



DNM-9602 Microplate Reader

USER'S MANUAL



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INTRODUCTION

1.1 Characteristics

The DNM-9602 Microplate Reader is mainly used on clinical immunity-tests in the hospitals or epidemic prevention stations. It has good characteristics such as high sensitivity, high accuracy, fast checking, and ease for operation etc. The instrument has a dedicated keyboard that enables you to rapidly change functions and set parameters. Display is a liquid crystal type with alphanumeric and graphic options. Setting and detecting operations are easy and straightforward.

1.2 Main Functions

- (1) Detections of enzymatic plate and cultivated plate during enzymatic tests in the hospitals or other organizations;
- (2) Corresponding detection for microanalysis in chemistry or biochemistry.

1.3 Cautions

The instrument has been strictly inspected and tested before leaving the factory, so it does not need assembly and testing before detection, and you should be able to operate it just by following the instructions of the manual.

2. PRINCIPLE AND FEATURES

2.1 Work Principle

Work principle of the instrument is photoelectric colorimetry. 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.

2.2 Arrangement Features

The instrument consists of two main components: mainframe and 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.

2.3 System Schematics

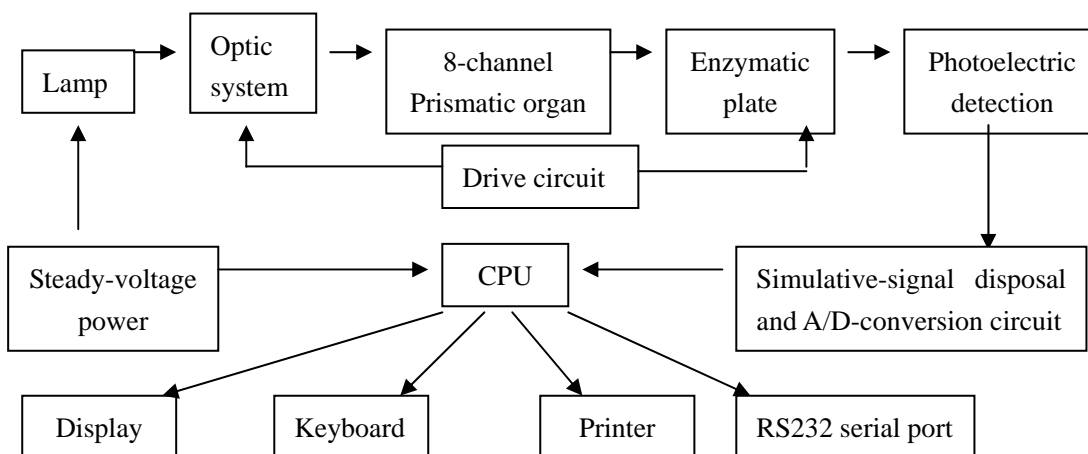


Fig. 1: System Schematics

3. SPECIFICATIONS

3.1 Functions

- (1) The instrument can detect on absorbance method and carry out detection based on quality and quantity respectively;
- (2) The instrument can save up to 30 programs for common use and display their parameters on the LCD;
- (3) The instrument can automatically select filters for different items;
- (4) The instrument will conduct auto-check first when it starts up, and an initial setting and self-checking will begin. If there is something wrong with the instrument, the corresponding diagnosis hint will be displayed on the screen;
- (5) The instrument has the printing function.

3.2 Technical Specifications

- (1) Range of working wavelength is from 400nm to 700nm. It has 4 filters when leaving factory: 405nm, 450nm, 492nm, 630nm;
- (2) Characteristics of the filters

Accuracy of wave (nm)	Half-width (nm)
± 3.0	12

Table 1: Characteristics of the Filters

- (3) Detection range of the instrument is from 0.1A to 3.0A. The error of absorbance accuracy is as follows:

Absorbance (A)	Accuracy Error
0.1--1.0	± 1.0% or ± 0.01A
>1.0--2.0	± 2.0% or ± 0.02A
>2.0--3.0	± 10.0% or ± 0.10A

Table 2: Absorbance Accuracy

- (4)

Absorbance (A)	Error (%)
0.1--1.0	± 1.25
>1.0--2.0	± 2.0
>2.0--3.0	± 8.0

Table 3: Linearity of the Instrument

- (5) Repeatability: 1.0%;
- (6) Stability: ± 0.005A/10min ;
- (7) Detection modes: single wavelength or dual wavelengths;
- (8) Display: 240x128 pixels LCD screen;
- (9) Print: external printer;
- (10) Data Link: RS232 serial port;

- (11) Output: absorbance, qualitative judgment, value of P/CO, concentration, judgment of normal value and quality control value
- (12) Dimensions: 420x290x180mm:
- (13) Weight: 10Kg.

