

Kjeldahl Nitrogen Analyzer DW-K1160 User Manual



Please read operating manual before installation and operation.

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I. Safety

1. General

This User Manual is for laboratory instrument operators. Please read this User Manual carefully before using the instrument and operate it according to the Manual. Personnel who are not familiar with instrument operation and safety information shall not operate the instrument. Improper use of the instrument may cause potential safety hazards.

The instrument manufacturer has already evaluated the possible residual hazards of:

- Instrument operation by inexperienced personnel.
- Failure to operate the instrument in accordance with normal regulations.

2. Safety

Warning: This instrument is applicable to laboratories only. The manufacturer is entitled to refuse to accept any consequences if the instrument is damaged by the operation in defiance of operating instruction.

Warning: The company will not accept the liability for the security of the instrument caused by the incorrect operation in defiance of operating instruction.

Warning: The safety performance of this instrument may be impaired if it is not operated as per the instructions.

Warning: Please observe the safety regulations of the laboratory when treating the solutions used during inspection. Operators shall wear rubber gloves, lab coat and goggles during operation.

Warning: The oral administration of boric acid will cause acute poisoning, mainly manifested as gastrointestinal symptoms, including nausea, vomiting, abdominal pain and diarrhea, followed by dehydration, shock, coma, or acute kidney failure, possibly causing high fever, liver and kidney injury and convulsions, resulting in death in severe cases. It is easy to be absorbed by damaged skin to cause poisoning. Chronic poisoning: Long-term absorption of small amounts of boric acid from the gastrointestinal tract or skin may lead to mild gastrointestinal symptoms, dermatitis, alopecia, and damnification of liver and kidney.

Warning: Sodium hydroxide is strongly irritating and corrosive. Dust or smoke can irritate the eyes and respiratory tract, and corrode the nasal septum. Direct contact between skin or eyes and sodium hydroxide can cause burns. Digestive tract burns, mucosal erosion, bleeding and shock may be caused by wrongly oral administration.

Warning: Sulfuric acid (96-98%) is strongly irritating and corrosive to skin, mucous membranes and other tissues. Steam or mist may cause conjunctivitis, chemosis and corneal opacity, resulting in blindness; it can cause respiratory stimulation, even dyspnea and pulmonary edema; high-concentration sulfuric acid will lead to death by suffocation due to laryngospasm or glottidial edema. Oral administration will cause anabrosis due to gastrointestinal burns; even lead to gastric perforation, peritonitis, renal damage and shock.

Warning: The temperature of the digestion tube can reach 100°C during the experiment. Therefore, the tube shall be removed with a test tube clamp to avoid burns after the distillation.

Warning: Please use the power cable provided by Drawell. Otherwise, the safety performance of this instrument may be influenced.

Warning: This instrument is equipped with a special power plug for grounding to prevent electric shock. Grounding receptacle shall be used to prevent electric shock.

Warning: Danger of electrical shock. Only qualified professional personnel can open the cover and panel of the instrument.

Warning: The instrument shall not be used in any explosive atmosphere.

Warning: Paraffin or reagents containing paraffin can cause damage to the equipment.

Warning: Waste liquid can be drained directly into the sewer if this action does not violate local waste disposal regulations. The waste draining pipe shall not be bent, upward flow shall be avoid, and it shall be as short as possible. The outlet end shall not below the level of liquid in the sewer. (Hot water discharged under cold water can cause noise). Meanwhile, the pipeline shall be fixed as the waste solution drained from the system has pressure.

Warning: The power switch at the right bottom of the instrument shall be easily available under any circumstances to ensure free switch on and off at any time.

Attention: Do not touch or open the safe door during instrument operation.

Attention: Make sure that the liquid solution does not contact with wires or any electric parts in the instrument.

Attention:Please contact a nearby Drawell service center for help in stead of operating the instrument in case of fault.

Attention: This instrument must be repaired by personnel authorized by Drawell. The use of original spare parts is recommended, and the warranty does not work for other spare parts.

Attention: This instrument is designed and tested based on EU standards (CE). To ensure that the instrument consistently complies with the standards, the instrument can only be connected with equipment that conforms to CE.

Attention: Unboxing, assembly and installation of the instrument should be carried out by the personnel authorized by Drawell.

Attention: Please make sure that the supplies of water, power and air to the instrument are cut off after experiment! (Please operate as per the practical situations!)

3. Guidelines for Waste Disposal

Electronic devices shall not be discarded together with unclassified garbage. Improper disposal will do harm to the environment and health. Please collect and dispose of devices based upon local waste disposal regulations.

4. Warranty Policy

The warranty is usually specified in the purchase order or contract, and is only applicable to the following conditions:

• The user shall comply with all written instructions and documents of Drawell.

• The equipment shall be installed, maintained, adjusted and calibrated according to the methods described and recommended in the document.

• The equipment shall not be used for other purposes than those specified in the Manual.

• The equipment shall not be refitted or repaired with non-Drawell spare parts, and shall not be repaired by non-Drawell authorized personnel.

• Only the accessories and consumables provided or recommended by Drawell can be used.

• The equipment shall not be operated in a manner inconsistent with the usual habits.

• Only the software authorized by Drawell can be installed on the Android screen of the equipment.

• The external computer that meets the requirements recommended by Drawell shall be used.

• It is not allowed to play games on the Android screen, including those installed together with the operating system.

• The equipment shall be properly maintained according to the requirements recommended by Drawell.

• The equipment contains some vulnerable parts, which can be inquired from the User Manual and user guide.

• The warranty liability of vulnerable parts is limited to the damage caused by material defects or production problems.

II. Overview

1. Application

The K1160 Automatic Kjeldahl Analyzer is used to determine nitrogen content according to Kjeldahl method. It can be widely used to analyze nitrogen and protein in macro and semi-micro samples in food processing, feed production, cigarettes and tobacco, animal husbandry, soil fertilizer, environmental monitoring, pharmaceuticals, agriculture, scientific research, teaching, quality monitoring and other sectors, and also to detect ammonium salts, volatile fatty acids/ alkali, etc. Three processes, i.e., digestion, distillation and titration are required during the test of samples with Kjeldahl method, and the last two are the main determination processes of the K1160 Kjeldahl Analyzer.

The K1160 Automatic Kjeldahl Analyzer is a system of distillation, titration and measurement designed according to the classical Kjeldahl method; it provides great convenience for laboratory testers during the determination of nitrogen and protein, featuring safety, reliability, simple operation, saving of time, etc. The users can quickly learn how to operate the instrument with easy operating and friendly Chinese interactive interface.

2. Principle

Three steps (digestion, distillation and titration) are required for the determination according to the Kjeldahl method.



The K1160 Automatic Kjeldahl Analyzer can complete distillation and titration processes. The following chemical reactions are completed in the instrument when the tested sample is completely digested:

[1].
$$(NH)_{,SO_{4}} + 2NaOH \xrightarrow{\text{high-temperature steam}} Na_{,SO_{4}} + 2H_{,O} + 2NH_{,\uparrow}$$

$$[2] \quad 2NH_3 + 4H_3BO_3 = (NH_4)_2B_4O_7 + 5H_2O$$

[3].
$$(NH_4)_2 B_4 O_7 + 5H_2 O + 2HCl = 4H_3 BO_3 + 2NH_4 Cl$$

Ammonia released during above reactions is collected in the receiving cup with boric acid absorbent (containing a mixed indicator) after being condensed with water vapor through a condensing tube. Then the automatic titrator titrates, and the volume of standard titration acid consumed is recorded. The instrument calculates nitrogen content and crude protein content according to the formulas listed below.

