Modulus™ II
Microplate Multimode Reader

A modular, easy to use and cost effective multimode reader for Luminescence, Fluorescence, and Absorbance Life Science applications.

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Modulus™ II Microplate Multimode Reader Instrument Specifications (9310-010)

Detection Modes: Luminescence, Fluorescence, Absorbance
Read Type: Glow, Flash, Kinetic, Repeat
Sample Format: 6, 12, 24, 48, 96, 384-well plates
Shaking: Three speeds (150, 300, 500 rpm) linear and orbital modes
User Interface: Built-in PC, touch screen navigation and operation
Data Output: PC or Mac compatible .csv file format exported to USB flash drive, or connect to PC (not included) through optional PC Connect Kit
External PC Requirements (optional): Windows XP or higher
Computer Interface: USB type B or RS-232 port
Power: 100 - 240 VAC, 50 - 60 Hz
Auto Shutoff: Touch screen hibernates after 15 min of inactivity
Dimensions: 21" D x 17.3" W x 12.83" H (53 cm D x 44 cm W x 32.6 cm H)
Weight: ~35 lbs (~16 kg)
Operating Temperature: 60 - 85 ºF (15 - 30 ºC)
Warranty: One year parts and labor
Approvals: CE

Modulus™ II Microplate Multimode Reader Instrument with Heating (9310-011)

Temperature Control: 2 ºC above ambient temperature to 45 ºC +/- 0.75 ºC

Luminescence Module Specifications (9310-020 Factory Installed)

Detector: Head-on photomultiplier tube (PMT) for photon counting
Spectral Range: 350 - 650 nm
Peak Wavelength: 420 nm
Detection Limit: 3 x 10^{-21} moles of luciferase or 1 x 10^{-18} moles of ATP
Linear Dynamic Range: >8 logs
Crosstalk: 5 x 10^{-5}

Fluorescence Module Specifications (9310-040 User Installable)

Light Source: Wavelength-matched LED
Detector: PIN-photodiode
Read Position: Top reading
Wavelength Selection: Snap-in Fluorescence Optical Kits
Wavelengths:
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)
Detection Limit: 0.5 fmol/200 µl or 1 ppt of fluorescein in 96-well plate, 30 pg/well dsDNA with PicoGreen®
Linear Dynamic Range: 6 logs, assay dependent
Read Out: Relative Fluorescence units
Discrete Sample Average: Sample readings averaged over 0.5 sec to improve accuracy

Visible Absorbance Module Specifications (9310-050 User Installable)

Light Source: LED
Detector: Large-area photodiode
Spectral Range: 400 - 800 nm
Wavelengths for Installed Filters: 450, 560, 600, 750 nm
Photometric Measuring Range: 0 - 5.0 OD
Linear Dynamic Range: 0 - 4.0 OD, assay dependent
OD Accuracy: 0.01 OD ± 3% at ≤ 2.5 OD
OD Precision: 0.01 OD ± 1%
Stray Light: 0.002% @ 560 nm in clear bottom, black wall plate

UV-Visible Absorbance Module Specifications (9310-051 User Installable)

Light Source: Xenon lamp
Detector: Photodiode
Spectral Range: 200 - 1100 nm
Wavelengths for Installed Filters: 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% at ≤ 2.5 OD
OD Precision: 0.002 ± 3%
Stray Light: 0.001% @ 560 nm in clear bottom, black wall plate

Single Injector System Specifications (9300-061 Optional)

Number of Injectors: One injector
Dispense Volume Range: Selectable between 25 - 200 µl in 5 µl increments
Waste Tray Volume: ~50 ml

Dual Injector System Specifications (9300-062 Optional)

Number of Injectors: Two injectors
Dispense Volume Range: Selectable between 25 - 200 µl in 5 µl increments
Waste Tray Volume: ~50 ml

For the most up-to-date specifications, visit www.turnerbiosystems.com.

