

VAPODEST 50

INSTRUCTION MANUAL

Please read this instruction manual carefully and completely to familiarise yourself with safe and effective usage procedures.



Observe all safety instructions for the Vapodest 50 using the following safety symbols.



Vap 50
Order-NR.: 7650, 7658



LAB Online Exhibition



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Precautions

Operational usage

With the Vapodest 50 you have purchased a highly automated distillation system for the distillation of Kjeldahl digestions and associated distillations. Programmable addition of H_2O , $NaOH$, H_3BO_3 and titration acid as well as the removal of the sample remains after distillation by suction are features of this new system.

Safety instructions



Make sure no liquids get into contact with cables or the interior of the electrical parts of the unit!
Danger of electric shock!

For repairs of electrical, electronic, or mechanical parts always contact your dealer or a qualified engineer!

Always switch off the apparatus at the mains and unplug before opening! Danger of electric shock!

The Vapodest 50 must not be operated in humid or hazardous locations. The maximum humidity allowed is 80%, the maximum ambient temperature must not exceed $40\text{ }^{\circ}\text{C}$ ($104\text{ }^{\circ}\text{F}$)!

The equipment must not be exposed to aggressive vapours of acids, alkalis, or solvents.

The equipment must be operated according to this instruction manual. It is not permitted to change any part in order to modify its application.

Attention when handling acids and alkalis! Please observe your national safety regulations!

Use gloves when removing the glass digestion tubes as these can be very hot and there is danger of burning yourself! Also make sure you wear eye protection!

Be careful whenever handling glass and follow the national safety regulations concerning the handling of glass parts!

1. Technical description

1.1. Warranty

Vapodest 50 is designed and fabricated following the high quality guidelines of DIN EN ISO 9001. On the basis of the C. Gerhardt conditions of warranty our products are guaranteed for 1 year as long as the equipment is used according to the instructions in this manual. Please note that the natural wear- and -tear is excluded from warranty.

1.2. Technical specifications

Voltage: 230 V AC, 50 Hz
 Wattage: 1600 W
 Cooling water: about 3 litre per distillation minute
 Cooling water pressure > 1.3 bar
 Pump capacity:
 - Diaphragm pump: about 10 ml/s
 - Peristaltic pump: about 10 ml/s
 Storage tank: any size, recommended: Kan 40
 Display Touch-Sensitive-Screen
 Number of Programs: ... 20
 Size: 440 x 690 x 340 mm (W x H x D)
 Weight: 36 kg
 Recovery Rate: >99.5%
 Reproducibility: +/- 1%

Interfaces **2 x parallel (Centronics)**
 LPT 1 for data transfer to external PC
 LPT 2 for printer cable
 **1 x serial (RS 232)**
 COM 1 for connection to scale
 **2 x RS 485** for connection to GerBus®
 **1 x VGA** for connection to an external monitor
 **1 x 5 pin connector** to keyboard
 **1 x 5 pin connector** as interface to level sensor in the store tanks KAN

40

Micro dosing pump: deviation of flowrate < 0.1%
 Printer: see the enclosed user's manual

1.3. Operating conditions

Vapodest distillation systems can be run under normal laboratory conditions.

For the connection to the tap (cold water) a permanent connection with an ½ inch thread is required.

2. Delivery

2.1. Check for transport damage

Before assembling the equipment please check it thoroughly! In case of any damage, please notify your carrier (mail, rail, road) immediately and obtain an expert's report!

The exact contents of the delivery can be checked by the following list.

2.2. Package list

1 x Distillation system VAPODEST 50, ready to use

1 x Printer (with instruction manual)

1 x Printer cable

1 x Electrode with screw plug connection

1 x Buffer solution pH 4.00, 250 ml

1 x Buffer solution pH 7.00, 250 ml

1 x KCL Electrolyte solution, 250 ml

Tubing set:

1 x Water inlet tube 10/17 with connections of $\frac{1}{2}$ and $\frac{3}{4}$ inch, 2 m

1 x Verprene tube 8/12, 2 m

3 x PVC tube 4/7, 2 m

3 x PVC tube 8/12, 2 m

3 x PVC pipe 6x1, 42 mm

1 x PVC pipe 10x1, 420 mm

1 x Pen (to operate the Touch-Sensitive-Screen)

