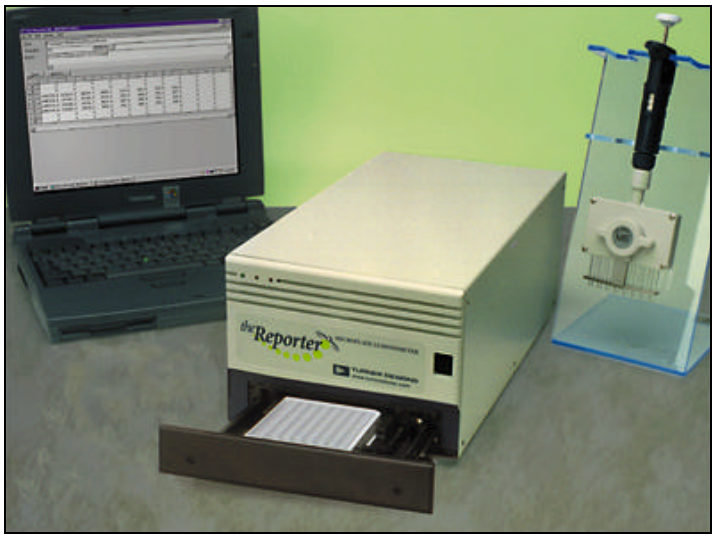
the Reporter

MICROPLATE LUMINOMETER

Operating Manual



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The Reporter™ Microplate Luminometer
Operating Manual

Table of Contents

I. Introduction

A. Description

The Reporter™ Microplate Luminometer is an easy-to-use, sensitive luminometer designed to read glow luminescent reactions in 96-well plates. The instrument's small size and affordable price make it an ideal laboratory instrument. This manual is designed to guide you through the installation, setup, and operation of your instrument.

B. Inspection

Upon receiving your luminometer, please inspect it carefully and make sure all accessories are present (refer to the packing list shipped with the instrument).

Included in this box should be:

- The Reporter™ Microplate Luminometer
- A power cord
- A 9-pin serial cable
- The Operation Manual
- A Quick Start Guide
- Software
- Plate-96 well pack of 5 (1 maybe installed in the sample tray)

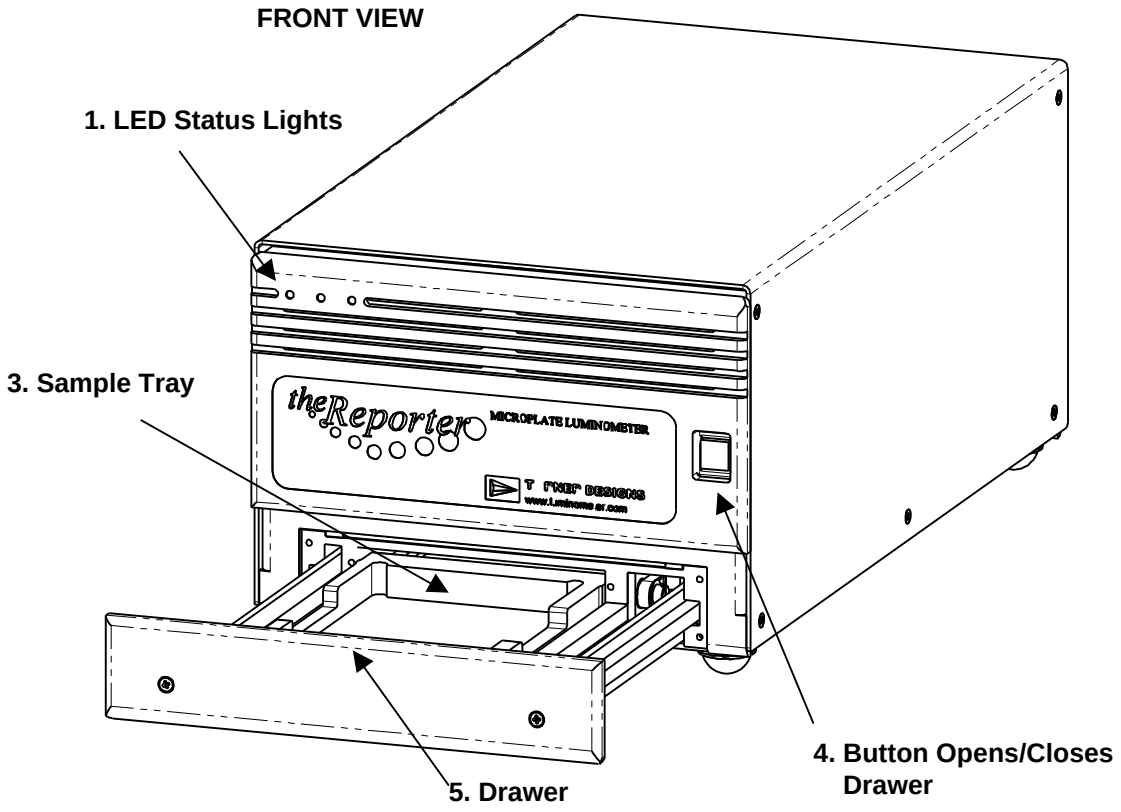
C. General Precautions

1. This instrument is intended for indoor use only.
2.* It is recommended that a clear, transparent adhesive film be placed over the 96-well microplate to prevent spills or cross contamination between wells.
3. Wipe up spills immediately. See Appendix 3 for cleaning instructions.
4. The luminometer contains sensitive optical components and precision aligned mechanical assemblies. Avoid rough handling.
5. The luminometer is protected by a 2A 250V Slow Blow fuse. If the fuse should blow, you may replace it with an equivalent fuse in the input power connector (see page 4). However, if the fuse blows again you should call Turner BioSystems for further instructions. See Appendix 3 for details on obtaining service.
6. Other than the fuse, this unit has no user-serviceable components. Opening the instrument case will void the warranty. See Appendix 3 for instructions on how to obtain service.

