iMark™

Microplate Absorbance Reader

Instruction Manual

BIO-RAD

ISO 9001 Registered

Warranty Statement

This warranty may vary outside of the continental United States. Contact your local Bio-Rad office for the exact terms of your warranty.

Bio-Rad Laboratories warrants to the customer that the iMark Microplate Absorbance Reader will be free from defects in material and workmanship, and will meet all performance specifications for a period of one year from the date of shipment. This warranty covers all parts and labor.

In the event that the instrument must be returned to the factory for repair under warranty, the instrument must be packed for return in original packaging. Please contact your local Bio-Rad representative for the necessary return documents. The required documentation includes a decontamination certificate.

Bio-Rad shall not be liable for any incidental, special, or consequential loss, damage, or expense directly or indirectly arising from the use of the iMark Microplate Absorbance Reader. Bio-Rad makes no warranty whatsoever in regard to products or parts furnished by third parties, such being subject to the warranty of their respective manufacturers. Service under this warranty shall be requested by contacting your nearest Bio-Rad office.

The following items are considered customer-installable consumables: thermal printer paper and light bulbs. These parts are not covered by this warranty. All customer-installed parts are warranted only to be free from defects in workmanship. This warranty does not extend to any instrument or parts thereof that have been subject to misuse, neglect, or accident, or that have been modified by anyone other than Bio-Rad or that have been used in violation of Bio-Rad instructions.

The foregoing obligations are in lieu of all other obligations and liabilities including negligence and all warranties of merchantability, fitness for a particular purpose, or otherwise expressed or implied in fact or by law, and state Bio-Rad's entire and exclusive liability and buyer's exclusive remedy for any claims or damages in connection with the furnishing of goods or parts, their design, suitability for use, installation or operation. Bio-Rad will in no event be liable for any special, incidental or consequential damages whatsoever, and Bio-Rad's liability under no circumstances will exceed the contract price for the goods for which liability is claimed.

Regulatory Notices

Electro Magnetic Compatibility:

This instrument is designed to meet the Class-A emissions and immunity levels of the EN 61326 product family standard for the CE mark. This rating requires that it only be used in a laboratory environment.

NOTE: These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.

Safety

This instrument is designed to meet EN 61010-1 requirements for the CE mark, which are internationally accepted safety standards for electrical equipment for measurement, control and laboratory use. EN 61010-1 applies to equipment which is used under the following conditions:

- Indoor use
- Altitude up to 2,000 m
- MAINS supply voltage fluctuations up to ±10%

This instrument has been tested, and its compliance has been confirmed under the following environmental conditions:

- Overvoltage category II
- Pollution degree 2

If the instrument is used in a manner not specified in this manual, the protection provided by the instrument may be impaired. This instrument should not be modified or altered in any way. Alteration of this instrument will result in the following:

- Void the manufacture's warranty.
- Void regulatory compliance.
- Create a potential safety hazard.

Protective Ground

This instrument has a detachable, three-wire power cord for connection to both the power source and protective ground. The protective ground contact is connected to the accessible metal parts of the instrument. To prevent electrical shock, always use a power source outlet that has a properly grounded protective-ground contact.

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Introduction

Description

The iMark™ Microplate Absorbance Reader (catalog #168-1130) is an eight-channel, vertical pathlength photometer that measures the absorbance of the contents in the wells of a 96-well microtitration plates. It can perform single or dual wavelength measurements and can report absorbance values to three decimal places.

The iMark reader can be programmed by entering commands through the membrane keypad to define plate reading and data analysis parameters as testing protocols and select report types. Hard copy reports can be produced by an optional on-board thermal printer or external printer.

The iMark reader can also be controlled by the Windows-based Microplate Manager® software (catalog # 168-9520) program, through its built-in USB 2.0 interface device. Microplate Manager software provides a complete, user-friendly solution for protocol programming as well as data analysis, for all microplate absorbance readers from Bio-Rad Laboratories.

USB Interface

The iMark Microplate Reader has a built-in USB interface. This allows external computers to control the instrument. When an external computer is in control of the microplate reader, the printer and the membrane keys, except for the Start/Stop and Open/Close keys, are automatically deactivated, and the LCD display appears as below.

```
Remote mode
```

The reader will remain in remote control mode until it is released or until the Start/Stop key is pressed on the reader.

Built-in Printer

The iMark Microplate Reader has a built-in printer. It can generate all types of reports, including graphs and kinetic plots.

Catalog #	Description
168-1130	iMark Microplate Absorbance Reader with built-in printer
168-1135	iMark Microplate Absorbance Reader with built-in printer, including Microplate Manager 6 software
168-6940	Checkmark Absorbance Reader Performance Validation Kit

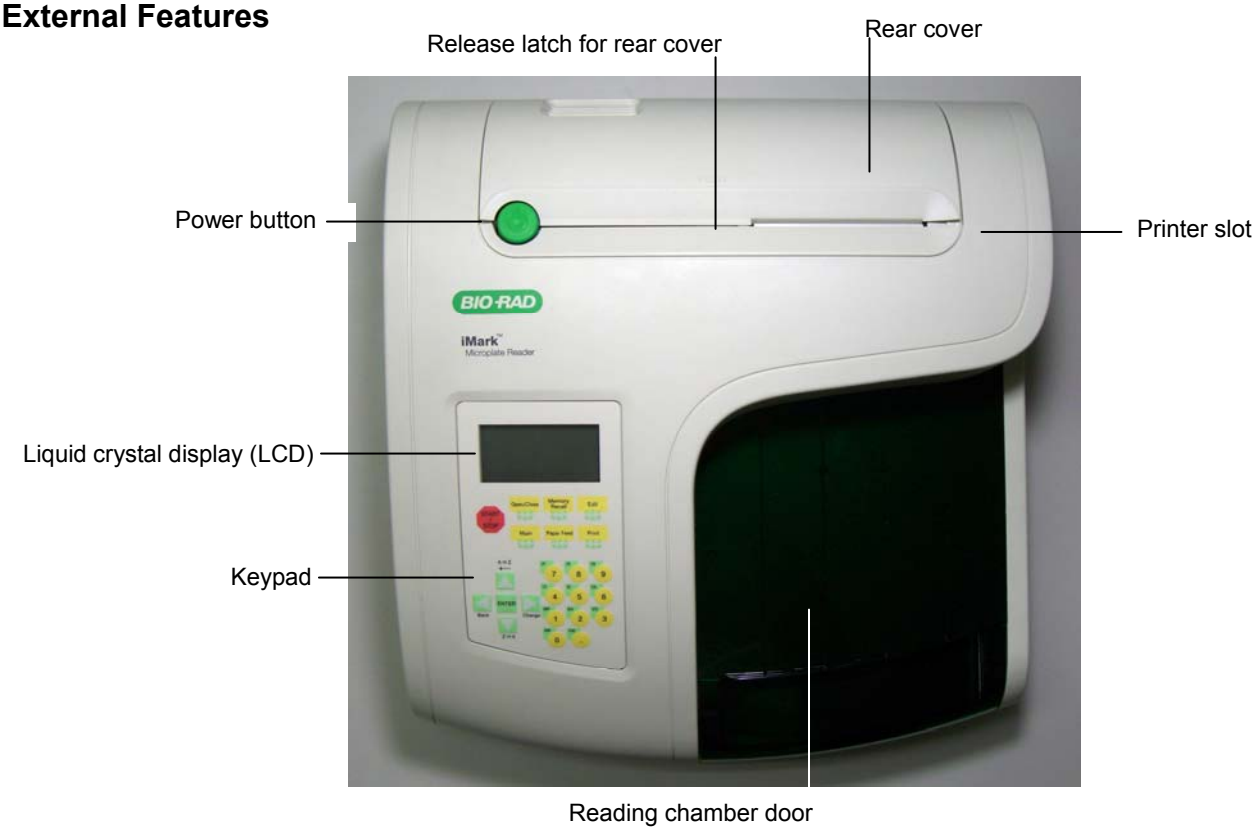
Accessories

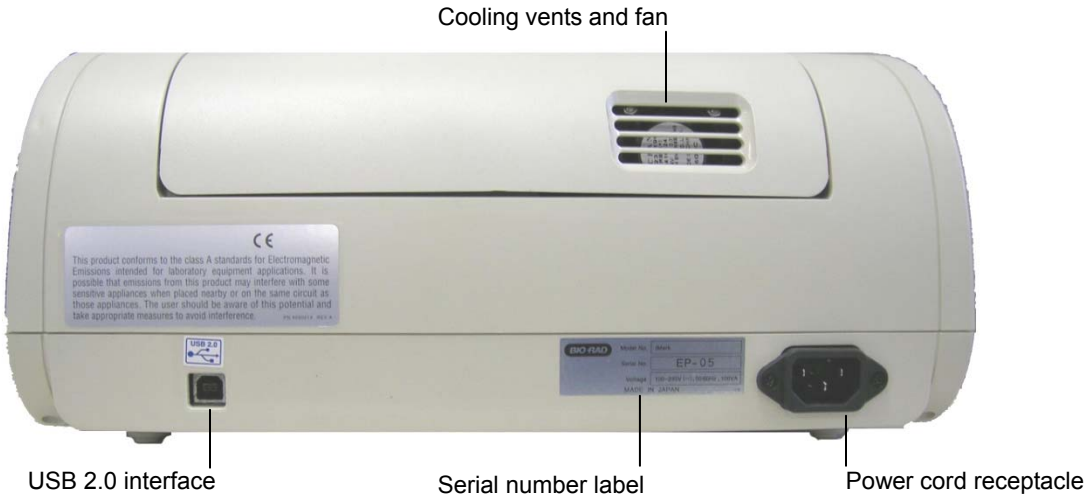
Catalog #	Description
168-1011	405 nm filter
168-1013	415 nm filter
168-1020	450 nm filter
168-1028	490 nm filter
168-1038	540 nm filter
168-1040	550 nm filter
168-1044	570 nm filter
168-1049	595 nm filter
168-1054	620 nm filter
168-1056	630 nm filter
168-1061	655 nm filter
168-1080	750 nm filter
168-1006	Replacement lamp for iMark Microplate Absorbance Reader
168-2007	Replacement printer paper, package contains 3 rolls

Custom filters between 400 and 750 nm may be ordered. Corresponding catalog numbers can be found on www.bio-rad.com, or you can order by specifying the wavelength and the model number of the reader.

Checkmark Absorbance Reader Performance Validation Kit (catalog item 168-6940) consists of a plate with absorbance standards and software to calculate the accuracy and precision of the iMark Microplate Absorbance Reader.

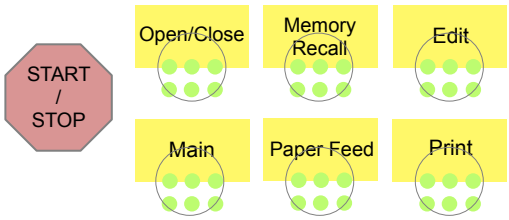
External Features



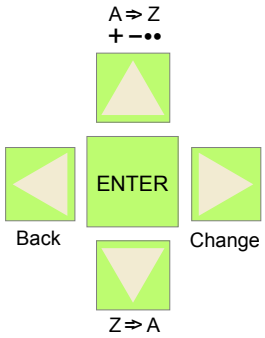


Keypad Guide

Main	Returns to MAIN SCREEN.
Start/Stop	Initiates plate reading using current active protocol.
	Stops plate reading and printing.
Paper Feed	Advances paper strip in internal printer.
Print	Prints out the plate data and protocol information.
Edit	Enters the Edit Menu, and sets up the instrument.
Memory Recall	Reads out protocol and plate data.
Open/Close	Opens or closes the reading chamber door.

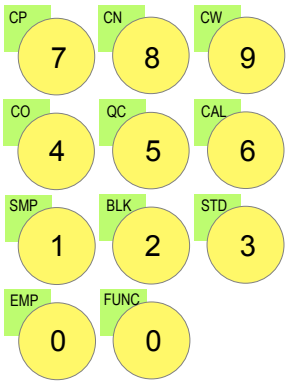


Up Arrow	Moves the cursor upward.
	Selects the alphabet or the symbol.
Left Arrow	Returns to the previous screen.
	Moves the cursor to the left.
Down Arrow	Moves the cursor downward.
	Selects the alphabet or the symbol.
Right Arrow	Moves the cursor to the right.
	Changes or selects the value and type.
Enter	Completes or seals a field entry.



