



PSY1 Stem Psychrometer Quick Start Guide

Version 4.4

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Quick Start Guide

NOTE: This manual should be used in conjunction with the instructional videos provided by ICT International to compliment each section of operation.

These videos are located on the ICT YouTube site:

<http://www.youtube.com/user/ictintl>

WARNING – The Thermocouples of the Stem Psychrometer Chamber are made from very fine wire only 25 μm in diameter. NOTE: Human hair is on average 100 μm thick. You will require a dissection microscope with a 20X magnification objective setting to view the thermocouples. You cannot see them or manipulate their position with the naked eye. Thermocouples are easily broken if handled incorrectly by unprepared operators. Please WATCH the video Adjusting the Thermocouples : <https://www.youtube.com/watch?v=kNsZnSYDBPE&list=UUxtXEr9V3UE5XzDQR6wwtRg> before removing the chamber's calibration lid.

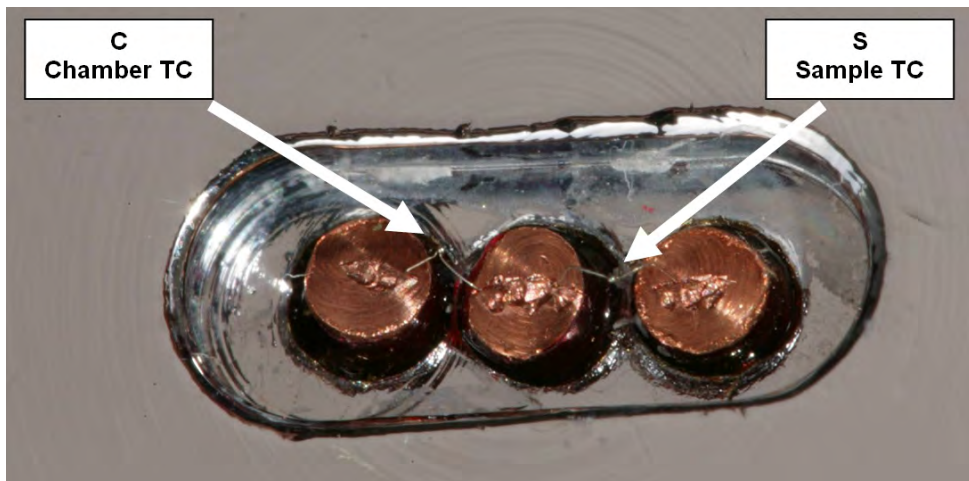


Photo: 25 μm Chromel/Constantan thermocouples viewed under a dissection microscope at 20X magnification.

PSY1 Start Up Check List



WARNING!

Please Read,
Understand and Complete this checklist before unpacking the PSY1



☐ Have you read the manual?

<http://ictinternational.com/support/product-manuals/>



☐ Have you watched the videos?

<http://www.youtube.com/user/ictintl>



☐ If you are unsure about anything regarding your Psychrometer contact ICT International before use.

email: sales@ictinternational.com.au phone: +61 2 6772 6770



If you break the microscopic 25 micron psychrometer thermocouples it will cost:

Replacement Thermocouples: \$220

Labour: \$120 / hour

Packing & Handling: AU \$45

Freight: TBA

System Requirements

CPU Processor:

The ICT Instrument software does not require large processing power.

For example it is compatible with NetBooks.

Minimum Recommended Processor Capacity:

Intel Atom Processors with a CPU N270 @ 1.66 GHz and 1GB RAM or higher.

Software:

The ICT Instrument software is compatible with the following

Windows Operating Systems:

- a. Windows Vista
- b. Windows 7
- c. Windows 8 and 8.1
- d. Windows Virtual OS run from a Mac computer

Screen Resolution:

The ICT Instrument software is written to a fixed screen resolution of 857 x 660 dpi (it does not Auto Resize) and works best on current model laptops that have a screen size of 11.6" or larger and a default screen resolution of 1366 x 768 (the vertical height of 768 being most important otherwise you can't see the bottom of the software window).

Power Requirements and Charging the PSY1 Internal Battery

The PSY1 is a self contained instrument that incorporates a lithium polymer battery. Before using the instrument, this battery **MUST** be charged.

To choose from a range of charging options see :

Connecting a Power Supply to the Instrument (pages 7 to 11).


The PSY1 can be charged from a range of external voltages via the Bus Plugs, however there are limits. For the PSY1 to correctly charge, the external power supply must be within a voltage range of 8Volts DC to 30Volts DC at all times. If the voltage falls below 8Volts DC the logger will automatically stop using the supply to charge the internal battery. 30Volts DC is a predetermined maximum voltage that the PSY1 can handle. Supply voltages that exceed this level are not recommended and may cause accidental triggering of the protection circuitry. Triggering this circuit may result in semi-permanent disabling of the external power which will require the PSY1 to be sent back to ICT for repair.


The unique power-bus plug design was developed by ICT International to simplify the electrical wiring process. It minimises the need for custom tools in the field, requiring only that the outer cable sheath be stripped back to expose the copper wire. See section: Connecting a Power Supply to the Instrument (page 7) No other tools are required with all necessary components fully incorporated into the instrument design. Retaining straps ensure that the power-bus plugs do not separate from the instrument when removed from the power-bus during wiring preparation and connection of external power.


Connecting a Power Supply to the Instrument


Individual Power Supply Connections


Important : Do not connect external power until the final step


- ① 


Remove both ICT bus plugs from one end of the logger
- ② 


Unscrew the end of the plug 1 to 2 turns.
- ③ 


Remove the Bus plug sealing cap.
- ④ 


Insert either polarity of the external power source cable.
- ⑤ 

Strip a maximum of 15mm from the end of the cable.
- ⑥ 

Pull the cable back so only that the stripped wires protrude from the ICT bus plug.
- ⑦ 

Bend the stripped wires back over the end of the ICT bus plug.
- ⑧ 

Important : Seal the cable against water ingress by tightening the end of the plug.
- ⑨ 

