i-LAB™ S-560

User's Manual

Preliminary Version 1.0

microSpectral Sensors

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1 Getting Started

Welcome

Welcome to the *i-LAB*™ system, a brand new concept in spectral measurement.

The ***i-LAB*** features a unique, miniaturized full-spectrum measurement system based on a proprietary imaging chip. The spectral imaging chip is produced in colLABoration with a leading company in thin-film deposition technology.

The 1 mm x 8 mm imager is based on silicon technology, and allows measurements in the ultraviolet (UV), visible (VIS), and near-infrared (NIR) spectral regions. The device is incorporated into a package described as a spectral engine, which includes the light/energy source, sensor and the data acquisition electronics. The ***i-LAB*** integrates this engine within a handheld personal micro-spectrometer, known as the ***i-LAB S-Series***. The ***i-LAB S-560*** operates in the visible region from 400-700nm.

What's in the Box

Your ***i-LAB*** system typically includes the following items:

- ***i-LAB***
- Protective cap
- 3 AA batteries
- 3 samplers
- USB cable
- Screwdriver
- User's Guide
- CD ROM with *i-LAB Spectrum* software & User's Manual

Safety

As with all LABoratory instruments, handle fluids in accordance with applicable Material Safety Data Sheets (MSDS).

Computer System Requirements

- Platform: PC
- Media Format: CD-ROM or Download

- System Requirements: Operating system: Microsoft Windows (R) Vista, Microsoft Windows XP with Service Pack (SP) 2
- CPU: 500 megahertz (MHz) processor or higher
- RAM: 256 megabyte (MB) RAM or higher
- Hard Disk Space: 2 gigabyte (GB)
- CD-ROM or DVD drive
- 1024x768 or higher resolution monitor
- Internet Explorer 6.0 or later, 32 bit browser only. Internet functionality requires Internet access (fees may apply).

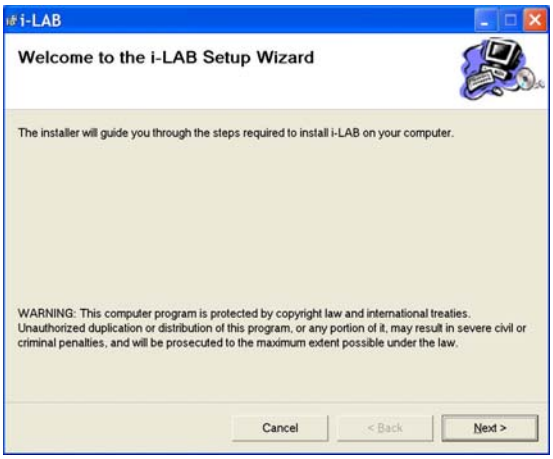
Installing i-LAB Spectrum – Windows XP

WARNING: This computer program is protected by copyright law and international treaties. Unauthorized duplication or distribution of this program, or any portion of it, may result in severe civil or criminal penalties, and will be prosecuted to the maximum extent possible under the law.

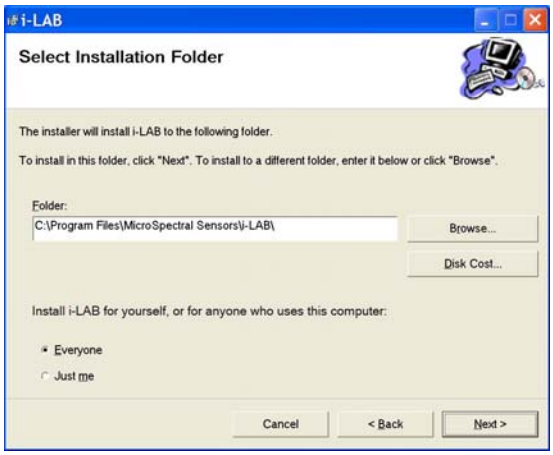
There are two steps to installing the i-LAB software. The first step is to install the Spectrum Software and the second step is to install the i-LAB driver.

Installing i-LAB Spectrum Software

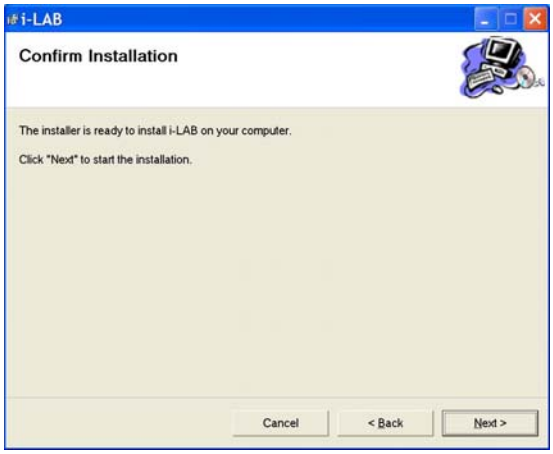
Insert the *i-LAB Spectrum* software CD into your PC's CD Player. The "Welcome to i-LAB Setup Wizard" presents itself:



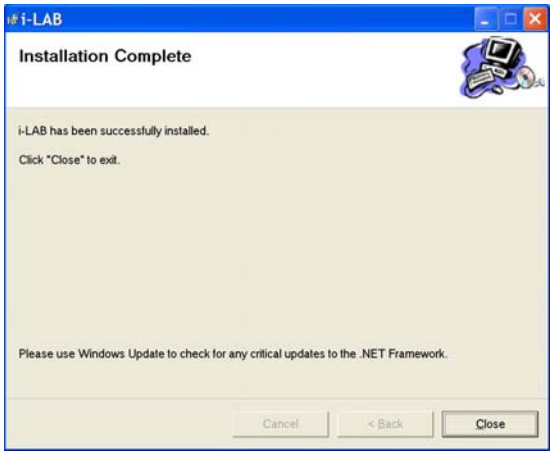
Press the "Next" Button to continue.



Choose and installation folder, then click “Next” to continue.



Click “Next” to begin the installation.

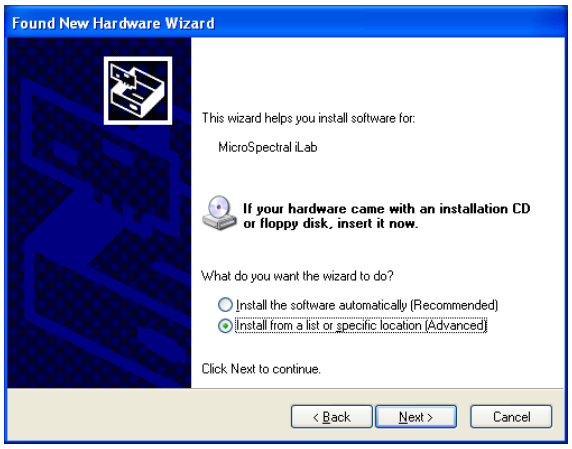


Click “Close” to finish the installation. The Spectrum Software is now installed on your system.

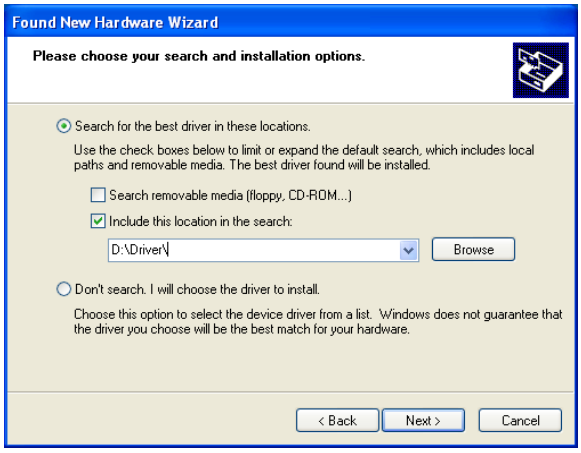
Installing the i-LAB Driver

Turn on the ***i-LAB*** device and plug ***i-LAB*** into your PC using the included USB cable as described in Connecting i-LAB and Your PC. The Windows "Found New Hardware Wizard" will present itself:

Select "**No, not this time**" and press the "**Next**" button to continue.



Select "**Install from a list or specific location (Advanced)**, then click "**Next**" to continue.



Select the "**Search for the best driver in these locations**" option, and then click the "**Include this location in the search**" checkbox.

In the textbox, enter or browse for the **path** of where the ***i-LAB* Driver** is located. The driver is located on the CD ROM in the 'Driver' directory. After you have entered or chosen the proper location, press the "**Next" button** to continue.

After successful installation, click the "**Finish**" button. You may now use your ***i-LAB*** device in concert with the *i-LAB Spectrum* program.

Installing i-LAB Spectrum – Windows Vista

WARNING: This computer program is protected by copyright law and international treaties. Unauthorized duplication or distribution of this program, or any portion of it, may result in severe civil or criminal penalties, and will be prosecuted to the maximum extent possible under the law.

NOTE: The *i-LAB Spectrum* program must be run with Windows **Administration** privileges. To run a program as a Windows Administrator, right click on the program executable and select the 'Run as Administrator' option.

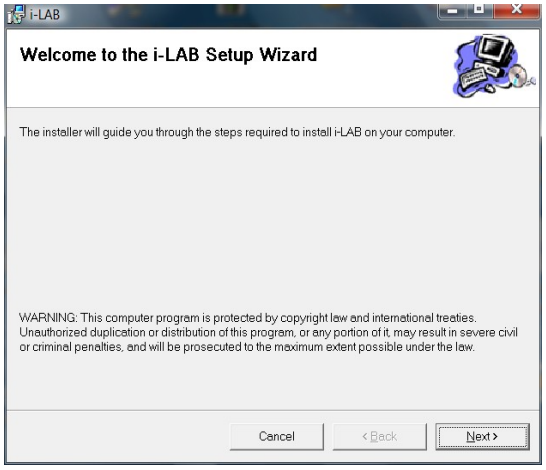
There are two steps to installing the i-LAB software. The first step is to install the Spectrum Software and the second step is to install the i-LAB driver.

Installing the i-LAB Spectrum Software

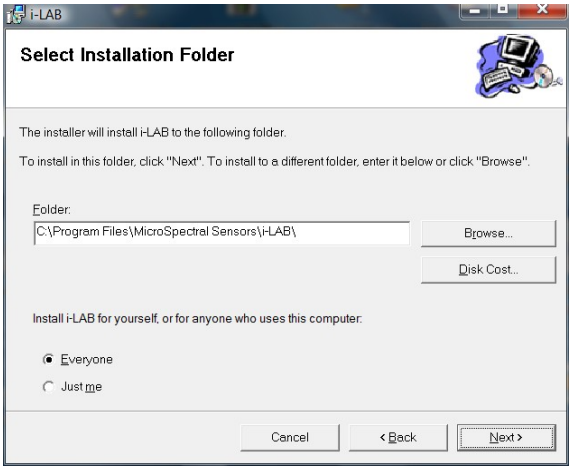
Insert the *i-LAB Spectrum* software CD into your PC's CD Player. If the "Autoplay" window presents itself:

Click "Run setup.exe" to begin installing the software.

