Operation Instructions

SDCHN435 Carbon Hydrogen and Nitrogen Analyzer

Hunan Sundy Science and Technology Co., Ltd.

Attention

- **Please read this instruction carefully before using Sundy instrument.**
- **Matters need attention when using the instrument.**
  - **Only high-temperature power cable provided with the instrument can be used.**
  - **Make sure that the electrical parameters of outlet and knife switch/air break switch meet the requirement of instrument.**
  - **Power of the instrument shall be cut off when instrument not been used for a long time.**
  - **Before using the instrument, the filling materials, such as foam, shall be taken out and instrument' cover cloth shall be taken off. It is prohibited to place any inflammable and explosive material near the instrument.**
  - **After use, cover cloth shall not be placed on instrument if instrument (inside and outside) temperature has not cooled down to room temperature.**
  - **The instrument shall be ground connected reliably.**
  - **It is not allowed to repair and dismantle the instrument if power is connected.**
  - **Vessel contained with water is prohibited to be placed on instrument.**
- **To ensure stable and reliable operation of instruments, spare parts and consumables provided by Sundy shall be used. If spare parts and consumables not provided by Sundy are used and result in reduction of performance, unstable test result or increase in malfunction, etc, Sundy will not provide service or guarantee and will not undertake any losses.**
- **Sundy shall not bear responsibilities for malfunction or damage due to auxiliary instrument and equipment not supplied by Sundy and misuse, negligence of users. Purchaser, users or successor shall take all the risk of their operation and mistakes.**

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Chapter 1 Instrument Properties and Features

1.1 Range of Application

The instrument is widely used to test the carbon, hydrogen, and nitrogen content in coal, coal slurry, coke and other substances. It can be applied in coal industry, electrical power, metallurgical industry, petrochemical industry, environment protection, scientific research, educational institutions and so on.

1.2 Property Index

- Analytical method: infrared absorption, thermal conduction
- Carbon measuring range: 0.02%~100%
- Hydrogen measuring range: 0.02%~50%
- Nitrogen measuring range: 0.01%~50%
- Repeatability: Cad≤0.5%, Had≤0.15%, Nad≤0.08%
- Analysis time for single sample: 5-7min.
- Combined furnace temperature: 950℃±5℃.
- Reduction furnace temperature: 700℃±5℃
- Range of sample weight: 75~105mg, the proposed weight is 100mg.
- Maximum power: 4.5kW.
- Number of samples: 34 samples can be placed consecutively at once.

1.3 Main Features of the Instrument

Superior performance, high automation and high humanization

- State-of-art ultra-low drift infrared cell and thermal conductivity cell, optimal gas circuit design and combustion processing are adopted to ensure excellent stability, precision and accuracy.
- Self-developed ultra-low drift and dispersible thermal conductivity cell adopt precise thermal static control technology which maximally guarantees its stability.
- The only carbon hydrogen nitrogen analyzer which can change crucibles

automatically. Easy and safe operation and high efficiency.

- The straight-through sample dropping method is suitable for samples with low density but large size, such as biomass samples, liquid samples, etc.
- Rapid test speed with analysis time of single sample not exceeding 5min.
- 34 samples can be placed at a time; the test process is fully automated and truly unattended.
- Split type furnace reagent tube is used for the convenient change of furnace reagents and it effectively improves the efficiency of instrument.
- Additional samples can be added during the analysis process, and the weighing results can be transmitted automatically with balance on-line function.

Chapter 2 Component and Working Principle of the Instrument

2.1 Component of the Instrument

SDCHN435 Carbon Hydrogen & Nitrogen Analyzer consists of main frame; general purpose CAN bus interface, gas supply device, computer (with display apparatus), printer, electronic analytical balance (optional accessory). The schematic diagram is as Fig. 2-1 shows:

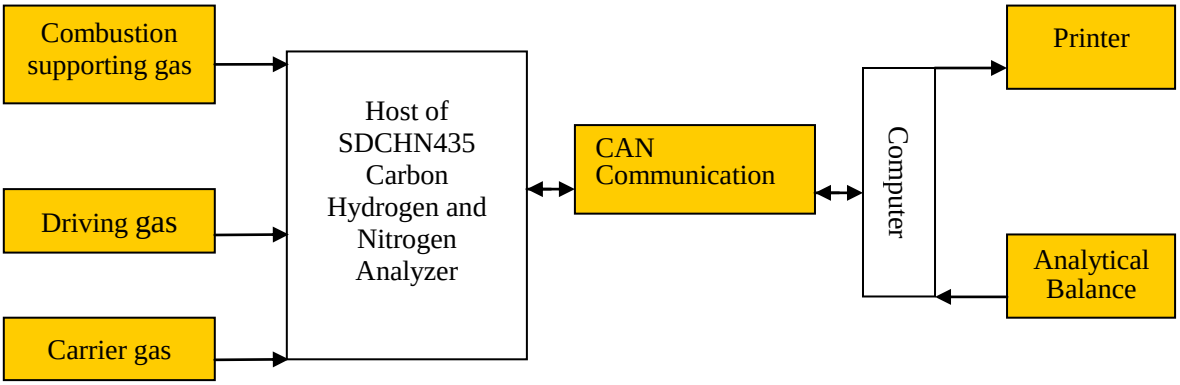


Fig. 2-1

2.1.1 Main Frame Structure

It mainly consists of sample placing tray, combined furnace, reduction furnace, gas collection chamber, infrared cell, thermal conductivity cell, Gas purification device, filter unit, control valve, manipulator and so on.

- Sample placing tray: where to place test sample.
- Combined furnace: samples combust completely with sufficient oxygen. After that, secondary combustion is carried out and SO_2 is removed.
- Reduction furnace: Remove Oxygen from the sample gases, Nitrogen oxide is converted to N_2.
- Gas collection chamber: collect combustion gases of samples.
- Infrared cell: detect molecular concentration of CO_2 or H_2O.
- Thermal conductivity cell: analyze the concentration of N_2.
- Drying tube: remove moisture and carbon dioxides in N_2 and sample gases.
- Filter unit: filter out dust generated during the combustion process, and protect gas collection chamber and infrared cell.

- Control valve: control the flow and sequences of gases during the test.
- Manipulator: change crucibles automatically.

2.1.2 Gas and Auxiliary Equipments

- Combustion supporting gas: oxygen purity ≥ 99.5%, total gas source pressure ≥ 1MPa.
- Driving gas: nitrogen or dry compressed air, total gas source pressure ≥ 1Mpa.
- Carrier gas: helium purity ≥ 99.99%, total gas source pressure ≥ 1MPa.
- Pressure reducing valve: range of high pressure gauge is 25MPa; and range of low pressure gauge is 0.4MPa; the proposed mode is 152X -40-V (oxygen), 152IN-40-V (nitrogen), and 152X-40-V (helium).
- PU pipes.

2.1.3 Printer

Laser printer

2.1.4 On-line Balance

The measuring range is 100g, readability is 0.0001g, and Sartorius balance is recommended.

2.2 Working Principle

SDCHN435 Carbon Hydrogen & Nitrogen Analyzer is used to analyze the carbon, hydrogen and nitrogen content in coal or other substances.

A complete sample analysis by SDCHN435 consists of three steps: gas circuit purging, combustion and analysis. First, the operator will put samples into the sample placing tray in sequence. Then input parameters, and Click on "Start test". The system will analyze the carbon, hydrogen and nitrogen content in the sample automatically under specified procedures. Finally, result will be displayed on the interface.

In the combustion process, sample is delivered into the combustion tube for oxygen-excess combustion. Gases generated shall be carried into reagent tube for secondary combustion and desulphurization. After multi-stage filtration, the gases will be collected in the gas collection chamber.

During the analysis process, the combustion gases collected in the gas collection

bottle will be mixed completely and then flow into the CO_2 infrared sensor, H_2O infrared sensor and the proportional chamber. After the gas is stable and balanced, the carbon will be detected by the CO_2 infrared sensor in the form of CO_2; and the hydrogen will be detected by the H_2O infrared sensor in the form of H_2O. Gases in the proportional chamber will firstly be carried by helium over heated copper for elimination of oxygen and transform of nitrogen oxides to N_2. The carbon dioxide, moisture will be absorbed by alkali asbestos and dehydrite. Then the gas will be introduced to the thermal conductivity cell to detect the nitrogen content.

The final analysis results shall be shown on the main interface window in the form of percentage.

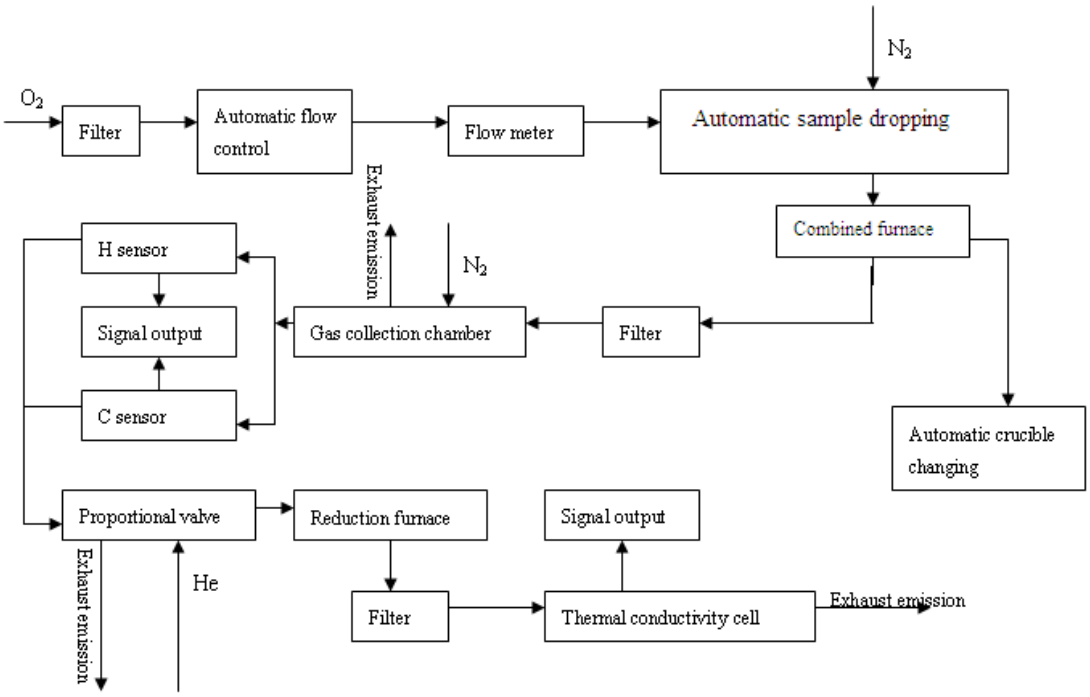


Fig. 2-1 SDCHN435 Working Principle

Chapter 3 Installation and Debugging of the Instrument

3.1 Environmental Requirements

3.1.1 Working Conditions

- Ambient temperature: 15~28℃.
- Humidity: ≤85%.
- The working environment shall be clean and tidy, without smoke and raise dust.
- The environment shall be stable, without strong interference source, vibration source and corrosive gases.
- The lab should be installed with air-conditioning. The instrument cannot be placed near the window or heat source.

3.1.2 Requirement of Power Source

- Power source: (187～242)VAC, 50Hz±1Hz.
- Be equipped with reliable ground wire.

3.1.3 Requirement of Gases

- Combustion supporting gas: oxygen purity ≥ 99.5%, pressure (0.18±0.01) MPa, and the total pressure of gas source ≥ 1MPa. The electrolytic oxygen shall not used and oxygen with purity ≥ 99.99% is recommended.
- Driving gas: nitrogen or dry compressed air, pressure of (0.18±0.01) MPa, and the total pressure of gas source ≥ 1MPa.
- Carrier gas: helium purity ≥ 99.99%, pressure (0.18±0.01) MPa, and the total pressure of gas source ≥ 1MPa. Helium with purity ≥ 99.999% is recommended.

3.1.4 Reagents

- Silica wool
- Furnace reagents
- Copper wire
- Thread-like copper

- Alkali asbestos
- Dehydrite
- Nitrogen catalyst

3.1.5 Software Environment

- Operating system: Windows XP, Windows 7, or above
- Basic configuration:
  - CPU：above 3.00GHz;
  - Internal memory: above1G;
  - Hard disk: 80G or above;
  - Driver: DVD-ROM or CD-ROM;

3.2 Installation of the Instrument

3.2.1 Preparations before Installation

- Appropriate lab in accordance with 3.1.
- Tinfoil cups, standard samples, and related equipments.
- Reagents, combustion supporting gas (oxygen), driving gas, and carrier gas (helium).

3.2.2 Installation Precautions

- Unpack the instrument carefully, and place it at proper place for convenient operation; meanwhile, make sure that the back side, front side and left side of the instrument is 0.4 meters to the wall at least.
- After unpacking, the user should count the instrument, accessories and consumables. Please properly keep relative booklets of the balance, computer, display apparatus, printer, packaging cases and packaging protective material as well.
- Carefully check if all wearing parts are in good condition.

3.2.3 Installation of Instrument Parts

1. Take off the instrument enclosure, and take the sponge and other filling material out of the instrument.
2. Installation of silica tube:
   a. Take five quartz tubes(see Fig. 3-1, Fig. 3-2, and 3-3), clean them with alcohol

and then make them dry;

b. Install the silica tube in the reduction furnace: firstly, dismount the sealing socket at the top of the furnace. Secondly, slowly insert the silica tube filled with reagents into the furnace from its top (refer to 3-1, the order of placing from the bottom is as follows: Copper wire 30mm→Nitrogen catalyst 50mm→Copper wire 15mm→Thread-like copper 200mm→Silica Wool 20mm). At last, fasten the sealing socket and screws when the tube reaches the bottom.

c. Install the combustion furnace quartz tube in the combined furnace: firstly, move the manipulator to the crucible change position, dismount the sealing socket located at the bottom of the sample introducing place. Secondly, mount two O rings at the lower end of the silica tube outer wall (refer to Fig. 3-2 for the mounting position of O rings), and then insert the silica tube slowly into the furnace. Lastly, fasten the sealing socket at the bottom of the sample introducing place, and mount two seal rings on the outer wall of silica tube, which is at the top of the combined furnace.

d. Install the desulfurization furnace quartz tube in the combined furnace: firstly, dismount the sealing socket at the top of the desulfurization furnace. Secondly, slowly insert the desulfurization furnace quartz tube filled with reagents into the furnace from its top (refer to 3-2, the placement order from the bottom is as follows: Quartz Filter screen → Filter rack with Silica Wool→ a thin layer of Silica Wool→ Furnace reagent about 32g→a thin layer of Silica Wool→ Filter rack with Silica Wool→ Quartz Filter screen). At last, fasten the screw on sealing socket at the top of the desulfurization furnace when the tube reaches the bottom.

e. Install the Drying tube: Install the drying tube filled with reagent according to the specified direction. (refer to 3-3 to place the reagent, the placement order from the bottom is as follows: Drying spacer→ Silica Wool→ Dehydrite 60mm→Alkali asbestos 100mm→Dehydrite 40mm→Silica wool)

Notes:

- Do not wrap too much or too little silica wool around the Filter rack. (The dust filter couldn't function with little wool, but the oxygen flow cannot reach 6L/min after turning on the SV4 Valve with too much wool.)
- The copper wire, thread like copper and silica wool in the reduction furnace quartz tube must be impacted in case system flow will change with the time of test.
- The Dehydrite, Alkali asbestos and silica wool in the drying tube must be impacted to avoid changing the system flow with increasing test times.
- The reagent replacement of the desulfurization furnace quartz tube and the reduction furnace quartz tube must be carried out at ambient temperature.
- The reagent replacement of the drying tube must be carried out after the instrument is powered off and the Helium gas resource is turned off.

