What's New in OPEN 6.2 thru 6.2.5

A summary of software changes for the LI-6400XT

If you already know how to run an LI-6400, then this document is for you. It contains what you need to know to use version 6.2.

All items discussed are also found in detail in the 6.2 edition of the manual, *Using the LI-6400XT*, and the page references are given in the discussions below.

Major Changes for 6.2

New Measurements Control Panel 2
AutoProgram Changes 7
LI-6400 Apps 14

Odds and Ends

Faster IRGA zeroing 15
User Definable Function Keys 16
Configuration Builder Revamped 17
Mass Based Fluxes 18
Match Mode System Variables 18
Log Option Changes 19
Fluorescence Computational Changes 20
Mixer Cal Handles Low Concentrations 20
View All Graphs Simultaneously 21
Pick-From-List Prompts 23
Connecting to li6400.licor.com 24

Subsequent Updates

Version 6.2.1 25
Version 6.2.2 25
Version 6.2.3 25
Version 6.2.4 25
Version 6.2.5 26

LI-COR® Measuring Change in a Changing World™

Biosciences

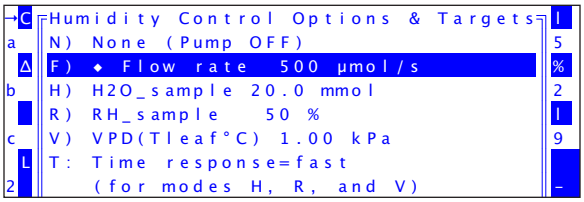
LI-COR Biosciences • 4647 Superior Street • P.O. Box 4425 • Lincoln, Nebraska 68504
Phone: 402-467-3576 • FAX: 402-467-2819
Toll-free 1-800-447-3576 (US & Canada)
envsales&licor.com • envsupport@licor.com
www.licor.com

984-12788 Jan 2014

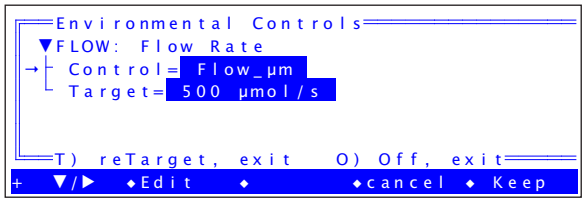
New Measurements Control Panel

The New Measurements Control Panels are the screens one uses to change Flow, CO_2, Temperature and Light manually in New Measurements mode. In version 6.2, this interface has changed to a node-based dialog, allowing more clarity and flexibility (the version 6.2 manual, chapter 7).

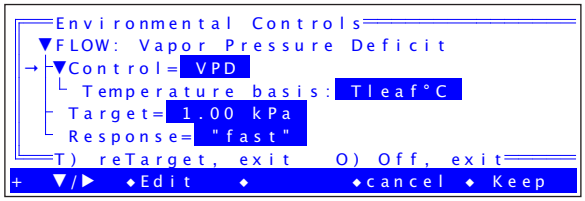
Old Look



New Look

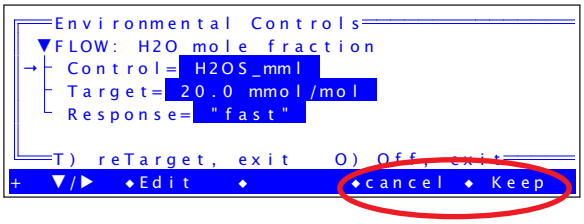


Only relevant entries are visible. Fixed flow (above) only requires a target, but vapor pressure deficit (below) has a few more settings.



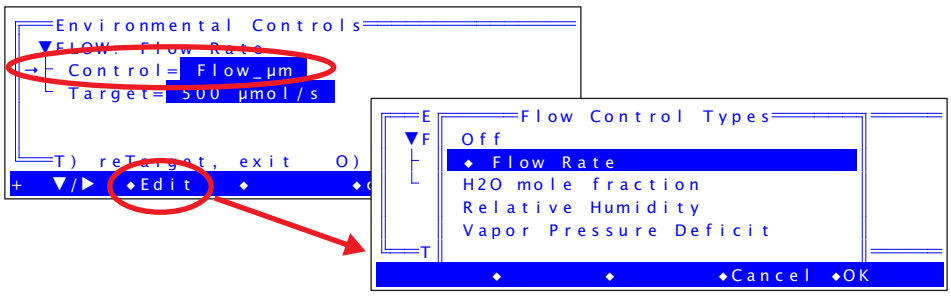
It's a Dialog

One big difference in the new interface is that it is a dialog box, which means you can change several settings and then implement them with **f5 (Keep)**, or abandon them with **f4 (cancel)**.



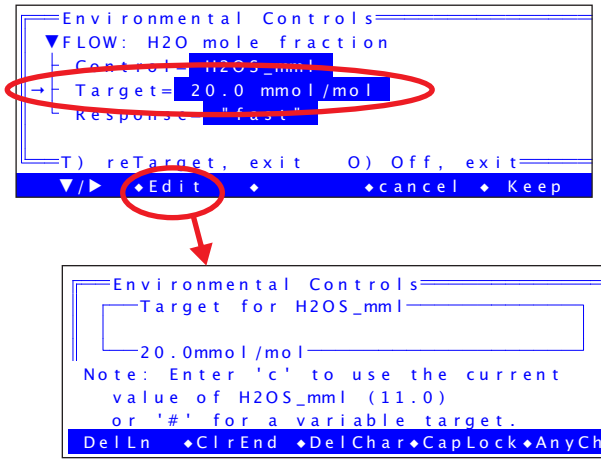
The Control Node

The Control node determines what quantity is being controlled. For example, if you edit the control node in Flow Control, you will see this familiar list of possibilities:



The Target Node

The Target node holds the desired value of the control setting. When you edit this node, you will see a target value entry dialog that shows not only the current value of the target, but also the current value of the variable being controlled. For example, if you just changed to controlling mole fraction, you might see something like this:



At this point, you have several options:
Type in a new value,
- or -
Enter nothing, and target remains 20
- or -
Enter **c**, and target becomes 11
- or -
Enter **#**, and pick the variable target,
- or -
Enter **#id** (e.g. #255, #-13, etc.) to enter the variable target id directly, if you know what it is.

Note the improvement: you can lock in the current variable's value as the control target, without having to remember to check it before entering the control panel screen.

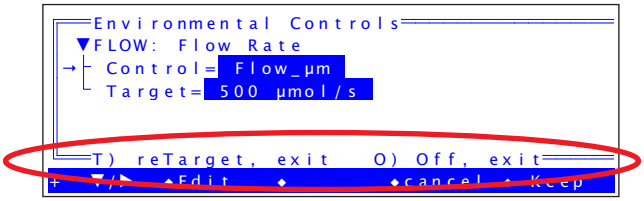
Shortcuts

Since the control panels are now dialogs, once you get all the nodes the way you want, you have to press **Keep** (**f5**) to implement it. However, there are two shortcuts available:

Press **T** to edit the Target node and - if the entry ends with **enter** being pressed, and not **escape** - it will exit the dialog (by **Keep**) automatically.

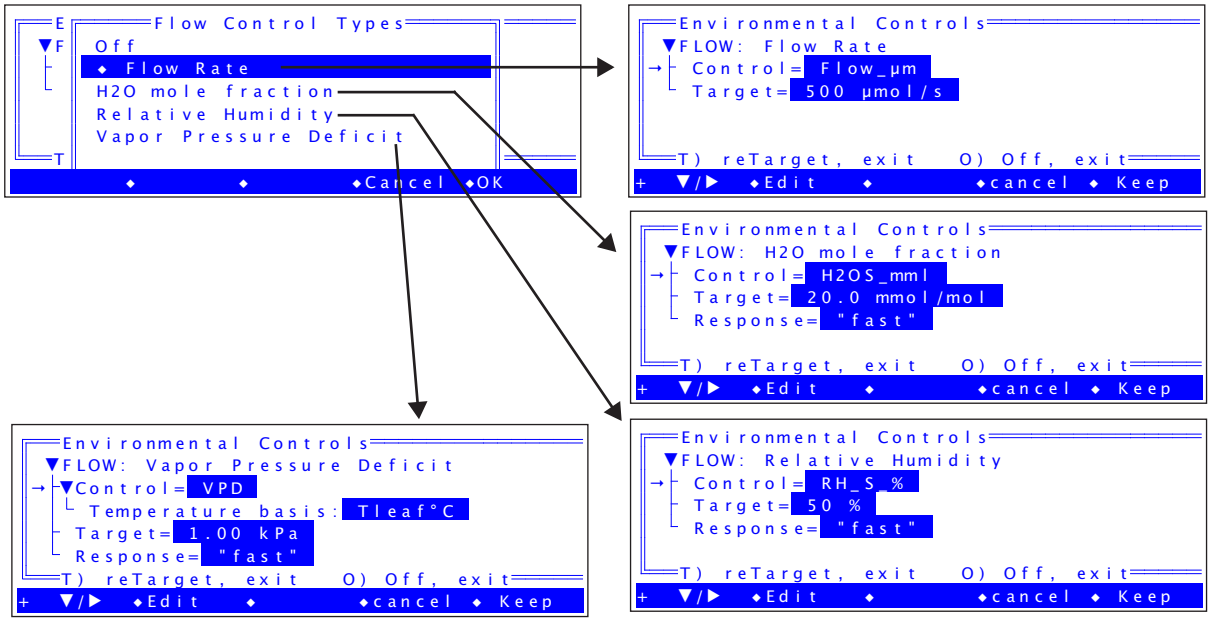
Press **O** (that's a letter, not a number) to select the 'off' option and exit (by **Keep**) automatically.

The control panel dialog provides a reminder of the shortcuts.



