



# SOVEREIGN QUANTUM MARINE (MOISTURE METER)



The unit is contained inside a high visibility **Peli** security case.

*Specifically designed for marine use and includes a self-calibration check facility. Both near surface and in depth readings can be compared and the moisture content displayed as a numerical readout from 1 – 100, or as % H<sub>2</sub>O WME (Wood Moisture Equivalent).*

*Surveyors can establish a datum reading and make comparative readings that display automatically above, or below, the selected datum, enabling large surface areas to be quickly assessed.*

*Proximity to Dew Point is automatically calculated and displayed.*

*Surface spot temperature readings may also be taken that automatically compare the spot temperature to the surrounding Dew Point temperature. This allows a check on conditions prior to commencing coating applications, or in eliminating spurious/misleading readings.*

*A bright traffic light series of LEDs display instant visual information and below this a numerical readout is available for recording specific readings.*

*Contained within the security case the unit sensor probe is permanently attached to the meter and there are no other costly auxiliary attachments required that can be mislaid or lost.*



## QUANTUM MARINE MOISTURE METERS Using software series 3-8 and 3-9.

### Initial Switching On

When the meter is switched on red LEDs will illuminate the figure **3-8** or **3-9**, for about 5 seconds, indicating the software series used in the unit.

*NB. Earlier Quantum Marine Meters incorporated different software programs, eg series 3-6, with separate literature that can be obtained on request. Alternatively contact the Technical Department to incorporate the latest software and modify the unit sensor head with a DEEP/SHALLOW changeover button.*

### Calibration Check Procedure

About five seconds after switching on the figure 3-8 will be replaced by either the figure “**0**” or “**.0**”. This will be dependent upon the mode last in use when the unit was switched off. “**.0**” indicates the unit is ready to be used in the % **H<sub>2</sub>O** mode. If the figure **0** is displayed then the unit is ready in the Relative mode.

However, in order to carry out a check calibration the unit must be in the % **H<sub>2</sub>O** mode. To change from relative readings (1 thru' 100) to % **H<sub>2</sub>O**, select and **hold down** the **HUMIDITY** button and the humidity LED reading will illuminate, but after 5 seconds will be replaced by the word **OFF**. The meter is then in the relative mode and by selecting **PAD MOISTURE DEEP**, or **PAD MOISTURE SHALLOW** will display relative readings. To revert back to % **H<sub>2</sub>O** reverse this procedure and the word **ON** will illuminate.

The calibration check unit is installed on the inside lid of the unit.



1. Ensure the lid is in the upright position and there is nothing behind the calibration check unit - including fingers!
2. Ensure the pad sensor is clean and hold the sensor in the air.
3. Switch unit on; confirm it is in the % **H<sub>2</sub>O** mode and select **PAD MOISTURE SHALLOW**.
4. The green Calibration Check Unit has two gold rectangular posts used for meters with pin sensors and also a circular ring with three locating points on the circumference, for use with the pad sensor. Carefully position the pad sensor unit between the three locating points and note the LED reading. For **SHALLOW** it should read between 17.5 and 18.5. To check the **DEEP** facility use the button on the sensor, or press **PAD MOISTURE** to select **DEEP** and the LED reading should be between 12.3 and 13.3. If the readings are outside these parameters then contact the Technical Department to recalibrate the unit.

## FUNCTIONS



**Select PAD MOISTURE**  
**DEEP** In depth readings  
**SHALLOW** Near surface readings  
**Select COMPARATIVE**  
**DEEP** Compared to datum  
**SHALLOW** Compared to datum  
**Select HUMIDITY**  
 Provides relative humidity readings % rh.  
**Select DEW POINT**  
 Compares surface temperature readings to Dew Point °C.  
**Select AIR TEMP**  
 Displays air temperature °C.  
**Select SURFACE TEMP**  
 Displays surface temperature readings °C from hand sensor.  
**Select BATTERY TEST**  
 Displays remaining % power.  
 ON/OFF and auto off. (See Technical Specification)  
 Low battery warning, "BAT"

### Audio Alarm On/Off

The audio alarm will activate whenever the LEDs light in the amber or red sectors.

### Setting the Audio Alarm

To switch the alarm on, select and hold down **DEW POINT** for more than 5 seconds and the LEDs will indicate **ON**.

### To deselect the Audio Alarm

To switch the alarm **OFF** select and hold **DEW POINT** for more than 5 seconds and the LEDs will indicate **OFF**.

### Assessing FRP/GRP

Moisture readings should be taken when the substrate being assessed is in equilibrium with the surrounding air temperature and humidity. Accordingly temperature and relative humidity are important factors that should be recorded at the time of survey. Other surveys taken at varying temperatures and relative humidity when the substrate is not in equilibrium may produce different and potentially conflicting results.