Nitrogen content:
$$N(\%) = \frac{Q \times c}{W} (V - V_0)$$

Crude protein content: $P(\%) = N(\%) \times F$

Where:

c: standard titration acid concentration (mol/L);

W: mass of the sample (g);

V₀: volume of standard titration acid consumed by the blank sample (mL);

V: volume of standard titration acid consumed by the sample (mL);

F: crude protein conversion factor;

Q: calculation factor, 1.0 mL of sulfuric acid $(1/2H_2SO_4=1.000 \text{ mol/L})$ or 1.0 mL of hydrochloric acid (HCI=1.000 mol/L) equivalent nitrogen mass of standard titrated solution (g).

Attention: Standard titration acid is H_2SO_4 or HCI. In this User Manual, the standard titration acid concentration is the H^+ concentration in the titration acid.

3. Operation Flow Chart



III. Main Performance

1. Technical Indicators

- a. Determined sample quantity: solid≤5g, liquid≤20mL;
- b. Determination range: 0.1mg-240mg nitrogen;
- c. Determination speed: 3-8 min;
- d. Recovery rate: \geq 99.5%;
- e. Titration accuracy: 0.2 µL/step, 0.4 µL/step, 1.0 µL/step;
- f. Repeatability error (RSD): ≤0.5%;

g. Data storage capacity: 1,000,000 (inside the instrument); unlimited (cloud storage);

- h. Condensate water consumption: 0.5L/min (at the temperature of 15°C);
- i. Interface: USB, LAN, RS232, CAN, WIFI;
- j. Overall dimensions (length × wide × height): 460mm × 360mm × 725mm;
- k. Net weight: 35kg.

2. Instrument Service Conditions

- a. Power supply: AC 220±10%V (50/60±1)Hz;
- b. Rated power: 2,000W;
- c. Condensate water pressure: >0.02MPa; flow: >1.5L/min;
- d. Condensate water temperature: ≤20°C;
- e. Ambient temperature: 10°C~35°C.

IV. Name of Instrument Parts

The instrument is a system for fully automatic distillation, titration, calculation, waste discharge and cleaning of the digested sample, it can display the workflow, calculate the results by microcomputer, and output the data by printer. The system is mainly composed of microcomputer controller, steam generator, distillation system, alkali adding system, boric acid adding system, titration system, waste discharge system and cleaning system.

The structure of the instrument is shown in the figure:



1. Label 2. Safety door 3. Digestion tube 4. Digestion tube bracket

5. Display screen 6. Right side door 7. Receiving cup 8. Instrument model



9. Power switch 10. USB interface 11. RS232 interface 12. CAN interface





- 15. Water bucket level 16. Distilled water 17. Boric acid bucket level
- 18. Distilled water 19. Alkali bucket level 20. Boric acid
- 21. Waste liquid bucket level 22. Alkaline liquor
- 23. Digestion tube waste discharge port
- 24. Receiving cup waste discharge port
- 25. Condensate water outlet
- 26. Heating cup waste discharge port 27. Condensate water inlet

V. Instrument Installation Method

1. Check before Installation

Please verify the instrument and its accessories according to the accompanying packing list, and check if there are any damages. If any, please promptly contact the manufacturer. (Please retain the damaged parts)

2. Installation Conditions

a. The instrument installation shall avoid direct sunlight, excessive coldness, excessive heat, and moist places. Generally, the indoor temperature shall be 10°C~35°C.

b. This instrument shall be installed near the water source and the drain tank, and configured with a power socket. The feed valve and the power supply shall be within 1m away from the instrument to facilitate operation and application.

c. The condensate water shall meet the requirements for water pressure and temperature in the service conditions of the instrument.

d. The drain tank shall be 50cm lower than the drainage outlet of the instrument to ensure smooth and natural drainage.

e. The power supply shall conform to the power supply requirements. The power supply shall be provided with ground wire, independent supply switch and fuse to ensure the security of operators.

f. The installation position of this instrument shall be away from large electric equipment, and with no vibration, corrosive liquid and the interference of strong electromagnetic field.

3. Installation

The instrument shall be placed steadily on the test stand and keep its back over 20cm away from the wall. The distance from power socket with a air switch, a leakage switch and reliable ground wires to the instrument shall not exceed 1m.

The condensate water inlet is connected to the tap water or water bath system, and the condensate water outlet and waste discharge port are respectively connected with drain pipe and waste discharge pipe that are put into the drain tank to ensure smooth drainage.

VI. Functions

1. Power On Self-Test

The test includes receiving cup detection, distillation detection, condensate water detection and titration detection, which are shown the figure below:

2018/12/	13 17:27:19	G
A Receiving Cup Detection	Passed	
ਰ੍ਹੋ* Distillate Analysis	Passed	
Condensed Water Analysis	Foiled	
Tarant Lookada	Waiting	

Status: Test Passed will be displayed for the items passing the test, while Waiting will be displayed for those not being tested, and Fail for those fail to pass the test.

Skip self-test: This function always exists during self-test available for the skipping at any time. Click Skip Self-Test to enter the home page directly.

The login page can be normally entered if there is no abnormality after detection, otherwise, the detection abnormality will be prompted. Click OK to enter the login page.

The power on self-test is enabled by default (including the first power on), it can only be canceled by administrator in the settings after logging into the system.

2. Boot Settings

The administrator account will log in to set the boot settings when the first power on self-test is completed, then it will enter the home page. The boot settings include the following parts: language setting, time setting, network setting, and advanced setting. The settings can not be skipped except network setting. The login for boot settings when powering on is not required only at the first time of use. The boot settings in the settings will be displayed as off after they are completed, it will be displayed as on when the switch is turned on. Only the administrator account has the authority to operate the settings and set the boot settings after logging in. The boot settings will not be displayed after the others log in.

2.1 Language Setting

Language setting is mainly used to set the language used by the instrument. Select the intended language in the pull-down menu, such as Simplified Chinese, then click Next. Shown as the figure below:

90,927	11700-09.50.51		
W	elcome		
Only a few steps are neede	d before you can use or s	et your system	
english		*	
	NEXT	1. J. J.	

2.2 Time Setting

Time setting is mainly used to set the time of the platform. Select the corresponding time zone from the pull-down menu, such as China Standard Time (Beijing). Click Next after selecting. Shown as the figure below:

	20222/11/2030-8	51110		
	Select Your Ti	me Zone		
Only a	a few steps are needed before you	can use or set your s	system	
	China Standard Time (Beijing)	*		
	BACK	NEXT		

2.3 Advanced Setting

Advanced setting is mainly used to set power on self-test, burette specifications, and printing methods. Click Next after setting. Shown as the figure below:

Advan	ced Settings	
Power on Self-test		•
Burette Specification		5mL -
Printing Method		Standard Format
BACK	NEXT	

Power on self-test: The status shown in the figure is on, click the button to turn it off.

Burette specifications: The instrument supports three specifications: 5mL, 10mL and 25mL. The factory standard configuration is 25mL.

Printing methods: The instrument supports USB connection to printer, with optional basic format and standard format.