3.3 Work Conditions

- (1) Environmental temperature: 10 ~ 30 ;
- (2) Relative humidity: <=70%;
- (3) Be away from strong electromagnetic field;
- (4) Avoid direct irradiation from strong light;
- (5) The work place must be dustproof and shake-proof. There should be no caustic gas such as hydrochloric acid in the air;
- (6) Power supply: 220 × (1 ± 10%) V, 50 × (1 ± 2%) Hz;
- (7) Power supply must be grounded perfectly.

4. PANEL

4.1 Front Panel

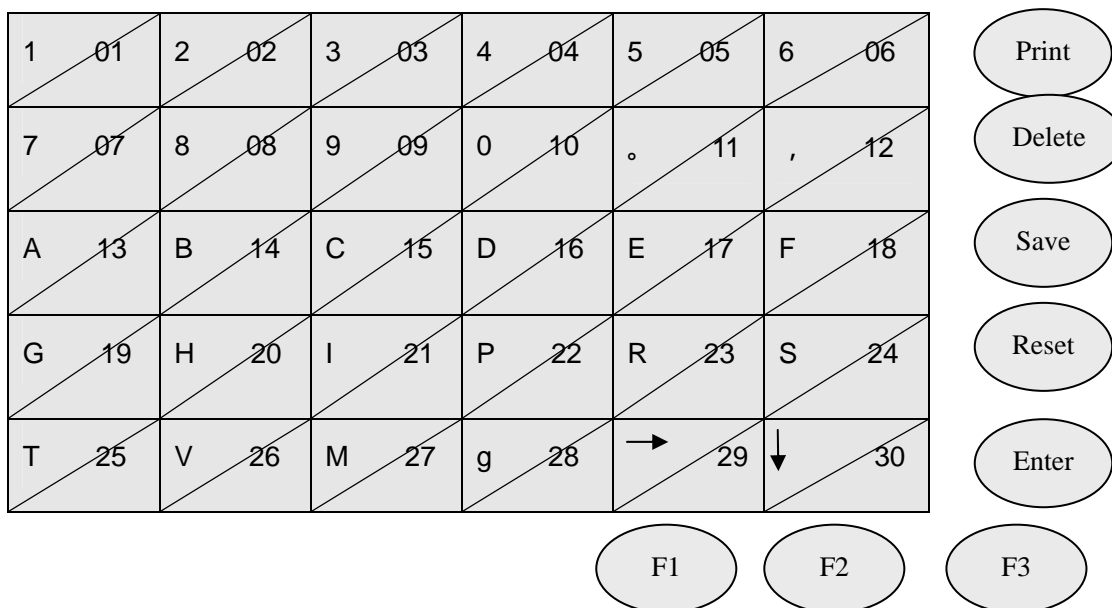
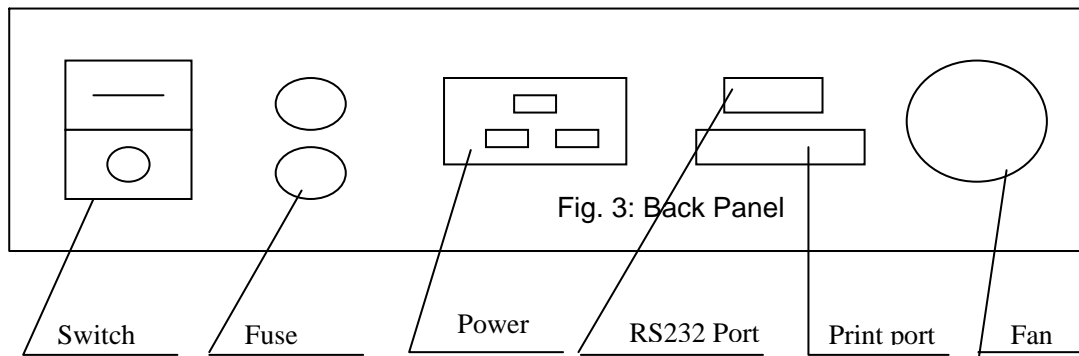


Fig. 2: Front Panel

Note: The numerals from 01 to 30 stand for serial number of the programs saved in the instrument. **F1** is the key for communication. **F2** and **F3** are spare keys. If the instrument is not connected with a computer, please do not press **F1**.

