NOTE

This manual only applies to FP640, FP6410, FP6430, FP6431, FP6440 and FP6450 flame photometer.

Contents

1 Principles, Applications and Features

1.1 Principles

Flame Photometer applies the emission spectrum as the basic principle, which uses the flame heat and excites part of the atoms in alkaline earth metal. The atoms absorb energy and transit to the previous energy level; when it drops to the normal energy level, it has to release energy. The released energy has only the spectral characteristics, namely, a certain wavelength range. For example, place salt in the flame, and it will display yellow color, due to the sodium atoms in flames falling back to the normal energy level and displaying yellow spectrum. It is often called “flame reaction”. Different alkali metals or alkaline earth metals in the flame display different colors. Qualitative tests can be carried out together with different filters. The flame color is proportional to the concentration of atoms contained in the solution, which constitutes a quantitative test basis. This method is typically referred to as flame photometry, and this type of equipment is known as flame photometer.

As the flame temperature is not high, measured atoms release limited energy. At the same time of the combustion process, self-absorption and self-erosion exist; therefore, the test is linear only in low concentrations.

As the flametemperature is not high, measured atoms release limited energy.

At the same time of the combustion process, self-absorption and self-erosion exist; therefore, the test is linear only in low concentrations. Flame photometer is a relative measuring appliance, and the concentration values of tested samples are relative values of standard solution concentration under the same test condition.

Therefore, before the test a group of the corresponding standard solutions must be prepared, then the calibration operation starts, standard curves are drawn artificially or through mapping equipments, finally test samples can be tested and their concentration or other necessary calibration data are obtained. The instrument is small in size, simple in structure, and easy to operate. It is also stable and reliable, and apply liquefied petroleum gas as fuel.

1.2 Applications

- Testing cement, glass, ceramics, refractory materials and other construction materials;
- Testing fertilizers and soil;
- Testing products of mining, petroleum, metallurgy, and chemical products;
- Testing pharmaceutical, beverages and other food;
- Testing Municipal solid waste (MSW);
- Various laboratory tests for scientific research, health, education and other fields.

1.3 Features

- Direct reading of the element concentrations
- 7-inch color LCD touch screen
- An automatic calibration of correlation coefficient and pre-set of flame sizes
- Direct printing devices (Built-in printer optional)
- Data testing, processing and reporting can be done with PC (Software package optional)

2 Technical Indicators and Specifications

2.1 Technical Indicators

	FP640	FP6410	FP6430	FP6431	FP6440	FP6450
Repeatability	≤ 2%					
Response Time	< 8s					
Suction & Spray Volume of Sample	< 3mL/min					
Print Function	-	optional	optional	optional	optional	optional
USB Port	-	●	●	●	●	●
Linear regression calculation	-	●	●	●	●	●

	FP640	FP6410	FP6430	FP6431	FP6440	FP6450
Linear Error mmol/L	K:≤0.005	K:≤0.005	K:≤0.005	K:≤0.005	K:≤0.005	K:≤0.005
	Na: ≤0.03	Na:≤0.03	Na:≤0.03	Na:≤0.03	Na:≤0.03	Na:≤0.03
	-	-	Li:≤0.021	-	Li:≤0.021	Li:≤0.021
	-	-	-	Ca:≤0.075	Ca:≤0.075	Ca:≤0.075
	-	-	-	-	-	Ba:≤0.066
Limit of detection mmol/L	K:≤0.004	K:≤0.004	K:≤0.004	K:≤0.004	K:≤0.004	K:≤0.004
	Na:≤0.008	Na:≤0.008	Na:≤ 0.008	Na:≤0.008	Na:≤0.008	Na:≤0.008
	-	-	Li:≤0.015	-	Li:≤0.015	Li:≤0.015
	-	-	-	Ca:≤0.050	Ca:≤0.050	Ca:≤0.050
	-	-	-	-	-	Ba:≤0.044
Filter transmittance characteristics: (Absolute value of the peak wavelength error)	K:≤7nm	K:≤7nm	K:≤7nm	K:≤7nm	K:≤7nm	K:≤7nm
	Na: ≤5nm	Na: ≤5nm	Na: ≤5nm	Na: ≤5nm	Na: ≤5nm	Na: ≤5nm
	-	-	Li: ≤7nm	-	Li: ≤7nm	Li: ≤7nm
	-	-	-	Ca: ≤7nm	Ca: ≤7nm	Ca: ≤7nm
	-	-	-	-	-	Ba: ≤7nm