*** This adhesive film may be purchased at Rainin, catalog no. 96-SP-100 or any similar manufacturer.**

II. Hardware Overview

The Reporter™ Microplate Luminometer Quick View Diagram



The Reporter™ Microplate Luminometer Functions and Features

1. **LED Status Lights.** These lights report the status of the instrument. The green LED indicates the unit is on. A steady yellow LED indicates the instrument is ready to start, a flashing yellow LED indicates measurement is in progress. The red LED indicates an error. See Appendix 2 for a detailed description of what the lights represent.

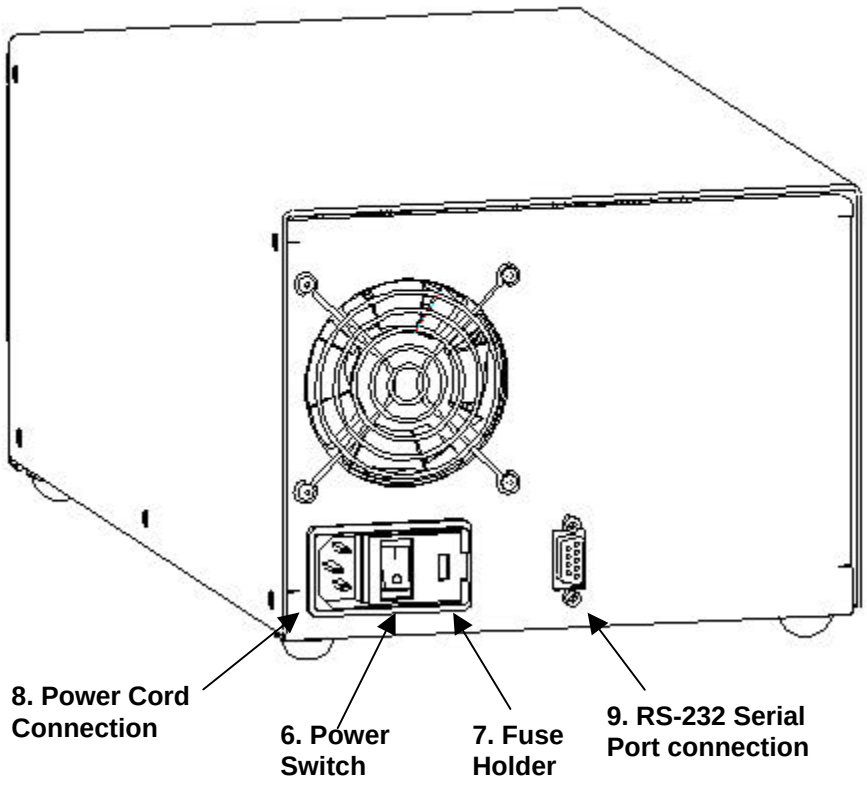
2. **Audible Beep.** The instrument will beep once when turned on and when a run is started. Beeps are also used to indicate errors. See Appendix 2 for a detailed description of what various beeps represent.

3. **Sample Tray.** Samples plates are placed on the tray for reading. The plate format for this version is 96-well. No other well format can be read.

4. **Open/Close Button.** This button automatically opens and closes the sample drawer when pressed.

5. **Drawer.** The drawer opens to receive sample tray.

REAR VIEW



6. **Power Switch.** ON/OFF switch is located on the back panel of the instrument.

7. **Fuse Holder.** The fuse is a 2A 250V Slow Blow. The power cord must be detached to replace the fuse.

8. **Power Cord Connection.** The power cord connects into the rear panel of the instrument.

9. **RS-232 Serial Port Connection.** 9-pin serial port for connecting to a computer.

III. Setting up the Reporter™ Microplate Luminometer

1. Position the instrument on a flat surface with the back of the instrument well ventilated (at least three inches from the wall). Leave enough room for the sample tray to extend in front of the unit (approximately 7 inches).

2. Plug in the unit. In some countries, the power plug provided may not match the wall connection. If this is the case, you can use the appropriate power cord if the input power is between 90 and 264 volts AC, and the nominal frequency is between 47 and 63 Hz.

3. From your own computer, install the software according to the instructions in Appendix 1.

4. Connect the 9-pin serial cable between the luminometer and the computer.

5. Turn on the power switch (rear of unit) and allow the unit to warm up for about 10 minutes.

6. Open the sample tray by pressing the black button on the front of the unit.

7. Place your sample tray in the instrument.

8. Close the sample tray by pressing the black button on the front of the unit.

IV. Software Overview.

The Reporter™ Microplate Luminometer Software is very easy to use. To operate the software press the Windows Start button, select Programs, then click on the Reporter icon.

Once the communications has been properly set up, you will not need to change the settings again.

A. Communications Settings

1. The software startup screen is shown in figure 1. There are four pull-down menus: File, Settings, Utilities, and Help.

Figure 1

2. Select Communications under the Settings pull-down menu, and the screen in figure 2 will be displayed.

3. Select the proper COM port and click on OK. The COM port selection depends upon the computer that is connected to the instrument. If you are unsure of which COM port to select, select COM 1 and proceed to the next step.