2.4 Network Setting

Network setting is mainly used to set the network of the instrument. Select whether to automatically obtain the IP address in the page. Network setting can be skipped. Shown as the figure below:



3. Login

On the login page, enter the correct user name and password, and click Login to successfully log in. Default login password: 888888. As shown in the figure:



4. Home Page

The user will enter the home page after successful login. The home page includes nine modules: test, cleaning, data, cloud service, personal information setting, message notification, settings, helptext, and exit. Shown as the figure below:



4.1 Test

Click the test button to enter the main test interface in the main interface. The basic settings, adding sample batches, and adding sample data can be performed in the test function. Check the number of sample to be measured, then click Run, and the system will automatically conduct the experiment. Shown as the figure below:

\bigcirc				
ample Batch No. +Add	+Add		S Cl	ear Experiment Status
rerun >	No.	Test Type Sample Name	Testing Method	Quantity of Experiment Sample Status
leaning >	E1	Instrument Cleaning Blank	Cleaning	0.0g
	□ E2	Instrument Cleaning Blank	Cleaning	0.0g
asic Settings				
Last Time of Automation				
Concentration		Sample Injector Rotation	Run	

4.1.1 Basic Setting

Basic setting is mainly used to set blank volume and titration acid concentration. Shown as the figure below:

	2022/11/09 10:28:03	¢
\bigcirc		
Sample Batch No. +Add		
O Bie	nk Volume Settings	× Clear Experiment Status
Cleaning	Last Time of Automation Auto Average Manual Enter	Quantity of Experiment Sample Status 0.0g 0:0g
Basic Settings	CANCEL	0.0g
Blank Volume		
Concentration Concentration B.limol/L		
\odot	2022/11/09 10:28:20	۰
Sample Batch No. +Add	-00	
	+Add	Clear Experiment Status
Preton	+Add	Tastian Clear Experiment Status
Prerun Cleaning	+Add centration Titration Acid Concentration	Clear Experiment Status
Protun Cleaning Basic Settings	+Add centration Titration Acid Concentration (mole CANCEL YES	Clear Experiment Status
Cleaning Basic Settings Biank Volume List Time of Automation	+Add centration Titration Acid Concentration 0 mole CANCEL YES E4 Instrument Prenun Bionik	Clear Experiment Status
Protum Image: Set Acid Construction Cleaning Image: Set Acid Construction Basic Settings Image: Set Acid Construction Image: Set Acid Construction Image: Set Acid Construction	+Add centration Titration Acid Concentration (mole CANCEL YES E4 Instrument Prenum Blank Prenum	Prerun 0.00

Blank volume: Click the blank volume module to pop up the window, Where the blank volume calculation method can be selected, including Auto Last Time (default), Auto Average, and Manual Input. The pop-up input box is available to input manually when the manual input is selected. Titration acid concentration: The default value is 0mol/L. Click the titration acid concentration module to pop up the window to manually enter the value of titration acid concentration.

4.1.2 Sample Batch

Add sample batch: Click+Add to pop up the page of adding sample batch. Enter the batch group name and click YES to add successfully. The xml file of the USB flash disk is also available to be imported for adding. Shown as the figure below:

	2022/11/09 10:27:15	
Sample Batch No. +Add	+Add	Clear Experiment Status
Prerun	roup	Testion Departury of Experiment
Rasic Settings	Please enter the batch group name CANGEL VES IMPORT	
Elastic Volume Last Time of Automation	Borrpile Injector Bistospe	100

Edit and delete sample batch: Check one of the information in the sample batch list on the left, and slide the screen leftward to display the Edit and Delete buttons. Click Edit to enter the editing page, Where the information of saved batch is available to be modified. Click Delete to pop up the secondary confirmation message. Click YES to delete all the data of the batch. Shown as the figure below:

\bigcirc				
Sample Batch No. +Add	+Add		× c	lear Experiment Status
> EDIT DELETE	No.	Test Type Sample Name	Testing Method	Quantity of Experiment Sample Status
Cleaning >	C E1	Instrument Blank	Prerun	0.0g
	🗆 E2	Instrument Prerun Blank	Prerun	0.0g
	🗆 E3	Instrument Prerun Blank	Prerun	0.0g
Basic Settings	🗆 E4	Instrument Prerun Blank	Prerun	0.0g
Blank Volume Last Time of Automation				
Titration Acid Concentration		Sample Injector Rotation	Ru	n

4.1.3 Sample Data

It is mainly used to add corresponding sample data to the sample batch, including number, test type, sample name, selection method base, selection method, and sample volume. Run the instrument to obtain the corresponding experimental data after adding sample data. Shown as the figure below:

	20	22/11/09 10:28:54		-
	Add Sample Data		×	
Comple Datab Ma	Select Method Base	Instrument Test	*	
Sample Batch No. +Add	Select Method	Cleaning	v	Clear Experiment Status
Prerun = Cleaning >	Parameters of method	Sampling Unit:g Result Un Dilution Water;100.0mL Al Receiving liquid:20.0mL Pi Coefficient:0.0 Distillate Qi 300.0s	it:mL kali:0.0mL rotein uantity:	Quantity of Experiment Sample Status
	No.	E3	*	a 0.0g
	Test Type	Instrument Blank	Ŧ	
Basic Settings	Sample Name	Cleaning		
Blank Volume	Quantity of Sample	0	g	
Last Time of Automation	Water Conversion			
Titration Acid Concentration 0.0mol/L	c	ANCEL YES		Ray

Add sample data: Click +Add to pop up the page of adding sample data to improve the number, test type, sample name, selection method base, selection method, and sample volume, then click YES. The added sample data will be displayed on the right, the selected batch will be displayed on the top, and the list will display the fields in the table, including number, test type, sample name, test method, sample volume, and experiment status.

Delete sample data: In the sample data list, slide leftward to pop up the Delete button. Click Delete to pop up the secondary confirmation box, then click YES to delete the data.

Empty experiment status: The experiment status " $\sqrt{}$ " represents the completion of the experiment, and "!" represents the interruption of the experimental process. The editing operation cannot be performed for the completed experiments or interrupted experiments. If editing operation is required, check the corresponding number, and click "Empty Experiment Status" in the upper right corner to clear the state.

Select All: activate the Select All button on the left, and click Select All on the left to select all. It is necessary to determine whether to display the multi selection function according to whether to enable multi selection or not. Sample injector rotation: This function is available when the Use Autosampler is checked in advanced setting. Click the button "Sampler Rotation" to rotate the sampler, and "Stop Sampler Rotation" will be displayed in the button.

Run: Click Run to run according to the checked serial number. Only one checked sample can be run if the sampler is unconnected. Click the Next button after manually preparing the sample.

4.1.4 Running Interface

During the experiment, the page will display the information of the experimental process and available operations. Shown as the figure below:



Progress: The running progress, titration volume and results of the current experimental object will be displayed during the experiment process.

Running status: Eight statuses will be displayed: adding receiving solution, adding diluting water, adding alkali, waiting, distilling, titrating, waste discharging, and test ended. There are two statuses (sampling, digestion tube homing) when an automatic sampler is connected to the instrument.

Event record: View the event record of the current experimental object.

Titration diagram: View the titration curve of the current experimental object.

Experimental method: View the method parameters used by the current experimental object.

Experimental result: View the results of all experimental objects in the current batch.

Return: During sample data running, click the "<" return button in the upper left corner that requires secondary confirmation. The result will be displayed normally, and the experiment status will be "!" after returning. The detailed data event record in the data module shows "Experiment Unfinished".

Alkali addition: Manual addition of sodium hydroxide (NaOH) is available at any time during the experiment.

Stop: Click Stop to pop up the dialog box for stop, and select Stop Experiment Now to forcibly stop the experiment, or selecting Stop After Experiment to stop after the experiment.

Alarm pause: When the instrument gives alarms of safe door out of place, digestion tube out of place, steam generator water shortage, steam generator overtemperature, condensate water overtemperature, Autosampler safe door out of place, Autosampler tray failure, Autosampler digestion tube failure, the experiment will be automatically paused, and error will be displayed at the progress area in the middle. Continue the experiment after the alarm is removed. According to the relevant settings, three statuses are displayed: gray state when closed, normal state when open, and alarm state when red.

If the test result is lower or higher than the low limit or high limit in the test method, a window will automatically pop up to prompt "Continue or pause, the result is lower or higher than the limit set by the method".

Sensor status: Water bucket level, receiving solution bucket level, alkali bucket level, titration acid bucket level, waste liquid bucket level, safe door,

digestion tube, steam generator temperature, condensate water temperature, automatic sampling.

