Gerhardt

Vapodest 45s

Programmable rapid distillation system

with external titration

Instruction Manual

Please read this instruction manual with care before you start operating the system!

Please observe the safety instructions of this manual marked with ⚠ in order to avoid any dangerous handling!

Vap 45s
01. December 2008_D

LAB Online Exhibition

Operation Manual

knowledge

Action movie

www.1788lab.com E-mail:info@1788lab.com

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Content

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Content

1 Important notes

1.1 How to use this instruction manual

Please make sure that the persons working with the Vapodest have read and understood this manual in order to observe all the instructions.

This instruction manual must be accessible to all users at any time and is a part of the Vapodest system!

The instrument will be called "Vapodest 45s" in the entire document.

This instruction manual only explains the technical details necessary for the operation of the instrument but is NOT a complete technical description.

The security advises given in this manual have to be observed under all circumstances! The symbols at the border of the text emphasize the dangers cited in the text.

Symbols at the instrument warn of possible dangers and will refer you to this manual!

1.2 Explanation of symbols

Attention!
Advance notice of danger spots, carefully read instruction manual!

Attention!
Read instruction manual!

Attention!
Hot surface!

Attention!
Use eye protection!

Attention!
Mains voltage!

Attention!
Use protective gloves!

Attention!
Beware of hot liquids and vapours!

Notice!
Important information!

Attention!
Advance notice of substances which might be a health risk or cause irritation!

2 Safety

2.1 Operation as directed

With the Vapodest 45s you have purchased an automatic distillation system for the steam distillation e.g. of Kjeldahl digestions and associated distillations. Automatic addition of H_2O, NaOH and H_3BO_3 as well as removal of the sample remains after distillation by suction. The distillation system is prepared to work with an external titrator.

Make sure to use the instrument according to our instructions, especially:
- all instructions of this manual
- the regulations in place in the country the instrument is used

All other usage is not recommended!

C. Gerhardt GmbH & Co. KG is not liable for any damages caused due to non recommended usage
- no modifications are allowed for safety reasons
- repairs of electric, electronic or mechanical components may only be done by authorized personnel!

2.2 Safety instructions

The Vapodest 45s corresponds to the technical standard used at this date and observes the safety rules and regulations in place.
It is understood that the user has to observe
- the accident prevention regulations in place
- the general accident prevention regulations
- EU-regulations or other country specific instructions

Indicating label and danger symbols must not be taken off!

Alle engineered safeguards must not be taken out of operation!

Make sure that no liquid gets into contact with cable connections or the interior of the electrical parts of the unit!
- Danger of electric shock!

In case of an emergency disconnect from mains immediately!

Always pull the mains plug before opening!
- Danger of electric shock!

Prior to each start, make sure that the protection door is closed tightly.
Danger of burns and splashing liquids!

Make sure to wear protective gloves when taking the digestion tubes out and wear protective glasses as well.
The digestion tubes are very hot and there is the danger of burns!

Attention when handling chemicals! Please observe the manufactures safety instructions (see label) and your national safety regulations!

2 Safety

2.3. Work bench / Authorized user

The Vapodest 45s must not be run in damp or hazardous location. The maximum humidity allowed is 80 %, the maximum room temperature must not exceed 35 °C!

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

The Vapodest 45s has to be placed on a horizontal and stable footprint.

The Vapodest 45s may only be operated by trained staff or specially trained persons.
The user has to:

- read, comprehend, and observe the operation manual
- wear suitable clothes for laboratory work
- deny access to any unauthorized personnel

2.4. Danger spots at the instrument

- Attention, danger of burns on the surface of the digestion tubes!

- Attention, danger of splashing hot or caustic liquids at the tubing connections at the back of the instrument!

- Attention, danger of burns when taking out the hot glass container!
  Use gloves when removing the glass digestion tubes!

3 Technial description

3.1. Warranty conditions

Vapodest 45s 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 12 months as long as the equipment is used according to the instructions in this manual. Also fill in the "Report for the installation and initial operation" and return it to C. Gerhardt.

Please note that the following parts are excluded from warranty.
- Digestion tube, Order-no.: 1002178
- Vitone cone, Order-no.: 12-0351

3.2. Technical data

Nominal voltage:	230 V AC, 50 Hz or 115 V 60 Hz or 230 V 60 Hz
Nominal wattage:	1600 W
Cooling water consumption:	about 5 liters per distillation minute
Cooling water pressure:	min. 0,5 bar, max. 6 bar
Pump capacity (read chapter 6.3.2. Calibration dosing pumps)	
- Diaphragm pump	about 15 ml/s with water about 10 ml/s with NaOH
- Peristaltic pump	about 10 ml/s with water
Storage tanks:	any size, recommended: Set of storage tanks KAN 40
Display:	LED with illumination
Programs:	20
Dimensions:	440 x 690 x 340 mm (W x H x D)
Weight:	29 kg
Interfaces:	
- Vapodest	2 x RS 485 interface: Connection for GerBus® 1 x RS 232 interface: Connection for titrator 1 x 5-pin connector for level sensor storage tanks

4 Assembly and Installation

4.1. Check for transport damage

Before assembling the apparatus please check if the content of the box is complete and intact!

In case of any damage, please notify your carrier (post, rail, road) as well as your supplier!

4.2. Unpack apparatus and set up

The VAPODEST must not be run in damp or hazardous location. The maximum humidity allowed is 80 %, the maximum room temperature must not exceed 40 °C!

There should be sufficient space for the set of tanks below the work bench.. Make sure, however, that those tanks are not higher than the Vapodest!

You need a connection (cold water pipe) with 1/2 inch thread to connect it to the water supply.

Make sure to take a faucet, which can be connected to the inlet tubing permanently. The water pressure must be at least 0,5 bar in order to activate the integrated pressure detector.

Please observe the local water and waste regulations and those of your public water supply company! Please note that the length of the inlet and outlet tubing is restricted to 2 metres.

The VAPODEST 45s distillation system comes fully pre-assembled. Please unpack the equipment with care !

1. Place the equipment on a stable work bench.

2. Unpack accessories

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

4 Assembly and Installation

4.3. Package list

1 x Distillation system Vapodest 45s, complete mounted

1 x Water inlet tube 10/17 mm with connections of 1/2 inch and 3/4 inch, 2m Item-No. 1000394

1 x Verprene-tube 8/12, 2 m, Item No. 1000499

3 x PVC-tube 4/7, 2 m, Item-No. 1000500

3 x PVC-tube 8/12, 2 m, Item-No. 1000047

3 x PVC-pipe 6 x 1, 400 mm, Item-No. 1000566

1 x PVC-pipe 10 x 1, 400 mm, Item-No. 1000567

1 x Mains cable, Item-No. 10-0048

1 x Kjeldatherm-digestion tube, 250 ml, Item-No. 12-0301

1 x Instruction manual

1 x Test report

1 x Installation report

Optional:

1 x Titrator Titro Line easy, Item-No. 12-0054

1 x pH-Electrode with screw plug connection, Item-No. 12-0355

1 x Electrode cable DIN Vap 45, Item-No. 1002170

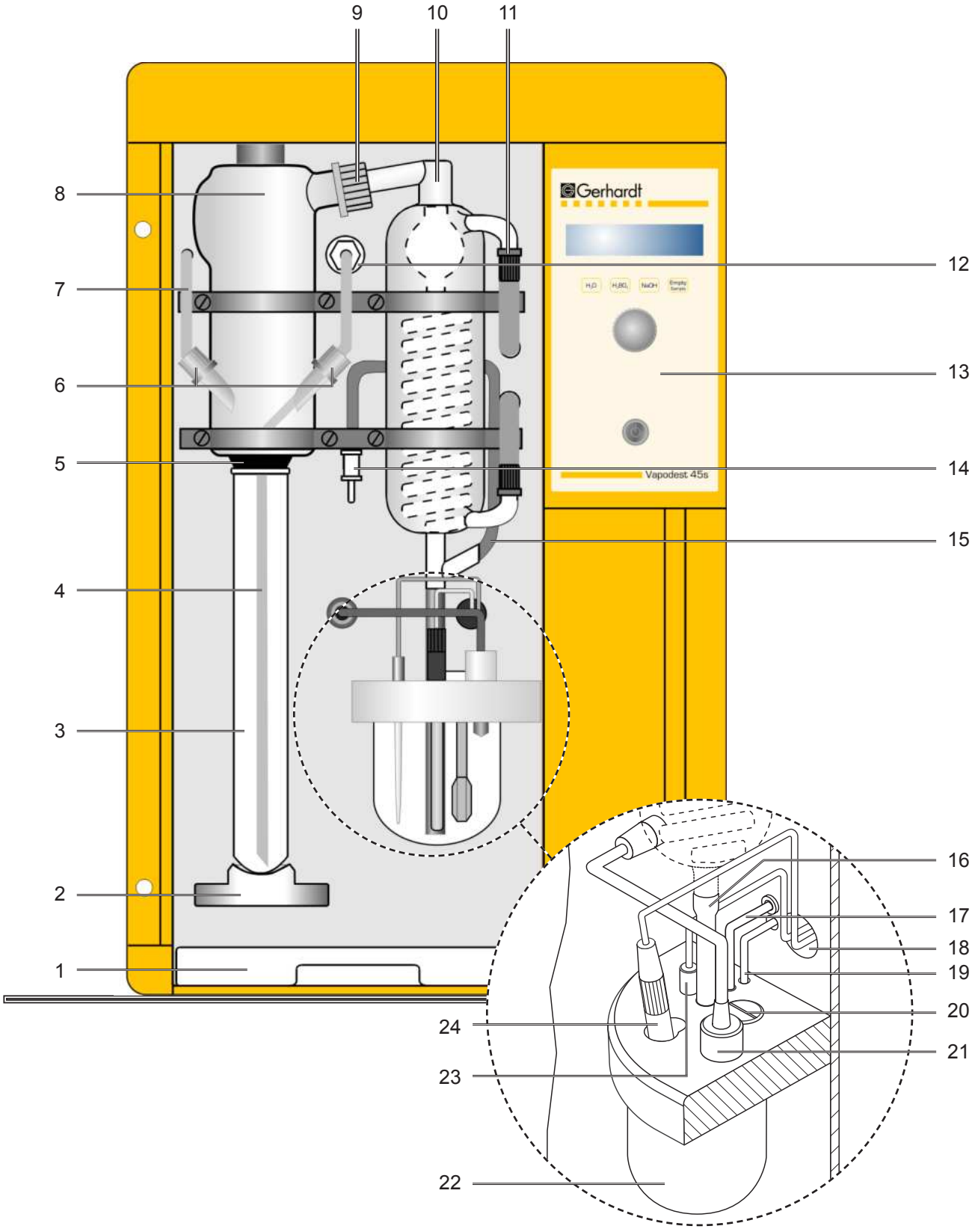
1 x Buffer solution pH 4, 250 ml, Item-No. 1000176

1 x Buffer solution pH 7, 250 ml, Item-No. 1000177

1 x KCL-Electrolyte solution, 250 ml, Item-No. 1000178

4 Assembly and Installation

4.4 Front view Vapodest 45s - Version with titration



4 Assembly and Installation

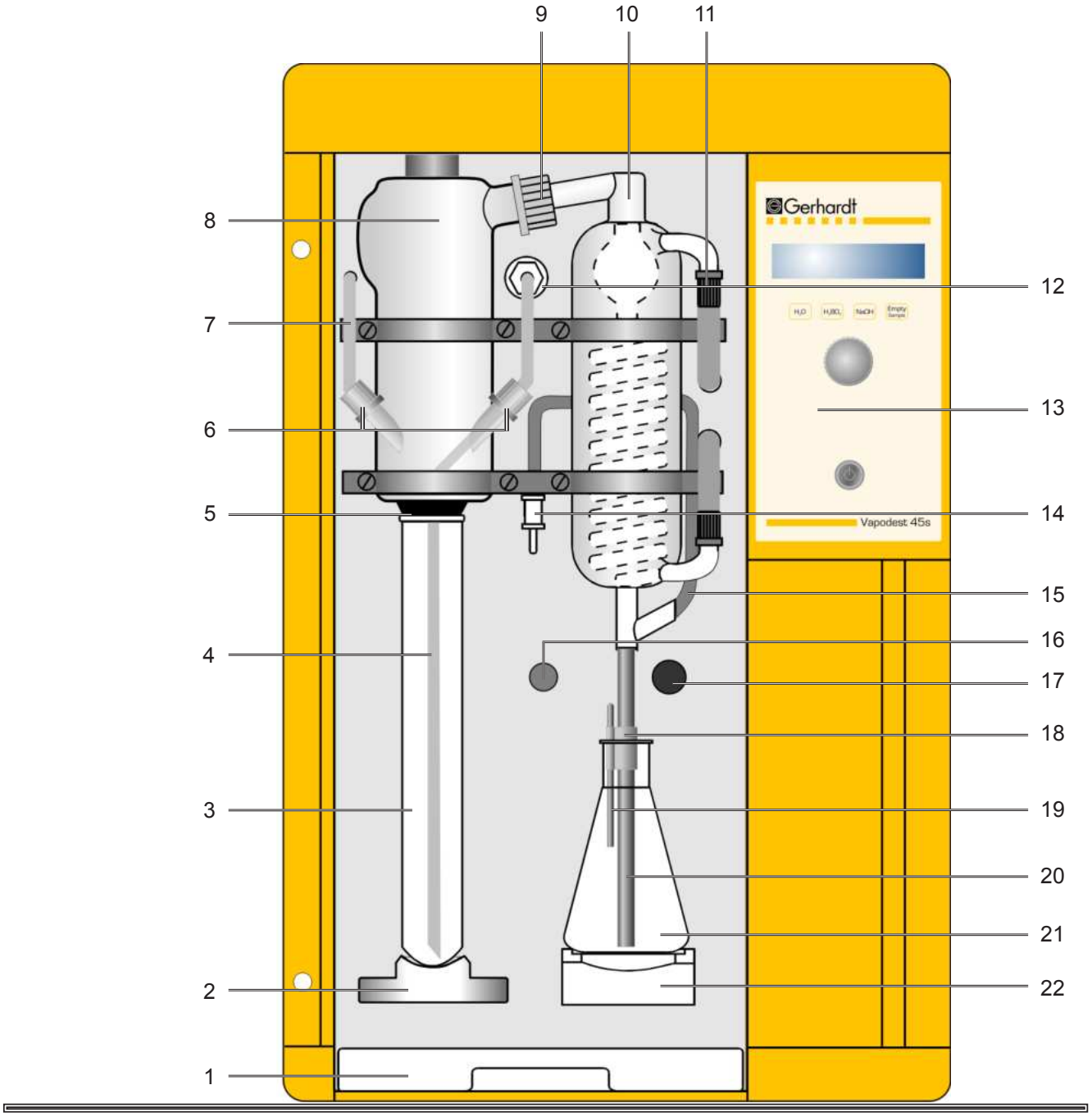
4.4.1. Description of front view with titrator