1 x Mains cable

1 x Kjeldatherm digestion tube, 250 ml

1 x Data transfer disk

1 x Instruction manual

3. Description of the equipment

3.1. Front view

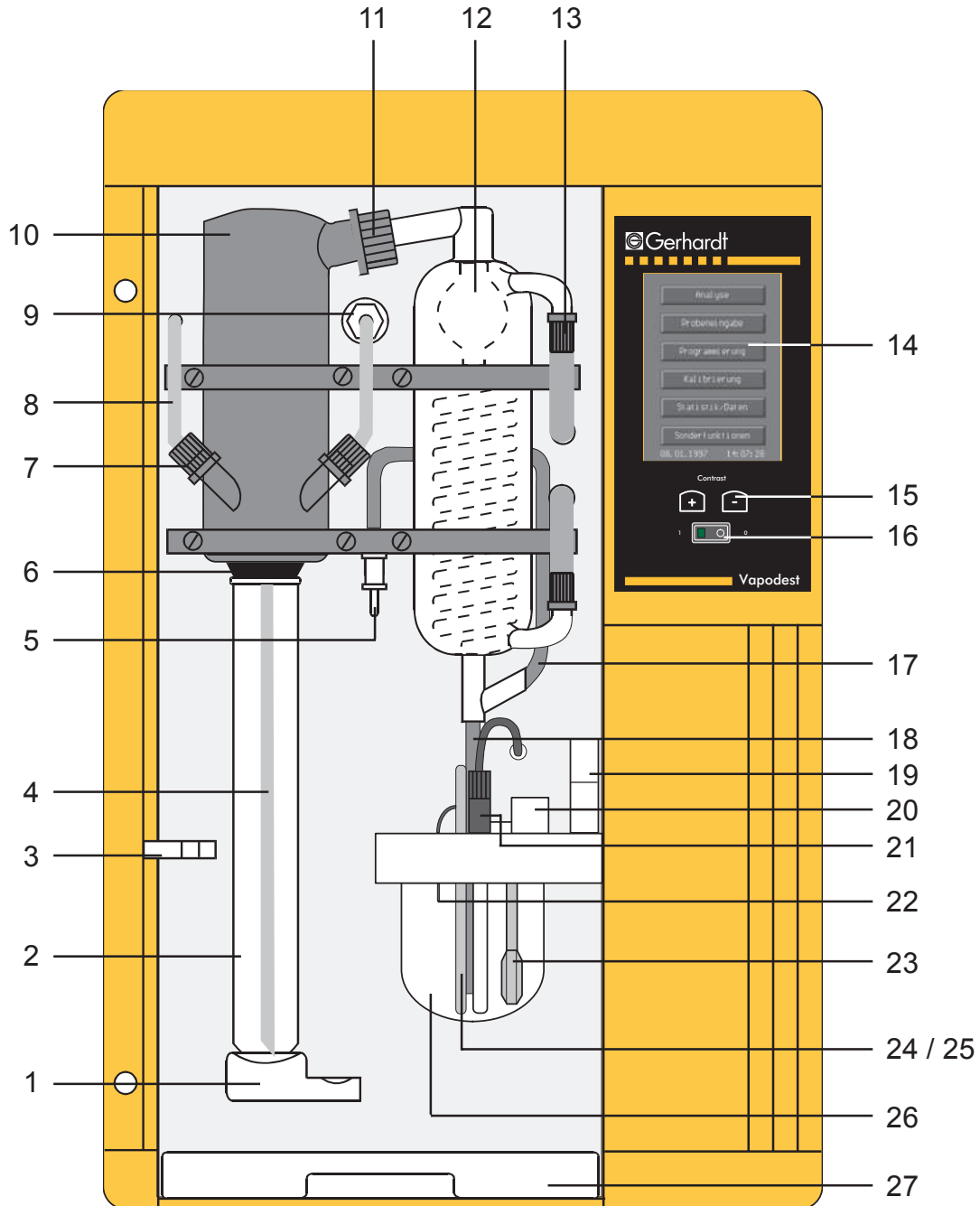


Fig. 3.1: Vapodest 50 - Front view

3.2. Rear view

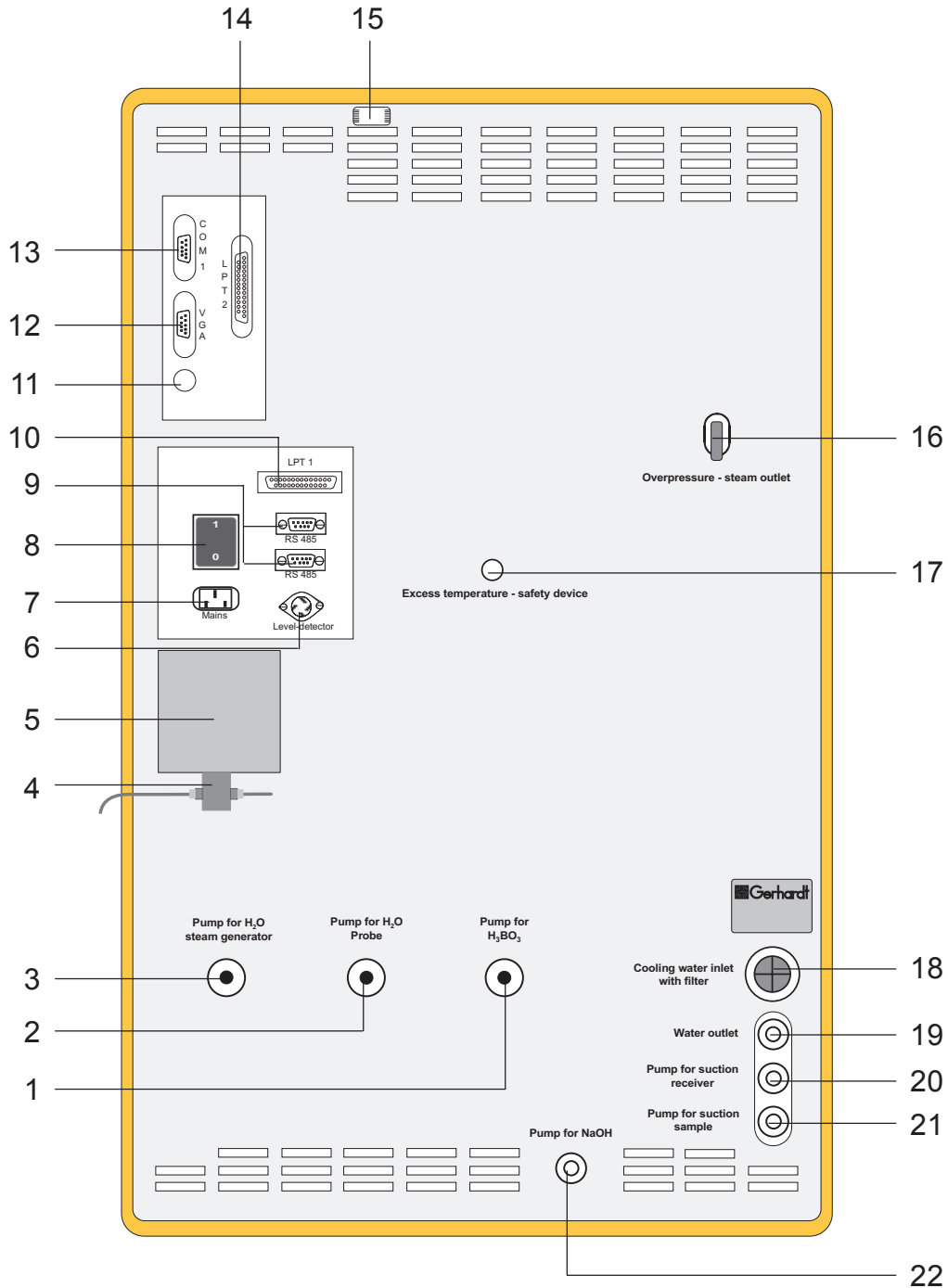


Fig. 3.2: Vapodest 50 - Rear view

3.3. Structural components and parts of front- and rear view

3.3.1. Front view

- 1 Quick clamping device with wedge**
Digestion glass can be pressed to connection piece safely and securely. Press down the quick clamping device in order to insert digestion tube.
- 2 Kjeldatherm digestion tube**
Special glass with cut
100/250 ml or flask with enlarged neck 250/500/750 ml or KDD 400/800 ml.
- 3 Holder for steam inlet tubing**
If no digestion tube is attached the tubing can be fixed here instead.
- 4 PTFE-inlet tubing, steam**
Steam, water for dilution, and the suction of the sample residues passes through here. Please regularly check that the opening of the PTFE-tube is not blocked by crystallisation.
- 5 Ventilation valve**
During and after distillation the ventilation valve prevents suck back of the receiver solution into the condenser.
- 6 Viton-cone, macro or micro**
The stopper ensures a perfect fit to the digestion tubes.
- 7 Screw cap GL 18 with silicone/PTFE seal**
- 8 PTFE-inlet tubing, NaOH**
Sodium hydroxide solution enters here.
- 9 PP-Distributor with PP-threaded joint**
- 10 Distribution head**
The inlet tubing for steam and sodium hydroxide solution pass through the distribution head. They are secured with screw caps (pos. 7). The distribution head prevents contamination of the distillate by the sample.
- 11 Screw cap GL 32 with silicone/PTFE seal**
- 12 Distillation condenser**
A combination of a bulb condenser and a coiled condenser acc. to Dimroth which provides intensive cooling capacity.
- 13 Screw cap GL 14 with plastic screw connection**
- 14 Touch Sensitive Screen**
See chapter 5 "Programming of the System"
- 15 Key pad, chemical resistant**
See chapter 5 "Programming of the System"
- 16 Mains switch, green, illuminated**
Turns the equipment on or off
- 17 Tube for ventilation valve**
Connection tube to the ventilation valve

18 Distillate outlet tubing, silicone 8/12**19 pH electrode holder**

The holder can be filled with potassium chloride solution 3.5 mol/l (included in the delivery). Here you can store the electrode when it is not in use to prevent the porous frit from drying out.

20 Sensor for level detection

The built-in sensor stops the program if the receiver vessel overfills during the distillation and titration.

21 pH-electrode (combined electrode)

Combined electrode with screw thread.
For further details please check the enclosed instructions by the electrode's manufacturer.

22 Inlet tubing for titration acid**23 Stirring motor with propeller****24 Tubing for suction of the distillate****25 Inlet tubing for boric acid,**
is behind the tubing for suction of the distillate**26 Receiver vessel**

For easy removal turn the glass through 90° and pull it downwards.

27 Drip tray

Condensate which might drip is collected in the drip tray. Make sure to clean the tray regularly.

**** Protection door (not illustrated)**

Whenever you run the distillation system make sure you shut the protection door!



3.3.2. Rear view

- 1 Diaphragm pump for H_3BO_3**
Connection pipe for PVC-tubing 4/7, connection to the storage tank " H_3BO_3 "
- 2 Diaphragm pump for H_2O sample**
Connection pipe for PVC-tubing 4/7, connection to the storage tank " H_2O "
- 3 Diaphragm pump for H_2O steam producer**
Connection pipe for PVC-tubing 4/7, connection to the storage tank " H_2O "
- 4 Micro dosing pump**
Micro dosing pump made of chemically inert ceramic components. The deviation of the flowrate of the pump is under 0.1%. This fact guarantees extremely precise titration and very exact results in the Kjeldahl analysis.
- 5 Box for micro dosing pump**
- 6 Level detector**
Connector for diode plug, 3-pin (level detector for set of storage tanks KAN 50)
- 7 Appliance plug with mains cable**
The enclosed mains cable is plugged in here
- 8 Excess current switch, 10A**
Equipment is cut off automatically if there is excess current
- 9 Interface RS 485**
Interface RS 485 guarantees an ISO/GLP conform quality control. Up to 32 different units (also of different brands) can be connected to each other.
- 10 Parallel interface LPT 1 for connection to external PC**
- 11 Interface for external keyboard**
- 12 VGA connector for external monitor**
- 13 Serial interface COM 1 for connection to scale**
- 14 Parallel interface LPT 2 for connection to printer**
- 15 Outlet ventilation tubing**
- 16 Excess pressure - steam outlet**
Safety device to let steam escape in case of an overpressure in the boiler.
- 17 Excess temperature fuse**
Safety measurement to turn off heating if the water level in the steam generator drops so low that the heating cartridge is not covered any more.
- 18 Cooling water inlet with sieve**
Connection thread $\frac{3}{4}$ inch for water inlet tubing 10/17
- 19 Water outlet**
Connection pipe for PVC-tubing 8/12, connection to water outlet
- 20 Peristaltic pump for receiver**
Connection pipe for PVC-tubing 8/12, connection to water outlet
- 21 Peristaltic pump for sample suction**
Connection pipe for Verprene-tubing 8/12, connection to store tank "*Sample waste*"
- 22 Diaphragm pump for NaOH**
Connection pipe for PVC-tubing 8/12, connection to storage tank "*NaOH*"

4. Assembly and installation

4.1. Set up of equipment

Please observe the local water and waste regulations and those of your public water supply enterprise!



Please note that the length of the inlet and outlet tubing is restricted to 2 meters.

The equipment should be located on a fixed laboratory bench, close to the cold water connection and the drain.

The water pressure must be at least 0,5 bar in order to activate the integrated pressure detector.

There should be sufficient space for the set of tanks below the work bench.

4.2. General information

The VAPODEST 50 distillation system comes fully pre-assembled. Please unpack the equipment with care !

1. Place the equipment on the work bench. Ideally, the equipment should be set up under constant light conditions. This ensures that the contrast of the display does not have to be adjusted all the time. Be aware that direct sunlight on your screen has a negative influence on the quality of your display.
2. Unpack accessories.

4.3. Tubing connections

When connecting the tubings please observe the inscription on the connection pipes at the back of the equipment (see also chapter 3.2. "Rear View" and chapter 14. "Tubing Diagram")

1. Connect the pump tubes to the PVC-pipes of the store tanks:
 - Inlet tubing sodium hydroxide (PVC-tubing 8/12)
 - Inlet tubing for distilled water steam generator (PVC-tubing 4/7)
 - Inlet tubing for distilled water sample (PVC-tubing 4/7)
 - Inlet tubing for H_3BO_3 (PVC-tubing 4/7)
 - Connection tubing for titration acid to microdosing pump
2. Connect water inlet tubing (pressure proof tissue tubing 10/17) to cooling water inlet and laboratory water supply.
3. Connect outlet tubing:
 - Connect water outlet tubing (PVC-tubing 8/12) to corresponding pipe at the rear of the equipment and place in the drain.
 - Connect sample waste outlet (Verprene tube 8/12) to corresponding pipe at the rear and direct to sample waste tank.
 - Connect outlet (PVC-tubing 8/12) to corresponding pipe at the rear of the equipment and place in the drain.

4.4. Connection of the electrode

1. Take off the upper screw cap and the lower porous frit protection cap - please look for instructions inside of the electrode box. Now, connect the electrode to the cable and carefully introdu-

ce it in the receiver vessel (see also chapter 3.1. "Front View", pos. 21).

2. Fill the holder for the pH-electrode up to the marked level with potassium chloride solution 3.5 mol/l. You should store the electrode in here in order to prevent it from drying out.

4.5. Printer connector

Connect the enclosed printer cable between, the printer and Vapodest (LPT 2). Insert the mains cable of the printer in a shock proof socket. You will find further information about the printer in the enclosed instruction manual.

4.6. Connection to the balance

An electronic balance can be connected at the rear (COM 1, chapter 3.2, pos.13) to transfer the weight of the samples to the Vapodest.

Set up the balance according to the instruction manual enclosed. Connect balance to Vapodest using the data transfer cable. All balances with a standard RS 232 interface can be connected directly. Device drivers for various types of balances are provided and updated regularly. For the communication between balance and Vapodest you have to set up the following features:

- **Data output:**
external print command as stability
- **Baud:**
2400 Bd
- **Parity:**
Odd

If there are any problems with your balance please contact the manufacturer or C. Gerhardt.

4.7. Connection of store tanks

1. Set up store tanks for distilled water, sodium hydroxide solution, boric acid solution, and sample waste under the work bench. You also have to provide a vessel for the titration acid. See also chapter 14 "Tubing Diagram".

Use of the set of tanks KAN 50 (optional):

1. Connect the diode plugs of the level detectors to the distribution box and connect to the socket level detection (chapter 3.2, pos.6).

4.8. Mains connection

Please check the nominal voltage on the identification plate before connecting to the mains.



1. Mains connection of the Vapodest:
 - Make sure that the mains switch at the front of the equipment is off (i.e., in position "0")
 - Insert appliance plug in rear outlet
 - Connect mains cable to shock proof socket
2. Excess current switch:

Check if excess current release at the rear of the equipment is in position "1". This switch turns the equipment off when it takes too much current.

5. Starting operation

Be careful when working with acids and alkalis! Make sure you observe the safety instructions concerning work with hazardous materials!

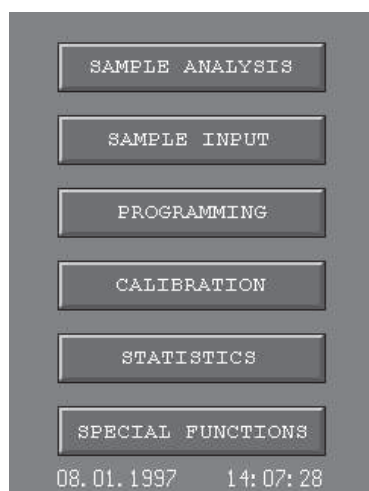


Always close the protection door before operating the distillation unit!



1. Fill tanks with chemicals:
 - H₂O distilled or demineralized
 - NaOH: 32%
 - H₃BO₃: 2-4%
 - Titration acid
2. Turn on tap. Make sure you turn on tap completely in order to activate the integrated pressure detector of the cooling water valve.
3. Start Vapodest by turning the mains switch on.
4. Turn on mains switch of the printer.

Always make sure to turn on printer after you have started Vapodest to avoid problems during booting the system.



After switching on the unit the pump to fill the steam generator starts immediately. During booting sequence, the display shows the number of the current software version. Then, the display shows the main menu from which all major functions can be selected.

The steam generator is filled with water up to the pre-set level, then the heating starts. In order to run an analysis you have to wait for about 5 minutes till the steam generator has reached its operating pressure. All other functions are available right away.

You will find the instruction for setting up Time/Date, Cleaning, Test program in chapter 7 "Special Functions".

If the unit is used for the first time, it is necessary to clean the titration dosing pump. To do that, please see chap 7.1 "Special functions" - "Dosing pump".

6. Control panel

The VAPODEST 50 can be programmed and controlled through the "Touch Sensitive Screen" of the control panel. Please note, that the contrast adjustment of the display depends on the light conditions in the laboratory. The unit should be placed under constant lightning conditions and the display should not be exposed to direct sunlight as this can reduce the contrast of the display so making it unreadable.

