
20/20ⁿ Luminometer Operating Manual



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I. Introduction

Description

The 20/20ⁿ Luminometer is an ultra-sensitive, compact, laboratory instrument for measuring luminescent materials. Specifically, the 20/20ⁿ accommodates measurement of firefly and *Renilla* luciferase for genetic reporter studies, ATP determination for biomass analysis, and chemiluminescence detection using horseradish peroxidase and alkaline phosphatase. The touchscreen allows for easy set up and operation. The optional automatic dual injectors permit reproducible and convenient measurements of flash-type luminescent reactions. The 20/20ⁿ also features optional modules for measuring certain fluorescent materials including fluorescein, Hoescht dye, 4-MU, PicoGreen[®], and RiboGreen[®].

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:

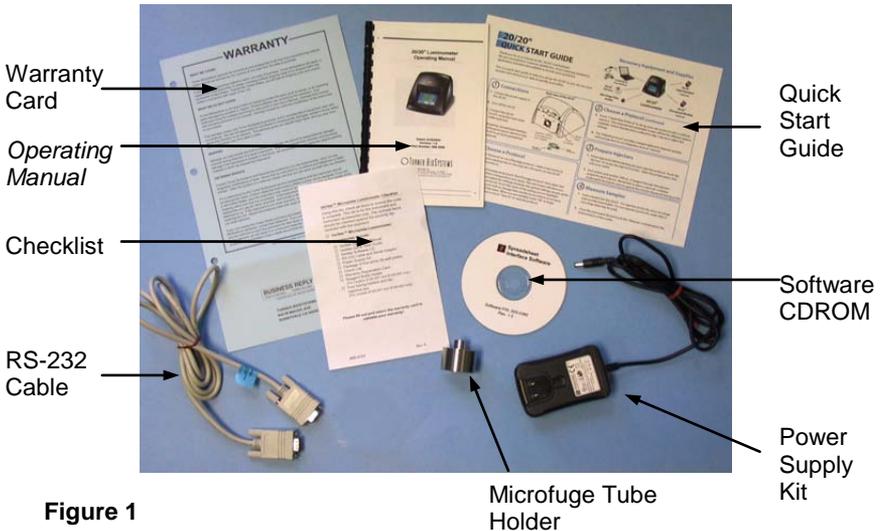


Figure 1

Standard accessories for models 2030-001 and 2030-002 also include:

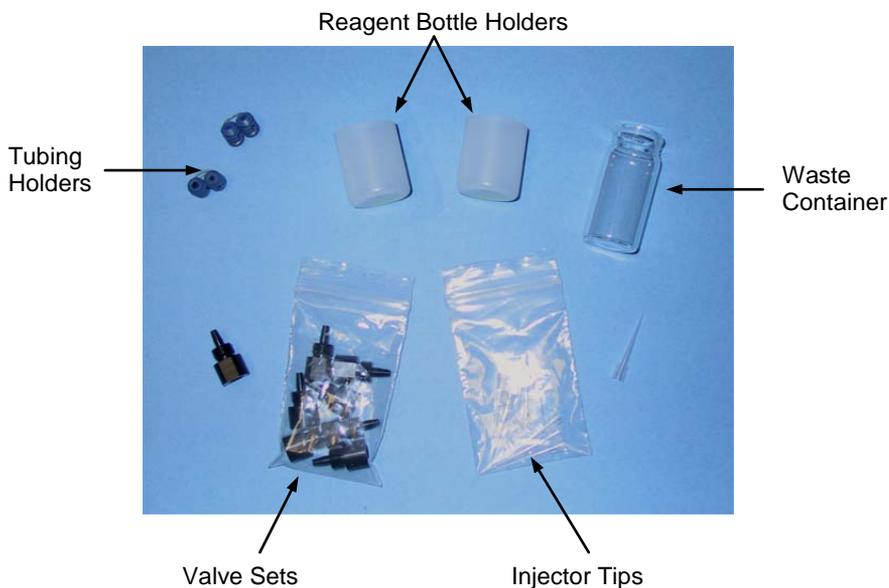


Figure 2

Precautions

The 20/20ⁿ Luminometer is intended for indoor use only. Wipe up spills immediately. The 20/20ⁿ Luminometer contains sensitive optical components and precision-aligned mechanical assemblies. Avoid rough handling.

For models 2030-001 and 2030-002, handle the injector tips carefully.

Do not perform injections with bent or damaged tips. If the injector tip appears damaged, replace it.