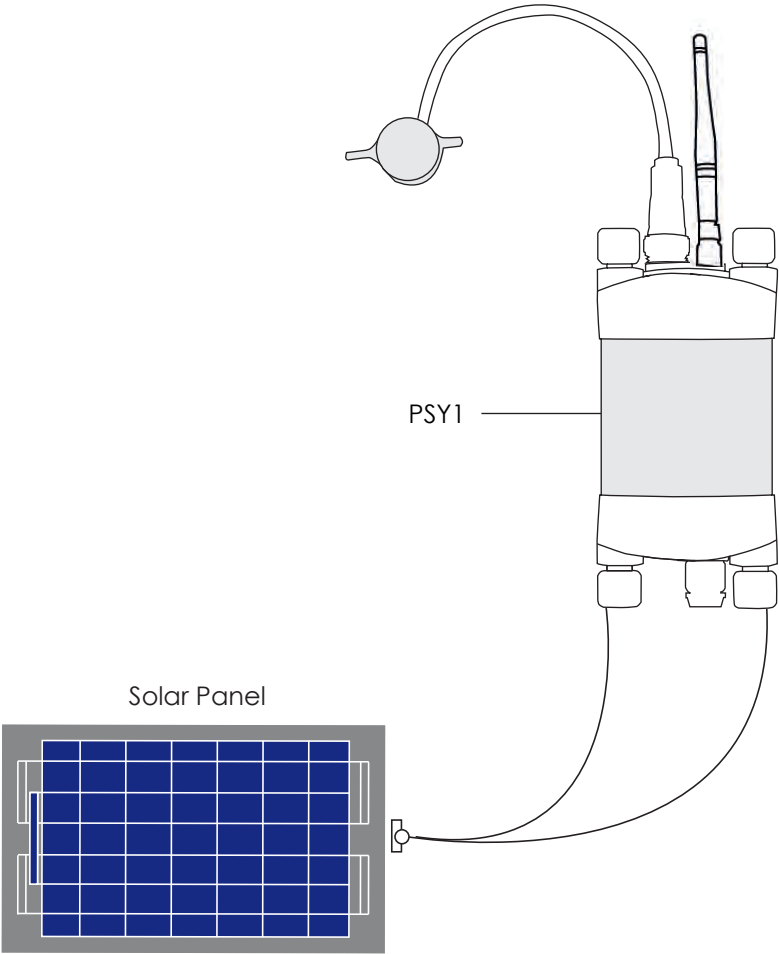
Repeat for second bus plug
- ⑩ 

Insert the ICT bus plugs into the endcap of the sensor. The plugs can be inserted in either polarity and will click when seated into position.

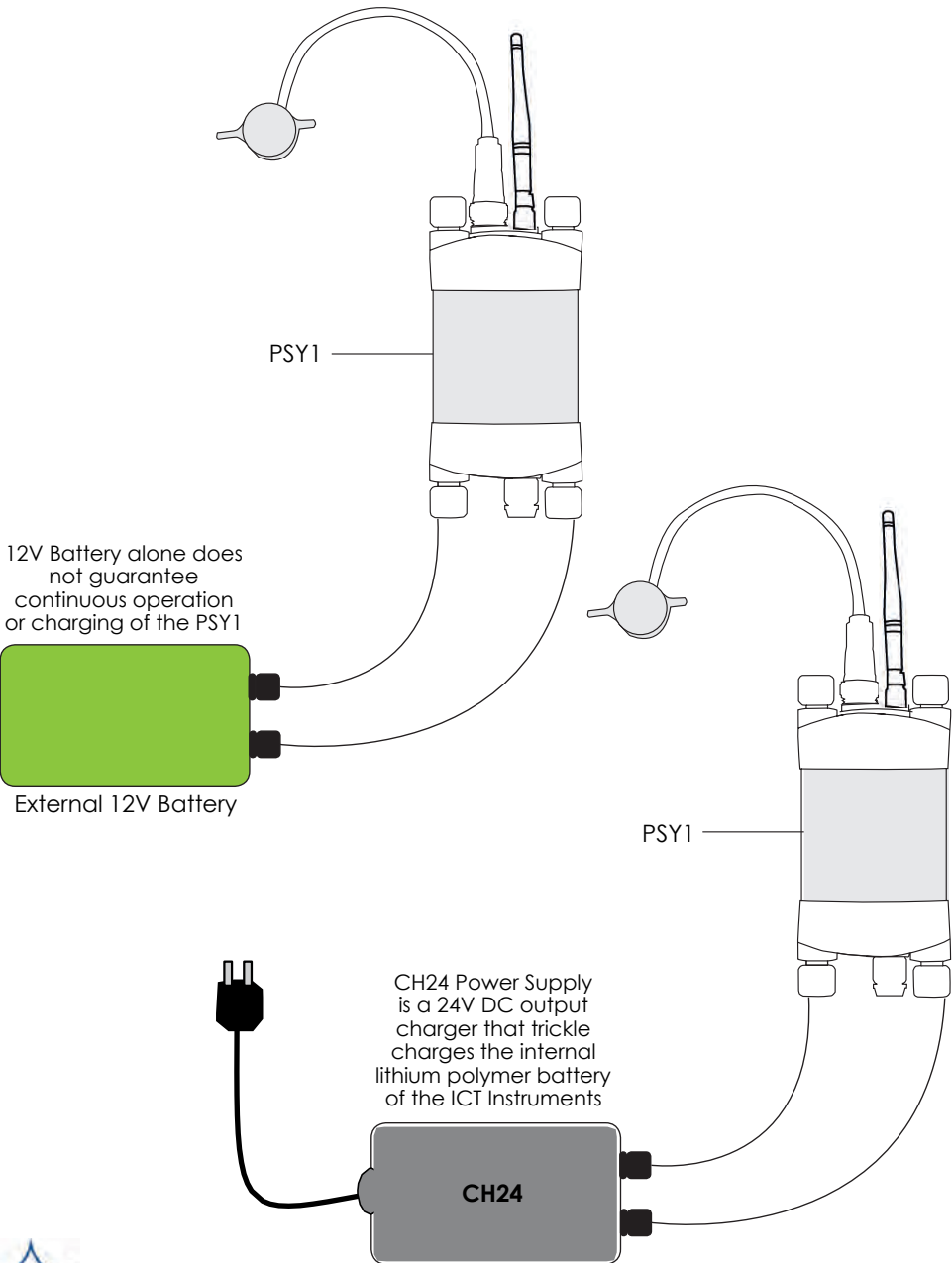
External power options
see pages 8 - 11

Connect the power cable to the external power source.

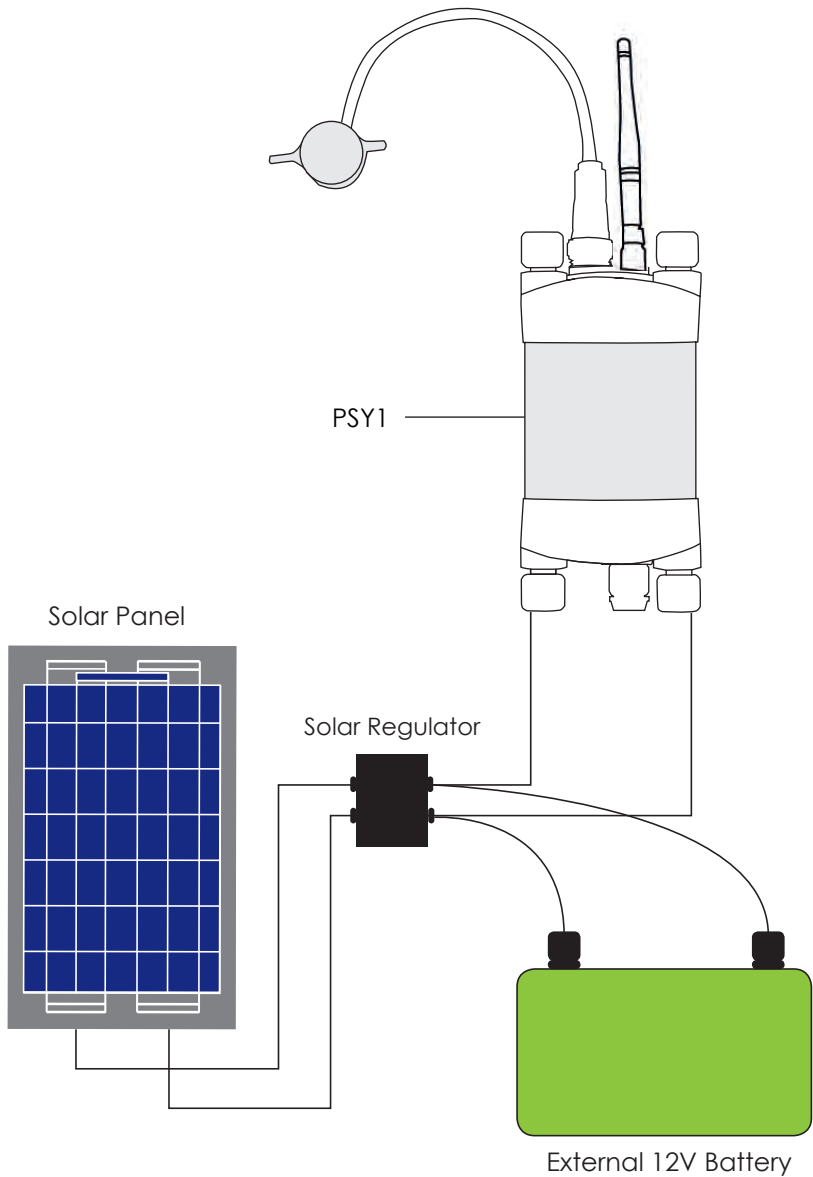
Connecting Power Directly via Solar Panel



