21 Frequently Asked Questions - FAQ's

1) Will sap, resin or latex exuded by the tree damage the measurement needles?

Answer: NO. The needles are completely sealed with a soldered tip and are made from surgical grade Stainless Steel. Sap, resin & latex will not damage the needles.

2) How do you turn off one of the measurement points along the needle?

Answer: The SFM1 is designed to provide two points of measurement radially across the sapwood by using two thermistor pairs. Either the Inner or the Outer Measurement point can be deselected or "turned off" in the SD Logging options in the SFM1 Software

3) What does it mean if the value of the Outer measurement point is greater than the Inner measurement point?

Answer: This is typically what you would expect to find in a correctly functioning SFM1 Sap Flow Meter, installed in a healthy plant. Sap flow is not uniform across the sapwood. A radial gradient exists where sap flow is often highest on the outside of the stem in the young sapwood and generally decreases to zero as it reaches the heartwood.

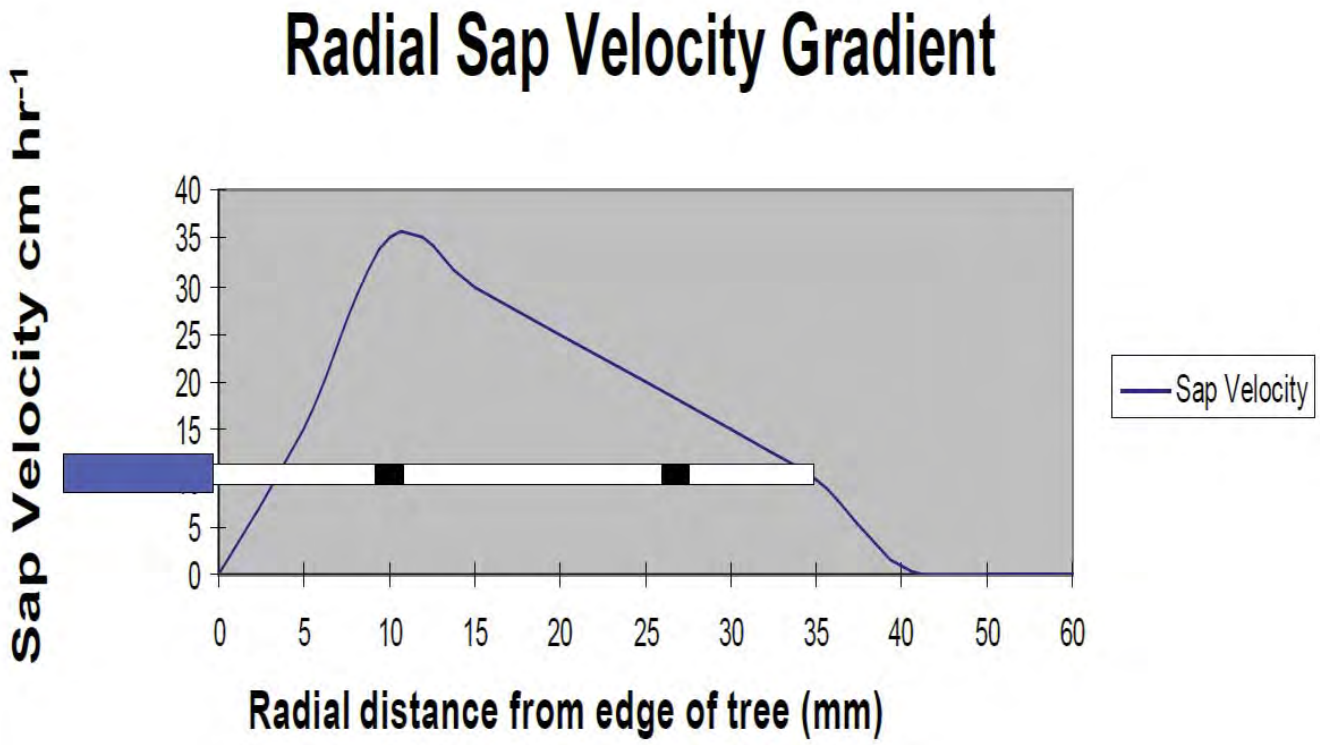

Figure 124: Example of a Radial Sap Velocity profile and how the positions of the SFM1 Needle characterise the radial gradient.

4) What does it mean if the Inner Measurement point is greater than the Outer Measurement point?

Answer: It is likely that the Outer Measurement point is not located properly in the sapwood. This may be due to an insufficient depth of bark being removed from the tree prior to installation. The sensor must be removed and re-installed.

5) What is the maximum and minimum sap velocity range for the SFM1 Sap Flow Meter?

Answer: The HRM principle is based upon symmetrical measurement geometry. The SFM1 features a 24-bit digital microprocessor at the point of measurement for Analogue to Digital Conversion, effectively eliminating noise from the measured input signal. Therefore theoretically, the SFM1 has the range and resolution to accurately measure positive flows up

to 100 cm hr^{-1} and negative flows down to -100 cm hr^{-1}. This has been empirically tested with a lab based calibration protocol using a high pressure flow meter to push water through a cut stem segment at a range of flow rates up to 100 cm hr^{-1}.

6) What is an expected range for sap velocity measurements in plants?