1 **Drip tray, Item-No. 1000399**
Condensate which might drip is collected in the drip tray.
2 **Quick clamping device with wedge, Item-No. 1000537**
Press down the quickclamping device in order to insert digestion tube.
3 **Kjeldatherm-digestion tube, Item-No. 12-0301**
Special glass with cut, 250 ml
Also applicable, flask with enlarged neck 250/500/750 ml or KDD 400/800 ml.
4 **PTFE-inlet tubing steam, Item-No. 1002178**
Steam, water for dilution, and the suction of the sample residues passes through here. Please check regularely that the opening of the PTFE-tube is not blocked by crystallisation.
5 **Viton cone, Item-No. 12-0351**
Macro for 250 ml tubes or micro for 100 ml tubes
6 **Screw cap GL 18, Item-No. 1004321**
with silicone/PTFE seal
7 **PTFE-inlet tubing, NaOH, Item-No. 1003401**
Sodium hydroxide solution enters here.
8 **Distribution head glass, Item-No. 12-0363**
Distribution head prevents that any sample residue gets into the receiver.
9 **Screw cap GL 32, Item-No. 1004322**
with silicone/PTFE seal
10 **Distillation condenser, Item-No. 1000058**
Combined ball- and coil condenser with high cooling power.
11 **Screw cap GL 14, Item-No. 1004320**
with plastic screw connection
12 **PP-Distributor with PP-threaded joint, Item-No. 1000538**
13 **Control panel Vapodest**
See chapter 5.2. Control panel Vapodest".
14 **Ventilation valve, Item-No. 1000036**
During and after distillation the ventilation valve prevents suck back of the receiver solution into the condenser.
15 **Tube for ventilation valve, Item-No. 1000484**
Connection to ventilation valve.
16 **Distillate outlet tubing, Silicone 8/12, Item-No. 1000496**
17 **Tubing for suction of the distillate, Item-No. 1000498**
18 **Wall duct for titration hose and electrode cable**
19 **Inlet tubing for boric acid, Item-No. 1000488**
20 **Stirring motor, Item-No. 1001266 with propeller, Item-No.1001260**
21 **Sensor for level detection with conection, Item-No. 1001265**
The built-in sensor stops the program if the receiver vessel overfills during the distillation and titration.
22 **Receiver vessel, Item-No. 1001269**
For easy removal turn the glass for 90° and pull it downwards.
23 **Inlet tubing for titration acid (with cone)**
24 **pH-electrode, Combined electrode with screw thread.**
Item-No. 12-0355
For further details please check the enclosed instructions by the electrode's manufacturer.

** **Protection door (not illustrated) - Item-No. 1001263**
Whenever you run the distillation system make sure you shut the protection door!

4 Assembly and Installation

4.5 Front viewVapodest 45s without titration



4 Assembly and Installation

4.5.1. Description to front view without titration

1 **Drip tray, Item-No. 1000399**
Condensate which might drip is collected in the drip tray.

2 **Quick clamping device with wedge, Item-No. 1000537**
Press down the quickclamping device in order to insert digestion tube.

3 **Kjeldatherm-digestion tube, Item-No. 13-0301**
Special glass with cut. 100/250 ml or flask with enlarged neck 250/500/750 ml or KDD 400/800 ml.

4 **PTFE-inlet tubing steam, Item-No. 1002178**
Steam, water for dilution, and the suction of the sample residues passes through here. Please check regularely that the opening of the PTFE-tube is not blocked by crystallisation.

5 **Viton cone, Item-No. 12-0351**
Macro for 250 ml tubes or micro for 100 ml tubes

6 **Screw cap GL 18, Item-No. 1004321**
with silicone/PTFE seal

7 **PTFE-inlet tubing, NaOH, Item-No. 1003401**
Sodium hydroxide solution enters here.

8 **Distribution head glass, Item-No. 1000057**
Distribution head prevents that any sample residue gets into the receiver.

9 **Screw cap GL 32, Item-No. 1004322**
with silicone/PTFE seal

10 **Distillation condenser, Item-No. 1000059**
Combined ball- and coil condenser with high cooling power.

11 **Screw cap GL 14, Item-No. 1004320**
with plastic screw connection

12 **PP-Distributor with PP-threaded joint, Item-No. 1000538**

13 **Control panel Vapodest**
See chapter 5.2. Control panel Vapodest".

14 **Ventilation valve, Item-No. 1000036**
During and after distillation the ventilation valve prevents suck back of the receiver solution into the condenser.

15 **Tube for ventilation valve, Item-No. 1000484**
Connection to ventilation valve.

16 **Interface for stirrer motor / level detection**
Optional - for the connection of an external titrator

17 **Wall duct for titration hose and electrode cable**
Optional - for the connection of an external titrator

18 **Holder PVC for H_3BO_3-tube, Item-No. 1000654**

19 **Inlet tubing for boric acid, Silicon 4 x 7, Item-No. 1000488**

20 **Distillate outlet tubing, Silicone 8/12, Item-No. 1000496**

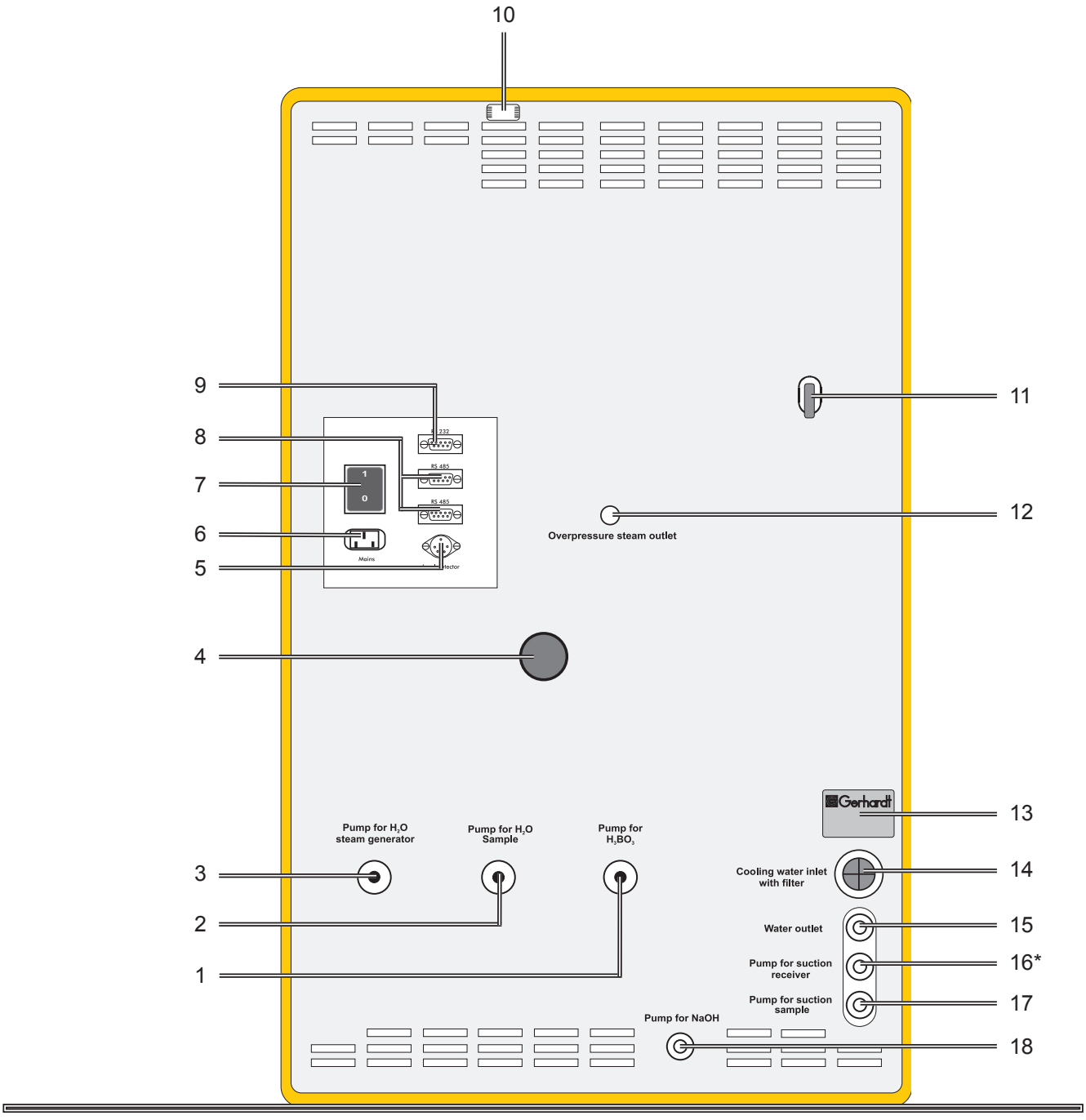
21 **Erlenmeyer flask or other vessels (not included in delivery)**

22 **Platform - Item-No. 1001871**
can be unscrewed if external titrator is used

** **Protection door (not illustrated) - Item-No. 1001263**
Whenever you run the distillation system make sure you shut the protection door!

4 Assembly and Installation

4.6 Rear view Vapodest upper part



* only Vap 45 with external titrator

4 Assembly and Installation

4.6.1. Description of rear view upper part

1 **Diaphragm pump for H_3BO_3 - Item-No. 1001736**
Connection pipe for PVC-tubing 4/7, connection to the storage tank "H_3BO_3"
2 **Diaphragm pump for H2O sample, Item-No. 1001736**
Connection pipe for PVC-tubing 4/7, connection to the storage tank "H_2O".
3 **Diaphragm pump for H2O steam generator, Item-No. 1001736**
Connection pipe for PVC-tubing 4/7, connection to the storage tank "H_2O".
4 **Wall duct**
Duct for the titration liquid tube as well as the cable for the electrode (only by using with titrator).
5 **Level detector**
Connector for diode plug, 3-pin (level detector for set of storage tanks)
6 **Appliance plug for mains cable**
The enclosed mains cable is plugged in here
7 **Excess current switch, 10A,**
Equipment is cut off automatically if there is excess current
8 **2 x Interface RS 485**

9 **Interface RS 232**
Prepared to take the external titrator.

10 **Outlet ventilation tubing (protected)**
Ventilation for steam generator, here hot steam can escape
11 **Excess pressure - steam outlet**
Safety device to let steam escape in case of overpressure in the boiler.
12 **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. See also eror message in chapter 9.
13 **Identification plate with serial number of the instrument**
Please make sure to always refer to the serial number in any case of service problem.
14 **Cooling water inlet with sieve, Item-No. 1000363**
Anschlussgewinde 3/4 Zoll für Wasserzulaufschlauch 10/17.
15 **Water outlet**
Connection pipe for PVC-tubing 8/12, connection to water outlet
16* **Peristaltic pump for receiver, Item-No. 1000084**
Connection pipe for PVC-tubing 8/12, connection to water outlet
17 **Peristaltic pump for sample suction, Item-No. 1000084**
Connection pipe for Verprene-tubing 8/12, connection to storage tank "Sample waste".
18 **Diaphragm pump for NaOH, Item-No. 1001738**
Connection pipe for PVC-tubing 8/12, connection to storage tank "NaOH"