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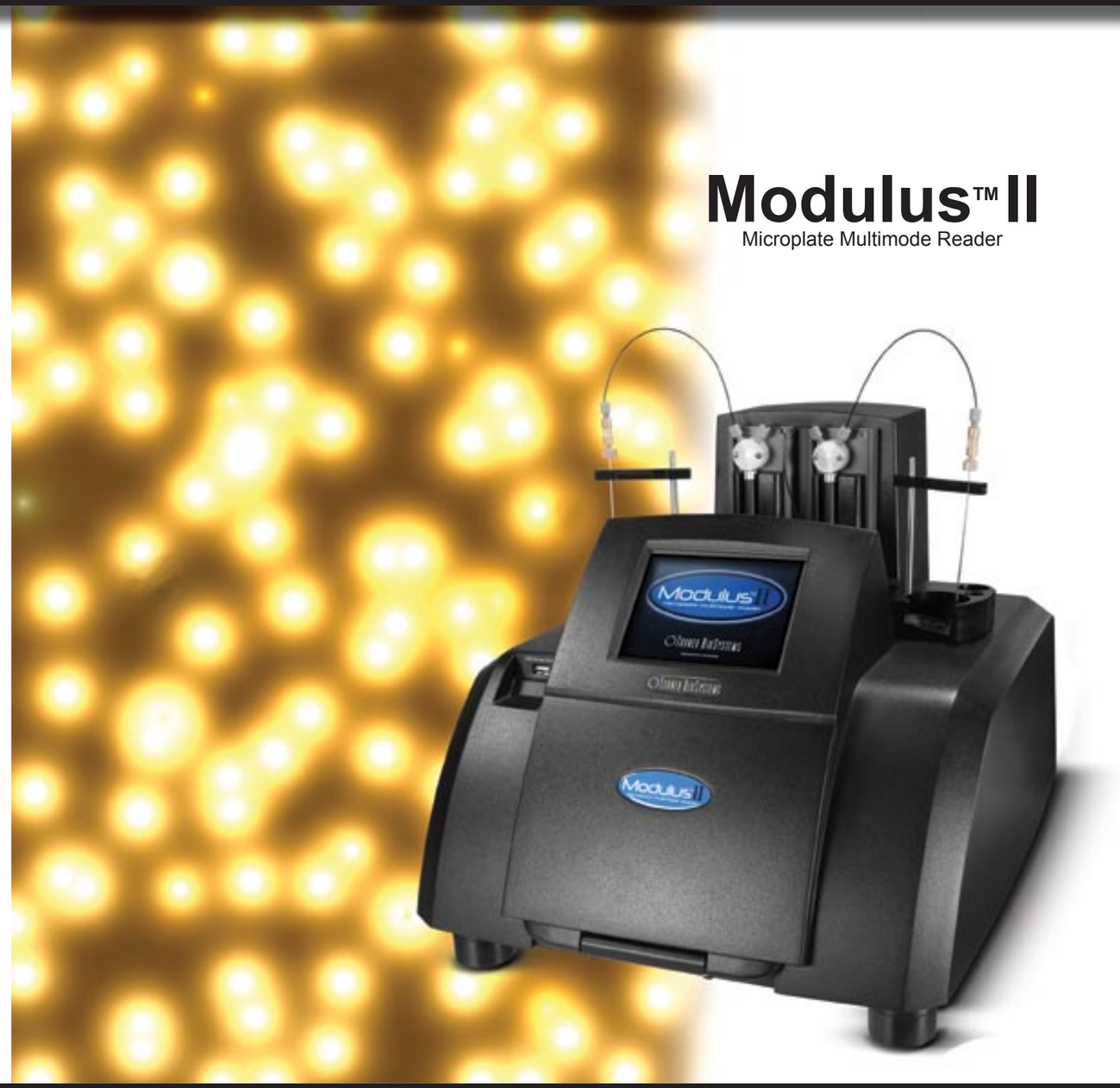

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For international sales, contact our headquarters or refer to our Web site at www.turnerbiosystems.com and click the "How to Buy" tab.

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Product:	Modulus™ II Microplate Multimode Reader
Product Series:	Multimode Readers
Plate Format:	6, 12, 24, 48, 96, and 384-Well Plates
Technologies:	Luminescence, Fluorescence, and Absorbance
Features:	Shaking, Protocol Composer
Optional Features:	Single or Dual Auto Injectors, Temperature Control

Modulus™ II

Microplate Multimode Reader

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Overview

The Modulus™ II Microplate Multimode Reader is skillfully designed for today's life science laboratory. In addition to having performance on par with single-mode instruments, the Modulus™ II Microplate blends user-friendly operation with easy data handling and flexible purchasing options. The result of this design is an instrument with superior performance that is easy to use, is affordable, and can be customized to your laboratory's needs.