	FP640	FP6410	FP6430	FP6431	FP6440	FP6450
Filter transmittance characteristics: (half-width)	K: ≤15nm	K: ≤15nm	K: ≤15nm	K: ≤15nm	K: ≤15nm	K: ≤15nm
	Na: ≤15nm	Na: ≤15nm	Na: ≤15nm	Na: ≤15nm	Na: ≤15nm	Na: ≤15nm
	-	-	Li: ≤15nm	-	Li: ≤15nm	Li: ≤15nm
	-	-	-	Ca: ≤15nm	Ca: ≤15nm	Ca: ≤15nm
	-	-	-	-	-	Ba: ≤15nm
Filter transmittance characteristics: (background transmittance)	K:≤0.5%	K:≤0.5%	K:≤0.5%	K:≤0.5%	K:≤0.5%	K:≤0.5%
	Na:≤0.5%	Na:≤0.5%	Na:≤0.5%	Na:≤0.5%	Na:≤0.5%	Na:≤0.5%
	-	-	Li:≤0.5%	-	Li:≤0.5%	Li:≤0.5%
	-	-	-	Ca:≤0.5%	Ca:≤0.5%	Ca:≤0.5%
	-	-	-	-	-	Ba:≤0.5%

2.2 Specifications

	FP640	FP6410	FP6430	FP6431	FP6440	FP6450
Display	7-inch color LCD touch screen					
Spectroscopic methods	Interference filters					
Photoelectric Conversion device	Silicon photocell					
Dimensions	400mm×250mm×500mm					
Weight	8.0Kg					

3 Installation Instructions

3.1 Conditions

The instrument should be placed on a solid stable work station which meets the requirements for laboratory environment, keeps the indoor environment clean, and avoids serious dust pollution.
A working environment to protect the instrument requirements are as follows:

- The ambient temperature of laboratory remains between 10 ℃ to 35 ℃, with relative humidity less than 85%.
- Avoid sunlight, free of vibration and strong airflow and erosion of corrosive substances, and equipped with fire extinguishers.
- Power supply voltage is AC220V ± 22V, frequency of 50Hz ± 1Hz, and must be equipped with a good grounding.
- Away from high-intensity magnetic field, electric field, and the occurrence of high-frequency waves of electrical equipment. Avoid sharing the same power outlet with other devices.

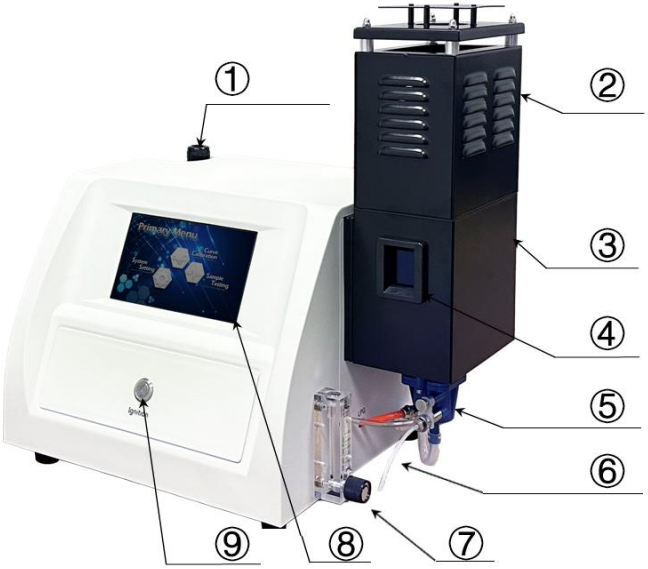
Note: If the power supply voltage fluctuates dramatically, it is recommended to use more than 500W AC electronic power supply.

3.2 Unpacking

Open along with the sealing (please save package box, prepare for the moving needs), in accordance with accessories and spare parts list to check the host machine and spare parts. If there is anything missing, please contact the local sales representative or directly contact our company.

4 Instrument Appearance and Structure

4.1 Instrument Appearance



1	Air filtering and pressure relief valve
2	Chimney cover
3	Combustion chamber
4	Viewing window
5	Atomizing chamber
6	Sampling capillary
7	Gas flow meter and adjusting knob
8	Display
9	Lgnition / Flameout button

4.2 Instrument Structure

4.2.1 Atomizing System

The system consists of air compressor, air filtration valve, sprayer, and atomizing chamber.

◆ Air Compressor:

The air compressor (see the right figure) is oil free. The max. output pressure is 0.20MPa, and the max. air flow is 0.9m3/min. The input power shall not be greater than 200W. The power supply voltage is 220V±22V. It's better to have an independent outlet with a switch.

