and flexible arm
8502	ColonyStar without accessories
8503	Automatic counting pen
8504	Felt refill, replacement part for 8503
8505	Clear glass plate with dark field

Bench autoclaves with electromagnetic control

8510	**1730 ML**	170 x 300 mm,	7.5 l,	220 – 240 V,	1.3 kW
8512	**2540 ML**	250 x 420 mm,	23 l,	220 – 240 V,	2.2 kW
8513	**3850 ML**	380 x 510 mm,	62 l,	380 – 400 V,	4.0 kW
8514	**3870 ML**	380 x 690 mm,	85 l,	380 – 400 V,	4.8 kW
8515	**5050 ML**	500 x 500 mm,	110 l,	380 – 400 V,	4.8 kW
8516	**5075 ML**	500 x 750 mm,	160 l,	380 – 400 V,	7.2 kW

Bench autoclaves with microprocessor control

8517	**1730 EL**	170 x 300 mm, 7.5 l, 220 – 240 V, 1.3 kW
8518	**2540 EL**	250 x 420 mm, 23 l, 220 – 240 V, 2.2 kW
8519	**3850 EL**	380 x 510 mm, 62 l, 380 – 400 V, 4.0 kW
8520	**3870 EL**	380 x 690 mm, 85 l, 380 – 400 V, 4.8 kW
8521	**5050 EL**	500 x 500 mm, 110 l, 380 – 400 V, 4.8 kW
8522	**5075 EL**	500 x 750 mm, 160 l, 380 – 400 V, 7.2 kW

Stand autoclaves with electromagnetic control

8523	**2540 MLV**	250 x 400 mm, 23 l, 220 – 240 V, 2.2 kW
8524	**3850 MLV**	380 x 490 mm, 62 l, 380 – 400 V, 6.0 kW
8525	**3870 MLV**	380 x 690 mm, 85 l, 380 – 400 V, 6.0 kW
8526	**5050 MLV**	500 x 500 mm, 110 l, 380 – 400 V, 9.0 kW
8527	**3875 MLV**	500 x 750 mm, 160 l, 380 – 400 V, 9.0 kW

Stand autoclaves with microprocessor control

8528	**2540 MLV**	250 x 400 mm, 23 l, 220 – 240 V, 2.2 kW
8529	**3850 MLV**	380 x 490 mm, 62 l, 380 – 400 V, 6.0 kW
8530	**3870 MLV**	380 x 690 mm, 85 l, 380 – 400 V, 6.0 kW
8531	**5050 MLV**	500 x 500 mm, 110 l, 380 – 400 V, 9.0 kW
8532	**5075 MLV**	500 x 750 mm, 160 l, 380 – 400 V, 9.0 kW

Portable bench autoclave

for rapid and efficient steam sterilization at 140 °C/2.7 bar or 125 °C/1.4 bar. Also suitable for autoclaving of small amounts of culture media. Special valves for 115 °C/0.7 bar and 121 °C/1.1 bar are available on request.
220 – 230 Volt, 50 – 60 Hz, 1.6 kW to 1.75 kW, Al silk gloss, polished, thermostatic temperature control, checked safety (GS)

8540	CV-EL 10 L volume 10 l, diameter 24 cm, internal height 22 cm, max. working space Ø 30 cm
8541	CV-EL 12 L volume 12 l, Gewicht 6.1 kg, diameter 24 cm, internal height 24 cm, max. working space Ø 32 cm
8542	CV-EL 18 L volumen 18 l, Gewicht 7.7 kg, diameter 24 cm, internal height 38 cm, working space Ø 43 cm
8543	Sieve basket
8544	Instrument plate

Starter culturing devices

for cultivation of individual dairy-farm cultures 8 different sizes from 1 x 5 l to 4 x 20 l, stainless steel-culture vessels 5 l with cover and mixer, PP casing, microprocessor controlled