II. Hardware Overview

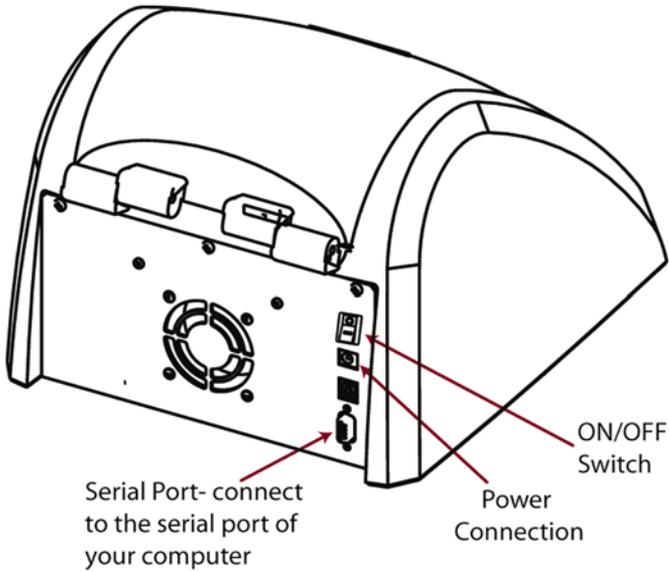


Figure 3

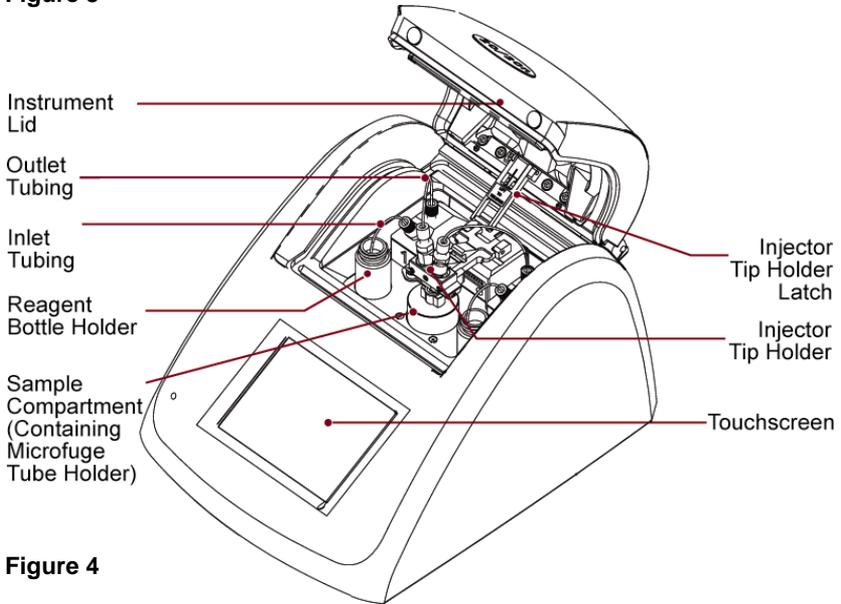


Figure 4

III. Setting Up the 20/20ⁿ Luminometer

Setup

1. Place the 20/20ⁿ Luminometer on a flat, level surface. Allow at least 6 inches (16 cm) of vertical clearance to open and close the lid. Position the luminometer so that the touchscreen faces you.

Power Supply

1. Connect the power supply into the back of the luminometer.
2. Plug the line cord into a wall outlet. See “Appendix – D Specifications and Features” for power requirements.
3. Turn ON the ON/OFF switch. (See Figure 3.)

Software Installation

To export data from the luminometer to an Excel spreadsheet, you must first install the Spreadsheet Interface Software. The Spreadsheet Interface Software requires a PC loaded with Windows '98 or higher, an available serial port, and Excel. Insert the software CDROM into the CDROM drive of your computer. This will initiate the installation program. When installation is complete, the “Spreadsheet Interface Software” icon will appear on your PC desktop and in the Programs menu.

System Connections

Next, you need to establish a connection between the luminometer and the PC. Connect the 9-pin RS-232 serial cable between the luminometer and your PC. The male 9-pin connector attaches to the luminometer and the female connector attaches to the PC.

Alternatively, connect the luminometer to a printer to print the data as it appears on the touchscreen. Use the serial cable included with the thermal printer to connect the luminometer to the printer.

IV. Operating the 20/20ⁿ Luminometer

Touchscreen Basics

The touchscreen monitor on the 20/20ⁿ Luminometer permits easy and intuitive measurements for luminescence. The touchscreen is sensitive to the light pressure of a fingertip. After turning ON the luminometer, the touchscreen will automatically light up with the “Home screen.” After 15 minutes without activity or user stimulation, the touchscreen will hibernate to conserve power. To re-activate, lightly touch the screen once. To select a function, touch the button corresponding to the function once.