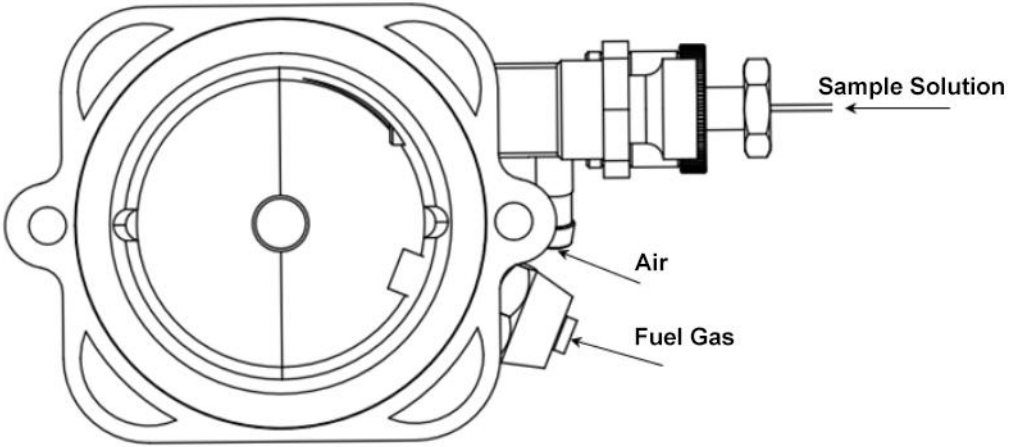
◆ Air Filter Valve:

Air released by the air compressor flows through air filter valves, and becomes cleaner, drier, with more stable pressure. The air filter valve (see the left figure) has two functions: one is to stabilize pressure, and the other is to filter. The way to adjust the air pressure is as following: pull out the control valve at the top of air filter.

Rotate clockwise to increase output pressure, and counterclockwise rotation reduces output pressure. After working for a period of time, the air filter valves have some water. The water should be excluded on a regular basis. (For drainage method, please refer to "maintenance")

◆ Atomizer:

we have adjusted the atomizer to the best effect and fixed. In any case, please don't try to adjust or remove the atomizer, and if you adjust the atomizer, we will not be able to ensure that your flame photometer can work in the best state.



4.2.2 Gas System

◆ LPG:

The instrument uses liquefied gas as fuel, which is liquefied petroleum gas, briefly LPG. If an odorant is smelled in the work place, make sure to double check if there is any leak of LPG.

Users themselves need to prepare the LPG cylinder. When buying cylinders, users must check the quality of suppliers, namely, cylinder safety must be approved by the local technical supervision department. The workplace must be well-ventilated. When cylinders are placed in a box, the lower part of the box must have several ventilation holes.

Cylinders cannot be placed horizontally instead of vertically, or exposed to direct sunlight; besides, flammable materials must not be placed near them. Rubber tubes cannot be used for more than a year.

If unknown leakage of LPG occurs, users must immediately switch off cylinders, and open doors and windows. Do not switch on/off electrical appliances. Do not let objects collide. If it is necessary to evacuate staff, don't panic and act calmly. Report to relevant department, if necessary.

◆ Gas Valve:

The gas valve consists of three parts: ignition device, adjusting device, and flameout protection device.

1) Ignition device: Users start from right, press the gas adjustment knob, and turn left 90°. Now the ignition device automatically is powered on, and pulse generator generates a high-voltage electric spark on the verge of the burning head. Now liquefied petroleum gas has overflowed from the head. When it meets electric spark, it automatically induces ignition. Hold on the adjustment knob for a few seconds, and then release it. The flame is burning normally. Then turn the adjustment knob to the left, the flame gets smaller and smaller as it goes far left.

2) Flameout protection device: without igniting, if users turn on the switch of the cylinder, LNG will not overflow from the burning head even if the adjustment knob is at the working position. When the ignition is successful, the thermocouple installed in the head starts working and triggers electromagnetic valve to work. Since the magnetic valve is open and the flame will not extinguish even if letting go of hand. If the flame is off accidentally, thermocouple cools and triggers electromagnetic valve to shut off the cylinder.

◆ Gas control knob:

In order to make the instrument test data more stable, the knob on the gas flow meter on the side of the instrument can be slightly adjusted to adjust the flame size. when the dark blue flame height is 6-8mm, It is the best state of instrument testing.

