
User Manual

DNM-9602 Microplate Reader



Please read operating manual before installation and operation.

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Warnings and Safety Precautions

DNM-9602 Microplate Reader can be used for outside body diagnosis(is in vitro diagnostic medical devices). Please read the following precautions with great care and abide by them strictly. When using electrical products, basic safety precautions should always be followed, including the following.

- 1.Materials of some items maybe have biological dangers, so before you turn on the instrument you should defend yourself well, for example: wearing defending clothes and gloves.
- 2.Please do not discard the used detecting materials randomly. All samples, negative or positive controls, standards and waste should be treated as infectant. (When the disposal of waste liquid or replace the tube ,be sure to wear rubber gloves. Please do not touch the waste liquid directly, because they may be infectious)
- 3.Please do not refit the instrument.
- 4.The instrument should be grounded by the ground wire of the power wires. To avoid electric attack, the ground wire should be connected well with the ground.
- 5.The AC power supply should be stabilized. Avoid using the same power supply with high-power equipments (especially break frequently) and avoid disturbing by strong electromagnetism.
- 6.If you want to drag off the power wire, please hold with the plug itself instead of the power wire.
- 7.If you find smog, peculiar smell or strange sound from the instrument, please cut off the power supply immediately and contact with the franchiser.
- 8.After you finish detection, please cut off the power supply of the instrument and cover the dustproof.
- 9.If you need to uninstall the cover for repair or other causes, you should first turn off the instrument and then cut off the power supply.
- 10.When you maintain the instrument, please wear rubber gloves and wash your hands after work to avoid infection.
- 11.Don' t touch reagents or patient samples by hands or other parts of body. If you have contacted with patient samples by your wound, please wash in time and examine by doctors.
- 12.The instrument is clinical detection equipment and has no taboos.
- 13.Only trained and qualified medical personnel should operate the device
- 14.The equipment is rated to operate at an altitude less than 2000 m.
- 15.Equipment not suitable for use in the presence of flammable mixtures, explosion gas.
- 16.Replace with same type and rating fuse, fuse specification as below: MAIN FUSE: AC 250V, F 2A L.
- 17.WARNING: No use-serviceable parts inside, before servicing to authorized representative or manufacturer!

Directions for safe use





Before using, please read “Directions for safe Use” and using illumination carefully and conduct the operation correctly.

For the sake of using instrument safely and correctly, and keep you and others or the possession far away from the damage, we use various symbols and signs.

The meanings of symbols and signs are as follows:

Please understand its meanings fully, then read the body of this book.

Signs and meanings:

Symbol	Meaning
	Disconnect AC power supply
	Switch on AC power supply
	Warning: Waste liquid has potential biohazards.
	Protective ground
	In vitro diagnostic medical devices

1. INTRODUCTION
1.1 Characteristics

The DNM-9602 Microplate Reader is mainly used on clinical immunity-tests in the hospitals or

epidemic prevention stations. As for the safety classification, it belongs to I Class B Type. The machine can be operated continuously. Display is a liquid crystal type with alphanumeric and graphic options. Setting and detecting operations are easy and straightforward. The program and test operations are in the mode of man-machine conservation. Using large screen to display, make it easy to use for the user.

1.2 Main Functions

- (1) Immunology detections in the hospitals or other relative clinical laboratories.;
- (2) Corresponding detection for microanalysis in chemistry or biochemistry .

1.3 Principle and Features

1.3.1 Work Principle

Work principle of the instrument is photoelectric colorimetry. The instrument carry out detections after it is conjugated with ELISA reagents. Firstly, it detects absorbencies of under detection sample and standard liquid. Secondly, it performs analyses and calculations. Finally, it produces values or conditions of the under detection material in the sample liquid.

1.3.2 Structure Features

The instrument consists of two main components: mainframe and built-in printer

The mainframe is composed of optic system, 8-channel detection system, single-chip system and enzymatic plate driving system. The instrument can detect enzymatic plate that has 96 or 48 wells. Refer to figure 1 for system schematics.

1.4 Specifications

1.4.1 Functions

- (1) interface: instrument adopts full display in Chinese, has the boot self-checking function, if there is a fault detection system, instrument silently. The instrument can save inspection programs for common use in advance and display the program list on the LCD for clinical inspections
- (2) light source signal detection: instant check each channel light signal;
- (3) Filter selection: instrument according to the program Settings can be automatically select the filter to detect;
- (4) Style: measurement instrument with single or double wavelength and single and double hole detection method for the choice;
- (5) Input methods: through the keyboard input;
- (6) Input format: You can use uppercase and lowercase letters and numbers.
- (7) Parameter Settings: Settings, save, modify, and query 126 test parameters, for later call when testing;
- (8) Testing calibration: It has the function of testing calibration can save and modify the calibration parameters and the curve of the 126 projects, when doing the same test project can call and can print calibration curve.
- (9) Detection: instrument has absorbance detection, qualitative, quantitative and qualitative control testing four methods.
- (10) Storage the results: DNM - 9602 can save 105 plate holes (10080) examination test results, for later use.
- (11) Output mode:
 - Absorbance detection, display and print testing instrument the absorbance value;
 - Qualitative detection, display and print testing instrument absorbance value, the critical value, S/CO value and qualitative determination results;
 - Quantitative detection: the instrument display and print test absorbance value, density, normal reference value, judgment of quantitative results.
- (12) Quality control: can to five projects to carry out the indoor quality control, at the same time can query and print quality data and quality control chart.

(13)Communication:RS-232

(14)It has light source lamp dormancy function, prolong the service life of the light source lamp.

1.4.2 Technical requirements

(1) Wavelength characteristics: instrument configuration of filter center wavelength deviation is ± 1.0 nm, half width is $6 \text{ nm} \pm 1 \text{ nm}$.

(2) Detection range of the instrument is from 0.0A to 3.0A. The error of absorbance accuracy is as follows:

Absorbance (A)	Accuracy Error (A)
0.000-2.000	± 0.005
>2.000-3.000	± 0.02
>3.000-4.000	± 0.10

Table 1: Absorbance Accuracy

(3)

Absorbance (A)	Error (%)
0.000-2.000	$\pm 0.5\%$
>2.000-3.000	$\pm 1.0\%$
>3.000-4.000	$\pm 2.5\%$

Table 2: Linearity of the Instrument

- (4) Resolution: 0.001 A;
(5) Stability: $\leq \pm 0.002\text{A}/10\text{min}$;
(6) Reading speed: single wave 3s, dual wave 6s;;
(7) Display: 240x128 pixels LCD screen;
(8) Print: external printer;
(9) Data Link: RS232 serial port;
(10) Output: Original absorbency, qualitative judgment, value of P/CO, concentration, judgment of reference range and quality control results
(12) Dimensions: 420*350*181 mm;
(13) Weight: 9kg.

1.4.3 Work Conditions

- (1) Environmental temperature: $10 \sim 30^\circ\text{C}$;
(2) Relative humidity: $\leq 70\%$;
(2) Be away from strong electromagnetic field;
(3) Avoid direct irradiation from intense light;
(4) The work place must be dustproof and shake-proof. There should be no caustic gas such as hydrochloric acid in the air;
(5) Power supply: $\sim 100\text{V} \sim 242\text{V}$;
Input power: 100VA;50Hz $\pm 1\text{Hz}$;
(6) Power supply must be grounded perfectly.

2. INSTALLATION

2.1 Unpacking of the Instrument

- (1) Remove the package and the materials used for transportation. Take care of the packing case and

materials for re-packing the instrument in the future.

- (2) Take out the instrument from the packing case.
- (3) Put the packing materials away and take the instrument out from the plastic packing bag.
- (4) Check the things in the packing case to ensure the following parts are packed:
 - a. DNM-9602 Microplate Reader mainframe
 - b. User's Manual;
 - c. Delivery and acceptance certificate
 - d. Accessories: power wires, spare fuse.

Note: Please contact with the saler if any part is damaged or lacking.

2.2 Environmental Requirements

Choose a location away from intense sunshine in your working places. The Microplate Reader should be placed on a even worktable with enough space. The front edge of the instrument should be near to the working edge. Keep the worktable from shock.(for example, there is a centrifuge on the worktable.)

Notes: The environment temperature for the operation of the instrument should be 10°C – 30°C, with the relative humidity being less than 70%.

To ensure the normal operations of the instrument, it is prohibited to place the instrument in the following places:

- a. Sharp change in temperature;
- b. Extremely hot or cold;
- c. With mass dust;
- d. Near to electromagnetic equipments producing magnetic fields.

2.3 Power Supply Requirements

- a. AC 220X(1±10%)V
- b. 50× (1±2%) Hz
- c. 100VA

2.4 Installation

2.4.1 Connect the instrument with the power supply.

- 1) Insert one end of the power wires into the power socket of the machine.
- 2) Insert the other end of the power supply into the AC power socket.

2.4.2 Connect with external printer

- 1) Ensure both the printer and the instrument are turned off.
- 2) Insert the square end of the printing cable of the USB interface into the USB interface socket at the back of the printer.
- 3) Insert the flat end of the printing cable into the parallel printing port of the instrument.
- 4) Connect the printer with AC power supply by using the power wires matching the printer.
- 5) Turn on the power supply of the mainframe first. Afterwards, turn on the power supply for the external printer to ensure the printer works normally. It is advisable to shut off the power supply of the Microplate Reader mainframe and the printer when the printing cable is pulled out or inserted. Otherwise, the printer interface may be damaged and the printer fails to work. Remember to disconnect the power supply for the printer if any printing malfunction occurs. Then, re-connect the power supply to restart the printer.

2.4.3 Layout of the instrument back

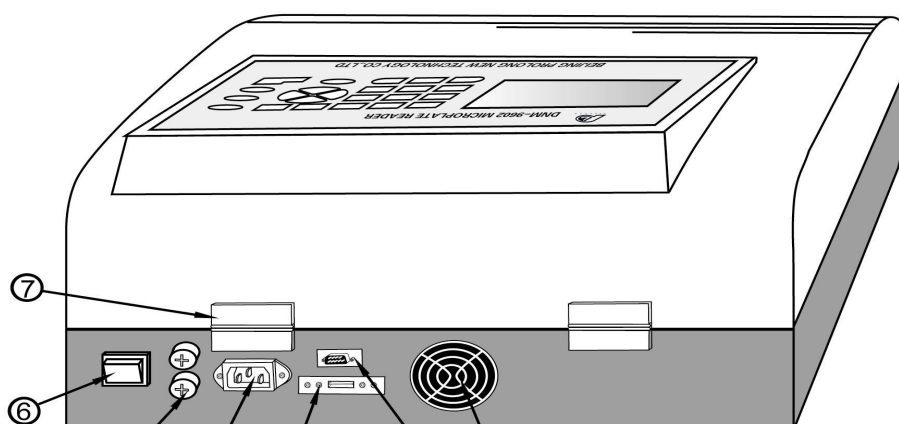


Fig.3 Backsight

Fig.2 Back layout of the instrument

- ①-cooling fan; ②-RS232 parallel communication interface; ③-USB printer interface;
 ④-socket for power supply; ⑤-power supply insurance; ⑥-power supply switch;
 ⑦-gemel

3. INPUT TOOLS AND OPERATIONS

3.1 Input Tools

This instrument uses pellicle keyboard as the input tools. It can input numbers from 0-9 and 26 capital and small English letters. The numbers and the letters are on the same keyboard surface . The arrangements are as follows:

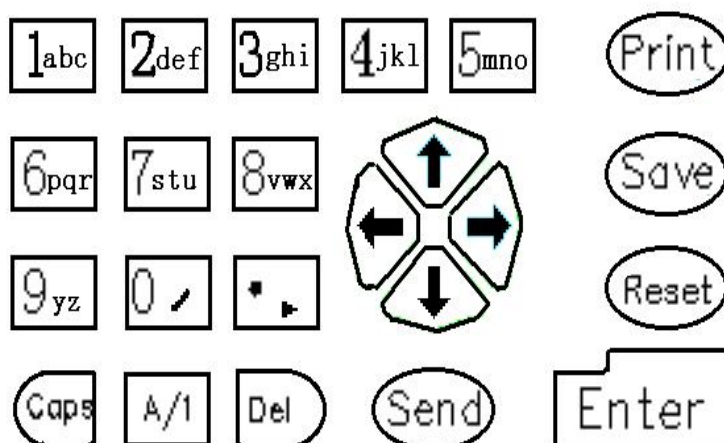


Fig3. Layout of the keyboard

Explanation for the function of the keys:

Caps Switch for the capital or small letter. It does not work when it is in the state of inputting numbers.