4.2 Back Panel



4.3 Preparation and Examinations

You should first examine the instrument whether there are any damages such as distortion or crack from inappropriate transportation and storage. If there is no damage found, you can plug into the electric socket and switch on power. The instrument will conduct auto-check first. If there is something wrong with the instrument, the corresponding diagnosis hint will be displayed on the screen. For example, if the filters fail, the instrument will display: "Filter failure"; if the optical system has malfunction, it will display: "Optical system failure". You should fix these problems before detection. If the instrument passes auto-checking, the machine will go into the main menu and wait for orders. At that time, you can operate the instrument (program, detect, or inquire) according to your needs.

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

5. PROGRAM

Before beginning the detection, you should first program the instrument according to your needs. For the convenience of future work, the numbering of the programs should be based on the following principles:

- (1) Put the most commonly used detection item at first and arrange combined items together.
- (2) Because the instrument can only allow 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.

5.1 Program Introduction

5.1.1 Each function in each menu of the instrument has a sequential number, so there are two methods to select function:

- (1) Use direction keys to make cursor move to the required function, and then press **Enter** key;
- (2) Press the corresponding sequential number key on the panel to select the function.

5.1.2 There is a default function in each menu. If the default function meets actual need, you can press **Enter** key to go to submenu.

5.1.3 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.

5.1.4 In case of any input mistake, you can always go back by using the cursor or pressing **Delete** key on the panel.

5.1.5 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 from small to large values according to rows or lines.

5.1.6 Main menu of the instrument is as follows:



Fig. 4: Main Menu

Explanations:

1. If you press numeric key **5** on the panel when the main menu is displayed, date and time will appear at the lower part of the panel. Then if you press the key again, date and time will disappear. When date and time are displayed, you can't select other functions.
2. The displaying order of date and time from left to right is year, month, date, hour and minute.
3. After completing the detection, you can press numeric key **6** to take the working tray return to the instrument. If you want to resume the detection, press numeric key **6** again.

5.2 Program Operation

5.2.1 Programming

If you want to program the instrument, select **2** in the main menu and then the following menu will appear on the display.



Fig. 5: Program Menu

Explanations:

1. Press alphanumeric keys in the panel to input test name (for example: HSV.I.IgG), and then press **Enter** key. The cursor will shift to **No.**, which means test number;
2. Input test number (01~30), then the cursor will shift to **Next**;
3. Press **Enter** key again when the cursor stays on **Next**, then it will go to the sub menu (Fig. 6);
4. If you want to return to the main menu, you can move the cursor to the main menu with **←**, and then press **Enter** key, or you can press numeric key **4**. (subsequent operation is the same)

5.2.2 Wavelength

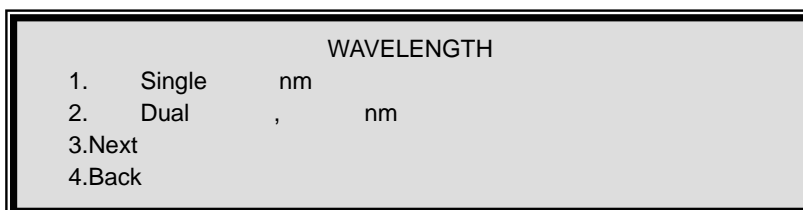


Fig. 6: Wavelength

Explanations:

1. 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 (Fig. 10);
2. Otherwise you should select single-wavelength or dual-wavelength detection mode and input the prescribed working wavelength according to the reagent specification. Be sure to input checking wavelength first and then input referenced wavelength if you select dual-wavelengths detection mode;
3. If the instrument refuses the input wavelength, please return to the main menu to reset wavelengths again, and then reprogram (see paragraph 7.2).