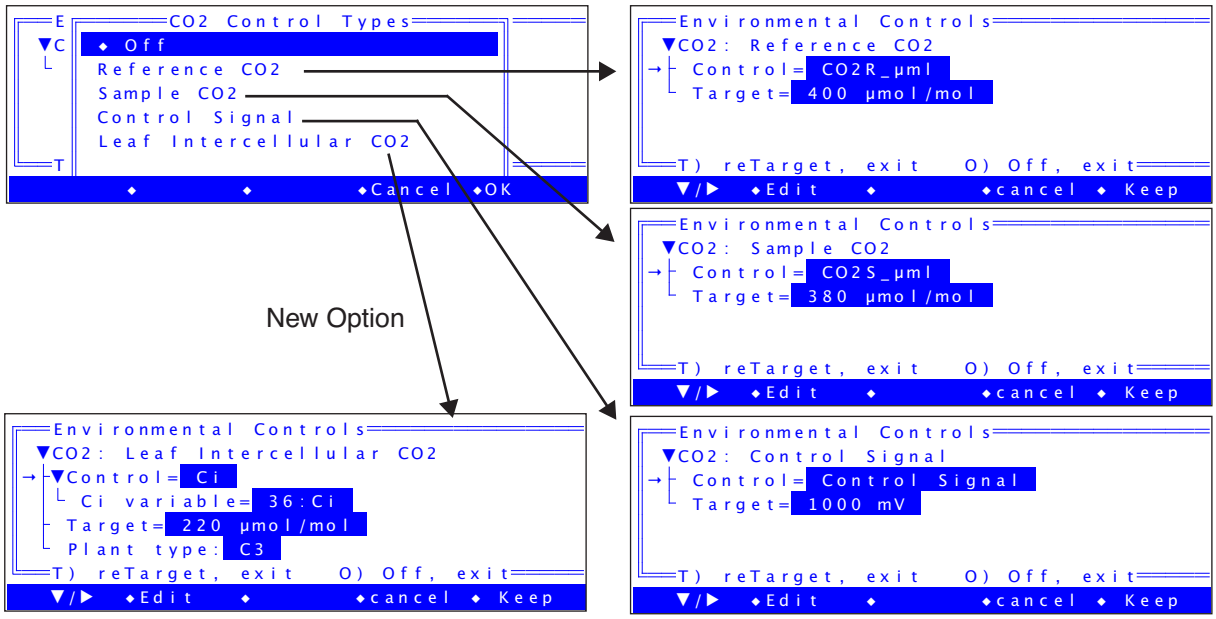
Flow Control Options and Nodes

The flow control panel has these options:



CO_2 Control Options and Nodes

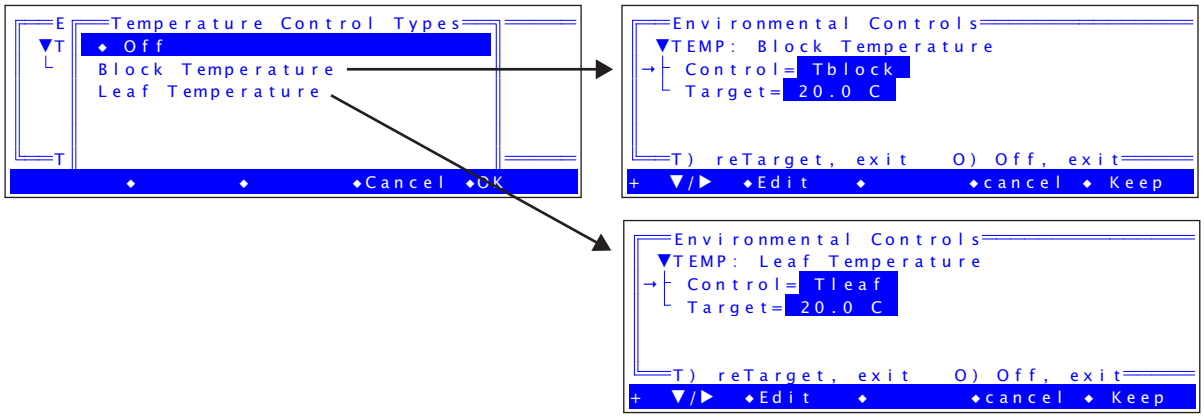
The CO_2 control panel has these options (note the addition of C_i control):



The new C_i control option is discussed in the manual on page 7-17, but in summary, it is best used for maintaining constant C_i while doing a rapid light curve. Do not try and do an A-Ci curve with this option, however.

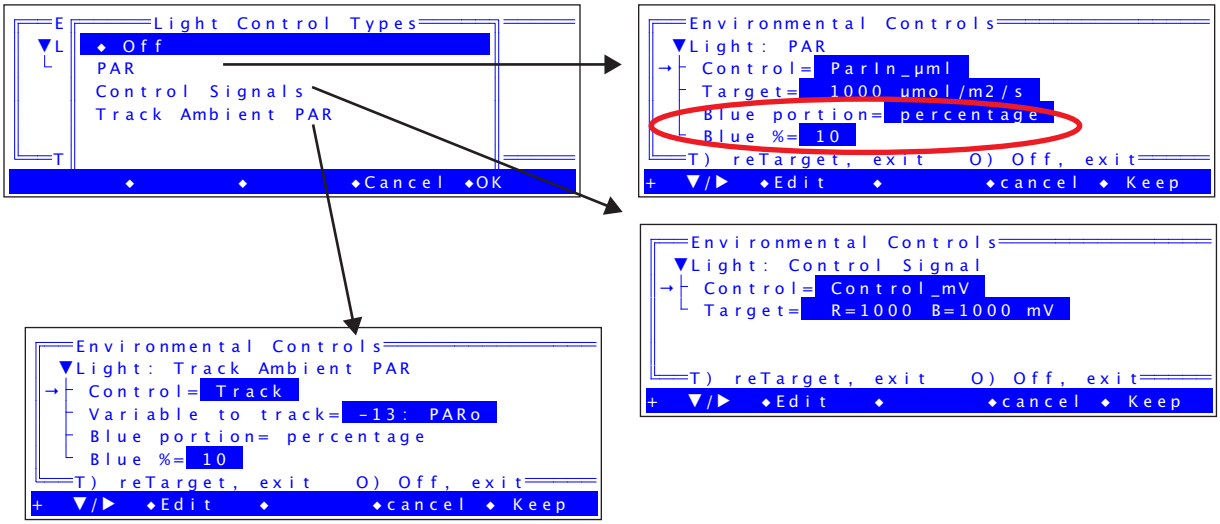
Temperature Control Options and Nodes

The temperature control panel has these views

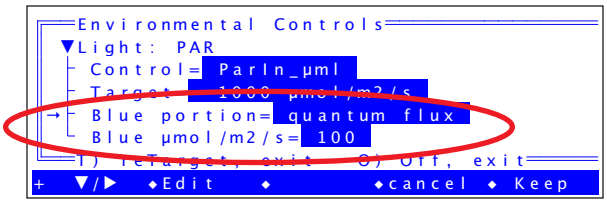


Light Control for the 6400-40 LCF

When configured for the LCF, the Light Source screens will look like this:

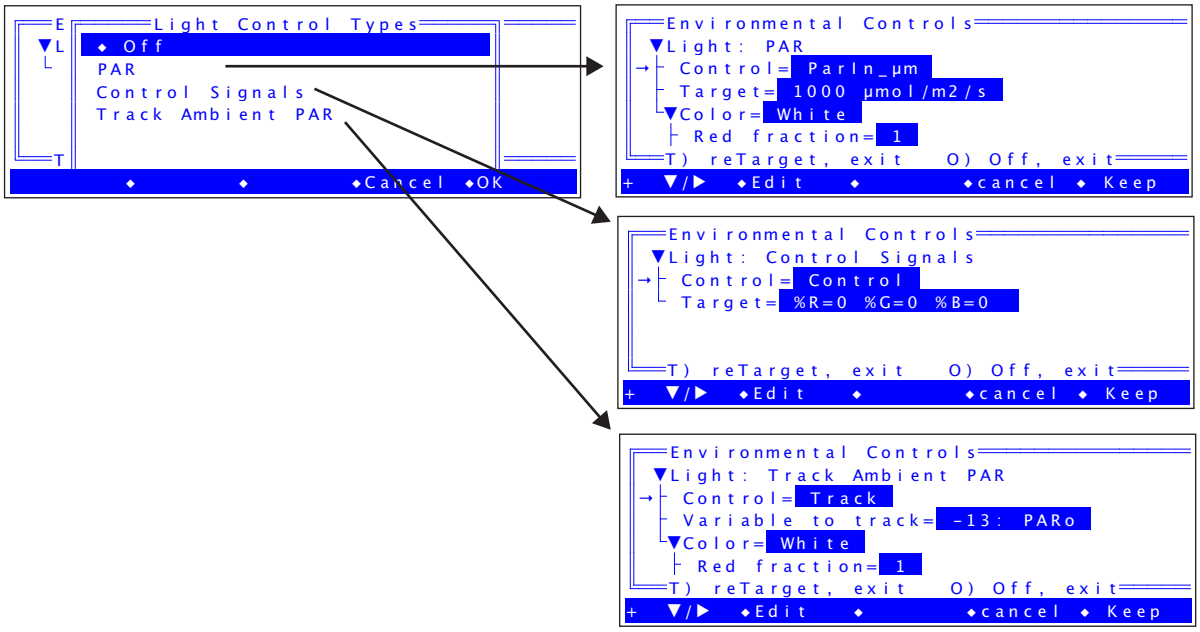


The change here is that the old options of "PQuantum" and "FQuantum" have gone away. Now there is just one PAR option, and you set *Blue portion* to be *percentage* or *quantum flux*. In the above panel (circled), it is set to percentage. If you set it to quantum flux, it looks like this:

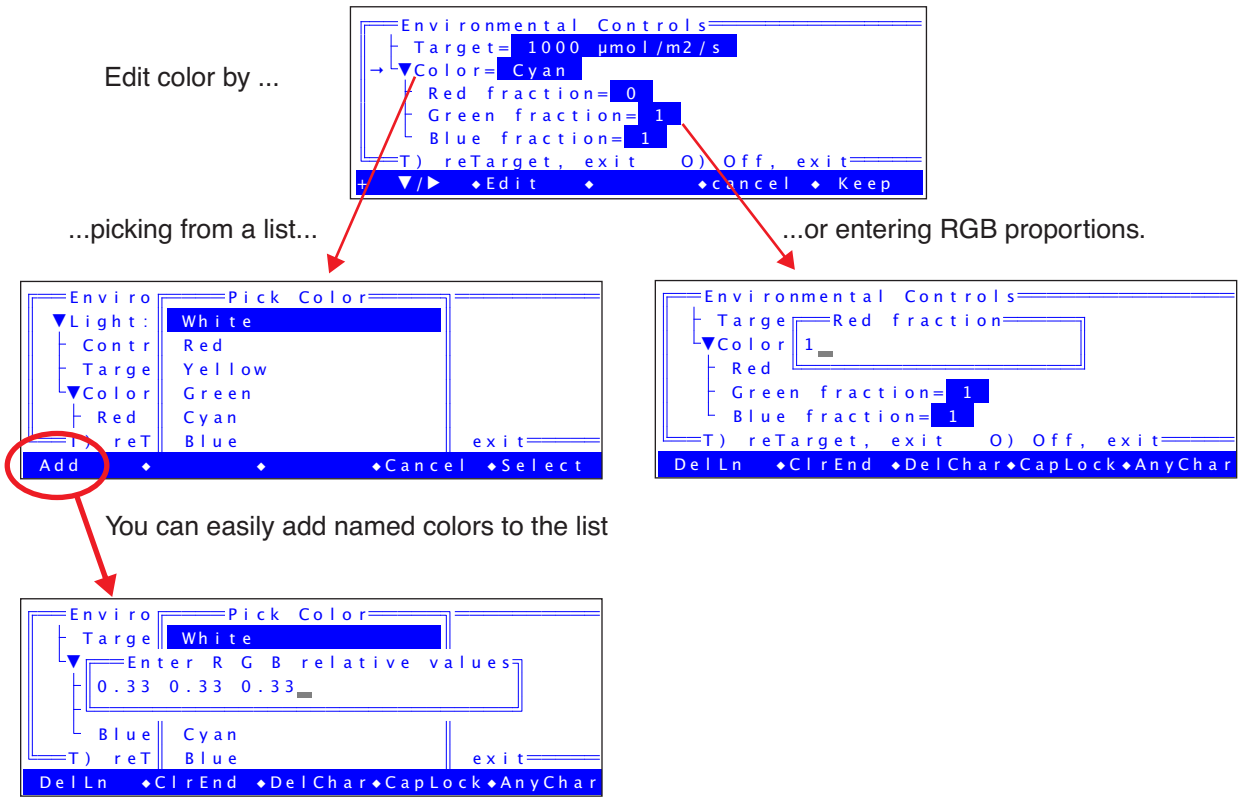


Light Control for the 6400-18 RGB

When configured for the RGB source, the Light Control screens will look like this:



The color option is available when controlling on PAR or Tracking Ambient.



AutoProgram Changes

AutoPrograms are discussed in the version 6.2 manual starting on page 9-31.

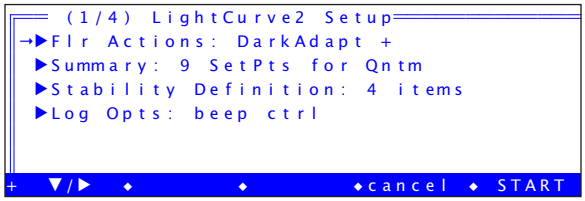
Nearly all of the AutoPrograms in OPEN 6.2 have been revised. Some have been eliminated. (If you've upgraded from an earlier version, all of your old AutoPrograms will be found in the directory /User/Configs/AutoProgs_old).

Table 1: Autoprogram Changes in 6.2

Program	Remarks
AutoLog2	Replaces AutoLog. New interface, increased capability.
A-CiCurve2	Replaces A-CiCurve. New interface, increased capability.
LightCurve2	Replaces LightCurve. New interface. Adapts to current light source.
TimedLamp2	Replaces TimedLamp. New interface. Added capability.
StandardSystemTest	Unchanged
Flr Kinetic	Removed. Use AutoLog2.
Flr A-CiCurve	Removed. Use A-CiCurve2.
Flr LightCurve	Removed. Use LightCurve2.
CO2Curve_MultipleLight	New. Adapts to current light source.
LightCurve_MultipleCO2	New. Adapts to current light source.
FlrLoop2	Replaces Flr Loop. New front interface.

Node-based Interface

The 6.2 versions of AutoPrograms use a node-based interface. This allows the user to interact with the complete configuration in any order, instead of the old "one pass through" method. For example, the LightCurve2 program interface looks like this:

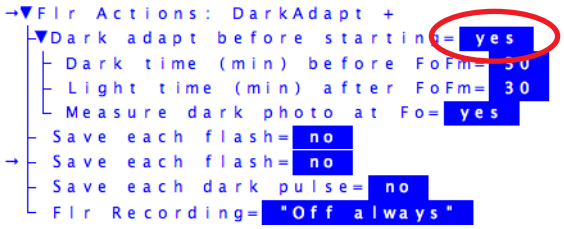


The first thing to note is that it is a dialog, so once the settings are the way you want them, press **f5** (**START**) to launch the program, or **f4** (**cancel**) to quit.

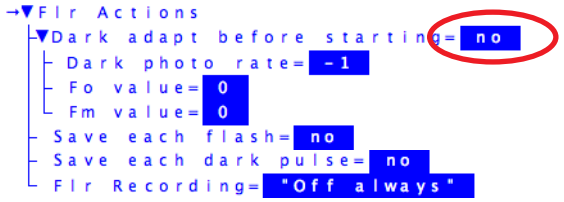
The next thing to note is the nodes. There are usually three or four. The first one in the above example, *Flr Actions*, appears only if the instrument is configured for a fluorometer. The next one, *Summary*, is the one that is specific to each AutoProgram. The bottom two, *Stability* and *Log Opts*, are generic, and appear if they are relevant to the AutoProgram. Details follow.

Flr Actions

If the LI-6400 is configured for the 6400-40 LCF, then most AutoPrograms will display a *Flr Actions* node. If you elect to do dark adaptation at the start of the program, it looks like this:

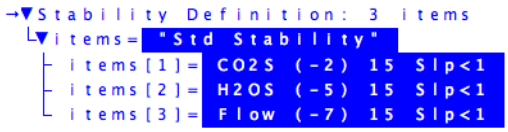


If skipping dark adaptation, it looks like this:



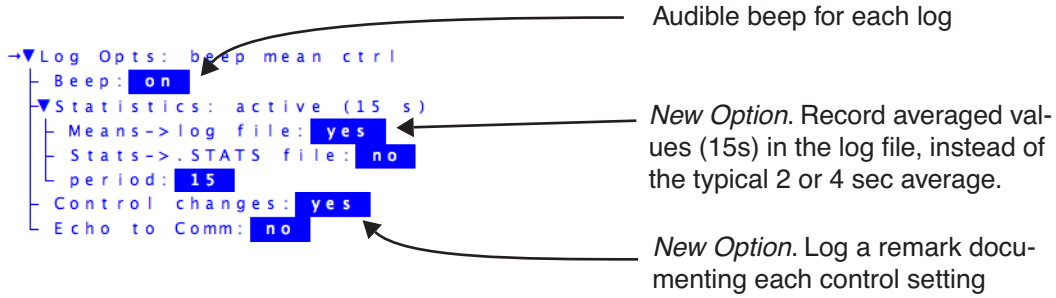
Stability Node

The stability definition node lets you define your criteria for stability that will take effect if you launch the AutoProgram. These are not necessarily the current definitions, but if you do launch the AutoProgram, they will take effect and remain in effect after the AutoProgram is done.



Log Opts Node

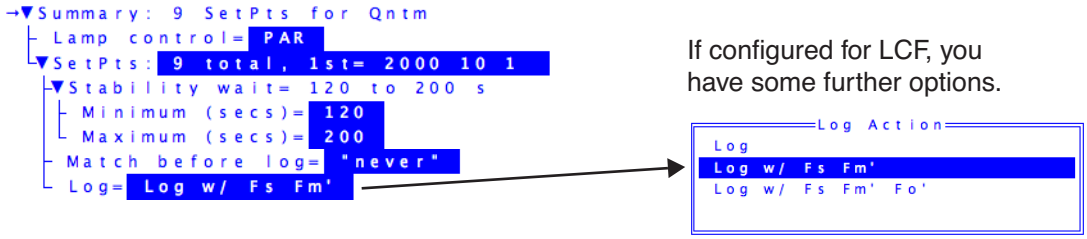
The Log Options node lets you define the log options that will take effect if you launch the auto-program. Note that these are not necessarily the currently defined log options, but if you do launch the AutoProgram, they will take effect and remain in effect after the AutoProgram is done.



The two new options are described below. See "Log Option Changes" on page 19.

Summary Node

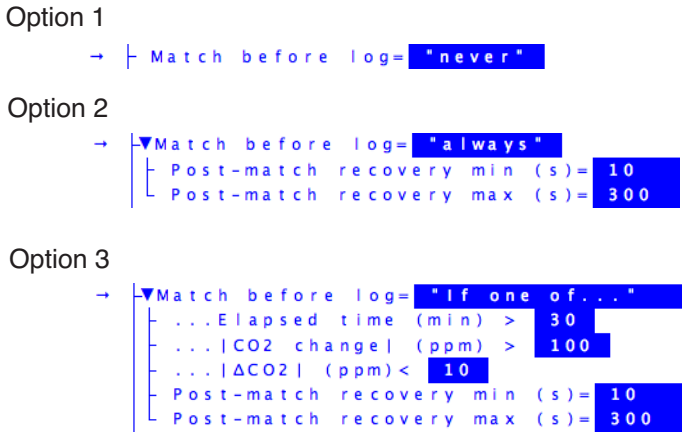
This is the node that contains the settings unique to each AutoProgram, such as light levels for a light curve, minimum and maximum wait times, etc. In the case of LightCurve2, it looks like this:



One of the items within the Summary node in this example is one about Matching, named *Match before log*. This item controls when matching occurs, and is described next.

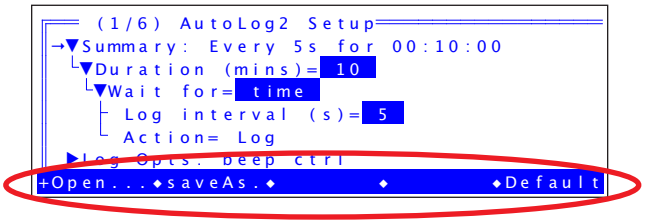
Conditional Matching

You can now elect to never match, always match, or else match only if one of three conditions is true: 1) time since last match exceeds some threshold, 2) reference CO_2 is now sufficiently different from when it was last matched, or 3) the CO_2 delta is sufficiently small. In the configuration tree, the match node (contained in the Summary node) looks like this



Save and Recall Settings in Named Files

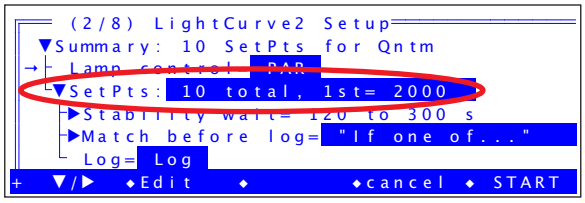
Another advantage of the new interface is that not only are previous choices always remembered, but the user can elect to save and recall settings in named files. Also, the AutoPrograms have factory default settings that you can revert to at any time while you are interacting with the configuration tree.



