



Resonance RF-Powered Lamps Software Manual

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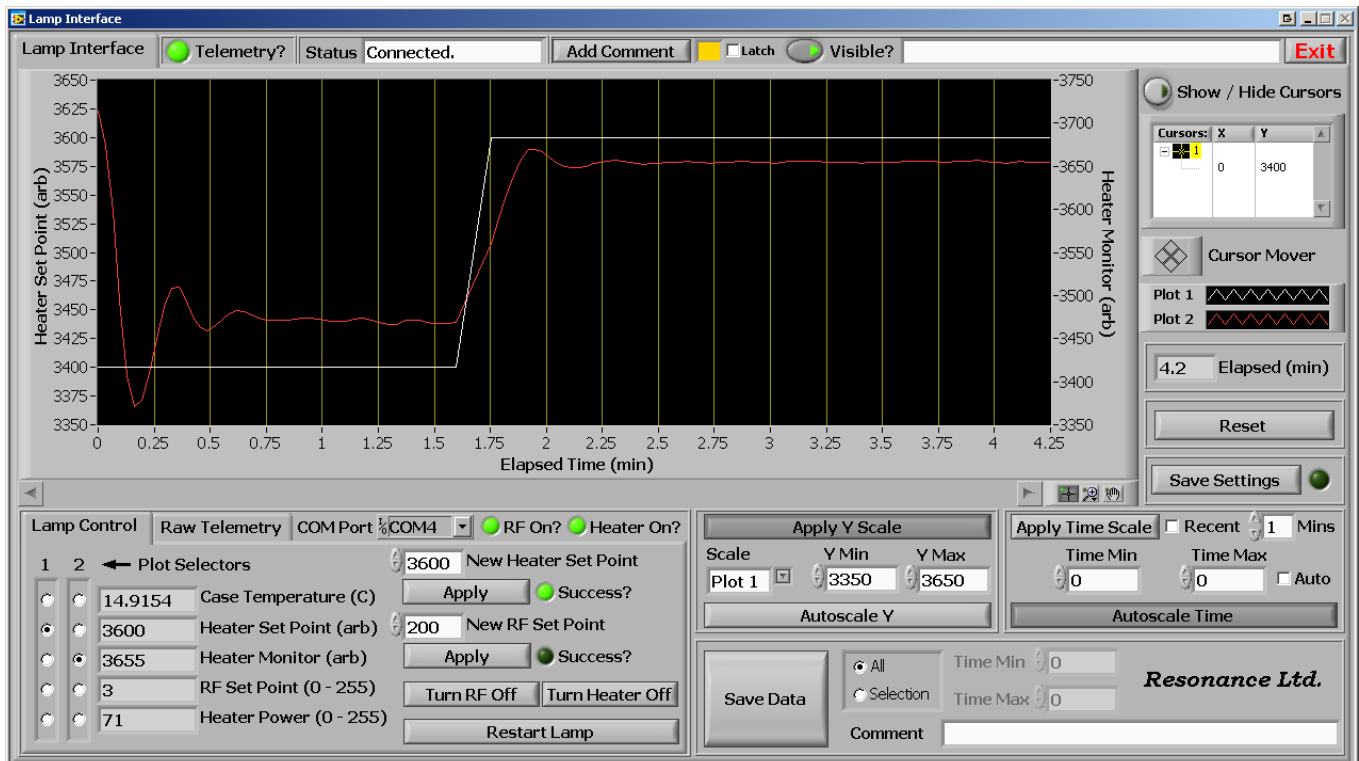


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Overview

The RF-powered lamps offered by Resonance Ltd. have built-in microprocessors for closed-loop temperature control of the source heater and RF output, and also supply temperature readings and power with telemetry output. These lamps are in essence “smart” and can be interfaced with to provide the user with the ability to customize the spectral characteristics of the lamps’ output. The “Lamp Interface” software is a LabVIEW-based, fully-featured graphical application which allows easy setting and logging of all the lamps’ parameters. Not every lamp will have the same hardware, and therefore some features of the software apply only to certain lamps. For example, if a given lamp does not have a heater module the software settings pertaining to the heater are irrelevant; even though the lamp’s onboard firmware recognizes the commands. This ensures the software is compatible with every lamp, and vice-versa, since all lamps run the same generic firmware.

The operating software provides a chart recorder which is provisioned for two y-axes. The user can decide which telemetry data to display at a time. All data is logged and can be saved as Excel-friendly .csv files. Annotations can be added to the chart, and comments added to the logged data. The software is designed to be straight-forward yet remain rich with features, and Resonance Ltd. is always improving and updating its interface to meet customer needs.