A/1 Switch for the number or letter state.

0/ Used to input number 0 when in the number state. Used to input “/” when in the letter state.

. Used to input radix point when in the number state.

Del Delete key. Delete the characters or numbers that have been inputted when item names ,wells, or number parameters are inputted. When the interface of item information is displayed, it can be used to change the item information.

Send Send function key. When the detecting results is displayed, the detected absorbency will be sent to PC machine by pressing this key. The RS232 serial port wire should be connected well before use.

Reset Reset key. It is used to quit the current operations and return to the main interface during

detection. Press down this key under the main interface and draw back the tray. Stop operating and wait for the machine to shut down.

Save Used to confirm and save the detected results and items.

Print Print key. It supports the printing of the detected results, calibration curve, programme items, quality control data, and quality control number.

Enter Confirm key. Confirmation to the current operations.

↑, ↓, ←, → Direction keys. They are used to move the displaying cursor and select the current records when selecting the items and examining the item information.

3.2 Operation

3.2.1 Names of input items, concentration unit.

The names of items consist of numbers from 0-9 and capital or small letters. numbers and letters on the keyboard are on the same key, and they can be switched for each other by pressing key **A/I**. The corresponding state (letter or number) will be displayed at the bottom of the screen. “→ABC” means that the current state is capital letters; “→abc” shows that the current state is small letters; “→123” means that it is in the state of inputting numbers. There will be a period of delay when a letter is inputted. During this period of time, all the letters on this key can be switched for each other by pressing down the same key continuously. Take key **1_abc** for example: when in the state of inputting numbers, it indicates the inputting of “1”; while in the state of capital letters, press this key continuously will lead to a letter cycle of “A” → “B” → “C” → “A” in turn. If letter “C” is needed, press key **1_abc** three times continuously. The cursor will jump to the next position for inputting automatically as soon as the period of delay finishes. Operations are the same as mentioned above when in the state of small letters. In the process of input, key **Del** is used to delete the letters that have been just inputted. When concentration unit is inputted, character “/” can be inputted by pressing **0** under the state of characters.

Attention: The default state of the machine is capital letters.

For example: Supposed the item name to be inputted is “Hbc450”, the procedures are as follows:

- Press **3_ghi** twice continuously to input ‘H’;
- As soon as the delay finishes, press **Caps** to switch to the state of small letters, and “→ abc” will be displayed at the bottom of the screen;
- Press **1_abc** twice to input ‘b’. Then, wait till the delay finishes;
- Press **1_abc** three times to input ‘c’. Then, wait till the delay finishes;
- Press **A/I** to switch to the state of numbers, and “→123” will be displayed at the bottom of the screen;
- Press **4_ikl** to input ‘4’;
- Press **5_mno** to input ‘5’;
- Press **0 /** to input ‘0’;
- Press **Enter**, and the current input finishes.

3.2.2 Wells input

The method of wells input is the same as that of the item name input. But there is a point must be mentioned: after a letter is inputted, the current input state will change to the state of numbers automatically (“→123” will be displayed at the bottom of the screen). This facilitates the users to input.

For example, if the user wants to input well “A12”, he/she can do as the following:

- Press **1_abc** to input ‘A’ and wait till the delay finishes;
- Press **1_abc** to input ‘1’;
- Press **2_del** to input ‘2’;
- Press **Enter**, and the current input finishes.

For wells like “A9” containing two characters, ‘A’, ‘9’ can be inputted directly. There is no need to

input it according to the mode of :A09". During the input process, characters that have been just inputted can be deleted by pressing **Del**

4. TURN ON THE INSTRUMENT

4.1 Flow

Switch on power, and the instrument will conduct self-check. The following will be displayed on the screen:

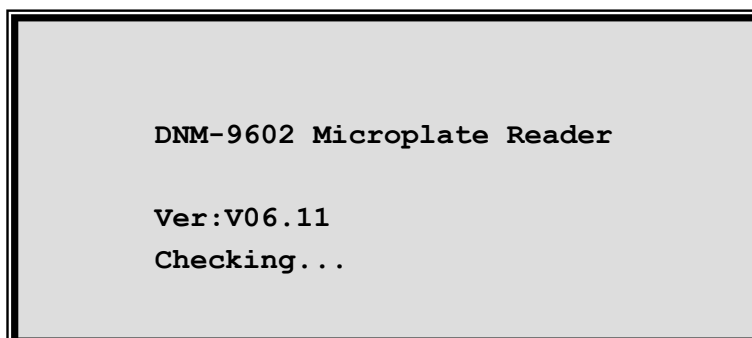


Fig.4 Menu for self-check

The self-check flow of DNM-9602 Microplate Reader contains the following procedures:

- a) Actions of the tray and filter disk.
- b) Check the going of each wavelength according to sequence of wavelength set by the system. If there is something wrong with a certain wavelength, hints will be given.
- c) Check the whole optical system, hints would be given in time should there be any malfunction.

In the process of self-check, the system will give indications if there is any malfunction. Users can refer to "Ordinary Troubleshooting" in "Instrument Maintenance" in this manual to inspect. If the malfunction can not be resolved, please contact with the seller.

The instrument will display the main menu if the initialization is normal. At this time, users can carry out the operations according to their needs. (program, detection, inquiry etc..)

Note: Before the beginning of detection, you must wait 20 minutes for a complete warming up from the time when the instrument was switched on.

4.2 Main Menu

After the flow ends, the instrument will enter the main menu window:

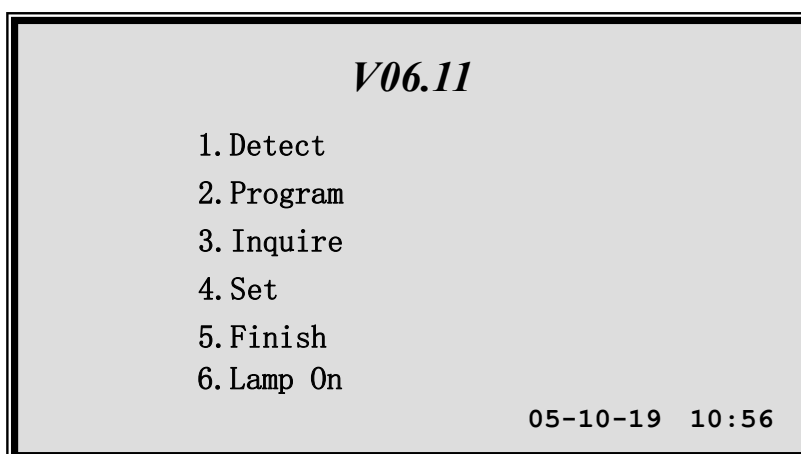


Fig.5 Main menu

Main menu serves as the entrance of all the functions of this microplate reader Microplate Reader. Press down **1abc**—**5mno** on the keyboard, the user can enter the corresponding function. (The corresponding function can be selected by **↑**, **↓** . Then, press **Enter** to enter the corresponding function.) Date and time will be displayed at the bottom of the main menu screen and they can update per minute. When the detection is over, press **5mno** and the tray will be drawn back to the instrument. If the detection is needed again, just press **5mno** again. The lamp can be turned on or off by pressing **6pqr** under the main menu. (The lamp will go out automatically under other interfaces if the keyboard is not

operated for half an hour.)

Note: As real-time clock refurbish should be carried out for the main menu, so please press for a long time when the key is pressed. (The response is longer than that of keys under other interfaces). Only in this way, it can be executed accurately by the scan.

5. PROGRAMME

5.1 Explanation

Before the operations, the instrument should first be programmed according to user's needs. (actual detect items). For the convenience of future work, the numbering of the programs should be based on the following principles:

- Put the most commonly used detection item at first and arrange combined items together.
- Because the instrument can only allows five items to process quality control at the same time, you should put the item, which needs quality control, among the first five items when programming.
- There is a default function in each menu. If the default function meets actual need, you can press **Enter** key to go to submenu.
- There are Back and Next functions in each menu. If Back is selected, the instrument will return to the main menu; if Next is selected, the instrument will go to submenu.
- Stipulations for the instrument: You can freely set blank, negative, positive and quality control wells on the enzymatic plate when you are conducting qualitative detection and can set blank, negative and positive wells from 1 to 3 respectively, but the quality control well must not be more than one. When you are conducting quantitative detection, you can set standard wells and decide whether to use blank wells at will.
- If you want to terminate the programme and return to the main menu during the programme, press **Reset** and the instrument will return to the main menu.

5.2 Program Operations

5.2.1 Selective items

Press **2_{def}** under the main menu to enter the programme , and the instrument will display a menu of the selective items:

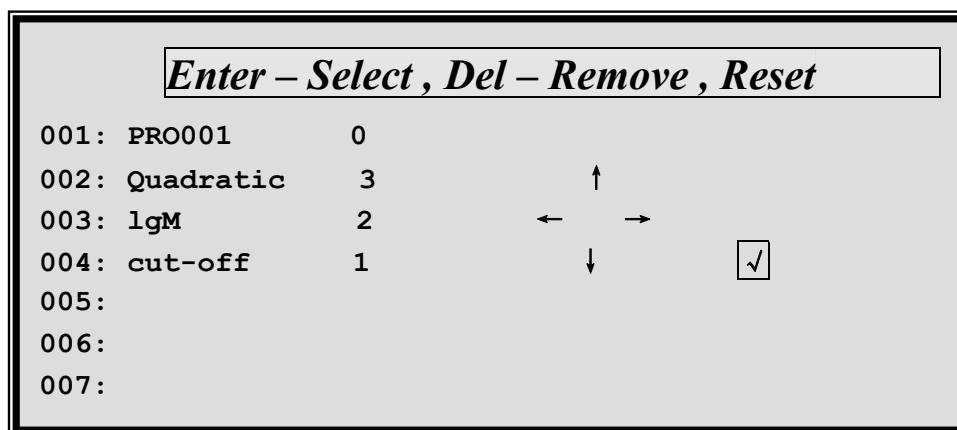


Fig.6 Selective items menu

This interface will display all the items stored in the instrument (total 126). For the items that have been edited and stored, the number, item name and detect type will be displayed. Take "001: PRO001" for example: "001" stands for the number of the item; "PRO001" is the name of the item; "0" indicates the absorbency detection. (This position can also include other numbers 1-Cutoff Formula 2-Cutoff Control 3-Concentration) The blank item displays nothing.

When the items are selected, the cursor can be moved through , , , . Afterwards, press **Enter**. Select a blank number to establish a new item. If a stored item is selected, its parameters can be modified. The detailed information on the keys is as follows:

1. , , , are used to move the cursor . Then, press to select the appointed item. , Can move only one item each time, while , can move seven items, at most 126 items.
2. is used to delete an appointed item
3. is used to return to the main interface.
4. is used to print the programme information about the selected item.

After selecting an item number, the next programme can be continued.

5.2.2 Item name and number

After selecting an item, press to enter the menu displayed as the following figure7:

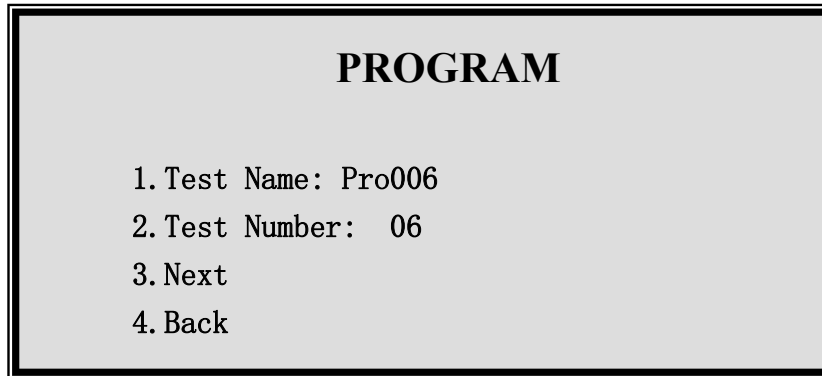


Fig.7 Item name, number menu

Operation explanations:

Test Name is blank if the item is newly established, while it is what has been inputted if it is the modification to the stored item. Test Number displays the item number. The default position of the cursor is at . You can directly go to the **Next** by pressing if no modification is needed for the above two items. You can return from the programme and go to the main interface by pressing . Press if you want to modify the item name, and then input item name according to the methods in 3.2.2. Item number can be modified by pressing . (from 1-126). After the selection, the cursor will automatically move to the next position and you can enter the **Next** by pressing .