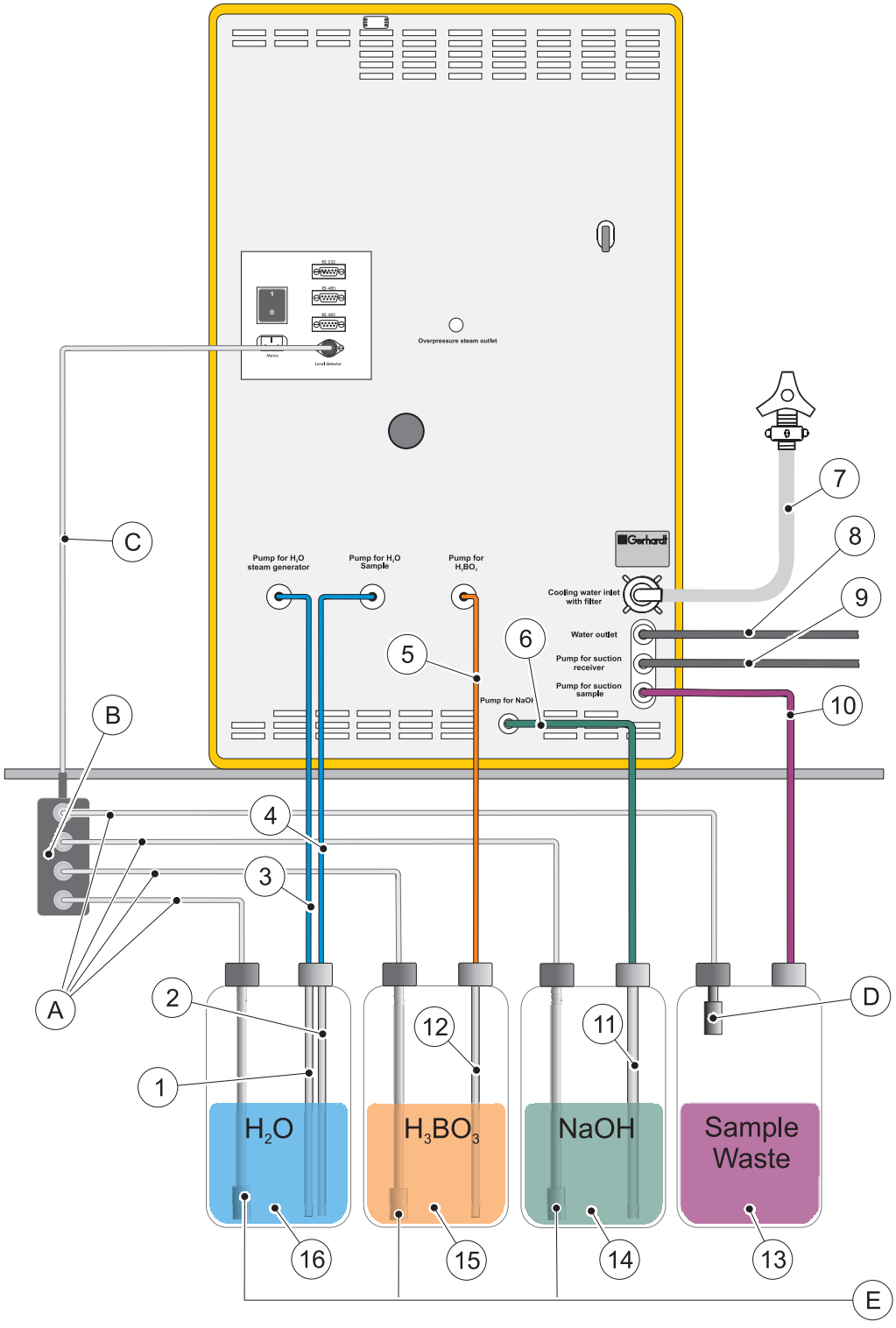
* only Vap 45 with external titrator

4 Assembly and Installation

4.7. Tubing connections

When establishing the tubing connections, make sure to observe the labeling of the connection at the rear of the instrument.
Set up store tanks for distilled water, sodium hydroxide solution, boric acid solution, and sample waste under the work bench.

Fig. 5.4.a Tubing diagram (with set of storage tanks KAN 40, optional)



4 Assembly and Installation

Description to tubing connections (Fig. 5.4.a)

1	PVC-pipe 6 x 1 mm, 400 mm long
2	PVC-pipe 6 x 1 mm, 400 mm long
3	PVC-tubing 4/7, 2 m, inlet H_2O steam generator
4	PVC-tubing 4/7, 2 m, inlet H_2O sample
5	PVC-tubing 4/7, 2 m, inlet H_3BO_3
6	PVC-tubing 8/12, 2 m inlet NaOH
7	Cooling water inlet tubing 10/17, 2 m lang
8	PVC-outlet tubing 8/12, 2 m, for cooling water (place into a drain)
9*	PVC-outlet tubing 8/12, 2 m, for receiver (place into a drain) *only for models with external titrator
10	Verprene-tubing white 8/12, 2 m for sample waste
11	PVC-pipe 10 x 1 mm, 400 mm long
12	PVC-pipe 6 x 1 mm, 400 mm long
13	Storage tank 20 l, for sample waste
14	Storage tank 20 l, for NaOH (Reagent)
15	Storage tank 20 l, for H_3BO_3
16	Storage tank 20 l, for H_2O

Connection of set of storage tank KAN 40 / KAN 50

A	4 x connection cable from level detection tank to distribution box
B	Distribution box with 4 plugs (KAN 50 with 5 plugs)
C	Connection cable from distribution box to socket level detection Vapodest
D	Level sensor with plug for sample waste tank, complete
E	Level sensor with plug for chemicals tank, complete

Fill tanks with chemicals:

- H_20 distilled or demineralizedt
- e.g. H_3BO_3 2 - 4 %
- e.g. NaOH 32%
- Titration acid

4.8. Mains connection Vapodest

Please check the nominal voltage on the product information plate before connecting to the mains. Should the nominal voltage deviate for more than +/- 10%, then you must contact your service engineer.

- Connect the mains cable with the rear appliance plug and the shockproof socket

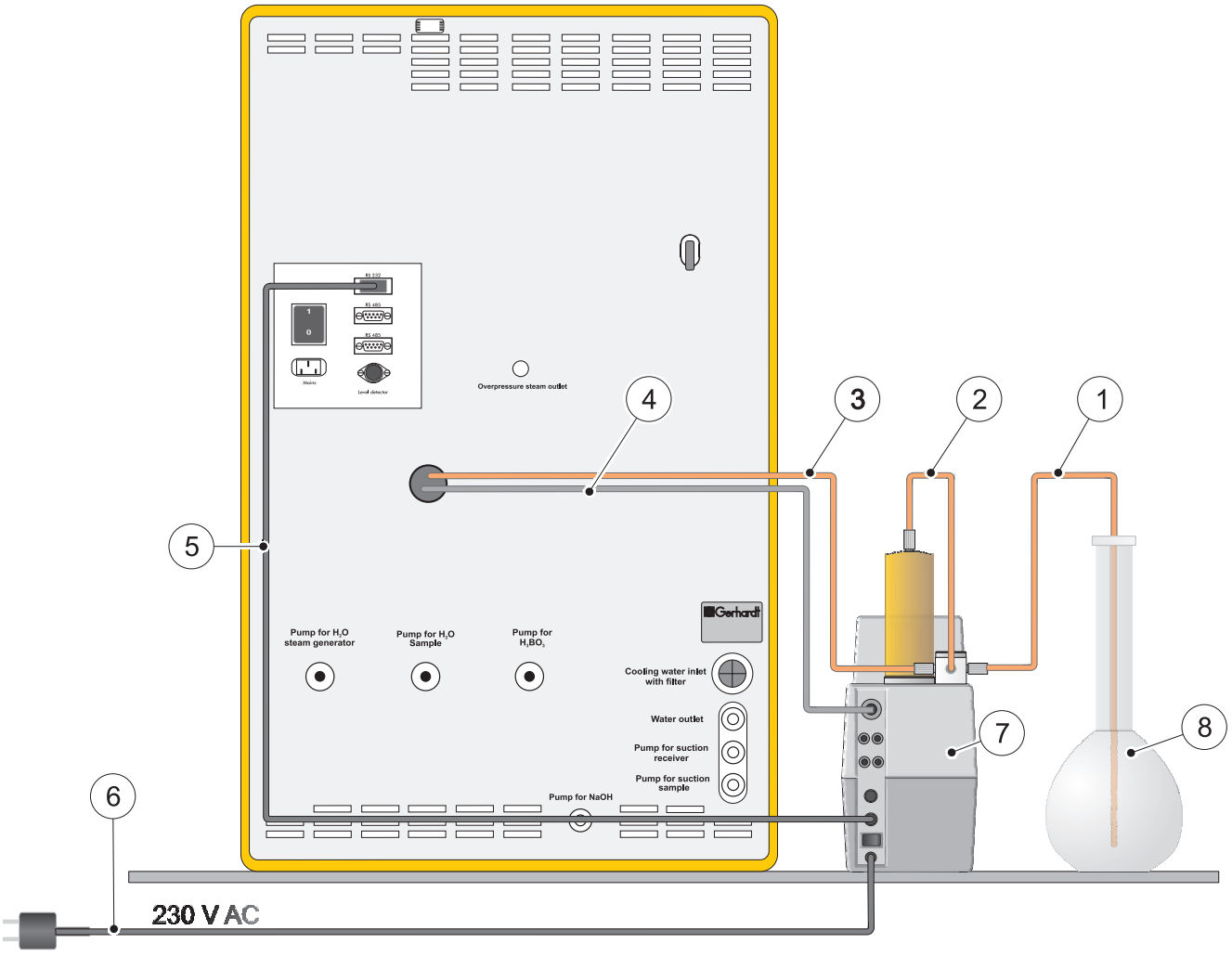
- Check if excess current release at the rear (chapter 4.6., pos. 7) of the equipment is in position „1“. This switch turns the equipment off when it takes too much current.

4 Assembly and Installation

4.9. Connection of titrator and electrode

The illustration shows the connection with titrator type Schott TL easy.

Fig. 5.6.a. Connection of titrator and electrode, rear view



Description of the tubing connections

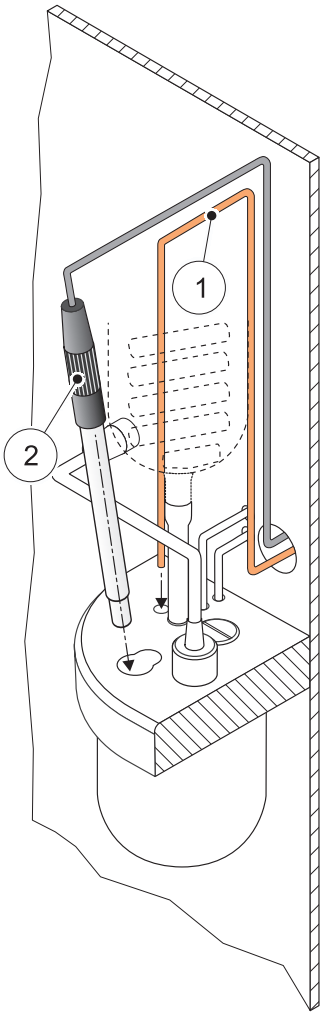
1 Titration tube, connection from titrator to titration acid
2 Titration tube, connection from buret to distributor (t-piece)
3 Titration tube, connection from titrator to Vapodest
4 Electrode cable, connection of electrode
5 Interface cable RS 232
6 Mains cable
7 Titrator Schott TL easy
8 Flask with titration acid

4 Assembly and Installation

4.9.1. Connection of the external titrator

Please, make sure to study the enclosed instruction manual before using the titrator!

Fig. 5.6.b.
Connection electrode and titration tube in the receiver



1. Set up titrator:
   - Unpack titrator with utmost care and place titrator next to Vapodest.

2. Connect the titration tubes
   Using utmost care, slide the tip of the titration tube (pos. 1) through the opening till it makes contact with the titration cell. Make sure that after the titration cell is filled, the tip must be immersed completely.
   Guide the other end of the titration tubing from the front of the instrument to the titrator.

3. Connect the interface cable with the interface RS 232 of the Vapodest.

4. Provide mains connection for the titrator

4.9.2. Connection of the electrode

Please, make sure to study the enclosed instruction manual before using the electrode!

1. Unpack electrode (pos. 2) with utmost care and connect it with the electrode cable.

2. Insert the electrode carefully through the opening into the titration cell till the limit stop.

3. The electrode cable has to be guided through the wall duct from the front of the instrument. Then, connect it to the previewed connection for the titrator

Notice:
The electrode has to be **calibrated regularly**. Please follow the instruction manual of the titrator.

5 Turn on apparatus and operation

5.1. Turn on apparatus

Always close the protection door before operating the distillation unit!

1. Turn on tap completely.
2. Turn on titrator
3. Start Vapodest by turning the mains switch on.

   The display shows the number of the current software version and the actual status.

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.