3. The placement and volume of the reagents are as follows.

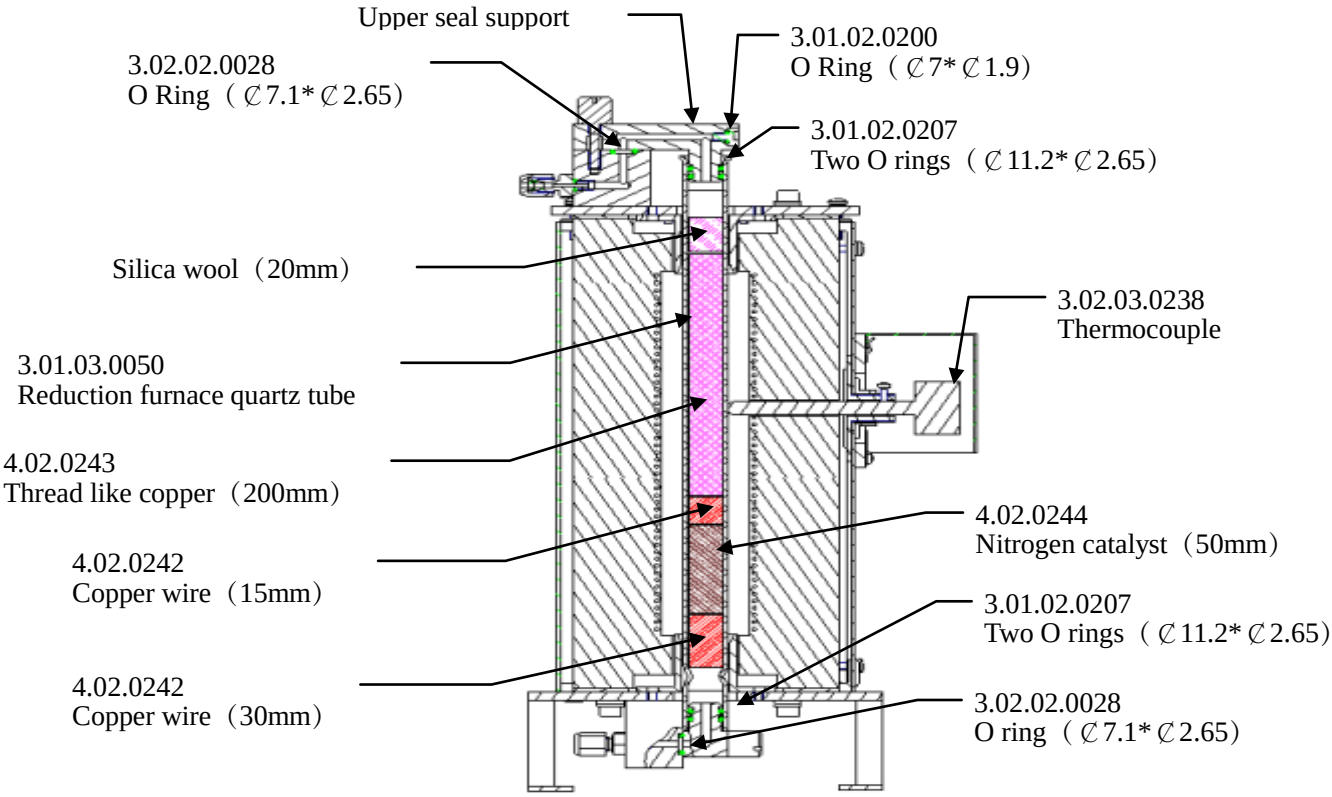


Fig. 3-1 Placement of related components and reagent of reduction furnace

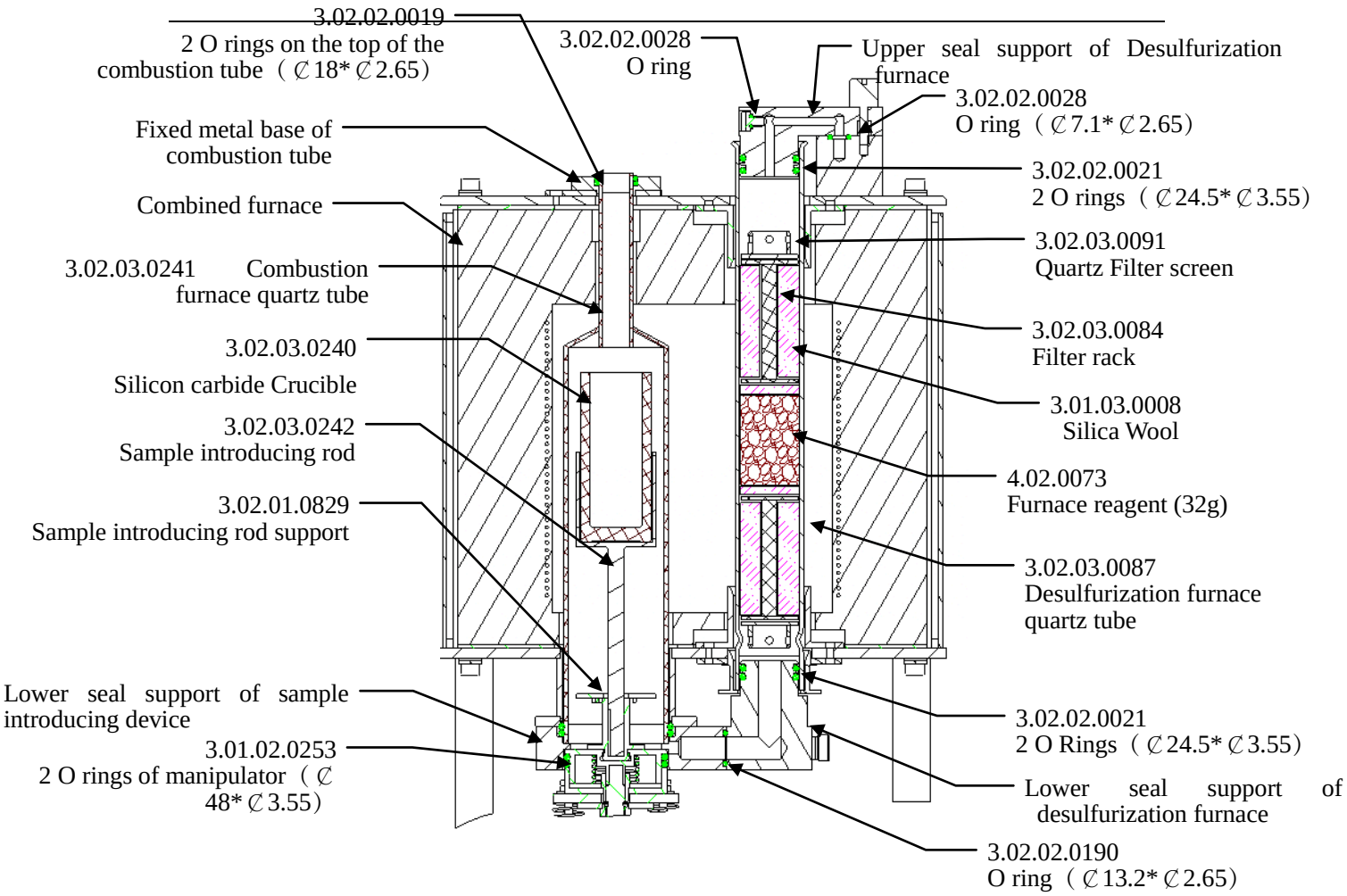


Fig. 3-2 Placement of related components and reagent of combined furnace

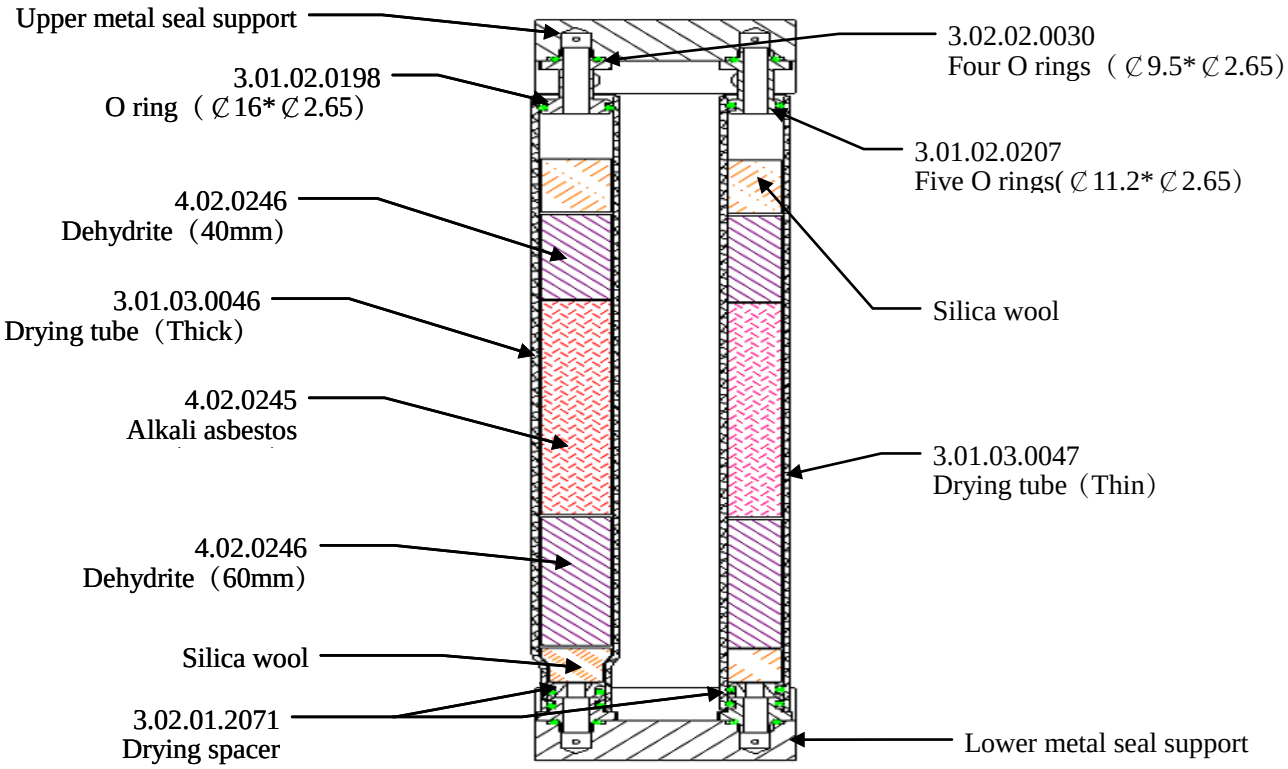


Fig. 3-3 Placement of Reagent of Drying Tubes

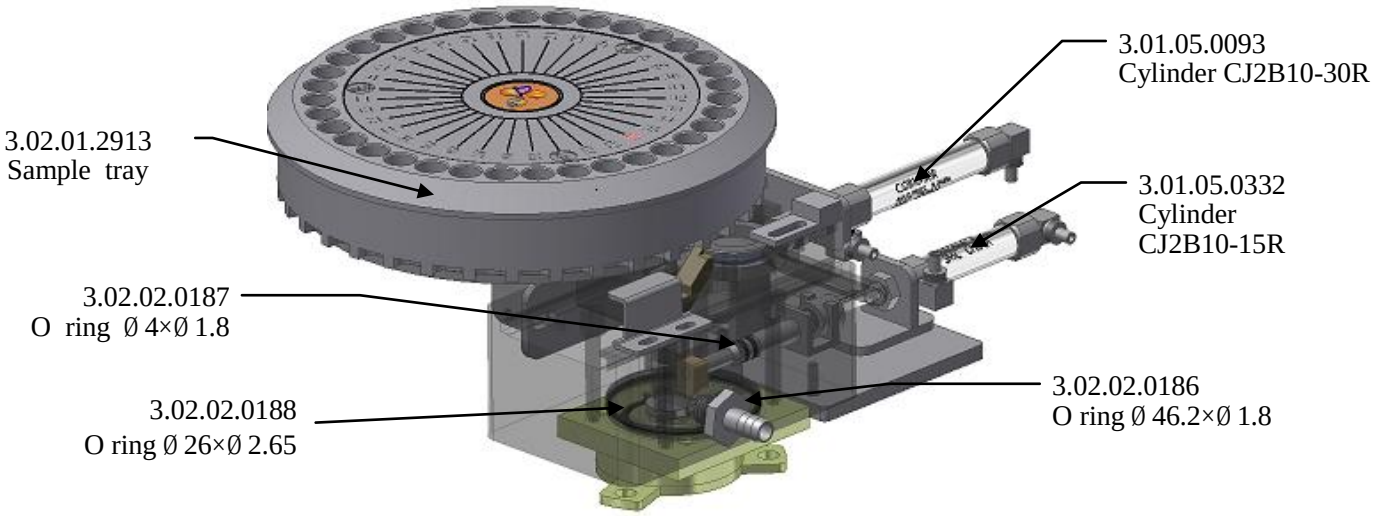
4. Installation of thermocouple:
   a. Take two thermocouples (K) and insert them respectively into the thermometer holes of the combined furnace and reduction furnace, until the front end of the thermocouple reaching the silica tubes in furnaces.
   b. Connect the red wire of the compensating lead with the "+" (positive) pole of the thermocouple, and the blue one with the "-" (negative) pole of the thermocouple.
   c. Fix the thermocouple, and properly connect the connecting wire (compensating lead). Make sure the thermocouples will not touch the surface of furnace to avoid damage.

Note:

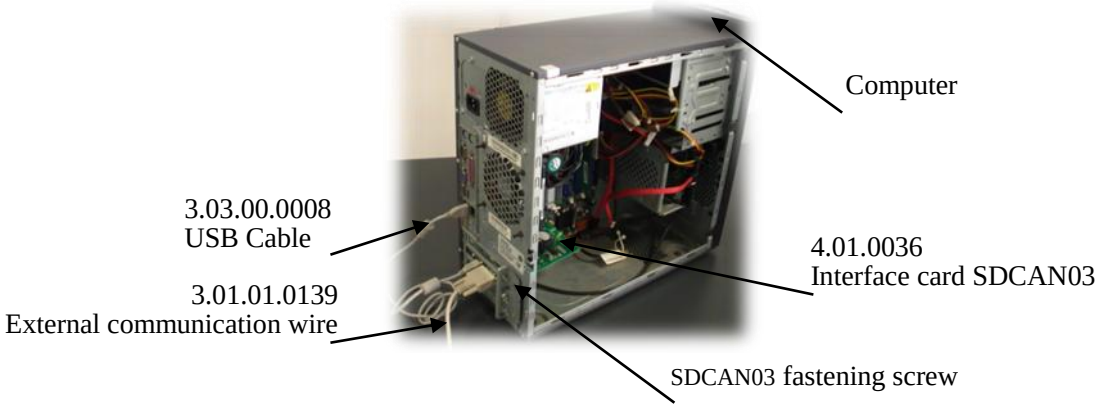
- ✧ **When installing thermocouples, pay attention to the number of the thermocouples. "Z" is specialized for combined furnace and "H" is for reduction furnace.**

5. Installation of sample introducing rod:
   a. Take the sample sending rod and crucibles out of the case;
   b. Insert the sample introducing rod into the sample introducing rod support and fix it with screws, and then fix this whole part on the manipulator with screws, and finally place crucibles on the sample introducing rod.
   c. Adjust the position of the manipulator (refer to 3.3 Instrument Debugging for more details). Make sure the manipulator will not touch and damage crucibles or the sample introducing rod during its moving.
6. Installation of sample placing tray

   Put the sample placing tray on the round hole at the top of the instrument in prescribed direction and cover it with screw cover.

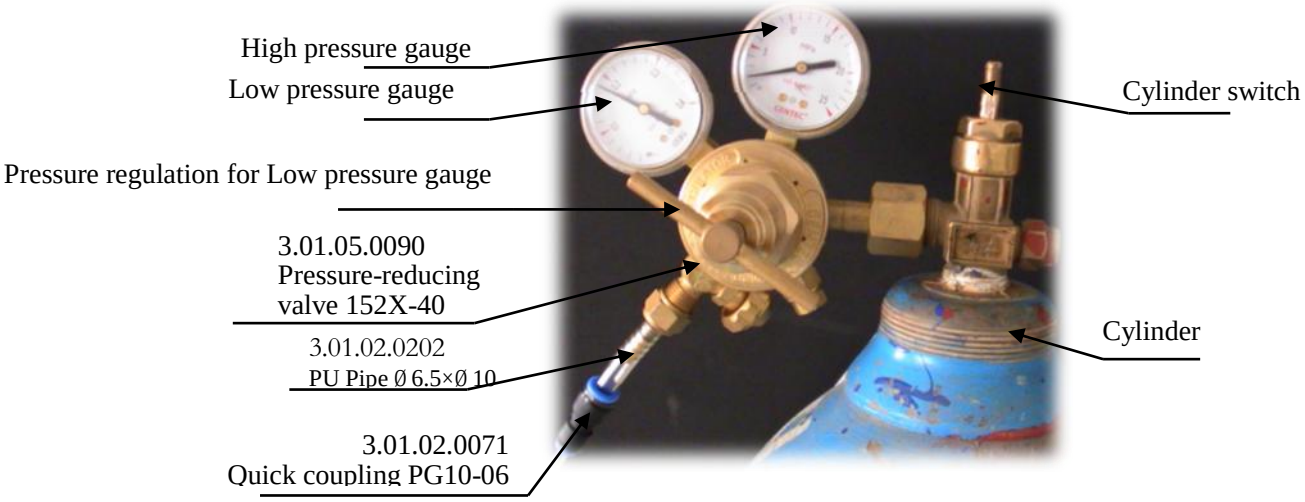


7. Fix the USBCAN interface card inside the computer mainframe. Connect the USB end of the card to the USB interface of computer mainframe with USB cable, and CAN end to the CAN1 (or CAN2) on the back plate of SDCHN435 with external communication wire, and fasten the screws at the end of the external communication wire. The connection diagram is as follows:

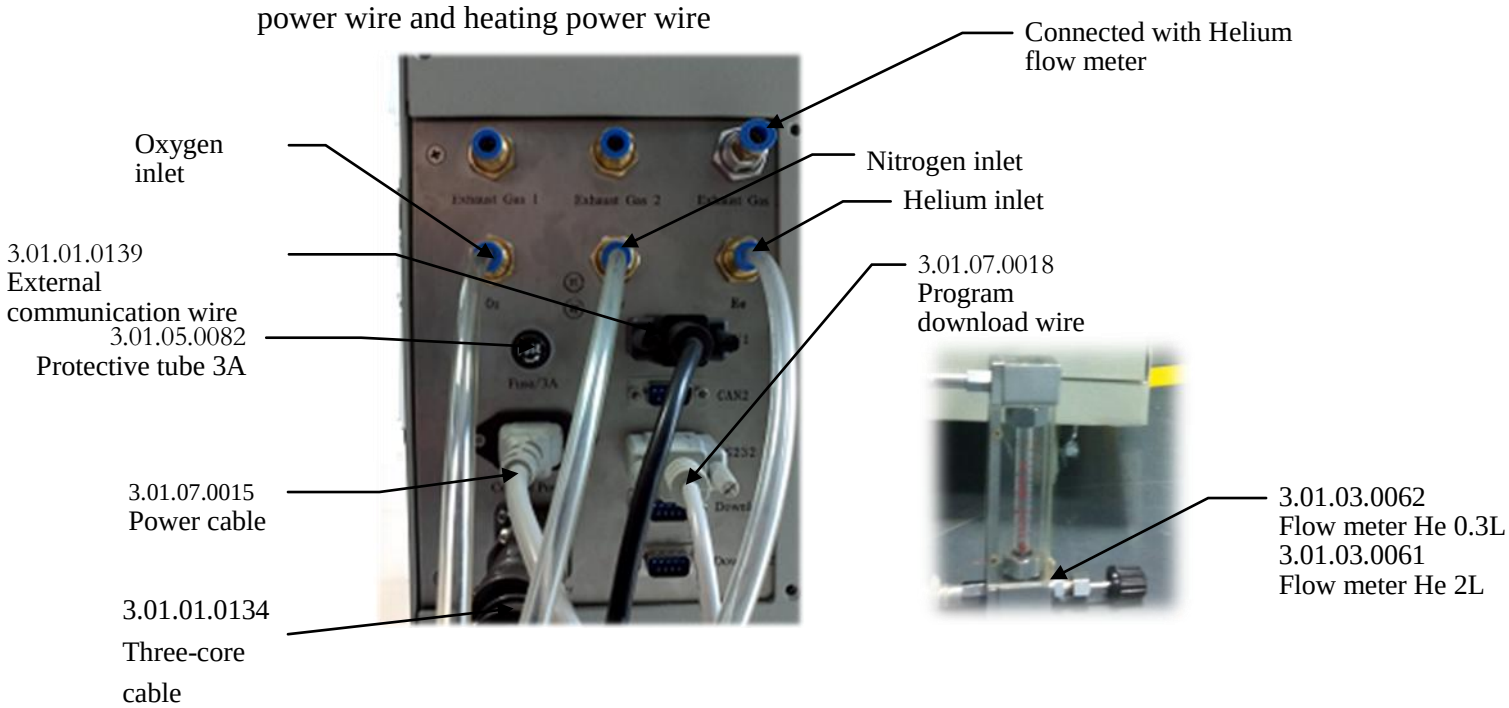


8. Combustion gas, driving gas, and carrier gas connection

   The end of the high pressure gauge of the reducing valve is fixed to the oxygen cylinder, nitrogen cylinder or helium cylinder, and the end of the low pressure gauge shall be connected to the related connector on the back cover plate of the instrument by the gas transmission duct.



9. Check if there is a drape of the air tube, or if the air tube clings to the surface of the high temperature furnace. If yes, adjust it at once.
10. According to the prompts on the back plate of the instrument, connect the control power wire and heating power wire



3.2.4 Software Installation, Un-installation

3.2.4.1 Software installation

1. Check whether the computer has been installed with “Message Queue”. (Method: Start → Control Panel → Add/Remove Programs → Add or Remove Components → select “Message Queue” in the Components List → click on

"Next", and install "Message Queue" according to the prompts).

2. Put the CD that is marked with "SDCHN435 Carbon Hydrogen and Nitrogen Analyzer Software" into the CD-ROM drive. Start the CD drive and find "Sundy.exe" in the root directory.
3. Double click on "Sundy.exe" icon and follow the prompts to install "SDCHN435 Carbon Hydrogen and Nitrogen Analyzer" program and "USBCAN service program". After the installation, the system will automatically create a shortcut icon called "SDCHN435 Carbon Hydrogen and Nitrogen Analyzer" on the desktop.
4. Right click on "My Computer" → "Properties" → "Hardware" → "Device Manager → "+" under "Sundy". Then you can see identification name as "Sundy USBCAN", which means the USBCAN card driver has been normally installed; otherwise, click on "Scan" and re-install USBCAN card driver according to prompts.

3.2.4.2 Software un-installation

Click on the "Start" in the task bar→ "Control Panel"→ double click on "Add/Remove Programs" → Select "Change or Remove Programs", click on "SDCHN435 Carbon Hydrogen and Nitrogen Analyzer" in the program group → Click on "Delete" button to perform the un-installation. SDCHN435 Carbon Hydrogen and Nitrogen Analyzer software and shortcut icon can be safely and efficiently removed following prompts. But the related parameter files, data base files of SDCHN435 Carbon Hydrogen and Nitrogen Analyzer software will not be uninstalled. Instead, they still remain in the operating system.

3.3 Instrument Debugging

After the hardware and software of the instrument have been installed, turn on the power, start the program, and enter "Manual Detection" for on-line debugging, the contents and precautions of the debugging are as follows:

3.3.1 Hole Position Adjustment of Manipulator at Combustion Tube

First Click on "Descending" in "Manual Detection" to move the manipulator in

combustion low order position, and then insert the sample sending rod into the rod pedestal and fasten it with screws (screws cannot be over tightened; they should just touch the milling plane of the sample sending rod). Observe whether the rod, the rod pedestal, and the lower seal support hole of the combustion tube are aligned. If the rod pedestal and hole are not aligned, adjust the locator cards of the combustion position and align them as much as possible; if the rod and the lower seal support hole are not aligned, adjust four screws on the pedestal of the sample sending rod, align the crucible with the lower seal support hole, and then slowly rise the manipulator into the combustion tube in the way of inching (The crucible should not scratch other parts or components during the up and down of samples sending).

3.3.2 Hole Position Adjustment of Manipulator at Crucible Change Position

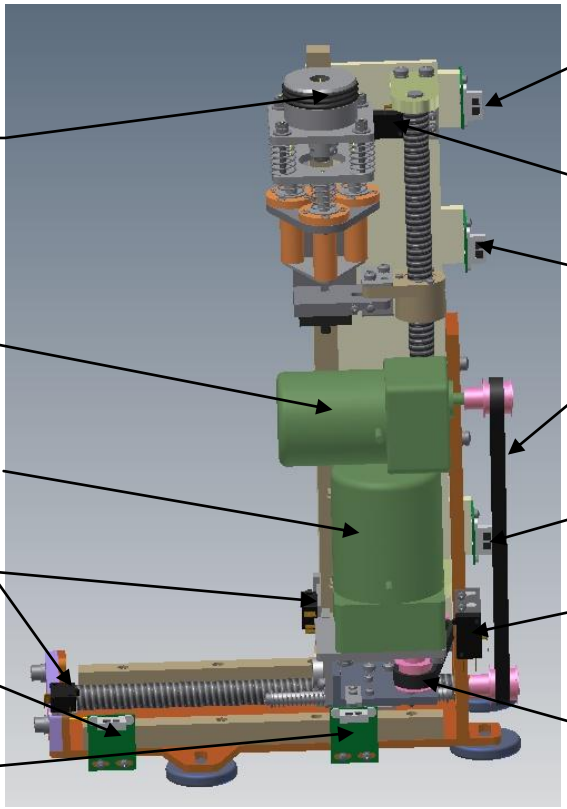
After the hole position of manipulator at the combustion position has been adjusted, click on “Descending” to move the manipulator to the low order position. And then Click on “Forward moving” to move the manipulator to the crucible change position. Open the crucible change door and check whether the sample sending rod, rod pedestal, crucible, and crucible change hole are aligned. If the crucible and the crucible change hole are not aligned, adjust the locator card of the crucible change position and make them locate in a straight line as much as possible (The crucible should not scratch other parts or components during the up and down of crucible change). For SDCH135 Infrared Carbon & Hydrogen Analyzer and SDH135 Infrared Hydrogen Analyzer, there is no need to adjust the crucible change position.

3.3.3 Adjustment of the Top, Middle and Bottom Fixed Positions of Manipulator

Top fixed position: to fix the top position when changing crucibles. Adjust the top and bottom positions of the manipulator, and make the crucible stay at the crucible change hole. Then adjust continually until it is convenient to fetch crucibles with small crucible tongs. For SDCH135 Infrared Carbon & Hydrogen Analyzer and SDH135 Infrared Hydrogen Analyzer, there is no need to adjust the top fixed position.

Middle fixed position: adjust the position to keep the sealing socket in sealing status, that is, compress the up/down buffer spring 10mm.

Bottom fixed position: adjust the locator card, and make sure the manipulator does not scratch other parts or components during its forward and backward moving.



3.3.4 Pressure Adjustment of Combustion Supporting Gas, Driving Gas and Carrier Gas

The total gas source pressure of combustion supporting gas (oxygen), driving gas, and carrier gas (helium) are not less than 1MPa. When gas flow rate is not less than 1L/min, adjust the low pressure gauges of combustion supporting gas (oxygen), driving gas, and carrier gas (helium) to 0.18MPa respectively.

3.3.5 Hole Position Adjustment of Sample Placing Tray

After the sample placing tray has been installed, turn on “SV10” valve and then click on “SV11” valve and “SV12” valve in “Manual Detection”. Check whether the sample hole and sample dropping hole of the sample placing tray are aligned. If not, adjust the reset block on the sample dropping slider to control the rotation distance of the tray; if the moving sound of the sample dropping slider is too loud or if the pushing is not steady, adjust the flows of “SV12” valve and of “SV13” valve to make

the moving steady.

Sample dropping clapboard adjustment: turn on “SV10” valve and then click on “SV11” valve and “SV12” valve in “Manual Detection”. Check whether the end of the combustion tube, the sample hole and sample dropping hole of the sample placing tray are aligned. If the sample hole and sample dropping hole of the sample placing tray are aligned, but the end of the combustion tube is not aligned with them, then adjust the flow of the “SV11” valve and “SV12” valve to make them be aligned.

3.3.6 Adjustment of Flow and Precision Pressure-limiting Valve

1. Adjustment of precision pressure-limiting valve in gas circuit of oxygen: turn on SV9→SV16→SV17→SV18→SV7→SV6→SV13→SV4 successively on the single unit control in the window of “Manual Detection”. Adjust the pressure of pressure-limiting valve to 0.04MPa, and make sure the flow of SV4 is 6L, otherwise, please do not start the test.
2. Adjustment of precision pressure-limiting valve in driving gas circuit: turn on SV7→SV6→SV13→SV3 successively on the single unit control in the window of “Manual Detection”, raise the piston of oxygen cylinder to the top fixed position, and then close SV3 valve. After that, turn on SV9→SV16→SV17→SV18 successively and adjust the pressure of precision pressure-limiting valve to 0.04MPa.
3. Adjustment of precision pressure-limiting valve in carrier gas (helium) circuit: turn on SV36→SV34→SV35 successively on the single unit control in the window of “Manual Detection”. Adjust the pressure of the precision pressure-limiting valve to 0.04MPa.
4. Flow adjustment in driving gas circuit: raise the piston of oxygen cylinder to the top fixed position and connect the “exhaust 2” with a Nitrogen flow meter (10L), after that, turn on SV7→SV14→SV33→SV18→SV16 successively to adjust the flow of SV17 current limiter to 1.5L/min and make sure that the pressure of the collection chamber is 130000~135000 Pa. Otherwise, please do not start the test.
5. Flow adjustment in carrier gas (helium) circuit:

a)Reference arm flow adjustment: Connect the “Exhaust 3” with a 300ml/min

helium flow meter, and then turn on SV36→SV34→SV35 successively. Turn off the precise flow adjusting value of reference arm and measuring arm slowly. Adjust flow of helium flow meter from 300mL/min to 0L/min. At the same time, turn on the precise flow adjusting valve of the reference arm slowly to make the flow to be 50ml/min and lock the precise flow adjusting valve of the reference arm.

b) Measuring arm flow adjustment: (The measuring arm flow should be adjusted after the adjustment of reference arm flow.) Connect the "Exhaust 3" with the 2.0L/min helium flow meter, and then turn on SV36→SV34→SV35 successively. At this time, turn on the precise flow adjusting valve of the measuring arm slowly to make the flow to be 700ml/min, and then lock the precise flow adjusting valve of the measuring arm.

c) Throttling flow adjustment: (The throttling flow should be adjusted after the adjustment of reference arm flow and measuring arm flow.) Connect the "Exhaust 3" with the 300ml/min Helium flow meter, then turn on SV36→SV35 successively and turn off SV34 valve. At this time, adjust the flow-limiting valve beside the SV34 valve slowly to make the flow to be 100ml/min and lock the flow-limiting valve.

6. The adjustment of combustion flow: Flow adjustment of SV3 valve: turn on SV9→SV16→SV17→SV18→SV7→SV6→SV13→SV3 successively on the single unit control in the window of "Manual Detection" and adjust the flow of SV3 valve to be 5L. Flow adjustment of SV2 valve: turn on SV9→SV16→SV17→SV18→SV7→SV6→SV13→SV2 successively on the single unit control in the window of "Manual Detection" and adjust the flow of SV2 valve to be 1L. Flow adjustment of SV1 valve: turn on SV9→SV16→SV17→SV18→SV7→SV6→SV13→SV1 successively on the single unit control in the window of "Manual Detection" and adjust the flow of SV1 valve to be 0.5L. (The principle of the test flow is that the combustion time is about 260s.)