5.2.3 Detection Modes

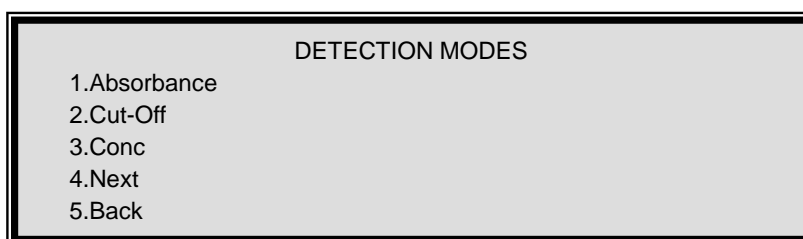


Fig. 7: Detection Modes

Explanations:

1. The defaulted detection mode of the instrument is absorbance detection. If you only want to obtain absorbance of the sample without any analysis and calculation, you can select this mode. At that time press **Enter** key to go to the sub menu (see 5.2.6);
2. When it is required to judge the negative and positive critical values (cut-off values) of the sample, you should select the detection mode of Cut-off. Please press numeric key **2** on the panel and then press **Enter** key to go to the submenu (see 5.2.4);
3. When it is required to detect concentration of the under detection sample, you should select the **Conc** detection mode in above figure, where **Conc** is the abbreviation for concentration. Please press numeric key **3** on the panel and then press **Enter** key to go into the submenu (see 5.2.5).

5.2.4 Cut-off Detection Mode

5.2.4.1 Formula for calculation

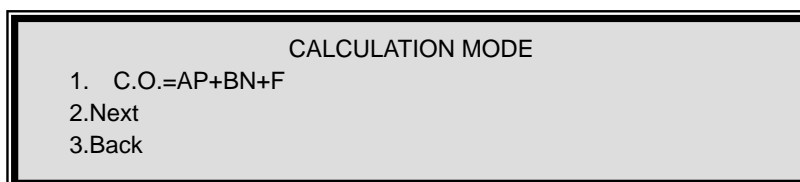


Fig. 8: Calculation Mode

Explanations:

1. The definitions of letters in above formula are as follows:
 - P**-Average absorbance of positive-control wells;
 - N**-Average absorbance of negative-control wells;
 - A**、**B**、**F**-Parameters to be input (according to reagent specification) .

2. When a formula is selected, the right-hand side of screen will display: **A=** , **B=** , **F=** etc.. At that time you should input the values according to reagent specification, and then press **Enter** key to confirm;
4. When the cursor stays on **Next**, you can press **Enter** key or directly press numeric key **2** on the panel to go to the sub menu (Fig. 9).

5.2.4.2 Limitation of negative-control values

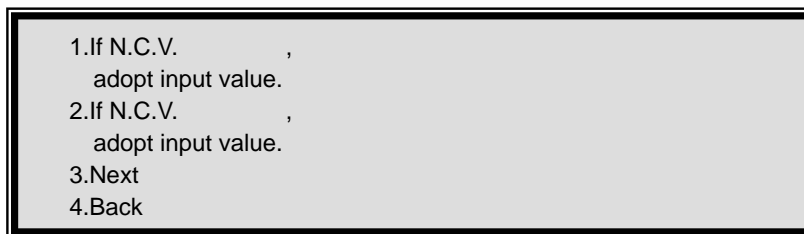


Fig. 9: Limitation of Negative-Control Values

Explanations:

1. **N.C.V.** means negative-control value in above figure;
2. If the reagent specification prescribes that you should calculate according to the input value when the negative-control 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-control value is more than the input value (for example: 1.20), please select the first item and input the regulated value.



5.2.4.3 Qualitative mode selection

Fig. 10: Qualitative Mode Selection

Explanations:

1. The first qualitative direction suits the items that if the value of the unchecked sample is not less than **C.O.** (cut-off value), it is positive (+); contrarily negative (-);
2. The second qualitative direction suits the items that if the value of the unchecked sample is not less than **C.O.** (cut-off value), it is negative (-); contrarily positive (+);
3. The first type is set as default. If it is equal to the demand, you can press **Enter** key and go into the sub menu (Fig. 11).

5.2.4.4 Shaking modes

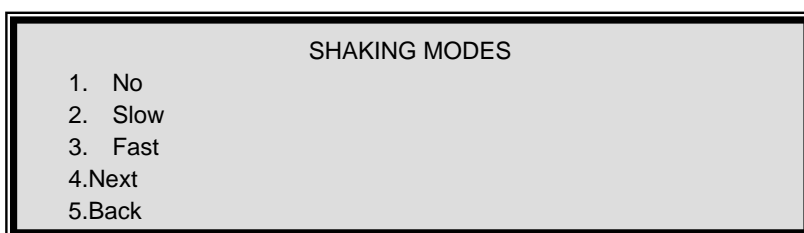


Fig. 11: Shaking Modes

Explanations:

1. The instrument has shaking function, but the intensity is limited. If you already have a shaking machine, it is suggested to use your shaking machine and not to use the instrument to shake.
2. No (means no shaking speed) is set as default in the instrument. If you needn't shake, please press **Enter** key to go into the sub menu (Fig. 12).