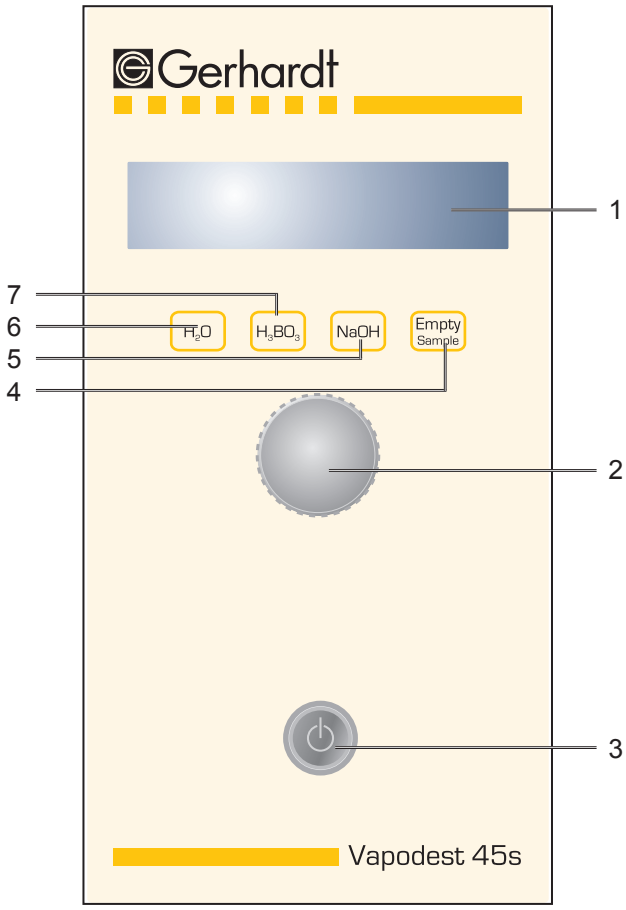
4. After the system is ready, the display shows the following message:

5. Now you can enter further system settings or start an already entered program. Make sure to read the next chapter!

5 Turn on apparatus and operation

5.2. Control panel Vapodest

Fig. 6.1:
Operator panel
Vapodest 45s



1. **Display**
Shows the current status of the instrument

2. **Operator button**

Turn the operator button = select menu or increase respectively lower the amount

Press the operator button = confirm selection

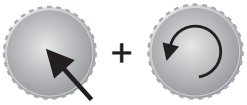
3. **Mains switch**
Turn instrument on or off

4. **Key "Empty Sample"**
Manual suction sample tube

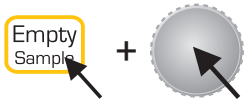
5. **Key "NaOH"**
Manual addition NaOH

6. **Key "H_2O"**
Manual addition H_2O

7. **Key "H_3BO_3"**
Manual addition H_3BO_3



Keep the push button pressed and turn it back in counter clockwise direction **= back to main menu (exit function)**

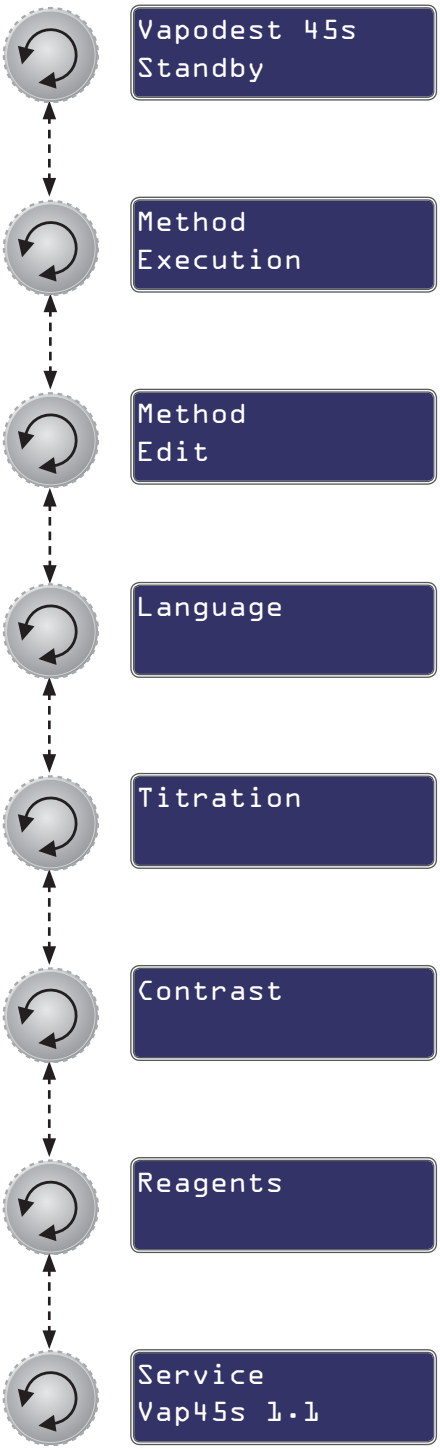


Press key 'Empty Sample' and push button simultaneously = **manual suction of receiver (only for Vap 45s version with external titrator)**

5 Turn on apparatus and operation

5.3. Main menus Vapodest

From the initial menu you get to the main menus by turning the multi functional push button.



- **Initial window**
  Will always show up when starting the Vapodest

- **Run method**
  Start programmed method for analysis.
  For detailed info please see in **chapter "8. Execution of method".**

- **Create a method**
  Create and administrate up to 20 methods.
  For detailed info please see in **chapter "7. Edit methods".**

- **Language**
  Select system language.
  For detailed info please see in **chapter "6.1. Selection of languages".**

- **Titration**
  Settings for titrations with titrator
  For detailed info please see in chapter "6.5. Titration".

- **Contrast**
  Setting the contrast of the display.
  For detailed info please see in chapter "6.2. Contrast".

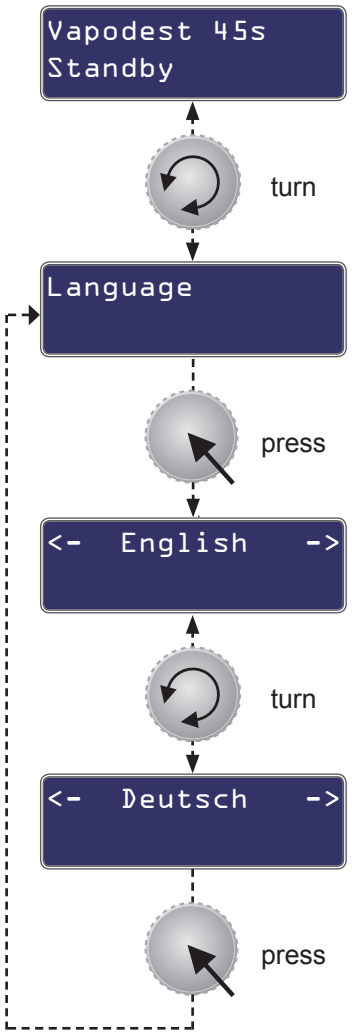
- **Reagents**
  Set level sensor in tank and calibrate pumps.
  For detailed info please see in **chapter "6.3. Reagents".**

- **Service**
  Statistical information about e.g. total analysis time, total time that pumps worked
  For detailed info please see in **chapter ‚6.4. Service'**.

6 System settings

In this chapter the basic functions for Vapodest are explained. For standard procedures it is sufficient to determine these functions once when the instrument is taken into use for the first time.

6.1. Select language



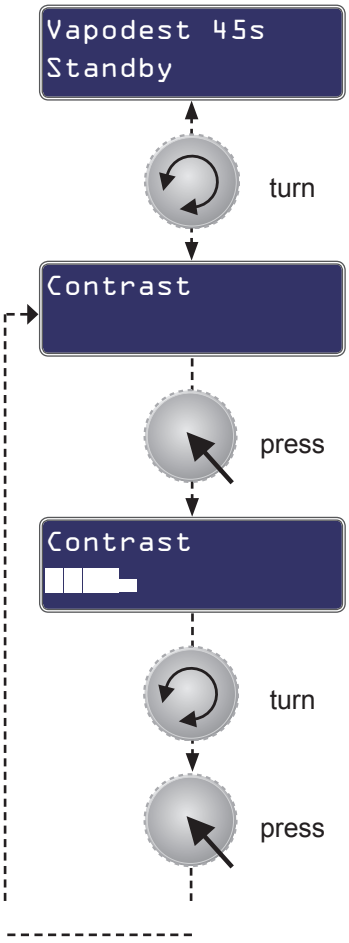
- Selection:
  German, English, French
- More languages on request

6 System settings

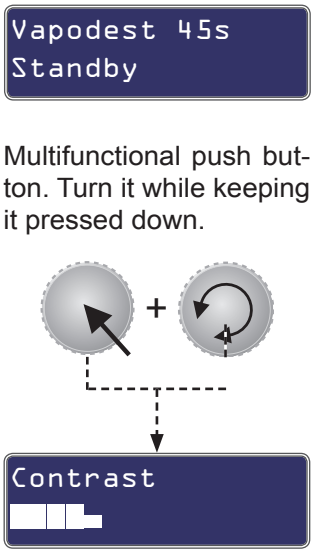
6.2. Setting contrast

From the initial window, there are 2 options to set the contrast.

1. Option
Via main menu



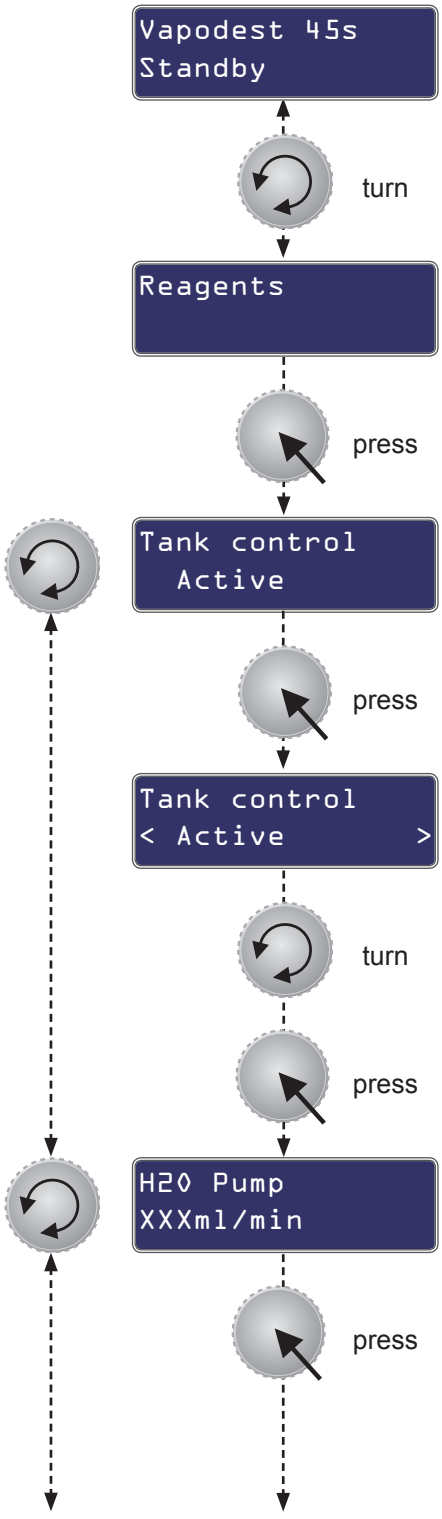
2. Option
Using the combination of keys



6 System settings

6.3. Reagents

Menu for setting the level control in the tank and calibrating the pumps.
The delivery rate of the pump depends on the viscosity of the chemicals used, the delivery height and various other conditions. Thus, you must calibrate the dosing pumps prior to the first operation or whenever the chemicals used are changed.



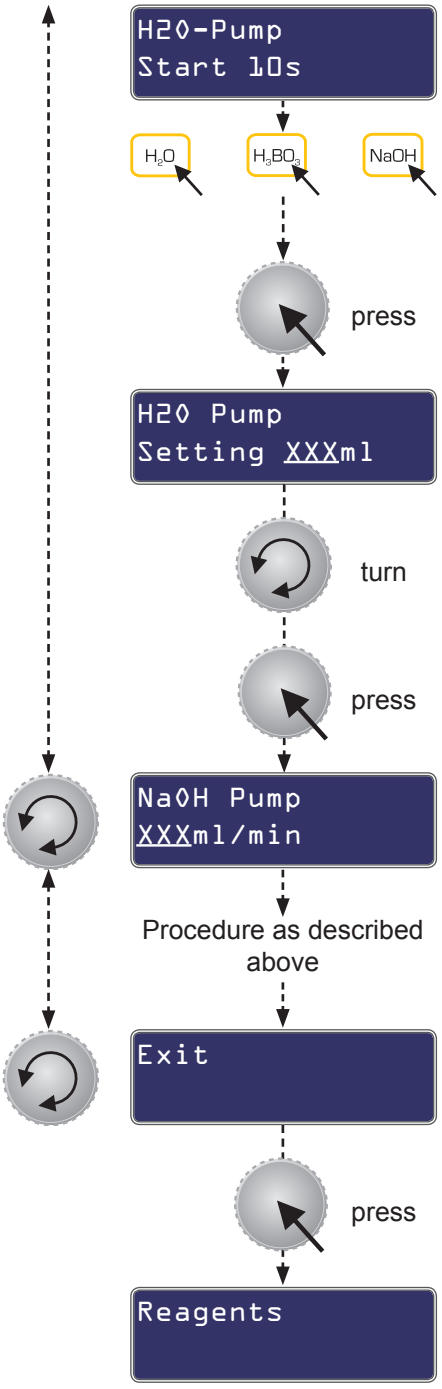
6.3.1. Set level sensor for tank

- **Active** when using set of tank with level sensor (e.g. with KAN 40/ KAN 50)
- **Not active** when using other tank sets

6.3.2. Calibrate dosing pumps

The calibration of the pump can only be done if you put in an empty digestion tube. Make sure that the tanks are filled with the respective chemicals.

6 System settings



1. Push quick clamping device down and put in **empty digestion tube**.

2. Aerate tubings
   Press Vapodest-key **H_2O, H_3BO_3 and NaOH** till liquid accumulates in the digestion tube or receiver.

3. Empty digestion tube and then put it in again.

4. Press operator button to start the process.

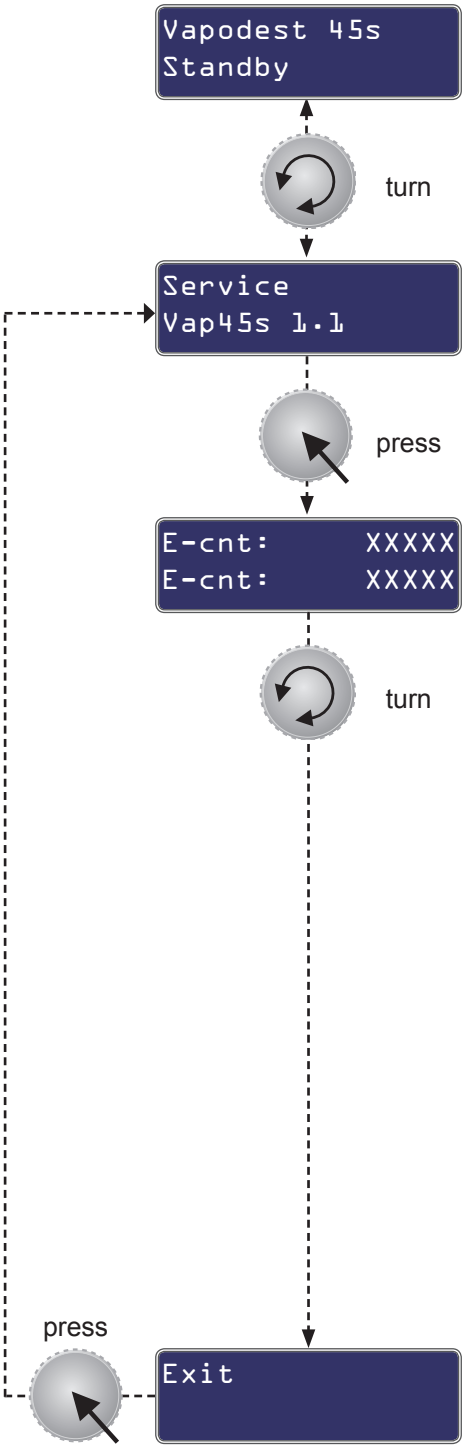
5. Determine the delivery volume
   After 10 seconds of the transport time, take out digestion tube and fill content into a measuring flask.
   Turn multi functional button to enter the volume.
   Comment, the volume entered is calculated to ml/min.