Home Screen

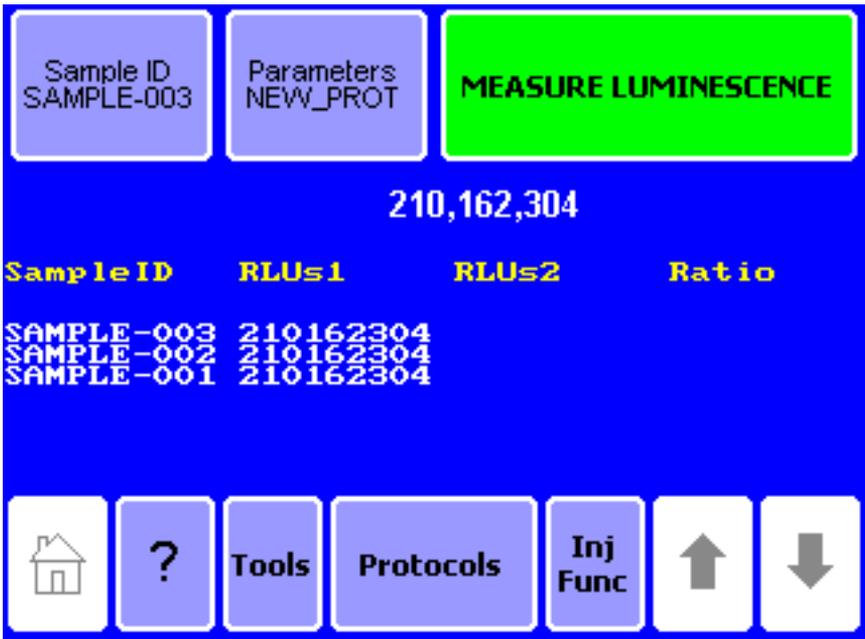


Figure 5. The Home Screen.

The “Home screen” provides orientation for the multiple functions of the 20/20ⁿ. From the “Home screen,” you may select “Protocols,” “Tools,” “Help,” and “Injector Functions.” You may also measure luminescent samples from the “Home screen” by touching “Measure Luminescence.”

Navigation

A navigation bar at the bottom of the touchscreen allows you to access menus quickly. Touching the “Home” key takes you to the “Home screen.” The “Help” menu is also available from the navigation bar. You may touch “Tools” to access the “Tools and Settings” options. Touch “Protocols” to access Promega protocols, create a new protocol, access a saved protocol, or use the default protocol. When applicable, touch “Inj Func” to prime and flush the injectors. When applicable, touch “Inj Func” to prime and flush the injectors.

Setting Up a Protocol

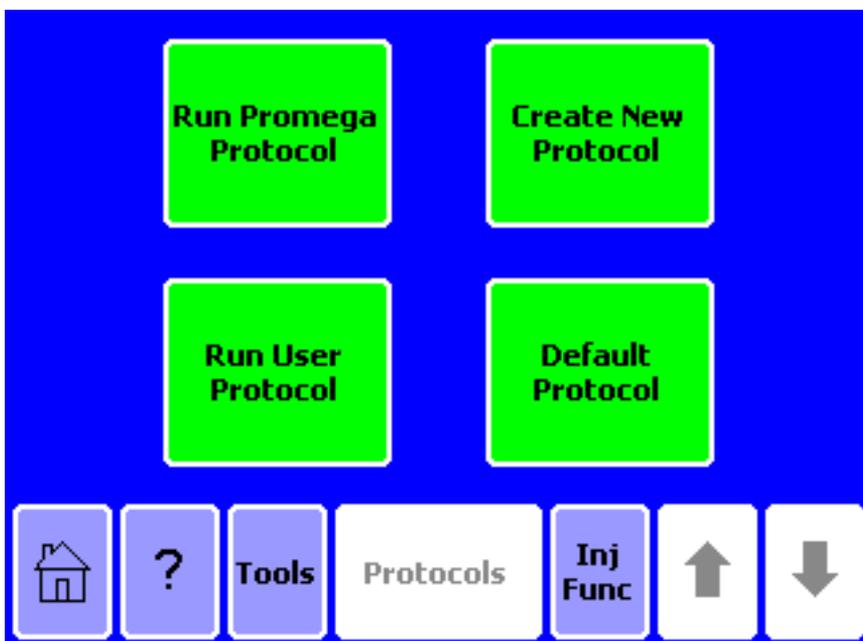


Figure 6. The Protocol Menu

Running a Promega Protocol

The 20/20⁰ Luminometer accommodates the measurement requirements for luminescent assays from Promega. Touch “Run Promega Protocol” and select the protocol that corresponds to your assay system. For example, if you are using the Steady-Glo[®] Assay for a luciferase gene reporter study, touch “Steady-Glo.” The luminometer will open a Steady-Glo protocol with the recommended measurement settings automatically programmed. Touch “OK” to accept the parameters and return to the “Home screen.” You are now ready to measure your samples.

Creating a New Protocol

If you select “Create New Protocol,” the 20/20ⁿ prompts you to select 0, 1 or 2 injectors depending on the number of injectors installed on your 20/20ⁿ.