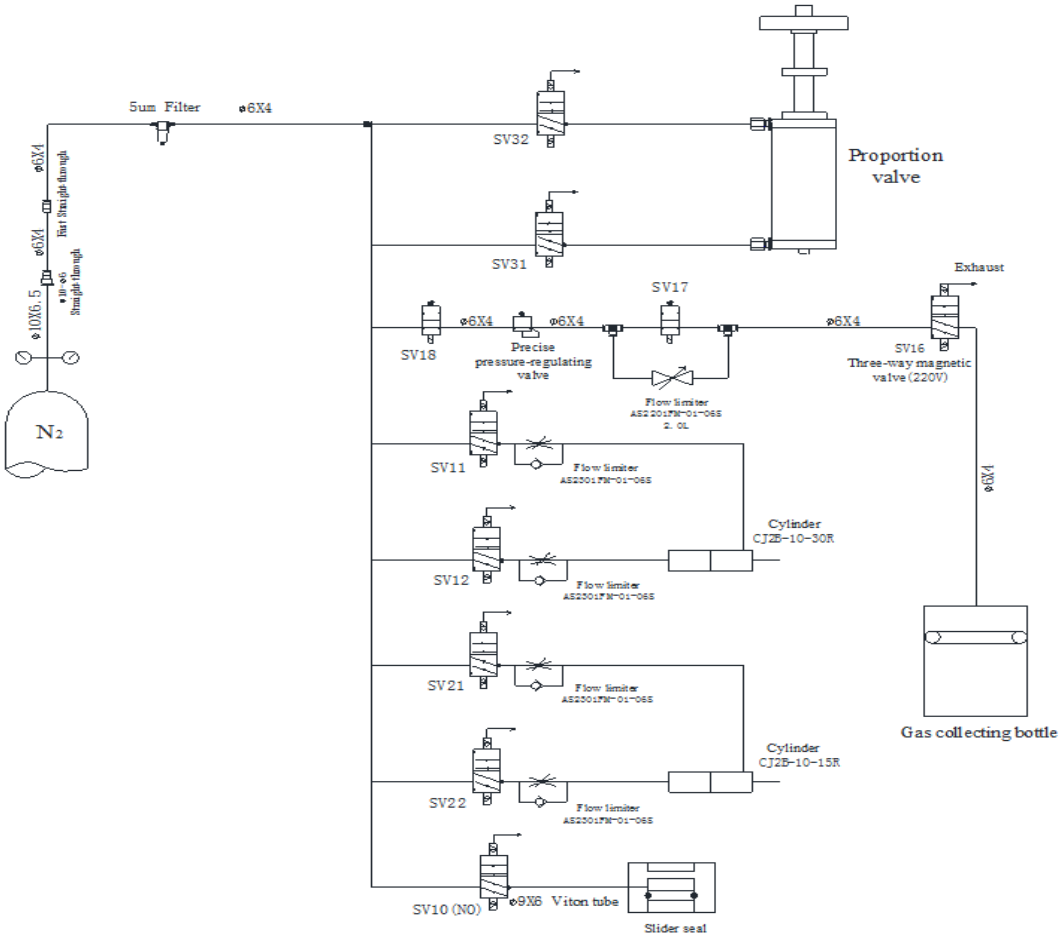
Notes:

1. Adjust the pressure of all the precision pressure-limiting valves before adjust the flow of all the valves.

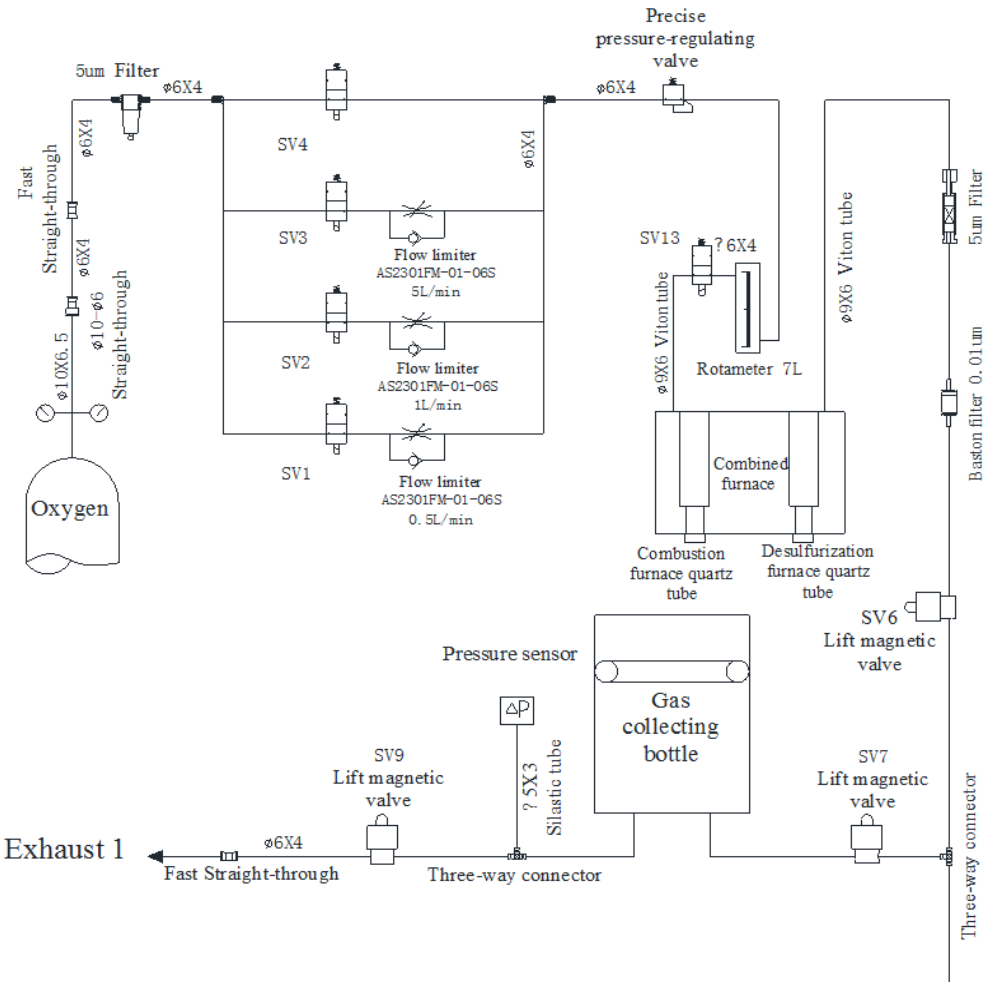
2. The carrier gas flow has been adjusted before delivery, so it does not need to be adjusted again.

3. It is prohibited to take the flow meter to read when adjusting the flow of the helium circuit and the driving gas circuit.

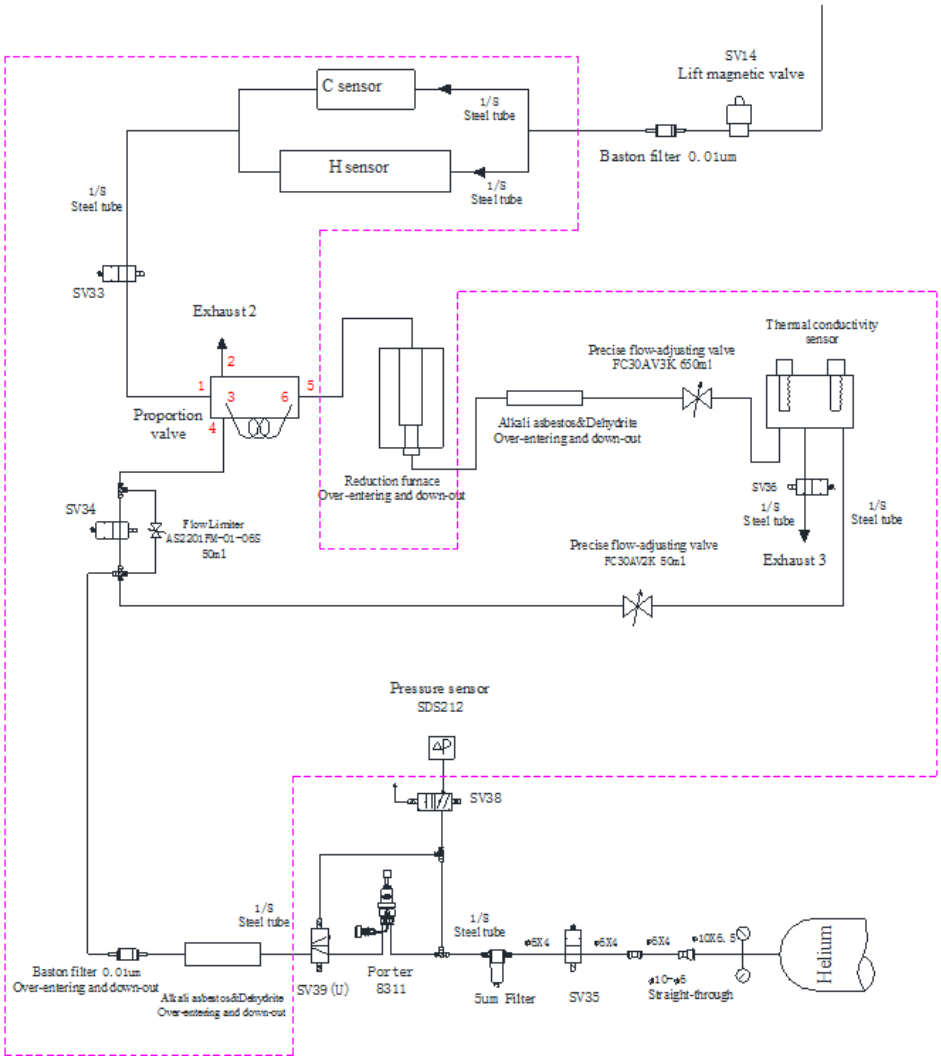
7. Diagram



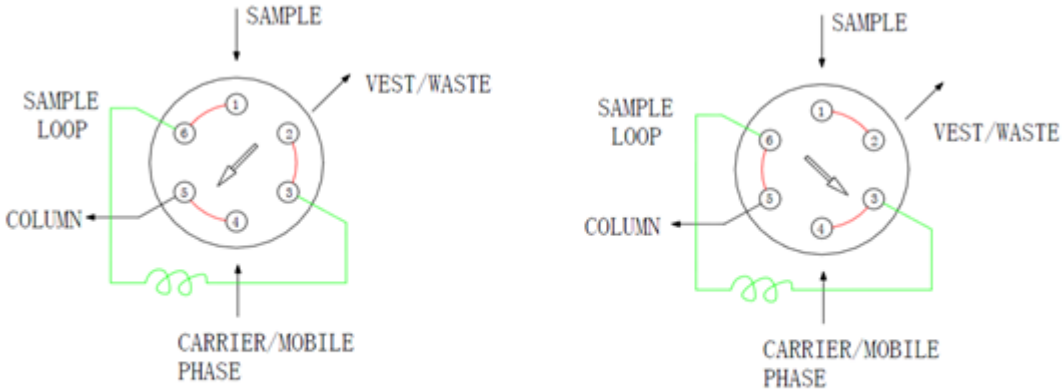
Nitrogen circuit



Oxygen circuit Fig.1



Oxygen/Helium circuit Fig.2



State of proportion valve

3.3.7 Parameter Tuning

Click on “Detection” at the menu bar of the main interface → “Parameter tuning”. Then operate according to the prompts of the program.

Note:

- ✧ **For the parameters missing results from the first use of the instrument or software upgrades, the precision and accuracy tests can be conducted only after the parameter tuning is finished.**
- ✧ **The parameter tuning can be carried out only after the temperature of the instrument have been constant and stable for 2h and gas tightness test is qualified.**
- ✧ **The pressure of the low pressure gauge of reducing valve on oxygen cylinder and the gas flow of the instrument must be stable and cannot be adjusted randomly during the parameter tuning and subsequent tests.**
- ✧ **After the pressure of the low pressure gauge of reducing valve on oxygen cylinder and the gas flow of the instrument has been adjusted, it is proposed to restart the parameter tuning.**
- ✧ **A new parameter tuning must be made after the adjustment of gas collection bottle.**

3.3.8 Check and Calibrate the Precision and Accuracy of the Instrument

1. Please refer to Chapter Six for detailed test procedures.
2. The precision and reproducibility shall be in line with the requirements listed below:

(Unit: %)

Item	Repeatability	Item	Reproducibility
Cad	0.50	Cd	1.00
Had	0.15	Hd	0.25
Nad	0.08	Nd	0.15

Chapter 4 Use of System

4.1 Start and Exit of the Measurement & Control Software

4.1.1 Start of the Measurement & Control Software

Method 1: Click on “Start” at the task bar → “Program” → select “Sundy” → click on “SDCHN435 Carbon Hydrogen and Nitrogen Analyzer”, to enter into the main interface shown as Fig. 4-1.

Method 2: directly double Click on “SDCHN435 Carbon Hydrogen and Nitrogen Analyzer” shortcut icon on desktop, to start the software (Fig. 4-1).

4.1.2 Exit of the Measurement & Control Software

Click on “X” on top right corner of the main interface or click on “Set” on main menu bar →“Exit” →“Yes” to exit the software and back to desktop.

4.2 Functions of the Main Forms

The main forms of SDCHN435 measurement & control software consists of title bar, menu bar, shortcut button, status bar, data sheet etc. And all columns in the data sheet can be dragged and placed at will for convenient viewing (Fig. 4-1):

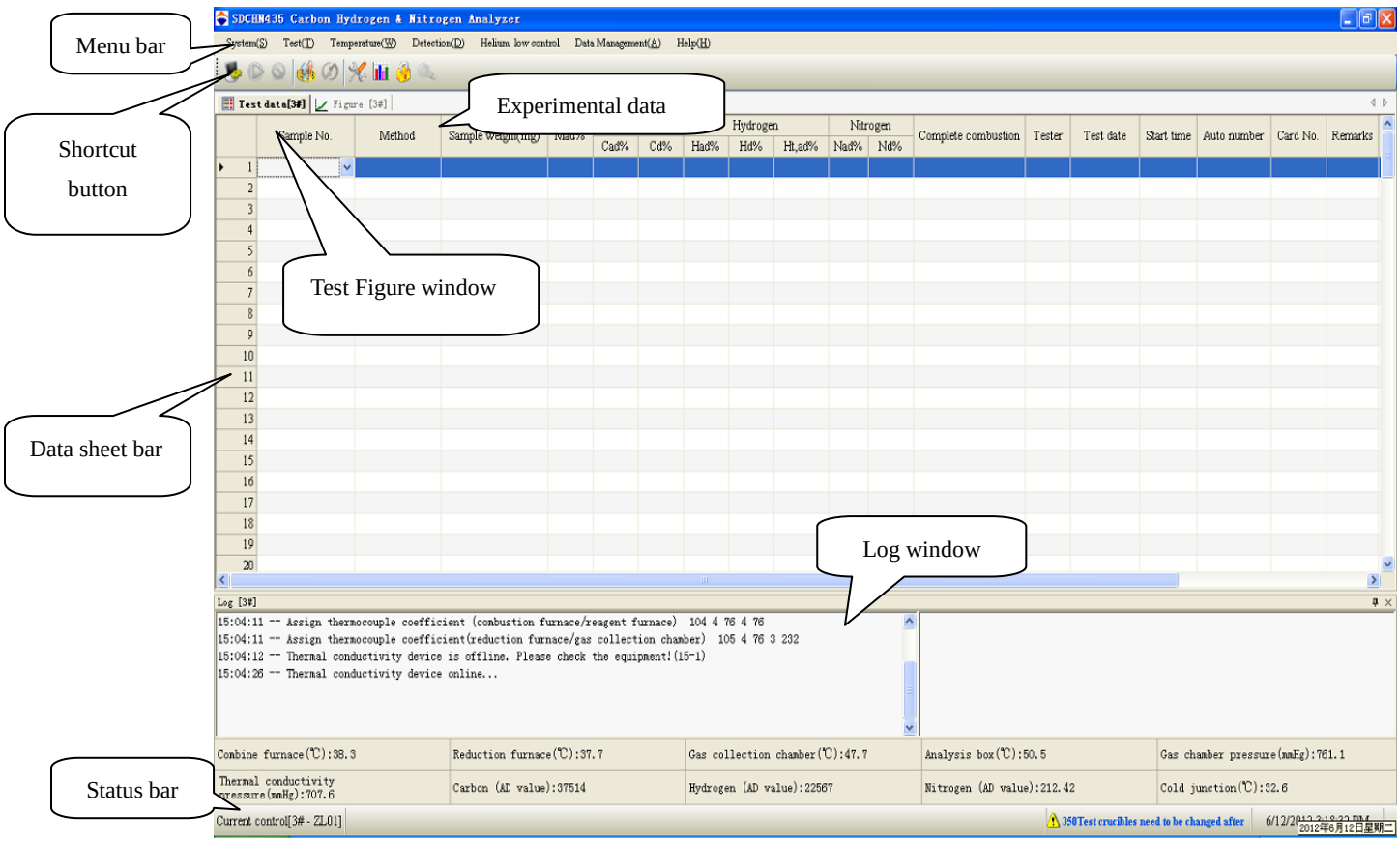


Fig. 4-1

Among them, there are functions of column width adjusting, column hiding and displaying, and column freely dragging and placing, row inserting and deleting on the data sheet. When you move the cursor to data bar, click on the right mouse button, then Fig. 4-2 menu will popup. The details of all functions will be introduced below.

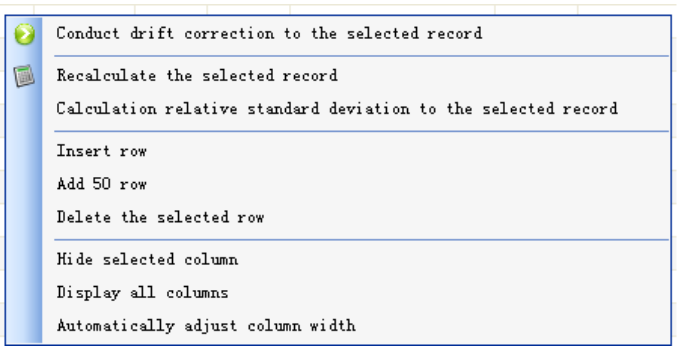


Fig. 4-2

- Conduct drift correction by using the selected record: select a shift record on the data bar of the program main interface to create drift coefficient for conducting drift correction to the instrument. The sample number of selected

record shall be reference material existed in the reference material database.

Note: The drift correction coefficient will directly influence the instrument precision, so the selection of drift **record will be of vital importance. It's suggested to select drift record according to the following principles:**

- ✧ **Drift record must be standard samples or reference material and all of them can be checked in reference material database.**
- ✧ **More than 2 records of the same standard samples or reference material must be selected as drift records for "Intercept correction", and their sample number must be the same with that of the reference material database.**
- ✧ **Only one standard sample is required to carry out drift correction for "One sample correction". It is suggested to select the standard sample whose contents of carbon, nitrogen and hydrogen is the same with the tested coal sample.**
- ✧ **Two or more kinds of standard samples should be selected to carry out drift correction for "Multi-sample correction". It is suggested to select the standard samples with high, medium and low contents of carbon, nitrogen and hydrogen.**
- ✧ **Accuracy of the drift record of parallel samples must satisfy the requirement of the national standard.**

- ➢ Recalculating the selected records: when modifying correction curve, drift coefficient, Mad %, sample weight, the selected records will be recalculated and the latest results shall be updated and stored into data base by the software automatically.
- ➢ Calculate the relative standard deviation (RSD) of selected records: to calculate the relative standard deviation index of the selected records.
- ➢ Insert rows: to insert blank rows before the selected record for users to adjust test sequence conveniently.
- ➢ Add 50 rows: to add new 50 blank rows automatically at the end of data sheet of the main interface.

- Delete the selected rows: to delete the selected record row
- Hide selected column: to hide the selected column
- Display all columns: to display all the most original data sheet columns.
- Automatically adjust column width: all data columns' width will be adjusted properly.

4.3 Functions of Each Menu

4.3.1 System menu

As shown in Fig. 4-3-1:

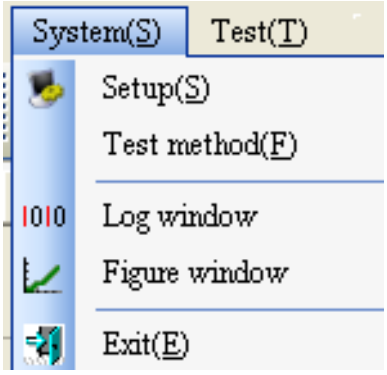


Fig. 4-3-1

4.3.1.1 Settings

Select this item or Click on "System Setting" icon in shortcut icon bar, the setting window as Fig. 4-3-2 will popup.

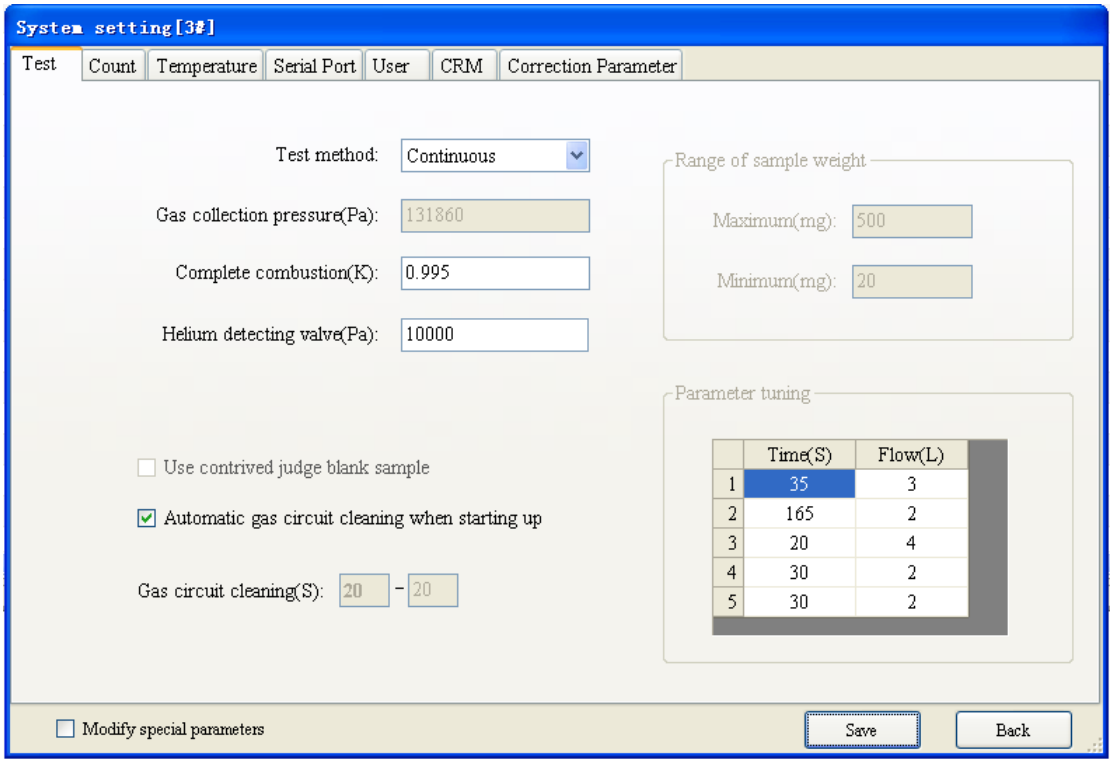


Fig. 4-3-2

- Save: save modified parameters.
- Back: exit the current window and back to main interface window of the program.
- Modify special parameters: After selecting it and inputting passwords, the advanced parameters in the window can be edited and modified.
- Test method: consist of successive and single test method. The default method is successive method.

  Successive test: Click on "Start test" to start automatic analyzing of multi-samples based on the entry sequence.

  Single test: Click on "start test" to start automatic analyzing of one sample.
- Helium detecting valve value (Pa): set the valve value of judging whether there is Helium flow when detecting the Helium gas tightness.
- Gas collection pressure: set maximum pressure controlled by gas collection bottle during the test according to the local atmospheric pressure. Generally, it is 1.3 times of the local atmospheric pressure. Otherwise, the system will

prompt:”The Oxygen is insufficient.” The default pressure is 131860.

- Complete combustion (K): set coefficient of judging whether the samples fully combusts or not. It should be set according to the sample quality and test results.
- Automatic gas circuit purging during start-up: select it, after the system rises to the constant temperature, the 5min gas circuit purging of the system will be implemented automatically.
- Start blank sample manual judgment: After selection, blank sample should be input manually before test, otherwise, the software will not generate blank sample calibrate value and the test results will be influenced.
- Gas circuit purging: separately set the purging time for gas collection circuit and analysis gas circuit.
- Range of sample weight: set the valid range of the sample mass.
- Parameter tuning: set oxygen flow rate and time for parameter tuning which should be in accordance with those during test.

  Notes: when debugging, the testing pressure of gas tightness should be set according to the local atmospheric pressure. Generally, it is 1.3 times of the local atmospheric pressure. Otherwise, the system will prompt:”The Oxygen is insufficient.” The default pressure is 125000.

