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 Warning: The instrument can not provide the designed protection for operators who do not follow the right procedures and requirements given by the manufacturer.

 Warning: All solutions must be handled with care according to the lab's safety regulation. Please make a reference to the related material safety data sheet. Wear the lab-gown, goggle and rubber gloves all the time. Be care of hot reagents.

 Warning: Be aware of the risk of electric shock. Only the trained professionals are permitted to open the face panel or back cover.

1. Introduction

1. Application

The Kjeldahl method is the classical method of nitrogen and protein determination. Currently, K9840 Automatic Distillation Unit plays important role in determining the nitrogen and protein contents of soil, food, agricultural products and feeding stuff etc. K9840 Automatic Distillation Unit can be widely used in areas of food processing, feeding stuff production, tobacco, farming, soil fertilizer, environment monitoring, agriculture, scientific research, education, and quality control and so on, performing either the nitrogen and protein analysis to macro and semi-micro samples, or tests of ammonium salt and volatile fatty acid/alkali etc. There are three processes including digestion, distillation and titration when Kjeldahl method is adopted to test samples. The distillation is the main determining process used in K9840 Automatic Distillation Unit, which is an automatic distillation system designed according to the classical Kjeldahl method. This instrument provides the lab staff with a great convenience in measuring the content of nitrogen and protein, owning features such as high reliability, uncompromised safety, hassle-free operation and time and energy-saving performance etc. The user-friendly interface written in English is easy to operate and can display the sufficient information, making users easily understand how to handle the instrument.

2. Theory

According to the Kjeldahl theory, there are three processes including digestion, distillation and titration in the test. It is able to execute the distillation process automatically.

The chemical reactions listed below occur after a sample has been completely digested.



Via the condensing pipe, the ammonia gas and steam released during the reaction are condensed and collected into the receiving flask where the boric acid (with mixed indicator) is added.

II. Specifications

1. Technical specifications

- Measurable amount of the sample: solid sample < 6g per sample; liquid sample < 16 mL per sample
- Measurement range: 0.1~240 mg nitrogen;
- Time for measurement: 3~6 minutes per sample;
- Recovery rate: $\geq 99.5\%$;
- Repetition rate: relative error of average value $< 0.5\%$;

2. Working Condition

- Rated power: 1.3KW
- Input voltage: AC 220V $\pm 10\%$ 50Hz;
Reliable ground wire is needed.
- Cooling water pressure: $> 0.15\text{Mpa}$;
- Cooling water temperature: $\leq 20^{\circ}\text{C}$;
- Temperature of environment: $+10\sim 28^{\circ}\text{C}$

Working Humidity: 35°C and Max. relative humidity 67%; 31°C and Max. relative humidity 80%;

III. Names of Instrument Parts

The instrument is a special system, which can automatically distill the completely-digested samples and show the workflow in real time mode. The system mainly consists of micro controller, steam generator, distillation system, and automated reagent dispensing system. The exterior structure is shown in the following diagram:

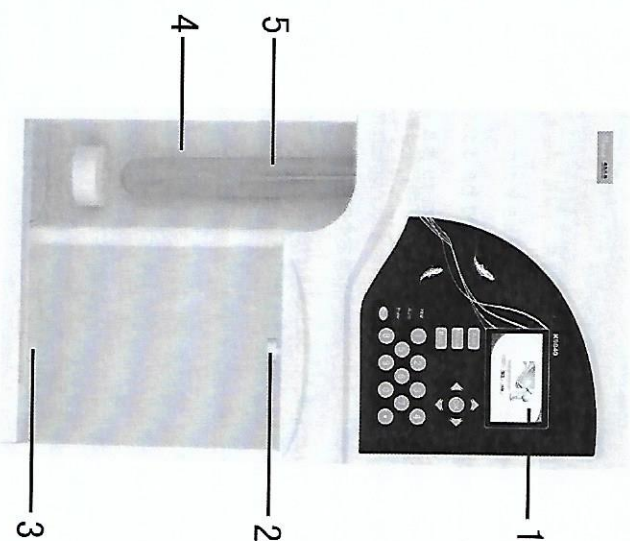


Figure 1 Front view

- LCD
- Connector for liquid-collecting tube
- Waste receiving tank
- Protection door
- Digestion tube

IV. Installation Instruction

1. Pre-installation check

After the instrument is unpacked, check the whole instrument and all marked spare parts according to the attached packing list and check whether they are damaged or not. If something is damaged, please contact the manufacturer timely. (Please keep the damaged parts well).

