

Switching Adapter

- **Input:** 100 - 240 V ~1.6 A max.
50-60 Hz
- **Output:** +12 V --- 4.17A min.
- **Output power:** 50 - 65 W

Measurement modes

- cow milk
- sheep milk
- UHT milk
- goat milk
- buffalo milk
- cream
- whey
- recovered milk
- other /pasteurized milk/

CAUTION!

Keep the switching adapter dry!
Please, read and follow strictly all the instructions in the manual.

Due to continuous improvement in milk analyser, information contained in this manual is subject to change without notice. Contact producer for revisions and corrections

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SAFETY INSTRUCTIONS

- 1. Read this manual carefully and make sure that you understand all the instructions.**
- 2. For safety purposes the device is equipped with grounded power cable. If there is no grounded electrical outlet where the device will be used, please, install such before using the device.**
- 3. Place the device on leveled and stable plate. In case it falls or is severely shocked it may be damaged.**
- 4. Connect to the electrical network in such a way that the power cable to stay away from the side for accessing the device and not to be stepped on.**
- 5. Every time before cleaning the device switch it off and unplug it from the electrical outlet. The device has to remain unplugged till the cleaning completion.**
- 6. Do not disassemble the unit in order to avoid possible electrical shock. In case of malfunction contact your local dealer.**
- 7. Handle the liquids the device works with carefully, following all the instructions for their preparation.**
- 8. Place the switching adaptor in such a way as to be protected from overflow and spillage of liquids.**

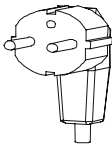
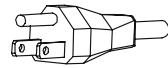
PARTS AND ACCESSORIES

In the table below the standard delivery configuration of the milk analyser is listed:

No	Description	Item No	pcs
1.	Ultrasonic milk analyzer	LSMCC001	1
1 sample measurement time		90 sec.	<input type="checkbox"/>
		60 sec	<input type="checkbox"/>
		30 sec	<input type="checkbox"/>
2.	Operation manual	LSMCC002	1
3.	Plastic sample holder	LSMCC003	2
4.	Spare Pipes	LSMCC004	2
5.	12 V DC Power Supply Cable	LSMCC005	1
6.	Alkaline cleaning solution Lactodaily	100 g	1
7.	Acidic cleaning solution Lactoweekly	100 g	1

In the table below the milk analyser spares and accessories, which are delivered on customers' request are listed:

No	Description a) included in the set: <input checked="" type="checkbox"/> b) not included in the set (may be additionally bought): <input type="checkbox"/>	Item No	pcs	<input checked="" type="checkbox"/> / <input type="checkbox"/>
8.	RS232 Interface Cable - Analyser-IBM PC	LSMCC006		<input type="checkbox"/>
9.	Service Pack - CD	LSMCC007		<input type="checkbox"/>
10.	pH measuring system	LSMCC009	1	<input type="checkbox"/>
11.	pH probe with cable and holder	LSMCC010	1	<input type="checkbox"/>
12.	Buffer solution Ph 60 ml (pH7.00±0.01/20°C)	LSMCC011	1	<input type="checkbox"/>
13.	Buffer solution pH 60 ml (pH4.00±0.01/20°C)	LSMCC012	1	<input type="checkbox"/>
14.	Milk conductivity measuring system	LSMCC013	1	<input type="checkbox"/>
15.	Buffer solution conductivity 50 ml (5.02 (±5%) mS/cm (18±0.1°C)	LSMCC014	1	<input type="checkbox"/>
16.	Real time clock	LSMCC015	1	<input type="checkbox"/>
17.	High-fat measuring function	LSMCC016	1	<input type="checkbox"/>
18.	ECS POS Serial Printer	LSMCC017	1	<input type="checkbox"/>
19.	12 V Serial Printer Power Supply Cable	LSMCC018	1	<input type="checkbox"/>

20.	RS232 Interface Cable - Milk Analyser – Serial Printer	LSMCC019	1	<input type="checkbox"/>
21.	Power supply from embedded accumulator with charger	LSMCC021	1	<input type="checkbox"/>
22.	Weighting scales - function	LSMCC022	1	<input type="checkbox"/>
23.	Weighting scales platform	LSMCC023	1	<input type="checkbox"/>
24.	Plug type		1	<input checked="" type="checkbox"/>
			1	<input type="checkbox"/>

FUNCTION

The function of the milk analyser is to make quick analyses of milk on fat (FAT), non-fat solids (SNF), proteins, lactose and water content percentages, temperature (°C), pH, freezing point, salts, conductivity as well as density of one and the same sample directly after milking, at collecting and during processing.

2. TECHNICAL PARAMETERS

2.1. Working modes characteristics:

The program of the milk analyser has four working modes.

2.1.1. Measurement mode milk / dairy product – first type

2.1.2. Measurement mode milk / dairy product – second type

2.1.3. Measurement mode milk / dairy product – third type

These modes have been calibrated on customers' request for 3 milk types from the following: cow, sheep, UHT, buffalo, goat, camel milk, cream, ice cream mixtures, whey, recovered milk, etc. before leaving the production facilities and the text on the display will be for the corresponding types, as is indicated on the page with measurement modes.

2.1.4. Cleaning

2.1.4.1. Current

2.1.4.2. Final

2.2. Measuring range:

Fat .....	.....from 0.01% to 25% (45%*)
SNF .....	.....from 3% to 40%
Density ** .....	.....from 1000 to 1160 kg/m ³
Proteins .....	.....from 2% to 15 %
Lactose .....	.....from 0.01 % to 20 %
Water content .....	.....from 0 % to 70 %
Temperature of milk	from 5 °C to 40°C (if measurement is 30 sec, then t° is from 15 to 40°)
Freezing point **** .....	.....from – 0,400 to – 0,700°C
Salts .....	.....from 0,4 to 4%
PH*** .....	.....from 0 to 14
Conductivity** .....	.....from 2 to 14 [mS/cm]

* Option, on customers' request

** Density data are shown in an abbreviated form. For example 27.3 have to be understood as 1027.3 kg/m³. To determine the milk density, write down the result from the display and add 1000.

Example: result 21,20; density = 1000 + 31,20 = 1031,2 kg/m³

The abbreviated form of the density is used also when entering data for samples in working mode **Recalibrate**, for example:

If the measured sample density is 1034.5 kg/m³, then in the menu for entering the samples parameters used for calibration, across the parameter Den = , you have to enter 34.5.

*** pH and conductivity measurements are optional and are embedded in the device on customers' request.

**** Please, carefully read Appendix Freezing Point.

2.3. Accuracy:

Fat	± 0.06%
SNF	± 0.15%
Density	± 0.3 kg/m ³
Proteins	± 0.15%
Lactose	± 0.20%
Water content	± 3.0%
Temperature of milk	± 1°C
Freezing point.....	± 0.005°C
Salts	± 0.05%
PH**	±0.05
Conductivity**	±0.05[mS/cm]

2.4 Correct ambient conditions:

Accuracy is guaranteed in case of normal ambient conditions:

Air temperature.....	from 10°C to 40°C (43 °C)
Relative humidity	from 30% to 80%
Power supply	220V (110V)
extent of contamination at normal environmental conditions.....	2



Accuracy values in point 2.3 are in dependence on the correctness of the corresponding chemical method, used for component content determination. In point 2.3. are used the following reference methods: Gerber – for fat, gravimetric – for SNF, Kjeldahl – for protein. The boundary for maximum variation of repeatability when the power supply voltage is from +10 to – 15% from the nominal voltage values (220V) have to be no more than 0.8 accuracy according point 2.3. The analyser is used in conditions free of outer electrical and magnetic fields (except the magnetic field of the Earth) and vibrations.

2.5. Dimensions:

.....290/300/330 mm, mass 5,0 kg

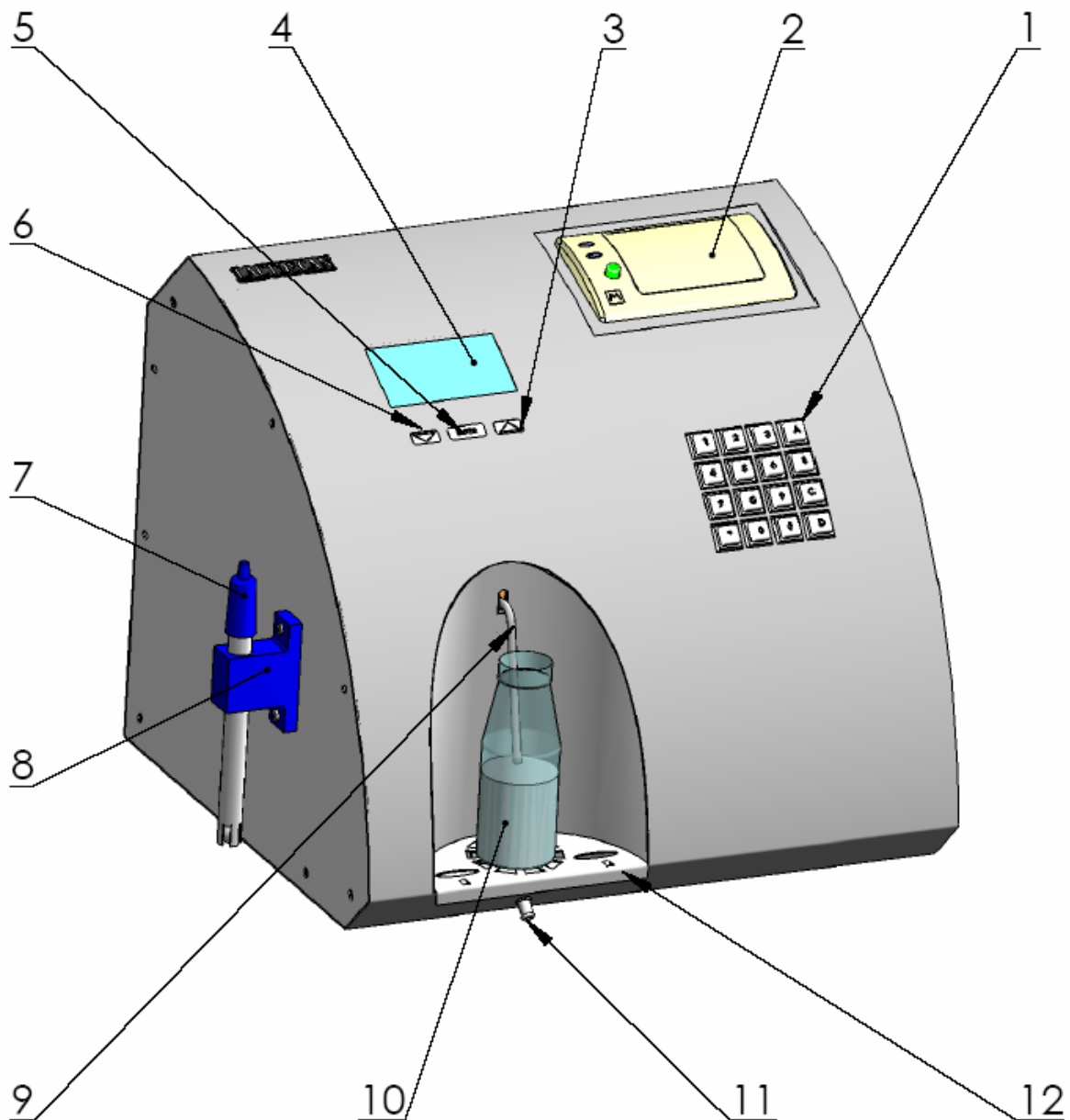
2.6. Continuous working time:

.....non-stop

2.7 Milk sample volume per one measurement:

.....15 cm³ (= 25 ml)

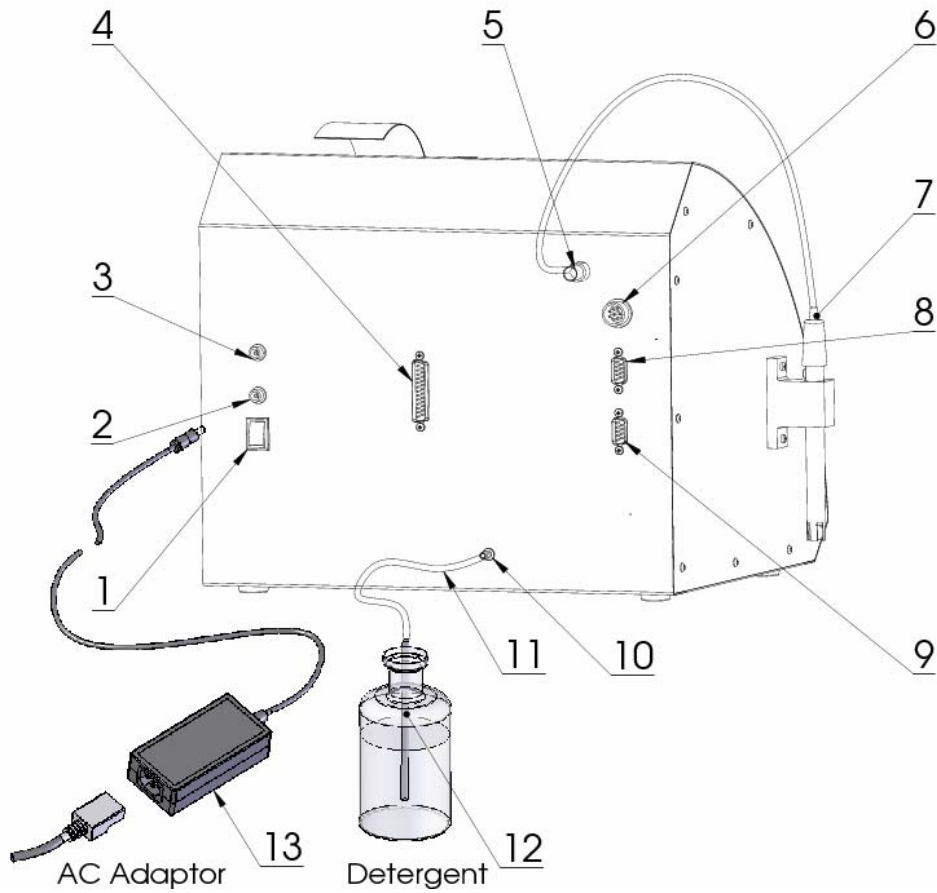
Fig.1 Front panel



- 1. Keyboard
- 2. Printer
- 3, 5, 6 Buttons Up, Enter, Down
- 4. Display
- 7. pH probe

- 8. pH probe holder
- 9. Input pipe
- 10. milk sample holder
- 11. Waste liquid pipe
- 12. ss grid

Fig.2 Back panel



- | | | | |
|----|----------------------------|-----|-------------------------------------|
| 1. | Power switch | 8. | Com Port 2 |
| 2. | AC adaptor input | 9. | Com Port 1 |
| 3. | DC Power Supply output | 10. | Connector for the cleaning solution |
| 4. | Parallel printer connector | 11. | Plastic pipe |
| 5. | pH probe input (option) | 12. | Metal pipe |
| 6. | Weigh Scale input (option) | 13. | Switching adapter |
| 7. | pH probe | | |