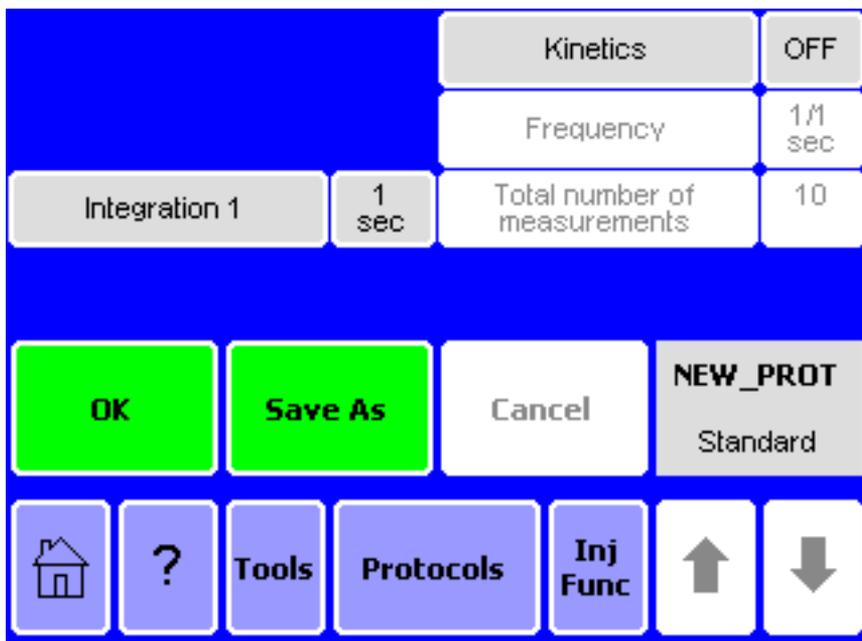


Figure 7. A typical parameters screen for a non-injection protocol.

For non-injection protocols, the next screen allows you to adjust the integration time. The integration time is another term for the measurement duration. Select “Integration,” then use the UP and DOWN arrow keys to increase or decrease the integration time. When you are finished, touch “Save As” to save your protocol under a specific name of your choice. Alternatively, touch “OK” to return to the “Home screen” to measure your samples. The luminometer will automatically name your protocol “New Protocol” and return to the “Home screen.”

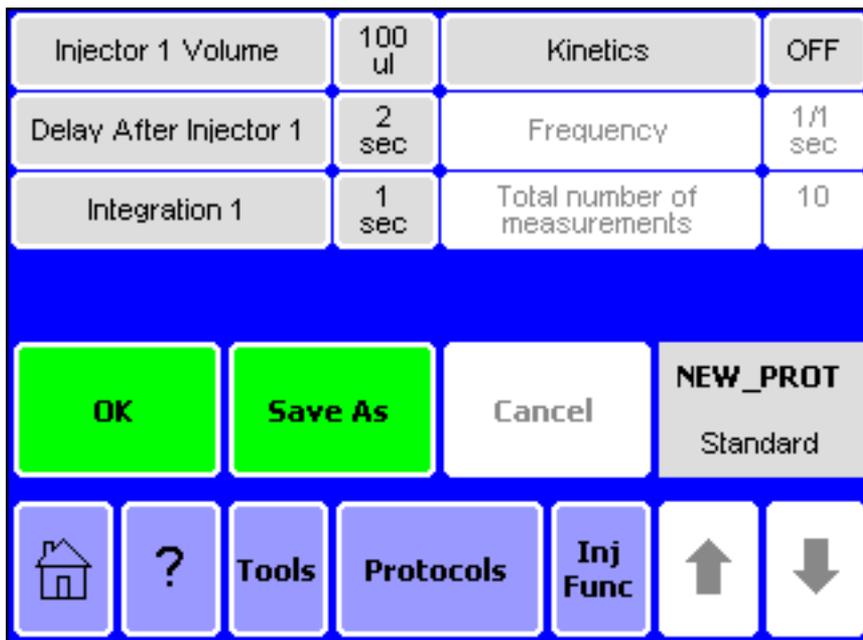


Figure 8. A typical parameters screen for a single-injection protocol.

For 1 and 2 injector protocols, the next screen permits adjustment of the injection volume, the delay between injection and measurement, and the integration time (measurement duration). Select the setting you wish to change, then use the arrow buttons to increase or decrease the value. When you are satisfied with the parameters, touch “Save As” to save your protocol under a specific name of your choice. Alternatively, you can touch “OK” to return to the “Home screen” and measure your samples without saving your protocol. The luminometer will automatically name your protocol “New Protocol” and return to the “Home screen.” In either case, remember to prime the injectors before measuring any samples.

Kinetic Measurements

The kinetic measurement feature provides a method for monitoring real-time luminescence. The data point frequency is the rate at which the measurements are taken for a particular luminescent reaction. Access the kinetic measurement options from the protocol screen. (See Figure 8.) Touch “Kinetics” to turn Kinetics ON. Use the UP and DOWN arrow keys to set the frequency of data point collection as well as the number of total data points. The integration time does not apply when the kinetics feature is turned on. It is important to connect the luminometer

to a computer or printer using the RS-232 serial cable to collect the data points during a kinetic protocol. Touch “OK” to save your changes.

NOTE: Kinetic measurements are not possible for dual-injector protocols.

