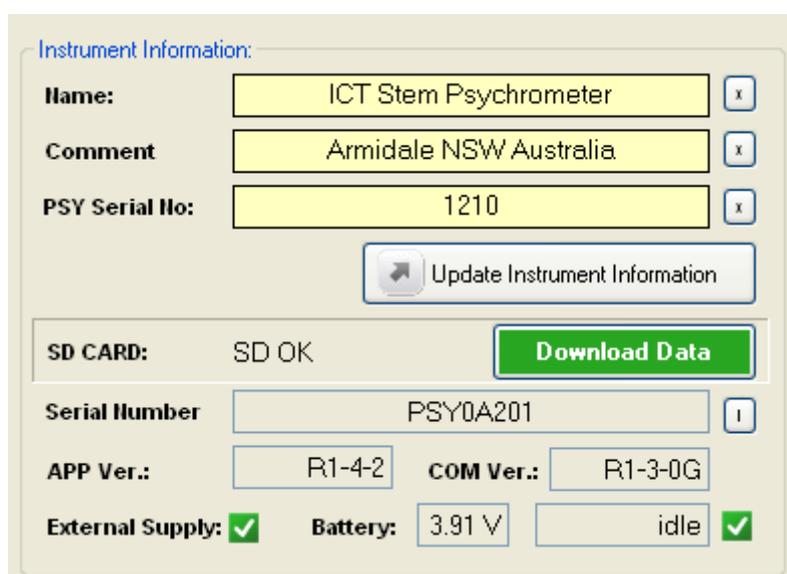

18 Instrument Setup & Configuration

18.1 Instrument Information

The instrument information panel is a summary of the instruments setup and status. It provides a simple, intuitive Graphical User Interface (GUI) that displays the configuration settings as stored in the instruments memory (non-volatile RAM). Important operational information such as Serial Number, Firmware versions, internal battery voltage, external power supply and charging status are, immediately obvious. You can immediately download data and or change the descriptive information such as Name, Comment and Psychrometer Serial Number directly on screen.



Instrument Information:

Name: ICT Stem Psychrometer [x]

Comment: Armidale NSW Australia [x]

PSY Serial No: 1210 [x]

[Update Instrument Information]

SD CARD: SD OK [Download Data]

Serial Number: PSY0A201 [i]

APP Ver.: R1-4-2 COM Ver.: R1-3-0G

External Supply: Battery: 3.91 V idle

Figure 54: Instrument Information Panel.

The function, purpose and the intended use for each of these parameters is described in detail below:

18.1.1 Name:

This field provides the user with a site Identifier to relate the data set back to the plant being measured. The name is stored in the header line of the data file.

18.1.2 Comment:

A 28 character field for the user to store a comment with the data set. The comment is stored in the header line of the data file.

18.1.3 PSY Serial No:

Enter the individual serial number of the stem psychrometer chamber here. Each Psychrometer is labelled with a unique 4-digit number. This enables the user to generate a specific custom calibration for each chamber. The calibration information is stored on the internal MicroSD card under the 4 digit serial number of the chamber located within the “psycal” folder.

18.1.4 The X:

Entries in these fields can be deleted by clicking on the x.

18.1.5 Update Instrument Information:

Clicking this icon saves your changes to non-volatile RAM so your settings remain in memory and active even after disconnecting from the PSY1.

NOTE 42: Whenever any of these 3 fields are updated a new header line is inserted into the data file. This provides a tracking mechanism by which columns of processed data, (that can be logged such as water potential) can be referenced to the data and calibration slope & intercept used to automatically calculate the data.

18.1.6 SD Card:

The status of the SD card is displayed. If a SD card is inserted and functioning correctly it will display SD OK.



Figure 55: SD Card Status & Download Icon.

If the SD card is removed or not inserted the message NO CARD is displayed.

NOTE 43: It is possible to think you have pushed the card in, but failed to have it click in fully. Be sure to listen for the clicking sound when inserting otherwise the PSY1 will rightly state NO CARD.

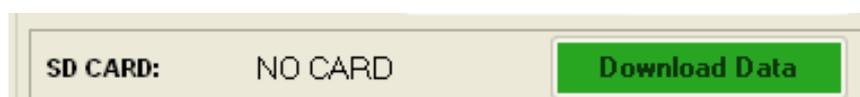


Figure 56: SD Card Status & Download Icon.