Fig 3 Principle working scheme

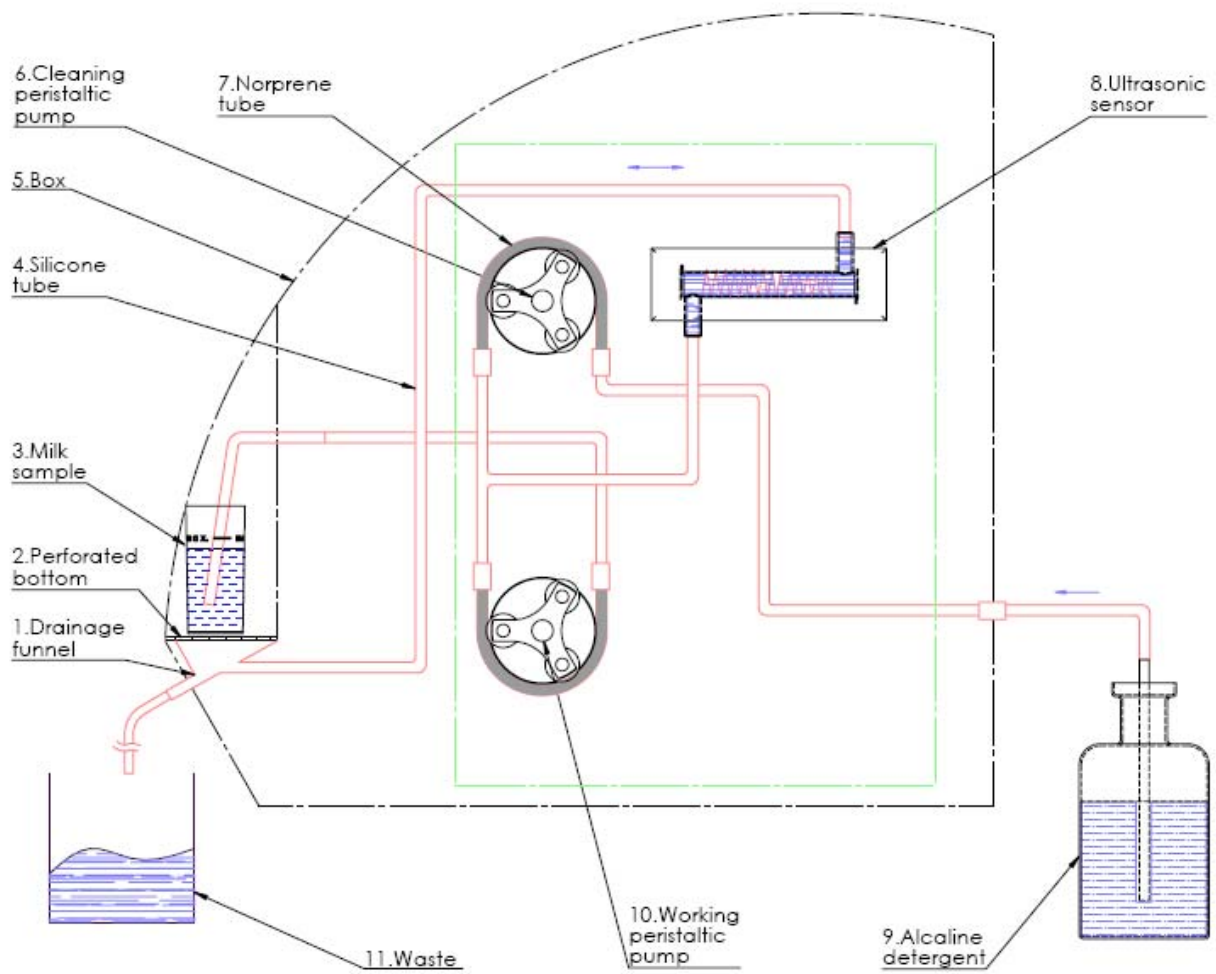


Fig. 4 Connecting peripheral devices

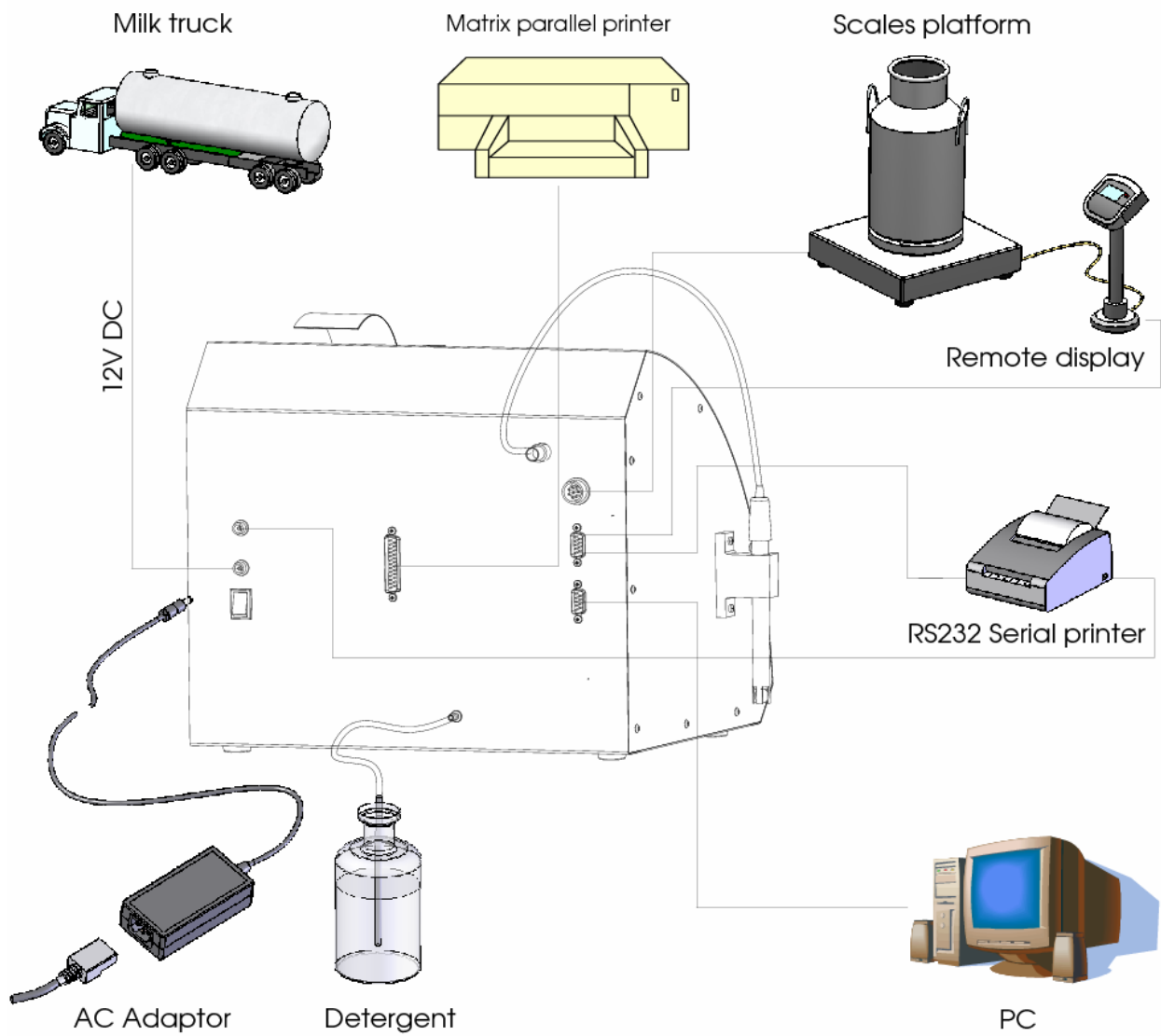
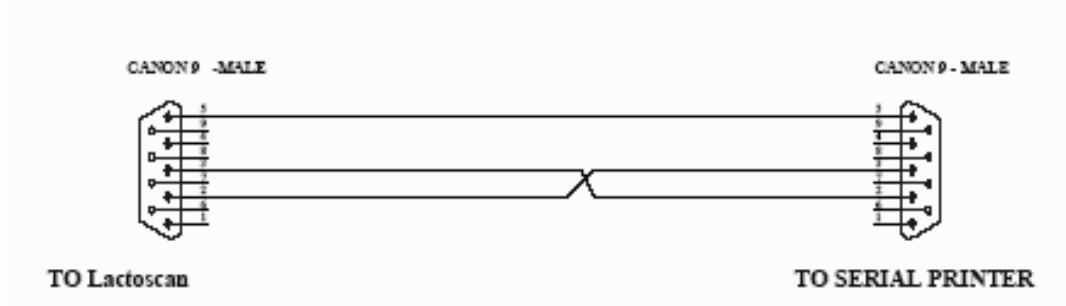


Fig. 5 Cable Description

Art. Number 30011

RS232 Interface Cable - Milk Analyser – Serial Printer



Art. Number 30012

RS232 Interface Cable - Milk Analyser – IBM PC

<p>2. TxD 3. RxD 5. GND</p>	<p>Milk Analyser DB 9-pin male</p>		<p>PC DB 9-pin female</p>	<p>2. Receive Data (RxD) 3. Transmit Data (TxD) 5. Signal Ground (GND)</p>
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Art. Number 10128

Probe pH with cable

Art. Number 30030

DC 12V Power Supply Milk Analyser Cable

- 1. GND
- 2. No connection
- 3. No connection
- 4. 12V DC

The analyzer has an option – embedded USB interface for connection with computer type IBM PC. It is suitable for connecting laptop computers, where there's no standard interface RS 232 (COM Ports). USB interface is based on elements from company Future Technology Devices International Ltd. – site: <http://www.ftdichip.com>. In order to establish connection using this interface the necessary drivers have to be installed on the corresponding computer. For this purpose follow the procedure, described in details on the producer's Internet site <http://www.ftdichip.com/Drivers/VCP.htm>, choose the appropriate for the operation system of the computer drivers. After installation of the driver, choose COM port, which to be used for the real communication (chosen from the corresponding software tool from LS Service Pack).

3. QUALIFICATION OF RAW MILK, THERMALLY TREATED MILK, OTHER DAIRY PRODUCTS AND DERIVATIVES

3.1. Taking samples and preparation for analyses

In order to receive reliable results in qualification of milk, dairy products and derivatives are needed: precise samples taking; correct samples storing (in need to be preserved); correct preparation before making measurement. The rules and requirements for this are described in details in *Appendix Milk sampling*.

3.2. Making the measurement.

3.2.1. Preparing the analyser for working mode

3.2.1.1. Put the analyser on the working place, providing good ventilation and not in the vicinity of heat providing devices or sources. The temperature in the premises has to be in the boundaries 10-40°C.

3.2.1.2. Check if the power switch is in "0" position and that the outlet voltage complies with the voltage indicated on the switching adapter of the analyzer.

3.2.1.3. Switch on the "POWER" button, which starts the identification procedure. For a short time the display shows the number of the software versions, for example:

Milk analyser xxx
LCD vers xx
MA vers yy
MA ser. N. xxxx

Where:

Milk analyser xxx	- is the time for measurement.
LCD vers XX	- is display control software version.
MA vers YY	- is the motherboard software version.
MA ser. N. xxxx	- is the serial number .



If in the process of exploitation there is a need to ask a question the company-producer, you have to send the data, written on the display during the above described initialization procedure.

3.2.1.4. Till the analyser is prepared for work (at about 5 minutes) the following message is written on the display: “**Getting ready**”. Above pointed time is in dependence of the environmental temperature and increases with decreasing the temperature.

3.2.1.5. When the device is ready for work, a beep is heard and the display shows: “**Ready to start**”. The analyser is ready to make analyses in mode 1 (normally Cow)

3.2.1.6. If you want to pass to another mode press the button **Enter** and hold it pressed. The following message appears on the display:

**Release button to
start menu**

Release the button **Enter**. The display shows the possible working modes:

Milk selector
Cal1 – Cow
Cal2 – Sheep
Cal3 – UHT

Cleaning
Final clean

Using “up” ▲ and “down” ▼ buttons choose the working mode and press **Enter** in order to start it.

3.2.2. Making analyses



Make sure the analyser is still during measurement. Vibrations may lead to inaccurate results.

To start measurement:

- pour the preliminary prepared sample in the sample holder (now you may use holders with different size - plastic and glass 100 ml);

Fig.6 Input pipe



The input pipe of the analyser is knee-joint (mobile). Move it forward in order to be possible to dip its end in the milk sample and place the sample holder in the recess of the analyser.

- press the button **Enter**.

The analyser sucks the milk, makes the measurement and used milk sample is poured through the holes of the grid below the input pipe of the analyser and enters the vessel for collecting waste liquids (see Fig. 3 Principle working scheme

of the analyser). During the measurement the temperature of the sample is shown on the display.

Ignore the results received immediately after switching on the analyser and after measuring distilled water. Make a second measurement with new portion of the same sample.

3.2.3. Displaying the results

3.2.3.1. When the measurement is finished, the sample returns in the sample-holder and the display shows the results. For example:

Results:	
F=ff.ff	S=ss.ss
D=dd.dd	P=pp.pp
L=ll.ll	W=ww.ww

Where:

- | | |
|-----------------|--|
| F= ff.ff | - measured FAT in percentage; |
| S= ss.ss | - measured SNF in percentage; |
| D= dd.dd | - measured density in percentage; |
| P= pp.pp | - measured protein in percentage; |
| L= ll.ll | - measured lactose in percentage; |
| W= ww.ww | - measured sample's added water in percentage; |

By pressing the button "Down" ▼ the display shows the second page, containing the results:

Page 2 Results:
T=tt.tC pH=pp.pp
FP=-0.fff sol=0.sss

Where:

tt.tC - sample's temperature;
pp.pp - sample's pH result – if there is a pH probe connected;
-0.fff - measured sample's freezing point;
0.sss - measured salts values;

By pressing the button "Up" ▲ display shows the third page with results:

Page 3 Results:
L=l.ll

Where:

L= ll.ll - measured Lactose in %;

By pressing the buttons "up" ▲ and "down" ▼, the operator has the possibility to pass from one page result to another.



If the device has an embedded option "Conductivity" and "conductivity measurement" started, the result is shown on the display, showing the basic results replacing lactose results in the following way:

C=xx.xx

In this case the Lactose result is shown on a new page - Page 3 Results.

xx.xx is the measured milk sample's conductivity in [mS/cm]. If the results are outside the limits for this type of sample (see table from the Appendix Conductivity measurement), the cursor flashes after the letter C, reminding that the sample is not correct. On the printout it is printed as !!!.

If the conductivity value is outside measuring range (2-14 mS/cm), the following message appears on the display:

C=OutRg (Out of Range), and on the printout there isn't any line with conductivity value.

3.2.3.2. Write down the results in the form. The results remain on the display till a new measurement is started. If the analyser is connected to a computer, it automatically sends the data to the computer and/or prints them.

Fig. 7 Printing the results

For more information for the printer see 8.2. Working with Printer.

SCHEME:
PRINTOUT OF THE RESULTS-EXAMPLE

```
Time: xx:xx:xx
Date: xx:xx:xxxx
Milk analyser 60 SN: xxxxx
Calibration 1 – UHT
      Results:
Temp.Sample..... °C
Fat.....xx.xx%
SNF.....xx.xx%
Density.....xx.xx
Protein.....xx.xx%
Lactose.....xx.xx%
Added water.....xx.xx%
pH.....xx
Salts.....xx.xx%
Freezing point.....-x.xxx °C
Deliverer No.....xxxx
Liters.....xx.x
Conduct.(mS/sm).....xx.xx
```

4. CLEANING THE ANALYSER

This procedure prevents gathering milk fat residues and milk stone on the sensor. The milk stone consists of milk solids, calcium, iron, sulphates, magnesium, etc. All these substances form layer on the pipe and sensor's walls, which leads to deviations in the measurement results and blocking up the piping.



The company-producer recommends usage of the chemicals, supplied with the analyser – alkaline and acidic (Lactodaily and Lactoweekly). You may order them separately or together with the analyser. Try to use only these chemicals for cleaning the analyser.

In case you missed to order these chemicals the alternative is to use alkaline and acidic cleaning solutions for dairy, produced by one the companies, supplying such chemicals:

<http://www.johnsondiversey.com/Cultures/en-GB/OpCo/Your+Business/Dairies.htm>

http://www.ecolab.com/SolutionGuide3.asp?name=1345&PS_GRP_CD=FDBV&BUS_NM

http://www.calvatis.com/documents/products/produkte_farm_melkhygiene.pdf

4.1. Automatic cleaning the analyser

Analyser's contamination as a result of the irregular cleaning is the basic reason for inexactness during measurement. In order to be avoid this, in the milk analysers with peristaltic pump is embedded automatic cleaning. For this purpose the analyser has to be prepared on the following way:

The reservoir with the cleaning solution have to be connected towards the analyser and outgoing pipe towards reservoir for collecting the measured samples and used cleaning solution, as is shown on Fig.2.



Pay attention to the pipes in both reservoirs. The pipe in the reservoir with the cleaning solution has to be well dipped in the cleaning solution while the pipe in the reservoir with the already used samples and cleaning solution **MUST NOT** be dipped in the liquid.

Pay attention to the level of the cleaning solution in the reservoir. Add solution when the level is below 2/3!