4.2.3 Measuring Device

Measuring device is a set of optical and electrical appliances, the optical part of which consists of protecting glass and interference filters. The protecting glass prevents dust from contaminating the interference filter and the flame burning, so as to extend the service life of interference filters. Users should use interference filters with corresponding wavelengths to test different metal atoms. If the user needs to test other metal atoms, the filter shall be changed to meet the testing requirement. Electrical appliances transfer the solar energy into electric energy, which is displayed on the screen after signal magnification and being processed into analog quantity by CUP data processor. The CUP data processor can also perform piecewise or linear fit 1st order, which saves a lot of efforts. The testing results can be stored or printed out.

4.2.4 Gas leak alarm

If an uninterrupted "drip" sound is heard from inside the instrument during the use of the instrument, it indicates that the gas alarm has detected a gas leak. The instrument will automatically close the solenoid valve. At the same time, please immediately cut off the power supply of the instrument, close the switch valve of the coal gas tank, and cut off the gas input. Open Windows or other ventilation devices, people leave, to avoid breathing coal gas. Finally, please call the after-sales personnel and handle the machine under the guidance of professional personnel.

5 Installation Debugging

5.1 Installation

1) Install JYT-0.6 valve at the exit of liquefied petroleum gas cylinders. The valve joint is L-thread, namely L is tight, D is loose, and it must be tightened. Exit of the valve and the entrance of the equipment have tapered connectors, connecting with rubber tubes (which can be found in the spare parts) and the fixed chuck must be installed at the link. Use wrenches or screwdrivers to tighten the fixed chuck. After installation, users must check the quality of the installation. Open cylinder switches, blow with hands the air at the joint, and smell to see if it smells, or put soapy water at the joints, and observe whether there are air bubbles out. Do not attempt to use the instrument until the test has been completed. It is highly recommended that the outer pipe gas line be checked regularly and must be checked after each gas cylinder replacement.
2) Connect the exit of air compressor and the air valves of the air filtration with a 6 × 4PU pipe. Insert the pipe to the mouth, and it has to reach the bottom. If users can pull out PU pipe only by the hand, it must be re-installed. When it is necessary to remove the tube, users can press and hold down the joint and pull out the tube.

3) Insert one end of the latex tube (waste water) into the outlet of waste water cup, the other focuses to the container of the waste liquid.
4) The grid power socket of the air compressor should be equipped with a switching device. The power supply of the grid must be well grounded.
5) If you want to connect to the computer, you can connect the computer to the instrument with a USB cable, and install a dedicated workstation software on the computer

5.2 Debugging

5.2.1 Check atomization

1) Turn on the air compressor power supply. Adjust the air filter reducing valve to make the pressure gauge shows 0.04~0.05MPa.
2) In the absence of ignition, insert the sample tube into the sample cup containing distilled water, and white water mist can be seen floating out when the chimney cover is removed.
3) Check whether there is water draining from the waste liquid container. If it doesn't work, pinch the latex.

5.2.2 Cautions when switching on/off

1) Switch on the host and the air compressor, and insert the sample tube into a sample cup filled with distilled water.
2) Open the LPG cylinder pressure reducing valve switch (if the LPG pressure reducing valve has a safety valve, press the safety valve button at the same time), and adjust the gas pressure reducing valve to open to the maximum
3) Install the "glass cover" in the attachment into the combustion chamber, and then cover the "chimney cover".

4) Before shutdown, in the burning state, use distilled water instead of sample injection to clean the atomizer and combustion head, and the cleaning time is about 5 minutes.
5) After cleaning, turn off the gas cylinder switch and cut off the power supply of the instrument

5.2.3 Ignition Preheating

1) Turn on the instrument , air compressor, LPG cylinder valve and LPG pressure reducing valve switch (if the LPG pressure reducing valve has a safety valve, please press the safety valve button at the same time), and adjust the LPG pressure reducing valve to the maximum.
2) Adjust the air pressure reducing valve on the instrument so that its pressure is 0.04~0.05MpaSwitch on the air compressor, and insert the plastic capillary into distilled water.
3) Put the sample plastic capillary tube into the sample cup containing distilled water, and add water to the waste liquid cup until the water is filled with the silicone tube connected to the waste liquid cup and the atomizer.
4) Chimney cover must be installed before ignition. After 20 seconds, you can click the "Ignition" button on the front panel, and you can see the spark through the viewing window. When the gas flow is set properly, ignition is successful. When the ignition is not successful, the gas flow rate can be appropriately increased (that is, the gas flow meter knob is slightly counterclockwise, generally 0.2 to 0.4). The ignition process lasts up to 20 seconds. If the Ignition fails, click the

"Ignition" button again after 5 seconds. (Note that the gas flow meter is a fine-tuning valve, not a switching valve, and both ends shall not be rotated to the end)

5) After the Ignition is successful, click the "Ignition" button again can achieve automatic flameout. If you need to fire again, do it after 5 seconds.