The functions can be activated by gently pressing the corresponding sections of the panel.

Attention!

To operate the Touch-Sensitive-Screen please always use the pen. Never use sharp or pointed objects to operate the touch sensitive screen as this will damage the screen.

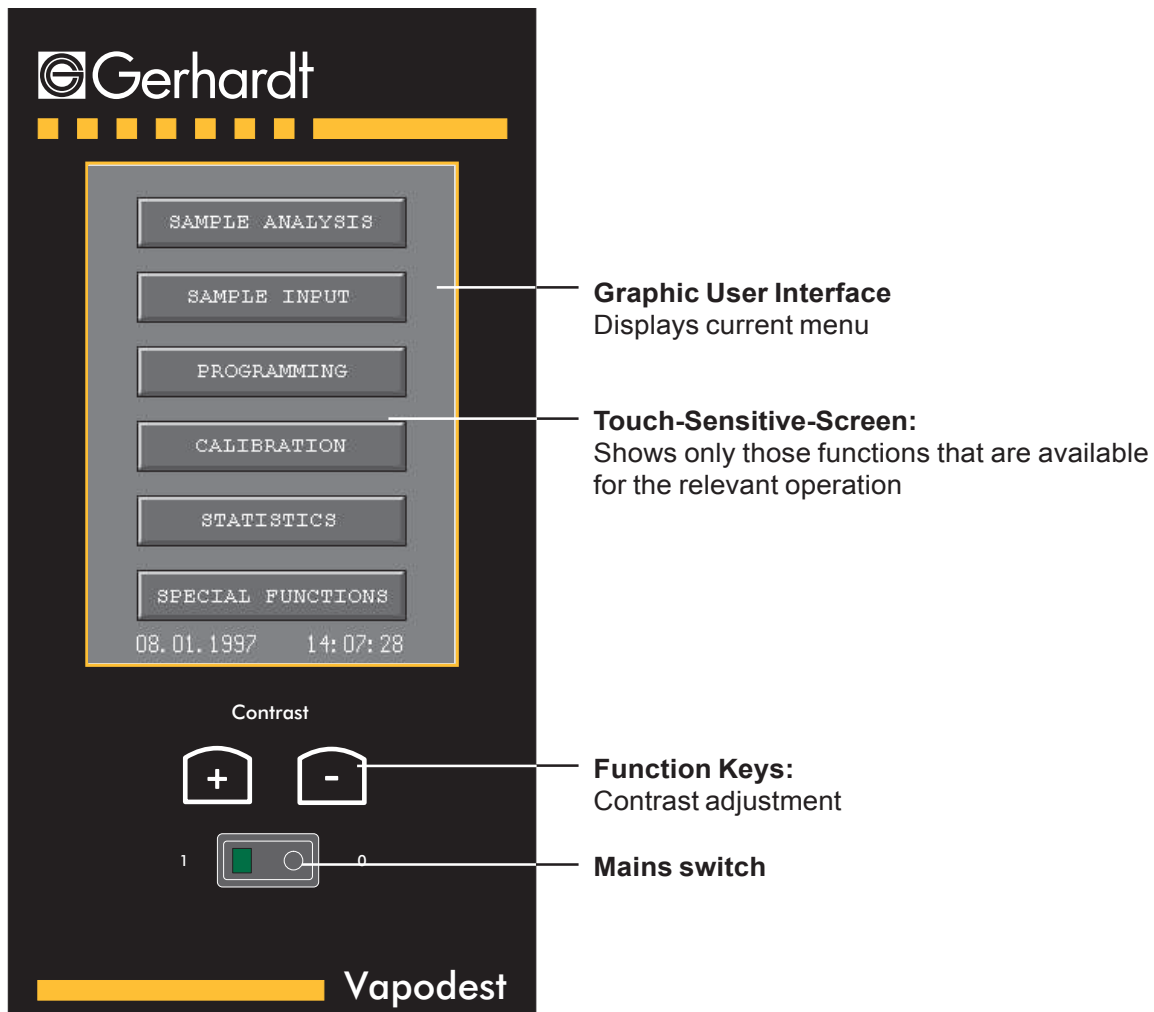






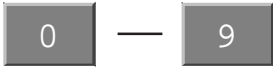








Fig. 6.1: Graphic user interface - Control panel

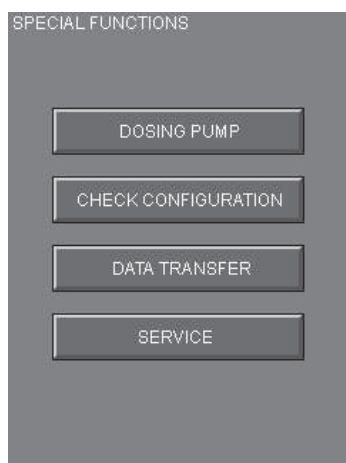
6.1. Description of the keys and functions

Keys/Functions	Description
	Confirmation and storage of actual values.
	Return to previous menu
	Abort task currently in progress; return to main menu. Attention , the values entered are not stored
	Cursor keys "up" and "down": Control the cursor movements between fields and are used to scroll within program step.
	
	Cursor keys "left" and "right": Control the cursor movements within field Option wanted can be marked or demarked
	Input keys for entering numerical values
	Delete key: erases value at current cursor position
	Point / Comma Key
	Activates the character input and symbols

Keys / Functions	Description
	<p>Activates character input and symbols</p> <p>Press the key on which the required input is marked. Each key holds 3 letters/symbols. To select an individual symbol (i.e., one out of three) first press the key with the symbol followed by a numerical key (i.e., "1", "2", or "3") identifying the position in this group. For convenience, any number from the first column (e.g., "7", "4", or "1") will select the first symbol from the group of 3. Similarly, keys from the second and third column will select the second and third symbol from the group, respectively. To leave a blank press "right" key. Repeat for the next character input or symbol.</p>
	<p>Either/Or function:</p> <ul style="list-style-type: none"> <input checked="" type="radio"/> = indicates activation of the function <input type="radio"/> = indicates deactivation of the function
	<p>Further option:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> = activated <input type="checkbox"/> = deactivated

7. Special functions

The submenu for the special functions is selected by pressing the key "Special Functions". There are five functions available which are described in this chapter.



By pressing the desired function the respective menu is called up. The individual items of the menu are described in detail in this chapter.

7.1. Dosing pump

The cleaning program is used for the rinsing of the micro dosing pumps and the inlet tubes. Be aware that air in the inlet tube could tamper the results. Therefore, make sure you check the Inlet tubes regularly for air bubbles.

*Careful!
Check tubes
on a regular
basis!*

It is necessary to clean this component in any of the following situations:

- if the titration liquid is changed
- if there is air in the inlet tubing
- if the equipment is used for the first time
- if the instrument has not been used for some time

In all cases, about 10 ml of titration liquid is sufficient.

1. Press key "Dosing Pump":

- Enter the amount of titration liquid through the numerical keypad. The cleaning process is started by pressing "Enter". The dosing pump is supposed to transport 0.05 ml per rotation. Small deviations are possible but they are compensated for by an internal calibration unit. At the end of the process, the actual amount of liquid used is displayed.

2. By pressing "Enter" you get back to the main menu.

If there are still air bubbles in the inlet tube after the rinsing process, then you should check whether the tube connections at the micro dosing pump and the titration tank are attached correctly. Then, repeat the rinsing!

7.2 Check configuration

By choosing this function another submenu is opened. The following functions are available:

7.2.1. Language

With this function you can select language required.

1. Press key "Language"
2. Select language required and press "Enter". After that the system asks for a restart. If the apparatus is turned off and on again the required language is set. All data entered remains stored.

7.2.2. Time / Date

This function sets the time (24 hour mode) and date. Usually, an adjustment is only necessary during the configuration of the apparatus. Be aware, that the correct time and date are important for all statistics, data and printouts.

1. Press key "Time/Date".
 The time is displayed: **hour minute**
 The date is displayed: **day month year**
2. Address the input field with the cursor "up" or "down" and write in it with the numerical keys.
3. By pressing "Enter" you return to the main menu and the data entered is stored.

7.2.3. Titration adjustment

The user has the option to work with a T-factor which he can select at his wish or a titration table, which he can also select at his wish. The titration table may speed up the titration.

1. Using the cursors 'up' or 'down' you can address the respective entry form and using the numeric keys make your input.



7.2.3.1. Selection of T-Faktor

It can be set between 0.1 - 9.9. The manufacturer has set it to 1 as this value is perfect for most titrations.

The setting of the titration is in accordance with a 2 % boric acid. If a boric acid solution is weaker values > 1 are to be inserted, to avoid an over-titration. Should a boric acid solution be stronger, then values <1 are to be inserted to optimize the duration of the titration.

Should a boric acid solution be stronger, then values <1 are to be

7.2.3.2. Selection of Tabelle

The function of the table can be set at 0 -3:

0 = the function of the table is not active, 1 - 3 = table can be selected

After selection a table number the following window is displayed on the screen:



- 01** 1st step, altogether 12 steps, firmly allocated
- Delta pH** PH-difference to the endpoint, firmly allocated
- Delay** Time to the next dosing step can be chosen between 1-99 sec
- Step** Amount of standard solution can be chosen between 0.05 - 9.95 ml

1. Using the cursor 'left' or 'right' you can address the respective entry form and using the numeric keys make your input.
2. Confirm input using the key 'Enter', then, the next lower pH difference is shown on the display.
3. After confirming all further steps with 'Enter' you can print the data of the table. Upon completion of the print out, press 'Enter' to terminate the programming.

7.2.4. Chemical reservoirs

If the set of tanks KAN 40 is used the level detector checks the level of chemical inside the tanks.

1. Push button 'Chemical reservoirs':
 - Select option 'Connected' in order to activate the level sensor detection for the external set of tanks.
2. By pushing the button 'Enter' you get back to the main menu; the values selected remain stored.

7.3. Data communications

It is possible to transfer data to an external PC. This is necessary if e.g. the storage capacity of the hard disc is exhausted. Please connect the interface LPT 1 with the parallel interface at the external PC before transferring the data. For more details see data transfer disk.

7.4. Service


System-check for authorised service. This special function is for internal use and is not available for the user.

8. Calibration

In order to reach a perfect pH measurement the electrode has to be calibrated at regular intervals. A two-point calibration is carried out. The zero point deviation is determined with the buffer solution pH 7, the slope with buffer solution pH 4 or pH 9. The selection of the second buffer solution depends on the pH range to be worked with.

For Kjeldahl analysis the buffer solution pH 4 should be used. The measurements are displayed in mV. The values are ideal if you get a zero point deviation of 0 mV and a slope of 58,2 mV/pH. The tolerance for the zero point deviation should not exceed +/- 15 mV, the slope is acceptable between 50 mV and 70 mV/pH. The conversion of mV/pH is carried out after the calibration is completed. During the measuring the actual voltage is shown. The ideal value for the buffer solution pH 4 is 174,6 mV if the zero point is exactly at 0 mV. A further criteria for the condition of the electrode is the response time. If the electrode reacts slowly and does not give a stable measurement within 30s, the calibration is not accepted. If one of the tolerance ranges is exceeded during the calibration, the appropriate error message appears and the calibration must be repeated with a fresh buffer solution and/or a new electrode. The last accepted calibration is the one stored. Although, in case the calibration procedure did not succeed, the equipment would be ready for operation even though the result would be wrong. Therefore, analysis should not be run, as the condition of the electrode is crucial for the precision of the titration. For maintenance and storage of the electrode see the manufacturer's instruction. Buffer solutions should be kept at room temperature (20° C).