Description of the cleaning procedures:

There are two ways of cleaning the analyser embedded in it – current and end (final) cleaning.

4.1.1. Current cleaning.

4.1.1.1. Automatic start

The current cleaning is made with alkaline solution (for working solution preparation see 4.2.1.), with which the reservoir for the cleaning solution is filled in.

It is automatically started, without operator's interference after the set time intervals elapse

1. 55 min. after switching on the power supply of the analyser, but idle work;
2. 15 min. after the last measurement of real milk sample.

After cleaning a new measurement is started in the above described intervals.

The display shows the following message and a sound signal is emitted:

**Auto clean
started!
Put empty glass**

After this the cleaning is started. The display shows:

**Cleaning
Please wait**

If there is a glass with sample it is completely emptied and then the analyser automatically fulfills procedure for sucking the cleaning solution and rinsing the analyser's inner system. In order the input metal pipe to be cleaned out for a short time a cleaning solution is pumped out for a short time in the already empty glass or in case there is no empty glass there – in the funnel for the waste liquids. It is filled to the middle and then is sucked back and poured in the reservoir with the used liquids. In case that you are sure that you'll not use the analyser for a longer period, but it will be connected to the power supply and switched on, which means that the process of automatic clean will be active, do not leave sample holder in the recess of the analyser, in order not to be overfilled during cleaning from the output pipe. Then the cleaning solution will be directly poured in the funnel for waste liquids.

After the cleaning is finished the displays shows the following:

End of cleaning

After 2 seconds the display shows:

Analyser ready

Then the analyser is ready for normal measurement.

4.1.1.2. Manual start

The current cleaning may be completed by manual start of the menu **Cleaning**. It is used before starting the menu Final Clean. It serves for cleaning the fats from the measuring tract with alkaline cleaning solution with which the canister is filled in. It is started using the menu for choosing the working mode of the analyser. After the measurement is completes, by continuous pressing the button **Enter**, the possible analyser operation modes are shown on the display.

**Cow
Sheep
UHT
Cleaning
Final Clean**

By choosing **Cleaning** the current cleaning is started. The display shows the following:

**Auto clean
started!
Put empty glass**

In this way the current cleaning is started. The procedure and operator's actions are described above.



Do not switch off the device at the end of the working day before the automatic cleaning procedure is completed. If it is not automatically cleaned and there is not a possibility to wait starting the automatic cleaning, then start manually the cleaning procedure with alkaline cleaning solution and if it is necessary with acidic cleaning solution as it is described below.

4.1.2. End (final) cleaning.

4.1.2.1. Final cleaning .

It is done with acidic cleaning detergent (for working solution preparation see 4.2.2.). It is done daily. Serves for cleaning the protein deposits from the measuring system of the analyser, which were not removed during work with the alkaline cleaning solution and removing milk stone layers.



Do not use chemicals, which are not intended for milking equipment and vessels in dairy industry. Pay particular attention to the acidic cleaning solution concentration. The higher concentration may damage the measuring sensor.

Always before the final acidic cleaning rinse the device with alkaline cleaning solution by manual starting if it was not already automatically cleaned. It is necessary to be done in order to remove the milk residues which could react with the acidic cleaning solution.



Do not forget to rinse with clean water!

It is started using the working modes menu. After the measurement is completed, by pressing and holding pressed the button **Enter**, the display shows the possible working modes of the analyser.

**Cow
Sheep
UHT
Cleaning
Final Clean**

1. Choose **Final Clean**. After choosing the final cleaning, the following message appears on the display:

**Put filled with
Water glass
and press Enter
to Continue**

2. Put a glass filled with water and press the button **Enter** in order to continue the procedure. Then the following message appears on the display:

**Cleaning
Please wait**



Do not miss to clean with water because the residues from the alkaline cleaning solution could react with the acidic solution, which will lead to gas and sediment formation.

After rinsing with water, the display shows the following:

**Put filled with
Detergent glass
and press Enter
to Continue**

3. Pour warm alkaline solution in the glass and press the button **Enter**, in order to continue the cleaning.

Then the following message appears on the display:

**Cleaning
Please wait**

Follow repeatedly sucking/pouring out the cleaning solution and heating it up. After the cleaning is finished, the cleaning solution is emitted in the reservoir with the waste liquids.



For maximum cleaning effect it is recommended the cleaning solution to be preliminary heated up to 40-50 degrees centigrade.

Follows rinsing with water:

4. Put a glass with water for rinsing the device.

**Put filled with
Water glass
and press Enter
to Continue**

After rinsing the display shows the following:

End of cleaning

After 2 seconds the following appears on the display:

Analyser ready

After this the analyser is ready for normal measurement or to be switched off from the power supply.

4.2. Preparation of cleaning solution

4.2.1. Preparation of alkaline cleaning solution

Preparation of 1 % alkaline solution of Lactodaily for circulation cleaning in the milk analyser:

1. Take the package 100 g concentrated powder chemical Lactodaily
2. Carefully cut the upper end, paying attention not to spill it.
3. In appropriate vessel (for example bucket) pour 1 l water.
4. Add the powder and then again water up to 10 l.

Then follow the instruction for milk analyser cleaning.

4.2.2. Preparation of acidic cleaning solution

Preparation of 1 % acidic solution of Lactoweekly for circulation cleaning in the milk analyser:

1. Take the package 100 g concentrated powder chemical Lactoweekly
2. Carefully cut the upper end, paying attention not to spill it.
3. In appropriate vessel (for example bucket) pour 1 l water.
4. Add the powder and then again water up to 10 l.

Then follow the instruction for milk analyser cleaning.



For final cleaning with the syringe it is recommended to use 1% acidic solution of Lactoweekly, preliminary heated up to 70 °C.

Fig. 8 Labels for acidic cleaning chemical Lactoweekly and alkaline cleaning chemical Lactodaily

Lactoweekly Acidic cleaner and descaler	Lactodaily Alkaline detergent sanitizer with QAC.
<p>General Description: Low foaming powder product for acidic cleaning of all types milk analysers Lactoscan according their instructions. The product very effectively removes milk stone and hard water deposits thus improving hygienic status of all milking equipment. May be used for manual application as well as for automatic circulation cleaning.</p> <p>Application: Automatic application: 1. Pre-rinse with sufficient water to remove milk residues 2. Circulate a 1% (10 g/l) cleaning solution for 10 to 20 minutes at a temperature above 40°C 3. Rinse thoroughly with tap water.</p> <p>Manual application: Use 0,5 - 1,0%(5 - 10g /l) after sufficient pre-rinsing at 30 to 40°C, soak for at least 10 minutes Rinse thoroughly with tap water. Determination of concentration Titration of p-value with 1 N sodium hydroxide</p> <p>Special instructions: Keep container closed and away from humidity.</p>	<p>Material compatibility: Stainless steel is not affected by the solution. Aluminium is slightly etched.</p> <p>Physical and chemical properties: Appearance: white powder Odour: faintly of surfactant pH-value (1%) 1,5 p-value: -4,5</p> <p>Composition: Sulfamic acid, phosphates, sulfates, surfactant, defoamer</p> <p>Hazard label: Xi, irritant</p> <p>Risks: R 36/38 - Irritating to eyes and skin R 52/53 - Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment</p> <p>For health and safety information, refer to the Safety Data Sheet (SDS) for this product</p>
<p>General Description: Alkaline powder product with QAC for combined cleaning and disinfecting of all types milk analysers Lactoscan according their instructions. Suitable for all water conditions and may be used for manual application as well as for automatic circulation cleaning. Non corrosive on most materials and mild to skin.</p> <p>Application: Automatic application: 1. Pre-rinse with sufficient water to remove milk residues 2. Circulate a 1% (10 g/l) cleaning solution for 10 to 20 minutes at a temperature above 40°C 3. Rinse thoroughly with tap water.</p> <p>Manual application: Use 0,5 - 1,0%(5 - 10g /l) after sufficient pre-rinsing at 30 to 40°C, soak for at least 10 minutes Rinse thoroughly with tap water. Determination of concentration Titration of p-value with 1 N Hydrochloric acid</p> <p>Special instructions: Keep container closed and away from humidity.</p>	<p>Material Compatibility: Stainless steel and Aluminium are not affected by the solution.</p> <p>Physical and chemical properties: Appearance: white powder Odour: faintly of surfactant pH-value (1%) 11,5 p-value: 4,5</p> <p>Composition: Carbonates, phosphates, silicates, surfactants, defoamer, disinfectant</p> <p>Hazard label: Xi, irritant</p> <p>Risks: R 36/38 - Irritating to eyes and skin</p> <p>For health and safety information, refer to the Safety Data Sheet (SDS) for this</p>

4.3. Working with the peristaltic pumps

There are 2 peristaltic pumps inside the examiner – 1 for the sample and 1 for the cleaning.

Fig. 9 Peristaltic pumps

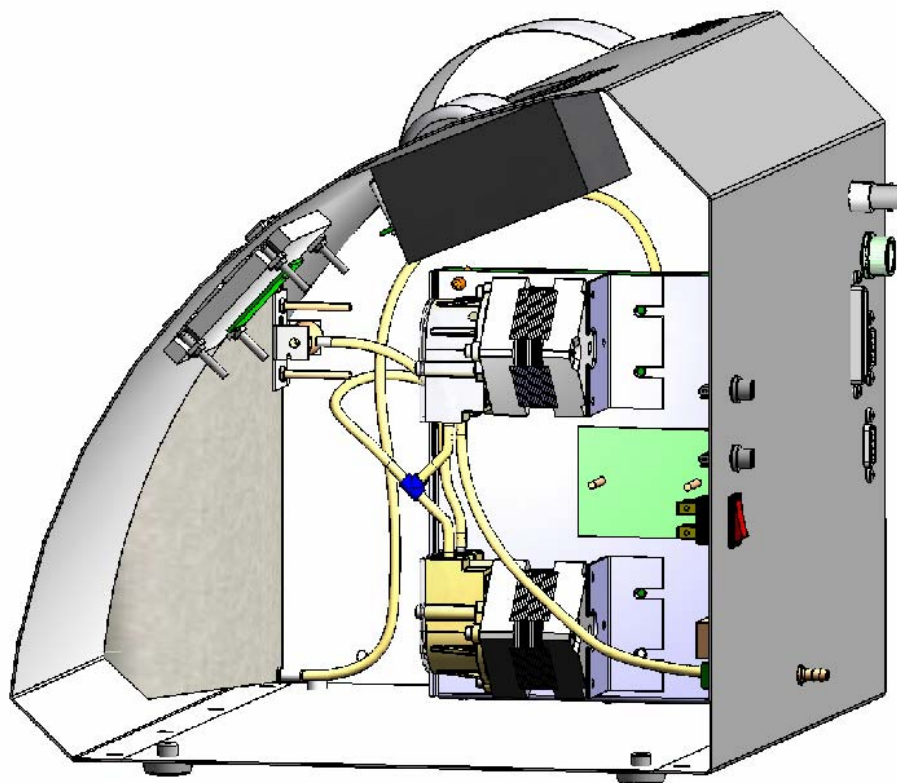
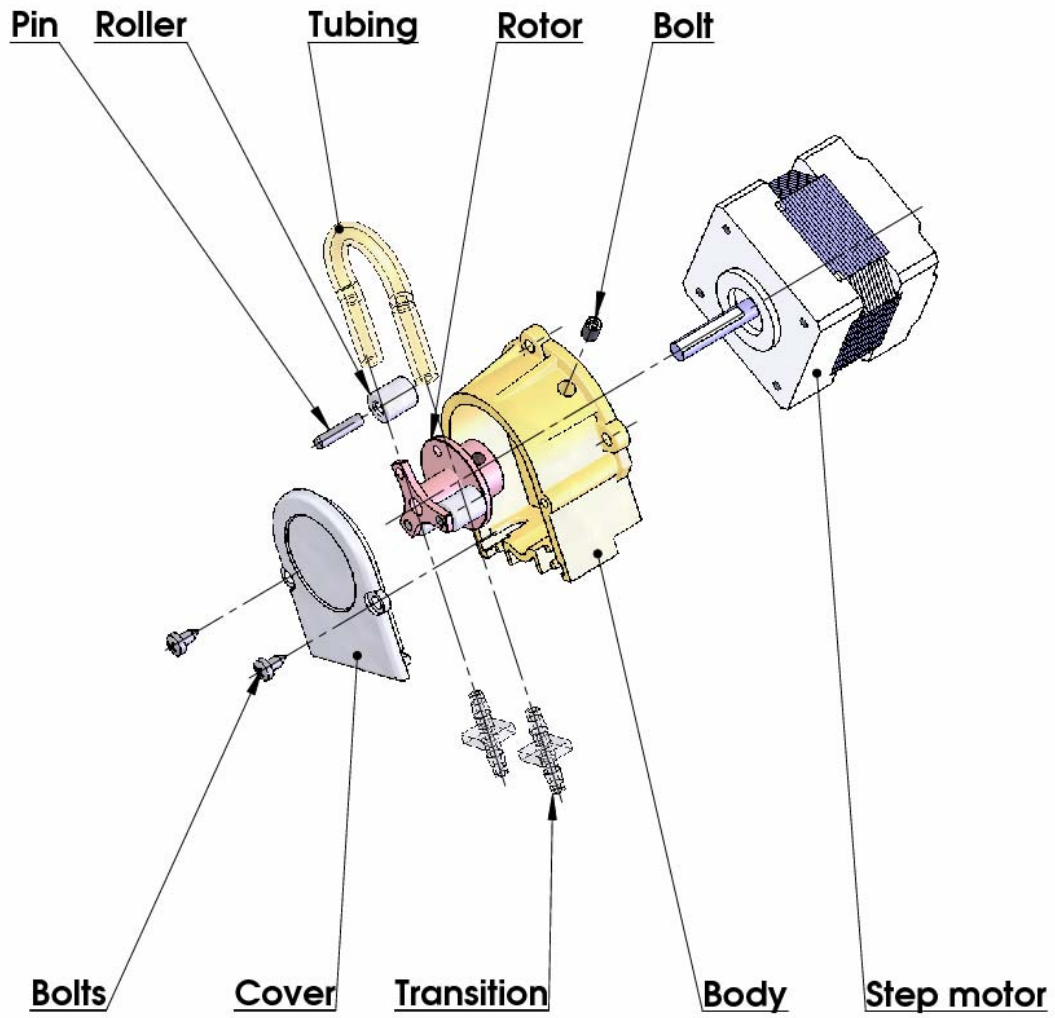


Fig. 10 Peristaltic pump LS16



5. POSSIBLE MALFUNCTIONS AND ERROR MESSAGES, TROUBLESHOOTING

In the table below are described the possible malfunctions during the milk analyser's exploitation and ways for their repair/remedy. If the problem persists after all recommended measures are taken, please, connect the nearest service center.

Error message	Possible problem /cause	Repair/remedy
MA overheated Accompanied by a continuous sound signal	Overheated milk analyser	Immediately switch off the analyser. Pay attention the analyser to be situated away from direct sunlight or heating devices. Wait 5-10 minutes the device to cool down or to be normalized the ambient temperature and switch it on again.
Empty Camera	Insufficient quantity of the milk sample sucked in the system or air in the sample	The analyser is ready to measure the next sample. In order to avoid the future appearance of the same error message, please, check the following: <ul style="list-style-type: none"> - The sample is prepared according the instructions and there aren't air bubbles in it. - There is a real suction of the sample after starting measurement, i.e. it is obvious that the level of the milk sample in the sample holder decreases. In other case – there is damage in the suction system. - Avoid the end of the suction pipe to be above the surface of the liquid (not dipped enough). - Avoid curdling of the milk sample. Clean immediately if there is a sample curdled in the system. - In mode Measurement, after starting the measurement, remove the sample holder and see if there is no milk poured back in the sample holder.
Sample Overheat	Sucked overheated sample	The analyser is ready to measure the next sample. In order to avoid the future appearance of the same error message, please, check the following: <ul style="list-style-type: none"> -The sample is prepared according the instructions and its temperature does not exceed the maximum permissible sample's temperature. -Complete the procedure for checking the analyser in case of error message Empty Camera.

