NOTES

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1.0 INTRODUCTION

Thank you for selecting a new MRH instrument.

The MRH has 3 modes of operation:

1. The MRH utilises “state of the art” electronic technology to provide you with an accurate and easy to use non-invasive instrument for non-destructive testing (NDT) of Moisture Content (MC) and tracing moisture in a wide range of building materials.

2. By inserting one of the optional plug-in electrodes for wood and selecting Pin Probe the instrument can then be use in Pin Probe (wood pin-meter resistance measurement) Mode. This enables the MRH to measure the percentage moisture content (%m.c.) of wood and give an indication of the moisture content of wood-based products.

3. By inserting the optional plug-in RH-probe, the instrument automatically changes to hygrometer mode. This enables the MRH to measure relative humidity (RH), temperature, dew-point temperature and mixing ratio of the environment or equilibrium relative humidity in a structural material. A structural material such as a concrete slab can be tested using the in-situ (ASTM F2170) or RH Hood (ASTM F2420) methods and British standards BS 5325 and BS 8203.

17.0 WARRANTY

Checkline Europe (Checkline) warrants to the original purchaser that this product is of merchantable quality and confirms in kind and quality with the descriptions and specifications thereof. Product failure or malfunction arising out of any defect in workmanship or material in the product existing at the time of delivery thereof which manifests itself within one year from the sale of such product, shall be remedied by repair or replacement of such product, at Checkline’s option, except where unauthorized repair, disassembly, tampering, abuse or misapplication has taken place, as determined by Checkline. All returns for warranty or non-warranty repairs and/or replacement must be authorized byCheckline, in advance, with all repacking and shipping expenses to the address below to be borne by the purchaser.

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Some State jurisdictions or States do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation may not apply to you. The duration of any implied warranty, including, without limitation, fitness for any particular purpose and merchantability with respect to this product, is limited to the duration of the foregoing warranty. Some states do not allow limitations on how long an implied warranty lasts but, not withstanding, this warranty, in the absence of such limitations, shall extend for one year from the date of invoice.

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14.0 CALIBRATION

For regular on-site assessment of your MRH in moisture measurement mode, a calibration-check box is available from the suppliers of your MRH. Should it be found that readings are outside the set tolerances, it is recommended that the MRH be returned for re-calibration. Calibration adjustments should not be carried out by anyone other than Checkline Europe who will issue a calibration certificate on completion.

Requirements for quality management and validation procedures, such as ISO 9001:2008, have increased the need for regulation and verification of measuring and test instruments. It is therefore recommended that calibration of the MRH should be checked and certified in accordance with the standards and/or protocols laid down by your industry (usually on an annual basis) by an authorized test provider. The name of your nearest test provider and estimate of cost is available on request.

15.0 LIMITATIONS

The **MRH** will not detect or measure moisture through any electrically conductive materials including metal sheeting or cladding, black EPDM rubber or wet surfaces.

16.0 PRODUCT DEVELOPMENT

It is the policy to continually improve and update all its products. We therefore reserve the right to alter the specification or design of this instrument without prior notice.

2.0 HOW IT WORKS

In **non-destructive moisture measurement mode** i.e. without the plug in probes, the instrument operates on the principle that the electrical impedance of a material varies with its moisture content. The electrical impedance is measured by creating a low frequency alternating electric field between the electrodes as illustrated in Figure 1 below.

This field penetrates the material under test. The very small alternating current flowing through the field is inversely proportional to the impedance of the material. The instrument detects this current, determines its amplitude and thus derives the moisture value.

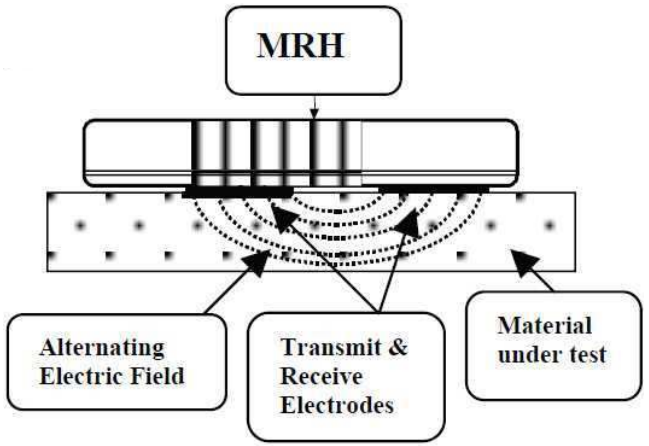


Figure 1

In **Pin Probe Mode** (i.e. with pin probe mode selected and an electrode plugged in), the MRH is a resistance type pin meter for determining the percentage moisture content of wood.

In **Hygrometer mode** (i.e. with the RH Probe plugged in), the MRH determines the capacitance of the RH probe sensor, which varies with the relative humidity of the test area environment. The MRH displays this capacitance as percentage relative humidity (%RH). It also measures temperature and displays dew-point temperature and mixing ratio.

3.0 INSTRUMENT FEATURES

Your MRH employs advanced digital technology to enable the incorporation of many features, which are listed below.

- 3 modes of measurement: Non-destructive moisture measurement, hygrometer and wood pin probe.
- simple membrane keypad controls:
  - **ON/OFF**
  - **SCALE**
  - **UP**
  - **DOWN**
  - **HOLD/AUDIO**
  - **BACKLIGHT**
- 5 Scales: Wood, Roof, Masonry, Drywall and Laminate. These are selected using the ⊙ key and the ▲ or ▼ keys.
- Moisture readings and scale are displayed on a clear easy to read liquid crystal display (LCD).
- Relative Humidity (RH) readings, probe temperature, dew-point temperature and mixing ratio are automatically displayed when the RH Probe is plugged into the MRH (Hygrometer Mode).
- The Roof, Masonry, Drywall and Laminate Scales use a reference/comparative scale that is displayed both numerically (0-99) and in a bar form on the bottom line of the display. The display also shows low (LO), medium (MD) and high (HI) readings for these scales.

These do not necessarily indicate low, medium or high levels of moisture but indicate the area of the 0-100 comparative scale where the reading lies.

Example

L	A	M	I	N	A	T	E				M	D		3	3
LO					MD						HI				
0	-	30			31		-			70	71		-	99	

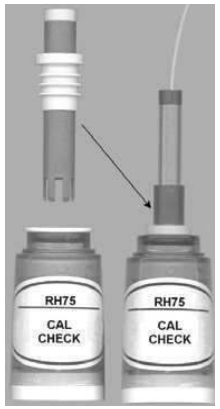
- To conserve battery life, the instrument automatically powers OFF after 10 minutes of inactivity or when the key is pressed. If a key is pressed the power off will
- Backlit display allows the display to be easily read in poor light conditions. This is enabled by pressing the key. The backlight stays on for a period of 30 seconds.