5.2.4.5 Invalidity judgment

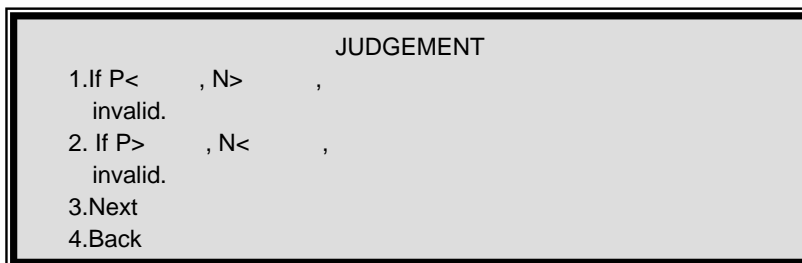


Fig. 12: Invalidity Judgment

Explanations:

1. Reagent specifications of some detection items prescribe the validity judgment of the absorbance for positive-control value and negative-control value to ensure validity of detection results. Under this circumstance, please input the prescribed value as required by reagent specification;
2. If the reagent specification has no requirement, you can press **Enter** key to go into the sub menu (Fig. 13).

5.2.4.6 Wells setting



Fig. 13: Wells Setting (1)

Explanations:

1. The instrument allows each comparison well to be set at any place on the plate;
2. If you need to amend the quality of a well, please choose the corresponding number, and then the defaulted quality will automatically disappear. Under this circumstance you only need to input the appropriate quality of the well. When wells of the same type need more than two places, be sure to input a comma between two wells;
3. If the quality control is needed, please input the place symbol for the quality control wells, and notice that the instrument only memorizes the detection result of one quality control well. If the instrument does not accept the input symbol of the well place, it means that the serial number exceeds 05;
4. The input symbol of the well place must be consistent with the sample place on the enzymatic plate;
5. Number of the blank wells can be 0-2; number of the negative or positive comparison wells can be 1-3 and number of the quality control wells should be 0-1.

5.2.4.7 Program finishing

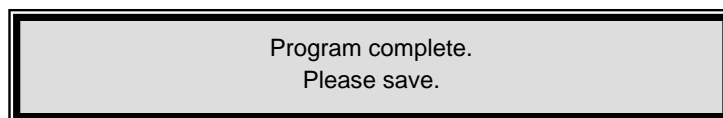


Fig. 14: Finishing Programming

Explanations:

1. When the screen displays above figure, it means programming is finished. Be sure to press **Save** key on the panel to store the program information in the instrument for future use;
2. After you press **Save** key, the instrument will go back to the main menu automatically.

5.2.5 Concentration Detection Mode

5.2.5.1 Calculation modes

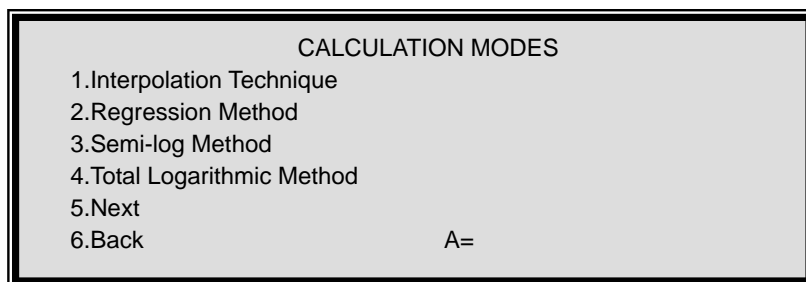


Fig. 15: Calculation Modes

Explanations:

1. Selection of the calculation method is decided by reagent specification;
2. When a calculation method is selected, the screen will display "**A=**". Please input the dilution multiple required by the reagent specification, and press **Enter** key to confirm your input. If the reagent is not diluted, please input **1** and press **Enter** key to go into the sub menu (Fig. 16).