Adapts to Light Source in Use

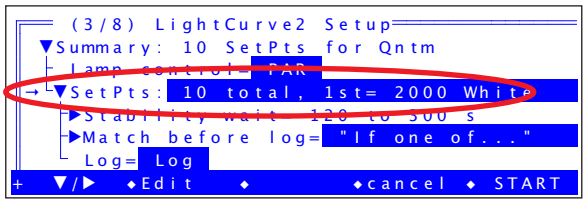
The new AutoPrograms are adaptive. That is, they adapt to whatever light source you have attached. For example, the LightCurve2 program looks like this for the three light source options.

If using -02B



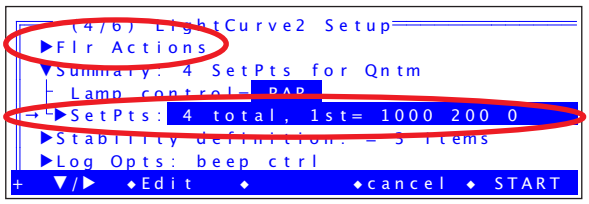
Each setpoint is a single value (PAR)

If using RGB



Each setpoint contains a PAR value and a color.

If using LCF



Each setpoint contains three values: total PAR, blue value, and a 1 or 0, where 0 means the blue value is μmol m^{-2} s^{-1}, and 1 means the blue value is %. Here, our first point is 1000 μmol m^{-2} s^{-1} total, 200 of it blue. Also note the Flr Actions node.

This means that AutoPrograms that ask for multiple light levels (LightCurve2, CO2Curve_MultipleLight and LightCurve_MultipleCO2) have some built-in capability that the old LightCurve program did not have: you can now change color (for the RGB) or how blue is handled (for the LCF) as you progress through the light levels.

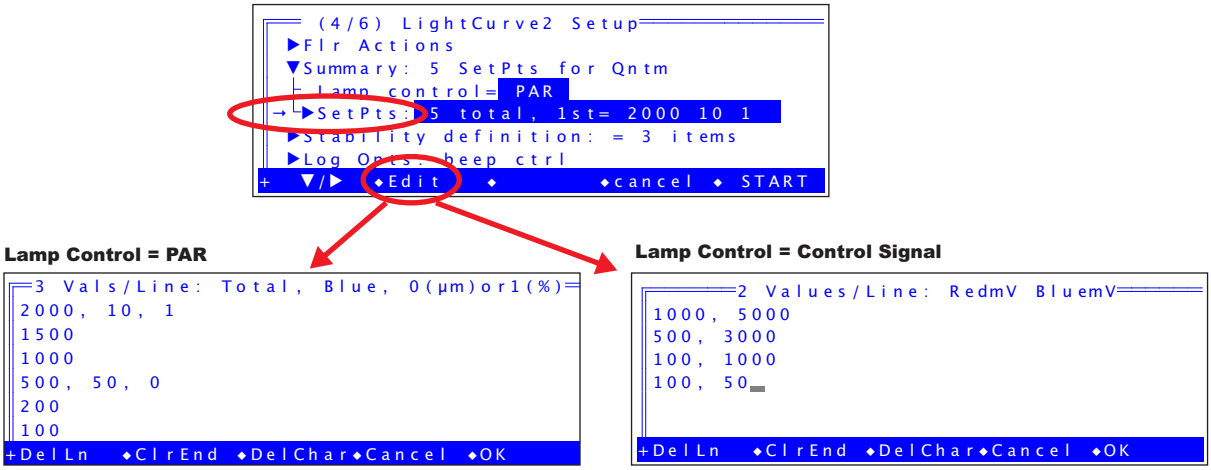
For the LCF, you enter three values for each light level (see next page): total, the blue value, and a flag (0 or 1). The flag determines how the blue value is to be interpreted. 0 means μmol m^{-2} s^{-1}, and 1 means percent.

For the RGB, you enter multiple values for each light level (see next page): total, and color. The color can be a name, or a three-value color specifier.

In all cases, there is a handy shortcut for entering light values. If you don't specify all the expected values, the missing ones default to their previous ones. So, to specify a light curve for the LCF using 10 percent blue all the time, you can just put the blue info in the first entry, like this:

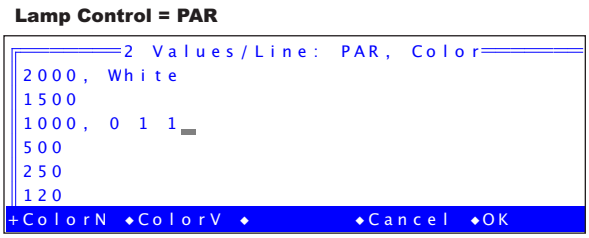
```
2000, 10, 1
1500
1000
:
```

Set points for the LCF and RGB are entered via a full screen editor. For the LCF:

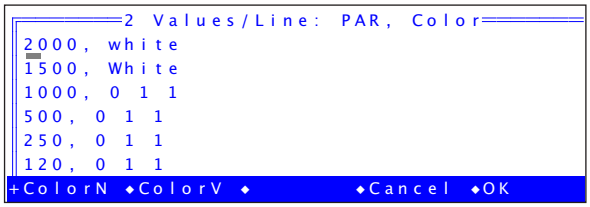


Note that you don't necessarily have to enter all 2 or 3 entries per line. In the above left example, the 2nd and 3rd setpoints will re-use the blue value from the 1st set point (10%), while the 4th and later set-points will use the blue value of 50 μmol m^2 s^{-1} from the 4th setpoint.

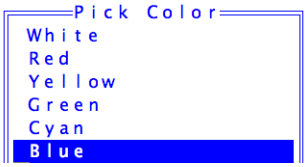
The setpoint editors when using the RGB look like this:

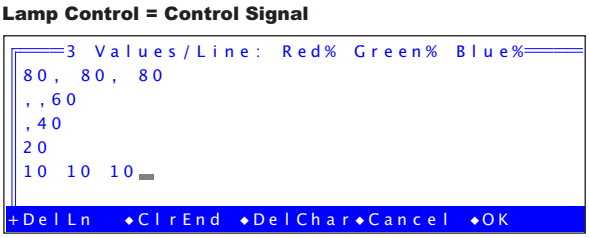


The first two points will use white, then for the 3rd and remaining points, the color changes to cyan (no red, and matched green and blue). It is equivalent to this:

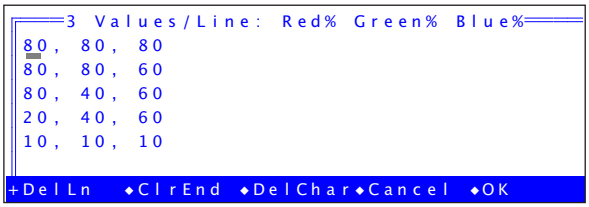


One last thing: Note the **ColorN** and **ColorV** keys. These keys will pop up the color dialog (below) which will insert the specified Name or triple Values into the text at the cursor location.



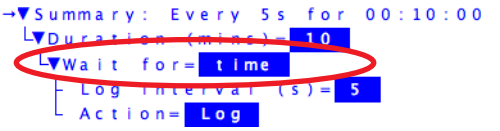


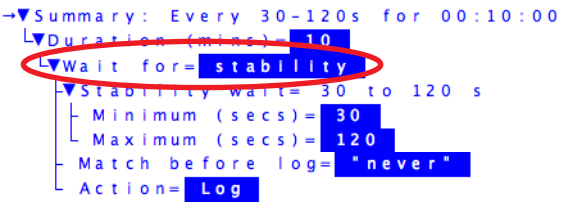
Once again, not all values need be entered. Missing values use the previous value. Thus, the above settings (if you re-edit to check) will come out looking like this:



AutoLog2 Summary Node

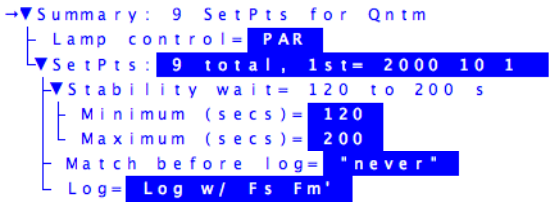
AutoLog2 will log a fixed number of times. The interval between the logs can be a fixed time, or else based on stability. The summary node looks like this:





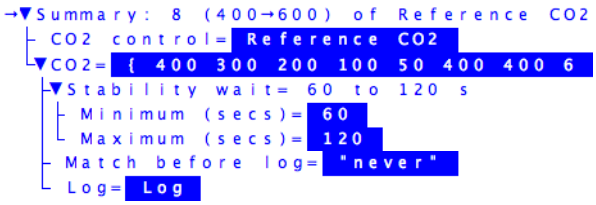
LightCurve2 Summary Node

The summary node for the light curve program looks like this:



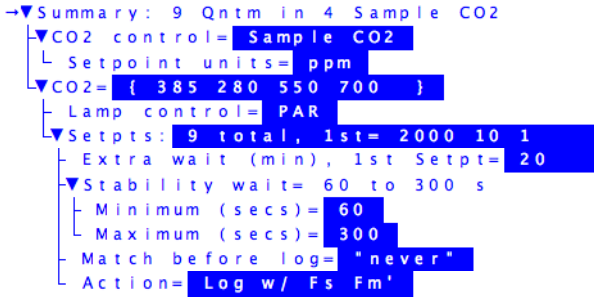
A-CiCurve2 Summary Node

The Summary node for the A-Ci program is



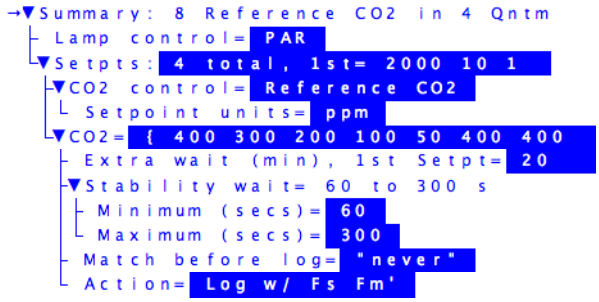
LightCurve_MultipleCO2 Summary Node

This program does light curves at multiple CO_2 settings. The summary node looks like this:

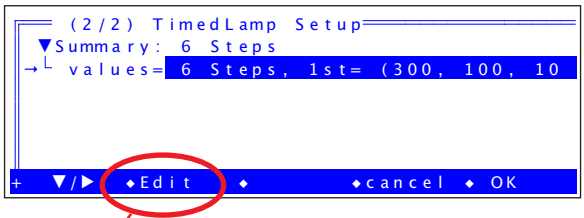


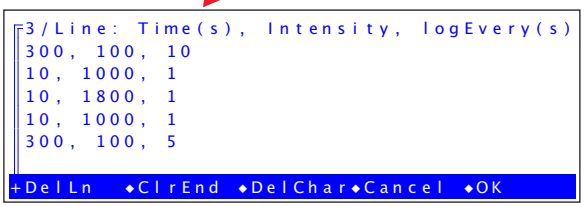
CO2Curve_MultipleLight Summary Node

This program does CO_2 curves at multiple light levels. The summary node looks like this:

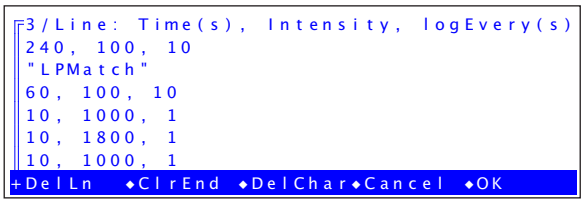


TimedLamp2 Summary Node. TimedLamp2 does what TimedLamp did before, but with some enhancements. It now uses a configuration tree interface.

