Modulus™ II Microplate Multimode Reader

Operating Manual
Part Number 998-9375
Rev E

Turner BioSystems

NOTICE TO PURCHASER: The Modulus™ II Microplate Reader is for research purposes only. It is not intended or approved for diagnosis of disease in humans or animals.

Made in the USA

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1 Instrument

1.1 Getting Started

1.1.1 Description

Thank you for purchasing the Turner BioSystems, Inc. Modulus™ II Microplate Reader. This manual will guide you through the installation, setup, and operation of your instrument.

The Modulus™ II Microplate Reader is an expandable multimode reader with unbeatable performance. Each detection mode has dedicated optics for the highest versatility without sacrifice of performance. The Modulus™ II Microplate Reader can be used as a reader dedicated to a single mode or as a multimode reader. As application needs expand, the system can easily accept the add-on of additional detection modes. This modular flexibility allows users to customize the system to fit their laboratory needs.

1.1.2 Precautions

Keep the instrument door closed when access to the interior of the instrument is not needed. Leaving the door open for an extended period of time will result in damage to the Photomultiplier Tube (PMT) due to light exposure, dust accumulating on the mechanical parts, or physical damage due to accidentally bumping of the open door.

IMPORTANT: Do not leave the instrument door open when the instrument is not in use.

The Modulus™ II Microplate Reader is intended for indoor use only. Wipe up any spills immediately. The reader contains sensitive optical components and precision-aligned mechanical assemblies. Avoid rough handling.

The maximum volume recommended for a typical 96-well microplate is 250 µl/well. Do not place more than the recommended volume in each well. Overfilling of wells may lead to spills and/or damage to the instrument. Sample residue can cause the optical head to malfunction.

NOTE: Turn the instrument off any time you access the interior, install detection modules, or clean the injectors.

1.1.3 Unpacking and Inspection

Upon receiving the Modulus™ II Microplate Reader, inspect it carefully for any damage to the exterior such as scratches and/or dents. Make certain that all accessories are included. Refer to the checklist shipped with the instrument for order-specific items. Save all packaging materials, if possible, in case the instrument needs to be shipped to a service center in the future.

Figure 1-1: A Complete Modulus™ II Microplate System

#	Content	#	Content
1	Modulus™ II Microplate Reader Instrument	7	96-Well Microplates *(Optional Starter Pack)*
2	Power Line Cord	8	Waste Collection Tray *(Included with Injector System)*
3	Power Supply Brick, 24V, 60W	9	Outlet Injector Tube Assembly *(Included with Injector System)*
4	USB Flash Drive, 256 MB	10	DB-15 Serial Cable *(Included with Injector System)*
5	Fluorescence Optical Kits *(Included with Fluorescence Module)*	11	Injector System *(Optional)*
6	Luminescence Standard Light Plate *(Optional)*		

1.1.4 Instrument Set Up

1. Place the Modulus™ II Microplate Reader on a flat, level surface. Leave at least 7.5 inches (19 cm) of clearance in front of the instrument to allow the instrument door to open without hindrance. Position the instrument so that the touch screen faces outward.
2. Plug the power line cord into the power connector on the back panel of the instrument. Plug the power supply brick into a power outlet. *For power specifications, refer to Appendix A.*
3. Turn on the Modulus™ II Microplate Reader. The power switch is located on the back panel next to the power connector.
4. Look for an LED light to come on within one minute. The light is located to the left of the touch screen and indicates when the instrument is initialized.
5. After warming up, the touch screen will activate and default to the HOME screen.

If the optional injector system was included with the purchase of the instrument, refer to Section 4 for installation and operation instructions.

1.1.5 Instrument Overview

Figure 1-2: Front View of Modulus™ II Microplate Reader

	Components	Description
1	Color LCD Touch Screen	• Finger touch sensitive
2	LED Light	• Indicates when power is on
3	USB Port	• USB port for data transfer and software updates • DO NOT use this port to connect to a computer
4	Absorbance Module	• When installed, enables Absorbance capability
5	Microplate Sample Tray and Cover	• Holds a 96-well microplate or a Waste Collection Tray • The cover reduces cross-talk in Luminescence applications
6	Luminescence Module	• When installed, enables Luminescence capability
7	Injector Tip Holder	• Holds and positions injector tips
8	Fluorescence Module and Optical Kit	• When installed, enables Fluorescence capability

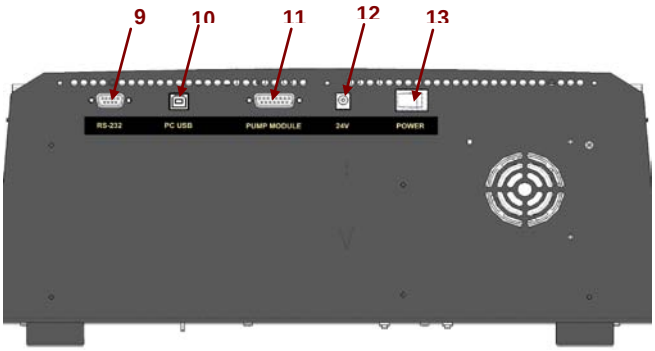


Figure 1-3: Back Panel of the Modulus™ II Microplate Reader

	Components	Description
9	RS-232 Port	• Connects to a PC, 9-pin serial port
10	USB Port	• Connects to a PC
11	Injector System Connector	• Exclusively connects the Injector System to the instrument's 15-pin port
12	Power Connector	• Connects with an AC power supply
13	Power Switch	• Turns the instrument on and off

Note: Do not connect anything except the injector system to the instrument's injector system connector. This connector is supplied with 24V of power and may damage your device if used incorrectly.

1.2 Touch Screen Basics

A built-in Windows-based PC with a custom interface enables user-friendly control of the Modulus™ II Microplate Reader. This all-in-one modular instrument saves bench space while eliminating computer compatibility and maintenance issues.

WARNING: Do not touch the LCD screen with any sharp object, pen, pencil, or marker as these may cause permanent damage. Avoid spilling any liquid onto or near the touch screen.

The touch screen is sensitive to the light pressure of a fingertip. It is not necessary to use a stylus. To select a function, touch the corresponding button once.

To conserve power, sleep mode is activated after 15 minutes without activity or user stimulation of the touch screen. To reactivate the instrument, lightly touch the LCD screen one time.

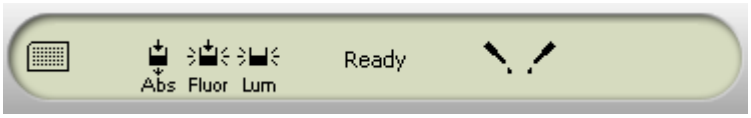
1.2.1 Buttons and Icons on the INSTRUMENT CONTROL Screen

- HOME screen

- HELP screen

- Opens and closes the instrument door
- Changes to a **STOP** button when a run is in progress
- Touch the **STOP** button to cancel a run, if needed

- Selects one of the three screens in the INSTRUMENT CONTROL screen



- **INSTRUMENT STATUS** bar (shown above)

- **PLATE** icon, visible when a microplate or a Waste Collection Tray is detected inside the instrument
- Icon turns dark when a microplate has been read

- **DETECTION MODE** icon
- A gray icon indicates which detection modules are installed
- A black icon indicates the active module

- Indicates the instrument is ready to begin a run

- Indicates that one or two injectors are installed

- **TEMPERATURE DISPLAY** icon
- Indicates that the Heater option is activated
- Current temperature of instrument is displayed to the right

- Visible when a USB flash drive is detected
- Icon turns dark when files have been saved to the USB flash drive

1.2.2 Buttons on the READ Screen

- **PROTOCOL** button
- Touch the white **TEXT** button to see the list of preset and user-defined protocols

- **PLATE MAPPING** button and well selection indicator
- Touch the button to specify which wells to read
- Green wells are selected for reading
- Gray wells are deselected and will not be read

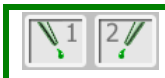
- In Luminescence mode, this button enables **KINETIC** readings

- In Absorbance mode, the **WAVELENGTH** button enables use of single or dual wavelengths

- Starts a run

- Activates the PMT before starting a Luminescence run
- PMT activation is required before the first Luminescence run of the day

- The **SETUP** button appears when injectors are connected
- Prepares the injector(s) for a prime, a flush, or a reverse purge



- Touch one of the **INJECTOR** buttons to activate an injector(s)
- Green indicates the injector is selected
- Gray indicates the injector is deselected

- Button for keypad entry
- Used on the USER PROTOCOL screen to enter a protocol name

- **INCUBATION** Button

- **SHAKING** Button

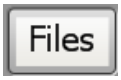
- **DISPENSE** Button

- **USER PROMPT** button
- Interrupts an assay run so that instrument parameters can be adjusted

- Single measurement for each assay well

- Well scan mode for plate formats other than 96 and 384-well standards
- Allows for nine measurements within 6-well plate format
- Allows for five measurements within 12, 24, and 48-well plate formats

1.2.3 Buttons on the RESULTS Screen



- Displays a list of the 50 most recent results files

- Use the **UP** and **DOWN** buttons to scroll through the 50 most recent results

- Use the **RIGHT** and **LEFT** arrow buttons to scroll the wells in columns 1 -12 for 96-well formats or 1-24 for 384-well formats

- Use the **UP** and **DOWN** arrow buttons to scroll the wells in rows A -H for 96-well formats or A-P for 384-well formats

- When viewing Absorbance results, the button toggles between the different data formats: OD, %T, and %A

- Toggles through the sets of results generated from repeat runs

- **PLATE VIEW** button shows the full or partial view of the results in a microplate format

- Displays the results as a ratio
- See Section 2.8.2 for ratio calculations

- Copies results files in .csv format to a USB flash drive

- **DELETE FILES** button
- **DELETE PROTOCOLS** button

1.2.4 Buttons on the TOOLS Screen

- Displays instrument-related information

- Transfer instrument event log in .txt format through the USB port to a USB flash drive

- Toggles the sound on or off

- Set time and date

- Port setting for PC Connectivity
- Visible on the PC version of the software

- Use to update software versions

1.2.5 Terminology Used in Parameter Settings

Integration: The duration of measurement per well, ranging from 0.1 to 10 seconds in 0.1-second increments. In assays where noise is much lower than signal, a 1-second integration time will yield the same sensitivity as a 10-second integration time. Unless specified by the assay protocol, a 1-second integration time should be sufficient.

Volume: The volume injected into each well, ranging from 25 to 200 µl in 5-µl increments. Determine the sample volume per well before selecting an injection volume. Although, the maximum volume of a typical 96-well microplate is 300 µl, the recommended maximum volume per well is 250 µl. Overfilling a well will result in spills and possible damage to the instrument.

Delay: The number of seconds between the injection of the reagent and taking a measurement. Setting a delay after the injection will allow flash-type luminescence to fully actualize before a reading. The minimum delay value is 0.5 seconds in 0.1-second increments.

Wavelength: Selects one or two Absorbance filters from a list.

Optical Kit: Selects an appropriate Fluorescence Optical Kit from a list.

Reading: The number of times a sample plate is read. The number of reads can be set between 1 and 99.

Period: The time interval between readings of the same well, ranging from 1 to 120 minutes in 1-minute increments.

Prime: The injector system is wetted and filled with the reagent.

Flush: The protocol used to clean the injector system after a run. The recommended flush protocol consists of steps for washing with deionized water, 70% ethanol, deionized water, and then air drying.

Reverse Purge: The protocol retrieves any unused reagent from the injector system. After a run, this protocol can be used to push the reagent back into the reagent bottle to cut down on waste.

Dispense: The injector system delivers 25 - 200 µl of reagent in 5-µl increments. This option can be used in conjunction with the **INCUBATION** icon to allow sufficient incubation time in the plate.

Preset Protocols: A set of popular assay protocols are preloaded into the instrument for user convenience. These protocols cannot be renamed or deleted. A user-modified version can be saved by touching the **USER** button on the PROTOCOL screen.

User Protocols: Protocols created by the user which can be retrieved later. All parameters, including the plate-well mapping, are saved. These protocols can be modified, renamed, or deleted.

Protocol Options: The list of available instrument operations that can be selected and dragged into the Protocol Composer.

Protocol Composer: The section of the GUI where Protocol Options are dragged to. This defines the order in which the protocol will run.

1.3 Modulus™ II Microplate HOME Screen

The HOME screen contains four options:

- **NEW PROTOCOL** launches the wizard to set up a new protocol.
- **SELECT PROTOCOL** launches the wizard to select pre-programmed protocols from a list.
- **INSTRUMENT CONTROL** is for instrument set up, managing results, and managing the instrument.
- **HELP TOPICS** offers informational instruction.

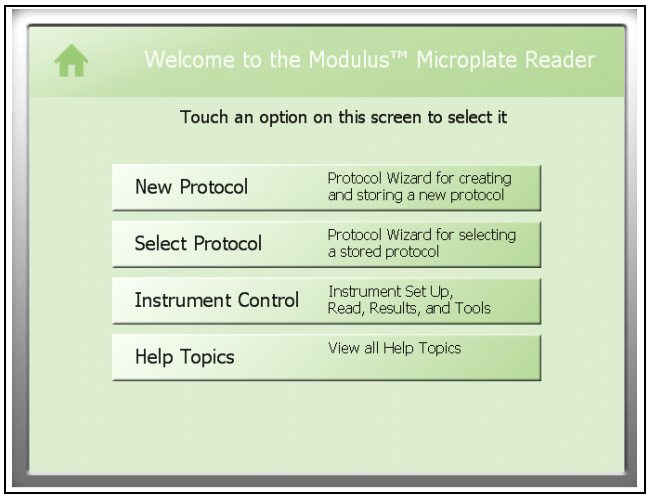


Figure 1-4: HOME Screen

From any of the **PROTOCOL** wizards, return to the HOME screen by touching the **CANCEL** button. In the INSTRUMENT CONTROL screen, use the **HOME** button found at the bottom left of the touch screen.

Figure 1-5: HOME Button

1.4 Protocol Management

The Modulus™ II Microplate Reader is designed to be easy-to-use straight out of the box. The protocol wizards are set up to guide the user in setting up all required parameters for a run. After completing the set-up wizards, insert the sample plate then touch the **START** button.

On the HOME screen, there are two protocol selection buttons:

- **NEW PROTOCOL** allows the user to create new protocols. Touching this button launches the **NEW PROTOCOL** wizard. It guides the user through a series of steps to define a protocol. After completing the wizard, the user may save the protocol under the User list of protocols.
- **SELECT PROTOCOL** allows the user to retrieve stored protocols. There are two types of stored protocols: Preset and User. The convenient preset protocols are permanently stored on the instrument and cannot be renamed or deleted. However, a modified version of these preset protocols can be saved into the User protocol list. Customized User protocols can be modified, renamed, or deleted at any time.

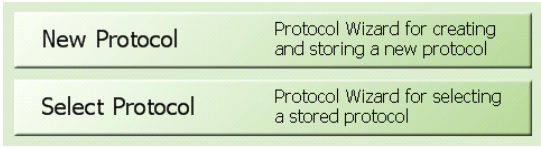


Figure 1-6: Protocol Options on HOME Screen

The Modulus™ II Microplate Reader has a built-in PC. This gives the instrument its capability for creating, storing, and retrieving user-defined protocols. The Preset protocols contain run parameters for popular third-party Luminescence, Fluorescence, and Absorbance assays.

1.4.1 Defining a New Protocol Through Instrument Control

1. Select and drag the desired **PROTOCOL OPTION** icon over to the Protocol Composer.

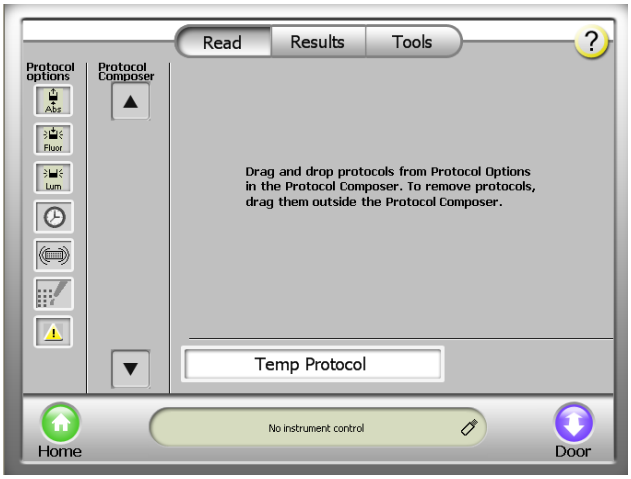


Figure 1-7: Defining a New Protocol Screen

2. With the **PROTOCOL OPTION** icon chosen, define the plate layout and Optical Kit.

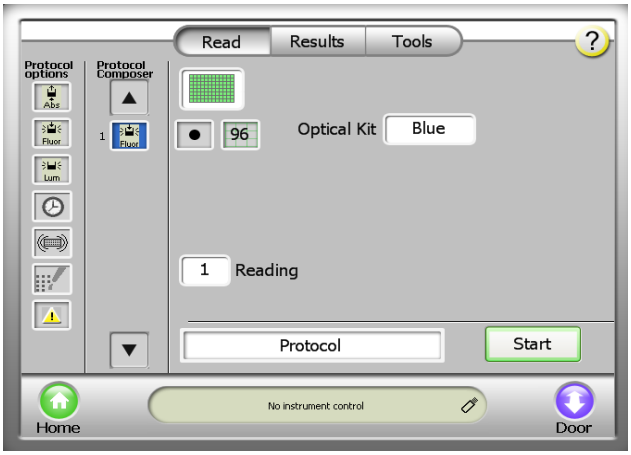


Figure 1-8: Setting Fluorescence Options Screen

NOTE: Once a plate format has been selected, this format will become the default setting for all subsequent selections.

1.4.2 Modifying a Saved Protocol

1. From the HOME screen, touch the **INSTRUMENT CONTROL** button, then touch the **READ** button. *See Figure 1-7(A).*
2. Touch the **PROTOCOL NAME** button to call up the Preset and User protocol window.
3. Select a protocol from the list of Preset or User-modified choices and touch the **OK** button.
4. To modify the desired parameter(s), touch the white numeric button next to the parameter label. Make the desired change then touch the **OK** button.
5. Touch the **PLATE** button and select the wells to be read. Green indicates that a well is selected and gray indicates that a well is deselected.
6. To run the modified protocol under the current name, touch the **START** button.