13.1 Calibration checking of RH Probe

Each RH probe is factory calibrated using precision equipment traceable to NIST standards. With reasonable care in use and storage, RH probe measurements should remain within the ±3% specification. RH probe accuracy can be degraded by exposure to polluted atmospheres such as dust, aggressive chemical vapors, or contaminated wetting. It is thus advisable to periodically check the RH Probe accuracy by using RH 75 or a similar suitable reference kit. These kits contain a saturated Sodium Chloride salt solution that creates a nominal 75% relative humidity within the measuring cell. The precise relative humidity is temperature dependent. The RH 75 calibration check is available from the manufacturer or the supplier of your MRH meter.

To carry out a calibration check:

1. Remove cell from sealed plastic bag.
2. Remove white stopper plug from cell.
3. Insert plastic calibration sleeve into cell as shown in photo on left.
4. Remove sleeve stopper plug and fully insert RH probe.
5. Place cell/probe in a stable, draft free, temperature environment, e.g., inside a desk drawer, and leave for at least 2 hours.
6. After 2 hours, connect probe to MRH and measure RH value.
7. The RH reading should be 75% ± 3%
8. If the value is outside this range, repeat the test after a further 2 hours.
9. If the RH value is still outside specification, return the RH probe for investigation.
10. When the calibration check test has been completed, removeRH probe and sleeve from cell. Fit white stopper plug into cell and seal cell inside the plastic bag.



13.0 RH PROBE

The RH Probe utilises “state of the art” electronic technology to provide an “easy to use” and accurate method for measuring relative humidity, mixing ratio, temperature and dew point in a wide range of applications such as:

- Heating, ventilation and air conditioning (HVAC) systems.
- Environmental and building monitoring.
- Building inspection.
- Flooring (including ASTM F 2170 In Situ & ASTM F 2420 RH Hood methods)

A typical MRH display with the RH Probe attached is shown on page 8. Pressing the ▲▼ on the instrument changes the temperature readings from ºC to ºF, the mixing ratio from g/kg (gms) to Grains/Lb (GRN) or vice-versa.

NOTE: **When performing Humidity tests on Concrete Flooring it should be noted that:**

A) If artificial aids for accelerated drying of concrete are being used it is recommended that they be turned off at least four days before taking final readings.

B) It is important that the installer ensures that the floor covering is applied at the moisture content and or relative humidity specified by the manufacturer of the floor coverings and/or adhesives.

C) It is very important that RH probes are handled with care and protected from harsh environments in order to maintain their long-term stability. It is recommended that you do not insert the RH probe into concrete until the chemical reaction between the cement and water has taken place and the drying process has begun. To achieve this it is recommended that you do not insert the probe into the hole in the concrete until the moisture content of the concrete has dropped below 5% when measured with a CME4, CRH or CMEX. RH probes should not be left enclosed in concrete or similar environments at an RH level greater than 93% for long periods, in these situations it is recommended to remove the RH probe and allow the test area to continue to acclimatise by replacing the stopper in the hole-liner sleeve.

- When the battery requires replacement a LOW BATTERY message is shown on the LCD.
- **HOLD** freezes reading to facilitate ease of recording readings. When the MRH is in HOLD mode, ‘H’ will flash on the display.
- If **HOLD** was selected prior to the MRH automatically powering off, the frozen display reading is digitally memorized and restored next time ON is selected.

4.0 OPERATING INSTRUCTIONS

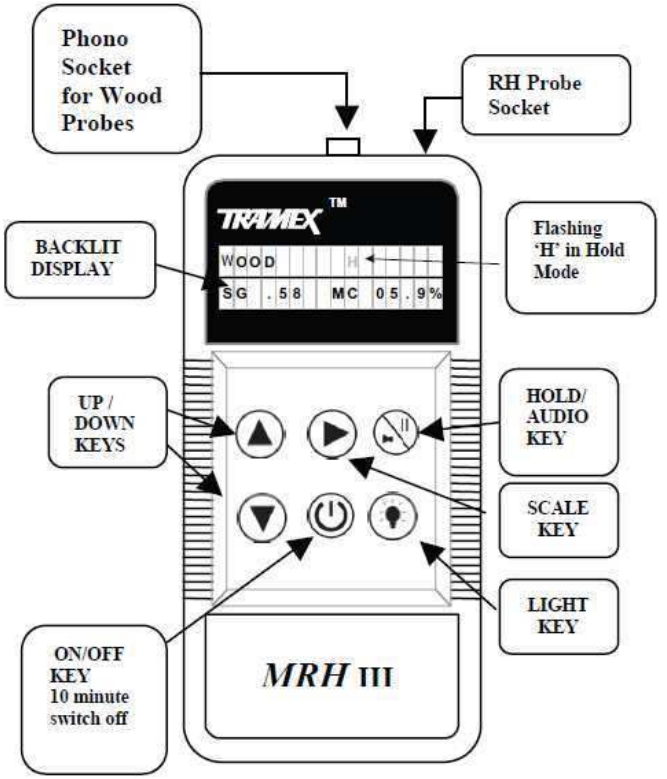


Figure 2

A diagram of the instrument face with brief notes on the push button controls and LCD is shown above (Figure 2).

5.0 NON-DESTRUCTIVE MEASUREMENT MODE

1. Press the ⏻ key to power up. With no RH probe or pin probe connected the last used scale will be displayed on the LCD. Press ⏻ key again to power off.
2. To change scale, press ▶ key to select the wood scale or the comparative material scales. Select the required material scale using the ▲ or ▼ key.
3. Hold your MRH directly on the wood, roof, masonry, drywall or other material being tested, ensuring both conductive-rubber electrodes are fully in contact with the surface
4. For the Roof, Masonry, Drywall and Laminate scales the readings are comparative from 0 to 99. A visual indication is also given by the bar display on the bottom line of the LCD. The display also shows low (LO), medium (MD) and high (HI) readings for these scales. LO is displayed for readings from 0 to 30, MD for readings from 31 to 70 and HI for readings from 71 to 99.

   These do not necessarily indicate low, medium or high levels of moisture but indicate the area of the 0-100 comparative scale where the reading lies.
5. The readings on these scales are not to be interpreted as a measurement of percentage moisture content (% MC) or relative humidity (RH). It is not a relative humidity reading and it does not have any linear correlation with Relative Humidity measurements. This scale should be regarded as a comparative or qualitative scale only.
6. When the Wood Scale is selected the moisture content (MC) in percent of wood is shown on the right-hand side of the bottom line of the display. The left-hand side of this line shows the specific gravity (SG) being used.