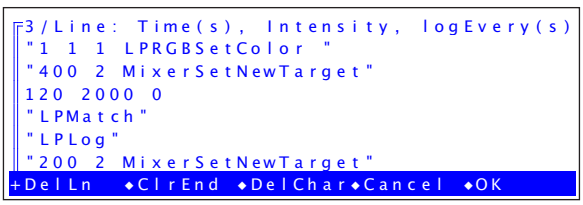




As before, you specify time, intensity, and log intervals.



A new feature: if you wish to do a match somewhere in there, just insert it in the sequence.

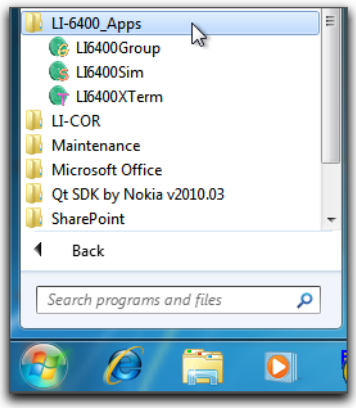


In fact, you can insert any command you wish, allowing you to write a completely separate autoprogram that does not necessarily have anything to do with light sources.

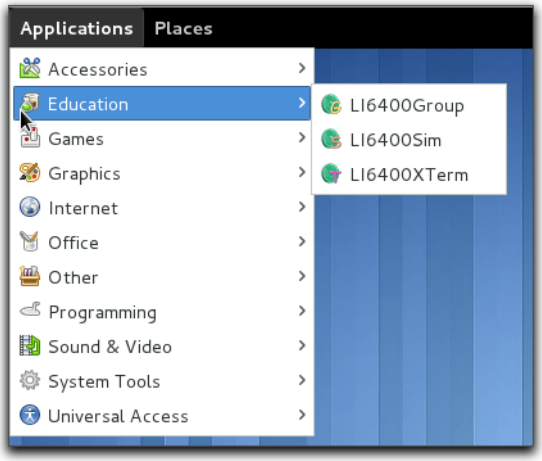
LI-6400 Apps

Until now, the support software for the LI-6400 has been almost exclusively Windows based. That has now changed. With the launch of version 6.2, we are also launching a collection of support programs that will run on Mac OS X, Linux, and Windows.

On Windows



On Linux

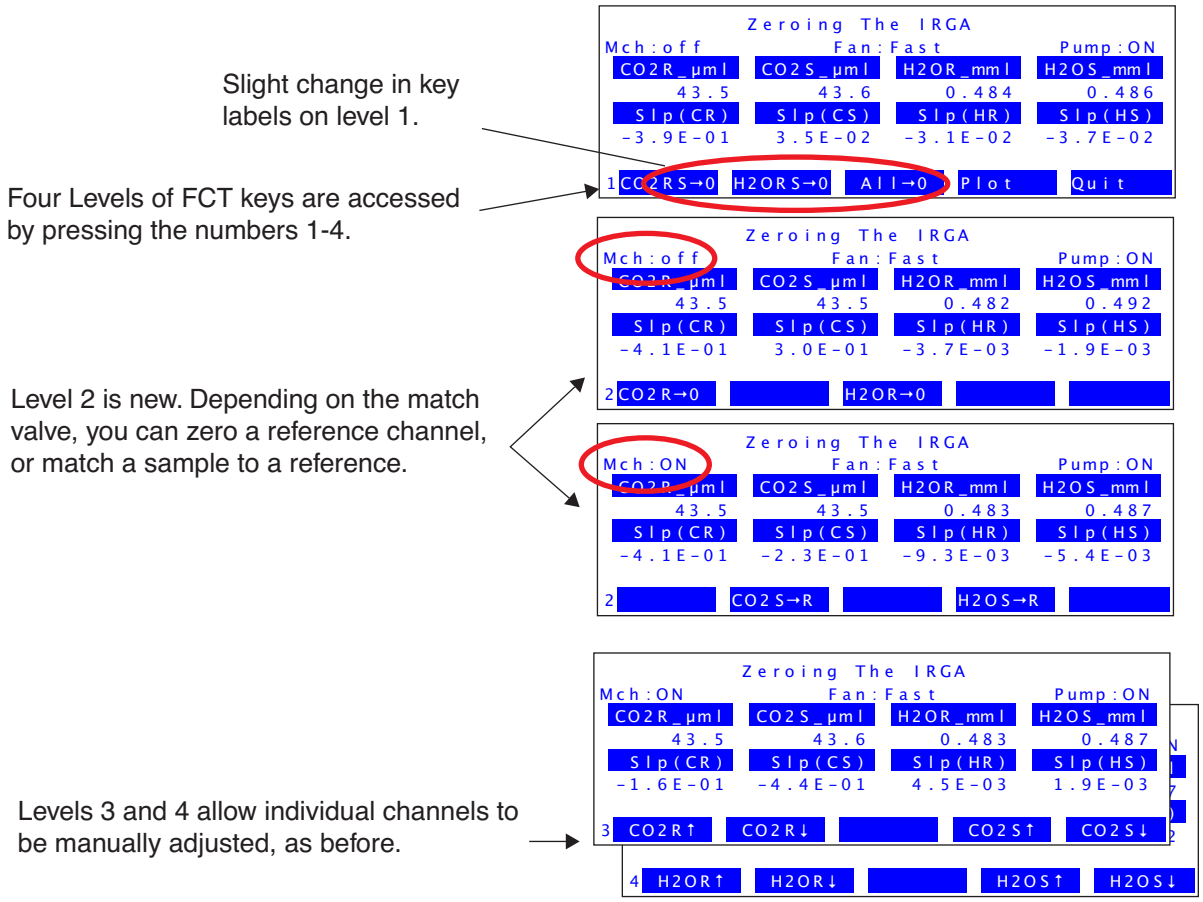


On OS X

The Apps are LI6400XTerm (remote terminal and file exchange operations), LI6400Sim (simulates an LI-6400 running any of 6 versions of OPEN from 3.4.3 to 6.2), and LI6400Group (remote terminal for multiple LI-6400s). They are all described in the version 6.2 manual in chapter 11.

Faster IRGA zeroing

The IRGA zeroing routine has added the ability to automatically zero the reference cells only, and the ability to set the sample to match the reference value, depending on the state of the match valve.



You can use this capability to do more rapid zeroing, since you don't have to wait for the sample cell to become stable at zero. Here's how:

1. Zero reference only

Match off. When reference is stable, **f1** (level 2) to zero CO_2, **f3** (level 2) to zero H_2O.

2. Match sample to reference

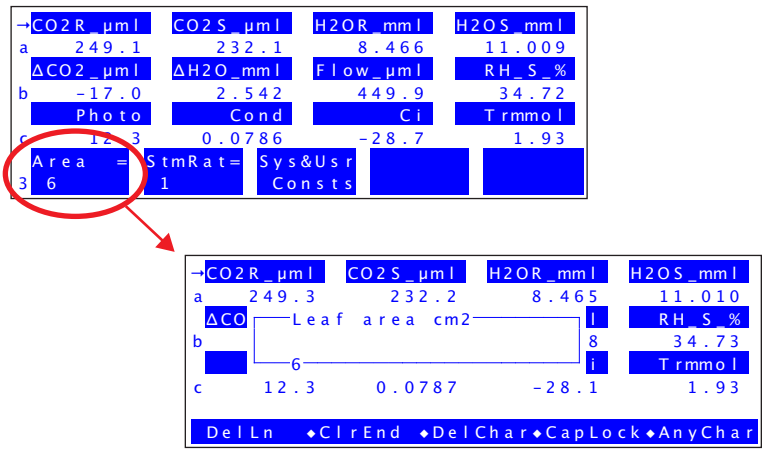
Match ON, wait 30 seconds for the reference to adjust, then **f2** (level 2) to "zero" CO_2, and **f4** (level 2) to "zero" H_2O. You aren't really zeroing them, but rather doing a zero adjustment to make them match the value as reported by the reference cell.

For more details, see the version 6.2 manual, page 18-16.