6. Now, you can calibrate the NaOH-pump and then calibrate the H_3BO_3-pump. The procedure is identical to the calibration of the H_2O pump.

6 System settings

6.4. Service (Statistic)

Menu to call up statistical data, like e.g. total running period, run-time of pumps, etc



E-cnt: = Start-up counter since initial operation
E-cnt: = Start-up counter since last service

By turning the push button you can obtain further data.

D-tot: = Number of distillations since initial operation
D-cnt: = Number of distillations since last service

O-tot: = Total running time of distillation system since initial operation
O-act: = Total running time of distillation system since last service

H-tot: = Total running time of H_2O-pump since initial operation
H-act: = Total running time of H_2O-pump since last service

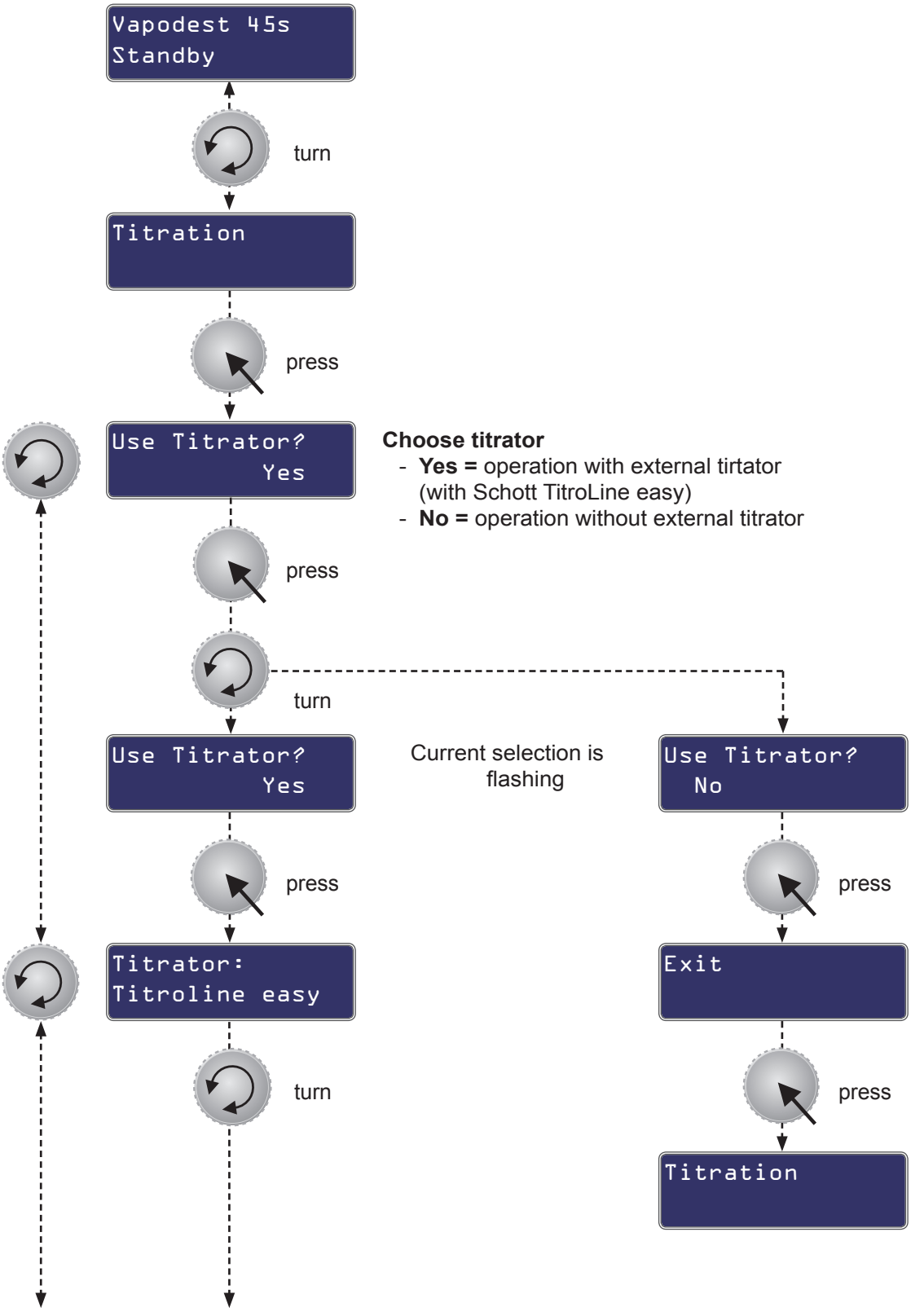
N-tot: = Total running time of NaOH-pump since initial operation
N-act: = Total running time of NaOH-pump since last service

B-tot: = Total running time of H_3BO_3-pump since initial operation
B-act: = Total running time of H_3BO_3-pump since last service

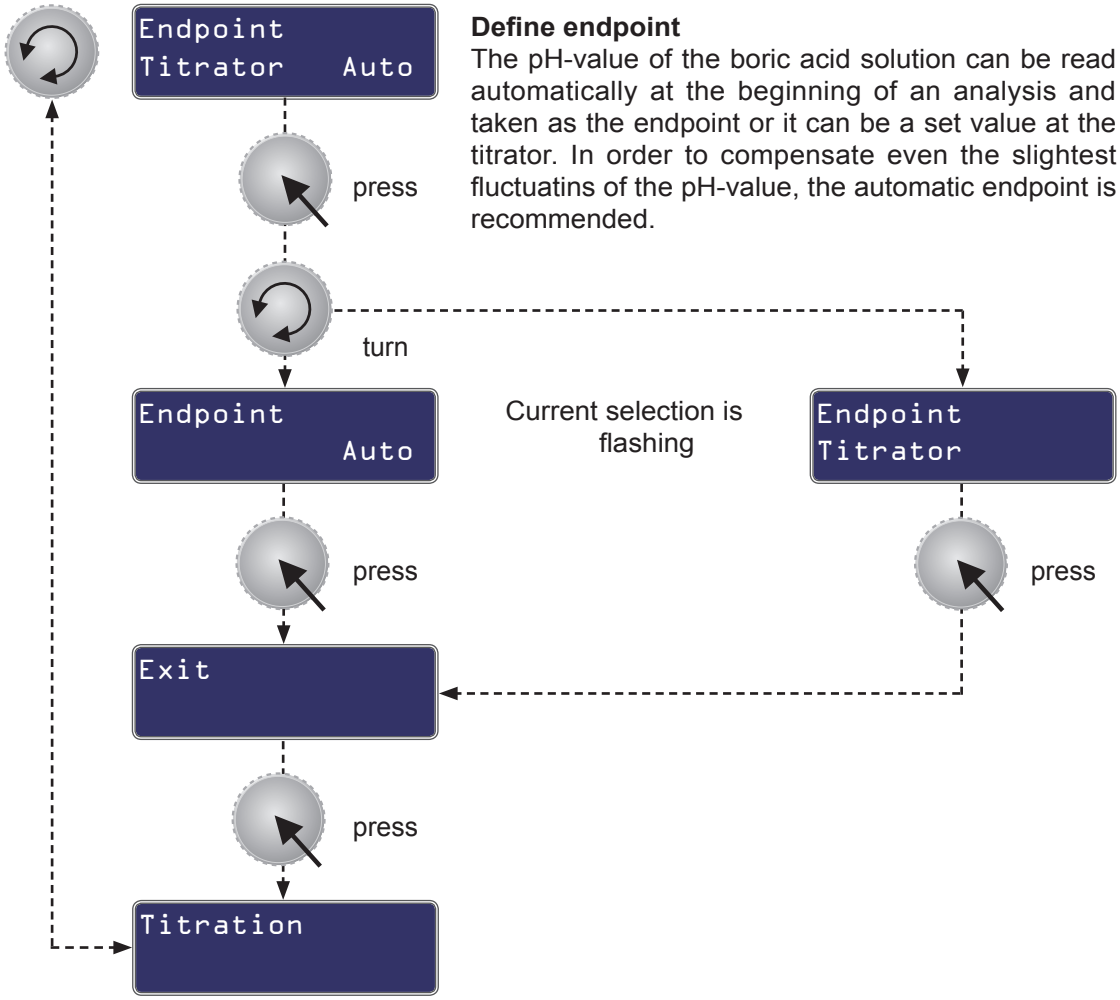
6 System settings

6.5. Titration

Here, you can select the option of using the Vapodest with the external titrator via the RS 232 interface.



6 System settings



Define endpoint
The pH-value of the boric acid solution can be read automatically at the beginning of an analysis and taken as the endpoint or it can be a set value at the titrator. In order to compensate even the slightest fluctuatins of the pH-value, the automatic endpoint is recommended.

6.5.1. Settings of the titrator

Schott TitroLine easy

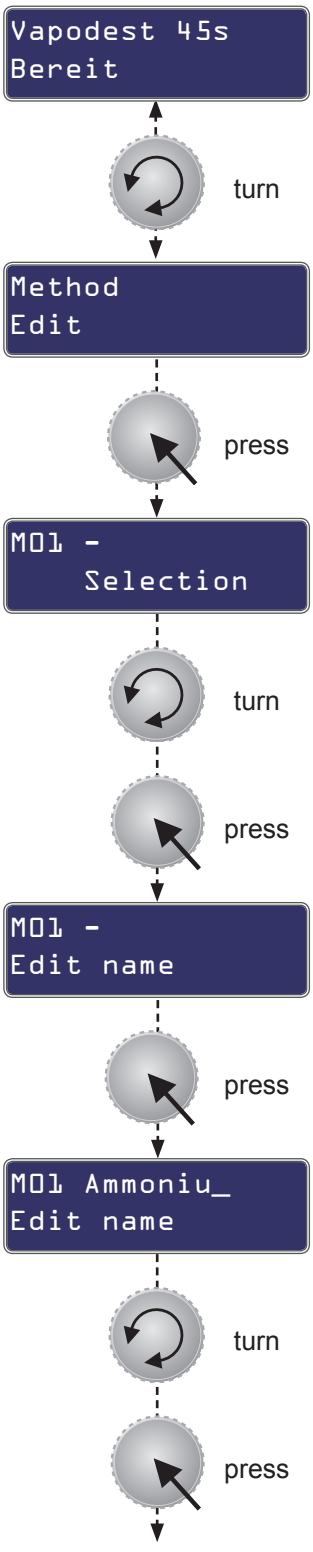
- In combination with TL-Easy and Vapodest 45s there will only be the consumed volume and the pH-endpoint shown on the display.
- If the option "Endpoint auto" is selected during the programming of the Vapodest 45s, then the titration will go back to the pH-value of the boric acid receiver at the beginning of the distillation. the mode of the titrator should be set also on "endpoint titration"
- If selecting "End point fixed", the titration is done to a defined endpoint at the end of the distillation. The mode at the titrator has to be EP (End point determination) in this case.
- A selection of languages in general is possible.
- Titrations to the equivalent end point are not possible.
- Calculations are not possible.
- During the distillation and titration procedure the titrator cannot be operated manually.

Please, make sure to study the enclosed instruction manual before using the titrator!

7 Create a method (Programming)

In this chapter "Create a method", all relevant parameter for the control of the analysis are explained. Up to 20 programs can be defined. Program 00 is a defined test program.

7.1. Define a new method



Example:
The programming example refers to a sulphuric acid digestion acc. to Kjeldahl, during which 20 ml H_2SO_4 were used.

1. Selection of program M00 up to M19

2. Enter or edit program name here (max. 12-place)

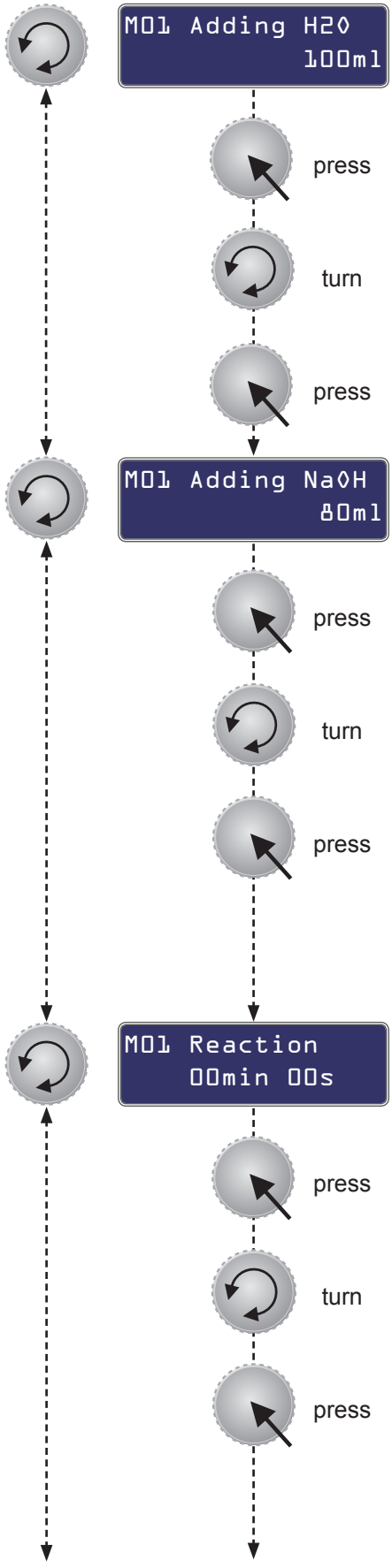
Turn the push button till the desired character is shown.
The following characters are available:

A B C D E F G H I J K L M N O P Q R S T U V W X YZ
1 2 3 4 5 6 7 8 9 0 - + & @ = _ ! ? % $ > < #

Then, press the button so that the cursor gets to the next available space. Now, you can enter an additional character or terminate the name assignment by pressing the button again.