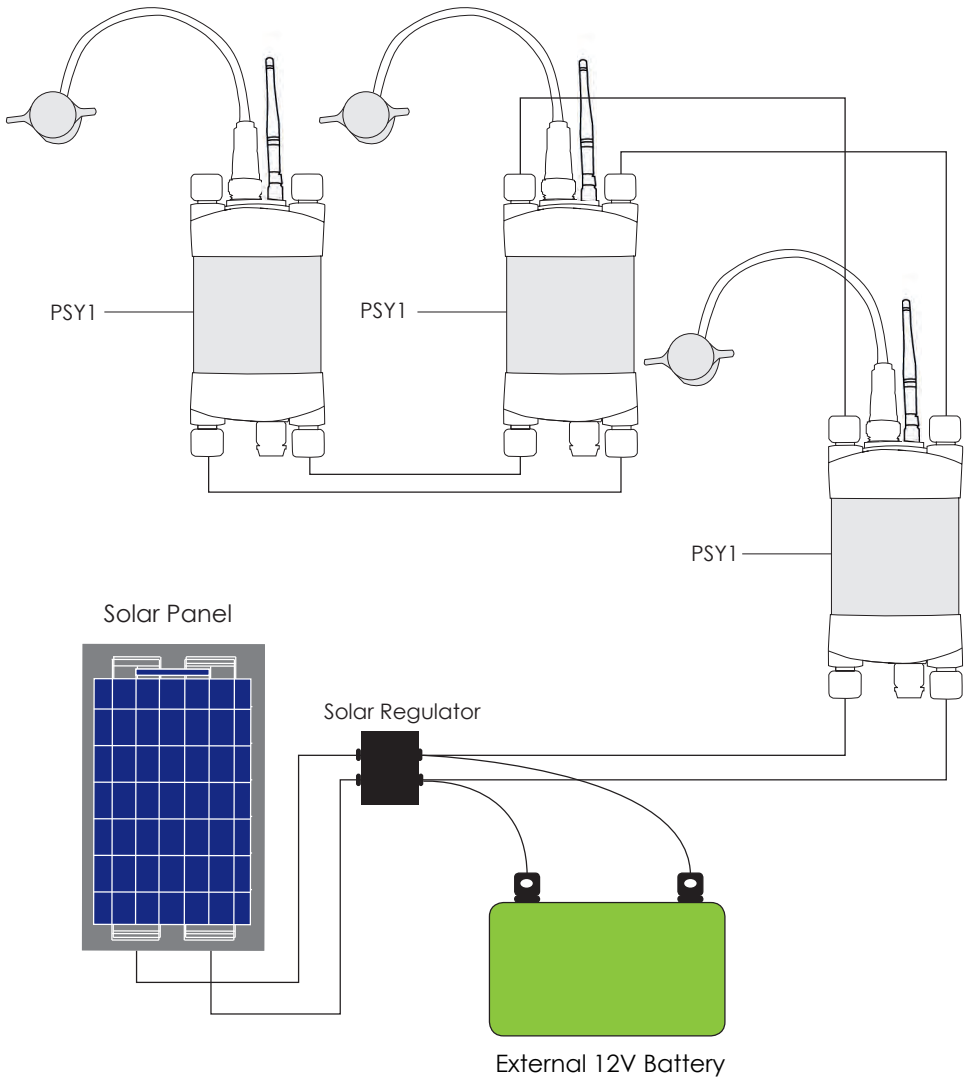
Connecting Power via External 12V Battery or the ICT CH24



Connecting Power via External 12V Battery and Solar Panel



Sharing an External 12V Battery and Solar Panel via Daisy Chaining



Clean the Psychrometer Chamber

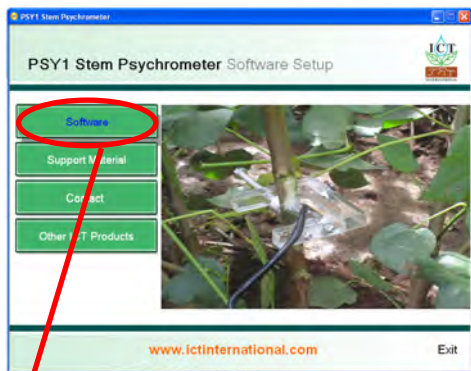
The Stem Psychrometer consists of two very small welded thermocouples made of very fine wire only 25 μm in diameter. **AGAIN NOTE:** Human hair is, on average 100 μm thick. You will require a 20X dissection microscope to view the thermocouples.

This makes the sensor very sensitive to measuring water potential, but equally as sensitive to dirt and even mild oxidation. It is recommended that before starting any measurements you clean the thermocouples. The cleaning process involves using an organic solvent such as chloroform or an electronics contact cleaner such as CRC qd Electronics Cleaner or CRC CO Contact Cleaner. **Watch the video: Cleaning the Psychrometer:**

<https://www.youtube.com/watch?v=-SaQzdIOOJs&list=UUxtXEr9V3UE5XzDQr6wwtRg>

Install the PSY1 Software & USB Driver

Insert the supplied DVD into the computer. The DVD will auto-run and a menu will appear on-screen. Select "software" (a) then choose "USB Driver" (b) and then "PSY1 Installation Software" (c).