Performance

The Modulus™ II Microplate Multimode Reader combines the superior performance expected from single-mode instruments with the functionality of multiple modes. To achieve industry-leading performance, the Modulus™ II Microplate is designed with optical channels dedicated to each individual technology. Unlike other multimode systems, readings taken with the Modulus™ II Microplate are not degraded by indirect fiber-optic transmission or crowded optical channels. Dedicated optical channeling ensures that the Modulus™ II Microplate provides sensitivity and dynamic range on par with the highest performing single-mode instruments.

Ease of Use

The Modulus™ II Microplate Multimode Reader is designed to be put into use straight from the box, without the need to read a manual or obtain special training. To achieve this plug-and-play usability, the Modulus™ II Microplate combines a color touch screen display with a Windows-based onboard computer. The built-in computer eliminates the connectivity hassles, cost, and space requirements of running an external computer. Assay set-up on the Modulus™ II Microplate is effortless with several flexible set-up options to choose from. Once an assay is run, data can be transferred in Excel-compatible .csv format from the Modulus™ II Microplate using the built-in USB drive and the USB stick that comes with the instrument.

Affordable Modularity

The Modulus™ II Microplate is a modular instrument that easily fits into most budgets. Purchase the technology or modes that you need now and add onto the system later as your needs expand. For example, the Modulus™ II Microplate can be purchased as a luminometer, then fluorescence and/or absorbance modules can be purchased and added later.

There is no need for a service call or downtime. Installations take less than ten minutes and can be done right in your lab using just an Allen wrench which is provided with the module. In addition, after installing a new module, you will not need to download and install new software. The Modulus™ II Microplate instantly detects the newly installed module(s) and will automatically adjust screens, protocols, and options.

Luminescence

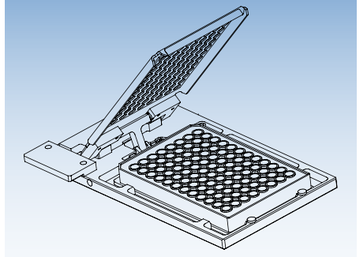

Figure 1: The Luminescence Module light path is isolated through a dual-masking system at both the detector and at the well being read. The dual-masking system is designed to eliminate stray light by creating a column through which the light from the sample passes to the detector.

Fluorescence

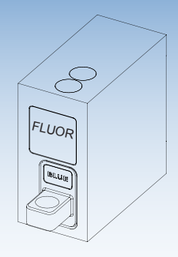

Figure 2: The Fluorescence Module uses an epifluorescent design to ensure a consistent measurement position. This approach reduces the impact of small sample volume fluctuations by consistently measuring the sample at the same position from well to well.

Absorbance

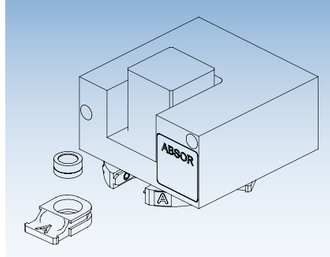

Figure 3: The Modulus™ II Microplate Multimode Reader provides scientists with two different options for photometric measurements. The UV-Visible Absorbance Module allows measurements from 200 - 1100 nm. The second option is the Visible Absorbance Module allowing measurements from 400 - 800 nm.

Injectors

Both single and dual injectors are available for the Modulus™ II Microplate Luminometer. Each injector has a volume range of 25 – 200 µl in 5-µl increments. Installed injector systems are automatically recognized by the instrument and controlled using the touch screen and fluidics wizard. Prime and Flush commands provide easy maintenance and a Reverse Purge command saves valuable reagents. Injectors are recommended for labs running experiments with flash-based luminescence applications or dual-reporter assays.

Luminescence Light Plate

The optional Luminescence Light Plate provides an external control to confirm that the luminometer functions properly. Some labs require this additional verification procedure. Reading the light plate before taking measurements is a quick and easy way to ensure quality control over linearity and consistency of readings.

Microplate Format

The Modulus™ II Microplate Multimode Reader accepts 6, 12, 24, 48, 96, and 384-well plates conforming to the SBS plate standard.