6. MAKING CORRECTIONS AND RECALLIBRATION OF THE DEVICE



At least once monthly check the correctness of the results and need of corrections and calibration.

In the process of work with the analyser there is a possibility the results to start differing between the data for some of the measuring parameters when measured with the milk analyser and the corresponding reference method of analyses (Gerber for fat, Kjeldhal for proteins etc). In order to establish the possible discrepancy and to correct the readings of the milk analyser do the following:

6.1. Taking samples and preparation of samples for checking the accuracy of the milk analyser, making corrections and recalibration

This is a basic moment for the correct checking the accuracy of the analyser and for making correct and precise correction and calibration. It is accomplished according *Appendix Taking and preparation of samples for checking correctness of the milk analyser, making corrections and recalibration.*

6.2. Determination the type of the discrepancy:

6.2.1. Making measurements

Make measurements with different samples (not less than 3) with known values of a separate parameter (for example fat content), determined by the known reference methods of analyses (for example Gerber's method for determination of fat content). For more accuracy it is recommended among these samples to be also such with values, close to the lowest and highest bounds for the measured parameters.

Make 5-time measurement for each of the samples. Calculate the average value for each sample parameter, without taking into consideration the first measurement for each sample.

6.2.2. Analyzing the measurement results

Make comparison between the values of the parameter from the reference sample and measured with the analyser. Make analyses of the difference received.

6.2.2.1. If the received differences are relatively constant value for samples with different content of the analyzed parameter, it is necessary to make correction.

For example

M% of the reference samples:	2,20	3,00	3,80	4,60	5,20
M% average when measuring with the analyser:	<u>2,38</u>	<u>3,17</u>	<u>4,01</u>	<u>4,79</u>	<u>5,42</u>
Difference:	0,18	0,17	0,21	0,19	0,22

Conclusion: the difference is relatively constant value and correction is possible to be done with – 0,2 % (see Corrections, p. 6.3.3)

6.2.2.2. If the differences are not a constant value it is necessary recalibration to be done.

For example.

M% of the reference samples:	2,20	3,00	3,80	4,60	5,20
M% when measured with the analyser:	<u>2,02</u>	<u>2,93</u>	<u>3,76</u>	<u>4,75</u>	<u>5,44</u>
Difference:	-0,18	-0,07	-0,04	0,15	0,24

Conclusion: It is obvious that the difference is variable value and recalibration has to be done (See Recalibration, p.6.4).

6.3. Making corrections

6.3.1. Possible corrections, limits and changing steps

Every parameter from each calibration may be separately corrected. Below is the table with possible corrections, limits and changing steps:

Parameter	Increasing	Decreasing	Step
FAT	0.95%	0.95%	0.01%
SNF	4.75%	4.75%	0.05%
Density	4.75%	4.75%	0.05%
Lactose	0.95%	0.95%	0.01%
Salts	0.95%	0.95%	0.01%
Proteins	0.95%	0.95%	0.01%
Added water	9.00%	9.00%	1.00%
Sample's temperature	9.90°C	9.90°C	0.1°C

6.3.2. Preparing the analyser for mode Corrections

6.3.2.1. Press the button **Enter** and without releasing it switch on the power supply of the device, wait for the starting identification messages and release the button after the following message appears on the display:

**Release button
to start setup**

After releasing the button on the display is shown:

MA Setup

followed by possible to be entered by the operator menus:

**Special modes
Corrections
Settings**

**Tests
pH & Co Meter
Accessories
Exit**

6.3.2.2. By using buttons “up” ▲ and “down” ▼ position on **Corrections** and press **Enter**.

6.3.3. Making correction

6.3.3.1 Determining the correction mode

When starting **Corrections**, the following appears on the display

**Corrections:
Calibration 1
Calibration 2
Calibration 3**

**Temperature
Exit**

By using buttons “up”▲ and”down”▼position on the corresponding calibration (for example **Correction 1 – cow**) and press **Enter**.

6.3.3.2. Choosing correction parameter

After choosing calibration mode the display shows the following:

Cal1 Correct's
FAT
SNF
Density

Lactose
Salts
Proteins
Water

Exit

Using the buttons “up”▲ and”down”▼position on the parameter to be corrected (for example **FAT**) and press the button **Enter**.

6.3.3.3. Making correction

After choosing parameter (for example fat) the display shows the following:

FAT Correction
0,05
 - **OK** +

Using the buttons “up”▲ and”down”▼is possible to increase or decrease the value of the measured parameter in the above pointed limits. Leaving this mode means saving the correction value and activating it.

6.3.3.4. Making verification

After the corrections are made put the milk analyser in working mode following the sequence below:

1. Switch off the power supply.
2. Switch on the “**POWER**” button, which starts the identification procedure. For a short time the display shows the number of the software versions, for example:

**Milk analyser xxx
LCD vers xx
MA vers yy
MA ser. N. xxxx**

3. Till the analyser is prepared for work (at about 5 minutes) the following message is written on the display: “**Getting ready**”.
4. When the device is ready for work, a beep is heard and the display shows: “**Analyser ready**”. The analyser is ready to make analyses in mode 1 (normally Cow).
5. Make several times measurement of reference samples with known values of the corrected parameter. If the difference between the values of the parameter from the reference methods and milkanalyser are in the limits for the parameter it may be considered that the correction is successfully made.

If the discrepancy between the measurements from the milk analyser and classical methods is bigger than is necessary to make second correction according above described way.

If after the second correction the results are unsatisfactory we recommend making a calibration of the analyser. In dependence of the conditions and your requirements you may make the calibration using a personal computer type IBM PC and the company's calibration program or autonomous - by recalibration.



When making corrections or calibrations be 100% sure in the accuracy of the reference methods result.

6.4. Recalibrating the milk analyser

6.4.1. Running the analyser in mode Recalibrate

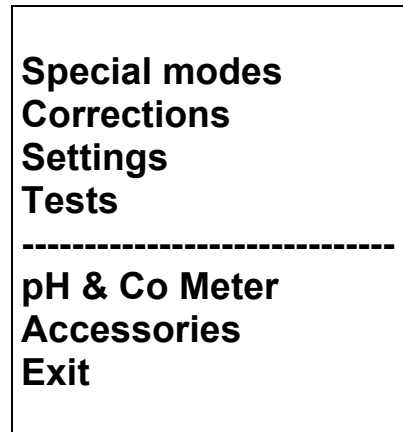
6.4.1.1. Press the button **Enter** and without releasing it switch on the power supply of the device, wait for the starting identification messages and release the button after the following message appears on the display:

**Release button
to start setup**

After releasing the button on the display is shown:



Followed by the possible to be entered by the operator menus:



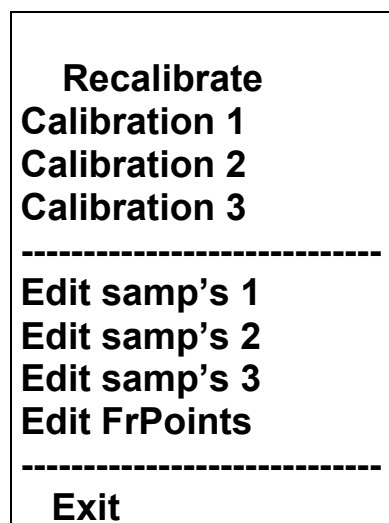
6.4.1.2. By using buttons “up” ▲ and “down” ▼ position on **Settings** and press button **Enter**.

6.4.1.3. Analogically, position on **Recalibrate** and press the button **Enter**.

6.4.2. Making recalibration

6.4.2.1. Determining the calibration mode

After starting **Recalibrate**, the display shows the following:



Using the buttons “up” ▲ and “down” ▼ position on the corresponding calibration (for example if you need to recalibrate cow milk, which is assigned

in the milk analyser as **Calibration 1 - cow**) and press the button **Enter**. The following message appears on the display:

**Calibration 1
Getting ready**

6.4.2.2. Entering values for the separate sample parameters

Wait for the sound signal and the following menu on the display:

**Cal1 Samp High
Fat=f.ff
SNF=y.yy
Den=d.dd

Lac=l.ll
Sol=s.ss
Pro=p.pp
Exit**

In this display is possible to be entered the results from the milk **with high FAT** chemical analyses, which were received by the methods from Appendix Methods.

For example:

- by using the buttons "up" ▲ and "down" ▼, choose the needed parameter to be entered;
- by pressing "**Enter**" the cursor will mark the number to be changed. For example: FAT=01.29;
- using the buttons "up" ▲ and "down" ▼, enter the needed value;
- by next pressing of **Enter** pass towards the next number;
- after completion of entering the needed FAT value, press **Enter**;
- the cursor returns to its starting position.

**Cal 1 Samp.High
Fat=f.ff
SNF=y.yy
Den=d.dd**

With the button “down” ▼ move the cursor across SNF and analogical to the above described consequence enter the value for SNF and after that the rest of the values.

Using menus **Edit samp's 1(2, 3)** the operator has the possibility preliminary to prepare the data for the parameters for each recalibration separately or to check the sample data.

6.4.2.3. Making recalibration with the available samples

After entering the values for the separate parameters of the sample position the cursor across **Exit**, press **Enter** and the following menu appears on the display:

**Recalibrate 1
Put sample High 5
times**

Which reminds us to put 5 times the sample with high **FAT**.



The sample has to be with temperature in the boundaries 15-25°C.

Stir 2-3 times the milk sample before each measurement by pouring it from one vessel to another. The needed quantity is poured in the sample-holder and it is put in the recess of the device. Starts the measurement. The sample is sucked. Appears the following menu:

**Recallibrate 1
Put sample high 5
times
Samp T=16.8**

After the sample is measured, appears the following menu:

**Recalibrate 1
Put sample High
Cal meas=1/5**

Follow the procedure till the 5th measurement.

After 5th measurement completion automatically appears the menu:

Cal 1 Samp Low
Fat = f.ff
SNF=y.yy
Den=d.dd

Lac=l.ll
Sol=s.ss
Pro=p.pp
Exit

Which reminds to enter the values for the sample with low FAT? Enter the values analogically to the procedure, described in the previous sample. After entering the last parameter position the cursor on “**Exit**”, press “**Enter**” and the following menu will appear:

Recal 1
Put sample Low 5
times

Make 5 times measurement of the low FAT sample.

After 5th measurement completion automatically appears the menu:

Recal 1
Put sample water

Which reminds for 5-times water measurement? There is no need to enter values after placing the sample-holder. Measurement starts directly.



The used water has to be distilled or boiled.

After the 5th measurement appears the menu:

**Recalibrated
Analyser ready**

This means that the calibration was completed successfully and the analyser is recalibrated for cow milk, marked as “**Calibr 1**”.

Switch off the power supply of the device and switch it on again.

The device is ready to work with the new calibration.

If during work the sample's temperature exceeds the temperature range 15-25° C the following message appears:

**Temperature out of
range**

Wait till the end of the measurement. When the message appears:

Put sample again

Put sample with temperature in the temperature range and continue the measurement till completion of 5-time measurement.

7. STARTING THE DEVICE IN A SERVICE TEST/SETUP OPERATIONAL MODE. MENUS DESIGNATION

7.1. Starting the device in a service Test/Setup operational mode.

In order to start the **Setup** of the device the operator has to press the button **Enter** and without releasing it to switch on the power supply of the device, to wait for the starting identification messages and to release the button after the following message appears on the display:

**Release button
to start setup**

After releasing the button on the display is shown:

MA Setup

Followed by possible to be entered by the operator menus:

**Special modes
Corrections
Settings**

**Tests
pH & Co Meter
Accessories
Exit**

You may move in the menus by using buttons “**up**” ▲ and “**down**” ▼. If by pressing the button **Enter** you choose a menu, each menu offers new points/submenus. When **Exit** is chosen the device leaves the **Setup** mode and returns to normal work.



Due to continuous device improvement or due to the type of ordered type device it is possible some of the functions of the analyser to be not active (options not included). In this case, when trying to enter such function will display the following message: **Not available option**

7.2. Menus Function:

7.2.1. Special modes.

Serve for choosing special (technological) working modes. After starting it the following appears on the display:

```
Special modes
Calibration
Cycle
Exit
```

This mode is normally used in production conditions.

7.2.1.2. Calibration mode

In mode **Calibration** the analyser is ready to make measurement and to send the received results towards the technological milk analysers calibration system. For this purpose you need personal computer type IBM PC, company's calibration system LSC.EXE and methods for calibration of milk analysers (see the corresponding documents). To start measurement in this mode, the operator has to put a sample-holder containing milk sample in the recess of the analyser and to press the button **Enter**.

7.2.1.2. Cycle mode

Mode **Cycle** serves for training the analysers. When you start this mode, the analyser, without additional commands, sucks the sample, makes the measurement, pours the sample out in the sample-holder and displays the received results cyclically.

7.2.2. Corrections

Serves for entering corrections in the measured data. Detailed description in point 6.3.2 and 6.3.3.

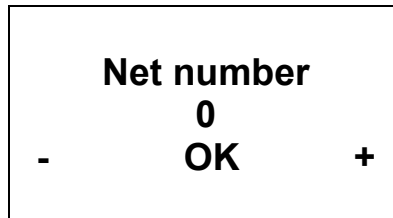
7.2.3. Settings.

Serve for assigning different working parameters (modes).

7.2.3.1. Net number.

Serves for assigning the device network number when connecting it in the production network. The possible numbers are from 0 to 15 including.

After starting this function the display shows the following:



By using the button “up”▲ the operator has the possibility to increase the number, showing the channel’s number, and by button “down”▼, to decrease it. Pressing the button **Enter** saves the chosen channel and exits the function.



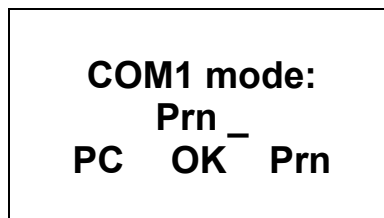
When connected in the production network each device has to have a unique number.

7.2.3.2. COM1 mode.

Serves for choosing the working mode of COM1 (RS232 on the rear panel). Chooses the device towards which the measurement results are send. There are two possibilities:

- towards a personal computer - PC;
- towards serial printer - Prn.

After starting this function the display shows the following:



Using the button “up”▲” the operator has the possibility to send the results towards **Prn**, and by button “down”▼, towards **PC**. Pressing the button **Enter** saves the chosen output device and exits the function.

Forwarding the printer towards COM1 is necessary when connecting additional external keypad to the analyser. In this case the keypad is connected to Com.port 2, and the printer – to com port 1.



Forwarding the printer could not be necessary if there is a special cable – fork-joint (from the company-producer), which allows both the keypad and serial printer to be connected towards **Com. Port 2**. In this case **Com. Port 1** is free and may be used for communication with computer IBM PC type.

7.2.3.3. LCD Setup.

Serves to adjust the backlight of the display. The two parameters may be changed in two modes:

- fast – for rough adjustment;
- fine – for precise adjustment.

After starting this function the displays shows the following:

```
LCD Setup:
B. Light fast
B.Light fine
Exit
```

7.2.3.4. Recalibrate.

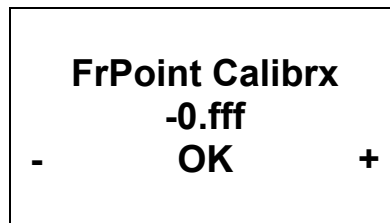
Serves for changing definite calibration. Methods are described in point 6.4.