Dot/Function	Inputs the dot.
	Changes the input mode.
Ten Keys	Inputs numbers or well type in plate mapping.

- 0 / EMP : Empty
- 5 / QC : QC control
- 1 / SMP : Sample
- 6 / CAL : Calibrator
- 2 / BLK : Blank
- 7 / CP : Positive Control
- 3 / STD : Standard
- 8 / CN : Negative Control
- 4 / CO : Cutoff control
- 9 / CW : Weak Positive Control



Instrument Setup

Unpacking the Instrument

The shipping carton contains the following items:

- iMark™ Microplate Reader, with 415 nm, 450 nm, 490 nm, 595 nm, 655 nm, and 750 nm interference filters installed on the filter wheel
- Power cord
- USB cable
- Dust cover
- Instruction manual
- Warranty card
- One roll of thermal printer paper

Inspect the exterior of the instrument for any signs of shipping damage. Contact your local Bio-Rad representative if any of these items are damaged or missing.

Initial Instrument Startup

1. Place the instrument on a clean, sturdy table or bench. It is important to keep the instrument in a clean, relatively dust free environment to ensure optimal performance.
2. Connect the power cord to the back of the instrument. Before connecting the instrument to the main electrical supply, check that the AC voltage is appropriate for the instrument.
3. To turn the power on press the green power button on the top of the instrument. The LCD will display the version number of the on-board firmware. After about three seconds, the instrument will perform an initial self-diagnosis that requires about fifteen seconds. The login screen displays for you to choose your user level (administrator or common user), and enter the password (initial password: 00000). Please allow three minutes for the instrument to warm up (reach thermal equilibrium) before reading plates.

Change password
Select "**Change Password**" in the **Security Menu**.
Enter the current Password then move the cursor to the 3rd line and enter a new password. Press **Enter** to complete the field entry. The system will return to the previous **Security Menu**.

Change user mode
Select "**Change user**" in the **Security Menu**.
Select a desired user mode by pressing the **Right** Arrow key. Enter the appropriate password for the selected user mode. Press **Enter** to complete the field entry. The system will return to the previous **Security Menu**.

4. Install the printer paper. The thermal printer paper is printable on one side only and must be properly installed for the printer to function. The outside of the roll is the printable side.

   a. Open the rear cover of the instrument.
   b. Tear off a small piece at the beginning of a new roll at an angle to form a point.
   c. Place the roll of paper in the small pan-like holder positioned below the printer. The roll should be positioned so that it will feed from the bottom.
   d. While pressing the PAPER FEED key, feed the pointed end of the paper into the paper feed slot in the underside of the printer until the printer grabs the paper and feeds it through the slot in the top of the instrument.
   e. Securely close the rear compartment.

Multi-language support

The iMark LCD can produce text in three languages; English, Russian and Chinese. To switch to English from Russian or Chinese, press the Main button, then the Edit button to get to the configuration screen. Press the downward-pointing arrow on the key pad six times to navigate to the language options line. Press Enter twice to select English, and then press Enter a third time to shut down the reader. When restarted, the iMark will display in English.

Instrument Shutdown

To shut down the instrument, press the green power button on the top of the instrument for a few seconds. Then the LCD will display a Power off, Yes or No screen. Select “Yes” to shut down the instrument.

```
   Power off

>>Yes     No
```

Software Overview

Capabilities

The iMark Microplate Reader has on-board software that allows the user to set the plate reading and data analysis conditions, to save these settings as a test protocol, to read a microplate under this protocol, and to print reports from the built-in printer. The software communicates through the 4-line, 20-character LCD and is controlled through the instrument's membrane keypad.

The software has three different protocol types: End-point analysis, Kinetic analysis, and Checkmark validation. The Checkmark validation function is used only by the administrator to verify quality control.

The display shows the current mode. The user can choose between these protocol types, or can press the Memory Recall key to use the current protocol type.

Quick Guide to Reading a Plate

1. Turn on the instrument. Allow about 30 seconds for self-diagnosis. The instrument needs to warm up for about three minutes prior to reading a plate.
2. Upon power up, the login screen will appear. Enter the login password (initial password: 00000), press Enter.
3. Program a protocol for your assay. See page 22 for information on *Editing a Kinetic protocol*, or page 25 for *Editing an End Point Protocol*. Make sure filters installed correlate with information entered in reader firmware.
4. Select the protocol of choice, if programmed. See the *Memory Recall* section on page 21 for detailed operation.
5. Review or print parameters set in the protocol. See the *Editing End Point Protocol* section on page 25 for details.
6. Verify settings on Cutoff, Report, Limit, STDs, Mode, Mapping, and kit name parameters are as desired.
7. Protocol setting can be printed; see the *Printing Reports and Protocols* section on page 20 for information.
8. All reports other than the raw data report require plate mapping. Set the plate map with instructions from the *Plate Map Setting Procedure* section on page 33.
9. The Matrix and Limit reports require assignment of upper and lower limits. Set the upper and lower limits in the Editing End Point Protocol Limit setting window.
10. The Cutoff report requires definition of the cutoff setting. Refer to the *Cutoff Setting Procedure* section on page 26.
11. The Curve fit and Concentration reports require that standard concentration and locations must be defined. Refer to page 29 for details on how to define the standards and the curve fit parameters.
12. Set the general reading mode (single or dual wavelength reading, plate shaking, read mode) following the instructions in the *Mode Setting Procedure* section on page 32.

After warm-up is complete:

13. Press the “Main” key. The main screen appears on the LCD.
14. Carefully place the microplate in the reading chamber. Press the “Start/Stop” key to read.

Instrument Functions

Calculations

The Microplate Reader uses Beer's Law to calculate the absorbance value of each well. Beer's Law states that absorbance is equal to the log10 of the ratio of the baseline measurement intensity (Io) to the sample measurement intensity (I).

Beer's Law: Absorbance = Log10 (Io/I)

Before measuring the plate, the reader takes a reading for all eight photodiode channels. These values are recorded as the baseline measurement (Io) values for each channel, respectively. The reader then records the sample measurement (I) value for each well, and calculates the absorbance using these values.
Channel-to-channel error is significantly reduced because the Io value for a given channel is used only in determining the absorbance of the wells of that channel.

Security password

The iMark Microplate Reader requires a user login with password. This security feature helps to prevent any unwarranted modifications to the analysis conditions/protocols and data stored in the instrument, and identifies the operator on reports. The reader has two user settings, the Administrator and the Common user. Each user level has its own security password.

Memory Back-Up

The battery back-up provides memory even after the reader is turned off.

The following information will be saved in the memory until new reading parameters are set by the user or a new plate is read by the instrument. Note that if a run is aborted before it is finished, all the previous plate reading data remain in memory and none of the data from the aborted reading is stored.

- The ten latest sets of End-point protocol plate reading results
- The two latest sets of Kinetic plate reading results (max. 30 series of readings for each Kinetic Protocol)
- 64 End-point Protocol settings and 2 Kinetic Protocol settings
- A set of Checkmark reference data and the one latest set of Checkmark reading result
- A set of standard curve data for the storage of standard curves and graphs
- Eight wavelength values for filters
- Laboratory name
- Two security passwords (for the Administrator and the Common user)
- Instrument serial number

In addition to the battery back-up memory, the instrument has a small amount of non-volatile memory to keep the system information after the battery is dead. The serial number is stored in this memory. The average battery life is 5 years.

The first time the instrument is turned on, or after a battery failure, the following default information is held in the memory.

1. Both Administrator and Common user security passwords are set to "00000".
2. Laboratory name is "Bio-Rad Laboratories".
3. All wavelength values of the filters are set to "---" nm.
4. The date and time of the calendar chip are set to 1 day, 1 month, 00 year, 0 hour and 0 minute.
5. No plate reading data is available.
6. End-point protocol is chosen and the protocol number is set to #1.
7. No standard curve data for the storage of standard curves and graphs is available.

Limits

The Microplate Reader displays absorbance readings with absolute values as 3.500. Out-of-range absorbance values, (those with absolute values greater than 3.500) are displayed as either "*.***" or "-*.***". For example, if the absorbance is 4.500, then the display will read "*.***", and if the absorbance is -4.500, the display will read "-*.***".

Report Types

Two types of reports can be generated; End-point protocol, and Kinetic protocol. Each of these and their subtypes are described below. After these descriptions, there are flow diagrams that show how to access specific choices.

End-point Protocol Reports

Nine types of End-Point Protocol reports can be generated: raw data, absorbance, limit, matrix, cutoff, curve fit, concentration, difference, and TeSeE screening reports.

1. Raw data report

The Raw data report is the uncorrected absorbance values (without blank subtraction). In single-wavelength mode, the reported value is the measured absorbance. In dual-wavelength mode, the reported value is the difference between the uncorrected readings taken with the measurement filter and with the reference filter.

2. Absorbance report

The Absorbance report is the blank-corrected absorbance values. The mean absorbance value of all of the wells designated as assay blanks is calculated and then subtracted from all 96 values of the raw data set to produce the Absorbance report.

Abs = Raw – Blank mean

Blank mean = X/n

S.D. = [{X^2 – n*(Blank mean)^2}/{n-1}]^1/2

Where:

S.D. = Standard deviation

X = Sum total of the raw absorbance for each blank

X^2 = Sum total of the squared raw absorbance for each blank

n = Number of blanks

3. Limit report

The Limit report provides a qualitative YES/NO report. Wells with blank-subtracted absorbance values between the upper and lower limits are represented with an asterisk (*), wells with absorbance values below the lower limit by minus signs (-), and wells with absorbance values greater than the upper limit by positive signs (+).

4. Matrix report

The Matrix report provides a qualitative report of the relative magnitude of the absorbance values on the plate. The absorbance range defined by the upper and lower limits is divided into 10 equal partitions, numbered 0 through 9. The blank-subtracted absorbance value of each well is classified according to the partition of the matrix to which it corresponds, and is reported as a signal digit. Wells with absorbance values greater than the upper limit are reported by plus signs (+), and wells with absorbance values less than the lower limit by minus signs (-).

5. Cutoff report

The Cutoff report provides a qualitative report of the relative magnitude of the absorbance values or converted concentrations on the plate.

Four types of cutoff reports are supported; ranged constant, single constant, formula and ratio. These and their subtypes are listed below.

a. Ranged Constant

The user inputs Positive and Negative values to be used as the cutoff.

For units designated "Abs", if the absorbance of a well is within the positive and negative cutoff values, the well is scored "*". If the absorbance of a well is greater than the positive value, the well is scored "+", and if the absorbance of a well is below the negative value, the well is scored "-".

For units not designated "Abs", the absorbance value of each well is converted to the concentration value using the curve fit constants of the curve fit report. If the concentration of a well is within the positive and negative cutoff values, the well is scored "*". If the concentration of a well is greater than the positive value, the well is scored "+", and if the concentration of a well is below the negative value, the well is scored "-".

b. Single Constant

The user inputs Positive and Gray zone values to be used as the cutoff.

For units designated "Abs", if the absorbance of a well is within the gray zone value of the positive cutoff value, the well is scored "*". If the absorbance of a well is more than the gray zone value and greater than the positive value, the well is scored "+", and if the absorbance of a well is more than the gray zone value below the positive value, the well is scored "-".

Upper cutoff absorbance = Positive absorbance + ((Gray zone/100) * Positive absorbance)

Lower cutoff absorbance = Positive absorbance – ((Gray zone/100) * Positive absorbance)

For units not designated "Abs", the absorbance value of each well is converted to the concentration value using the curve fit constants of the curve fit report. If the concentration of a well is within the gray zone value of the positive cutoff value, the well is scored "*". If the concentration of a well is more than the gray zone value greater than the positive value, the well is scored "+", and if the concentration of a well is more than the gray zone value below the positive value, the well is scored "-".