Temperature Control

The Modulus™ II Microplate Multimode Reader may be purchased with an optional heater allowing for precise temperature control from 2º above ambient temperature to 45º C.

Shaking

The Modulus™ II Microplate Multimode Reader is configured with a factory-installed shaker that allows for either linear or orbital shaking.

Protocol Composer

The Modulus™ II Microplate Multimode Reader comes with a Protocol Composer. The Protocol Composer allows complex protocols to be easily developed by combining multiple technologies into one experiment. Save time and reagents by testing for both luminescence and fluorescence or fluorescence and absorbance in one run.

Data Analysis

Because data is provided in .csv format, any necessary data manipulations can be done within Excel. For optimum ease of analysis, Turner BioSystems has additionally developed optional, specialized software. This Curve-Fitting Data Analysis Software program provides calculation, graphing, and printing of eight different curve-fitting methods: linear fit, quadratic fit, cubic fit, two-parameter fit, four-parameter with linear x-axis fit, four-parameter with log two-axis fit, linear spline, and cubic spline. This software option is compatible with the Windows XP operating system for PC computers.

Computer Interface

An optional software program is available for those labs that would prefer to operate the Modulus™ II Microplate Multimode Reader through an external PC. The PC Connect Kit contains all of the same ease-of-use features which are available via the instrument's built-in touch screen.

Temperature Control | USB | Injectors | Protocol Composer | Shaking

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Luminescence Features
- > 8 logs dynamic range
- Optional Single or Dual Auto Injectors
- Dual-masking system reduces crosstalk

Luminescence Module Injector/Application Chart

Injectors*	Applications
2	Dual Reporter Assays
0	Steady-Glo® Luciferase Assays
1	Flash Glow Luciferase Assays
1	Cell Viability/ATP Assays
1	Kinetics Assays
1	Calcium (Aequorin)

*Recommended

DLReady™

Luminescence Module
(Factory Installed)

The Modulus™ II Microplate Multimode Reader with the Luminescence Module is designed to deliver performance equivalent to dedicated microplate luminometers while also offering the flexibility of a multimode reader.

To achieve sensitivity on par with that of a dedicated luminometer, the luminescence channel is separated from other measurement technologies and positioned directly above the sample well. These conditions maximize light capture for the best possible sensitivity. In conjunction, a low-noise photomultiplier tube ensures that collected light is not compromised in any way. This design makes the Modulus™ II Microplate between 10 to 1000 times more sensitive than competing multimode luminometers.

In addition to high sensitivity, the Modulus™ II Microplate boasts greater than 8 logs of dynamic range, eliminating the need to dilute samples or manage detector-driven gain changes. To achieve this extra large reading range, the Modulus™ II Microplate is capable of simultaneously measuring samples of varying brightness. The photomultiplier tube automatically adjusts for the optimum reading of bright or dim samples. This means that the Modulus™ II Microplate is capable of achieving a reading range of 2 – 3 logs more than competing multimode luminometers.

For further functionality, a Modulus™ II Microplate with the Luminescence Module is designed to reduce crosstalk. The luminescent light path is isolated through a dual-masking system at both the detector and the well being read. Dual masking eliminates stray light by creating a column in which the light from the sample passes directly to the detector. When using 96-well white plates, this dual-masking system effectively results in a crosstalk rejection of 5×10^{-5}.

Fluorescence Features
- Epifluorescent detection
- Easy optical kit switching
- Wavelength-matched LEDs ensure high sensitivity

Fluorescence Module Application Chart

Fluorescence Optical Kit	Typical Applications
UV Optical Kit Ex: 365 nm Em: 410 - 460 nm	DNA Quantitation (Hoechst dye), Enzyme Activity (4-methyl-umbelliferone)
Blue Optical Kit Ex: 490 nm Em: 510 - 570 nm	DNA Quantitation (PicoGreen®, Quant-iT™ dsDNA), RNA Quantitation (RiboGreen®), Protein Labeling (Fluorescein), Protein Quantitation (Quant-iT™ Protein), Gene Expression (EGFP, rAcGFP)
Green Optical Kit Ex: 525 nm Em: 580 - 640 nm	Nucleotide or Protein Labeling (Rhodamine, Cy3), Enzyme Activity (Rhodamine)
Red Optical Kit Ex: 625 nm Em: 660 - 720 nm	Nucleotide or Protein Labeling (Cy5), RNA Quantitation (Quant-iT™ RNA)

Fluorescence Module
(User Installable)

The Modulus™ II Microplate Multimode Reader with the Fluorescence Module installed is designed to deliver both high performance and user flexibility.