   The SG is changed by using the ▼ or ▲ key to adjust to the required SG value. The range of SG covered is 0.30 to 0.80. The S.G. increases and decreases in increments of 0.01
7. A chart showing the approximate specific gravity of a wide range of different species is shown on pages 16 and 17. For SG greater than 0.80 please refer to species adjustment table (Table 2 on Page 14).
8. To turn audio tone on or off, press % key twice in quick succession.
9. The MRH will automatically power-off after ten minutes if no key is pressed. If a key is pressed the power-off will be extended for an additional ten minutes.
10. To freeze readings press the % key once. While on HOLD, H will flash slowly on the upper line of the display. If the unit powers OFF while on HOLD, the frozen meter reading is digitally memorized and restored next time ON is selected. To remove freeze, press % key again.

Meter reading (% moisture)	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Species						***Correct moisture content***												
Tingle, yellow	9	10	11	12	13	14	15	17	18	19	20	21	22	23	25	26	27	28
Totara	8	9	10	10	11	12	12	13	14	14	15	16	16	17	18	18	19	19
Touriga, red	11	11	12	13	14	14	15	16	17	17	18	19	20	20	21	22	23	23
Tuart	9	10	11	12	12	13	14	15	15	16	17	17	18	19	20	20	21	22
Turpentine	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	24
Vitex, New Guinea	7	8	8	9	10	11	12	13	14	15	16	17	18	18	19	20	21	22
Walnut, African		10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Walnut, American Black		8	9	10	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Walnut, Brazilian		8	9	10	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Walnut, blush		10	11	11	12	12	13	14	15	16	17	18	19	20	21	22	23	24
Walnut, European		9	10	11	12	13	14	15	16	17	18	19	20	22	23	24	25	26
Walnut, New Guinea		7	8	9	10	11	12	13	14	15	16	17	17	18	19	20	21	22
Walnut, Peruvian		7	8	9	11	12	13	14	15	16	17	18	18	20	21	22	23	24
Walnut, Qld		9	10	11	12	13	14	15	16	17	18	19	20	22	23	24	25	25
Walnut, yellow		7	8	8	9	10	10	11	12	12	13	14	14	15	16	17	17	18
Wandoo		10	11	12	13	14	15	16	16	17	18	19	20	21	22	23	24	25
Wattle, hicory		8	9	10	11	11	12	13	13	14	15	16	16	16	17	18	18	19
Wattle, silver		9	10	10	11	12	13	13	14	15	16	17	17	18	19	20	21	22
Western Hemlock		7	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Western red spruce		7	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	25
Wollybutt		10	10	11	12	13	14	15	15	16	17	18	19	20	20	21	22	24

Meter reading (% moisture)	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Species						*Correct moisture content*												
Rosarosa	8	9	10	10	11	12	13	13	14	15	15	16	17	18	18	19	-	-
Sapele	9	10	11	12	13	14	15	16	17	18	19	20	22	23	24	25	26	27
Sassafras	8	9	10	10	11	12	13	13	14	15	16	16	17	18	18	19	20	21
Sassafras, southern	9	10	11	11	12	13	13	14	15	15	16	17	17	18	19	19	20	21
Satinash, grey	8	9	9	10	11	12	13	14	15	16	16	17	18	19	20	21	22	23
Satinash, New Guinea	7	8	8	9	10	11	11	12	13	13	14	15	16	16	17	18	19	19
Satinash, rose	7	7	8	8	9	10	10	11	12	12	13	13	14	15	16	16	-	-
Satinay	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Satinheart, green	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	-	-
Sepetir	8	9	10	12	13	14	15	16	17	18	20	21	22	23	24	25	26	27
Sheoak, river	8	9	10	10	11	11	12	12	13	14	14	15	16	16	17	17	18	-
Sheoak, rose	9	10	11	11	12	13	13	14	14	15	15	16	16	17	18	18	19	19
Sheoak, WA	9	10	11	11	12	12	13	14	14	15	16	16	17	18	18	19	20	20
Silkwood, bolly	9	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	18	18
Silkwood, red	6	7	7	8	9	10	10	11	12	12	13	14	14	15	16	17	17	18
Silkwood, silver	9	10	11	12	12	13	14	15	15	16	17	18	18	19	20	20	21	22
Spruce, Sitka	7	8	9	11	11	12	13	15	16	17	18	19	20	21	22	23	25	26
Spruce, western white	7	8	10	11	12	13	14	15	16	17	18	19	20	21	21	23	24	25
Stringybark, brown	9	10	11	11	12	13	14	15	16	17	18	19	19	20	21	22	23	24
Stringybark, Darwin	8	8	9	10	11	12	13	14	15	15	16	17	18	19	20	21	22	22
Stringybark, yellow	11	12	13	14	14	15	16	17	18	18	19	20	21	21	22	23	24	24
Sycamore	7	7	8	9	10	11	12	13	14	15	15	16	17	18	19	19	20	21
Sycamore, satin	9	9	10	11	11	12	12	13	14	14	15	16	16	17	18	18	19	20
Sycamore, silver	9	10	10	11	12	12	13	13	14	14	15	16	16	17	17	18	19	19
Tallowwood	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Tawa	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	18
Teak, Brazilian	8	9	10	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Teak	7	7	8	9	10	11	12	13	14	14	15	15	16	16	17	18	19	20
Tingle, red	9	10	11	12	13	15	16	17	18	19	21	22	23	24	25	27	28	29

6.0 WOOD PIN METER (PIN PROBE) MODE

This mode is activated by plugging one of the optional Wood Electrodes into the socket at the top of the instrument and selecting Pin Probe using the ▶ key. In pin probe mode the MRH works on the principle of electrical resistance. When the electrode pins are pressed or driven into the wood, the electrical resistance between the electrodes is measured and indicated on the digital display. If the wood is dry, the resistance is very high. The higher the moisture content, the lower the resistance. This resistance is accurately measured by the instrument, which translates it into percentage moisture content for wood. The MRH gives moisture readings from 7% to 40%. It should be noted that readings above 27% (nominal value of the fibre-saturation point) are indicative only.

Wood Pin Meter Mode Vs. Non-Destructive Measurement Mode

The two main types of moisture meter for measuring moisture content in wood are the pin type meter and the nondestructive or impedance type meter. Both types are calibrated using gravimetric or oven-drying test methods.

The Tramex MRH combines both of the above methods in one instrument so it is important to understand how each test method works as the results from the two tests may sometimes be different and appear to be contradictory.

The **pin type meter** measures the resistance between two pins, which are inserted into the timber. The standard calibration for this type of meter is based on a Douglas Fir with a specific gravity (S.G.) of 0.5.