Attention:

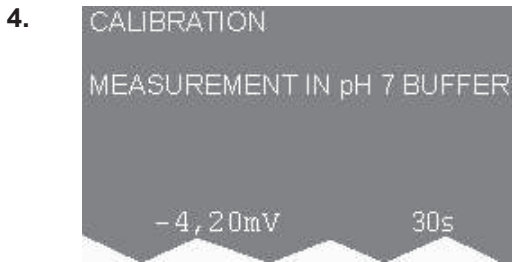
Our experience has shown that the electrodes have an average life span of 1.5 - 2 years. In any case, when measuring seems to become sluggish then make sure to exchange the electrode under all circumstances. In order to guarantee a perfectly working instrument you should only use the original electrodes from Gerhardt. 

8.1. Calibration performance

1. Choose the "Calibration" key.

2.  Select buffer solutions.

3.  The electrode, rinsed with distilled water and dried (dabbed, not rubbed!) is dipped into buffer solution pH 7. Start the measurement by pressing the "Enter" key.

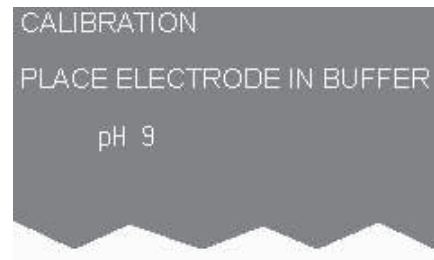


The measured voltage and the stabilisation time, counting down from 30s, are displayed. As soon as a steady measurement over 2s is reached, the system is ready for the next calibration step.

Selection pH 4

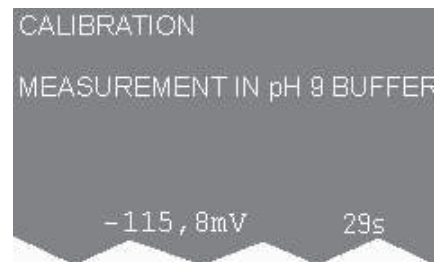
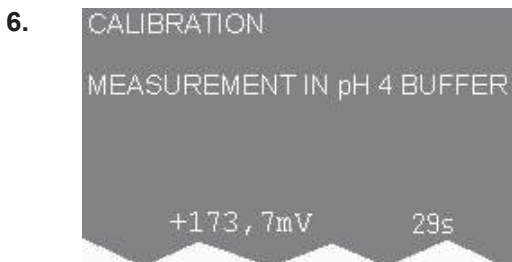


Selection pH 9



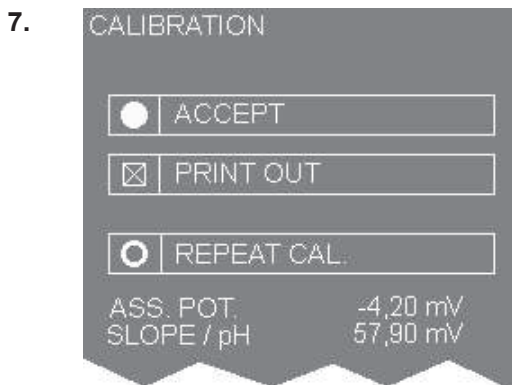
Rinse/dry electrode again, dip into buffer solution pH 4 and start the measuring procedure.

Rinse/dry electrode again, dip into buffer solution pH 9 and start the measuring procedure.



The measured voltage and the stabilisation time, counting down from 30s, are displayed. As soon as a steady measurement over 2s is reached, the calibration is finished.

The measured voltage and the stabilisation time, counting down from 30s, are displayed. As soon as a steady measurement over 2s is reached, the calibration is finished.



After the calibration is finished the results can be accepted and printed. There is the possibility to repeat the calibration without the values being stored. Press "Enter" to finish the calibration.

9. Programming

In this main menu all relevant parameters for the control of the distillation/titration are defined. There are 20 programs available. The structure of the program is set. The flow rate of the dosing and suction pumps is **about 13 ml/s**, the flow rate of the dosing pump for NaOH depends on the concentration of the alkali (**about 10 ml/s** for 32 percent sodium hydroxide solution). The amount of distillate is about 120 ml/4 min at maximum steam power.

The following example refers to a sulphuric acid digestion acc. to Kjeldahl using 20 ml H₂SO₄. A decisive factor for the programming is the residual acid once the digestion is over. This depends on the type of sample, digestion time, and digestion temperature.

9.1. Programming performance

1. Choose the "Programming" key.



Enter program number desired. There are 20 different programs available.

Example:
Program No. 1
Range 1-20



A sufficient dilution of the residual concentrated sulphuric acid ensures that the subsequent alkali addition does not cause a too violent reaction. The addition of H₂O depends on the amount of free (uncombined) sulphuric acid at the end of the digestion.

Example:
90 ml = ca. 8 s
Range 0-99 s



In order to distil the ammonia over it is important to create a superalkaline environment. When a sample containing copper sulphate catalyst is used the solution will discolour when alkaline. When using a selenium catalyst an indicator can be added in order to get a visual control. The addition of NaOH depends on the amount of the free (uncombined) sulphuric acid at the end of the digestion.

Example:
110 ml = ca. 11 s
Range 0 - 99 s





The reaction time is required for the nitrate nitrogen determination when using the Devarda alloy (e.g. determination of fertiliser), but not for the Kjeldahl analysis.

Example:
0 min 0 s
Range 0 - 99 min and 0- 59 s

Select the distillation time so that approx. 100 ml is collected. This corresponds to between 3 min 30 s and 4 min with maximum steam power. For the determination of ammonia in the water analysis a phosphate buffer is used for the determination of the ammonia nitrogen instead of NaOH solution and 200 ml of distillate must be collected. Switch between min/s with cursor "up" / "down".

Example:
3 min 30 s
Range 0 - 99 min 59 s

The steam power can be set between 40 % to 100 %. The Kjeldahl analysis works preferably at maximum power. If the power is reduced, the distillation time has to be increased in order to collect the same volume of distillate. For some determinations, e.g. the ammonia determination, a specific amount of distillate is required within a specific time. The steam power can then be ad-

If the on-line titration mode is used, the pH difference to the actual endpoint towards which is titrated during the distillation must be entered. The difference is then titrated once the distillation is finished.

The range of the delta pH is between 1 and 13.

justed accordingly.
 100% correspond to 1500 W heating power, 50 % 750 W etc.
 Range 40 % - 100 %.

Attention! When using micro-tubes, 100 ml, the maximum heating power should only be 80 %.

Enter

9. PROGRAMMING PROGRAM 1
 SUCTION SAMPLE 30 s

If the distilled sample is not required for further analysis, it can be emptied via the built-in peristaltic pump, then collected for disposal.

Example:
 30 s
 Range 0 - 99 s

↓ Enter

10. PROGRAMMING PROGRAM 1
 SUCTION RECEIVER 25 s

The suction time must be long enough so that the receiver vessel is emptied completely. Residual drops do not influence the subsequent analysis.

Example:
 25 s
 Range 0 - 99 s

↓ Enter

11. PROGRAMMING PROGRAM 1
 ADDING H₂BO₃ 7 s

The porous frit of the electrode must be completely immersed into the receiver solution in order to ensure a stable pH measurement.

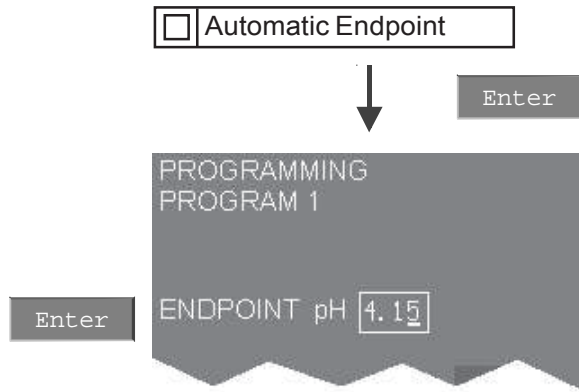
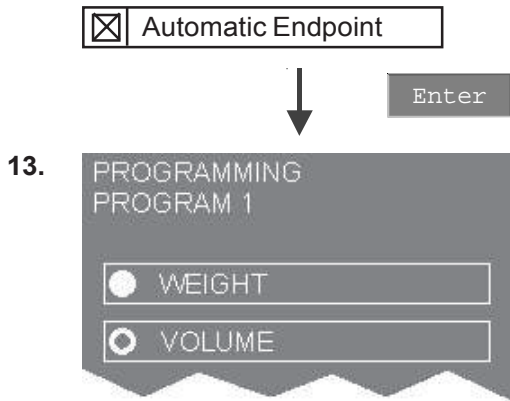
Example:
 7 s
 Range 0 - 99 s

↓ Enter

12. PROGRAMMING PROGRAM 1
 AUTOMATIC ENDPOINT

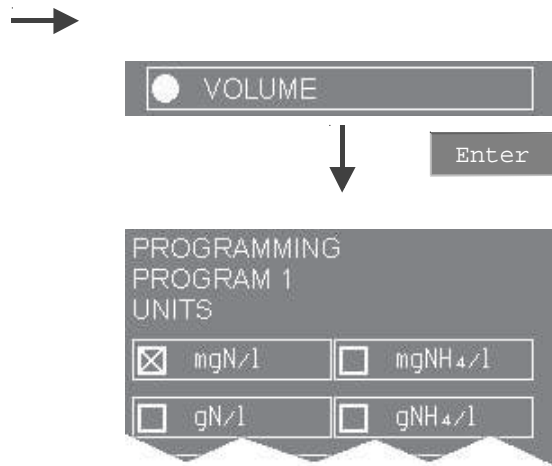
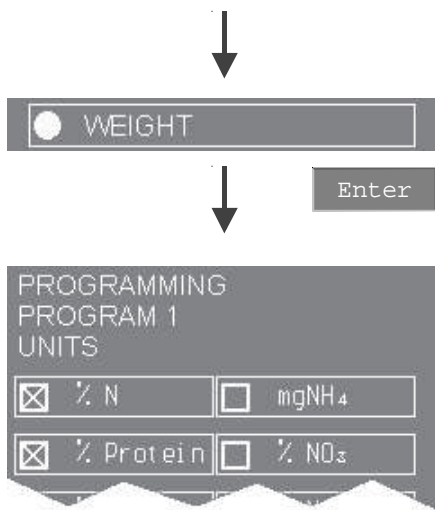
When a back titration to the initial pH value is required, then the mode "automatic endpoint" has to be selected. The pH value is measured at the beginning of each analysis and adopted as the endpoint. Small variations of the pH value in the receiver are thus compensated for.

↓



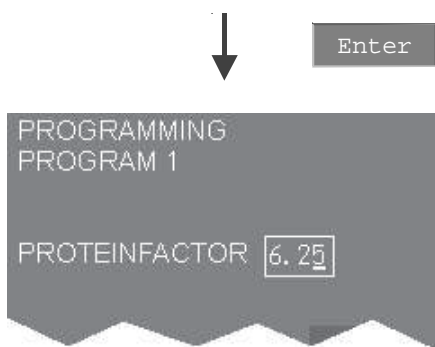
The program determines whether the calculation is carried as a weight or volume.

14. If a specific endpoint is required that does not conform with the pH value of the receiver solution, it has to be entered manually using the numerical keys.



Select the criteria required for the calculation. Any combination is possible.

Select the criteria required for the calculation. Any combination is possible.



If the calculation selected is %protein, the protein factor has to be entered.

Example:

6,25

Range 0.01 - 9.99



16. PROGRAMMING
PROGRAM 1

NO CALCULATION OF RESULT
ONLY AMOUNT OF TITRANT



Enter

Without the selection of these criteria there will be no calculation. Only the amount of tritration acid consumed will be shown.