2. Installation condition:

The instrument should be installed in neither excessively hot, cold or humid places nor places with excessive sunlight exposure. Commonly, the room temperature should be maintained between $10^{\circ}\text{C}\sim 28^{\circ}\text{C}$. The instrument should be installed on the clear, level and stable platform, which should be close to the water source and draining sink. The distance from the instrument to the water valve, draining sink and power supply should be shorter than one meter to ensure the convenient operation. The distance between the instrument and the wall or other devices should be at least 40 cm. For your safety, do not store anything on the top of the instrument and put any container, chemical agent or devices etc. behind the instrument.

The pressure and temperature of the water supply should meet the certain requirement, and the water should be clear and free of impurities (see Chapter 2 Item 2 for details). The draining sink should be lower than the discharge outlet of instrument to ensure the good water-discharging performance.

The power supply should meet the specified requirement, which must have ground wire, independent power switch and fuse protection to guarantee the safety of operators.

The instrument should be far away from any big-scale electric equipment, and its working environment should be free of vibration and electromagnetic interference, in which there is not corrosive substance.

3. Installation procedures:

According to the view of left side (figure 2):

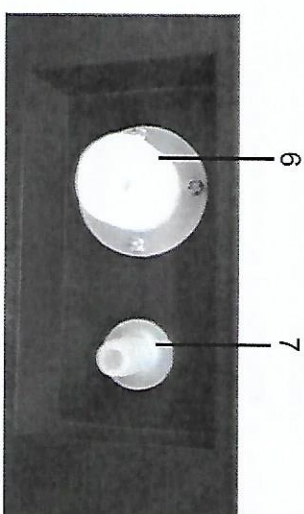


Figure 2 View of left side

6. Cooling water intake 7. Water discharge outlet (connect to drainage sink) The water intake (6) is commonly connected to the faucet of tap water. The water discharge outlet (7) is connected to drainage sink and make sure that the discharging performance is good.

According to the view of right side (figure 3):

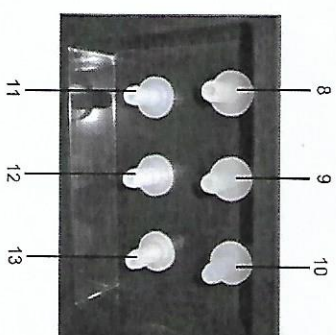


Figure 3 View of right side

8. Ventilation hole for alkali bottle 9. Ventilation hole for boric acid bottle 10. Ventilation hole for distilled water bottle 11. Intake of alkali solution 12. Intake of boric acid 13. Intake of distilled water

The ventilation hole for alkali bottle (8) is connected to the air tube of alkali bottle.

The ventilation hole for boric acid bottle (9) is connected to the air tube of boric acid bottle.

The ventilation hole for of distilled water bottle (10) is connected to the air tube of distilled water bottle.

The intake of alkali solution (11) is connected to delivery tube of alkali solution bottle.

The intake of boric acid solution (12) is connected to delivery tube of boric acid solution bottle.

The intake of distilled water (13) is connected to delivery tube of distilled water bottle.

According to the back view (figure 4):

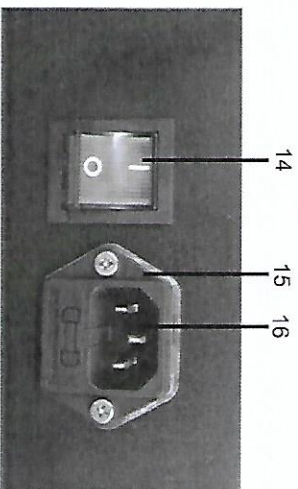


Figure 4 Back view

14. Power switch 15. Power cord socket 16. Fuse device

The power cord can be plugged into the power cord socket (15). The blown fuse can be replaced in the fuse device (16) (There is a spare fuse in the fuse socket). Slide the power switch (14) to turn on the instrument.