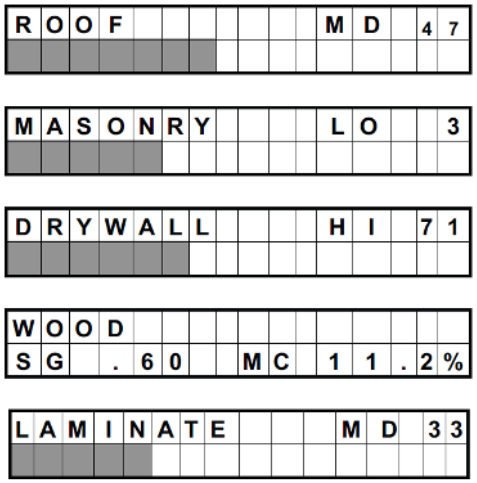
The impedance or **non-destructive type meter** has two electrodes, which transmit a low frequency signal into the timber up to a maximum depth of 1¼ " (30mm). This meter takes an average reading over a much larger area but the S.G. of the material being tested affects the reading more.

On the MRH non-destructive test it is possible to adjust the specific gravity for better species-dependant readings if the material is of sufficient thickness. If the SG of the material is not known it is possible to use the readings from the pin meter to give an approximation of the SG for the nondestructive meter. This is done by Adjusting the SG on the non invasive test until both tests give approximately the same reading. This is not as accurate as knowing the exact S.G. of the material but can be a good indication.

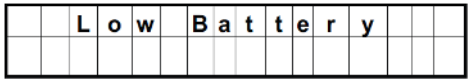
It is very important to note that the readings of the non-destructive meter will penetrate up to 1¼ " (30mm) into the material being tested. If the material is less than 1¼ " (30mm) thick it is possible to get false readings from another material in contact with it. A typical example of this would be a laminate floor over concrete.

7.0 TYPICAL MRH DISPLAYS

Moisture Measurement Mode

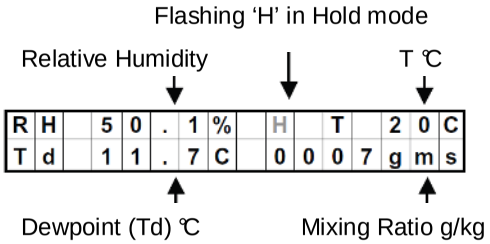


Battery warning



Humidity Probe Display

Metric



Meter reading (% moisture)	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Species						*Correct moisture content*												
Obeche	7	8	9	10	10	1	12	13	14	15	15	16	16	17	18	18	19	20
Padauk, African	7	7	8	9	10	11	12	13	14	15	15	16	17	18	19	19	20	21
Peppermint, broad-leaved	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Peppermint, narrow-leaved	10	11	11	12	13	14	14	15	16	17	18	18	19	20	21	22	22	23
Persimmon	7	8	9	10	10	11	12	13	14	15	15	16	16	17	18	18	19	20
Pine, bunya	10	11	12	12	13	14	14	15	16	16	17	18	18	19	20	21	22	22
Pine, Corsican	9	10	11	12	13	14	15	16	17	18	19	20	22	23	24	25	26	27
Pine, cypress, white	9	10	11	11	12	13	14	15	17	17	18	19	20	21	22	22	23	24
Pine, hoop	10	11	11	12	13	14	15	16	17	17	18	19	20	21	22	22	23	24
Pine, Huon	10	10	12	12	13	13	14	15	15	16	17	18	18	19	20	20	21	22
Pine, King William	9	9	11	12	12	13	14	14	15	16	16	17	18	18	19	20	20	21
Pine, klinki	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Pine, longleaf	9	10	11	12	13	14	15	16	17	18	19	20	22	23	24	25	26	27
Pine, lodgerpole	7	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Pine, maritime	10	11	12	12	13	14	15	15	16	17	18	18	19	20	21	21	22	23
Pine, white, NZ	-	-	-	11	12	12	13	14	15	16	16	17	18	19	19	20	21	22
Pine, Parana	7	8	9	10	11	12	13	14	15	16	16	17	18	19	20	21	22	23
Pine, ponderosa	7	9	10	11	13	14	15	16	17	18	19	20	21	22	22	23	24	25
Pine, radiata	10	11	11	12	13	14	15	16	17	18	19	20	21	22	24	25	26	27
Pine, scots/shortleaf	7	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Pine, slash	8	9	10	11	12	13	14	15	16	17	17	18	19	20	21	22	23	24
Pine, sugar	8	9	10	11	12	13	14	15	16	17	18	20	21	22	23	24	25	26
Pine, white, western	-	8	9	10	11	11	12	13	14	15	16	17	17	18	19	20	21	22
Poplar	7	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Quandong, silver	7	8	9	10	10	11	12	12	13	14	14	15	16	16	17	18	18	19
Redwood	9	9	10	11	12	13	14	15	16	16	17	18	19	20	20	21	22	23
Redwood, European	7	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Rosewood, Patagonian	8	9	10	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Rosewood, Tiete	8	9	10	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

Meter reading (% moisture)	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Species						***Correct moisture content***												
Mahogany, miva	10	11	12	12	13	14	15	15	16	17	18	18	19	20	20	21	22	23
Mahogany, red	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	24	25	26
Mahogany, rose	9	10	10	11	12	12	13	14	14	15	16	16	17	18	18	19	20	20
Mahogany, santos	8	9	10	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Mahogany, southern	8	9	10	11	12	12	13	14	15	16	17	18	19	20	20	21	22	23
Mahogany, Honduras	7	7	8	9	10	11	12	13	14	15	16	17	18	19	19	20	21	22
Mahogany, white	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Makoré	9	10	11	12	13	14	15	15	16	17	18	18	19	20	21	22	23	24
Malas	7	8	9	9	10	11	12	12	13	14	15	15	16	17	18	19	19	20
Maple, Canadian	7	8	9	10	11	12	13	14	15	16	17	18	18	20	21	22	23	24
Maple, Qld	10	10	11	12	13	14	15	16	17	18	18	19	20	21	22	23	24	24
Maple, rose	8	8	9	10	10	11	12	12	13	14	14	15	16	16	17	18	18	19
Maple, sugar	7	7	8	10	12	13	14	15	16	17	18	19	20	21	22	23	24	-
Mararie	10	11	11	12	13	14	14	15	16	17	18	18	19	20	21	21	22	23
Marri	7	8	9	9	10	11	11	12	13	13	14	15	15	16	17	17	18	19
Matai	9	9	10	11	12	12	13	14	15	16	16	17	18	18	19	20	21	22
Meranti	7	8	9	10	11	12	13	14	13	16	17	18	19	20	21	22	23	24
Messmate	10	11	12	12	13	14	15	16	16	17	18	18	19	20	21	22	22	23
Nutmeg (Fiji source)	7	8	9	10	11	11	12	13	14	14	15	16	17	18	18	19	20	21
Oak, American red	7	8	9	11	12	13	14	15	16	17	18	18	20	21	22	23	21	25
Oak, European	7	8	9	10	11	12	13	14	15	16	17	18	19	21	22	23	24	25
Oak, New Guinea	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Oak, silky, northern	8	8	9	10	11	12	13	14	15	16	17	17	18	19	20	21	22	23
Oak, silky, red	8	9	9	10	11	11	12	13	13	14	15	16	16	17	18	18	19	20
Oak, silky, southern	7	10	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Oak, tulip, blush	7	11	12	12	13	14	15	16	16	17	18	19	20	21	22	23	24	25
Oak, tulip, brown	10	11	12	12	13	13	14	14	15	16	16	17	18	18	19	19	20	20
Oak, tulip, red	11	12	13	14	15	16	17	18	18	19	20	21	22	23	24	25	25	26
Oak, white	6	7	8	9	10	11	12	13	14	15	16	17	18	18	19	20	21	22