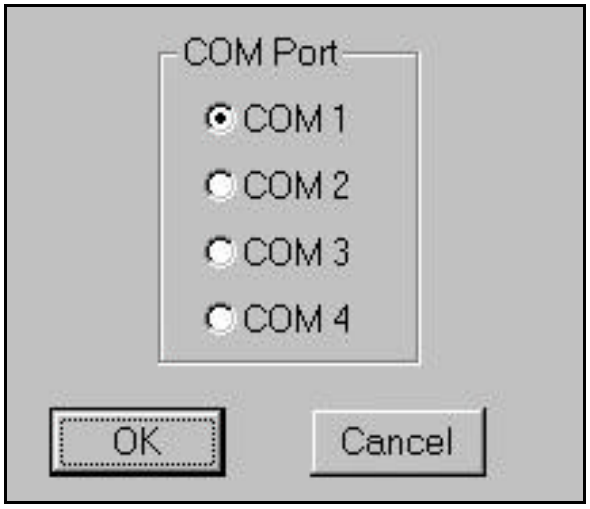


Figure 2.

4. Select New under the File pull-down menu. If an error message appears, such as the one displayed in figure 4, then go back to step 3, but select the next COM port. For most computers, the COM port selection will need to be either COM 1 or COM 2. If no error message appears, and the screen appears like figure 5, then note the COM port selection that worked in your lab notebook for future reference.

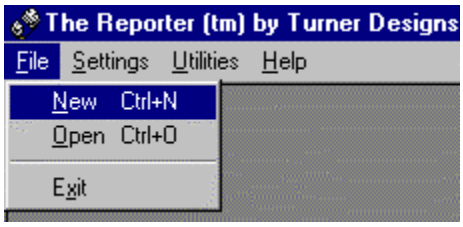


Figure 3.

Figure 4.

B. Setting the Options

Once the communications is properly set up, you are ready to start selecting the options for your measurement. You should see the main screen as shown in figure 5.

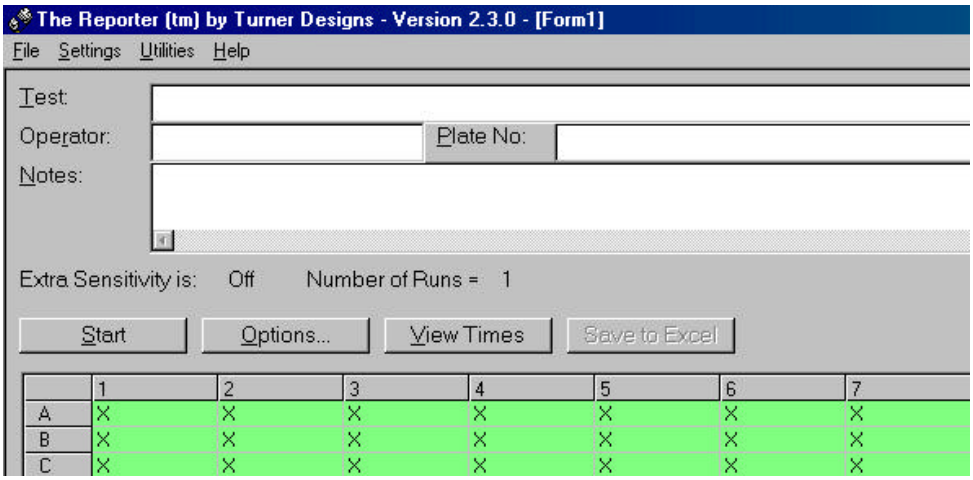


Figure 5.

1. Click on Options to access the options screen as shown in figure 6.

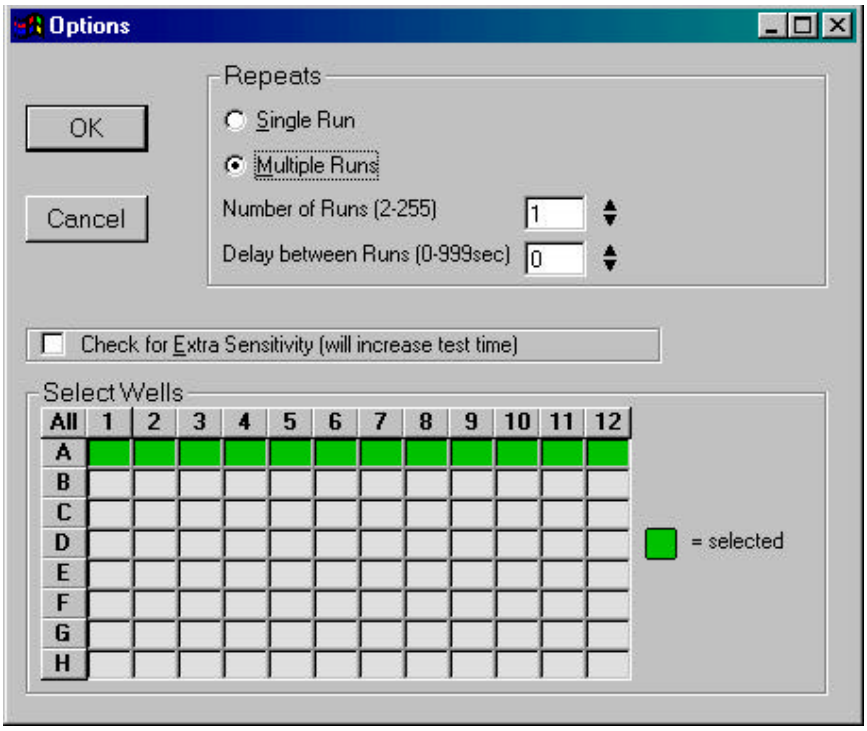


Figure 6

2. There are two choices under the Repeats section: a single run or multiple runs. If you only want to read the plate once, select Single Run. If you need to run the same plate multiple times, select Multiple Runs. You can select up to 255 runs of the same plate with up to a 999 second delay between the end of one run and the start of the next run.