(a)



(c)

The PSY1 Stem Psychrometer software can also be downloaded from the ICT International [Software Downloads Page](http://www.ictinternational.com/support/software/):

<http://www.ictinternational.com/support/software/>

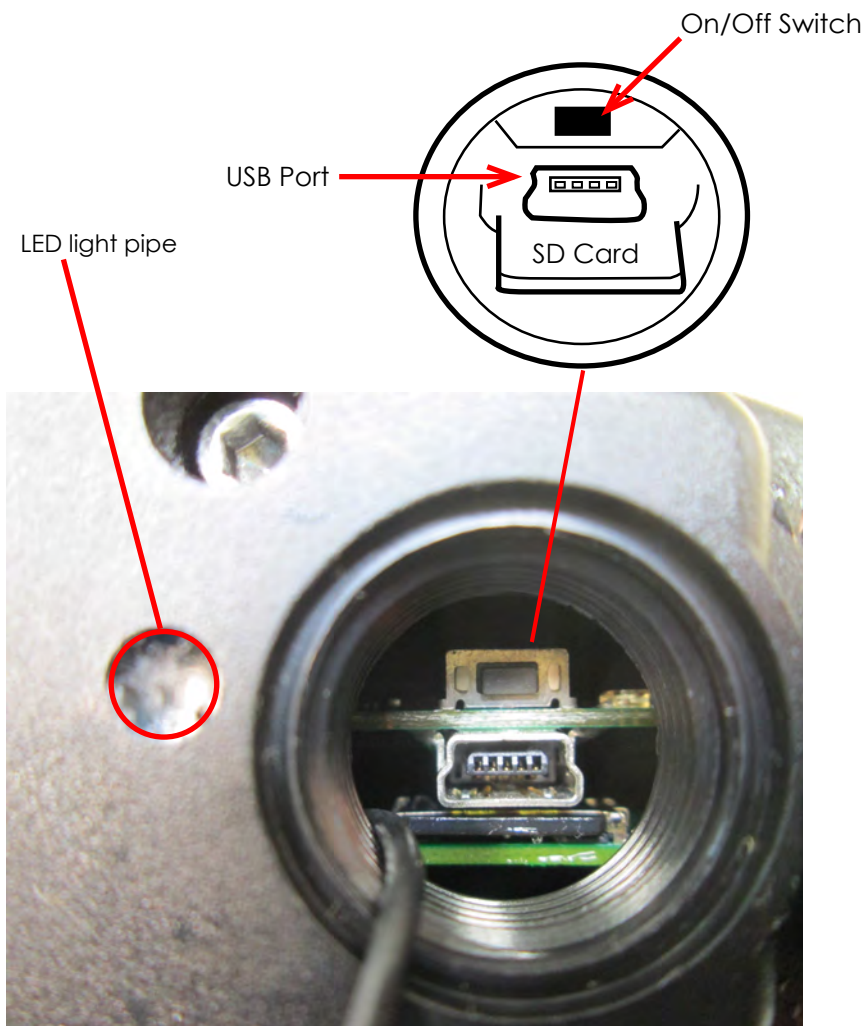
Turn the Instrument On

To turn on your PSY1, connect the Instrument to a computer via a USB cable. Alternatively the PSY1 can either be turned on manually by pressing the power button or automatically by connecting an external power supply via the Bus Plugs.

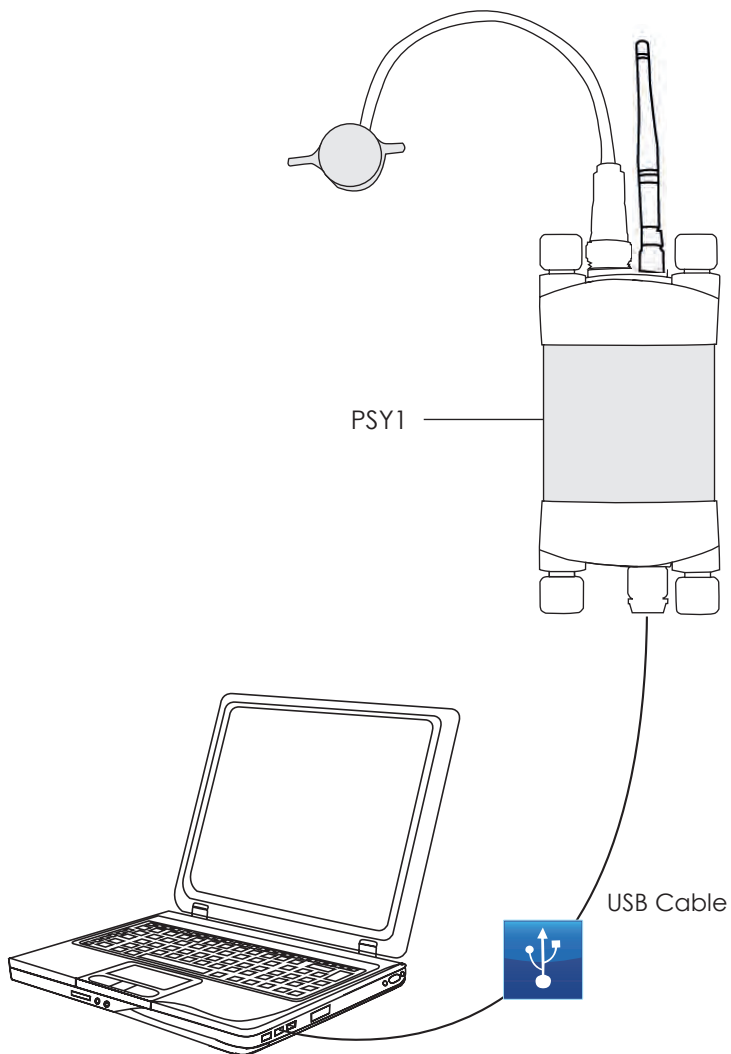
When the instrument is turned on the green light (visible through the light tube, adjacent to the communication port) will flash rapidly for a few seconds during start up. Once the PSY1 has started the green light will flash once every 10 seconds to indicate it is on.

Connect to the Instrument via USB Cable

Connect the USB cable to the instrument. The PSY1 will be detected by the computer automatically and the driver will also install automatically. Double click the PSY1 software icon on the desktop to open the software.