Imperial

R	H		5	0	.	1	%		H		T		6	8	F
T	d		5	3	.	1	F		0	0	5	1	G	R	N

Wood Pin Probe Display

P	I	N													
P	R	O	B	E				M	C	=	1	0	.	8	%

Moisture Content

8.0 HUMIDITY MEASUREMENT MODE

The optional Relative Humidity (RH) Probe can be plugged into the socket at the top of the instrument. The display shows relative humidity (RH), temperature (T), dew-point temperature (Td) and mixing ratio in grains/lb (GRN) or g/kg (gms). When the RH Probe is plugged into the MRH, the ▲ or ▼ key is used for changing the temperature between °C and °F and the mixing ratio between g/kg and grains/lb.

9.0 WORKING WITH YOUR MRH

Comparative Material Scales

The MRH has 4 comparative material scales: Roof, Masonry, Drywall and Laminate. The comparative material scales are selected using the ⓡ key and switching between the various scales using ⓤ or ⓓ key.

9.1 Roof Scale

Roof Testing

a) The presence of moisture in built-up roofs covered with multi-ply roofing felt, PVC, modified bitumen and all non-conductive membranes (See Limitations Section), can cause blistering and splitting of the roof covering. In addition moisture can cause considerable damage to the contents and fabric of the building as well as heat loss through wet insulation. Your MRH can be used to confirm a new roof has been installed dry and help tracé leaks.

b) If the waterproofing membrane develops a leak, the water can travel within the built-up-roof structure and enter the building some distance away. Testing the membrane surface and comparing the dry areas with areas where moisture is present below the surface can assist in tracing such a leak to its source.

c) As there are many different types and thickness sizes of roofing membranes, it is not possible to give a calibrated percentage measurement. Instead, a comparative scale is displayed both numerically, (0 to 99) and in a bar form on the bottom line of the display. The display also shows low (Lo), medium (Md) and high (Hi) readings for the scale.

   These do not necessarily indicate low, medium or high levels of moisture but indicate the area of the 0-100 comparative scale where the reading lies.

d) If gravel surfacing is present, this should be removed to ensure your MRH comes into direct contact with the surface of the membrane.

e) It is recommended that a core be cut to determine the depth and density of the moisture before carrying out roof repairs. Alternatively, the area can be checked with a resistance-type moisture meter with insulated pins up to a length of 7”(180mm).

Meter reading (% moisture)	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Species						***Correct moisture content***												
Gum, American, red	10	11	12	12	13	14	15	16	17	18	18	19	20	21	22	23	24	24
Gum, red, river	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Gum, rose	9	10	11	12	13	14	14	15	16	17	18	18	19	20	21	22	23	24
Gum, shining	8	9	10	11	11	12	13	14	15	16	17	18	19	20	20	21	22	23
Gum, yellow	9	10	11	12	12	13	14	15	15	16	17	18	18	19	20	21	21	22
Hemlock, western	8	9	10	11	12	13	15	16	17	18	19	20	21	22	23	24	26	27
Hickory	-	7	9	11	13	14	16	17	18	20	21	22	24	-	-	-	-	-
Iroko	7	7	8	9	10	11	12	13	14	15	15	16	17	18	19	19	20	21
Ironbark, red	11	12	12	13	14	15	16	16	17	18	19	20	21	22	22	23	24	24
Ironbark, red, broad-leaved	11	12	12	13	14	15	16	16	17	18	19	20	21	22	22	23	24	25
Ironbark, red, narrow-leaved	8	9	10	11	12	13	14	14	15	16	17	18	19	20	21	22	23	24
Jarrah	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Jelutong	8	9	10	11	12	12	13	14	15	16	16	17	18	19	20	21	21	22
Kamarere (PGN source)	8	9	10	10	11	12	13	14	15	16	17	18	19	19	20	21	22	23
Kamarere (Fiji source)	7	8	8	9	10	11	11	12	13	13	14	15	15	16	17	17	18	19
Kapur	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Karri	7	8	9	10	11	12	13	13	14	15	16	17	18	18	19	20	21	22
Kauri, Qld	10	11	12	13	14	15	16	16	17	18	19	20	21	22	23	24	24	25
Kauri, NZ	9	10	10	11	12	12	13	13	14	14	15	16	16	17	17	18	18	19
Kauri, Vanikoro	11	12	13	13	14	14	15	15	15	16	16	17	17	18	18	18	19	19
Kempas	10	11	11	12	13	14	14	15	16	16	17	18	19	19	20	21	21	22
Laran	8	8	9	10	11	11	12	13	14	14	15	16	17	17	18	18	19	19
Larch, European	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Lodgepole Pine	7	8	9	10	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Lumbayau	8	9	10	11	12	12	13	14	15	15	16	17	18	19	19	20	21	22
Mahogany, African	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Mahogany, American	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mahogany, Brazilian	-	-	-	10	10	11	12	13	14	15	15	16	17	18	19	20	21	22
Mahogany, brush	8	9	10	10	11	12	12	12	13	14	14	15	15	16	16	17	18	18