3. Click the check box if extra sensitivity is desired. This is generally used if you have several low level samples you are trying to detect. Selecting this option will improve your detection limit but the test time will increase.

4. Select the wells you want to read. If the well is highlighted in green, the well will be measured. You can select or de-select all the wells by pressing the “All” button in the top left corner of the grid. Alternatively, you can select or de-select individual rows and columns by pressing the letter or number at the head of the row or column. You can also select or de-select individual wells by clicking on the well.

5. Once you have made your selections, press the OK button.

6. The main screen will now indicate the options you have selected (see figure 5). It indicates if the extra sensitivity option is on or off and displays the number of runs. The wells to be measured are also highlighted in green.

V. Reading Samples

A. Starting a Run

The process of reading samples with the Reporter™ Microplate Luminometer is simple. The instrument will read only the wells that are selected in the Options menu. Any skipped wells are denoted with an "X" in the data. To read samples:

1. Fill in the experiment information under the Test, Operator, Plate Number, and Notes areas. These are text areas for you to enter any information that would be useful for you to document the test.
2. Verify that the Options menu has the correct wells selected and the correct number of runs selected.
3. Press the open/close door button to open the door on the instrument.
4. Insert the plate in the tray so that well A1 is in the right rear of the tray.
5. Press the open/close door button to close the door on the instrument.
6. Click on the Start button in the software to start the instrument.
7. Input the filename for the data. Do not type an extension, the software will automatically assign a .tdf (turner designs format) extension. This allows the software to open the file for later viewing.

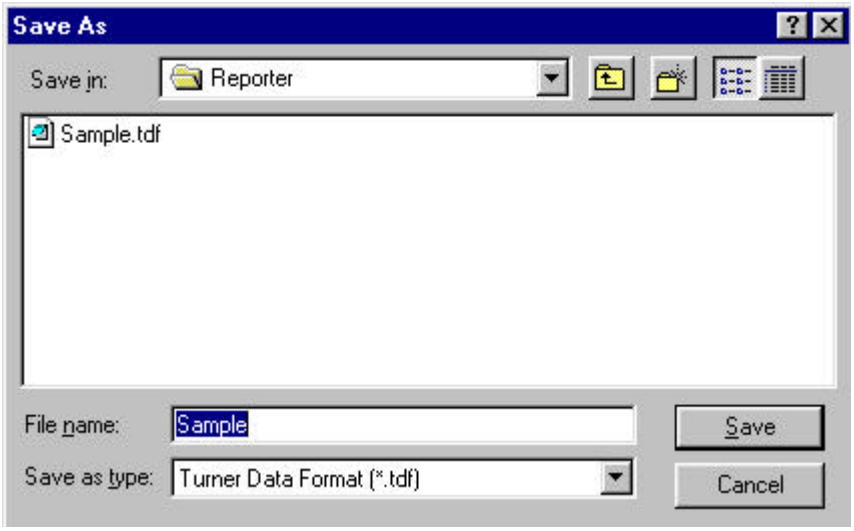


Figure 7

8. Wait for the instrument to complete the run. It should take about 2 to 6 minutes per run. While the run is in progress a status bar at the bottom of the main screen will display the current state of the instrument as shown in figure 8.

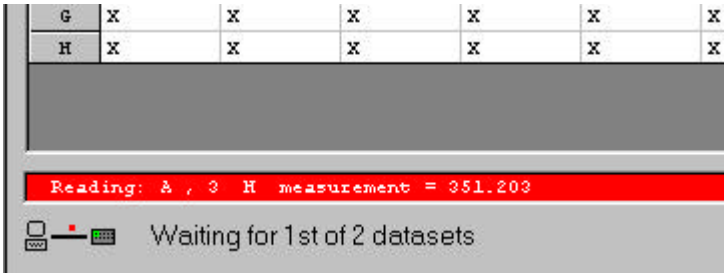


Figure 8

9. Read the results from the software's main screen when the run is complete. If "sat" is displayed in a well this indicates that the sample was too bright for the luminometer to read (it saturated the detector). If multiple runs are selected, a yellow scroll bar will appear above the data, and the user is able to scroll through the data run by run once all of the runs have completed.

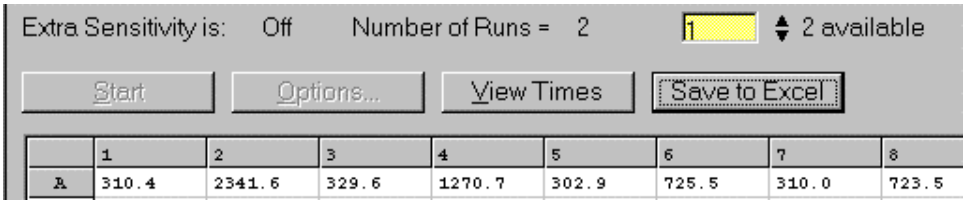


Figure 9

10. Clicking on the "View Times" button will change the display to show the time that each well was read relative to the time the first well was read for the first time (Figure 10). In other words, it displays how long from the start of the run each well was read. The time is in seconds and is accurate within +/- 0.5 seconds. The time readings will not necessarily always be sequential. Wells with bright samples will require lower gains. Since the luminometer reads all wells at the highest gain setting first then re-reads saturated wells at progressively lower gains, those wells that require lower gains will have larger relative time readings. This data can be used to adjust the readings if you know that the luminosity of your sample is decaying during the run. Clicking on the "View Data" button will change the display to show the data.