The Quantum Marine Meter can display relative humidity and air temperature. Additionally, on selecting **Dew Point** a comparison of air temperature and humidity is made that automatically displays the proximity of the current temperature from/to dew point and potential condensation. See - [Humidity, Air Temp and Dew Point](#).

To confirm the meter is working within the correct parameters a calibration check (see [Calibration Check Procedure](#) above) should be made and recorded in the Report.

### Choosing % H<sub>2</sub>O or Relative Readings on FRP/GRP

To take readings on materials outside the design parameters of the instrument being used, manufacturers may recommend using their instruments in the timber mode. Using an electronic moisture meter and recording the result as % H<sub>2</sub>O WME (% H<sub>2</sub>O Wood Moisture Equivalent) produces an arbitrary, but meaningful, comparative reading.

The alternative would be to use a relative scale with readings, 1 – 100, where the relevance of the readings would be assessed and a table (see page 7) produced to interpret such readings.

Sovereign Mark 1 & II Meters were not specifically designed for use with GRP/FRP and marine surveyors used either Range A, on Scale A and refer % H<sub>2</sub>O (WME) (Wood Moisture Equivalent), or alternatively used Range A and Relative Scale readings from 1 – 100.

Both the old style Sovereign meters and the Sovereign Quantum Meter have the advantage of measuring timber moisture content to below 2%, whereas most meters will cut off at about 9%. As such they are very effective when it is necessary to differentiate between miniscule amounts of moisture, for example, when assessing GRP/FRP during a pre-purchase survey, or where the gelcoat has been removed and the substrate is drying out prior to treatment.

### **Selecting % H<sub>2</sub>O or Relative Readings on the Quantum Meter**

When the meter is switched on a 3 figure red LED will illuminate for about 5 seconds, indicating the software series used and will then be replaced by the figure 0 (zero) or .0 (decimal point zero).

Where a decimal point precedes the figure zero, then the meter is already preset for % H<sub>2</sub>O readings. Simply select **PAD MOISTURE DEEP** or **PAD MOISTURE SHALLOW** to take readings.

To change from % H<sub>2</sub>O to relative readings (1 thru' 100), select and **hold down** the **HUMIDITY** button and the humidity reading will illuminate, but after 5 seconds will be replaced by the word **OFF**. The meter is then in the relative mode and by selecting **PAD MOISTURE DEEP**, or **PAD MOISTURE SHALLOW** will display relative readings. To revert back to % H<sub>2</sub>O reverse this procedure and the word **ON** will illuminate.

### **Selecting PAD MOISTURE SHALLOW and PAD MOISTURE DEEP**

The Quantum Marine Meter has both **PAD MOISTURE SHALLOW** and **PAD MOISTURE DEEP** functions that can be selected for readings on materials including FRP/GRP. On FRP/GRP the Shallow sensor obtains averaged readings slightly deeper behind the gelcoat than the Mk 1 & Mk II Meters, whereas the Deep sensor monitors moisture, dependent upon the type of substrate, to approximately 30mm.

By selecting **PAD MOISTURE DEEP** the surveyor can obtain deeper average readings that can be compared with the **PAD MOISTURE SHALLOW** readings. This can be particularly useful on sandwich constructions. If the deeper readings are high, or higher than the shallow readings, then drying out could be a long process. On the other hand, if the deeper readings are lower than the shallow readings, then superficial dampness such as condensation may indicate a relative short-term problem. Assistance in identifying condensation and other potential problems can be made by using the **Dew Point** facility in conjunction with the surface thermistor sensor.

### **Establishing and Using a Datum**

Some surveyors establish a datum reading from a (dry) point on the hull above the waterline and then make reference to comparative readings on other areas of the hull. Readings found that are above datum would deserve further investigation.

### **Area Searches Using the COMPARATIVE Facility**

Once a suitable datum has been established this principle can be automated using a Quantum Meter. With the sensor in position, select and hold down the relevant **COMPARATIVE** function (Deep or Shallow). Initially the LED will display the datum figure, but then will automatically zeroise around that particular datum. The readings taken in the **COMPARATIVE** mode on the hull thereafter **will then be automatically displayed either above, or below, the chosen datum figure**.

In addition to the LED figure, a series of green, yellow or red LEDs will illuminate dependant on whether the moisture reading is lower/drier than datum, around datum, or higher/wetter than datum. This colour coded system allows the surveyor/operative to scan large areas quickly, but confidently, in the knowledge that any readings above datum will be signified by a warning change in LED colour from yellow through to red.

Using the **DEEP/SHALLOW** changeover switch on the sensor head allows the surveyor to rapidly compare moisture readings through profile the hull.

### **Humidity, Air Temp and Dew Point**

To obtain an accurate measurement of air temperature and humidity first allow the meter time to reach equilibrium with the surroundings; for example, not straight out of a car left in an overnight frost, or after leaving the meter in direct sunlight on a windowsill.