17. PROGRAMMING
PROGRAM 1
PRINTOUT STYLE

AS SERIES

INDIVIDUAL

CALIB. SERIES

PROGRAM GRAPH



Enter

At this stage, the print out of the result can be selected. You have 2 options:

- print out after the last analysis of a series has been run (serial print out)
- each result is to be printed immediately on an individual sheet (single print out).

If the second option is chosen the print-out is only possible if all information for a calculation is available. Regardless of the choice there is the possibility of a complete print-out (the actual calibration data, program or / programs, all series entries and a graphical diagram of the pH-value) during the distillation / titration. These options can be combined.

The programming is ended by pressing the "Enter" key and the values are stored.

18. PROGRAMMING
PROGRAM 1
FINISHED

PRINT OUT

Enter

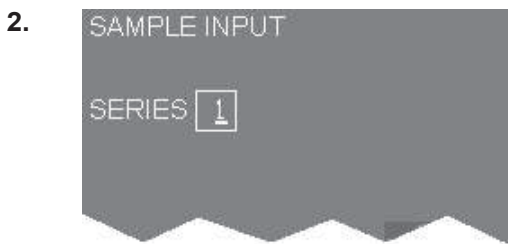
The program just entered can be printed for checks and documentation. By pressing the key "Print out" the data is stored and a print out is run. Press "Enter" once the data is printed to finish the programming.

10. Sample input

In this main menu the samples (weights / volumes) can be entered in so-called series. A series contains a maximum of 20 samples. In total, there are 99 series available. A series can contain samples and blank samples, which can be worked through with one or more programs.

10.1. Procedures for sample input

1. Press the "Sample Data" key



The first available series is automatically selected. This default decision can be overwritten by selecting another available series.

Range 1 - 99



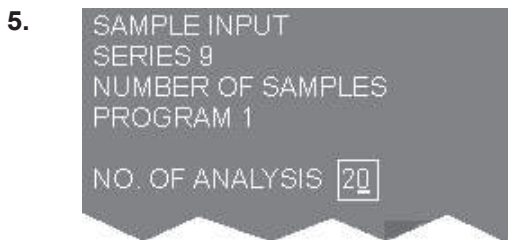
Enter the number of determinations (samples and blank samples) to be dealt with in this series. 20 entries are always the maximum.

Range 1-20



Select the program for the distillation of at least a part of the samples.

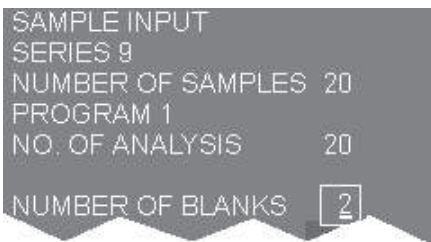
Range 1 - 20



Enter the number of samples and blank samples for the program selected. The amount of samples cannot exceed the amount of determinations.

Range 1 - 20



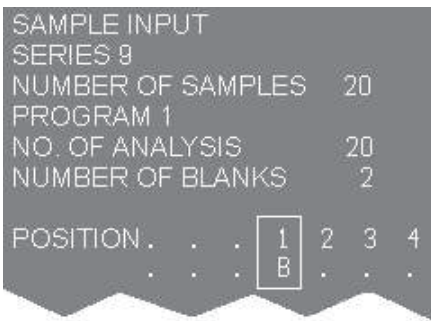
6. 

SAMPLE INPUT
 SERIES 9
 NUMBER OF SAMPLES 20
 PROGRAM 1
 NO. OF ANALYSIS 20
 NUMBER OF BLANKS 2

↓ Enter

Enter the number of blank samples to be determined with the selected program. The maximum number of blank samples cannot exceed the number of samples for this program.

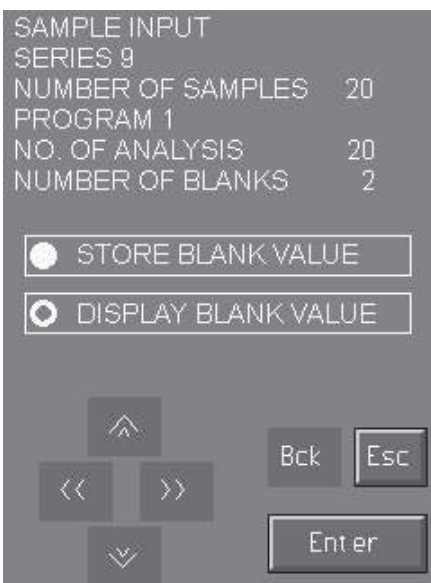
Range 0 - 20

7. 

SAMPLE INPUT
 SERIES 9
 NUMBER OF SAMPLES 20
 PROGRAM 1
 NO. OF ANALYSIS 20
 NUMBER OF BLANKS 2
 POSITION . . . 1 2 3 4
 . . . B . . .

↓ Enter

If the amount of blank values > 0 is entered, their position must be specified. The selection of the position is done with the cursor key (left/right). It can only be made for a position, which is within the range of determinations for the selected program. When the position is reached it is identified with the cursor "up" or "down". The identity is shown by the letter "B" under the position selected. This type of entry can only be left if the number of blank values is identical with the number of markings.

8. 

SAMPLE INPUT
 SERIES 9
 NUMBER OF SAMPLES 20
 PROGRAM 1
 NO. OF ANALYSIS 20
 NUMBER OF BLANKS 2

STORE BLANK VALUE
 DISPLAY BLANK VALUE

↑ ↓ ← → Bck Esc
 Enter

↓

DISPLAY BLANK VALUE

↓ Enter

If the blank samples are run for test purposes only and have no influence on the calculation, then select "Display Blank Value". If the blank samples are needed for the calculation, confirm by "Store Blank Value".

→

STORE BLANK VALUE

↓ Enter

9.



If the number of samples and blank samples for a program is smaller than the number of determinations then the remaining samples must be assigned further programs. In this case go to point 4 in this chapter.

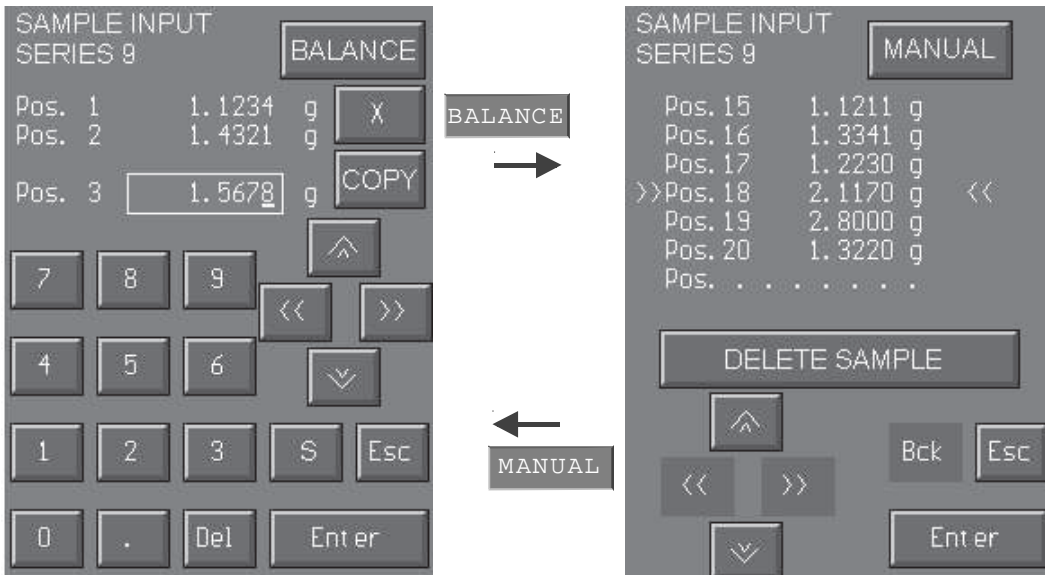
The blank samples (B) can be entered with different weighting (W) for the blind value calculation. The same specific weight is always pre-set for all blank values. If the amount of blank values is >1 then the average of the blank value out of all blank samples is calculated. To switch to the next blank values use the cursor "down".



The formula for the calculation of the average is:

$$\bar{M} = \frac{W1 \times B1 + W2 \times B2}{W1 + W2}$$

10.



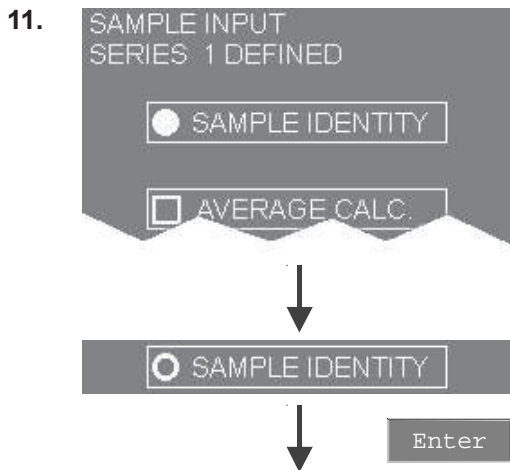
If all samples are related to a program, the weights/volumes are entered. To switch over to the next available input space press the cursor "down". If the same value is needed several times, e.g. 100 ml, this once entered value can be copied into all free positions with the "Copy" key. If the number of samples entered is the same as the number of determinations you can change to the next entry display by pressing the "Enter" key.

Key „X“ = delete current position

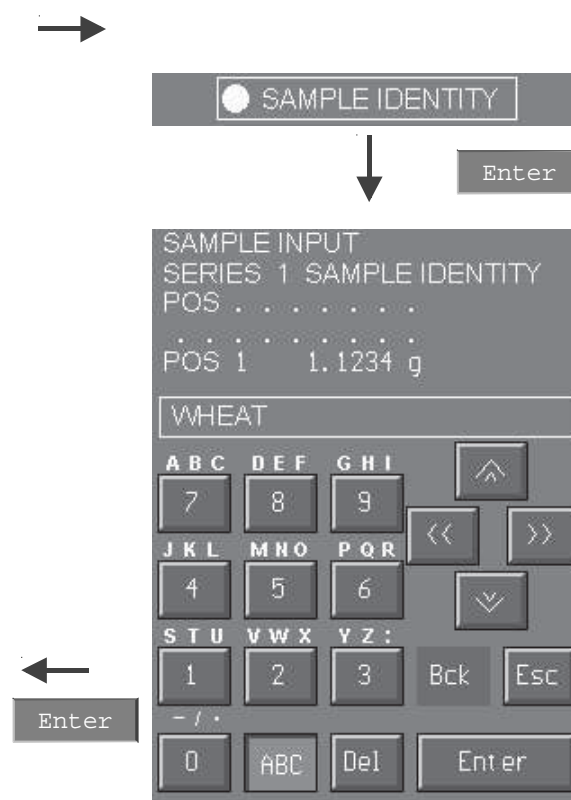
Key „S“ = all following values entered will be put one position up, the present value can be overwritten.



When entering weights you can switch over to a balance display by pressing the "Balance" key. The sample entry is then made via the RS 232 interface of the balance. For the adjustment parameters of the balance for the data transfer please see chapter 4.6 "Connection to the balance". If more samples are transmitted than there are positions for they have to be deleted. The balance display can be left at any time by pressing the key "Manual".



The samples can be given any identity during the sample identity. Once it is activated an average value can be calculated for all samples of the same name within the program.



The defined series can be printed for test or documentation purposes. If necessary, corrections of sample entries or identities can be made. Press key "Enter". The sample entry is now finished.