7 Create a method (Programming)

BeiPlease note!
When using the Vap 45s without titrator,the addition of H_3BO_3 is programmed here, also see step 10.



3. Addition H_2O
A sufficient dilution of the concentrated sulphuric acid reduces the energy which is set free during the alkalinisation process. The addition of H_2O depends on the amount of the free (unbound) sulphuric acid at the end of the digestion.

In general the 5fold amount of water is sufficient.

- Setting range 0 - 200 ml
(the specification of the dosing steps depends on the calibration of the pumps).

4. Addition NaOH
In order to be able to distil ammonia over it is important to create a strong alkaline environment. When catalysts containing copper sulphate are used, a colour change of the sample takes place if it is alkaline. When Selen is used as a catalyst, an indicator can be added to the sample to have a visual check. The addition of NaOH depends on the amount of free (unbound) sulphuric acid at the end of the digestion.

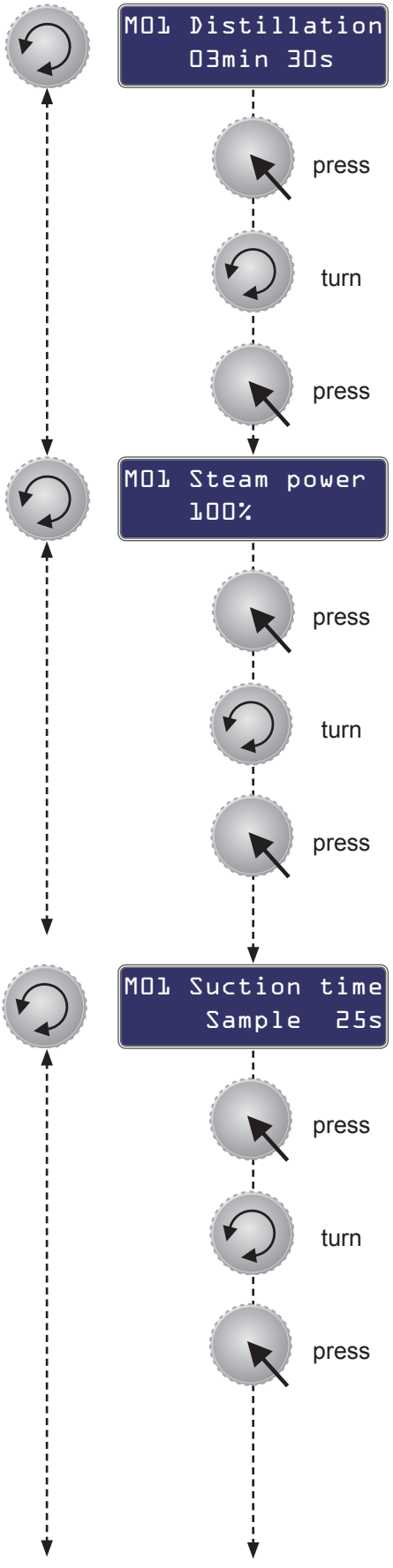
In general, the quadruple amount is needed for a 32% NaOH.

- Setting range 0 - 200 ml
(the specification of the dosing steps depends on the calibration of the pumps).

5. Reaction time
The reaction time is especially for the nitrate nitrogen determination when Devarda's alloy is used (e.g. for the analysis of fertilizers). For Kjeldahl analysis this amount of time is not necessary.

- Setting range 0 - 99 min and 0 - 59 s

7 Create a method (Programming)



6. Distillation time
The distillation has to be set so that about 100ml distillate is produced. If the steam output is set to maximum this corresponds to 3 min 30 s to 4 min. In the water analysis, a phosphate buffer is used instead of NaOH for the determination of the ammonium-nitrogen. In such a case, 200 ml have to be distilled over.

- Setting range 99 min and 59 s

7. Steam power
Usually, maximum power is used for the Kjeldahl analysis. If the power is reduced, the distillation time is increased at the same time to obtain the same amount of distillate. For some determinations, e.g. for the determination of ammonium, a certain amount of distillate is required for a given amount of time.

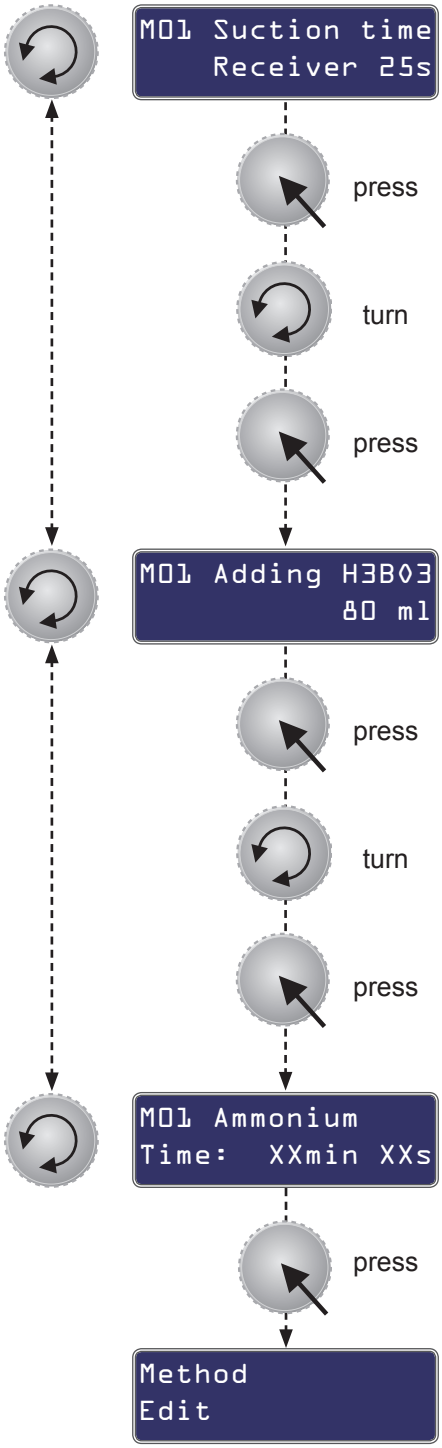
Attention, when micro glasses with 100 ml are used, the max. heating power should be 80 %.

- Setting range 30 % - 100 %

8. Suction time sample
If the distilled sample is not longer needed for further analysis, it can be sucked off using the built-in tubing pump.

- Setting range 0 - 99 s

7 Create a method (Programming)



9. Suction time receiver
(only in combination with external titrator)
The duration of the suction is calculated so that the receiving vessel is completely empty. Should there be any remaining single drops, they won't have any influence on the following analyses.

- Setting range 0 - 99 s

10. Adition H_3BO_3
The diaphragm of the electrode must be completely immersed in the receiving solution, so that a stable pH- measurement is ensured.

- Setting range 0 - 200 ml
(the specification of the dosing steps depends on the calibration of the pumps)

11. Total time
Display shows the total time for this program.

8 Execution of method

This chapter describes the execution of a distillation. However, we can only give you a general overview how to work with Vapodest in this manual. Should you need any specific methods we will send you the respective application on request. These data sheets contain detailed info about the sample preparation and programming.

Make sure to always wear protective clothes (gloves, protective glasses, lab coat) when working with Vapodest.

When you take out the digestion tube, make sure to wear protective glove or have glass tongs at hand and wear protective glasses. The glass container is very hot and there is the danger of burns!

Be careful when handling acids and alkalis! Please observe the safety regulations according to the current laws regarding handling of dangerous goods!

8.1. Prior to the analysis

Check set of tanks
Check the level of reservoirs and the connections at regular intervals.

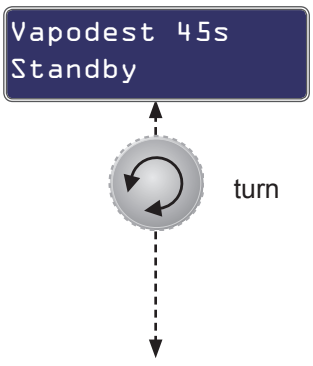
Turn on faucet
The system is only working when the faucet is turned on.

Test run
In order to make sure to obtain reproducible results, we kindly ask you to run a distillation without sample every day prior to the first analysis. In order to do so, insert the digestion tube and start **Program M00 Test run**.

8.2. Distilling a sample without external titrator

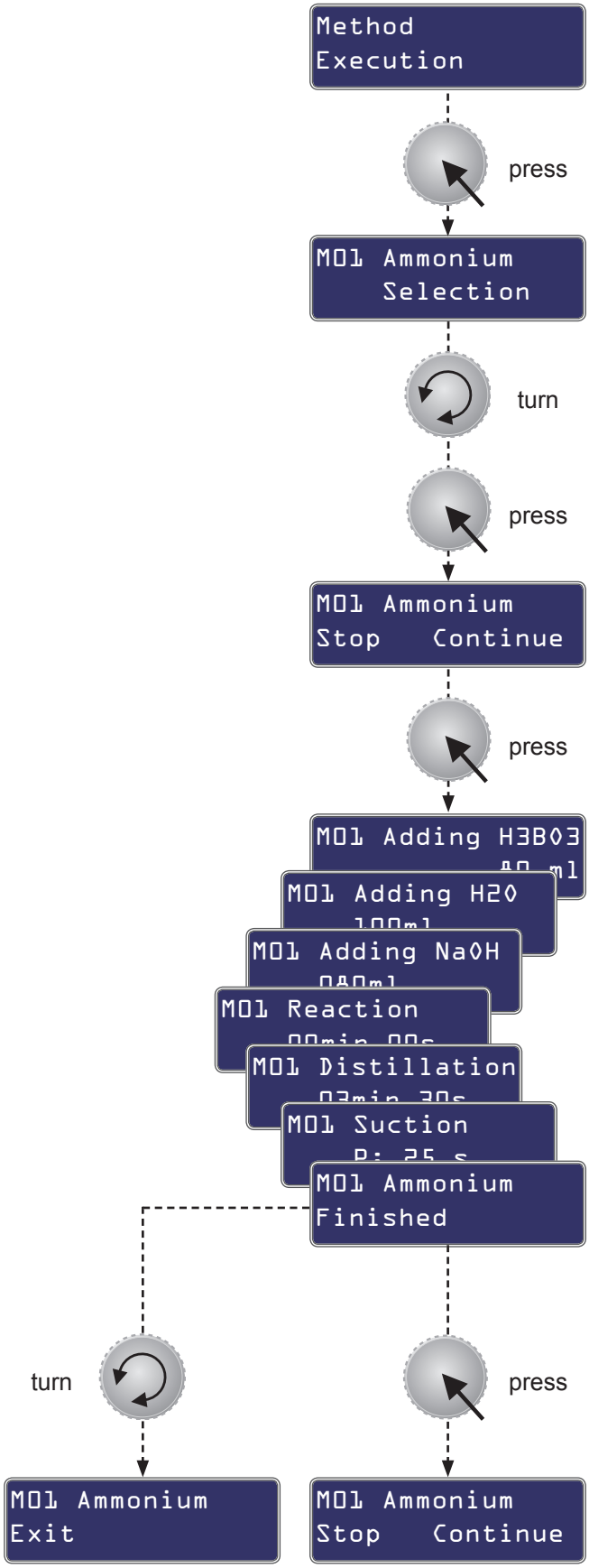
Whenever using an external titrator, make sure to read chapter "8.3. Start analysis with external titrator".

1. Place an Erlenmeyer flask into position
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. The display shows the standby mode

8 Execution of method



6. **Program number is flashing.**
   Select the method program as desired (M00 to M19).

7. Continue = the program starts immediately
   Stop = back to main menu

   Current selection is flashing

   In the display, the individual program steps are shown.
   The program can be interrupted at any time during the distillation in progress. Please see chapter **"8.4. Interrupt distillation"**.

8. At the end of the program, take out the digestion tube. In order to do so, push the quick clamping device downwards.
   Careful ! At the end of the distillation, the digestion tube is very hot. Thus make sure to wear protective gloves and protective goggles!!