Features

- Setting and monitoring of lamps’ heater and RF output
- Chart recorder with two customizable y-axes
- Annotations and comments can be added to chart recorder and logged data
- Excel-friendly .csv file output
- Display of case temperature, heater set point, monitor, and power; RF set point and power
- Selective saving of data; can specify time range
- Supports cursors for analyzing chart record data
- Easy zooming and changing of graph scales
- Compatible with Windows XP, Vista, and 7 (32 and 64-bit versions)

Installation & Requirements

The “Lamp Interface” software can be installed on any PC running Windows XP, Vista, or 7 in both 32-bit and 64-bit modes. The only driver required is also compatible with all these systems, and automatically detects the correct driver to install when launched. The software has very minimal requirements and can run on netbooks, laptops, and desktops with processors > 1 GHz. More than 2 GB of RAM is recommended if the software is to log data for a long time, on the order of days, otherwise any amount of memory will do as long as it is greater than 512 MB. In order to successfully install the lamp software, please follow these steps:

1. Make sure the lamp’s breakout box is not plugged into the USB port of the computer you are installing the software on.
2. Install the virtual COM port driver by running the “FTDI Setup.exe” file and following its instructions.
3. Install the “Lamp Interface” software by running the “setup.exe” package that came with the installation package. You should notice that shortcuts have been added to the desktop and start menu. Do not start the software at this time.
4. Plug the USB cable of the breakout box into a USB port on the PC. Depending on the operating system you are running, Windows will find the hardware and look for a suitable driver. If it asks to look online, tell it not to. Windows will scan its driver directories, and automatically find and install the driver which was placed by the executable run in step 2.
5. Open up *Device Manager* through your *Windows Control Panel* and look for a category called “Ports (COM & LPT)”. You should see the lamp’s breakout box listed in this section as a virtual COM port. Remember the COM port number, this will be needed to set in software for successful interfacing (described in the next section).

COM Port

The driver for the lamps is a virtual COM port. It emulates a hardware serial port and shows up in your PC as a physical COM port. In order to use the “Lamp Interface” software, you must tell it which COM port to listen for the lamp telemetry. Run the “Lamp Interface” software by using one of its shortcuts, found on the desktop and Windows “Start Menu”. Refer to figure 1 below and note the “COM Port” parameter.

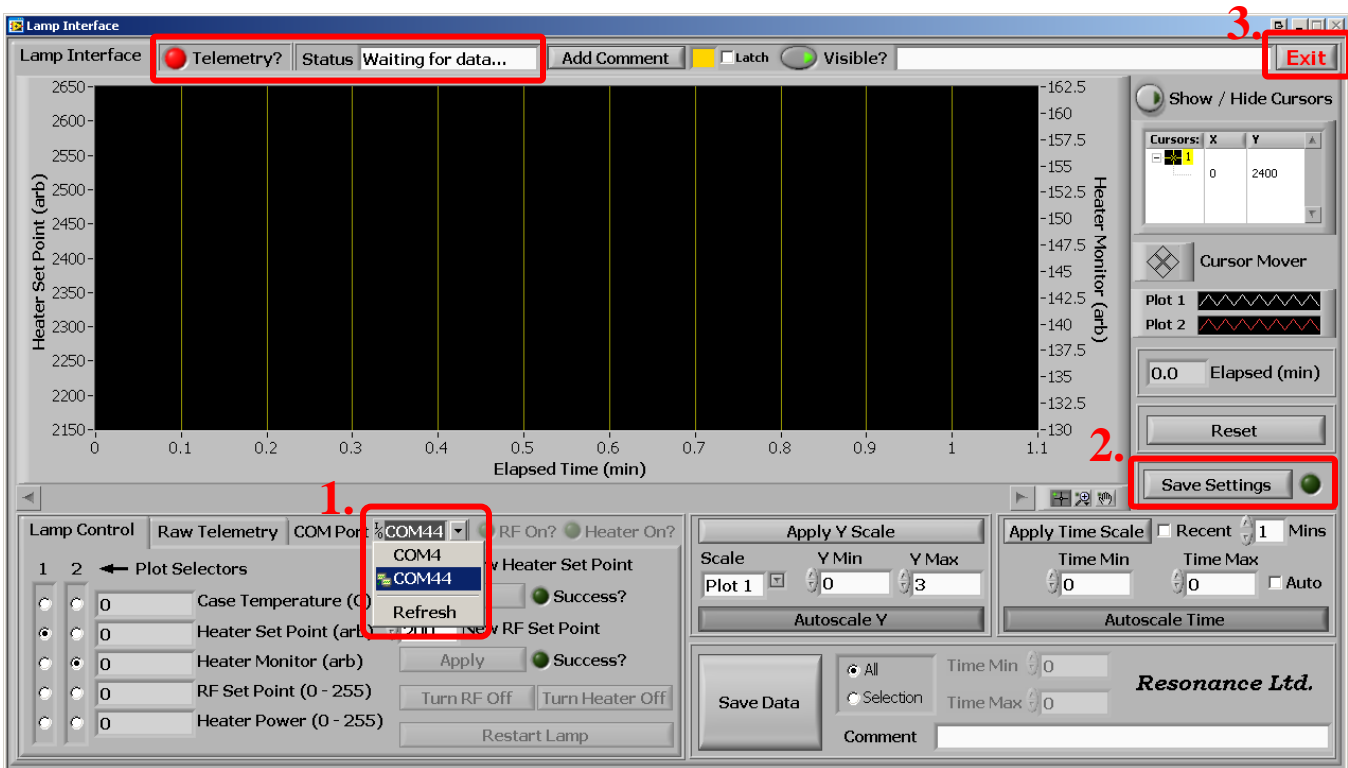


Fig. 1: The “Lamp Interface” software waiting for the correct COM port input.