1. Count: Click on “Count” tab in “System Setting” window, the window as Fig 4-3-3 will popup.

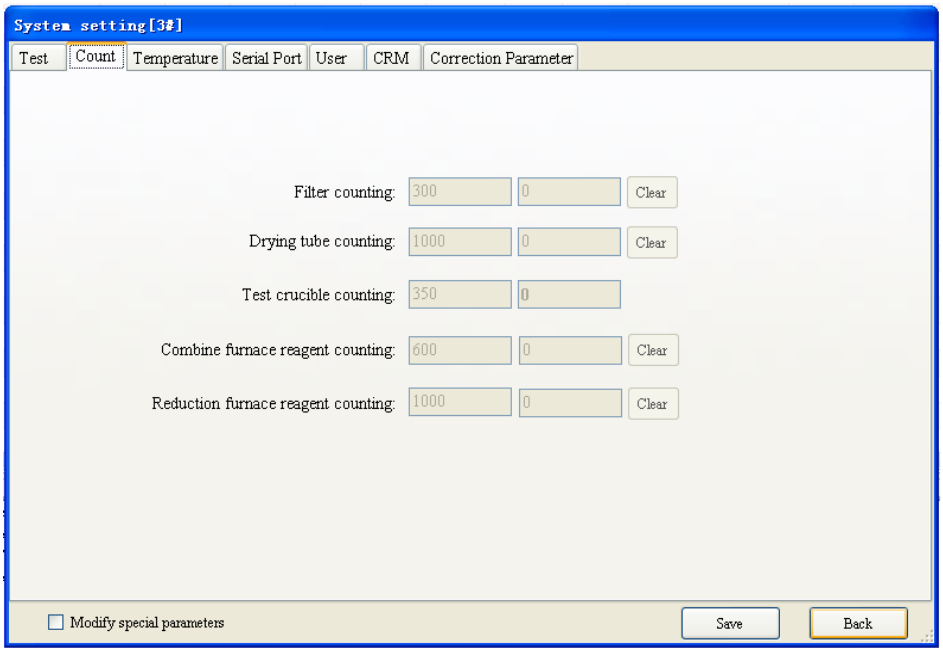


Fig4-3-3

- Filter counting: In the first text box, you can set the maximum counting valid number of sample. In the second text box, the number of samples done will be recorded. Click on “Clear” on the right, then the counting will be reset and restart to count. Its default value is 300.
- Drying tube counting: In the first text box, you can set the maximum counting valid number of sample. In the second text box, the number of samples done will be recorded. Click on “Clear” on the right, then the counting will be reset and restart to count. Its default value is 1000.
- Test crucible counting: In the first text box, you can set the maximum counting valid number of sample. In the second text box, the number of samples done will be recorded. After “Change Crucible” is conducted, then the counting will be reset automatically. Its default value is 350.
- Combined furnace reagent counting: In the first text box, you can set the maximum counting valid number of sample. In the second text box, the number of samples done will be recorded. Click on “Clear” on the right, then the counting will be reset and restart to count. Its default value is 600.
- Reagent of reduction furnace counting: In the first text box, you can set the valid maximum number of samples. In the second text box, the number of

samples analyzed will be recorded. Click on “Clear” on the right, then the counting will be reset and restart to count. The default value is 1000.

Note:

- ✧ **After replacing or purging, the counting of the above items should be reset manually. Or when replacement and cleaning are prompted by the software, replacement and purging should be done timely to avoid influence to the test results.**

2. Temperature: Click on “Temperature” tab in “system setting” window, window as Fig 4-3-4 will popup.

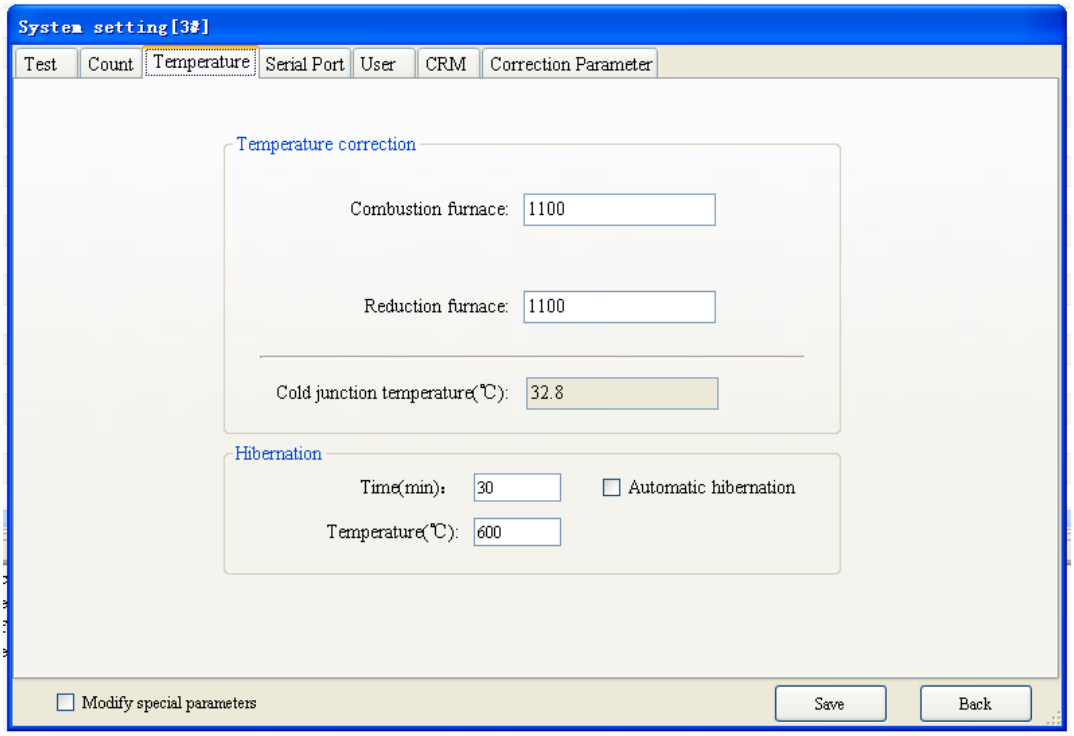


Fig. 4-3-4

- ➢ Temperature correction tab bar：
  - ◆ Combined furnace: set thermocouple coefficient of combined furnace
  - ◆ Reduction Furnace： set thermocouple coefficient of reduction Furnace

Note:

- ✧ **It's not allowed to modify parameter of the combined and reduction furnace if the thermocouple is not changed. Otherwise the instrument may be damaged.**

- ➢ Hibernation: if samples to be analyzed by the instrument are few and the

waiting time is long, it's suggested to apply this function for prolonging instrument service life.

- Time: set hibernation time
- Temperature: set hibernation temperature
- Automatic hibernation: after selecting it, the instrument will enter into hibernation state according to the set time.

3. Serial port: Click on option tab “Serial Port” of “system setting” window, the window as Fig. 4-3-5 will popup.

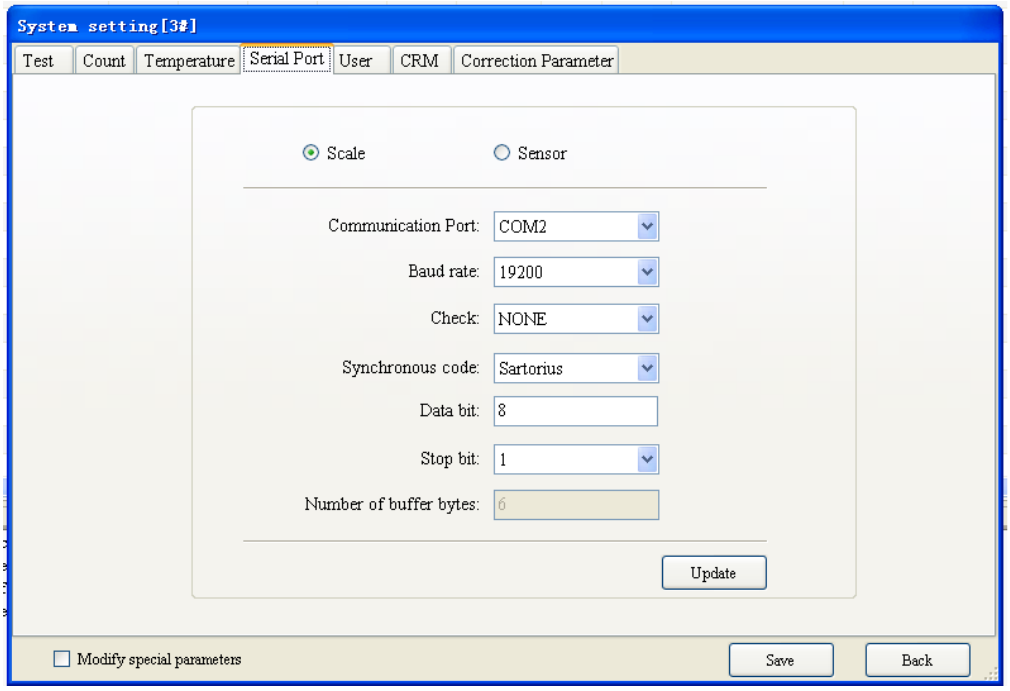


Fig 4-3-5

- Balance: set communication parameter of the balance:
  - Communication mouth: setting value of this item according to the practical situation
  - Baud rate: set value of this item according to the parameter of the balance.
  - Check: set value of this item according to the parameter of the balance.
  - Synchronous code: set value of this item according to the parameter of the balance.
  - Data bit: set value of this item according to the parameter of the balance.

- Stop bit: set value of this item according to the parameter of the balance.
- Update: after modifying the above parameters, it's necessary to click on this icon and the parameters can be saved and take effect, otherwise it can't be saved and take effect.

➢ Sensor: set communication parameter of the sensor.

4. User: Click on “User” at “System Setting” window, window shown as Fig. 4-3-6 will popup.

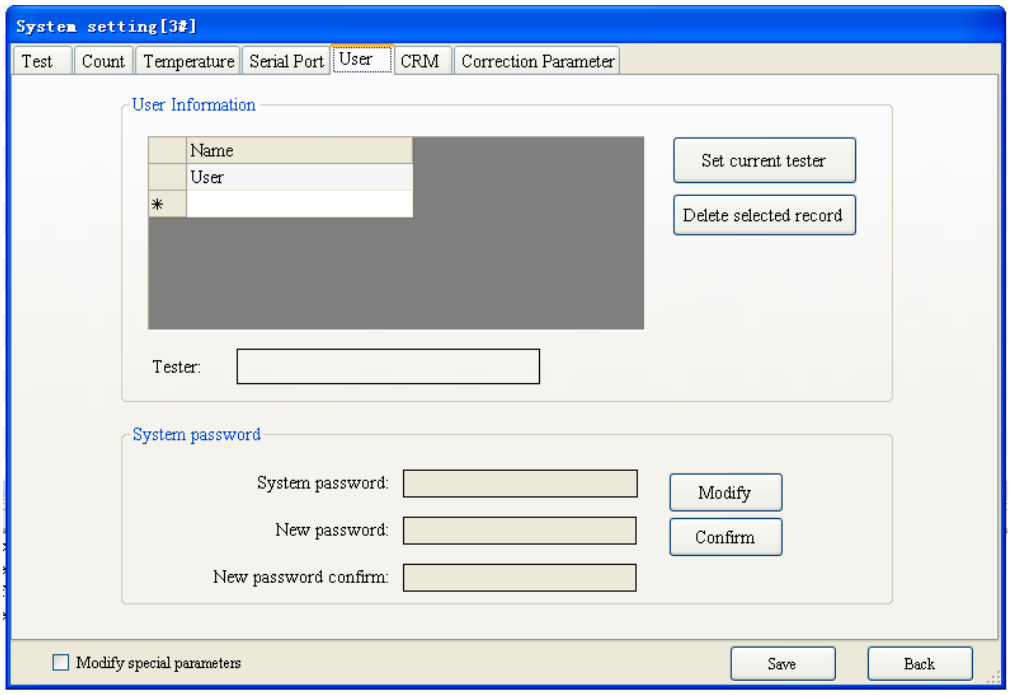


Fig. 4-3-6

➢ User information tab bar：

- Directly input the name of tester in the list box and the program will automatically add blank record row.
- Set current tester: after selecting record on table column on the left, click on this icon, the program will automatically display the selected record on the tester’s label.
- Delete selected records: Click on this icon, the program will automatically delete the selected records in the tables on the left.
- Tester: Select displaying name of the tester, link to and display in “Test” column on data sheet of the program main interface.

- System password tab bar:
  - Original password: input original password
  - New password: input new password.
  - New password confirm: confirm new password.
  - Modify: click on the button, textbox on the left will be activated. Modification can be made.
  - Yes: click on the button to save new password.

5. Reference Material: Click on “CRM” option tab of “System Setting”, the window shown as Fig. 4-3-7 will popup.

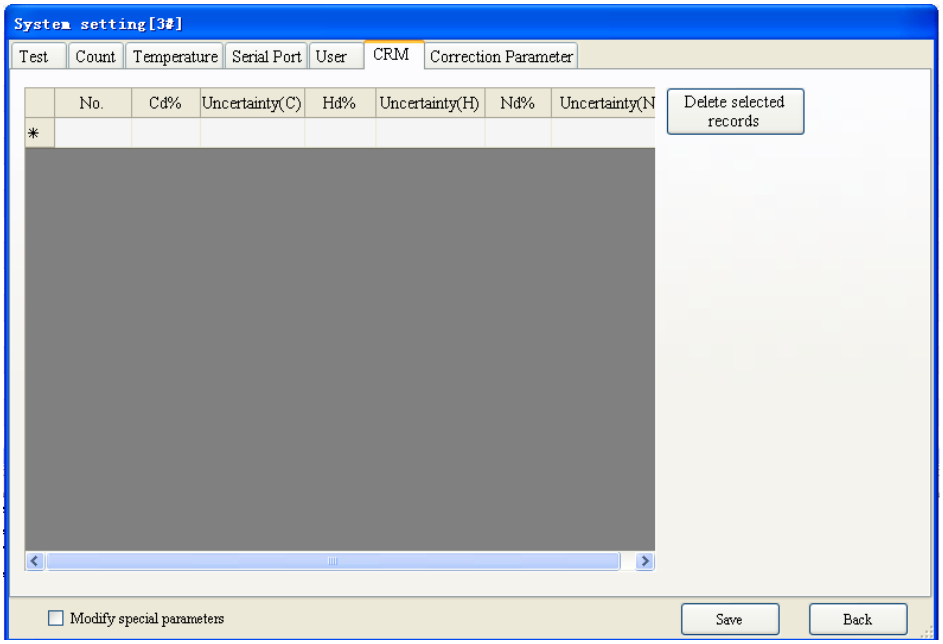


Fig. 4-3-7

- Delete selected records: Click on this icon, the selected record row in table on the left will be deleted automatically.
- Add standard sample: directly input related parameter in the table, and the program will automatically add blank record row.
  - Number: input number of standard sample into text box on the right.
  - Cd (%): input carbon standard value of the standard sample into text box on the right
  - Hd%: input hydrogen standard value of the standard sample into text box on the right.

- **Nd%:** input nitrogen standard value of the standard sample into text box on the right.
- **Uncertainty:** Input the uncertainty of all sample indexes in the right text box.

4.3.1.2 Test method

Selecting this menu or click on "Test Method" icon in the shortcut icon bar, the window shown in Fig. 4-3-8 will popup.

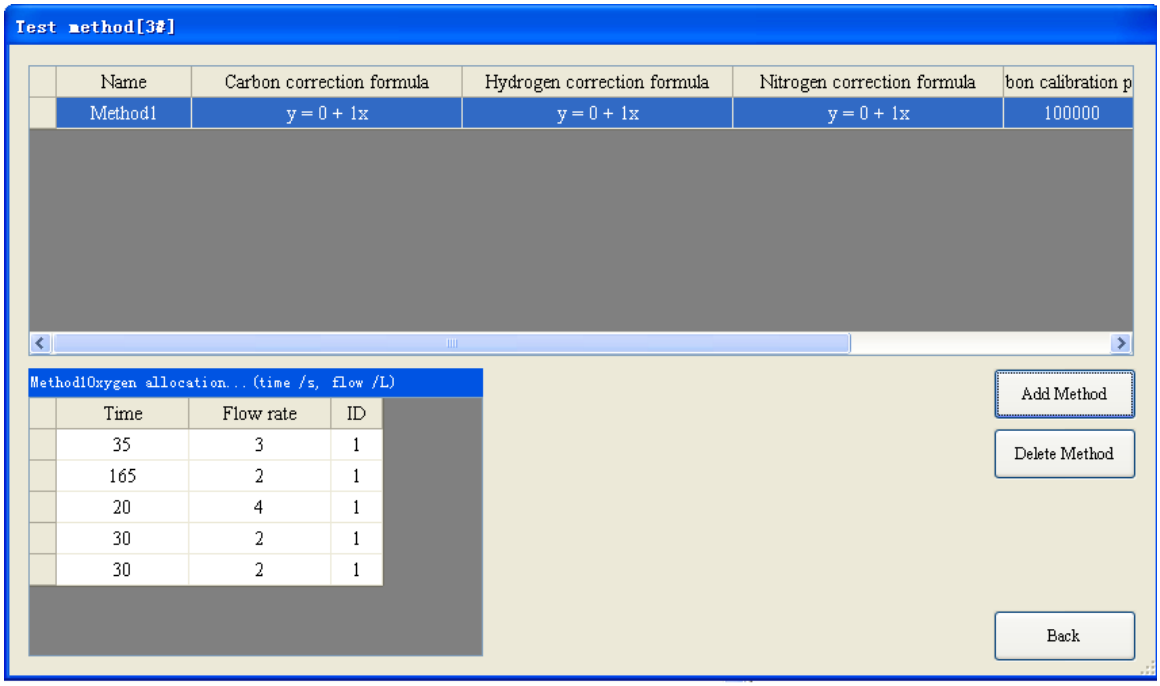


Fig 4-3-8

- Add method: click on this icon, the program will automatically add blank record row, and user can edit this blank record row.
- Delete method: Click on this icon, delete the selected record.
- Oxygen allocation: set corresponding combustion flow and time of the relevant method.

4.3.1.3 Log window

Opening command window, see Fig 4-1.

4.3.1.4 Figure window

Opening figure window, see Fig 4-1.

4.3.1.5 Exit

Click on this item or “X” at the top right corner of the program’s interface, window as shown in Fig 4-3-9 will popup.

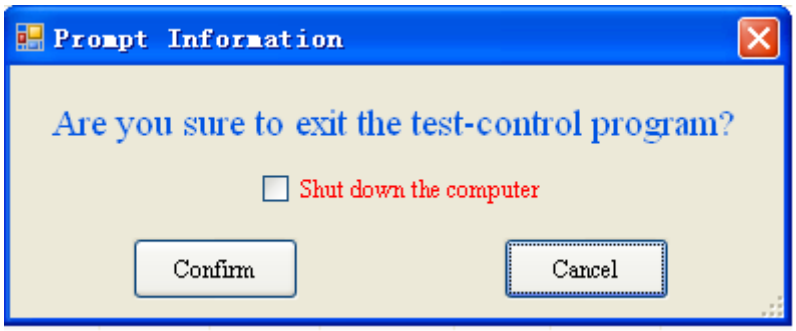


Fig. 4-3-9

- Shut down the Computer: after selecting it, SDCHN435 carbon hydrogen and nitrogen analyzer program will exit firstly. Then the computer will be shut down automatically.
- Confirm: to exit SDCHN435 carbon hydrogen and nitrogen analyzer program and back to Windows desktop.
- Cancel: not to exit SDCHN435 carbon hydrogen and nitrogen analyzer program.

4.3.2 Test Menu

As shown in Fig. 4-4-1:

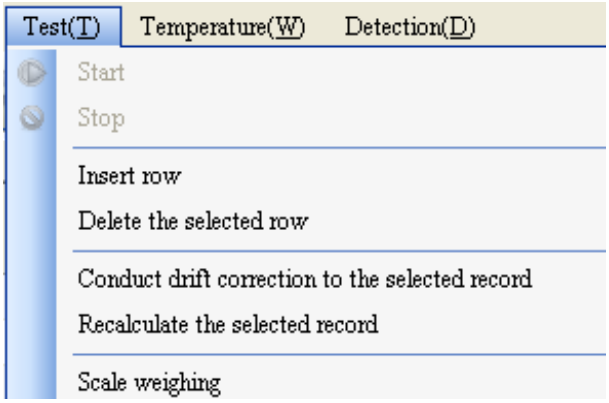


Fig. 4-4-1

4.3.2.1 Start

Click on this menu or shortcut icon on the shortcut icon bar, the system will automatically enter test state.

4.3.2.2 Stop

Click on this menu or shortcut icon on the shortcut icon bar, the system will stop

the next test, but the current test will be continued to completion.

4.3.2.3 Insert row

Insert blank rows before the selected record for users to adjust the test sequence conveniently.

4.3.2.4 Delete the selected rows

Delete the selected record line.

4.3.2.5 Conduct drift correction with a selected record

Select a record for drift correction at the data bar of the program main interface, and create drift coefficient to conduct drift correction for the instrument. The sample number of the selected record should exist in the reference material database. “Intercept correction” method is recommended for drift correction.

4.3.2.6 Recalculate the selected records

When modifying correction curve, drift coefficient, Mad %, sample weight, the selected records will be recalculated and the latest results shall be updated and stored into data base by the software automatically

4.3.2.7 Balance weighing

Click on this item, the program realizes online weighing; otherwise, online weighing would not be realized.

4.3.3 Temperature Menu

As shown in Fig. 4-5-1:

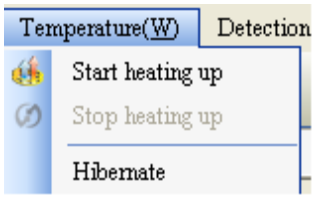


Fig. 4-5-1

4.3.3.1 Start heating up

Click on this menu or shortcut icon of shortcut icon bar, the program will automatically make the instrument heating and keep constant temperature.

4.3.3.2 Stop heating up

Click on this menu or shortcut icon of shortcut icon bar, the program will

automatically make the instrument cool.

4.3.3.3 Hibernate

Click on this menu, the program will make the system hibernate according to the given parameter to protect the instrument

4.3.4 Detection Menu

Shown in Fig. 4-6-1:

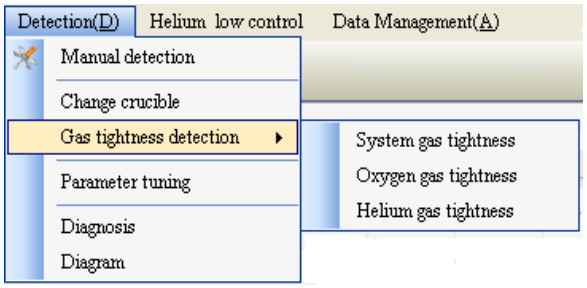


Fig. 4-6-1

4.3.4.1 Manual detection

Click on this item or “Manual Detection” icon, the detection window shown in Fig. 4-6-2 will popup.

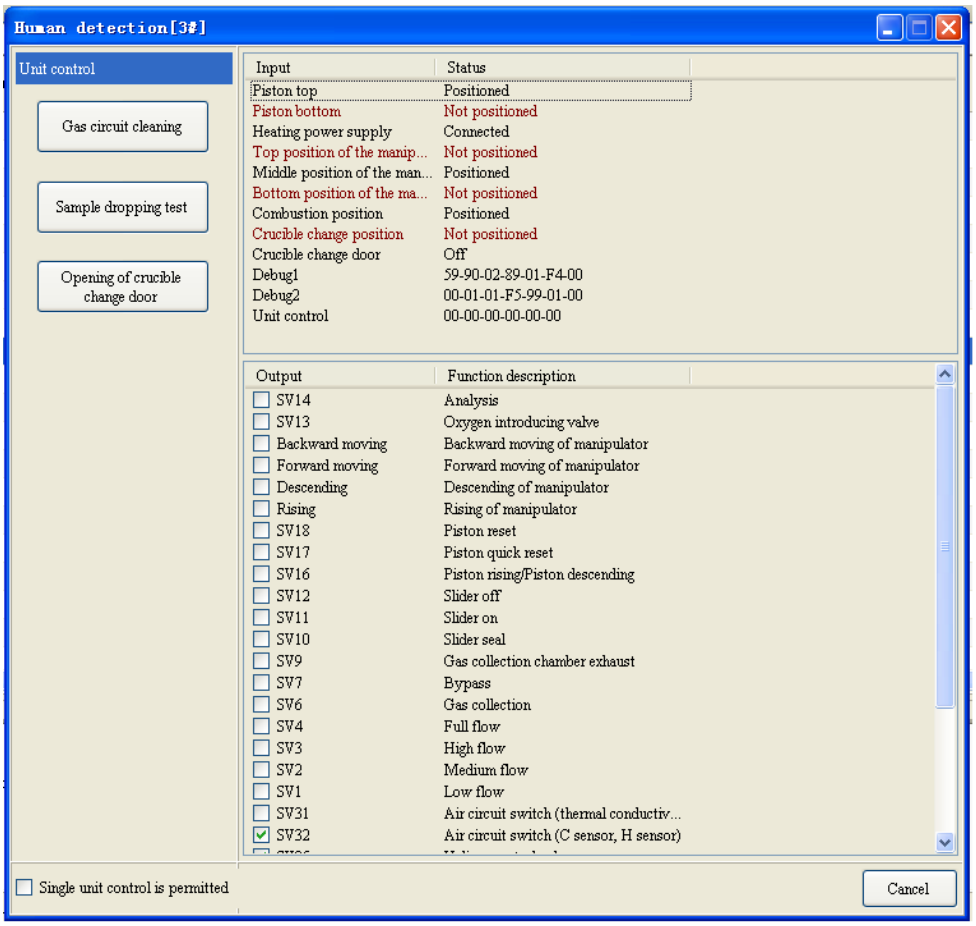


Fig. 4-6-2

- Gas circuit purging: Click on this item, the program will start gas circuit purging automatically, and default time for purging gas circuit is 10minutes and the purging also can be stopped manually.
- Sample dropping test: test the sample dropping situation to observe whether the samples drop into combustion tube reliably or not when debugging.
- Opening/closing of crucible change door: open or close crucible change door
- Single unit control is permitted: after selecting this item and inputting password, you can control some parts manually.

