Veritas™ Microplate Luminometer
Operating Manual

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Part Number: 998-9100

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I. Introduction

Description

The Veritas™ is an easy to use, highly sensitive microplate luminometer with a broad dynamic range. It features two optional injectors and reads both glow and flash luminescent reactions in 96-well plates. Its superior sensitivity and dynamic range makes the Veritas an ideal laboratory instrument for a wide range of luminescent assays. This manual will guide you through the installation, setup, and operation of your instrument.

Inspection

Upon receiving your luminometer, please inspect the package carefully to make sure all accessories are present. (Refer to the checklist shipped with the instrument.) Standard accessories typically include:

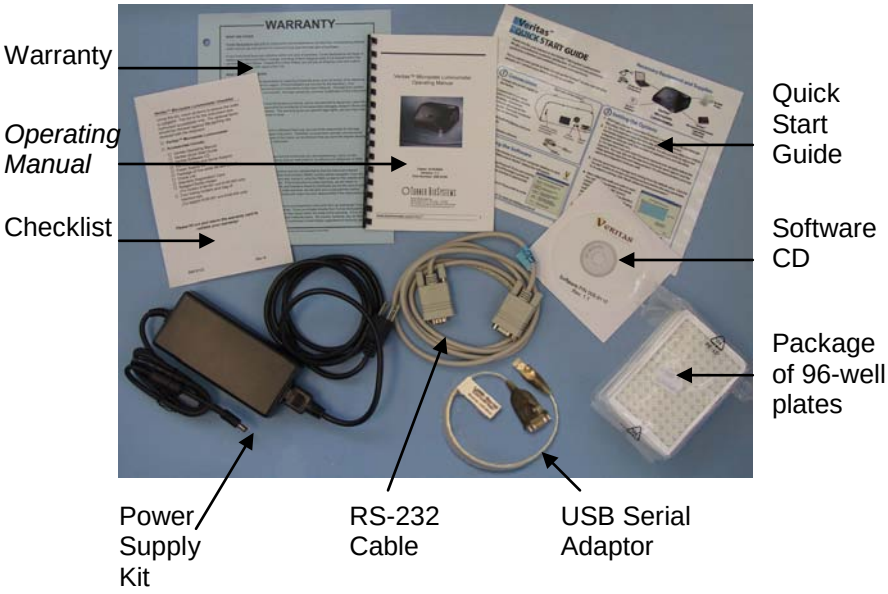


Figure 1

Standard accessories for models 9100-001 and 9100-002 also include:

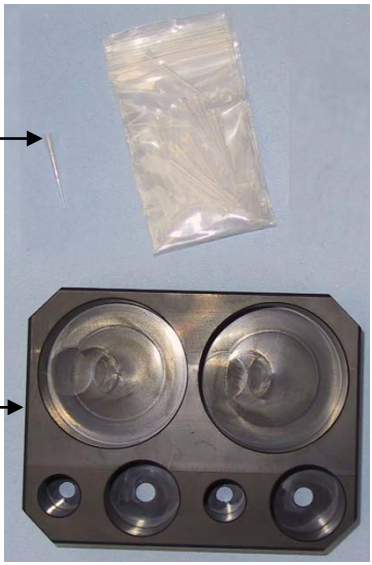


Figure 2

Precautions

- Veritas contains sensitive optical components and precision-aligned mechanical assemblies. It is intended for indoor use only. Avoid rough handling. Wipe up spills immediately.
- The maximum volume for the microplate is 300 µL/well. Using an injector with a bent or damaged tip or overflowing the microplate will cause fluid to leak onto the sample tray cover. The residue can cause the optical head to malfunction. If any wetness appears on the sample tray cover, clean the optical head and the interior of the Veritas. (See Appendix A – Cleaning the Interior of the Veritas.)
- Do not perform injection runs with bent or damaged tips. If the injector tip appears damaged, replace it. (See Appendix A – Changing Injector Tips.)
- If the instrument is ON, the optical head must remain in the home position when the lid is open. Attempting to move the optical head when the instrument is ON exposes it to ambient light. Ambient light will damage the sensitive electronics in the optical head.

II. Hardware Overview

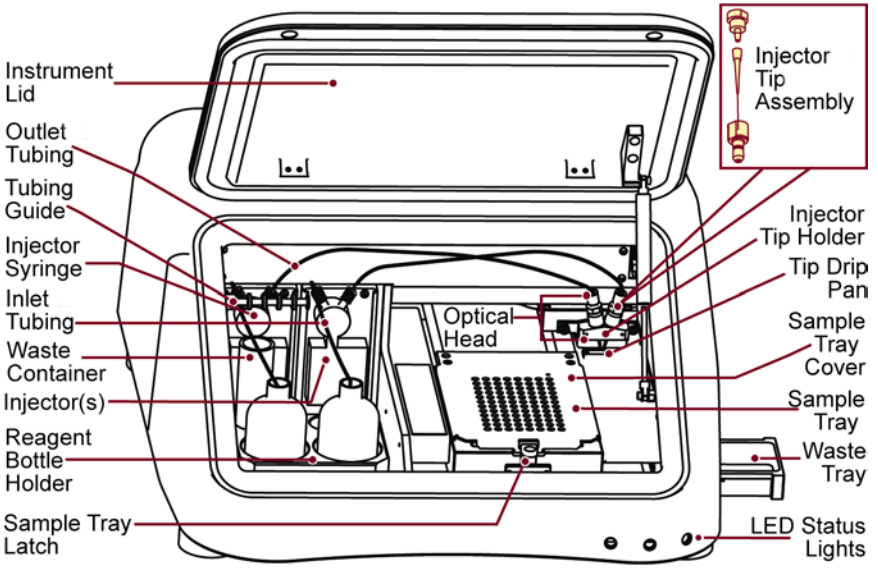


Figure 3

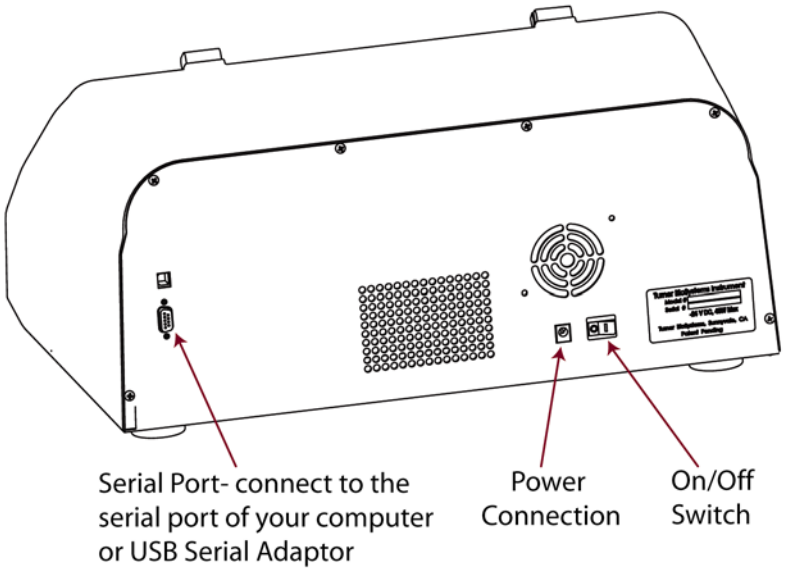
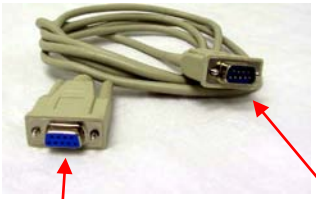


Figure 4



9-pin Female Connector (To Computer or USB Serial Adaptor)

9-pin Male Connector (To Veritas™)

Figure 5

III. Software Installation and Setup

1. Position the Veritas on a level surface. Leave enough clearance above the Veritas to open the instrument lid (approximately 7 inches or 18 centimeters).