Menu explanation:

1. The frontal numeral serial number in the menu present the whole menu. For example: The following “1” stands for “1. Test Name:”. The subsequent is the same.
2. “**3.Next**、**4.Back**”in the subsequent interface has the same function. Hence, there is no explanation in the following parts.

5.2.3 Wavelength

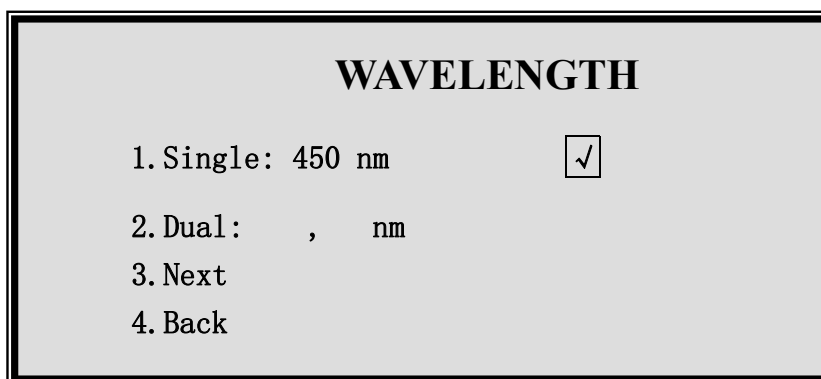


Fig.8 Wavelength menu

Operation explanation:

With the consideration that working wavelengths of most tests are 450nm, the single wavelength working mode is set as default in the instrument and the default wavelength is 450nm. The cursor will

stay on **Next** automatically. If the default value is consistent with the reagent specification, you can press **Enter** key directly and go into the submenu. Press **1_{abc}** to select single wavelength detection, and then input the prescribed working wavelength according to the reagent specification. Press **2_{def}** to select dual-wavelength detection. Be sure to input detecting wavelength first and then input referenced wavelength. If the instrument refuses the input wavelength, please return to the main menu to reset wavelengths again, and then reprogram. After all these steps, the cursor will shift to the Next position. Press **Enter** to go to **Next**

5.2.4 Single and dual well select

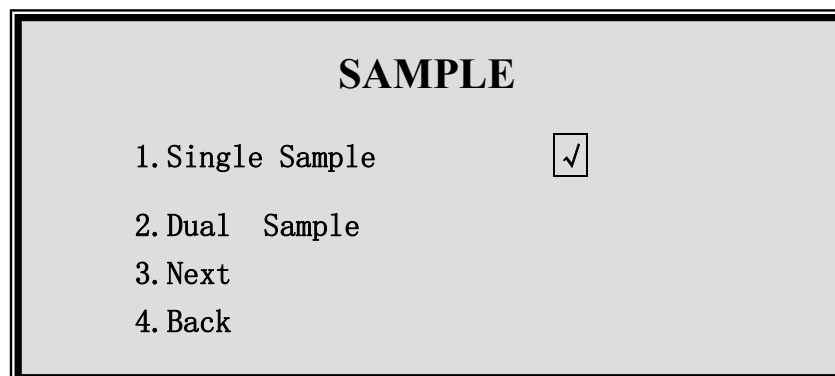


Fig9. Single and dual well menu

Operation Explanations:

With the consideration that most detect items adopts single well, the default detection mode for the instrument is single well. The cursor rests on the Next automatically. Directly press **Enter** to go to the Next menu if the default value is consistent with the reagent specification requirements. Place a copy of both standard liquid and sample when press **1_{abc}** to carry out single well detection.; When press **2_{def}** to carry out dual well detection, every two neighbouring wells are seen as a group (A1,A2), (A3,A4).....(B1,B2), (B3, B4)...(H11,H12). Take the average value of the absorbencies of the two wells. Put the same sample or standard liquid in a group of wells when the detection is performed. After the selection, the cursor will move to the Next automatically. You can press **Enter** to go to the Next.

5.2.5 Shaking mode

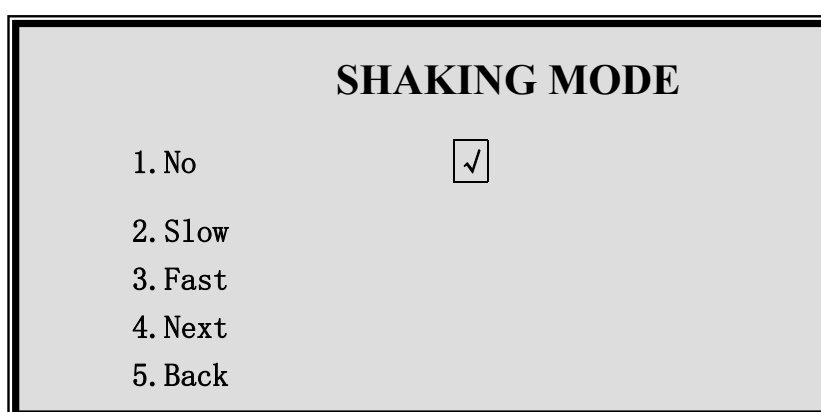


Fig.10 Shaking mode menu

Operation explanations:

The equipment has shocking function, but the intensity is limited. If the user has prepared a vibrator, it is advisable to use the prepared vibrator rather than the equipment. When the instrument defaults "1.No", namely, there is no need to shock, press **Enter** directly to go to the Next. Press **2_{def}** to select slight shock while press **3_{ghi}** to select intense shock. After the selection, the cursor will go to the Next

automatically.. Then, press **Enter** to shift to the Next.

5.2.6 Detect mode

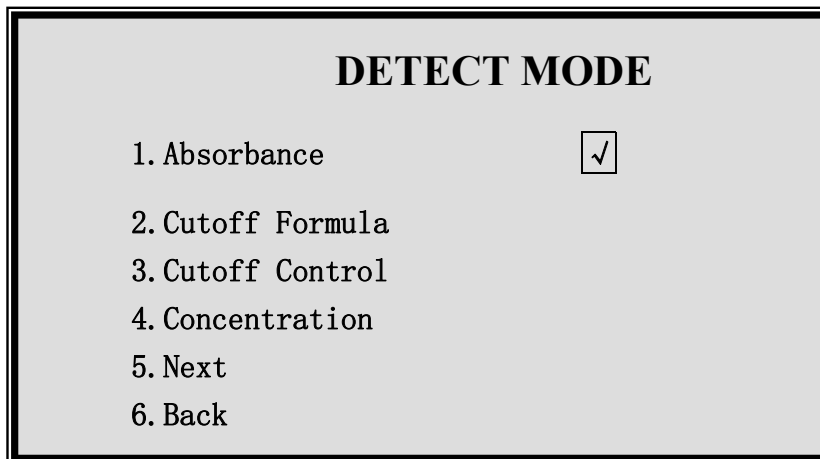


Fig.11 Detect mode menu

Operation explanations:

The default detect mode for this interface is absorbency detection. The cursor rests at **Next**. If the default value complies with the **reagents** specification requirements, press **Enter** directly to enter the next menu. The absorbency detection method can be selected by pressing **1_{abc}**, and it only displays the absorbency of the whole plate; Press **2_{def}** to select qualitative formula detection. Work out the critical value (cut-off value) by the contrast between negative and positive, which serves as the standard for judging the negative or positive of the sample. Select the qualitative control method by pressing **3_{ghi}**. Use the absorbency of low-positive well as the critical value (cut-off) value, and it also serves as the standard for judging the positive and negative of the sample. Press **4_{ijkl}** to select the concentration detection. There are nine methods to figure out the concentration of the sample. After the selection, the cursor will shift to the next position automatically. Press **Enter** to go to the Next.

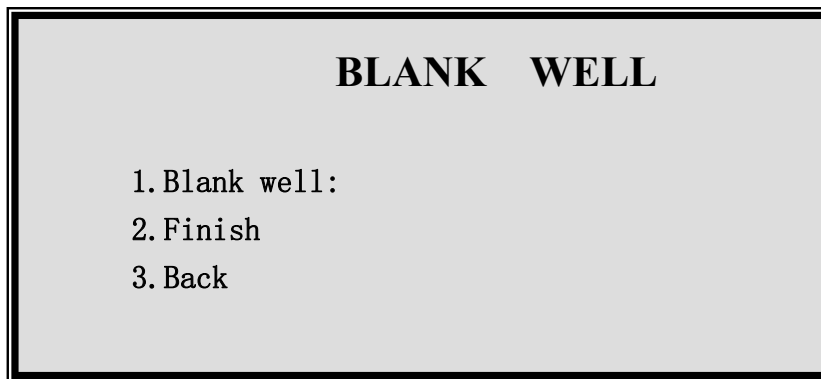
Menu explanation:

1. “1” The current item setting is the absorbency detection method. It only detects the absorbency of the whole plate and displays the value.
2. “2” The current item setting is qualitative (formula method): the critical value, which also acts as the judging standard for the detection results, is calculated value of the appointed formula. After the detection, the absorbency of the whole plate or the quotient of sample and critical value (cut off value) is displayed on split screen.
3. “3” The current item setting is qualitative control method. Regard the absorbency of the low-positive well as the critical value (cut-off value). After the detection, the absorbency of the whole plate or the quotient of sample and critical value (cut off value) is displayed on split screen.
4. “4” The current item setting is quantitative method. It supports nine kinds of quantitative calculating methods, for example, single-point quantitative, point-point quantitative, linear regression quantitative, and quadratic non-linear quantitative mode, etc..

Note: After this procedure, the machine will enter different interfaces according to different calculating mode. The following is the detailed information.

5.2.7 Blank well setting for the absorbency method

Fig.12 Menu of the blank well setting for the absorbency method



Operation explanations:

The cursor will rest at **2.Finish** if the absorbency detection method is selected. When the blank well is not appointed in the **reagents** specification, press **Enter** directly to finish the programme. But if the blank well is **set**, the original absorbency of the whole plate will subtract the absorbency value of the blank well. Press **l_{abc}** to enter the operations of the blank well input. Input the wells according to 3.2.2. As soon as the input of one well finishes, the cursor will shift to input position of next well. (there are at most 3 blank wells) When the cursor shift to a new position, press **Enter** to retreat from the blank well input operations. For example, Press **l_{abc}** to input the blank wells, afterwards, input “A1” and press **Enter** to finish the input of current well. Meanwhile, the system will add “,” and move to a new position. At this time, press **Enter** directly to withdraw from the well input operations. The cursor will return to “**2.Finish**”. The operation for an appointed blank well is completed. After the selection, the cursor will automatically move to the next **position**. Press **Enter** to go to the Next.

5.2.8 Programming complete, enter and save

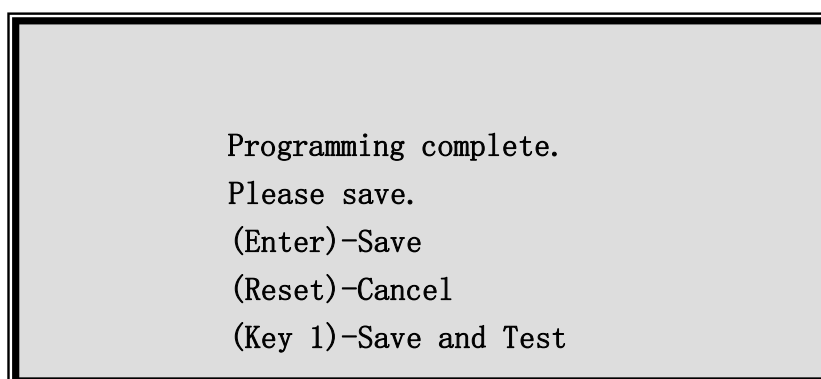


Fig.13 Programming complete menu

Operation explanation:

Up till now, the programming operations is completed. The cursor will rest at **Save**. If the user wants to save the current programming results, he/she can press **Enter** directly to save the programming information in the program section appointed by the item number and return to the main menu. If the user wants to give up the programming results, he/she can press **Reset** to save nothing and return to the main menu. However, if the user wants to use the current item to detect, he/ she can press **l_{abc}** to save the program results firstly and then shift to the detection directly.