V. Sample Preparation

1. Solution

Cooper sulfate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$)

Potassium sulphate (K_2SO_4)

Vitriol (1.8419g/L)

2. Procedure

Weight 0.2-2g solid sample or 2-5g semisolid or take 10-20ml liquid sample (around 30-40mg Nitrogen), then put it into digestion tube, adding Cooper sulfate 0.1g, Potassium sulphate 6g, Vitriol 20ml, heating the sample, when the substances carbonized completely and no foam heated the liquid to tiny boiling and keep it, until liquid to clear and blue-green. Then heating 0.5hr-1hr continually, when finished cooling it. At the same time, Do the blank test.

VI. Operation Instruction

1. Preparation of chemical reagent

(1) Add distilled water into the distilled water bottle (with a blue label marked with "H₂O") and then tighten the bottle cap.

(2) Prepare the sodium hydroxide solution (NaOH) (concentration: 30%~40%), add it into the alkali solution bottle (with a yellow label marked with "NaOH") and then screw the bottle cap firmly. (The concentration of 35% is recommended because the solution with this concentration is not subject to the crystallization and does not cause the pipe clogging when the room temperature fluctuates).

(3) According to the need of experiment, make up Bromocresol Green/Methyl Red Indicator



Fig. 1

The initial interface provides three modes: test, maintenance and help. You may use **【Left】** and **【Right】** key to target "test" button and press **【OK】** key for the test mode. See Fig. 2

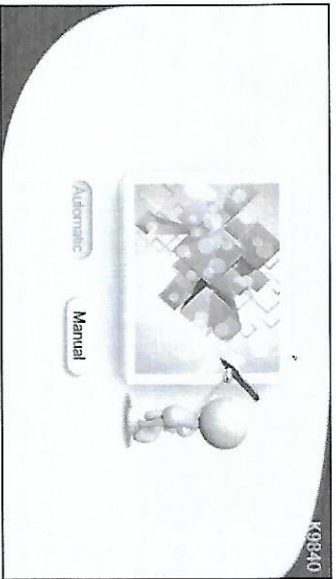


Fig. 2

You may use **【Left】** and **【Right】** key to target the desired operation and press **【OK】** key for next interface. Or you may press **【Auto】**key for automatic test parameter interface, or press **【Manual】**key for manual test interface.

1 Test

1 automatic test

The instrument Enters automatic test parameter interface shown in Fig. 3

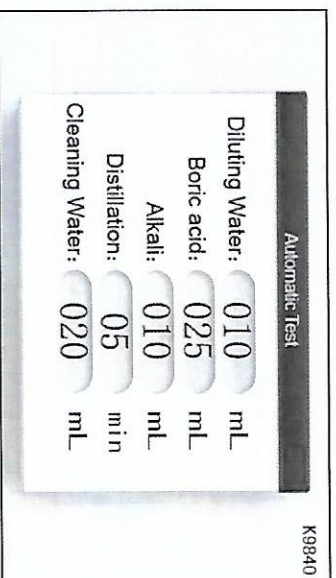


Fig. 3

Press **【Up】**, **【Down】**, **【Left】**, **【Right】** keys to target the parameter, and press **【Number】** key for modification. Press **【OK】** key for safely notes shown in Fig. 4 after input of parameters and press **【Back】** key for the previous interface.



Fig. 4

Press **【DK】** key for the test. The test will be carried out automatically by the system, and adding boric acid, adding dilution water, adding alkali, distillation and drip washing shall be performed in sequence. The small icon will turn colorful and revolve during operation and turn grey in idle condition. The icon in idle condition, take

adding boric acid for instance, is shown in Fig. 5.



Fig. 5

The icon during operation is shown in Fig. 6.



Fig. 6

You may press **【Stop】** key to end the experiment. The first interface on completion of the test is shown in Fig. 7.



Fig. 7

2 Manual test

The system will offer safety notes first shown in Fig.8 when you select the manual test interface.



Fig. 8

Press **【OK】** key for manual test interface. Each option may be selected by **【Up】** **【Down】** keys. Take adding boric acid for example, as shown in Fig. 9, press **【Down】** key for dilution water interface and press **【Up】** key for drip washing interface.