There is an alphanumeric keyboard with some symbols for the sample marking. If the ABC key is not pressed, the numerical part of the keyboard is activated. Press the ABC key for letters and symbols.

Information on how to use the alphanumeric keyboard see chapter 6.1. "Description of the Keys and Functions". The sample identity is stored with the switch to the next sample (cursor "down"). The last written sample name is automatically copied into the next free line. It can be deleted with the "Del" key. Or you mark the next characters that are to be changed with the cursor. The sample marking can be left any time by pressing the "Enter" key.

11. Analysis

In this part of the main menu distillation and titration are performed.

11.1. Safety instructions

Attention when handling acids and alkalis! Please observe your national safety regulations!



Use gloves when removing the glass digestion tubes as these will be very hot and there is danger of burning yourself! Also make sure you wear eye protectors!



Be careful whenever handling glass and follow the national safety regulations concerning the handling of glass parts!



11.2. Before starting with the analysis

Test Run

In order to obtain results which can be reproduced easily make sure you run a distillation without sample before you distil a sample. To start choose key "Clean" from the initial display of the analysis program (see chap. 11.3.1. step 10 or chap. 11.3.2. step 12).

Check the chemical reservoirs

Check the connections of the reservoirs regularly.

Turn on tap

If the tap is not turned on the system is not working.

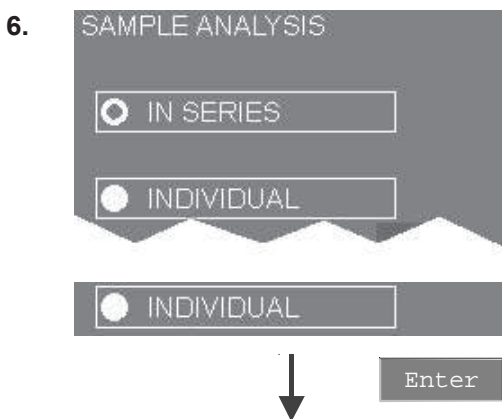
11.3. Single determination or serial determination

Serial determination means that the weights or volumes have already been stored in the main menu "Sample Input" and can be worked on one after the other.

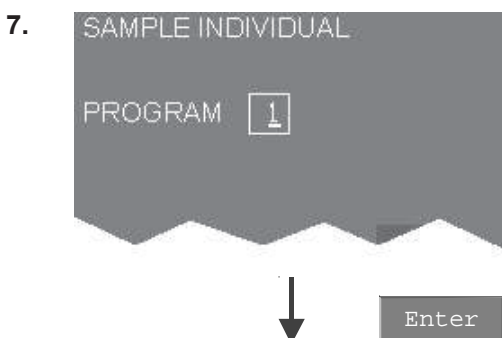
Single determination means that the weight or volume is entered before each analysis. An average value of results or blind values cannot be calculated in that case.

11.3.1. Sample individual

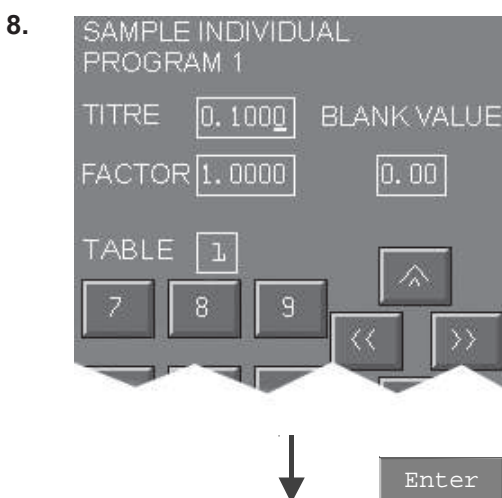
1. Insert the inlet tubing into the digestion tube with the sulphuric digestion.
2. Press down quick clamping device and insert the digestion tube.
3. Check correct fit of the tube.
4. Close protection door and turn on equipment.
5. Press key "Analysis" in order to get into the analyse menu.



Press "Sample individual".



Either input or select a pre-entered program using numeric keys.



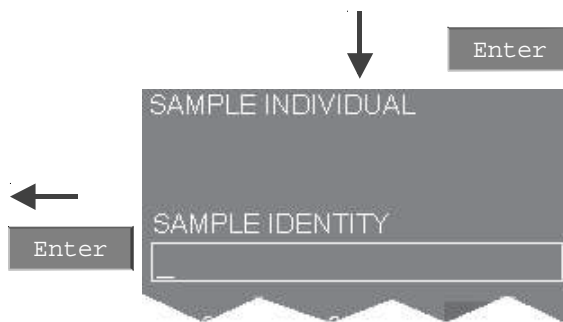
Enter the normality of the titration acid used. If a correction value has been determined enter it as well. If a blank value has been defined in the chosen program it is displayed. This value can be overwritten.

Table:

0 = analysis without titration table
 1 - 3 = analysis with titration table 1, 2 or 3 (see chapter 7.2.3. Titration adjustment)



Enter weight/volume of sample and decide whether a sample name should be used. If no sample, but only a blank value is going to be determined then enter a "0".



If "Sample Identity" is pressed the display switches to the alphanumeric mode. Now, you can name the sample. If the ABC key is not pressed, the numerical part of the keyboard is activated. Press the ABC key for letters and symbols. Information on how to use the alphanumeric keyboard see chapter 6.1. "Description of the Keys and Functions".

As long as the analysis is not running you can activate the following functions manually:

- Suction of sample and receiver
- Adding H₂O, H₃BO₃, and NaOH



The display shows which part of the program is running.

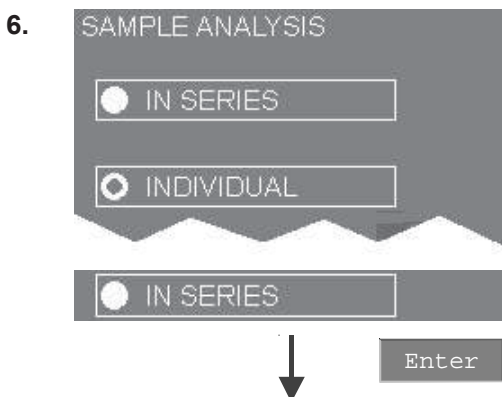
By pressing "Stop" the analysis can be aborted at any time.

The following function can be selected **during** the analysis:

- Manual addition of NaOH

11.3.2. Serial determination

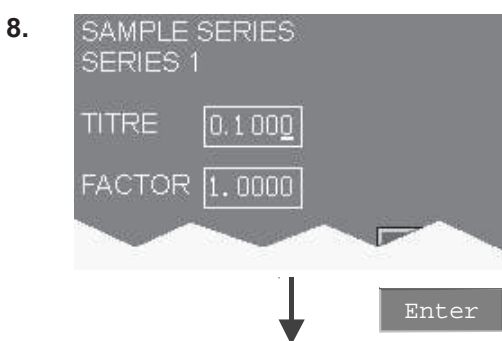
1. Insert the inlet tubing into the digestion tube.
2. Press down quick clamping device and insert digestion tube.
3. Check correct fit of the tube.
4. Close protection door and turn on equipment.
5. Press key "Analysis" in order to get into the analyse menu.



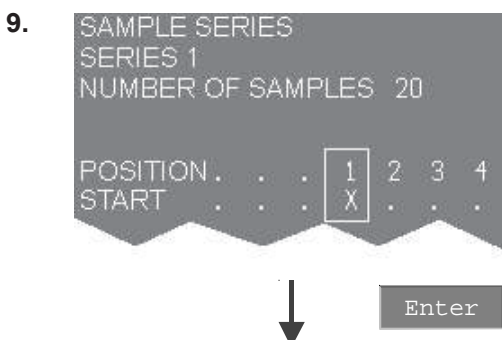
Press "Serial Determination".



Select a series that has already been defined using numeric keys.



Enter normality of titration acid used. If a correction value has been determined enter it as well.



It is suggested to start a series with position 1. But if you wish you can start with any position. Use keys "left" or "right" to move and mark starting position with cursor "up".
X = starting position

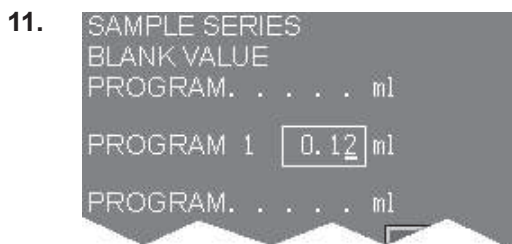


To clean the distillation system it is possible to start a cleaning process.

Mark which positions should be cleaned. Use key "left" resp. "right" to move cursor and mark the cleaning position with key "up". Delete with key "down".

S = Cleaning position

If a running analysis is left by pressing "Esc" the positions for cleaning have to be marked again. The cleaning is done with the program selected for the marked position.



If blank samples with blank value transfer have been defined during the sample input it is shown in the display with "auto". This means that the average calculated for all blank samples is used for the calculation and is assigned to the corresponding program. If no new blank value calculation is selected the display shows the last determined blank value that has been assigned to the program. This value can also be overwritten.

Range 0 - 9.99 ml

If the series has been defined with several different programs the blank value for all programs has to be entered. To switch between programs press keys "up" or "down".



As long as the analysis is not in process you can activate the following functions manually:

- Suction of sample and receiver
- Adding H₂O, H₃BO₃, and NaOH

Press "Enter" to start analysis.



The display shows which part of the program is running.

By pressing "Stop" the analysis can be aborted at any time.

The following function can be selected **during** the analysis:

- Manual addition of NaOH

Put in samples as via the defined sequence. After the last sample is finished the message "Analysis finished" is displayed.

By pressing "Enter" you get back to the beginning of the serial analysis. You can either enter a new series or leave the analysis by pressing "Esc".

11.3.2.1. Special features of the serial determination

- Abortion of the serial determination

If necessary the series in progress can be aborted and reassumed at a later time. The values assigned to the titre and factor have to remain unchanged if a series already started is reassumed again (also see chap. 13.2. "Error Messages during the Analysis"). The samples already processed are marked in the following way:

V = Analysis finished off successfully

F = Analysis aborted or deleted using the key X in the main menu 'Sample Input'

X = New starting position



- Comment

A series that has been partially processed can be printed at any time under the main menu "Statistics/Data" - "Results", chap. 12.2.4. If a new calculation of the blank value is demanded and not all information for the calculation of the average value are available a "Temporary Calculation" with a blank value of 0.00 ml is done. Samples that have not yet been processed are marked with "Not analysed" on the print-out.

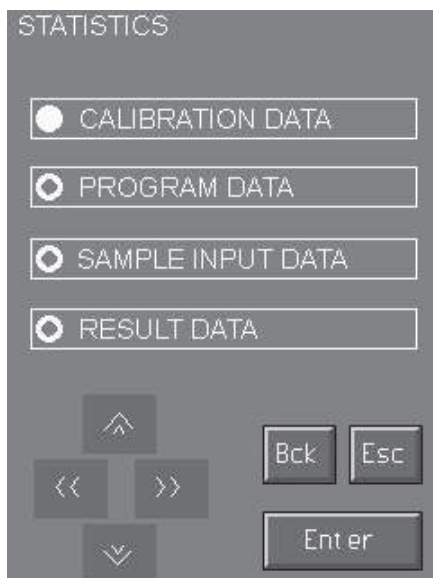
12. Statistics

All data is stored on the built in hard disk in order to have maximum control of all procedures which are relevant for the analysis. They can be activated at any time for documentation and checking. If there is no more storage capacity on the hard disk some data has to be deleted. It can be printed before deletion, transferred to an external PC, or checked on the monitor. A maximum amount of 1000 calibration data and up to 10.000 analysis data can be stored.