NOTE 44: Clicking on the “Download Data” icon will take you directly to the SD Card Tab. This tab is detailed fully in the SD Card section.

18.1.7 SD Card Initialisation:

Upon insertion of the MicroSD card the PSY1 Initialises the card then performs a simultaneous communication and format check. If the SD card fails the communication and initialisation check

the SD card status is reported as **SD ERROR**. This means the SD card is damaged and should be replaced with a new MicroSD card.

NOTE 45: ICT International recommends SanDisk MicroSD Cards, however any brand of MicroSD card is compatible and should perform well in the PSY1 within the limits of the card's own specifications.

18.1.8 SD Card Formatting:

If the SD card uses a higher level of formatting such as exFAT then a message will appear saying "WRONG FORMAT" at which point you would reformat the SD card to FAT32 format.

18.1.9 Instructions to reformat a MicroSD Card

- (1) Remove the card from the PSY1
- (2) Place it in the USB card reader
- (3) Insert it in to a computer.
- (4) Right click on the drive and choose Format.
- (5) Select FAT32,
- (6) Name the "Volume Label" PSY1
- (7) Check the "Quick Format" box
- (8) Click Start

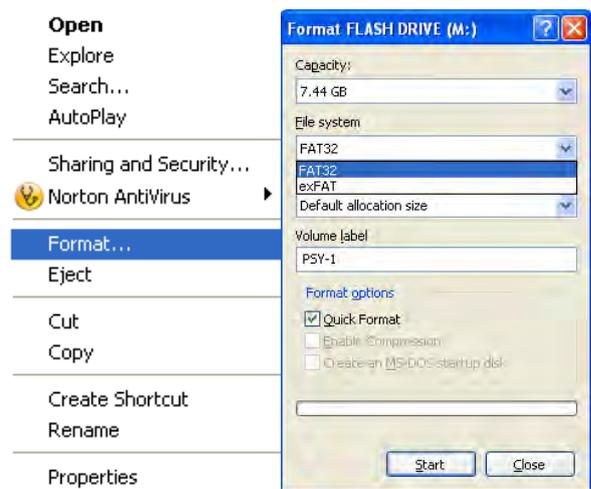


Figure 57: Microsoft Windows Right Click Menu for Formatting a Drive.

NOTE 46: The PSY1 works fine with FAT and FAT32 file formats. It is not designed to be compatible with exFAT (extended File Allocation Table format also known as FAT64).

18.1.10 Format Check:

If the format check is ok, a check of the serial number is performed to see if a valid CSV file can be created. If this check is ok, the SD Card status to reported as SD OK

18.1.11 File Name Error:

If the instrument serial number has been lost or corrupted the check will fail, and the SD Card status is reported as **FILENAME ERROR**. At this point, please contact your local ICT distributor in your country or ICT International direct for support.

NOTE 47: The SD card is “hot Swappable” meaning it can be ejected and inserted while connected. The SD card status is updated in real time.

18.1.12 Serial Number:

The Overall instrument serial number is displayed. This serial number is used automatically as the 8 character data file name. When using the instrument for the first time or inserting a new SD card upon making the first measurement the data file is automatically created using this number as the file name with .csv extension. Once downloaded to a PC the file name can be changed but data can only be saved to the SD card in this format. This serial number is also stored in the header line of the data file. It is used for technical support purposes by ICT technicians.



Figure 58: Serial Number Field.

18.1.13 I icon:

Clicking on the I icon toggles between the overall instrument serial number and the serial numbers of the individual circuit boards that make up the instrument.



Figure 59: Individual Serial Number Toggle Icon.

18.1.14 APP Serial #:

The serial number of the Application circuit board that is custom designed and manufactured specifically to measure the Stem Psychrometer. This serial number is also stored in the header line of the data file. It is used for technical support purposes by ICT technicians.



Figure 60: Application Board Serial Number Field.

18.1.15 COM Serial #:

The serial number of the communication circuit board that operates the Micro SD card, USB and wireless radio communications of the instrument. This serial number is also stored in the header line of the data file. It is used for technical support purposes by ICT technicians.



Figure 61: Generic Communication Board Serial Number Field.

18.1.16 O:

Clicking on this icon toggles between the individual circuit board serial numbers and the overall serial number field.



Figure 62: Overall Instrument Serial Number Toggle Icon.