The status of the Autosampler includes the status of the sample injector tray, sample injector safe door, and sample injector digestion tube, and they are combined into one icon (the corresponding part of the sample injector icon alarm displays as red).

4.2 Cleaning

Cleaning is mainly used to clean pipelines and parts before or after the experiment. It mainly includes: Cleaning for acid replacement (recommended for replacement of titration acid), all pipeline cleaning, alkali pipeline cleaning, receiving solution pipeline cleaning, receiving cup cleaning and digestion tube waste discharge. Shown as the figure below:



Start cleaning: Select the instrument and click to enter the cleaning page, the Cleaning will be promoted, and Cleaning Completed will be prompted when the automatic cleaning is completed.

Stop cleaning: Stop cleaning is available at any time during the automatic cleaning process of the system, click it to return to the previous layer.

4.3 Data

The data display interface is mainly used to display, query, print, export and delete experimental data. The experimenter can only view all the data of his own experiment, and the supervisor or above can view all the experimenters and their experimental data. Shown as the figure below:



Query: Enter the sample name, the experimenter, or select the range of experimental dates, and click Search to filter out the corresponding experimental data.Previous Page, Next Page and Jump buttons will appear to turn pages in a single page or by jumping when the data is displayed in multiple pages.

Display: Brief information includes serial number, sample name (name of sample data that has completed the experiment, The name in manual manual mode). sample volume. mode is experimental results. experimenters, experimental time, events (click to view the event record pop-up window, where all event records of this data are displayed). Slide the data display leftward and click to view all data information in details, including test type, sample volume, blank volume, titration acid concentration, titrated volume, result, tester and test time.

Manual mode: The sample name is displayed as manual mode, the sample volume is 0g, and the test type is manual (not the three types of automatic mode); the method name shows manual mode, the result unit is milliliter, and the titration is the external result. The sample volume shall be kept to six decimal places, and the result shall be rounded to four decimal places.

Print: Check the data to be printed. When you click Print, you need to determine whether the printer is connected. If the printer is connected, the data will be directly printed on the paper; if not connected, "Please check whether the printer is connected, and then try again." will be promoted. The printing content depends on the printing settings (simple report and detailed report). If the data in the test data is inconsistent with the method calls when clicking Print, Unable to Print will be prompted, and multiple event records will be separated by commas.

Export: Check the data to be exported. When clicking Export, the pop-up window will display the export method (XML, Excel or PDF); the instrument will judge whether to connect the peripheral USB flash disk. If the USB flash disk is connected, the export mode will pop up. Export multiple data to a single file. The file is named according to the title in the print + year month day hour minute second. When exporting, the export progress will be displayed. To cancel the export, you need to confirm again. After the export is completed, you will be prompted with "Export Succeeded", and the prompt will be automatically hidden after 3 seconds.

Delete: It can only be deleted by personnel with administrator permission.

4.4 Cloud Services

The cloud service mainly uploads the experimental method base and experimental database to the cloud server for downloading and viewing. The user can enter the correct user name and password on the login page to log in. The account of the cloud service system and the account of the Drawell instrument platform are independent of each other. Shown as the figure below:

	5 Back to Home Page
Cloud Services	
Usemame	
Password	
LOG IN	

4.5 Personal Information Setting

4.5.1 Theme Modification

The page displays the list of themes currently available for the system. Users can select a theme from the list to set as the theme used by the system. Shown as the figure below:



4.5.2 Avatar Modification

The page shows the list of avatars currently available for the system and the currently selected avatar. Users can select one of the avatars to set as the user avatar. Shown as the figure below:



4.5.3 Password Modification

User shall enter the original password, the new password, and the new password again. Click YES to complete the modification. Shown as the figure below:

Personal Information Settings	Change Password	1	
	Old Password	Please enter your old password	
hange Theme >	New Password	Please enter your new passworld	
hange Profile Photo 🤉	Confirm Password	Please enter your new password again	
hange Password >		YES	

4.6 Message Notification

The message notification interface displays all received messages, and can be clicked to enter the message detail page for viewing, including read messages and unread messages, which can be deleted individually or cleared completely. Shown as the figure below:



All messages: Where all messages, including unread and read messages are displayed. Click the Messages to enter the message detail page to view the message details.

Read messages: Where the list of read messages is displayed. Click the Read Messages to enter the detail page.

Unread messages: Where the list of unread messages is displayed. Click the Unread Messages to enter the detail page.

Delete: Select a message, and slide the screen leftward to pop up the Delete button for deleting a single message.

Clear all: Click Clear All to delete all messages under the category.

4.7 Settings

The setting module is mainly used to set instruments, including method editing, account, debugging, instrument calibration, advanced setting, cloud setting, system update, network setting, audit traceability, and about instrument. Shown as the figure below:



4.7.1 Method Editing

Method editing is mainly to manage the method library, experimental methods and experimental method parameters. The method library on the left side has Drawell method library by default, and the experimental methods and parameters of Drawell are displayed on the right side of the Drawell method library. Shown as the figure below:



Method library: The list of method library shows the methods that can be used. You need to select a method before conducting an experiment. Click Add to enter the name of the method library in the pop-up window. Click YES to add a method library. Press and hold the name of the method library and slide to the left to delete or edit the operation.

Experimental methods: The list of experimental methods mainly shows the data of experimental methods. Click Add to improve the corresponding experimental method parameters on the right. When adding methods, the parameters of the previous experimental method are copied by default, and the method parameters are uniform. The default values of the parameters are as follows: the sampling unit is g, the result unit is mL, the protein coefficient is 0, and the default values of receiving solution, diluting water, alkali and distillation amount are 0; click Advanced Settings to set more method parameters; the default value is as follows: the calculation coefficient is 1.400 by default; result alarm low limit and high limit are 0 by

default; the titration method defaults to "titration while distilling"; the way of adding alkali defaults to "adding alkali first and then distilling", and the distillation flow rate defaults to 100%; digestion tube waste discharge, digestion tube cleaning, receiving cup cleaning and closing; preheating and waiting time is 0 seconds, the end point is judged as "from blue to red", the test method defaults to "Kjeldahl nitrogen determination method", and the slope and intercept are displayed when "direct distillation method" is selected, both of which are 0 by default.

Operation: Slide to the left at the method library column to edit and delete the operation, and the method parameters are displayed on the right and the method can be modified and deleted; when deleting a method, the administrator's permission is required, and the supervisor only has the permission to edit and add. The deletion needs to be confirmed again. After adding, this method can be called for the sample data that can be added in the automatic mode of the test function.

4.7.2 Account

The account module is mainly used for adding, editing, and deleting operations. Shown as the figure below:

	2022/11/09 10:32:33	÷
Account +Add	Account Information	
Admin >		
	Admin	
	Creation Time: 2022-11-09 02:26:13	
	Authority: Administrator	
	Default Login: Allowed	
	Change Account Information	

Add: Click Add to pop up the add page on the right side, upload the avatar, enter the user name, password, confirm the password, permissions, and

whether to log in by default, and then click Save. Among them, the permission includes: administrator, supervisor and experimenter.

View: Click the User on the left, and the user information will pop up on the right, showing the user avatar, user name, creation time, permission and whether to log in by default.

Modify account information: In the user information on the right, click Modify Account Information to pop up the modification page, where you can modify the avatar, password, permission and whether to log in by default, and then click Save.

Delete account information: In the user information on the right, click Delete Account Information to pop up a second confirmation box, and click YES to delete it.

Unlock account: When the account is set as the default account for login, the Unlock Account is displayed in the upper right corner. Click Unlock Account to pop up a secondary confirmation box. Click YES to unlock the account.