7.2.3.5. Edit FrPoint

Through this menu you have the possibility to enter the basic freezing point separately for each calibration. For more information, see *Appendix Freezing point*. After choosing the menu the following is displayed:

```
Edit FrPoints
FrPoint Calibr1
FrPoint Calibr2
FrPoint Calibr3
-----
Exit
```

After choosing freezing point for the calibration, the following is displayed:



Where:

- Calibrx** - basic freezing point to be edited for chosen calibration;
- 0.fff** - basic freezing point current value;

By pressing the buttons:

- “up” ▲** - you may increase the absolute value of the freezing point;
- “down” ▼** - you may decrease the absolute value of the freezing point;
- “Enter”** - saves the edited value and exits the menu;

7.2.3.6. Save/Rest Cal.

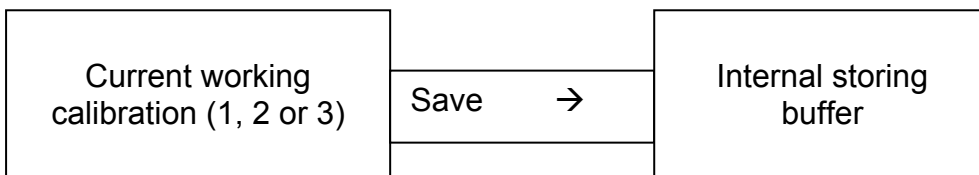
Through this menu you may save the new calibration in the device or to restore the old one (factory) calibration. This is necessary in case that you’ve calibrated the device for cow milk, but after that the device is not measuring correctly and you decide to restore the factory calibration settings. Position the cursor across **“Restore calibration”** and press **“Enter”**

Possibilities:

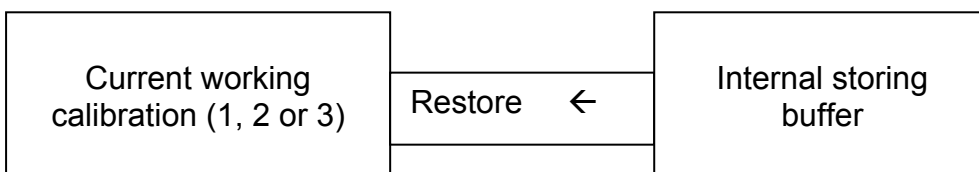
Save calibration – saves the chosen calibration in an internal buffer.

Restore calibration – restores the chosen calibration from the internal buffer.

The procedure **Save/Restore** is done for each calibration separately.



Current calibration content is not changed, the analyser continues using it, but there is a reserve copy in an internal buffer.



The current calibration is replaced with the calibration from the internal buffer and the analyser starts working with it. The content of the internal buffer is not changed.



If after recalibration “Save calibration” is pressed the new calibration settings will be saved over the factory settings. After that is impossible to restore the factory settings of the calibration. Save the newly made calibration only if you are sure about its correctness.

7.2.3.7. Settings Page 2.

After this menu is started the display shows the following:

**Settings Page2
Final clean Cnt
Auto Print Res
Larg Res En/Dis
Set Calibr Name
Exit**

Now there is a possibility one of the following options to be set:

7.2.3.7.1. Final Clean Cnt

Sets the number of cleaning cycles.

7.2.3.7.2. Auto Print Res.

It is possible (if it is needed) to prohibit the automatic printing the measurement results. If there is external keypad connected, then the results could be printed by pressing the button 1 from the keypad. It is possible to print out unlimited number of printouts for one and the same measurement.

7.2.3.7.3. Larg Res En/Dis.

The format of the measurement data send towards the computer is set.

If the option **Large Disable**, is chosen, then only the main results are send to the computer – Fat, SNF, Density, Lac, Proteins, Added Water, sample temperature, device serial number and calibration number.

If the option **Enable**, is chosen, except the above mentioned parameters also data for Salts, Freezing Point, pH, Conductivity will be send to the computer. In this case is necessary the software in the computer to be conformable to the format of the sent data. After starting the menu, the display shows (for example):

Large Results

No

No OK Yes

7.2.3.7.4. Set Calibr Name.

Sets the names of the separate calibrations. The name could be chosen from the group of predefined calibrations names or to edit a new one. When editing the new name there is a possibility all ASCII codes to be used, as letters (caps and normal), numbers and punctuation marks and popular symbols. The calibration name consists of 8 symbols.

Example:

When it is suitable to us this possibility of the analyser? For example if you have a device factory calibrated for Cow milk, Sheep Milk and UHT milk, but you need oftenly to measure camel milk. Using the methods, explained in details in Appendix Methods you may make a new calibration without need to send the analyser back to the producer for calibration. Using this procedure you may make calibrations for most oftenly analysed milk and to write down the exact calibration name, which will be shown on the display and printed on the printer.

After starting this menu the display shows:

Select Calibr

Cal1: Sheep

Exit Yes Next

There are the following possibilities:

With button **Exit** – to leave the menu.

With button **Yes** – to confirm the chosen for editing calibration name.

With button **Next** – to choose the next calibration name for editing.

If a calibration for change or edit of name is chosen, the display shows (example):

Cal:Sheep

PreDef Exit Edit

There are the following possibilities:

With button **PreDef** – to choose a calibration name from the list of preliminary given names.

With button **Exit** – to leave the menu.

With button **Edit** – to edit the new calibration name.

If a name from the preliminary given names list is chosen, the display shows:

**Cal1: Sheep
UHT**

Exit Yes Next

There are the following possibilities:

With button **Exit** – to leave the menu.

With button **Yes** – to confirm the chosen from the list calibration name. Now the program returns to the beginning of the menu for setting calibration names.

With button **Next** – to show the next calibration name from the list.

If it is decided a new calibration name to be edited, the display shows:

**Cal1: Sheep
User Edited
Name:
Prev Set Next**

There are the following possibilities:

With button **Prev** – to display the previous ASCII symbol.

With button **Set** – to confirm the ASCII symbol, shown on the display and passes to editing the next symbol from the calibration name.

With button **Next** – to show the next ASCII symbol.

After editing the last (eighth) name symbol, the display shows:

**Cal1: Sheep
User Edited
Name: MilkShp
Exit Save**

There are the following possibilities:

With button **Exit** – to leave the menu.

With button **Save** – to confirm already edited calibration name and to save it in the device. The program returns to the beginning of the menu for setting calibration names.

7.2.4. Tests.

Start different tests. Possibilities:

7.2.4.1. Test pump.

Starts pump's test. The number of the completed suction/display cycles is indicated.

7.2.4.2. Ultrasound.

Test for the ultrasonic system. Used in production conditions.

7.2.4.3. Serial Prn.

Display a short text of a serial printer, connected to COM2 – output with inscription **Printer** on the back panel of the device.

7.2.4.4. Set Amplitude.

Serves for ultrasound amplitude adjustment. It is used under production conditions or by the customer (after sensor change) according the instructions in the document *SetCell.pdf*.



Please, use this menu only after reading the above pointed document SetCell.pdf

7.2.5. pH meter & Co meter

Ph and conductivity measuring are additional possibilities for the analyser and are optional. Their usage is described in *Appendices PH Measurement and Conductivity Measurement*.

7.2.6. Exit

By pressing the button you may leave the program and pass towards another menu.

7.2.7. Milk analysers' setup menu structure

		Analyzer Setup	
Special modes	Calibration Cycle Reports Shut Down		
Corrections	Calibration 1	Fat SNF Density Lactose Salts Proteins Water	
	Calibration 2	Fat SNF Density Lactose Salts Proteins Water	
	Calibration 3	Fat SNF Density Lactose Salts Proteins Water	
	Temperature Cond measure		
	Settings	Net number	
		COM1 mode	
		LCD Setup	Contrast fast Contrast fine B.Light fast B.Light fine
		Recalibrate	Calibration 1 Calibration 2 Calibration 3 Edit samp's 1 Edit samp's 2

	Edit samp's 3
Edit FrPoints	FrPoint Calibr1 FrPoint Calibr2 FrPoint Calibr3
Save/Rest Cal	Save Calibr 1 Save Calibr 2 Save Calibr 3 Rest Calibr 1 Rest Calibr 2 Rest Calibr 3
Fan Temp Offs Settings Page2	Final clean cnt Auto Print Res Larg Res En/Dis Set Calibr Name Option Select
	Sel Pump Speed Speed for Cal 1 Speed for Cal 2 Speed for Cal 3 HFSpeed for Cal OutSample Delay
	Reslt Precision Fat - Precision SNF - Precision Den - Precision Lac - Precision Sol - Precision Pro - Precision AdW - Precision
	Properties PCB Main Identi PCB LCD Identi
Tests	Test pump Ultrasound Serial Prntr KeyPad Displays Parallel Prn
pH & Co Meter	

pH
Calibration
pH
Measuring
pH
En/Disable
pH U Display
pH Test U[V]
Co Meter
Calibr
Co Meter
Test
Co Meter
En/Dis

Accessories

Weight scale

Raw Test
Calibration
Measure
On Line En/Dis

Battery

Measure Bat U
Ctrl Enabl/Dis

RT Clock

Display Time
Adjust Time
Adjust Date

8. ENTERING DATA WITH THE KEYPAD AND PRINTING OUT THE RESULTS

8.1. Working with the keypad

To make the operation easier there is embedded keypad in the device.

Via it one may enter 4 digit number of the milk supplier (from 1 up to 9999) and the delivered by this milk supplier liters of milk (from 0.1 up to 9999.9 liters) with accuracy up to 0.1 l.

Entering these data is done before starting the measurement. For that purpose:

1. Press the button # (**Enter**) on the keyboard and the display will show the following:

**Enter Data
Del N:**

2. Now enter the number of the supplier.

3. By pressing # **Enter** on the keyboard, the display shows:

**Enter Data
Del N:xxxx
Liters =**

4. Now enter the liters and press the button # (**Enter**) on the keyboard. The display shows:

**Del N:xxxx
Liters=yyyy.y
Are you sure?
0-No Yes**

Where:

xxxx - entered by the operator number of the supplier
yyyy.y - entered by the operator liters

The operator has the following two possibilities:

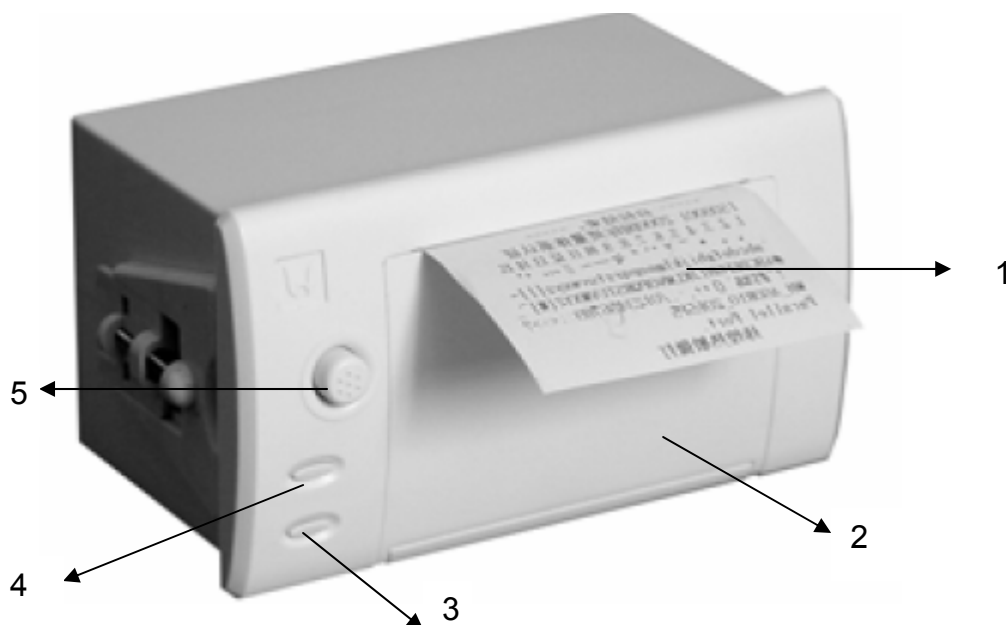
1. To cancel the entered data by pressing the button 0 on the keyboard and to start entering them again.
2. To confirm the entered data by pressing the button # (**Enter**) on the keyboard, and then the display will show currently chosen calibration. Now the device is ready to start measurement. After finishing the measurement, data, entered for the supplier are printed out.

8.2. Working with the printer

8.2.1. Basic printer characteristics

Printing method	Thermal line dot printing
Paper width:	57.5±0.5mm
Printing density:	8dot/mm, 384dot/line
Printing speed:	50mm/s or 20line/s
Printing width:	48mm
Feeding speed:	50mm/s or 20line/s
Power:	DC 5V , 3A

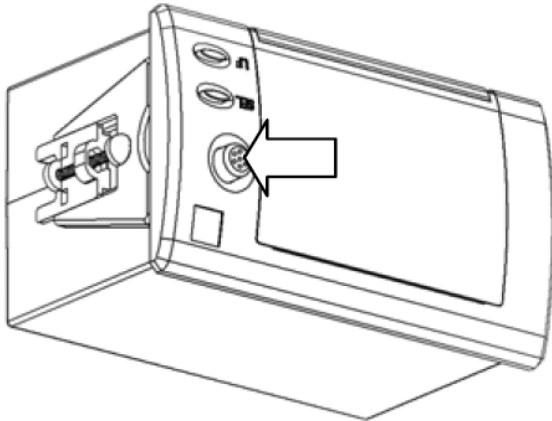
Фуз. 11 Printer control panel



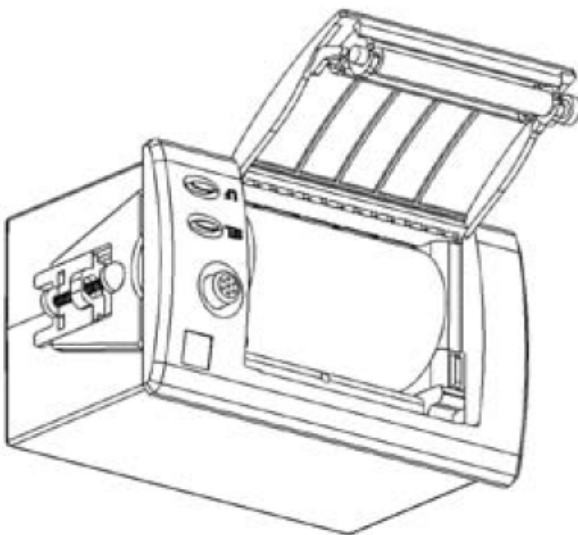
1. *Printout*
2. *Paper roll compartment*
3. *Select (Sel)*
4. *Line Feed (LF)*
5. *Cover opening button*

Changing the roll

To change the paper rolls proceed as follows:



1. Press the button as it is shown on the figure.



2. Position the paper roll making sure it unrolls in the proper direction.
3. Tear off the paper and close the cover

- Method of changing the printer's direction

- 1 Press SEL Key and make printer power on at the same time, The printer will print out the state of serial interface and the printer direction.
2. Press LF once. The printer will print out the printer direction.
3. After that the printer direction could be changed through the both keys.
- 4.The printer has to be re-powered after setting.

- The way to self-check:

Make the printer power on. Press the LF Key and the SEL Key at the same time, and then the printer print out the self-check scrip.

8.2.2. Consequence of actions when printing

The embedded printer is automatically switched on with switching on the device. After finishing the measuring procedure the results are automatically printed out. If there is a need of repeated printing of the same results the operator has to press the button 1 on the embedded keyboard (each pressing the button 1 on the keyboard the results will be printed out). If the operator does not need to print out the results after the measurement is completed the following has to be made:

1. Start Setup of the device (see p.7.1 Starting the device in service Test/Setup mode).
2. Using the buttons up and down select menu Settings, page 2 results. The display shows the following:

Settings Page2
Final clean cnt
Auto Print res
Exit

Choose **Auto Print res**. The display shows the following:

Auto Print res
No OK Yes

Now the operator may choose or cancel the automatic printing the results. Additional printing out of the results by pressing the button 1 on the keyboard is active even if the automatic printing is switched off i.e. pressing the button 1 will print out the results from the last measurement as many times as you press the button 1.

9. ADDITIONAL POSSIBILITIES OF THE ANALYSER

9.1. Connecting to 12 V DC power supply.

If there is a need the analyser to work on place without electrical supply available, then it could be powered by car battery or other 12 V DC external power supply. Use the 12 V power supply cable (art. number 30030).

9.2. Connecting to IBM PC

The analyser can be connected to IBM PC using the RS232 interface cable (art. number 30012, Parts and Accessories, point 16). In order to make the connection: switch off both the milk analyser and PC. Connect the RS 232 cable towards Com. Port 1 and towards the computer. Turn on both analyser and PC. Now the device is ready to communicate with IBM PC. For more detailed information regarding milk collection data program see the file resLS_SupLiters.pdf from the CD, accompanying the device.