2. Plug the power cord into an outlet. Plug the AC adaptor into the power connection of the Veritas.

3. Connect the 9-pin serial cable between the Veritas and your computer. The male 9-pin connector attaches to the Veritas. The female 9-pin connector attaches to your computer. (See Figure 5.) If necessary, use the USB Serial Adaptor to connect the serial cable to a USB port. Refer to the USB Serial Adaptor operating manual for installation instructions.

4. Turn ON the ON/OFF switch. (See Figure 4.)

5. Insert the Veritas software CD from the accessory kit in the CD-ROM drive. The software CD will automatically launch an installation wizard to assist you in the installation. **NOTE**: For Windows XP, only an administrator may successfully install the Veritas software. If you are unsure of your user privileges, contact your IT department.

6. Allow the installation wizard to launch the program immediately after the wizard completes the installation.

7. The Veritas software will attempt to establish communication between the computer and the Veritas. If the default COM port is not available, the COM port selection box will appear. Select the COM port that

corresponds to the serial port for your computer. If using the USB Serial Adaptor, choose the COM port that corresponds to the USB port for your computer.

8. If the software cannot establish communication with the Veritas, check the power and serial cable, and then click “OK.” The software will again attempt to establish communication. If you wish to access the software without a Veritas, click “Cancel.”

IV. Using the Veritas™ Software

Overview

The Veritas™ Microplate Luminometer software is easy to use. This direct-to-Excel-based software gives the user flexibility in data retrieval, storage, and analysis. The software comes preloaded with protocols for Promega luminescent assays. It is also possible to create, store, and retrieve user-defined protocols.

Software Operation

To launch the Veritas software, click on the Veritas icon either on the desktop or in the “Program Manager.” The program can be run by selecting the program from the "Start" menu. The "Welcome to Veritas" dialog box will appear:

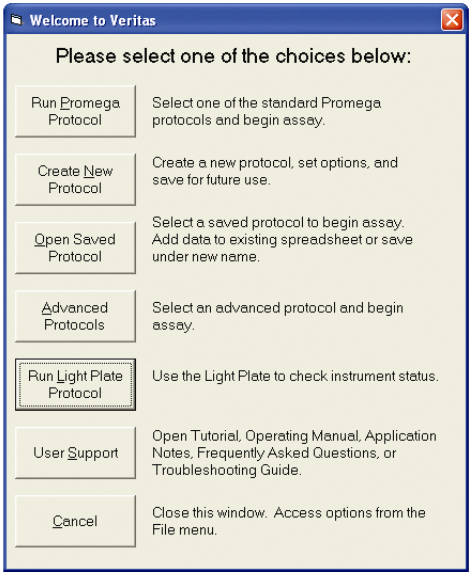


Figure 6

New users should click on "User Support" to view a tutorial that explains the basic principles of luminescence and the capabilities of the Veritas. To start running assays, select one of the five protocol options.

Choosing a Protocol

The five protocol options available in the "Welcome to Veritas" dialog box are "Run Promega Protocol," "Open Saved Protocol," "Create New Protocol," “Advanced Protocols,” and “Run Light Plate Protocol.”

Running a Promega Protocol

To run a Promega assay, select "Run Promega Protocol." A dialog box will appear, allowing you to browse the available Promega protocols. (See Figure 7.)

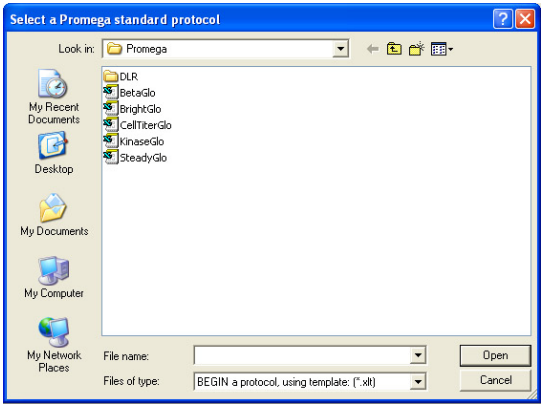


Figure 7

The folder for the DLR Promega assay contains two protocols. The one you select will depend on your choice of injectors. Open the specific Promega protocol that corresponds to your assay. The default settings for Promega templates are optimized for reagent performance. You do not need to change the settings. For information on the Promega protocols, choose "User Support," then "Application Notes" from the "Welcome to Veritas" dialog box.

Running the Light Plate Protocol

The optional Veritas Light Plate provides a quick way to verify instrument performance. The Light Plate consists of three highly stable light sources that simulate luminescent samples at signal levels spanning over four decades. The Light Plate Protocol automatically analyzes the results of the Light Plate run and gives you a clear indication of the instrument status. Save the file after you run the Light Plate. Refer to the Light Plate instruction card for detailed instructions on using the Light Plate.

Opening a Saved Protocol

You may open an existing protocol to recall previous assay conditions or to add new data. After selection, a new window will allow you to browse stored protocols from previous experiments.

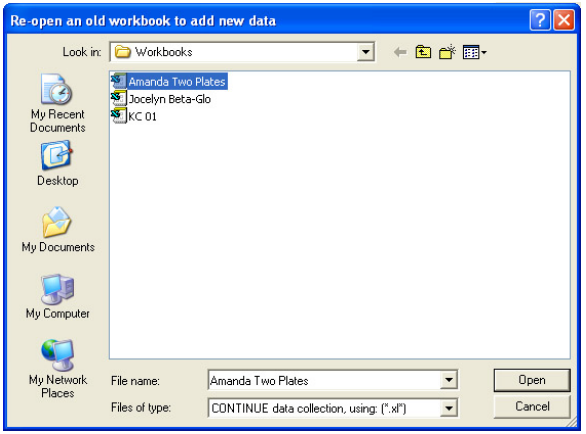


Figure 8

Running an Advanced Protocol

Refer to “Appendix B – Advanced Protocols” for more information on protocols including “Kinetics,” “Super Protocols,” and “Injector-Only Protocols.”

Creating a New Protocol

If you wish to select all of the options manually, then click on "Create New Protocol" to launch the "Protocol setup wizard.” It will guide you through a series of steps to customize your protocol. (See Figure 9.)

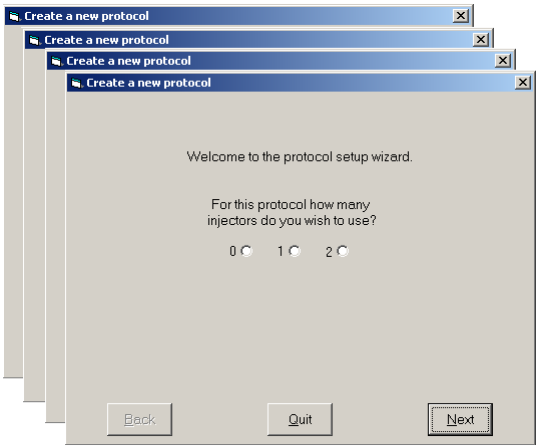


Figure 9

Veritas Options

You have several measurement and injection options to tailor a protocol to your needs:

Injectors: You may choose to use zero, one, or two automatic injectors. If you select one or two injectors, you can also choose to measure your plate before injection.

Delay before measurement: You can set a delay before the Veritas begins a run. The delay is useful for dark-adapting samples and microplates in order to lower background.

Number of runs: If you choose a non-injection run, you may set up to 999 automatic repeats of the run. This option is useful for measuring a change in luminescence over an extended period of time.

Delay between runs: For repeated runs, you may set a rest period between each run. **NOTE:** Do note open the instrument lid during the delay between repeated runs.