Fig. 9

Input the volume of boric acid to be added with **【Number】** key and press **【OK】** key for adding, as shown in Fig. 10

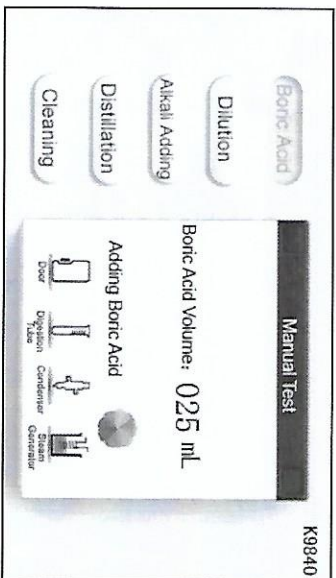


Fig. 10

You may press **【Stop】** key to stop adding halfway.

3 Maintenance

Maintenance includes flushing of alkali piping, liquid adding for calibration, function commissioning, safety setting and flushing of alkali piping. The alkali piping shall be flushed regularly in strict accordance with the instructions, as shown in Fig. 11.

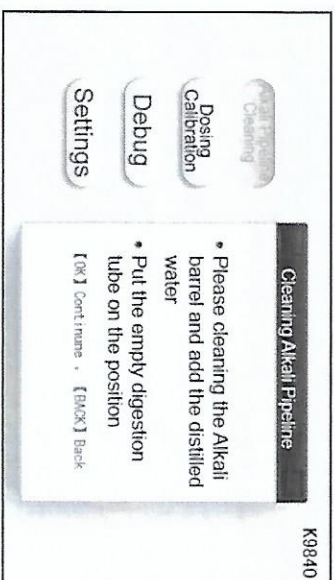


Fig. 11

Wash the alkali jar clean, add the distilled water and place the empty digestion tube in position. When everything is ready, press **【OK】** key for the next step, as shown in Fig.12

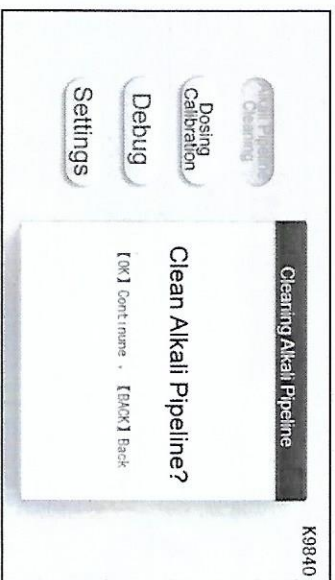


Fig. 12

Press **【DK】**key for flushing of alkali piping, otherwise press **【Back】**key for exit. The interface for alkali piping flushing is shown in Fig.13, and it will Back to maintenance interface after flushing.



Fig. 13

Liquid adding for calibration

Liquid adding for calibration includes calibration by dilution water, alkali solution, boric acid solution or drip washing water, as shown in Fig.14.

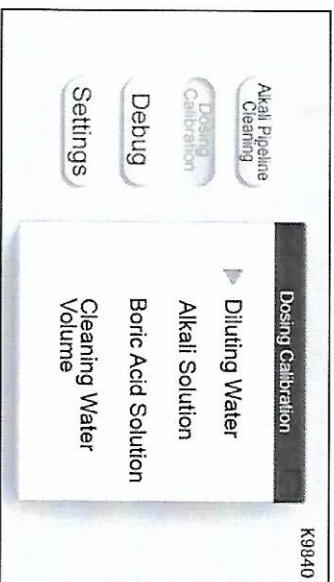


Fig. 14

The calibration by dilution water is shown in Fig. 15. Calibration by other solutions is operated in the similar way.