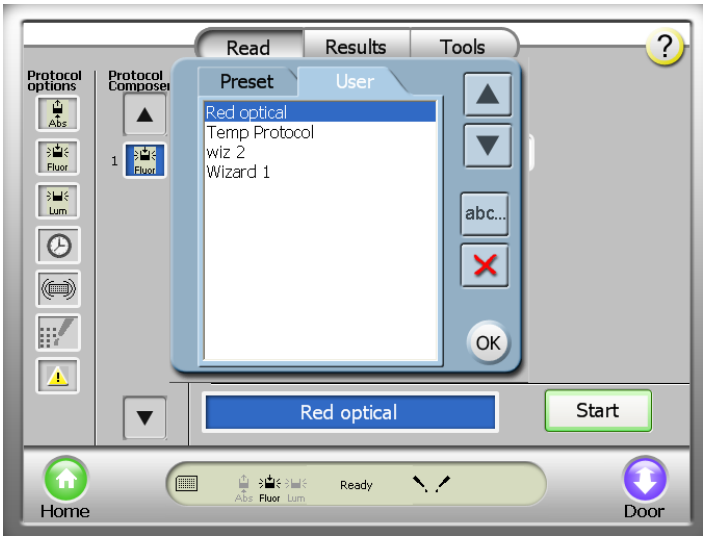


Figure 1-9: Modifying a Saved protocol screen

Use the **DELETE** button to permanently remove unwanted protocols from the User protocol list.

NOTE: Well selections are linked to a protocol. Before running any protocol, always verify the wells to be read.

1.4.3 To save the modified protocol:

1. Touch the white text button with the protocol name.
2. Touch the **YES** button in the dialog box.
3. To save the protocol under the same name, touch the **SAVE** button.
4. To save the protocol under a new name, touch the **EDIT** button. Use the activated keypad to enter the new name and touch the **OK** button when editing is complete. Then touch the **SAVE** button to save the renamed protocol.
5. Modified protocols are saved in the User list.

To delete a protocol from the User list, highlight the protocol then touch the **DELETE** button. Protocols from the Preset list cannot be deleted.

1.5 Using the Protocol Composer to Set Up Multiple Read Formats

The Protocol Composer on the Modulus™ II Microplate Reader allows multiple assay requirements to be strung together into one protocol. Simply select the parameters of choice by dragging the appropriate icon from the Protocol Options list section on the left to the Protocol Composer section on the right. Once the **PROTOCOL OPTIONS** icons have been selected, the user may define specific requirements for each option in the window on the right.

1.5.1 Defining a Multiple Parameter Option Protocol

1. Select and drag **PROTOCOL OPTION** icons onto the Protocol Composer.

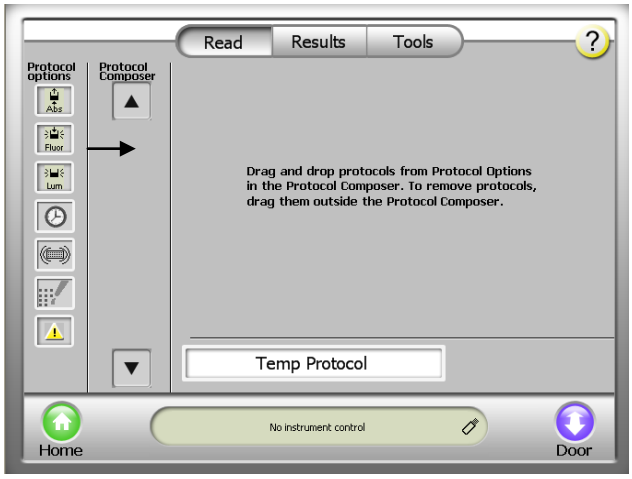


Figure 1-6: Dragging Icons from Protocol Options to the Protocol

2. With the **PROTOCOL OPTION** icons chosen, define the desired plate layout and Optical Kit.

   Note: Once a plate format is selected, this formatting will become the default for all subsequent selections.

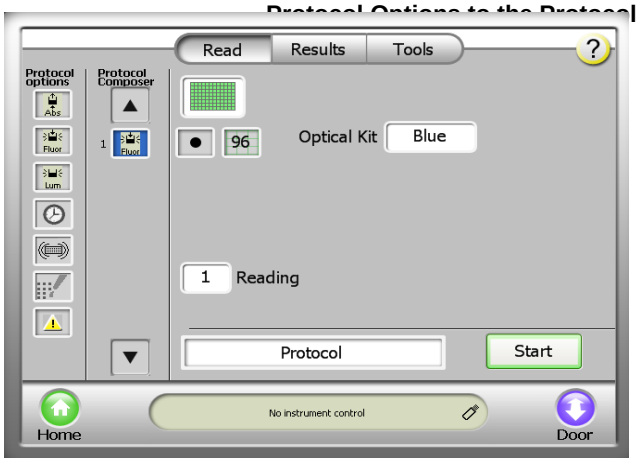


Figure 1-7: Defining a Multiple Parameter Protocol

3. Select and drag the **USER PROMPT** icon to the Protocol Composer and type an instructional message into the EDIT bar.

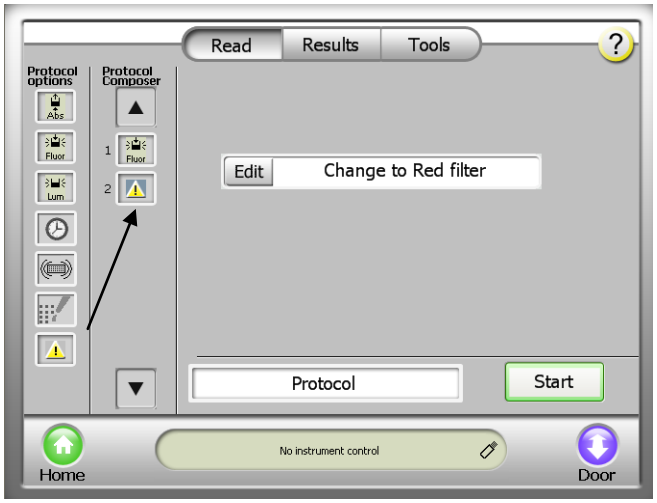


Figure 1-8: Defining USER PROMPT

4. Select and drag the **FLUORESCENCE** icon to the Protocol Composer and select the Red Optical Kit.

5. Insert a plate into the Modulus™ II Microplate Reader and press the **START** button to begin a run.

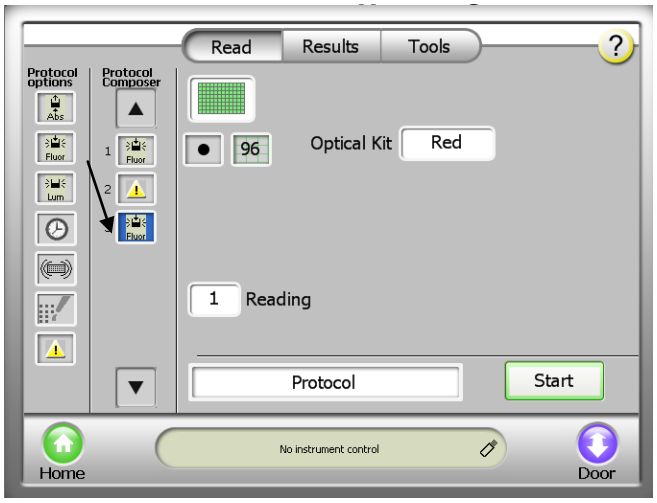


Figure 1-9: A Defined Protocol Ready to Run

1.6 Plate Format Selection

- The Modulus™ II is capable of measuring 6 to 384-well formats in all three detection modes.
  - It is necessary to ensure that the plate adapter is in the correct orientation according to plate format. Incorrect plate positioning can damage the instrument and may result in sample loss.
  - In the case of low-density formats (6, 12, 24, and 48-well plates), users have the option to select either single or multiple readings per well.

- The instrument reads from A1 to A12, B2 to B12, etc. The read speed is similar in both the horizontal and vertical reading directions.

1.6.1 Plate Format Selection

1. Touch the **PLATE FORMAT** button to call up the plate selection window.

2. Select from the menu of plate formats for the option that is required.

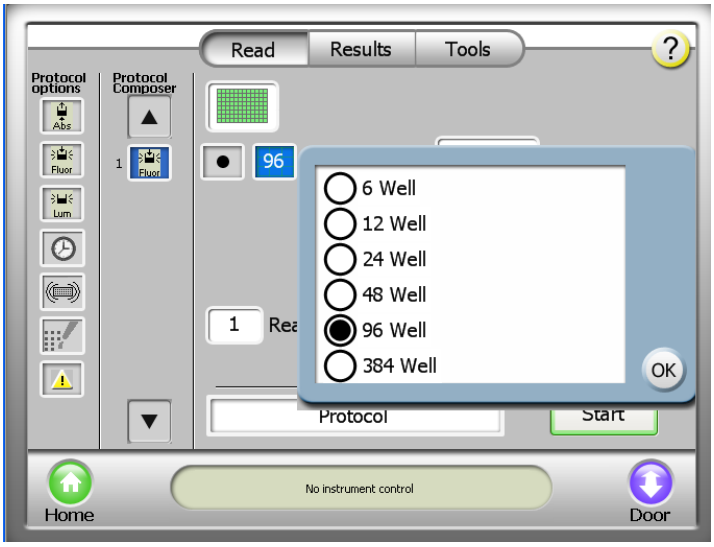


Figure 1-10: Multi-Well Format Parameters on the READ Screen

NOTE: When using low-density plate formats in conjunction with shaking, it is necessary to use a film cover to prevent spillage and loss of sample.

1.6.2 Well Selection

To select or deselect a well, touch the well. This will toggle the coloration of the well on the touch screen. Green indicates that a well is selected and gray indicates that a well is deselected. In Absorbance mode, touching the screen also toggles to Ref for indicating reference wells.

To select or deselect a whole row or column, touch the corresponding number or letter. Hold down the button and drag to select multiple rows or columns.
When the **ALL** button is touched, the entire plate toggles between being selected or deselected.

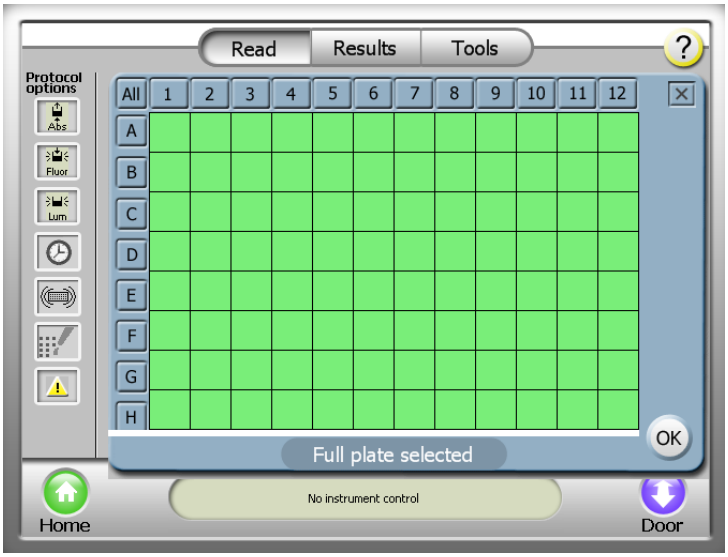


Figure 1-11: PLATE MAPPING Screen

NOTE: On the PLATE MAPPING screen, green indicates selected wells, gray indicates deselected wells, and Ref indicates reference wells (used in Absorbance mode).

- Touch the **PLATE** button to open the PLATE MAPPING screen. Select wells to be read. Green indicates a well is selected. Grey indicates a well is deselected. Ref indicates a reference well when in Absorbance mode.
- The message box below the wells summarizes the well selection.
- Touch the **OK** button to commit changes made on the PLATE MAPPING screen. Touch the **X** button to cancel any changes made.
- The wells that are selected to read are saved with each protocol setting. When using a saved protocol, always double-check that the well selection is properly set to read the intended wells.

REMINDER: To run a protocol, at least one microplate well must be selected to read.

1.6.3 Selecting Reference Wells

Reference wells are optional in Absorbance mode. The detection mode needs to be on Absorbance to enable this feature. Touch a well to toggle between select, deselect, and reference (Ref). Column and row selections do not have the option to toggle to reference.

Readings taken from reference wells are used as a blank. If more than one well is selected as a reference, an average of all reference values are applied to each of the readings.

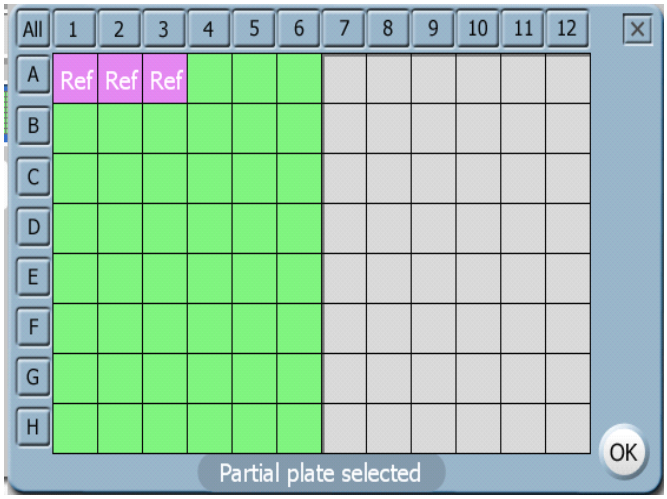


Figure 1-12: Selecting Reference Wells

1.6.4 Changing the Plate Adapter Orientation

1. Touch the **DOOR** button to automatically open the instrument door and eject the Microplate Sample Tray.
2. Remove the plate adapter by popping the plate adapter out from the bottom and orient it so that the label for the desired plate format shows an arrow pointing towards the interior of the instrument.
3. Firmly snap the plate adapter into place to continue with an assay run.

CAUTION: The Microplate Sample Tray should ONLY have the cover in place for 96-well plate formats. For all other plate formats, the cover must be removed. For instructions on how to remove the Microplate Sample Tray Cover refer to Instrument Maintenance section 11.4 Realigning the Microplate Sample Tray Cover of this manual.

1.6.5 Changing the Optical Crosstalk Mask for 384-Well Option

1. Remove the injector tips from the injector tip holder.
2. Remove the injector tip holder from the optical head. Facing the front of the Modulus™ II Microplate Reader, push the optical head upward, then leftward. Use the figure to the right as an example.

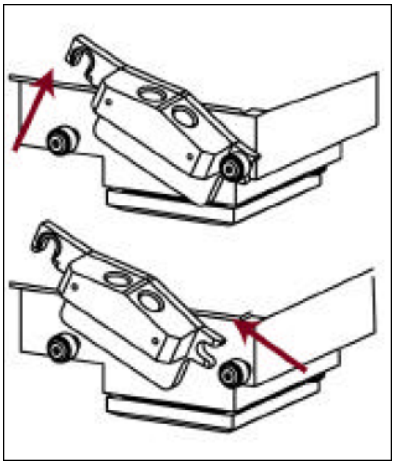
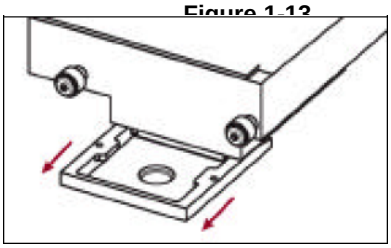


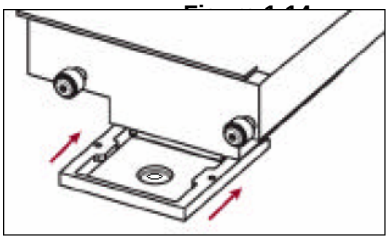
Figure 1-13

3. Place your hand underneath the optical mask. Grasp the sides of the optical crosstalk mask and pull it towards you.

   Note: Do not touch the bottom of the optical head.



4. Slide the 384-well optical crosstalk head mask into place on the optical head. Align the mask with the optical head and gently guide the optical crosstalk mask onto the optical head.



5. 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.

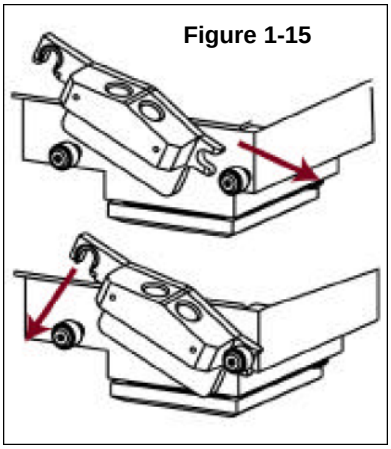


Figure 1-15

6. Insert the injector tip(s) into the injector tip holder and snap into place.

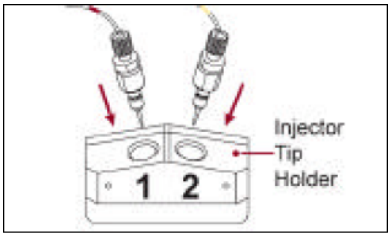
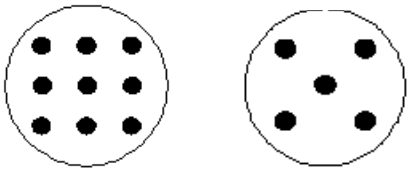


Figure 1-17

1.6.6 Well Scan Mode for 6 to 48-Well Plate Formats

- When using multi-well formats other than 96 and 384-well plate formats, the Modulus™ II Microplate has the option to scan each well multiple times and display the results by showing an average of those readings.
- For 6-well plates the instrument will take a total of nine readings. For 12, 24 and 48-well plates the instrument will take five readings *(see Figure 1-13).*
- Viewing of all readings per well can be accessed by zooming in on the particular well and touching the well on the User **INTERFACE SCREEN** once the plate read is finished.



6-well **12, 24 and 48-well**

Figure 1-18: Read Patterns for Low-Density Plate Formats

NOTE: Scan mode for 6 to 48-well plate formats is not compatible with Kinetics measurements and dual-wavelength Absorbance measurements.

1.6.7 *Viewing Multiple Read Results for 6 to 48-Well Plate Formats*

- In lower density formats where multiple readings are taken, the results are shown as an average for each well.
- Viewing of all readings per well can be accessed by zooming in on the particular well and touching the well on the User interface once the plate read is finished.

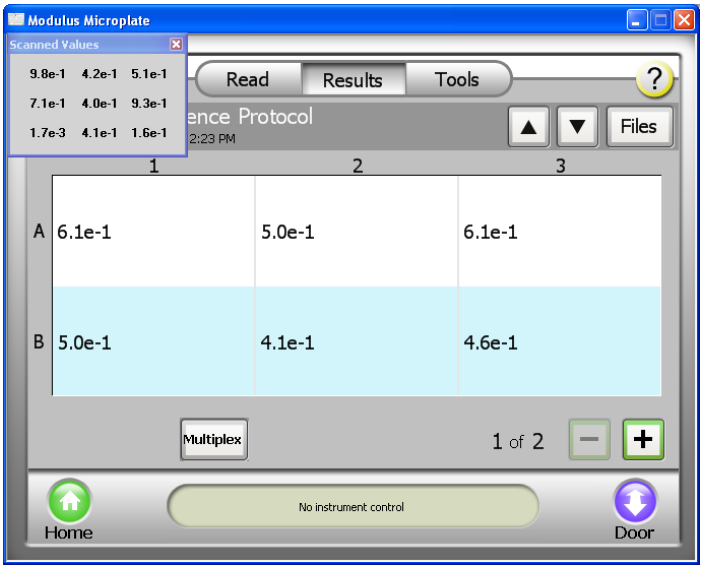


Figure 1-19: Viewing Multiple Read Results for 6 to 48-well Plate Formats

1.6.8 *Accessing the Interior of the Instrument*

Touch the **DOOR** button to open and close the instrument door. The Microplate Sample Tray automatically extends and retracts when the **DOOR** button is touched. If the optional Microplate Sample Tray Cover is installed, it will also automatically open and close with the Microplate Sample Tray. Do not use force to close the Microplate Sample Plate Cover.