Injection Volume: The volume injected per well ranges from 25–250 µL. The maximum volume capacity per well is 300 µL. Determine the volume of your sample per well before selecting injection volume. Overfilling a well will cause flooding and impair performance. (See “Appendix A - Maintenance” for cleaning instructions.)

Delay after injection and before measurement: Setting a delay after the injection will allow flash-type luminescence to fully actualize before a reading.

Integration Time: Adjust the measurement time per well according to your assay protocol. In the case of flash-type luminescence, a longer integration time ensures an accurate reading of the entire peak of luminescent output.

Selecting Wells: Click the "All" button at the top left corner of the grid to select or deselect all the wells. Alternatively, you can click on a letter to select or deselect the indicated row. Click on a number to select or deselect that column. (See Figure 10.) You may also select individual wells by clicking on the well you wish to measure. The instrument reads only the wells that are selected. Selected wells are blue on the grid. Unselected wells are gray. (Unselected wells are marked with an "X" in the Excel spreadsheet.)

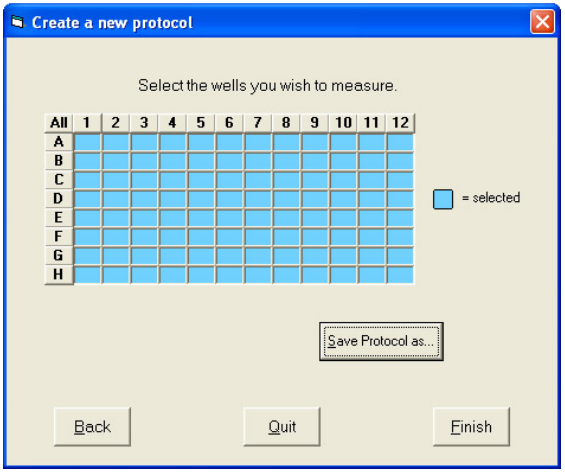


Figure 10

After you click on "Finish," the wizard will automatically record your choices into the “Options” menu. To access your settings, click on the "Options" button from the "Main Dialog Box." (See Figure 11.)

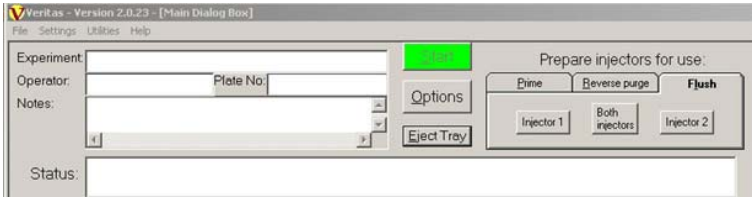


Figure 11

Saving a Protocol

After setting up your new protocol with the wizard, you may store the protocol for future use. Click on "Save Protocol as" to save the protocol as an Excel template. Saving the new protocol automatically closes the wizard and takes you to the "Main Dialog Box.” You are ready to begin measurements.

V. Preparing For a Run

The "Main Dialog Box" (Figure 11) allows the user to start runs, change setup options, establish communication between the Veritas and a computer, prime injectors, flush injectors and reverse purge injectors.

Priming Injectors

If you need injector(s) for your assay, you must prime the injector(s) before running the assay.

1. Fully insert the inlet tubing into the reagent bottle. Secure the tubing to the bottle with the tubing guide.

2. Click the "Prime" tab on the "Main Dialog Box." Select the injector(s) you wish to prime. (See Figure 12.)

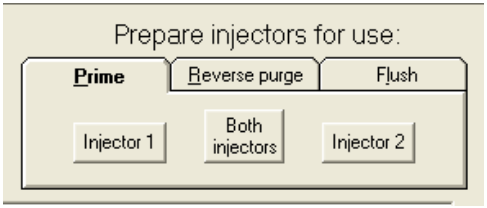


Figure 12

3. Click on "Prime" to start priming the injector(s). An automatic priming sequence will begin. Each priming sequence uses 700 µL of reagent. Approximately 300 µL will be dispensed into the Waste Tray. (See Figure 3.) Refer to "Appendix A – Maintenance" for instructions on "Cleaning the Waste Tray."

4. Click on "Exit window to start a run" to return to the "Main Dialog Box."

Reverse Purging Injectors

After you finish your assay, you may retrieve any unused reagent by clicking on the "Reverse purge" button in the "Main Dialog Box." This will push any reagent left in the injector and the tubing back into the reagent bottle.

Flushing Injectors

NOTE: It is important to rinse the injectors thoroughly after a run.

Failure to flush injectors after use will cause injector clogging, and the injectors may not be serviceable in the field, requiring costly repairs. To flush the injectors and maintain your system, follow these steps:

1. Click on the "Flush" tab in the "Main Dialog Box." Select the injector(s) you wish to flush. (See Figure 11.)

2. Flush the injector(s) three times each with deionized water, 70% ethanol, then deionized water again and finally air.

VI. Obtaining Measurements

The process of reading samples with the Veritas is simple.

To start a run:

1. Fill in the information you would like in the "Experiment," "Operator," "Plate Number," and "Notes" text boxes of the "Main Dialog Box." This step is optional.

2. Open the instrument lid.

3. Gently press the sample tray latch to release the sample tray cover. (See Figure 3.)

4. Insert your 96-well plate into the sample tray and close the sample tray cover.

5. Close the instrument lid and click on the "Start" button in the "Main Dialog Box." The Excel spreadsheet will occupy the lower portion of the computer screen. Data will appear in the Excel spreadsheet.

NOTE: Do not open the instrument lid while a run is in progress.

If you need to stop or cancel a run, click on the "Cancel" button in the "Main Dialog Box" before you open the instrument lid and remove the plate.

When the run is complete, the "Main Dialog Box" will display the message, "The plate completed run successfully." Turner BioSystems recommends removing the plate and saving the data immediately after the run is finished.

VII. Saving Templates and Data

To save a file as a template for future measurements, choose all the necessary options from the "Plate Setup and Options" screen, then click on the "Save Protocol as" button. Alternatively, you can click on the "Apply Changes" button, run the plates, then save the Excel data file by choosing "Save a copy as" from the "File" menu in the “Main Dialog Box.” Both templates and data files can be opened later by clicking on "Open Saved Protocol" on the "Welcome to Veritas" dialog box.

APPENDIX A - Maintenance

Routine Maintenance

The Veritas Microplate luminometer requires the following maintenance tasks every 30 days:

- Cleaning the Optical Head
- Cleaning the Interior
- Cleaning the Injector(s) (for models 9100-001 and 9100-002)
- Cleaning the Waste Tray

Use the "Appendix A - Maintenance Schedule," located in Appendix J, for your records.

Cleaning the Optical Head

1. Turn OFF the Veritas. Disconnect the power supply. DO NOT attempt to clean the optical head while the instrument is ON.

2. Push the tray from the home position to the back of the Veritas.

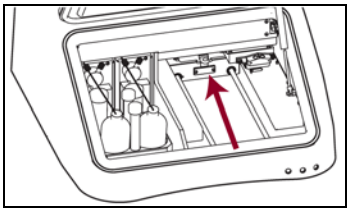


Figure 13

3. Push the optical head from the home position toward the center of the instrument.

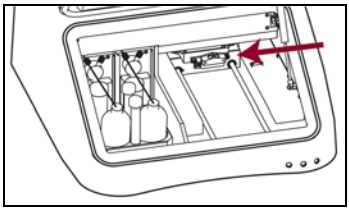


Figure 14

4. Remove the injector tip(s), if possible. If not, remove the tubing from

the injector syringe. Go to “Removing/Replacing Injector Tubing” for further instructions.

5. Remove the injector tip holder from the optical head. Facing the front of the Veritas, push upward, then leftward (as viewed from the bottom of the holder to release the holder from the optical head). (See Figure 15.)