Upper cutoff conc. = Conc. of positive controls + ((Gray zone/100) * Conc. of positive controls)

Lower cutoff conc. = Conc. of positive controls - ((Gray zone/100) * Conc. of positive controls)

c. Formula

The mean absorbance values of the Positive and Negative wells defined in the plate map are used for the cutoff formula calculation.

The 12 types of formula-based cutoff reports are:

i.	k * CNx	vii.	k + CNx
ii.	k * CPx	viii.	k + CPx
iii.	k * COx	ix.	k + COx
iv.	CNx / k	x.	k*CNx + CPx
v.	CPx / k xi.	xi	(CNx + CPx) / k
vi.	COx / k	xii.	k1*CNx + k2*CPx

The result absorbance value of the formula calculation and the gray zone value that is entered by the user are used for the cutoff.

The upper and lower cutoff values are:

Upper cutoff absorbance = Result of a Formula + ((Gray zone/100) * Result of a Formula)

Lower cutoff absorbance = Result of a Formula - ((Gray zone/100) * Result of a Formula)

The absorbance range of the upper and lower cutoff is divided into 10 equal partitions, numbered 0 through 9. The absorbance value of each well is classified according to the partition of the matrix to which it corresponds and is reported as a signal digit. Wells with absorbance values greater than the upper cutoff are reported by plus signs (+), and wells with absorbance values less than the lower cutoff by minus signs (-).

d. Ratio

The mean absorbance value of the Calibrator wells defined in the plate map and the concentration value entered by the user are used for the cutoff ratio. Before the cutoff, the absorbance value of each well is converted into the concentration value. The ratio of Concentration/Absorbance of Calibrator is applied to the conversion. Then, the cutoff is done with the defined Positive and Negative or the defined Positive and Gray zone values.

6. Curve Fit Report

The Curve fit report provides a regression analysis based on the absorbance values of a series of standards. There are ten types of curve fits supported with the onboard software on iMark Microplate readers:

i. 5P Logistic Rodbard
ii. 4P Logistic Rodbard
iii. 5P Logistic Cook-Wilkenson
iv. 4P Logistic Cook-Wilkenson
v. 5P Exponential
vi. Sigmoid Logistic
vii. Linear regression
viii. Quadratic regression
ix. Cubic
x. Point-To-Point regression

The onboard software calculates the best fit of the defined curve between each set of two consecutive data points in the standard curve of absorbance vs. concentration. And then it generates the report with the coefficients of regression, the correlation coefficient, and the standard error.

For readers with the optional internal printer or with an external ESC/P printer which accepts ESC/P code, a graph of the standard curve may be generated when selected in the report parameter.

7. Concentration Report

In case of the curve fit, the Concentration report also provides the regression analysis. After the calculation of the curve fit, it calculates the concentrations values of the samples, and generates the report.

In case of the cutoff constant with the unit not designated "Abs" and in case of the cutoff ratio, the reader generates the list of concentration of each well.

8. Difference Report

The Difference report is the subtraction report between the neighboring columns or row.

9. TeSeE Screening Report

Analysis of the TeSeE screening assay results can be done with two pre-programmed protocols: “TeSeE” protocol is stored in Endpoint Protocol position #5 and “TeSeE eq” is stored in Endpoint Protocol position #6 as factory default setting. Both protocols are locked.

TeSeE screening report is generated only if these protocols are selected as current active protocol. Plate is first validated according to negative and positive controls validation criteria; samples are then compared to the calculated cut-off.

Criteria for plate validation are set as follows:

Criteria #1:	Individual Negative Control must be < 0.150
	Number of valid Negative Control must be >= 3
Criteria #2:	Individual Negative Control must be < 1.400 * Negative Control average
	Number of valid Negative Control must be >= 2
Criteria #3:	Positive Control average must be >= 1.000

Cutoff is calculated as follows:

TeSeE:

Positive cutoff = Negative Control average + 0.210

Negative cutoff = (Negative Control average + 0.210) * 0.900

TeSeE eq:

Positive cutoff = Negative Control average + 0.210

Negative cutoff = Negative Control average + 0.090

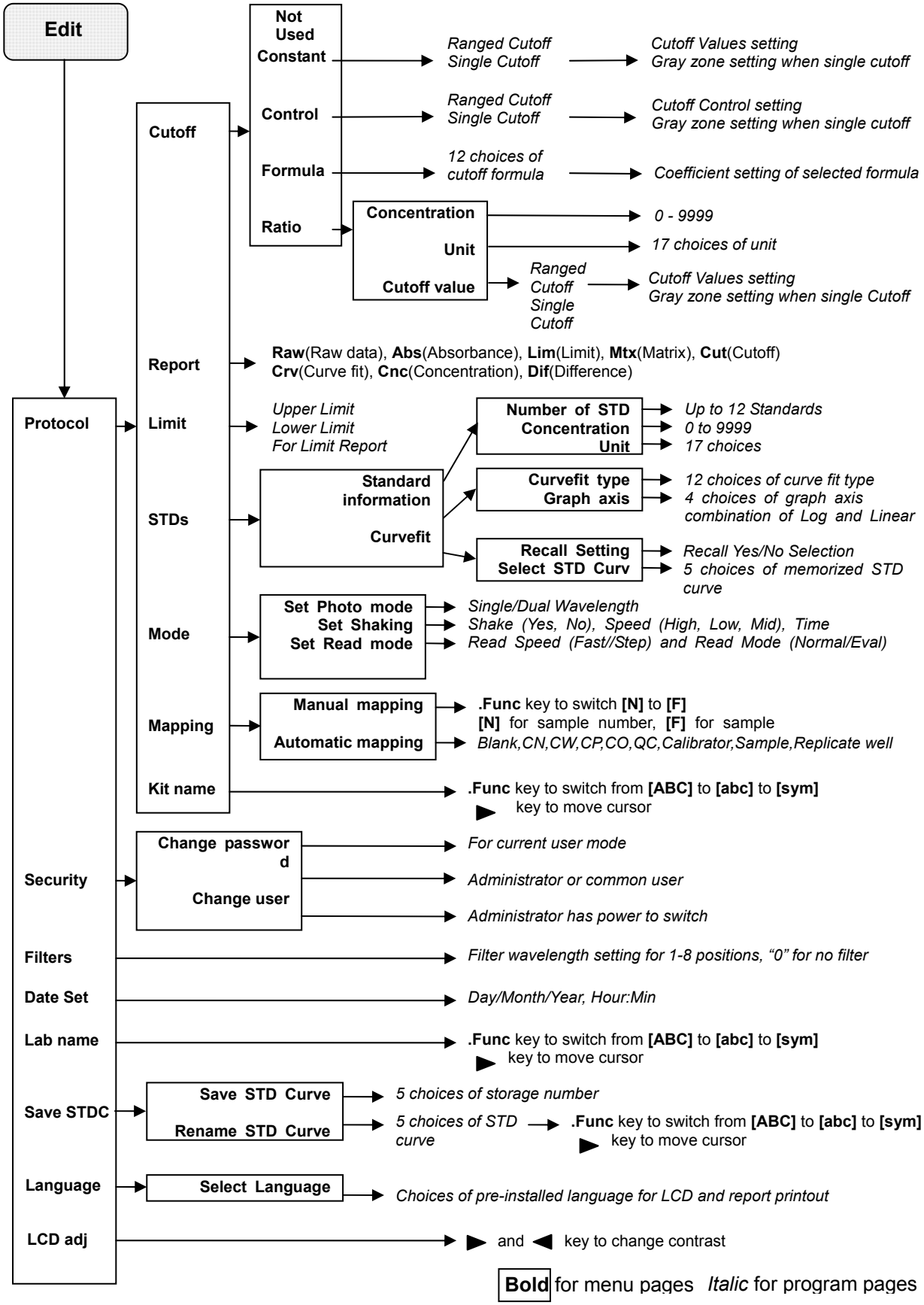
Samples are interpreted as follows:

“POS”: Positive when sample OD >= Positive cutoff

“NEG”: Negative when sample OD < Negative cutoff

“???”: Gray zone: NEG cutoff =< sample OD < POS cutoff

End-point Analysis Protocol



Kinetic Protocol Reports

Four types of Kinetic protocol reports can be generated: absorbance, kinetic plots, linear regression, and GALT reports.

1. Absorbance Report

The Kinetic Absorbance report is the series of absorbance data in the kinetic sequence.

2. Kinetic Plots Report

The Kinetic plots are the absorbance plots of each well in the plate. It is available for readers with the optional internal printer or with an external ESC/P printer which accepts ESC/P code.

3. Linear Regression Report

The Linear Regression report provides the calculation of Kinetic reaction rate for each well using the linear regression.

4. GALT Report

The GALT report calculates the following formula for each well between two readings of a plate.