Note:

- ✧ **Only service technicians from Sundy Company can do this operation.**

4.3.4.2 Change crucible

Click on this item, window shown in Fig 4-6-3 will popup. The program will prompt window as shown in Fig 4-6-4 after the manipulator move to crucible

changing hole. And at this moment, use tweezers to take the crucible out and place another new crucible, and click on “Reset of crucible change” icon in window as shown in Fig 4-6-4, then the manipulator return to normal place automatically.

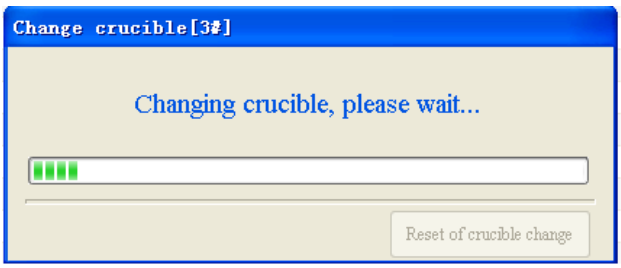


Fig. 4-6-3

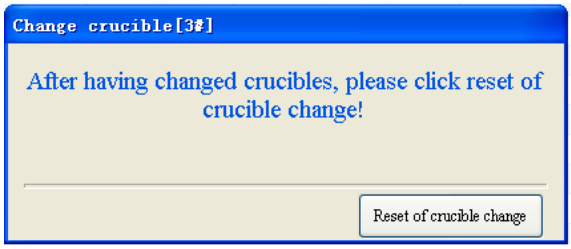


Fig. 4-6-4

Note:

- ✧ **Avoid scalding to hand when changing crucible under high temperature.**
- ✧ **Clean the manipulator or the sampling sending rod regularly with dust collector according to prompts.**
- ✧ **After changing crucible, it's suggested to conduct gas circuit purging and gas tightness detecting operations to ensure the stability of the instrument.**
- ✧ **After finishing 350 samples or the program reminding it needs to change crucibles, the crucibles must be changed, otherwise the combustion tube will be damaged and then the test result will be affected.**

4.3.4.3 Gas tightness detection

Click on this item, window as shown in Fig 4-6-5 will popup and the program will automatically detect gas tightness of the system (the gas tightness of oxygen and helium circuit) according to specified method. Click on “Stop detection” icon in window as shown in Fig 4-6-5, then window as shown in 4-6-6 will popup and the current tightness detection process will be stopped.

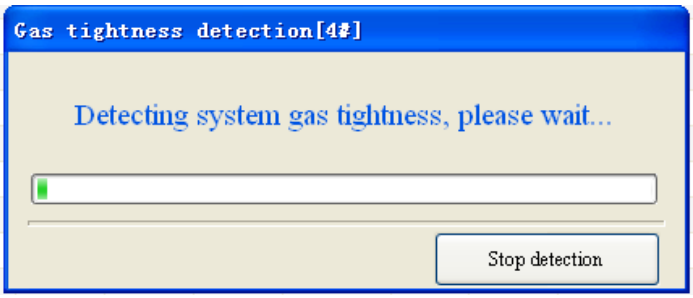


Fig. 4-6-5

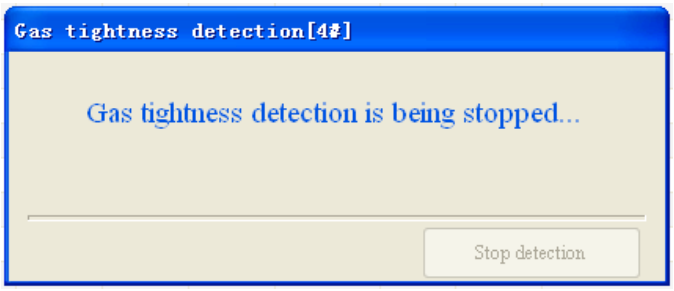


Fig 4-6-6

Note:

- ✧ **After changing crucible, furnace reagent and seal ring, it's necessary to conduct gas tightness detection operation.**
- ✧ **When the program prompts "System is unstable", please extend preheating time and conduct gas tightness detection again.**
- ✧ **When the program prompts "gas circuit leakage in gas collection bottle section", please inspect and repair.**
- ✧ **When the program prompts "gas circuit leakage in high temperature furnace section", please inspect and repair.**
- ✧ **When the program prompts "gas circuit leakage in carbon and hydrogen sensor section" please inspect and repair.**
- ✧ **When the program prompts "Oxygen gas tightness detection failure" or "Helium gas tightness detection failure", please conduct gas tightness detection operation or inspect and repair once again.**
- ✧ **Helium gas tightness: To detect the gas tightness of the helium circuit only.**
- ✧ **Oxygen gas tightness: To detect the gas tightness of the oxygen circuit only.**

4.3.4.4 Parameter tuning

Click on this item, window as shown in Fig 4-6-7 will popup. Click on “Yes” to start parameter tuning operation shown as Fig 4-6-8. Click on “No” to cancel parameter tuning operation and back to interface of the program. Click on “Stop tuning” in the window as shown in Fig 4-6-8, window as shown in Fig 4-6-9 will popup and the current parameter tuning process will be stopped.

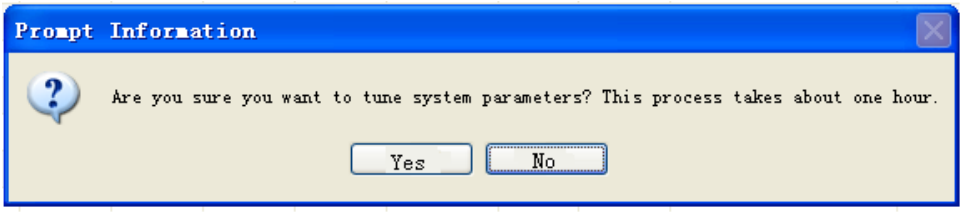


Fig. 4-6-7

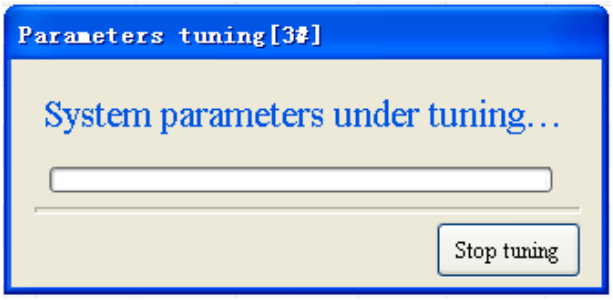


Fig. 4-6-8

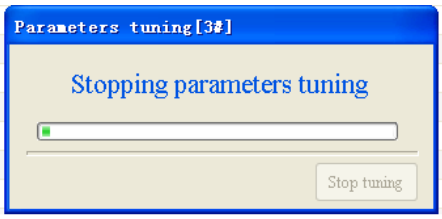


Fig. 4-6-9

Note:

- ✧ **Using the instrument for the first time, it’s necessary to conduct parameter tuning so as to conduct precision and accuracy test.**
- ✧ **If parameter lose because of changing software or updating software, it is necessary conduct parameter tuning so as to conduct precision and accuracy test.**
- ✧ **There is no need of this operation after the instrument being debugged**

well.

- ✧ **It's necessary to conduct this operation after changing gas transmission conduit between combined furnace and gas collection chamber.**
- ✧ **It's necessary to conduct parameter tuning after adjusting gas flow and pressure of oxygen cylinder or replacing gas collection bottle.**
- ✧ **If the program prompts "Failed to tune the parameters", please tune the parameters or inspect and repair again.**

4.3.4.5 Diagnosis

Click on this item, window as shown in Fig 4-6-10 will popup.

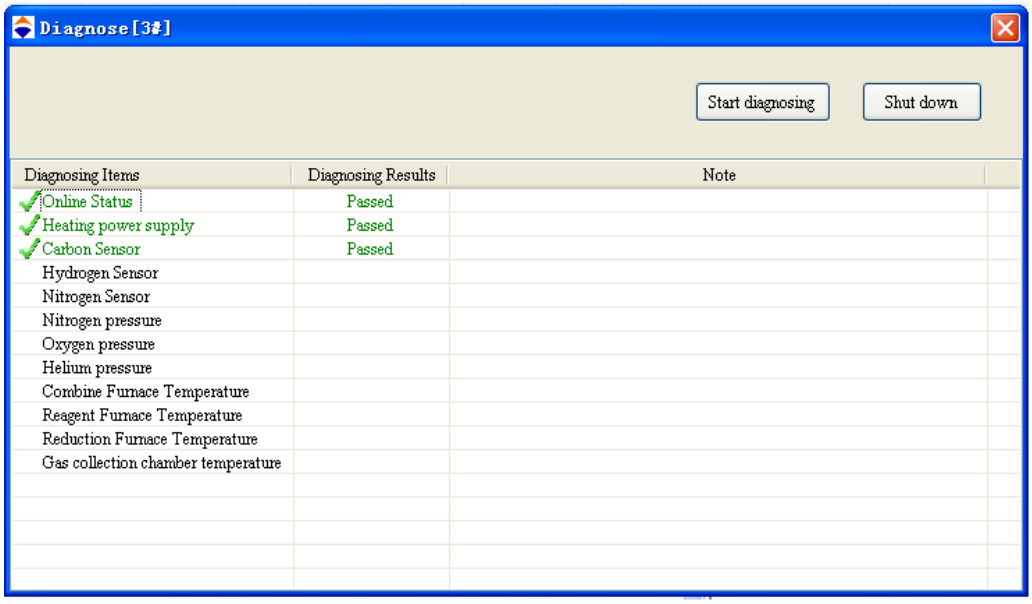


Fig4-6-10

- ➢ Start diagnosis: Click on this item, the program will detect all items on the "Diagnosing Items" column by sequence. And the results will be displayed on the "Diagnosing Results" or "Note" column.
- ➢ Stop diagnosis: Click on this item, the instrument will stop diagnosing all items.
- ➢ Shut down or "X": Click on this item to exit the "diagnosis" window.

4.3.4.6 Figure

Click on this item, window as shown in Fig4-6-11 will popup to show the curve chart and signal value of all items.

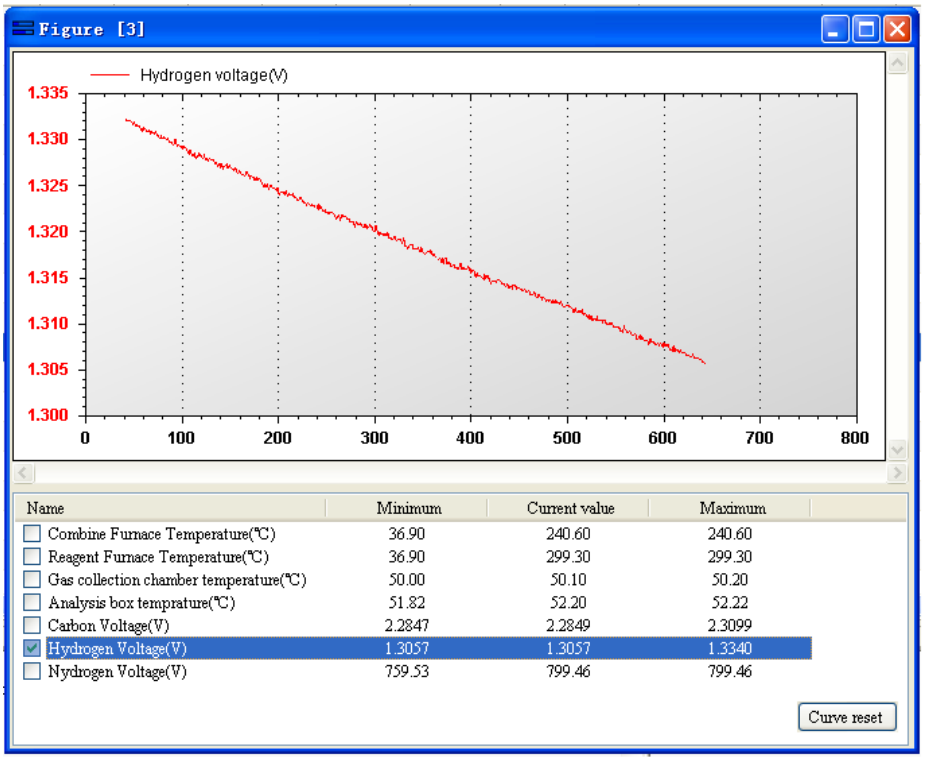
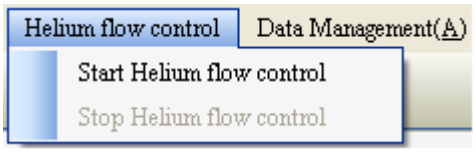


Fig4-6-11

4.3.5 Helium flow control menu

Shown in Fig. 4-7-1:



4-7-1

- Start Helium flow control: click on this button or  button in the shortcut button column, then the system will shut down SV34 valve automatically to keep the total Helium flow to be 100ml/min, which will reduce the Helium cost greatly.
- Stop Helium flow control: click on this button or  button in the shortcut button column, and then the system will turn on SV34 valve automatically to keep the total Helium flow return to be 700ml/min.

Note:

For cost saving, the Helium flow should be throttled when the system is on standby until 30 min before the test starts.

4.3.6 Data Management Menu

Details refers to Chapter 5

4.3.7 Help Menu

Shown in Fig. 4-8-1:

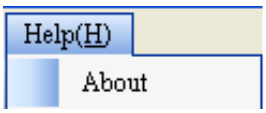


Fig. 4-8-1

4.3.7.1About

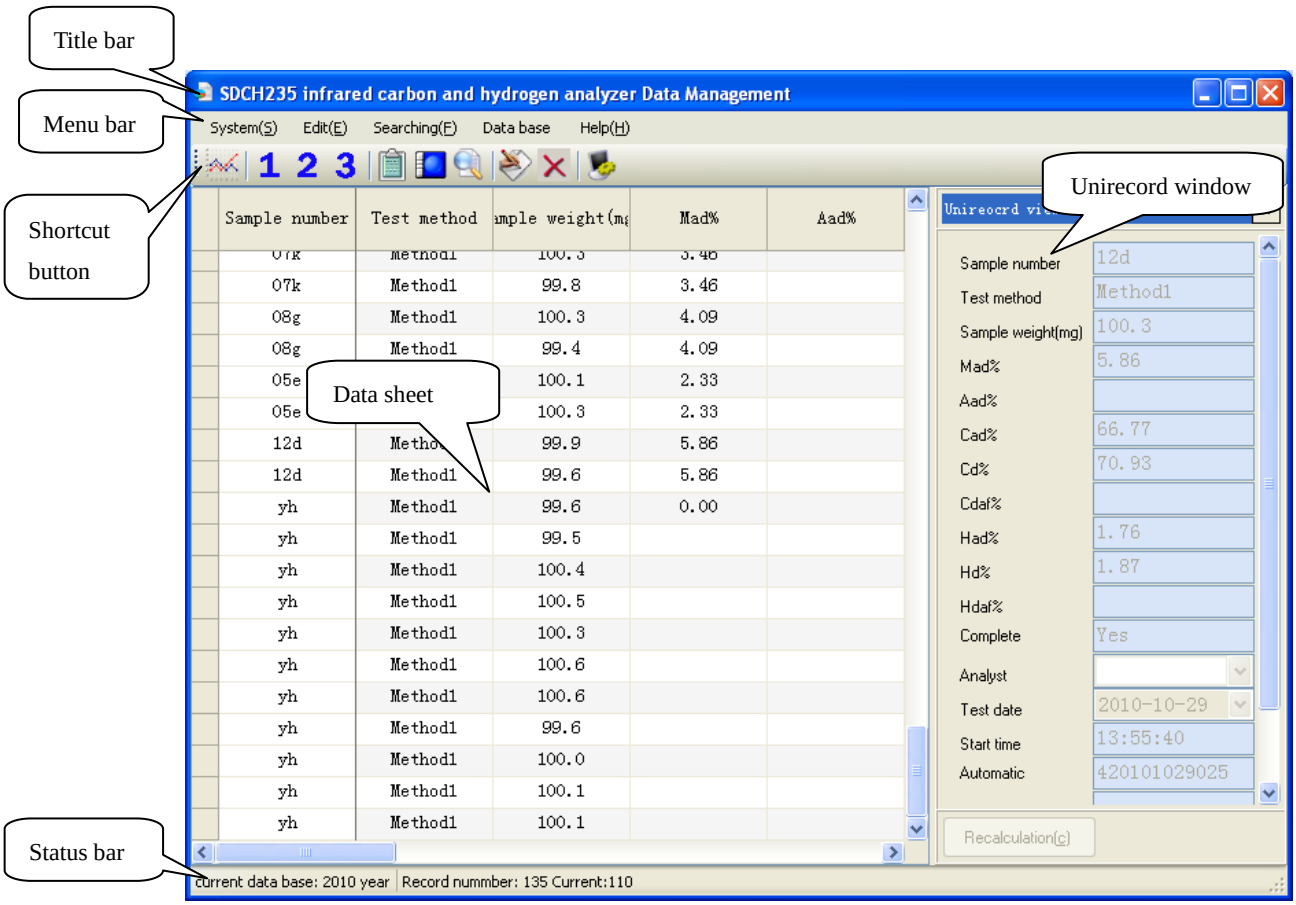
Click on this item, and you can get the program's version information. Click on "Yes", back to main interface of the program

Chapter 5 Data Management

Click on “Data Management” on the main interface menu of SDCHN435 carbon hydrogen and nitrogen analyzer or the  button on the shortcut button, popup the indicated window as Fig 5-1, and then enter into Data Management window.

5.1 Functions of the Main Forms

The main forms of the data base of the SDCHN435 consist of title bar, menu bar, shortcut button and data sheet etc. Every line in the data sheet can be dragged and placed at will for convenient viewing. The detailed introduction to the menu is as follows.



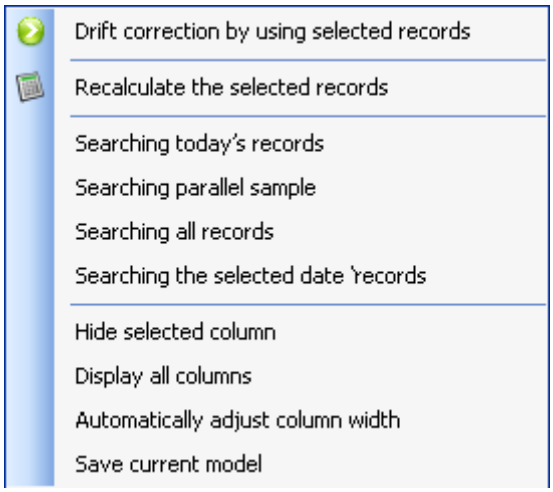


Fig. 5-1

5.2 Functions of Each Menu Bar

5.2.1 System Menu

As Fig.5-1-1:

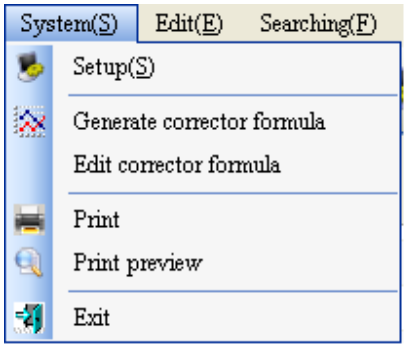


Fig. 5-1-1

5.2.1.1 Setting

Click on this bar, window as Fig.5-1-2 will popup.

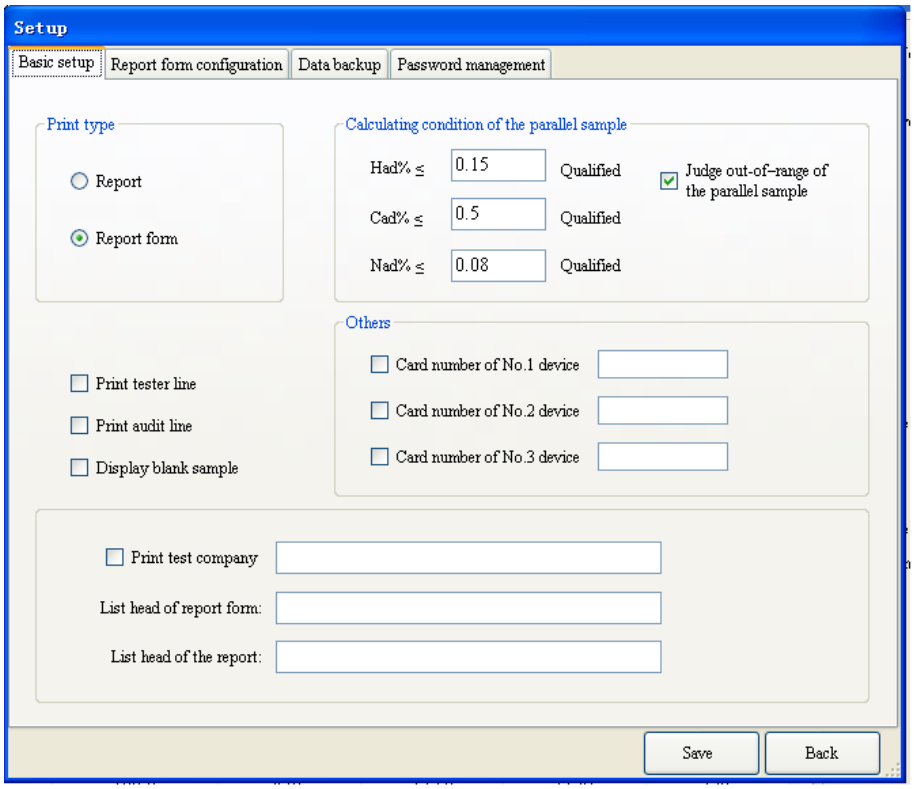


Fig. 5-1-2

- Print type
  - Report: Select the item, then print the selected records in report
  - Report form: Select this item, and then the selected records will be printed in report form.
- Calculation condition of the parallel sample.
  - Cad% less than or equal to: Set the condition of judging whether the repeatability of carbon value is qualified or not.
  - Had% less than or equal to: Set the condition of judging whether the repeatability of hydrogen value is qualified or not.
  - Nad% less than or equal to: Set the condition of judging whether the repeatability of nitrogen value is qualified or not
  - Whether the parallel sample is out-of–tolerance or not: Select this item, it will be marked that the parallel results are out-of-tolerance or not when printing the report or report table
- Others: Set up related device card No. as No.1 Device, No.2 Device or No.3 Device to facilitate data searching.

- Print tester column: Select this item, and then the tester name will be printed on the underside of the form.
- Print audit column: Select this item, and then the audit column will be printed on the underside of the form.
- Display blank sample or not: Select this item, and then the blank sample record will be displayed on the data sheet column.
- Print test company column: Select this item, and then the test company will be printed on the underside of the form.
- Content of report header: Input the content on the right textbox, and then the content will be printed on the report form header.
- Content of report form header: Input the content on the right textbox, and then the content will be printed on the report form header.
- Save: After modifying related parameters, click on the button, then the parameters can be saved; otherwise, the parameters cannot be saved.
- Back: Click on the button to quit the window and back to the main interface of the data base.

1. Report form configuration: Click “Report Form Configuration” on the Setting window, the window as Fig. 5-1-3 will popup.

The function is to set the printed fields for the report form. Select some recorded lines on the Print Column of the window, then the fields will be printed when printing the report form.