Connect via USB Cable



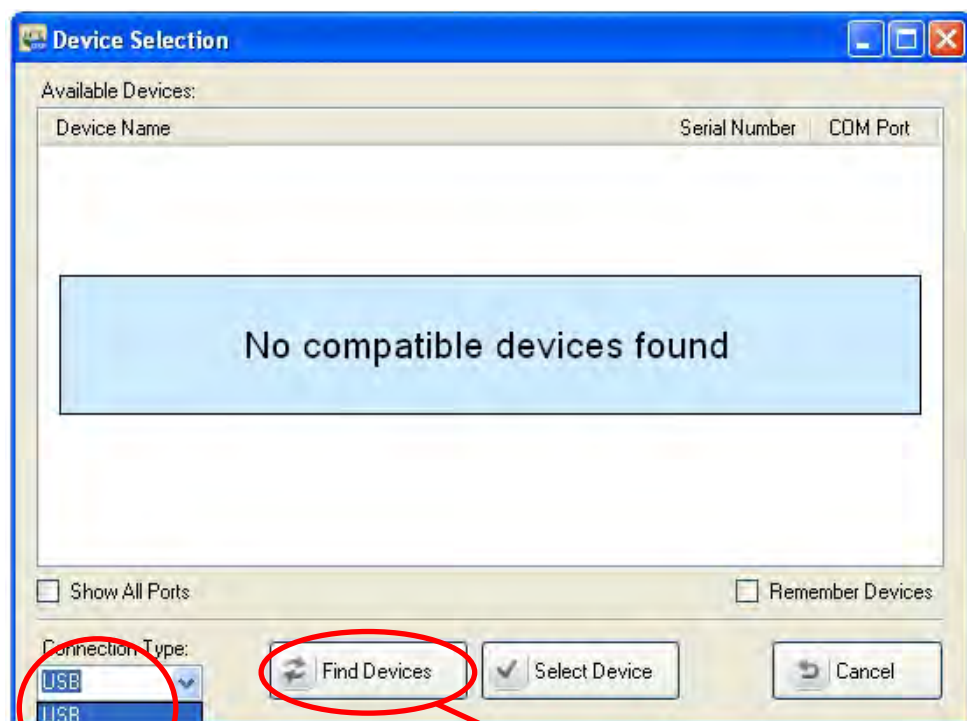
USB Connection Software Procedure Step 1:

Double click on the PSY Software Icon on your desktop. Select **“Connect to PSY”**, then select **“Find Devices”** to search for the target instrument, Select the target instrument from the Available Devices within the Device Selection Window.

Click the icon **“Connect to PSY”**



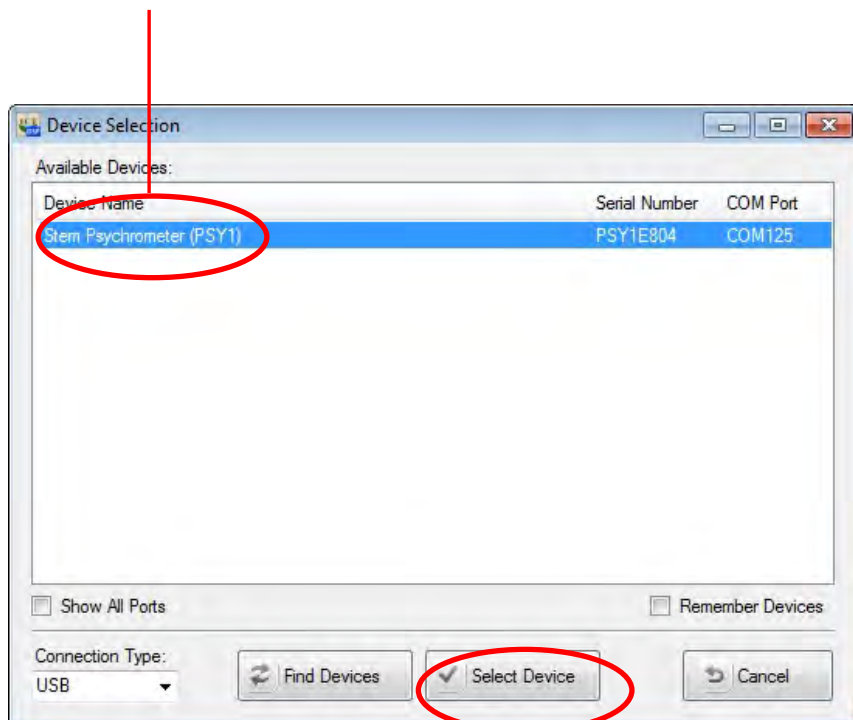
USB Connection Software Procedure Step 2:



You must first choose the connection type **“USB”** then Click **“Find Devices”** to search for the instrument via USB cable.

USB Connection Software Procedure Step 3:

Find on the list the device that matches the serial number of the target PSY1. Double click on the device to connect. Alternatively highlight then click "select device" to connect.



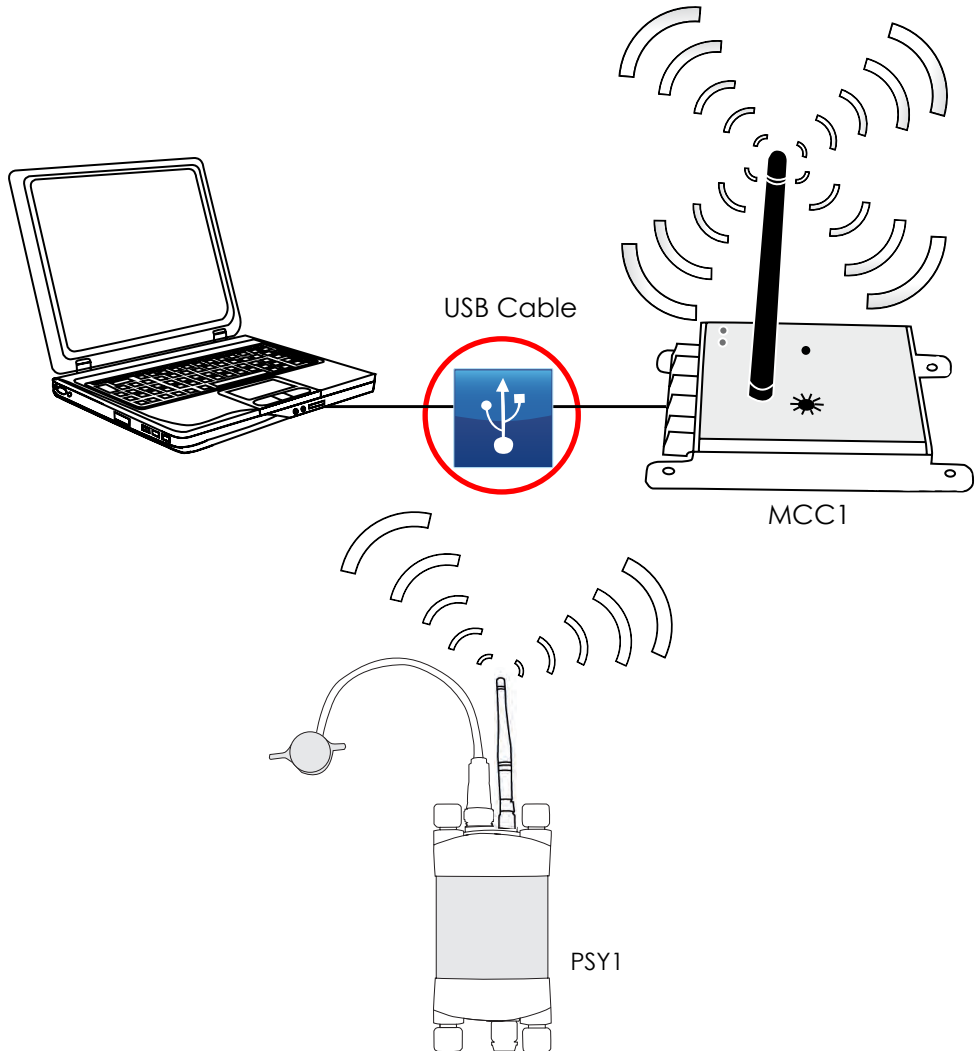
After you highlight the target device then click ***“Select Device”***.