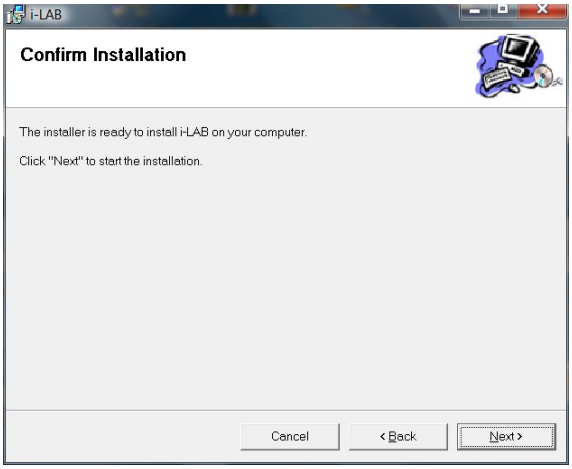
If the "Welcome to i-LAB Setup Wizard" presents itself:



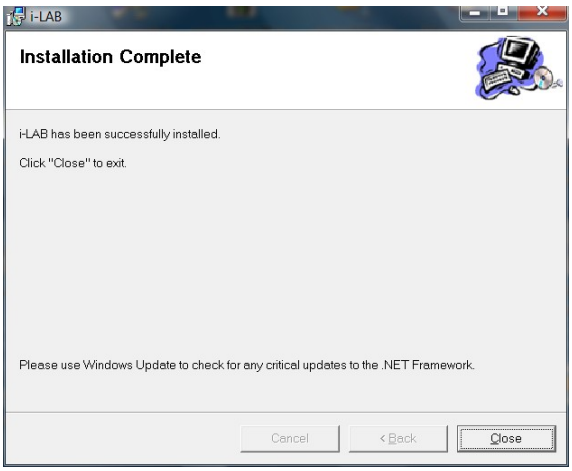
Click on "Next" to continue.



Choose and installation folder, then click “Next” to continue.



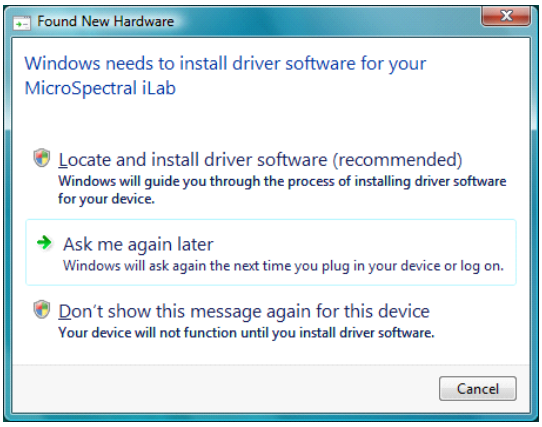
Click “Next” to begin the installation.



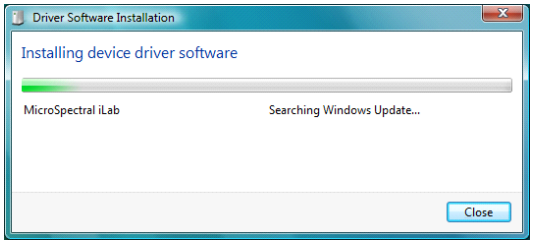
Click “Close” to complete the installation.

Installing the i-LAB Driver

Connect the ***i-LAB*** device as described in Connecting i-LAB and Your PC. You will then be presented with the Windows "Found New Hardware" wizard:

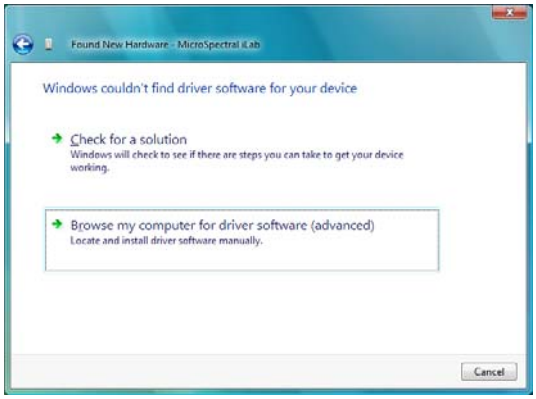


Click the "**Locate and install driver software**" option. Windows Vista security may ask you to continue.

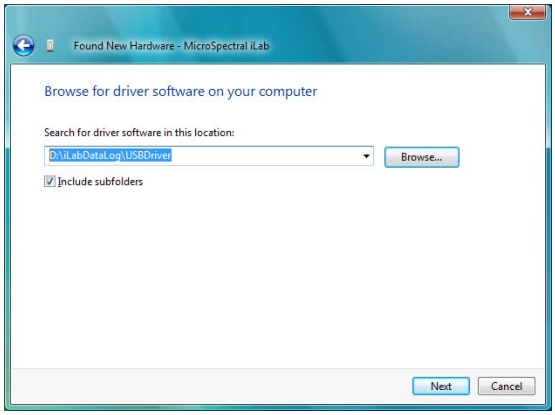


Windows will attempt to automatically install the driver, and after approximately one minute you will be presented with the next screen.

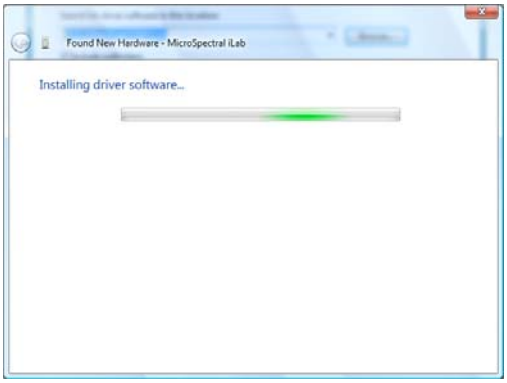
If you have the ***i-LAB*** Installation CD, insert it now. Otherwise, press "**I don't have the disc. Show me other options**"



After selecting "I don't have the disc..," select the "**Browse my computer for driver software (advanced)**"



In the textbox, enter or browse for the **path** of where the ***i-LAB* Driver** is located. The driver is located in the 'Driver' directory on the CD ROM. After you have entered or chosen the proper location, press the "**Next" button** to continue.



Windows Vista will install the driver as needed. After successful completion, you may now use your ***i-LAB*** device in concert with the *i-LAB Spectrum* program.

License Key

Your license key will enable the *i-LAB Spectrum* features depending on whether you purchased *i-LAB Spectrum Lite*, *i-LAB Spectrum Standard*, or *i-LAB Spectrum Pro*. You will receive your license key via email when you purchase the *i-LAB Spectrum* software.

1. Launch *i-LAB Spectrum*, typically **Start, Programs, microSpectral Sensors, i-LAB Spectrum**.
2. From the Main menu at the top of the screen, select **Tools, Upgrade Your i-LAB Spectrum Software**.
3. Type in your license key and then click **Upgrade**. The license key will enable your *i-LAB Spectrum* features. Check the application name at the top of the screen to verify that the correct version of *i-LAB Spectrum* is installed.
4.

i-LAB Embedded Software (Firmware)

Your ***i-LAB*** comes with the embedded software pre-loaded at the factory.

To update the embedded software, see Updating Your i-LAB Device.

Technology

The ***i-LAB*** measurement system consists of a handheld controller (the ***i-LAB***) with single-use, disposable pipette-style samplers and several options for PC software functionality. The ***i-LAB*** is equipped with a light source, spectral detection electronics, and embedded software designed to manage the acquisition, storage, processing, logging, and transfer of spectral data. The Lite version of the PC software allows for data transfer to/from the ***i-LAB*** and method downloading from the web. The Standard and Pro versions provide higher-level functions from spectrum acquisition to multivariate modeling and library functions.

i-LAB

The ***i-LAB*** is the handheld controller that, along with the fluid sampler, is used to take spectral measurements.

Light Source

The light source is a set of spectrally balanced Light Emitting Diodes (LEDs) controlled by the embedded software. The combination of LEDs covers the full spectral range from 400 nanometers to 700 nanometers. The LEDs are calibrated at manufacturing time to insure optimal spectral emission.

Fluid Sampler

The pipette-style sampler contains a thin, flat optical window constructed from polycarbonate and a 45-degree from normal mirror pair that act as the retro-reflective element. When the LEDs are activated, light is directed from the LEDs, through the fluid sample, back into the detection system.

Spectral Detection Electronics

The detection system consists of a fiber faceplate that feeds into a Linear Variable Filter (LVF) and a sensor. The sensor module consists of a photo diode array (PDA) packaged with the LVF.

Embedded Software

The ***i-LAB*** contains embedded software that allows you to perform spectral measurements, store and view measurement results, and transfer results to the PC. The ***i-LAB*** ships with default methods installed at the factory called **Scans**. You can take common measurements using the Scans, or download additional methods to your ***i-LAB*** device using the *i-LAB Spectrum* software.

The embedded software also contains setup functions that allow you to customize your device preferences.

Spectral Results

The device stores 128 points of raw spectral data per measurement. The spectral measurements are graphed as transmittance data, where

X (horizontal axis) is the frequency in nanometers of wavelength
Y (vertical axis) is the intensity at the corresponding frequency in X

For each sample, the device takes a series of measurements: dark current, background, and sample. The dark current measurement is an intensity reading with the sampler chamber filled with neat solvent only and the LEDs off. The background measurement is a measurement with the sampler chamber filled with neat solvent only and the LEDs powered on. The sample reading is a measurement with the sampler chamber filled with the actual sample and the LEDs powered on.

The ***i-LAB*** performs a ratio of differences to create a Sample Ratio spectrum:

$$\frac{\text{Sample measurement} - \text{dark current measurement}}{\text{Background measurement} - \text{dark current measurement}}$$

Normalization and re-sampling are then applied to convert the spectrum to a Uniform Data Format (UDF). The normalization in X converts the range to a standard, default range of 400 to 700 nm (X Spectrum UDF). Normalization and cubic spline re-sampling in Y is applied to interpolate the 301 points in the new range from the raw data.

Calibration

Each ***i-LAB*** device is calibrated at the factory to optimize the LED intensity and wavelength frequency as well as normalize the device for any variations. In addition, the embedded software performs a calibration at the time of measurement to account for variation in the samplers.

i-LAB Spectrum

i-LAB Spectrum is the PC program that allows you to extend the power of your ***i-LAB*** device. *microSpectral Sensors* offers three levels of functionality, depending on your needs.

i-LAB Spectrum Lite

i-LAB Spectrum Lite is a limited function package that allows you to transfer your spectral data from your ***i-LAB*** to the PC and to download methods from the PC to your ***i-LAB***. With ***i-LAB*** connected to your PC, you can run standard built-in methods from within *i-LAB Spectrum*. You can also organize and download methods from the web onto your ***i-LAB***.

i-LAB Spectrum Standard

In addition to the functionality in *i-LAB Spectrum Lite*, *i-LAB Spectrum Standard* allows you to create methods and download them to the ***i-LAB***, as well as increased data handling, result computation, and reporting.

i-LAB Spectrum Pro

The *i-LAB Spectrum Pro* package is the enhanced version that includes all of the functionality in *i-LAB Spectrum Lite* and *i-LAB Spectrum Standard*, plus multivariate modeling, vector-based spectrum matching, and library functions.

Methods

A method is a measurement routine comprised of a series of steps. These steps allow you to run sophisticated spectral operations from the acquisition of the spectrum to calculation and processing of the results.