Meter reading (% moisture)	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Species	***Correct moisture content***																	
Box, grey	10	11	12	12	13	14	14	15	16	17	17	18	19	20	20	21	22	23
Box, grey, coast	9	10	11	11	12	13	14	14	15	16	17	18	18	19	20	21	22	22
Box, kanuka	8	9	10	11	12	12	13	14	15	16	16	17	18	19	20	20	21	22
Brownbarrel	7	8	9	10	11	12	12	13	14	15	16	17	18	18	19	20	21	22
Buchanania	6	7	8	9	10	10	11	12	13	14	14	15	16	17	18	19	19	20
Candlenut	5	8	10	12	14	16	18	21	23	25	27	29	31	34	36	38	40	42
Carabeen, yellow	8	9	9	10	11	12	12	13	14	14	15	16	16	17	18	18	19	20
Cedar, red	9	10	11	12	13	14	16	17	18	19	20	21	22	23	25	26	27	27
Cedar, red, western	7	9	10	11	12	13	13	14	15	17	18	19	20	21	22	23	24	25
Cedar, South American	9	10	11	12	13	13	14	15	16	17	17	18	19	20	21	22	22	23
Cherry	8	9	10	11	12	13	14	15	16	17	18	19	20	22	23	24	25	26
Cherry, Brazilian	8	9	10	11	12	13	14	15	16	17	18	19	20	22	23	24	25	26
Coachwood	6	7	8	9	10	11	12	13	14	14	15	16	17	18	19	20	21	22
Dakua salusalu	9	10	11	11	12	13	14	15	16	17	18	19	19	20	21	22	23	24
Douglas Fir	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Elm	6	7	7	8	9	10	12	13	13	14	15	15	16	17	18	19	20	20
Erima	8	8	9	10	11	12	12	13	14	15	15	16	17	18	19	19	20	21
Fir, Alpine	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Fir, amabilis	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Fir, red	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	25	26
Fir, white	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	25	26
Gum, blue, southern	9	10	11	12	13	14	15	15	16	17	18	18	19	20	21	22	23	24
Gum, blue Tasmanian	8	9	10	11	12	12	13	14	15	16	17	17	18	19	20	21	22	22
Gum, grey	8	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Gum, grey, mountain	9	9	10	11	12	13	14	14	15	16	17	18	19	19	20	21	22	23
Gum, lemon-scented	6	7	8	9	10	10	11	12	13	13	14	15	16	17	17	18	19	20
Gum, Maiden's	10	11	11	12	13	14	15	16	16	17	18	19	20	20	21	22	23	24
Gum, manna	7	7	8	9	10	11	12	13	14	14	15	16	17	18	19	20	21	21
Gum, mountain	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

9.2 Masonry Scale

Testing plaster, brick and Block

Your MRH gives comparative (relative) readings (0 to 99) on plaster, brick and block. These readings are displayed both numerically and in bar form on the LCD. The display also shows low (Lo), medium (Md) and high (Hi) readings for the scale.

These do not necessarily indicate low, medium or high levels of moisture but indicate the area of the 0-100 comparative scale where the reading lies.

For plaster, brick and block use the **Masonry** scale. For **Drywall** the more sensitive dedicated **Drywall** scale is used. Always press the electrodes firmly against the surface.

The moisture profile of a masonry wall can be determined by moving your MRH across the surface where it will read through most paints and wall coverings. It will help identify the different levels of moisture even if not apparent on the surface. Moisture can often be trapped behind wall coverings.

Rising damp and moisture migration from leaks and defective, or non-existent, vapor barriers can be identified and profiled and often its source identified by moving the instrument across the wall surface. Water damage following flooding or fire fighting can be checked and the drying out and de-humidification process can be monitored.

9.3 Drywall Scale

Because of its deep signal penetration, your MRH can identify excess moisture behind drywall, ceramic tile and other wall coverings when used on the **Drywall Scale**.

Testing on ceramic tiles, other wall and floor coverings

Excess moisture trapped behind covering materials such as ceramic tiles, carpet, wall coverings etc can cause major problems. For instance, excess moisture behind ceramic tiles on drywall or other substrates can cause decay, delamination and mold growth. The longer these problems go undetected, the worse the problem can get, eventually leading to system failure.

Your MRH can be used to detect and identify areas of elevated moisture within or behind most types of wall and floor coverings. For example the MRH can detect elevated moisture behind most types of ceramic tiles.

Should the **Drywall Scale** prove to be too sensitive for testing ceramic tiles or other coverings, reduce sensitivity by choosing the **Laminate Scale** and take readings on a comparative basis.

9.4 Laminate Scale

For applications where the Roof or Drywall scales are too sensitive and the Masonry scale is not sensitive enough, the Laminate scale can be used. This scale used can be used for testing on ceramic tiles and other wall and floor coverings. It can also be used in many other applications where the other scales do not have the required sensitivity.

9.5 Wood Scale

Testing wood and wood products

a) When testing wood, power-on, select Wood Scale using the ⓡ key.

b) When the Wood Scale is selected the moisture content (MC) in percent is shown on the right-hand side of the bottom line of the display. The left-hand side of this line shows the specific gravity (SG) being used. *See note on specific gravity* on page 17. The SG is changed by using the ⓤ or ⓓ key to adjust to the required SG value. The range of SG covered is 0.30 to 0.80. The S.G. increases and decreases in increments of 0.01.

c) A chart showing the approximate specific gravity of a range of different species is shown on pages 16 and 17. For SG greater than 0.80 please refer to specific gravity adjustment chart (Table 2 on page 14). For species not listed a more comprehensive list is available on the USDA website www2.fpl.fs.fed.us/ (in the US) or from timber importers and forestry departments in other countries.

d) If possible, always take readings with the length of the instrument parallel to the direction of the wood grain.

e) Calibration tests were carried out by Forbairt, the Irish Institute for Industrial Research and Standards, and are based on Douglas Fir, which had a published specific gravity (SG) of 0.50.

f) Acceptable levels of moisture content depend on climatic conditions and we advise you check the levels acceptable in your area. Table 1 on page 13 shows the approximate relationship between the ambient relative humidity and equilibrium moisture content in woods.

g) The following moisture content levels are given as a guide.
   - Furniture: 5% to 6% when used in locations of low relative humidity and up to 10% to 11% may be acceptable where the relative humidity is higher.
   - Interior wood: 6% in low humidity areas. Up to 12% in higher humidity locations.
   - Exterior wood: 10% to 15% depending on local humidity levels.
   - Generally, wood with a moisture content in excess of 23% - 25% is susceptible to rot.