Alternatively, if you are using a MCC1 Wireless Radio Modem

Connecting the Wireless Hardware via a USB Cable

Connect the MCC1 to a computer via a USB Cable.

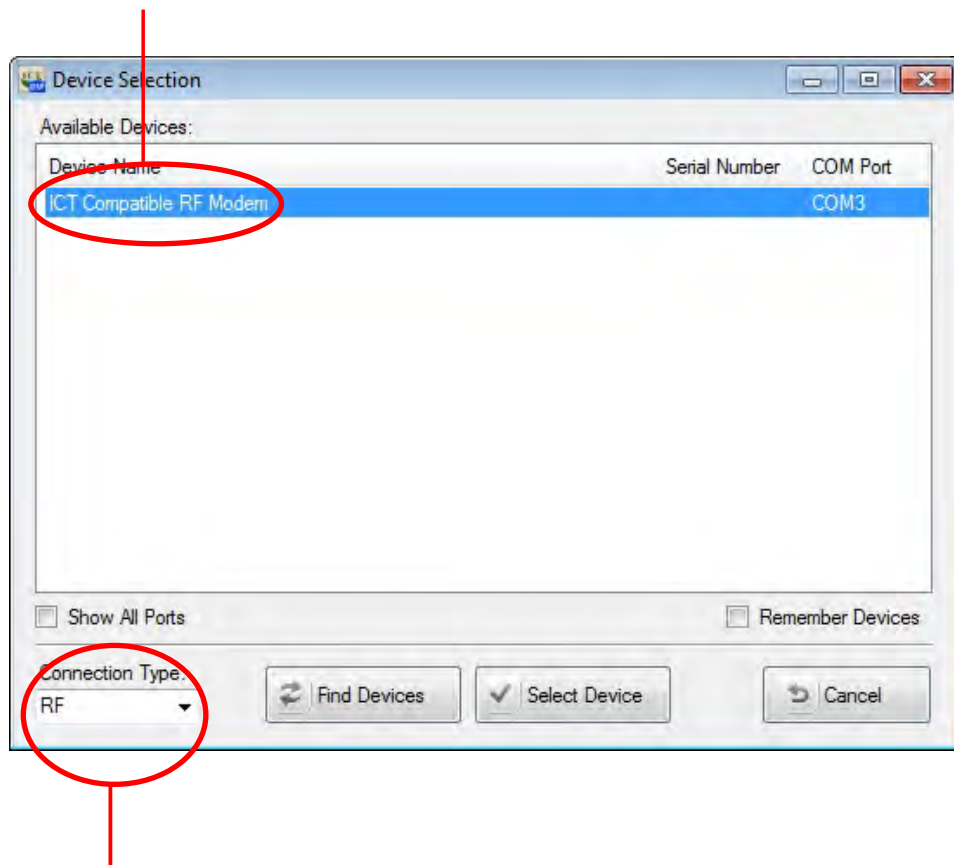
Double click the PSY Software icon on the Desktop to open the software and click the icon **“Connect to PSY”**.



MCC RF Connection Software Procedure Step 1:

Change the Connection Type from **"USB"** to **"RF"** and click **"Find Devices"**. When **"ICT Compatible RF Modem"** appears double click on it to bring up the RF Device Chooser Window.

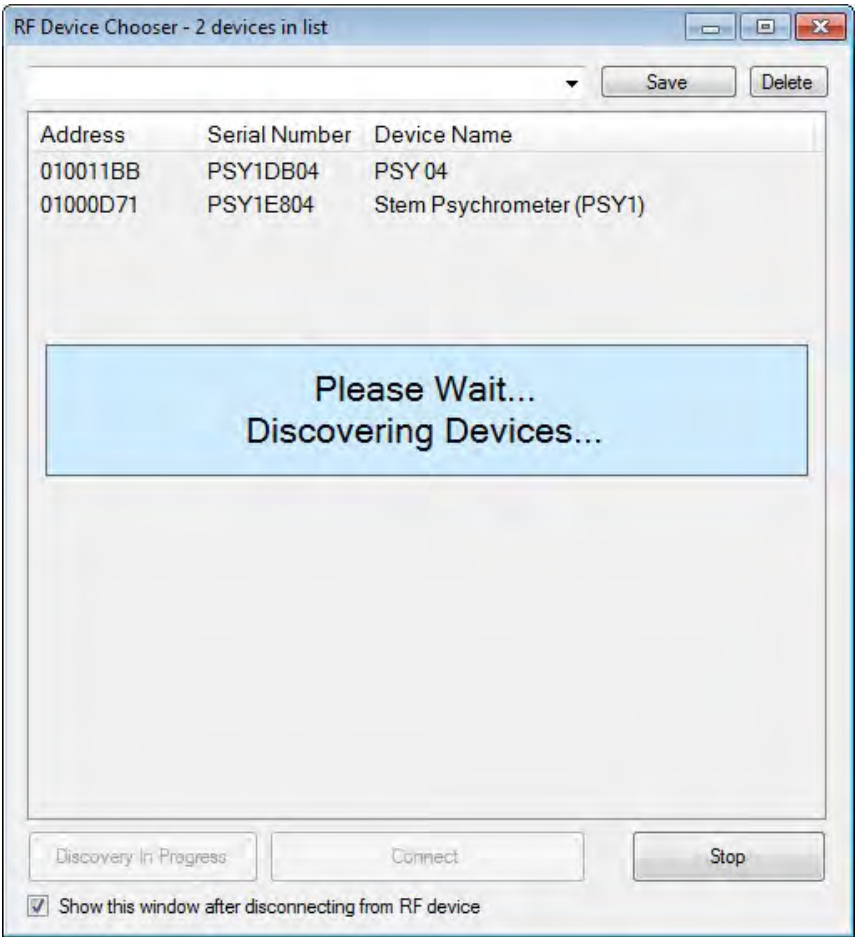
Make sure the MCC1 has been detected then highlight.