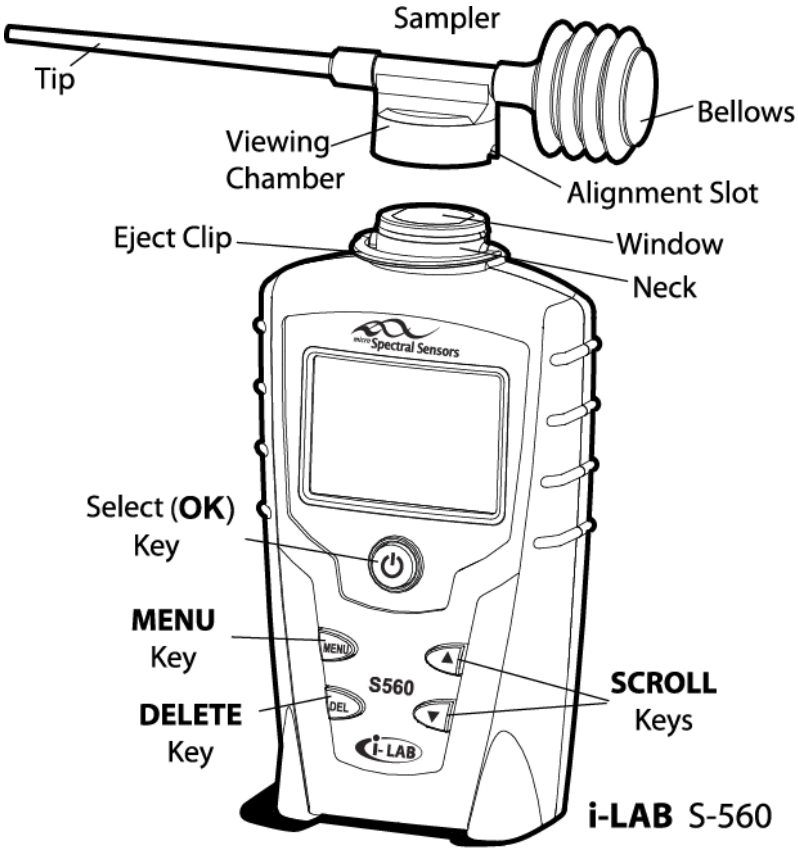
microSpectral Sensors has created a collection of methods ranging in complexity from simple scans to multiple steps with complicated spectral mathematics. Your ***i-LAB*** ships with a set of default methods called Scans that are available to you immediately. The PC software, *i-LAB Spectrum*, contains additional example methods of varying complexity that you can download to your ***i-LAB***. You can also purchase methods from the *microSpectral Sensors* website at www.microspectralsensors.com.

Spectral Library

A library is collection of spectra. A library spectrum could be a standard or it could be a result that you have collected. Many method steps perform comparisons and calculations using spectral results and library spectra. When you download methods from *i-LAB Spectrum* to your ***i-LAB***, the system will also download all of the spectra in your Spectral Library. Likewise, when you purchase a method from *microSpectral Sensors*, the download will include any library spectra associated with the method.

2 Using the i-LAB Handheld

Operation



Power On

To turn on your ***i-LAB***, press and release the Select button.

Connecting to a PC

When connecting your ***i-LAB*** to a PC, turn on the ***i-LAB***, wait for the Ready screen to display, and then connect to your PC using the enclosed USB cable.

If you do not turn on the ***i-LAB*** first, you may encounter a Windows “Found New Hardware” error. If this occurs, *i-LAB Spectrum* will not be able to recognize ***i-LAB***. Disconnect your ***i-LAB*** and reconnect as described above.

Auto Off

The ***i-LAB*** will automatically turn itself off after 2 minutes of inactivity. To adjust the Auto-off timer see the section, Auto-Off Timer.

Manual Off

Press and hold the Select Button for 3 seconds.

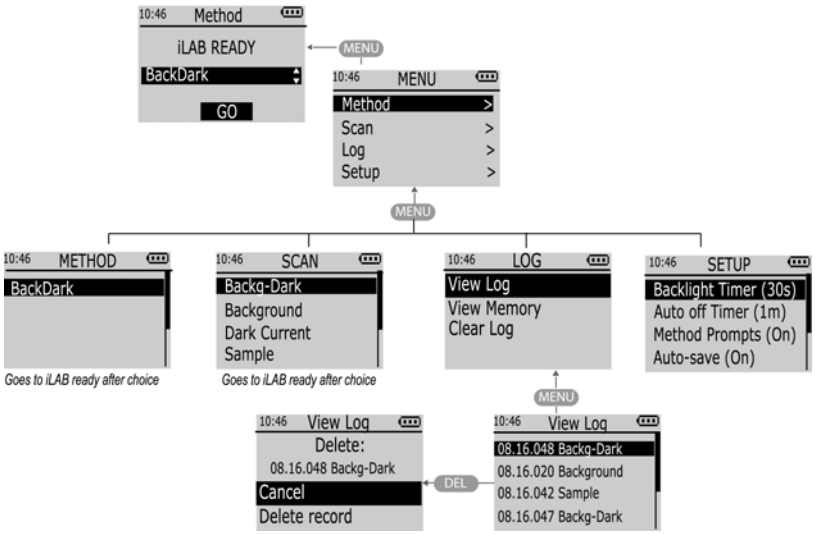
Button Navigation

The ***i-LAB*** provides five buttons for operation and navigation.

Select

The **Select** button is the center button directly under the LCD screen. Press the **Select** button to power the unit on and off, to select a highlighted option, or to move to the next step in a measurement sequence. When directing you through a sequence of steps, the ***i-LAB*** will display a label for the **Select** button, such as **OK** or **GO**.

MENU



Press **MENU** one or more times to view the main Menu options.

While in the menu, each time you press the **Select** button to choose the highlighted option, you will step through the menu tree until you reach the lowest level for that branch of the menu tree. To return, press **MENU** successively, stepping up with each press until you reach the main Menu again.

DEL (Delete)

DEL removes the record of a measurement and its associated results from the Handheld.

To delete a measurement record, press **MENU**, select **Log**, then **View Log**. Scroll to select the measurement. Press the **Select** button if you wish to view the results. After viewing, press **MENU** once then press **DEL**. Confirm by selecting Delete record.

SCROLL KEYS

The **Scroll** keys are the up and down arrow keys on the right side of the device. Press the **Scroll** keys to move the cursor up or down through a list. A scroll bar will appear to the right when a list extends past the viewable region of the screen.

Methods

To view the list of user-defined Methods currently stored on your ***i-LAB***, press **MENU** and select **Method**. Use the **Scroll** keys to navigate through the list of methods and press the **Select** button to select a method for measurement. The **Ready** screen will display with the selected method highlighted.

Scans

To view the list of default methods, or Scans, on your ***i-LAB***, press **MENU** and select **Scan**. Use the **Scroll** keys to navigate through the list of Scans and press the Select button to select a Scan for measurement. The Ready screen will display with the selected Scan highlighted.

Setup

The Setup options allow you to configure your ***i-LAB*** to suit your preferences. To adjust the settings on your ***i-LAB***, press **MENU** and select **Setup**. The list of Setup options will display followed by the current setting in parentheses.

Backlight

You can set the screen backlight to turn off after **15**, **30**, or **45 seconds**, after which time the first key press will turn the backlight back on. (The next key press will operate normally.) You can also set the backlight to **Off**. Turning the backlight off or to a low setting will save battery power. The default setting is **30 seconds**.

Auto-Off Timer

The ***i-LAB*** will power off after **1**, **2**, or **3 minutes** of inactivity. This Auto-off function helps preserve power when the device is not in use. The default setting is **2 minutes**.

Method Prompts

The Method Prompts On/Off option allows you to design methods with detailed prompts to aid new users, but allows an experienced user to turn these prompts off to speed sampling time. The default setting is **On**.

Auto-Save

Set the Auto-save option to **On** when you want your ***i-LAB*** to automatically save results from each measurement. Set the option to **Off** when you want the option to save or discard results at the end of a measurement. The default setting is **Off**.

Sound

When the Sound is **On**, the ***i-LAB*** will emit a short beep with each key press, and longer beeps during measurement steps. Sound **Off** suppresses all sounds. The default setting is **Off**.

Time/Date

Use the Time/Date option to set your ***i-LAB*** clock. Note that time is set and displayed in 24-hour time.

About

The About screen displays the following information about your ***i-LAB***:

- Serial number
- Model
- Spectral range in nanometers
- Firmware revision
- Hardware revision

Log

The Log stores the date, time, and sample number for each measurement you've taken along with its saved results. The Sample number is a sequential number that increments each time you take a measurement. You can view the log at any time, as well as upload your results to *i-LAB Spectrum* where you can view more detail, analyze and compare results, and create reports.

View Log

To view the Log, press **MENU**. Select **Log** then **View Log**. Use the scroll keys to navigate through the list of measurements and press the Select button to view a selected measurement. If there is more than one result for a measurement, a scroll bar will display.

View Memory

To check the status of your ***i-LAB*** memory, press **MENU**. Select **Log** then **View Memory**. The available memory will display.

Clear Log

To delete ***ALL*** of the measurements and results stored in your ***i-LAB***, press **MENU**. Select **Log** then **Clear Log**. If you are sure you want to erase all of your log data, select **Erase all**.

If you need to clear the ***i-LAB*** memory but you want to save your results, upload your results to *i-LAB Spectrum*. The upload process will save your results on the PC and clear the ***i-LAB*** log.

Taking a Measurement

i-LAB Ready

At power on, the Ready screen displays with the current Method or Scan selected.

To scroll through the available Scans or Methods, press the **Scroll** buttons (up/down arrows).

To change the measurement type, press **MENU**, and then select **Method** or **Scan**. Press the **Scroll** buttons to navigate through the list and press the Select button to select.

To take a measurement using the selected Method or Scan, select **GO** by pressing the **Select** button. The ***i-LAB*** will direct you through the measurement process.

Taking a Measurement

1. **Power the *i-LAB* on.** The **Ready** screen will display with the active method highlighted.

   (Press the **Scroll** buttons to select a different method or scan; press **MENU** to view all scans or methods.)

   Select **GO**. Follow the method instructions, selecting **OK** when finished with each step.

2. **Attach a new sampler.** When the "Attach new sampler…" instruction appears, select a new, dry sampler of the type indicated on the screen. If you use a different sampler type (i.e. a 20mm sampler instead of a 10mm sampler), your results may be inaccurate. For optimal results, we recommend that you use a new sampler for each measurement.

   Align the slot on the sampler with the tabs on the ***i-LAB***. The alignment is symmetric, allowing for left or right-handed use. ***Be sure to snap the sampler firmly in place.***

   Do not select OK.

   Once you have attached the sampler, do not remove it until instructed to do so.

3. **Flush the sampler with solvent.** Dip the tip of the sampler into a pure, neat version of your solvent (no sample). For water-based sampler, this would be pure water, for alcohol-based samples, pure alcohol, etc.

   Depress the bellows fully, and then release the bellows, drawing the solvent into the sampler. Remove the tip from the solvent and depress the bellows again to expel and discard the solvent. Repeat this step once, and then draw the solvent fluid into the sampler.

   This step clears contaminants from the sampler and reduces the likelihood of bubbles forming inside the chamber. Using a neat solvent (blank) provides optimal measurement accuracy.

4. **Perform baseline calibration readings.** Select **OK**. The ***i-LAB*** will perform a calibration, or baseline, reading. ***It is normal for the backlight to turn off during the measurements.***

5. **Fill sampler with your sample.** When the "Fill sampler…" instruction appears, dip the tip of the sampler into your sample. Depress the bellows fully, and then release the bellows, drawing the sample into the sampler. Remove the tip from the sample and depress the bellows again to expel and discard the sample. Repeat this step once, and then draw the sample fluid into the sampler.