Default Protocol

Select “Default Protocol” to measure your sample for an integration of 1 second without any injections. Touch “Default Protocol” to jump directly to the “Home screen.”

Running a User Protocol

To access a saved protocol, select “Run User Protocol.” The next screen will display protocols previously saved on the luminometer. Identify and touch the name of your protocol. The next screen will display the parameters of the saved protocol for your review and adjustment. Touch “OK” to go to the “Home screen.” If your saved protocol uses injectors, remember to prime the injectors before measurement.

V. Obtaining Measurements

Measuring Your Samples

The 20/20ⁿ is a bottom-reading luminometer and does not require a minimum sample volume. The sample compartment of the luminometer accommodates 35 mm petri dishes and 1.5 mL microcentrifuge tubes with a tube holder. **NOTE:** For injection protocols, we recommend using microcentrifuge tubes only.

1. Open the lid of the 20/20ⁿ and insert the microfuge tube holder.
2. Place your sample in a microfuge tube and gently place it in the microfuge tube holder. Alternatively, you can place a petri dish directly into the sample compartment.
3. Close the lid.
4. Touch “Sample ID” to name your sample. **NOTE:** This step is optional.
5. Using the keypad, enter the sample name into the name field. You can enter a maximum of 10 characters. Touch “Save” to save the

sample ID.



Figure 9. You may name your samples from the “Sample ID” screen.

6. Touch “Measure Luminescence” once to begin the protocol sequence. **NOTE:** Do not open the instrument lid while a run is in progress.

To abort a measurement in progress, touch the screen once. **NOTE:** Touching any part of the screen during measurement will abort the reading.

The 20/20ⁿ will report the Relative Luminescence Unit (RLU) on the “Home Screen.” If you are running a dual luciferase reporter (DLR) protocol, the ratio for each set of measurements will also appear. The 20/20ⁿ will display the status of the last 20 measurements. Use the arrow keys located in the navigation bar to scroll through recent measurements. **NOTE:** Measurements are not saved after power down.

VI. Saving Data

Saving Your Protocol

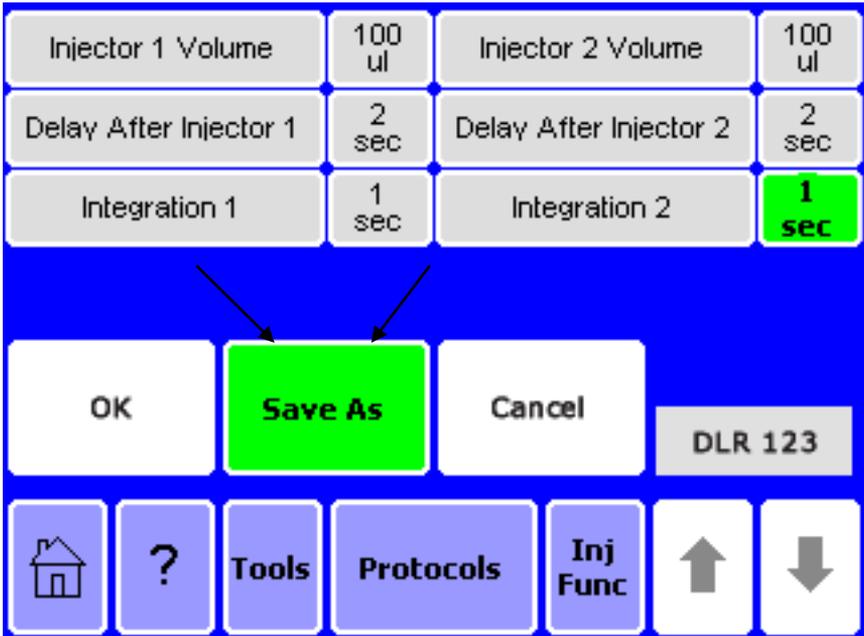


Figure 10. You can customize and save your protocol for future use.

If you wish to store your protocol for future use, touch “Save As” from the “Parameters screen.” The “Save As” screen contains a keypad to name your protocol. Enter the name of your protocol in the “name” field. You can enter a maximum of 10 characters for your protocol name. Touch “Save” to store the protocol. You can access the saved protocols from the “Run User Protocol” feature in “Protocols.” You may save as many as 18 protocols at one time.

VII. Automatic Injectors

Models 2030-001 and 2030-002 include one and two automatic injector systems, respectively. The complete injector system includes inlet tubing, outlet tubing, inlet valve, outlet valve, injector pump, injector tip, and injector fitting.