6) The instrument can be preheated for 30 minutes under the condition of sampling distilled water before testing. (please note that after the instrument is ignited, it cannot be burned empty, and the sample tube must be inserted into the sample cup containing distilled water, and the waste liquid cup should have water discharged.) Repeat the above operations each time you start the ignition.

5.3 Keypad Operations

The series of instrument is operated through the pop-up touch keypad. There are number and letter keys.

Number keys:【 CE 】is to clear data;【 Cancel 】is to cancel the current input;【 Enter 】is to confirm the input data.

Letter keys:【 CE 】is to clear data;【 Cancel 】 is to cancel the current input; 【 Enter 】 is to confirm the input data.

【 ← 】is to clear last character or backspace.

6 Operations

When turned on, the instrument will automatically perform the series of system self-test.

After the self-test, it enters the main menu interface. Main menu contains three menu options: Curve calibration, sample testing and system settings. (Except FP640)

6.1 Curve Calibration

From the main menu, select curve calibration button to enter the interface. (Except FP640)

Click the [Menu] button on the top right corner of the screen to return to the main menu interface.

6.1.1 Interface Introduction

Curve calibration interface consists of an analog value display field, calibration area and functional operation components.

The upper end of the table shows the current analog value of corresponding elements. Different elements are all tested simultaneously.

The central of the table is test operation area, which can perform curve calibration. The series of instruments can calibrate 12 curve points for each element, display 6 lines per page, which can be

flipped with the right side of the screen buttons [↑] and [↓]. Numbering is only served as reference mark and each line can be clicked to perform calibration. C column data represents concentration values (which need to be entered manually), and A column data indicates an analog value.

Form the lower functional operating area. Each button corresponds to a different operation content. [curve] after completion of the calibration, click on the button to automatically generate the curve, and the interface will switch to curve generation interface with the grid.

[Enter] is used to confirm the single-line calibration data, indicating that the line calibration is complete.

[Clear] is to clear all of the current calibration data.

[Print] is to print this calibration data.

[Storage] is to store the current calibration data. Click it to enter calibration dedicated file list interface. (See 6.1.3)

[Call] is to bring up once a stored calibration data. Click it to enter calibration dedicated file list interface. (See 6.1.3)

6.1.2 Calibration Example

1) Get the calibration solution ready (at least 2 kinds of solution with different concentrations). Otherwise it is impossible to form two different calibration points, and unable to form curves.
2) Put the injection pipette into the vessel containing the calibration solution.
3) Click on any cell of the C column (better in numerical order), it will display inverted color, and pop up numeric keypad, you can type in the desired concentration of the calibration solution. Press [ENTER] to confirm from the numeric keypad.
4) Click on the row corresponding blank cell in column A, it will display inverted color.
5) Wait for the stabilization of analog value display in the analog value area. Click [OK] from the lower end of the operating table and the measured analog value will be displayed in column A of the row.
6) To replace the calibration solution, directly put the injection pipette into calibration solution, which contains the next container. Repeat the above steps 3, 4, and 5.
7) If you need to re-calibrate a certain point, you can directly click the recalibration cell in column C. If you need to clear all calibration data, click [Clear] from the operating area.
8) When the calibration is complete, click [curve] to view the generated curve, and the element button to the calibration curve corresponding to the element. Click [Back] to return the calibration interface.

If you need to print the current calibration data, you can click [Print] from the operating area.

If you need to store the current calibration data, you can click [Save] from the operating area. (See 6.1.3)

If you need to call the previous calibration data, you can click [call] from the operating area. (See 6.1.3)

6.1.3 Save/recall

◆ **Save:**

Only when calibration data shows on the current screen, click [storage] to enter the file list screen. The series instrument can store 20 calibration curves.

1) Select the desired location where the file is to be saved, click a blank cell, and show inverted color. (if a storage already exists, a pop-up will ask whether to overwrite)

2) Click [OK] on the screen part of the operating area, storage is complete.

◆ **Call:**

1) Select the desired location of the calibration curve file and display inverted color.

2) Click [OK] from the lower part of the screen in the operating area, the interface will automatically jump back to curve calibration and data retrieval is successful.

6.2 Sample Test

In the main menu select: sample test button to enter the interface. (Except FP640)

Click [Menu] from the top right corner of the screen to return to the main menu interface.

6.2.1 Interface Introduction

Sample test screen consists of concentration value column, test area and functional operation. The upper part of the table shows the current concentration value corresponding to the element. Different elements are all tested simultaneously.