12.0 SPECIES CORRECTION CHART

Meter reading (% moisture)	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Species	***Correct moisture content***																	
Alder, brown	9	10	10	11	12	13	13	14	15	15	16	17	18	18	19	20	20	21
Amberoi	7	7	8	9	9	10	11	12	12	13	14	14	15	16	17	17	18	19
Ash, alpine	9	10	11	12	13	14	15	16	17	18	18	19	20	21	22	23	24	25
Ash, American	9	10	11	11	12	13	14	14	15	16	17	18	19	20	21	23	24	25
Ash, Crow's	9	10	10	11	12	12	12	14	14	15	16	17	17	18	19	20	20	21
Ash, European	8	9	10	11	12	12	13	14	14	15	16	17	18	18	19	20	21	21
Ash, mountain	9	10	11	12	13	14	15	16	17	18	18	19	20	21	22	23	24	25
Ash, silvertop	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Balsa	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Baltic, red	9	10	11	12	13	14	15	15	16	17	18	18	19	20	21	22	23	24
Baltic, white	9	10	11	12	13	14	15	16	17	18	19	20	22	23	24	25	26	27
Bauvudi	7	8	9	9	10	11	11	12	13	13	14	15	15	16	17	17	18	18
Bean, black	9	10	11	12	13	14	15	16	16	17	18	19	20	21	22	23	24	25
Beech, American	7	8	10	11	12	13	14	15	16	13	18	19	20	21	23	23	24	25
Beech, Japan	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Beech, myrtle	8	9	10	11	11	12	13	14	15	15	16	17	18	18	19	20	21	22
Beech, silver	9	10	10	11	12	12	13	13	14	14	15	16	16	17	17	18	19	19
Beech, Wau	9	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Beech, white	8	9	10	11	12	13	14	14	15	16	17	18	19	19	20	21	22	23
Birch, European	7	8	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Birch, white	9	10	11	12	12	13	14	15	15	16	17	18	18	19	20	21	22	22
Blackbutt	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Blackbutt, WA	9	10	11	12	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Blackwood	9	9	10	11	12	12	13	14	15	16	16	17	18	19	20	20	21	22
Bloodwood, red	10	10	11	12	13	14	15	15	16	17	18	19	19	20	21	22	23	23
Bollywood	7	8	9	10	11	12	12	13	14	15	16	16	17	18	19	20	21	22
Box, brush	7	7	8	8	9	9	10	10	11	11	12	13	13	14	14	15	15	16

Temperature Adjustment Chart

For use in pin-meter only. The instrument had been calibrated on wood at an ambient temperature of 20℃ (68℉). When measuring moisture in wood at a different temperature, the following temperature adjustment needs to be applied. (Figures rounded to the nearest whole number).

Wood temp.		**Meter reading**						
℃	**℉**	**7%**	**10%**	**12%**	**15%**	**20%**	**26%**	**30%**
		Adjustment						
5	40	+1	+2	+2	+3	+4	+5	+7
10	50	+0	+1	+1	+2	+2	+3	+4
20	68	+0	+0	+0	+0	+0	+0	+0
30	80	+0	-1	-1	-1	-1	-2	-2
40	100	-1	-2	-2	-3	-3	-3	-4
50	122	-1	-3	-3	-4	-5	-7	-8
60	140	-2	-3	-4	-5	-6	-8	-10
70	158	-3	-4	-5	-6	-8	-10	-12

Example 1:
If meter reads 15% and temperature of wood is 10℃ (50℉), actual moisture content is 17%. i.e.15%+2%=17%

Example 2:
If meter reads 15% and temperature of wood is 50℃ (122℉), the actual moisture content is 11%. i.e.15%-4%=11%

Combined Species/Temperature Correction

Example 1
If meter gives reading 15% on a sample of Sitka Spruce and the wood temperature is 40℃, the correction is as follows:
Species correction @15% = 16%
Temperature correction @ 40℃ = - 3%
Corrected reading: 13%

Example 2
If meter gives reading 24% on sample of Teak and the wood temperature is 10℃, the correction is as follows:
Species correction @24% = 20%
Temperature correction @ 10℃ = + 2%
Corrected reading: 22%

- Wood moisture content in excess of 18% - 20% may provide an environment for termite and woodboring insects to thrive and multiply. Wood at these high levels can also support mold and biological growth.
- Wood at 28% moisture content is considered to have reached fiber saturation point.

h) Avoid taking readings on wood from the top of a stack stored outside as these may be affected by surface moisture from recent rain.

i) When taking readings in chemically treated wood, it is advisable to allow for possible effects that the treatment may have on readings.

9.6 Relative humidity and moisture content

The following table shows the approximate relationship between relative humidity (RH) and equilibrium moisture content (EMC) of some woods. These figures are approximate values and may vary for different species.

Relative Humidity	**Wood MC%**
10%	3 to 5
20%	5 to 6
30%	6 to 8
40%	8 to 10
50%	10 to 11
60%	11 to 13
70%	13 to 15
80%	15 to 18
90%	18 to 23
100%	23 +

Table 1. Approx relationship between RH and EMC.

Depth of field penetration
Depending on the density of the material being tested, the instrument field can penetrate approximately 30mm (1 ¼ inches) below the surface. When testing thin materials such as wood veneers it is recommended that they are stacked to at least that thickness.

9.7 Wood Flooring

a) Excess moisture in wood flooring or concrete sub-floors can cause major problems. For instance, if installed with excess moisture, the wood can subsequently shrink leading to job failure.

b) If a wood floor (solid, laminated or engineered) is installed above wet concrete the wood can absorb moisture emitting from the concrete causing the wood to swell and buckle and even cause structural damage to the building. For measuring the moisture in concrete, the CME4, CRH or CMEXpert should be used.

c) Your MRH can be used to measure the moisture content of the wood floor to ensure it meets specification. Likewise it can be used to check, on a **comparative basis**, through the floor covering, to identify elevated moisture in the substrate.

NOTE: On the Wood, Drywall, Roofing and Laminate Scales the depth of penetration of the MRH signal can be up to 1¼" (30mm). When using any of these scales on wood or laminate over concrete or other screeds, the MRH will be reading through the material and may be giving a much higher than expected reading. This is invariably due to the fact that concrete is a much denser material than wood or wood-based products. In such instances, the wetter areas can be identified non-invasively and the wood probe can then be used to make select intrusions to determine the moisture content of the wood or laminate.

Reading S.G. set at 0.5	S.G.			
	0.85	0.9	0.95	1
	Adjustment			
5 to 9	-3	-4	-4	-4
10 to 12	-4	-5	-5	-5
13 to 15	-5	-6	-6	-6
16 to 18	-6	-7	-7	-8
19 to 21	-7	-8	-9	10
22 to 24	-9	-9	-11	-11
25 to 27	-11	-11	-12	-13
28 to 30	-12	-13	-13	-14
31 to 33	-14	-14	-14	-15
34 to 36	-15	-15	-15	-16

Table 2. Specific Gravity Adjustment Table (S.G. > 0.80)

Testing wood and wood products

a) When testing wood, power-on, insert wood probe into phono-socket at the top of the MRH and select Pin Probe Mode using the ⊙ key.

b) When a wood probe is inserted the moisture content (MC) in percent is shown on the righthand side of the bottom line of the display.

c) If possible, always take readings with the pins parallel to the direction of the wood grain.

d) Calibration tests are based on Douglas fir, which has a published specific gravity (SG) of 0.50.

e) Acceptable levels of moisture content depend on climatic conditions and we advise you check the levels acceptable in your area. Table 1 on page 13 shows the approximate relationship between the ambient relative humidity and equilibrium moisture content in woods.

f) The following moisture content levels are often quoted in the wood industry and should be used as a guide only. Please contact industry associations and manufacturers for their specifications.

