microLAB 2017

LEARNINGWITHOUTLIMITSLEARNINGWITHOUTLIMITSLEARNINGWITHOUTLIMITS

MicroLab's FS-528 *FASTspec*™

- Smaller, safer, lower-cost samples
- More effective use of lab time
- Easy Visualization – Graphs to Concepts

NEW 5th Generation Features!

Constant Temperature Heater System - Sample Illumination - Rotating Field Magnetic Stirring
Real-time Tactile Control - Regulated Electroplating/Coulometry Power Supply - Cyclic Voltammetry

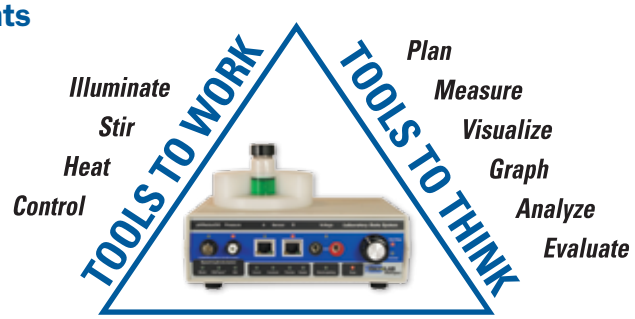
1.888.586.3274 • www.microlabinfo.com

*FAST*spec™ Scanning Spectrophotometry 360-880 nm

- Patented *FAST*spec™ Technology
- Transmission
- Absorbance
- Scatter
- Fluorescence
- Color Comparison
- Turbidity / Nephelometry
- Beer's Law
- Kinetics
- Spectral Profiles
- Backscatter Turbidity
- Spectrophotometric pH/Indicator Titrations

Basic Measurements

- pH/Redox /DO
- Gas Pressure
- Temperature
- Conductance
- Voltage/ Electrochemistry
- Time
- Counts/drops
- Thermocouple
- Light
- Volts/Millivolts
- Milliamperes



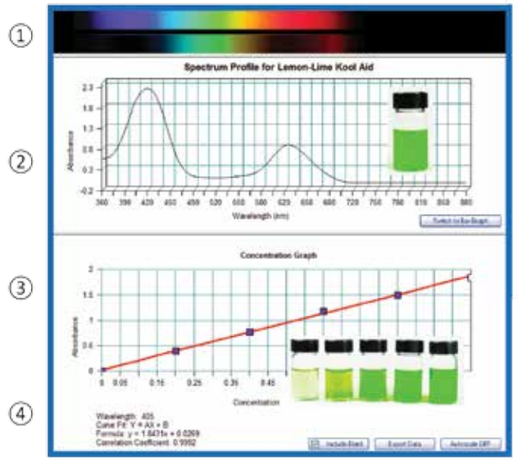
TOOLS TO MEASURE

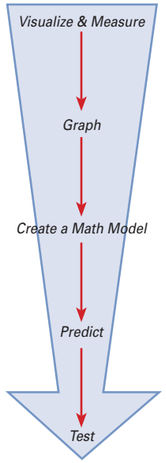
Temperature • Pressure • pH • Light/Spectrophotometry • Counts
Conductance • Voltage/Electrochemistry • Time

FS-528 FASTspec Overview
GENERAL CHEMISTRY • ANALYTICAL • ORGANIC • PHYSICAL • BIOCHEMISTRY • UNDERGRADUATE RESEARCH

Visualization, Beer's Law , and Mathematical Models: MicroLab's Integrated FASTspec™ Spectrophotometer

Our patented ***FASTspec***™ scanning spectrophotometer provides simultaneous 360-880 nm high resolution measurement of Fluorescence— Absorbance—Scatter—Transmission, plus 880 nm international standard turbidity measurements and stirred spectrophotometric titrations.