The results can be corrected or recalculated subsequently and they are documented as corrected values.

12.1. How to use statistics

1. Press key "Statistics" in the main menu.



Select the data wanted and confirm by pressing "Enter".

Regardless of the selection the following options are given for all statistical data:

- **Print out**
The data selected is printed on a printer
- **Display**
The data selected is shown on the display
- **Delete**
The data selected is deleted
- **Data transfer**
It is possible to transfer the selected data to an external PC. This is necessary eg. if the storage capacity of the hard disk is full. In order to be able to transfer data the LPT1 interface has to be connected to the parallel interface of the external PC.
- **Correction (only if "Results" is selected)**
The data selected is corrected.

12.1.1. Calibration data

- Print out, Display

The actual amount of stored calibration data and the storage location are displayed. Select the processing mode. No matter what processing mode is selected the sequence following is always the same.

Set the time frame which should be worked in. If no frame is given all calibration data stored is displayed. The request is confirmed by pressing "Enter".

- Data transfer

If data transfer is selected a file name is given as well. The first two positions are already defined as **VC** but the remaining 6 positions can be allocated as desired by using the numeric keys. The data transfer is started by pressing "Enter".

12.1.2. Program data

- Print out, Display, Delete

The number of defined programs is displayed. Select the processing mode and confirm by pressing "Enter". No matter which processing mode is selected the sequence is always the same. By pressing the keys "up" or "down" the programs wanted are selected and by pressing the key "right" it is marked resp. by pressing "left" it is demarked. By pressing "Enter" the program data is processed in the defined sequence.

- Data transfer

If data transfer is selected a file name is given as well. The first two positions are already defined as **VP** but the remaining 6 positions can be allocated as desired by using the numeric keys. The data transfer is started by pressing "Enter".

12.1.3. Sample input data

- Print out, Display, Delete

The number of defined series is displayed. Additionally, information about the total number of samples stored in the series is displayed. Select the processing mode and confirm by pressing "Enter". No matter what processing mode is selected the sequence is always the same. By pressing the keys "up" or "down" the programs wanted are selected and by pressing the key "right" it is marked, by pressing "left" it is demarked. By pressing "Enter" the series data is processed in the defined sequence.

- Data transfer

If data transfer is selected a file name is given as well. The first two positions are already defined as **VS** but the remaining 6 positions can be allocated as desired by using the numeric keys. The data transfer is started by pressing "Enter".

12.1.4. Results

- Print out, Display, Delete

The actual number of stored results and the storage location are displayed. Select processing mode and confirm by pressing "Enter". No matter what processing mode is selected the sequence is always the same. Set the time frame which should be worked in. If no frame is given all calibration data stored is displayed. The request is confirmed by pressing "Enter". In order to be able to make a clear choice the starting time of the series is given as well. Only complete series can be selected. It is not possible to select a single result that has been stored in a series.

By pressing the keys "up" or "down" the results needed can be selected and by pressing "right" they are marked, by pressing "left" they are demarked. By pressing „Enter“ the series are processed in the defined sequence.

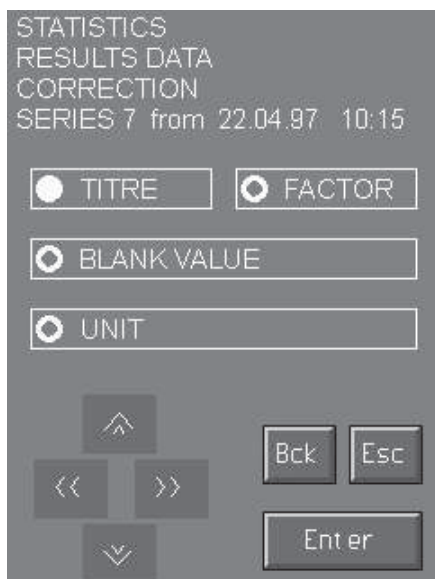
Single determinations are marked with "Series 0". In contrast to the serial determination during the single determination the end of the analysis is displayed and not the starting time.

- Data transfer

If data transfer is selected a file name is given as well. The first position is already defined as **V** but the remaining 7 positions can be allocated as desired by using the numeric keys. The data transfer is started by pressing "Enter".

- Correction

If results are selected in order to be corrected there can be another subdivision of a series. This subdivision is only possible for the blank value and the unit (calculation of the result) but the normality of the titration acid and the factor have to be recalculated for all results of a series. The correction of single results is not possible.



Select option eg. blank value for a series that used several programs.

If "Titre" or "Factor" is selected the actual value is displayed and may be overwritten. Confirm values entered by pressing "Enter".

If "Blank Value" or "Unit" is selected it is important whether one or several programs have been used during the series. If several programs have been used a selection is made by pressing keys "up" or "down". By pressing „right“ they are marked and by pressing "left" they are demarked. Then the value displayed can be simply overwritten.

Corrections are marked as such when printed.

13. Error messages

All functions of the distillation system are controlled continuously. As soon as there is an error it is indicated on the display as well as by an acoustic signal.

In most cases the error message on the display can be erased by gently touching the display. But the error as such is not corrected by doing so. This chapter will inform you what actions to take if there is an error message.

13.1. General error messages

Error message	Actions
<div style="border: 1px solid black; padding: 5px; text-align: center;"> SENSOR STEAM GENERATOR FAULT </div>	Turn off equipment and turn on again. If failure persists consult technical support.
<div style="border: 1px solid black; padding: 5px; text-align: center;"> OVERPRESSURE STEAM GENERATOR </div>	Turn off equipment and turn on again after approx. 15 minutes. If failure persists consult technical support.
<div style="border: 1px solid black; padding: 5px; text-align: center;"> NO H₂O FOR STEAM GENERATOR </div>	Turn off equipment, check tank for H ₂ O, turn on again. If failure persists consult technical support.
<div style="border: 1px solid black; padding: 5px; text-align: center;"> ATTENTION! CORRECT DATE </div>	The battery might be damaged and therefore, the date is overwritten. Type current date. If failure persists consult technical support.

13.2. Error messages during the analysis

Error message	Actions
<div style="border: 1px solid black; padding: 5px;"> ATTENTION! 95 % OF THE MEMORY IS TAKEN. 500 RESULTS CAN BE STORED </div>	The system points out that the storage capacity of the hard disk is nearly taken and only 500 more analysis are possible. By deleting results already stored more storage capacity on the hard disk is available (see chapter 12 "Statistics"). This message has to be confirmed by pressing "Enter".
<div style="border: 1px solid black; padding: 5px;"> ANALYSIS CANNOT BE STARTED FOR RESULTS. MEMORY IS TAKEN COMPLETELY </div>	The results stored on the hard disk have to be deleted in order to provide storage capacity for future results (see chapter 12 "Statistics"). This message has to be confirmed by pressing "Enter".

Error message	Actions
<p style="text-align: center;">NO COOLING WATER</p>	<p>Cooling water pressure < 0,5 bar. Check cooling water inlet. Make sure tap is open completely. Press "Enter" to continue analysis. Press "Stop" to interrupt analysis.</p>
<p style="text-align: center;">RECEIVER HAS OVERFILLED</p>	<p>Analysis is stopped. Empty the receiver (take out glass or start suction manually).</p>
<p style="text-align: center;">NO SAMPLE TUBE</p>	<p>Insert tube and restart by pressing "Enter". If this happens during an analysis it is interrupted.</p>
<p style="text-align: center;">WAIT FOR STEAM</p>	<p>Message disappears as soon as the steam generator has reached the necessary pressure. Start analysis by pressing "Enter".</p>
<p style="text-align: center;">CHECK CHEMICAL RESERVOIRS</p>	<p>If using set of tanks KAN 40 check tanks. If using other tanks, switch off "Chemical Reservoirs" (see chapter 7.6. "Chemical Reservoirs"). The analysis is continued. Error message disappears only after error is corrected.</p>
<p style="text-align: center;">CORRECT TITRE/FACTOR</p>	<p>The defined values for the series in process have to be kept. They can be called up in the main menu "Statistics" (see chap. 12 "Statistics").</p>
<p style="text-align: center;">THE FOLLOWING PROGRAMS HAVE NOT BEEN DEFINED</p>	<p>If a series is called up which uses a program that has been deleted after sample input the program has to be defined again. Call main menu "Programming" and check programming.</p>
<p style="text-align: center;">THE FOLLOWING PROGRAMS HAVE BEEN INCORRECTLY DEFINED</p>	<p>If a series is called up that uses a program in which the units (weights, volumes) have been changed the program has to be defined again. Call main menu "Programming" and check programming.</p>

13.3. Error messages during the calibration

Error message	Actions
<div style="border: 1px solid black; padding: 10px; text-align: center;"> STABILIZATION TIME > 30 S </div>	Check electrode (see instruction leaflet of and if necessary, replace it.
<div style="border: 1px solid black; padding: 10px; text-align: center;"> ASS. POT. > +/- 15 mV </div>	Repeat calibration with new buffer solution or check electrode.
<div style="border: 1px solid black; padding: 10px; text-align: center;"> SLOPE / PH = X TOLERANCE VALUE: (50-70 MV) </div>	Repeat calibration with new buffer solution or check electrode.

13.4. Error messages special functions

Error message	Actions
<div style="border: 1px solid black; padding: 10px; text-align: center;"> DATE / TIME ENTRY INCORRECT </div>	The date of the last storage of results cannot be set earlier than actual date. Check time/date input. If necessary delete stored results.

13.5. Error Messages during the Programming/Sample Input

If the input is not correctly defined or not allowed an error message is displayed during the program.