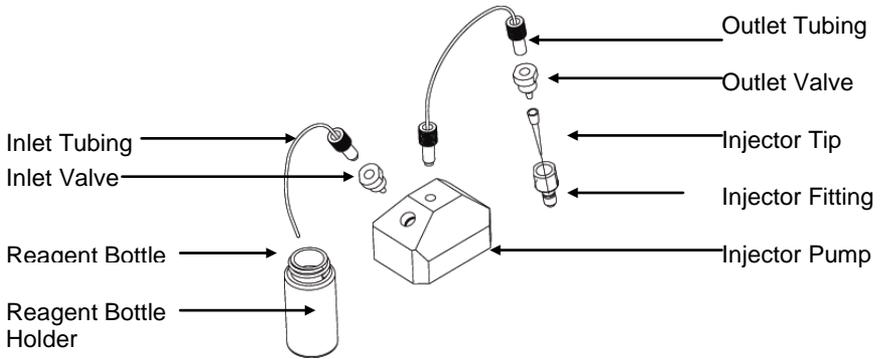


Figure 11

The inlet tubing guides liquid from the reagent bottle to the injector. The valves control the direction of liquid flow. The outlet tubing connects to the injector tip. **NOTE:** The inlet and outlet tubing and the injector tips are regular maintenance parts and should be inspected daily for residue, salt deposits and other damages before use. The valves are also maintenance parts and may need replacement over time. Proper care and cleaning of the automatic injector system will prolong the service life of these maintenance parts. See “Appendix B – Maintenance” to learn how to properly replace the valves, tubing and tips for the injector system.

Priming Injectors

It is necessary to prime the injectors before use.

1. Touch “Inj Func” from the navigation bar of the screen to prime or flush injectors.
2. To prime the injector, insert the inlet tubing into a reagent bottle. You may use a tubing holder to secure the inlet tubing inside the reagent

bottle. Attach the blue tubing holder to the mouth of the reagent bottle, then feed the inlet tubing through the tubing holder.

3. Place a waste container underneath the injector tip assembly. If necessary, unlatch the injector tip holder from the instrument lid. By unlatching the injector tip holder from the instrument lid, you can prime and flush the injectors with the lid open. (See Figure 12.)

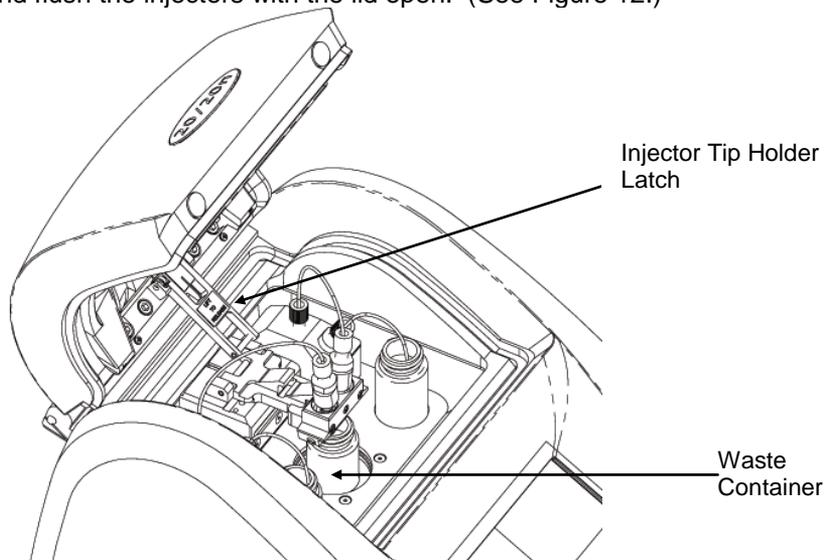


Figure 12. Place a waste container underneath the tips during prime and flush.

4. Alternatively, place a microfuge tube in the tube holder and close the lid with the injector tip seated properly in the injector tip holder. Touch “Prime Injector 1” to fill the injector system with reagent. Each prime sequence pushes 1000 μL of reagent through the injector system.

NOTE: Do not exceed the 1.5 mL maximum volume of the microfuge tube.

Flushing Injectors

After use, it is important to flush the injectors thoroughly. Touch “Inj Func” to access the flushing options, then select the injector(s) you wish to flush. Position a waste container underneath the injector tips to collect the flush solution. **NOTE:** Do not use microfuge tubes as a waste container. The following flush sequence is recommend for each injector:

- 1 x deionized water
- 1 x 70% ethanol
- 1 x deionized water

Each flush cycle uses 3000 µL.

Injector Maintenance

For instructions on tip replacement, valve replacement and tubing replacement, please see “Appendix B – Maintenance.”

VIII. Tools

Use the “Tools” menu to access “Settings and Diagnostics.” Touch the “Tools” key to reach the menu.

Settings

Contrast

The screen contrast adjustment is located under the “Settings” menu. Use the left and right arrow keys to increase the brightness of the touchscreen. Touch “Home” when finished to return to the “Home screen.”

Reset

The reset key is located under the “Settings” menu. It automatically power cycles the luminometer. The power cycle erases any unsaved protocols and the data on the “Home screen.” The reset key is an easy way to re-start the luminometer after inserting a Fluorescence Module or the Light Standard.

Lid Start

The lid start feature is also located under the “Settings” menu. When lid start is enabled, the luminometer begins measurement immediately after closing the lid. Touch “Lid Start” once to enable the lid start feature. Return to “Tools” to disable the “Lid Start” feature.