The central area of the table is calibration data are, which can perform curve calibration . The series of instrument can test 100 rows of data results, with displaying 10 lines per page, and can flip to view with buttons [↑] and [↓] from the right side of the screen. Table data represents the confirmed concentration values which have been tested . The lower part of the table is functional operating area. Each button corresponds to a different operation.

[Calibration] is to perform curve calibration before testing sample. (See 6.2.3)

[OK] is to confirm the concentration is needed to scroll the data and recorded in the table.

[Clear] is to clear all of the current test data. [Print] is to print test data.

[Save] is to save the current test data. Click to enter the dedicated test file list. (See 6.2.4)

[Call] is to call test data which was save before. Click to enter the dedicated test file list. (See 6.2.4)

6.2.2 Test Example

1) If you need to perform calibration before the test, click [calibration] from the operating area (see 6.2.3). Or skip the step, depending on the specific test conditions.
2) Get the test solution to be used ready, put the injection pipette into the test vessel with solution to be tested.
3) Observe the concentration value change from the top of the display column until the data is stable, click [OK] in the operating area, and the current density values measured will be automatically recorded in the table.
4) When the testing page is full, it will automatically jump to the next page, you can use the page button to view data back and forth.

If you need to remove all the test data, click [Clear] in the operating area.
If you need to print the current test data, click [print] in the operating area.
If you need to save the current test data, click[save] in the operating area. (See 6.2.4)
If you need to call before test data, click [call] in the operating area. (See 6.2.4)

6.2.3 Test Calibration

To perform calibration, this function can be used.

1) Prepare a standard solution with known concentration for calibration, put the injection pipette into the container with the standard solution.
2) Click [calibration] on the bottom of the table, and a calibration dialog box pops up.
3) Click the blank cell which is on the left of the column C for the corresponding element, and the selected one shows inverted color.
4) With the pop-up numeric keypad, type the concentration of standard solution, click [ENTER] and the input is successful. Click [OK] to confirm the concentration of calibration.
5) The calibration is complete, click [×] to close the calibration dialog.
6) The calibration of different elements should be performed separately. It's necessary to be individually calibrated.

6.2.4 Save/Call

◆ Save:

1) Only when calibration data shows on the current screen, click [storage] to enter the file list screen. The series instrument can store 20 calibration curves.
2) Select the desired location where the file is to be saved, click a blank cell, and show inverted color. (if a storage already exists, a pop-up will ask whether to overwrite)
3) Click [OK] on the screen part of the operating area, storage is complete.

◆ Call:

1) Select the desired location of the calibration curve file and display inverted color.
2) Click [OK] from the lower part of the screen in the operating area, the interface will automatically jump back to curve calibration and data retrieval is successful.

6.3 System Configuration

In the main menu: after pressing System Settings button, enter the interface. (Except FP640)

Click [Menu] from the top right corner of the screen to return to the main menu again.

After changing the settings, the modifications will take effect only after clicking [Save Settings]. Otherwise, click [Menu] directly to exit without changing the settings.

6.3.1 Calibration methods

The series of products provides two calibration methods: curve fit 2nd order and linear fit 1st order. The user can click the button to select. When it flashes purple color, it indicates the method is chosen.

6.3.2 Concentration Units

The series of products provide three concentration units: mmol/L, mg/100mL and ug/mL. The user can click the button to select. When it flashes purple color, it indicates the unit is chosen.

6.3.3 Language Options

The series of instruments currently offers two languages: Chinese and English. Users can click the button to select.

The purple color indicates the selected language. After clicking [Save Settings], the system will switch to the selected language.

6.3.4 Element & Concentration Range

The corresponding elements provided by the series of instruments can adjust the sensitivity with three options: Lo (low), Mid (middle) and Hi (high). Click the appropriate green color to select.

The series of instruments can choose whether to apply the element to test, click the element button, corresponding purple indicates selected element. The later test will show the test information of the element. If the element buttons which are not selected is white, and the test does not appear in the element.

6.4 Direct Reading of Proportional Value

The function only applies to FP640.

After the instrument is switched on and finished with self-test, model FP640 directly enters the direct reading of proportional value.

6.4.1 Interface Introduction

The interface is the direct reading mode of proportional value.

Digital display box shows current scale value.

Next to K and Na, [Open] and [Close] keys can control the channel switching of element, and decide whether to test the element. When opened, the element is bright white letters, and dimmed when the element is closed.

K and Na both have [Set High Standard] and [Set Low Standard] key.

[Set High Standard] is to set the high concentration reference value of the solution with known concentration.

[Set Low Standard] is to set the low concentration reference value of the solution with known concentration.