Only administrators can access this function and assign supervisors, experimenters and other permissions; there can be multiple administrator permissions and only one Admin.

There can only be one default login. After setting the default login, the default login label will be displayed in the account list on the left. When setting the first default login and then setting the second account as the default login, the first default login will be overwritten, and the latter will be the default.

4.7.3 Debugging

Debugging is mainly used to debug various parameters of the instrument, in which the supervisor and above roles can operate. Debugging includes six parts: debugging parameters, color sensor, titrator debugging, Autosampler debugging, instrument real-time status, and manual mode.

\bigcirc			
Commissioning Sett	ings	Commissioning Parameters	
Parameters	>	Digestive tube and dilution water pump	
alex Canada		Make-up water pump for steam generator	
olor Sensor	í	Cleaning Pump of Receiving Cup	
Titrator	5	Receiving Liquid Pump	
auto Sample Injector	5	Waste Discharge Pipes & Valves	
nstruments Status	>	Pipe Clamping Valve	
		Stirring Motor	

Debugging parameters: mainly used to debug various parameters, that is, you can turn them on or off. By default, all of them are closed. When debugging parameters are opened, a command is sent to the instrument for debugging. When returning to the setting function, all of them become closed. (When leaving the debugging interface, send the command that all parameters are in default state, and all debugging parameters except the pinch valve are closed).

Color sensor: mainly used to view the parameters of various colors of the color sensor. Shown as the figure below:

0			
Commissioning Setti	ings	Commissioning Parameters	
arameters	>	Digestive tube and dilution water pump	
		Make-up water pump for steam generator	
color Sensor	2	Cleaning Pump of Receiving Cup	
itrator	5	Receiving Liquid Pump	
uto Sample Injector	5	Waste Discharge Pipes & Valves	
struments Status	>	Pipe Clamping Valve	
famuel Mede		Stirring Motor	

Titrator debugging: mainly used to debug the titrator, including whether the three-way valve for titration is opened, the plunger pump rises, and the plunger pump falls. Among them, the three-way titration valve is closed by default, and the three-way titration valve can be debugged up and down. Shown as the figure below:



Autosampler debugging: mainly used to set the Autosampler, including whether the Autosampler rotation is enabled, selecting the hole position of the Autosampler, raising the digestion tube, and lowering the digestion tube. Shown as the figure below:

0		Auto Sample Injector Commissioning		
Commissioning Sett	ings			
Parametere		Auto Sample Injector Rotating		
arameters	×	Select Hole of Auto Sample Injector	*	
Color Sensor	2	Processing Pipe Lift	100%	
litrator	×.	Processing Pipe Down		
Auto Sample Injector	->-			
nstruments Status	ş			

Instrument real-time status: mainly used to check whether the index status of each instrument is normal. When the instrument state has sample injector, add sample injector state: "safe door" and "feed tray", which will not be displayed when the sample injector is not connected; red is displayed when error is reported, and gray is displayed when it is normal or closed. (The real-time parameters have no closed state, only the test state has closed state) as shown in the figure:



Manual mode: mainly used for the user to manually set the operation, save the test method for experiment, select the sample injector hole position, select the operation, input data, and choose to add the solution, etc. Shown as the figure below:

Select Hole of Auto Sample In	jector			Ŧ	Operation Record
Select Operation	Enter Data				Receiving Liquid:
Receiving Liquid(mL)	Please	enter the	number ca	innot exceec	Dilution Water:
Dilution Water(mL)	1	2	3	4	Alkali: Distilled Water:
Distille s 💌	5	6	7	8	Titrant:
Titrant(uL)	9	0	С	DEL	-
DISCHARGE		R	UN		CLEAR DATA SAVE METHOD

Select the hole position of Autosampler: "Select the hole position of

Autosampler" is displayed when there is an Autosampler, which can be selected from 24 numbered hole positions. Default E1; If there is no Autosampler, this control will not be displayed; After changing the hole position, it is necessary to display the data results in the data and then clear the hole position data. The name of the experimental method "Manual Mode" is only for display, and the method is not saved.

Receiving solution: unit is mL; the maximum injection is 150mL, the right data input text box should be limited to 150, and the default prompt for the text is "Please enter a value not exceeding 150".

Diluting water: unit is mL; the maximum injection is 150mL, the right data input text box should be limited to 150, and the default prompt for the text is "Please enter a value not exceeding 150".

Alkali: unit is mL; the maximum injection is 150mL, and the right data input text box should be limited to 150, and the default prompt for the text is "Please enter a value not exceeding 150".

Distillation: unit is second or milliliter; maximum is 720 seconds or 420 mL; on the right side, the value is inputed according to the limit value of selected unit; the default prompt for text is no more than 420, and the default unit is mL.

Titration: unlimited; unit is microliter.

Waste discharge: Click Waste Discharge to waste the liquid in the pipe, but do not clear the data record.

Status: See the introduction of automatic mode for details.

Data input: the text box displays the corresponding numerical limit prompt according to the limit of each operation column; the numeric keypad is customized; click Clear on the left side to clear the value and click Delete on the right side to backspace one digit. Click Run to run the manually set operation.

Operation record: show the experimental record, and clear the operation record data after changing the hole position.

Clear experimental data: after clicking Clear Experimental Data, you need to confirm whether to clear the data twice. After clearing the experimental data, it is necessary to display the data results in the data. Save the experiment method: only the supervisor and above can save it as a method, and other roles cannot save it.

Rule:

a. Select the second one in the method library by default (the first one is self-contained in the Drawell method library, which cannot be added, deleted or modified), and enter the method name, then select the sampling unit (the default unit is g), lastly, select the result unit (the default unit is mL). The protein coefficient is 0 by default;

b. Click the Advanced Settings and the pop-up window will display: the calculation coefficient is 0.014 by default; result alarm low limit and high limit are 0 by default; the titration method defaults to "titration while distilling"; the way of adding alkali defaults to "adding alkali first and then distilling", and the distillation flow rate defaults to 100%; digestion tube waste discharge, digestion tube cleaning, receiving cup cleaning and closing; preheating and waiting time is 0 seconds, the end point is judged as "from blue to red", the test method defaults to "Kjeldahl nitrogen determination method", and the slope and intercept are displayed when "direct distillation method" is selected, both of which are 0 by default.

c. Click Save to return to manual mode.

4.7.4 Instrument Calibration

The instrument calibration includes: plunger pump calibration, receiving solution, alkali pump calibration, diluting water pump calibration and color adjustment. Only supervisor and above roles can conduct the operation.



Plunger pump calibration: it is divided into three steps. Calibrate according to the guidance prompt, and recalibrate after the calibration.

Receiving solution calibration: it is divided into two steps. Calibrate according to the guidance prompt, and recalibrate after the calibration. Shown as the figure below:



Alkali pump calibration: it is divided into two steps. Calibrate according to the guidance prompt, and recalibrate after the calibration. Shown as the figure below:

		2022/11/09 10:37:06	
\bigcirc		Allesti Dense Onlibertion	
Instrument Calibration			
Calibration of Burette	>	 Put the empty digesting pipe on the instruments and make sure the alkali pipeline is full of liquid. Then click NEXT. 	
Receiving liquid	>		
Alkali Pump Calibration	>	Next	
Calibration of Dilution	ě.		
Adjust Color	>		
White Balance	>		

Diluting water pump calibration: it is divided into two steps. Calibrate according to the guidance prompt, and recalibrate after the calibration. Shown as the figure below:



End point color adjustment: Mainly calibrate the color; it is divided into three categories: adjustment from blue to red, adjustment from green to red, adjustment from yellow to red. Shown as the figure below:

$\langle \rangle$				
Instrument Calibration	n	Adjust Color		
Calibration of Burette	3	Adjust from blue to red	230	
Receiving liquid	2	Adjust from green to red	260	
Alkali Pump Calibratio	n >	Adjust from yellow to red	260	0
Calibration of Dilution	>	ć	-č	0
Adjust Color	>			
White Balance	>			

White balance: mainly calibrate the light source reference of the color sensor. Shown as the figure below:

		2022/11/09 10:38:23	(î•
Instrument Calibration	1	White Balance	
Calibration of Burette	- 5:	WHITE BALANCE	
Receiving liquid	-		
Alkali Pump Calibration	n >		
Calibration of Dilution	æ		
Adjust Color	2		
White Balance	*		

4.7.5 Advanced Settings

It includes eleven settings, namely: startup wizard, power on self-test, Autosampler, restore factory settings, time settings, language selection, test settings, security settings, burette specifications, cleaning settings and print settings.