9.3. Connecting additional serial printer (option).

The interface connector for the printer is on the rear panel of the device (Com. Port 2). The printer should be connected towards it. Connect it via cables, delivered by the company-producer. If the printer is connected directly to the electrical network, then the analyser and the printer should be connected to one and the same electrical phase.

Communication parameters: 9600 bps, No parity, 8 bits, 1 stop bit. It's one-way communication (uses one line) – the analyser only sends and the printer only accepts data.

9.4. Connecting matrix printer (option).

If the device is working in milk collection center, where work load is heavy, and there are a lot of results to be printed out, we suggest an option connecting standard matrix printer (paper expenses would be less, the reliability better).

Interface connection with the printer is at the rear panel of the analyser "Parallel printer interface".

9.5. Connecting and working with external keypad (option).

It is possible external keypad (supplied by the producer of the device) to be connected to the device, using special cable to the serial printer connector. In order to connect external keypad to the milk analyser, follow the procedure below:

1. Connect the keypad towards connector labeled Printer.
2. Connect the printer towards connector labeled **RS 232**.
3. Forward the printer towards output **RS 232**, doing the following:
 - Press the button **Enter** (on the front panel of the analyser).

- While holding it pressed, switch on the analyser's power supply.
- Release the button **Enter**.
- Using the buttons **Up/Down** choose menu **Settings** and press **Enter**.
- Using the buttons **Up/Down** choose menu **COM1 Mode** and press **Enter**.
- With the right button (**Up**) choose **COM1 Mode – Prn**, press **Enter** and leave the menu.

With the external keypad 4 digit identification number of the milk deliverer may be entered (from 1 to 9999) and quantity of delivered milk in liters (from 0,1 to 9999.9) (accurateness up to 0.1 l). These data entering have to be completed before starting measurement. Pressing the button **Enter** on the keypad will display the following:

Enter Data
Del N:

Now enter the deliverer's identification number. After pressing **Enter** on the external keypad, the display shows:

Enter Data
Del N:xxxx
Liters =

Now, enter how many liters have been delivered and press the button **Enter** on the external keypad the following is displayed:

Del N:xxxx
Liters=yyyy.y
Are you sure?
0-No Yes-Enter

Where:

- xxxx** - entered by the operator identification number of the deliverer
- yyyy.y** - entered by the operator liters.

The operator has two possibilities:

1. To cancel the entered data by pressing the button 0 on the external keypad and to start entering them again.
2. Confirm the entered data by pressing the button **Enter** on the external keypad. The display shows currently chosen calibration. The device is ready to start measurement. After completing the measurement, the data for the deliverer are printed out.

9.6. Measuring high fat samples (option).

The standard device measures samples up to 25% fat.

On customer's request, the device could be produced with possibility to measure samples up to 50% fat. The customer can choose which calibration to have this possibility and which not, as well as during the process of exploitation to change the measuring mode i.e. to pass from measuring normal fat percentage towards high and vice versa.

What the operator sees during these passes is the difference in the speed of sucking the sample. For that purpose, the high-fat sample has to be preliminary heated up to 30C +- 3C.

To choose the mode, follow the sequence below:

Setup->Settings->Settings
Page2->Option
Select->SelPumpSpeed->Speed for Cal x

After which the display shows:

<p style="text-align: center;">Calibr x Pump Speed</p> <p>Normal OK HiFat</p>
--

By pressing the correspondent buttons the operator can choose the type of measurement and to exit the menu.

When changing the type of measurement on a calibration is necessary a new calibration of the device on the new speed to be done. When calibrating measuring high fat sample, before starting the calibration procedure, the operator has to choose from the menu:

Setup->Settings->Settings
Page2->Option
Select->SelPumpSpeed-> HFSpeed for Cal

By which the device passes in a mode of measuring high fat samples. This calibration mode is active till the power supply of the device is switched off i.e. it has to be always set if the device will be calibrated for high fat measurement.

9.7. Working with embedded accumulator (option).

On customers' request accumulator could be embedded in the milk analyser. In this way it could work independently on the electrical network. In this case the Power switch on the rear panel of the analyser serves for close / open the electric circuit of the outer power supply. After closing the circuit, in order to start the analyser, the operator has to press the Start button on the front panel of the analyser.

Switching off the analyser could be done on one of the following ways:
Through the analyser – by switching the Power button on the rear panel of the analyser.

Through the software – by using the option Shut Down from the Calibration and Working mode menus.

After pressing and holding pressed the button Enter (when choosing calibration), the following is displayed:

<p>Milk selector Cal1 – Cow Cal2 – Sheep Cal3 – UHT</p> <hr/> <p>Cleaning Final clean Shut Down</p>
--

By choosing the option Shut Down the operator may switch off the power supply of the analysers.

In case that the external power supply from the electrical network, the analyzer automatically starts working with power supply from the battery. Possible working modes with battery:

1. The analyser is powered by the battery, works normally, the display shows the following message

<p>Battery Powered</p>

2. The analyser is in mode Sleep – do not accept any commands, expects change in the power (supply from switching adapter for starting the battery), display shows the following

Low Battery

3. The battery power is under the allowed minimum, milk analyser is automatically switched off. Before switching off, for a short time, the display shows

Out of Battery

9.8. Automatic weighting the milk with scales (option).

Scales could be connected towards the milk analyser, which to be used for weighting the delivered milk before measuring its parameters. For using the scale the operator has to follow up the two procedures:

- Preparation for work and checking the scales
- Weighting delivered milk

9.8.1. Preparation for work and checking the scales

Put the scales on round and solid surface and level it, using its helical legs. Checking the scales is done by using 2 standards of weight – light and heavy, for example 5 and 50 kg, in mode:

Setup ->Accessories->Weigh Scale->Measure

(this is OFF Line measuring mode). In case there is discrepancy noticed, you need to make scales calibration, as is described below.

9.8.2. Weighting delivered milk.

The procedure is analogous to work when entering data for the deliverer using additional keypad. The difference is that weight of milk is automatically send from the scales.

Consequence of work is as follows: switch on the analyser for normal work. Place the vessel where the milk from different deliverers will be collected, for example with 80 l volume. When the analyser is ready for work, the operator has to press “#” (Enter) on the digital keyboard. Display shows the following:

Enter Data
Del N:

Now enter the deliverer's number and press the button “#” (Enter) on the digital keyboard. Display shows the following:

Net =xx.xxx [kg]
Tare =yy.yyy[kg]
Totl =zz.zzz[kg]
0-Tare #-
OK

where:

xx.xxx – weight of the poured milk of the current deliverer.

yy.yyy – tare's weight (weight of the milk collecting vessel plus milk, collected from the previous deliverers, if there is such in the vessel)

zz.zzz – sum of Net + Tare

After the first measurement, across Net will be shown the weight of the milk collecting vessel, and Tare will show 0. Now press the button Tare, and now the scales is ready to weight the milk of the deliverer, i.e. Net shows 0. Fill the glass for sample measuring and the rest of the milk pour in the milk-collecting vessel, placed on the weighting scales. Now the value on the display across Net is changing. The operator has to wait the scales to be set at rest and press the button “#”. The display shows the following:

Net =xx.xxx [kg]
Tare=yy.yyy[kg]
Totl=zz.zzz[kg]
0-Tare #-
OK

where:

xx.xxx – weight of the poured by the first deliverer milk, for example 20.00 kg.

yy.yyy – Tare's weight (milk collecting vessel)

zz.zzz – Sum of Net + Tare

After the scales are set at rest, the operator has to press the button “#”, and the display shows the following:

Del N:aaaa
Kg=yy.yy
Are you sure?
 0-No Yes-#

Now the operator has to check the data and if there is need something to be corrected to press button “0”, which returns in the main menu for entering deliverer’s number. By pressing the button “#” data is confirmed and following appears on the display:

Measure:CalName

Start:Enter or *

The operator has to place the sample holder filled with milk sample in the milk analyser and to start the measurement. The milk analyser measures the sample and shows the results as in a normal mode. On the print out 2 new lines appear:

Litres.....19.4
 Kilograms.....20.00

Please, have in mind the formula for calculating liters from weight measured:
 Litres = Kilograms / Density

where:

Density is measured by the analyser density of the correspondent sample.

When the next deliverer arrives, the operator has to press “#” and to start again the procedure for entering deliverer’s number and weighting. In this case weighting scales are ready for the next deliverer’s milk. This procedure is repeated for every deliverer. When the milk-collecting vessel is full, pour its content in the cooling tank. Place it back on the scales and press again the button for new tare calculation.

9.8.3. Control options when working with scales.

They are entered by using the Setup of the analyser. They are started using the following menu:

Setup ->Accessories->Weigh Scale:

Raw Test - test for weight scales control. Used mainly in production conditions.

Calibration – serves for scales calibration (if there is deviation noticed). For the purpose you have to have 2 standards of weight, for example 5 and 50 kg.

After starting the following is displayed:

**Weight Scale Cal
Put Low Weight
Weight =zz.z**

Using the buttons Up, Down, Enter (as it is done when calibrating the rest of the milk analyser's options) enter the weight of the lighter standard of weight, in our case 05.000. After it, on the bottom line of the display appears:

ADC=xxxx.x Set

where:

xxxx.x – calibrating data from the scales.

The operator waits for the value to be shown and presses the button below the word Set. The same procedure is repeated with the heavy standard weight, for example 50.000 kg. After the value is shown and pressing the button Set, a message for completed calibration is displayed. Scales are ready for work.

Measure – Off Line measuring mode, i.e. the analyser is used as universal scales. In this mode periodically control of the accuracy of the scales with standards of weight is needed.

On Line En/Dis – allows / forbids On Line weight scales work (automatically transferring the kilograms measured milk from the scales to the analyser, after setting the deliverer's number). If option Enable is chosen, follow the way of work described above. If not, then the operator has the possibility to enter manually liters and number of the every deliverer.

9.9. Working with embedded report system for generating and making reports – Report System (option).

On customer's request hardware could be embedded in the analyzer, allowing results from 1000 measurements to be recorded and kept as a record. On the base of these recorder measurements different reports are made. Making results' archives is made automatically after the measurement is finished, and is controlled via the following menus system:

Special modes Calibration Cycle Reports
--

9.9.1. Setup menu structure

Special modes

...

Reports

Init

Report En/Dis

Busy/Free Recs

New Report

Reject Deliv N

Del last Meas

Report Options

Prn Single rep

Sel Out Device

Lines On Page

Empty Lines Bot

Delay New Line

Delay Pr Header

Print Deliv N

Generator

Fat&SNF Rate

Set Coeffs

Rep for Calibr

Short Report

Large Report

All Large Rep

Shift Selector

Print Page Num

Tools

Send Rec to PC

9.9.2. Basic terms.

The system generates reports on the basis of the archived results. The results could be send towards:

Serial printer

Parallel printer

Through RS 232 towards IBM PC.

On the basis of Fat and SNF and liters (calculated from kilograms, received from Weight Scale or entered directly) delivered the system calculates:

$$\text{Rate} = \text{Fat} * \text{FatCo} + \text{SNF} * \text{SNFCo} \quad (1)$$

$$\text{Amount} = \text{Rate} * \text{Litres} \quad (2)$$

Separately, for every measurement. Via option Prn Single rep the operator may forbid or allow adding these results when, after each measurement, is printing the rest of the measurement results on the serial printer.

For all the measurements from the archive, the system calculates:

$$\text{Average Fat} = (\text{Fat1} * \text{Litres1} + \text{Fat2} * \text{Litres2} \dots) / \text{Litres1} + \text{Litres2} \dots (3)$$

$$\text{Total Amount} = \text{Amount1} + \text{Amount2} \dots \quad (4)$$

$$\text{Average SNF} = (\text{SNF1} * \text{Litres1} + \text{SNF2} * \text{Litres2} \dots) / (\text{Litres1} + \text{Litres2} \dots) \quad (5)$$

Calculations are made for each separate calibration. Average results for Fat and SNF may be used for control of total gathered milk.

In order to start working the report system needs the operator to enable it (Report En/Dis), and to set the old report in initial adjustment (New Report). Using IBM PC (via RS232 cable) user can enter the name of Milk collection center and names of 2 working shifts (i.e. Morning shift 1,2).

During work the operator may delete the result from the archive for the last measurement (if there is a need to be done). Before starting generating the reports, coefficients, used for calculations have to be entered (Set Coeffs). After the working shift is over, the operator has the possibility to print out Short or Large Shift Report. User has possibilities to reject selected deliverer number from report (Reject Deliv N).

9.9.3. Menus' description:

Group Init:

Report En/Dis –enables/disables work of the system for archives and reports

Report Enable		
Yes		
No	OK	Yes

Busy/Free Recs – shows the number of busy/free places in the archive. Total number of records – 1000. When the analyser's power supply is switched on, the display shows the number of free records. During real

measurements user can control current archive number using “Page 2 Results”.

<p style="text-align: center;">Show Records Busy: 0038/0000 Free: 0962 Exit</p>
--

where:

Busy xxxx / yyyy

xxxx - number of measurements, which will be used when generating reports

yyyy - number of measurements, which will not be used when generating reports i.e. were marked as invalid using the command Reject Deliv N

New Report – deletes the old archive. In this way the number of free records for making archives of the results remains 1000.

<p style="text-align: center;">Start New Rept No</p> <p>No OK Yes</p>

The operator has to be very careful with this command, because, by choosing Yes the whole archive from previously made measurements will be deleted and the memory will be set to zero, free for new measurements to be stored.

Reject Deliv N – measurement for selected Deliverer Number are excluded from reports.

<p style="text-align: center;">Reject meas for</p> <p>Del N:</p>
--

Del last Meas – deletes the archive from the last measurement. If this command is repeated, it deletes the result from the measurement before the last one etc. till the wh

<p style="text-align: center;">Del Last Meas OK! Free = xxxx</p> <p style="text-align: center;">Exit</p>
--

Where:

xxxx is the number of the free places for saving measurements results in the memory.

9.9.4. Report Options:

Prn Single rep – enables / disables printing the results from every sample's Rate and Amount on the serial printer right after the measurement is finished.

Prn Single Rep		
No		
No	OK	Yes

Sel Out Device – chooses the outgoing device for Large Shift Report – it could be parallel printer (printed copy) or IBM PC (file).

Select Output		
For Report:		
IBM PC		
LPT	OK	IBM PC

Lines On Page – determines the number of lines in one page for Large Report.

Lines on Page		
64		
-	OK	+

Empty Lines Bot – determines the number of empty lines at the bottom of page.

Empty Lines Bot		
0		
-	OK	+

Delay New Line – printer delay after passing to a new line. Measured in ms.

**Delay LPT for
NLine[ms]:**

Delay Pr Header – printer delay when printing header of the page. Measured in mS.

**Delay LPT prn
Header[ms]:**

Note:

The normal values of these parameters are 0. When using old model printers (without input memory buffer), it is necessary time delay to be set, for example 400, in order to be possible speed of the device and printer to be harmonized.

Print Deliv N – prints on serial printer results from measurements (the same after real measurement).

**Print meas for
Del N:**

The operator has to enter the number of the deliverer, whose results want to be printed again. If there are no results from a deliverer with such number, the following message appears on the display:

Not Available

Exit

Group Generator Fat&SNF Rate:

Set Coeffs – sets the coefficients CoefFat и CoefSNF, through which the report is calculated.

Fat&SNF Rate
Fat Co= 1.000
Edit Save Exit

Rep for Calibr – chooses the calibration for which the report is calculated.

Select Calibr For Report:	
1.Cow	
Select	Exit

Short Report – prints out on the serial printer report for the archive, calculated using the formulas (3) and (4), for each calibration, separately. Only the final, summarized results are printed out, without details about each sample. It is used when quick processing of measurements is needed for receiving summarized results.

Example for the printout:

```

MCC Name
Report Fat & SNF
Shift Name
Calibr Cow
FatCo= 1.000
SNFCo= 2.000
Records=6
Litres=13.50
Amount=160.27
Average Fat= 2.35
Average SNF= 4.76
    
```

Large Report – makes detailed report for each sample separately for the chosen calibration (Rep for Calibr, on the chosen device (Sel Out Device). Report can be send to LPT or IBM PC (via RS 232).