Note the highlighted fields in figure 1. The top bar displays a red LED indicator for the telemetry stream and also the status reports “Waiting for data...”. The “COM Port” selector is seen expanded via its drop-down arrow and on this particular system there are two COM ports to choose from. Select the appropriate COM port that was identified in the last step of the “[Installation & Requirements](#)” section. Once this COM has been chosen, the settings must be saved by pressing the “Save Settings” button. The software must then be restarted – hit the “Exit” button and then re-launch the executable. Upon initialization the “Telemetry” indicator should turn to a green LED and you should see all the lamp’s parameters displayed. Refer to subsequent sections for a description of this information.

Indicators

Figure 2 below is a screenshot of the software in action; actively connected to a lamp.

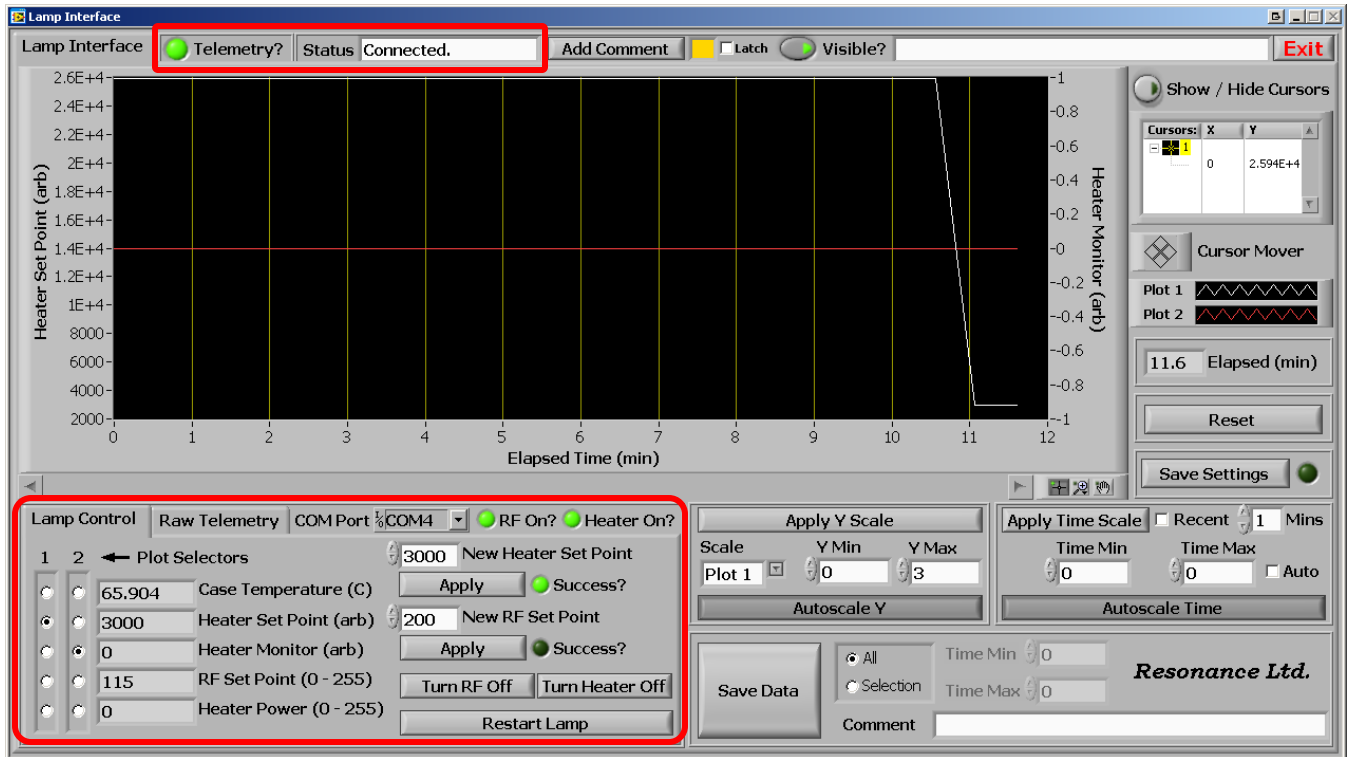


Fig. 2: The “Lamp Interface” software connected to a lamp.