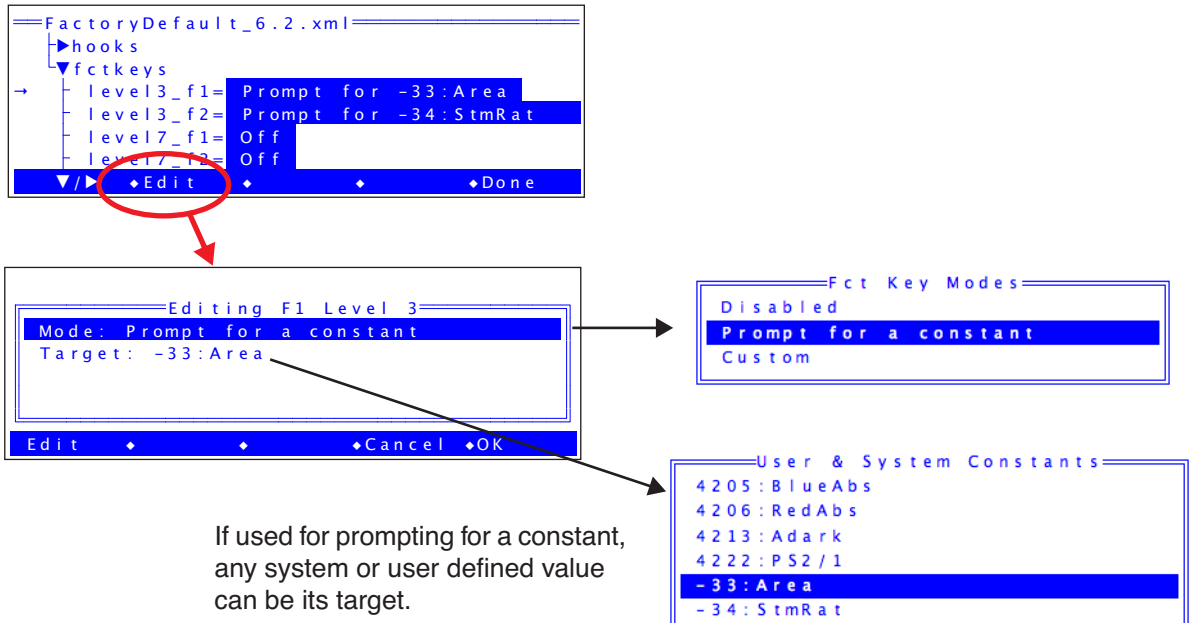
User Definable Function Keys

Version 6.2 provides a method to easily define 7 of the New Measurements function keys: **f1** and **f2** in level 3 (by default, the Area and Stomatal ratio key), and **f1** through **f5** on level 7 (usually unused). Any of these function keys can be in one of three states: 1) disabled, 2) prompt for a constant, or 3) custom.

Prompting for a constant (any value with a sys or user ID number) will make the fct key show the constant's name and value in its label, and when pressed, will prompt you for a new value.



To define a key to prompt for a constant, go to Config Menu -> View/edit..., and find the <open> <comps> <fctkeys> node. Entries for the 7 definable function keys are listed under that.

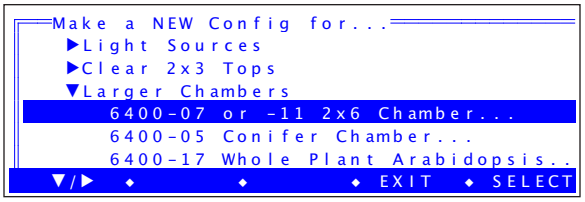


For more, see the version 6.2 manual page 16-22.

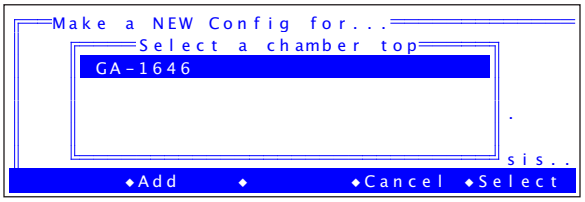
Configuration Builder Revamped

The Configuration Builder (Config Menu -> New...) is now tree-based. That is, once you've decided what to build a configuration for, all the options are in front of you, and you can adjust them at will before actually implementing it. Below is an example for building a config for the 2x6 chamber.

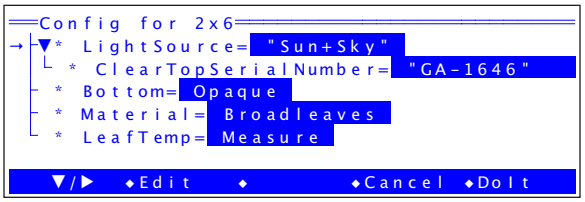
1. Start with a 2x6 chamber



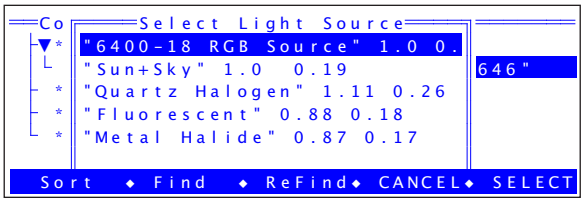
2. You'll be asked which calibrated chamber top to use.



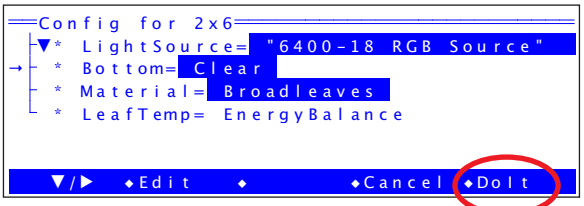
3. Here is the config setup tree. You can edit any node you wish.



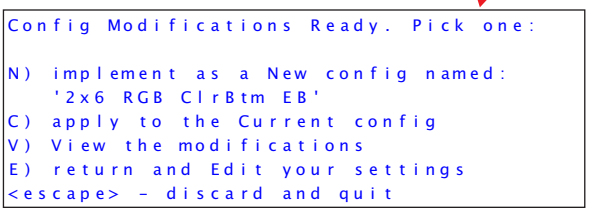
4. Let's change the light source to the RGB.



5. Then change the bottom from opaque to clear. Notice the *ClearTopSerialNumber* node is gone (cal not used with RGB), and the LeafTemp is forced to be energy balance.



6. When you are done editing, you are taken to the familiar final dialog box.

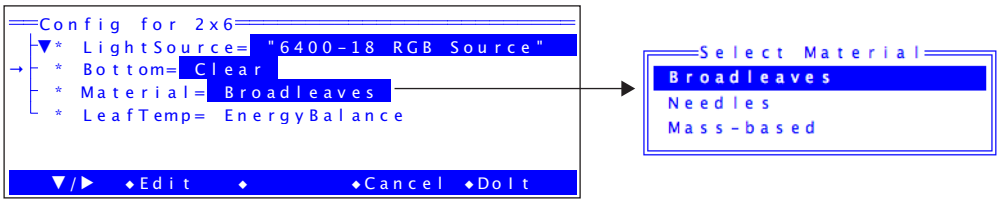


For more information, see the version 6.2 manual page 16-5.

Mass Based Fluxes

Mass based fluxes means computing photosynthesis and transpiration on a per mass basis, rather than a per area basis. Sometimes it is easier to determine weight rather than area, such as when measuring insects, pieces of fruit, mosses, etc.

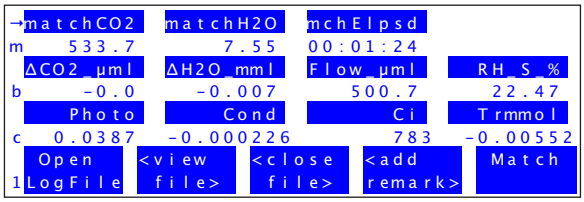
With 6.2, you can now configure for mass-based fluxes for any chamber using the new configuration builder (described above). There is a "Material" node in the config tree that lets you select between broadleaves, needles, and anything mass-based.



For more details, see the version 6.2 manual, page 16-51.

Match Mode System Variables

Three system variables have been added that pertain to matching, and can be found on display line *m*. *matchCO2* (ID=-112) is the CO_2 at the last match, *matchH2O* (ID=-113) is the water concentration at the last match, and *mchElpsd* (ID=-114) is the time (HH:MM:SS) since the last match. If matching has not yet occurred, *mchElpsd* will show "Too Long".



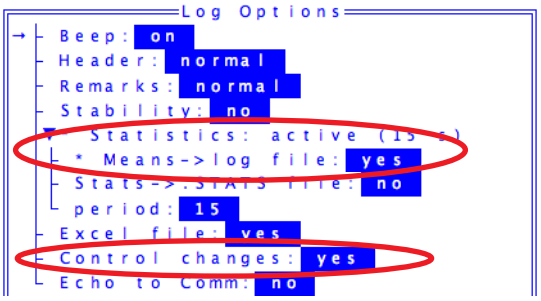
These will be on display line *m* for the configuration FactoryDefaults_6.2.xml, and also for any new configurations that you create. (Existing configurations are unchanged.)

For further details, see the version 6.2 manual, page 14-27.

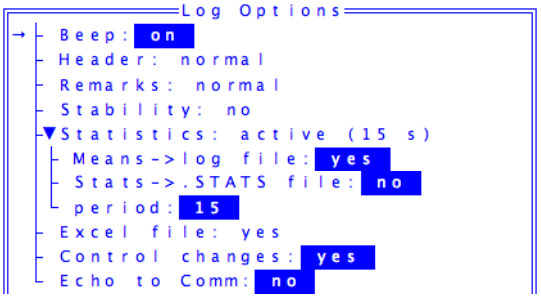
Log Option Changes

There are some changes in the Log Options: we've made a couple of changes, and one of them is that you can now access the Log Options (**f3** level 5) when a log file is open. You won't be allowed to change some of them, however, and they are the ones without inverse value fields (below right).

No log file open



Log file open



Log Option: Statistics

The old statistics log option created a .stats file in parallel with the log file that recorded the means, standard deviations, and rates of change of all logged floating point variables. Version 6.2 adds an option to this. When **Means→logFile** is enabled, the logged value of all floating point variables will be the average over the previous *x* seconds (*x* = whatever the Period is set to). Thus, this affects the value in the log (and Excel) file, not just the mean value in the .stats file. In fact, the two will now agree.

For further details, see the version 6.2 manual, page 9-16.

Log Option: Control Changes

When this option is enabled, any control changes (flow/humidity, CO_2, temperature, or light) that happen while a log file is open will have a remark added indicating the control change.

```
"17:17:06 "
$STARTOFDATA$
"Obs""HHMMSS""ETime""Photo""Trmmol""TChamAir""Tair""Tleaf""TBlk""CO2R  "…"Status"
"17:22:27 CO2 Mixer: CO2R -> 400 uml"
1   "17:22:30"342.87.36    1.16    26.52   24.56   26.52   26.02   249.20  232.25…
2   "17:22:31"343.37.35    1.16    26.52   24.56   26.52   26.02   249.02  232.08…
"17:22:40 Coolers: Tleaf -> 20.00 C"
3   "17:22:46 359.37.44    1.16    26.52   24.56   26.52   26.02   249.25  232.11…
4   "17:22:47"359.87.3     1.16    26.52   24.56   26.52   26.02   249.08  232.25…
```

This is discussed in the version 6.2 manual, page 9-17.