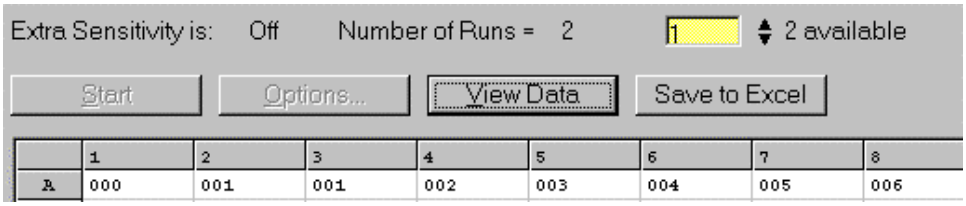
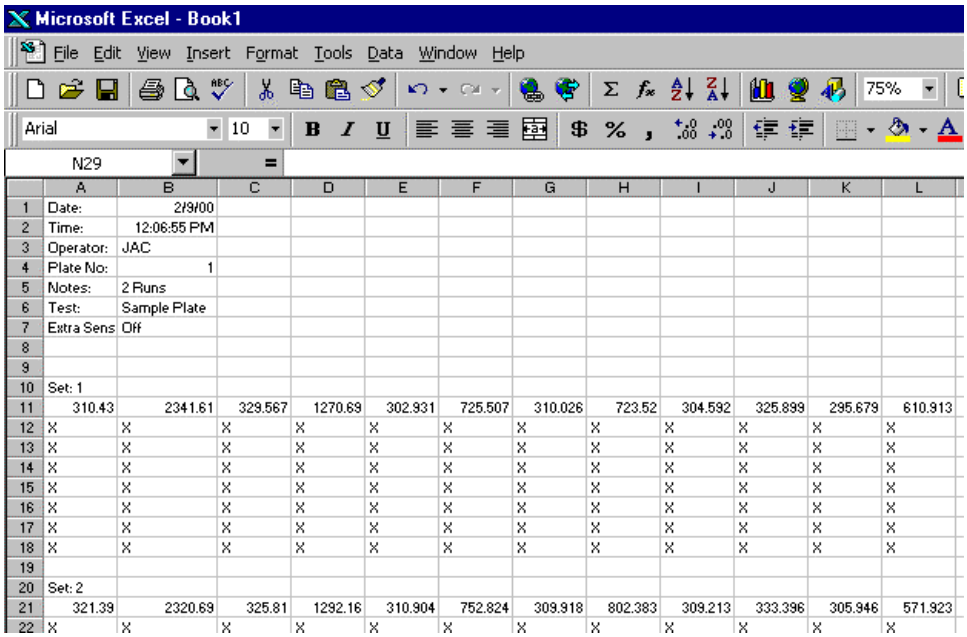


Figure 10

B. Converting Data to Excel™

If your computer has Excel™ installed, then the Reporter™ Microplate Luminometer software has an easy way for you to convert the data into a spreadsheet for further analysis. Simply click on the “Save to Excel” button on the main screen. Excel™ will automatically open and all of the data shown on the main screen (including the text and options settings) will be written into a spreadsheet. Save the data in Excel™ if desired as you normally would. Sheet 1 of the worksheet will contain the data.


Microsoft Excel - Book1

File Edit View Insert Format Tools Data Window Help

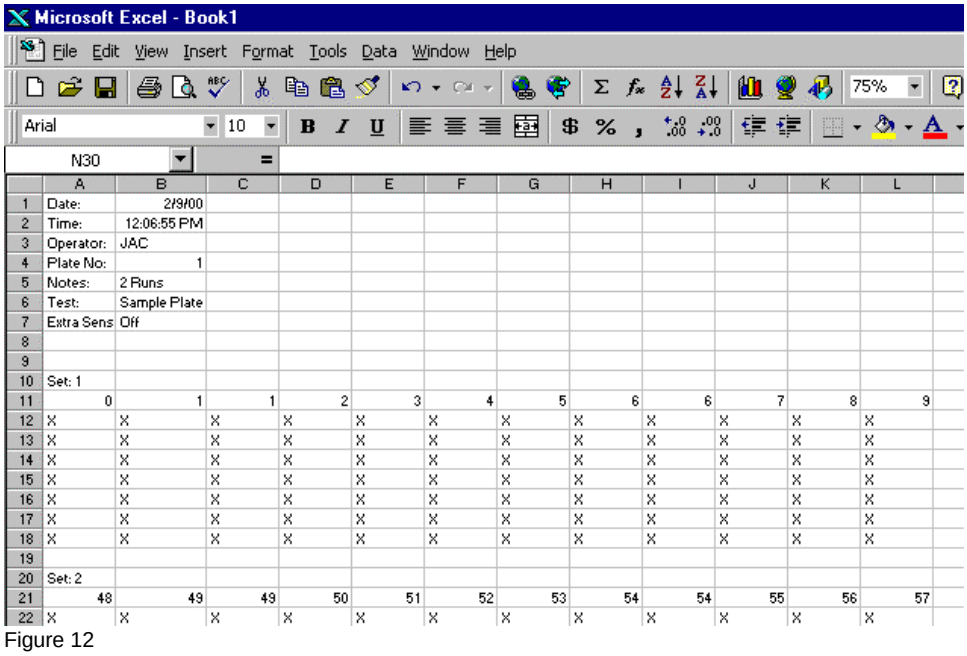
Arial 10 75%

N29 =

	A	B	C	D	E	F	G	H	I	J	K	L
1	Date:	2/9/00										
2	Time:	12:06:55 PM										
3	Operator:	JAC										
4	Plate No:	1										
5	Notes:	2 Runs										
6	Test:	Sample Plate										
7	Extra Sens	Off										
8												
9												
10	Set: 1											
11	310.43	2341.61	329.567	1270.69	302.931	725.507	310.026	723.52	304.592	325.899	295.679	610.913
12	X	X	X	X	X	X	X	X	X	X	X	X
13	X	X	X	X	X	X	X	X	X	X	X	X
14	X	X	X	X	X	X	X	X	X	X	X	X
15	X	X	X	X	X	X	X	X	X	X	X	X
16	X	X	X	X	X	X	X	X	X	X	X	X
17	X	X	X	X	X	X	X	X	X	X	X	X
18	X	X	X	X	X	X	X	X	X	X	X	X
19												
20	Set: 2											
21	321.39	2320.69	325.81	1292.16	310.904	752.824	309.918	802.383	309.213	333.396	305.946	571.923
22	X	X	X	X	X	X	X	X	X	X	X	X

Figure 11

Sheet 2 of the worksheet will show the relative time readings for each well.