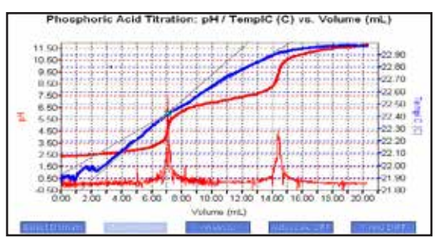


All MicroLab data appears live as the experiment runs, in simultaneous visual, digital and graphic displays. The ***FASTspec***™ Beer's Law data above illustrates this sequencing from ① visual display of the data (top, visual reference spectrum above the visual absorption spectra of a green sample), ② graphic presentation of the spectral absorbance, ③ creation of a graph and math model (equation) relating absorbance to concentration, and finally to ④ the ability to use the equation to predict the concentration of an unknown sample.

Note the correlation coefficient for the Beer's Law plot: 0.9992. Variation in the vials is the principal source of error. Vial sized 28mL and 14mL included, minimum sample volume 7 mL, path length 2.24 cm. An optional Model 186 vial adapter/vial pack adds two additional path lengths 1.66 cm and 1.1 cm and minimum volumes 4 mL and 1.5 mL.

pH, Drop Counting, and Titrations: MicroLab titrations may be performed in the stirred 28 mL spectrophotometer vial pictured above, or as a traditional larger scale laboratory titration. This graph shows data from a MicroLab phosphoric acid titration conducted in nested Styrofoam cups to track heat of reaction. The first derivative plot shows endpoints to 0.03 mL for the first and second hydrogen removal. The blue line shows a 0.9 degree Celsius increase in temperature during the titration, with the slope changing as the heat of reaction decreases after removal of the first hydrogen. The BNC input also accepts Redox, DO, and ion-specific electrodes.

High resolution data makes visualization easy. Students quickly turn graphs into concepts.

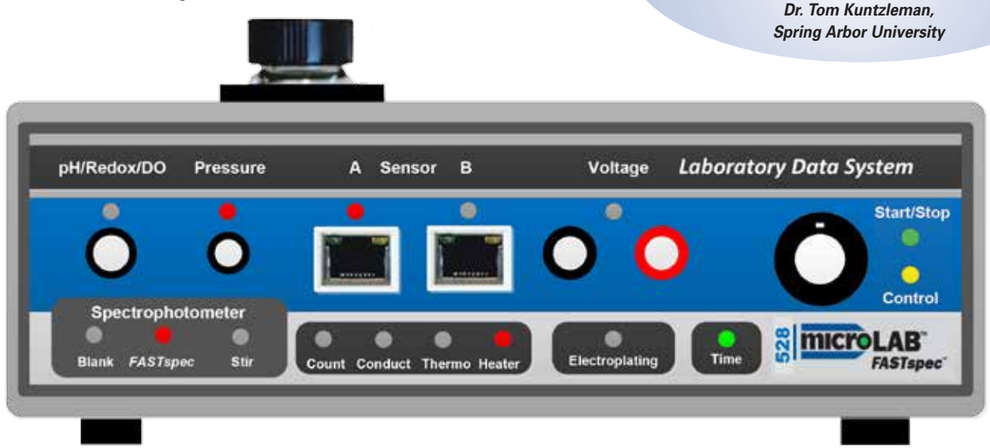


Integrated Sample Illumination —Titrations and Kinetics:

A removable translucent illuminated titration module fits over the spectrophotometer vial holder. It reflects light from software-controlled white, green, and red LED's mounted in the top of the cabinet. The white LED's provide adjustable backlighting so students can watch kinetic reactions fade, or indicators change color during a titration. Green and Red LED's signal "OK to add titrant", or "Stirring ". 28 mL vial shown.

Fluorescence and Scatter: MicroLab provides sixteen different excitation wavelengths 360-880 nm to observe or measure fluorescence or scatter. Fluorescence measurements, such as this web cam shot into the sample vial of chlorophyll excited at 405 nm, are made against a dark background and at right angles to the excitation beam. They can be very sensitive.

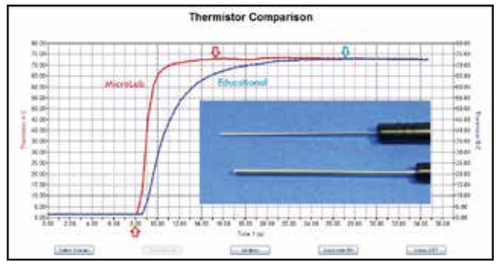
Pressure: 0-2000 torr, resolution ± 0.03 torr. Boyle's Law, absolute zero, vapor pressure, plant respiration. Leur hose fitting.