5.2.5.2 Report modes

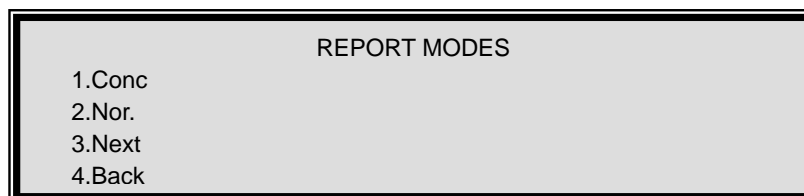


Fig. 16: Report Modes

Explanations:

1. In the above figure, **Conc** is the abbreviation for concentration and **Nor.** is the abbreviation for normal value judgment;
2. Default report mode is concentration mode. If you only need to print concentrations of each sample, press **Enter** key to go into the sub menu (Fig. 11);
3. If you also need to judge if the result is normal, please press numeric key **2** or select **Nor.**. Then you can print both concentration and judgment results of the sample.

5.2.5.3The sub menu is the shake setting menu. Operations of the menu are completely the same as in the cut-off detection mode, so they are not repeated here.

5.2.5.4 Wells setting

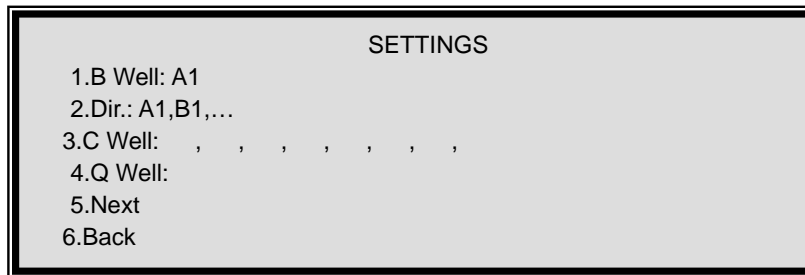


Fig. 17: Wells Setting (2)

Explanations:

1. The instrument prescribes **A1** is the blank well when the detection mode is concentration mode;
2. If you want to change the direction, please press on the panel:
 - (1) If **A1, A2** follows **2. Dir.**, it means setting standard wells in row sequence (A1 A12).
 - (2) If **A1, B1** follows **2. Dir.**, it means setting standard wells in row sequence (A H).
3. Press **Enter** key when the setting order is selected, and then press to set the amount of the required wells.
4. If the quality control is required for the item, please press numeric key **4** on the panel, and then input the symbol of the wells (you can set 0~1 well). What should be paid attention to is showed in section 5.2.4.6.
5. The amount of standard wells is prescribed by the reagent specification (the largest amount is eight).

5.2.5.5 Standard values inputting

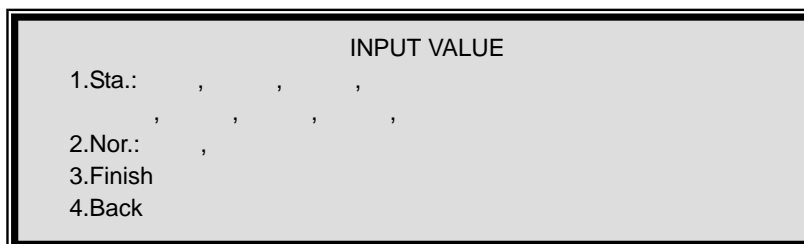


Fig. 18: Standard Values Inputting

Explanations:

1. Input the standard concentrations as required by the reagent specification in the order from small value to large value. Press **Enter** key to confirm after a value is input (The amount of concentrations input should be equal to the standard wells set before);

Caution: When the detection method is logarithm method, you can't input the first concentration value if it is zero, otherwise the detection results will contain errors.

2. If you have normal values and want to know whether the result is in the normal value range, please input normal values following **Nor.** on the display. (The amount of normal values can be one or two.)

5.2.5.6The sub menu is the program finishing menu. Operations of the menu are completely the same as in

the cut-off detection mode, so they are not repeated here.

5.2.6 Absorbance Detection Mode

5.2.6.1 When the absorbance detection mode is selected, the instrument will directly display the shake setting menu. Operations of the menu are completely the same as the former one.

5.2.6.2 Wells setting



Fig. 19: Wells Setting (3)

Explanations:

1. If you want to print the original absorbance, please press **Enter** key continuously to end programming (without inputting the blank wells);
2. If you want to print the actual absorbance (deducting the blank value), please input the symbol of blank wells (1~2).

5.2.6.3 Programming is finished. Operations of the menu are completely the same as the former one.

6. DETECTION

The instrument can be used for clinical tests after being programmed.

Attention: To ensure veracity of the detecting results, you must arrange the places of the blank wells, negative-control wells and the positive-control wells on the board to be consistent with the detection program.