   Stand the ***i-LAB*** upright on a level surface. The ***i-LAB*** should remain in this position until the measurement is complete.

Select **OK**.

The screen will display “Acquiring…” while the ***i-LAB*** takes the measurement. ***It is normal for the backlight to turn off while measuring.***

6. **Review results and eject sampler.** When the measurement is complete, the ***i-LAB*** may display a result. If so, select **OK** to continue.

   When instructed, eject the sampler. To do this, depress the eject clip located under the sampler to the front of the ***i-LAB***. Remove the sampler and select **OK**.

   CAUTION:
   Handle and dispose of the used sampler and fluid in accordance with the Material Safety Data Sheet (MSDS) for the sampled fluid.

7. **Complete the method.** Follow the instructions to complete the method.

   Depending on the method and on your settings, the ***i-LAB*** may display results, ask you to take another measurement, ask you to choose to save or discard the results, or simply return to the Ready screen.

3 Using i-LAB Spectrum

Screen Layout

The program title displays at the top of the screen in the blue border.

Launching and Closing

Lite, Standard, Pro

Launch i-LAB Spectrum

1. In MS Windows XP or Vista, navigate to the program through **Start, Programs, microSpectral Sensors, i-LAB Spectrum**.

   i-LAB Spectrum Lite, Standard, or Pro will open, depending on the version that you have purchased.

Close i-LAB Spectrum

1. From the **File** menu, select **Exit**.

   The program will end all processes and close.

Connecting i-LAB and Your PC

Lite, Standard, Pro

You will need your ***i-LAB***, the USB cable delivered with your system, and a PC with *i-LAB Spectrum* installed.

When connecting your ***i-LAB*** to a PC, first turn on the ***i-LAB***, wait for the Ready screen to display, and then connect to your PC using the enclosed USB cable. If you do not turn on the ***i-LAB*** first, you may encounter a Windows **Found New Hardware** error. If this occurs, *i-LAB Spectrum* will not be able to recognize the ***i-LAB***. Disconnect your ***i-LAB*** and reconnect as described here:

Connect i-LAB and your PC

1. Launch ***i-LAB Spectrum*** on your PC.
2. Power your ***i-LAB*** on.
3. Connect your ***i-LAB*** to your PC using the enclosed USB cable. The USB icon will display on the ***i-LAB*** screen.

Your ***i-LAB*** is ready for viewing, uploading or downloading when a USB icon displays on the device screen.

My Methods

Lite, Standard, Pro

My Methods contains folders to organize methods. *i-LAB Spectrum* ships with a set of default methods, or Scans, stored under **Defaults** and a set of example methods stored under **Examples**. You can add a new folder, remove folders, and move methods from one folder to another.

Locate **My Methods** in the left Menu pane. If double down arrows display, click to expand the My Methods selections.

Method Folders

Add a folder

1. At the bottom of the left **Menu** pane, select **Add Folder**. A new folder will display under My Methods with the temporary name highlighted.
2. Type the name of the folder and press **Enter**.

Remove a folder

1. In the left **Menu** pane under My Methods, click on a folder.
2. At the bottom of the left Menu pane, select **Add Folder**; or right-click and select **Remove**.
3. When the message dialog asks you to confirm, select **Yes**. *i-LAB Spectrum* will remove the folder and all of its contents.

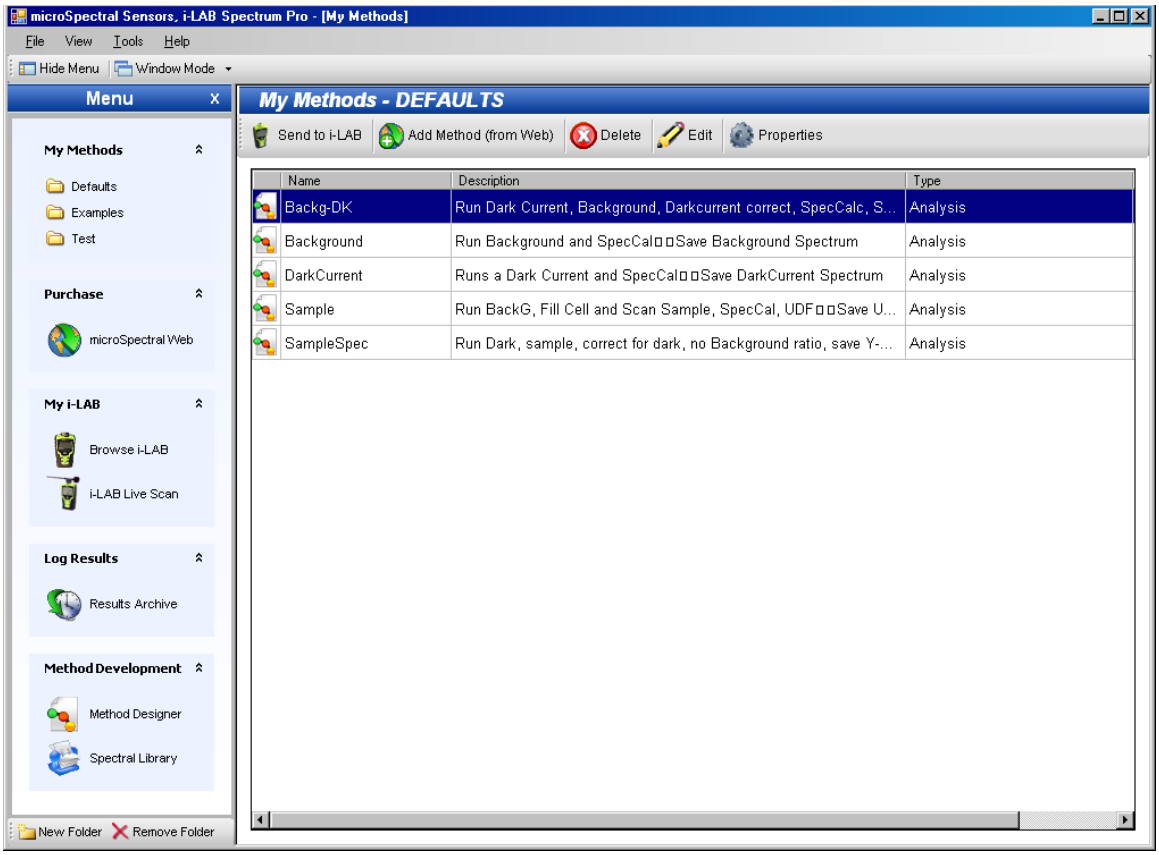
Move method from one folder to another

1. In the left **Menu** pane under **My Methods**, click on the folder that contains the method you wish to move. The **My Analysis Methods** grid will display.
2. Click and drag the method from the grid to the folder in the left **Menu** pane. The program will remove the method from the grid to the new folder.

My Analysis Methods

When you select a Method folder, *i-LAB Spectrum* displays a grid on the right listing all the methods with method name, description, type, and sampler designation.

Menu pane, My Methods, Defaults:



You can view the properties of a method, delete a method, add a method you have purchased from the *microSpectral Sensors* web site, or send a method to your ***i-LAB***.

Send to i-LAB

1. Power your ***i-LAB*** on.
2. Connect your ***i-LAB*** to your PC using the enclosed USB cable. The USB icon will display on the ***i-LAB*** screen.
3. In *i-LAB Spectrum* in the left Menu pane, click on a folder under **My Methods**. The list of methods will display.
4. Click to highlight a method that you want to download to your ***i-LAB***.
5. In the toolbar directly above the list of methods, select **Send to i-LAB**.
6. When you are asked to confirm, click **Yes**. The program will communicate with the ***i-LAB*** to download the chosen method.
7. When the Download successful message displays, click **Yes**.

Add method from web

You must first purchase a method from the *microSpectral Sensors* website, www.microspectralsensors.com. When your purchase is complete, you will receive a license key. You will need the license key to add the method to *i-LAB Spectrum*.

1. Purchase a method from www.microspectralsensors.com and note your license key.

2. In *i-LAB Spectrum* in the left Menu pane, click on a folder under **My Methods**. The list of methods located in the selected folder will display.
3. In the toolbar directly above the list of methods, select **Add Method (from Web)**.
4. Type your license key, and then press **Download**.
5. The method will be downloaded into *i-LAB Spectrum*.

Delete

You can delete example methods and purchased methods from *i-LAB Spectrum*.

1. In the left Menu pane, click on a folder under **My Methods**. The list of methods located in the selected folder will display.
2. Click on the method you wish to delete.
3. In the toolbar directly above the list of methods, select **Delete**.
4. When you are asked to confirm, click **Yes**. The method will be removed from *i-LAB Spectrum*.

Properties

You can view the following properties of a method:

- Name
- Type
- Sampler type
- Folder name
- Method form
- Description

1. In *i-LAB Spectrum* in the left Menu pane, click on a folder under **My Methods**. The list of methods will display.
2. Click to highlight a method that you want to download to your ***i-LAB***.
3. In the toolbar directly above the list of methods, select **Properties**. The Properties window will display.
4. Click on **OK** to close the Properties window.

My Methods

Standard, Pro

If you have purchased the Standard or Pro versions of *i-LAB Spectrum*, you will be able to create and edit methods.

My Analysis Methods, Edit Option

1. In the left Menu pane, click on a folder under **My Methods**. The list of methods located in the selected folder will display.
2. Click on the method you wish to edit.
3. In the toolbar directly above the list of methods, select **Edit**. The **Method Designer** window will display with the selected method loaded and ready for editing.
4. Make changes to the method as described in Method Development.

Purchase

Lite, Standard, Pro

Although not available at this time, direct purchases from the *microSpectral Sensors* web site will be supported in the future.

Browsing My i-LAB

Lite, Standard, Pro

Locate **My i-LAB** in the left Menu pane. If double down arrows display, click to expand the My i-LAB selections.

Once you have connected your ***i-LAB*** to your PC, click on **Browse My i-LAB** to see the user-defined methods and results currently stored on your ***i-LAB***.

Browse i-LAB

1. Power your ***i-LAB*** on.
2. Connect your ***i-LAB*** to your PC using the enclosed USB cable. The USB icon will display on the ***i-LAB*** screen.
3. In *i-LAB Spectrum* in the left Menu pane under **My i-LAB**, click **Browse i-LAB**. Two windows will display: **Methods on My Device** and **Method Log Results on My Device**.

Methods on My Device

The **Methods on My Device** grid displays the name, description, and last date modified for each user-defined method stored on your ***i-LAB***. (Remember that the default methods, or Scans, are available under My Methods, Defaults.)

Send Method to i-LAB

This option allows you to send one method at a time from your *i-LAB Spectrum* library to your ***i-LAB***.

1. **Browse i-LAB** as described above. The **Methods on My Device** window will display.
2. In the tool bar above the grid, select **Send Method to i-LAB**. The **Open a Method** window will display, listing all the methods you have stored in *i-LAB Spectrum*.
3. Click on a method to highlight it, and click on **Select**. While communicating with your ***i-LAB***, the program will display status messages. When the messages close, the request is complete. Your new method will display in the grid.

Remove Selected

This option allows you to remove one method at a time from your ***i-LAB***.