Integrated Stirring Motor: The 528 's stirring motor consists of small ferrite core coils placed below the vial. These produce a rotating magnetic field which spins the magnetic stir bar in the vial. Variable stir rate 1-12 revolutions per second, instantly reversible.

Temperature Control: A software-controlled 20-watt, test-tube sized heater will maintain a controlled temperature for kinetics experiments. It will fit in the 28mL spectrophotometer vial (top of page).

Counter, Conductance, Thermocouple, and Heater: Inputs are on the back panel. Conductance 0-2000, 0-20,000 uS, resolution ±0.03, ±0.3 uS. K thermocouple: -200 to + 1000 C, resolution ±0.04 C.



Milti-purpose Sensor Inputs: Two multi-purpose inputs accept sensors for temperature, light, and all of the MicroLab expansion modules such as Energy of Light, Cyclic Voltammetry, and others.

MicroLab uses exclusively industrial-grade sensors. These are rugged, withstand student use well, and have a long service life. When coupled with MicroLab's low noise, high resolution signal processing, they produce near research-grade data.

This chart compares the response of a MicroLab 103 Stainless Steel Thermistor with a standard educational thermistor as both are moved from ice water to water at 73 degrees C.

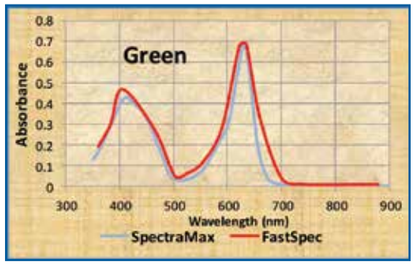
The MicroLab thermistor will track the experiment almost three times better than the educational thermistor.

I'm continually amazed at the research quality data we get from MicroLab. We can do things in teaching and undergraduate research at a small institution that we never dreamed possible.

Dr. Tom Kuntzleman, Spring Arbor University

Spectral Profiles:

Spectral profiles serve two purposes: (1) to choose an analytical wavelength for Beer's Law experiments, and (2) to identify unknown compounds by comparing their spectral profiles with known compounds.



Since UV-VIS molecular absorption spectra change smoothly with wavelength, a mathematical curve fit to ***FASTspec***™'s accurately-spaced narrow-band absorbance measurements produces a spectral profile very similar to measurements made by a research-grade spectrophotometer.

FASTspec™ point measurements report photometric precision of better than ± 0.1%. Beer's Law and Kinetics experiments produce excellent results. One-hundred point spectral profile data may be exported directly to Excel.

MicroLab has made our labs much more economical. Experiments use smaller samples, run more quickly, and students use their time more effectively.

Virginia Wairegi, Rice University

Real Time Control: The real-time rotary control is new to the MicroLab interface family. Students can use it to control software-selected experimental variables such as stir rate, heater power, voltage applied to electro-chemical cells, etc. The "push" function is used for start/stop or to step beween user-controlled variables.

Voltage: The Electrochemical Series and Electroplating: The two "Voltage" banana jacks play double duty. In the normal operating mode, they serve as a **voltage input port** with four ranges - ± 10 volts, ± 2.5 volts, ± 1.0 volts, and ± 100 mV. This serves electrochemical series and Nernst Equation experiments.

In the **Electroplating** mode, these jacks provide an adjustable regulated 0-5 volts, 750 mA power supply for electroplating / coulometry experiments including atomic mass , Avogadro's Number, and coulometric titration experiments. Software calculates coulombs and moles of electrons delivered.

Timers: Two automatic or programmable timers plus real-time clock. Time resolution 0.001 sec.

Cyclic Voltammetry: The optional Model 170 Cyclic Voltammetry module plugs into MicroLab Port A. It uses Pine Instruments screen-printed electrodes and can scan with ± 2500 mV 1-20 mV steps.