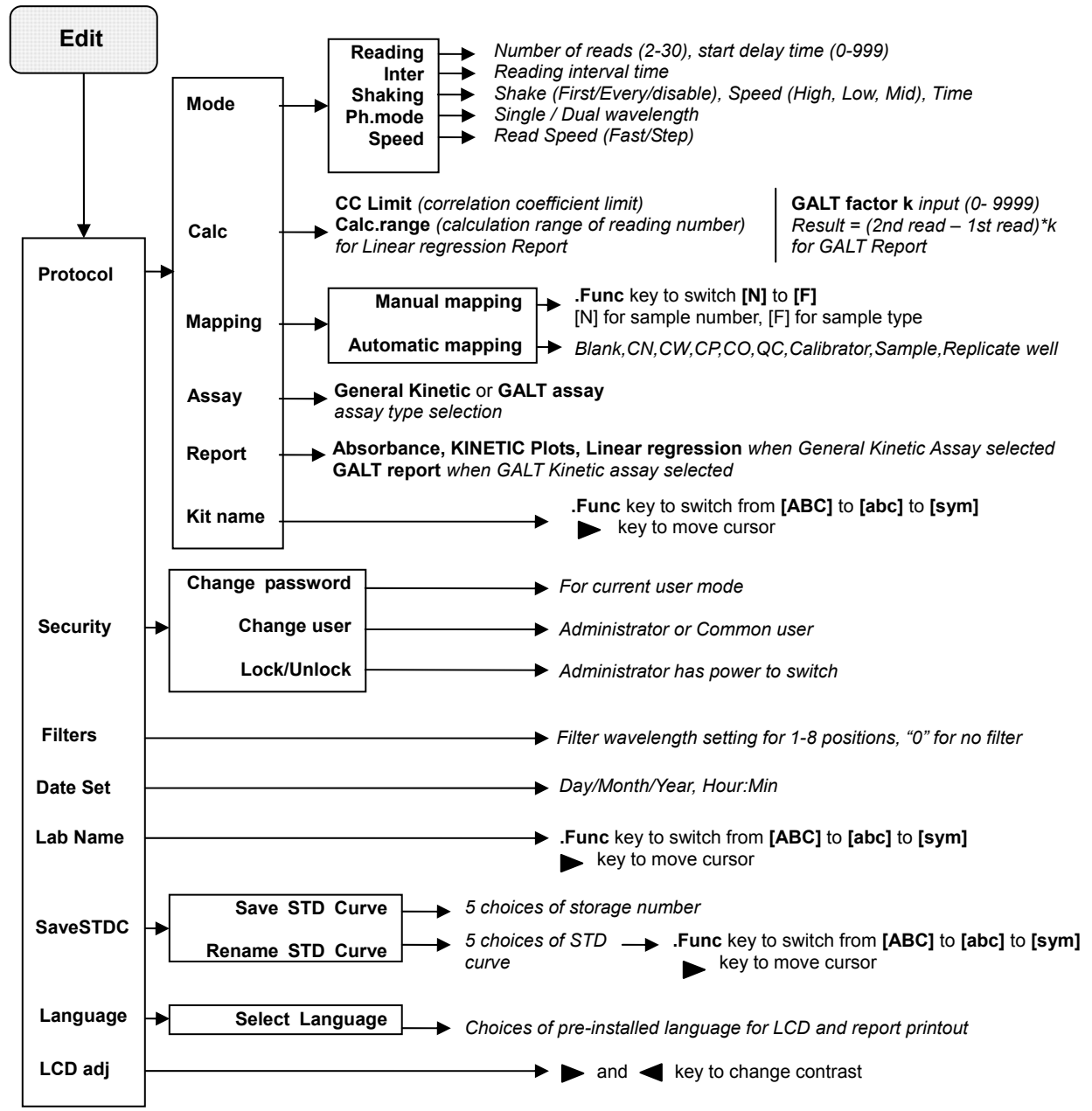
$$GALT = (R2 - R1) * k$$

Where: R1 = Absorbance value of 1st reading

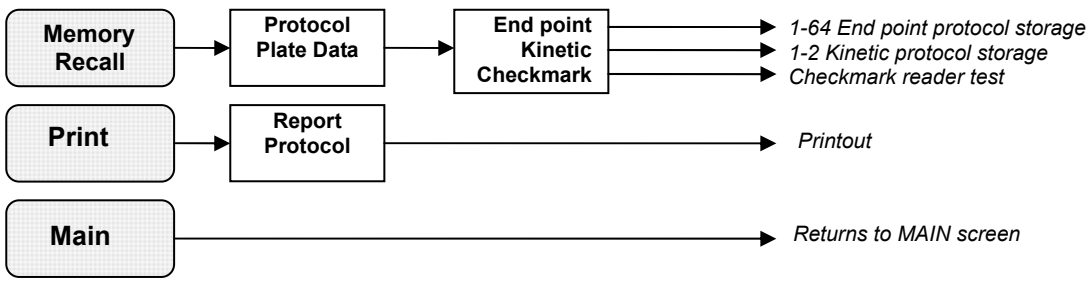
R2 = Absorbance value of 2nd reading

k = GALT factor

Kinetic Analysis Protocol



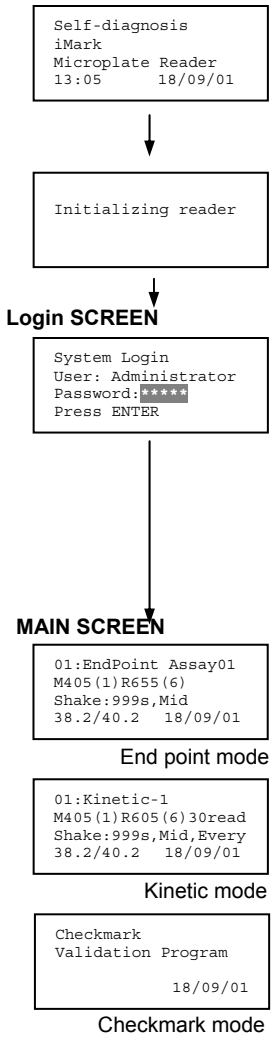
Special Buttons



Bold for menu pages *Italic* for program pages

Screen by Screen Procedures

Initial Startup



Self-Diagnosis

This screen will appear upon power-up and during self-diagnosis. Date and time are also indicated on this screen.

Initialization

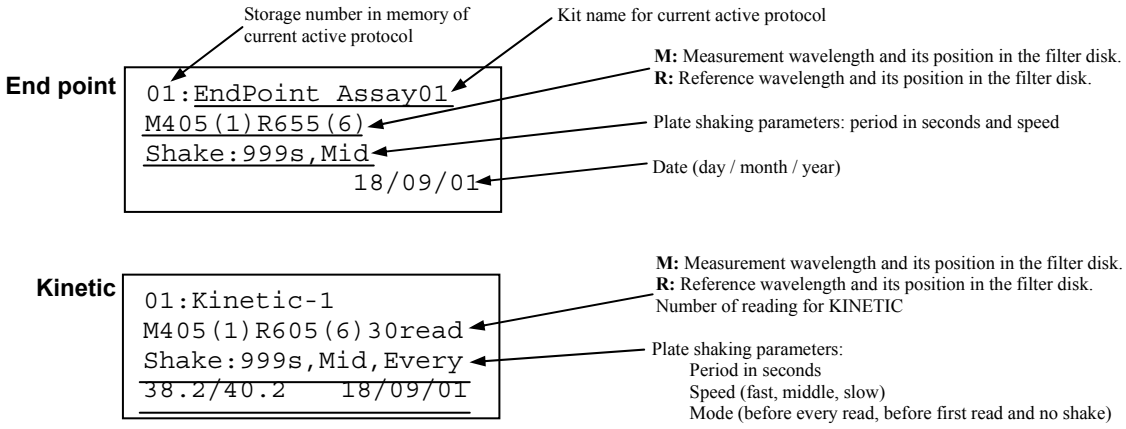
After self-diagnosis, the system initializes all the hardware.

Security Check

The system requires a password to confirm that the user is the authorized operator.
Pressing the **Change/Right arrow** key will switch the user mode between Common user and Administrator.
Password for both Common user and Administrator is set as "00000" upon factory shipment.
Operator can change the password in the **EDIT** menu. See **Security**.

System Ready

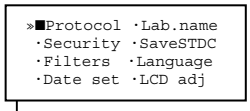
When this **MAIN** screen is on the LCD, the **Start/Stop** key can be pressed for microplate reading. Pressing **Start/Stop** key will begin reading with the current protocol.
There are three kinds of **MAIN** screens, depending on the current protocol type: Endpoint, Kinetic, and Checkmark program.
The four arrow keys, **Numeral** keys, **Main** key and **Enter** key are inactive.
Start/Stop, **Memory Recall**, **Edit**, **Print** and **Paper Feed** keys are active.



Configuring the System

NOTE: To return to the previous screen, use the **back/left** arrow key.

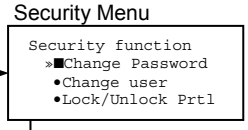
Edit Menu



Edit Menu

This menu can be accessed by pressing the **Edit** key in the **MAIN SCREEN**.

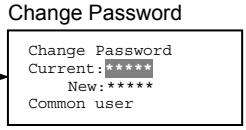
Security Menu



Security Setting

Select "Security" in the **Edit** Menu screen, and press Enter. The Security Menu appears on the screen.

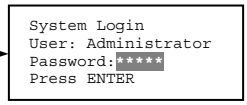
Change Password



Change Password

Select "**Change Password**" in the **Security Menu**.
Enter the current password then move the cursor to the 3rd line and enter a new password. Press **Enter** to complete the field entry. The system will return to the previous **Security Menu**.

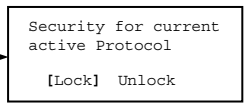
Change user



Change User Mode

Select "**Change user**" in the **Security Menu**.
Select a desired user mode by pressing the **Right** Arrow key. Enter the appropriate Password for the selected user mode. Press **Enter** to complete the field entry. The system will return to the previous **Security Menu**.

Lock/Unlock

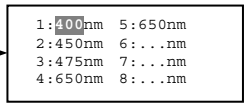


Lock/Unlock Protocol

Select "**Lock/Unlock Prtl**" in the **Security Menu**. Move the selected mark "**[ ]**" to the desired position: Lock or Unlock using the **Right** Arrow key.
Press **Enter** to complete the field entry.
The system will return to the previous **Security Menu**.

If "**Lock**" is selected, the current active protocol will be protected against modification made by a Common user. If "**Unlock**" is selected, the current active protocol can be modified by any user mode.
NOTE: Only the Administrator has authority to lock and unlock the Checkmark Protocol.

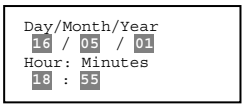
Filter



Filter Setting

Move the cursor to the desired position by using the **Up, Down,** and **Right** arrow keys.
Enter the filter wavelength on the selected position using the number keys.
If the selected position of the filter disk is empty, enter three "...".
Press **Enter** to complete the field entry. The system will return to the previous **Edit Menu** screen.

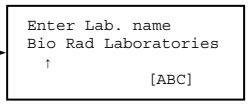
Date set



Calendar Setting

Move the cursor to the desirable position for date or time input by using the **Up, Down,** and **Right** arrow keys. Enter the present date or time using the number keys.
Press **Enter** to complete the field entry. The system will return to the previous **Edit Menu** screen.

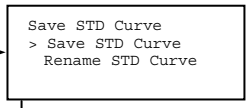
Lab. name



Lab. Name Setting

Use the **Up** and **Down** arrow keys to select from "A" to "Z" and symbols.
Use the **Number** keys for numeric input.
Use the **Right** arrow key to move the cursor to the right.
Use the **Left** arrow key to return the cursor to the **Edit Menu** screen.
Pressing the **./FUNC**" key will toggle the character mode between Upper case alphabet, Lower case alphabet, and symbol. The current character mode is indicated on the lower right corner of the LCD.

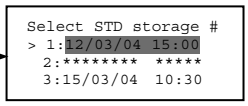
Save STDC

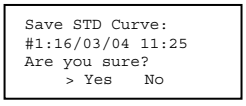


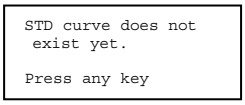
Save STDC Setting

Select "Save STDC" in Edit Menu screen above, and press **Enter.** The Save STD Curve Menu appears on the screen.
Move the cursor to the desired position by using the **Up** and **Down** arrow keys.

Save STD Curve





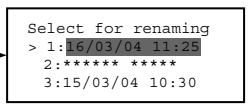


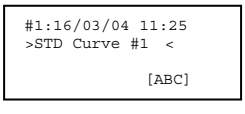
Save STD Curve

To save a STD Curve, select the storage number between 1 and 5. Use the **Up** and **Down** arrow keys to move the cursor to the desired storage number, and press **Enter** to complete the selection.
After the storage number selection, the "**Are you sure?**" message appears.
Select "**Yes**" or "**No**" and press **Enter**. In case of "**Yes**", the reader saves the STD Curve and returns to the **Edit Menu** screen.

If the curve fit calculation is not done, or has not finished successfully, an error message will appear and the STD Curve will not be saved.

Rename STD Curve

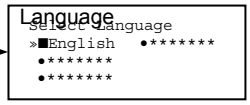


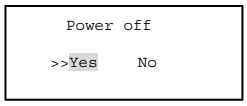


Rename STD Curve

To change a name of an STD Curve, select a storage number between 1 and 5. Use the **Up** and **Down** arrow keys to move the cursor to the desired storage number, and press **Enter** to complete the selection.
Use the **Up** and **Down** arrow keys to select from "A" to "Z" and symbol.
Use the **Number** keys for numeric input.
Use the **Right** arrow key to move the cursor to the right.
Use the **Left** arrow key to return the cursor to the **Edit Menu** screen.
Pressing the **./FUNC**" key will toggle the character mode between Upper case alphabet, Lower case alphabet, and symbol. The current character mode is indicated on the lower right corner of the LCD.

Language

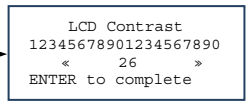




Changing Language

Select a desired language using the **Up** and **Down** arrow keys, and press **Enter** to complete the selection. The system will generate a message for an immediate power off to restart.
Select "Yes" and press **Enter** to activate the selected new language.
The newly-changed language will be applied to the LCD screen and printed reports.

LCD adj

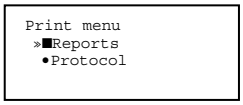


Adjusting LCD Contrast

Adjust LCD contrast by using the **Right** and **Left** arrow keys, and press **Enter** to complete the adjustment.

Printing Reports and Protocol information

Print Menu



Print Menu

Access this menu screen by pressing the **Print** key in the **MAIN** screen.

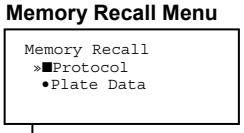
Printing Reports
Select "**Reports**" and press **Enter** to print the current active plate data report.

Printing Protocol Information
Select "**Protocol**" and press Enter to print all parameter settings in the current active protocol.

Stop Printing
Press the **Start/Stop** key during printing to stop the print job immediately.
When printing is completed, the system automatically returns to the **MAIN** screen.

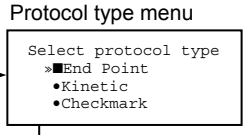
Memory Recall Operation

Memory Recall Menu



This menu screen can be accessed by pressing the **Memory Recall** key in the **MAIN** screen.