1. **Browse i-LAB** as described above. The **Methods on My Device** window will display.
2. Click on a method to highlight it.
3. In the tool bar above the grid, select **Remove Selected**.
4. When asked to confirm, click **Yes**. While communicating with your ***i-LAB***, the program will display status messages. When the messages close, the request is complete. Your method no longer displays in the grid.

Remove All (Methods and Log Data)

This option allows you to remove ALL of the user-defined methods from your ***i-LAB*** device as well as ALL of your result data. It does not, however, remove any methods from *i-LAB Spectrum*. After selecting option, your ***i-LAB*** will contain only the default methods (Scans).

1. **Browse i-LAB** as described above. The **Methods on My Device** window will display.
2. In the tool bar above the grid, select **Remove All**.
3. When asked to confirm, click **Yes**. While communicating with your ***i-LAB***, the program will display status messages. When the messages close, the request is complete. The grid will be empty, showing no user-defined methods on your ***i-LAB***.

Refresh from Device

This option refreshes the PC screen with the current methods and results stored on your ***i-LAB***.

1. **Browse i-LAB** as described above. The **Methods on My Device** window will display.
2. In the tool bar above the grid, select **Refresh from Device**. While communicating with your ***i-LAB***, the program will display status messages. When the messages close, the request is complete.

Log Results on My Device

For each method that you've executed on your ***i-LAB***, the **Log Results on My Device** grid displays the method name, author ID, temperature (degrees C) at the time of the measurement, sample number, date/time of the measurement, and the last date modified for the method that was used to take the measurement.

Move to Results Archive

This option removes all results from your ***i-LAB*** and stores them in the Results Archive in *i-LAB Spectrum*.

1. **Browse i-LAB** as described above. The **Log Results on My Device** window will display.
2. In the tool bar above the grid, select **Move to Results Archive**.
3. When asked to confirm, click **Yes**. The program will communicate with your ***i-LAB***, remove all results, and store them in your *i-LAB Spectrum* Results Archive.

View Details

This option allows you to review the details of a specific result in the list. You will be able to see graph and tabular results if they exist.

1. **Browse i-LAB** as described above. The **Log Results on My Device** window will display.
2. In the grid, click on a result to highlight it.
3. In the tool bar above the grid, select **View Details**.
4. The program will communicate with your ***i-LAB***, then display the **Sample Result Details** window.
5. Select **Properties**, **Graph**, or **Tabular** to view the data.
6. Click **Ok** to close the **Sample Result Details** window.

Remove from Device

This option deletes all log results from the ***i-LAB*** device, WITHOUT saving them to the Results Archive.

1. **Browse i-LAB** as described above. The **Log Results on My Device** window will display.
2. In the tool bar above the grid, select **Remove from Device**.
3. When asked to confirm, click **Yes**. The program will communicate with your ***i-LAB***, and delete all results.

Go to Results Archive

This option is a shortcut to the Results Archive.

1. **Browse i-LAB** as described above. The **Log Results on My Device** window will display.
2. In the tool bar above the grid, select **Go to Results Archive**. The **Results Archive** will display.

For details on working with the Results Archive, see Viewing Results.

View a Single Measurement

1. Connect your ***i-LAB*** and PC as described in Connecting i-LAB and Your PC.
2. Under **My i-LAB** in the left **Menu** pane, select **Browse i-LAB**. The **My Device** window will display your ***i-LAB*** Methods and Results.
3. Highlight a result in the **Method Log Results on My Device** grid.
4. From the tool bar above select **View Details**. The **Sample Result Details** window will display.
5. A list of the saved variables will display in a drop-down list under the method name at the top of the window.
6. Select a variable, and then view the associated data.

Properties

The **Properties** tab displays information about the measurement such as the date, temperature, and sample number.

Graph

If graphical results exist for a variable, the graph will display on the **Graph** tab. To see the graph full screen, click **Full Screen** on the tool bar. To return to normal view, press the **Escape** key on your keyboard (**Esc**).

Tabular

If graphical results exist for a variable, a tabular listing of the data will display on the **Tabular** tab.

Export Data

Click the **Export Data** option on the tool bar at the top of the window if you want to export the data for a variable to a MS Excel *.CSV file.

View Results Archive

There are two ways to access the Results Archive.

1. Connect your ***i-LAB*** and PC as described in Connecting i-LAB and Your PC.
2. Under **Results** in the left **Menu** pane, select **Results Archive**. The **Results Archive** window will display.

OR

1. Connect your ***i-LAB*** and PC as described in Connecting i-LAB and Your PC.
2. Under **My i-LAB** in the left Menu pane, select **Browse i-LAB**. The **My Device** window will display your ***i-LAB*** Methods and Results.
3. From the tool bar above the **Method Log Results on My Device** grid, select **Go to Results Archive**. A listing of all results that are currently saved in the Results Archive will display.

For each measurement saved, the Results Archive lists the method name, author ID, temperature (degrees C) at the time of the measurement, sample number, date/time of the measurement, and whether or not the data includes graphical data (Y UDF Spectum).

Sort Results

You can sort the list of results by clicking on the column title in the grid. Click again to toggle the sort order between ascending and descending.

Display Criteria

Above the grid are four fields in which you can enter display criteria. The default criteria are always the date range of your entire archive. To change the display criteria, enter a different value for any of the fields below and press **Enter**.

- Method name
- Sample number
- Date range

View Details

See View a Single Measurement.

Delete Selected Result

Note: You cannot undo this operation.

1. In the **Results Archive** window, click to highlight a result.
2. From the toolbar, click **Delete**.
3. When asked to confirm, click **Yes**. This result will be removed **permanently** from your archive.

UDF Spectra Combine

For those results that contain UDF spectra, this option will allow you to combine multiple results into one graph.

You will be able to export the result of this operation to a MS Excel *.CSV file or save the resultant graph to your Library.

1. In the **Results Archive** window, Ctrl-click on more than one result that contains a UDF spectrum. The result entries will highlight.
2. From the toolbar, click **UDF Spectra Combine**.
3. The program will combine the data and display the results in the **View Result Spectra** window.

Uploading Results to the PC

Lite, Standard, Pro

Upload All Results

1. Connect your ***i-LAB*** and PC as described in Connecting i-LAB and Your PC.
2. Under **My i-LAB** in the left **Menu** pane, select **Browse i-LAB**. The My Device window will display your ***i-LAB*** Methods and Results.
3. From the tool bar above your Log Results select **Move Results to Archive**.
4. Select **Yes**. *i-LAB Spectrum* will remove all results from your ***i-LAB*** and copy them to the archive on your PC.

Remove All Results From i-LAB

1. Connect your ***i-LAB*** and PC as described in Connecting i-LAB and Your PC.
2. Under **My i-LAB** in the left **Menu** pane, select **Browse i-LAB**. The My Device window will display your ***i-LAB*** Methods and Results.
3. From the tool bar above your Log Results select **Remove from Device**. *i-LAB Spectrum* will erase all results from your ***i-LAB***.

Downloading Methods

Lite, Standard, Pro

Download i-LAB Spectrum Methods

1. Connect your ***i-LAB*** and PC as described in Connecting i-LAB and Your PC.
2. Under **My Methods** on the left **Menu** pane, select **Defaults** or **Examples**. The **My Analysis Methods** window will display with the available Methods.
3. Select a method.
4. From the tool bar above select **Send to i-LAB**.
5. Select **Yes**.
6. When the message “Download successful” displays, select **OK**. The new method is now available on your ***i-LAB***.

This option allows you to run a specific set of basic methods and, with the ***i-LAB*** and the PC connected, vary the integration time and number of scans to determine which combination allows you to achieve the best measurement for your sample.

Note that when you increase the integration time or the number of scans you willincrease the time it takes to complete the measurement. The goal is to use the smallest integration time and number of scans to achieve a useful result.

Integration Time

Integration time can be thought of as analogous to shutter speed on a camera. It is the amount of time, in milliseconds, that the ***i-LAB*** LEDs are on and the sensors are accumulating data. The longer the integration time, the more data is accumulated. Longer integration times are helpful when measuring noisy or dilute samples. However, if the integration time is too long, the sensors can become saturated. This will result in invalid data.

Number of Scans

A Scan is defined as one pass, of length equal to the integration time, with the LEDs on. The ***i-LAB*** will repeat the scan up to 1000 times. The ***i-LAB*** *Spectrum* Software averages the results from multiple scans in order to improve the signal-to-noise of the spectrum.

Run Live Spectra

To run Live Spectra:

1. Connect your ***i-LAB*** and PC as described in Connecting i-LAB and Your PC.
2. Under **My i-LAB** on the left **Menu** pane, select **i-LAB Live Scans**. The Run Live Spectra window will display.
3. Under Settings, select a method from the drop-down list.
4. Enter the integration time in milliseconds.
5. Enter the number of scans.
6. Press **Scan**.
7. Follow the instructions that appear on your PC as the method runs on your ***i-LAB***.
8. When the method completes, the results will display.
9. Select the Graph or the Tabular tab to view the results.

Clear

To clear the results, go to the tool bar at the top of the window and click on **Clear**.

Save

To save the results to your Results Archive, go to the tool bar at the top of the window and click on **Save**.

Full Screen vs. Normal View

Click on **Full Screen** to view the graph in full-screen mode; press **Esc** key on your keyboard to return to normal view.

Scale

To change the scale for the X and Y-axes, go to the tool bar at the top of the window and click on **Scale**. Select Auto Scale, or, type in a value for any of the following:

- Y-axis minimum
- Y-axis maximum
- X-axis minimum
- X-axis maximum

Results Archive

Lite, Standard, Pro

View Results Archive

1. To access the Results Archive, connect your ***i-LAB*** and PC as described in Connecting i-LAB and Your PC.
2. Under **Results** in the left **Menu** pane, select **Results Archive**. The **Results Archive** window will display.

You can view all saved data in the Results Archive. In addition, you can export data to a .CSV file, delete items, and view saved spectra in graphical format. You can also sort data and setup view criteria through a date query function.

UDF Spectra Combine allows you to highlight several spectra and view them together in a single graph format. You then have the option to export to a .CSV file or save the data to your Library.

Method Development

Standard, Pro

If you have purchased *i-LAB Spectrum Standard* or *i-LAB Spectrum Pro*, you will have access to the Method Designer. The Method Designer allows you to create and test your own Methods.

A Method is a series of steps which, when executed in order, make up a measurement routine that can be performed with the ***i-LAB*** device. A step is a single task; examples include display an instruction on the device, change the contents of a variable, add a constant to a spectra, compare two variables, etc.

All methods are created and edited using the *i-LAB Spectrum* software.

Method Development Rules

- Every method must start with **Initialize Variables** and end with **END**. If you forget to add the END step, *i-LAB Spectrum* will insert it for you.
- All measured spectra are transmittance spectra.
- All library spectra are transmittance spectra.
- All library arrays must have the same frequency spectrum and length (maximum of 501 items) as the UDF array with which they will be compared.

If you change or delete a method from the device that has log entries associated with it, the log will not be able to associate a method with the entry. The log entry will display as “unknown method.” To prevent this problem, always (1) download the log, (2) erase the log, (3) then modify the method.

When planning to upgrade the embedded software (firmware) on the device, always (1) download the log, (2) erase the log, (3) then update the firmware. This will prevent loss of log-to-method association due to method changes or changes to setup values.