Note:

- **The selected record lines cannot exceed the printed range of A4 paper.**

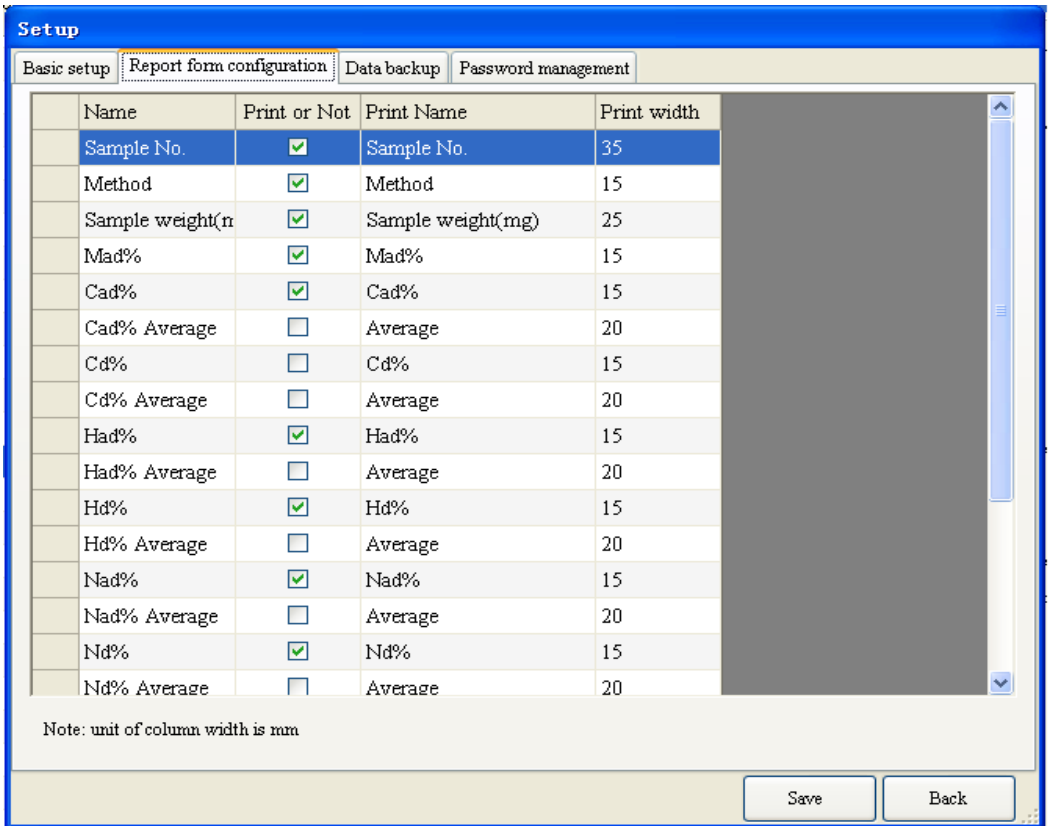


Fig. 5-1-3

2. Data backup: Click on “Data Backup” on the Setting window, popup the window as Fig. 5-1-4.

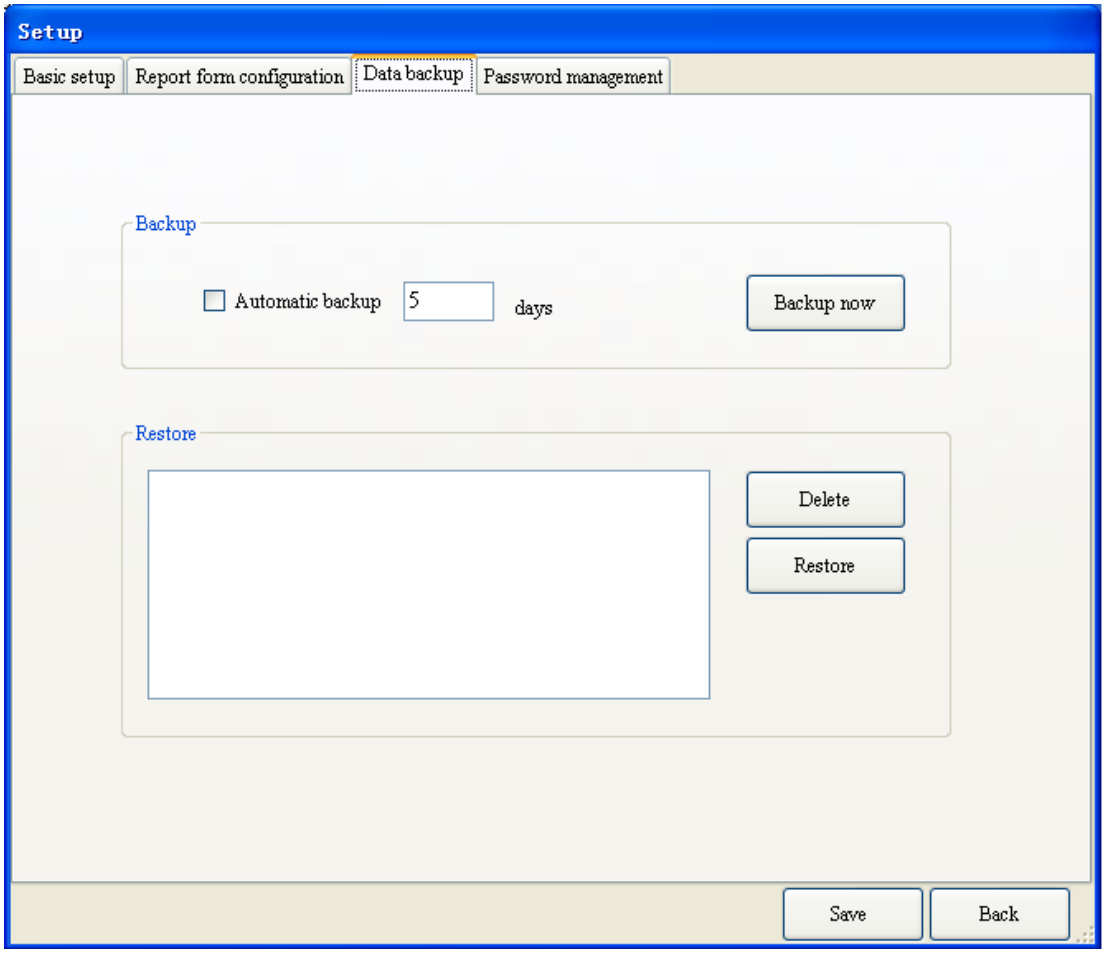


Fig. 5-1-4

- Backup
  - Automatic backup: Input the content on the right textbox and select this item, then the program will automatically back up the data base based on the set condition.
  - Backup now: Click on the button, the current data base be backed up.
- Restore
  - Delete: Select the records on the left textbox and click on the button, and then the backup data base can be deleted.
  - Restore: Select the records on the left textbox and click on the button, and then the backup data base can be restored.

Note:

- **Please use this function with caution.**

3. Password management: Click on the “Password Management” on the Setting window, popup the window as Fig.5-1-5.

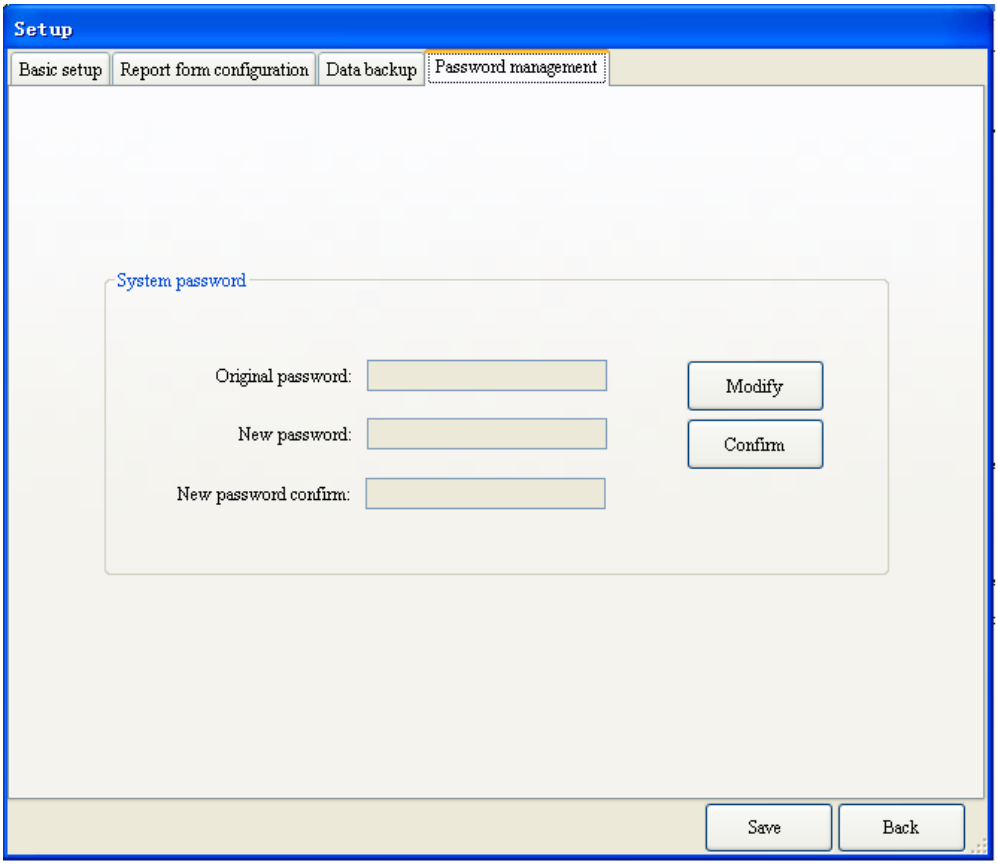


Fig. 5-1-5

- System password tab bar:
  - Original password: input original password.
  - New password: input new password.
  - New password confirm: confirm new password.
  - Modify: click on the button, and the left textbox can be activated and then it can be modified.
  - Yes: click on the button, and then save the new password.

5.2.1.2 Generate correction formula

Select the records that should take part in generating correction formula on the data display column and click on the item, then the carbon correction window as Fig. 5-1-6, the hydrogen correction window as 5-1-7 and the nitrogen correction window as 5-1-8 will popup.

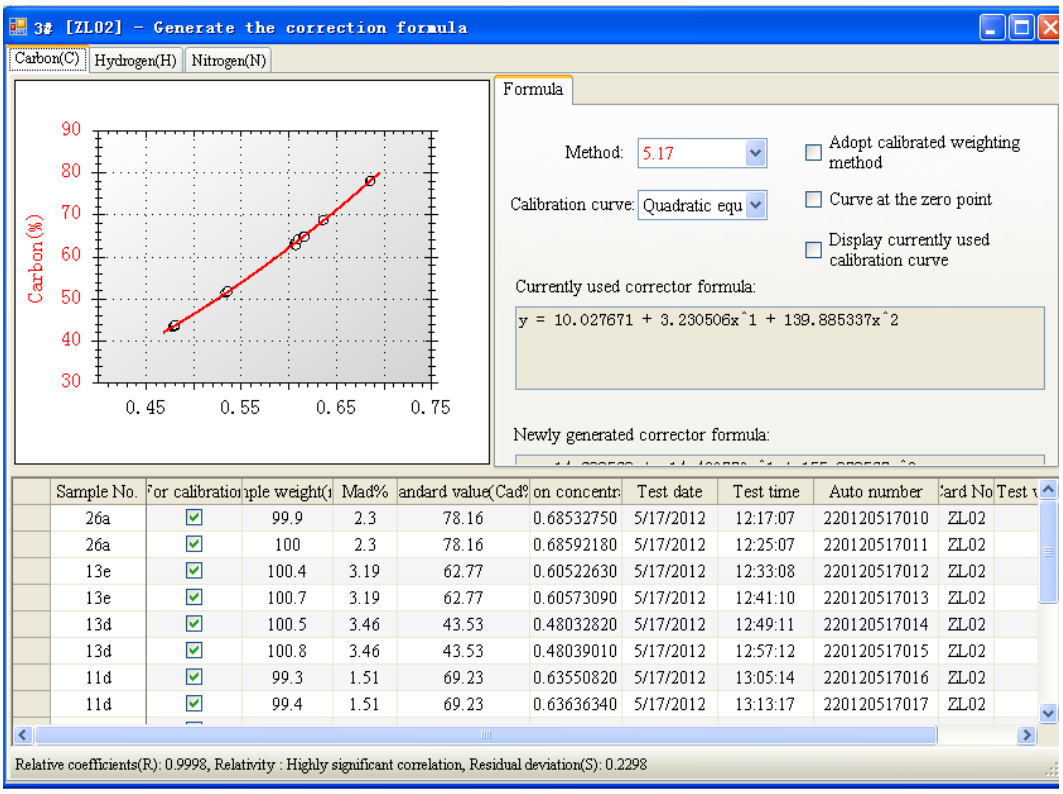


Fig. 5-1-6

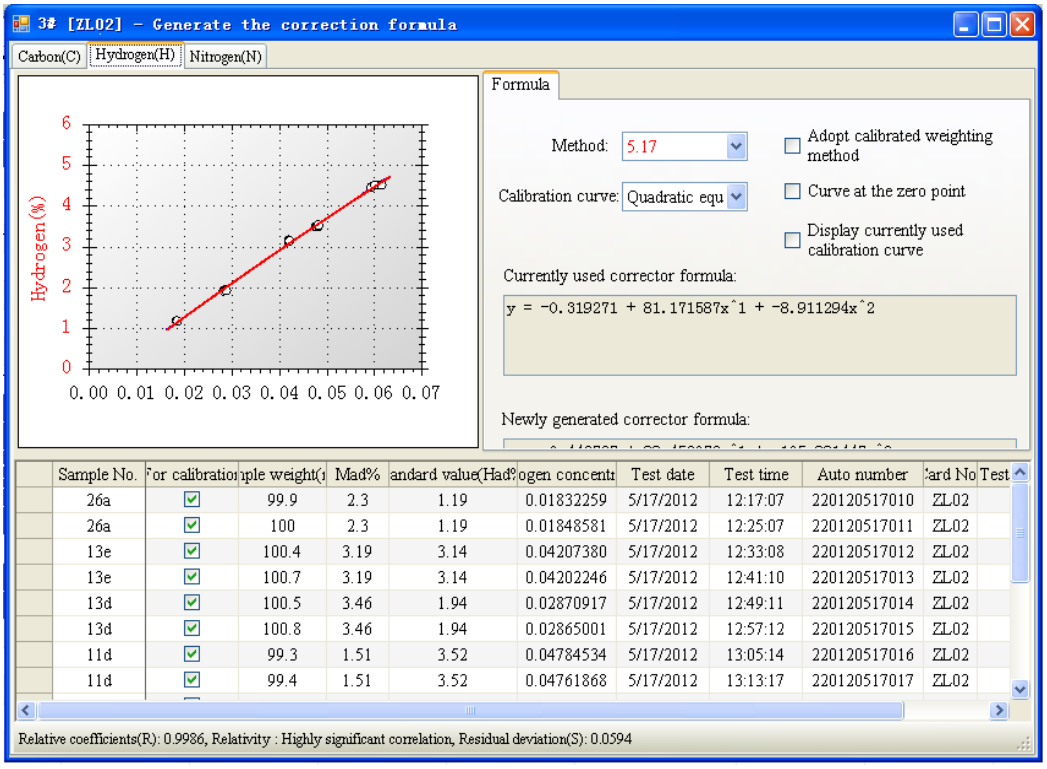


Fig. 5-1-7

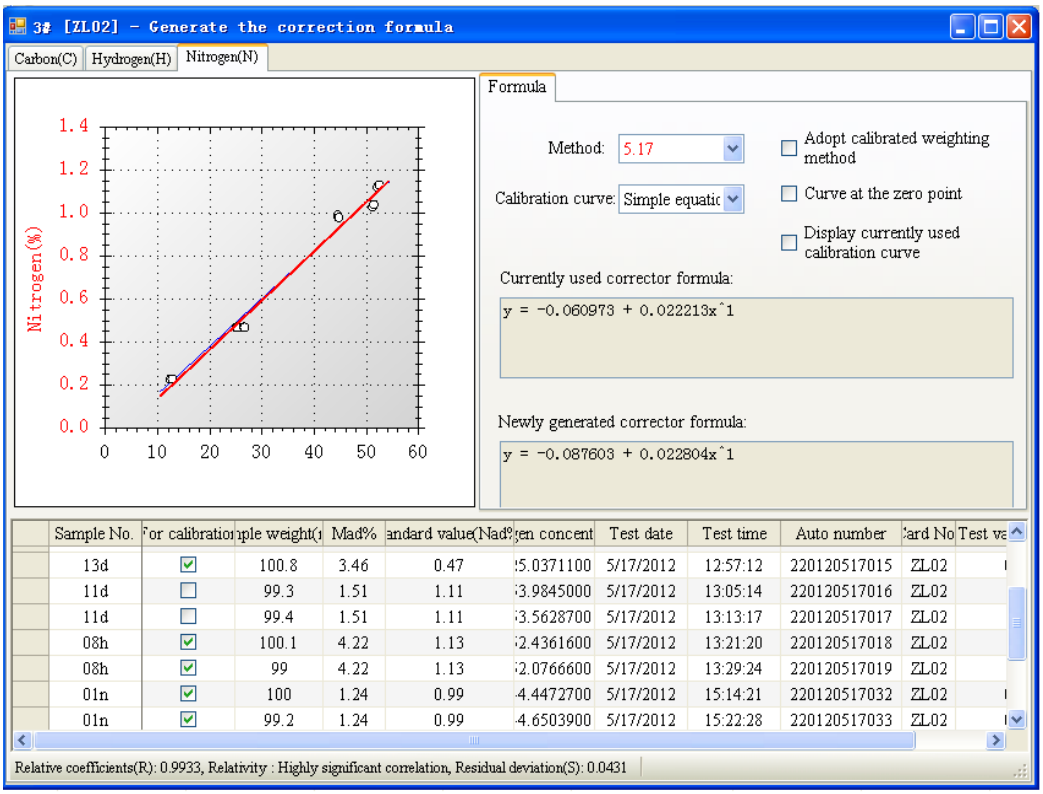


Fig. 5-1-8

Select the effective records that should take part in generating correction formula on the data sheet of the main interface window of the data base, and then click on  on the shortcut button column or click on ”System” → “Generate correction formula” on the menu, the window as above Figures will popup.

- Method: Select the method that needs calibration, generally, it should in accordance with that of the selected records.
- Correction curve: Select the correction line type. Generally, quadratic curve is chosen for carbon and hydrogen, and straight line is chosen for nitrogen. For the above line types, their related coefficient (R) should be more than 0.9990.
- Curve zero-crossing point: After selecting, the correction curve will be forced to cross zero point.
- Display currently used correction curve: After selecting, the current correction curve is displayed on the left picture window.
- Generate correction curve: click on the button, the program will automatically generate correction curve.

- Apply newly generated correction formula: click on the button, the program will automatically generate new correction curve.
- Records on the data sheet used in the correction line: Select the records in the line, and then the selected records will take part in the correction. Otherwise, the records will not take part in the correction.

  After the correction curve is modified, the records that use the corresponding method should be re-calculated. Otherwise, the records will not be updated.

Note:

- **The selected records for generating correction curve should be samples in the reference material database. Otherwise, the unqualified records will be abandoned automatically when the correction data is being imported.**

5.2.1.3 Edit correction formula

Click on this item, popup the window as Fig.5-1-6; Fig.5-1-7 or Fig.5-1-8 for checking and modifying the correction formula and linear of some method.

5.2.1.4 Print

Print the selected records in the data sheet.

5.2.1.5 Print preview

Preview the selected records in the data sheet.

5.2.1.6 Exit Data Management

As Fig. 5-1-9, click on this item or "×" on the top right corner of the main interface of the Data Base, and then click on "Yes" to exit the data base window; back to the main program interface of SDCHN435 carbon, hydrogen and nitrogen analyzer; click on "No", it is to waive the exit.

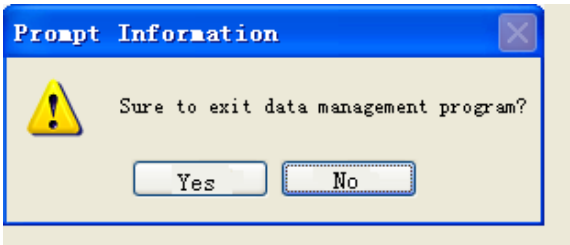


Fig. 5-1-9

5.2.2 Edit Menu

As Fig. 5-2-1

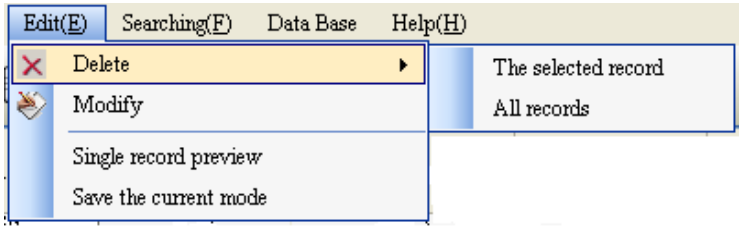


Fig. 5-2-1

5.2.2.1 Delete

Delete the selected records in the data base.

1. Selected records: delete the selected records in the data display column.

2. All records: delete all records in the data display column.

5.2.2.2 Modify

After click on, it automatically open mono record and enter into edit state.

5.2.2.3 Single record preview

1. Click this item to open single record preview window and re-click it to close the window.

2. The single record preview window can also be opened or closed by double clicking the data in the data window.

5.2.2.4 Save current model

Save the state of current data base window.

5.2.3 Searching Menu

As Fig. 5-3-1:

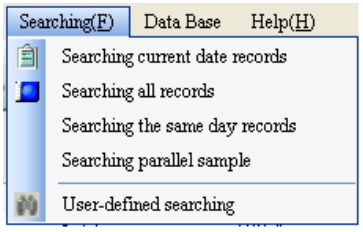


Fig. 5-3-1

5.2.3.1 Searching current date records

Click on this item to display the records whose date is the same as the computer system date in the data display column.

5.2.3.2 Searching all records

Click on this item to display all records of the data base in the data display

column.

5.2.3.3 Searching current date records

Click on this item to display the records whose date is the same as that of the selected records in the data display column.

5.2.3.4 Searching parallel sample

Click on this item to display all records of the current date which are the same as the selected records in the data display column.

5.2.3.5 User-defined searching

Click on this item to popup the displayed window as Fig. 5-3-2.

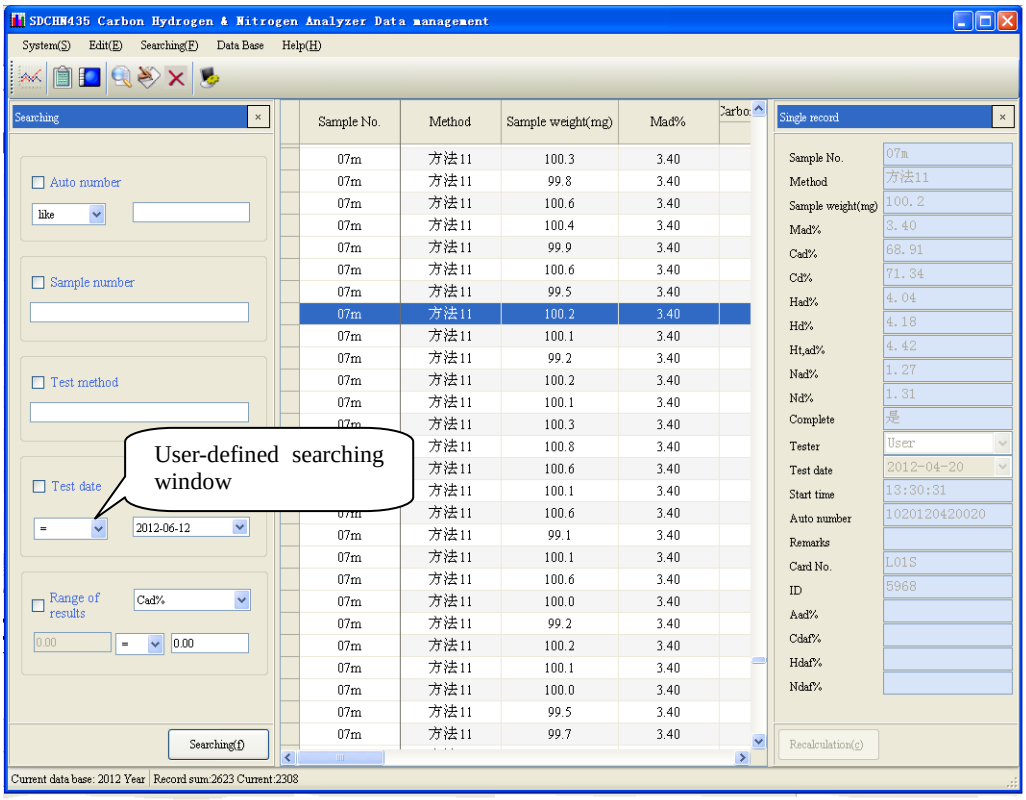


Fig. 5-3-2

There are 5 methods for data query: automatic number, sample number, test method, test date, and range of results.