6.1 Switch the instrument on and then it will start auto-checking first. If the instrument passes auto-checking, the screen will display the main menu. At that time, you should not start the detection immediately. Please wait 20 minutes for a complete warming up before you begin the detection;

6.2 When you start the detection, please press numeric key **1** on the panel to select **Detect** function, the screen will display the list of detection programs. Press **Enter** key to find the number for the required program, and press the corresponding key on the panel. Then the program will display as follows:

(1) Cut-off detection method:

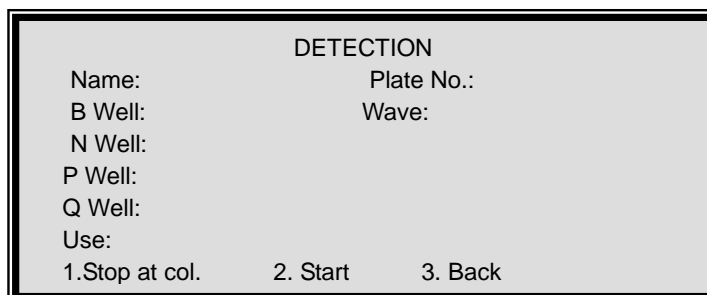


Fig. 20: Detection Interface (1)

(2) Concentration detection method:

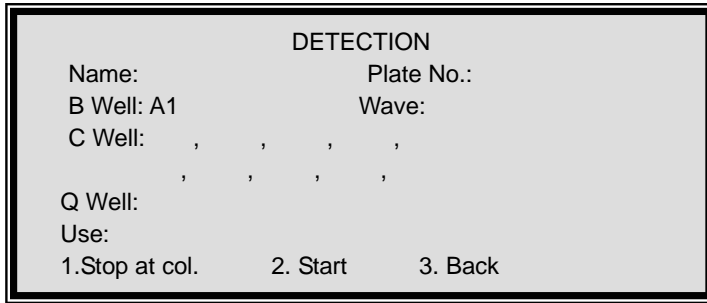


Fig. 21: Detection Interface (2)

If you know the number for the required program, you can directly press the numeric key to select the program regardless the serial number is displayed or not.

6.3 Firstly, you should check the appeared program over to see if it corresponds with the needs (if not, press **Reset** key to select again). If it is for a whole board detection, press **Enter** key directly, otherwise press **1** to input the required list number (01~12) and then press **Enter** key to start detection. If you need to set the original plate number, press numeric key **0** first. Secondly, input the number of original plate. Finally, press **Enter** key to confirm your input. Since then, the number of plate will add 1 automatically after each time of detection. When you change detection item, you can change the plate number at the same time if you want.

6.4 After the detection is started, the screen will display “Checking”. When the detecting is finished, the screen will display “Calculating”, and it will display the absorbance of each well first after the calculation is finished. If you want to print the absorbance, press **Print** key on the panel; if not, press **Enter** key, the screen will display detecting results. If both output methods are selected, the screen will display the first one. Then press **Enter** key, it will display the second one. Under this circumstance, if you press **Enter** key again, it will return to the first one.

6.5 If the detecting results need to be stored for query, press **Save** key on the panel (it won't store the results if you don't press **Save** key).

6.6 If you want to print, press **Print** key on the panel (it will print the results displayed on the screen). The instrument will send the data to the printer if you press **Enter** key. You can perform other operations once the printing is started and do not need to wait until the printing is finished. The printing format shows as in table 4.

Item	Plate	Wavelength	Date	Time	Operator							

	01	02	03	04	05	06	07	08	09	10	11	12
A												
B	(Results)											
C												
D												
E												
F	Qualitative Results			-0.8		+1.3 S/CO Value						
G												
H	Negative		Positive		Cut-off value			Quality control				

Table 4: Printing Format

Explanations:

The output of detecting results is decided by the program. Detecting results mainly include the following four parameters:

- (1) Absorbance;
- (2) Result of cut-off judgment (+, -) and value of S/CO;
- (3) Concentration;
- (4) Judgment based on normal concentration value (H, L).

If the detecting result of concentration is 99999, it means the concentration of the sample is beyond the linear range, so you should dilute the sample and conduct the detection again.

6.7 Connect the signal wire when it is required to send the detection data to PC, and make the PC wait. When the detected absorbance appears, please press **F1** key on the panel.