- Only transmittance spectra are saved to the log on the ***i-LAB*** device.
- When saving absorption spectra to the log using the Save Variable To Log step function, the system will first translate this data into transmittance data.
- All spectra displayed from the log will be shown as transmittance spectra.
- When the Method Prompt On/Off selection in the setup menu is set to ON, the following steps will not be displayed on the screen:
  Display Variable
  Display String
  Display Variable with String
  Compare Greater
  Compare Lesser
- The Initialize Variables step initializes all variables to be used by the step functions. All arrays are set to zero except for the input frequency array, which is created using the start and end frequencies from the calibration data. It also keeps track of whether the Y Spectrum UDF is transmittance or absorbance data.

Method Properties

In addition to the Step sequence, each Method contains the following properties:

- Name
- Description
- Type (Analysis, Background, DarkCurrent)
- Sampler Type
- Folder name

Method Designer

To access the Method Designer, go to the left **Menu** pane, and under **Method Development** select **Method Designer**.

Toolbar

The toolbar at the top of the Method Designer window contains the following options:

- Send to i-LAB
- Sharing
- New
- Open
- Save
- Delete Method
- Remove Step
- Run Method Simulated
- Run Step Simulated
- Hide Toolbox

Toolbox

The Toolbox contains the Steps that you can use to create methods. Steps are organized into functional groups for ease of use. Alternatively, you can select the group **All** to see an alphabetical listing of all Steps in one location.

Work Area

The Work Area is where you will build your method. Fill in the data on the **Properties** tab,drag and drop steps from the Toolbox into the method on the **Step** tab.

Area Functions

Area functions are math functions performed on spectra to calculate or help to calculate area. Area calculations are the foundation of the determination of component concentrations, such as the iron concentration in water.
Note the convention <= means that the value on the right is stored in the variable on the left.

MaximumY

- Determines the maximum y value in ySpectrumUDF
  - Output<= Y_Max & Freq
- Example Method
  - AreaCalc, DLW_Peak

MinimumY

- Determines the Minimum y value in ySpectrumUDF
  - Output<= Y_Max & Freq
- Example Method
  - AreaCalc, DLW_Peak

Peak Area to Baseline

- Computes the area between spectrum UDF and baseline.
  - Requires SetRangeMin & SetRangeMax
  - Requires SetBaselineStart & SetBaselineEnd
  - Output<= Area
- Example Method
  - AreaCalc, DLW_Peak

Peak Area to Zero

- Calculates the area (to defined baseline) under ySpectrumUDF Requires SetRangeMin & SetRangeMax
  - Output<= Area
- Example Method
  - AreaCalc, DLW_Peak

Peak Height Baseline

- Calculates the Peak Height (to defined baseline) frequency of ySpectrumUDF
  - Output<=y_Value
- Example Method
  - DLW_Peak, Quant1Peak

Peak Height Zero

- Calculates the peak height under ySpectrumUDF
  - Output<= y_Value
- Example Method
  - AreaCalc, DLW_Peak

Desktop Functions

Desktop functions are steps that run in the desktop environment only; they will not run on the ***i-LAB*** device.

Beers Law

- Develops a Beers Law calibration curve from Lib Spectra
- Uses spectra stored in the library with known concentrations
- Can used peak height, or peak area
  - Measured to spectrum zero or a baseline
- Can use linear or non-linear (3rd order polynomial)
- Example Method
  - GreenDye, Beer's Law

Beers Law Peak Ratio

- Develops a Peak Ratio Beers Law calibration curve from Lib Spectra
- Develops a Beers Law calibration curve from Lib Spectra
- Uses the ratio of two peaks within the spectrum
- Uses spectra stored in the library with known concentrations
- Can used peak height, or peak area
  - Measured to spectrum zero or a baseline
- Uses a linear calculation
- Example Method

InputBox

- Prompts the user for input
- Example Method
  - MathPkg1, InputLiveSc

Peak Table

- Works on Spectrum Y and X UDF only.
- Example Method
  - PeakTable

i-LAB

i-LAB steps are specific to the iLAB device. These steps interact with specific functions of the iLAB operation or protocol.

Acquire Background

- Gets the background spectrum.
- Property Defaults
  - Time = 1.9 to 6553.5 ms
  - #Readings = 1 to 65535

- Example Method
  - Most Methods

Acquire Dark Current

- Gets the darkcurrent spectrum
- Property Defaults
  - Time = 1.9 to 6553.5
  - #Readings = 1 to 65535
- Example Method
  - Most Methods

Acquire Sample

- Gets the sample spectrum
- Property Defaults
  - Time = 1.9 to 6553.5
  - #Readings = 1 to 65535
- Example Method
  - Most Methods

Acquire Spectrum

- Gets the standard spectrum.
- Property Defaults
  - Time = 1.9 to 6553.5
  - #Readings = 1 to 65535
- Example Method
  - Standard

Dark Current Adjust

- Subtracts the dark current array from the specified array
- Example Method
  - Most Methods

END

- The last step in all methods.

Get Temperature

- Records the ambient temperature of the device.

Initialize Variables

- Must be executed first in every method, initializes variables and flags
- Runs SpecCal
- Amount of delay between turning LEDs on and acquiring spectrum
- Example Method

- Most Methods

Ratio to Background

- Takes the ratio of sample (or standard) – dark current) to (background – dark current)
- Example Method
  - Most Methods

SpectCal

- Creates an input Freq array to be consistent with the properties. (Note that this step is also part of the Initialize Variables step.)
- Example Method
  - Most Methods

Library Functions

These steps utilize the spectra stored in the device Library. If you organize your Library into Groups, you can set a Library function to look at only one Group of spectra within the Library. All these steps process or compare the current spectrum with spectra in the Library.

Add Library to Spectra

- Takes a Library Spectra and adds it to the Current UDF Spectrum
  - Y <= Y + lib(p1)
- Example Method
  - LibraryFunc

Diff Library

- Takes a Library Spectra and subtracts it to the Current UDF Spectrum
  - Y <= Y - lib(p1)
- Example Method
  - LibraryFunc

Divide with Library

- Takes a Library Spectra and Divide it to the Current UDF Spectrum
  - Y <= Y / lib(p1)
- Example Method
  - LibraryFunc

Euclid Vector Corr

- Performs a Euclidean correlation between ySpectrumUDF and each library entry.

        - p1 - library index start, p2 - library count
    - Example Method
        - EuclidExam, LibraryFunc

MLR Calc

- Multiplies Y Spectrum UDF by library index, then sums result.
    - Variable (p2) <= Y * lib(p1)
- Example Method
    - LibraryFunc

Multiply with Library

- Takes a Library Spectra and Multiply it to the Current UDF Spectrum
    - Y <= Y * lib(p1)
- Example Method
    - LibraryFunc

Pearson Corl Lib

- Performs Pearson Correlation between the ySpectrumUDF and the library array specified.
    - Y and lib(p1)
- Example Method
    - PassFail, LibraryFunc

Math Functions

These steps execute basic math functions on parameters (not spectra).

Math Add

- Adds parameters 2 and 3, stores in parameter 1
    - Variable (p1) <= Variable (p2) + Variable (p3)
- Example Method
    - AreaCalc, MathPkg1

Math Divide

- Divides parameters 2 and 3, stores results in parameter 1
    - Variable (p1) <= Variable (p2) / Variable (p3)
- Example Method
    - MathPkg1

Math Exponent

- Raises p2 to the p3 power.
    - Variable (p1) <= Variable (p2) ^ Variable (p3)
- Example Method

        - MathPkg1

Math Log

- Take the log base 10 of p2, store in p1
    - Variable (p1) <= log10(p2)
    - Property Defaults
        - Variable = +1000.000 to -1000.000
- Example Method
    - MathPkg1

Math Multiply

- Multiplies parameters 2 and 3, stores result in parameter 1
    - Variable (p1) <= Variable (p2) * Variable (p3)
- Example Method
    - Quant1Peak, MathPkg1

Math Subtract

- Subtracts parameters 2 and 3, stores result in parameter 1
    - Variable (p1) <= Variable (p2) - Variable (p3)
- Example Method
    - Quant1Peak, MathPkg1

Spectral Math Functions

These steps execute math functions upon a spectrum, such as adding a number to a spectrum. This group also includes mathematical conversions to a spectrum, such as converting a spectrum from transmission to absorbance.

A to T

- Converts the ySpectrumUDF array from absorption to transmission.

Add Const to Spectrum

- Add a constant value to each item in the ySpectrumUDF array
    - Y <= Y + C
    - Property Defaults
        - Constant = +1000.000 to -1000.000
- Example Method
    - MathPackage

Add Standard

- Adds the spectrum stored in standard to the sample spectrum, ySpectrumUDF
    - Y <= Y + S

- Example Method
  - StandardCalc

Add Var to Spectrum

- Add the value of a variable to each item in the ySpectrumUDF array.
  - Y <= Y + Variable (p1)
- Example Method
  - MathPkg1

Diff Standard

- ySpectrumUDF becomes the difference between ySpectrumUDF and standardUDF.
  - Y <= Y – S
- Example Method
  - StandardCalc

Divide Constant

- Divide each item in the ySpectrumUDF array by a constant value
  - Y <= Y / C
  - Property Defaults
    - Constant = +1000.000 to -1000.000
- Example Method
  - MathPackage

Divide Variable

- Divide each item in the ySpectrumUDF array by the value of a variable
  - Y <= Y / Variable (p1)
- Example Method
  - MathPkg1

Log of Spectra

- Takes the log base 10 of each member of the spectrum. p1 is the spectrum to be modified
  - Y <= log(Y) (or) S <= log(S)

Multiply Constant

- Multiply a constant value by each item in the ySpectrumUDF array
  - Y <= Y * C
    - Property Defaults
    - Constant = +1000.000 to -1000.000
- Example Method
  - MathPackage

Multiply Variable

- Multiply the value of a variable by each item in the ySpectrumUDF array.
  - Y <= Y * Variable (p1)
- Example Method
  - MathPkg1

Pearson Corl to Sample

- Performs a Pearson Correlation between the ySpectrumUDF and the standard UDF
  - Y and S
- Example Method
  - PearsonEx

Raise Power Variable

- Raise the power of each item in the ySpectrumUDF array by the value of the specified variable.
  - Y <= Y ^ Variable (p1)
- Example Method
  - MathPkg1

Raise to Nth Power

- Raise the power of each item in the ySpectrumUDF array by an exponent
  - Y <= Y ^ C
  - Property Defaults
    - 1 and 255
- Example Method
  - MathPackage

Savitsky Golay Der

- Derivative Calculation
- Example Method
  - Savitsky

Subtract Constant

- Subtract a constant value from each item in the ySpectrumUDF array
  - Y <= Y – C
  - Property Defaults
    - Constant = +1000.000 to -1000.000
- Example Method
  - MathPackage

Subtract Variable

- Subtract the value of a variable from each item in the ySpectrumUDF array.
  - Y <= Y - Variable (p1)
- Example Method
  - MathPkg1

T to A

- Converts the ySpectrumUDF array from a transmission to an absorption spectrum
- Example Method
  - Quant1Peak

Spectral Range

These steps adjust or define the set of frequency values (from smallest to largest) represented on the X-axis of a spectrum.