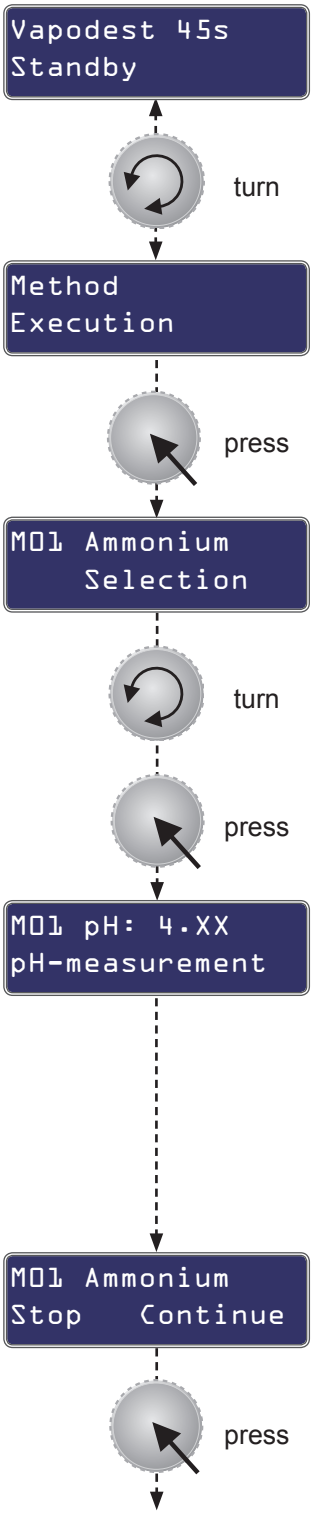
9. Would you like to continue with the program and run additional analysis, then please insert a new digestion tube and press the push button. The receiver will be filled with boric acid again.

   Should you not wish any additional analysis, then turn the push button in any direction and select "Exit".

8 Execution of method

8.3. Distilling a sample with external titrator

1. Press down quick clamping device and insert the digestion tube.
2. Check correct fit of the tube.
3. Close protection door and turn on equipment.



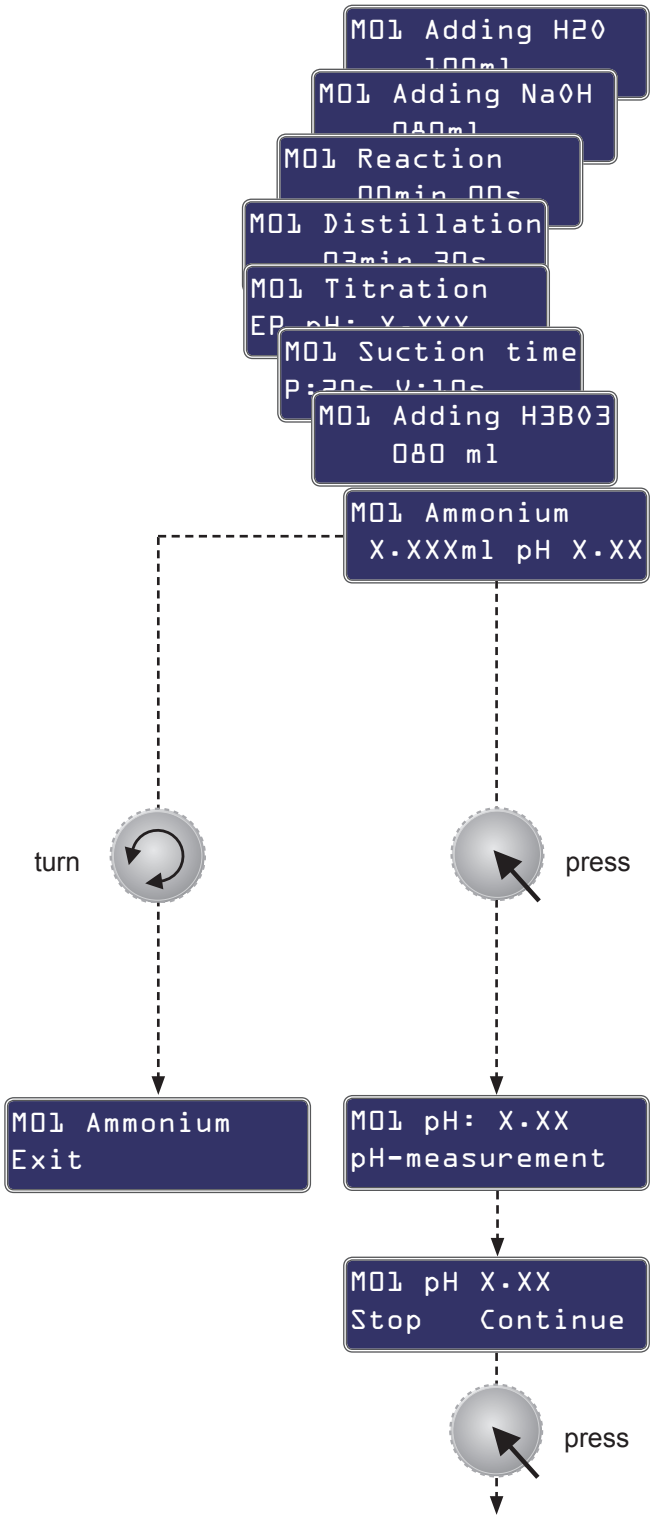
4. The display shows the standby mode

5. Program number is flashing
Select the desired method program (M01 to M20).

6. Current pH-value is entered
   - If you have selected endpoint "Auto" in the menu „Titration settings" (see chapter 7.5.Titration), the pH-value of the receiver solution is shown after a short period of measuring. This is the pH value to which it is titrated back at the end of the distillation.
   - If you select endpoint "Fixed", the initial window is shown immediately.

7. **Continue** = the program starts at once

8 Execution of method



8. The display shows the individual program steps. You can interrupt the program at any time, during the distillation in process. Please make sure to read chapter **"8.4. Interrupt distillation"**.

9. At the end of the analysis, the result of the titration is shown. Sample and receiver are sucked off automatically. press the fast clamping device downwards, if you want to take out the digestion tube.

Careful ! At the end of the distillation, the digestion tube is very hot. Thus make sure to wear protective gloves and protective goggles!

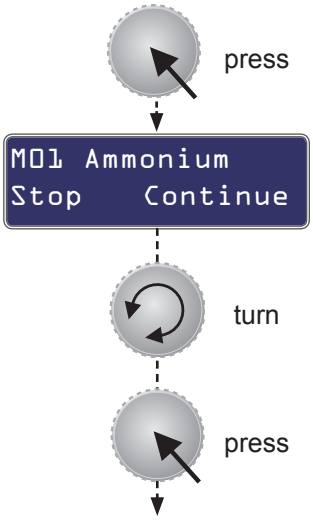
10. Would you like to continue with the program and run additional.
Analysis, then please insert a new digestion tube and press the push button. The receiver will be filled with boric acid again.

Should you not wish any additional analysis, then turn the push button in any direction and select "Back".

8 Execution of method

8.4. Interrupt distillation

The distillation program in process can be interrupted at any time.



1. Press push button during the distillation.

2. Select option .

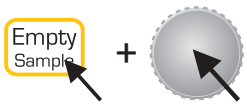
Select Stop = Abort distillation
Select Continue = Distillation is continued

The current selection is flashing.

9 Trouble shooting

The functions of the distillation system are monitored continuously. As soon as an error occurs, it is shown in the Vapodest-display, After solving the problem, the analysis can be continued in most cases. The user might have to confirm a corresponding message in the display.

9.1. Error messages

Error message	Reason for error	Actions to be taken
Water pressure low	Cooling water pressure < 0,5 bar.	Check cooling water inlet. Make sure that the faucet is turned on.
Tube or door Error	No sample tube or door open	Insert digestion tube and / or close protection door.. Distillations can only be done if the digestion tube is inserted correctly and the protection door is closed.
Wait for steam	Steam generator has not yet reached its required pressure	Message disappears, as soon as the steam generator has reached the correct pressure.
Method Not defined	The selected program has not yet been defined	Define method program or select a different method
Tank level Error	One or more storage tanks are empty or sample waste tank is full.	- Check content of storage tanks and if necessary, fill it up. - Also, check contacts for level sensor - The distillation in process will be completed.
Titration time >15min	Electrode is too slow or broken	Calibrate electrode or replace.
Titrator not ready	- Check whether titrator is connected correctly - Cable to titrator might be broken	- Check cable connecting titrator with Vapodest - Use new cable for titrator
Receiver Overfilled	- Sucction for receiver manually	Press combination of keys. 

9 Trouble shooting

Error message	Reason for error	Actions to be taken
Steam generator Low water	Not enough water in the steam generator, water inlet might be broken	Check tubing connection from water tank to Vapodest Should the problem reoccur, call customer service.
Steam generator Sensor Error	Water level of steam generator is not measured any longer.	Turn instrument off, and then turn it on again. Should the problem reoccur, call customer service.
Steam generator Excess pressure	Water level in steam generator too low. Heating starts too early.	Turn off instrument for ca. 15 min and turn on again. Should the problem not be solved, call customer service.

9.2. Breakdown of operation

Error message	Reason for error	Actions to be taken
Excess current switch cuts off	Excessive current consumption	Turns switch on again. Should the problem reoccur, call customer service.

9 Trouble shooting

9.3. Results too high

Reason for error	Actions to be taken
The chemicals used are contaminated with nitrogen compounds.	Check the chemicals one after the other, get a blank value, a replacement of the chemicals might be recommended.
Strong reaction in the digestion tube, caustic soda drops got into the receiver.	Increase the amount of water.
Part of the glass condenser is broken, drops of the caustic soda got into the receiver.	Exchange the glass condenser.
Tubes are contaminated with nitrogen	Clean the tubes without detergent or rinsing agent.
Carry over of ammonia from the previous sample	Extent the distillation time or check whether sufficient alkali was added.

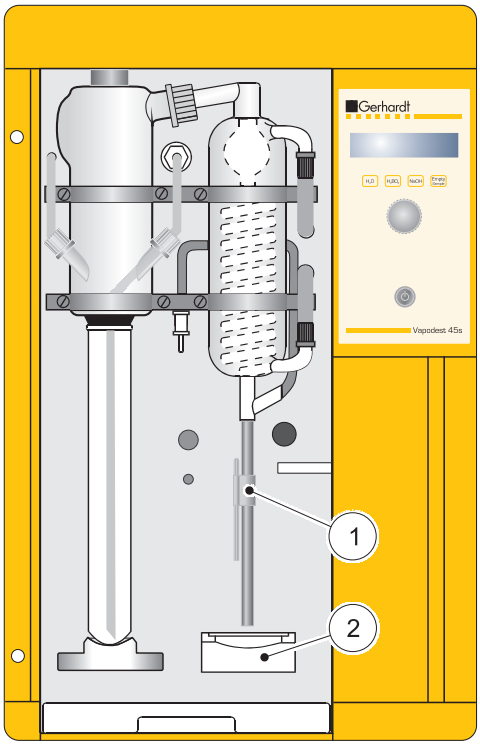
9.4. Results too low or no results

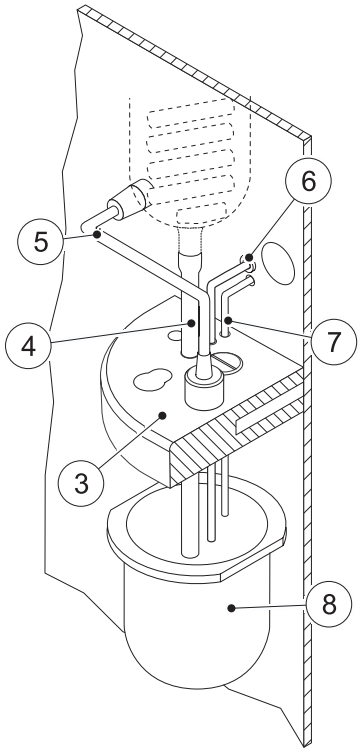
Reason for error	Actions to be taken
Distillation has not been complete or distillation time has been too short.	No quantitative carry over of the ammonia content, the amount of the distillate should be 100ml.
Ammonia escapes at leaks.	- Contaminated or detective viton cone; clean or replace. - Check seals at the distribution head and if necessary, replace it. - Non return valve at the condenser is bonded, clean or replace it. - Digestion tube is damaged at the wide neck opening. - Glass of the distribution head is leaking, replace it!
Amount of caustic soda which is added is too low, no release of ammonia.	Check the amount delivered by the NaOH pump; about 4 ml should be delivered per second.
Not enough boric acid in the receiver, escaping ammonia is not entirely absorbed.	Increase of the amount of boric acid.
Tube is not immersed entirely into the boric acid receiver.	Increase of the amount of acid.
Formation of ammonia complexes which are not destroyed by the caustic soda.	This problem only occurs with catalysts containing mercury, sodium thiosulphate solution destroys these complexes.

10 Rework instruction

10.1. Upgrade the Vap 45s to be operated with external titrator

In case you have ordered the Vapodest 45 without titrator and now, wish to upgrade your unit to be used with an external titrator, we kindly ask you to follow the instructions enclosed:





- Take off platform pos 2. and PVC tube holder pos. 1

- Slide the fitting of the receiver pos. 3 on the fitting and attach it with the screw enclosed (M3 x 20).

- Attach receiver glass pos. 8 under the receiver table. Move the receiver glass for about 90°, in order to attach it.

- Silicone tubing for the addition of boric acid pos. 7 and Slide silicone tubing of the distillate outlet tubing pos. 4 through the opening into the titration cell (shorten tubing so that they will end shortly above the glass bottom).

- Remove protective cap from the connection pos. 6. Put Verprene tubing for the suction on the connection and join with the respective Teflon connection.

- Establish plug-in connection:
  Connect 5-pos. Drehverschlussstecker pos. 5

- Set up titrator and connect:
  See chapter "4.9. Connect titrator and electrode"

- Connect electrode.
  See chapter "4.9. Connect electrode and titrator“

- Change system settings
  To make sure that the Vapodest recognizes that an external titrator has been connected, you must make a selection in the menu "Titration".
  See chapter "6.5. Titration

11 Maintenance

Please make sure that only original C. Gerhardt spare parts are used.

To minimize malfunctions of the VAPODEST, we recommend having it checked by authorized service personnel annually.