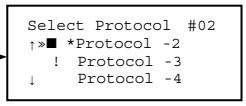
Protocol type menu



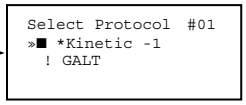
Changing Current Active Protocol

Select "**Protocol**" in **Memory Recall** menu above, and press **Enter**. The Select **Protocol type** menu will appear on the screen.
Select a protocol using the **Up** and **Down** arrow keys. Press **Enter** to complete the selection.

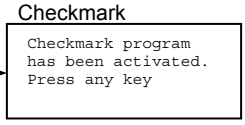
End Point



Kinetic



Checkmark



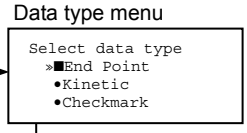
Selecting Protocol

Move the cursor to the position of the desired protocol and press **Enter** to complete the selection.

NOTE: "*****" indicates the currently activated protocol, and "**!**" indicates a security locked protocol.

There is no protocol selection with "**Checkmark**".
When a protocol is selected, the system will then automatically return to the MAIN screen.

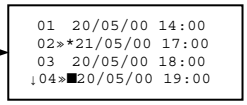
Data type menu



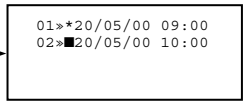
Changing Current Active Plate Data

Select "**Plate Data**" using the **Memory Recall** button and press **Enter**. The **Data type** menu will appear.
Use the **Up** and **Down** arrow keys to select a plate data type. Press **Enter** to complete the selection.

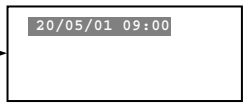
End Point



Kinetic



Checkmark



Selecting Plate Data

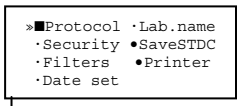
Move the cursor to the position of the desired plate data and press **Enter** to complete the selection.

NOTE: "*****" indicates the currently activated plate data.

There is only one storage for "**Checkmark**" data.
When plate data is selected, the system automatically returns to the MAIN screen.

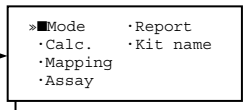
Editing the Kinetic Protocol

Edit Menu



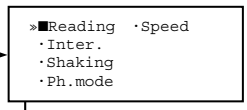
This menu screen can be accessed by pressing the **Edit** key in the **MAIN screen**.

Kinetic Protocol Menu



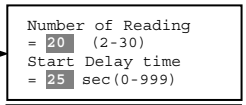
Select "**Protocol**" in the **Edit** Menu and press **Enter**. The **Kinetic Protocol** menu will appear on the screen if the current active protocol type is Kinetic.

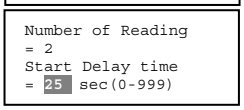
Kinetic Mode



This menu screen can be accessed by selecting "Mode" in the Kinetic Protocol menu above.

Reading

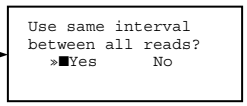


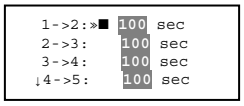


Number of Readings and Start Delay Time Setting

Press the **Up** or **Down** arrow key to change the number.
Enter the appropriate numbers with the numeral keys, and press **Enter** to complete the field entry. The system will return to the Kinetic Edit Menu.
If GALT is the current assay type, the number of reading fields is fixed at 2.
Press the **Start/Stop** key to set the Start Delay time, enter a value and press **Enter**, until the reading starts.

Inter.





Setting Reading Intervals

The system prompts the operator to set a reading interval before each plate run.
Move the cursor to the desired selection "**Yes**" or "**No**" and press **Enter**. The system generates the interval entry screen.
Move to the active entry field by pressing the **Up** and **Down** arrow keys, and enter appropriate numbers using numeral keys. Press **Enter** to complete all field entries.
The system will return to the **Kinetic Mode** menu.

Shaking

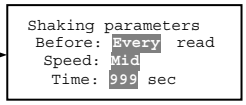
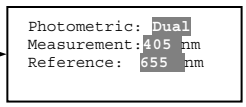


Plate Shake Parameters

When the "**Before**" field is activated, pressing the **Right** arrow key will change the field entry: "**Every**"**->"--"->"First"->.** When the "**Speed**" field is activated, pressing the **Right** arrow key will change the field entry: "**Mid**" **->"Hi"->"Low"->.**
When the "**Time**" field is activated, enter the time value for plate shaking period using the numeral keys.
Press **Enter** to complete all field entries.

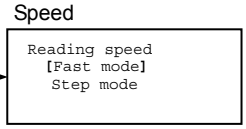
Ph. mode



Photometric Mode Setting

When the "**Photometric**" field is activated, pressing the **Right** arrow key will switch the field entry: "**Single**" **<->"Dual".**
Pressing the **Up** or **Down** arrow keys will move the cursor to the next entry field.
Pressing the **Right** arrow key when the wavelength field is activated will change the wavelength to the next available selection installed in the reader.
Press **Enter** to complete all field entries.

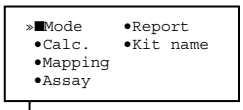
Speed



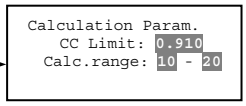
Selecting Reading Speed

Use the **Up** or **Down** arrow keys to switch the selection. Press **Enter** to complete the selection.

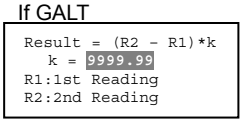
Kinetic Protocol Menu



Calculation



If GALT



Calculation Parameter Setting

When the "**CC Limit**" field is activated, pressing the numeral key will enter the desired numbers. Press **Enter** to complete all field entries.
If the GALT Reports is activated, pressing the numeral keys will enter the desired numbers. Press **Enter** to complete all field entries.

Mapping

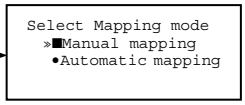
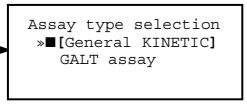


Plate Mapping

See **Plate Map setting procedure**.

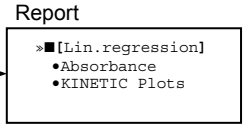
Assay



Selecting Kinetic Assay Type

Move the cursor to the desired Assay type by pressing the **Up** or **Down** arrow keys.
Press **Enter** to complete the selection.
The item with mark "**[ ]**" is the currently selected item.
GALT assay: Result = factor x (2nd Read – 1st Read)

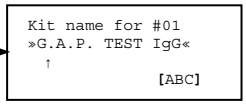
Report



Selecting Report Type

Move the cursor to the desired report type by pressing the **Up** or **Down** arrow keys.
Pressing the **Right** arrow key will select or deselect the item.
Press **Enter** to complete the selection.
Note: When GALT assay is selected "**GALT report**" shall be the only one option on this screen.

Kit name

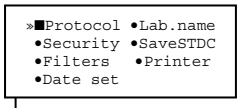


Setting the Kit Name

Use the **Up** and **Down** arrow keys to select alphabet from "A" to "Z" and space.
Use the **Number** keys for numeric input.
Use the **Right** arrow key to move the cursor to the right.
Use the **Left** arrow key to return to the **Protocol Menu** screen.
Pressing "**./FUNC**" key will change the character mode: Upper case alphabet **->** Lower case alphabet **->** symbol. The current character mode is indicated on the lower right corner of the LCD.

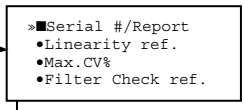
Checkmark Value Setting (Administrator only)

Edit Menu



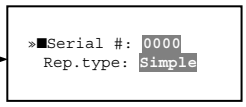
This menu screen can be accessed by pressing the **Edit** key in the **MAIN screen**.

Checkmark Protocol Menu



Select "**Protocol**" in the **Edit** Menu and press **Enter**. The **Checkmark Protocol** Menu will appear on the screen if the current active protocol type is Checkmark mode.

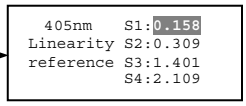
Serial #/Report



Setting the Serial Number and Report Type

Pressing the **Up** and **Down** arrow keys will move the cursor and change the field entry.
When "**Serial #**" field is active, enter the serial number that will be shown in the data sheet of the Checkmark plate using the numeral keys.
When the "**Rep. type**" field is active, pressing the **Right** arrow key will switch the report type between "**Simple**" and "**Full**".

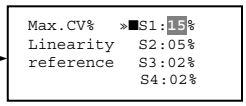
Linearity reference



Setting the Linearity Reference Value

Pressing the **Up** or **Down** arrow keys will move the field entry from S1 to S4.
Pressing the **Right** arrow key will change the wavelength:
405 nm->450 nm->492 nm->540 nm->620 nm->690 nm
Use the **numeral** keys for the reference value setting.
Pressing **Enter** will complete all field entries at all wavelength.

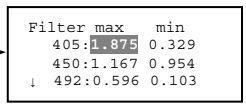
Max. CV%

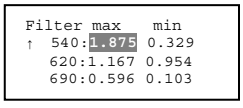


Max. CV% setting

Pressing the **Up** or **Down** arrow keys will move the field entry from S1 to S4.
Use the **numeral** keys for the Max. CV% setting. Press **Enter** to complete all field entries.

Filter check reference



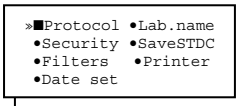


Setting the Filter Check Reference Value

Initial screen shows the reference entries for 405 nm to 492 nm and pressing the **Down** arrow key at the bottom of the screen entries will scroll to the next page for 540 nm to 690 nm. Pressing the **Up, Down** and **Right** arrow keys will move the field entry. Use the **numeral** keys for the filter check reference value setting. Press **Enter** to complete all field entries.

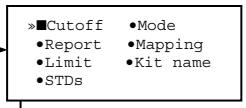
Editing End Point Protocol

Edit Menu



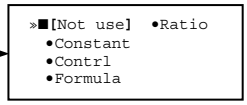
This menu screen can be accessed by pressing the **Edit** key in the **MAIN screen**.

End Point Protocol Menu



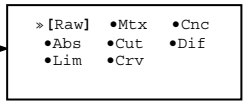
Select "**Protocol**" in **Edit** Menu screen above, and press **Enter**. The **End point Protocol** Menu will appear on the screen, if the current active protocol type is End point mode.

Cutoff

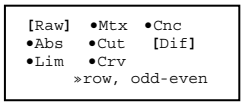


See **Cutoff setting procedure**

Report



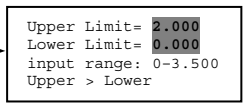
If "Dif" selected



Seting the Report Type

Use the **Up** and **Down** Arrow key to move the cursor, and press the **Right** Arrow key to select or deselect the report type. Selected report type is marked as "**[ ]**". Press **Enter** to complete the selection.

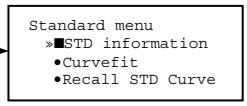
Limit



Setting the Limit Value

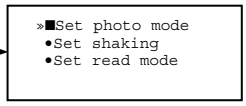
Use the **Up** and **Down** Arrow key to move the cursor, and enter the OD value using the **numeral** keys. The OD value range is 0.000 - 3.500. Press **Enter** to complete the selection.

STDs



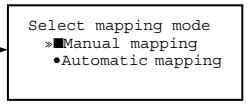
See **Standard setting procedure.**

Mode



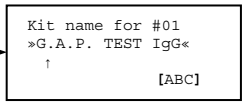
See **Mode setting procedure.**

Mapping



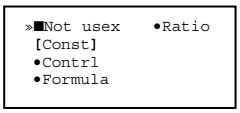
See **Plate Map setting procedure.**

Kit name



See **Kit name setting** in **Editing Kinetic Protocol.**

Cutoff Setting Procedure



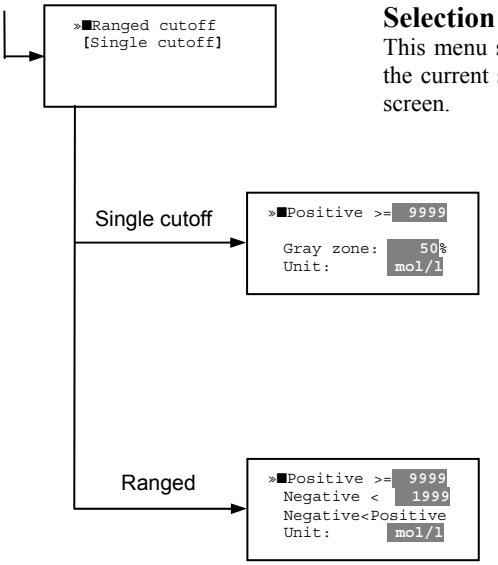
Cutoff Setting Menu

This menu is entered by choosing "Cutoff" in the End Point Protocol Menu. It is used to set the cutoff type. The cutoff type marked with "**[ ]**" is the current selection. The **Up** and **Down** arrow keys move the cursor to the desired item in the menu list. When the desired parameters have been selected, press **Enter** twice to accept the selection and to continue to the next screen. "Not use" means that the reader does not generate the cutoff report.