You can see that the “Telemetry” LED is green, and the status reports “Connected.”. This lets the user know that a lamp is being monitored. The “Lamp Control” tab shows all the available information from the lamp. The two green LEDs labeled “RF On?” and “Heater On?” show whether these two modules are actively being controlled according to their set points. They can individually be turned on and off, if the lamp hardware supports them (remember, every lamp is different!). The green LEDs labeled “Success?” indicate whether a parameter that has been applied has been accepted or rejected by the lamp’s firmware. This is an important indicator, as it lets the user know if their inputs are being recognized.

Telemetry

The telemetry from a lamp consists of ASCII strings with parameters delimited by spaces. Refer to the next section “RS-232 Syntax” for a more detailed description. This data is available over USB thanks to the virtual COM port, and also simultaneously on the RS-232 port on the lamp’s breakout box. In this manner the software can monitor the lamp at the same time as an external microprocessor or PLC.

Parameters

The information embedded in the telemetry stream is listed below along with a description of the parameter:

Case Temperature

Reported in degrees Celsius, this is simply the temperature of the lamp’s forward-cylindrical case covering its bulb. It is very useful for monitoring the lamp’s thermal stability over time.

Heater Set Point

An arbitrary integer which sets the temperature the lamp will heat its bulb. The useable range is 0 – 5000, and the lower the number the higher the set temperature will be. Please note that values below 3000 can be dangerously hot for the lamp bulb and may induce cracking of its window, or loss of its seal to the bulb body.

Heater Monitor

Using the same arbitrary integer scale as the set point, this reports the actual temperature of the heater. Monitoring this parameter can let the user know whether the lamp is successfully heating the bulb to its set point.

RF Set Point

Using a different arbitrary integer scale, the RF set point has a useable range of 0 to 255, where 255 is the maximum RF power (100%).

Heater Power

This parameter reports the output of the lamp’s heater, in a scale of 0 to 255, where 255 is the heater’s maximum setting (100%).

Raw Strings

Figure 3 below is a screenshot of the software running with the “Raw Telemetry” window displaying the received sentences from the lamp.