CAUTION: Do not use force closure of the Microplate Sample Plate Cover. The cover and instrument door will automatically close after the DOOR button is touched.

Opening the instrument door while the Microplate Sample Tray is in motion will cause it to stop.

When it is necessary to access the instrument interior, turn off the instrument. Manually hold the instrument door open. Do not use the **DOOR** button. The Microplate Sample Plate Cover may be in the way.

IMPORTANT: Close the instrument door immediately after each use.

1.7 Viewing the Data on the RESULTS Screen

Touch the **FILES** button to see a list of results files. The files are sorted by date and time run. Select a file to view.

Use the **UP** and **DOWN** arrow buttons to scroll through the displayed list of results files.

The results are displayed in a microplate format in either a full or partial view. Toggle between the two views by touching the **PLATE VIEW** button between the horizontal arrows. A partial view of the results displays three or six columns of data, depending on the protocol.

Use the **LEFT** and **RIGHT** arrow buttons to scroll through partially viewed results.

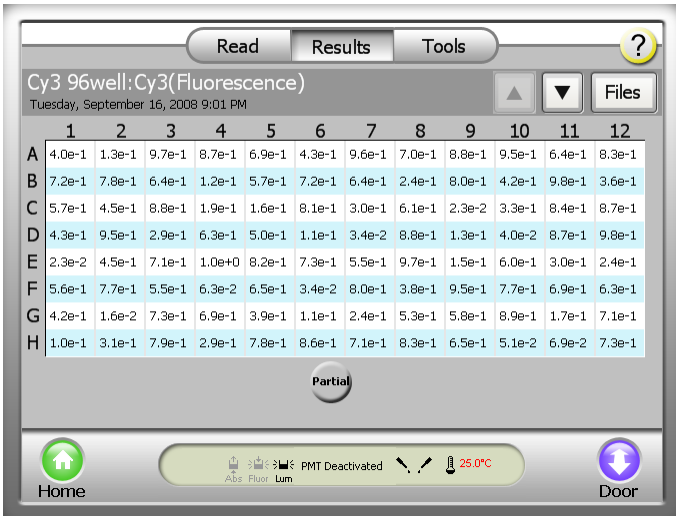


Figure 1-20: Viewing Data on the RESULTS Screen

Use the **UP** and **DOWN** arrow buttons to scroll the wells in rows A -H for 96-well formats or A-P for 384-well formats

Use the **DELETE** button to permanently remove unwanted results from the results list.

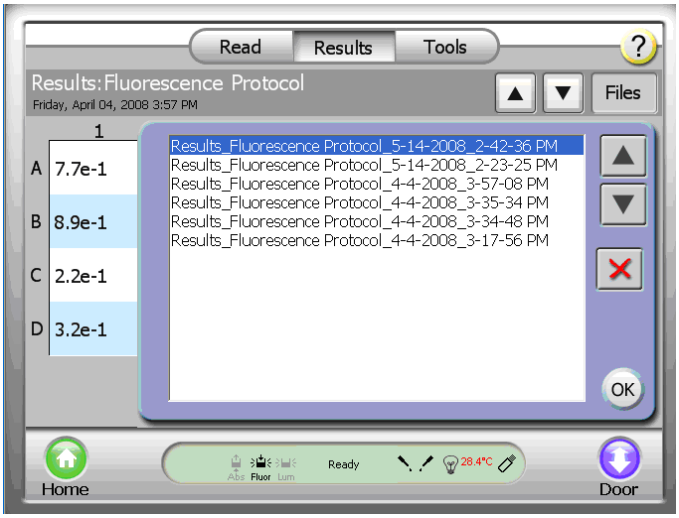


Figure 1-21: Deleting Data Files from the RESULTS Screen

1.8 Transferring Data

Results files are transferred to a PC or Mac via a USB flash drive. Use the USB port located to the left of the touch screen. Files are exported in .csv format and are compatible with Microsoft® Excel on both Windows and Mac computers. Step-by-step directions follow.

1. To transfer data from the Modulus™ II Microplate Reader to an external computer, insert a USB flash drive into the USB port located left of the touch screen. When insertion is

detected, an icon depicting a USB flash drive should appear on the **INSTRUMENT STATUS** bar.

2. Touch the **RESULTS** button on the INSTRUMENT CONTROL screen.
3. Touch the **FILES** button and highlight the file to be exported.
4. Touch the **USB** button under the **TOOLS** button.
5. Touch the **OK** button to export only the selected file. Touch the **COPY ALL FILES** button to export all of the results files. The .csv-formatted file will be saved onto the USB flash drive in the folder named Modulus II™ Microplate.
6. Move the USB flash drive to your local PC or Mac computer.

- For Windows, double-click to open the file in Excel.
- For Mac, click to open the file and import the data into Excel.

Most USB flash drives are compatible with the Modulus™ II Microplate Reader. USB flash drives greater than 1 GB may take longer than others to be recognized. Wait a few seconds for the instrument to recognize the USB flash drive. If the problem persists, try a different flash drive.

IMPORTANT: Results files can only be transferred from the instrument to a computer via a USB flash drive. Use the USB port on the front of the instrument.

After the transfer of results files, backup copies will remain on the internal memory of the Modulus™ II Microplate Reader. The 50 most recent files are displayed in the **FILES** window of the RESULTS screen.

IMPORTANT: Inserting the USB flash drive while the instrument is conducting a plate read is not recommended. It is recommended to either insert it before or after pressing the START button

1.9 Repeat Runs

Each detection modality has the option to do repeat runs. Injectors cannot be used in this mode. In repeat runs, the entire sample plate is read between each period.

1.9.1 Repeat Runs Parameters

Readings: The number of times a sample plate is read. When the number of readings is set to a value between 2 and 99, the period parameter and time estimates are displayed. The time estimate for a plate (located below the readings parameter) is based on the number of wells selected to read.

Period: The time difference between readings of the same well. If this value is less than the time estimated to read the plate, a caution message will appear to inform user that the actual interval between readings will be longer. The instrument will begin reading A1 (or the first well selected) immediately after completing the last reading of the plate. The actual period time is indicated on the results .csv file when

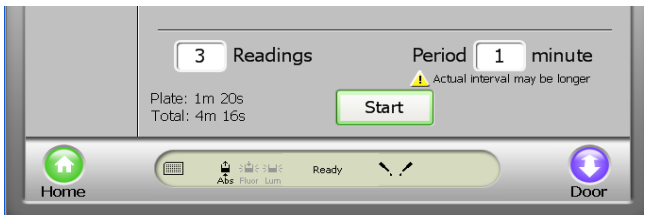


Figure 1-22: Parameters for Repeat Runs

exported to a computer. The range is between 1 to 120 minutes in 1-minute increments.

1.9.2 Viewing Repeat Runs Data on the RESULTS Screen

The results are displayed as a set of data on the RESULTS screen. To view the other sets of data, touch the **PLUS** button to move forward and touch the **MINUS** button to move back. All data from repeat runs are saved in one results file. The Modulus™ II Microplate Reader saves all captured data to its internal memory. However, when the **FILES** button is touched, only 50 of the most recent files are visibly listed. To view results files not displayed, touch the **USB** button to transfer all files to a USB flash drive and view them on a PC or Mac.

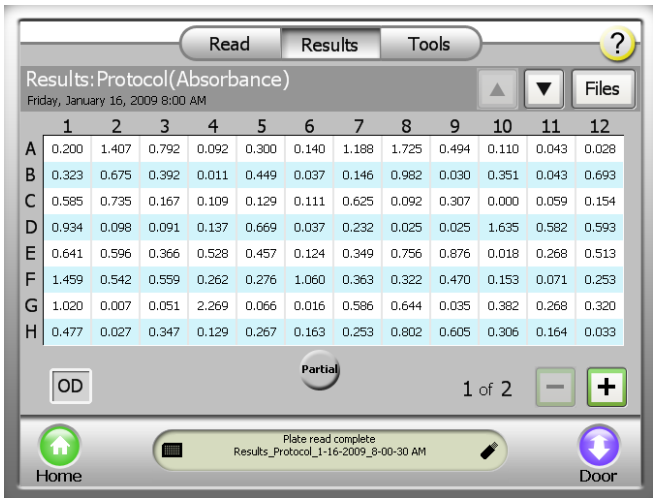


Figure 1-23: RESULTS Screen with Repeat Run Data

2 Luminescence (P/N 9310-020)

2.1 General Information

- The Luminometer detection wavelength range is from 350 to 650 nm.
- Microplate Recommendations:
  - White plates are recommended for general luminescence detection.
  - Black plates are recommended primarily for bright assays, such as ELISA, but will generally yield decreased sensitivity despite the benefit of having lower background noise and cross-talk than white plates.
  - Clear plates are not recommended due to high cross-talk.
- For luciferase assays, samples and reagents must be equilibrated to room temperature prior to taking the measurements for optimal light intensity.
- For best results, make sure all reagents are as freshly prepared as possible and assay protocols are followed.
- To reduce levels of high background noise, keep the interior of the instrument clean. Always flush the injectors after each use and clean up any spills.
- To reduce cross-talk from adjacent wells, always use the Microplate Sample Tray Cover.

2.2 Microplate Sample Plate Cover

A Microplate Sample Plate Cover is installed on the Microplate Sample Tray with the purchase of the Modulus™ II Microplate Reader. Its primary purpose is to reduce cross-talk signal from adjacent wells.

- The Microplate Sample Plate Cover is for use only with 96 well plates. The cover MUST BE REMOVED prior to running any other plate format. See Section 11.4 for Microplate Sample Plate Cover removal.

- If any moisture appears on the Microplate Sample Tray Cover, clean the optical lens, the mask, and the interior of the instrument. *See Section 1 for general care and cleaning instructions.*

2.3 PMT Activation

The Luminescence Module uses Photomultiplier Tube (PMT) detection. It requires a 5-minute warm up to ensure consistent results. Activating the PMT prior to preparing the sample plate for reading will reduce the wait time before the run.

When the Luminescence mode is selected, an **ACTIVATE PMT** button is visible in place of the **START** button. This forces the user to warm up the PMT before initiating a run. After PMT activation begins, the **START** button will appear.

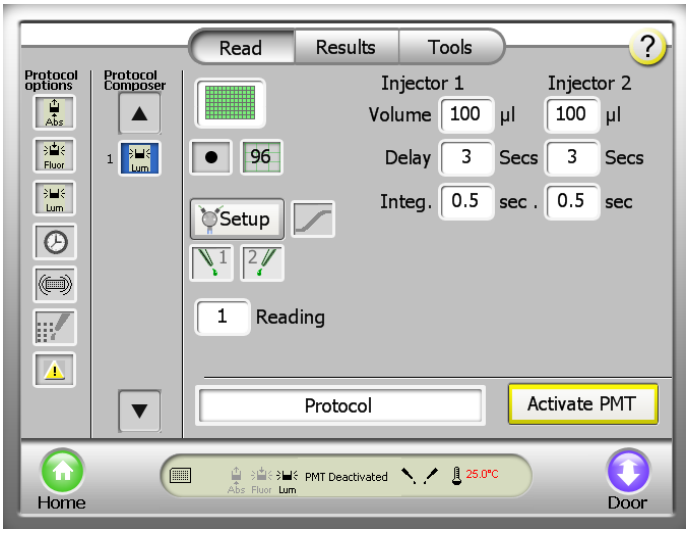
While the PMT is activating, a user can maneuver around the software and select other detection modalities without interfering with the PMT activation. If the instrument door is open for more than one minute, the PMT will deactivate.

Parameters and file names can be set during the activation of the PMT. If the **START** button is touched before the PMT is completely activated, the run will begin immediately after the 5-minute warm up of the PMT.

2.4 Starting a Run

Easy-to-use protocol wizards can be accessed from the HOME screen to set up the run parameters. *See Section 1.4 for protocol management.* Otherwise, follow the steps below to set up a Luminescence run.

1. From the HOME screen, touch the **INSTRUMENT CONTROL** button, and then the **READ** button.
2. Select and drag the **LUMINESCENCE** icon from the Protocol options to the Protocol Composer.
3. Touch the **PLATE FORMAT** button and select the plate format that is required.
4. Touch the **PLATE** button and select the wells to be read. Green indicates a well is selected and gray indicates a well is deselected.
5. If injectors are required, press the **INJECTOR** icons to activate injectors and set the Volume, Delay and Integration time.
6. Touch the **DOOR** button to automatically open the instrument door.



7. Place the sample plate on the Microplate Sample Tray. The A1 well must be at the top right corner.
8. Touch the **DOOR** button again to automatically close the Microplate Sample Tray Cover and retract the sample plate back into the instrument. Do not push down on the Microplate Sample Plate Cover or force it to close.
9. Touch the **START** button.
10. To name the results file, touch the **EDIT** button to activate a keypad. Enter the results file name and touch the **OK** button when editing is complete.
11. Touch the **OK** button on the dialog screen to save. The Modulus™ II Microplate Reader will initialize and begin the run.
12. To stop a run at any time, touch the **STOP** button.
13. Remove the sample plate after the run is complete.

Figure 2-1: Defining a Luminescence Plate Read

REMINDER: To prevent dehydration and spills, remove the sample plate from the equipment after a reading is complete.

2.5 Kinetics

In Kinetic mode, the instrument performs multiple reads of a single well with defined frequency over a defined period of time before moving to the next well. The kinetic feature is available in Luminescence mode only. One or both injectors can be used in the Kinetic mode. Each sample reading is taken after the second injection and injection delay.

2.6 Kinetic Parameters

Initial Delay: Delay before the start of the first reading to allow the sample plate to dark-adapt. The range is from 0 to 60 minutes in 1-minute increments.

Readings: The number of data points to collect per well. The range is from 2 to 250 in 1-unit increments.

Kinetic Interval: The reading frequency. The range is from 0.1 to 60 seconds in 0.1 second increments. A 1 second Kinetic Interval means the readings are taken every 1 second.

Well: The time each well takes to read using the defined parameters.

Plate: The time estimated to read the entire sample plate using the defined parameters.

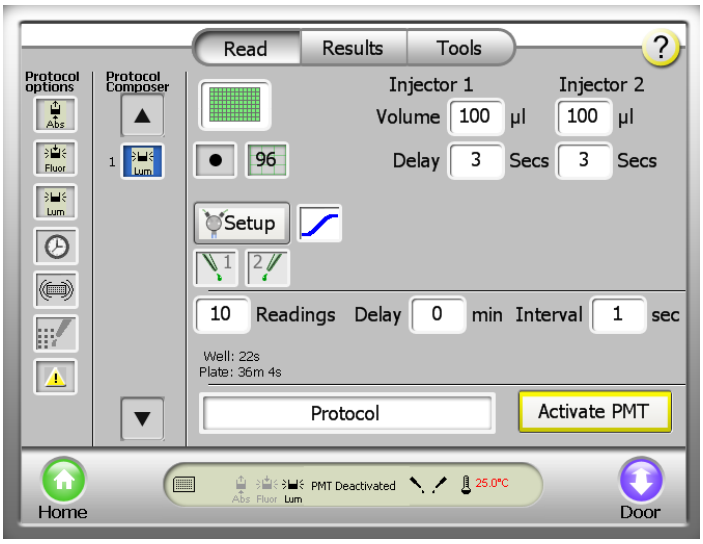


Figure 2-2: Setting Kinetic Parameters

REMINDER: Kinetics Mode is not compatible with 384-well plate format or Well Scan Mode for 6 to 48-well plate formats.

2.7 Using a Luminescence Light Plate

The optional Luminescence Light Plate provides a quick way to verify instrument performance. The Standard Light Plate consists of three highly stable light sources which simulate luminescent samples at signal intensity ranging over four logarithmic scales of data.

2.7.1 Getting Started

1. Briefly press the **START** button on the Microplate Luminescence Light Plate.
2. The BATTERY CHECK indicator will flash a green light as long as the **START** button is pressed and the battery has sufficient power.
3. The green light will turn OFF once the **START** button is released. The light plate is now ON and ready for use. After five minutes it will automatically turn OFF. The built-in timer can be restarted at any time by pressing the **START** button again.
4. If the green light does not appear while the **START** button is pressed, replace the battery. *See Section 9.3.3*.

2.7.2 Running the Luminescence Light Plate Protocol

1. From the HOME Screen, choose INSTRUMENT CONTROL.
2. From the INSTRUMENT CONTROL screen, select Luminescence by pressing the **DETECTION MODE** button.
3. After Luminescence has been selected, press the **LUMINESCENCE PROTOCOL** button and scroll down to Luminescence Light Plate.
4. Load the Luminescence Light Plate and press the **START** button.

2.7.3 Analyzing the Results from the Luminescence Light Plate Protocol

1. Transfer the data file from the Modulus™ II Microplate Reader to an external computer via use of the USB flash drive.
2. Open the .csv file with Microsoft® Excel and plot the results against $1x10^8$ for B2, $1.2x10^6$ for D2, and $1x10^4$ for F2.