Four types of cutoff are supported:

1. Cutoff Constant
2. Cutoff Control
3. Cutoff Formula
4. Cutoff Ratio

a. Cutoff Constant



Selection of Single/Ranged Cutoff Constant

This menu selects Single or Ranged cutoff type. The cutoff type marked with "**[ ]**" is the current selection. The **Enter** key seals the selection and resumes to the next setting screen.

Single Cutoff Constant

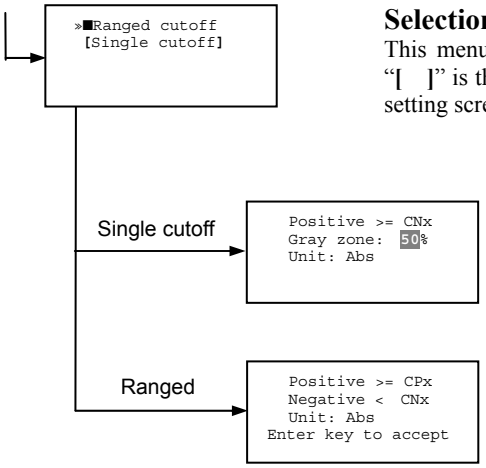
The **Numerical** keys and the **Decimal point** key are used to enter the positive and gray zone values. The **Right** arrow key is used to select the unit. The **Up** and **Down** arrow keys move the cursor to the desired parameter of the single cutoff. The **Enter** key sets all values and selection of the cutoff constant and returns the user to the previous screen.

Ranged Cutoff Constant

The **Numerical** keys and the **Decimal point** key are used to enter the positive and negative values. The **Right** arrow key is used to select the unit. The **Up** and **Down** arrow key moves the cursor to the desired ranged cutoff parameters. The **Enter** key sets all values and selection of the cutoff constant and returns to the previous screen.

NOTE: Two available Cutoff constants are "Absorbance" and "Concentration". If "Abs" is chosen, the Absorbance cutoff will be done with the cutoff constant parameters defined and the absorbance report is generated. For other units defined in the curve fit setting, the Concentration value using the curve fit and then cutoff is done with the cutoff constant parameters defined and the concentration value of each well. It is necessary to set the curve fit parameters.

b. Cutoff Control



Selection of Single/Ranged Cutoff Control

This menu screen selects Single or Ranged cutoff type. The cutoff type marked with "**[ ]**" is the current selection. The **Enter** key seals the selection and resumes to the next setting screen.

Single Cutoff Control

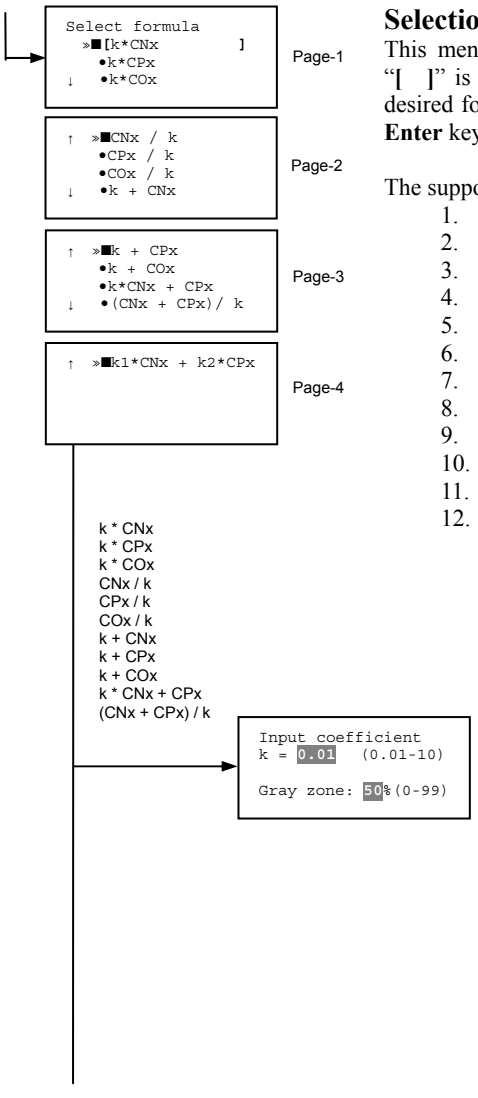
The **Numerical** keys are used to enter the gray zone value. The unit is fixed to "Abs". The **Enter** key sets the value of the cutoff control and returns to the previous screen.

Ranged Cutoff Control

There is no parameter to set for the ranged cutoff control.
The **Enter** key returns to the previous screen.

NOTE: "CNx" is the mean absorbance value of Negative control wells and "CPx" is the mean absorbance value of Positive control wells. These wells are defined in the plate map setting. The cutoff is done with the Positive and Negative value to the absorbance value of each well.

c. Cutoff Formula



Selection of Formula

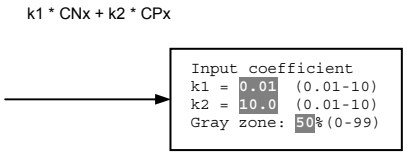
This menu screen selects a formula for cutoff calculation. The formula marked with "**[ ]**" is the current selection. The **Up** and **Down** arrow keys move the cursor to the desired formula type. The movement of the cursor follows the scroll of this screen. The **Enter** key marks the selection and advances the user to the next setting screen.

The supported formula types are:

1. k * CNx
2. k * CPx
3. k * COx
4. CNx / k
5. CPx / k
6. COx / k
7. k + CNx
8. k + CPx
9. k + COx
10. k*CNx + CPx
11. (CNx + CPx) / k
12. k1*CNx + k2*CPx

Coefficient for Cutoff Formula 1 to 11

The **Numerical** keys and the **Decimal point** key are used to enter the coefficient "k" and gray zone values. The **Up** and **Down** arrow key moves the cursor to the desired parameter of the cutoff formula. The **Enter** key sets all values of the cutoff formula and returns to the previous screen.

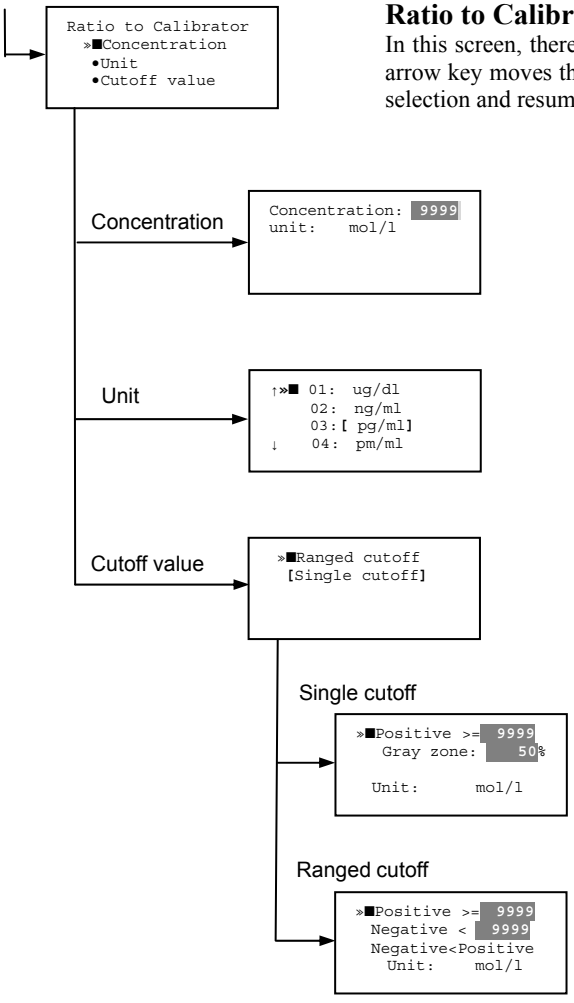


Coefficient for Cutoff Formula 12

The **Numerical** keys and the **Decimal point** key are used to enter the coefficient "k1" and "k2" and gray zone values. The **Up** and **Down** arrow key moves the cursor to the desired cutoff formula. The **Enter** key sets the all values of the cutoff formula and returns to the previous screen.

NOTE: "CNx" is the mean absorbance value of Negative control wells, "CPx" is the mean absorbance value of Positive control wells, and "COx" is the mean absorbance value of Cutoff control wells. These wells are defined on the plate map setting. The cutoff value is calculated using the defined formula with the defined values and coefficients.

d. Cutoff Ratio



Ratio to Calibrator

In this screen, there are three items for setting the ratio to calibrator. The **Up** and **Down** arrow key moves the cursor to the desired item in the menu list. The **Enter** key seals the selection and resumes to the next setting screen.

Concentration of Calibrator

The **Numerical** keys and the **Decimal point** key are used to enter the calibrator concentration value. The **Enter** key sets the value and returns to the previous screen.

Unit of Calibrator

Seventeen standard units are supported. The unit marked with "**[ ]**" is the current selection.
The setting procedure is the same as the unit selection of Standards.

Cutoff Value Setting

This menu screen selects Single or Ranged cutoff type. The cutoff type marked with "**[ ]**" is the current selection. The **Enter** key marks the selection and continues to the next setting screen

Single Cutoff Control

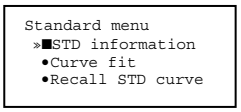
The **Numerical** keys are used to enter the Positive cutoff concentration value and gray zone value. The **Enter** key sets these cutoff ratio values and returns to the previous screen.

Ranged Cutoff Control

The **Numerical** keys are used to input the Positive and the Negative cutoff concentration values. The **Enter** key sets these cutoff ratios and returns to the previous screen.

NOTE: The calibrator concentration value is used to convert the absorbance value of each well into a concentration value. The ratio of Concentration/Absorbance of Calibrator well is applied to the conversion. The cutoff uses defined Positive and Negative values to the converted concentration value of each well.

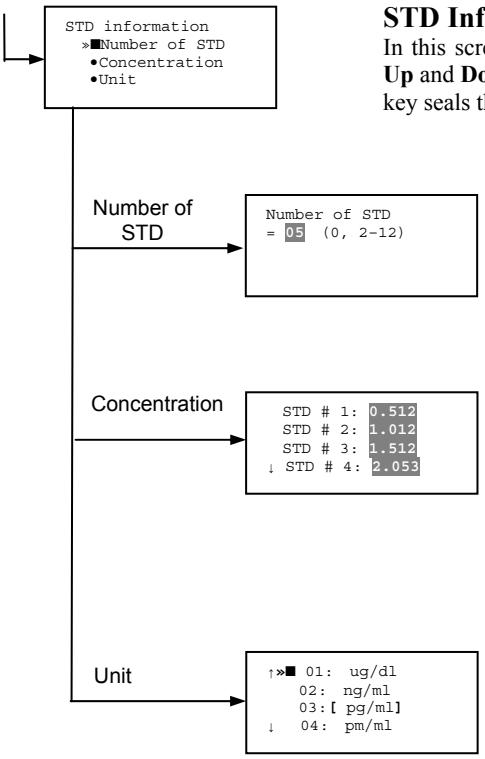
Standard Setting Procedure



Standard Curve Setting Menu

This menu screen is entered by choosing "STDs" in the End Point Protocol Menu screen. It is used to set the concentration data and the curve fit type for a standard curve or to recall a memorized standard curve.
The **Up** and **Down** arrow key moves the cursor to the desired item in the menu list. The **Enter** key seals the selection and continues to the next setting screen.

a. STD Information Setting



STD Information

In this screen, there are three items for setting the concentration data of standards. The **Up** and **Down** arrow keys move the cursor to the desired item in the menu list. The **Enter** key seals the selection and continues to the next setting screen.