Power on Wizard: Only administrator and supervisor can choose startup wizard. Only supervisor and above will be able to reset the boot settings after login when the Power on Wizard is on or after reboot, while it will not be performed by testers. The status will automatically closed after boot setting.

Power on self-test: Only the administrator and supervisor can control the power on self-test. The power on self-test is enabled by default, including receiving cup detection, distillation detection, condensate water detection and titration detection. Shown as the figure below:

		2022/11/09 10:57:40	(·•
$\langle \rangle$			
Advanced Settings		Auto Sample Injector	
Power on Wizard Power on Self- test	•	Use Autosampler	
Auto Sample Injector			
Cleaning Settings	ä.		
Printing Settings	2		
Time Settings	>		
Select I annuane	5		

Autosampler: Only the administrator and supervisor can control the Autosampler. The Autosampler is closed by default. Shown as the figure below:

	2022/11/09 10:57:40	
Advanced Settings	Auto Sample Injector	
Power on Wizard	Use Autosampler	
Auto Sample Injector	2	
Cleaning Settings	а. Э	
Printing Settings	3	
Time Settings	>	
Select Language	5	

Cleaning settings: Click Cleaning Settings on the page and the cleaning settings page will pop up on the right, where the times and time of the six cleaning types are available to be set.. Shown as the figure below:

S		
Advanced Settings	Cleaning Settings	
	Dispensing Time After Distillation	10Seconds
Power on Wizard	Waste Discharging Time of Processing Tube	20Seconds
lest	Cleaning Time of Processing Tube	5Seconds
uto Sample Injector	Waste Discharging Time of Receiving Cup	20Seconds
leaning Settings >	Cleaning Time of Receiving Cup	5Seconds
rinting Settings	Cleaning Time of Alkali Pipeline	20Seconds
	Cleaning Time of Receiving Pipeline	36Seconds
ime Settings		

Print settings: Click Print Settings on the page to display it on the right to

set title content, header title, footer title and printing mode. Shown as the figure below:



Time settings: Click Time Setting on the page to display it on the right. Either manual or automatic settings are available to be selected to set time zone and time. Shown as the figure below:



Language selection: Click Language Selection on the page to display is on the right. There are 6 languages available for selection at present. All the contents of the platform will be displayed with selected language. Shown as the figure below:

Advanced Settings		Select Language	
		English	~
Printing Settings	>	русский	
Time Settings	3	Français	
Select Language	2	español	
Fest Settings	5	简体中文	
Safety Settings	>	中文繁体	

Test settings: Click Test Settings on the page to display it on the right, including the switches of Delete date after batch testing and multiple choices for batch test display. Shown as the figure below:

0			
Advanced Settings		Test Settings	
		Delete data after batch testing	
rinting Settings	>	Automatic lock screen time	30
ime Settings	3		
Select Language	>		
est Settings			
est Settings afety Settings	>		

Security settings: Click Security Settings on the page to display it on the right, including the switches of eight detection types. Shown as the figure below:

		2022/11/09 10:59:18	
\bigcirc		Safety Settings	
Advanced Settings		Detection of Liquid Level in Bucket	
Printing Settings	2	Level Detection of Receiving Liquid Bucket	
Time Settings	2	Liquid Level Detection of Alkali Bucket	
Select Language	*	Liquid Level Detection of Waste Liquid Bucket	•
Test Settings	>	Liquid Level Detection of Titration Acid Bucket	•
	-	Detection of Protection Valve in Position	•
Safety Settings	>	Detection of Processing Pipe in Position	
Select Burette	>		

Burette specification: Click Burette Specification on the page to display it

on the right. Three types of burette are available, including 25ml, 10ml and 5ml. Shown as the figure below:

Advanced Settings		Select Burette	
		25mL	
Printing Settings	×.	10mL	
Time Sattings	~	5mL	~
rine Settings	č.		
Select Language	>		
Fest Settings	>		
Safety Settings	÷		
Coloct Russite			

Restore factory settings: Click Restore Factory Settings on the page to pop up the prompt of restoring factory settings. Click YES button, and all data will be cleared after successful setting. Shown as the figure below:



4.7.6 Cloud Settings

Cloud settings are mainly cloud parameters and LIMS settings.

Cloud settings: It includes the switches of Automatic Synchronization of Test Results, Automatic Synchronization of Method Library and Push Massages. Shown as the figure below:

	2022/11/09 11:00:40	4
Cloud Settings	Parameter of Cloud Settings	
Cloud Settings >	Auto Sync of Testing Result	
	Auto Sync of Method Base	
Line octang	Push Messages	۰

LIMS settings: Automatic synchronization test results, IP address settings, PORT settings.

	2022/11/09 11:00:51	4
\bigcirc	LIMS setting	
Cloud Settings	Auto Sync of Testing Result	
LIMS setting >	IP Address	
	Port	
		Save

4.7.7 System Update

System update refers to updating system version information. Check whether it is the latest version and show the version parameters. The system will prompt update if it is not the latest version, and manually updating is available. Shown as the figure below:



4.7.8 Network Settings

Network settings include three items: local name, WLAN, and IP address settings.

Local name: Click the local name to display the name of the Drawell platform instrument. Shown as the figure below:



WLAN: Click WLAN on the page to display the available networks on the right, Select one and enter its password for the connection. Shown as the figure below:

2022/11/09 11:03:46	হ
WLAN	
WLAN	
<u>.</u>	
×	
2	
	2022/11/09 11:03:46

IP address settings:Click IP Address Settings on the page to display its information on the right. Either manually or automatically obtaining IP address is available. The system will automatically obtain the ID address when the switch is on, otherwise the corresponding information needs to be entered and saved manually. Shown as the figure below:

0	2022/11/09 11:05:29	
Network Settings	IP Address Settings Obtain IP Address Automatically	
Equipment Name >	IP Address	
IP Address Settings >	Subnet Mask	
	DNS	

4.7.9 Audit Traceability

Audit traceability is an operation log, which shows the list of operation logs of the platform users. The information displayed includes: operator, operation time and operation instructions, they can be queried, exported and printed. Shown as the figure below:

		2022/11/09 11:05:50		
0		Please enter key words of operator's account	SELECT DATE	PRINT
0	No.	Operation Manual	Operator	Operation Time
	1	Printing Method of Printing Settings is set to 【Basic Format】	Admin	2022/11/09 11:00:19
	2	Auto Settings of Time Settings is set to [Close]	Admin	2022/11/09 10:58:26
	3	Power on Self-test of Advanced Settings is set to [Open]	Admin	2022/11/09 10:57:21
	4	Power on Self-testOpen Successfully	Admin	2022/11/09 10:57:21
	5	Power on Wizard of Advanced Settings is set to [Close]	Admin	2022/11/09 10:57:20
	6	Power on WizardClose Successfully	Admin	2022/11/09 10:57:20
	7	Power on Self-test of Advanced Settings is set to [Close]	Admin	2022/11/09 10:57:11
	8	Power on Self-testClose Successfully	Admin	2022/11/09 10:57:11
Page	page;	in total3page JUMP		NEXT

Search:Input the user name of operator or select the operation time to filter out corresponding operation information.