### **Proximity to Dew Point**

When **DEW POINT** is selected the meter automatically assesses temperature and relative humidity, displaying a LED reading of **how far away** the air temperature is from dew point (and potential condensation). The metal strip thermistor, situated on the reverse of the sensor, can then be placed against any potential colder substrate and the

### Sensor head.



← Large diameter pad sensor head for averaging moisture readings.

→ Metal thermistor and the red control button for switching between Deep and Shallow readings.



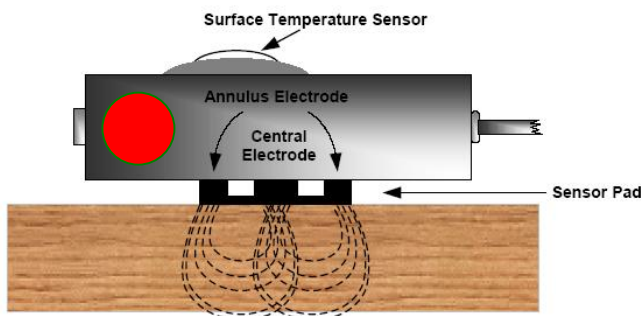
LED displays the temperature difference. Where the substrate temperature is lower, then as the thermistor readings approach dew point the coloured LED traffic lights will illuminate, going from green, to amber and finally to red, indicating the substrate is **below dew point**.

This can be extremely useful where isolated higher than normal moisture readings are found. Use the **DEW POINT** facility to check and compare the area in question with the surrounding areas.

Before applying epoxy coatings, either as remedial work or as a preventative measure, check to ensure the air temperature and relative humidity are within the parameters laid down by the manufacturer. In addition selecting **DEW POINT** can monitor actual substrate temperature by using the thermistor to confirm the substrate temperature is above dew point.

### Variations in Readings

In **SHALLOW** mode the central electrode is the signal source and the outer electrode is the earth, providing very accurate close range readings that are less influenced by external factors. This is ideal where the moisture is in the gelcoat, or in the initial laminate layers behind the gelcoat.



The substrate is penetrated by the electric field emanating from an electrode coupled to a stable low frequency oscillator.

In **DEEP** mode a different technique employs the use of a signal probe, but also couples to free space to provide circular impedance. This has a dramatic influence on the depth of readings obtained, which are not as accurate as using the **SHALLOW** function. Select **DEEP** mode and compare the readings obtained. If the **DEEP** reading is lower then the moisture will be closer to the surface substrate, but if the reading increased the implication is the moisture continues deeper into the substrate. As such the **DEEP** facility is principally used for comparative purposes against shallow readings, but can also be employed to find deeper voids where fluid is present.

NB. The Sovereign Mk 1 & Mk II Meters read closer behind the gelcoat and will appear to achieve a slightly lower readings on GRP/FRP during the drying out process, prior to remedial or preventative treatments.

### Pre Assessment Considerations

1. Ensure that surfaces are visibly dry and that bilges are well ventilated before taking moisture readings.
2. Temperature and relative humidity should be noted at the time of survey.
3. Boats built in the last 15 years are generally much more moisture resistant and also dry out quicker. These will often exhibit low readings straight out of the water once the surface is dried off. Readings **MUST** be considered in conjunction with the period a vessel has been ashore and the weather conditions when the readings were obtained. If the boat has been ashore less than a week in summer and a month in winter (UK), it is reasonable to say in the report that readings can be expected to fall were the vessel to remain ashore for a few weeks, (but obviously not when **physically detectable signs** are also present).
4. Washing down the hull with fresh water will help remove any salts that may be hygroscopic and absorb moisture from the atmosphere.