To achieve high performance, the Fluorescence Module utilizes powerful light-emitting diodes (LEDs) as excitation sources. LEDs have very specific light-output profiles which closely match the excitation profiles of commonly used fluorescent molecules. LED usage increases sensitivity by fully exciting the fluorophore and reducing non-specific light leakage, a problem often found when using broad-spectrum light sources. Additionally, the Modulus™ II Microplate Fluorescence Module uses an epifluorescent design to ensure a consistent measurement position. This pinpointed approach reduces the impact of volume fluctuation within small samples by reliably measuring at the same position from well to well.

The Modulus™ II Microplate Fluorescence Module accepts different Fluorescence Optical Kits for measuring a variety of fluorophores. Four standard optical kits are available to measure the most popular fluorophores including Hoechst dye, fluorescein, rhodamine, Cy3, and Cy5. In addition, custom optical kits can be readily made for non-standard applications. Optical kits can be easily exchanged in seconds and built-in software ensures that the installed optical kit matches the selected application protocol. Protocols for nucleic acids and proteins such as PicoGreen®, RiboGreen®, and Quant-iT™ assays are preprogrammed into the Modulus™ II Microplate for your convenience.

The Modulus™ II Microplate Fluorescence Module is designed as a user-installable module. This means that you can either buy the Fluorescence Module now or add it to your system later when your lab is ready to run fluorescence experiments. The ability to add modules as you need them gives you great purchasing flexibility. Installation is easy and takes less than ten minutes with the provided tool. There is no downtime or need for a service call.

Absorbance Features
- UV-Visible or Visible Modules
- Flexible filter system
- Reads single or dual wavelengths

Absorbance Module Filter Application Chart

Wavelength	Applications
260	DNA and RNA Quantitation
280	Protein Quantitation
450	ELISA, QuantiCleave™ Protease Assay
560	BCA™ Protein Assays
600	Bradford Protein Assays, Coomassie Blue Protein Assays, PeroXOquant™ Quantitative Peroxide Assay
750	Lowry Protein Assay

Absorbance Module
(User Installable)

The Modulus™ II Microplate Multimode Reader provides scientists with two different options for making photometric measurements. Both modules are user installable, so there is no downtime or need for a service call.

The Modulus™ II Microplate with an Absorbance Module provides measurements that are highly sensitive and cover a wide dynamic range. In addition, it is easy to run ratiometric absorbance-based assays to adjust for optical imperfections or to assess DNA purity. Simply use the color touch screen to select two desired wavelengths. The instrument has an easy-to-read screen that displays Optical Density (OD) values for each wavelength or a ratio of two wavelengths.

Visible Absorbance Module (400 - 800 nm)

The Visible Absorbance Module has a reading range of 0 - 5.0 OD with an accuracy that deviates less than 2%. This module comes with four factory-installed filters for measuring 450, 560, 600, and 750 nm. These filters accommodate the most common ELISA and protein assays. Additionally, you can customize the module by inserting a filter of your choice into either of two removable filter paddles.

UV-Visible Absorbance Module (200 - 1100 nm)

The UV-Visible Absorbance Module has a reading range of 0 - 4.0 OD with an accuracy that deviates less than 2%. This module comes with a 6-position filter wheel that includes filters for measuring 260, 280, 450, 560, 600, and 750 nm. These filters accommodate UV DNA and protein quantitation in addition to ELISA and protein assays. Like the Visible Absorbance Module, you can customize the UV-Visible Absorbance Module by substituting a filter of your choice into either of two removable filter paddles.

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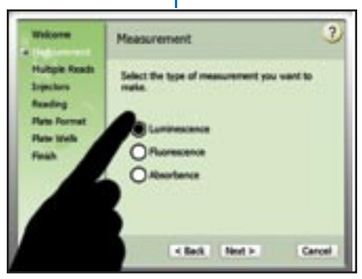
Intuitive User Interface

The Windows-based computer built into the Modulus™ II Multimode Microplate Reader offers dynamic user-interface capabilities. Simply choose from three options on the instrument touch screen to start setting up a run.