Number of Standards

The **Numerical** keys are used to enter the number of standards.
"0" means that the curve fit report is not used. The **Enter** key sets the number and returns to the previous screen.
The maximum number of standards is 12.

Concentration

The **Numerical** keys and the **Decimal point** key are used to enter the concentration values of standards. The **Up** and **Down** arrow keys move the cursor to the desired position. The movement of the cursor also follows the scroll of this screen. The **Enter** key sets all values of the concentration of standards and returns to the previous screen.

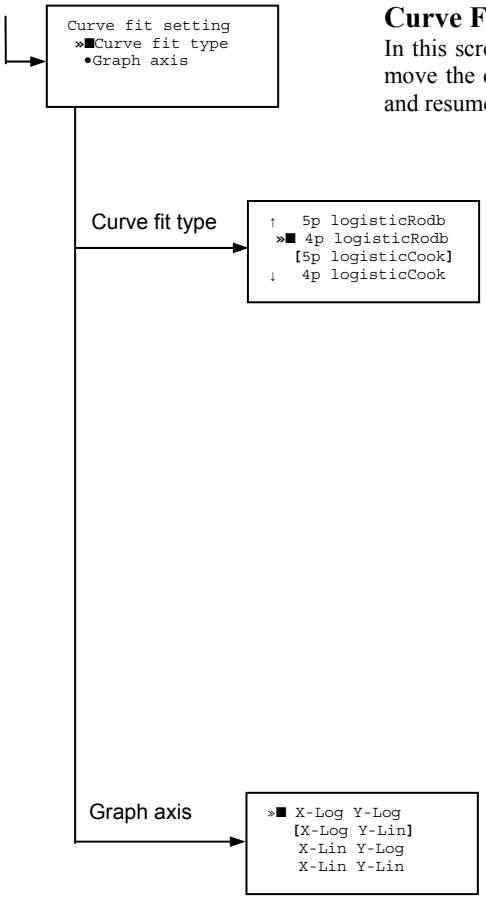
Unit

Seventeen units are supported. The unit marked with "**[ ]**" is the current selection. The **Up** and **Down** arrow keys move the cursor to the desired unit type. The movement of the cursor also follows the scroll of this screen. Press **Enter** twice to select the unit type and to return to the previous screen.

The supported types of unit are:

1. mol/l
2. m mol/l
3. u mol/l
4. n mol/l
5. p mol/l
6. mg/l
7. ng/l
8. pg/l
9. ug/dl
10. ng/ml
11. pg/ml
12. U/ml
13. IU/ml
14. uIU/ml
15. mIU/ml
16. EU
17. Arbit.

b. Curve Fit Setting



Curve Fit

In this screen, there are two choices to set the curve fit. The **Up** and **Down** arrow keys move the cursor to the desired item in the menu list. The **Enter** key seals the selection and resumes to the next setting screen.

Curve Fit Type

10 types of curve fit are supported as below. The curve fit type marked with "**[ ]**" is the current selection. The **Up** and **Down** arrow key moves the cursor to the desired curve fit type. The movement of the cursor follows the scroll of this screen. Press **Enter** twice to select the unit type and to return to the previous screen.

The supported curve fit types are:

1. 5P Logistic Rodbard
2. 4P Logistic Rodbard
3. 5P Logistic Cook-Wilkenson
4. 4P Logistic Cook-Wilkenson
5. 5P Exponential
6. Sigmoid Logistic
7. Linear regression
8. Quadratic regression
9. Cubic
10. Point To Point regression

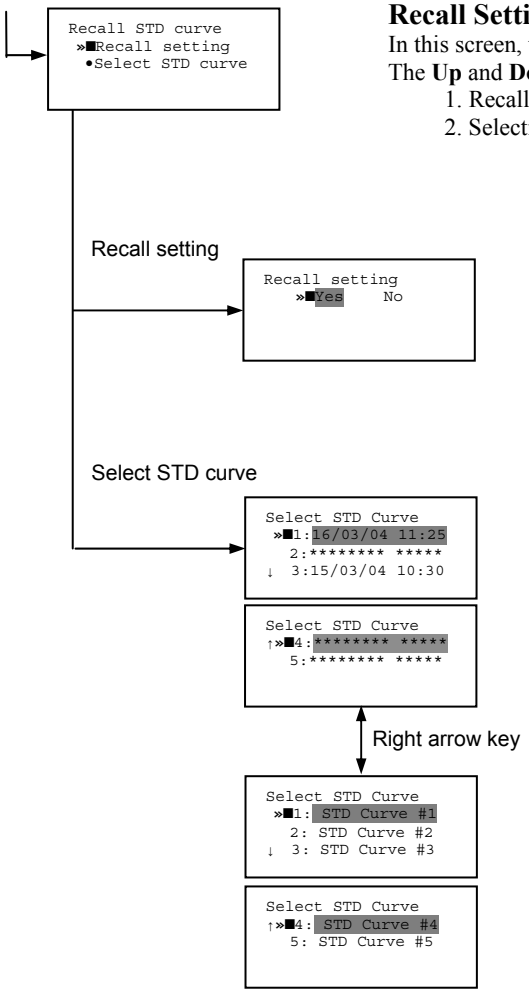
Graph Axis

Four types of graph are supported. The curve fit type marked with "**[ ]**" is the current selection. The **Up** and **Down** arrow keys move the cursor to the desired graph type.
Press **Enter** twice to select the unit type and to return to the previous screen.

The supported graph types are:

1. Log - Log
2. Log - Linear
3. Linear - Log
4. Linear - Linear

c. Recall STD Curve Setting



Recall Setting of Standard Curve

In this screen, there are two items for setting the Recall STD curve as below.
The **Up** and **Down** arrow keys move the cursor to the desired item in the menu list.

1. Recall setting (Yes/No)
2. Selecting the storage number of standard curves (1 -> 5)

Recall Setting

Move the cursor to the desired position using the **Up**, **Down** or **Right** arrow keys. **Enter** key accepts the setting and returns the user to the standard menu screen.

Yes: Recalling of the standard curve is active.
No: Recalling of the standard curve is inactive.

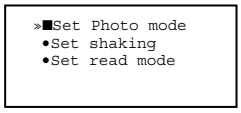
Storage Number Selection

Five memories are selectable. The vacant memory (marked with asterisks on the date and time field) is also selectable. It is necessary to save a standard curve before using its protocol.
Move the cursor to the desired position using the **Up** and **Down** keys.

This setting screen consists of two parts. The **Right** arrow key is used to switch the indication field between the date and time to the standard curve name.
Move the cursor to the desired position using the **Up** and **Down** keys. The **Enter** key accepts the storage number and returns to the standard menu screen.

NOTE: If the recall of standard curve is active (the recall setting is “Yes”), the standard information setting and the curve fit setting will be invalidated and their setting screens will not open.

Mode Setting Procedure



Mode Setting Menu

This menu screen is entered by choosing the "Mode" in the End Point Protocol Menu screen or the Kinetic Protocol Menu screen. It is used to set the plate reading conditions. The **Up** and **Down** arrow keys move the cursor to the desired item in the menu list. The **Enter** key seals the selection and resumes to the next setting screen.

a. Set Photo Mode

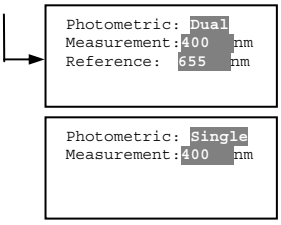
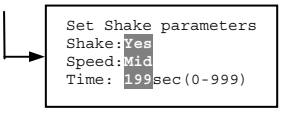


Photo Mode

In this screen, the user chooses Single or Dual wavelength measurement and assigns the measurement and reference (for dual wavelength measurement) filters. The assignment of the reference filter appears for dual wavelength measurement.

The **Up** and **Down** arrow keys move the cursor to the desired parameter. The **Right** arrow key chooses Single/Dual wavelength measurement and selects the installed filter on the "Filters" of Edit Menu screen. The **Enter** key seals the selection and returns to the previous screen.

b. Set Shaking

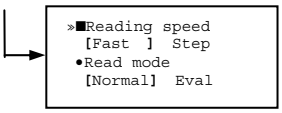


Shaking

In this screen, the user selects/deselects shaking function, sets the shaking strength, and enters the shaking time. A shaking time of 0s indicates no shaking. The maximum shaking time is 999 seconds.

The **Up** and **Down** arrow key moves the cursor to the desired parameters. The **Right** arrow key toggles between Yes/No (Select/Deselect) shaking or selects strength: Low/Middle/High. The **Numerical** keys are used to enter the shaking time. The **Enter** key seals the selection and returns the user to the previous screen.

c. Set Read Mode



Read Mode

In this screen, the user chooses Fast or Step reading and also chooses Normal or Evaluation mode.

The "**[ ]**"indicates the current selection. The **Up** and **Down** arrow key moves the cursor to the desired parameters. The **Right** arrow key chooses Fast/Step speed or chooses Normal/Eval mode. The **Enter** key seals the selection and returns to the previous screen. The followings are the description of each read mode parameter.

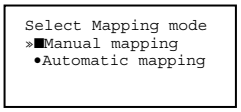
Reading speed

Fast reading:	6 sec/single wavelength reading, 10 sec/dual wavelength reading
Step reading:	15 sec/single wavelength reading, 30 sec/dual wavelength reading

Reading mode

Normal mode:	Plate reading once
Evaluation mode:	Four plate readings per one of measurement are performed and the average data of their plate readings is generated as a plate data.

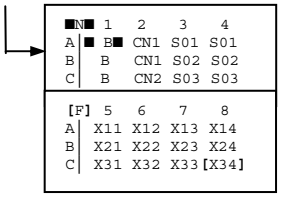
Plate Map Setting Procedure



Select Mapping Mode Menu

This menu screen is entered by choosing "Mapping" in the End Point Protocol Menu screen or the Kinetic Protocol Menu screen. It is used to map the plate format. The **Up** and **Down** arrow keys move the cursor next to the desired item of menu list. The **Enter** key seals the selection and changes this screen to the next setting screen.

a. Manual Mapping



Manual Mapping

In this screen, the user can set the plate format manually. Ten well types can be set.

Well types:

The supported well types are:

Well type		Indication on LCD
1. Blank:		**B**
2. Sample:		**X00…X99**
3. Standard:		**S01…S99**
4. In-kit Control:	Positive Control	**CP0…CP9**
5.	Weak Positive Control	**CW0…CW9**
6.	Negative Control	**CN0…CN9**
7.	Cutoff Control	**CO0…CO9**
8. Calibrator		**CL0…CL9**
9. QC Control:		**QC0…QC9**
10. Empty well:		**-**

The key assignments of well type are:

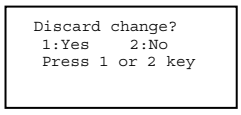
"0/EMP"	Empty well	"5/QC"	Quality Control well
"1/SMP"	Sample well	"6/CAL"	Calibrator well
"2/BLK"	Blank well	"7/CP"	Positive Control well
"3/STD"	Standard well	"8/CN"	Negative Control well
"4/CO"	Cutoff Control well	"9/CW"	Weak Positive Control well

Two Edit Modes in Plate Mapping:

There are two editing modes; for well type input mode and for well number input. The current input mode is displayed at the upper left corner of the screen. When using the well type input mode, the mode sign is "**[F]**". When using the well number input mode, the mode sign is "**■N■**".

The cursor that encloses the editing position of well has two types of enclosures depending on the mode. For example, "**[S01]**" accepts the well type keys that be assigned to the numerical keys and "**■S01■**" accepts the numerical input.

The mode is easily changed with the **Decimal point** key.