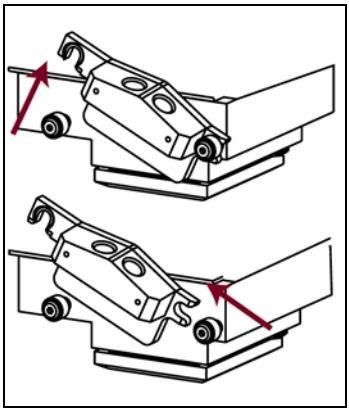


Figure 15

6. Place your hand underneath the optical head. Grasp the sides of the optical head mask and pull the mask toward you.

NOTE: Do not touch the bottom surface of the optical head.

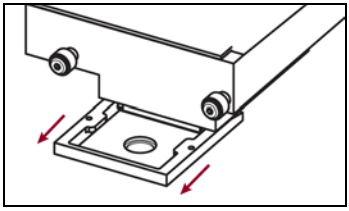


Figure 16

7. Soak the injector tip holder and the optical head mask in a 70% ethanol solution for 30 minutes to dissolve reagent residue. Rinse with deionized water.

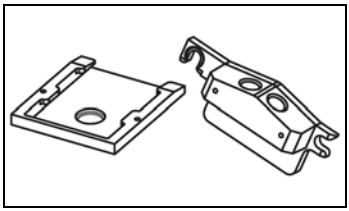


Figure 17

8. Allow the injector tip holder and optical head mask to air dry completely before proceeding. Alternatively, blot the optical head mask and injector tip holder dry with a lint-free, delicate task wipe.

9. Return the optical head mask to the optical head. Align the mask with the optical head and gently guide the mask onto the optical head.

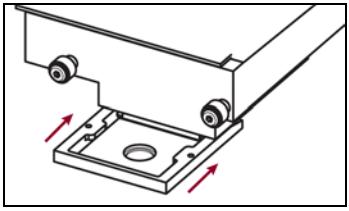


Figure 18

10. Return the injector tip holder to the optical head. Position the holder just above the front pins on the optical head. Push the holder toward the right to lock the holder securely to the right pin of the optical head. Then push down and lock the holder on the left pin. (See Figure 19.)

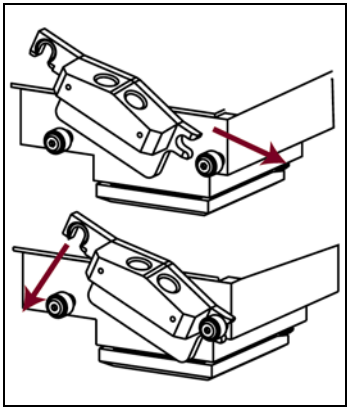


Figure 19

11. Insert injector tip(s) into the injector tip holder. Snap injector tip(s) in place.

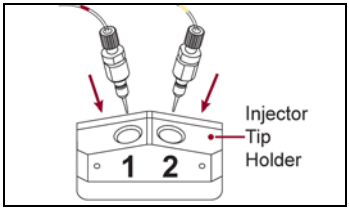


Figure 20

12. Return the optical head to the home position. (Push the optical head from the center of the instrument all the way to the right.)

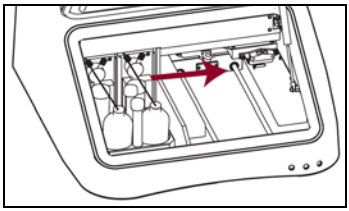


Figure 21

13. Pull the sample tray forward to the home position.

14. Reconnect the power supply. It is now safe to turn the Veritas ON.

Cleaning the Interior of the Veritas

NOTE: Failure to properly maintain a clean interior may cause a mechanical error and the irretrievable loss of data. Clean the interior every 30 days.

The accumulated residue from various luminescent substrates may inhibit proper movement of the optical head. It is therefore recommended to thoroughly clean the interior of the Veritas every 30 days and immediately after any spills.

1. Turn OFF the Veritas.

2. Use a KimWipe® dampened with 70% ethanol to wipe the sample tray cover. Repeat.

3. Push the sample tray to the back of the luminometer, exposing the two steel guide rails upon which the sample tray glides. (See Figure 13.) Use a KimWipe® and 70% ethanol to clean the guide rails.

4. Push the optical head to the center of the luminometer, exposing the black metal shelf on the right side of the luminometer. (See Figure 14.)

5. Clean the black shelf with a fresh KimWipe® dampened with 70% ethanol. Be sure to clean the rest position for the optical head.

6. Return the optical head to the home position. (See Figure 21.)

7. Close the lid and turn ON the Veritas.

8. Use the “Eject Tray” button to automatically return the sample tray to the home position.

Cleaning the Injector(s)

*For models 9100-001 and 9100-002, Turner BioSystems recommends a thorough cleaning of the injector(s) every 30 days. Use the Injector “Appendix A - Maintenance” Schedule [Appendix J] for your records.

To thoroughly clean the injector(s):

1. Prepare a solution of 70% ethanol and use it to flush the injector(s) three times.

2. Allow the solution to sit in the fluid path for 30 minutes before flushing the injector(s) nine times with deionized water.

3. Flush the injector(s) three times with air. A small volume of water will remain in the injector after the air purge.

Cleaning the Waste Tray

A removable waste tray prevents flooding of the Veritas interior. The capacity of the waste tray is approximately 100 mL. There is a time delay between the departure of liquid from the tip and the arrival of the liquid in the waste tray. Place an absorbent paper towel underneath the Veritas while emptying the waste tray.

Removing/Inserting Injector Tip(s) from/into the Optical Head

1. Grasp the injector fitting. Pull upward in a single, smooth motion. Do not use excessive force. If the tip does not release easily from the injector tip holder, refer to “Cleaning the Optical Head” for further instructions.

2. To replace the injector tip, carefully align the tip with the injector holder. Hold the tip by the fitting.

3. Gently push the injector tip into the injector tip holder. Continue with a steady push until the injector snaps into place. Do not force the tip farther than allowed by the injector tip holder. An internal clip locks the tip into place. If the tip does not insert easily into the injector tip holder, refer to “Cleaning the Optical Head” for additional instructions.

Changing Injector Tips

NOTE: Replacement injector tips are available from Turner BioSystems (P/N: 9100-962). Only injector tips from Turner BioSystems are fully tested and compatible with the Veritas.

1. Gently remove the injector tip(s) from the injector tip holder.

2. Twist the tip fitting counterclockwise to release the fitting from the tubing.

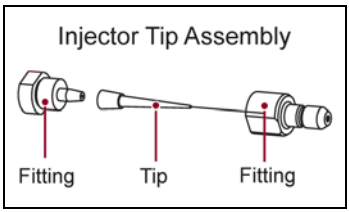


Figure 22

3. Untwist the tip fitting to release the tip.

4. Discard tip.

5. Insert a new tip into fitting.

6. Twist the fitting clockwise to complete the injector tip assembly. Twist the fitting just until tight. A small gap (approximately 1 mm) between the two fittings is normal.

7. Twist the assembled fitting with the new tip clockwise onto the tubing.

8. Insert the tip into the injector tip holder on the optical head.

Removing/Replacing Injector Tubing

1. Grasp the injector tubing fitting(s) located on the top of the injector syringe.

2. Disconnect the inlet and outlet tubing from the injector syringe by twisting the fitting counterclockwise.

3. Discard the used injector tubing.

4. Twist the fitting of the replacement tubing to secure the tubing onto the syringe.

Additional Maintenance

Periodically wipe off the outside of the instrument with a damp cloth. Do not use solvents or abrasive cleaners to clean the instrument. Avoid spilling liquids into the sample tray.