8610	1 x 5 l vessels, 2 x 0.5 l starter culture flasks
8611	2 x 5 l vessels, 2 x 0.5 l starter culture flasks
8612	4 x 5 l vessels, 4 x 0.5 l starter culture flasks
8613	1 x 10 l vessels, 2 x 0.5 l starter culture flasks
8614	2 x 10 l vessels, 2 x 0.5 l starter culture flasks
8615	4 x 10 l vessels, 4 x 0.5 l starter culture flasks
8616	2 x 20 l vessels, 2 x 0.5 l starter culture flasks
8617	4 x 20 l vessels, 4 x 0.5 l starter culture flasks

Magnetic stirrer MONO

without heating, 1 – 3000 ml capacity (H20),
100 – 1000 rpm, dimensions 150 x 200 x 35 mm, 1.4 kg, plug connection for 115 or 230 V AC / 50 – 60 Hz included in scope of delivery

8690	

Magnetic stirrer MONOTHERM

with heating, 1 – 3000 ml capacity (H20),
100 – 1000 rpm, dimensions 160 x 295 x 60 mm, 2.5 kg,
230 V AC / 50 Hz,
115 V AC / 60 Hz by special order

8691

Sieve machine AS 200 basic

for separation, fractionation, particle-size determination, dry and wet for powder, bulk goods and suspensions from 20 µm to 25 mm, 9 or 17 fractions, max. 3 kg screen feed, diameter of sieve 100/150/200/203 mm (8") are possible
400 x 840 x 347 mm, ca. 30 kg

8710

Spanning unit

8711 Standard for 200 mm sieves

8712 Standard sieve set with sieves diameter 200 mm, height 50 mm, pursuant to DIN/ISO 3310/1 with mesh sizes 45 – 63 – 125 – 250 – 500 – 1000 – 2000 – 4000 µm and bottom jar

8713 Sieves various pursuant to DIN/ISO or ASTM on request

Laboratory microscope Standard

binocular transmitted-light microscope transverse vision rotatable by 360°, infinitely variable Halogen lamp (10 W), condenser N.A. 0.65 with iris diaphragm, quadruple revolving nosepiece, coaxial coarse and fine focusing control, specimen traverse, plug connection, protective cover.
Achromatic objectives: 4/0.10; 10/0.25; 40/0.65; 100/1.25 oil
Eyepieces WF 10x/18; 1x with pointer; 1x without pointer,

8760

Laboratory microscope Professional

higher operational convenience and better focusing control by stationary mechanical stage and condenser N.A. 1.2 with iris diaphragm

8761

Trinocular microscope

additionally to type Professional with trinocular sliding beak

8762

Automatic water distillation apparatus

for generation of distilled water with conductivity of under 2.3 µS/cm at +20 °C. Efficient energy consumption by using the cooling water heated up to 80 °C.
The apparatus is completely manufactured from stainless steel 1.4301. It is delivered including wall mount fixture and water supply and discharge hoses.

Distillation volume: 4 l/h
Storage container: 4 l
Cooling-water consumption: 50 l/h
220 V/50 Hz; 3.2 kW
Dimensions: 510 x 460 x 230 mm
8771 Weight: 13 kg

Distillation volume: 7 l/h
Storage container: 7 l
Cooling-water consumption: 70 l/h
220 V/380 V/50 Hz; 4.8 kW
Dimensions: 670 x 500 x 340 mm
8772 Weight: 19 kg

Water distillation apparatus, Mono, glass type

Distillation volume: 3.5 l/h
Cooling-water consumption: 45 l/h
Conductance: 0.85 µs
ca. 600 x 200 x 180 mm, 4 kg

8775

Water bath

7 l with gable cover, stainless steel
240 x 210 x 140 mm, ca. 11 kg

8786	

Water bath

22 l with gable cover, stainless steel
350 x 290 x 220 mm, ca. 17 kg

8788	

Beaker,

short, borosilicate glass, with markings and spout

8800	50 ml
8801	100 ml
8802	250 ml
8803	400 ml
8804	600 ml
8805	800 ml
8806	1000 ml

Beaker,

tall, borosilicate glass, with markings and spout

8808	50 ml
8809	100 ml
8810	250 ml
8811	400 ml
8812	600 ml
8813	800 ml
8814	1000 ml
8815	2000 ml