Export: Export the operation log information in PDF format to the local for viewing; An error massage window will pop up when exporting the operation log without the connection with external storage medium.

Print: Either all operation logs or selected are available to be printed with corresponding title, header and footer, and there is no limits to the printing method. An error massage will pop up without the connection with any printing service.

4.7.10 About the Instrument

Model, software version, master control version, serial number, etc. are displayed. Neutral interface setting is added for the manufacturer's

debugging password login, and the normal interface can be restored by clicking again. Shown as the figure below:



4.8 Help Management

Help Management displays help description documents. Click the button on the left to display relevant content on the right. Shown as the figure below:

\bigcirc	
Help	Help
HELP >	Contents
	I. Safety. 1 1. Overview. 1 2. Safety. 1 3. Guidance for waste disposal. 4 4. Quality guarantee policy. 5 I. Summary. 6 1. Application. 6 2. Principles. .7 3. Operating procedures. .8 III. Main performance .10 1. Technical parameters. .10 2. Use conditions .10 V. Name of device components. .11 V. Name of device components. .13 VLFunction introduction. .15 VII. Usage and setting of K1124 fully automatic samplers injector
	VIII.Automatic test of sample 71 IX.Search of test record .74 X.Routine maintenance of device .74 X.LCommon fault and Troubleshooting of device .76 XII.Supplements .78 XII.LCaurions .78

4.9 Exit System

Exit System is for users to exit the system. Click the exit button in the upper right corner to exit. Shown as the figure below:



VII. K1124 Autosampler Usage Settings

The K1160 Automatic Kjeldahl Analyzer is used with the K1124 Autosampler (hereinafter referred to as the Autosampler), which can achieve one-key automatic sampling, distillation, titration and sample withdrawal, as well as unattended whole process. The automatic sampler is equipped with 24 hole positions for the maximum of 24 samples at a time. The experiment data is saved automatically. in addition, it is directly connected to K1160 automatic Automatic Kjeldahl Analyzer without additional power supply, which makes the whole system more energy-saving. It frees up manpower and improves efficiency.

1. Overall Effect Drawing



2. Name of Instrument Parts



- 1. PC cover plate 2. Sampling tray 3. PC cover 4. Rotary table baseplate
- 5. Desktop plate 6. Label 7. Drawer handle 8. Instrument model
- 9. Universal castor

3. Technical Parameters

- a. Power supply: DC 24±10% V
- b. Rated power: 48 W
- c. Communication interface: CAN
- d. Rotary table speed: ≥ 0.04r/s
- e. Digestion tube ejector rod ejection speed: \geq 40mm/s
- f. Sample capacity: 24x300mL
- g. Sample injector built-in solution tank volume: 4x15L
- h. Overall dimension (L x W x H): 923mmx618mmx894mm
- i. Net weight: 100kg

4. Instructions

Please check the liquid level of solution tanks before operating the instrument, and the sample digestion tubes shall be properly placed. All the pipelines and tank level sensors shall be properly connected with the instrument.

Please make sure that the power communication connection line is correctly connected before operating the instrument. Firstly, turn on the Autosampler by the using switch on the operation interface of K1160 Automatic Kjeldahl Analyzer Secondly, turn on the Autosampler power switch. Specific operation: Settings-Advanced Settings-Automatic Sampler-switch on the usage of automatic sampler, and turn on the correlative functions and settings.

A simple function test of the automatic sampler can be performed before the operation to avoid abnormal status.Specific operation: Settings -Debugging - Autosampler Debugging. Specified hole position can be selected to rise or fall by rotating the automatic sampler.

The built-in ARM processor defines the specific time window and mechanical movement range for each sampling. The corresponding fault information will be generated and displayed on the display screen if a certain step fail to be completed during the sampling, which is convenient for troubleshooting and diagnosis.

The sampler will automatically remove the tube after each analyzation, and rise the next tube to the testing position. There is no transfer of digestion tube and sample during the whole analysis process, which ensures the analysis accuracy.

5. Operation Process

Remove the PC cover plate and PC cover, then rotate the sampling tray and put the sample digestion tubes in it (up to 24 sample digestion tubes can be put at a time). Put the PC cover plate and PC cover back to the rotary table baseplate after the placement.

Set the method library on the K1160 Kjeldahl Analyzer, edit and add number, quality, titration acid concentration and blank volume of the corresponding samples, select the sample number of the digestion tube to be analyzed, and click to operate to automatically complete the whole process of sampling, distillation, titration, and sample withdrawal. The sampler will automatically stop when the test is completed, and the test data will be saved automatically.

After the test is completed and the digestion tube is cooled, remove the PC cover plate and PC cover, put the digestion tube into the digestion tank for cleaning and make preparations for the next test, turn off the Autosampler and K1160 Automatic Kjeldahl Analyzerfor wiping, and keep the instrument's surface clean.

VIII. Sample Test

1. Reagent Preparation

a. Boric acid solution (20 g/L): weigh 20.00 g of boric acid, dissolve it with distilled water and dilute it to 1000 mL of the volumetric flask, agitate it for standby, add methyl red - bromocresol green mixed indicator at the ratio of 100:1, and mix it evenly.

b. Sodium hydroxide solution (400 g/L): weigh 400.00 g of sodium hydroxide, dissolve it with distilled water and dilute it to 1000 mL of the volumetric flask, and shake it up for standby.

c. Sulfuric acid standard titration solution $[c(1/2H_2SO_4)=0.1000 \text{ mol/L}]$: take 3.00 mL of concentrated sulfuric acid (density: 1.8419 g/mL), dilute it with distilled water to 1000 mL of the volumetric flask, shake it up, and calibrate it.

d. Hydrochloric acid standard solution [c (HCI)=0.1000 mol/L]: take 9.00 mL of concentrated hydrochloric acid (hydrochloric acid concentration: 36%~38%), dilute it with distilled water to 1000 mL of the volumetric flask, shake it up, and calibrate it.

e. Ammonium sulfate standard solution: take 6.6065 g of dried ammonium sulfate (GR), dissolve it with distilled water and dilute it to 1000mL, and shake it up for standby. The nitrogen content in the solution is 1.4 mg/mL.

f. Mixed indicator: one 0.1% methyl red ethanol solution (1g/L) dissolved in 95% ethanol and five 0.1% bromocresol green ethanol solutions (1g/L) dissolved in 95% ethanol are mixed when needed.

Note: The digestion of samples needs sulfuric acid (H_2SO_4), copper sulfate (CuSO₄) and potassium sulfate (K_2SO_4). Tip: weigh 0.5g~1g of sample, add 8mL~10mL of concentrated sulfuric acid, and add 3.2g of mixture of copper sulfate and potassium sulfate (1:15). (Please refer to national standards or relevant industrial standards for specific dose)

There are suggestions as follows to reduce the measurement error of the instrument when using Automatic Kjeldahl Analyzer

(1) The pH of 2% boric acid absorption solution shall be adjusted to about 4.5;

(2) Please add 10-20ml of distilled water to alleviate violent neutralization reaction before dilution.

(3)The added volume of 400g/L sodium hydroxide is appropriately four times of the volume of concentrated sulfuric acid;

(4) The maximum volume of liquid at the beginning of the distillation is appropriately 1/3 of the total volume.

2. Test Reference Values

The nitrogen content in the sample shall be considered during sample weighing. Less sample shall be weighed on the premise of minimizing the weighing error when testing samples with high content of nitrogen. More sample shall be weighed on the premise of minimizing the weighing error when testing samples with low content of nitrogen. The appropriate range of nitrogen content of weighed samples is 15~50mg.