If a spill has occurred:

1. Unplug the instrument.

2. Wipe up any moisture inside the sample tray.

3. Use a KimWipe® dampened with a 70% ethanol solution to clean the tray.

4. Plug in the instrument and turn ON the power. Allow the instrument to warm up for a few minutes or until it is completely dry inside.

5. If wetness appears on the sample tray cover, refer to “Cleaning the Optical Head.”

IF YOU SUSPECT THAT FLUIDS HAVE SPILLED ONTO THE LIGHT DETECTOR, PLEASE CONTACT TURNER BIOSYSTEMS FOR CLEANING INSTRUCTIONS.

Appendix B – Advanced Protocols

The “Advanced Protocols” folder contains “Kinetics,” “Automatic Injector Options,” and “Super Protocols.”

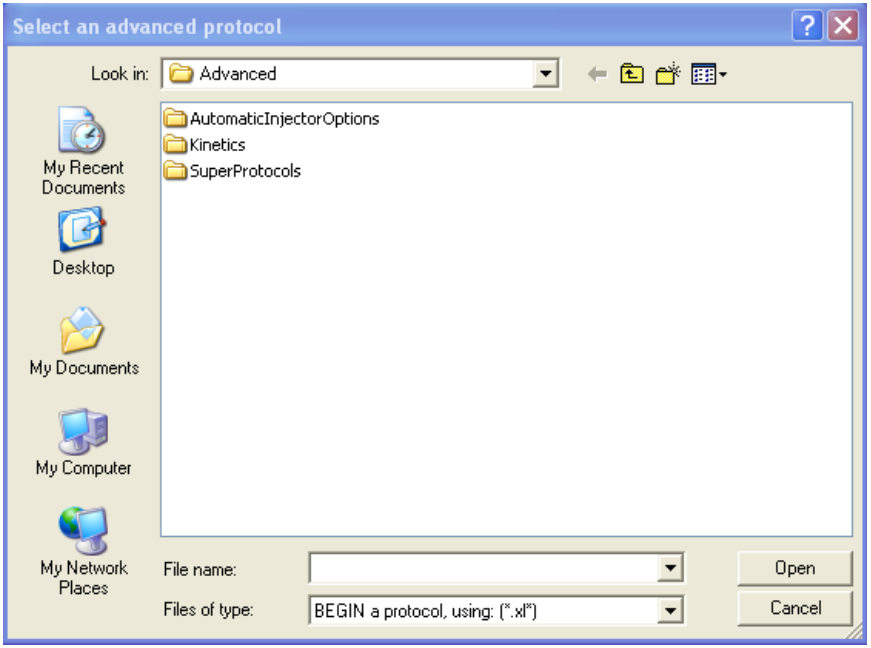


Figure 23

Kinetic Measurement

Kinetic protocols are available for measurement with and without injection. Open the “Kinetics” folder and choose the protocol of interest.

Plate Setup

Click on “Options” to select the wells for measurement. During the Kinetic protocol, the Luminometer will collect data for each well and send the data to the Excel spreadsheet. The results for all kinetic runs appear in column format.

Other Options

Select the “Other Options” tab to adjust the frequency of data point collection as well as the number of total measurements per well. (See Figure 24.)

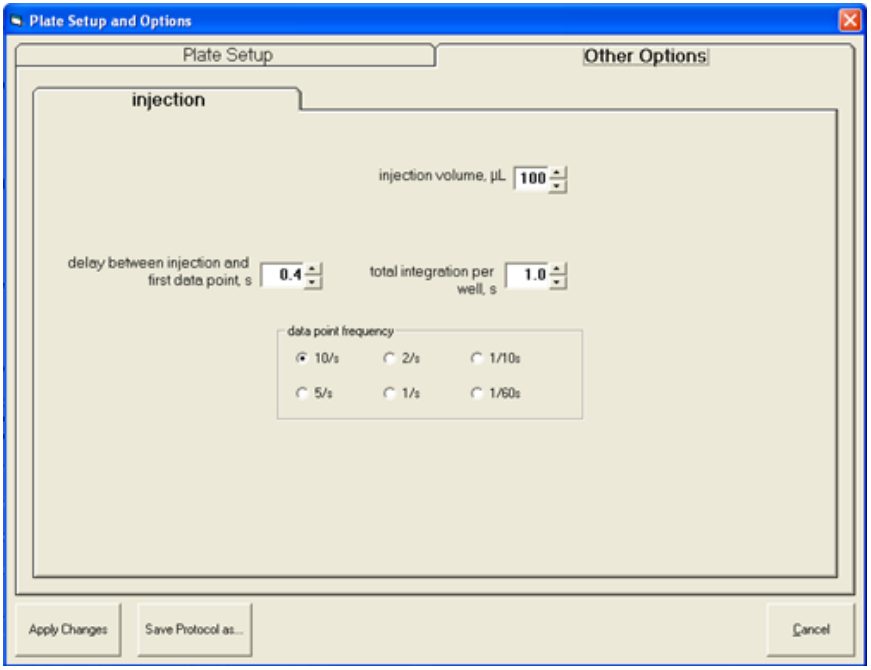


Figure 24

The dynamic range for kinetic measurements is limited when compared to the dynamic range of discreet or normal measurements.

Extremely bright samples may saturate the luminometer in “Kinetics” mode.

Automatic Injector Options

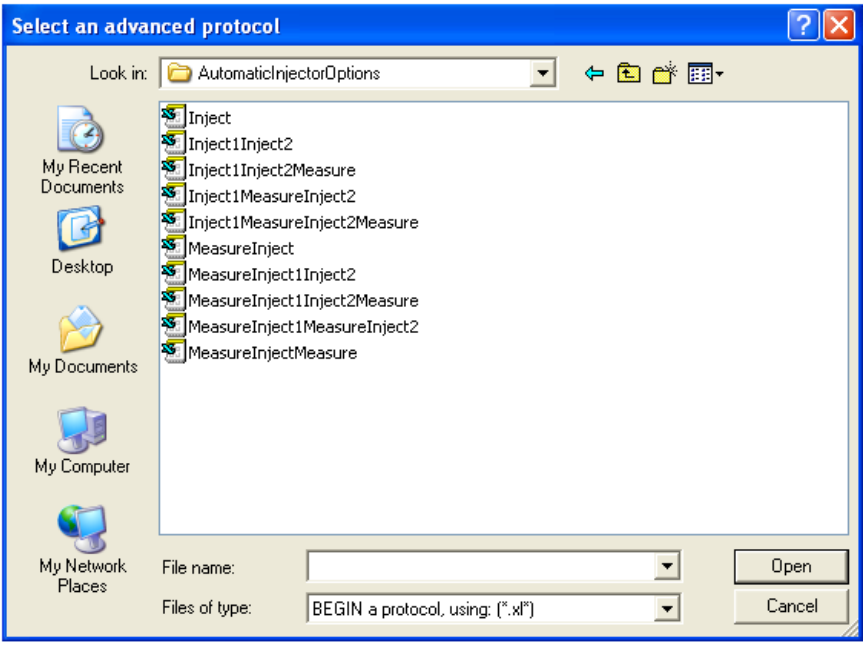


Figure 25

The “Automatic Injector Options” folder contains a variety of automatic injection sequences with and without measurement. The title of the protocol reflects the sequential order of injection and measurement. For example, the protocol entitled “Inject1Inject2Measure” programs an injection by Injector 1 followed by an injection by Injector 2 immediately followed by a measurement of the well. This sequence repeats for each well selected. Use “Options” to adjust the volume for each injection and the measurement time.

Super Protocols

Super Protocols allow multiple individual protocols in a user-preferred sequence. For example, a properly designed Super Protocol might execute an injection-only run followed by a 5-minute incubation period and finally a measurement-only run.