Fluorescence Computational Changes

F_m

Prior to 6.2, the maximal fluorescence achieved during a rectangular flash was simply determined from the maximum value. That is, just one data point. In version 6.2, the program finds the maximum, then averages it together with the six neighboring data points (three on each side) to determine F_m. This is, in other words, a .06 second average centered on the maximum value).

F_o, F_s

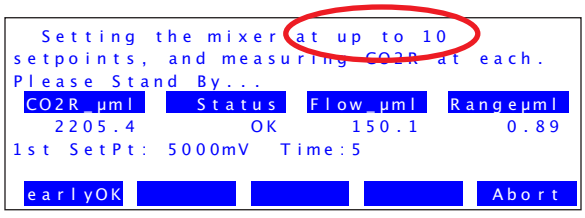
Prior to 6.2, these values were simply the latest value of F at the moment the SetFo or SetFs command occurred (or button pressed). In version 6.2, these values are now set using the mean value of F over the previous x seconds, where x is the period specified by the <FlrSettings> <stats> <period> node in the fluorescence configuration tree.

These statistics on fluorescence are not new: this is in fact how the dF/dt stability variable has always been computed. What is new is that the period is now accessible for user setting, and the mean value is now being used for something (setting F_o and F_s), and is available for the first time as a system variable (ID #-114) for logging, plotting, etc.

Mixer Cal Handles Low Concentrations

A while ago we published an App Note describing how to re-plumb the console to allow the CO_2 mixer to control concentrations down to 0 ppm, instead of the normal 40 or 50 ppm (App Note 7, *Modification of LI-6400 to Control at Low CO_2*, PPS-267). That note describes some file editing that was necessary to get the mixer calibration program to cover that range. Version 6.2 takes care of all that, with a mixer calibration that doesn't depend on whether or not that modification has been done.

The following scheme is used: 10 setpoints are tried, (the normal 8, plus two more: 50 and 0 mV). On the 8th one (100 mV), the program starts computing the change in CO_2 per the change in mV setpoint. When this drops below 0.1, it is done. Thus, calibrating a normal console will probably quit after the 100 mV set point, while calibrating a modified one will go all the way to zero.

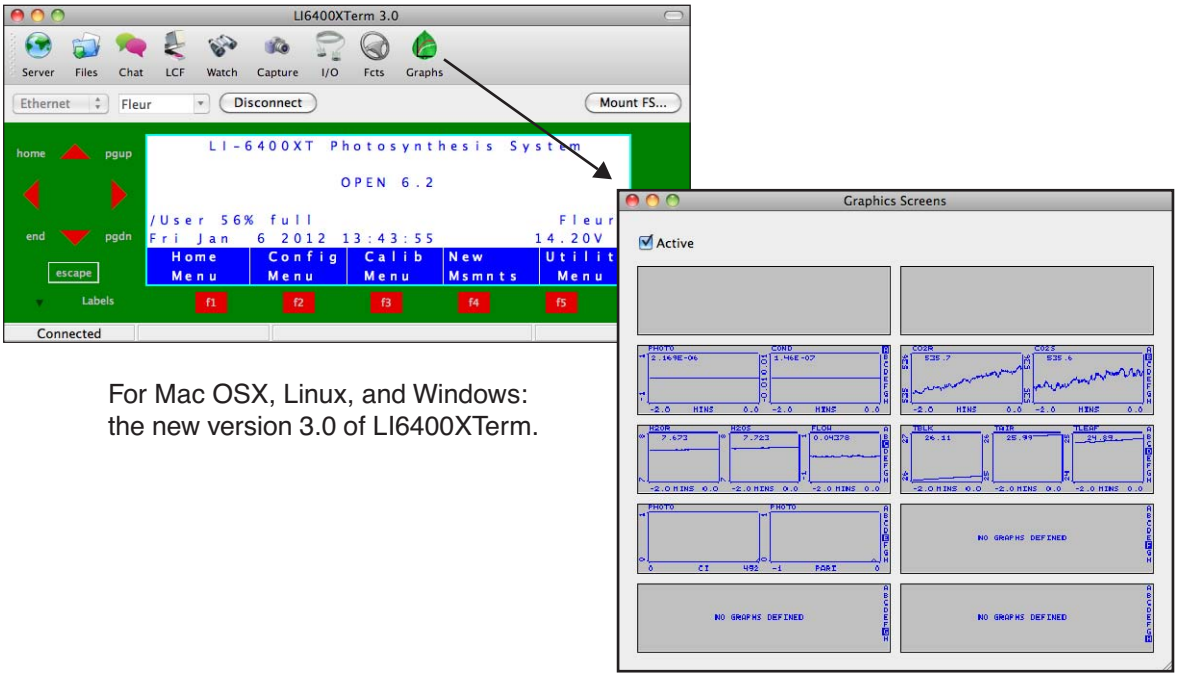


The only outward sign of the change is the vague message.

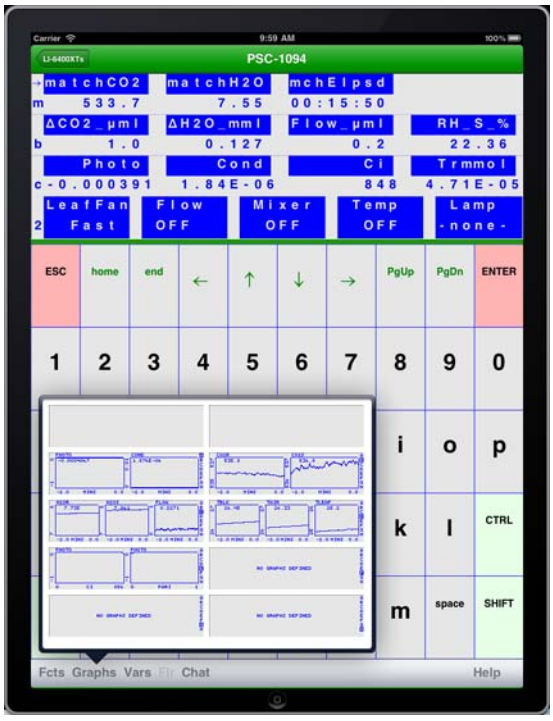
The mixer calibration is described in the version 6.2 manual, page 18-25.

View All Graphs Simultaneously

Version 6.2 supports showing all graphics screen simultaneously on a remote terminal.

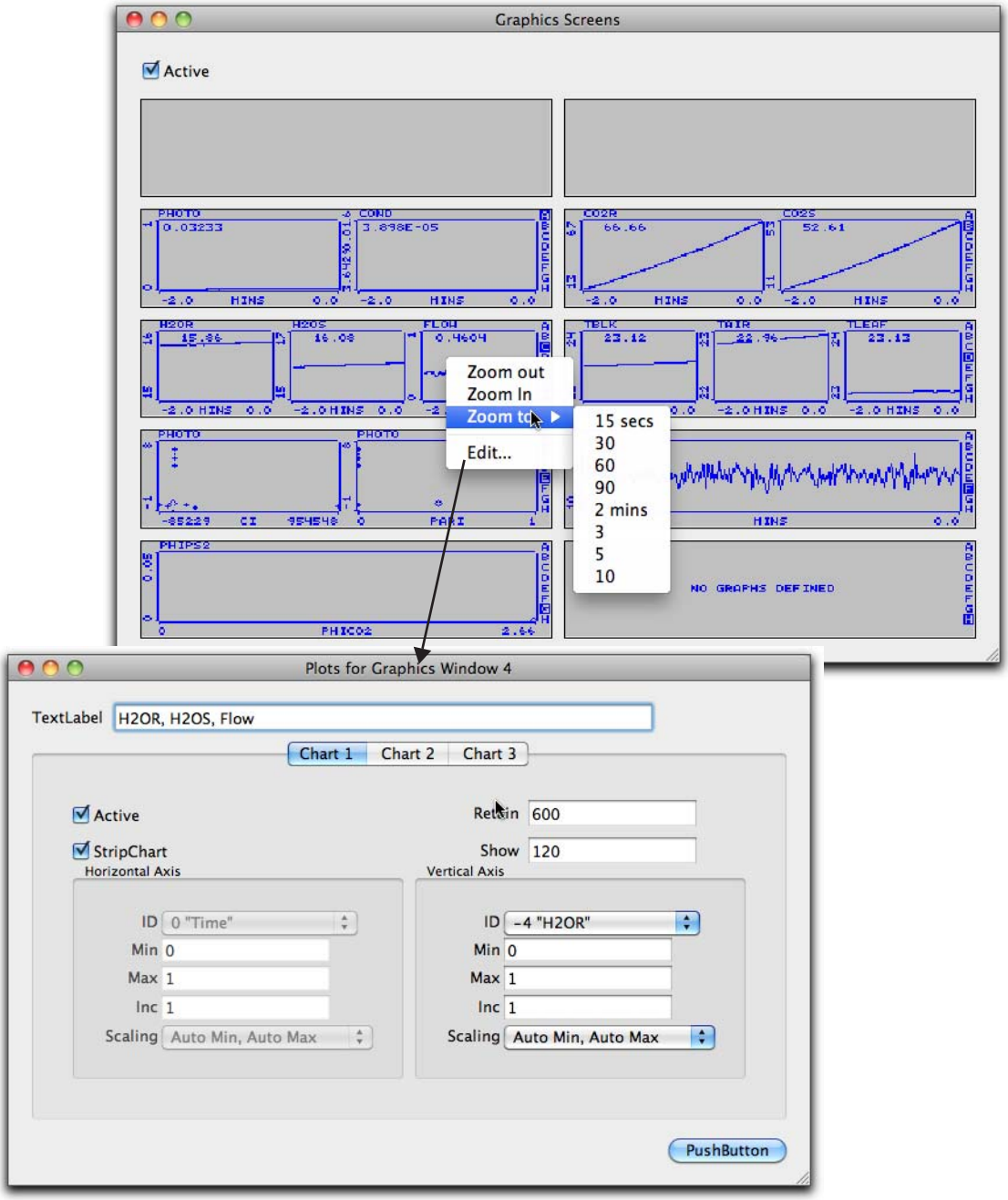


For Mac OSX, Linux, and Windows: the new version 3.0 of LI6400XTerm.