5.2.9 Cutoff Formula programming explanations

5.2.9.1 Calculating mode

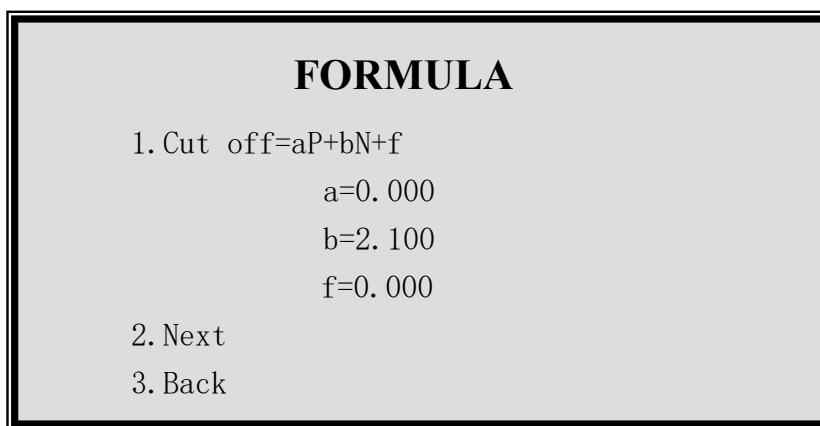


Fig.14 Calculating mode menu

Operation explanations:

Definition of the letters in the formulas:

Cut off-----Cut off value of qualitative; N---- Average absorbance of negative-comparison wells;

P--- Average absorbance of positive-comparison wells;

a, b,f--- Parameters to be input (according to reagent specification)

The cut off value is appointed by the form of formula. The calculating results of this formula is regarded as the standard for determining the positive or negative of the sample. Besides, the quotient of the sample and the cut off value is the detecting results. For example, 0.5 time negative contrast value is stipulated as Cut off in the **reagents** specification. The parameters a, b, f should be inputted according to the following formats:

a=0.000 b=2.100 f=0.000

The systems defaults that a=0, b=0,f=0.But during the actual use, the user should correctly input three parameters. After the input, the cursor will shift to the next position automatically. Press **Enter** to go to Next.

5.2.9.2 Qualitative judgement and gray area setting

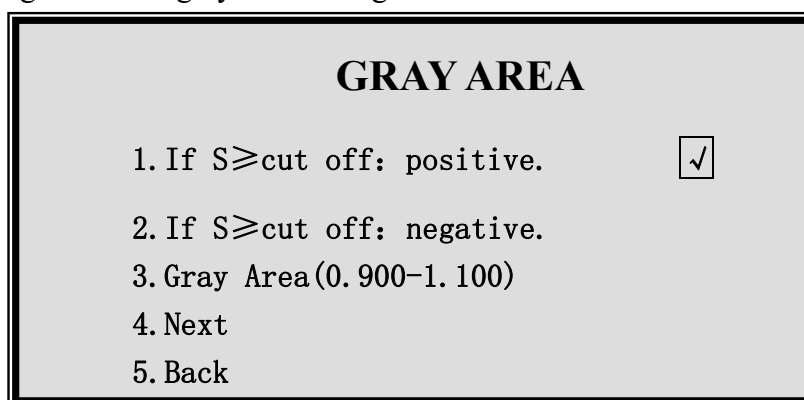


Fig15. Menu for qualitative determinant and gray area

Operation explanation:

S stands for the absorbency of the sample. The first qualitative direction suits the items that if the value of the sample to be tested is not less than **C.O.** (cut-off value), it is positive (+); contrarily negative (-);The second qualitative direction suits the items that if the value of the sample to be tested is not less than **C.O.** (cut-off value), it is negative (-); contrarily positive (+); The gray area is used to specify the dubious range around the C.O. value. The two displayed figures multiply the Cutoff value respectively, and the results is the specific gray area scale. For example, when 0.900-1.100 is inputted,

it means that: When the absorbency of the sample is more than $0.9 \times \text{cutoff}$ **while** less than $1.1 \times \text{cutoff}$, the sign “G” reminds the operator that the sample is in the gray area. The machine defaults the first qualitative direction, and the gray area is 0.900-1.100 times of Cutoff. If the default value is in accordance with the requirements in the **reagents** specification, press **Enter** directly to go to the Next menu.

Menu explanations:

- “1” specifies that when the sample absorbency is \geq Cutoff value, the result judgement is positive(“+”);
- “2” specifies that when the sample absorbency is \geq Cutoff value, the result judgement is negative(“—”);
- “3” specifies the gray area range. It requires to input two floating point numbers from small to big.

5.2.9.3 Limiting range of negative-comparison values

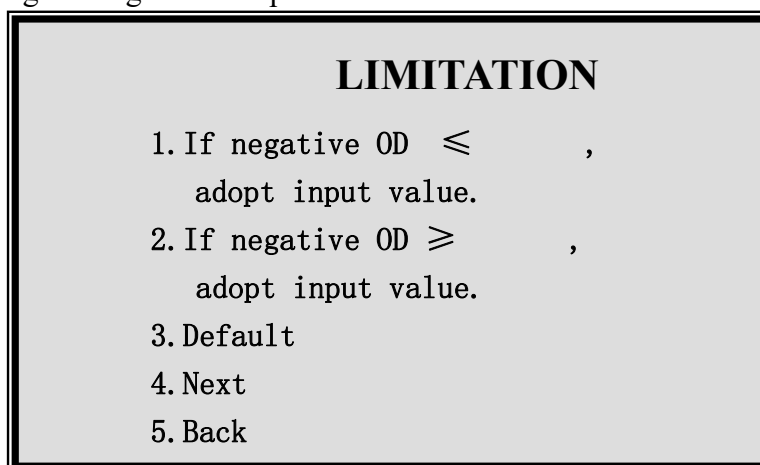


Fig.16 Menu of negative-comparison values

Operation explanations:

If the reagent specification prescribes that you should calculate according to the input value when the negative-comparison value is less than the input value (for example: 0.05), please select the first item and input the regulated value. If the reagent specification prescribes that you should calculate according to the input value when the negative-comparison value is less than the input value (for example: 0.05), please select the second item and input the regulated value. This item is optional. There is no limitation of negative-comparison values for the default options. (3. Default). Examine the reagent **reagents** specification to see if there is requirements for the negative-comparison value. If not, press **Enter** directly to skip over it.

Menu explanation:

- “1” when the absorbency of negative-comparison value is \leq the appointed value, the negative-comparison value (N) is to be calculated according to this value. (optional item)
- “2” when the absorbency of negative-comparison value is \geq the appointed value, the negative-comparison value (N) is to be calculated according to this value. (optional item)
- “3” there is no limitations for negative-comparison value. (N)

5.2.9.4 Limiting range of positive-comparison values

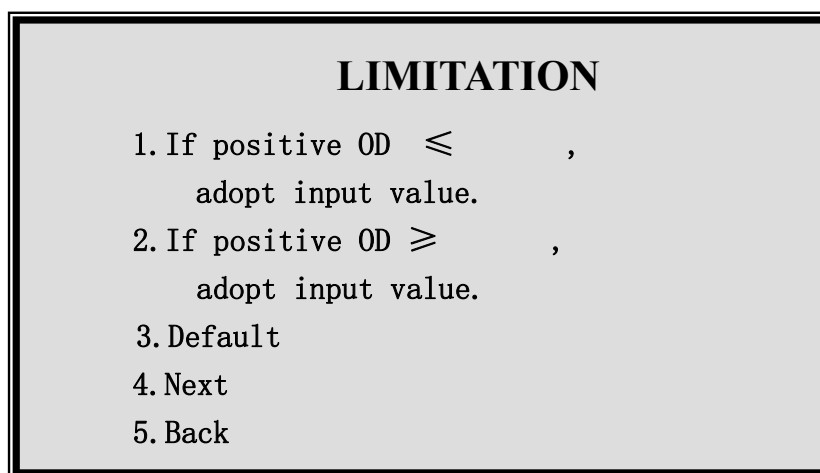


Fig.17 Menu for positive-comparison values

Operation explanation:

If the reagent specification prescribes that you should calculate according to the input value when the positive-comparison value is less than the input value (for example: 0.05), please select the first item and input the regulated value. If the reagent specification prescribes that you should calculate according to the input value when the positive-comparison value is less than the input value (for example: 0.05), please select the second item and input the regulated value. This item is optional. There is no limitation of positive-comparison values for the default options. (3. Default). Examine the **reagents** specification to see if there is requirements for the positive-comparison value. If not, press **Enter** directly to skip over it.

Menu explanation:

- a. "1" when the absorbency of positive-comparison value is \leq the appointed value, the positive-comparison value (P) is to be calculated according to this value. (optional item)
- b. "2" when the absorbency of positive-comparison value is \geq the appointed value, the positive-comparison value (P) is to be calculated according to this value. (optional item)
- c. "3" there is no limitations for positive-comparison value. (P)

5.2.9.5 Invalidity judgement

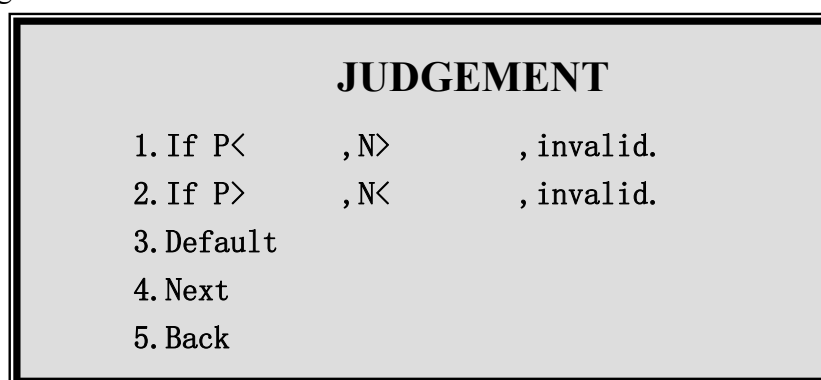


Fig.18 Invalidity menu

Operation explanation:

This option is optional. The default option stipulates no invalidity judgement (3.Default). Examine the **reagents** specification to see if there is requirements for **judging** the range of the negative-comparison absorbency and positive-comparison absorbency. If no requirement, press **Enter** directly to skip over it. For example: If the **reagents** specification stipulates that: the positive

-control absorbency value(P) should be more than 0.8 while the negative-comparison absorbency value (N) should be less than 0.1.. here, first press **1_{abc}** and input 0.8, 0.1 in turn. It shows: Under the circumstance of $P < 0.8$ or $N > 0.1$, the detecting results is invalid. Press **2_{def}** to perform restrictions in the opposite direction. If the invalid condition that has been inputted is not wanted, the user can press **3_{ghi}**. This means that the invalidity judgement of the detecting results is not performed any more. After the selection, the cursor will move to the next position automatically. The user can press **Enter** to go to the Next.

5.2.9.6 Wells input

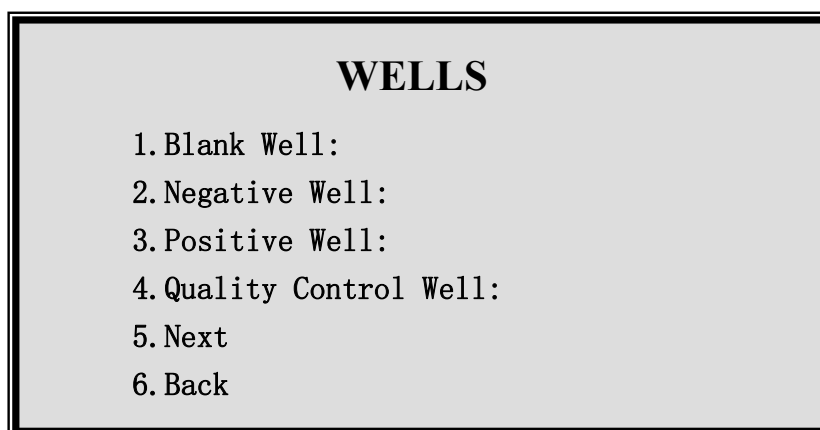


Fig.19 Menu for wells input by qualitative formula method

Operation explanations:

Setup the positions of the blank well, negative well, positive well, and quality control well on the enzymatic plate. The instrument allows each comparison well to be set at any place on the plate. The code of the inputted well should comply with the actual arrange of the sample on the enzymatic plate. The next procedure is possible only after the input of the negative **and** positive wells. Input the wells in compliance with the methods explained in 3.2.2. Add “,” automatically between multi-wells. At the input position of a new well, press **Enter** directly to finish the input operations of the current wells. After each operations, the cursor will shift to next position automatically. Press **Enter** to go to the next.