11.1. Cleaning and regularly check

11.1.1. Cleaning general

Make sure to wear gloves at all times when cleaning the components.

To avoid damage by corrosion, leaking liquids (especially acids and alkali) must be wiped off and neutralized immediately to prevent damage to casting, lacquer or housing.

Never use abrasive cleaners! In most cases it will be sufficient after each use to clean the plates using a moist cloth and some household washing-up liquid. Subsequently rub dry.

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

11.1.2. 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.

We suggest using the following programming:

Addition H_2O	120	ml
Addition NaOH	0	s
Reaction time	0	s
Distillation time	7	min
Steam power	100	%
Suction sample	20	s
Suction receiver	20	s
Addition H_3BO_3 0	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.

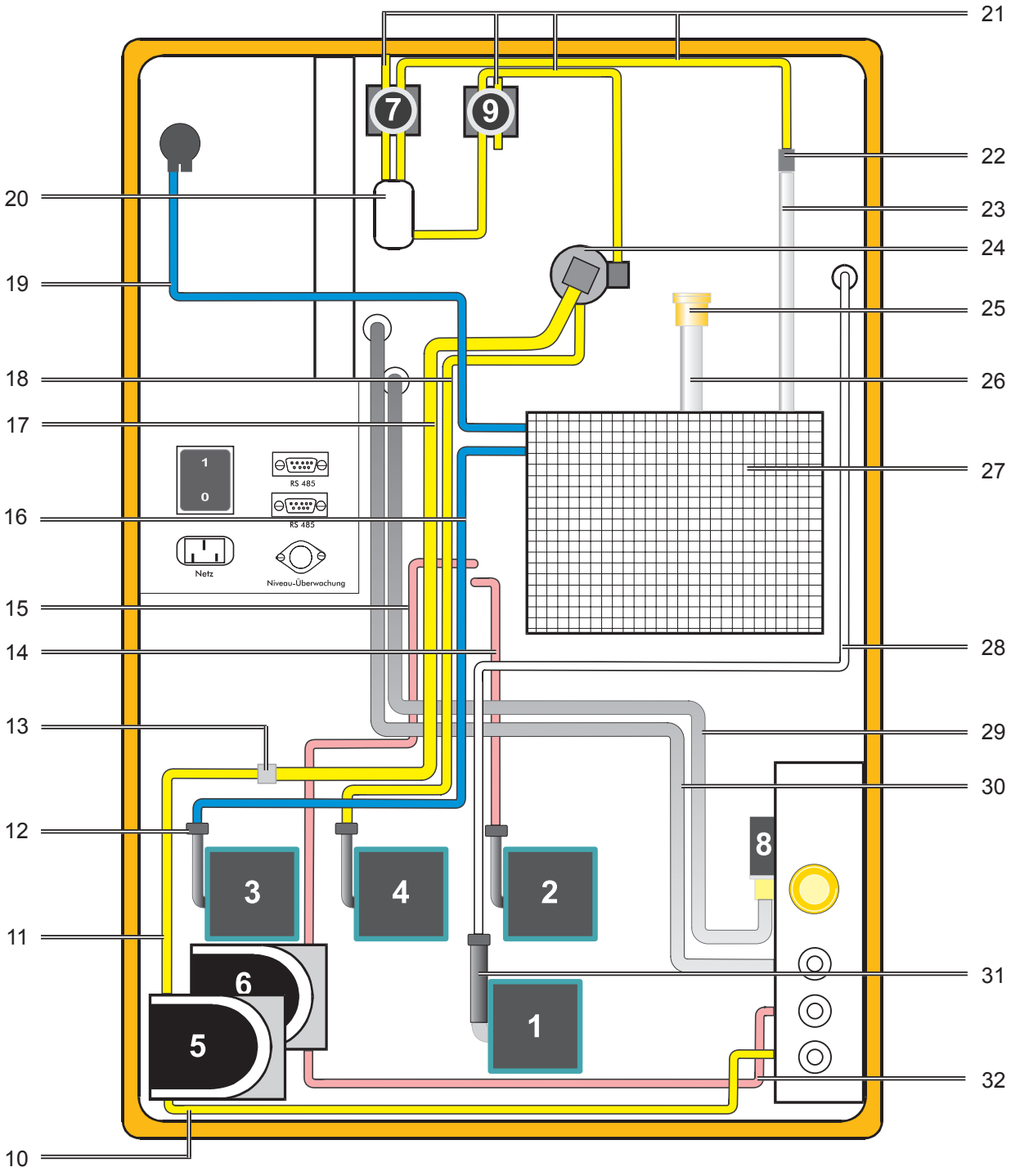
11.1.3. Check the tight fitting of the tubes

The connection of the tubes at the rear of the instrument has to be checked once a month to ensure tight fitting. Should the tubes become lose eventually, they can be secured with a hose clamp.

11 Maintenance

11.2 Tubing diagram Vap 45 s (with open rear wall)

The instrument may only be opened by an authorized and trained person.



11 Maintenance

11.2.1. Description of the tubing diagram

Pos.	Description	Item-No.
1	Diaphragm pump NaOH	1001738
2	Diaphragm pump H_3BO_3,	1001736
3	Diaphragm pump $H_2O$for steam generator	1001736
4	Diaphragm pump H_2O for sample	1001736
5	Peristaltic pump for suction sample	1000084
6	Peristaltic pump for suction receiver	1000084
7	Pinch-solenoid valve, steam	1000090
8	Magnetic valve with pressure control	1000363
9	Pinch-solenoid valve, shut-off	1000090
10	Verprene-tubing 4 x 8 mm	1000498
11	Verprene-tubing 4 x 8 mm	1000498
12	Non-return valve for diaphragm pumps	1000081
13	Tubing reduction PP 51 x 10 x 5 mm	1000398
14	Silicone tubing 4 x 7 mm	1000488
15	Silicone tubing 4 x 7 mm	1000488
16	Verprene-tubing 8 x 12 mm	1000499
17	Verprene-tubing 4 x 8 mm	1000498
18	Silicone tubing 4 x 7 mm	1000488
19	Silicone tubing 4 x 7 mm	1000488
20	Ventilation glass	1000048
21	Novoprene-tubing 4,8 x 8 mm	1002289
22	Tubing reduction	1000397
23	Silicone tubing 6 x 10 mm	1000484
24	PP-distributor with PP-thread	1000538
25	NKT-valve (built in with brass fitting)	1002842
26	Silicone tubing 8 x 16 x 80 mm	1000497
27	Steam generator	1000232
28	PTFE-inlet tubing NaOH	1003401
29	Silicone tubing 8 x 16 for cooling water inlet	1000497
30	Silicone tubing 8 x 16 for cooling water outlet	1000497
31	Vitone-tubing 6 x 12 * 50 mm	1000495
32	Silicone tubing 4 x 7 mm	1000488

When you order additional tubing, please make sure to also give the desired length!

11 Maintenance

11.3. Spare parts

Distillation system	Item-No.
Distillation condenser, glass	1000058
Plastic screw connection for distillation condenser	1000358
Ventilation valve	1000036
Distribution head, glass	12-0363
Vitone cone	12-0351
PTFE-inlet tubing, steam	1002178
Tubing reduction for item-no. 1002178	1000608
PTFE-inlet tubing, NaOH	1003401
PP-distributor	1000538
PP-tube joint	1000250
Screw cap GL 14, white	1004320
Screw cap GL 18, white	1004321
Screw cap GL 32, white	1004322
Silicone-/PTFE-seal GL 18	1000356
Silicone-/PTFE-seal GL 32	1000357
Plexiglass protection door	1001236
Door handle	1000392
Door hinges, 1 pair	1000391
Drip tray, PP	1000399
Mains switch	1004331
Control panel	1004118
Knob for operator button	1004325
Excess current switch, 10A	1001358
Tubular heating element for steam generator	1000259
Steam generator	1000232
Excess pressure valve, steam generator	1000483
Mains cable	10-0048
Magnetic valve with pressure control	1000363
Micro switch for quick clamping device	1000290
Pinch-solenoid valve steam and shut-off	1000090
Ventilation glass	1000048
Diaphragm pump for NaOH	1001738
Diaphragm pump for H_3BO_3 or H_2O	1001736
Peristaltic pump	1000084
Receiver	
Receiver vessel, glass	1001269
Motor with gear for stirrer	1001266
Propeller PP stirrer	1001260
Level sensor	1001265
Cable for electrode DIN Vap45	1002170
pH-combined electrode maintenance free (incl. the delivery)	12-0355
pH-combined electrode refillable	12-0354

11 Maintenance

When you order additional tubing, please make sure to also give the desired length!

Tubes	**Item-No.**
Water inlet tubing 10/17, 2 m	1000394
Silicone tubing 6 x 10	1000484
Silicone tubing 8 x 12	1000496
Silicone tubing 4 x 7	1000488
Silicone tubing 8 x 16	1000497
Novoprene-tubing 4,8 x 8	1002289
Verprene-tubing 4 x 8	1000498
Verprene-tubing 8 x 12	1000499
PTFE-tubing 4 x 6 x 135	1000559
PVC-tubing 4/7	1000500
PVC-tubing 8/12	1000047
Tubing reduction, PP 51 x 10 x 10	1000397
Tubing reduction, PP 51 x 10 x 5	1000398
PVC-pipe 6 x 1, 420 mm	1000566
PVC-pipe 10 x 1, 420 mm	1000567

11.4. Accessories

Titrator	
Titrator Titro Line Easy, special model with Gerhardt-software	12-0054
Titrator Titro Line Easy, regular Schott model	1002169
Titrator set of acessories, needed for operation with Vap 45 and titrator	1001994
Cable for electrode DIN Vap 45	1002170
Buffer solution pH 4, 250 ml	1000176
Buffer solution pH 7. 250 ml	1000177
KCL-electrolyte solution, 250ml	1000178
Set of storage tanks KAN 40 complete with: - Storage tank 20 l for H_2O - Storage tank 20 l for H_3BO_3 - Storage tank 20 l for NaOH - Storage tank 20 l for sample waste - Level sensor with plug for all tanks	12-0390
Set of storage tanks KAN 50 complete with: - Storage tank 20 l for H_2O - Storage tank 20 l for H_3BO_3 - Storage tank 20 l for NaOH - Storage tank 20 l for Sample Waste - Storage tank 10 l for titration acid - Level sensor with plug for all tanks	12-0394
Spare parts for storage tanks:	
Level sensor with plug for H_2O, H_3BO_3 and NaOH-tank	1002124
Level sensor with plug for „Sample waste“ tank	1002125
Level sensor with plug for titration tank	1002126
Upgrade kit Micro	
Viton cone VK, micro, for 100 ml tubes KMT	12-0352

11 Maintenance

Set of adaption Devarda	
PP-distributuion head Devarda VPD 7, bottom part	1000053
Glass distribution head Devarda VGD 7, top part	1000054
Ventilation valve condenser (Glass)	1000603
PP-adaptor	40213
PP-distribution head distance piece	50025
Screw cap GL 32, open	1000353
Silicone-/PTFE-seal GL 32	1000357

More accessories	
Tubes	
250 ml, KTG 250 standard version	12-0301
400 ml, KDD 400 standard version	12-0310
800 ml, KDD 800 standard version	12-0311
400 ml, BS 400 special version, diminished	12-0308

EDV	
Data cable DK 42 for RS 485, 2 m	10-0192
Data cable DK 45 for RS 485, 5 m	10-0193
Terminator plug AST for RS 485	10-0196
RS-Adapter	10-0190

Further accessories and information about the Vapodest program can be found in the product catalogue or at your local dealer!

12 Decommissio and disposal

12.1. Decommission

In case of shipment, of repair or disposal, the instrument has to be taken out of operation and has to be cleaned (decontaminated). Please contact customer service of your dealer or C. Gerhardt, to terminate the operation of the instrument.

12.2. Contact service

In case of more problems or failures of your Vapodest 45s, please contact your local dealer or:

C. Gerhardt GmbH & Co. KG
Cäsariusstr. 97
D-53639 Königswinter

Tel.: +49 (0)22 23 - 29 99 0
Fax: +49 (0)22 23 - 29 99 99
info@Gerhardt.de
www.gerhardt.de

12 Decommissioning and disposal

12.3. Disposal

The disposal of the packaging and the parts used has to be done according to the rules and regulations which are valid in the country of installation. Should the product itself be disposed of, make sure to observe the local rules and regulations.

12.3.1. Information for the Disposal of Electric and Electronic Instruments within the European Union

The disposal of electrically operated instruments is settled within the European Union by national regulations, which are based on the EU-directive 2002/96EC about electric and electronic used-instruments (WEEE). Thus, all instruments delivered after August 13th 2005 must not disposed into the communal domestic waste.

Since the regulations about disposal of waste might vary from one country to the other within the European Community, we kindly ask you to contact your supplier or dealer.

In Germany, this obligation for identification is valid as of March, 23rd 2006. As of this date, C. Gerhardt takes back all instruments delivered after August, 13th, 2005 without charges and will dispose of them according to the regulations, or Gerhardt will come to an agreement with the last user of the unit. For all instruments delivered prior to August 13th, 2005 the last user will be held responsible for the proper disposal. The only crucial factor accepted, for the chronological placement, it the serial number at the back of the instrument.

12.3.2. Ban on Materials according to ROHS Regulation 2002/95/EG

Ban on materials from the ROHS regulation 2002/95/EG is not valid for the electro- and electronic instruments of category 8 and 9 and thus not for those instruments described in this instruction manual. However, we want to draw your attention to the fact that we feel obliged to observe the regulations for the RoHs for all our products. Please be kind enough to contact us if you have any further questions.

12.3.3. Transfer

We kindly ask you to always make sure to add this instruction manual to the product in case of transferring it to another party.