18.1.17 APP Ver.:

The firmware version number loaded into the application circuit board. The user should review this at regular intervals and compare it against the current version available from the ICT web site: www.ictinternational.com/support/software. If a new version is available the user can upgrade the firmware using ICT's Boot Strap Loader Utility software. This firmware version number is also stored in the header line of the data file. It is used for technical support purposes by ICT technicians.



Figure 63: Application Board Firmware Number Field.

18.1.18 COM Ver.:

The firmware version number loaded into the communication circuit board. The user should review this at regular intervals and compare it against the current version available from the web site: www.ictinternational.com/support/software. If a new version is available the user can upgrade the firmware using ICT's Boot Strap Loader Utility software. This firmware version number is also stored in the header line of the data file. It is used for technical support purposes by ICT technicians.



Figure 64: Generic Communications Board Firmware Number Field.

18.1.19 External Supply:

These fields display the status of any external power supply that may be directly connected to the instrument such as:

- (a) An external 12V DC power supply either, mains powered or solar powered
- (b) The external voltage supply whether from Solar Panel or battery
- (c) The Internal Battery voltage
- (d) The internal battery status either idle (not charging) or Charging



Figure 65: External Power Supply Status Fields.

These fields are dynamically updated showing a Green check box when external supply is present or a red box with a white X when there is no external supply present. The external power supply voltage and charging current can be stored to the Micro SD card as a measured parameter, with each water potential valued logged. This is detailed in the section on SD Logging Options.



Figure 66: External Power Supply Status Icons.

18.1.20 Battery:

The instruments internal 4.3V Lithium polymer, rechargeable battery voltage is displayed in real time. This battery voltage can be stored to the Micro SD card as a measured parameter with each water potential valued logged. This is detailed fully in the section on SD Logging Options.

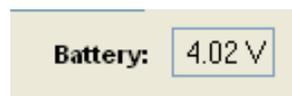


Figure 67: Internal Battery Voltage Field.

18.1.21 Status:

This field indicates the status of the instrument. If the instrument is fully operational and charged the field displays the message “*idle*”. Alternatively, if the instrument’s internal battery has dropped below the operational threshold of 3.7V and an external power is attached, the instrument displays the message “*charging*”.



Figure 68: Internal Battery Voltage Status Fields.

18.2 Raw Data Tab

The “**Raw Data**” tab displays in real time, data being measured by the instrument. Each output is clearly displayed and labelled. A “**Measurement Status**” indicator keeps the user informed of the progress of each measurement (when connected to the software).

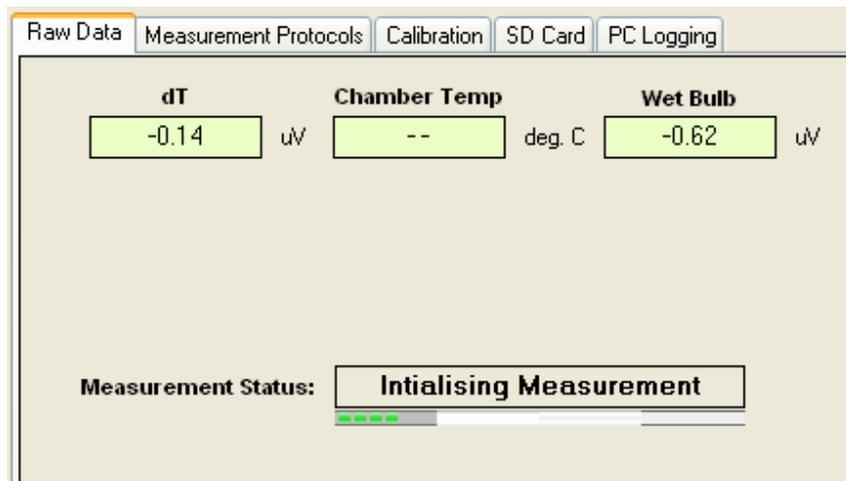


Figure 69: Raw Data Tab displays measured values from the Thermocouples of the Psychrometer.

No values are displayed either before a measurement is made or after a measurement is completed. This is done to avoid confusion over where the values on screen have come from. After a measurement has been completed the results can be reviewed in the [dialogue box](#) located in the bottom left hand corner of the GUI window.