Before setting up a Super Protocol, set up the individual sub-protocols and save each protocol with a descriptive file name. Close the sub-protocols before selecting “Super Protocols” from the “Advanced

Protocols" folder. Standard and column formats are available for reporting data from "Super Protocols."

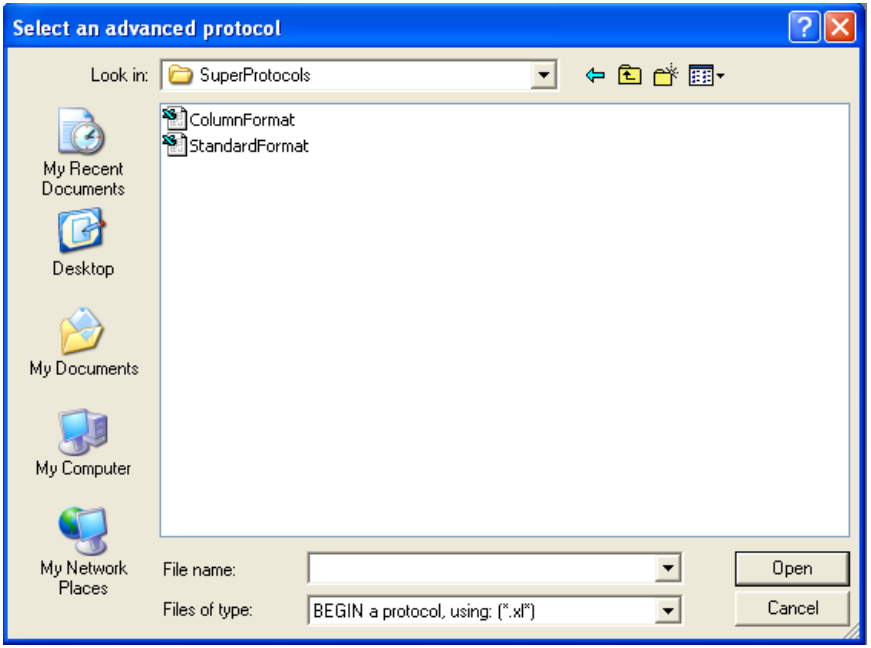


Figure 26

	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1														
2		Show Experiment Parameters												
3														
4		1	2	3	4	5	6	7	8	9	10	11	12	
5	A													A
6	B													B
7	C													C
8	D													D
9	E													E
10	F													F
11	G													G
12	H													H

Figure 27 – Standard Format

	A	B	C	D	E	F	G	H	I
1									
2		Show Experiment Parameters							
3									
4		D3	E2	F2	F3	G2	G3	H2	H3
5		53	29	12621	1	4	5	3	3
6									
7									
8		65	23	12599	4	2	6	4	3
9									
10									
11		50	36	12546	2	2	1	1	0

Figure 28 – Column Format

Click on “Options” then the “Other Options” tab to assemble the order of execution for each individual sub-protocol. (See Figure 29.)

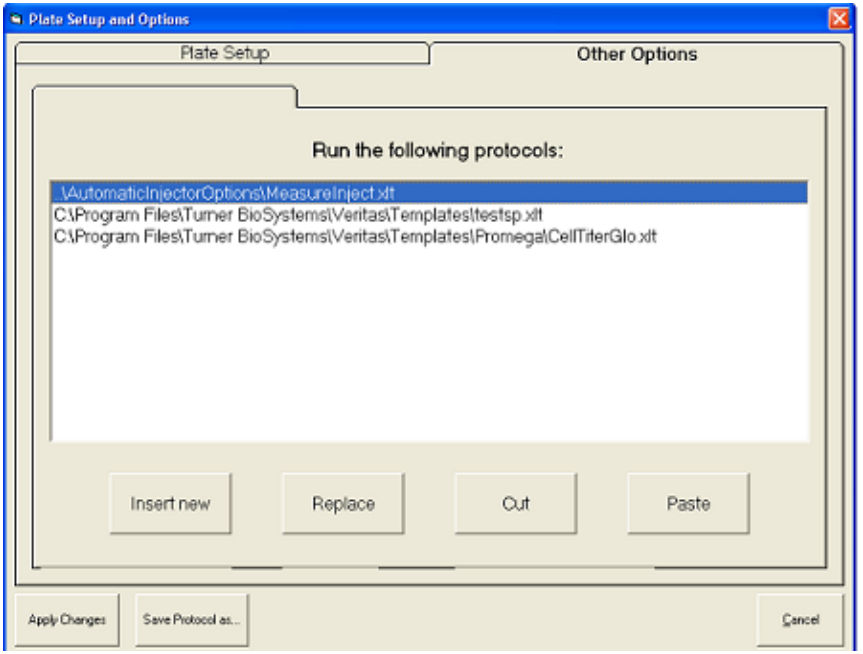


Figure 29

The following rules apply to Super Protocols:

1. Kinetic measurements are not compatible with Super Protocols. It is not possible to successfully complete a Super Protocol if a sub-protocol executes kinetic measurements.

2. The luminometer only executes actions on wells selected in both the sub-protocol and Super Protocol. Select all wells in the sub-protocols, then use the Super Protocol to select individual wells, rows or columns for measurement.

3. Protocols constructed in earlier software versions may not work for Super Protocols. Re-construct older protocols using the “New Protocol” wizard.

4. The flooding of a microplate by multiple injections into the same well may cause serious mechanical problems as well as increase the background readings. Clean up spills immediately. Refer to “Appendix A – Maintenance” for information on “Cleaning the Interior.”

APPENDIX C – Troubleshooting Guide

Table 1. Troubleshooting Software Problems

Symptom	Possible Cause	Action
The software does not respond. When I click a button, nothing happens.	The computer is not connected to the instrument.	Check the yellow status light on the front of the instrument. If it is illuminated, the Veritas and computer are not communicating. Make sure the RS-232 cable connects the Veritas with the computer.
	The Veritas is not ON.	Check the green status light to see if the instrument is ON. If it is not illuminated, check the power supply and the ON/OFF switch.
Communications Error: Veritas is not communicating with the computer.	The 9-pin RS-232 cable is not fully connected to the instrument or computer.	Check the female and male connectors of the 9-pin RS-232 cable to ensure complete connection.
	The USB Serial Adaptor is not fully connected to the 9-pin RS-232 cable or computer.	Check the USB Serial Adaptor for proper installation. Refer to the USB Serial Adaptor operating manual for installation instructions.
	The Veritas is not ON.	Check the green status light to see if the instrument is ON. If it is not illuminated, check the power supply and the ON/OFF switch.

	There is a firmware problem.	Check the red status light. If illuminated, turn OFF the Veritas and restart your computer. Open the Veritas software, then turn ON the Veritas. If the red status light is still illuminated see “Appendix F – Firmware Upgrades” for firmware information.
Error Message: Veritas Run-time error '8018': Operation valid only when the port is open.	There is a software problem.	Remove the Veritas program and reinstall the software file.
Communications Error: Cannot open COM port; connection. Use the “Settings” menu.	The communication between the Veritas and the computer was disrupted.	Restart the Veritas software.
Error Message: Veritas can't exit yet. A run is still in progress.	Another program has reserved the serial port.	Contact your IT department to determine the availability of serial ports on your computer.