Example for the printout:

```

SHIFT REPORT Calibr: Cow Time Date Page Number
MCC Name Shift name
-----
> N: ! DelN: ! Ltrs ! Fat % ! SNF ! Rate ! Amount !
-----
> 1 ! 5 ! 2.1 ! 2.35 ! 4.76 ! 11.87 ! 24.93 !
> 2 ! 12 ! 2.8 ! 2.59 ! 4.71 ! 12.01 ! 33.63 !
> 3 ! 66 ! 5.2 ! 2.14 ! 4.79 ! 11.72 ! 60.94 !
> 4 ! 266 ! 3.4 ! 2.49 ! 4.75 ! 11.99 ! 40.77 !

Total Litres = 13.5
Average Fat= 2.35
Total Amount=160.27
Average SNF= 4.76
    
```

FatCo = 1.00

SNFCo= 2.00

Where:

- column N: measurement consecutive number
- column DelN: deliverer's number, sorted by ascending number
- column Ltrs delivered liters
- column Fat% measured Fat in percentage
- column SNF% measured SNF in percentage
- column Rate calculated Rate (according formula 1)
- column Amount calculated Amount (according formula 2)
- Total Litres sum of liters delivered. Liters are received by

weighted kilos, using the formula:

$$\text{Litres} = \text{Kilograms} / \text{Density}$$

where

Density is measured sample's density

Total Amount sum of all calculated Amount (according formula 4)

Average Fat average Fat value, calculated according formula 3

Average SNF average SNF value, calculated according formula 5

FatCo, SNFCo values of the coefficients, used in formula 1

All Large Rep - makes detailed report for each sample separately for all the calibrations (Rep for Calibr) on the chosen device (Sel Out Device).

Shift Selector – user selects which name (Shift 1 or 2 – enter from IBM PC) will be printed in the header of each list from LPT report. Using the program LS-SetReports.exe (see its description) the operator has the possibility to edit the name of the Milk Collecting Center and 2 unique names for two work shifts.

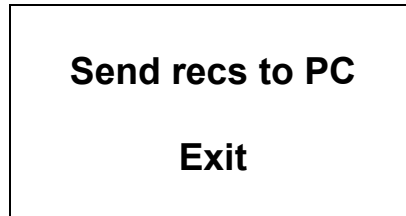
**Select Shift
For Report:
Morning
Mornng OK Eveng**

Print Page Num – generates total report, but the printing out starts from chosen by the operator sheet.

**Print Report
Page Num:**

Group Tools

Send Rec to PC – sends the whole archive using RS 232 towards IBM PC. Measurement results are send in the order they've been made, without being sorted or processed. In the IBM PC they have to be received from program from the family resLS (LS-Data Collection System). These data are not processed from report generating system, but are in an archive Raw data from measurements. They are gathered in a file, ready to be processed with MS Excel (see description of programs resLS).



9.10. Embedded real time clock (option).

On customer's request, a real time clock could be embedded in the device, showing astronomical time and date. The clock is powered by battery, so it is independent on power supply of the device. The advantage of this option is that on the print out with the measurement results are shown also the exact time, when the measurement is made, for example:

```
Time: 18:14:33
Date: 22:03:2007
Lactoscan MCC30
Serial Number:0002
Calibr 1 Camel
Results:
Fat.....00.00%
SNF.....00.00%
Lactose.....00.00%
Solids.....00.00%
Protein.....00.00%
Temp. Sample...21.0°C
```

The embedded clock is controlled by the device's Setup, from the main menu Accessories, submenu RT Clock. When chosen, the display shows the following:



Using these menus, the operator has the possibility to show on the display the current time and date, and if necessary – to adjust them.
The time is shown in the format:

hh:mm:ss
dd:mm:yy

Exit

where:

hh - the current hour
mm - current minutes
ss - current seconds
dd - current day
mm - current month
yy - current year

APPENDICES

APPENDIX 1: EASY CALIBRATION OF THE MILK ANALYSER BY CALCULATING THE BASIC PARAMETERS VIA FORMULAS



DETERMINATION OF THE BASIC PARAMETERS IN THE MILK SAMPLE BY USING FORMULAS IS NOT AS PRECISE AS USING THE ARBITRARY METHODS, BUT IS SUITABLE FOR USAGE IN FIELD WORK.

1. Determination some of the parameters by formulas

There is dependence between the different parameters in milk and its density, which may be expressed with mathematical equation. On this base different formula, tested and confirmed by the classical laboratory methods for analyses, are developed. We recommend the following:

2. SNF determination.

For determination of SNF the correlation dependence exists between the milk's density, fat and SNF in the milk. When the density and the fat are known, the SNF can be calculated.

There are several formulas with different applicability.

A/ When the salts and fat are known

SNF is calculated by subtracting the fat percentage from the salts.

$$SNF = \text{Salts} - F (\%)$$

Where

Salts – salts in (%),

F – fat content in (%),

This formula is used for determination of SNF in whey, buttermilk, and cream.

B/ Known quantity of fat and density (most commonly used method when maximum accuracy is needed).

We recommend the following formula:

$$SNF = \frac{0,075 * F\% + 100 - 100 / \text{density}}{0,378}$$

This is a universal formula and actual for milk of almost all kind of cows and sheep all over the world.

3. Determination of lactose content

We recommend the following formulas:

A/ for cow milk

$$\text{Lact.} = \text{SNF} * 0,55 (\%)$$

Where

SNF – content of SNF in percentages (%),

0,55 – constant coefficient.

B/ for sheep milk

$$\text{Lact.} = \text{SNF} * 0,45 (\%)$$

Where

SNF –solids-non-fat content in percentages (%),

0,45 – constant coefficient.



This is an actual coefficient for sheep breeds on the territory of the Balkan Peninsula.

4. Determination of salts content

We recommend using the following formulas:

A/ for cow milk

$$\text{Salts} = \text{SNF} * 0,083 (\%)$$

Where

SNF – solids-non-fat content in percentages (%),

0,083 – constant coefficient.

B/ for sheep milk

$$\text{Salts} = \text{SNF} * 0,075 (\%)$$

Where

SNF – solids-non-fat content n percentages (%),

0,075 – constant coefficient.



This is an actual coefficient for sheep breeds on the territory of the Balkan Peninsula.

5. Determination of total proteins content

We recommend using the following formulas:

A/ for cow milk

$$\text{Protein} = \text{SNF} * 0,367 (\%)$$

Where

SNF - solids-non-fat content in percentages (%),

0,367 - constant coefficient.

B/ for sheep milk

$$\text{Protein} = \text{SNF} * 0,475 (\%)$$

Where

SNF - solids-non-fat content in percentages (%),

0,475 - constant coefficient.



This is an actual coefficient for sheep breeds on the territory of the Balkan Peninsula.

APPENDIX 2 FREEZING POINT DETERMINATION

1. Methods for determination.

The milk analyser determines the freezing point of each sample and the quantity of added water. The milk analyser does not measure the freezing point, but calculates it from the components it depends on. The basic components in the milk are water, solids, lactose, FAT, proteins, minerals (salts) and acids. The freezing point depends only on the diluted in the milk components and quantity of the solvent (in the milk it is water). The ultrasonic technology allows direct measurement of FAT, proteins, lactose + salts (the soluble components, only influencing the freezing point), and the quantity of the solvent in % is determined by $100\% - \text{total solids \%}$, $\text{total solids} = \text{lactose \%} + \text{FAT \%} + \text{proteins \%} + \text{salts \%} + \text{acids \%}$.

Without understanding the meaning of the freezing point – determined or shown from the milk analyser added water result easily may lead to a mistake for the value of this parameter.

2. The basic freezing point.

Milk freezes at lower temperature than water. The average freezing point of the raw milk in the most regions is at about $-0,540^{\circ}\text{C}$. The average reading for your region is called “basic” freezing point.

The freezing point of milk is a “physiological constant”. This does not mean that it will not vary. In fact feed, breed, season, time of lactation, climate, whether the sample is taken at the beginning, middle or end of lactation – all these factors will have an effect on the freezing point of the individual sample. This means that there is an average value of all these numbers. The more samples used in obtaining this average, the more reliable it is as a base. Or the basic freezing point is an average of freezing points of milk, taken from many cows. When a laboratory checks a producer, it is only comparing the average of the producer’s cows against a larger area average.

The Health authorities establish the basic freezing point or agriculture departments in some regions, sometimes by universities, separate dairy producers, or their associations. Frequently, tolerances have been established on top of a basic freezing point to allow some variations in the milk as well as device or operator variations.

Without mentioning the basic freezing point, the Association of Official Analytical Chemists now recommends an upper limit freezing point at $-0,525^{\circ}\text{C}$ (2,326 standard deviations above the most recently determined North American average of $-0,5404^{\circ}\text{C}$), below which there will be at 95%

confidence that will show 99% of all freezing point determinations on milk without added water:

“if the freezing point is $-0,525^{\circ}\text{C}$ or below, milk may be presumed to be free of water or may be confirmed as water free by tests, specified below. If the freezing point is above $-0,525^{\circ}\text{C}$, milk will be designated as “presumptive added water” and will be confirmed as added water or added water free by tests specified below. Evaluate extreme daily fluctuations in the freezing point of herd, pooled herd, or processed milk for presence of added water”.

“Presumed added water”, as described above, must be “confirmed” by means of tests on authentic milk samples obtained as specified in the AOAC METHODS.

After determination the freezing point of your sample via the milk analyser, the added water is calculated using the following formula:

$$\text{AddedWater} = \frac{\text{FrPoint}_{\text{Base}} - \text{FrPoint}_{\text{Calc}}}{\text{FrPoint}_{\text{Base}}} * 100[\%]$$

Where:

FrPointBase is the basic freezing point

FrPointCalc is measured freezing point

Note:

If the freezing point is not correctly determined, the result for the added water is not valid. In this case results for FrPoint and AddWater are not shown on the display and on the printout from the printer. If the density of the measured sample is 0, the result for AddWater is not valid and is also not shown on the display and the printouts.

Sample:

First variant

If you've entered for milk analyser basic freezing point -0.520°C (according article 5.9 of the EU Milk Hygiene Directive 92/46/EEC), measured freezing point -0.540°C , using the above pointed formula you'll receive $-3,8\%$. Because it is not possible the added water to be negative value, the milk analyser indicates 0% added water. The reason for this is the tolerance in the basic freezing point, reasons for which are described below.

If in the same milk we add 3,8% water, and the basic freezing point is the same, the milk analyser will measure freezing point -0.520°C , and will indicate again 0% added water.

Second variant

If you've entered for the device basic freezing point -0.540°C , measured freezing point -0.540°C , the milk analyser will indicate 0%. When you add 3,8% water, the device will indicate 3,8%-added water.

From the above mentioned follows that it is very important to enter correct basic freezing point in the device.



The device's results for added water may give information about doubt of added water in the milk and the exact value of this added water may be determined after a "cowshed sample" is taken and the result for the freezing point, measured by the milk analyser of the "cowshed sample" is entered as basic freezing point in the formula for calculation of added water.

Then the result from this formula will give us the absolute value of the added water for the corresponding milk supplier.

APPENDIX 3 PH MEASURING (ONLY FOR DEVICES WITH EMBEDDED FUNCTION)

1. General information

PH probe is a unit, measuring the solution acidity or alkalinity degree. It is measured on scale of 0 to 14. The term pH is derived from "p", the mathematical symbol for the negative logarithm, and "H", the chemical symbol of Hydrogen. The formal definition of pH is the negative logarithm of the Hydrogen ion activity.

2. pH Electrode

For pH measurement the milk analyser needs a combination electrode, compatible with most pH electrodes that have BNC connectors and zero potential (the pH where the mill volt output of the electrode equals 0) near 7 pH.

2.1. Electrode part

The electrode is the most important part of the pH measurement. The electrode glass membrane is fragile and must be handled with care. To protect the glass membrane and to maintain activation, a protective rubber cap containing a suitable storage solution covers the glass membrane.

2.2. Electrode care & Electrode maintenance

pH Electrodes are susceptible to dirt and contamination and need to be clean regularly depending on the extent and condition of use. At no time should one touch or rub the glass bulb as this causes the build-up of electrostatic charge.

2.3. Storage

For best results, always keep the pH bulb wet. An optimal storage solution for combination electrode is pH 4 buffer with 225 grams of KCl per liter. Table salt, NaCl, can be used if KCl is not really available. Other pH buffers or tap water are also acceptable storage media, but avoid storage in de-ionized water. The protective rubber cap filled with the buffer solution provides ideal storage for long periods.

2.4. After Use

After measurement is completed, follow the sequence below for storage.

- Wash the electrode and reference junction in de-ionized water.
- Close the refilling hole by returning its rubber sleeve or stopper cap. (Necessary for only refillable electrode).

- Store the electrode as mentioned above (see section Storage).

2.5. Electrolyte Replacement (for refillable electrode only).

The reference electrolyte needs to be refilled when the electrode has been used for a long period, or when the internal electrolyte has dried up. To accomplish this, follow the procedure described below.

- Remove the protective rubber cap or sleeve;
- Remove the protective rubber sleeve to expose the filling port of the electrode;
- Remove the old reference electrolyte with a syringe;
- Fill the new reference electrolyte.

2.6. New electrolyte preparation:

- Open the KCl container;
- Add in de-ionized water until it reaches the level of 20 ml;
- Close the container and shake it to dissolve the KCl;
- Add in fresh electrolyte until it reaches the level of the refilling port. The reference electrolyte used should be 3M(Mol) KCl;
- Replace the rubber sleeve.

2.7. Re-use the electrode.

- Rinse the liquid junction with de-ionized water.



If these steps fail to restore normal electrode response, you may attempt to rejuvenate it (See: Electrode Rejuvenation).

2.8. Electrode cleaning

Electrodes which are mechanically intact can often be restored to normal performance by one or combination of the following procedures.

- Salt deposits:

Dissolve the deposit by immersing the electrode in tap water for ten to fifteen minutes. Then thoroughly rinse with de-ionized water. Wash the electrode pH bulb in a little detergent and water. Rinse electrode tip in with de-ionized water.

- Oil/Grease films:

Wash electrode pH bulb in a little detergent and water. Rinse electrode tip with de-ionized water.

- Clogged Reference Junction:

pH electrodes have junction, which allows the internal fill solution of the measuring electrode to leak out into the solution being measured. The

junction can become clogged by contamination in the solution. If a clogged junction is suspected it is best to clear the junction.

Heat up the diluted KCl solution to 60-80°C. Place the sensing part of the pH electrode into the heated KCl solution for approximately 10 minutes. Allow the electrode to cool while immersed in some unheated KCl solution.

- Protein Deposits

Prepare 1% pepsin solution in 0.1 M HCl. Allow the electrode to stand in this solution for five to ten minutes. Rinse the electrode with de-ionized water.

2.9. Electrode activation

Generally, if the procedure of storage and maintenance had been closely followed, the electrode can

be used immediately. However, should the electrode response become sluggish, it may be possible that the bulb has dehydrated.

The bulb can be dehydrated by immersing the electrode in an ideal storage solution (e.g. buffer pH 4 solution) for 1-2 hours. If this fails, the electrode may require re-activation. If the above procedure does not reactivate the electrode to acceptable status, try rejuvenation the electrode by following the procedure outlined below.

2.10. Rejuvenation Procedure

Dip and stir the electrode in freon or alcohol for 5 minutes.

Leave the electrode in tap water for 15 minutes.

Dip and stir the electrode in concentrated acid (HCl, H₂S₄) for 5 minutes.

Leave the electrode in tap water for 15 minutes.

Dip and stir in strong base (NaOH) for 5 minutes.

Leave the electrode in tap water for 15 minutes.

Test with standard calibration solution.

Finally, test with standard calibration buffer solution to see if the electrode yields acceptable results. You may repeat again for better response (maximum 3 times). If the response does not improve, then the electrode has completed its useful life. Replace with a new electrode.

2.11. Electrode Lifespan

pH electrodes have a finite lifespan due to their inherent properties. How long a pH electrode will last will depend on how it is cared and the solution it is used to measure. Even if an electrode is not used it still ages. Electrode demise can usually be characterized by a sluggish response, erratic readings or a reading, which will not change. When this occurs an electrode can no longer be calibrated. pH electrodes are fragile and have a limited lifespan.