Microsoft Excel - Book1

File Edit View Insert Format Tools Data Window Help

Arial 10 75%

N30 =

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1	Date:	2/9/00										
2	Time:	12:06:55 PM										
3	Operator:	JAC										
4	Plate No:	1										
5	Notes:	2 Runs										
6	Test:	Sample Plate										
7	Extra Sens	Off										
8												
9												
10	Set: 1											
11	0	1	1	2	3	4	5	6	6	7	8	9
12	X	X	X	X	X	X	X	X	X	X	X	X
13	X	X	X	X	X	X	X	X	X	X	X	X
14	X	X	X	X	X	X	X	X	X	X	X	X
15	X	X	X	X	X	X	X	X	X	X	X	X
16	X	X	X	X	X	X	X	X	X	X	X	X
17	X	X	X	X	X	X	X	X	X	X	X	X
18	X	X	X	X	X	X	X	X	X	X	X	X
19												
20	Set: 2											
21	48	49	49	50	51	52	53	54	54	55	56	57
22	X	X	X	X	X	X	X	X	X	X	X	X

Figure 12

C. Opening Files

Data from previous runs can be viewed by selecting File, then Open.

Figure 13

A screen will open which will display all of the saved files (figure 14). They are sorted by date with the most recent run at the bottom of the list. Select the file you wish to view and click on the Open button. Once opened the data can be converted to Excel™ as described previously.

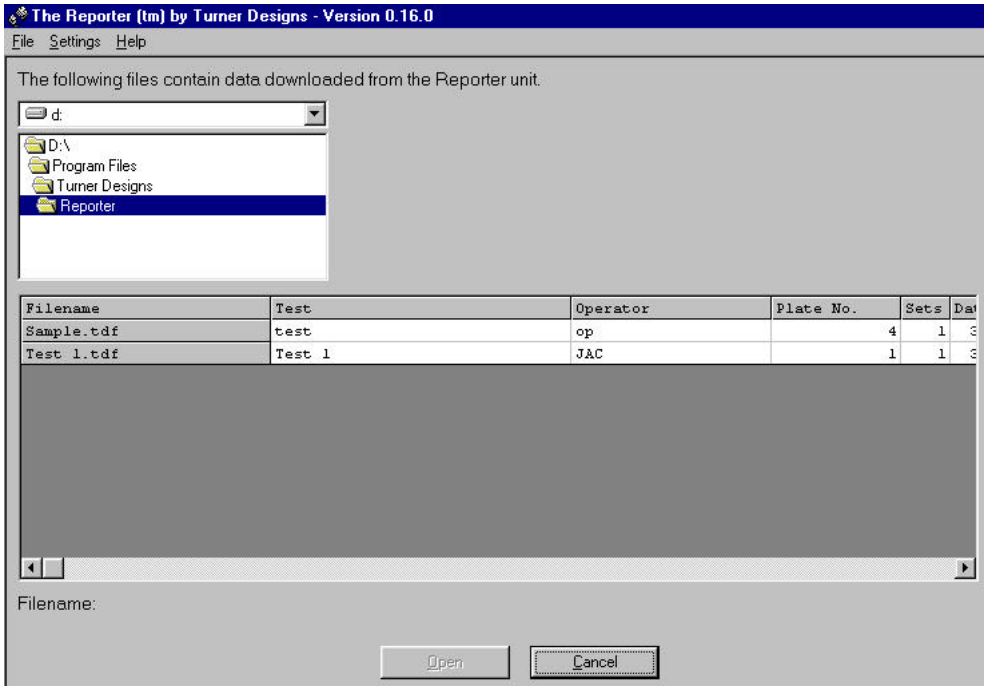

Figure 14

VI. Theory of Operation

The Reporter™ Microplate Luminometer's patented design gives you high performance for a sensible price. Following is a brief description of how the luminometer operates after you press the Start button.

1. The PC sends a start signal to the luminometer. The luminometer beeps once and sends a signal to the PC indicating it is ready.

2. The PC downloads all of the options data to the luminometer.

3. Once all of the options data has been received, the luminometer takes "dark" readings (i.e. the baseline readings) from the detector at the 4 gain levels. The last gain level to be measured is the highest and requires a 15 second warm up period for maximum accuracy. The PC will display a countdown during this period in the red status bar.

4. The luminometer moves to the first well to be measured. The gain is set at the highest level for maximum sensitivity. The timer for tracking the relative time each wells is read starts. Normally each well is measured for approximately 1 second. If the extra sensitivity option is selected the measurement takes approximately 3 seconds.

5. The measurement and relative time of the reading is saved for each well. If a well has a high enough luminescence level to saturate the detector at this gain setting, then the luminometer remembers that well location for later measurement at a lower gain setting. There may be a slight pause in the measuring of the next well after a saturated reading. The luminometer automatically waits for the detector to settle to a proper reading after a saturated reading.