Choose the connection type **"RF"** instead of **"USB"**

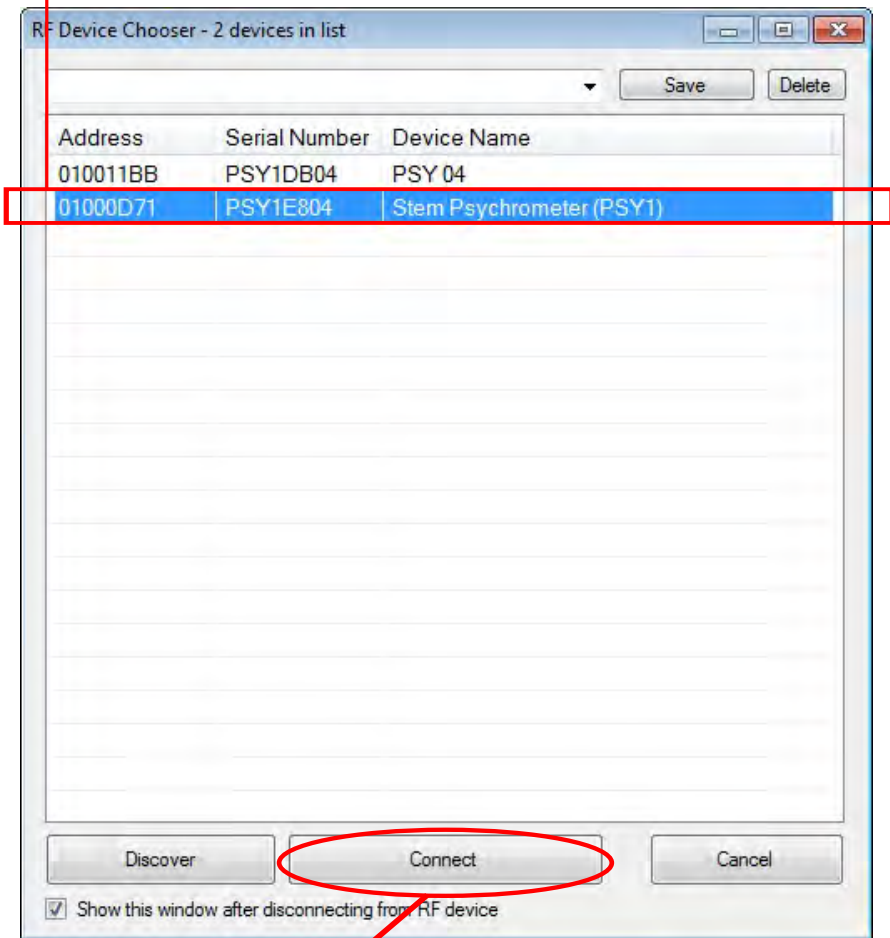
Then select **"Discover"**, The PSY software will now use the MCC to perform a wakeup routine, and search for instruments within range.

A set amount of time is used to find devices, If they have not all appeared wait for 1 minute and perform a merged rescan to fill the list.



MCC RF Connection Software Procedure Step 2:

Click on device.



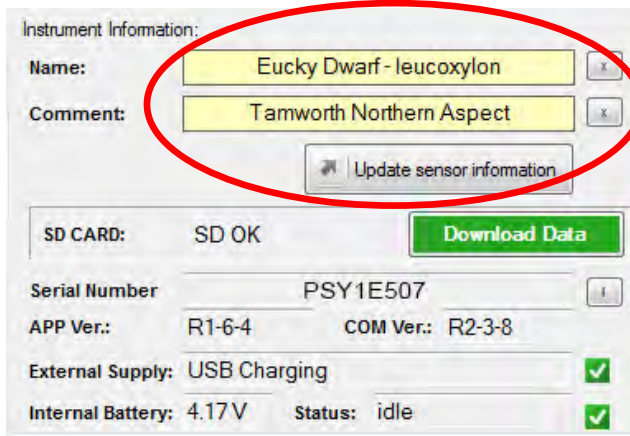
After you highlight the device click ***“Connect”***.

Instrument Information

On the PSY Software, fields are given for Naming and adding a Comment, These fields are specific to the individual serial numbers of the PSY1 loggers. This naming system can be helpful for experiments, for instance naming them based on location or purpose of the PSY1 and to tell them apart easily. Of the two fields, the Name field ties to the PSY1 serial number within the RF and USB chooser list, this makes it easier to find the logger you wish to connect to when using multiple PSY1 loggers in the field.

Entering Information:

- 1) To edit the fields the original text needs to be erased, select the X next to the field you need to clear.
- 2) Type in the desired description – make sure to keep it short or abbreviated to a naming scheme.
- 3) Select “Update Sensor Information” – this will save both fields into the PSY1 memory (note this will retain in the loggers memory regardless of SD Card present or removed.)
- 4) For the update to be successful, you will need to power down the PSY1 for 5 minutes and then power it back up. To do so, remove external power to the bus plugs, disconnect in the PSY software and power down by the power button (hold in for 2+ seconds) or use the power down command in the PSY software – once the software disconnects remove USB cable if USB cable was used.
- 5) When ready use the power button to turn the logger back on or alternatively power can be turned on automatically by connecting external power and/or a USB cable.



Instrument Information:

Name: Eucky Dwarf - leucoxylon [X]

Comment: Tamworth Northern Aspect [X]

[Update sensor information]

SD CARD: SD OK [Download Data]

Serial Number: PSY1E507 [I]

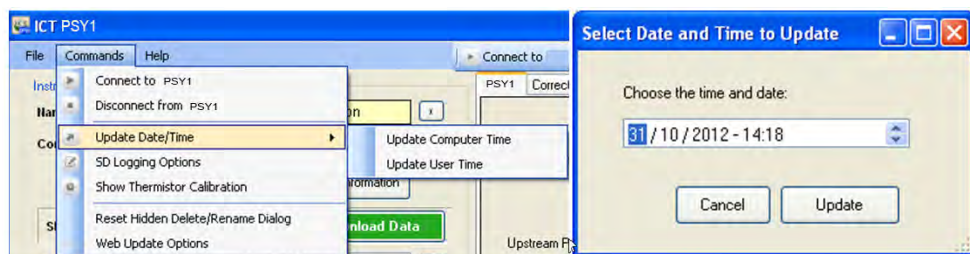
APP Ver.: R1-6-4 COM Ver.: R2-3-8

External Supply: USB Charging [✓]

Internal Battery: 4.17 V Status: idle [✓]

Set Date & Time

The date and time are accessible via the commands menu along the top menu bar of the PSY1 software. The date and time can be automatically set to the date & time of the computer that the PSY1 is connected to by selecting the option **"Update Computer Time"**. An alternative option is provided to update the instrument to a user defined time. This is very important as Psychrometers are often deployed in regions away from your usual office or local time zone. The day, month and year can be set by clicking on the cell and using the arrows to scroll to the required values. This is the same for both hours and minutes. Alternatively, you can type the value directly into each cell. Then click update and the new date & time will be saved to the real time clock of the PSY1's microprocessor.



Power Management

The PSY1 logs the instrument's internal battery voltage, the external charging supply voltage and external charging current. The battery voltage and external supply voltage are automatically selected in SD Card logging options and cannot be disabled. These parameters are set to be helpful in troubleshooting suspect logging problems that typically can be caused by power supply issues.

Set the Measurement Protocols

Each installation will be slightly different. For this reason, measurement protocols such as the Sensor Calibration slope and intercept, Peltier Cooling Pulse options or Chamber Heating schedule should be set before deploying the instrument and checked periodically throughout the experiment.

Measurement Options: The default settings are a cooling time of 10 seconds and a wait time of 6 seconds. This ensures that water in the atmosphere of the chamber condenses and cools the thermocouple. A wait time of six (6) seconds allows for stabilisation of the psychrometric wet bulb depression.

Reverse Warming: Should not be required for a clean psychrometer and is an advanced option typically only required for very humid conditions.

Chamber Heating: Should be employed whenever the psychrometer is subjected to very cold temperatures at night that could induce condensation. If such conditions are expected, A good protocol to follow is to employ chamber heating between 5:00AM and 10:00AM to prevent the chamber from becoming colder than the stem.