14. Tubing diagram

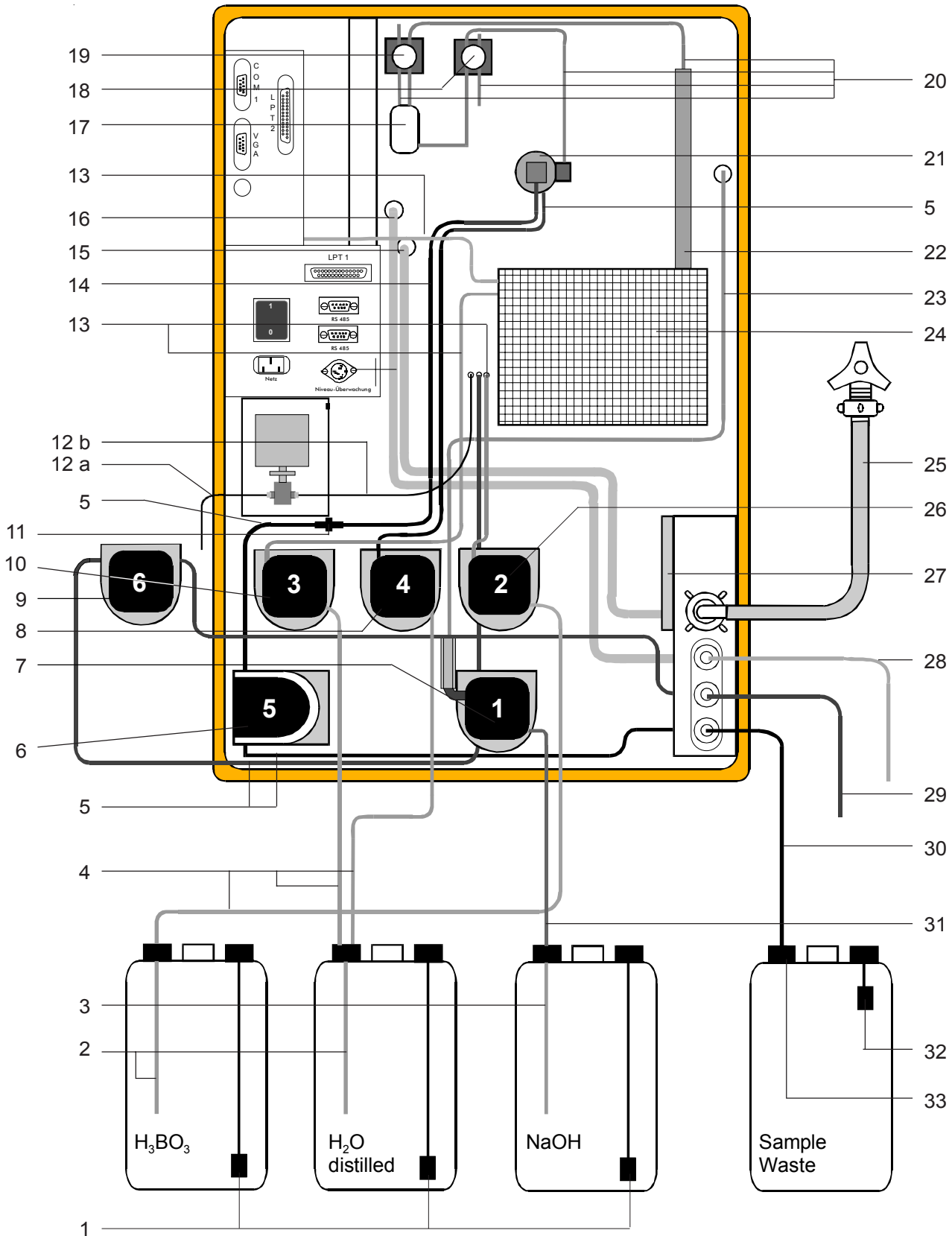


Fig 14.1: Vapodest 50 - Tubing diagram

14.1. Description of the structural components and tubing connections

- 1 Level detector with plug for chemical tanks
- 2 PVC-pipe 6 x 1, 420 mm
- 3 PVC-pipe 10 x 1, 420 mm
- 4 PVC-tubing 4/7
- 5 Verprene-tubing 4/8
- 6 Peristaltic pump suction waste
- 7 Diaphragm pump NaOH
- 8 Diaphragm pump H₂O sample
- 9 Peristaltic pump suction receiver, is behind the diaphragm pump steam generator
- 10 Diaphragm pump H₂O steam generator
- 11 Tubing reduction, PP 51 x 10 x 5
- 12 a PTFE-tubing for micro dosing pump
- 12 b PTFE-tubing for micro dosing pump
- 13 Silicon tubing 4/7
- 14 Verprene-tubing 8/12
- 15 Silicon tubing 8/16, Inlet condenser
- 16 Silicon tubing 8/16, Outlet condenser
- 17 Ventilation glass
- 18 Pinch-solenoid valve, shut-off
- 19 Pinch-solenoid valve, steam
- 20 Novoprene-tubing 4,8 x 1,6 mm
- 21 PP-distributor with PP-thread
- 22 Adapter silicone tubing 6/10 und Reduction
- 23 PTFE-Inlet tubing, NaOH
- 24 Steam generator
- 25 Water inlet tubing 10/17
- 26 Diaphragm pump H₃BO₃
- 27 Magnetic valve cooling water
- 28 Outlet tubing, PVC 8/12
- 29 Verprene-tubing 8/12
- 30 Verprene-tubing 8/12
- 31 PVC-tubing 8/12
- 32 Level detector with plug for "Sample waste" tank
- 33 Knurled knob with socket

15. Maintenance

In case of replacements of parts make sure that only original C. Gerhardt products are used!



15.1. Spare parts and accessories

Parts description	Order No.	
Distillation condenser	7676	<i>Spare Parts</i>
Plastic screw connection for distillation condenser	16609	
Ventilation valve	6474	
Distribution head, PP	7482	
Viton-cone	6470	
PTFE-inlet tubing, steam	11810	
Teflon sieve for 11810	30698	
PTFE-inlet tubing, NaOH	11811	
PP-distributor	50024	
PP-tube joint	17542	
Holder for pH-Electrode	50034	
Level recorder in the receiver	40870	
pH-Electrode	6602	
Propeller	50037	
Receiver	10214	
Screw cap GL 14	16601	
Screw cap GL 18	16602	
Screw cap GL 32	16604	
Silicone-/PTFE seal GL 18	16606	
Silicone-/PTFE seal GL 32	16607	
Silicone seal with connection, straight, for DK/Vap	16609	
Plexiglas protection door, single	19017	
Door handle	18251	
Door hinges, 1 pair	18250	
Rubber foot GF21, self adhesive	17945	
Drip tray, PP	50015	
Mains switch, green, illuminated	11750	
Keyboard	11235	
Excess current switch, 10A	15378	
Heating element	12354	
Steam generator	40850	
Exces pressure valve, steam generator	20604	
Ventilation valve WMF	20620	
Mains cable	1311	
Magnetic valve with pressure control	17109	
Semiconductor relay WG-A5-6D25	15350	
Micro switch for quick clamping device	13308	
Pinch-solenoid valve steam and shut-off	10385	
Ventilation glass	40272	
Diaphragm pump PML 2734 NF 100	10310	
Peristaltic pump	10360	

Parts description	Order No.	
Water inlet tubing 10/17, 2 m	22802	
Silicone tubing 6 x 10	20903	
Silicone tubing 8 x 12	22704	
Silicone tubing 4 x 7	20914	
Silicone tubing 16 x 8	22705	
Novoprene-tubing 4,8 x 1,6	20919	
Verprene-tubing 4 x 8	20920	
Verprene-tubing 8 x 12	20921	
PTFE-tubing 4 x 6 x 135	21902	
Isoversinic-tubing	21918	
Inlet tubing for micro dosing pump (with screw cap)	11812	
Outlet tubing for micro dosing pump (with screw cap)	11813	
Tubing reduction, PP 51 x 10 x 10	50022	
Tubing reduction, PP 51 x 10 x 5	50023	
PVC-tubing 4/7, 2 m	22601	
PVC-tubing 8/12, 2 m	22604	
PVC-pipe 6 x 1, 420 mm	25450	
PVC-pipe 10 x 1, 420 mm	25451	
Set of storage tanks (KAN 50)	7659	
Level sensor with plug for H ₂ O, H ₃ BO ₃ and NaOH-tank	11320	
Level sensor with plug for „Sample waste“ tank	11321	
Level sensor with plug for titration tank	11323	
RS 232/485 Adapter ARS	4260	<i>Interface</i>
Data cable DK 42 for RS 485, 2 m	4261	
Data cable DK 45 for RS 485, 5 m	4262	
Data cable DK 22 for RS 232, 2 m	4264	
Terminator AST	4265	
Viton cone VK, micro, for 100 ml tubes KMT	7671	<i>Micro</i>
PP-distribution head Devarda VPD 7, bottom part	7474	<i>Devarda</i>
Glass distribution head Devarda VGD 7, top part	7475	
Ventilation valve condenser (glass)	30244	
Condenser, shortened	7676	
PP-adaptor	40213	
PP-distribution head distance piece	50025	
Screw cap GL 32, open version	16604	
Silicon-/PTFE seal GL 32	16607	

15.2. Service and cleaning

Condensate that might escape is collected in the drip tray. Please clean the drip tray regularly.

Regularly check the state of the tubing and tubing connections and change if damaged.

To minimize malfunctions of the Vapodest 50, we recommend to have it checked by authorized service personnel regularly.

15.3. Cleaning program

Glass parts and suction pump should be cleaned before long periods of non-usage (i.e. holidays). This way blockages caused by crystalline deposits are avoided.

The following program should be run:

Addition H ₃ BO ₃	0	s
Addition H ₂ O	13	s
Addition NaOH	0	s
Reaction time	0	s
Distillation time	7	min
Steam power	100	%
Suction time	20	s

Place an empty digestion tube and an Erlenmeyer flask into position, and start the program.

In case of extreme deposits in the glassware you can clean the system by putting about 10 ml of sulphuric acid into the digestion tube.

15.4. Trouble shooting

The excess current switch cuts off in case of excessive current consumption. Switch on the excess current switch again. If this problem reoccurs, call service!

In case of breakdown or failure of your extraction unit, **please contact your local dealer or:**

C. Gerhardt GmbH & Co. KG

Bornheimer Straße 100

D-53119 Bonn

Tel.: + 49 (0) 228 / 98179-17 Vertrieb/Office

+ 49 (0) 228 / 98179-16 Service

Fax: + 49 (0) 228 / 98179-60

e-mail: Info@Gerhardt.de

Subsidiaries:

C. Gerhardt UK Ltd.

Unit 5, Avonbury court, County Road, Brackley,
Northants NN13 7AX

Tel.: 0044-1280-706772

Fax: 0044-1280-706088

e-mail: Info.Gerhardt@pop3.hiway.co.uk.

C. Gerhardt France s.a.r.l.

9, rue du 11 novembre
78690 Les Essarts le Roi

Tel.: 0033-1-30464100

Fax: 0033-1-30464101

e-mail: gerhardt@wanadoo.fr

16. Other

Calculation of the results

T = Titer

F = Factor

1) % N (Percent nitrogen)

$$\% N = \frac{1,4007 \times T \times F (\text{Consumption [ml]} - \text{Blank value [ml]})}{\text{Content [g]}}$$

2) % Protein = $\frac{\text{Factor protein} \times 1,4007 \times T \times F (\text{Consumption [ml]} - \text{Blank value [ml]})}{\text{Content [g]}}$

3) % NH₃ = $\frac{1,7031 \times T \times F (\text{Consumption [ml]} - \text{Blank value [ml]})}{\text{Content [g]}}$

4) % NH₄⁺ = $\frac{1,8039 \times T \times F (\text{Consumption [ml]} - \text{Blank value [ml]})}{\text{Content [g]}}$

5) mg NH₄⁺ = T x F (Consumption [ml] - Blank value [ml]) x 18,039

6) mg NH₃⁺ = T x F (Consumption [ml] - Blank value [ml]) x 17,031

7) % NO₃⁻ = $\frac{6,2005 \times T \times F (\text{Consumption [ml]} - \text{Blank value [ml]})}{\text{Content [g]}}$

8) mg NO₃⁻ = 62,005 x T x F (Consumption [ml] - Blank value [ml])

9) mg N/l = $\frac{14007 \times T \times F (\text{Consumption [ml]} - \text{Blank value [ml]})}{\text{Volume [ml]}}$

10) g N/l = $\frac{14,007 \times T \times F (\text{Consumption [ml]} - \text{Blank value [ml]})}{\text{Volume [ml]}}$

11) mg NH₃/l = $\frac{17031 \times T \times F (\text{Consumption [ml]} - \text{Blank value [ml]})}{\text{Volume [ml]}}$

12) g NH₃/l = $\frac{17,031 \times T \times F (\text{Consumption [ml]} - \text{Blank value [ml]})}{\text{Volume [ml]}}$

13) mg NH₄⁺/l = $\frac{18039 \times T \times F (\text{Consumption [ml]} - \text{Blank value [ml]})}{\text{Volume [ml]}}$

14) g NH₄⁺/l = $\frac{18,039 \times T \times F (\text{Consumption [ml]} - \text{Blank value [ml]})}{\text{Volume [ml]}}$

15) mg NO₃⁻/l = $\frac{62005 \times T \times F (\text{Consumption [ml]} - \text{Blank value [ml]})}{\text{Volume [ml]}}$

16) g NO₃⁻/l = $\frac{62,005 \times T \times F (\text{Consumption [ml]} - \text{Blank value [ml]})}{\text{Volume [ml]}}$