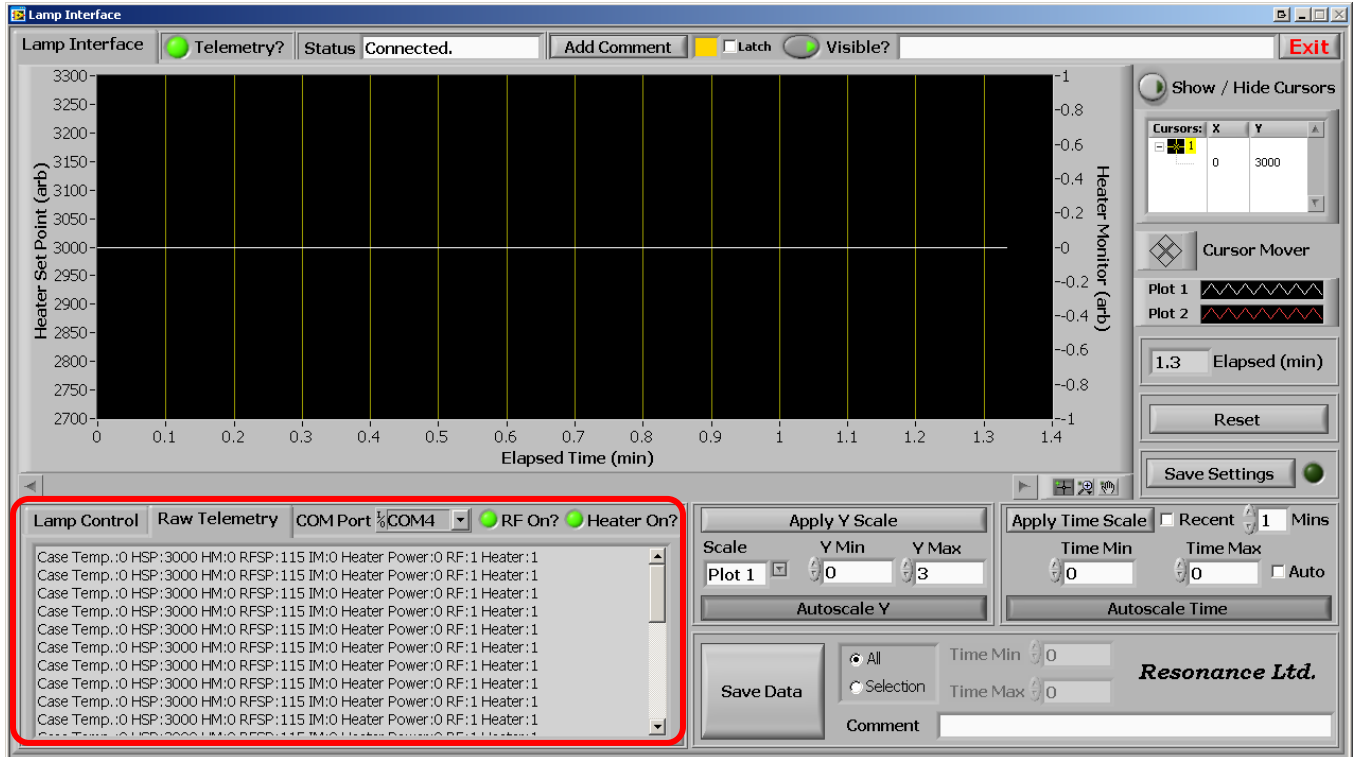


Fig. 3: The “Lamp Interface” software displaying raw, received telemetry.

This window is useful to debug any serial communication problems. For example, if the “Telemetry?” indicator reports no received information at times (red LED), it may be an issue with a broken or noisy serial cable from the breakout box to the lamp, or the box to the PC. If the sentences appear garbled or display funny characters in this window, it indicates that many errors are present in the serial data, which would prevent proper parsing of the sentences.

RS-232 Syntax

As previously mentioned, the telemetry sentences are ASCII characters delimited by spaces and terminated with carriage returns (<CR>). Parsing the sentence is easy if the programmer simply looks for these spaces to separate the data fields. Here is an example sentence:

Case Temp.:0 HSP:3000 HM:0 RFSP:115 IM:0 Heater Power:0 RF:1 Heater:1

From this sentence we can derive the following information:

Case Temperature:	0° C
Heater Set Point (HSP):	3000 / 5000
RF Set Point (RFSP):	115 / 255
Intensity Monitor (IM):	0 / 255 (not used)
Heater Power:	0 / 255
RF ON or OFF? (1 or 0):	ON
Heater ON or OFF? (1 or 0):	ON

The sentences are not fixed-width so it is very important to search the string for spaces, and not rely on offsets from the beginning of the sentence for parsing. This information is output approximately once per second, and is available on the RS-232 port on the lamp's breakout box.

The RS-232 interface is 2-way, and all these parameters can be set with a command set. This set can be obtained by request from Resonance Ltd.. Contact information can be found on the Resonance Ltd. website: <http://www.resonance.on.ca/>

Chart Recorder

The chart recording function of the “Lamp Interface” software is one of its most useful features. All telemetry parameters are automatically stored with respect to elapsed time. The chart recorder allows the user to graphically display any two parameter fields simultaneously, on their own y-axis. Refer to figure 4 below:

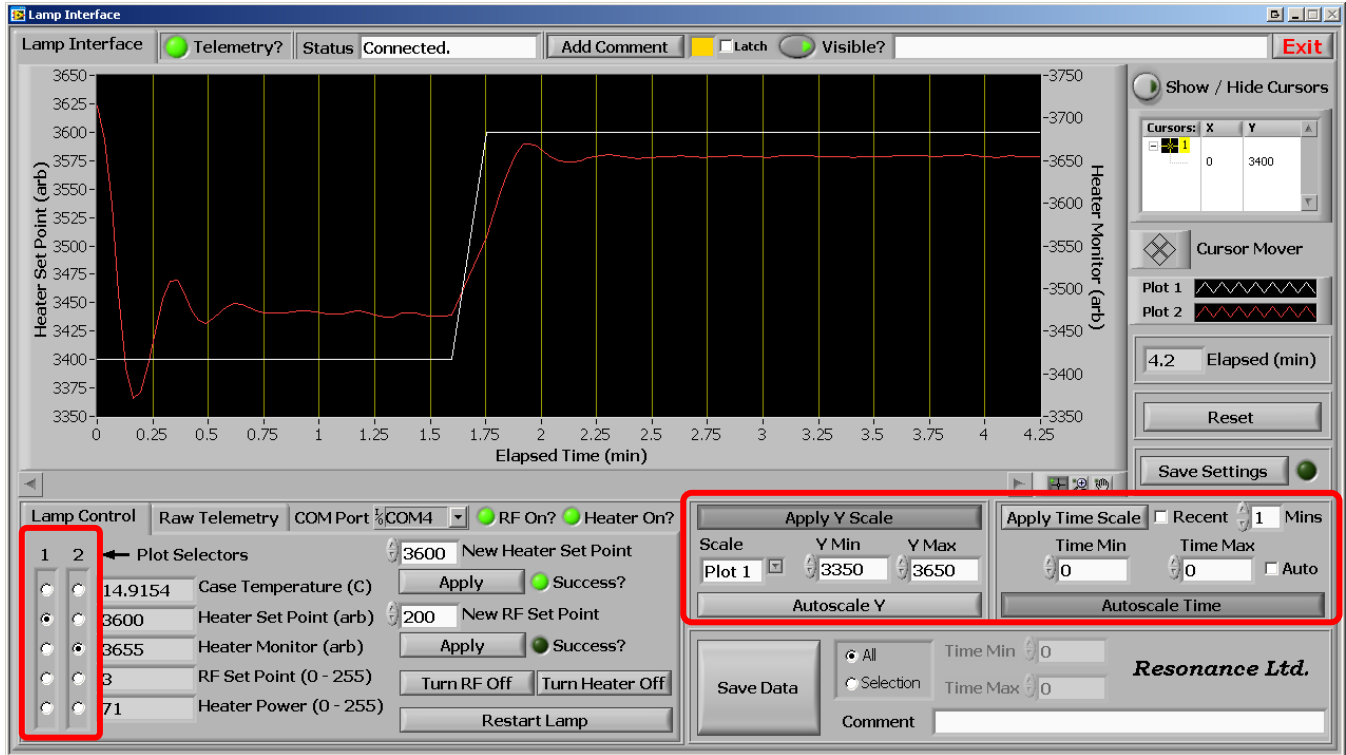


Fig. 4: The chart recorder with heater set point (white) and heater monitor (red).

Y Scales

We can see in figure 4 that in this screenshot, the heater set point is displayed on the primary y-axis (plot 1, left side, white) and heater monitor on the secondary y-axis (plot 2, right side, red). Note how useful this information can be; the monitor shows how the heater control loop is trying to achieve the set point of 3400, but the set point was changed to 3600. You can now see how the heater monitor gets closer and closer to the set point over time.

You can assign a parameter to a plot by changing its “Plot Selector” using the two vertical radio boxes that correspond to the parameter to its immediate right. You can also change the limits of each y-axis individually by selecting “Apply Y Scale” and entering a “Y Min” and “Y Max” value. The plot to which these limits apply is determined by the “Scale” drop-down box.

Time Scale (Elapsed)

The x-axis, which is always elapsed time, can be set to autoscale or manual limits just like the y-axes. Additionally, this scale supports a few extra options to enhance the way in which recorded data is viewed. The “Recent” checkbox is used to tell the software how many “Mins” (minutes) of data to display from the current time. That is, if this was checked and “Mins” was set to 5, the chart will always display the last 5 minutes of data. The “Auto” checkbox next to the “Time Max” box is used to always allow the latest data to be displayed while maintaining a set “Time Min” (minimum time, in minutes). For example, the user may wish to display data only from x minutes forward until the current time. These features are only active if the “Apply Time Scale” button is clicked (autoscale is disabled).

Annotations / Cursors / Reset

The chart recorder has come useful functions beyond its x and y axes. Refer to figure 5 below.