6.4.2 Test Example

1) Prepare the calibration standard solution (two or more) to establish a standard curve.
2) Put the injection pipette into the vessel with the calibration solution of lowest concentration (usually blank).
3) Click [Set Low Standard], pop up a numeric keypad, and type [0]. Click [ENTER] to confirm from the keypad.
4) Remove the pipette, and put the injection pipette into the vessel containing the calibration solution of highest concentration.
5) Click [Set High Standard], pop up numeric keypad, type "100" (or larger numbers, any number less than 999.9, such as 120, 150 and 180). Press [ENTER] to confirm from the numeric keypad.
6) Repeat step 2 and 3for several times until the concentration is adjusted to the lowest standard reading "0", and the highest concentration standard reading is "100".
7) There are more than 2 points (i.e. with two or more standard solutions), it's necessary to follow the injection sequence from low to high concentrations, and record the reading.
8) With the concentration value of each point of the standard curve established and the reading value of each point on the instrument, the curve can be calculated automatically.
9) Start measuring the test solution, put the injection pipette into the container with the test solution. Observe the screen value until it is stable, and record the reading. According to the curve, calculate the concentration value of the sample.

7 Mother Liquor

7.1 Potassium and Sodium

【2.5mmol/L Potassium Standard Mother Liquor】

Put solid KCl reagent on weighing plate and place it in the oven, bake at 130℃ ~ 150℃ for two hours, then take it out and cool down to room temperature in the dryer. Precisely weigh 93.19 mg on the analysis balance, and then put it in a 100mL beaker. Dissolve it with water and pour it into a 500mL volumetric flask. Wash the beaker three times, and pour it into the volumetric flask, then add enough water to full scale and shake well.

【10mmol/L Standard Sodium Mother Liquor】

The same preparation method is as above. The amount of sodium chloride should be 1,168.8 mg and the solution should be 2,000mL.

【Mixture of 0.04mmol/L Potassium and 1.40mmol/L Sodium】

Absorb 32mL potassium standard mother liquor and 280mL sodium standard mother liquor with a 50mL burette, respectively. Inject the liquor into the same 2000mL volumetric flask. After each injection, wash the burette, and inject the lotion into the volumetric flask. Then dilute it with water to full scale and shake it up.

7.2 Potassium Oxide and Sodium Oxide

【0.5mg/mL Standard Potassium Oxide Mother Liquor】

Same preparation method as above, the amount of potassium chloride weighs 792mg; the solution weighs 1000mL, the potassium in which is 0.5 mg per milliliter.

【0.5mg/mL Standard Sodium Oxide Mother Liquor】

Same preparation method as 7.1.1, the amount of sodium chloride should be 943 mg; the solution weighs 1000mL, the sodium in which is 0.5 mg per milliliter.

【Standard Solution for Work Curve】

Work curve should be set by a group of standard solution, the number and spacing within the group should be determined by actual work. If the test solution has lower concentration and less change, they only need to be set at one lower and one higher end of this range. Otherwise, users should do more.

If preparing 0.5 mg/100mL standard solution, users need to transfer 5mL standard mother liquor with burette into 500mL volumetric flask. Dilute with water to full scale and shake it up. Other solutions with higher analogs can be prepared in the similar way. To determine both content of potassium oxide and sodium oxide, users can prepare their mixture. If the tested solution has less than 0.5mg/100mL, then the standard mother liquor should be diluted, but must be diluted in a countable way, otherwise they will cause confusion in quantitative terms.

7.3 Potassium and Sodium

【500μg/mL Standard Potassium Mother Liquor】

Same preparation method as 7.1.1, the amount of potassium chloride weighs 477 mg, the solution weighs 500mL. Potassium the solution has is equivalent to 500 μ g per milliliter, or 500PPm.

【500μg/mL Standard Sodium Mother Liquor】

Same preparation method as 7.1.1, the amount of sodium chloride weighs 636 mg, the solution weighs 500mL. Sodium contained in the solution is equivalent to 500 μ g per milliliter, or 500PPm.

【Standard Solution for Work Curve】

Work curve should be set by a group of standard solution, the number and spacing within the group should be determined by actual work. If the test solution has lower concentration and less change, they only need to be set at one lower and one higher end of this range. Otherwise, users should do more.

If preparing 10μg/mL standard solution, users need to transfer 10mL standard mother liquor with burette into 500mL volumetric flask. Dilute with water to full scale and shake well. Potassium (Sodium) contained in the solution is equivalent to 10 μ g per milliliter, or 100PPm.