6. Once all of the selected wells have been measured at this gain setting, the luminometer checks to see if any wells had a saturated reading. If there are, then the gain is lowered and steps 4 through 6 are repeated for this gain setting. Only wells that have saturated will be measured at a lower gain setting. All measurements at lower gain settings take approximately 1 second per well. There are a total of 4 gain settings.

7. Once the luminometer has valid readings on all wells or has gone through all 4 gain settings it sends the readings to the PC. The luminometer automatically scales the readings for each gain setting so the user does not need to make any calculations.

8. The PC saves the readings to the specified file then displays the results on the main screen.

9. If a single run was selected, then the luminometer will be finished and is ready for another run. If multiple runs was selected then the PC waits the specified delay time then starts the process over again at step 1. Steps 1 through 9 are repeated for the number of runs specified in the options menu. Time readings are relative to the reading of the first well on the first run.

VII. Relative Light Units and Common Questions

The Reporter™ Microplate Luminometer's output is in relative light units. This means that there is no absolute way to quantitate the number of photons emitted from the sample. This is true for all luminometers. All luminometers are "photon counters", but no luminometer manufacturer can claim that the unit output of the instrument is in photons. This poses a dilemma for many researchers. Some common questions and answers are presented:

Q: How do I determine which luminometer is more sensitive?

A: The best way to do this is to run a side-by-side comparison between instruments with samples that are representative of your experiment. Compare the statistics of a group of replicate samples and blanks for both instruments. It is not sufficient to compare the statistics on the blanks alone because the samples give a relative scale of the light units between different instruments. If a detailed sensitivity study with multiple serial dilutions of the sample is not possible, a common tool for determining rough sensitivity is %CV. %CV is defined as the standard deviation of a group of samples divided by the average of the samples. If the blank is non-zero, the %CV should be blank corrected. The blank corrected version of the %CV is shown below.

$$\frac{\text{STD DEV (samples – average blank)}}{\text{Average(samples) – Average(blank)}}$$

Q: Which plates should I use with my luminometer?

A: For weakly luminescent samples, white plates give better results because they reflect more light to the instrument's detector. Black plates are appropriate for samples with a strong luminescent signal.

Q: What luminescent assays can I run on the Reporter™ Microplate Luminometer?

A: The instrument is designed for glow reactions, so any chemistry that has a half-life of 15 minutes or greater is appropriate.

APPENDIX 1
Installing the Software

Installing the software on your computer is the next step once you have verified that all the components of your instrument are present. **This software requires Windows® 95 or later.** To install the software, follow the instructions below:

A. Place disk 1 of the Turner BioSystems Reporter™ Microplate Luminometer software in the A: drive of your computer.

B. Press the Windows Start button, and select Run. Type in A:\setup.exe if your disk drive is drive A, or substitute A with the letter that represents your floppy disk drive.

C. Follow the instructions given during the installation process. You must choose what directory you wish to install the software. The default directory is C:\Program Files\Turner Designs\Reporter. To select an alternative directory, click on the Browse button shown in figure 15. Click the "Next" Button when you are ready to continue with the software installation.

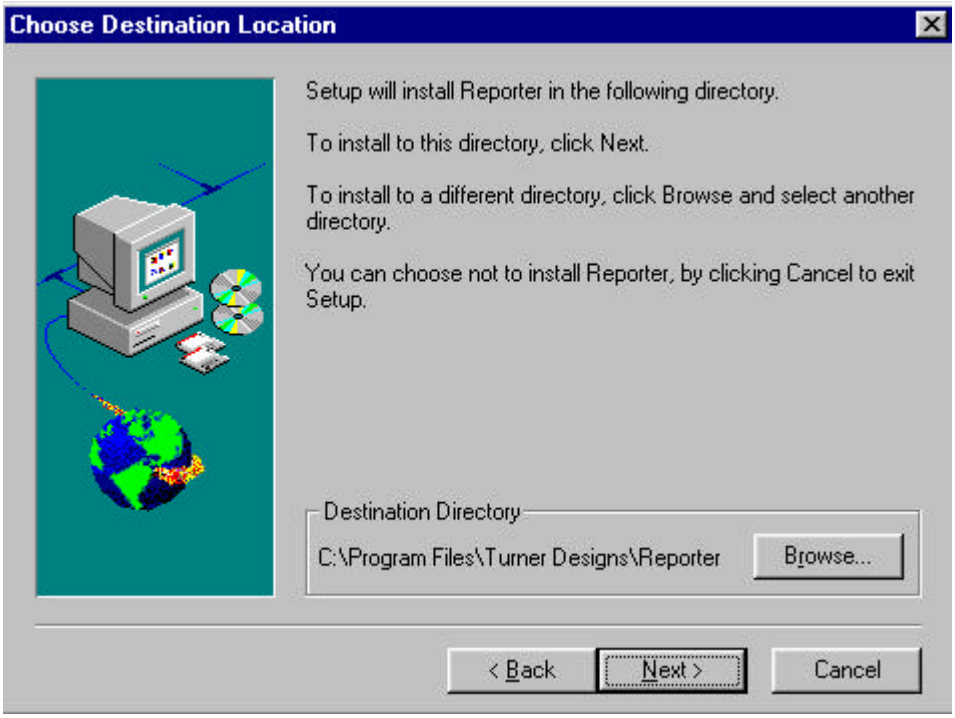

Figure 15

D. The installation program will now install the necessary files into your computer. Install disks 2 and 3 into the A: drive when prompted. When the installation is complete you may be asked if you wish to restart your computer. You need to restart for the software to be properly installed.

APPENDIX 2
Alarms, Error Messages, and Firmware Upgrades

1. Audible Alarm/Beeps

There are 2 kinds of beeps. Short ones are for normal operation, Long ones are for errors.