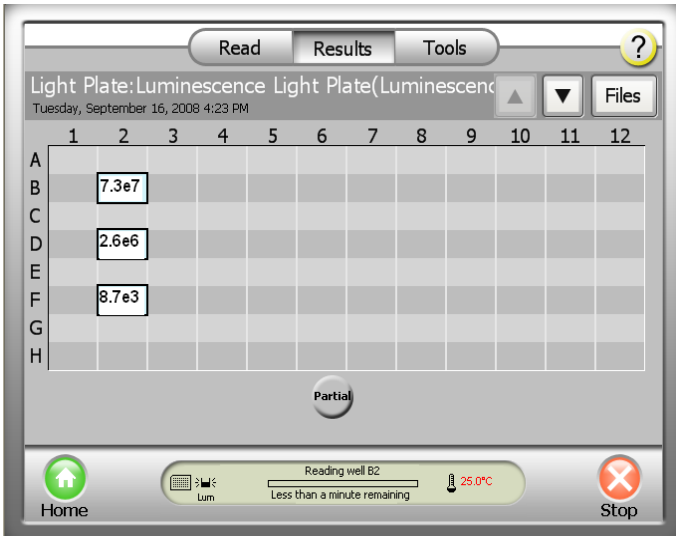


Figure 2-3: Viewing Luminescence

3. The R^2 value generated should be > 0.98. If the results are < 0.98 contact Turner BioSystems for technical support.

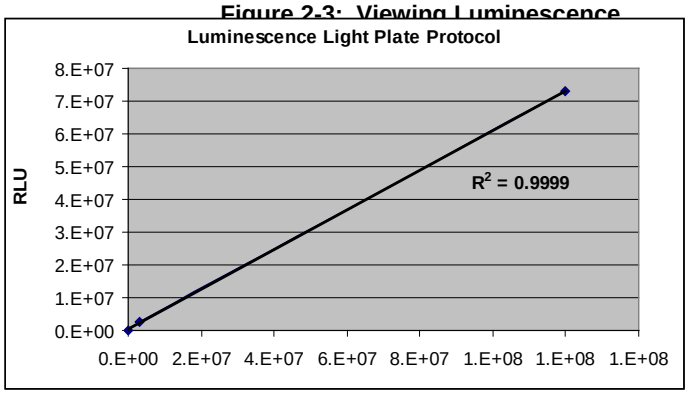


Figure 2-4: Calculating R^2 value

2.8 Luminescence Data

Luminescence data is displayed in Relative Luminescence Units (RLU).

2.8.1 Kinetic

Kinetic results are displayed in graphic curve format on the RESULTS screen. To obtain the numeric readings, export the results file to a USB flash drive and transfer it to a computer. *See Section 1.8 for instructions on transferring data.* There will be a single result file for the entire run.

The x-axes are displayed in linear time and y-axes are displayed in log RLU scale. The y-axes have a minimum range of 1 log (a result-value range of 10). Each well auto adjusts to display the graph in full y-axis scale.

2.8.2 Ratio Readings

When two injectors are used in a protocol, two readings are taken for each sample. Results are displayed side-by-side in the corresponding well (partial view) or first reading on top of the second reading (full view). To view a ratio of the two readings, touch the **RATIO** button. The ratio calculated for Luminescence data is different than for Absorbance data. The Luminescence ratio is calculated as:

$$\text{Ratio} = \frac{1^{st} \text{ reading}}{2^{nd} \text{ reading}}$$

NOTE: A value of 1E29 indicates saturation of luminescence signal.

2.9 Luminescence Module

To add Luminescence detection capability to the Modulus™ II Microplate Reader, contact the Turner BioSystems Sales Department or a Distributor for information on the purchase and installation of the Luminescence UHS Detection Module. *See Appendix C for ordering information.*

Due to optical and alignment complexities, the Luminescence UHS Detection Module may only be installed at authorized service centers. Please contact us for details.

3 Fluorescence (P/N 9310-040)

3.1 General Information

- Microplate Recommendations:
  - Black plates are highly recommended.
  - Clear plates can be used as a low-cost alternative if a high level of signal intensity is expected.
  - White plates are not recommended as they will increase noise by 20 - 50 times.

- Samples with bubbles or high surface tension will affect Fluorescence readings.

- Ensure the correct Optical Kit is used for the assay's fluorophore.

- If the instrument was ordered with a Luminescence Module, a Microplate Sample Tray Cover will have been installed. The Microplate Sample Tray Cover is not required for running in Fluorescence mode. *For instructions on how to remove the Microplate Sample Tray Cover, refer to Section 11.4 in the maintenance section.*

- All values recorded are in raw RFUs (relative fluorescence units). To normalize, use the Curve-Fitting Data Analysis Software. *See Appendix C for ordering information.*

3.2 Optical Wavelengths and Commonly Used Fluorophores

Optical Kits	Max. Excitation Wavelength	Emission Wavelength	Typical Fluorophores
UV	365 nm	410 – 460 nm	Hoechst dye, 4-MU
Blue	490 nm	510 – 570 nm	EGFP, AcGFP, PicoGreen®, RiboGreen®, Fluorescein, Quant-iT™ Protein, Quant-iT™ dsDNA
Green	525 nm	580 – 640 nm	Rhodamine, Cy®3
Red	625 nm	660 – 720 nm	Cy®5, Quant-It™ RNA

Table 3-1: Commonly Used Fluorophores

3.3 Fluorescence Data

The Relative Fluorescence Units (RFU) are displayed in scientific notation with two significant digits.

NOTE: A value of 1E33 indicates saturation of fluorescence signal.

3.4 Switching Fluorescence Optical Kits

1. Close the instrument door by touching the **DOOR** button. This will ensure the Microplate Sample Tray is at the HOME position.
2. Manually open the instrument door and hold it down with one hand.
3. Gently pull out the Fluorescence Optical Kit found under the FLUOR label.
4. Insert a new Fluorescence Optical Kit into the opening by pushing it in firmly. The label should be facing up and outward.

Figure 3-1: Installing a Fluorescence Optical Kit

3.5 Starting a Run

Easy-to-use protocol wizards can be accessed from the HOME screen to set up the run parameters. Follow the steps below to set up a Fluorescence run.

1. From the HOME screen, touch the **INSTRUMENT CONTROL** button, and then the **READ** button.
2. Select and drag the **FLUORESCENCE** icon from the Protocol options to the Protocol Composer.
3. Touch the **PLATE FORMAT** button and select the plate format that is required.
4. Touch the **PLATE** button and select the wells to be read. Green indicates a well is selected and gray indicates a well is deselected.
5. Select the Fluorescence Optical Kit.
6. Touch the **DOOR** button to automatically open the instrument door.
7. Place the sample plate on the Microplate Sample Tray. The A1 well must be at the top right corner.
8. Touch the **DOOR** button again to automatically retract the sample plate back into the instrument.
9. Touch the **START** button.
10. To name the results file, touch the **EDIT** button to activate a keypad. Enter the results file name and touch the **OK** button when editing is complete.
11. Touch the **OK** button on the dialog screen to save. The Modulus™ II Microplate Reader will initialize and begin the run.
12. To stop a run at any time, touch the **STOP** button.
13. Remove the sample plate after the run is complete.

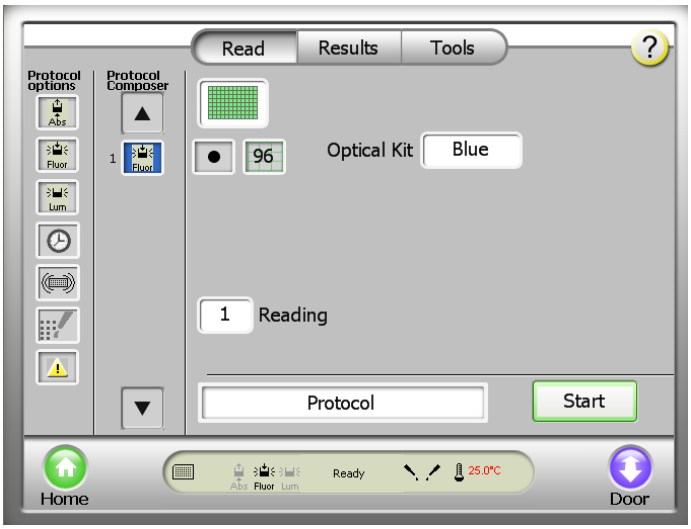


Figure 3-2: Defining a Fluorescence Plate Read

REMINDER: To prevent dehydration and spills, remove the sample plate from the instrument when a reading is complete.

3.6 Fluorescence Module

To add Fluorescence detection capability to the Modulus™ Microplate Reader, purchase and install the Fluorescence Module. *See Appendix C for ordering information.*

1.6.1 Installing the Fluorescence Module

1. Touch the **DOOR** button to automatically close the instrument door and set the Microplate Sample Tray into HOME position.
2. Power off the Modulus™ II Microplate Reader.
3. Manually open the instrument door and hold it down.
4. Slide the Fluorescence Detection Head into the position labeled FLUOR located inside the instrument. Be cautious to not damage the printed circuit board on the back of the detection head.
5. Hand-tighten the two captive screws using the Allen Wrench (size 7/16) provided with the Optical Kit. Too much force may damage the screws. *See Figure 3-2.*
6. Insert one of the Fluorescence Optical Kits into the opening found on the detection head, making sure to push it in completely.
7. Manually close the instrument door.
8. Power on the instrument.
9. To ensure the instrument detects the newly installed module, verify that the FLUOR icon appears on the **INSTRUMENT STATUS** bar on the INSTRUMENT CONTROL screen. *See Figure 3-3.*

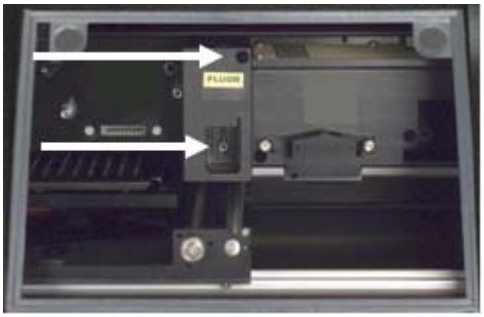


Figure 3-3: Arrows Point to the Two Captive Screws on the Fluorescence Module

Figure 3-4: DETECTION MODE Icon on the INSTRUMENT STATUS Bar Indicating that the Fluorescence Module is Detected

1.6.2 Calibrating the Fluorescence Module

1. Set up a fluorescence protocol using the optical kit of your choice
2. Place an empty plate into the instrument and press start
3. A message stating that there is a new filter installed will appear.
4. Press OK to insert the calibration plate that came with the fluorescence module.
5. Press continue to close the door and calibrate.
6. The calibration will occur automatically.
7. Once the calibration is completed, follow the onscreen prompts to replace your calibration plate with your assay plate.
8. Repeat these steps for all new fluorescence optical kits.

NOTE: To prevent dust from accumulating on the optics, always keep an Optical Kit in the Fluorescence Module and the instrument door closed.

4 Visible Absorbance (P/N 9310-050)

4.1 General Information

- Four installed filters and two customizable filter holders are included on the six-position filter wheel.
- The Absorbance LED spectral range is 400 - 800 nm.
- Microplate recommendations:
  - Black wall and clear flat bottom are recommended.
  - Clear microplate can be used.
- Two Absorbance wavelengths can be selected per well when running ratiometric assays.

NOTE: When using clear microplates, it is recommended that the Microplate Sample Tray Cover be used to reduce light scatter from adjacent wells. See Section 11.4 for removing and attaching the Microplate Sample Tray Cover.

4.2 Optical Filters Wheel

The optical filter wheel located on the bottom of the Absorbance Detection Head holds four fixed optical filters and two customizable filter paddles. The wavelength is easily selected using the touch screen interface and the filter is selected automatically by the instrument. A manual change of the filter is not required.

Filter Wavelength (nm)	Assays
450	ELISA, QuantiCleave™ Protease Assay
560	BCA Protein Assays
600	Bradford Protein Assays, Coomassie Blue Protein Assays, PeroXOquant™ Quantitative Peroxide Assay
750	Lowry Protein Assays

Table 4-1: Optical Wavelengths for Various Assays

4.2.1 Customizable Absorbance Paddle

Two Absorbance Paddles are included for customization. The Absorbance Paddle can accommodate any 12.7-mm diameter, < 6.4-mm thickness filter in the spectral range of 400 – 800 nm. Users can order an optical filter through a third party vendor or Turner BioSystems. Contact Turner BioSystems' Technical Support Department for more details.

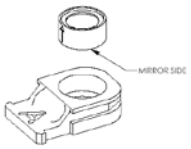


Figure 4-1: Absorbance Filter Paddle

Wavelengths for custom filters cannot be manually entered by the user. The user has the option of selecting from the custom positions labeled A or B.

To assemble the Absorbance Paddle, simply place the filter (with the mirror side down) into the opening. Press down on the filter collar until filter fits snuggly. Avoid getting smudges or fingerprints on the filter.

To remove the filter, turn the Absorbance Paddle upside down. Press down on the collar of the filter. Avoid touching the filter itself.

4.3 Starting a Run

Easy-to-use protocol wizards can be accessed from the HOME screen to set up the run parameters. Follow the steps below to set up an Absorbance run.

1. From the HOME screen, touch the **INSTRUMENT CONTROL** button, and then the **READ** button.
2. Select and drag the **ABSORBANCE** icon from the Protocol Options to the Protocol Composer.
3. Touch the white text button to select a protocol or modify the displayed parameters. .
4. Single or dual wavelengths can be selected by toggling the **WAVELENGTH** button.
5. Touch the **WAVELENGTH FILTER SELECTION** button to select a wavelength. There is an option for each of the installed filters. For custom filters, select either position A or B.
6. Touch the **PLATE** button and select wells to be read. Green indicates a well is selected, grey indicates a well is deselected, and Ref is for reference.
7. Touch the **DOOR** button to automatically open the instrument door.
8. Place the sample plate on the Microplate Sample Tray. Well A1 must be at the top right corner.
9. Touch the **DOOR** button again to retract the sample plate back into the instrument.
10. Touch the **START** button.
11. To name the results file, touch the **EDIT** button to activate a keypad. Enter the results file name and touch the **OK** button when editing is complete.
12. Touch the **OK** button on the dialog box. The Modulus™ Microplate Reader will automatically begin reading samples.
13. To interrupt a reading at any time, touch the **STOP** button.
14. Remove the sample plate after the reading is complete.

Figure 4-2: Setting Up a Single

Figure 4-3: Setting Up a Dual Absorbance Read

REMINDER: To prevent evaporation and spills, remove the sample plate from the instrument when a reading is complete.

4.4 Ratiometric Assay

For ratiometric assays, two wavelengths can be selected for each well reading. Only Optical Density values at each wavelength or a ratio of the two readings appear on the RESULTS screen. *For more details on Absorbance results, see Section 4.5.*

4.5 Absorbance Data

Single wavelength Absorbance data can be displayed in three different units: Optical Density (OD), Percent Transmittance (%T), and Percent Absorbance (%A). Data exported to .csv format is displayed only in OD units. To view the different units on the **RESULTS** screen, toggle the button corresponding to the unit type.

Data calculations:

$$\text{Transmittance (T)} = \frac{I}{I_0}$$

$$\%T = 100T$$

$$OD = -\log 10_{(T)}$$

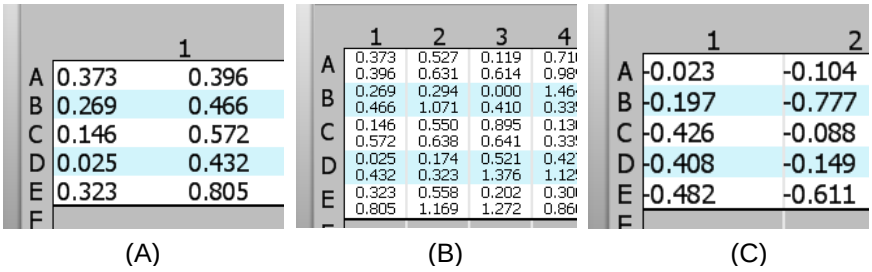
$$\text{Absorbance} = 2 - \log 10_{(\%T)}$$

I is the light intensity at a specific wavelength that has passed through the sample. I_0 is the light intensity before it enters the sample.

NOTE: A maximum OD value of 5.0 means there was zero transmittance.

Wells marked as Ref were designated to be Reference wells. A reference value applied to each wavelength reading. If more than one Reference well is selected, an average of the Reference values at each wavelength is used.

4.5.1 Ratiometric Data



	1	
A	0.373	0.396
B	0.269	0.466
C	0.146	0.572
D	0.025	0.432
E	0.323	0.805

(A)

	1	2	3	4
A	0.373 0.396	0.527 0.631	0.119 0.614	0.71 0.98
B	0.269 0.466	0.294 1.071	0.000 0.410	1.46 0.33
C	0.146 0.572	0.550 0.638	0.895 0.641	0.13 0.33
D	0.025 0.432	0.174 0.323	0.521 1.376	0.42 1.12
E	0.323 0.805	0.558 1.169	0.202 1.272	0.30 0.86

(B)

	1	2
A	-0.023	-0.104
B	-0.197	-0.777
C	-0.426	-0.088
D	-0.408	-0.149
E	-0.482	-0.611

(C)

Figure 4-4: Absorbance Ratiometric Results as Displayed on the READ Screen

When two wavelengths are selected for a protocol, a reading at each wavelength is taken for each sample. The results are displayed in OD units in three possible formats.

- When in partial view, reading 1 and reading 2 are displayed side-by-side in the corresponding well. *See Figure 4-4(A).*
- When in full view, reading 1 is displayed on top of reading 2 in the corresponding well. *See Figure 4-4(B).*
- When the **RATIO** button is touched, the results are displayed as a single value. *See Figure 4-4(C).*

The ratio calculated for Absorbance data is different than for Luminescence data. The Absorbance ratio is calculated as:

$$\text{Ratio} = \quad 2^{nd} \text{ reading} - 1^{st} \text{ reading}$$

4.6 Absorbance Module

To add Absorbance detection capability to the Modulus™ II Microplate Reader, purchase and install the Absorbance Module. *See Appendix C for ordering information.*

4.6.1 Installing the Absorbance Housing unit

1. Touch the **DOOR** button to automatically close the instrument door and reset the Microplate Sample Tray to HOME position.
2. Power off the Modulus™ II Microplate Reader and disconnect the power supply from the back of the instrument.
3. Gently tip the Modulus™ II Microplate Reader so that it rests on it's back panel so that the bottom of the instrument is accessible.
4. Using a 3/16 inch allen wrench remove the four 3/16 inch allen head screws from the metal plate cover exposing the interior. *See Figure 4-5.*
5. Carefully insert the connector on Vis housing unit into the connector inside the bottom of the Modulus™ II Microplate Reader. *See Figure 4-6.*
6. Using the provided 3/16 inch allen wrench, tighten the four 3/4 inch allen head screws.
7. Manually open the instrument door and install the Vis Absorbance Module.
8. Power on the instrument.
9. To ensure that the instrument is detecting the newly installed Vis Absorbance Module, verify that the **ABSOR** icon appears on the **INSTRUMENT STATUS** bar of the INSTRUMENT CONTROL screen.