For iPad: LI6400TermHD version 1.1 (to be released early 2012)

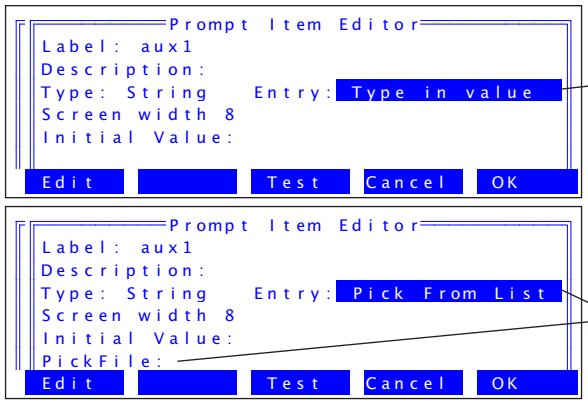
On the LI6400XTerm version 3, you can directly change the graph parameters on the instrument without having to do any navigating or editing on the instrument. You simply right click on the plot to change, as shown below.



Pick-From-List Prompts

Sometimes it is convenient to have a prompt whose response comes from an item in a list, instead of having to type in the response. For example, a plot identifier might be some long string (e.g. "A274-B324K"), but there are only some limited number of them, so can be "pre-loaded" in a list.

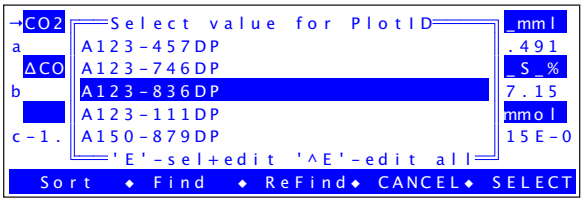
Version 6.2 introduces the "Pick From List" option for entering prompts. The Prompt Item Editor now looks like this:



Normal. You type in responses from the keyboard (or use a barcode reader).

New. Entry will come from a list that lives in the specified file.

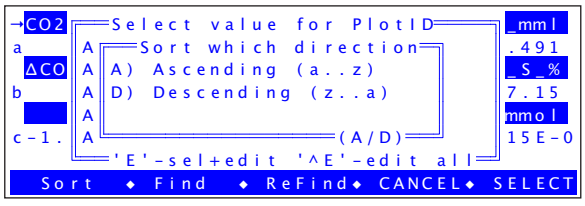
When a prompt whose entry method is specified as 'Pick From List' is asked (e.g. as part of **Prompt All** (**f5** level 3) or **Sys&Usr Consts** (**f3** level3), it looks like this:



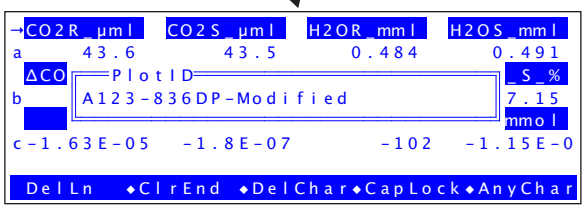
Pick the desired response, and press enter or f5.

Notice there are also some options:
f1 - sort the list
f2 - search for target
f3 - find the next occurrence of the target
E - select the current item, then edit it like a normal prompt response
ctrl+E - edit the whole list, and update the file.

f1 - Sort



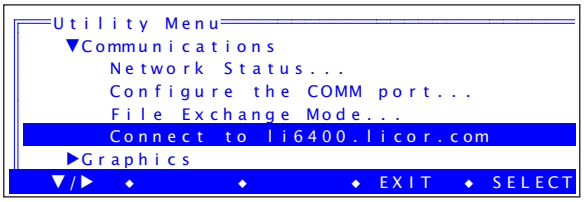
E - Select + Edit

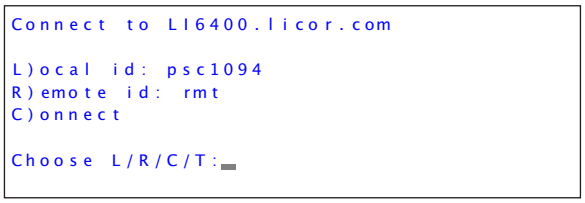


For further details, see the version 6.2 manual, page 9-25.

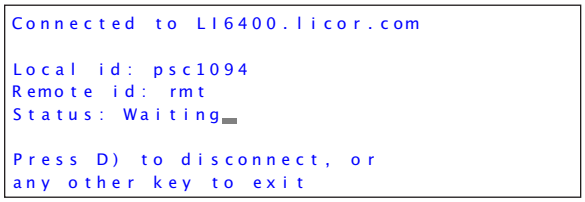
Connecting to li6400.licor.com

The routine for connecting an LI-6400XT to li6400.licor.com (See Using the LI-6400XT, Connection via Internet, page 11-35) is now found in the Utility Menu

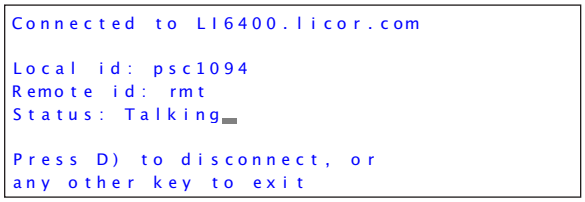




Prior to connecting



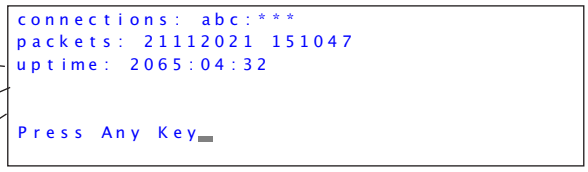
Connected to li6400.licor.com, but waiting for the other party (local id = rmt, remote id = psc1094)



You and the other party connected and talking.

The difference in 6.2 is that the connection *persists* even when the user on the other end of the server disconnects his terminal. This means you can connect the LI-6400XT to the server, go home, and connect to the LI-6400XT from there. Disconnect and reconnect all you want to - the LI-6400XT will always be there. The only way to get it to stop is to press **D** in the connection dialog (above).

The **T** option tests the server, to see what connections or pending connections there are.



One connection pending. ('abc' is waiting for someone).

How many packets the server has handled.

How long the server has been running.

This connection routine is described in the version 6.1 manual on page 11-38.

Version 6.2.1

Fixed bug that prevented insect respiration configuration from installing correctly.
Changed default configuration for Whole Plant Canopy chamber to Photosysthesis and Transpiration only.
Added LCF capability to AciCurve2 autoprogram.

Version 6.2.2

Fixed bug in tracking ambient option for all light source controls.

Version 6.2.3

Improved how RGB fractions are computed in RGB light source.
Synchronized function key labels when turning mixer on when pump is off.

Version 6.2.4

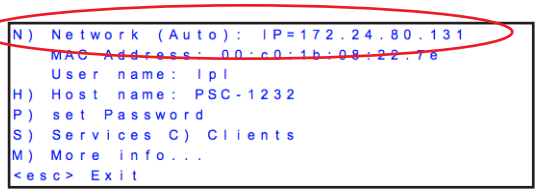
Improved square flash calibration to cover wider range of LCF behaviors.
Fixed several bugs in AutoLog2 and AciCurve2.
Fixed cursor issue when data exceeds window space in single line edit box.
Changes to support LI6400XTerm version 3.4 and above:
- Added support for allowing remote client to control LCF configuration directly.
- Several changes to address performance issues when connected to a remote client via RS-232.

Version 6.2.5

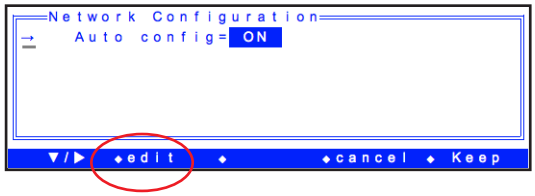
Static IP Addresses

Version 6.2.5 allows you to set static IP addresses. This is done through the NetworkConfig utility (type **N** in the LPL screen, or if OPEN is running, use "Network Status..." in the Utility Menu.

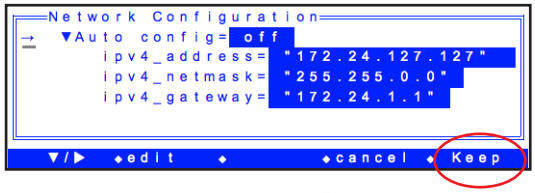
Once the Network Status utility is running, type **N** to make a change to it. In this example, the configuration is automatic.



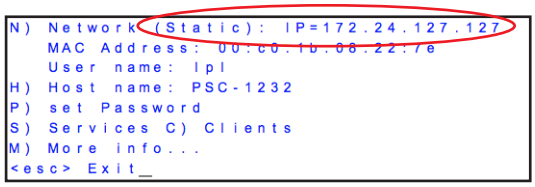
To set a static IP, change Auto config to off by pressing **f2**.



Set the IP, network mask, and gateway addresses to appropriate values by moving cursor to the line and pressing **f2** (edit). When done, press **f5** to implement your changes.



After a few seconds while networking restarts, the new IP should appear.



External Quantum Sensor

Fixed the issue involving prompting for an external quantum sensor. Prior to 6.2.5, if there were no external quantum sensors in the accessory list, the SynchSerialNumbers routine will ask you to pick one from the empty list. You can add one from there, but if you don't you will be pestered with this on every config change. The way it works in 6.2.5 is this: When a config is implemented that has external PAR being measured, and no S/N is specified, you be prompted as before. If you don't implement one, or pick one, the config will change the external Quantum setting to 'none'. (This can result in the default configuration showing an unexpected modification (*) when you implement it.)

Another aspect of this is energy balance, and the potential need for an external quantum sensor. You now will get a warning when modifying the config in the View/Edit tree when these three conditions are true: Energy Balance is enabled, F_parOut > 0, and the quantum sensor list is empty.

Illegal Characters
When entering a file name on the LI-6400 console, the software doesn't allow you to type characters that file systems find illegal. 6.2.5 adds a character to the list: the pipe character (|). The current list of characters masked is now:

```
: " * ? ; / \ |
```

(colon, double quote, asterisk, question mark, semicolon, forward slash, back slash, and pipe).

Bug Fixes
Fixed several issues that could arise during AutoProgs when using the LCF as a light source.

Fixed the issue that caused "Can't open /User/LCF" messages when logging during AutoProgs, and a related issue that would keep dark pulses from being automatically saved.

Quicker LED and LCF shutdown when specifying a 0 target value.

In the soil respiration configuration, the previously computed Efflux remains visible on the display instead of being zeroed out at the start of the next measurement.

Fixed the issue of the light source being reported as not stable (and delaying AutoProgs) when no light source is being used, or (in the case of LCF and red-blue LED) turned off.