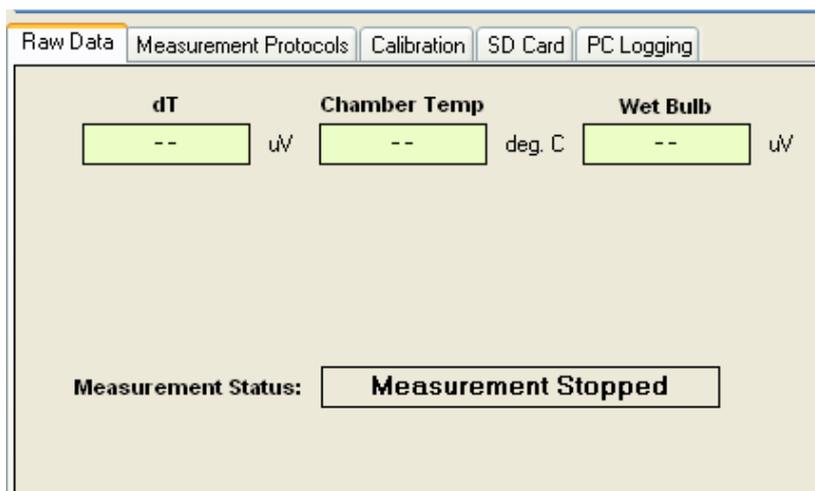


Figure 70: No values are displayed in the Raw Data Tab Fields unless a measurement is in progress.

NOTE 48: When the instrument is in “Live” Mode values are constantly displayed in real time, refreshed at the sampling rate of the instrument, 10 Mhz or every 0.1 second.

Each measurement parameter displayed on the Raw Data tab is explained in detail below:

18.2.1 dT:

Displays the difference in temperature (dT) measured in (μV) between the Thermocouple-S and Thermocouple-C. In the manual mode dT will be measured initially at the commencement of the measurement process and this value remains on display until the completion of the measurement.

NOTE 49: In the “Live” mode the dT is continuously monitored and updated.

18.2.2 Chamber Temp:

Is the measured temperature ($^{\circ}\text{C}$) of the entire psychrometer chamber body. The measurement is made by a Copper-Constantan thermocouple located within the insulated base of the psychrometer chamber. It is representative of the ambient conditions under which the measurement is made. The chamber temperature measurement is made and subsequently displayed after the Peltier cooling pulse and psychrometric wet bulb measurement has been made.

NOTE 50: In the Live mode the Chamber Temp is continuously monitored and updated.

18.2.3 Wet Bulb:

Is a direct measurement (μV) of Thermocouple-C within the chamber of the psychrometer. Thermocouple-C is initially the Dry Bulb and then, following condensation of water vapour via Peltier cooling, the Wet Bulb thermocouple of a classical Psychrometric measurement of vapour pressure.

Upon initiating a measurement Thermocouple-C is momentarily measured. This is a measure of the electronic noise or offset from electronic zero of the instrument which we call the Electronic Dry Bulb Offset (EDBO). The PSY1 uses this value as the zero set for the measurement and is automatically performed before each measurement either in the manual mode or when configured for automatic logging.

NOTE 51: In the Live mode the Chamber Temp is continuously monitored and updated.

18.2.4 Measurement Status:

This is a user feedback feature that details each stage of the measurement process:

18.2.4.1 Initialising ADC

Powering up and stabilising the microprocessor

18.2.4.2 Initialising Measurement

Equilibrating the electronic circuit

18.2.4.3 Peltier Cooling

Generating and passing a Peltier cooling pulse through Thermocouple-C to cool the thermocouple and condense water within the chamber from the gaseous phase to liquid phase, resulting in a Psychrometric Wet Bulb Depression

18.2.4.4 Measurement in Progress

Waiting for a user definable time (typically 6 seconds) before reading the μV output of Thermocouple-C, this is the Wet Bulb Depression. The measurement then continues to monitor the thermal decay as Thermocouple-C returns to zero. This is done as a verification of performance and accuracy of the measurement.

NOTE 52: if Thermocouple-C is dirty, microscopic beads of water will remain attached to the thermocouple preventing it from quickly returning to its original starting temperature. In extreme cases the Peltier curve will be indiscernible and simply drift indefinitely never returning to the starting temperature. It should also be mentioned that a similar response may occur in samples with very wet (close to zero) water potentials. To be rule out a dirty thermocouple always perform a verification test of the chamber before installation ([see Appendix A PSY Test Procedure](#))

18.2.4.5 Measurement Stopped

No measurement is currently being performed.