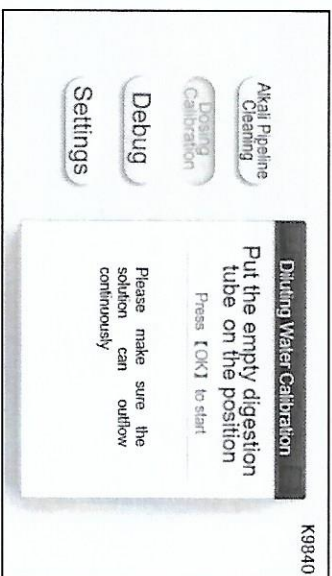


Fig. 15

The instructions on the interface shall be observed strictly prior to calibration. When everything is ready, press **【OK】** key and the instrument starts adding liquid to the digestion duct through the dilution water valve. Liquid adding will end with a "tick" sound and the dialogue box will appear in lower part of the interface, as shown in Fig. 16. Input the volume of the liquid received in the "Please input the volume of the liquid received" section and press **【DK】**key for end of calibration. Or press **Return】** key to quit calibration.

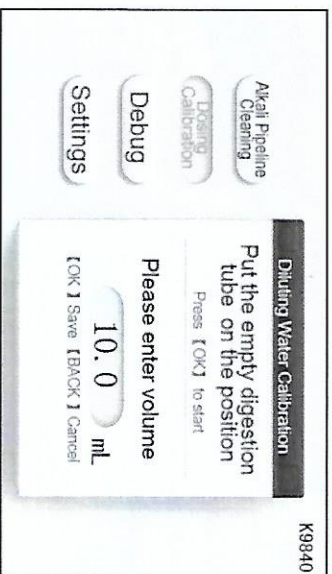


Fig. 16

Press **【OK】** key, and a small interface will appear, as shown in Fig. 17. You may verify the accuracy of the solution calibration by pressing **【OK】** key for adding a particular amount of solution, otherwise press **【Return】** key to quit calibration.

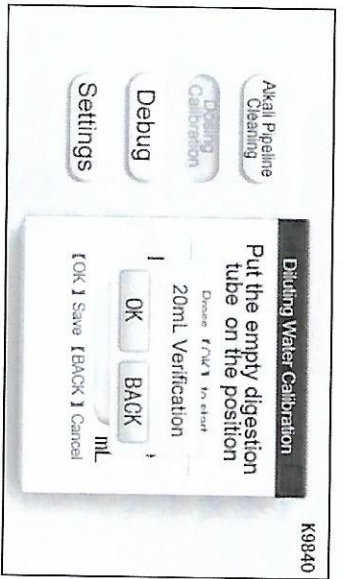


Fig. 17

Notes : Please desert the liquid received in the first calibration for accuracy. The volume of liquid received may be measured several times and input the average result to the parameter box if it is possible.

Function commissioning

Function commissioning is aimed at testing each component to see whether it is in normal operation condition, as shown in Fig. 18. Press **【Up】**, **【Down】**, **【Left】**,

【Right】 keys for selection of corresponding components. Press **【OK】** key for opening and press it again for closing. Correct positioning of the protection door, digestion duct, water level cup and condensed water is for supervision of the instrument safety. Correct positioning is indicated by , and incorrect positioning or no placement is indicated by . Press **【Return】** key and all the components will close down automatically.

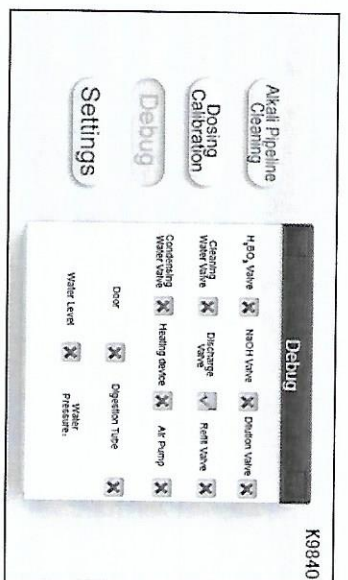


Fig. 18

Safety setting

Safety setting is mainly aimed at test for correct positioning of the protection door, digestion duct and condensed water. You may not select the item not intended to be tested by the system in the test. The item will indicate if it is selected, or it will indicate . Press **【OK】** key for either selection or cancellation of selection. When the setting is over, press **【Back】** key for saving data and exit. See Fig. 19

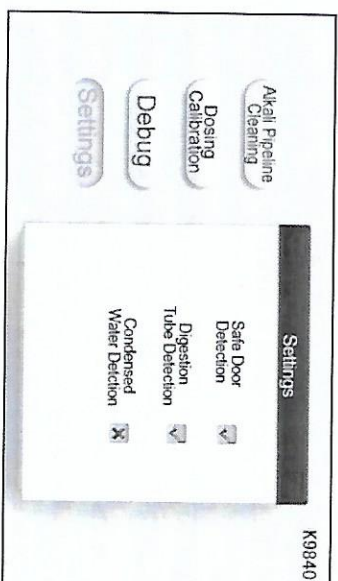


Fig. 19

Help

Choosing [Help] in the original interface will display interface as shown in Fig. 20.