Erlenmeyer flasks

narrow neck, borosilicate glass, with markings, DIN 12380

8817	50 ml
8818	100 ml
8819	200 ml
8820	250 ml
8821	300 ml
8822	500 ml
8823	1000 ml
8824	2000 ml

Erlenmeyer flasks

wide neck, borosilicate glass, with markings, DIN 12385

8826	50 ml
8827	100 ml
8828	200 ml
8829	250 ml
8830	300 ml
8831	500 ml
8832	1000 ml
8833	2000 ml

Measuring cylinder, tall

glass, with spout

8850	50 ml : 1/1
8851	100 ml : 1/1
8852	250 ml : 2/1
8853	500 ml : 5/1
8854	1000 ml : 10/1

Measuring cylinder, tall

PP, blue graduation

8855	50 ml : 1/1
8856	100 ml : 1/1
8857	250 ml : 2/1
8858	500 ml : 5/1
8859	1000 ml : 10/1
8860	2000 ml : 20/1

Mixing cylinder

AR glass, round stem, with NS-PE stopper

8862	100 ml : 1/1
8863	250 ml : 2/1

Measuring flask

borosilicate glass, with ring mark, DIN 12664, calibrated to “In”

8870	25 ml
8871	50 ml
8872	100 ml
8873	250 ml
8874	500 ml
8875	1000 ml

Glass funnel

AR glass, smooth, short stem with oblique end,
DIN 12445

8876	55 mm Ø
8877	100 mm Ø
8878	150 mm Ø
8879	200 mm Ø

Measuring pipettes

Color-Code, AR-Glas

8882	1 ml : 1/100
8883	2 ml : 1/50
8884	5 ml : 1/10
8885	10 ml : 1/10
8886	25 ml : 1/10
8887	50 ml : 1/5

Volumetric pipettes

Color-Code, AR-Glas

8888	1 ml
8889	2 ml
8890	5 ml
8891	10 ml
8892	20 ml
8893	25 ml
8894	50 ml
8895	100 ml

Laboratory bottles

borosilicate glass, with ISO-threads, graduation, with PPN screw cap and PPN pouring ring (blue)

8970	100 ml
8971	250 ml
8972	500 ml
8973	1000 ml
8974	2000 ml

Reagent bottles, wide neck

AR glass, white with standard ground and joint stopper

8980	50 ml, NS 24/20
8981	100 ml, NS 29/22
8982	250 ml, NS 34/35
8983	500 ml, NS 45/40
8984	1000 ml, NS 60/46
8985	2000 ml, NS 60/46

Reagent bottles, narrow neck

AR glass, white with standard ground and joint stopper

8990	50 ml, NS 14/15
8991	100 ml, NS 14/15
8992	250 ml, NS 19/26
8993	500 ml, NS 24/29
8994	1000 ml, NS 29/22
8995	2000 ml, NS 29/32

Culture tubes

DURAN glass, straight rim
16 x 160 mm, 100 pieces

9050	

Culture tubes

with ISO-thread, with screw caps,
AR glass, sterilizable

9054	16 x 100 mm, 100 pieces
9056	16 x 160 mm, 100 pieces

Test tubes

9080	DURAN glass, 16 x 160 mm, without rim, 100 pieces
9081	DURAN glass, 16 x 160 mm, with rim, 100 pieces
9090	Test tube brush with wool head

Weighing dishes

low shape, with knob lid

9120	35 x 30 mm
9121	50 x 30 mm

Digital burette µl 10

certificated conformity to 100 ml,
smallest adjustment 10 µl.