Other solutions with higher analogs can be prepared in the similar way. To determine both content of potassium oxide and sodium oxide, users can prepare their mixture.

If the tested solution has less than 10μg/mL, then the standard mother liquor should be diluted, but must be diluted in a countable way, otherwise they will cause confusion in quantitative terms.

7.4 Conversion between mmol/L and μg/mL

K:	1mmol/L≈39μg/mL	1μg/mL≈0.0256mmol/mL
Na:	1mmol/L≈23μg/mL	1μg/mL≈0.0435mmol/mL
Li:	1mmol/L≈6.9μg/mL	1μg/mL≈0.145 mmol/L
Ca:	1mmol/L≈ 40μg/mL	1μg/mL≈0.025 mmol/L
Ba:	1mmol/L≈137μg/mL	1μg/mL≈0.007 mmol/L

8 Maintenance and Troubleshooting

8.1 Notes

1) Gas and assisting gas (air) must be dry, clean and not contaminated. Do not use the equipment in an environment of high humidity and a lot of dust.
2) Inflammable and explosive materials cannot be placed around the equipment and the cylinder. Experimental environment must be well-ventilated. Mandatory exhaust ventilation should be installed and the equipment can be set in a cabinet if possible.
3) Stable 220 V voltage supply must be used. No powerful and frequently used electrical equipments near the working environment. Grounding must be reliable, and zero line cannot be used to replace grounding line.
4) During operation, the combustion chamber and the chimney are hot. Do not get close to or touch them.
5) Collect the waste water from the cup, and treat them appropriately without arbitrary disposal.
6) The atomizing chamber and the burning head should keep clean and be maintained on a regular basis. If a high-salt sample test is performed, appropriately prolong the burning time of sampling capillary with distilled water.

7) Some samples of larger surface tension need the appropriate amount of surfactant. Pay attention to add the same amount in sample, standard, and blank solution.
8) Prepare standard solution precisely. In order to store for a long time, pay attention to the storage conditions, and add the appropriate antimicrobial agents. Samples cannot be stored in a sodium glass container.
9) Samples cannot contain particle materials. The best option is to use after filtering. During regular operation, pay attention to the surface height, make sure the plastic capillary only injects the upper solution.

8.2 Maintenance

8.2.1 Air Compressor

About every 100 hours' work, shut down the power, pull out the tubes, twist the joints, and dump the water in the two drum-shaped cans. If the environment is damp, the maintenance shall be performed more frequently.

8.2.2 Draining Method of Air Filter Valve

Under pressure, use a clean liner to hold up the thimble below the air filtration and pressure reduction valve.Water will discharge on the liner. Loose it after emissions, and it will be reset.

8.2.3 Cleaning

After each test, there should be about 5min washing time with distilled water, put the sampling capillary into distilled water, as in normal working conditions, burning for 5min, and clean the atomizing chamber and the combustion head.

8.3 Troubleshooting

Phenomenon	Causes	Solutions
No discharge sound	1) 5V power no output 2) Pulse generator broken	1) Check 5V power 2) Replace pulse generator
There is discharge sound, but no electric spark	1) No discharge circuit	1) Adjust the distance between ignition and combustion head 2) Check the grounding status 3) Replace the ignition cable
Chamber not caught fire, but smells foul	1) Discharge position deviation	1) Adjust the position of ignition head and combustion head
Combustion chamber without the foul smell, not on fire	1) The LPG did not reach the burning head	1) If the burner is blocked, clean the burner 2) If the solenoid valve is broken or blocked, repair the solenoid valve or replace it 3) Gas is exhausted, need to replace 4) The gas flowmeter knob sets the flow rate too small
The fire lit, but went out automatically	1) Photodiode failure 2) The ratio of air and gas is inappropriate	1) The photodiode is loose and needs to be fixed again 2) The photodiode is covered with dirt and polluted. The photodiode needs to be cleaned

		3) The photodiode is damaged. Replace the photodiode 4) Adjust the air pressure and gas flow to the recommended range in 5.2.3
The air pressure is small and cannot be adjusted	1) The air filter reducing valve is damaged 2) The life of the air compressor is up	1) Replace the air filter reducing valve 2) Replace the air compressor
No sample injection	1) The sample tube is blocked 2) The air pipe in the atomizing room is blocked	1) Use the attached syringe to pump air into the sample tube, dredge the sample tube, or replace the sample tube 2) Replace the atomizer components
The display is not bright	1) Fuse failure	1) Replace fuse

9 Warranty

Within 12 months after the user purchased the instrument, if it doesn't work properly without any physical damages, the factory is responsible for repair free of charge (not including the consumable parts).