Veritas does not read the microplate when I click on "Start.”	The Veritas is reading a microplate.	Click "OK" to return to the ”Main Dialog Box.” If necessary, click "Cancel" from the "Main Dialog Box" to stop a run in progress. To close Veritas, go to the Task Manager on your computer and use "End Task" to override Veritas and close the software. You may lose data by closing the software from your Task Manager.
	Instrument is waiting through a user-set delay time.	Inspect the Status Bar on the "Main Dialog Box" to see if a delay time is set. Cancel the run and select "Options" to reset the delay time.
Veritas does not respond when I click on "Start.”	There is a software problem.	Close the Veritas software. Restart your computer and turn ON the Veritas. Open the Veritas software and re-prime injectors (if necessary) before starting the run.
Data appears in the wrong spreadsheet and overwrites saved data.	There are no wells selected for measurement.	Select "Options" from the "Main Dialog Box" to choose the wells you want to measure. Selected wells are blue. Unselected wells are gray.

The data fields have a yellow background.	The Veritas will enter data into any Excel spreadsheet opened in the "Excel serving Veritas" window.	After Veritas finishes the run, cut and paste the new data into a new Excel spreadsheet. Close the old Excel spreadsheet but DO NOT SAVE changes. In the future do not open another Excel spreadsheet in the "Excel serving Veritas" window.
The data fields have a red background and zero RLU values.	The samples are too bright.	Dilute the samples and re-run the microplate or switch to a black microplate.
	A run was canceled or an error occurred during the run.	Premature attenuation of a run may cause loss of data. Re-prime injectors if they are in use and start a new run.

Table 2. Troubleshooting Injector Problems

Symptom	Possible Cause	Action
The injectors are not available under the "Options" menu.	Injectors were not chosen when the user set up a new protocol.	It is not possible to add automatic injectors to an existing non-injection protocol. Choose "Create new protocol" from the "Welcome to Veritas" dialog box and select the injectors you wish to use.
	The Veritas does not have injectors installed.	Contact Turner BioSystems, Inc. to ask about automatic injectors on the Veritas.
Error message: Pump 1, needed for this run, is not primed. Prime it, then click START again.	The injector was not primed or the instrument was power-cycled after the injector was primed.	Select the "Prime" tab from the "Main Dialog Box" and prime the injector(s). Remember to prime into a waste container.
Injector(s) will not inject.	Air bubbles are blocking the line.	Make sure the inlet tubing is completely inserted into the reagent bottle. Re-prime the injector(s).
	The end of the inlet tubing is not in the reagent.	

Injector(s) will not inject.	Reagent residue is clogging the tubing.	Replace tubing. Always flush the tubing after use to prevent reagent residue from building up inside the injector, tubing, and tip.
	Reagent residue is clogging the valve(s).	Contact Turner BioSystems, Inc.
Injectors do not prime or flush properly.	Tray is not in home position.	Restart software. Select “Eject Tray” to return tray to home position.
Injector tips are damaged or bent.		See “Appendix A - Maintenance” for instructions on “Changing Injector Tips.”
Injections sputter, drip, or are otherwise weak.	Air bubbles are blocking the line.	Check the inlet tubing to make sure the tubing is completely inserted into the reagent bottle. Re-prime the injector(s).
	Reagent residue is clogging the tubing.	Replace tubing. Always flush the tubing after use to prevent reagent residue from building up inside the injector, tubing, and tip.

Injector leaks.	The inlet or outlet tubing is not properly connected to the injector syringe.	See “Appendix A - Maintenance” for instructions on “Removing/Replacing Injector Tubing.”
Injector tips do not sit properly in the injector tip holder.	Reagent residue has built up inside injector tip holder.	See “Appendix A – Maintenance,” for instructions on “Cleaning the Optical Head.”

Table 3. Troubleshooting Miscellaneous Problems

Symptom	Possible Cause	Action
Grinding noise heard during run.	Reagent residue has built up on optical head mask.	See “Appendix A - Maintenance” for instructions on “Cleaning the Interior” of the Veritas.
	The sample tray cover is open during run.	Close the sample tray cover and secure with the sample tray latch.
Red LED Status Light is ON.	The Veritas is non-operational.	See Appendix D.
The sample tray cover does not close.	Microplate does not sit flat in the sample tray.	Gently push tray cover up to a 90° angle with sample tray to completely open tray. Set the microplate down inside tray.
Wetness appears on top of the sample tray cover after a run.	Injector tips bent.	See “Appendix A - Maintenance” for instructions on “Changing Injector Tips” and “Cleaning the Optical Head.”
	Microplate has overflowed inside the Veritas.	See “Appendix A - Maintenance” for instructions on ”Cleaning the Optical Head.” Check the wells selected for injection and /measurement. Check the total injection volume from the “Options” menu. Check the volume of sample inside well. The maximum volume per well is 300 µL. Thoroughly clean the interior of the instrument.

	Reagent spilled inside the Veritas.	Wipe up spills immediately using an absorbent paper towel or delicate task wipe. If necessary, use a 70% ethanol solution to remove reagent residue.
Light Plate reads very low or blank.	The Light Plate was not ON before the run.	Press the "Start" button to turn the Light Plate ON. The green status light will flash. The Light Plate will automatically turn OFF after 5 minutes.
	The wells selected do not correlate with the Light Plate.	Select the “Light Plate protocol” option from the "Welcome to Veritas" dialog box. The light plate sample wells are B2, D2, and F2.
Error Message: run #1 canceled. Lid opened-Recipe canceled.	The lid was opened during the run.	Re-prime the injector(s) if they are in use. Close lid and do not open lid until the run is completed.
	The optical head is stuck or jammed.	See “Appendix A - Maintenance” for instructions on ”Cleaning the Interior” of the Veritas.
Error Message: run #1 canceled. Move to plate sense position not done.	The optical head is stuck or jammed.	See “Appendix A - Maintenance” for instructions on ”Cleaning the Interior” of the Veritas.
Error Message: run #1 canceled. Move failed.		

Error Message: cannot START with the lid OPEN. Please close the lid and try again.	The height of the reagent bottles may impair full closure of the lid.	Check for any obstruction that may prevent full closure of the lid. The lid should close easily. Do not force it.
Error Message: cannot START without a microplate in the instrument.	Microplate is absent.	Insert microplate and click on "Start."
	Clear plate in sample tray.	Use a white or black opaque microplate with the Veritas.
Readings are extremely low on positive controls.	Injection failure.	Determine if the correct volume was injected into the well. Make sure the inlet tubing is fully inserted into reagent bottle. Look for air bubbles in outlet tubing. Re-prime injector(s) before next run.
	Wrong wells injected or measured.	Check the wells selected from the “Options” menu. Check the plate orientation.
High background on negative control or empty wells.	White microplates phosphoresce inside the Veritas.	Dark-adapt the microplate by setting a delay time before measurement under the “Options” menu.
	The light detector is saturated with ambient light.	Remove the microplate and keep the lid closed for 30 minutes. That will allow the light detector to recover.
	Very bright samples are causing crosstalk interference.	The Veritas reads from left to right, rows A–H. On injection runs, position your negative controls at the beginning of the plate.

RLU readings appear inconsistent with expected results.	Ambient temperature is too high.	The ambient temperature should be at or below 23° C for optimal performance.

APPENDIX D – LED Status Lights

There are three LED status lights on the front panel of the Veritas. (See Figure 3.) All three illuminate briefly after powering the Veritas ON, but only the green light should remain illuminated. It indicates that the instrument is powered and ready.

If the yellow light remains lit, the computer and the instrument are not communicating. A communication failure can occur if

- the Veritas is ON, but the software is not open on the computer.
- the Veritas is ON, but the 9-pin RS-232 serial cable is not connected to the computer.

The red LED indicates other types of errors. When the red LED is illuminated, the software may initiate an automatic firmware download. Follow the instructions as they appear on the screen. It may take several automatic downloads to fully restore the Veritas. As long as the red LED is illuminated, the Veritas is non-operational. If the software does not initiate an automatic firmware download, turn OFF the Veritas. Close the software and reboot the PC. Turn ON the Veritas, then open the software. This power cycle may restore the Veritas.