Key Functions:

The **Up**, **Down**, **Right** and **Left** arrow keys move the cursor to the desired well. The movement of the cursor follows the scroll of this screen. The **Left** arrow key will return the screen to the preceding screen, or the "select Mapping mode Menu", only if the cursor is on column #1. At this time, the selection screen appears (see the left figure).

The **Decimal point** key changes the input mode.

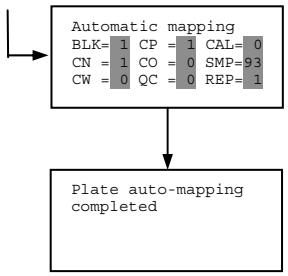
The **Numerical** keys have two functions; one to input the number and another to select a well type.

The **Enter** key checks the consistency between the edited plate map and other parameters, memorizes the plate map into the protocol and changes this screen back to the preceding screen. If it finds any inconsistency, a warning message will appear on the screen.

Acceptable Number Ranges for each well type:

1. Blank and Empty wells do not use numbers.
2. Sample and Standard wells: 00 - 99
3. Standard wells: 01 - 99
4. Control and Calibrator wells: 0 - 9

b. Automatic Mapping



Automatic Mapping

The user can input the number of each well type in this screen. These defined numbers are used to set a plate map automatically.

Well type:

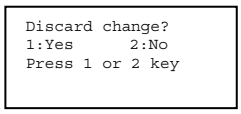
Nine well types are available.

1. BLK : Blank (0->10)
2. CN : Control CN (0->9)
3. CW : Control CW (0->9)
4. CP : Control CP (0->9)
5. CO : Control CO (0->9)
6. QC : Control QC (0->9)
7. CAL : Calibrator (0->9)
8. SMP : Sample (0->96)
9. REP : Replicate well (1->4)

It is possible to define the number of blanks, samples, calibrators and controls. But the number of Standards is not included, because standards are defined at the Standard Setting Menu.
The number of replicate wells is also included. It is used for replicating each well type individually.

Key Functions:

The **Up**, **Down**, **Right** and **Left** arrow keys are used to move the cursor to the next position. The **Numerical** keys are used to input the mapping parameters. The **Enter** key accepts the mapping parameters and sets a plate map automatically using these parameters.
During the execution of the plate mapping, the "Plate auto-mapping completed" message appears on the screen. After that, the user returns automatically to the previous **Protocol Menu** screen.



If the **Left** arrow key is pressed at the left end position of the cursor, the left figure will appear on the screen. If the user chooses "Yes", the system will return to the previous **Protocol Menu** screen. If the user chooses "No", the system will stay in this setting screen.

Assigning Order and Direction of plate mapping:

Assigning Order:
The order of blanks, standards, samples, calibrators and controls are fixed as follows. Numbering for standards, samples, calibrators and controls is started at 1.

1. Blank
2. Standard 1 ->12 ---- **NOTE**
3. Control CN 1->9
4. Control CW 1->9
5. Control CP 1->9
6. Control CO 1->9
7. Control QC 1->9
8. Calibrator 1->9
9. Sample 1->96
10. Empty well

NOTE: If “Cutoff Control”, “Value by Formula” or “Ratio to Calibrator” is selected for the Cutoff, plate mapping skips arranging the standards.

Assigning Direction:
The placing direction of the mapping is limited to the column direction as below.
Column direction: A1 -> H1, A2 -> H2, ----- ,A12 -> H12

```
Warning: The total
Of mapped wells has
Exceeded 96.
Press any key
```

Warning and Error of Automatic Mapping:

Warning screen:

If the total number of wells mapped exceeds 96 wells, a warning message in the left figure appears on the screen. The calculation of the total number of mapping wells is as follows:

(Blanks+Standards+CNs+CWs+CPs+COs+QCs+Calibrators+Sample)*Replicates

The plate mapping is executed normally and the exceeded part is invalidated.

```
Entered value is
Out of range
BLK: 0 - 10
Press any key
```

Error screen:

If one or more mapping parameters are over the input range, an error message in the left figure will appear on the screen.

On the third line of the LCD, the name of the parameter which is out of range and its input range will appear.

Example: “BLK: 0 – 10”

In case there is more than one error, the first parameter of errors is indicated. By pressing any key the user returns to the automatic mapping screen.

Example of automatic mapping:

An example of automatic mapping is as below.

1. Conditions of each parameter

Blank = 1
Standard = 8
Control CN = 2, CW = 0, CP = 2, CO = 0, QC = 0
Calibrator = 1
Sample = 32
Replicate number = 2

2. Plate mapping data

	1	2	3	4	5	6	7	8	9	10	11	12
A	B	S4	S8	CP2	X3	X7	X11	X15	X19	X23	X27	X31
B	B	S4	S8	CP2	X3	X7	X11	X15	X19	X23	X27	X31
C	S1	S5	CN1	CL1	X4	X8	X12	X16	X20	X24	X28	X32
D	S1	S5	CN1	CL1	X4	X8	X12	X16	X20	X24	X28	X32
E	S2	S6	CN2	X1	X5	X9	X13	X17	X21	X25	X29	E
F	S2	S6	CN2	X1	X5	X9	X13	X17	X21	X25	X29	E
G	S3	S7	CP1	X2	X6	X10	X14	X18	X22	X26	X30	E
H	S3	S7	CP1	X2	X6	X10	X14	X18	X22	X26	X30	E

Instrument Maintenance

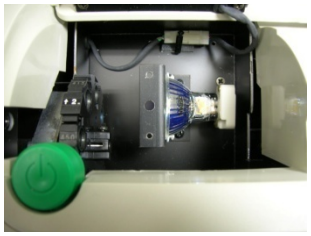
Caution: Electrical shock hazard! Always disconnect the instrument from the AC power source before opening the service compartment.

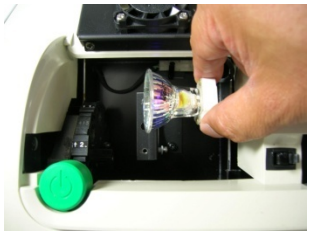
Caution: The lamp and the lamp cover may be very hot! Use caution and allow the lamp to cool before attempting service.

Installing Interference Filters

1. With the power off, open the rear cover of the instrument by pressing the release latch located on the top left portion of the cover.
2. Locate the filter wheel on the left side of the instrument. Note that the filter wheel has eight filter positions.
3. Rotate the filter wheel to the desired filter. Grasp the top of filter frame and pull up to remove the filter.
4. Insert the new filter into the desired filter position.
5. Ensure that the new filter is added to the filter list as follows: Main menu->Edit->Filters.

Changing the Lamp





1. With the power off, open the rear cover of the instrument by pressing the release latch located on the top left portion of the cover.
2. Remove the two screws on the black plastic cover and carefully remove the plastic cover.
3. Remove the screw on the metal cover. Lift the cover up and away from the instrument. This will allow the lamp to be pulled free from the lamp housing.
4. Holding the ceramic base in one hand and the lamp housing in the other, carefully pull the lamp free of the base.
5. Carefully insert the new lamp firmly in the ceramic base. Apply even pressure when inserting the lamp so that the bulb dose not become misaligned in the reflector housing. Be extremely careful not to touch the front glass of the lamp during installation.
6. Position the new lamp into the housing so that the plastic guides hold the flange of the lamp.
7. Carefully place the metal cover over the lamp. Tighten the screw.
8. Replace the plastic cover and tighten the screws.
9. Close the rear cover.

Troubleshooting and Error Messages

The iMark Microplate Reader constantly monitors several functions and displays appropriate messages on the LCD as errors are encountered.

	Error		Recommendation
1.	LCD appears blank on power up.		
	a.	Power is not turned on.	The AC outlet is non-functional.
	b.	Unit is not plugged into AC outlet or power code is not attached to the instrument.	Check power cord connections at outlet and on the rear panel of the instrument.
	c.	The AC outlet is non-functional.	Check circuit breakers or fuses.
2.	Instrument displays “Light bulb error” message indicating that the bulb is burned out.		Check whether lamp is emitting light.
	a.	Lamp is not emitting light.	Replace the lamp as described in x
	b.	Lamp is emitting light.	Check the alignment of the lamp in the housing. Align or replace the lamp if necessary.
3.	Printer will not print on command.		
	a.	Printer paper is not installed properly.	Verify that the paper is properly installed. Refer to x for details.
4.	Plate carriage jams during reading, and “Plate carrier error” is displayed.		
	a.	Plate is not seated in carriage properly.	Press the STOP button immediately. Position the plate carefully in the carriage, making certain that it is properly seated.
	b.	Plate height is exceeding 16mm.	Use Microplate which is less than 16mm in height.
5.	LCD displays “Filter missing”.		Install a filter in the empty position. Select the installed filter by pressing Edit key.
6.	LCD displays “Filter disk jammed”, indicating that the filter wheel is not turning freely.		Turn off the instrument, and inspect the filter wheel. Turn by hand to verify that the wheel is moving freely. Make sure all the filters are properly installed and firmly seated. Contact your Bio-Rad representative if the filter wheel is jammed or if the problem persists.
7.	LCD displays “Filter not installed”.		Enter the Edit Menu by pressing Edit key, and set up the filters.

8.	Wells have color, but absorbance values seem low.		
	a.	Incorrect filter used for measurement and/or reference wavelength.	Check wavelength used in analysis. Read plate in single wavelength mode at all wavelength to verify that the proper filter was used. The measurement wavelength should produce the highest absorbance.
	b.	The best measurement wavelength filter for the substrate in use has not been installed in the filter wheel.	Check references for the substrate you are using, or determine the best measurement wavelength by analyzing the substrate product on a scanning spectrophotometer. Custom filters are available from 400 to 750 nm.
	c.	The filters have been switched in the wheel.	Check that the filters are installed in the correct position.
9.	"Printer error" displayed.		Check for paper jam. Install the printer paper correctly.
10.	"Battery error" displayed.		The internal battery is almost dead. Contact your local Bio-Rad office.
11.	The following messages are displayed. "Memory error" , "Calendar error" , "LCD hardware error" , "Printer error", "Light level error" , "D/A conversion error" , "A/D conversion error" "EEPROM error", "USB error"		Contact your local Bio-Rad office if these problems persist.

Instrument Specifications

Computer interface	USB 2.0
Plate shaking	3 speeds (low, mid, high) Programmable time period: 0 - 999 seconds
Data storage	The most recent 10 data plates for end-point, most recent 2 data plates of 30 readings for kinetic readings, protocol data and calendar/clock function shall be kept in memory by a lithium battery even when the power is off. Average lifetime of the battery shall be 5 years.
Warm-up time	3 minutes
Photometric Methods	Single and dual wavelength
Photo detectors	8 silicon photodiodes for measurement and 1 silicon photodiode for reference
Light source	Tungsten halogen lamp 20W with 3000 hours average lifetime
Spectral range	400 nm to 750 nm
Interference filters	Wavelength tolerance: ±3.0 nm, Band width: 10 nm typically
Filter capacity	8 filters
Reading speed	Fast Reading 6 sec. with single wavelength reading 10 sec. with dual wavelength reading Step Reading 15 sec. with single wavelength reading 25 sec. with dual wavelength reading These times are minimum interval times between repetitive reads using onboard KINETIC protocol.
Indication range	0.000 to 3.5 OD
Resolution	0.001 OD
Accuracy	±1.0% or 0.010 from 0 to 3.0 OD at 490 nm
Linearity	±1.0% from 0 to 2.0 OD, ±2.0% from 0 to 3.0 OD
Reproducibility	1.0% or 0.005 OD from 0 to 2.0 OD, 1.5% from 2.0 to 3.0 OD
Inter-channel variability	1.5% or 0.005 OD from 0 to 3.0 OD
Stability and Drift	0.010 OD at OD=1 with single wavelength reading
Built-in Printer	Thermal printer, Paper width 80mm
Line Voltage	Universal input: 100 - 240 VAC, 50/60Hz
Power consumption (max)	100 VA max.
Dimensions (W x D x H	346 mm x 377 mm x 164 m mm
Weight	5.5 kg
Operating Environment	15ºC - 40ºC, up to 90 % relative humidity without condensation
Storage Temperature	10ºC - 50ºC, up to 90 % relative humidity without condensation

Bio-Rad
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