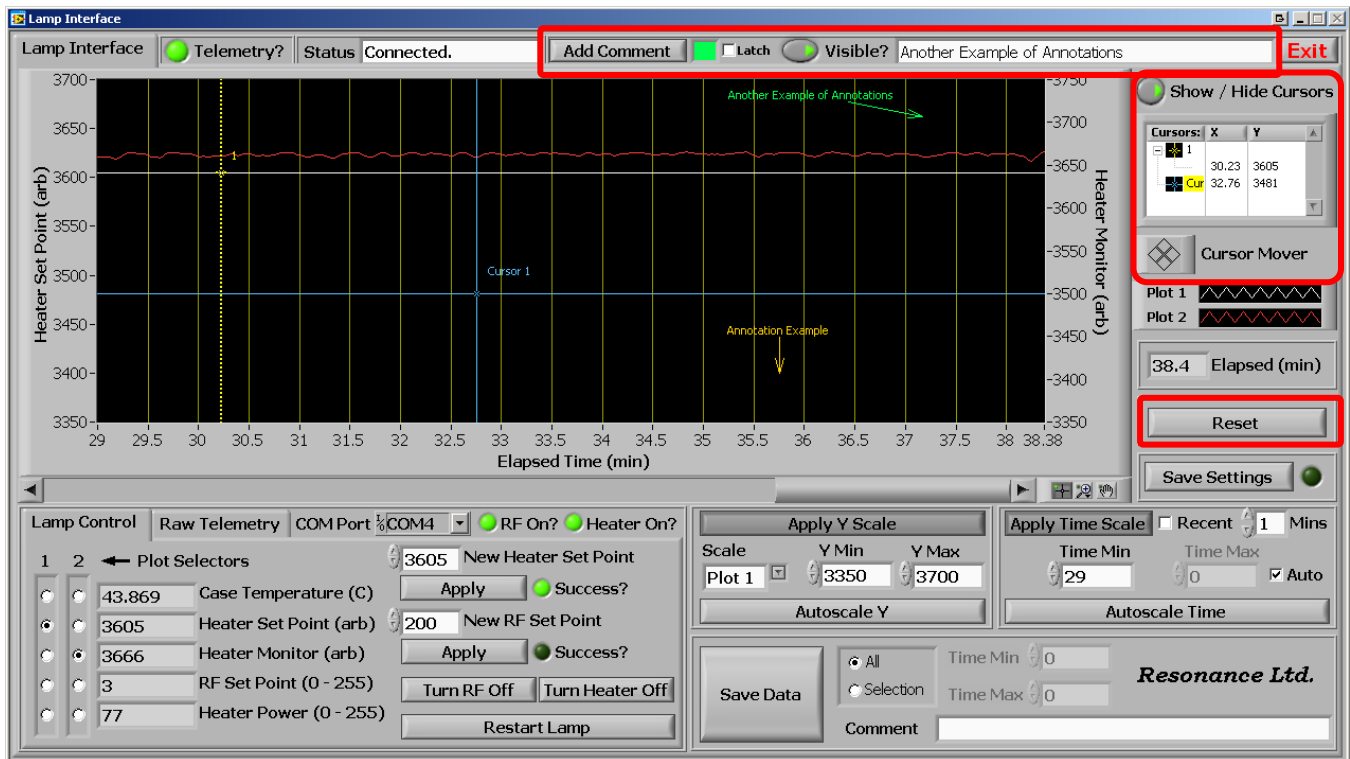


Fig. 5: The chart recorder with annotations and cursors displayed.

Annotations can be added by clicking the “Add Comment” button, where any text in the adjacent input box to the right is added to the graph with the specified colour, selected by clicking on the coloured square immediately to the button’s right. The “Latch” checkbox

is used to repeatedly an annotation every time data is received, which is useful for indicating a section of data where a pertinent action is being performed in the system the lamp is part of. Annotations are saved along with data in the output .csv data file.

Cursors can be used to display useful information about the plots on the chart. Cursors can be created or deleted, and customized in many ways. These actions are accessible by right-clicking inside the “Cursors” box and selecting the various options in the menu that pops up. Cursors can also be shown / hidden by toggling the “Show / Hide Cursors” button.

The “Reset” button clears all chart recorder data that is currently being held in the program’s memory (RAM). Sometimes the program may become sluggish if it has been logging data for many days, or the computer it’s running on doesn’t have a lot of free memory. Once this button is pressed the data is gone for good, so be sure to save any useful data before resetting the chart recorder.

Lamp Control

There are a number of commands that are easily accessible under the “Lamp Control” tab of the software (refer to figure 6 below).