APPENDIX E – Save and Restore Parameters

The “Utilities” menu features two options regarding parameters. Each instrument contains its own unique parameters that aid in its ability to measure light. Under normal operation, it is not necessary to save or restore parameters. In certain cases, restoration of parameters will resolve erratic behavior.

APPENDIX F – Firmware Upgrades

The Veritas can download new firmware to the instrument from a computer. This capability is reached through the "Utilities" menu. This is a password-protected function to prevent accidental use. The purpose of firmware upgrades is to add new capabilities to the system. When a new version of firmware is developed in the future, Turner BioSystems will send you specific instructions on how to perform the upgrade.

APPENDIX G – Instructions for Using the Data Analysis Macro

The Veritas Microplate Luminometer software includes a data analysis macro for the Dual-Luciferase® Reporter Assay from Promega.

Running the Dual-Luciferase Reporter Assay

Open the Veritas software and select “Run Promega Protocol.” Open the “DLR” folder and select “DLRwithOneInjection” or “DLRwithTwoInjections.” Next, open “Options” from the “Main Dialog Box” and select the wells for measurement. Prime the injector(s). Insert the microplate into the sample tray, close the lid and click on “Start” to begin the protocol. Please see the application note for more information on running this assay.

Simple Ratio of Raw Data

After the Veritas finishes reading the microplate, go to the “Excel Serving Veritas” window. The first spreadsheet entitled “Measurements” contains the data as reported by Veritas. The second spreadsheet entitled “Analysis” includes a data analysis tool that generates the ratio between the firefly and *Renilla* signals. Select the “Analysis” spreadsheet to view the raw ratio of firefly to *Renilla* signals. The data analysis macro also provides simple charts for the firefly and *Renilla* signals. Scroll to the right to view these charts.

Background Subtraction

It is possible to perform background or blank subtraction on the “Analysis” spreadsheet. Enter the term “BLK” for any well in the microplate map that represents a background measurement. Click on “Analyze Data” to perform the background subtraction. The data analysis macro averages the signal from BLK wells and subtracts this value from all other samples for both the firefly and the *Renilla* signals. The data analysis macro fields copy below the previous field and the adjusted ratio appears in the new data analysis macro field.

Sample Groups

It is possible to assign unique sample IDs to track experimental or unknown samples or sample groups. Enter the sample IDs into the microplate map. Remember to enter this information into the most recent microplate map. Repeat the Sample ID for each well containing the same sample group. Click on “Analyze Data.” The data analysis macro fields

copy below the previous fields. The software will take the average for any group of identical sample IDs and calculate the average, standard deviation, and coefficient of variance for the group.

Controls

Use the control option to distinguish your controls from your unknown samples. If the microplate contains positive or negative controls, you may designate these wells as CTL on the microplate map.

Charting and Graphs

Scroll to the right to see the charts generated by the data analysis tool. These charts provide a quick visual guide to the data analysis.

Multiple Analysis' of the Same Microplate

New data analysis macro fields appear after each analysis. It is possible to make adjustments to the microplate map and re-analyze the data. However, you must make any adjustments in the most recent microplate map. In most cases, it is necessary to scroll down on the "Analysis" spreadsheet to find the most recent microplate map.

Multiple Microplates

When the Veritas runs multiple microplates in the same protocol, new microplate data sets appear in the measurement spreadsheet. It is possible to analyze all of the microplates on the "Analysis" spreadsheet. However, you must analyze one run or microplate data set at a time. To analyze the next microplate data set, click "Step to Next Run's Measurements" on the top of the "Analysis" spreadsheet. After you proceed to the next microplate, you can not make adjustments to previous microplates. To match the analysis with the microplate data set, go to the "Measurements" spreadsheet. The highlighted microplate data set is the same set undergoing analysis.

On-the-Fly Analysis

For advanced users with multiple microplates containing identical sample and background mapping, it is possible to enable On-the-Fly Analysis. The On-the-Fly Analysis option automatically analyzes each new microplate data set according to the initial microplate map. Enter in the analysis information into the microplate map before starting the protocol. Then click on "Enable on-the-Fly analysis." Click on "Start" on the "Main

Dialog Box" to begin the protocol. After the Veritas finishes reading the microplate, the data analysis macro will immediately analyze the data.

APPENDIX H – Warranty and Obtaining Service

Warranty

Turner BioSystems warrants the Veritas™ 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:

- The instrument and accessories must be installed, powered, and operated in compliance with the directions in this operating manual and the directions accompanying the accessories.
- Damage incurred during shipping is not covered by warranty.
- Damage resulting from measurement of samples found to be incompatible with the materials used in the sample system is not covered by warranty.
- Damage resulting from reagent spills is not covered by warranty.
- Damage resulting from contact with corrosive materials or atmosphere is not covered by warranty.
- Damage caused by modification of the instrument by the customer is not covered by warranty.
- Damage caused by user neglect of injectors is not covered by warranty.
- Damage caused by failure of user to perform routine maintenance as recommended is not covered by warranty.

Obtaining Service

Warranty Service

To obtain service during the warranty period, please 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.

3. If the instrument is still not functioning properly, YOU MUST OBTAIN AN RMA NUMBER BEFORE SHIPPING the instrument to Turner BioSystems. Contact Turner BioSystems to start the RMA process.

4. After obtaining an RMA number, pack the instrument well (damage incurred in shipping due to improper packing is not covered), insure it, write the RMA number 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. Turner BioSystems will pay for return shipment and include a check to reimburse you for the cost of surface shipment to us. If you are an international customer who purchased directly from Turner BioSystems (not from a third-party distributor), contact Turner BioSystems for instructions. The instrument will be repaired at no charge if it is under warranty.

Turner BioSystems cannot, however, pay shipping, duties, or documentation costs outside the continental United States. Customers outside of the United States who have purchased our equipment from an authorized distributor should contact the distributor for further instructions.

NOTE: Under no circumstances should the instrument or accessories be returned without prior authorization from Turner BioSystems or our authorized distributor. Prior correspondence is needed to

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

- determine the nature of the problem, so that repair can be done with particular attention paid to the defect you have noted.

Out of Warranty Service

Follow the same steps as for Warranty Service. Our service department is happy to assist you by telephone or correspondence at no charge. Repair service will be billed at a flat rate. Your invoice will include freight charges.

Address for Shipment:

Turner BioSystems
645 N. Mary Ave.
Sunnyvale, CA 94085
USA

Telephone: 408-636-2400
Toll-Free: 888-636-2401 (US & Canada)
Fax: 408-737-7919

APPENDIX I – Specifications

Specifications for the Veritas™ Microplate Luminometer

Sensitivity	3 x 10^{-21} moles luciferase
Linear Dynamic Range	> 9 decades
Crosstalk	Better than 3 x 10^{-5}
Precision	CV < 3%
Detector	Photomultiplier Tube (PMT)
Spectral Response Range	350–650 nm
Peak Wavelength	420 nm
Plate Format	96-well, others under development
Injectors	One or Two Injectors (optional)
Injection Volume	Selectable between 25 and 250 µL (±1 µL); CV% < 1%
Computer Interface	RS-232 port
User Interface	Requires Windows® 95 or later and MS Excel.
Power	0.5A @ 100–240V, 50–60Hz (universal)
Dimensions	19.44" D x 18.75" W x 9.28" H (49.38 cm D x 47.63 cm W x 23.57 cm H)
Weight	28 lbs (12.7 kg)
Operating Temperature	60–105 °F (15–40 °C)
Warranty	One year
Approvals	CE

APPENDIX J – "Appendix A - Maintenance" Schedule

Keep a record of the cleaning of the interior, optical head and injectors of the Veritas, as well as tubing/tip replacement.

Date	Initials	Maintenance Performed