The unit will short beep once at power up. It will short beep once when it receives a start signal. It will short beep twice if the run is cancelled.

The following are all error (long) beeps.

- If the instrument will not run a plate and responds with one or more long beeps, call Turner BioSystems service department and report the number of long beeps that you hear.
- If the instrument responds with 1,2,3,4, or 6 long beeps, the computer and the instrument are not communicating correctly.
- If the instrument responds with 5 long beeps, the sample tray is not closed properly.
- If the instrument responds with 20 long beeps, the instrument is missing a configuration file.

2. LED Lights

There are 3 lights.

- The green is the power indicator and is always on.
- The yellow will be on steady when the unit is waiting to start. Once a run is started, it will turn off while the instrument is preparing to start measuring. Once wells are being measured, the yellow led will flash on and off (on for a measurement, off while it moves to the next well).
- The red is for errors, it will flash once when the instrument powers up (as a performance check), otherwise it flashes synchronously with the error beeps above.

3. Firmware Upgrades

The Reporter™ Microplate Luminometer has the capability to download new firmware to the instrument from the PC. This is reached through the Utilities Menu (figure 16). This capability is password protected to prevent accidental use. If new firmware is needed in the future, you will receive instructions on how to perform the upgrade.

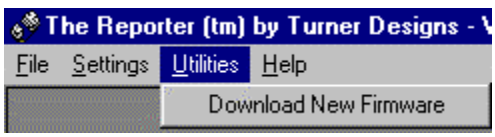

Figure 16

APPENDIX 3
Maintenance, Warranty, & Service

A. Maintenance

Do not spill liquids into the sample tray. If there is a spill:

1. Unplug the instrument.

2. Wipe up any moisture inside the sample chamber.

3. Use a damp ChemWipe wetted with a 70% ethanol, 30% water solution to clean the tray.

4. Plug in the unit and turn on the power. Allow it to stay on for a few minutes or until completely dry inside.

Periodically wipe off the outside of the instrument with a damp cloth. Do not use solvents or abrasive cleaners to clean the Instrument.

B. Warranty

Turner BioSystems warrants the Reporter™ Microplate Luminometer and accessories to be free from defects in materials and workmanship under normal use and service for a period of one year from the time of initial purchase, with the following restrictions:

1. The instrument and accessories must be installed, powered, and operated in compliance with the directions in this Reporter™ Microplate Luminometer Operating Manual and directions accompanying the accessories.

2. Damage incurred in shipping is not covered.

3. Damage resulting from measurement of samples found to be incompatible with the materials used in the sample system is not covered.

4. Damage resulting from reagent spills is not covered.

5. Damage resulting from contact with corrosive materials or atmosphere is not covered.

6. Damage caused by modification of the instrument by the customer is not covered.

7. Failure of limited life parts is not covered.

C. Obtaining Service

Warranty Service

To obtain service during the warranty period, the owner shall take the following steps:

1. Write or call the Turner BioSystems service department and describe as precisely as possible the nature of the problem.

2. Carry out minor adjustments or tests as suggested by the Service Department.

YOU MUST INCLUDE AN RMA NUMBER ON ALL EQUIPMENT RETURNS.

3. If proper performance is not obtained, YOU MUST OBTAIN AN RMA number BEFORE shipping the instrument to Turner BioSystems. After obtaining an RMA number, pack the instrument well; insure it; write the RMA # on the outside of the carton and ship it to Turner BioSystems prepaid. The instrument will be repaired and returned free of charge for all customers in the United States. We will pay for return shipment and include a check to reimburse you for the cost of surface shipment to us.

   If you purchased directly from Turner BioSystems outside of the United States, contact Turner BioSystems. We will repair the instrument at no charge. We cannot, however, pay shipping, duties, or documentation costs outside the continental United States.

   For customers outside of the United States, who have purchased our equipment from one of our authorized distributors, contact the distributor.

   NOTE! Under no conditions should the instrument or accessories be returned without notice. Prior correspondence is needed:

   a. To ensure that the problem is not a minor one, easily handled in your laboratory, with consequent savings to everyone.

   b. To specifically determine the nature of the problem, so that repair can be rapid, with particular attention paid to the defect you have noted.

Out-of-Warranty Service

Proceed **exactly** as for Warranty Service above. Our service department is happy to assist you by phone or correspondence at no charge.

Repair service will be billed on a flat rate basis. Your bill will include any shipment freight charges.

Address for Shipment:

Turner BioSystems
845 W. Maude Ave.
Sunnyvale, CA 94085

APPENDIX 4
Specifications

- **Sensitivity:** 10^{-19} moles of luciferase using Promega's Bright-Glo™ luciferase assay.
- **Linear Dynamic Range:** 10^{5}
- **Cross-talk:** Better than 5×10^{-5}
- **Detector:** Photomultiplier tube (PMT)
- **Spectral Response:** Range 300-650nm
- **Peak Wavelength:** 420nm
- **Detection Mode:** Glow luminescence
- **Plate Format:** 96-well
- **Reading Speed:** Approximately 2.5 minutes per plate (dependent on sample luminescence levels)
- **Computer Interface:** RS232C
- **User Interface:** User-friendly Windows® software controls instrument functions. Requires Windows® 95 or greater
- **Power:** 0.5A @ 90-264V, 47-63Hz (universal)
- **Dimensions:** 14.5" D x 8.0" W x 6.0" H (36.8cm D x 20.3cm W x 15.2cm H) (tray closed)
- **Weight:** 11.0 lbs. (5 kg)
- **Operating Temperature:** 60 - 105°F (15 - 40°C)
- **Warranty:** One-year warranty.
- **Approvals:** CE, UL (pending), CUL (pending)
- *Protected by US patent #5657118. International patents pending.*