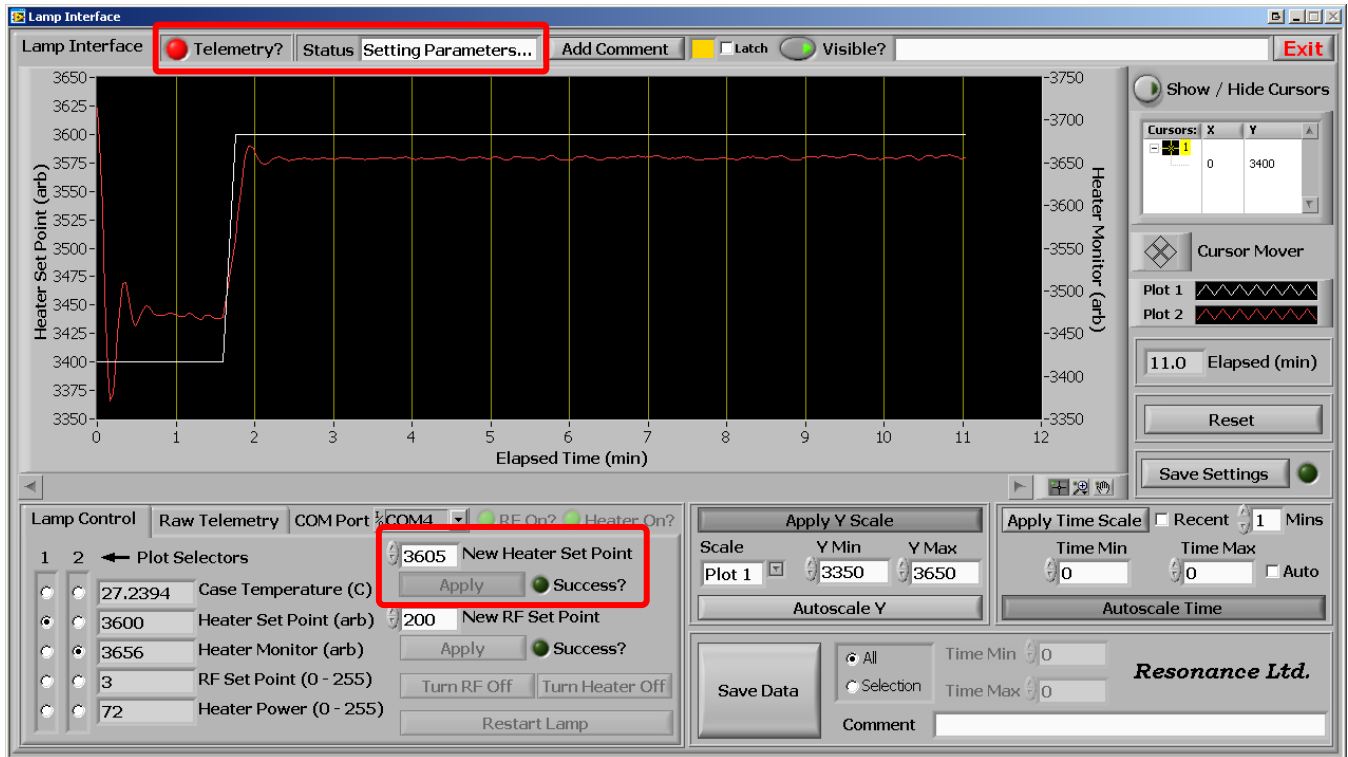


Fig. 6: The “Lamp Control” tab with a new heater set point being applied.

These commands are listed in the following sections and explained accordingly. When a parameter is changed, you must click on its corresponding button to apply it. Note how the greyed-out “Apply” button is depressed to apply the new heater set point of 3605. The “Telemetry?” indicator turns red during this process and the status box changes to “Setting Parameters...”. The “Success?” light next to the “Apply” button will indicate whether the setting took hold, when the “apply” button un-greys itself.

Heater Set Point

This applies a new heater set point, entered in the “New Heater Set Point” box. The “Success?” indicator will turn bright green if the new setting is successfully applied.

RF Set Point

This applies a new RF set point, entered in the “New RF Set Point” box. The “Success?” indicator will turn bright green if the new setting is successfully applied.

Turn Heater ON or OFF

This toggles the closed-loop heater circuit on or off. If the setting was successful, the button will change its label to reflect the current state of the heater. For example, if the button says “Turn Heater Off”, it means the heater is currently on, and will change to “Turn Heater On” if it was successfully turned off.

Turn RF ON or OFF

This toggles the RF circuit on or off. If the setting was successful, the button will change its label to reflect the current state of the RF output. For example, if the button says “Turn RF Off”, it means that RF output is currently active, and will change to “Turn RF On” if it was successfully turned off.

Restart Lamp

This button forces a restart of the lamp’s firmware. It is rarely used and is generally there as a means of debugging certain lamp operations. It should not generally be used unless requested by a support team from Resonance Ltd.

Data Saving

All telemetry parameters are automatically logged in program memory for as long as the executable is running. This data can be output in Excel-friendly comma-delimited .csv files by invoking this function. The user has the option to output all or some of the data, specified by a start and end time index (in minutes). Simply choose “Selection” and specify a “Time Min” and “Time Max” and then press “Save Data” to output a section of data.

Settings

There are a total of 3 settings that the “Lamp Interface” software writes to an INI file: COM Port, a default “New Heater Set Point”, and a default “New RF Set Point”. These settings are written when the “Save Settings” button is pressed, and are loaded at program startup. Be aware that the set points are merely loaded, and not actually applied to the lamp. The green LED indicator next to the save button displays whether the operation was successful (when the button un-greys itself).

Troubleshooting

The following is a quick guide meant for diagnosing problems and offers possible solutions which will hopefully rectify any unwanted behavior. You are encouraged to contact Resonance Ltd. with any problems, and can contact us via our website at

www.resonance.on.ca/

Telemetry is not Received

This issue can be caused by a number of things. First, make sure the breakout box is connected to the PC with a USB cable, and that the lamp is receiving power (the breakout box power switch is ON). Check *Device Manager* and make sure the lamp's breakout box shows up under the section titled "Ports (COM and LPT)", and take note of the COM port number. In the software, make sure the "COM Port" setting matches the observed port and change it if it does not. Click "Save Settings" and restart the software to retry connecting to the lamp.

Sometimes the COM port of the breakout box will change depending on how it is enumerated when plugged into the USB port of the PC. Changing the port in the software rectifies this.

Telemetry is Sporadic and Unreliable

If telemetry data is observed in the "Raw Telemetry" section, but the "Telemetry?" indicator LED is often red, serial data may have a high error rate, which is preventing the proper parsing of data. This could be caused by a bad cable connecting the breakout box to the lamp, or even a shoddy USB cable from the box to the PC. It could also be caused by intense interference from electro-magnetic sources that may be present in the room. There is no clear course of action other than making sure the cables are secured and unbroken.

The Software Reports No Settings File Could Be Found

When the software is started it attempts to read an INI file that contains program settings. If this file is missing or corrupt, the software informs the user and loads default settings. To create or overwrite a corrupt file, simply click "Save Settings" and watch for the green LED to indicate a successful write.