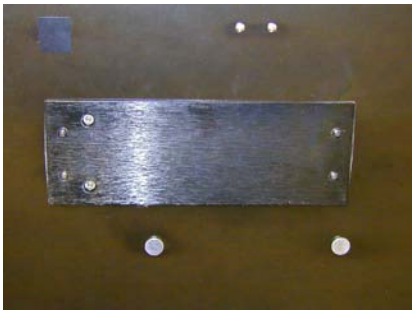


Figure 4-5: Removing the metal cover plate

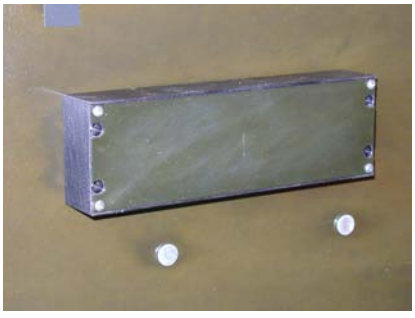


Figure 4-6: Attaching the UV-Vis housing unit

4.6.2 *Installing the Absorbance Module*

1. Touch the **DOOR** button to automatically close the instrument door and reset the Microplate Sample Tray to HOME position.
2. Power off the Modulus™ II Microplate Reader.
3. Manually open the instrument door and hold it down.
4. Hold the Absorbance Module using the fingertips of one hand. Guide the Absorbance Module onto the threaded stainless steel post located within the left side of the instrument interior. *See Figure 4-7.*
5. Slide the Absorbance Module into position. Be cautious to not damage the printed circuit board on the back of the detection head.
6. Hand-tighten the two captive screws using the Allen wrench (size 7/16) provided with the kit. Too much force may damage the screws. S*ee Figure 4-8*.
7. Manually close the instrument door.
8. Power on the instrument.
9. To ensure that the instrument is detecting the newly installed Absorbance Module, verify that the **ABSOR** icon appears on the **INSTRUMENT STATUS** bar of the INSTRUMENT CONTROL screen. *See Figure 4-9.*

Figure 4-7: Installing the Absorbance Module

Figure 4-8: Arrows Point to the Two Captive Screws on the Absorbance Module

4.6.3 *Calibrating the Absorbance Module*

1. Set up an absorbance protocol using the filter wavelength of your choice.
2. Place an empty plate into the instrument and press start.
3. A message stating that there is a new filter installed will appear.
4. Press OK to insert the calibration plate that came with the absorbance module.
5. Press continue to close the door and calibrate.
6. The calibration will occur automatically.
7. Once the calibration is completed, follow the onscreen prompts to replace your calibration plate with your assay plate.
8. For more detailed instructions, see the technical note that came with the module.

Figure 4-9: DETECTION MODE Icon on the INSTRUMENT STATUS Bar Indicating the Absorbance Module is Detected

5 UV-Vis Absorbance (P/N 9310-051)

5.1 General Information

- The Modulus™ II Microplate with UV-Vis Module detection has a wavelength range of 200 - 800 nm.
- Four fixed filters and two customizable filter holders for the 260-nm (Paddle A) and 280-nm (Paddle B) filter paddles are included in the six-position filter wheel.
- Two absorbance wavelengths can be selected per well when running ratiometric assays.
- Microplate recommendations:

Visible Region Measurements
- Black wall and clear flat bottom plates are recommended.
- Clear microplates can also be used.

UV Region Measurements
- UV transparent plates (Costar # 3635) are recommended.

NOTE: When using clear microplates, it is recommended that the Microplate Sample Tray Cover be used to reduce light scatter from adjacent wells. See Section 11.4 for removing and attaching the Microplate Sample Tray Cover.

WARNING: The Xenon Flash lamp emits ultraviolet light at levels that can injure the eye. DO NOT open the instrument door while taking measurements.

NOTE: For a detailed explanation on how to operate the UV-Vis Absorbance Module refer to Section 4 of the Operating Manual for instructions.

5.2 Optical Filter Wheel

The Optical Filter Wheel located on the bottom of the Absorbance Detection Head holds four fixed optical filters and two customizable filter paddles. The wavelength is easily selected by using the touch screen interface; the appropriate filter is automatically selected by the instrument. A manual change of the filter is not required.

Filter Wavelength (nm)	Assays
260	Nucleic Acid Quantification
280	Protein Quantification
450	ELISA, QuantiCleave™ Protease Assay
560	BCA Protein Assays
600	Bradford Protein Assays, Coomassie Blue Protein Assays, PeroXOquant™ Quantitative Peroxide Assay
750	Lowry Protein Assays

Table 5-1: Optical Wavelengths for Various Assays

5.2.1 Customizable Absorbance Paddles with 260-nm and 280-nm filters for UV-VIS Absorbance Module (P/N 9310-051*)*

Two Absorbance Paddles are included for customization; 260-nm and 280-nm filters come already installed for instruments ordered with the UV-VIS Absorbance Module (P/N 9310-051). The Absorbance Paddle can accommodate any 12.7-mm diameter, < 6.4-mm thickness filter in the spectral range of 200 – 800 nm. Users can order an optical filter through a third party vendor or Turner BioSystems. Contact Turner BioSystems' Technical Support Department for more details.

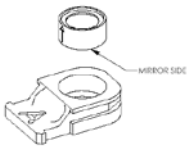


Figure 5-1: Absorbance Filter Paddle

Wavelengths for custom filters cannot be manually entered by the user. The user has the option of selecting from the custom positions labeled A or B.

To assemble the Absorbance Paddle, simply place the filter (with the mirror side down) into the opening. Press down on the filter collar until the filter fits snugly. Avoid getting smudges or fingerprints on the filter.

To remove the filter, turn the Absorbance Paddle upside down. Press down on the collar of the filter. Avoid touching the filter itself.

5.3 Adding the UV-Vis Absorbance Module

To add UV-Vis detection capability to the Modulus™ II Microplate Reader, contact the Turner BioSystems Sales Department or a Distributor for information on the purchase and installation of the UV-Vis Detection Module. *See Appendix C for ordering information.*

5.3.1 Installing the UV-Vis Absorbance Housing Unit

1. Touch the **DOOR** button to automatically close the instrument door and reset the Microplate Sample Tray to HOME position.
2. Power off the Modulus™ II Microplate Reader and disconnect the power supply from the back of the instrument.
3. Gently tip the Modulus™ II Microplate Reader so that it rests on its back panel so that the bottom of the instrument is accessible.
4. Using a 3/16 inch allen wrench remove the four 3/16 inch allen head screws from the metal plate cover exposing the interior compartment. *See Figure 5-2*

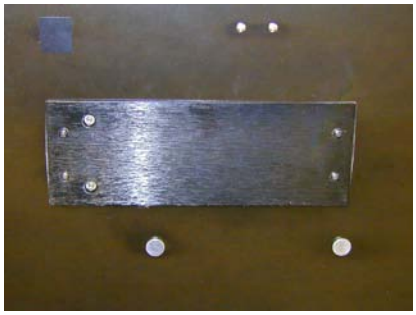


Figure 5-2: Removing the metal cover plate

5. Carefully insert the connector on UV-Vis housing unit into the connector inside the bottom of the Modulus™ II Microplate Reader. *See Figure 5-3*
6. Using the provided 3/16 inch allen wrench, tighten the four 3/4 inch allen head screws.
7. Set the instrument back on its feet.
8. Manually open the instrument door and install the UV-Vis Absorbance Module. *See Section 4.6.2 for complete instructions.*
9. Power on the instrument.
10. To ensure that the instrument is detecting the newly installed UV-Vis Absorbance Module, verify that the **ABSOR** icon appears on the **INSTRUMENT STATUS** bar of the INSTRUMENT CONTROL screen.

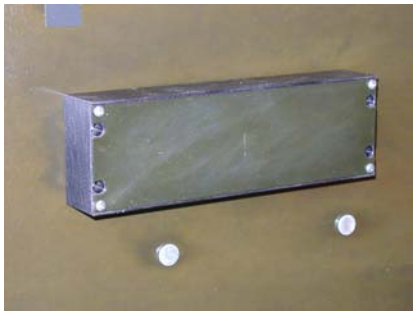


Figure 5-3: Attaching the UV-Vis housing unit

5.3.2 Calibrating the Absorbance Module

1. Set up an absorbance protocol using the filter wavelength of your choice.
2. Place an empty plate into the instrument and press start.
3. A message stating that there is a new filter installed will appear.
4. Press OK to insert the calibration plate that came with the absorbance module.
5. Press continue to close the door and calibrate.
6. The calibration will occur automatically.
7. Once the calibration is completed, follow the onscreen prompts to replace your calibration plate with your assay plate.
8. For more detailed instructions, see the technical note that came with the module.

6 Injector System (P/N 9300-061 and 9300-062)

6.1 Injector System Components

Unpack the Modulus™ II Microplate Reader injector system carefully. Verify all components and accessories have been received. See the enclosed list for details.

The components included are:

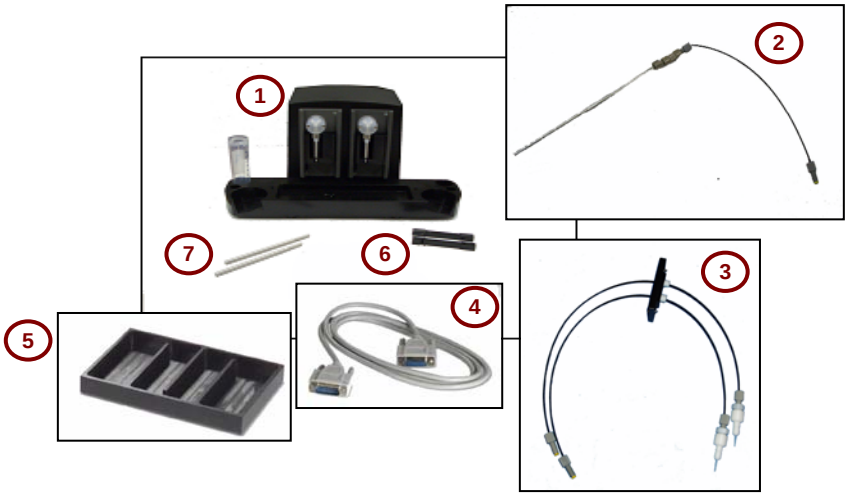


Figure 6-1: Modulus™ II Microplate Reader Injector System and Accessories

Number	Assembly	Components
1	Injector System Console	One or Two Injector Pump(s)
		Reagent Container Holders
2	Inlet Tubing Assembly	Stainless Steel Inlet Tube
		Tube Adapters and Fittings
		Black Inlet Injector Tubing
3	Outlet Tubing Assembly	Black Outlet Injector Tubing
		Black Rectangular Plate
		Tube Fittings
		Injector Tip Assembly
4		DB-15 Male-Female Cable
5		Waste Collection Tray
6		Inlet Tube Holder
7		Vertical Support Rod
Not shown		Injector Tips, 5/pk
Not shown		Ball Head Allen Wrench, 3/32”

NOTE: The reagent container holder can accommodate four size containers: a round flat bottom bottle, a 50 ml conical tube, a 15 ml conical tube, and a 15 ml test tube.

6.2 Installation Procedure

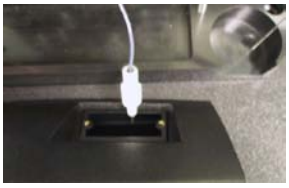
If an injector system was ordered after the initial purchase and receipt of the Modulus™ II Microplate Reader, follow all steps of the installation instructions. If the injector system was received with the Modulus™ II Microplate Reader, skip installation steps 3 - 6.

Figure 6-2: A Complete Injector System on Top of a Modulus™ II Microplate Reader.

1. Power off the Modulus™ II Microplate Reader.

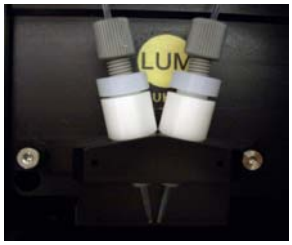
2. Place the Injector System Console on top of the instrument with the four rubber feet firmly inside of the indentation and level.

3. Remove the black rectangular plate located behind the touch screen by loosening the two screws with the provided Allen wrench.



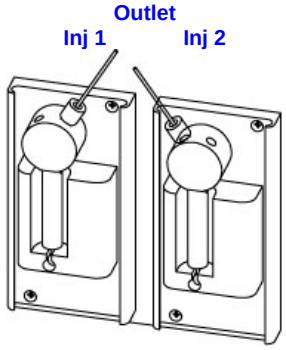
4. Drop the injector tip end(s) of the outlet tubing assembly through the opening of the instrument as shown.

5. The black plate connected to the injector tip should be oriented so that the screw holes are aligned with the angle found on the instrument. Tighten the two black screws with the provided Allen wrench.

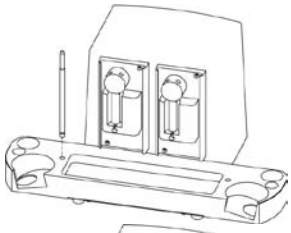


6. Manually open the instrument door and hold it down. Insert the injector tip into the injector tip holder on the front of the Luminescence Module. **Note:** Injector tip #1 is on the left and tip #2 is on the right.

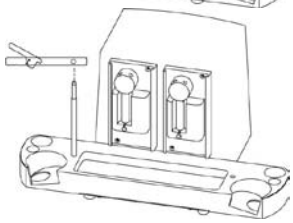
NOTE: During installation, use caution to prevent damage to the injector tip. Any nicks or deformations can adversely affect the quality of the injection and mixing.



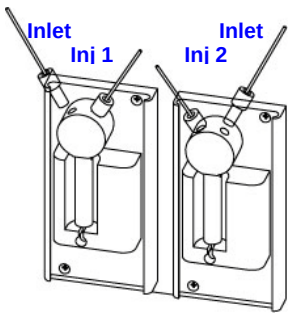
7. Attach the outlet tubing to the inside port of the respective injector pump. If there are two injectors, make sure the tubing to injector #1 goes to the inside port of the left pump and the tubing for injector #2 goes to the inside port of the right pump.



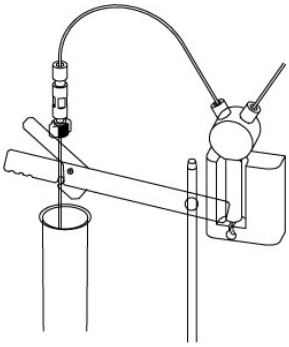
8. Insert the thicker end of the vertical support rod into the small opening on the injector base. Press down firmly until the rod clicks in place.



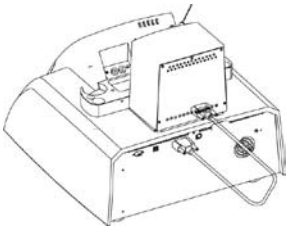
9. Slide the inlet tube holder onto the vertical support rod.



10. Following the diagram provided on the injector unit, attach the inlet tubing to the outside port of the injector pump. If there are two injectors, make sure the tubing goes to the correct outer port.



11. Pinch the lever on the back of the inlet tube holder to clip the stainless steel tube securely into place.



12. Plug one end of the DB-15 cable into the back of the injector system console and the other end to the connector labeled PUMP CONNECTION on the back panel of the instrument.

WARNING: Use only the cable provided with the instrument. Plugging any unauthorized cable into the connector may result in an electrical short.

13. Power on the instrument which automatically powers the Injector System. Go to the INSTRUMENT CONTROL screen, touch the **READ** button. Installation is successful if an **INJECTOR** icon appears on the **INSTRUMENT STATUS** bar. If no **INJECTOR** icon appears, verify that the DB-15 cable is securely connected to the correct port on the back of the instrument. Contact technical support if further assistance is needed.

6.3 Injector System Operation

The user can define the injection volume, delay time, and integration time for each of the two injectors using the **NEW PROTOCOL** wizard from the HOME window. This information is saved with each protocol. Injectors can only be used with the luminescence protocols.

The left **INJECTOR** button activates Injector 1 and the right **INJECTOR** button activates Injector 2.

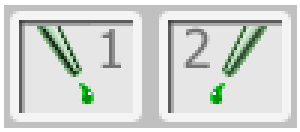


Figure 6-3: INJECTOR Buttons

If a protocol requires injectors, the injectors must be primed with the reagent first. Priming wets the fluid path and removes air bubbles to ensure delivery of an accurate injection volume for the assay.

Unused reagent in the fluid path can be retrieved. Select the option to **REVERSE PURGE** by touching the **INJECTOR SETUP** button on the READ screen. To prevent clogging of the fluid lines, flush after each use.

NOTE: The Injector System is capable of injecting reagent into all well formats EXCEPT for 384-well plates.

Periodically inspect the injector tip(s) (if installed) for bending or damage. When needed, promptly replace to avoid leaks onto the Microplate Sample Tray Cover.

WARNING: Do not use bent or damaged injector tips. Check the tips periodically and replace as needed.

6.3.1 Priming Injectors

1. Place the reagent container into the reagent holder.
2. Cover the bottle opening with Parafilm® to prevent reagent evaporation.
3. Insert the stainless steel tube through the Parafilm and into the reagent bottle.
4. Snap the stainless steel tube into the slot on the horizontal bar and ensure the tube reaches the bottom of the reagent bottle.
5. Touch the **DOOR** button to automatically open the instrument door.
6. Place the Waste Collection Tray on the Microplate Sample Tray.
7. Touch the **DOOR** button to automatically close the instrument door.
8. From THE INSTRUMENT CONTROL screen, touch the **READ** button.
9. Touch the **INJECTOR SETUP** button. Prime the injector(s) by following the step-by-step wizard. *See Figure 5-4.*
10. After priming is complete, remove the Waste Collection Tray.

Figure 6-4: SETUP Button for Injector(s)

Once the injectors are primed, they are ready for use according to the programmed protocol. Follow the **SELECT PROTOCOL** wizard from the HOME screen to select a saved protocol then go to the INSTRUMENT CONTROL screen to start the run.

NOTE: Periodically inspect the injector tip(s) for bending or damage. Immediately replace them as needed.

6.3.2 Retrieving Unused Reagents from Injectors (optional)

1. From the READ screen, touch the **INJECTOR SETUP** button.
2. Follow the wizard to run **REVERSE PURGE**. Any reagents left in the fluid lines will return back to the reagent container. It may be necessary to run **REVERSE PURGE** more than once to recover all unused reagent.

6.3.3 Flushing the Injectors after Use

1. Remove the sample plate from the instrument. Place the Waste Collection Tray on the Microplate Sample Tray.
2. From the INSTRUMENT CONTROL screen, touch the READ button, and then touch the **INJECTOR SETUP** button.
3. Follow the **SETUP** wizard for step-by-step instructions to run a FLUSH protocol.

There are two protocols used for flushing. The recommended flush protocol uses a sequence of deionized water, 70% ethanol, deionized water, then air to flush the fluid. The second protocol allows the user to define the number of flush cycles. This protocol does not offer an air-only flush cycle.

REMINDER: Remove Waste Collection Tray when priming and flushing are complete.

6.4 Using the Dispense option

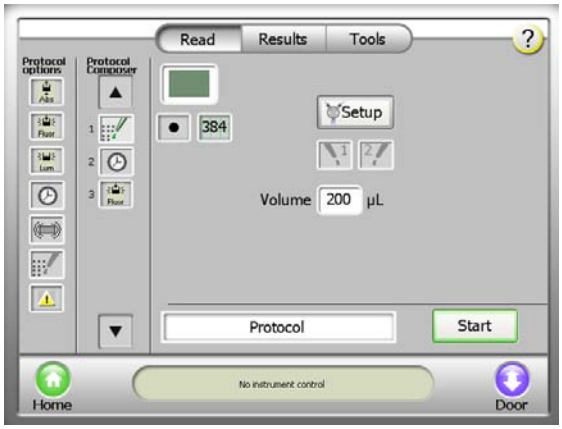
The Modulus™ II Microplate Reader Dispense option allows for the use of the injector system to dispense reagent independent from a plate read. This option can be used in conjunction with the Incubation option to inject reagent and then incubate the plate prior to a plate read.