How long an electrode will last is determined by how well it is maintained and the pH application. The harsher the system, the shorter the lifespan. For this reason it is always a good idea to have a back-up electrode on hand to avoid any system down time.

3. Buffer Solutions

Buffers are solutions that have constant pH values and the ability to resist changes in that pH level. They are used to calibrate pH measurement system.

PH buffer solution description (Pharmacopoeia standard)

Use only these types' standard buffers for calibration!

Description	pH 7.00±0,01/20°C	pH 4.00±0,01/20°C
Composition	Potassium dihydrogen phosphate, Di-sodium hydrogen phosphate	Borax, Sodium hydroxide solution
Temperature parameters	10°C - 7.06 25°C - 6.99 20°C - 7.00 30°C - 6.98 40°C - 6.95 50°C - 6.91	10°C - 4.00 25°C - 4.00 20°C - 4.00 30°C - 4.00 40°C - 4.00 50°C - 4.05

4. pH Electrode Calibration

pH Electrodes are like batteries; they run down with time and use. As an electrode ages, its glass changes resistance. For this reason, electrodes need to be calibrated on a regular basis. Calibration in pH buffer solution corrects for this change.

Calibration is an important part of electrode maintenance. This assures not only that the electrode is behaving properly but that the system is operating correctly.

Usually pH meters require calibration at 2 specific pH values. One calibration is usually performed at pH 7, second pH 5.



It is the best to select a buffer as close as possible to the actual pH value of the sample to be measured. Use standard calibration buffers that the temperature and the sample solution are the same.

Use the operation manual for the corresponding pH meter.

For pH electrodes, originally supplied with milk analyser read the following information:

Temperature compensations

The output of pH electrodes varies with temperature in manner, predicted by theory. When needed, Sensorex can supply electrode holders with build-in automatic temperature compensators. The need of automatic compensation depends on the temperature variation, the pH value being measured. At pH of about 7 there is no error due to temperature and, of course, at a constant temperature there is no error. As shown in the following table, the pH error due to temperature is a function of both the temperature and the pH value being measured. At a pH of about 7 there is no error due to temperature and, of course, at a constant temperature there is no error. The more the temperature changes from the ambient calibration temperature and the more the pH departs from 7 the greater is the pH error.

pH temperature error table

°C	pH										
	2	3	4	5	6	7	8	9	10	11	12
5	.30	.24	.18	.12	.06	0	.06	.12	.18	.24	.30
15	.15	.12	.09	.06	.03	0	.03	.06	.09	.12	.15
25	0	0	0	0	0	0	0	0	0		0
35	.15	.12	.09	.06	.03	0	.03	.06	.09	.12	.15
45	.30	.24	.18	.12	.06	0	.06	.12	.18	.24	.30
55	.45	.36	.27	.18	.09	0	.09	.18	.27	.36	.45
65	.60	.48	.36	.24	.12	0	.12	.24	.36	.48	.60
75	.75	.60	.45	.30	.15	0	.15	.30	.45	.60	.75
85	.90	.72	.54	.36	.18	0	.18	.36	.54	.72	.90

0 pH Error Range

Less than .1 pH Error Range

5. PH helpful hints

For greatest accuracy in pH measurement, follow these guidelines:

- Use the same technique to measure samples, which was used for calibration.
- Be consistent with stirring rates, times and conditions.
- Calibrate with buffers, which are close in temperature to that of the sample.
- Calibrate the pH electrode regularly, e.g. once a day for accuracy to within 0.05 pH.

- Use fresh buffers for calibrations. Avoid contamination of the stock buffer solution and do not use it beyond the expiry date.
- Keep all connections dry.
- Immerse the electrode far enough into the solution to insure the reference junction is below the surface.
- Allow adequate time for the electrode to stabilize in standards and samples before taking a reading.
- Clean the electrode periodically. Allow more time for aged electrodes.
- Do not use the pH electrode in solutions of fluoride ion at low pH. This will etch the glass membrane.
- Sulphide vapors can permeate the electrode wick and contaminate the reference element. Minimize contact in such environments and change the reference electrolyte frequently.

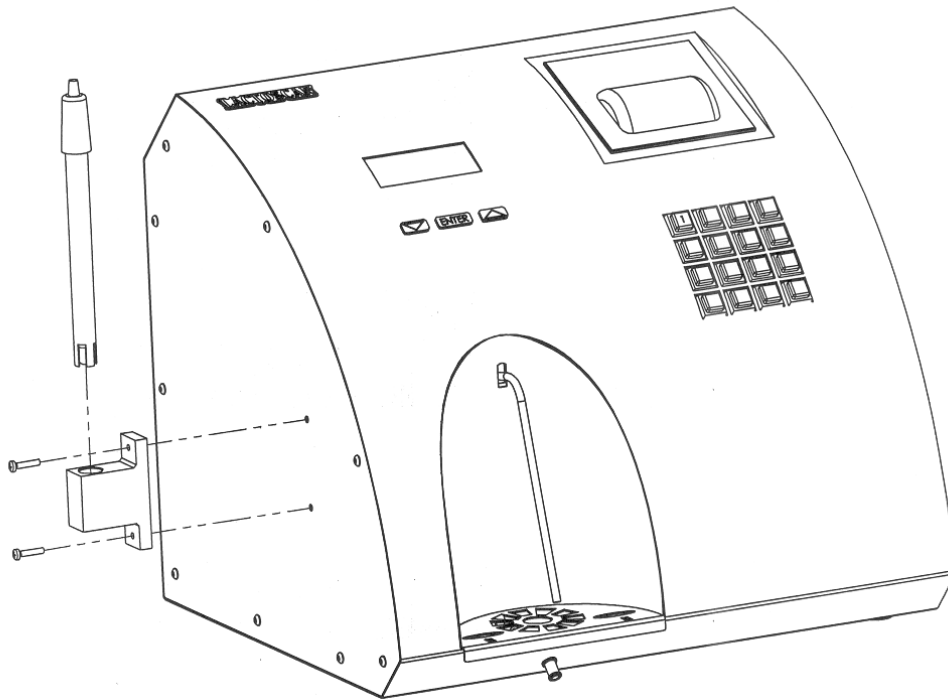
Milk acidity and pH

In the table below the connection between pH value and acidity in °T is shown

°T	deviation	pH average value	°T	deviation	pH average value
Raw milk			Pasteurized milk		
16	6,74-6,70	6,72	16	6,68-6,64	6,66
17	6,69-6,65	6,68	17	6,63-6,58	6,61
18	6,64-6,58	6,62	18	6,57-6,52	6,55
19	6,57-6,52	6,55	19	6,51-6,46	6,49
20	6,51-6,46	6,49	20	6,45-6,40	6,43
21	6,45-6,40	6,43	21	6,39-6,35	6,37
22	6,39-6,35	6,37	22	6,34-6,30	6,32
23	6,34-6,30	6,32	23	6,29-6,24	6,26
24	6,29-6,24	6,25	24	6,23-6,19	6,21

6. Replacing the pH electrode

Fig. 12 pH sensor and holder assembly



During transportation the pH sensor holder and sensor itself are packed separately. In order to place it in working position, follow the sequence:

1. Using the screws, attach the pH sensor holder on the side of the analyser as shown on Fig. 12.
 2. Tighten the screws.
 3. Put the electrode in the holder.
- Follow the instructions for pH measuring.

7. PH measuring.

Measuring pH is an additional feature of the analyser and is optional. Remove the protective rubber cap of the pH electrode. Take care to handle it appropriate in order not to be damaged. Use de-ionized or distilled water to rinse the electrode before usage. Fill in the sample holder with milk, put it in the recess of the analyser and dip the pH electrode into the milk sample, ensuring complete dip of the electrode in the sample. Stir gently for homogenization of the sample.

Measuring can be done in two modes:

Off line by starting the menu **pH & Co Meter | Measuring**, when the analyser works only as a pH meter.

On line automatic pH measuring, when measuring the rest of the sample's parameters.



When starting work with pH meter first connect the probe/sensor, and then the power supply of the device.

Having in mind the characteristics of the process of pH measuring it is necessary to dip the pH probe in the sample and then to press the button Enter.

After starting the menu **pH & Co Meter** the following message appears on the display:

```
pH Calibration
pH Measuring
pH En/Disable
pH U Display
-----
pH Test
Co Meter Calibr
Co Meter Test
Co Meter En/Dis
-----
Exit
```

8. pH Calibration.

Serves for calibrating the pH meter. For that purpose use 2 standard buffers, shown on the display as Low buffer (for example 5.00 pH) and High buffer (for example 7.00 pH). The procedure is following:

- 1. Start menu Calibration.**
- 2. Put the pH probe in Low buffer.**
- 3. By pressing the buttons of the analyser enter the exact buffer value. The display shows:**

```
pH Calibr
Put Izopot buff
Buf=xx.xxx
```

4. Input the buffer value when the probe is in its isopotential point and with which our probes are accompanied with.

Then the display shows:

**pH Calibr
Put Izopot buff
Buf=xx.xxx
V=x.xxxV Set**

Where **x.xxx** is measured by the probe voltage.

5. After the readings calm down, the operator has to press the button below the inscription **Set**.

6. Repeat the procedure with **Next buffer**.

The following is displayed:

pH Calibr OK

This means that the procedure for analyser calibration was successfully completed.

7. pH measuring mode is started automatically.

8. Check calibration correctness by measuring buffer solution 7.00.

9. pH Measuring.

After starting this menu the measurement is done in mode off line, i.e. the analyser works only as a pH meter. The operator has to dip the probe in the sample and on the display the following is shown:

**pH measuring
x.xxxV
y.yy pH
Exit**

Where:

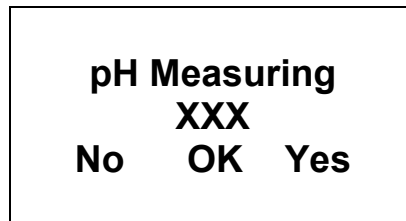
x.xxx – measured by the probe voltage

y.yyy – measured probe's pH

By pressing the button **Exit**, the operator may exit the program and to pass towards another menu.

10. pH En/Disable

Serves for enabling/disabling the pH measuring during normal work of the analyser - On line. After starting it the display shows:

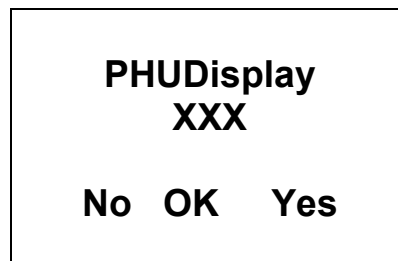


Where:

XXX is the current situation of the working mode. By pressing the buttons below the corresponding inscriptions it could be changed, as **Yes** – means that during normal work of the analyser – measuring the rest of the parameters, pH will also be measured. If **No** is chosen, then pH is not measured.

11. pH U Display

Serves for allowing/forbidding the value of the pH probe voltage during pH parameter measuring. After starting it the display shows:



Where **XXX** is the current state of the displaying mode. By pressing the buttons below the inscriptions it could be changed, as **Yes** – means that during pH measuring the voltage of the pH probe will be shown.

If **No** is chosen, it will not be shown. It refers to both of the measuring modes.

12. pH test

serves for testing the measuring system in production mode.

APPENDIX 4 CONDUCTIVITY MEASURING (ONLY FOR DEVICES WITH EMBEDDED FUNCTION)

1. Method of determination.

Conductivity (or Electrolytic Conductivity) is defined as the ability of a substance to conduct electrical current. It is the reciprocal of the resistance.

In a healthy animal*, the mean value of electric conductivity is:

Milk type	Conductivity values
Cow milk	between 4 to 6 mS/cm (18°C);
Sheep milk	between 3 to 5 mS/cm (18°C);
Buffalo	between 2,5 to 5 mS/cm (18°C);

*These values depend on the geographical region, the breed and on other factors.

Milk conductivity changes on the concentration of ions in the milk:

Added water, sugar, proteins, insoluble solids	Decrease the ion's concentration. Milk conductivity decreases.
Added salts	Increase the ion's concentration. Milk conductivity increases. Often the milk is falsified by adding salt: towards milk with good characteristics: fat 4%, SNF 8,8, conductivity 4,5 are added salt and water. Then the results are changed to 3,2 and 8,8, conductivity 10. In other words adding water regulates the increased value of SNF and density till normal (within the boundaries/parameters) and even the fat is normal. By the values of these parameters may be determined if the sample is falsified, but the only characteristic, proving this is conductivity, which is out of boundaries nevertheless added water. But be careful, as the falsification is not the only possible reason for conductivity increasing. The other possibility is mastitis that's why we recommend using another (chemical) method for checking it.
Significantly extreme value (6,5 - 13,00 mS/cm (18°C))	Should indicate the development of mastitis. Infections damage the tissue of the udder. This allows sodium and chlorine ions from the blood to

	be released into the milk. The concentration of ions in the milk is thereby raised, and it can more easily conduct an electrical current - the conductivity of the milk increases.
--	--

Milk conductivity can be used as tests for degree of water evaporation in condense milk production.

Milk conductivity change notifies of powder (dry) milk solution rate.

2. Conductivity measurement

Conductivity measurement is additional possibility of the analyser and is delivered on customers request/

3. Co Meter Calibr

Serves for conductivity measuring system calibration. Clean the analyser before starting conductivity measurement. (see p. 4.1). You need a standard buffer with conductivity 5.02[mS/cm] (you may order it for delivery together with the analyser), with temperature 18°C. After starting this mode, the analyser makes preparation for measurement and when it is ready, the following message is displayed:

Co Meter Cal Put 5.02 buff and press Enter to start
--

The operator has to put the buffer and to start the measurement. The following message appears on the display:

Measurement started Wait please
--

The buffers' temperature is indicated during measurement. After finishing the measurement the following message appears on the display:

**Co Pass 1/5=xxxx
Put new sample
and press Enter
to start**

Where xxxx is the result from the first calibration measurement. The operator have to put a new buffer, N.B. do not use one and the same buffer more than once! Then start the next measurement. This procedure has to be repeated 5 times. At the end the following message appears on the display:

**Cond Meter
Calibr= xxxx
Switch Off/On**

Now the operator has to switch off the power supply of the analyser. After switching it on again, the analyser has to be cleaned again with water, which ends the calibration of the conductivity measurement system calibration.

Note:

Another possibility for calibration of analyzer's conductivity measurement function.

You need conductivity meter. First measure milk with normal acidity with conductivity meter and use it as sample for calibrating the analysers conductivity measurement function.

4. Co Meter Test.

Serves for testing the working mode of the milk's sample conductivity measurement system. It is used in the production conditions. After this menu is chosen, the analyser executes the procedure for sample's measurement and the display shows the data, used for obtaining the samples conductivity.

**Co Meter Test
CoADC= xxxx
Power Off - Stop**

5. Co Meter En/Dis.

Enables or disables the conductivity measurement system. The following message appears on the display:

Cond Measuring
Yes

No OK
Yes

6. Corrections in conductivity measurement

It is done by starting the menu **Corrections -> Cond measure**. You have the possibility to increase/decrease the measured conductivity value from – 1.00 till +1.00, with step 0.01. After starting this function the display shows the following:

Con Meter
-1.0<=Corr>=1.0
Co Corr=+0.00
Edit – Up/Down

The cursor is positioned below the +. By using buttons **Up/Down**, the operator has the possibility to change the value (number). By pressing the button **Enter**, the operator confirms the chosen value and moves to the next position for editing it. After the last position is edited, if the correction value is within allowed boundaries, the following is displayed: **Co Corr Saved**, which means, that the correction is entered and saved. On the contrary – it returns at the beginning and expects valid correction.

7. Conductivity calibration buffer preparation

In order a standard buffer for conductivity measuring to be prepared follow the instruction below:

1. Take the packet with the powder buffer.
2. Carefully shake the packet in order to gather the powder at the bottom.
3. Cut one end of the packet.
4. Empty its content in a measuring mug with 1 l volume, paying attention all its content to be emptied.

For standard buffer: 5,02 ms – 3,556 г

5. Add 600-700 ml distilled water, which was preliminarily deaerated in vacuum dryer or boiled and then cooled down to 20 °C.
6. Shake the mug till the powder is fully dissolved.
7. Add distilled water to the mark.

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