Menu explanation:

- a. “1” position of the blank well input, at most 3. (optional)
- b. “2” position of negative comparison well input, at most 3.
- d. “3” position of positive comparison well input, at most 3.
- e. “4” position of quality **control** well input, at most 1. (only the former 5 serial number items are available. Optional)

5.2.9.7 Complement of programing, enter and save

The operations are the same as 5.2.8. The user has the right to save the programme or not and can return to the main menu or carry out the detections directly.

5.2.10 Explanation for Cutoff control programme

5.2.10.1 The setting of the gray area and qualitative judgement are the same as 5.2.9.2.

5.2.10.2 The limiting range of the negative-comparison value is the same as 5.2.9.3.

5.2.10.3 The limiting range of the positive-comparison value is the same as 5.2.9.4.

5.2.10.4 Validity judgement is the same as 5.2.9.5.

5.2.10.5 Input wells

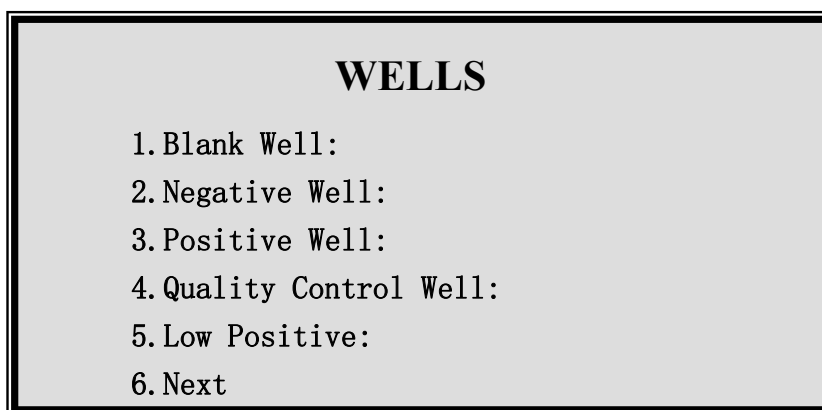


Fig.20 Menu for inputting wells by qualitative control method

Operation explanations:

Setup the positions of the blank well, negative well, positive well, quality control well, and low positive well on the enzymatic plate. The instrument allows each comparison well to be set at any place on the plate. The code of the inputted well should comply with the actual arrange of the sample on the enzymatic plate. The next procedure is possible only after the input of the low positive wells. Input the wells in compliance with the methods explained in 3.2.2. Add “,” automatically between multi-wells. At the input position of a new well, press **Enter** directly to finish the input operations of the current wells. After each operations, the cursor will shift to next position automatically. Press **Enter** to go to the next.

Menu explanations: the same as 5.2.9.5. But low positive well is added. (5. Low Positive).

5.2.10.6 Complement of programming, enter and save

The operations are the same as 5.2.8. The user has the right to save the programme or not and can return to the main menu or carry out the detections directly.

5.2.11 Explanation for quantitative detection (concentration)

5.2.11.1 Calculation modes

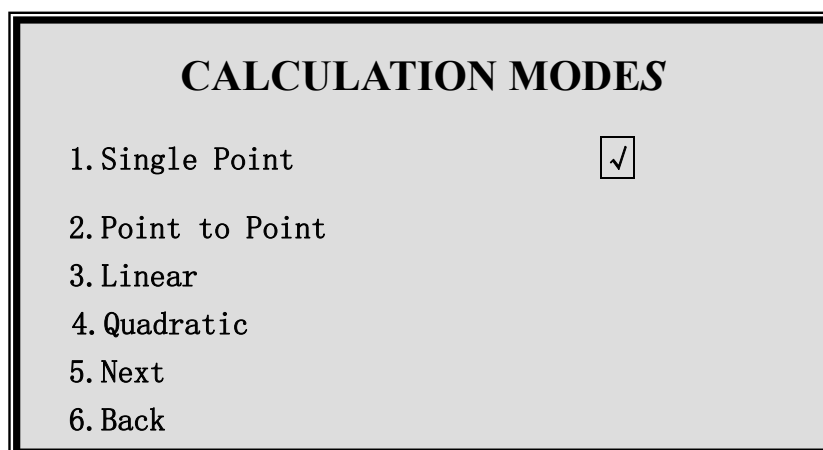


Fig.21 Menu for calculation modes

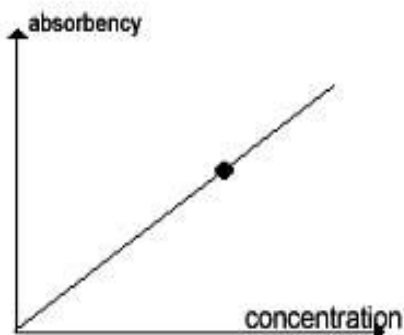
Operation explanations:

When the user decides to adopt the quantitative detection method, he/she should further specify the calculation method that he desires to use. This interface displays 4 calculation methods. But only one method can be selected. Press the corresponding numerical **key** directly and select the appointed calculating method. After the selection, the cursor will shift to the next position automatically.

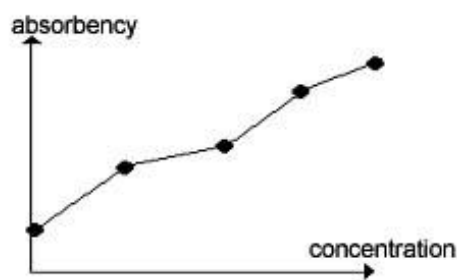
Press **Enter** to go to the Next. The default calculation method of the machine is single-point. If the user desires to use the default item, he/she can directly press **Enter** to skip over it..

Menu explanation:

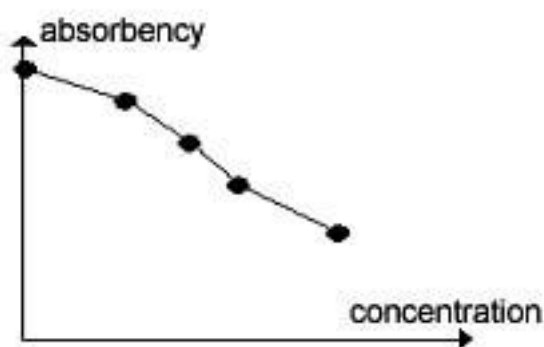
a. "1" single point. A standard should be set up. The calibration curve is the connection of the origin and the standard point. (the abscissa standards for the concentration while the ordinate standards for the absorbency.). Blank well should be setup for single point calibration to adjust zero point.



b. "2" point to point method (folding line method). 2-8 standard are allowed to be set up. The calibration curve is the connection between the standard points.

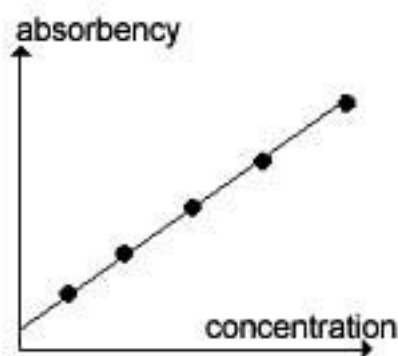


A-C is positive correlation



A-C is negative correlation

c. "3" linear regression method. The linear regression method allows transform from ordinate to abscissa, thus making the six regression calculating method A-C, logA-C, logA-logC, A-logC, %-C, %-logC become possible. During the clinical inspection, coordinate transform can be made and there is no need to specify. All are confirmed as linear regression method.



- 1) A-C: Linear regression method. 2-8 standard are allowed to be set. A beeline $Y=kX+b$ (namely $A=kC+b$), which is regarded as the calibration curve, is regressed from these standards.
- 2) logA-C: index regression. A index curve $Y=k10^{bX}$, which is regarded as the calibration curve, is regressed from these standards. The absorbency of the standards should be more than 0. If logarithm is taken from the absorbency ($Y'=\log Y$), the index regression can be changed to the form of linear regression: $Y'=b'X+k'$, namely ($\log A=kC+b$).
- 3) logA-logC: power regression. 2-8 standards are allowed to be set. A power curve $Y = kX^b$ acting as the calibration curve is regressed from these standards. The absorbency and concentration of the samples should be more than zero. If logarithms are taken from the concentration and the absorbency ($Y'=\log Y$, $X'=\log X$), the power regression can be changed to the form of linear regression: $Y'=b'X'+k'$, namely ($\log A=k \log C+b$).
- 4) A-logC: logarithm regression. 2-8 standards are allowed to be set. A logarithm curve $Y=k \log X+b$ regarded as the calibration curve is regressed from these standards. The concentration of these standards should be more than 0. If logarithm is taken from concentration ($X'=\log X$), then the logarithm regression can be changed to the form of linear regression: $Y=kX'+b$, namely ($A=k \log C+b$).
- 5) % - C: ratio regression. 2-8 standards are allowed to be set. The absorbency of the first standard is defined as 100% while the absorbency of other standards and samples to be tested are expressed by its corresponding percentage. The ratio and the concentrations of the standards are calculated according to the linear regression, namely ($A/A_0\% =kC+b$). Attention: The first standard required in this method should has the biggest absorbency. As for the negative relative regression, the first standard should has the smallest concentration and the biggest absorbency. While to the positive relative regression, the first standard should has the biggest concentration and absorbency.
- 6) %-logC: ratio half logarithm regression. 2-8 standards are allowed to be set. The absorbency of the first standard is defined as 100% while the absorbency of other standards and samples to be tested are expressed by its corresponding percentage. The logarithms of ratio and the standard concentration(namely, $A/A_0\%=k \log C+b$) are calculated in terms of the linear regression. The operations of standards should be performed in accordance with the notes stated in 5).
- “4” Quadratic equation of one variable method. 3-8 standards are allowed to be set. The concentration of the sample(namely $A=aC^2+bC+d$) is calculated according to $Y = aX^2+bX+d$, which is regarded as the calibration curve.

5.2.11.2 Report modes

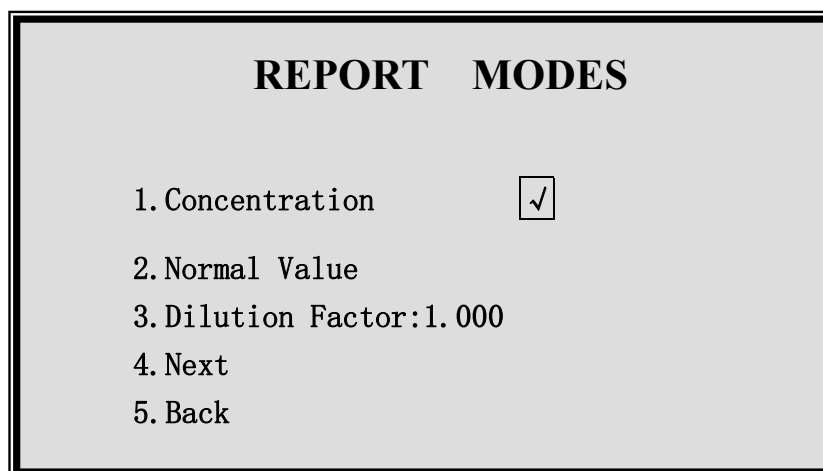


Fig.22 Menu for report modes

Operation explanations:

Quantitative detection supports two forms of report.: one form only displays the concentration value while the other form displays not only the concentration value but also the concentration state of the sample according to the reference range (high, low, or normal). Press **1_{abc}** to adopt the first report mode while press **2_{def}** to adopt the second report mode. After each operations, the cursor will shift to the next position automatically. Press **Enter** to go to the Next. Press **3_{ghi}** on this interface to set the dilution factor. The detection results of the concentration multiply the dilution factor, and the final concentration value is obtained. The default report mode only displays concentration value. And the default dilution factor is 1.000. If no modification is wanted, press **Enter** to go to the Next.

Menu Explanation:

- a. “1” displays and prints the concentration results, but it makes no judgements to the reference range.
- b. “2” displays and print the concentration results, but it makes judgements to the reference range. When the concentration value is smaller than the lower limit of the reference value, a “L” will be displayed in front of the concentration value. While when the concentration value is bigger than the upper limit of the reference value, a “H” will be displayed in front of the concentration value. When the concentration value is between the upper and lower limit, there displays no indicating signals.
- c. “3” is the dilution factor of the sample. There is only one dilution factor for the whole plate, that is to say, only the sample having only one kind of dilution factor can be detected on the piece of plate. The default value is 1.