The screenshot shows a software window titled "Measurement Options". It contains three main sections: "Measurement Options", "Reverse Peltier (Warming)", and "Chamber Heating".

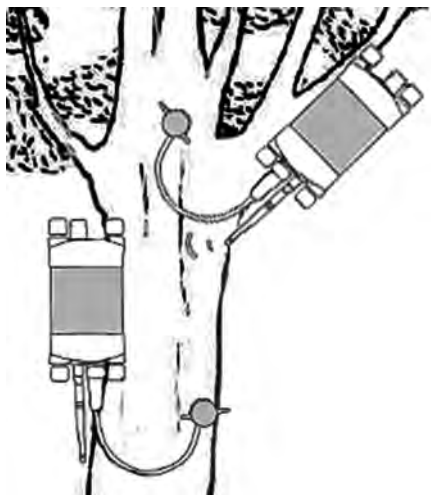
- Measurement Options:** Includes "Cooling Time" set to 5 s and "Waiting Time" set to 6 s, with an "Update" button.
- Reverse Peltier (Warming):** Includes a description: "Thermocouple warming is performed before a measurement takes place to ensure a dry measuring junction." It has "Warming duration" set to Disabled and "Wait before measurement" set to 15s, with an "Update Warming Protocol" button.
- Chamber Heating:** Includes a description: "Chamber heating is performed to mitigate condensation if required. It occurs immediately following completion of the measurement protocol." It has "Chamber heating duration" set to Disabled, "Chamber heating between:" set to 00:00 and 00:00, and a checked "Always allowed" checkbox, with an "Update Chamber Heating" button.

Calibrate the Psychrometer

The Stem Psychrometer **MUST BE** calibrated before each installation. The calibration employs a 6 point measurement protocol using NaCl solutions of known molalities. The calibration must be done under isothermal conditions at a controlled temperature of 25 °C to generate a specific slope and intercept that characterises the specific response of the individual thermocouples. A detailed calibration function is provided within the PSY1 software that can be used to generate and automatically load your new calibration into the PSY1 firmware.

Watch the videos: Stem Psychrometer Calibration [SP08](#), [SP09](#) and [SP10](#) on our ICT International YouTube channel: <https://www.youtube.com/user/ictintl> for details. The calibration is applied and tracked via the four-digit serial number of the psychrometer chamber and will remain in the instrument in non-volatile RAM until changed by the user. This number must be manually entered into the instrument firmware. Watch the video [Stem Psychrometer Calibration Function Demo](#) for details.

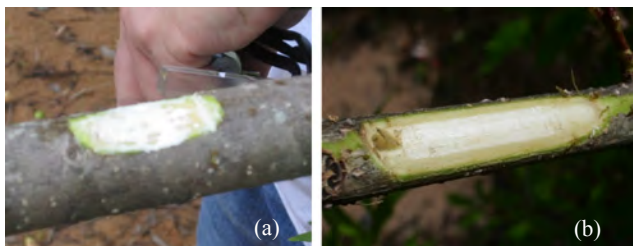
PSY Logger mounting methods and Installing the Sensor



When the PSY logger is installed in the field, ICT International recommend the following mounting methods to increase water repelling action.

Mount the logger with the PSY sensor cable and antenna facing straight down and the access end for the USB port/ Micro SD card and power switch facing up - ensuring that the USB port cap is tight. The angle can be up to 45 degrees from vertical.

Installation is an important aspect that is best explained by watching the series of installation videos, Search for [SP03](#), [SP04](#) and [SP05](#) on our ICT International YouTube channel: <https://www.youtube.com/user/ictintl>
Care must be taken to prepare the site for installation.



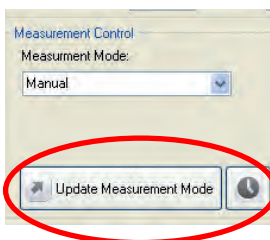
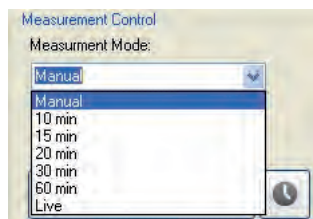
(a) Portrays latex exudates seeping from the stem. It would be unacceptable to install the Stem Psychrometer under these conditions.

(b) Portrays a stem that has been prepared appropriately. The xylem under the latex source is exposed. Here the Stem Psychrometer can be successfully installed.

NOTE: Any living tissue or cells left behind will grow into the chamber and cause terminal damage to the thermocouples of the psychrometer chamber and need to be returned to ICT International for repair. Please Request an [RMA#](http://ictinternational.com/support/rma-form/) <http://ictinternational.com/support/rma-form/> before returning anything to ICT.

Set the Logging Interval

The PSY1 Stem Psychrometer has a minimum temporal logging resolution of 10 minutes. This limit is imposed by the thermodynamics of the psychrometric principle. The PSY1 Stem Psychrometer chamber must be allowed time to dissipate all thermal gradients and re-equilibrate with the stem prior to commencing a new measurement.



Note: In order for your measurement changes to take effect you must click “*Update Measurement Mode*”

Download Data

Data can be downloaded in a number of ways. The simplest is to click the green Download Data icon on the main window under the Instrument Information section.

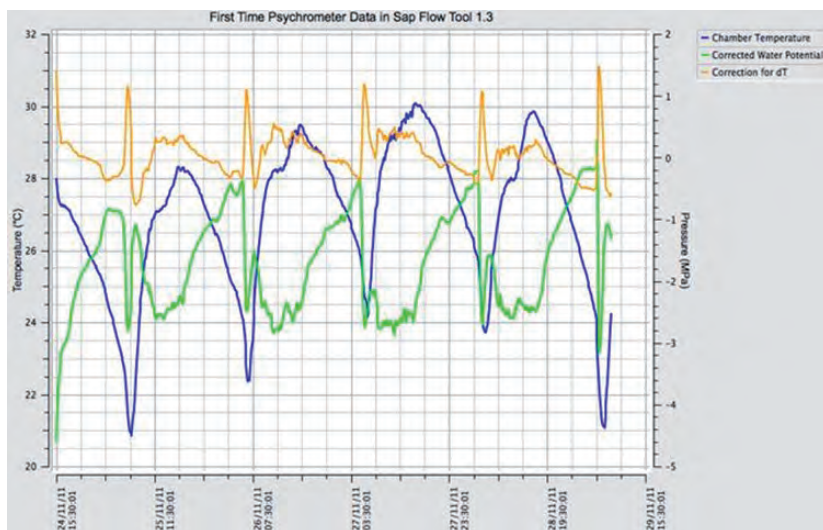


If a data file exists on the MicroSD Card then a Windows Explorer window automatically loads. The window provides a choice of directories to save the data file to. Alternatively, the MicroSD Card can be physically removed and read by a computer using a USB Adapter.



Analyse Data

Data is saved as a CSV file and can be analysed in your preferred software package. The [SFT Sap Flow Tool](#) software can also be used in combination with [SFM1 Sap Flow Meter](#) data or the [AWS Automatic Weather Station](#) data for advanced data analysis.





*Enabling better global research outcomes in soil,
plant & environmental monitoring.*

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