- Furniture: 5% to 6% when used in locations of low relative humidity and up to 10% to 11% may be acceptable where the relative humidity is higher.
- Interior wood: 6% in low humidity areas. Up to 12% in higher humidity locations.
- Exterior wood: 10% to 15% depending on local humidity levels.
- Generally, wood with moisture content in excess of 23% - 25% is susceptible to rot.
- Wood moisture content in excess of 18% to 20% may provide an environment for termite and woodboring insects to thrive and multiply. Wood at these high levels can also support mold and biological growth.
- Wood at 28% moisture content is considered to have reached fiber saturation point.

g) Avoid taking readings on wood from the top of a stack stored outside as these may be affected by surface moisture from recent rain.

h) When taking readings in chemically treated wood, it is advisable to allow for possible effects that the treatment may have on readings.

Temperature Adjustment Chart

The Pin Probe has been calibrated on wood at an ambient temperature of 20℃ (68℉). When measuring moisture in wood at a differ ent temperature, the following temperature adjustment needs to be applied. (Figures rounded to the nearest whole number).

11.0 WOOD PIN METER MODE

Factors Affecting Moisture Readings
The readings of all moisture meters are influenced by the characteristics of different species of wood as well as temperature and other factors listed below.

Species
Different species of wood can vary in density and conductivity, which can have an effect on the electrical resistance of the wood. This can influence meter readings for the same moisture content and can also apply to similar species from different origins. A species adjustment table is provided on page 21 to 27.

Temperature
Meter readings can be affected by wood temperature. The Wood Probe is calibrated at 20℃ (68℉). At wood temperatures above 20℃ (68 ℉), the meter readings are higher and at wood temperatures below 20℃ (68℉) t he meter readings are lower. A temperature adjustment chart is provided on page 20.

Chemical treatment or contamination
Readings may be affected by certain flame retardants, preservatives, aluminium paint and by contamination by salt water. Treat all readings on such wood as indicative readings only.

Surface Moisture
Surface moisture due to wetting or condensation can affect readings when uninsulated pins are used. It is recommended that insulated pins such as SP-52 are used in conjunction with HA-22 Hammer Action electrode. As the pins are driven into the wood, readings can be taken at different depths unaffected by moisture on the surface.

Wood Flooring
a) Excess moisture in wood flooring can cause major problems.

b) For instance, if installed with excess moisture, the wood can subsequently shrink leading to job failure.

c) If a wood floor (solid, laminated or engineered) is installed above wet concrete the wood can absorb moisture emitting from the concrete causing the wood to swell and buckle and even cause structural damage to the building.

d) Your MRH in **PIN Probe** mode can be used to measure the moisture content of the wood floor to ensure it meets specification.

Adhesives
The presence of different species, treatments, adhesives, etc., within products such as plywood, particleboard, OSB (oriented strand board), laminated and engineered woods will affect measurements. If in doubt please contact us and, if you wish, we can work with you in developing your own calibration for a specific product.

Concrete
Your MRH is not calibrated for concrete. The Concrete Encounter CME4, CMExpert and CRH instruments are specifically designed for concrete flooring and are recommended where quantitative measurements are required. However a comparative indication of the moisture condition of a concrete or sub floor can be obtained with the MRH set on the Masonry scale. **Comparative** readings can also be obtained through coverings such as vinyl, carpet and laminated wood flooring by using the Laminate Scale.

9.8 Chemical treatment or contamination

Readings may be affected by certain flame-retardants, preservatives, aluminium paint and by contamination by salt water. Treat all readings on such wood as indicative readings only.

10.0 TABLE OF WOOD SPECIFIC GRAVITIES (S.G.)

Hardwoods

(Am. = American)

Alder, **Red** (Am. Alder, Western Alder) *Alnus rubra* 0.41
Ash, **White** (Northern / Southern Ash) *F. americana* 0.60
Aspen, **Quaking** (Am. Aspen) *Populus tremuloides* 0.38
Basswood (Am. Basswood, Linden) *Tilia americana* 0.37
Beech *Fagus Grandifolia 0.64*
Birch, Yellow *(Gray, Silver, Swamp)B. alleghaniensis* 0.62
Cherry (Am. Black Cherry) *Prunus serotina* 0.50
Cottonwood (Eastern Cottonwood) *Populus deltoides* 0.40
Elm, Red (Slippery elm) *Ulmus rubra* 0.53
Hackberry (Common Hackberry) *Celtic occidentalis* 0.53
Hickory (Pignut, True Hickory) *Carya glabra* 0.75
Maple, Am. Hard (Sugar Maple) *Acer saccharum* 0.63
Maple Am. Soft (Red Maple) *Acer rubrum* 0.54
Maple, Silver *Acer saccharinum* 0.47
Maple, Black *Acer nigrum* 0.57
Oak, Northern Red *Quercus rubra* 0.63
Oak, Southern Red (Cherrybark) *Quercus falcata* 0.68
Oak, White (Am. White Oak) *Quercus alba 0.68*
Pecan Hickory (Am. Pecan) *CaryaiIllinoensis* 0.66
Red Gum (Sweetgum) *Liquidamber styraciflua* 0.52
Sassafras (Golden Elm) *Sassafras albidum 0.46*
Sycamore(Am. Planetree, Buttonwood) *P. occidentalis* 0.49
Walnut, Black (Am. Walnut) *Juglans nigra* 0.55
Willow, black (Am. Willow) *Salix nigra* 0.39
Yellow Poplar (Am. Tulipwood, Tulip Poplar, Canarywood) *Liriodendron tulipifera* 0.42

Softwoods

Cedar, Alaska (Alaskan Yellow) 0.44
Cedar, Incense 0.37
Cedar, Port-Orford 0.43
Cedar, Western Red 0.32
Douglas Fir, Coast 0.48
Douglas Fir, Interior West 0.50
Fir, California Red 0.38
Fir, Grand 0.37
Fir, noble 0.39
Fir, Pacific Silver 0.43
Fir, White 0.39

Hemlock, Western 0.45
Larch, Western 0.52
Pine, Lodgepole 0.41
Pine, Ponderosa 0.40
Pine, Sugar 0.36
Pine, Western White (Idaho) 0.38
Spruce, Engelmann 0.35
Spruce, Sitka 0.40

Exotic

Balsa 0.16
Ebony 1.10
Karri 0.82
Padauk 0.77
Tulipwood 0.96
Source: USDA: Wood Handbook 1987.

Note on specific gravity (S.G.):
The specific gravity (S.G.) of wood is the ratio of the density of wood to the density of water at a specified temperature (generally 4ºC where the density of water is at its maximum). The density of wood is usually based on the oven-dry weight and the volume at the specified moisture content (M.C.), generally 12%.

TRAMEX MRH III

PORTABLE MOISTURE METER

OPERATING INSTRUCTIONS

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