It used to be that students would spend a three-hour lab gathering data. Now, students can focus on what the data means; this enables them to decide quickly whether or not they need to do the experiment over. The discovery process—how the numbers relate to a concept—takes place in the lab, not when the students are writing their lab report.

Dr. Carolyn Mottley, Luther College

MicroLab FS-528 Equipment Packages

Spectrophotometry		Intro FS-528-I	Advanced 528-A	Titrations FS-528-T	Conductance FS-528-C	Comprehensive FS-528-C2
Absorbance/Transmission Beer's Law, Kinetics Fluorescence, Turbidity, Backscatter Beer's Law path length experiments Controlled temperature kinetics	Integrated ***FASTspec 380***-880 nm scanning spectrophotometer	●	●	●	●	●
	Model 183 Vial Pack	●	●	●	●	●
	Model 186 multi-path length Adapter/Vial pack					●
	Model 257 20 Watt Heater		●	●	●	●
Thermochemistry / Gas Laws						
Freezing/boiling points Supercooling Heat of reaction Absolute zero Boyles Law Vapor pressure	Model 103 Thermistor	●	●	●	●	●
	Integrated 0-2 atm pressure sensor	●	●	●	●	●
	Model 2011 Gas Pressure Syringe	●	●	●	●	●
	Model 116 Gas Pressure Apparatus					●
	Model 109 Stainless Steel Thermocouple					●
Acid-Base Chemistry / Titrations						
Titrations Visual and spectrophotometric indicator end-points.	Model 106 Sample Illumination Module	●	●	●	●	●
	Integrated rotating magnetic field stirring	●	●	●	●	●
pH, buffers, Ka, Indicators, titration curves, spectrophotometric titrations	Model 121 pH electrode		●	●	●	●
	Model 107 pH electrode holder		●	●	●	●
	Micropipette, 100 µL		●	●	●	●
Drop-counting titrations Titration Curves 1st & 2nd derivative plots	Model 226 IR Drop Counter, non-corroding clamp			●	●	●
	Model 154 Constant Volume Drop Dispenser, non-corroding clamp			●	●	●
Reflected light indicator titrations	Model 112 Light sensor					●
Electrochemistry						
Electroplating, Avogadro's number Atomic Mass	Integrated 0-5 volt, 750 mA regulated power supply	●	●	●	●	●
Half-Cells Electrochemical Series, Nernst Equation	Model 133 Voltage Lead	●	●	●	●	●
	Model 151 Metal Kit		●	●	●	●
	Model 152 Half-cell module		●	●	●	●
Ionization Conductance Titrations	Model 160 Conductance Electrode				●	●
Redox Titrations	Model 125 Redox Probe					●
Scientific Package Total		**$ 789**	**$ 974**	**$ 1125**	**$ 1215**	**$1490**

Atoms First / Visual Spectrometer Visual Spectrometer, Fiber Optic reference Spectrum Adapter, Adjustable Color Temperature White Light Source	**$ 299**

Atoms First Planck's Constant / Camera package			
Planck's Constant / Energy of Light	Model 214 Energy of Light Module	**$ 129**	Atoms First course organization emphasizes spectra, atomic structure, and atomic models early in the course. This content is not well supported by traditional "wet labs". MicroLab "Atoms First" experiments provide hands-on experience with light and color, Planck's Law, atomic spectra, and atomic models.
Web camera package with camera mount for visual spectrometer. Calibrated atomic spectra measurements and atomic models.	Model 243 Web camera and mount	**$ 119**	

The MicroLab Advantage

With three U.S. patents recently granted, MicroLab's technology and software are at the cutting edge. MicroLab's instruments are used in intro, general, analytical, physical, organic, and biochemistry laboratory courses, in undergraduate and graduate research, and in industrial and research laboratories.

Faculty can easily integrate MicroLab into existing laboratory curricula. They will save lab time, reduce sample size, cost, and prep time, and improve safety. Students will gain high resolution measurements and instant visualization of data. One MicroLab FS-528 can replace multiple single-purpose instruments.