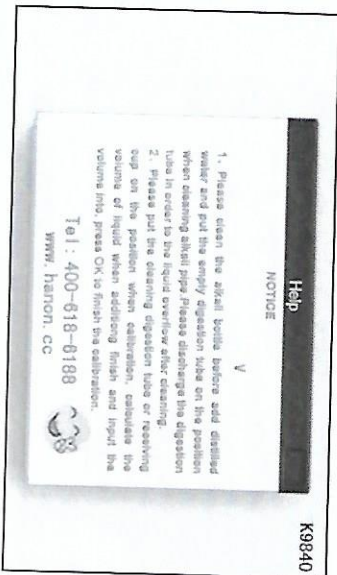


Fig. 20

VII. Regular Maintenance

1. Because in the operation, the instrument will perform the distillation process that generates the heat, the good ventilation and heat sink are required.
2. Wash away the sediments in the alkali solution bottle and boric acid bottle and clear them up regularly
3. Wipe out and clean the slot located in front of the instrument, in which the liquid may accumulate.
4. The water scale may accumulate in the distilling bottle after a long time, which can influence the heating efficiency. Follow the procedures listed below to remove it: Firstly, turn off the instrument and disconnect the power cord; secondly, screw the plug out from the distilling bottle and insert a small funnel in; thirdly, pour in the scale remover or glacial acetic acid to remove the scale; After the cleaning is done, open the discharge valve located behind the instrument to discharge the waste water completely and rinse the instrument repeatedly with the distilled water.

VIII. Common problems and troubleshooting

No.	Problem	Cause	Troubleshooting
1	No power	The fuse is burnt or the power cord is not plugged in firmly.	Replace the fuse or well plug in the power cord.
2	Water in distilling bottle has reached required level, but no steam is generated and heating indicator is still off.	Malfunction in heating controller or something is wrong with the wire connecting heating controller and distilling bottle	1. Check whether the wires are loose. 2. Replace the heating controller.
3	unable to add alkali solution.	1. The alkali solution is insufficient, the suction tube is not able to reach the alkali solution. 2. There is no air pressure in alkali solution bottle; air loop is not air-tight or the cap of alkali solution bottle is not screwed firmly into place. 3. The air pump does not work	1. Add pre-made alkali solution into alkali solution bottle 2. Check all connections and make sure the cap of alkali solution bottle is firmly screwed into place 3. Replace the air pump
4	Unable to add boric acid	Similar to above mentioned	Similar to above mentioned

IX. Appendix

One-year limited warranty starts from the purchase day (the invoice-issuing date), and does not cover the following situations:

1. The warranty has expired.
2. Any damage caused by the inappropriate operation.
3. Any damage caused by the disassembly that is not performed by authorized personnel.
4. Any damage caused by the inappropriate transportation or storage.

X. Attention

1. Check the amount of distilled water before use, and refill the bottle if necessary. The manufacturer does not take any responsibility for any damage caused by the insufficiency of distilled water.
2. When the alkali solution or acid solution is made up, users must be cautious to avoid the burn injury caused by chemical reagents.
3. It is prohibited to unplug the gas-liquid pipe when the instrument is working, if necessary, please open the bottle to release pressure.
4. Be careful about the glassware during the transportation.
5. If the inside parts need repair, make sure the power cord is unplugged and wait the distillation system to cool down.
6. The outlet of waste-discharging pipe should be lower than the whole instrument to ensure the good drainage.
7. Remove the alkali solution from its bottle and fill the water instead if the instrument will not be used for a long time. Install nitrogen tube back to the instrument and start manual mode of adding alkali solution to transfer the alkali solution stored in the pipe to the nitrogen tube. Then rinse the pipe with the clear water to avoid the pipe clogging caused by the crystallization.