Query based on one or more conditions: the first is to select query method and then select the query condition; input related condition in condition box and then click on “Searching” button, all records that satisfy the condition will display in the data column, such as the query steps of automatic numbering:

- Setting up searching method: click on automatic number check box, making it in selected state.
- Setting up searching condition: click on “v” button and select one item (such as “Like”), and then input the date in the right box (such as 200908).
- Searching: click on this button, the system will automatically display all test records whose automatic numbers contain 200908 in the data display column.

5.2.4 Database Menu

As Fig. 5-4-1, select the year, then all records of the selected year will be displayed in data display column.

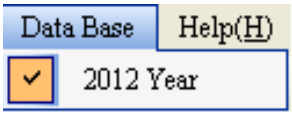


Fig. 5-4-1

5.2.5 Help Menu

As Fig. 5-5-1:

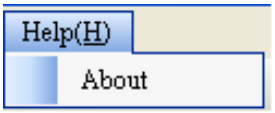


Fig. 5-5-1

5.2.5.1 About

Click this item. Then you can get the version information of SDCHN435 Carbon Hydrogen and Nitrogen. Click “Yes” to back to the main interface of the data management.

Chapter 6 Instructions to Operation

This chapter introduces how to conduct a complete test, including preparation work, system check, blank sample analysis, standard sample analysis and user sample analysis.

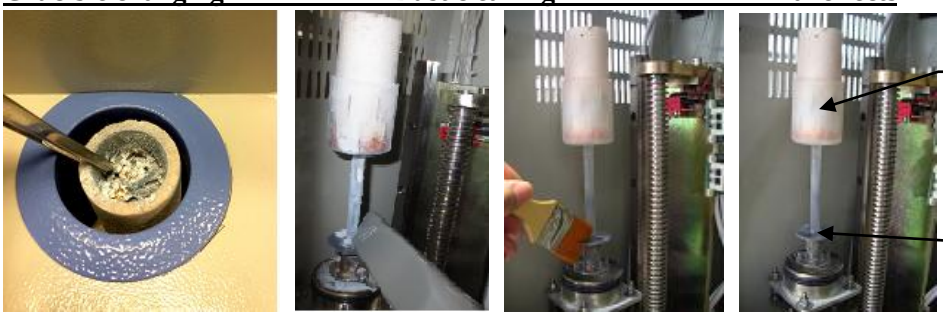
6.1 Preparation Work

1. Switch on the power supply of computer, instrument, printer and balance.
2. Start the computer, open the Windows desktop, and then double Click on "SDCHN435 Carbon Hydrogen and Nitrogen Analyzer" shortcut icon, to enter the main program window.
3. After the program has prompted successful online, confirm whether it is needed to change the crucible, clean the filter and replace the reagent, according to the number of samples or prompt message.

Note:

- ✧ **After 350 samples having been tested, the crucible should be changed and the dust should be cleaned (For dust cleaning, use the dust collector and then sweep with brush). Otherwise, test result may be influenced, or combustion tube may be damaged.**

Crucible changing **Dust cleaning** **Final effects**



3.02.03.0240 Crucible(Silicon carbide)

3.02.03.0242 Sample introducing rod

- ✧ **After 300 samples having been tested, please clean the filter, and replace the silica wool and filter cartridge (For cost savings, only silica wool needs to be replaced after 50 samples have been tested).**

✧ **After one month or 600 samples having been tested, please replace the reagent in the reagent furnace (refer to Fig.3-1). The reagent is around 32g, and the particle size is ₵ 3-4mm. Powdered reagent is prohibited. The reagent should be heated under 850℃ for 30 minutes, and then put into the drying tower for cooling.**

✧ **Whenever 1000 samples are tested, please replace reagent in the reduction furnace. Whenever 1000 samples are tested, please replace reagent in the two drying tubes.(refer to Fig.3-3)**

✧ **When the instrument is not used for a long time or the reagent is replaced, the gas circuit must be cleaned for 30 minutes in constant temperature.**

4. Heating up

Click on "Heating up" icon at the tool bar of the main interface, or Click on "Temperature" at the menu bar→ "Start heating up", to start automatic heating up until reach constant temperature.

5. Preheat the instrument to a stable temperature.

Note:

✧ **The instrument should be preheated for at least 3 hours. If the instrument keeps 24-hour uninterrupted work, preheating is unnecessary, but we suggest starting hibernation function.**

✧ **While preheating the instrument, the tester can do other preparatory work.**

6. Weighing samples

a. Use tweezers to put a tinfoil cup onto the balance tray, deduct the tare weight, and then use a ladle to add about 100mg sample into the tinfoil cup, till the balance reading is stable.

b. Take out the tinfoil cup from the balance tray, twist the cup rabbet to seal up the tinfoil cup, pack the sample into shape of drop.

c. Put the packed sample onto the balance for reweighing, record the sample weight.

d. Put the weighed samples into the mobile sample tray in order.

Note:

✧ **Tester should wear gloves to prevent the tinfoil cup from sweat and**

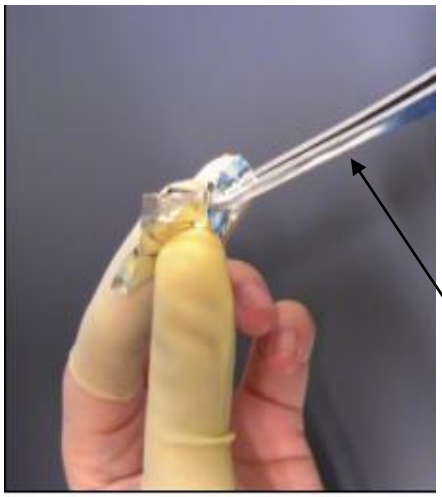
ensure accurate test results.

- ✧ **When using tinfoil cup to pack the sample, extrude the air out of the tinfoil cup as much as possible.**
- ✧ **When using tinfoil cup to pack the sample, the tester must not overexert, which may result in tinfoil cup breakage or sample spillage.**
- ✧ **Tinfoil cups with sand holes should not be used.**
- ✧ **Tinfoil cups and gloves should be kept in drying tower, and shall have no contact with other substance to keep clean.**
- ✧ **Keep sample placing tray and mobile sample tray clean.**

4.02.0263
Tin Foil Cup

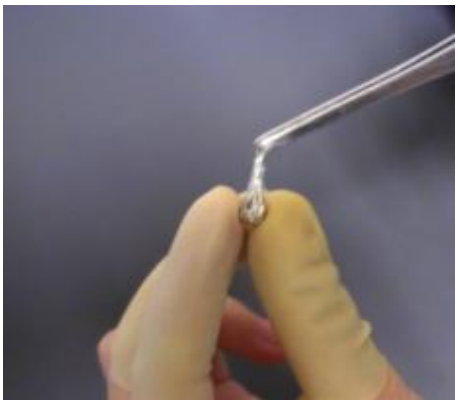
3.01.07.0071
Rubber gloves

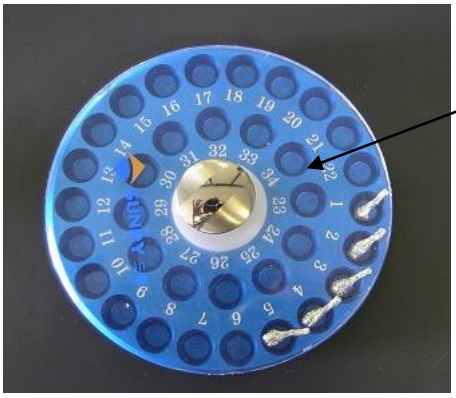
Sample weighing **Pile out the air**



3.01.01.0133
Tweezers

Pack the sample into shape of drop **Put into the Mobile sample tray**





4.02.0223
Mobile sample tray

6.2 System Detection

1. Detection of gas source:

Click on “Manual Detection” icon in the tool bar of the main interface, or Click on “Detection” → “Manual detection” → “Gas circuit purging” icon in the menu bar, to check the following items:

- Check whether the switches of oxygen cylinder, nitrogen cylinder, and helium cylinder are on.
- Check the indicated pressures of the high pressure gauges of the reducing valves on the oxygen cylinder, nitrogen cylinder, and helium cylinder. If the pressure is below 1MPa, please change the gas.
- Adjust the indicated pressures of the low pressure gauges of the reducing valves on the oxygen cylinder, the nitrogen cylinder, and the helium cylinder to 0.18Mpa.

Click on “Stop cleaning” to exit “Manual detection” and return to the main interface of the program.

2. Detection of gas tightness of the system

Click on “Detection” → “Gas tightness detection” icon in the menu bar to start automatic gas tightness detection of the system.

Note:

- ✧ **If the system indicates “Qualified oxygen tightness” and “Qualified helium tightness”, the test can be performed.**
- ✧ **If the system indicates “Gas leakage in section of …” please maintain and repair the gas section under prompt message.**
- ✧ **If the system indicates “Unstable system”, the tester should prolong the**

preheating and recheck gas tightness.

3. Sample placing

Reserve holes for blank analysis sample and samples should be placed in the holes next to the last blank analysis sample hole.

6.3 Setting the Oxygen Flow Parameter

Click on “System” in the menu bar of the software interface → “Test method”. In the test method window, you can find “Bitumite” and “Anthracite” for your choice. Bitumite test method is applicable for samples easy to be combusted, while anthracite test method for samples hard to be combusted.

Test method	Bitumite	Anthracite
Oxygen flow setting	4/2/4/3/2	3/2/4/2/2
Oxygen burning time (s)	20/120/15/18/30	35/165/20/30/30

6.4 Blank Analysis

When making blank analysis, no sample will be put into the crucible. Select or input “Blank sample” from or into the “Sample number” of the data sheet bar of the main interface, then input “100” into the sample weight bar and select a method in the method bar. After that, click on “Start test” icon in the toolbar of the main interface or click on “Test” → “Start” icon in the menu bar, the program will do blank analysis automatically.

Note:

- ✧ **The blank analysis is used to automatically balance the system baseline and ensure system stability.**
- ✧ **Make blank analysis till the instrument reaching balance (error≤0.1%), the blank analysis should be done at least 3 to 5 times.**
- ✧ **The blank analysis should be done every day, and should be executed before the test sample analysis.**
- ✧ **Continuous test method is recommended.**
- ✧ **After finishing blank analysis, before standard sample analysis or test sample analysis, it is necessary to do waste sample transition.**
- ✧ **Blank analysis should be conducted all over again and effective blank value should be generated if the Oxygen is replaced during the test.**

6.5 Standard Sample Analysis

Select standard coal number or input corresponding standard coal number in the "Sample number" bar of the data sheet bar of the main interface, and then input standard sample weight into the sample weight bar, and moisture value into the moisture bar. Finally, select method in the method bar to start automatic standard sample analysis.

Note:

- ✧ **The standard sample analysis is used for instrument correction and detection. For rating curve correction and drift correction, please refer to Section 4.5.**
- ✧ **The adopted standard samples must be defined in the reference material database. For building the reference material database, please refer to Chapter 4.**
- ✧ **Generally, it is necessary to analyze 2 or 3 standard samples, and the accuracy of carbon, hydrogen and nitrogen element value in the standard sample analysis should be in the repeatability allowable range.**
- ✧ **All the analysis must be continuous, with no interval analysis. If interval analysis occurs, it is necessary to do one or two waste samples for transition.**

6.6 Standard Sample Correction

Standard coal correction is to adjust the instrument mathematical model according to the given standard sample. Standard coal correction consists of rating curve correction and drift correction. Rating curve correction is used in generating a certain methodological linear of the instrument, drift correction is used in compensation standard sample correction, for the purpose of solving the slight change of the instrument hardware. Drift correction should be done every day or when the standard coal value deviates from the accuracy during the process of the standard coal analysis.

6.6.1 Rating Curve Correction

Method:

1. Method building: Click on "System" in the menu bar→ "Test method" → "Adding method", and then modify method name in the name bar.
2. Define standard sample in the reference material database: Click on

"System" → "Setup"→ "Standard substance", input Cd%, Hd%, Nd%, corresponding uncertainty and name of standard sample into the table of this page, and Click on "Save".

3. Analyze the standard sample in accordance with the requirements described from section 6.1 to section 6.5.
4. After the analysis, enter into the database and select standard sample analysis records for rating curve, then click on "Generate curve". Set up relative parameters such as those of curve linear in the dialog box popped-up, and then click on "Generate correction curve" → "Apply newly generated correction formula", to finish rating curve generating of a certain method.
5. Exit the data base, and back to the main interface. Select standard sample analysis record in the data sheet bar of the main interface, right Click on the mouse, and select "Recalculate selected records", to recalculate standard sample analysis records with the newly generated correction formula.

Note:

- ✧ **The standard sample for rating curve correction must be the standard sample defined in the reference material database. And its sample number must be consistent with the number in the reference material database. Mad% value must be input before the analysis.**
- ✧ **Tester can select multi-sample calibration or single-sample calibration. We suggest selecting multi-sample calibration and selecting standard samples with high, medium and low carbon, nitrogen and hydrogen contents for rating curve correction samples.**
- ✧ **We suggest to select quadratic curve linear for carbon and hydrogen and straight line for nitrogen, and their correlation coefficient (R) should be more than 0.9990, the best linear.**
- ✧ **Each standard sample must go through test of 2 or 3 sub-samples, and the accuracy must be in the range of national standard.**

6.6.2 Drift correction:

In the data sheet bar of the main interface, select standard coal analysis record, click on "Test" →"Drift correction by using selected records" in the menu bar of the main interface or right click to select "Drift correction by using selected records", the program will automatically generate drift coefficient, and sample analysis can be

conducted.

Note:

- ✧ **Drift correction for SDCHN435 is needed only once every 4 hours or when test results with standard coal are unqualified.**
- ✧ **For the standard sample used for drift correction, its accuracy of carbon hydrogen and nitrogen element values must be in the ranges of 0.5% and 0.15% and 0.08% respectively.**
- ✧ **Generally, the standard sample used for drift correction should be close to routine analysis samples in property and carbon, hydrogen and nitrogen element values. If "Intercept correction" method is used, then the standard sample used for drift correction should be slightly higher than routine analysis samples in property and carbon, hydrogen and nitrogen element values.**
- ✧ **The drift correction standard sample must be the standard sample defined in the reference material database.**
- ✧ **The standard sample used for reexamination must be different from drift standard sample.**

6.7 Analysis of User Sample

Input user sample number into the "sample number" in the data sheet bar of the main interface, and sample weight into the sample weight bar. Select adopted method in the method bar. Then the program will automatically make an analysis of the user sample.

Note:

- ✧ **If there are quite a few user samples, we suggest adding standard sample analysis once after finishing every 30 sub-sample analysis, for the purpose of ensuring the accuracy of the user sample analysis.**
- ✧ **If there is no Mad% value for a record, then Had% value of this record is the hydrogen element value (Ht,ad%).**

6.8 Recalculation

Select relevant record in the data sheet bar of the main interface and Click on "Recalculate selected records", the system will use new parameters to recalculate the analysis result.

Note:

✧ **The program will recalculate the analysis result automatically, based on relevant record fields (e.g. name, sample weight, method, analysis date, Mad%, and drift coefficient etc.).**

6.9 Printing

After finishing user sample analysis and recalculating, open the data base, print the record required. For printing, please refer to Chapter 5.

6.10 Dropping Temperature and Logging Out

Click on "Temperature" in the menu bar of the main interface → "Stop heating up". After the instrument cools down to or below 600℃, you can log out of the program and turn off the power supply of the instrument and the computer.

Note:

✧ **To directly shut down the power supply of the instrument at high temperature will affect the service life of the instrument.**

Chapter 7 Instrument Maintenance

Equipment maintenance is of great importance, which directly concerns the accuracy, precision, fault rate and service life of the equipment. Please carefully read this chapter and maintain the equipment regularly.

1. Computer and printer equipped with the instrument shall be maintained as required in corresponding operating manual. Check the computer and kill virus periodically to prevent virus invasion from affecting normal operation of instrument.
2. The instrument is a precise one. So the lab should be equipped with air-conditioner, and it should not be placed near the window, heat source or wind regime or be invaded by dust or corrosive gases.
3. Instrument shall be earthed reliably.
4. If instrument is not operated for long time, please use special dustproof cover to protect the instrument and periodically power on the instrument (The instrument shall be heated at least once a week). The time for heating by powering on instrument shall be not less than 90 minutes and the time for gas circuit purging shall be 30 minutes.
5. Instrument shall be maintained by a specially-assigned person. Each part of instrument shall not be dismantled at will to avoid fault due to misoperation.
6. Test shall be strictly operated as required in Chapter 6.
7. Instrument shall be used for a special purpose to avoid affecting the normal operation of system.
8. Carefully carry instrument to avoid damaging the wearing part of the instrument or displacing key parts.
9. Whenever 350 samples are tested, please change crucibles and clean the dust on the sample introducing rod. Whenever 50 samples are tested, please change the silica wool in the filter. Whenever 300 samples are tested or the filter cartridge turns black, please change the filter cartridge in the filter device. Whenever 600 samples are tested, please change furnace reagent. Whenever 1000 samples are

tested, please change reagent in the reduction furnace. Whenever 1000 samples are tested, please change reagent in the two drying tubes (Please refer to the corresponding Figures in Chapter3 and Chapter6).

Note:

- ✧ **Furnace reagent should be heated under 850℃ for 30 minutes, and then put into the drying tower for cooling.**

10. When instrument surface is dirty, after the instrument is powered off, use wet towel coated with a little detergent (soap, water or alcohol) to slightly wipe the housing, then use clean towel to remove detergent.

Note:

- ✧ **Before wiping, power supply must be cut off to avoid electric shock and damaging instrument.**
- ✧ **During wiping, water should be prevented from penetrating into instrument to result in fault.**

Chapter 8 Common Troubles and Solutions

This chapter describes the common trouble and maintenance knowledge of the instrument. If user cannot solve it by himself, please contact Sundy Company.

Trouble	Cause and solution
1. System displays that machine is not online.	1. Computer time is not in conformity with CAN card time. 2. USB-CAN card is not well connected. 3. Instrument is not powered on. Turn on power supply of instrument. 4. Drive program of USB-CAN card is not installed. Install the drive program and restart computer. 5. Program was damaged by virus. 6. Communication is abnormal. Please fix it by professional.
2. “Heating power supply not powered on” is prompted.	1. Heating power supply is not powered on or badly connected. 2. Instrument fuse is broken. Please replace it. 3. Control card has trouble. Please fix it by professional.
3. Cannot entere into test state.	1. Various temperature points are out of constant temperature range. 2. Sample mass is not input into data sheet of main program. 3. System has abnormal prompt.
4. Test results are unsatisfactory.	1. Weighing is not accurate or operation is not correct. 2. Preheating time for instrument constant temperature is not enough. 3. Blank analysis is not conducted until instrument is stable. 4. Correction is not conducted timely. 5. Flow is too low due to leakage or blockage of gas circuit. 6. Pressure of oxygen and nitrogen is not correct. 7. Balance is not preheated for 30min. 8. Sample combustion is incomplete.
5. Samples are stuck or not timely fed into combustion furnace.	1. Sample is not in proper shape or its size is too big. 2. Spiral angle of sample tray is not correct. 3. When this trouble occurs, the test must be stopped promptly for repair.
6. Gas collection bottle cannot reach rated pressure or reach top position.	1. Oxygen and nitrogen cylinder is not open or their pressure is not high enough. 2. Leakage or blockage of gas circuit. 3. Fault of electric circuit.

7. Indication of “overpressure of gas collection bottle”	1. Blockage of gas circuit. 2. Damage of SV16 and SV9 valves.
8. Printing cannot be made or printing error occurs.	1. Check whether signal cable of printer is well connected or damaged. 2. Printer program has problem. Reset printer. 3. Measuring control software has problem. Replace the software. 4. Printer has problem. Hold warranty to contact local maintenance agent.
9. Computer is halted.	1. Check and change computer CONFIG.SYS setup. Test software should be re-installed. 2. Computer has virus. The virus should be killed. 3. Test software is damaged. 4. Computer has trouble. Hold warranty to contact local computer maintenance agent.

Chapter 9 Installation Diagram

9.1 Shell parts

A、 Front side of the instrument:

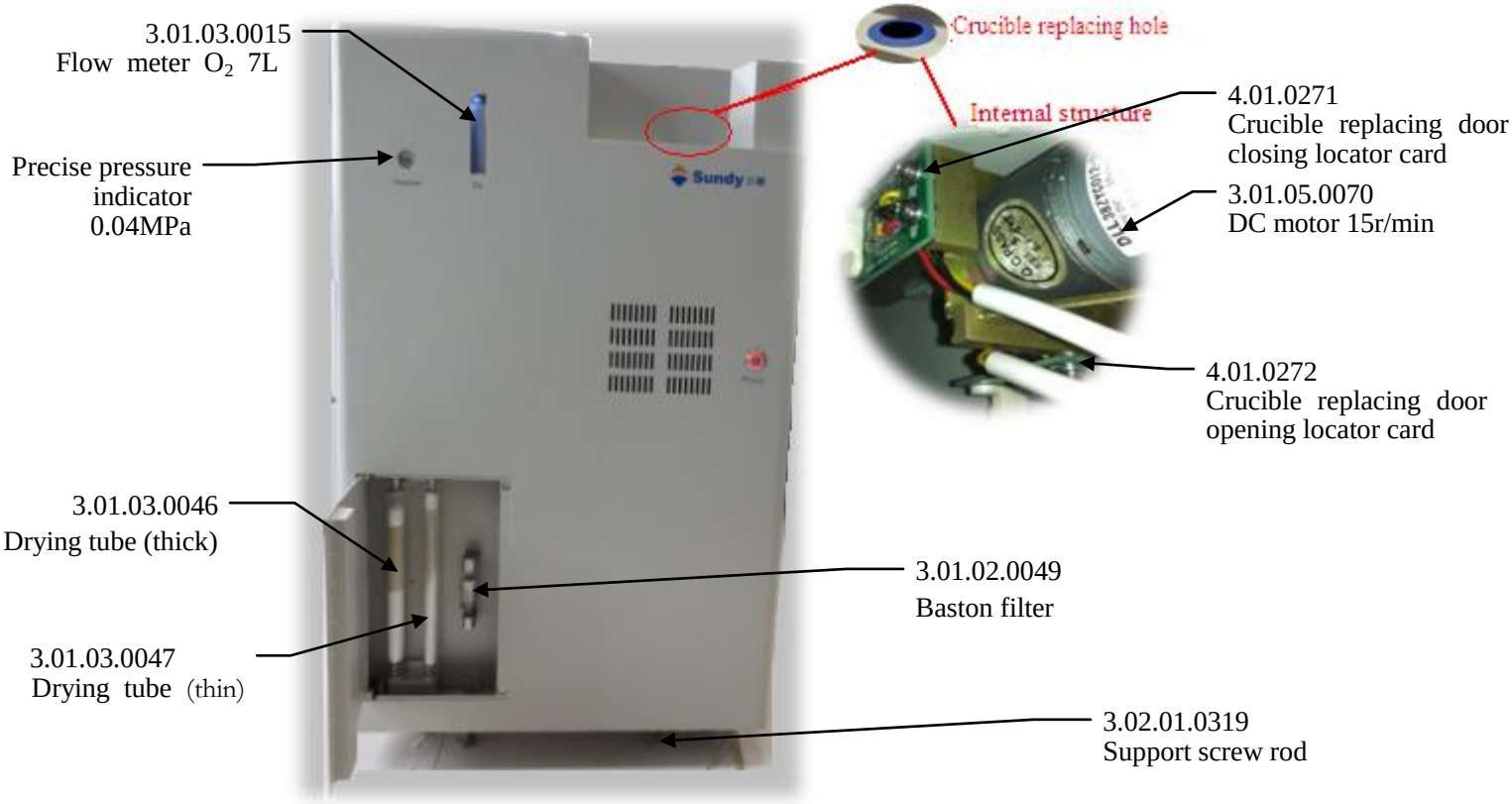


Fig. 1

B、 Top of the instrument:

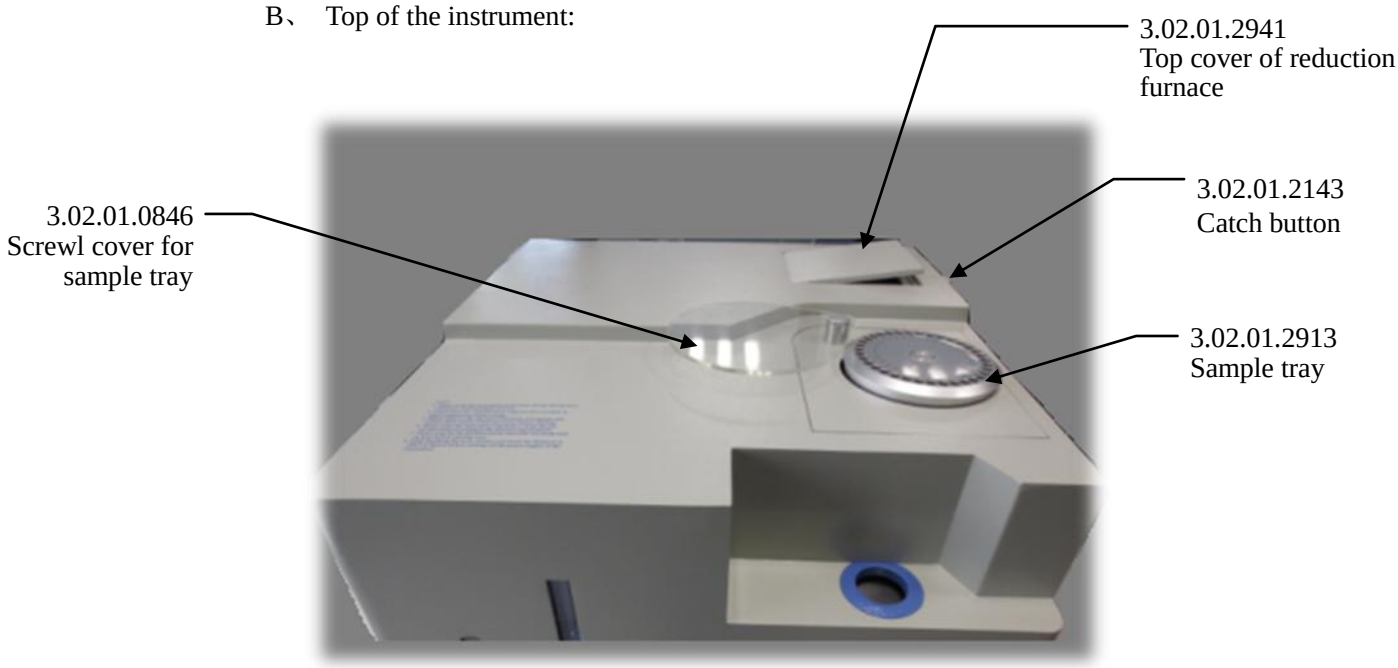


Fig. 2

9.2 Right side of the instrument：

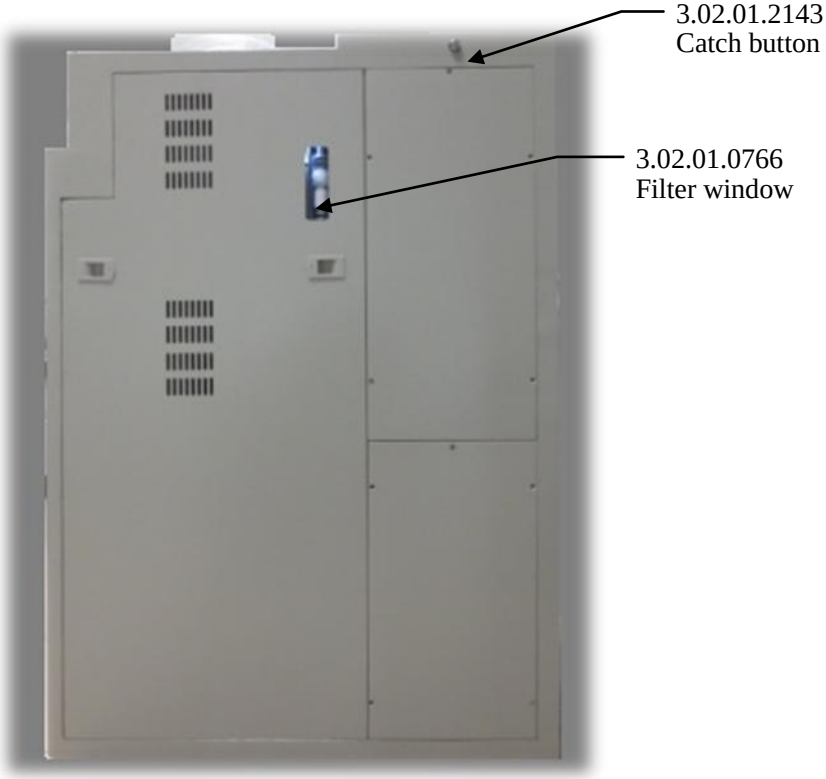


Fig. 3

9.3 Rear side of the instrument：

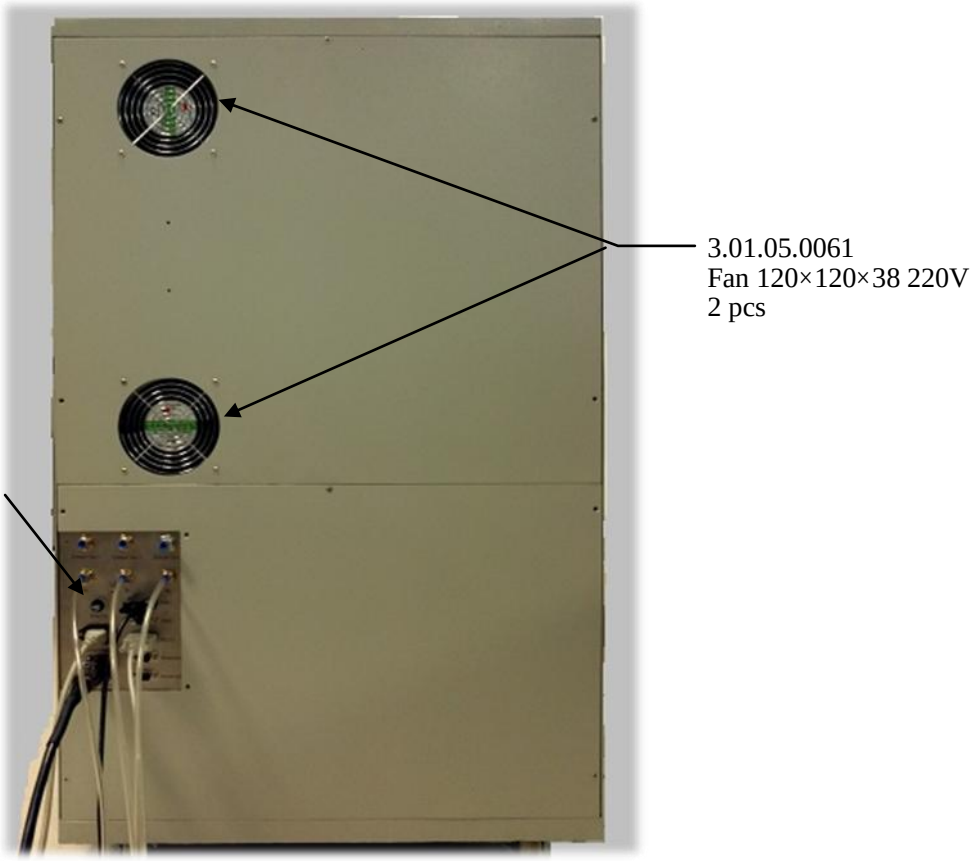


Fig. 4

9.4 Collection chamber parts

3.01.05.0237
Fan 120×120×25

3.01.02.0049
Baston filter

4.01.0270
Piston top locator card

3.01.05.0225
Stainless steel valve
SVX21-01S

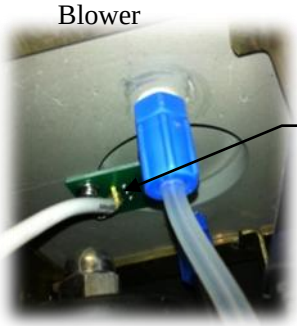
3.02.03.0093
Chamber body

3.01.03.0045Silicagel
heating plate 5W/220V

4.01.0096
Pressure sensor card

3.01.05.0209
Blower

3.01.02.0023
O ring
Ø 3.53×Ø 142.27

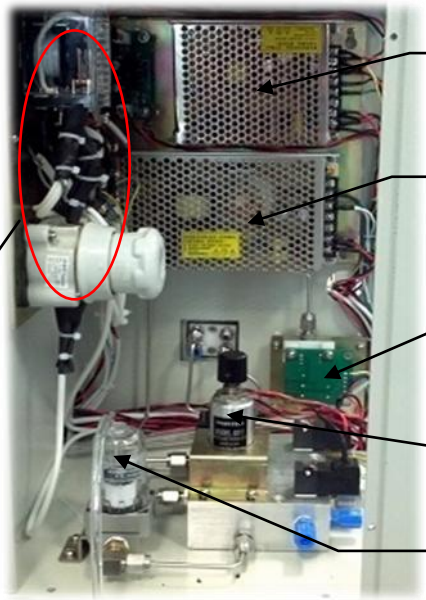


4.01.0269
Piston bottom locator card

3.01.07.0397
PU pipe Ø 4×Ø 6

Fig 5

9.5 Switching power supply and electrical parts

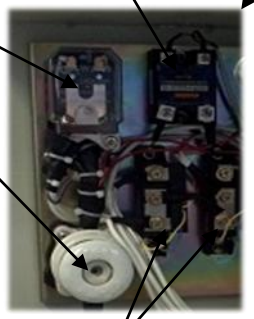


3.01.05.0241
Switching power supply
PU-60T5+15-15R

3.01.05.0017
Solid-state relay
SSR-H220D15

3.01.05.0023
Switching power supply
GST-H150S24）SDC311

3.01.05.0011
Contact relay（58F/12V）



4.01.0300
Pressure sensor card
（Nitrogen circuit）

3.01.05.0033
Ceramic protective tube 30A

3.01.05.0239
Pressure-regulating
valve 8311 type

3.01.01.0030
Filter（SAF20-02）

3.01.05.0003
Bidirectional controlled
rectifier MTC42-12

Fig. 6

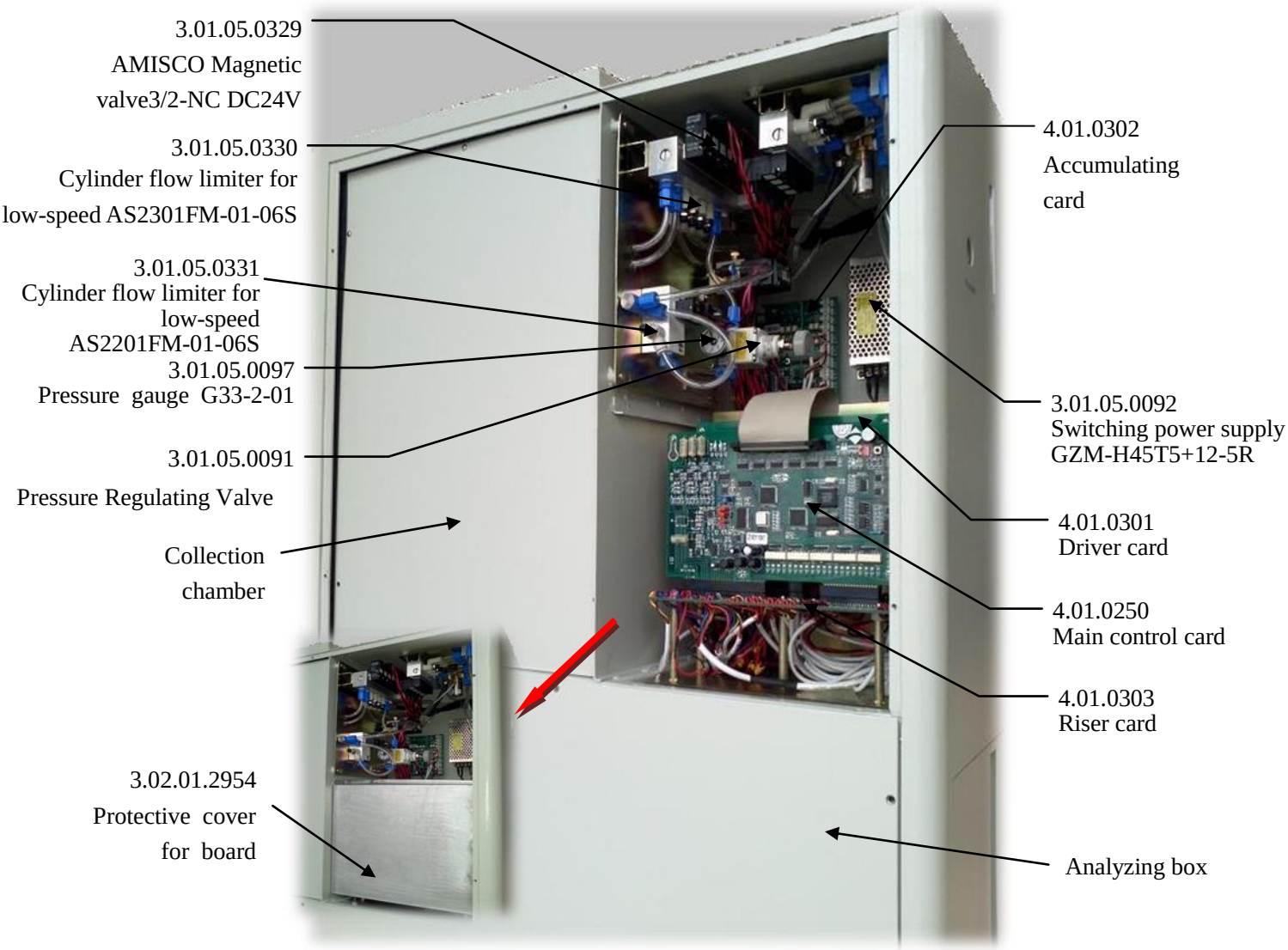


Fig. 7

9.6 Others

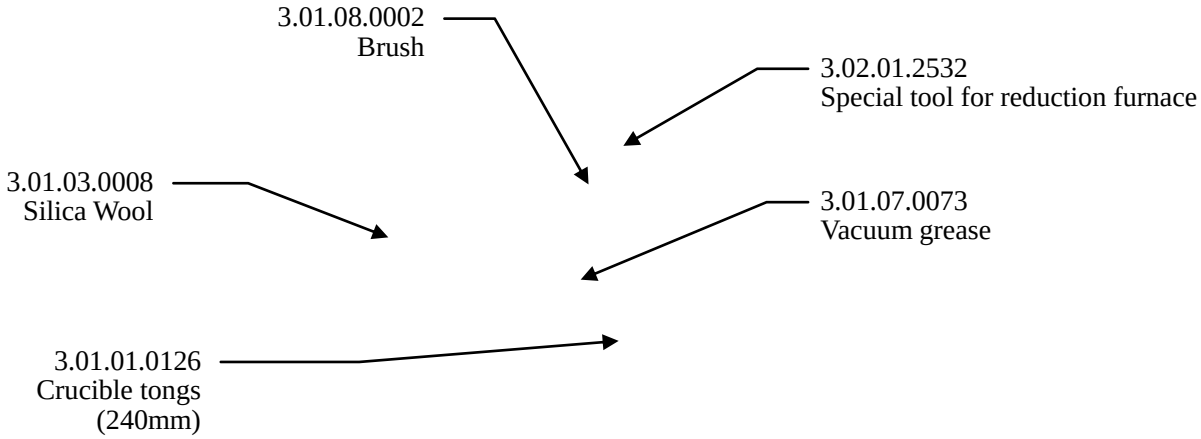


Fig. 8

Fig. 9

Fig. 10

Appendix:

List of Spare Parts of SDCHN435Analyzer

No.	Code	Name		No.	Code	Name
1	3.02.03.0087	Desulphurization furnace silica tube		33	3.01.02.0207	O Ring Ø 2.65×Ø 11.2
2	3.02.03.0241	Combustion furnace silica tube		34	3.02.02.0190	O Ring Ø 2.65×Ø 13.2
3	3.01.03.0050	Reduction furnace silica tube		35	3.01.02.0198	O Ring Ø 2.65×Ø 16
4	3.01.03.0047	Drying tube (thin)		36	3.01.02.0200	O Ring Ø 1.9×Ø 7（Silicagel）
5	3.01.03.0046	Drying tube (thick)		37	3.01.02.0210	O Ring Ø 2.65×Ø 7.1（Silicagel）
6	3.02.01.2197	Drying spacer（thick）		38	3.02.02.0188	O Ring Ø 2.65×Ø 26
7	3.02.03.0242	Sample introducing rod		39	3.02.02.0187	O Ring Ø 1.8×Ø 4
8	3.02.03.0091	Quartz Filter screen		40	3.02.02.0186	O Ring Ø 1.8×Ø 46.2
9	3.02.03.0084	Filter rack		41	3.01.02.0253	O Ring Ø 3.55×Ø 48
10	3.01.03.0069	Combined furnace body		42	3.02.02.0185	O Ring Ø 1.8×Ø 11.2
11	3.01.03.0070	Reduction furnace body		43	3.01.02.0238	O Ring Ø 1.9×Ø 7（neoprene）
12	3.01.05.0090	Pressure-reducing valve 152X-40(O2)		44	3.02.02.0027	O Ring Ø 1.8×Ø 6
13	3.01.05.0089	Pressure-reducing valve 152IN-40（He、N2）		45	3.01.07.0397	PU Pipe Ø 4×Ø 6
14	3.02.01.2913	Sample tray		46	3.01.02.0202	PU Pipe Ø 6.5×Ø 10
15	3.02.01.0846	Screw cover for sample tray		47	3.01.02.0071	Quick coupling PG1006
16	4.02.0223	Mobile sample tray		48	3.01.02.0089	Viton tube Ø 6×Ø 9
17	3.01.02.0029	Synchronous belt 240-3M-9		49	3.01.03.0037	Silastic tube Ø 3×Ø 5
18	3.01.02.0030	Synchronous belt 513-3M-9		50	3.01.05.0045	Micro switch
19	3.02.03.0238	Thermocouple（K degree L=85）		51	3.01.05.0033	Ceramic protective tube 30A
20	3.01.03.0045	Silicagel heating plate 75W/220V		52	3.01.05.0082	Protective tube 3A
21	3.01.05.0070	DC motor 15r/min		53	3.01.05.0237	Fan（120*120*25）12V
22	3.02.03.0085	Dust filter tube		54	3.01.05.0061	Fan（120*120*38）220V
23	3.01.01.0030	Filter（SAF20-02）		55	4.01.0036	Interface card (V1.03)SDCAN03
24	3.01.03.0007	Filter cartridge 02/01		56	3.01.01.0134	Three-core cable
25	3.01.02.0049	Bastogne filter 9900-05-BK		57	3.01.01.0139	External communication wire
26	3.02.02.0028	O Ring Ø 2.65×Ø 7.1		58	3.03.00.0008	USB cable（40cm）
27	3.02.02.0030	O Ring Ø 2.65×Ø 9.5		59	3.01.07.0015	Power cable (3core)220V/10A
28	3.02.02.0021	O Ring Ø 3.55×Ø 24.5		60	4.02.0035	Matching plug
29	3.02.02.0189	O Ring Ø 3.55×Ø 50		61	3.01.05.0093	Cylinder CJ2B10-30R
30	3.02.02.0019	O Ring Ø 2.65×Ø 18		62	3.01.05.0332	Cylinder CJ2B10-15R
31	3.01.02.0209	O Ring Ø 2.65×Ø 21.2		63	3.01.07.0018	Program download wire
32	3.01.02.0023	O Ring 3.53×Ø 142.27		64	3.01.05.0003	Bi-directional silicon controlled rectifier MTC42-12

No.	Code	Name	No.	Code	Name
65	4.01.0250	Main control card	89	3.01.08.0292	Dust collector（D-705）
66	4.01.0301	Driver card（V1.01）	90	3.01.05.0023	Switching power supply GST-H150S24
67	4.01.0303	Riser card（V1.01）	91	3.01.05.0004	Bidirectional controlled rectifier trigger modules QTM500-12
68	4.01.0096	Pressure sensor card（V1.01）	92	3.01.05.0086	Motor 60YN06-2CJ/JB7.5H6W
69	3.01.03.0008	Silica Wool（3-5μm）	93	3.01.05.0083	Vertical lift motor 70YN-2CJ/JB12.5
70	3.01.07.0071	Rubber gloves	94	3.01.05.0329	AMISCO Magnetic valve 3/2-NC DC24V
71	4.01.0273	Die-pin bottom locator card (V1.2)	95	3.01.05.0331	Cylinder flow limiter for low-speed AS2201FM-01-06S
72	4.01.0275	Die-pin top locator card (V1.2)	96	4.02.0263	Tin Foil Cup（100 pcs）
73	4.01.0274	Die-pin body locator card (V1.2)	97	3.02.03.0240	Crucible（Silicon carbide）
74	4.01.0271	Crucible replacing door closing locator card (V1.2)	98	3.01.07.0073	Vacuum grease
75	4.01.0272	Crucible replacing door opening locator card (V1.2)	99	4.02.0073	Furnace reagent
76	4.01.0276	Crucible replacing locator card (V1.2)	100	4.02.0245	Alkali asbestos
77	4.01.0269	Piston bottom locator card (V1.2)	101	4.02.0246	Dehydrite
78	4.01.0270	Piston top locator card (V1.2)	102	4.02.0242	Copper wire
79	3.01.03.0015	Flow meter O_2 7L(7-5 type)	103	4.02.0243	Thread-like copper
80	3.01.05.0097	Pressure gauge G33-2-01	104	4.02.0244	Nitrogen catalyst
81	3.01.05.0239	Pressure-regulating valve 8311 type	105	4.01.0277	Combustion position locator card (V1.2)
82	3.02.01.0829	Base for sample introducing rod	106	3.01.05.0225	Stainless steel valve SVX21-01S
83	3.02.01.2532	Special tool for reduction furnace	107	3.01.05.0091	Precise pressure-regulating valve IR1000-01
84	3.01.08.0002	Brush（1inch）	108	3.01.05.0011	Contact relay（58F/12V）
85	4.01.0302	Accumulating card	109	3.01.05.0017	Solid-state relay SSR-H220D15
86	4.01.0300	Pressure sensor card（Nitrogen circuit）	110	3.01.01.0126	Crucible tongs
87	3.02.01.2941	Top cover for reduction furnace	111	3.01.01.0133	Tweezers
88	3.02.01.2143	Catch button	112	3.02.01.0319	Support screw rod

No.	Code	Name		No.	Code	Name
113	3.01.08.0003	Sample ladle SDSM2000		118	3.01.05.0241	Switching power supply PU-60T5+15-15R
114	3.02.03.0093	Chamber body		119	3.01.03.0062	Helium flow meter 701HB-5-2,300mL/min
115	3.02.01.0766	Filter window		120	3.01.03.0061	Helium flow meter 701HB-5-2,2L/min
116	3.01.08.0272	Inside-hexagonal spanner （5# M6）		121	3.01.05.0209	Blower ZLB3019ODC12G-Z504
117	3.01.05.0092	Switching power supply GZM-H45T5+12-5R		122	3.01.05.0330	Cylinder flow limiter for low-speed AS2301FM-01-06S

Periodic Maintenance Schedule

Maintenance Item	Maintenance Period	Position	Operating method
Crucible replacing	350 tests	In the combined furnace	Click “Detection”→“Change crucible” and clean the dust on the manipulator according to prompts.
Silica Wool replacing	50 tests	In the filter	Detach the filter and replace the silica wool.
Furnace reagent replacing	600 tests	In the desulfurization furnace quartz tube	Detach the Desulfurization furnace quartz tube at room temperature, clean every part of it by alcohol and replace the furnace reagent after drying it.
Cleaning of Desulfurization furnace quartz tube and the filter.	600 tests	In the combined furnace	Detach the Desulfurization furnace quartz tube at room temperature, clean every part of it by alcohol and use them after drying.
Filter cartridge replacing	1000 tests	In the filter	Detach the filter and replace the filter cartridge.
Baston filter replacing	1000 tests	In the collection chamber	Open the collection chamber, loose the gas tube on both ends and replace the Baston filter.
Combustion furnace quartz tube cleaning	1000 tests	In the combined furnace	Click “Detection” → “Change crucible” at room temperature, put the brush deeply into the combustion furnace and clean the dust on the tube wall.
Sample placing tray cleaning	One week [Note]	On the top the instrument	Clean the sample placing tray by ear cleaning ball to eliminate the coal ash.
Thread-like copper	1000 tests	In the reduction furnace	Detach the reduction furnace quartz tube at room temperature, clean every part of it by alcohol and replace the thread-like copper, nitrogen catalyst and copper wire after drying it.
Nitrogen catalyst	1000 tests		
Copper wire	1000 tests		
Alkali asbestos	1000 tests	In the drying tube	Detach the drying tube, clean every part of it by alcohol and replace the Alkali asbestos and Dehydrite after drying it.
Dehydrite	1000 tests	In the drying tube	
Silicone tube	One year [Note]	The connect gas tube from the combined furnace to the collection chamber.	Replace a new Silicone tube

Note: Based on working 8 hours each day.

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