6.8 When all the work above is finished, you can take the enzymatic board out, and press **Enter** key. Then the instrument will display contents of the program again. If you still want to continue detection of the item, replace a new enzymatic board and repeat the operating steps starting from step 6.3.

6.9 If you still want to detect other items, please press **Reset** key, and then it will go back to the detecting program list. Under this circumstance, please repeat operating steps starting from step 6.2.

6.10 After all the detection items are finished, press **Reset** key on the panel when the screen displays detection program list. It will go back to the main menu. Then after you press key 6 on the panel, the tray of the enzymatic board will return to the instrument automatically. After that, you can turn off the power, and pull out the plug.

7. SET

Select **4** in the main menu, and then the screen will display as follows:

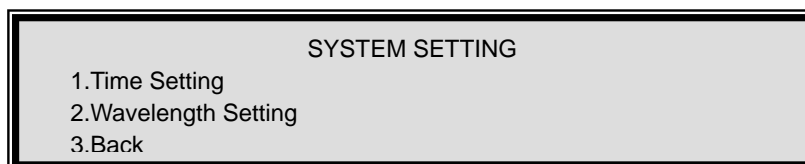


Fig. 22: System Setting

7.1 Time Setting

When there is something wrong with the date or the time displayed on the instrument, you can select this function and input the correct date and time in order in the sub menu, and press **Save** key on the panel. After that, the instrument will go back to the main menu automatically.

7.2 Wavelength Setting

7.2.1 Input the wavelength data (nm) of the filters in order, pay attention to inputting the data in accordance with the arrangement of the filters in the tray, otherwise it will lead to wrong results. There are four filters in the instrument, in the order of 405nm, 450nm, 492nm and 630nm.

7.2.2 The instrument can set 7 filters at most. Please continue to press **Enter** key when the total of filters is less than 7 until the screen displays information about saving. Press **Save** key to save the newly input data in the memory, and then go back to the main menu.

8. INQUIRE

The function is designed for inquiring the saved quality-control data and detection results.

8.1 Inquiry Introduction

Press numeric key **3** on the panel to confirm the function of inquiry when the screen displays the main menu, and then the following figure will appear:



Fig. 23: Inquiry Interface

Explanations:

1. If you need to print the quality-control results, press numeric key **1** on the panel. The screen will display list of quality-control items. Press the corresponding key on the panel, and then the printer will print the selected quality-control data.
2. When "Results" is selected, the screen will display the detection results list. You can move cursor to the needed item and press **Enter** key, or directly press numeric key on the panel. The instrument will display the result of the detection item. You can press **Print** key on the panel at this time, then the result will be printed again. Press **Enter** key again, and the screen will display detection results list again.

8.2 When the operation is finished, press **Reset** key on the panel and then the machine will go back to the main menu to wait for other orders.

9. MAINTENANCE

The instrument only needs cleaning during normal use. But the following assemblies may fail or malfunction after a long time of use. You must maintain them under the guidance of the specialist.

9.1 Filter

The transmission rate of filters will decline after a period of use. When the instrument can't work like normal, it gives you a clue. In order to maintain accuracy of detection, the invalid filter must be replaced in time by the specialist.

9.2 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, please replace it with a lamp of the same standard. If something is wrong with the power, you should repair it.

9.3 Tray

When there is something wrong with the tray (e.g. it can't pass through the instrument), there are some possible reasons: down lead of the step-motor is not perfectly connected; synchronous strap is loose or doffed; moving parts shift or get blocked etc. Please search for the cause and fix the malfunction.

9.4 Fuse

If the fuse burns out, you must cut off the power supply at first, and then replace the fuse with one of the same standard. You must replace the fuse under the guidance of the specialist.

10. TRANSPORTATION

- (1) Range of environmental temperature: -20 ~ +55 ;
- (2) Relative humidity of environment: <=93%;
- (3) Range of atmospheric pressure: 500hpa ~ 1060hpa.

11. EQUIPMENT PARTS LIST

Items	Quantity
(1) DNM-9602 Microplate Reader	1
(2) Printer	1
(3) User's manual	1
(4) Product certificate	1
(5) User inspection and acceptance sheet	2
(6) Accessories	
a. Wire for power supply	1
b. Fuse 5 x 20 2A	2
c. Plastic cover	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. We will answer maintenance related questions for the instrument even after the one year warranty period.

13. WARNING

- (1) The power supply should be grounded perfectly;
- (2) Filters must be replaced in time by the specialist if they fail.

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