Create a New Protocol

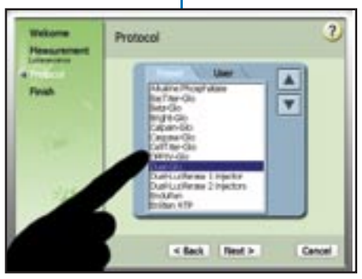


Use the NEW PROTOCOL wizard to create a customized protocol within the instrument software. The wizard guides you step-by-step through choosing read parameters, injection methods, plate wells to read, and in saving your newly created, unique protocol for future use.

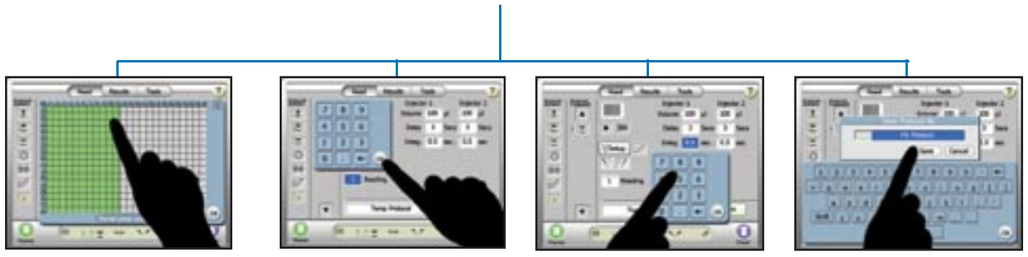
Instrument Control

From the INSTRUMENT CONTROL screen, simply move the parameter into the Protocol Composer list to create multi-parameter protocols. This method allows you to customize all settings necessary to obtain the perfect read for your application. Once your parameters are set, you have the option to save your settings for future use.

Select a Preloaded Protocol



By choosing SELECT PROTOCOL, you have access to the most popular assays from common reagent suppliers preprogrammed into the instrument by Turner BioSystems. You can also instantly access previously saved user-customized protocols. Simply choose the protocol of choice and touch START.



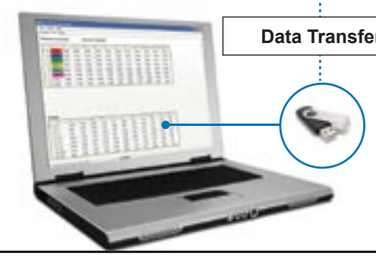
The Modulus™ II Microplate provides a simple and unique method for data handling. A USB stick is included and a USB drive is built into the instrument. To transfer data to either PC or Mac, simply copy the data from the Modulus™ II Microplate then move the USB stick to your computer. This method allows you to analyze your data when and where you find it most convenient.

The Modulus™ II Microplate combines a 6.6" color touch screen display with an onboard Windows-based computer. In addition, the intuitive user interface makes setting up a run and retrieving data fast and simple while maintaining the flexibility needed for advanced or custom protocols.

Protocol Selection

Preprogrammed protocols for common applications are factory-installed on the instrument and can be selected for easy sample analysis.

Data Transfer



Separate Channels

Luminescence Channel

Luminescence Applications

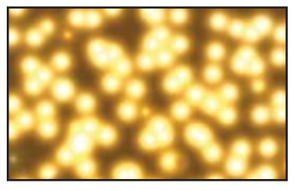
- Dual Reporter Assays
- Steady-Glo® Luciferase Assay System
- Flash Glow Luciferase Assays
- Cell Viability/ATP Assays
- Kinetics Assays

Fluorescence Channel

Fluorescence Applications

- Quant-iT™ Assays
- Fluorescein Measurement
- Cytotoxicity Assays
- Protease Assays

Absorbance Channel



Absorbance Applications

- EIA/ELISA
- BCA/Lowery/Bradford Protein Assays
- Protease Assays
- Peroxide Assays

Microplate Formats

The Modulus™ II Microplate Multimode Reader accepts 6, 12, 24, 48, 96, and 384-well plates conforming to the SBS plate standard.