- The injector system delivers 25 -200 µl in 5-µl increments of reagent to the plate well.
- The Dispense option can deliver reagent to all plate formats other than 384-well formats.
- It allows for the selection of either Injector 1 or Injector 2.

Figure 6-5: Dispense Icon

6.4.1 Instructions for Setting up Protocol with Dispense option

1. Select and drag **DISPENSE** icon from the Protocol Options to the Protocol Composer.
2. Setup injector system and select Injector. *Refer to Section 6.3 for instructions.*
3. Enter the volume of reagent to be dispensed by pressing the white Volume box.
4. Select plate format and wells that will be dispensed to. Refer to *Section 1.5 for instructions.*
5. Select and drag Incubation icon to Protocol Composer. *Refer to Section 7 for Instructions.*
6. If a Plate read is to follow Incubation step, select and define parameters.
7. Touch the **DOOR** button to open the instrument door and insert plate.



8. Touch the **DOOR** button again to retract the sample plate into the instrument.
9. Press the **START** button.

Figure 6-6: Protocol using dispense option prior to a Fluorescence Read

6.5 Cleaning the Injectors

It is recommended that the injector(s) be thoroughly cleaned every 30 days.

1. Use a prepared solution of 70% ethanol to **FLUSH** the injector(s) three times.
2. Place the container of 70% ethanol on the bottle holder. The stainless steel inlet tube should be inserted to reach the bottom of the bottle.
3. Place an empty Waste Collection Tray on the Microplate Sample Tray.
4. From the INSTRUMENT CONTROL screen, go to the READ screen. Touch the **SETUP** button to run the **PRIME** protocol.
5. Allow the solution to sit in the fluid path for 30 minutes before flushing the injector(s).
6. Run the **CUSTOM FLUSH** protocol nine times with deionized water.
7. Empty and clean the Waste Collection Tray and place it on the Microplate Sample Tray.
8. Place a container of deionized water on the bottle holder with the stainless steel inlet tube inserted to reach the bottom of the bottle.
9. From the INSTRUMENT CONTROL screen, go to the READ screen. Touch the **SETUP** button and run the **FLUSH** protocol.
10. Select the option for **CUSTOM FLUSH**.
11. Select nine **FLUSH** cycles.
12. When all **FLUSH** cycles are complete, empty and clean the Waste Collection Tray and place it on the Microplate Sample Tray.
13. **FLUSH** the injector(s) three times with air. A small volume of water will remain in the injector after the air purge.

6.6 Cleaning the Waste Collection Tray

The Waste Collection Tray prevents liquids from splashing or spilling inside the instrument during the **PRIME** and **FLUSH** protocols. The maximum volume capacity of the Waste Collection Tray is approximately 50ml. Use care when removing the Waste Collection Tray from the Microplate Sample Tray so that no liquid spills in the inside the instrument.

After each **PRIME** and **FLUSH** sequence, discard any fluid in the Waste Collection Tray and rinse with deionized water.

6.7 Replacing Injector Tips

Injector tip replacements are available from Turner BioSystems. Only injector tips from Turner BioSystems are fully tested and compatible with the Modulus™ II Microplate Reader. *See Appendix C for ordering information.*

1. Manually open the instrument door and hold it down with one hand.
2. Gently remove the injector tip assembly from the injector tip holder located on the Luminescence Module.
3. Twist the white tip valve counterclockwise to release it from the gray tube fitting.
4. Untwist the white tip fitting from the white valve to release the tip.
5. To remove the tip, hold the tip at the base and twist off.
6. Discard tip.
7. Insert a new tip onto the valve.
8. Twist the fitting clockwise until tight to complete the injector tip assembly. A small gap of approximately 1mm between the two fittings is normal.
9. Twist the assembled fitting with the new tip clockwise onto the tube fitting.

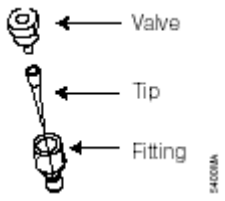


Figure 6-7: Injector Tip Assembly

10. Insert the tip into the injector tip holder on the Luminescence Module.

6.8 Inserting Injector Tip Assembly

1. Hold the injector tip assembly by the valve and fitting. Pull upward.
2. Gently and continuously push the injector tip assembly into the injector tip holder until the injector drops down into place.

6.9 Removing or Replacing Inlet and Outlet Plastic Tubing

Replacement tubing assembly is available from Turner BioSystems. *See Appendix C for ordering information.*

1. Disconnect the inlet or outlet tubing from the injector pump by twisting the gray fitting counterclockwise.
2. Discard the used injector tubing assembly.
3. Twist the fitting of the replacement tubing into the correct port of the injector pump.

6.10 Removing or Replacing Stainless Steel Tubing

Replacement stainless steel tubing is available from Turner BioSystems as part of the inlet tubing assembly. *See Appendix C for ordering Information.*

1. Hold the tan colored adapter just above the stainless steel tube.
2. Turn the adapter counterclockwise to disconnect it from the gray fitting.
3. Twist and separate the two tan-colored adapters.
4. Pull the stainless steel tube out of the adapter and discard.
5. Insert a new stainless steel tube into the adapter. Allow the tip of the tube to hang over the edge approximately 3 - 4mm.
6. Twist the second part of the adapter on until hand tight.
7. Attach the adapter to the gray fitting by turning it clockwise until it is hand tight.

7 Modulus™ II Microplate with Temperature Control (P/N 9310-011)

7.1 General Information

- The Modulus™ II Microplate Temperature Control option is capable of heating from ambient +2° C to 45° +/- 0.75° C.
- Before a run, allow ten minutes for the Heater to warm up and calibrate to the desired temperature.
- Access the Temperature Control option by selecting the **TOOLS** button on the INSTRUMENT CONTROL Screen.
- After two hours of inactivity, the Temperature Control option will automatically shut off.
- If the temperature of the instrument is different than the desired temperature when an assay run is started, the Modulus™ II Microplate will display a Warning window with the option to continue with or cancel the run.

IMPORTANT: The use of a plate cover is required to prevent sample evaporation and damage to instrument.

7.1.1 Activating the Temperature Control option

1. Touch the **TOOLS** button to go to the TOOLS screen.
2. Touch the **ACTIVATE HEATER** icon button to activate the Heater option.
3. Enter the desired temperature using the keypad.
4. Allow for a minimum of ten minutes for the Heater to calibrate to the desired temperature.

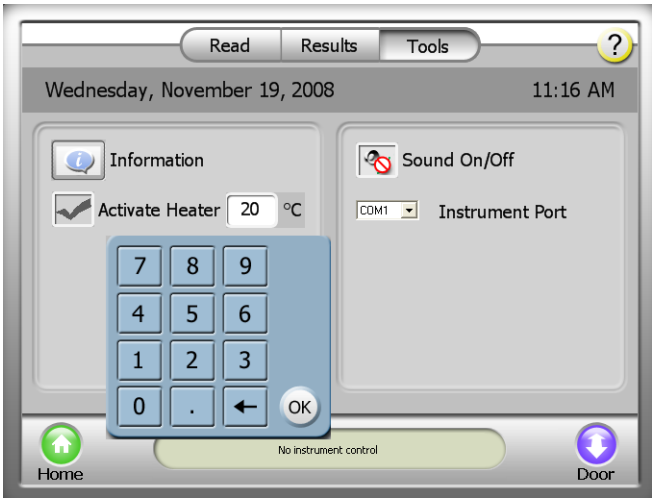


Figure 7-1: Accessing the Heater Option via the TOOLS Button

CAUTION: The Microplate Sample Tray Cover should only be in place when using a 96-well plate format. It is necessary to remove the Microplate Sample Tray Cover for runs using any other plate format and ensure that the plate adapter is in the correct orientation. *For instructions on removal of the Microplate Sample Tray Cover, see Section 11.4.*

7.1.2 Setting Incubation Parameters Followed by Plate Read

1. Activate Heater option. *See Section 7.1.1 for instructions.*
2. Select and drag the **MEASUREMENT** icon from the Protocol Options to the Protocol Composer and define the measurement parameters.
3. Select and drag the **INCUBATION** icon from the Protocol Options to the Protocol Composer.
4. Touch the **TIME** button to select the length of incubation.
5. Touch the **TEMPERATURE** button to set the desired assay temperature in Celsius degrees.
6. Touch the **TEMPERATURE CONTROL** button to activate the Heater controls.
7. Touch the **DOOR** button to automatically open the instrument door.
8. Place the sample plate on the Microplate Sample Tray. Well A1 must be at the top right corner.
9. Touch the **DOOR** button again to retract the sample plate back into the instrument.
10. Press the **START** button.

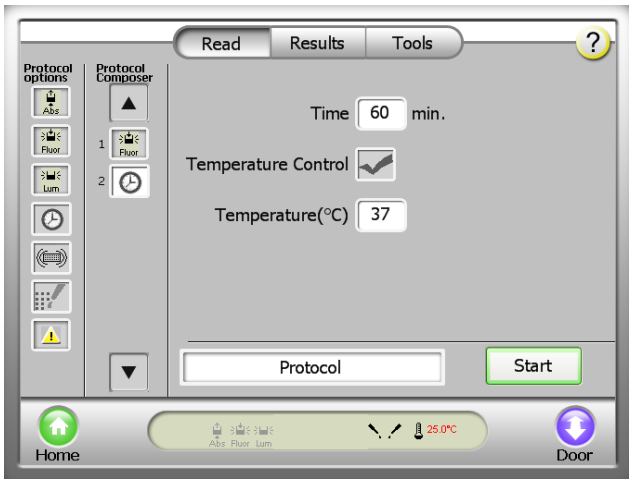


Figure 7-2: Setting the Incubation Parameters Followed by Plate Read

7.1.3 Setting Incubation Parameters without Plate Read

1. Activate Heater option. *See Section 7.1.1 for instructions.*
2. Select and drag the **INCUBATION** icon from the Protocol Options to the Protocol Composer.
3. Touch the **TIME** button to select the length of incubation.
4. Touch the **TEMPERATURE** button to set the desired assay temperature in Celsius degrees.
5. Touch the **TEMPERATURE CONTROL** button to activate the Heater controls.
6. Touch the **DOOR** button to automatically open the instrument door.
7. Place the sample plate on the Microplate Sample Tray. Well A1 must be at the top right corner.
8. Touch the **DOOR** button again to retract the sample plate back into the instrument.
9. Press the **START** button.

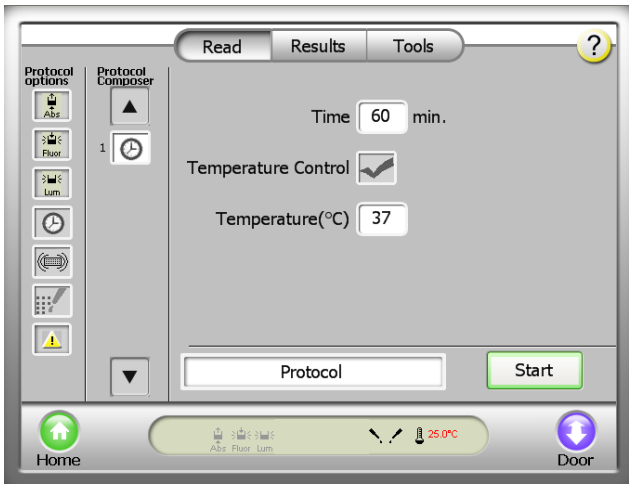


Figure 7-3: Setting the Incubation Parameters without Plate Read

NOTE: For assays that require an incubation step without heat, omit activating the Heater option upon the TOOLS screen and do not select the TEMPERATURE CONTROL button.

8 Modulus™ II Microplate Shaker

8.1 General Information

The Modulus™ II Microplate Shaker option allows the sample plate to be shaken as is necessary to meet the requirements of certain assays. Selecting the **SHAKER** icon will allow for defining the parameters of shake operation such as time, intensity and type of motion for the shake pattern.

Time:

- The Modulus™ II Microplate allows for shaking intervals of 0.1 - 120 minutes.

Intensity:

- The Modulus™ II Microplate has three rates of defined shaking intensities: low, medium, and high. These settings roughly equate to 150, 300, and 500 rpm, respectively.

Type of motion:

- **Linear:** The entire platform of the shaker moves in a linear motion.
- **Orbital:** The entire platform of the shaker moves in a circular orbit.

8.1.1 Selecting Shaker Options

1. Select and drag the **SHAKER** icon from the Protocol Options to the Protocol Composer.
2. Touch the **TIME** button to select the duration of shaking.
3. Touch the **INTENSITY** button to select the rate of shaking desired.
4. Touch the **TYPE** button to select the pattern of shaking desired.

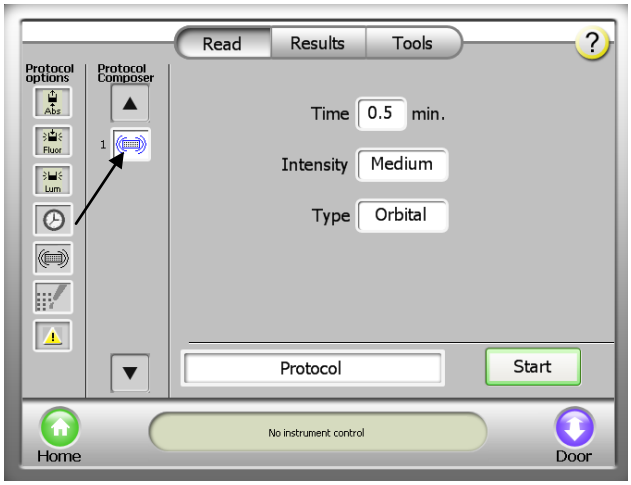


Figure 8-1: Selecting the Shaker Parameters

NOTE: It is necessary to use a film cover to prevent spillage and loss of sample when using the shaking option.

9 Accessories

9.1 Curve Fitting Data Analysis Software (9310-970)

Curve Fitting Data Analysis software is easy-to-use analysis software that analyzes 96-well plate format data and calculates the concentration of unknown samples using eight different curve-fitting methods. The eight different methods available are linear fit, quadratic fit, cubic fit, two-parameter fit, four-parameter fit with linear x-axis, four-parameter with log 2-axis fit, linear spline and cubic spline. The software is compatible with Windows XP.

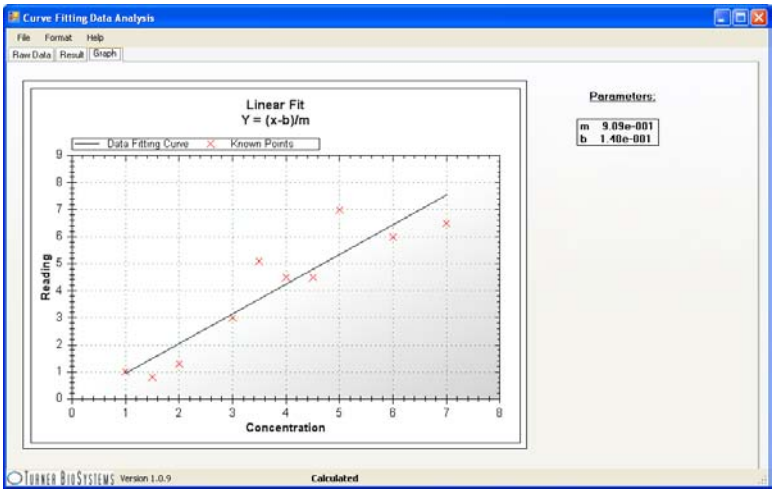


Figure 9-1: Graph Tab of the Curve Fitting Data Analysis Software

9.2 Connecting to a PC using External PC Connectivity Kit (9310-971)

It is possible to control the Modulus™ II Microplate Reader through an external PC and directly store the results on the hard drive of the PC using the optional External PC Connectivity Kit (9310-971). It is currently not possible to connect through a Mac computer. For pricing, contact Turner BioSystems via e-mail at sales@turnerbiosystems.com. If you have purchased this accessory, complete instructions have been included in the software package kit.

9.2.1 General Information

- Install the necessary software before connecting the PC to the instrument.
- Results files will not be saved on the internal computer of the Modulus™ II Microplate Reader when an external PC is directly connected.
- Data from the instrument's internal computer can only be transferred through the USB port located to the left of the touch screen.
- When an external PC has control of the instrument, the Modulus™ II Microplate Reader touch screen is disabled.

9.2.2 *File Locations*

While an external PC is directly controlling the Modulus™ II Microplate Reader, newly generated results files can be found in the following locations. The location of the file folders cannot be user-defined. For ease of access, it is recommended to create a desktop shortcut link to the file folders.

- **Data files** = C:\Documents and Settings*login name*\My Documents\Turner BioSystems\Modulus Data\Results

- **Protocol settings** = C:\Documents and Settings*login name*\My Documents\Turner BioSystems\Modulus Data\Protocols

- **Event Log** = C:\Program Files\Turner BioSystems\ModulusII Microplate\EventLog.txt

9.2.3 *System Requirements*

- Windows-based computer with Windows XP or Windows Vista operating system.
- Microsoft .NET Framework, version 2.0 (x86). Package is included with the External PC Connect Kit.
- USB cable or an RS-232 serial cable. *See Appendix C for ordering information.*
- The PC version of the Modulus™ II Microplate Reader software. The CD is available for ordering. *See Appendix C for ordering information.*

9.2.4 *Installing Microsoft .NET Framework version 2.0 (x86)*

The following steps are only necessary if Framework software is not already installed on the PC. Do either step one **or** step two.

1. Insert the External PC Connect software CD into a PC. View the files on the CD and double-click on the file *dotnetfx.exe*. Follow the step-by-step instructions to install the software.

2. Alternatively, download .NET from this web site: *http://www.microsoft.com/downloads*.

9.2.5 *Installing the Drivers for the Modulus™ II Microplate Reader*

When connecting to a PC through a USB cable for the first time, the computer will detect the instrument as being a new device. The drivers necessary to connect to the instrument are included with the PC version of the software. Follow the instructions below to install the drivers. The following example is based on using the Windows XP operating system.

1. Install the software onto the PC.

2. Connect the Modulus™ II Microplate Reader to the PC using the USB cable. Use the USB port on the back panel of the instrument. The USB port on the front of the instrument is only used for data transfer.