5.2.11.3 Well setting

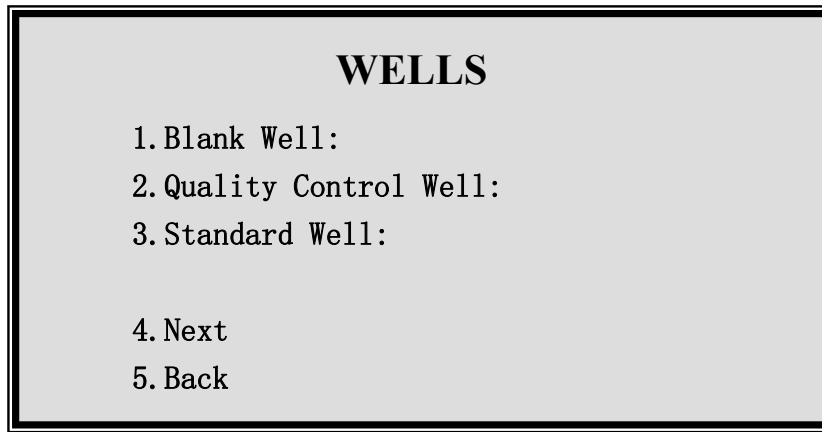


Fig.23 Menu for well setting

Operation explanation:

Press **1_{abc}** to input the blank well (at most 3) if blank comparison well is required in the reagents specification. When quality control is wanted for this item, press **2_{def}** and input the corresponding code of the quality control well. (Note: the instrument only stores the measured values of one quality control well. It only carries out quality control for item numbered as 01-05). Press **3_{ghi}** to input wells for the standard. At most 8 wells can be inputted. It is not allowed to input the same well number repeatedly. After each operation, the cursor will shift to the next position automatically. Press **Enter** to go to the Next. As the instrument does not default blank well and quality control well, so you can only enter the next after inputting the standard wells.

Menu explanations:

- a. “1” position for inputting blank well, at most 3. (optional)
- b. “2” position for inputting quality control well, at most 1. (only the first 5 item is available, optional)
- c. “3” input standard well, at most 8. Do not input same well repeatedly. After the operation, the cursor will go to the next place.. Press Enter to the next.
- d. The machine does not have blank well and quality control well. Input standard well if go to the next.

5.2.11.4 Standard concentration, concentration unit, reference value

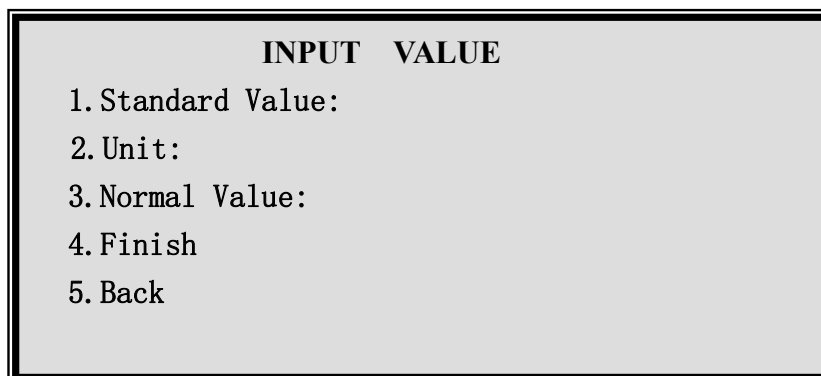


Fig.24 Standard concentration menu

Operation explanation:

1. Standard Value: Input the given concentration value of the standard in turn according to the sequence stipulated in the reagents specification. Press down **Enter** to confirm the inputted value. Note: the quantities of concentrations to be inputted should be the same as the quantities of the setted

standard wells in 5.2.11.3. when modification is needed for the concentration value that has been inputted, just press **Enter** to save the original value and shift to the next position. (there is no need to input each time). If report mode for reference value is selected in 5.2.11.2, press **3ghi** and input two reference values. Concentration unit can be inputted by pressing **2def** . (at most 10 characters). Refer to 3.2.2 for input method of concentration unit.

5.2.11.5 Programme finish, enter and save

Operations are the same as 5.2.8. Whether to save the program or to return to the main menu or carry out detections directly is optional.

Up till now, all the programming operations finish.

6. DETECTION OPERATIONS

6.1 Notes

Clinical detection could be performed after programming. In order to obtain accurate detection results, please pay attention to the followings:

6.1.1 The actual arrangement of the blank well, negative, positive comparison well or the standard well should be in accordance with the arrangement set in the detection program.

6.1.2 When new reagents is replaced, new negative, positive comparison sample should be used to calibrate again.

6.1.3 Perform the detection strictly according to the requirements and procedures stipulated in the instructions in the reagents box..

6.1.4 Set up inside quality control system, so as to grasp the quality of the spot detection by testing the quality control reagent.

6.1.5 Detection could be performed after at least 20minutes' warm-up. Detection couldn't be performed without warm-up.

6.2 Detection

6.2.1 Select items

When in the main interface, press **1abc** on the panel to choose detection function. then detect program menu will be displayed on the screen. Use **↑**, **↓**, **←**, **→** to move the cursor , then press **Enter** to choose current item. After adjusting the program, some general information of the detection methods will be displayed . Use **↑**, **↓** to check other programme information.

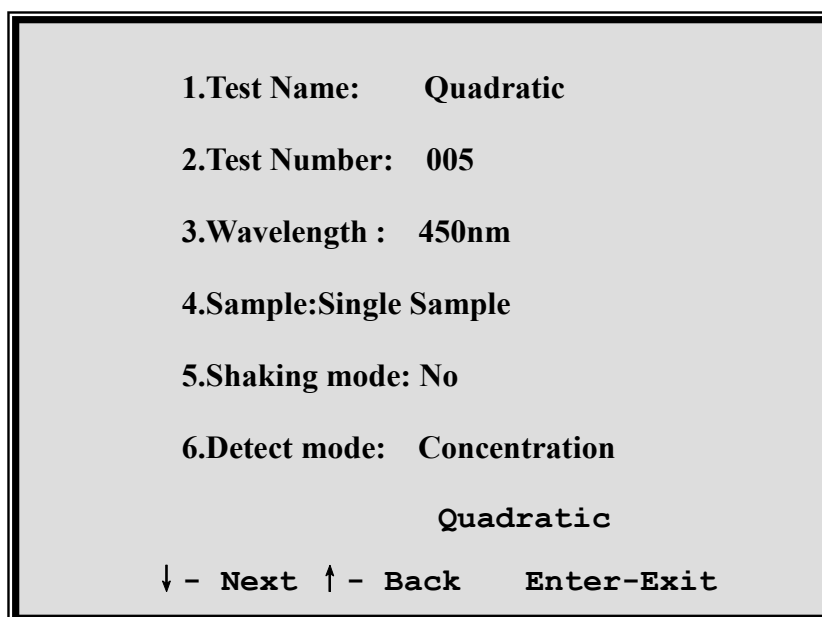


Fig. 25 The item information menu

Operation explanations:

This interface shows the chosen item, including item name, item number, wavelength, odd/even well detection, shaking mode, detection mode. Only item information is displayed but couldn't be amended directly. However, the item information can be amended by switching to the programme interface. After this, return to the item interface again.

Explanations for keys:

- a. **↓** show item information of next screen **↑** show item information of last screen
- b. **Enter** skip from the item information interface, and enter setting interface before detection.
- c. **Del** modify parameter of the current item, press it to go back to programme menu and make modifications.
- d. **Reset** jump out, and go back to the main interface.

6.2.2 Setting before detection

After the user has examined the selected item information, press **Enter** to enter setting interface before detection. When each detection is over, it will come back to this interface to remind whether to perform the same item continuously.

The remind interface is as below:

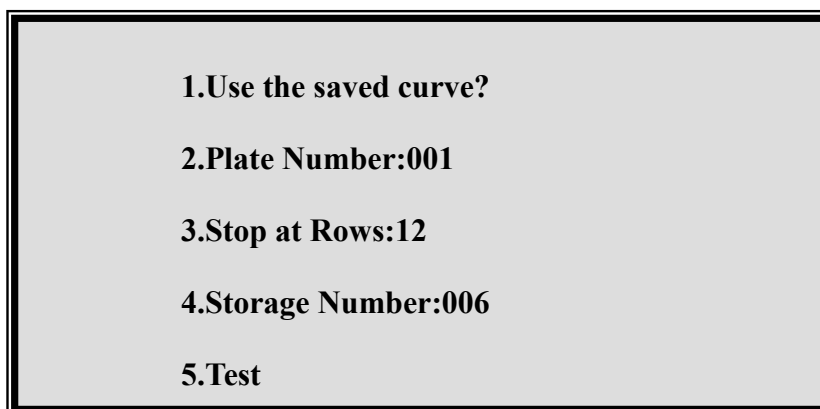


Fig. 26 Setting menu before detection

Operation explanations:

When choose qualitative and quantitative detection by repeatedly pressing **1_{abc}**, display **N** means use the last calibration parameter; Press **2_{def}** to input current plate number (recycle from 1 to 999). The plate number add 1 automatically for every plate reading. Press **3_{gh}** to confirm how many rows will be tested. Press **4_{ijk}** to modify the saved position of the detection results. After each operation, the cursor will stand at "TEST" position, then press **Enter** to perform the detection.

Menu explanations:

- a. "1" Switch to use the saved calibration parameter or not. When the user is carrying out the qualitative or quantitative detection, there is no need for he to put the comparison sample or standard if he intends to use the calibration parameter used before. He can calculate the sample results directly according to the last calibration parameter. If there is blank well in last calibration, the instrument will save the absorbency of the blank well. When this calibration parameter is used, the absorbency of the sample will subtract the saved absorbency of the blank well.
- b. "2" is used to set current enzymatic plate number, ranging from 1-999,
- c. "3" is to set how many rows will be tested, ranging from 1-12,
- d. "4" is to set starting position to save detection results. Totally 105 groups of absorbency and concentration values of the whole plates can be saved in the system. After storage is full, it will return

and cover the first data. User can enquire the current saving place, this value can be modified and saved in the new position. When display the detection result, press **Save** to save, the number for storage position will automatically add 1.

e. “5” is to start detection. The system defaults this item. Press **Enter** to start the detection.

f. Press“**Reset**” to jump out and return to main interface.

6.2.3 Start test

As soon as the detection starts, there will be a schedule bar to indicate the process of testing. Any key is unavailable during the detection..

6.2.4 Display detection result

6.2.4.1 Detection results display of absorbency method

After the detection, the absorbency values of all the wells will be displayed. Press **Reset** and **Enter** to skip from the display and return to 6.2.2. The interface for the absorbency results are as below:

Test:Quadratic		Plate No.:000	
05-10-19 11:51		450nm	
Absorbance			
	01	02	03
A	0.056	0.044	0.073
B	0.349	0.344	0.038
C	0.787	0.084	0.304
D	1.528	0.258	0.074

Fig. 27 Menu of absorbency display

Current item name is displayed in the top left corner while current plate number is displayed in the top right corner.

Detection time and wavelength is displayed in the next line. The absorbencies of the whole plate can not be displayed on the same screen, therefore, they can be obtained on different screens by direction keys.

The function of keys in this interface is as below:

- Reset** is to jump out, return to the interface before detection.
- ←** **→** **↑** **↓** are to move display interface and switch for displayed data
- Print** is to print the results of the current whole plate.
- Send** is to send data of the whole plate to PC software..

Explanations:

(1) The system has two correspond transfer agreement,

There are two communicating protocol in the instrument. Protocol1 is public open communicating protocol. (please refer to 7.4 for the details); protocol2 is used for the workstation softwares of our microplate reader. Remember to check if the communicating protocol to be used has been set before transmission.

Note: The communicating protocol should be preset according to 7.4 in chapter7 before transmission.

(2) Before the detection data is transmitted to external PC, please connect the signal wire and set PC under receiving mode.

(3) When the detected absorbency is displayed, press **Send** on the panel to send data.

e. **Save** is to save data of the current plate for enquiry in the future.