9190	

Desiccator

9201	glass, 250 mm
9211	**Desiccator plate**, porcelain

Wash bottles

Polyethylene

9230	100 ml
9231	250 ml
9232	500 ml
9233	1000 ml

Funnels

Polyethylene

9235	50 mm Ø
9236	70 mm Ø
9237	100 mm Ø
9238	120 mm Ø
9239	150 mm Ø

Test tube racks

plastic, for tubes 160 x 16 mm

9255	12 samples
9256	25 samples, PP, sterilizable to 121 °C
9257	36 samples, wire, plastic coated

Lyphan stripes

in plastic box

9360	pH 1 – 11
9361	pH 3.9 – 6.9
9362	pH 4.9 – 7.9
9363	pH 6.9 – 9.9
9364	pH 0 – 14

Indicator paper

for freshness of milk, Duplex, pH 7.9 – 11, 100 pieces

9365	

Burette stand

9400	plate 210 x 130 mm with rod 750 mm
9401	tripod 210 x 130 mm with rod 750 mm

Bosshead

9405	

Bosshead

9406	swivel type

Clamps

9407	25 mm, without bosshead
9408	60 mm, without bosshead

Retort ring

160 mm, with bosshead

9409	

Burette clamps

9410	single, with bosshead
9411	double, with bosshead

Laboratory clock

0 – 60 Min., with alarm

9440	

Laboratory vacuum pump/compressor

electrical, applicable as vacuum or pressure pump,
capacity max. 16 l/min., max. operating pressure 3.5 bar

9470	

Dispensers

semi-automatic, for aggressive acids and lyes
without flask

9480	0.4 – 2	ml : 1/10
9481	2 – 10	ml : 1/5
9482	10 – 50	ml : 1/1
9483	20 – 100	ml : 2/1

Microlitre pipettes

with fixed volume in sizes from 5 to 1000 µl

9490	

Microlitre pipettes

with variable volume, with tip release

9495	10 – 100 µl
9496	20 – 200 µl
9497	200 – 1000 µl

Pipette tips

9510	1 – 200 µl (yellow), 1000 pieces
9511	50 – 1000 µl (blue), 1000 pieces

Terms and Conditions of Delivery and Payment

1. The following terms and conditions are relevant for each placed order. Any modification is only valid if it was explicitly confirmed by us in writing. Any agreement that was made orally by phone or through a sales representative is only valid after written confirmation.
2. All our offers are subject to changes with regard to prices, quantities, possibilities and time of delivery.
3. All prices are EX WORKS Berlin.
4. The invoice total becomes due not later than 30 days after the date of issue regardless of any notice of defects.
5. The goods remain the property of the seller until all payments, including future claims, are made.
6. Indicated times of delivery in our offers are approximate and are subject to changes. The delivery time starts with the date of the order's confirmation but not before there is a final agreement about the order in writing. Fortuitous events (force majeure) and incapacity through no fault of us or our subcontractors entitle us to prolong the delivery time appropriately or to withdraw from the contract for sale without resulting claims for damage on the part of the buyer.
   A claim for damages by the buyer resulting from delayed delivery is excluded, also after the end of an extension time that was determined by the buyer.
   The buyer should only declare a withdrawal if we are in default and do not meet our delivery deadline culpably during an adequate extension time that was fixed by the buyer in writing.
7. Goods are delivered at the risk of the buyer. The risk should be transferred to the buyer as soon as the goods or the order leaves the works.
8. We grant a warranty period of 6 months from the date of invoice for perfect working of the instruments and devices that were delivered by us. The warranty is limited to such defects of the instruments and devices that were not caused by natural wear or improper operation or handling.Warranty should either be repair or replacement of the objected device which remains at our discretion. A claim to redhibition or reduction is excluded.

   Shipment of instruments, devices and spare parts shall be payable by the buyer. Return shipment of repaired or replaced parts shall be payable by the seller.

   Any obligation to warranty should expires if the buyer or a third party changes or repairs the instrument or device.
9. Complaints due to incomplete or incorrect deliveries or complaints because of visible defects should be stated in writing immediately but not later than 8 days after the goods were received. Defects that become apparent later are to be stated immediately after they were discovered. If the statement is not made in time, all warranty claims should expire.
10. Place of delivery and performance is Berlin and any disputes arising hereunder will be settled before a competent Berlin court of law. German law is applied. An annulment of any part of these terms and conditions does not result in its overall annulment.