Answer: Sap velocity will vary significantly between species, within species, between sites, within sites and diurnally within individual trees depending upon the prevailing environmental conditions. Realistically a maximum positive sap velocity in any plant will be in the range of up to 60cm hr^{-1}. However, as a huge generalization, velocities of between 4 to 40cm hr^{-1} account for approx. 80% of a plants water use or sap flow. Negative flows would rarely be expected to reach -10cm hr^{-1}.

7) What maximum temperature rise is required to ensure good data using the HRM Principle?

Answer: A temperature range between 0.5°C and 1.5°C is recommended. A Maximum temperature rise of 0.3°C may also be adequate to produce a good measurement using the SFM1 thanks to the 24-Bit A/D Microprocessor. However, at this low level, any ambient thermal gradient could overwhelm the signal, so insulation around the stem is required. Below this level, even with insulation, the signal is too weak; above this the temperature unnecessarily accelerates the wounding process reducing the longevity of the installation and may damage the plant. A temperature rise of approx. 0.7 °C to 1.0 °C is ideal.

8) What is a good range for the temperature ratio to ensure good data?

Answer: The ratio itself is not a good indicator of the likely validity of the data. Only the temperature rises will indicate reliable or unreliable data, taken together with the way they vary across the day. Very low rises will generally give rise to more unreliable data. However it should be remembered that a low rise in the lower (Upstream) needle is a normal and necessary condition during high positive flow rates. Low rises in both needles simultaneously should give rise to concern. If this happens frequently the needles may need to be re-installed.

9) What is wounding?

Answer: A wound is the plants response to drilling holes into the sapwood of the tree. The xylem cells close up or form a scab to prevent further infection and begin the healing process, in much the same way humans do.

10) What affects wounding?

Answer: The degree of wounding (thickness of the scab) and wound response (the time taken to produce the wound) is usually species specific and can also be site specific. One thing that does accelerate the wound response is the amount of heat used and the frequency of measurement. Always try to keep the energy input level as low as possible to minimise the wound response. This will increase the longevity of each installation and allow accurate data to be collected for a longer period between installations.

11) How do you know if the wounding affect has become too great to collect accurate data?

Answer: If the sap velocity begins to exhibit a continual decrease in the overall diurnal trend over successive days compared to previous data, compare these results against other trees in the measurement area. If none of the other trees exhibit a similar pattern and the maximum sap velocity values begin to approach zero, this is a strong indication that the wound has exceeded the maximum limit of approx. 3mm and the sensor needs re-installing.

12) How many days data storage does the SFM1 have when logging at 10 minute interval?

Answer: The SFM1 is supplied with a 4GB MicroSD Card. A 4GB MicroSD card has sufficient capacity to store a date/time stamped, 10 minute temporal resolution data set consisting of all measured and calculated ratios and sap flow parameters for, theoretically, hundreds of years! Larger capacity MicroSD cards can be used if necessary.

13) What is the resolution of the digital SFM1 Sap Flow Meter?

Answer: The SFM1 is a dedicated digital Sap Flow Meter. The SFM1 incorporates the very latest technology in low noise differential amplifiers (op-amps) and Analogue to Digital (A/D) converters which form the front end of the microprocessor that drives the Sap Flow measurement. The microprocessor uses 24-bit resolution that produces a 20 nanovolt or 0.0005°C measurement resolution. This is generally better than is achieved with advanced analogue dataloggers that only measure to a resolution of 40 nanovolts or 0.001°C, and well beyond the capability of a standard analogue datalogger.

14) Why is a digital SFM1 Instrument more accurate than an analogue sensor?

Answer: Using a dedicated microprocessor for each probe set reduces errors and enhances signal to noise ratio at the point of measurement far beyond what the most sophisticated analogue measuring devices are capable of. It also means that the analogue signal, from the thermocouples in the needles, travels only 0.2m to the integrated A/D converter, where it is converted to a digital signal. This results in no signal loss because the very short cable length used has negligible resistance and, being so short, is physically isolated from potential sources of noise compared to long lengths of cable running along the ground. The processed packet of digital sap flow data can then be transferred wirelessly without loss of signal or data integrity.

15) Can I force the Sap Flow Meter to fire a pulse more frequently for testing purposes even though I know the resulting sap flow data will not be meaningful?

Answer: Yes. Set the SFM1 to Manual Measurement mode and click the Start Measurement (Fire Pulse) Icon.

16) Can the SFM1 perform CHPM sap flow measurements?

Answer: Yes. Place the Sap Flow Meter in Needle Temperature mode and collect Raw Temperature data. Set the SD Logging Options for Raw Temperature to 3 measurements per second and at least 900 seconds after the heat pulse. Install the needles in an asymmetrical geometry around the heater. The typical Compensation Heat Pulse Method (CHPM) configuration is 5mm upstream and 10 mm downstream of the heater. The data can be automatically analysed by importing it directly into Sap Flow Tool software, and applying the CHPM algorithm.

17) How do I check the health of a wet cell external 12 V battery?

Answer: If you suspect the battery is failing to hold a charge or one cell of the battery has gone high resistance, check the health of the battery by measuring the voltage of each cell, if you can, (usually not possible in the field) or check the specific gravity of the cells (again, generally not possible in the field or with gel cell). Alternatively, connect a heavy load, for example, a 12V DC 150W spotlight available from automotive spares stores (such as Super Cheap Auto) and see if the battery voltage holds up. Or check the battery voltage at the battery terminals both with the solar panel connected and disconnected (on a sunny day). If the battery is healthy, there should be no more than a 2-3 volt drop (maximum) upon applying a heavy load.