6.2.4.2 Display of qualitative detection results

After the detection, the absorbencies of negative, positive, low positive comparison wells, the cutoff value, and gray area are displayed firstly. Refer to the following figures. At this time, the users are allowed to modify the absorbencies of negative, positive, low positive comparison wells and the cutoff value. (the modification is possible by pressing down the corresponding **Label**—**4jkl**). Meanwhile, the sample should be re-judged according to the changed parameters. Press **Reset** in this interface to skip from the display and return to 6.2.2. **Note: as this interface does not support printing function, so the parameters information will be printed out together with the print of S/CO value.**

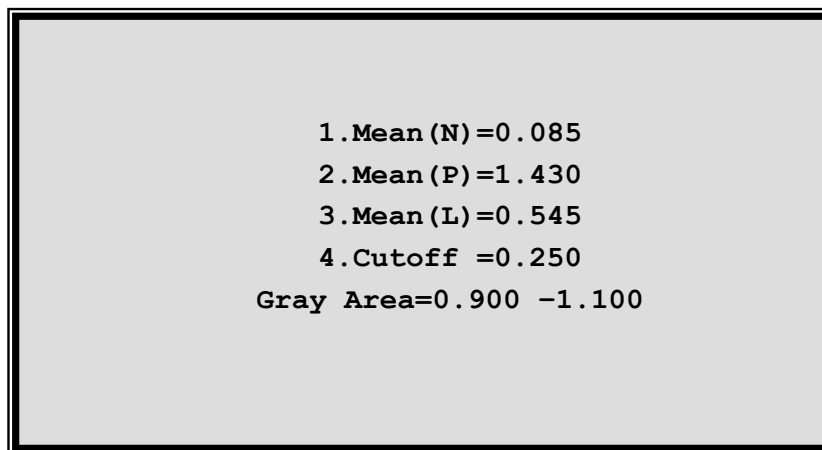


Fig.28 Menu for qualitative comparison value

Press **Enter** in this interface, then the absorbency of the sample will be displayed. (operations and the display format are the same as 6.2.4.1). Press **Enter** once again in the interface that displays absorbency to switch to the interface that displays qualitative results (S/CO). The display format of qualitative results is similar to that of absorbency. But there are still differences: 1. the third line displays Result rather than absorbence ; 2. add a character (“+”, “-”, “?”) that judges the results before the displaying S/CO value. For example, “+1.65” (S/CO=1.65). Different information can be switched by pressing **Enter** continuously. Users can retreat from the display by pressing **Reset** and return to 6.2.2.

6.2.4.3 Display of quantitative detection results

First, information concerning the standard wells is displayed. The users are allowed to modify the absorbency of the standard to calibrate the standard curve. The figure is as follows. The current state is the concentration value by quadratic method of quantitative detection. There are four standards in total. The information under ABS is absorbency while the information below STA is standard value. The concentration of a certain standard can be changed by pressing on the keyboard. After the modification, the coefficient of the equation should be recalculated, and the concentration result should also be recalculated.

	ABS	STA
1#	0.056	0.900
2#	0.349	1.100
3#	0.787	2.200
4#	1.528	3.330
$Y=0.039X^2+0.400X-0.250$		
Y Axis: A		X Axis: C
1-4 Abs		

Fig.29 Menu for calibration value

The X-axis and Y-axis of the calibration curve and the calibration regression coefficient are all figured out from the parameters in this interface. The axes can be changed under this interface for linear regression method, thus making the linear regression, logarithm regression, index regression, power regression, percentage regression, and ratio regression possible. **Note: single point, point to point, as well as quadratic do not support the change of axes.**

Under this interface, press **Reset** to skip from the display and return to 6.2.2. Press **Enter**, and the calibration curve is displayed as follows:

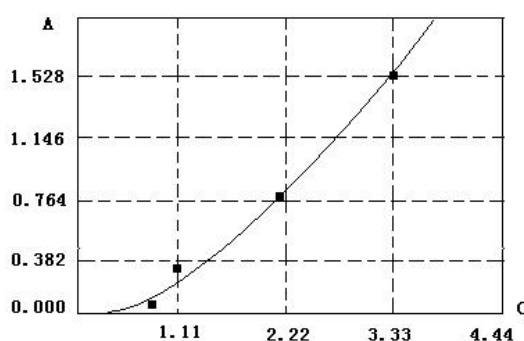


Fig.30 Calibration curve

The small black pane in the figure means the standard value. Press **Print** to print the calibration curve. Note: as the printer will withdraw the paper automatically after the calibration curve is printed, so it is suggested to print the results of absorbency and concentration value first, afterwards, the calibration curve can be printed.

In the interface that displays the calibration curve, press **Reset** to retreat from the display and return to 6.2.2. Press **Enter** to switch to the sample absorbency display (the operations and display format are the same as 6.2.4.1). Press **Enter** again in the interface that displays the absorbency to switch to the qualitative interface. The display format of the quantitative results is similar to that of the absorbency. But there are several explanations:

- The third line displays Result rather than Absorbance.
- If judgement on reference value after the concentration detection is made, “H”, “L” that indicating the reference range will be added before the concentration value.
- If the detection results display 99999, it means that the concentration of the sample exceeds the linear range, and a new detection is needed after the diluent multiples is changed. Different display information can be switched by pressing **Enter** continuously. Press **Reset** to skip from the display

and return to 6.2.2.

6.2.5 Detection finishes

When the detection is finished, press **Reset** continuously and the instrument will return to the main interface. At this time, press **5mno**, and the tray of the enzymatic plate will go to the inside of the instrument automatically. Afterwards, turn off the power switch and pull out the power plug.

7. SYSTEM SETTING

7.1 Basic Operations

Select **4jkl** in main menu to enter the system setting. The screen displays as follows:

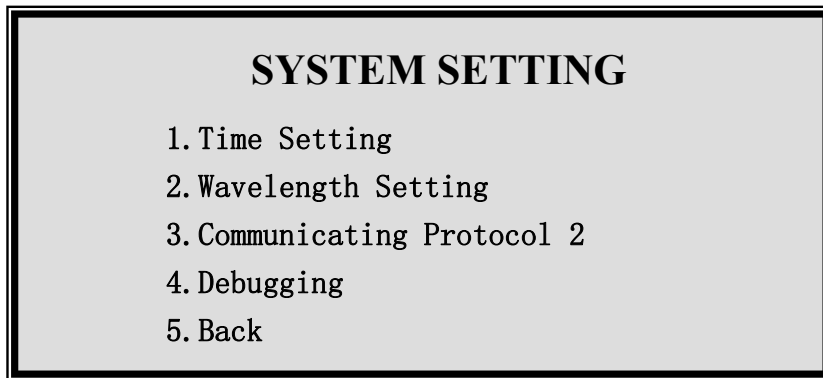


Fig.31 Menu for system setting

Operation explanations:

This function is used to set the time, wavelength, communicating protocol and debugging optical path system. Press the corresponding numeric key to start the corresponding function. You can return to the main menu by pressing **5mno**

Menu explanations:

- "1" is used to set the clock of the system. The programme time, detection time, and quality control month are all based on this.
- "2" is used to set the wavelength for the filters. **Note: Set the wavelength value according to the normal sequence, otherwise, self-check malfunction and incorrect detection results will occur to the instrument.** Normal setting sequence: 450, 630, 492, 405. The instrument defaults these four wavelengths. If a new filter is replaced, new wavelength should be reset after the installation.
- "3" chooses the communicating protocol used for communicating with PC. There are two kinds of protocols: 1-public open protocol (can be used by the users to develop softwares independently.); 2-communicating protocol matching the software of this microplate reader workstation of our company.
- "4" is used for the debugging system in the process of manufacturing. Thus, it makes no practical sense for users.
- "5" Return to the main interface.

7.2 Time Setting

Press **1abc** in system setting interface (refer to 7.1) to enter the function of modifying date and time. Then, input the correct date and time in turn. After the input, the instrument will return to the up menu automatically. The user can examine the time in the main interface. The interface of time setting is as follows:

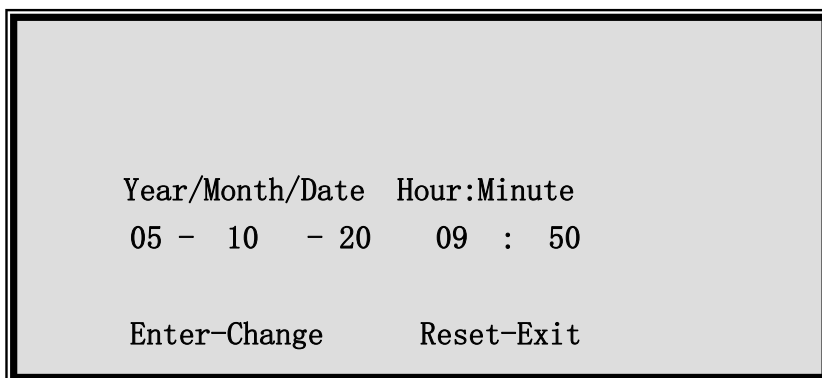


Fig.32 Menu for time setting

Operation explanations:

When this interface is displayed, press **Enter** to input date and time parameters one by one. When the input is invalid or illegal, the system will remind the user to input again. If **Reset** is pressed, no modification is made to date and time and the system returns to the main interface.

7.3 Wavelength Setting

Press in system setting interface (refer to 7.1) to enter the function of wavelength setting. Input the wavelength data of the filters in sequence (nm). Note: the input sequence should be in accordance with the array of filters on the filter plate. Otherwise, incorrect results will occur. Four pieces of filters have been installed in the instrument. Note: The input sequence of the filters should be 450, 630, 492, 405; Other wavelengths should be set as 0.

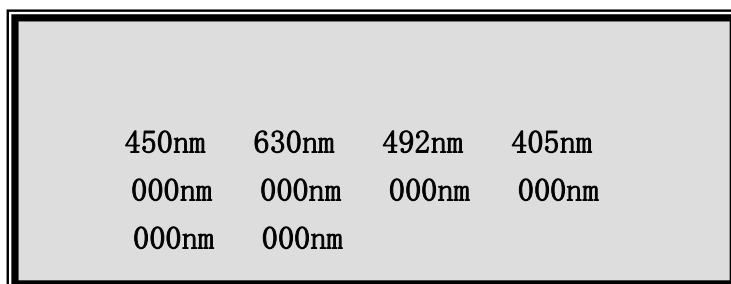


Fig.33 Menu for wavelength setting

Operation explanations:

When this interface is displayed, press **Enter** to input the wavelengths value one by one. All the values should be reset when the wavelength value is modified each time. If **Reset** is pressed, then the input is given up and the system returns to the main interface.

7.4 Communicating Protocol

Press in the system setting interface (refer to 7.1) to switch for the communicating protocol. Two communicating protocols are used : communicating protocol1 or communicating protocol2. Communicating protocol1 is interface protocol of public open software data. (ordinary protocol); communicating protocol2 is interface protocol of software data developed by our company for the microplate reader workstation. (encrypt protocol)

7.4.1 Detailed data format of communicating protocol1:

Serial communication: RS232C

Baud rate: 2400 bpc

Data bit: 8 bit

Odd /even checkout: no

Stop bit: 1 bit (work mode of the single chip inside the instrument: 8 bit UART mode1)

7.4.2 Data format of communicating protocol1: prefix+absorbency value of the 96 wells. Each absorbency value is composed of 3 bytes. Total transmitting bytes: 1+96x3=289, expressed by the form of hex.

7.4.3 Well sequence of communicating protocol1: prefix+well A1 + well B1 + well C1 +..... + well G1 +well H12

7.4.4 Data expressing mode of communicating protocol1:

‘@’ + [quotient of (integer fraction of absorbency + (decimal fraction X 1000/128) + remainder of (decimal fraction X 1000/128))

Take the incept of the following hex sequence for example:

40	03 02 42	00 00 73
prefix '@'	A1absorbency	B1absorbency $0+(0x73/1000)=0.115$
	integer fraction: 3	
	decimal fraction1: $(2 \times 128) = 256$	
	decimal fraction2: 0x42(hex form) algorism66	
	absorbency is $(3 + (256 + 66) / 1000) = 3.322$	

7.5 Debugging

Press in system setting interface (refer to 7.1) to enter debugging function, which is used to check the intensity of the optical path. This can facilitate the system maintenance. There is no need for users to start this function. Signals information of eight optical paths will ne displayed after entering the debugging function. The signal information will be expressed by sampling A/D value, with the max value being 32767. (The value is negative if it is more than 32767)

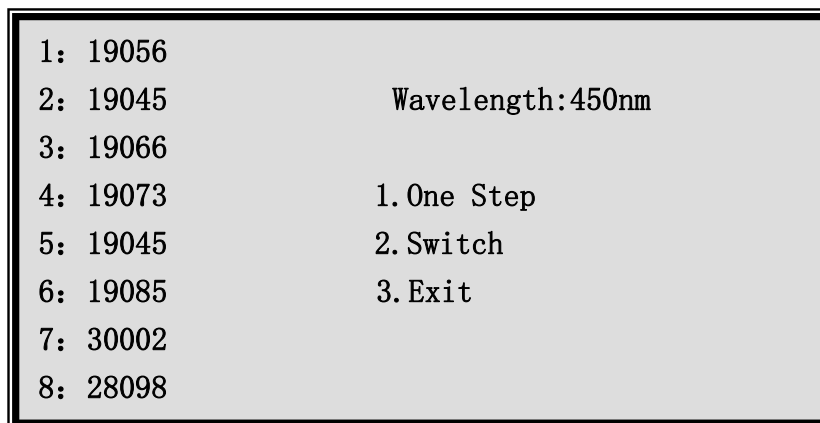


Fig.34 Menu for debugging

Menu explanations:

- “1” move the enzymatic plate forwards by one grille.
- “2” switch to another wavelength.
- “3” Exit from debugging function. “Reset” exits from debugging function.