Using Quantum Marine Meter in Shallow mode		Suggested Guidelines	Examples	Comments
Using Relative readings	Using % H <sub>2</sub> O (WME) Wood moisture equivalent			
0 - 15	0 – 10 % H <sub>2</sub> O (WME)	For all practical purposes may be considered dry.	<ol style="list-style-type: none"> <li>1. Modern yacht with epoxy protection from new.</li> <li>2. Yacht with Gelcoat removed <i>after</i> drying out period prior to epoxy treatment scheme.</li> </ol>	Establish minimum before proceeding with any treatment.
16 - 20	11 – 15 % H <sub>2</sub> O (WME)	Some moisture present at low levels, but of no great concern.	<ol style="list-style-type: none"> <li>1. Yachts with isophthalic and vinyl ester gelcoat resins after initial lift out, but will quickly reduce dependant on weather conditions.</li> <li>2. Older orthophthalic resins may take longer for readings to reduce.</li> </ol>	<p><b>Follow three steps:</b> Use both Shallow and Deep modes to make comparative readings.</p> <p>Use Dew Point facility and thermistor sensor to identify potential condensation problems and spurious readings.</p> <p>Monitor at a later date to confirm readings.</p>
21 - 30	16 - 18% H <sub>2</sub> O (WME)	Risk of associated moisture defects considered medium, but toward top of this range levels are becoming significant.		
31 - 45	19 – 20 % H <sub>2</sub> O (WME)	Considered high and at a level where the risk of moisture related defects being present, but not yet physically detectable, is significant.		
46 - 60	21 – 22 % H <sub>2</sub> O (WME)	Very high and is usually accompanied by physically detectable signs.		
61 - 80	23 - 24% H <sub>2</sub> O (WME)	Extremely high and indicative of possible laminate damage in addition to osmotic blistering and physically detectable signs.	<ol style="list-style-type: none"> <li>1. Blistering is visible or where the gelcoat has been starred or cracked.</li> <li>2. Susceptible location and boat age.</li> </ol>	As above.  Experience and knowledge of particular construction is essential before reaching any conclusions.
+80 thru 100 Towards saturation	+24% H <sub>2</sub> O (WME) Towards saturation			

### Suggested Guideline Interpretation of Moisture Readings

Where readings are unacceptably high we would recommend taking further readings after a suitable drying out period to establish whether the moisture level has fallen significantly. As a general rule of thumb experience suggests readings will fall by one range in the above table within a few weeks ashore and two ranges after 6 months.

Unless there has been delamination then the amount of moisture should be minimal. If delamination has occurred then this is a major problem with safety implications, but any surveyor should identify this during an inspection by acoustically testing (tapping) the hull.

To the client receiving a Marine Survey Report reading references to % H<sub>2</sub>O or Relative figures can be meaningless and confusing. The survey should provide further definition on what the readings mean and what the prognosis is; which will be based upon the evidence *available at the time of the survey*.

Where there are visible physical indications of problems then these will help the surveyor with the conclusions of the report, but where there is no visible evidence of a problem and high moisture meter readings are obtained, then these

will require careful interpretation. In such cases for a Surveyor to provide meaningful interpretations, then the service history is particularly relevant, especially if previous remedial work, or preventative coatings, have been undertaken.

Where there are unexplained high readings the recommendation should be that they are investigated further. Internal metal fixings, tanks, chain lockers, internal condensation etc may produce misleading readings especially from electronic meters with a “deep” function that penetrates through the hull.

However, a yacht that has been out of the water for an extended drying out period may produce consistently low moisture readings, suggesting *no further disruptive examination is necessary*, but could then become susceptible once back in the water.

Regardless of the reading obtained it would be unwise to decide whether a yacht requires treatment, or no treatment, based solely upon moisture meter readings alone. Where there is concern then a qualified surveyor should be used to evaluate the readings in conjunction with all the other information and factors that are available.

### Sovereign Technical Department

Should you wish to discuss any **technical points**, or are considering **purchasing** a Quantum Meter, contact **Dave Elvin**, [sovereignmeters@live.co.uk](mailto:sovereignmeters@live.co.uk) or **07836 638744 (mobile)**.

For general information use the Technical Advice Line, 0845 703 0722 (local rate for land lines), or for calls from outside the United Kingdom, telephone 44 (0) 1229870800. Web site [www.moisturemeters.uk.com](http://www.moisturemeters.uk.com)



### Training courses

Training courses are available in the United Kingdom, including the International Boatbuilding Training College at Lowestoft, Suffolk, Tel 44 (0) 1502 569663 with course dates on their Web Site [www.ibtc.co.uk](http://www.ibtc.co.uk). Short one day or weekend acquaint courses are also available on demand.

Sovereign Technical Dept  
October 2010

#### Technical Specification

Moisture content of GRP/FRP. As a relative/comparative reading 1 through 100, or from 1% to 30% H<sub>2</sub>O wood moisture equivalent (WME). (Beyond 30% is towards fibre saturation).

**Surface and air temperature:** -10 to +85°C. **Humidity:** 5 – 95%. **Dew Point:** Displays °C from actual dew point. Assessments should be made at temperatures above +5°C. Spurious readings may occur below 4°C as moisture becomes denser. Use the thermistor and **Dew Point** display to check the potential for surface condensation.

**Display:** LED Traffic light – green, amber, red and digital readout. **Size and weight** 235 x 115 x 190mm, 1.2 Kg.

**Batteries** Use 4 AA 1.5V. Operating temperature range: -10 to +45°C.

Auto **OFF:** 1. **Pad** after 5 minutes. 2. Other functions if readings are constant after 30 minutes.

**Calibration:** Calibration Checks can be made, but should be made with the meter in equilibrium with the surroundings. (See second page) and the calibration point is dependent upon the software used.

Dated October 2010. Technical specifications may change without notice as new developments are incorporated.