3. Power on the Modulus™ II Microplate Reader.

4. The **FOUND A NEW HARDWARE** wizard will appear. Follow the step-by-step instructions below to complete the wizard.

Figure 9-2: Step 5 of Installing the Drivers

5. Select the option **NO, NOT AT THIS TIME** on the WELCOME screen then click on the **NEXT** button to continue.

6. When asked, “What do you want the wizard to do?” select the default option **INSTALL THE SOFTWARE AUTOMATICALLY**. Click on the **NEXT** button to continue.

7. The driver will begin to install. A warning message will appear to inform the user that the driver has not passed Microsoft® Windows Logo testing. Click on the **CONTINUE ANYWAY** button.

8. When the driver finishes installing, a status window will appear.

9. Click on the **FINISH** button when all of the installation steps have been completed

10. A message reading “Your new hardware is installed and ready to use” will appear on the Taskbar to confirm successful installation.

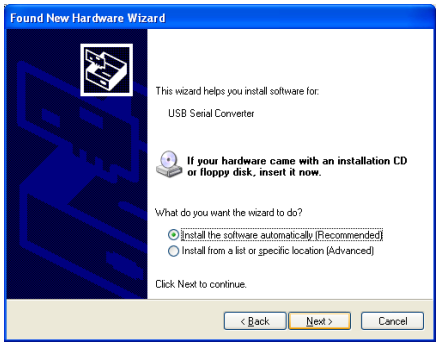


Figure 9-3: Step 6 of Installing the Drivers

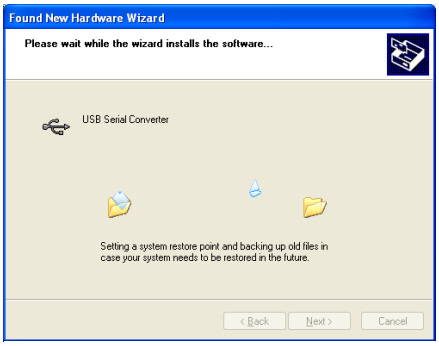


Figure 9-4: Step 8 of Installing the Drivers

9.2.6 Connecting to a PC Using a USB Cable

1. Power on the instrument and PC.
2. Connect the Modulus™ II Microplate Reader to the PC using a USB cable. Use the USB port on the back panel of the instrument. The USB port on the front of the instrument is only used for data transfer.
3. From the HOME screen, go to the INSTRUMENT CONTROL screen and touch the **TOOLS** button.
4. Touch the **EXTERNAL PC CONTROL** button.
5. Launch the Modulus™ Microplate Reader PC software from the PC.
6. Check the **INSTRUMENT STATUS** bar of the PC software for connectivity. When the connection is successful, the **INSTRUMENT STATUS** bar should read “Ready”.
7. If not, touch the **TOOLS** button of the INSTRUMENT CONTROL screen of the PC and confirm that the Instrument Port setting is on “USB”.

All instrument control should be done from the computer at this point. To return control back to the Modulus™ II Microplate Reader, follow the instructions in *Section 9.2.8.*

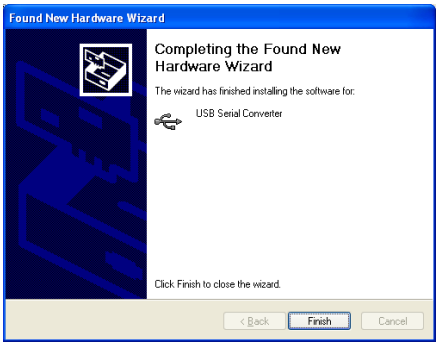


Figure 9-5: Step 9 of Installing the Drivers

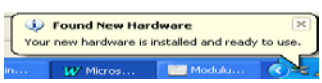


Figure 9-6: Step 10 of Installing the Drivers

9.2.7 Connecting to a PC Using an RS-232 Serial Cable

1. Power on the instrument and PC.
2. Connect the Modulus™ II Microplate Reader to a PC using the RS-232 serial port located on the back panel of the instrument.
3. From the HOME screen, go to the INSTRUMENT CONTROL screen and touch the **TOOLS** button.
4. Touch the **EXTERNAL PC CONTROL** button.
5. Launch the Modulus™ II Microplate Reader PC software from the PC.
6. Check the **INSTRUMENT STATUS** bar of the PC software for connectivity. When the connection is successful, the **INSTRUMENT STATUS** bar should read "Ready".
7. If not, touch the **TOOLS** button on the INSTRUMENT CONTROL screen of the PC and confirm that an appropriate COM Instrument Port is selected.

All instrument control should be done from the computer at this point. To return control back to the Modulus™ II Microplate Reader, follow the instructions in Section 9.2.8.

9.2.8 Disconnecting from a PC

To disconnect from the PC and return control to the Modulus™ Microplate Reader touch screen:

1. Using the PC version of the software, change the Instrument Port setting to **NONE**.
2. Touch the **CANCEL** button on the External Control Enabled dialog box of the Modulus™ II Microplate Reader touch screen.

Verify the transfer by checking that the **INSTRUMENT STATUS** bar on the Modulus™ II Microplate Reader touch screen reads "Ready".

9.3 Standard Light Plate (9100-036)

The optional Standard Light Plate provides a quick way to verify instrument performance. The Standard Light Plate consists of three highly stable light sources which simulate luminescent samples at signal intensity ranging over four logarithmic scales of data.

9.3.1 Getting Started

1. Briefly press the "Start" button on the Microplate Luminometer Light Plate.
2. The "Battery Check" indicator will flash a green light as long as the "Start" button is pressed and the battery has sufficient power.
3. The green light will turn OFF once the "Start" button is released. The light plate is now ON and ready for use. After five minutes it will automatically turn OFF. The built-in timer can be restarted at any time by pressing the "Start" button again.
4. If the green light does not appear while the "Start" button is pressed, replace the battery. *See Section 9.3.3*.

9.3.2 Running the Luminescence Light Plate Protocol

1. From the HOME Screen, choose INSTRUMENT CONTROL.
2. From the INSTRUMENT CONTROL Screen, select Luminescence by pressing the DETECTION MODE button.
3. After Luminescence has been selected, press the Luminescence Protocol button and scroll down to Luminescence Light Plate.
4. Load the Standard Light Plate and press the READ button.

9.3.3 Changing the Battery

1. Remove the two Phillips head screws.
2. Remove the battery retainer plate.
3. Pull the battery out of the battery compartment.
4. Install the new battery (4LR61) with notch aligned according to the drawing.
5. Reinstall the battery retainer plate.
6. Replace the two Phillips head screws.
7. Press the “Start” button while observing the “Battery Check” indicator to ensure the light plate is working (green light should appear).

9.4 USB Flash Drive (105-9300)

The USB Flash Drive (105-9300) included with the Modulus™ II Microplate allows data to be transported to an external computer. It includes 256MB of space, and has been tested to ensure compatibility with the Modulus™ II Microplate Reader.

Most USB flash drives are compatible with the Modulus™ II Microplate Reader. USB flash drives greater than 1GB may take longer than others to be recognized. Wait a few seconds for the instrument to recognize the USB flash drive. If the problem persists, try a different flash drive.

IMPORTANT: Results files can only be transferred from the instrument to a computer via a USB flash drive. Use the USB port on the front of the instrument.

10 Tools

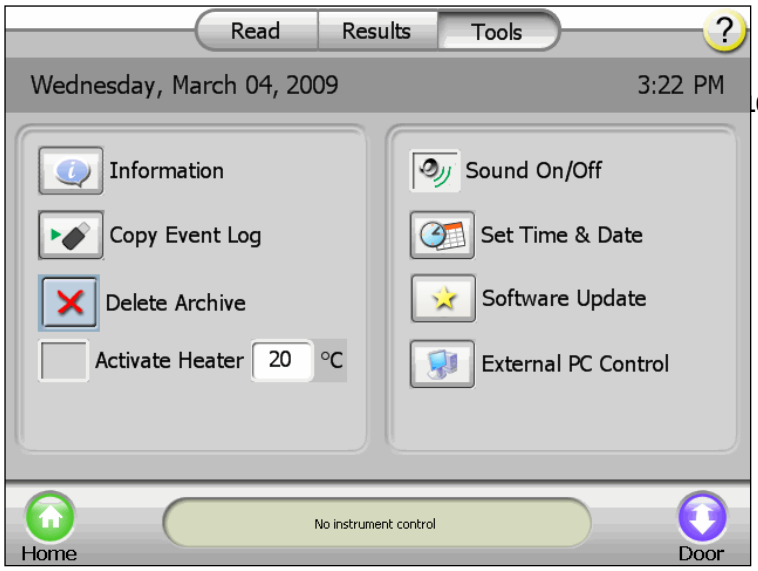
From the INSTRUMENT CONTROL screen, touch the **TOOLS** button to manage various aspects of the instrument.

10.1 System Information

Touch the **INFORMATION** button for information about the Modulus™ II Microplate Reader.

The following product information is provided:

- Part number and serial number of instrument
- Software version
- Part number and serial number of controller
- Firmware version
- FPGA version
- NVRAM
- Part number and serial number of detection module(s)
- Part number and serial number of installed fluorescence optical kit



10-1: Tools Screen

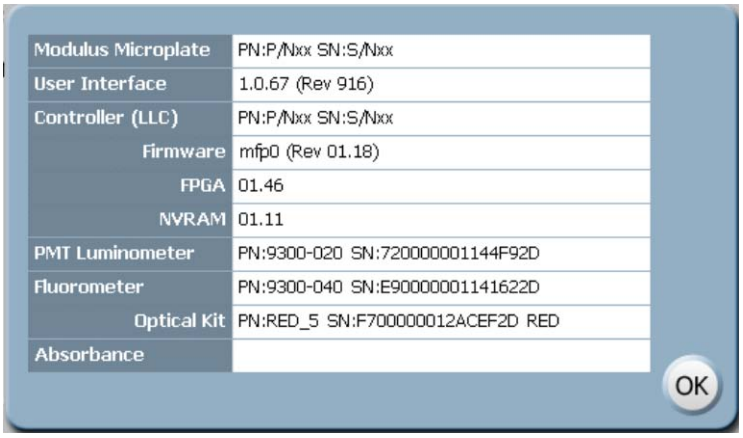


Figure 10-2: System Information

10.2 Event Log

The event log can be downloaded onto a USB flash drive in a .TXT format. Insert a USB flash drive into the USB port which is located on the front of the instrument to the left of the touch screen. Touch the **COPY EVENT LOG** button.

The event log cannot be viewed on the Modulus™ II Microplate Reader touch screen. To view the event log, download the file in .TXT format and open the log on a PC or Mac computer.

NOTE: If the instrument is being controlled by a PC, the event log will be stored on the hard drive at C:\Program Files\Turner BioSystems\Modulus II Microplate\EventLog.txt.

10.3 Sound Control

The touch screen beeps each time a field is touched. To disable the beep, touch the **SOUND ON/OFF** button.

10.4 Setting the Time and Date

Touch the **SET TIME & DATE** button to set the clock time and date for the appropriate location. Factory-shipped units are preset to Pacific Standard Time. The Modulus™ Microplate Reader does not automatically adjust for daylight savings.

10.5 Updating Software

The following instructions are used to update the Modulus™ II Microplate Reader Graphical User Interface software. The most current software versions can be obtained from Turner BioSystems' Technical Support Department.

1. Load the software onto a USB flash drive.
2. Insert the USB flash drive into the USB port on the front of the Modulus™ II Microplate Reader.
3. Touch the **SOFTWARE UPDATE** button and follow the wizard instructions to perform the update.
4. The Modulus™ II Microplate Reader will read the USB flash drive, recognize that a new software version is present, and ask the user if this upgraded software version should now be installed.

10.6 Updating Firmware

Perform a firmware update only when instructed by Turner BioSystems Technical Support Department. Follow the instructions below to update the firmware on the Modulus™ II Microplate Reader.

Action	Result
1. Copy the af.ldf file to the top level of the USB flash drive.	
2. Insert the USB flash drive into the USB port on the front of the Modulus™ Microplate Reader.	The message, "**Update the firmware?**" will appear.
3. Touch the **OK** button.	The message, "**To start the firmware update; turn the instrument off, then on"** will appear.
4. Turn the instrument off. Unplug the USB flash drive. Turn the instrument on.	The instrument powers on and the message, "**Start the firmware update?**" will appear.
5. Touch the **OK** button.	The message changes to: "**Firmware update in progress.**" The update will take approximately 2 - 3 minutes. When update is complete, the message, "**Firmware update complete, turn instrument off, then on**" will appear.
6. Turn the instrument off, then on again.	The instrument will power on with the new firmware.

Delete the af.ldf file from the USB flash drive after the upgrade is complete. Until the af.ldf file is removed from the USB flash drive, the instrument will prompt a firmware update every time the USB flash drive is plugged in.

11 Instrument Maintenance

11.1 General Instrument Care

The instrument must be on a level surface to operate properly. Allow 7.5 inches (19 cm) of clearance in front of the Modulus™ II Microplate Reader so that the instrument door may open without hindrance.

The maximum volume capacity per well is 250 µl. If a well is overfilled, immediately clean up any spills.

Touch the **DOOR** button to automatically open and close the instrument door. This **DOOR** button is located within the **INSTRUMENT CONTROL** screen on the bottom, right-hand corner of the touch screen. The instrument door should be kept closed whenever possible to avoid damage.

To gain access to the inside of the instrument, manually open the door and hold it down with one hand.

If the optional Microplate Sample Tray Cover is installed, it will also automatically open and close when the **DOOR** button is touched. Do not use force to manually close the Microplate Sample Tray Cover.

To start or stop a run, use the **START** and **STOP** button on the INSTRUMENT CONTROL screen.

11.2 General Cleaning

Power off the Modulus™ II Microplate Reader and disconnect the power supply whenever the interior of the instrument is open for cleaning and maintenance.

Residue accumulated from various reagents may inhibit proper movement of the optical head crosstalk mask. Besides immediately cleaning up any spills, it is recommended that the interior of the instrument be thoroughly cleaned every 30 days.

Periodically clean the Microplate Sample Tray, Microplate Sample Tray Cover, the Luminescence Optical Lens, and the Fluorescence Module Mask with KimWipe® dampened with 70% ethanol. Do **not** allow excess solution to run-off onto other electrical components as this may cause damage to the instrument and its electronics. Do **not** use solvents or abrasive cleaners.

Use a cloth dampened with deionized water to periodically wipe clean the exterior of the Modulus™ II Microplate Reader. Do **not** use solvents or abrasive cleaners.

WARNING: If a fluid spill on the detector is suspected, immediately contact the Turner BioSystems Technical Support Department for cleaning instructions.

11.3 Touch Screen Care

Do not use **any** sharp object such as a pen, pencil, stylus, or marker to make contact with the touch screen. These may damage or leave a permanent mark on the touch-sensitive LCD screen. Do not spill liquid on the screen.

To clean the Modulus™ II Microplate Reader touch screen, power off the instrument. Use a KimWipe® dampened with 70% ethanol to gently and cautiously clean the touch screen.

Screen contrast is preset to an optimized setting and is not adjustable.

11.4 Microplate Sample Tray Cover

Pressure should **not** be applied to the Microplate Sample Tray Cover. If pressure is inadvertently applied to the Microplate Sample Tray Cover, a Break-away tab is in place to prevent damage to Microplate Sample Tray assembly. *See Section 11.4.3 for instructions on how to replace this piece.*

CAUTION: The Microplate Sample Tray should ONLY be used for 96-well plate formats. For all other plate formats, the cover must be removed in order to prevent damage to the instrument.

11.4.1 Removing the Microplate Sample Tray Cover

1. Press the DOOR button to extend the Microplate Sample Tray assembly.

2. Using the allen wrench provided with the instrument, push on either of the crescent shaped tabs to disengage the Microplate Sample Tray Cover from the Tray assembly. *See Figure 11-1.* A finger or a pen can also be used to press on the crescent shaped tabs.

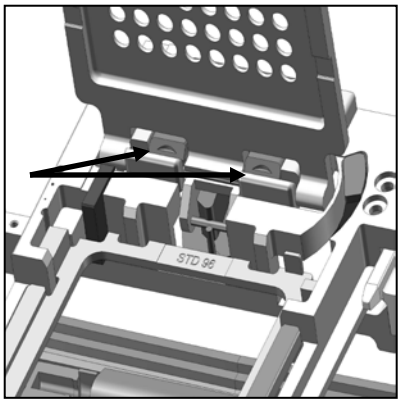


Figure 11-1: Disengaging the M

3. With the Microplate Sample Tray Cover disengaged, gently pull up to release it from the Tray assembly. *See Figure 11-2.*

4. Touch the **DOOR** button to retract the Microplate Tray assembly back into the instrument.

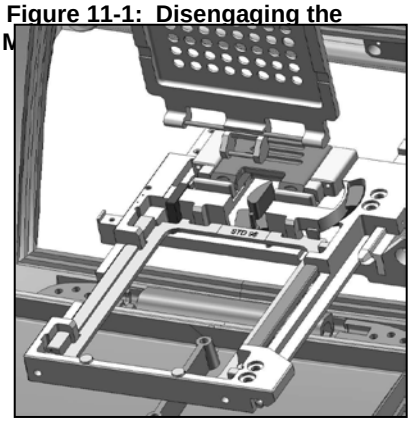
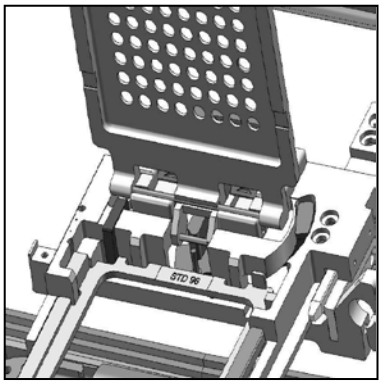


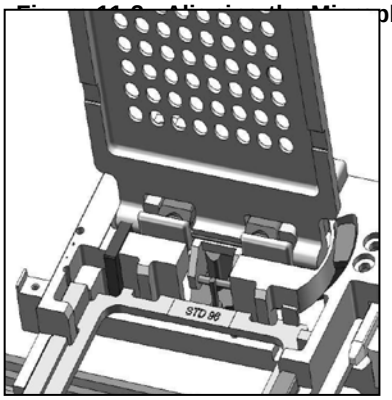
Figure 11-2: Removing the Microplate Sample Tray Cover

11.4.2 Installing the Microplate Sample Tray Cover



1. Align the steel pins on the Microplate Sample Tray Cover at a 90° angle to the Tray assembly just in front of the crescent-shaped tabs. *See Figure 11-3.*

2. To fully seat the Microplate Sample Tray Cover, gently push downwards until an audible click is heard. *See Figure 11-4.*



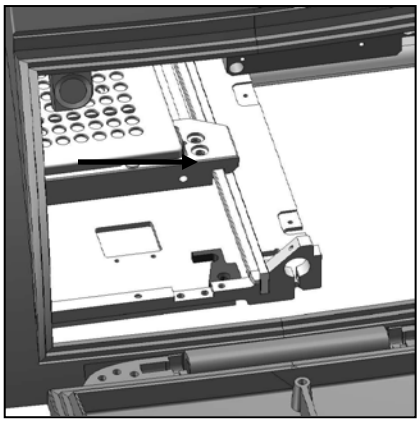
3. Touch the **DOOR** button to automatically close the Microplate Sample Tray Cover and retract the Microplate Tray assembly plate back into the instrument. Do not push down on the Microplate Sample Plate Cover or force it to close.