8. INQUIRY

8.1 Basic Operation

Press **3_{ghi}** on the mian interface to confirm the function of inquiry. Quality control data, detection

results, programme item parameters, and calibration curves can be inquired. The interface for inquiry is as follows:

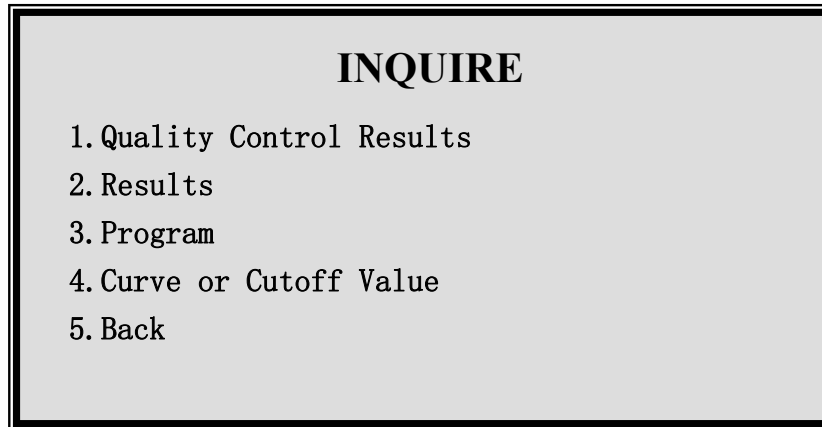


Fig.35 Inquiry menu

Menu explanation:

- a. “1” Inquiry quality control results and quality control figure. (at most 5 groups, only the first 5 items can be quality controlled)
- b. “2” Inquiry the detection results. (detection results of whole plate of at most 105 groups)
- c. “3” Inquiry the programme item information. (at most 126 pieces of item information)
- d. “4” Inquiry the cutoff value of qualitative detection and the calibration curve of quantitative detection. Parameters can be modified.
- e. “5” Return to the main interface..

8.2 Inquiry Quality Control Results

Press on the inquiry interface to enter the inquiry function of quality control results. First, the quality control data of the first quality control item for this month is displayed as the following figures: the topside displays the codes of current quality control items (from 1-5). [01]-[31] standards for the date. The figure 0.300 in the lower part is the quality control results corresponding to the date. Note: When the quality control results is 0, it displays nothing and no quality control operation is done.

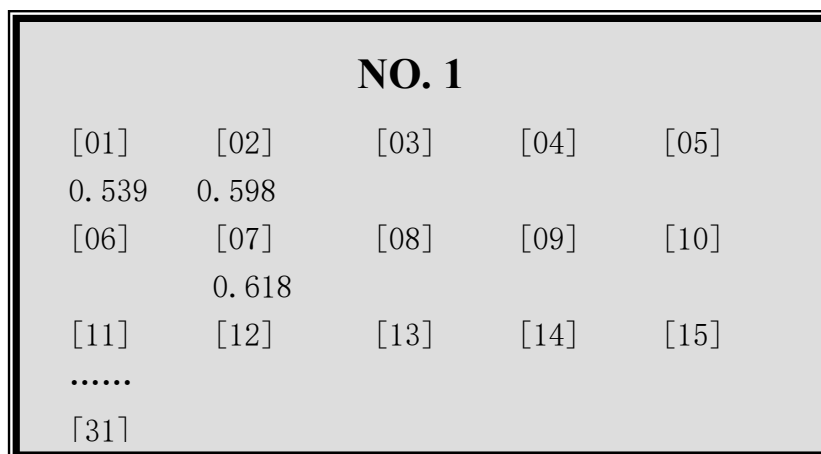


Fig.36 Menu for quality control data

Explanations for keys:

- a. Switch for quality control item forwards. **NO.5** → **NO.4** → **NO.3** → **NO.2** → **NO.1** → **NO.5**.
- b. Switch for quality control item backwards. **NO.1** ← **NO.2** ← **NO.3** ← **NO.4** ← **NO.5** ← **NO.1**
- c. Print out the current quality control data. The printing results include SD, X, and CV value.

- d. **Reset** Return to the inquiry interface.
 - e. **Del** Delete the quality control data of current month.
 - f. **Enter** Carry out the next procedure. Enter the interface to display SD, X.
- After the quality control item is selected, press **Enter** to go to next and to display and modify SD, X value. The interface is as follows:

RCV	
X =0. 585	X=
SD=0. 041	SD=
CV=0. 070	CV =
	1-Edit X
	2-Edit SD

Fig.37 Menu for SD, X display and modification

The left side displays the X, SD values calculated from the quality control data of the selected item. The right side is X, SD values used for drawing quality control figures. Remember to modify the X, SD values in column RCV (CV value is calculated automatically.), which serves as the standard for drawing quality control, before drawing quality control figures.

Explanations for keys:

- a. **1_{abc}** Input X value under RCV column.
- b. **2_{def}** Input SD value under RCV column.
- c. **Reset** Return to the inquiry interface.
- d. **Enter** Carry out the next procedure and go to the interface displaying quality control figure.

Quality control figure displays:

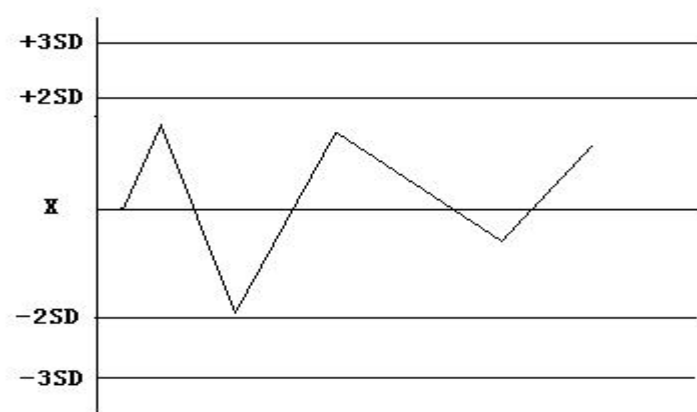


Fig.38 Quality control figure

Explanations for keys:

- a. **1_{abc}** Staff gauge for displaying date (displaying staff gauge. Staff gauge is also printed when printing is performed).
- b. **2_{def}** Staff gauge for eliminating date.
- c. **Print** Print out quality control figure.
- d. **Reset** Return to the inquiry interface.

8.3 Inquiry Detection Results

Press **2_{def}** on inquiry interface to enter the inquiry interface of detection results.

Name	Time	
001: PRO001	05-10-11	
	10: 06	↑
002: 1gM	05-10-22	← →
	11: 05	↓
003:		
007:		

Fig.39 Menu for detection results inquiry

Operation explanations:

The information below the Name column displays the numbers of the saved positions and the corresponding item name. The information below Time column records the date and time of the saved results. 7 pieces of detection results is displayed on each screen. Switch for screens to display by pressing down direction key. Select the detection results to be inquired by moving the cursor. Afterwards, press **Enter** to confirm the inquiry.

Explanations for keys:

- ←** Page up
- Page down
- ↑** Cursor up
- ↓** Cursor down
- Reset** Return to the inquiry interface
- Enter** Examine the currently selected detection results. (the current selected refers to the position where the cursor rests at). The interface for displaying results is the same as what is displayed during the detection. However, save function can not be executed further more.

8.4 Inquiry Item Parameters

First, the interface for selecting items will appear (same as chapter 5.2.1). Then, the detailed item information will be displayed. The displaying format and operation modes are the same as these of the item list displayed during the detection operation. Thus, they are omitted.

8.5 Inquiry the Calibration Curve or the Cutoff Value

First, the interface for selecting items will appear. **Note: only the items with the detection methods marked as 1,2,3 behind the item name have calibration parameters to inquiry. That is to say, the absorbency method has no calibration parameters.** The form and content to be displayed corresponds to the interfaces of the standard and calibration curve displayed when standard is used to detect. The saved calibration coefficient is allowed to be modified and saved for further use during inquiry.

9. MAINTENANCE

9.1 General Description

Only normal cleaning is needed for the normal operations of this instrument. However, invalid operation or malfunction may occur to the following parts after a long period of usage. At this time, the instrument can only be maintained at appointed maintenance locations or by the guidance of professionals. To ensure a good state for the machine, daily maintenance is necessary.

Warning: the maintenance can only be performed by professionals. The power supply should be

cut off when the outer crust is disassembled because of maintenance or other reasons. Meanwhile, disconnect the main unit.

9.2 Cleaning

- 1) Keep the working environment for the instrument clean.
- 2) Use neutral detergent or clean with a damp cloth to ensure the cleanness of the instrument surface.
- 3) Do clean the LCD with a soft cloth.

Warning: Never let any impregnant, greased or caustic substance touch the instrument.

9.3 Parts Replacement

9.3.1 Fuse

- 1) Disconnect the power supply
- 2) The fuse is installed in the fuse box near the power switch at the back of the machine. Unlock the cross-point bolt on the fuse box and replace the fuse having the same specification. Specification of the fuse: $\phi 5 \times 20$ 250V、2A

9.3.2 Filter

The transmission rate of filters will decline after a period of use. When the instrument can't work normally, it gives you a clue and reminds you to replace. Methods: firstly, open the upper lid of the instrument; secondly, find the filter plate and the invalid filter. Then, the invalid filter must be replaced with a new one in time by the specialist

9.3.3 Lamp

The instrument will prompt you if the lamp fails. At that time, you should open the lid of the instrument and examine it. If you confirm that the lamp is broken, plug off the lamp socket and please replace it with a lamp of the same standard. If the instrument still indicates malfunction after a new lamp is replaced, please inform a professional to perform the debugging.

9.4 Troubleshooting

Trouble	Reason	Solution
Microplate reader fails to start up	Abnormal power supply	Examine whether the power supply is connected; whether the power supply plug is loose or open circuit occurs to the fuse.;whether the power supply voltage is qualified.
The tray moves abnormally	The lead wires of the stepper motor doesn't insert well; synchronous belt is loose; the shift of the moving parts lock the branch; the positioning optical coupler is loose or damaged.	Revise the transmitting framework, and invite the professional to debug. Re-check the connections; lock the loose optical coupler..
Abnormal self-check	Optical system faults; wrong setting of wavelength	Examine whether the lamp is light on; Re-set the wavelengths of the system
Wrong detection results	1.The signal of light source is too low.	1.Replace with new lamp and filter in time.

	2.Detection signal is not steady. 3. Useless reagents. Not recalibrate after changing the batches of the reagents. 4.Abnormal samples.	2. Eliminate interference source 3.Change the reagents and recalibrate. 4. Collect the samples again.
Lamp of the printer flickers	Receiving faults of the printer; the transmission data goes wrong	Turn off the printer and re-start it a moment later; replace the control board of the printer

10. TRANSPORTATION

- a. Range of environmental temperature: -20°C ~ +55°C
- b. Relative humidity of environment: ≤93%
- c. Range of atmospheric pressure: 500 hPa~1060hPa

11. PACKING LIST

Items	Quantity
(1) DNM-9602 Microplate Reader	1
(2) Built-in thermal printer	1
(3) User's manual	1
(4) Product certificate	1
(5) User inspection and acceptance sheet	2
(6) Parts	
a. Wire for power supply	1
b. Fuse φ5×20 2A	2
c. Plastic cover	1
d. Printing paper	some
(7)Optional	
a.Built-in thermal printer	1
b. Wire for power supply	1
c. Parallel port wire	1
d. Ink cartridge	1

12. QUALITY GUARANTEE

We will repair or replace the instrument or accessories free of charge if there is any problem with the instrument, provided that you have complied with the instructions of this operating manual, and it is within one year from the date of purchase. You will be charged if you have not followed this operating manual or you have disassembled the instrument without authorization. Our company will answer maintenance related questions for the instrument even after the one year warranty period.

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