Diagnostics

Touchscreen Calibration

Access the screen calibration procedure from the “Diagnostics” menu. Although the touchscreen is calibrated at the factory, it may need re-

calibration over time. Contact Turner BioSystems for more information on screen calibration.

Device Configuration

The “Device Configuration” key contains information on the firmware version and other useful information for troubleshooting instrument-related problems.

Using the Light Standard

The optional Light Standard is a simple way to check the health status of the 20/20ⁿ before beginning measurement. The Light Standard contains three varying light levels to check the linearity and sensitivity of the 20/20ⁿ.

1. To use, turn OFF the luminometer.
2. Remove the microfuge tube holder from the sample compartment.
3. Insert the Light Standard into the sample compartment. (See Figure 13 and 14.)

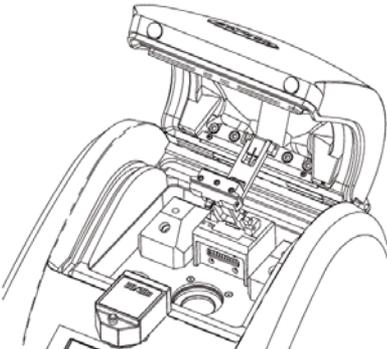


Figure 13

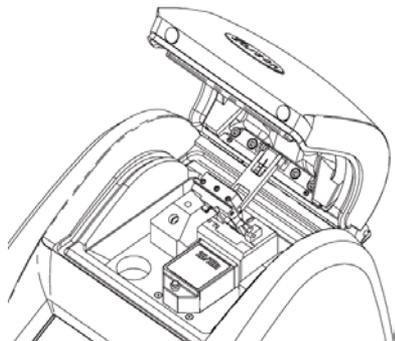


Figure 14

4. Turn ON the luminometer.

On the first use of the Light Standard, the “module identification screen” will appear. Identify the Light Standard. The luminometer will automatically power OFF. The 20/20ⁿ will automatically identify the Light Standard for subsequent Light Standard checks.

5. Turn ON the luminometer. The 20/20ⁿ will automatically begin the Light Standard protocol. Afterwards, the luminometer status will appear on the touchscreen. If the status is “Good,” remove the Light Standard

and proceed with measurement. Otherwise, contact Turner BioSystems for information.

Removing the Light Standard

1. To remove the Light Standard from the 20/20ⁿ, turn OFF the luminometer.
2. Grasp and lift the red knob located in the center of the Light Standard to unlock it from the sample compartment. (See Figure 15.)

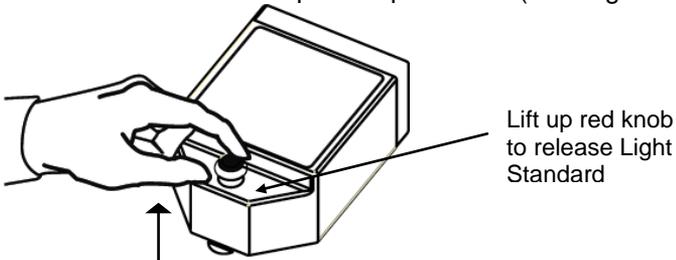


Figure 15

Appendix A – Troubleshooting Guide

Table 1. Injector Problems

Symptom	Possible Cause	Action
Injector does not prime.	Clogging of tubing from reagent residue.	Flush injector with water. If flushing fails to resolve the problem, replace tubing and valves.
Injections are not accurate.	Air bubbles in injector system.	Flush the injector system 3 times with deionized water. If flushing fails to resolve the problem, replace inlet and outlet valves.
Luminometer does not report measurements.	Integration time set to "0" seconds.	Touch "Parameters," then increase integration time.
Luminometer has injectors but does not run injection protocol.	Injectors are not primed.	Prime injectors before starting an injection protocol.

Table 2. Touchscreen Problems

Symptom	Possible Cause	Action
Touchscreen goes blank or is non-responsive.	Sample saturates luminometer.	Power the luminometer OFF. Wait 5 seconds. Power the luminometer ON. Prime injectors if necessary.

Fingerprints appear on the touchscreen.		Turn OFF the luminometer, then use a Kimwipe [®] dampened with 70% ethanol to clean the touchscreen.
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Table 3. Software Problems

Symptom	Possible Cause	Action
Excel does not open.	Excel is not installed on the PC.	Make sure Excel is installed on your PC.
Excel does not open.	The software cannot find Excel.	Open Excel from the “Programs” menu on the PC then open the spreadsheet interface software.
Both green lights are ON, but data fail to appear in Excel.	Wrong COM port selected.	Click “STOP” then click on the “COM” button to change the COM port.
Both green lights are ON, but data fail to appear in Excel.	Luminometer is not connected to PC.	Check the RS-232 connection between the luminometer and the PC. In some cases, another program may have reserved the COM port and locked out the software.
New data do not report to Excel.	There is an editing process occurring within an Excel cell.	Save the data currently displayed in Excel, then restart the software and begin collecting new data. In the future, wait until all the data is collected before editing the Excel spreadsheet.