Figure 11-4: Inserting the Microplate Sample Tray Cover

WARNING: If the Microplate Tray is moved out of position during Removal or Installation of the Microplate Sample Tray Cover, the Microplate Tray may not retract properly. Manually move the tray into the instrument until the door will close and then press the close door button to home the Microplate Tray.

11.4.3 Replacing the Microplate Sample Tray Break-away tab

In the event that excessive force has been exerted on the Microplate Sample Tray Cover, the Break-away tab will snap in order to prevent damage to the Tray assembly. *If the Break-away tab is broken, the tray cover will not stay upright.*



1. Touch the **DOOR** button to automatically close the instrument door and set the Microplate Sample Tray into HOME position.
2. Power off the Modulus™ II Microplate Reader.
3. Manually open the instrument door and hold it down.
4. Using a Phillips head screw driver, remove the broken Break-away tab and replace it with the one provided in the Accessories box.
5. Touch the **DOOR** button to automatically close the Microplate Sample Tray Cover and retract the

Figure 11-5: Replacing the Microplate Sample Tray Break-away tab

Microplate Tray assembly back into the instrument. Do not push down on the Microplate Sample Plate Cover or force it to close.

12 Troubleshooting

12.1 Table of Error Messages

Error Message	Description	Resolution
Start Problem		
Instrument busy	Trying to enter a command while the instrument is still processing another command	• Wait until the task is finished then re-enter the command
Injector not initialized	Injector is needed for the protocol but was not primed before starting the run	• Touch the **SETUP** button and follow the wizard to **PRIME** the injector
No plate in instrument	The instrument does not detect a microplate in the Microplate Sample Tray	• Make sure there is a microplate seated properly in the Microplate Sample Tray
Protocol Selection		
No wells selected	At least one well on the microplate needs to be selected (green) to be read	• Touch the **PLATE** button found on the READ screen and verify at least one well is selected
Instrument Busy		
Stop the run in progress before creating a new protocol	When trying to use any of the **PROTOCOL** wizards during a run	• Wait until the current run is over, then create or modify a protocol
Instrument Problem		
Door opened	Instrument door was opened during a run causing the reading to abort	• Restart the run
	Something prevented the instrument door from fully closing as the Microplate Sample Tray was retracting	• Check the instrument door for any obstructions
No tray in instrument	Prime and flushing injectors require use of the Waste Collection Tray	• Touch the **DOOR** button to open door and place the Waste Collection Tray on the Microplate Sample Tray
Plate location misaligned	The sensor did not detect the sample plate	• Push the Microplate Sample Tray all the way in, close the instrument door, and restart run
Injector 1 not installed	The protocol requires addition of reagent using Injector 1 but it is not detected	• Verify Injector 1 is installed correctly by checking all connections and looking for an **INJECTOR** icon on the **INSTRUMENT STATUS** bar

Injector 2 not installed	The protocol requires addition of reagent using Injector 2 but it is not detected	• Verify Injector 2 is installed correctly by checking all connections and looking for an **INJECTOR** icon on the **INSTRUMENT STATUS** bar
Luminometer not installed	Instrument does not detect the Luminescence Module	• Verify the module is installed • If the module is installed, try rebooting the instrument • If the instrument still does not detect the module, call Technical Support
Fluorometer not installed	Instrument does not detect the Fluorescence Module	• Verify the module is installed • If the module is installed, try rebooting the instrument • Undo the two set screws on the module • Inspect the connectors for defect • If the instrument still does not detect the module, call Technical Support
Absorbance Module not installed	Instrument does not detect the Absorbance Module	• Verify the module is installed • If the module is installed, try rebooting the instrument • If the instrument still does not detect the module, call Technical Support
Open the door manually. Install the “x” Optical Kit	The protocol requires the use of a particular Optical Kit but the instrument is not detecting the presence of any Optical Kit	• Insert the desired Optical Kit into the detection head • The color label of the Optical Kit should face up, toward the user • Firmly insert the optical kit into the Fluorescence Module
Open the door manually. Replace the “x” Optical Kit with the “y” Optical Kit	The wrong Optical Kit is installed for the specified protocol parameter	• Install the correct Optical Kit or change the protocol parameter
Input string was not in correct format	Too many commands were entered at the same time	• Re-enter only one desired command at a time
Instrument is not initialized	The connected PC has instrument control, disabling control of the Modulus™ II Microplate Reader via its built-in touch screen	• Use the PC software to run the instrument
No Data to Copy	This error message indicates that no results files are available	• Ensure there is at least one results file to copy
G System missing. Press any button to restart	A USB flash drive is plugged into the USB port on the front of the instrument	• Remove the USB flash drive from the USB port and reboot the instrument

12.2 Table of Common Problems

Symptom	Possible Cause	Resolution
Injections sputter, drip, or are otherwise weak	Air bubbles are blocking the line	• Make sure the stainless steel tubes are completely inserted to the bottom of the reagent container
	Reagent residue is clogging the tip	• Soak the injector tip in warm deionized water and wipe it clean
Injector leaks.	Injector tips are damaged or bent	• See Section 1 for instructions on *replacing the injector tip*
	The inlet or outlet tubing is not properly connected to the injector syringe	• See Section 1 for instructions on *removing or replacing the tubing assembly*
Injector tips do not sit properly in the injector tip holder	Reagent residue has built up inside the injector tip holder	• Clean the holder with 70% ethanol and a damp cloth
Injectors not injecting	Air bubbles are blocking the line	• **FLUSH** the injectors to remove any air bubbles
	The end of the stainless steel tube is not in the reagent	• Make sure the stainless steel tube is completely inserted to the bottom of the reagent container • Re-prime the injectors
	Reagent residue is clogging the tubing	• Replace tubing, if needed • Always flush the injector system after use to prevent build up of reagent residue
	Reagent residue is clogging the valves	• Contact technical support
Wetness appears on the top of the sample tray cover after a run	Injector tips are bent	• Clean up spill and replace injector tips
	Microplate has overflowed inside instrument	• Clean the optical head • Check that the total volume in each well is less than 250ul • Thoroughly clean the interior of the instrument
	Reagent spilled inside the instrument	• Wipe up spills immediately using 70% ethanol and a damp cloth
Standard Light Plate reads very low or blank	The Standard Light Plate was not turned on before the run	• Touch the **START** button on the Standard Light Plate • It will automatically turn off after 5 minutes
	The selected wells do not correlate with the Standard Light Plate	• The well locations on the Standard Light Plate are B2, D2, and F2
	The Standard Light Plate was placed in the wrong orientation	• Make sure the A1 notch on the Standard Light Plate is in the upper right corner

12.3 Commonly Asked Questions

12.3.1 PC Connectivity

Q: When I connect the Modulus™ II Microplate Reader to a PC through a different USB port, I get the "Found New Hardware Wizard" again. Do I need to reinstall the driver?

A: Yes, you will need to reinstall the driver as if it is the first time detecting the instrument. Instructions can be found in *Section 9.2*.

Q: Can I transfer data to and from the PC while connected?

A: No, this function is currently not available. To transfer data from the instrument, use the USB connector to the left of the touch screen and a USB memory stick. Data cannot be transferred to the instrument.

Q: Can I specify the folder location to store the data?

A: No, it is preset to C:\Documents and Settings*login name*\My Documents\Turner BioSystems\Modulus Data\Results.

Q: When I try to install the PC version of the software, a dialog prompts me to download the .NET Framework 2.0. What is it?

A: It is a Microsoft software component required to run the Modulus™ II Microplate Reader PC software.

Q: On the Microsoft .NET Framework download web page, what version of Framework should I install?

A: 2.0

12.3.2 Data Management

Q: Can I delete old data from the internal computer?

A: Data can be removed by the user by selecting the data file to be removed under files on the Results screen and then pressing the **DELETE** file button. To delete all archived data, go to the TOOLS screen and press the DELETE ARCHIVE button.

APPENDIX

Appendix A - Specifications

General Specifications

- Detection Modes: Luminescence, Fluorescence, Absorbance and UV-Vis Absorbance
- Sample Format: 6,12,24,48, 96 and 384-well microplates
- Integrated PC Operating System: Windows CE 6
- User Interface: 6.6 in VGA color TFT LCD display with touch screen
- Data Output: PC & Mac compatible .csv file format
- PC requirements (optional): Windows XP operating system or higher
- Dimensions: 53 cm D x 44 cm W x 31 cm H (21 in D x 17.3 in W x 12.2 in H)
- Weight: ~16 kg (~ 35 lbs)
- Power Source: 100-240V AC, 50/60Hz
- Operating Temperature: 15-30°C (60 - 85°F)
- Operating Humidity: 5-75% non-condensing
- Warranty: 1 year, parts and labor
- Regulatory: CE, for research use only

Luminescence Module Specifications

- Detector: head-on photon counting photomultiplier tube (PMT)
- Wavelength Range: 350 to 650 nm
  - Peak wavelength: 420 nm
- Detection Limit: $3x10^{-21}$ moles of luciferase
- Linear Dynamic Range: >8 logs
- Cross-Talk: 1 million RLUs using 96-well plates
  - White plates: 10^{-5} (for the Corning® Costar® product #3789)
    10^{-4} (for the Greiner Bio-One Lumitrac 200)
  - Black plates: $< 10^{-6}$

Absorbance Module Specifications

- Light Source: LED
- Detector: large-area photodiode
- Spectral Range: 400 - 800 nm
- Filter Wheel Capacity: holds up to six filters. Includes four installed filters and two empty filter holders for user configuration.
- Wavelengths Available: 450, 560, 600, 750 nm
- Photometric Measuring Range: 0 - 5.0 OD
- Linear Dynamic Range: 0 - 4.0 OD
- OD Accuracy: 0.01 OD +/- 3%
- OD Precision: 0.01OD +/- 1%
- Stray Light: 0.002% at 560 nm in Clear bottom Black wall plates

UV-Vis Absorbance Module Specifications

- Light Source: Xenon Flash Lamp
- Detector: photodiode
- Spectral Range: 200 - 1100 nm
- Filter Wheel Capacity: holds up to six filters. Includes four installed filters and two customizable filter paddle with 260 nm and 280 nm preinstalled.
- Wavelengths Available: 260,280,450, 560, 600, 750 nm
- Photometric Measuring Range: 0 - 5.0 OD
- Linear Dynamic Range: 0 - 4.0 OD (assay dependent)
- OD Accuracy: 0.05 OD +/- 3%
- OD Precision: 0.001% at 560 nm in Clear bottom Black wall plates

Fluorescence Module Specifications

- Light Source: wavelength matched LED
- Detector: PiN-photodiode
- Read Position: top reading
- Wavelength Selection: snap-in optical kits
- Wavelengths Available:
  - UV (Ex: 365 nm, Em: 410 - 460 nm)
  - Blue (Ex: 490 nm, Em: 510 - 570 nm)
  - Green (Ex: 525 nm, Em: 580 - 640 nm)
  - Red (Ex: 625 nm, Em: 660 - 720 nm)
  - Custom kits upon request
- Detection Limit: 0.5 fmol/200 µl, or 1 ppt of fluorescein in 96-well microplate
- Linear Dynamic Range: 6 logs (assay dependent)

Injector System Specifications

- Number of Injectors: single or dual injectors
- Dispense Volume Range: 25 – 200 µl in 5 µl increments
- Waste Collection Tray Volume: ~50 ml
- Dead volume: ~450 ul

Heater System Specifications

- Ambient +2 ^{o}C to 45^{o}C +/- 0.75^{o}C
- Heating Interval:
  - 0.1 to 120 minutes

Shaker System Specifications

- Linear and Orbital shaking pattern
- Shaking Intensity:
  - Low, Medium and High (150, 300 and 500 rpm respectively)
- Shaking Interval:
  - 0.1 to 120 minutes

For the most up-to-date specifications,
please visit our web site at www.turnerbiosystems.com.

Appendix B - Warranty and Obtaining Service

General Warranty Information

Turner BioSystems warrants the Modulus™ II Microplate Reader 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 incompatible samples 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 user modification to the instrument is not covered by warranty.
- Damage caused by user neglect of injectors is not covered by warranty.

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 the nature of the problem as precisely as possible.
2. Carry out minor adjustments or tests as suggested by the Turner BioSystems Service Department.
3. If the instrument is still not functioning properly, obtain an RMA number from the Turner BioSystems Service Department. This RMA number is necessary for repair under warranty and tracking.
4. Reference this RMA number on the exterior of the shipping carton when sending the instrument to our Service Department for repair. Obtain shipping insurance and pack the instrument well as damage incurred during shipping due to improper packing is not covered under warranty. Shipments sent should be prepaid.

The instrument will be repaired and returned free of charge for any customer in the United States within the one-year warranty period.

Turner BioSystems will pay for return shipment and reimburse by check the cost of the initial prepaid surface shipment to our Service Department.

However, Turner BioSystems cannot pay shipping, duties, or documentation costs for customers outside of the continental United States. International customers who purchased equipment directly from Turner BioSystems (not from a third party distributor) should contact our Service Department for further shipping instructions. International customers, who purchased Turner BioSystems equipment from an authorized third-party distributor, should contact their distributor directly for shipping instructions.

IMPORTANT: Under no circumstances should the instrument or accessories be returned without prior authorization from Turner BioSystems or our authorized distributor.

Prior correspondence is necessary to:

- Eliminate minor problems, easily handled on-site in your laboratory, both to save money and minimize equipment downtime.
- Determine the nature of the problem, so that efficient and timely repair(s) can be performed with particular attention paid to your needs.

Out of Warranty Service

Follow the same steps as detailed above for Warranty Service. Our Service Department will be happy to provide assistance for free by telephone or correspondence. Repair service will be billed at a flat rate. Invoices will include any freight charges.

Mailing Address:

Turner BioSystems, Inc.
645 N. Mary Avenue
Sunnyvale, CA 94085
USA

Phone: 1.408.636.2400
Toll-Free: 1.888.636.2401 (US & Canada)
Fax: 1.408.737.7919

Appendix C - Ordering Information

To get a price quote or place an order
call the Turner BioSystems Sales Department toll-free at:
1.888.636.2401 (US & Canada only)
or
1.408.636.2400
or
visit us on our web site at www.turnerbiosystems.com

Part Number	Description	Includes
9310-010	Modulus™ II Microplate Reader Base Instrument	Power supply kit, operating manual and accessories
9310-011	Modulus™ II Microplate Reader Base Instrument with Temperature Control	Power supply kit, operating manual and accessories
9310-020	Luminescence UHS Module	PMT Detection Head and factory installation
9310-040	Fluorescence Module	Fluorescence Detection Head, four Optical Kits (Blue, UV, Green, and Red), Allen wrench, and installation instructions
9310-050	Visible Absorbance Module	Absorbance Detection Head with filter wheel, two customizable filter paddles, Allen wrench, and installation instructions
9310-051	UV-Vis Absorbance Module	Absorbance Detection Head with filter wheel, 260 nm and 280 nm filters in customizable filter paddles, Allen wrench, and installation instructions
9300-061	Single Injector System for Modulus™ II Microplate Reader	Injector system with one syringe injector and accessories Customer installable
9300-062	Dual Injector System for Modulus™ II Microplate Reader	Injector system with two syringe injectors and accessories Customer installable

Part Number	Description	Includes
Accessories		
9300-966	Waste Collection Tray	Plastic-molded collection tray to be used with Injector System Holds ~50 ml
9300-970	Curve Fitting Data Analysis Software	Available as a download from the website www.turnerbiosystems.com
9300-999	Starter pack	96-wel plates (Black, White and Clear) and 256 MB USB Flash Drive
9310-971	External PC Connectivity Kit	PC software and USB cable
9100-036	Luminescence Standard Light Plate	Battery powered Standard Light Plate and instruction card
046-0108	Power Line Cord – 250V AC w/ 3A Fuse	UK compatible
046-0125	Power Line Cord – 250V AC w/ 6A Fuse	Australia compatible
046-0150	Power Line Cord – 230V AC	Europe compatible
105-9300	USB flash drive, 256MB	Turner BioSystems branded USB memory stick
998-9375	Modulus™ II Microplate Reader Operating Manual	Paper copy of operating manual
998-9376	Modulus™ II Microplate Reader Quick Start Guide	Laminated reference card for quick set-up of instrument

Part Number	Description	Includes
Replacement Part		
159-0246	Power supply Brick	24V, 150W
046-0400	Power Line Cord	US compatible
021-0615	DB-15 Communication Cable	15-pin male/female connector for Injector System
9300-042	Fluorescence Optical Kit - C460	Ex 460nm / Em 510-570nm
9300-043	Fluorescence Optical Kit - UV	Ex 365nm / Em 410-460nm
9300-044	Fluorescence Optical Kit - Green	Ex 525nm / Em 580-640nm
9300-045	Fluorescence Optical Kit - Red	Ex 625nm / Em 660-720nm
9300-046	Fluorescence Optical Kit - Blue	Ex 490nm / Em 510-570nm
9310-340	Microplate Sample Tray Cover	Cover for Microplate Sample Tray
9310-960	6-384 Well Plate Adapter	6-384 Well Plate Adapter
109-9300	96 Well Optical Cross-talk Mask	
109-9310	384 Well Optical Cross-talk Mask	
9300-963	Inlet Tubing Assembly	One set of stainless steel tube, black plastic tubing, and gray fittings
9300-964	Outlet Tubing Assembly, Single-Injector	One set of black plastic tubing and gray fittings connected to a black plate
9300-965	Outlet Tubing Assembly, Dual-Injectors	Two sets of black plastic tubing and gray fittings connected to a black plate
2030-931	Injector Tips, Replacement	5 tips per package

Replacement Part Numbers and Assemblies


9300-963


9300-964


9300-965


9300-966


9300-04x

Appendix D - How to Contact Us

Turner BioSystems, Inc.
645 North Mary Avenue
Sunnyvale, CA 94085 USA

Sales@turnerbiosystems.com
Techsupport@turnerbiosystems.com

By phone: + 1 (888) 636.2401, + 1 (408) 636.2400
By fax: + 1 (408) 737.7919
Or by visiting our web site: www.turnerbiosystems.com

645 N. Mary Avenue • Sunnyvale, CA 94085
Phone: (408) 636-2400 •Toll Free: (888) 636.2401 • Fax: (408) 737-7919
www.turnerbiosystems.com