Please add 10ml of distilled water to dilute the sample after the complete cooling of sample digestion for testing.Generally, 0.1 mol/L standard acid is selected as titration acid.

Table I Relationship between the Titration Standard Acid and the NitrogenContent in Sample

Molar Concentration of Titration Standard Acid (mol/L)	Nitrogen Content in Sample (mg)
0.02	0.1~10
0.10	5~50
0.20	30~150
0.50	100~210

3. Test Parameter Settings

(1) Install the instrument and connect the pipeline.

(2) Open the condensate water, and place an empty digestion tube, then turn on the instrument and steam for 5~10min to clean the pipeline and stabilize the steam flow.

(3) Place the digestion tube containing the digestive liquor, then set the corresponding parameters and functions, and start the test. The real-time detection function of the instrument is enabled simultaneously. Boric acid absorption solution, diluting water and alkaline liquor are automatically added by the instrument, the condensed ammonia released from steam distillation will be absorbed by boric acid and titrated with standard acid.

(4) The test results will be automatically calculated and displayed. Waste discharge and cleaning are automatically run by the instrument.

(5) The test results can be export or print in the format of xml or PDF.

4. Calibration of Instrument

Ammonium sulfate (grade: AR or above) is generally selected as the standard sample for the instrument calibration, either solution or pure solid is available.

Solid sample: weigh 0.1-0.2g of dried ammonium sulfate into the digestion tube, and directly determine it.

Liquid sample: weigh 6.6065g of dried ammonium sulfate and dilute it to 1000mL solution with distilled water as the standard solution containing 1.4mg/mL of nitrogen. Use a quantitative pipette to transfer the standard sample with the nitrogen content close to the measured sample for testing.

IX. Test Record Query

The storage space of the instrument for users to save and query previous test records is 8G. The sample number will automatically increase after the sample test is completed. Test records can be saved for a long time (generally more than 10 years) for users to query and print.

X. Daily Maintenance of Instrument

1. The instrument's socket must be kept clean and dry, and should not contact with acid or alkali solution to ensure the insulation and high-input impedance performance.

2. The alkaline liquor tank, boric acid solution tank, distilled water tank and titration acid tank shall be cleaned regularly.

3. Please clean the waste liquid receiving box at the bottom of the instrument safe door if there is waste liquid in it.

4. The scale that formatted in the steam generator after long time usage of the instrument will affect the heating efficiency, and the recommended cleaning period is 6 months, it can be shortened if the instrument is used frequently. Add scale remover or weak acid solution of a certain concentration into the distilled water pipeline for cleaning, drain it through the distilled water drain valve, and then connect the pipeline after rinsing it with distilled water for many times.

5. When the concentration of titration acid is changed, drain the titration acid in the pipeline and titrator by manual titration, then rinse it for at least 6 times with new acid, and drain the liquid in time.

6. Please clean the glassware after daily operation in order to prolong its service life; namely, add 100mL of distilled water and steam it for 5min.

7. There may be bubbles in plunger pump pipeline, please empty it before the test every day.

8. The plunger pump should be calibrated once a year.

9. Fix the pipeline at the waste discharge port to prevent high-temperature corrosive liquid from splashing out.

10. The receiving cup and alkali pump shall be cleaned after daily operation.

11. The minimum 5-minute liquid output is 150ml with sufficient condensate water during full power heating of the instrument.

12. Please wear goggles and gloves when testing or maintaining the instrument.

XI. Instrument Common Faults and Handling

S/	Fault	Cause Analysis	Troubleshooting
N	Phenomenon		
1	Whole	1. Insufficient power supply;	1. Check the power supply;
	machine is not	2. Poor connection of the	2. Connect the power cord;
	powered	power cord;	3. Replace the fuse.
		3. Fuse is blown.	
2	No steam is	1. Steam generator lacks	1. Fill the tank with water and
	generated	water;	click the "Continue" button;
	during	2. Heating controller is faulty;	2. Replace the heating
	distillation	3. Poor wire connection	controller;
		between the heating	3. Check whether the wire is
		controller and the steam	loose;
		generator;	
		4. Heating pipe is damaged;	4. Replace the heating pipe;
		5. Pressure protection switch	5. Replace the pressure
		is damaged;	protection switch;
		6. Temperature protection	6. Replace the temperature
		switch is damaged;	protection switch;
		7. Steam valve is damaged.	7. Replace the steam valve.

0 0	Alkali, boric acid and diluting water are not correctly filled	 There is too little solution in the solution tank and the pipe is above the solution level; The solution pipeline leaks; The filling pump does not work normally or cannot be turned on normally, and the pipeline is blocked; Pump is damaged; Solution valve is damaged. 	 Add solution to the solution tank; Check whether the pipeline interface is sealed; Clean the solution pump; Replace the pump; Replace the solenoid valve.
4	Titration is not completed	 Titration acid is insufficient; Titration system is faulty; Titration solenoid valve is blocked. 	 Add the titration acid; Replace the titration system; Replace the solenoid valve.
5	Test data is not stable	 Receiving cup is not clean; Steam generator is not clean; Burette is not installed in correct position; There is excessive liquid in digestion tube; Alkali added is not enough; Titration color is wrong. 	 Clean the receiving cup; Clean the steam generator; Install the burette in the correct position; Reduce the liquid in the digestion tube; Add sufficient alkaline liquor; Carry out color calibration again.
6	Test data is wrong	 Titration acid concentration is wrong; The instrument is not calibrated correctly. 	 Input correct titration acid concentration; Re-calibrate the instrument.
7	Test is suspended	 Safety door is not closed properly; Digestion tube is not placed properly; Condensate water is insufficient; Steam generator lacks liquid; Steam generator over-temperature; Receiving cup overflows; 	 Close the safety door; Fix the digestion tube; Check the condensate water; Check the steam generator; Check the steam generator; Check the receiving cup.

XII. Supplementary Provisions

The warranty period of this product is one year since the day when it is sold (the date written on the invoice shall prevail). However, any of the following circumstances is not included:

1. The warranty period has expired;

2. Damages caused by improper use;

3. Damages caused by self-disassembly without the permission of the manufacturer;

4. Damages caused by improper transport and storage.

XIII. Precautions

1. It is necessary to confirm the sufficiency of water in the distilled water tank before the use to avoid affecting the normal operation of the instrument. The manufacturer will not accept the instrument problems caused by insufficient addition of distilled water.

2. Sample data is stored according to the sample number in the internal memory of the instrument, and it increases progressively without repetition.

3. Please be careful when preparing alkaline or acid solutions in case of being burnt by chemical reagents.

4. There is glassware in the instrument, please be careful during handling.

5. Please shut the instrument down and unplug the power cord, waiting for the distillation to cool down when it is necessary to repair the internal parts of the instrument.

6. The outlet of the waste liquid discharge pipe should be lower than the position of the instrument to make the discharge unblocked.

7. The alkaline liquor in the alkaline liquor tank shall be replaced with distilled water when the instrument is not used for a long time. Put the digestion tube in place, and manually add alkali to remove the alkaline liquor in the pipeline and clean the pipeline to prevent crystal blockage.

8. A blank test shall be conducted after each startup to clean the instrument pipeline to ensure the accuracy of the test results.

9. The instrument will be strictly tested before delivery, therefore, it is normal to observe small amount of residual liquid.

10. The recommended maximum solution volume in the digestion tube is 2/3 of the total volume of the digestion tube.

Note: Please open the condensate water and check whether the solution in each solution tank (alkaline liquor tank, boric acid tank, distilled water tank and titration acid tank) meets the test requirements before operating the instrument, otherwise, please add it in time.



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