The software does not install.	The PC allows only administrators to install new software.	Log in as Administrator, then install the software or contact your IT support desk.
The software does not open.	The software was not installed properly.	Log in as Administrator. Remove the software and re-install.

Appendix B - Maintenance

Proper care for the 20/20ⁿ ensures accurate measurements and preserves sensitivity.

General Care

- ❖ Do not spill liquids into the sample compartment. Wipe up any spills immediately.
- ❖ Periodically wipe off the outside of the instrument with a cloth dampened in deionized water or 70% ethanol. Do not use solvents or abrasive cleaners. Take caution when cleaning the touchscreen. Use a Kimwipe[®] dampened with 70% ethanol to remove fingerprints.
- ❖ Do not open the lid while a measurement is in progress. This action may damage the light detector.

Changing Injector Tips

1. Gently remove the injector tip(s) from the injector tip holder. Grasp the injector tip assembly and lift up.
2. Twist the tip fitting counterclockwise to release the tip assembly from the tubing.

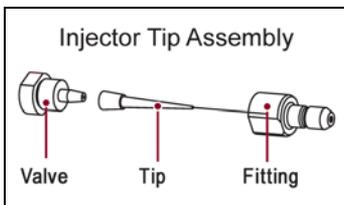


Figure 16

3. Untwist the tip fitting to release the tip.
4. Discard tip.

5. Insert a new tip into fitting.
6. Twist the fittings clockwise to complete the injector tip assembly.
7. Twist the assembled fitting with the new tip clockwise on to the tubing.
8. Insert the tip into the injector tip holder

Removing/Replacing Injector Tubing

1. Grasp the injector tubing fitting(s) located on the top of the injector pump.
2. Disconnect the inlet and outlet tubing from the injector syringe by twisting the fitting counter clockwise.
3. Remove the injector tip assembly. (See Figure 16.) Do not discard.
4. Discard the used injector tubing.
5. Twist the fitting of the replacement tubing to secure the tubing onto the pump.
6. Replace the injector tip assembly.

Removing/Replacing Valves

1. Disconnect the valve from tubing by twisting in a counter clockwise direction.

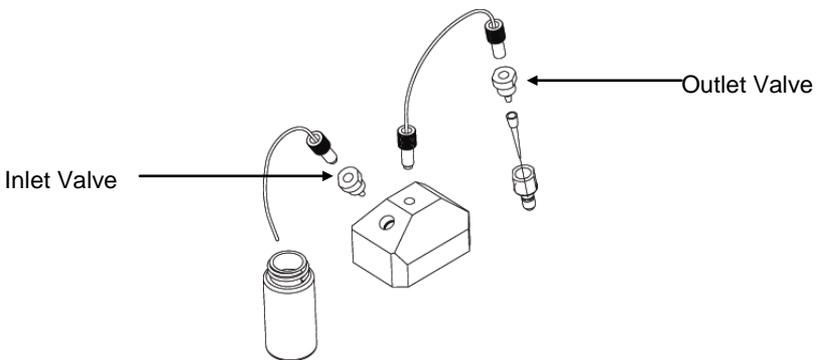


Figure 17

2. Discard used valve.

3. Connect a new valve to the tubing by twisting in a clockwise direction.

APPENDIX C – Warranty and Obtaining Service

Warranty

Turner BioSystems warrants the 20/20ⁿ 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.

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. 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
Fax: 408-737-7919

APPENDIX D – Specifications

Specifications for the 20/20ⁿ Luminometer

Detection Limit	Better than 700 molecules of luciferase
Linear Dynamic Range	> 8 decades
Sample Adaptor	Holds 1.5 mL microfuge tube
Detector	Photomultiplier Tube (PMT)
Spectral Response Range	350–650 nm
Peak Wavelength	420 nm
Injectors	One or Two Automatic Injectors (optional)
Injection Volume	Selectable between 25 and 300 μ L (\pm 3 μ L); CV% < 2%
Data Output	100% ASCII format through a 9-pin RS-232 serial cable at 9600 baud
User Interface	Requires Windows [®] 98 or later
Power	0.5A @ 100–240V, 50–60Hz (universal)
Dimensions	12.92" D x 10.44" W x 8.42" H (32.82 cm D x 26.52 cm W x 21.39 cm H)
Weight	8.1 lbs. (3.65 kg)
Operating Temperature	60–105 °F (15–40 °C)
Warranty	One year
Approvals	CE

PicoGreen and RiboGreen are trademarks of Molecular Probes, Inc. and are registered with the U.S. Patent and Trademark Office.

Steady-Glo is a trademark of Promega Corporation and is registered with the U.S. Patent and Trademark Office.

KimWipe is a trademark of Kimberly-Clark Corporation and is registered with the U.S. Patent and Trademark Office.