Change Range

- Creates a subspectral range
  - Set Range Min and Range Max.
- Example Method
  - RangeChange

Set Baseline End

- Sets the baseline End point (x,y)
- Used in peakAreaToBaseline
  - Set baseline X end
- Example Method
  - AreaCalc, DLW_Peak

Set Baseline Start

- Sets the baseline Start point (x,y)
- Used in peakAreaToBaseline
  - Set baseline X start
- Example Method
  - AreaCalc, DLW_Peak

Set Range Max

- Changes the end point of the frequency range.
- Used in peakAreaToBaseline , PeakAreatoZero, PeakHeighttoBaseline
  - Set max range

- Example Method
  - AreaCalc, DLW_Peak, Quant1Peak

Set Range Min

- Changes the start point of the frequency range.
- Used in peakAreaToBaseline , PeakAreatoZero, PeakHeighttoBaseline
  - Set min range
- Example Method
  - AreaCalc, DLW_Peak, Quant1Peak

User Interface

These steps display information to the ***i-LAB*** user during a measurement.

Attach Sampler

- Displays a message for the operator to attach the appropriate sampler.
- Example Method
  - Most Methods

Compare Greater

- Compare p1 and p2
  - Display larger number along with 2 message strings.
- Example Method
  - PassFail

Compare Lesser

- Compare p1 and p2
  - Display smaller number along with 2 message strings.
- Example Method
  - PassFail

Cubic Spline Range Change

- Converts spectrum to UDF format.
- Example Method
  - Most Methods

Display String

- This step is used to display a string on the LCD.
- Example Method
  - Quant1Peak

Display Variable

- Displays the contents of the specified variable.
- Example Method
  - Quant1Peak (y-SpectrumUDF)

Display Variable with String

- Display the contents of a variable along with a message.
- Example Method
  - Quant1Peak, LibraryFunc

Eject Sampler

- Displays message to user to remove the sampler.
- Example Method
  - Most Methods

Fill Sampler

- Displays a message telling the user to fill the sampler.
- Example Method.
  - Most Methods

Save Variable to Log

- To Log Used to save the Spectrum (Y & X) to log.
- Example Method
  - Most Methods

Set Variable Value

- Stores a constant value to a variable.
  - Variable (p1) <= p2
- Example Method
  - Quant1Peak, PassFail

Store Variable

- Save the contents of any float variable.
  - Variable (p1) <= Variable (p2) (p1 is a user Variable)
- Example Method
  - Many methods

All

This selection is a shortcut to an alphabetical listing of all of the steps in the previous sections.

Macros

This section contains Macros that you create. A Macro is a set of steps in a specified order. You can use a macro to combine steps sequences that you know you will use in multiple methods, thereby shortening the task of creating a new method.

Create a Macro

1. Create your Step flow chart on the **Steps** tab.
2. Select one or more Steps (hold down Control or Shift and mouse-click on the desired Steps), then right-click and select **Create Macro**.

Rules

1. Macros should not contain the steps End or Initialize Variables.
2. Macros do not retain the values of the parameters that were set in the original steps. ***You must reset properties and parameter values when adding a macro to a new method.*** (Of course, default values will apply as they would in the step).
3. You can nest a macro within a macro.
4. WARNING: If you delete a Macro, the steps in the Macro will be removed from all methods that contained the Macro.

Spectral Library

To access the Spectral Library, go to the left **Menu** pane, and under **Method Development** select **Spectral Library**. A listing of all of the spectra in your library will display.

Upgrading or Updating i-LAB Spectrum Software

Lite, Standard, Pro

Updating

This option allows you to check for software updates and patches to your existing *i-LAB Spectrum* software. You will need an Internet connection to update your software.

1. From the Main menu at the top of the screen, select **Tools, Upgrade or Update Your i-LAB Spectrum Software**.
2. in the LAB Software Update window, select the first option, **Check for software updates …** and click **Next**.
3. If updates exist, the updates will be downloaded and installed.

Upgrading

This option allows you to upgrade your *i-LAB Spectrum* software to the Standard or Pro versions.

1. First, you must purchase your upgrade. You will receive a license key via email that you will need in step 3.
2. From the Main menu at the top of the screen, select **Tools, Upgrade or Update Your i-LAB Spectrum Software**.
3. in the LAB Software Update window, select the second option, **Upgrade your current version …** and click **Next**.
4. Type in your license key and then click **Upgrade**. The system will enable your *i-LAB Spectrum* features. Check the application name at the top of the screen to verify that the correct version of *i-LAB Spectrum* is installed.

Updating Your i-LAB Device

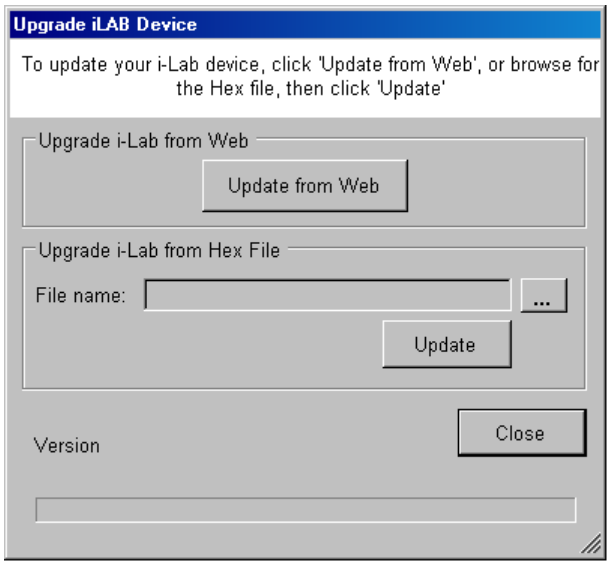
Lite, Standard, Pro

This option allows you to update the embedded software in your ***i-LAB*** device. You will normally be updating the device from the *microSpectral Sensors* website, so you will need Internet connectivity.

To find out what version is currently installed on your ***i-LAB***, press **MENU**, then select **Setup**, **About**, and note the **FW Rev.** number.

To update the embedded software on your ***i-LAB***:

1. Connect your ***i-LAB*** and PC as described in Connecting i-LAB and Your PC.
2. In *i-LAB Spectrum*, from the Main menu at the top of the screen, select **Tools, Update Device Firmware**. The following dialog will display.



3. Select Update from Web. When asked if you are sure you want to update, select **Yes**. The program will update your device with the latest embedded software.

4 Appendix

Samplers

You can purchase Samplers by contacting your local *microSpectral Sensors* distributor or by visiting the *microSpectral Sensors* website at www.microspectralsensors.com.

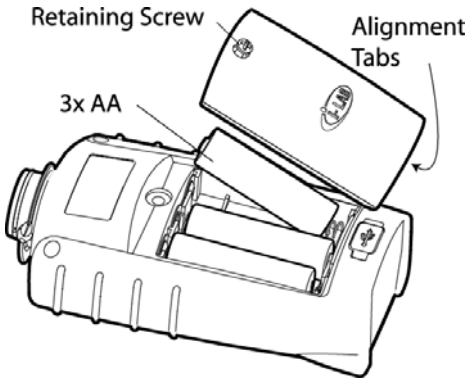
Batteries

Maintain Fresh Batteries

- ***i-LAB*** uses three (3) standard AA batteries.
- The batteries will last for approximately 30 hours of continuous use.
- When storing the ***i-LAB*** for extended periods of time, it is recommended that you remove the batteries to prevent unwanted damage from corroded cells.

Replacing Batteries

When batteries are removed, all information in memory is retained.



To install batteries, loosen the battery door screw with the small screwdriver. Remove old batteries and insert three fresh AA batteries. Do not mix old and new batteries. To replace the door tuck in the two tabs at the bottom, then tighten the screw. **DO NOT OVER TIGHTEN THE BATTERY SCREW.**

Note: ***i-LAB*** is battery-powered except when tethered to your PC via the USB cable. In tethered mode, ***i-LAB*** is powered via the USB cable.

Maintenance, Care & Cleaning

WARNING: The ***i-LAB*** is a delicate instrument. DO NOT EXPOSE IT TO EXCESSIVE SUNLIGHT, HEAT, OR MOISTURE! Handle it with care.

Store at room temperature (50° - 95° F, 10 – 35 C). Do not expose the instrument to extreme temperatures or humidity. For example, do not store in a car or on a windowsill.

The *i-LAB* may be cleaned carefully with a damp cloth only.
The window at the top must be kept clean and free of scratches. When not in use, replace the protective cap. Do not use Windex or other chemicals to clean this surface!

Troubleshooting

Problem	**Cause (and remedy)**
The ***i-LAB*** will not turn on	▪ Batteries may need replacement. Check batteries.
The ***i-LAB*** lost power	▪ Press the OK button again to confirm that the batteries still have power. ▪ A sudden impact could cause the batteries to become disconnected. Your data is not lost, but you will need to restart your method.
My method failed	▪ Make sure you followed the steps in *Basic Operation* ▪ Remove the Sampler and check if bubbles are present in the viewing chamber. ▪ Check that the Sampler is attached firmly on the neck.
I can't turn off the ***i-LAB***	▪ Pressing the Select (OK) button for 5 seconds will power off the ***i-LAB***. If this does not work, you may reset the device by taking out the batteries and re-inserting them as described in the Replacing Batteries section.

Technical Specifications

Wavelength Range	400-700 nm
Bandwidth	4-7nm (1% of center wavelength)
Photometric Range	up to 2A
Light Source	Spectrally Balanced LEDs
Detector	Linearized Photodiode Array
Operating Temperature	0 to 45C
Humidity	0 to 90%, non-condensing
Display	Backlit LCD, 2" x 2"
Display Output	Spectrum, Text
Download	Spectrum UDF, Spreadsheet via USB
Upload	Website Methods via USB
Dimensions	Approx. 2.5" x 4.5"
Power	3 AA Batteries, 30 hours cont. operation
Data Logging	Up to 500 Spectra
Method Storage	Up to 100 Methods
Compliance	CE mark

* Specifications are subject to change.

Contact

Purchases & Customer Support

microSpectral Sensors, LLC
284 Main Street Suite 200
Wilton, Maine 04294
USA
207-645-3600, Monday thru Friday 9:00 am – 5:00 pm EST
www.microspectralsensors.com
techsupport@microspectralsensors.com

References

ASTM E 284 Standard Terminology of Appearance
(See American Society for Testing and Materials, www.astm.org)

microSpectral Sensors warrants its products to the original purchaser against any defects that are due to faulty material or workmanship for a period of one year from the date of shipment.

In the event that a defect is discovered during the warranty period, *microSpectral Sensors* agrees that, at its option, it will repair or replace the defective product or refund the purchase price, excluding original and return shipping and handling charges. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

Contact *microSpectral Sensors* or your distributor to initiate warranty support. Products may not be returned without a return authorization from *microSpectral Sensors*.

Limitations

This warranty does not cover:

- Damage caused by misuse, neglect, accident or improper application or storage
- Damage caused by any repair or attempted repair not authorized by *microSpectral Sensors*
- Damage caused by acts of God, natural disaster, LABor unrest, acts of war (declared or undeclared), terrorism, civil strife or acts of any governmental agency
- Any product nor used in accordance with the quick start guide or operating manual furnished by microSpectral Sensors

This warranty contains the sole express warranty made by *microSpectral Sensors* in connection with its products. All implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

Some states within the United States do not allow the disclaimer of implied warranties and if this is true in your state the above limitation may not apply to you. This warranty gives you specific rights, and you may also have other rights that vary from state to state.

This warranty constitutes the final, complete, and exclusive statement of warranty terms and no person is authorized to make any other warranties or representations on behalf of *microSpectral Sensors*.