18.2.5 Show Diagnostics

The diagnostic parameters are not typically used in the course of a routine measurement. This facility is designed to be used in conjunction with an ICT technician to assist in troubleshooting possible problems with the instrument such as a broken thermocouple. For this reason the diagnostics parameters are hidden from view. They can be turned on and turned off by accessing the “PSY” menu and selecting “**Show Diagnostics**” or alternatively, “**Hide Diagnostics**”.

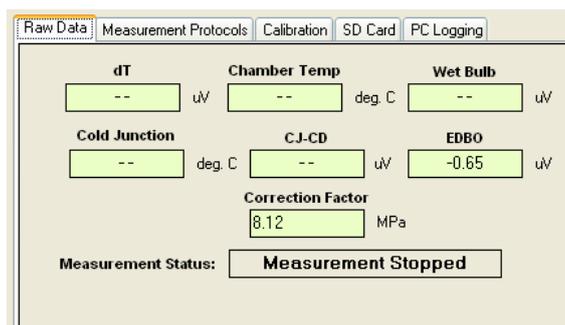


Figure 71 Raw Data Tab with Diagnostics Displayed.

18.2.5.1 *Cold Junction*

Is a calibrated measure (°C) of the differential Thermocouple reference located inside the PSY1, potted in a thermal insulating compound on the circuit board. This measurement is made using a Military grade specification thermistor in an insulated environment for ultra high accuracy.

18.2.5.2 *CJ-DJ*

Is a measure in (μV) of the stability of the analogue inputs

18.2.5.3 *EDBO*

Electronic Dry Bulb Offset. This is a measure (μV) of the electronic noise or offset from electronic zero of the instrument prior to making a measurement of Thermocouple-C. The PSY1 uses this value as the zero set for the measurement and is automatically performed before each measurement either in the manual mode or when automatically logging.

18.2.5.4 *Correction Factor*

Is the relationship between vapour pressure and temperature in $\text{MPa}/^\circ\text{C}$. It is applied to the value of dT (in degrees) to adjust the apparent water potential measurement for the effect of any temperature gradient between the sample (Thermocouple-S) and the measuring junction (Thermocouple-C). It is displayed in the dialogue box with the raw data for each measurement logged to the data file.

18.3 Measurement Statistics

The statistics facility is designed to provide the user with a real time comparative check of the performance of a psychrometer. From a series of readings the PSY1 will automatically monitor and display the Maximum, Minimum and Average Water Potentials measured. It will then calculate and display the difference between these measured values. This facility provides a convenient evaluation tool of the psychrometer chamber during setup to ensure optimal performance prior to deployment. It is also a good diagnostics tool for trouble shooting a faulty psychrometer chamber and, can even be used as a positive feedback tool during lab based manual measurements.

It is not designed to replace statistical analysis of data which should be performed on logged data, downloaded from the instrument. These statistics are not controlled and will be applied to any values recorded by the PSY. This means the statistics calculated could be from multiple psychrometer chambers attached to or interchanged with the PSY1 through the course of testing therefore rendering the results invalid. To reset the statistics click the “r” icon to the right of the “Difference” field.

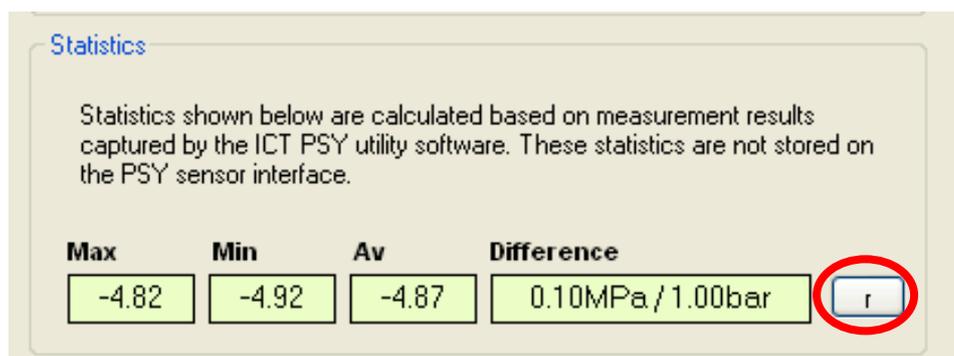


Figure 72: Statistics on manually performed measurements.