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The remedies of repair, replacement or refund of purchase price as stated above are the exclusive remedies for the breach of this warranty. On the basis of strict liability or under any other legal theory, in no event shall *microSpectral Sensors* be liable for any incidental or consequential damages of any kind for breach of warranty or negligence.

i-LAB Spectrum Software License Agreement

LICENSE AGREEMENT

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2. License.

(a) *microSpectral Sensors* does hereby grant to Customer a revocable, nonexclusive, non-transferable and paid-up license to use the software package known as *i-LAB Spectrum* (the "Software"). This License Agreement does not convey to you any ownership rights or any other interest in the Software.

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3. Term. This license is effective from the date that the License Fee (as hereinafter defined) is paid in full and will remain in force until terminated. You may terminate the License at any time by removing the Software from your computer and destroying the original Software and all copies. This license will automatically terminate if you breach any of the terms or conditions set out in this License Agreement. You agree to remove the Software from your computer, and either to destroy the original Software or to return the Software to *microSpectral Sensors*, upon termination of this license for any reason.

4. Software Maintenance. During the term of this Agreement and at no additional cost to the Customer except for out-of-pocket expenses (including, but not limited to, travel, materials, and telephone expenses) incurred by *microSpectral Sensors* in connection therewith, *microSpectral Sensors* agrees:

(a) *microSpectral Sensors* shall, at the Customer's request, (i) provide the Customer with the Software on a machine readable object code diskette suitable for the Computer System and provide one (1) set of user manuals and administrative manuals. Delivery of the Software and its installation shall be made at a mutually agreeable time.

(b) *microSpectral Sensors* shall for a period of ninety (90) days after the installation of the Software, (i) provide telephone consultation during *microSpectral Sensors*' regular business hours regarding the use and operation of the Software, and (ii) correct defects in materials and workmanship that affect the performance of the Software which are not the result of the Customer's misuse, neglect or error; a change or error in the operating system of any hardware; the failure by the Customer to maintain proper environmental conditions; or the interaction of the Software with software not prescribed by *microSpectral Sensors*; provided, further, that such obligations shall not include service, repair, maintenance, modification or testing of the Computer System.

(c) *microSpectral Sensors* shall provide Customer with all improvements or corrections (hereinafter referred to as "Improvements") to the Software, during the first twelve (12) months following the date hereof. If on-site support to install these Improvements is requested by Customer, then *microSpectral Sensors* will provide these services at the rate per person work-day then in effect plus expenses.

5. Additional Support Services. If the Customer desires to purchase additional support services from *microSpectral Sensors*, the Customer may enter into a Support Services Contract pursuant to which *microSpectral Sensors* will offer telephone consultation and software maintenance services to the Customer at the standard rates and conditions then in effect. These services will also provide the Customer with all applicable modifications, improvements and refinements to the Software which are not separately priced or marketed by *microSpectral Sensors*.

6. Software Additions. The Software as delivered to Customer shall contain all applicable modifications, improvements and changes thereto. In the event that *microSpectral Sensors* shall complete any additional functions which may be used with the Software (hereinafter referred to as "Additions"), then in such event Customer shall have the right to utilize such Additions without any additional software license charges, but any such Additions together with the Software shall remain the property of *microSpectral Sensors* and shall be subject to conditions and terms contained herein.

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(b) The Customer may not alter, merge, modify or adapt the Software in any way including disassembling, decompiling or decoding nor permit any third party to do so, without the prior written consent of *microSpectral Sensors*. The Customer shall not make any derivative work based on the Software without the prior written consent of *microSpectral Sensors*. Furthermore, the Customer agrees that any decompiling, reverse engineering, translating, decoding, disassembling or altering of any part of the Software which may result in the disclosure of the Source Code, or any part thereof, is strictly prohibited. The Customer agrees that any violation or attempted violation of this section will substantially diminish the value of *microSpectral Sensors*' proprietary rights in the Source Code.

(c) The Customer shall maintain the Software so as to prevent unauthorized disclosure or copying of the Source Code. The Customer shall notify *microSpectral Sensors* of any unauthorized use, copying or disclosure of the Source Code known to the Customer and shall take further steps as may reasonably be requested by *microSpectral Sensors* to prevent or remedy any such violation.

9. Events of Default. Any one or more of the following events shall constitute an Event of Default by the Customer:

(a) Default by the Customer in the payment when due of the License Fee, any installment thereof or any other charge hereunder;

(b) Failure by the Customer to comply with the terms and conditions hereof other than as set forth in subsection (a) above and such failure continues for a period of thirty (30) days following written notice to the Customer specifying the failure and requesting that it be corrected (provided that the Customer shall be entitled to only one (1) such notice in any one (1) year period with respect to the same or similar default), or in case of a default or contingency which cannot with due diligence be cured within said thirty (30) day period, the Customer fails to proceed within said thirty (30) day period to commence to cure the same and thereafter to prosecute the curing of such default with due diligence and within a period of time which under all prevailing circumstances shall be reasonable;

(c) Dissolution or insolvency of the Customer, or termination of the Customer's corporate existence. The term "insolvency" as used herein shall mean that there shall have occurred with respect to the Customer one or more of the following events: dissolution, termination of existence, business failure, the application for the appointment of a custodian or receiver of any part of the property of the Customer, the Customer is generally unable to pay its debts as they become due, there has been commenced by or against the Customer any proceeding or petition whether voluntary or involuntary, judicial or otherwise, under the Federal Bankruptcy Code or under any other state or federal bankruptcy arrangement, reorganization, insolvency or similar law for the relief of debtors, whether such relief is accomplished or to be accomplished through readjustment of liquidation or otherwise, or that there shall have been served any warrant, attachment, levy or similar process in relation to a tax lien or assessment against the property of the Customer which warrant, attachment, levy or similar process is not fully discharged within sixty (60) days of such service;

(d) The ordering, appointment or election of a custodian, receiver, assignee or trust mortgagee for any of the property of Customer;

(e) The rendering of final judgment against Customer for the payment of money which judgment remains unpaid, and the execution of which is not effectively stayed, for a period of thirty (30) days;

(f) Default by the Customer in the payment, performance or observance of any of the provisions, terms, conditions, agreements, warranties or covenants contained in any other agreement between the parties hereto not cured within any applicable grace period; or

(g) Any attachment, trustee process, lien or distraint of or lien against the Software;

and in any such event *microSpectral Sensors*, at any time thereafter, may give written notice to the Customer specifying such Event of Default or Events of Default and stating that this License Agreement shall terminate on the date specified in the notice, and upon such termination, this license shall be revoked and the Customer shall immediately return all copies of the Software to *microSpectral Sensors*, including any copies and modifications made by Customer and the Customer shall certify in writing that Customer has returned all copies of the Software.

10. Limited Warranty.

(a) *microSpectral Sensors* warrants that the Software shall be free from defects in materials and workmanship under normal use for a period of ninety (90) days from

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(b) THE SOFTWARE IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

(c) *microSpectral Sensors* does not warrant that the functions contained in the Software will meet the Customer's requirements or that the operation of the Software will be uninterrupted or error free.

11. Limitation of Remedies. Because software is inherently complex and may not be completely free of errors, the Customer is advised to verify its work and to make back-up copies.

(a) *microSpectral Sensors*' entire liability and the Customer's exclusive remedy shall be:

(i) the replacement of any diskette(s) or cassette(s) not meeting *microSpectral Sensors*' "Limited Warranty" and which are returned to *microSpectral Sensors*, or

(ii) if *microSpectral Sensors* is unable to deliver a replacement diskette(s) or cassette(s) which is free of defects in materials or workmanship, you may terminate this Agreement by returning the Software and License Fee will be refunded.

(b) IN NO EVENT WILL MICRO SPECTRAL SENSORS BE LIABLE TO CUSTOMER FOR ANY DAMAGES, INCLUDING ANY LOST PROFITS, LOST SAVINGS OR OTHER INDIRECT, COVER, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE SUCH SOFTWARE OR USER DOCUMENTATION EVEN IF *microSpectral Sensors* HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, OR FOR ANY CLAIM BY ANY OTHER PARTY. IN NO EVENT SHALL *microSpectral Sensors*' LIABILITY EXCEED THE AMOUNT OF THE LICENSE FEE PAID BY THE CUSTOMER.

12. Headings, Entire Agreement. Titles and paragraph heading are for convenient reference and are not a part of this Agreement. This Agreement supersedes in full all prior discussions and agreements between the parties relating to the Software, constitutes the entire agreement between the parties relating to the Software, and may be modified or supplemented only by a written document signed by an authorized representative of each party.

13. Force Majeure. *microSpectral Sensors* shall not be liable for any failure of or delay in the performance of its obligations hereunder for the period that such failure or delay is due to acts of God or the public enemy; civil war, insurrection or riots; fires, explosions or serious accidents; governmental priorities or allocations; strikes or LABor disputes; inability to obtain necessary materials, accessories, equipment or parts from the manufacturers thereof; or any other cause beyond *microSpectral Sensors*' reasonable control. *microSpectral Sensors* shall notify Customer promptly of the occurrence of any such cause and to carry out this Agreement as promptly as practicable after such cause is terminated.

14. Governing Law. This Agreement is being delivered and accepted in the State of Maine, and shall be enforced in accordance with the laws of the State of Maine.

15. Jurisdiction and Venue. In the event that *microSpectral Sensors* shall commence any legal proceeding before any Court in connection with the enforcement of, or collection of any amount due under this Agreement, the Customer consents that: (a) the courts of the State of Maine shall have jurisdiction over Buyer and over any such proceedings; (b) the venue of any such action shall be in any County in which *microSpectral Sensors* maintains an office; and (c) service of process in any such action may be effected by mailing such process to the address of the Customer designated in this Agreement (or such other address as the recipient may hereafter designate in writing), certified mail, return receipt requested, and shall be deemed served on the third day after the mailing of same.

16. Miscellaneous.

(a) No waiver of any breach of any provisions of this Agreement shall constitute a waiver of any prior, concurrent or subsequent breach of the same or any other provisions hereof and no waiver shall be effective unless made in writing and signed by an authorized representative.

(b) In the event that any action or proceeding is brought in connection with this Agreement, the prevailing party therein shall be entitled to recover its costs and reasonable attorney's fees.

(c) The Customer hereby agrees to pay interest on all overdue amounts at the annual rate of eighteen percent (18%).

(d) The provisions of Sections 3, 7, 8, 10, 11, 14, 15 and 16 shall survive the termination of this Agreement.

(e) The Customer hereby grants to *microSpectral Sensors* the right to visit Licensee's facilities during normal business hours upon reasonable notice to Licensee for the sole purpose of verifying that the Software is being used, and the proprietary information owned by *microSpectral Sensors* is being protected, in accordance with this Agreement. *microSpectral Sensors* will be provided with a software "security key" at the time of installation of the Software.

(f) This Agreement shall be binding upon and inure to the benefit of the successors or assigns of the *microSpectral Sensors*; also, it shall be binding upon and inure to the benefit of the successors of Customer, but Customer may not assign the same.

(g) The relationship between the parties hereto is solely that of licensor and licensee according to the express terms hereof; and nothing contained herein shall be deemed or construed to create any partnership, joint venture or other relationship whatsoever. Neither party hereto shall make any representations or statements to the contrary.

T:\D4182\License Agreement.wpd\28Dec07