TRAMEX
Innovation in moisture detection

user guide

MRH III

non-destructive moisture & humidity meter

ABQINDUSTRIAL
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Distributed by: ABQ Industrial LP USA
Tel: +1 (281) 516-9292 / (888) 275-5772 **eFax:** +1 (866) 234-0451
Web: https://www.abqindustrial.net **E-mail:** info@abqindustrial.net

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INTRODUCTION

Thank you for selecting the new MRH III instrument, from Tramex. It has 3 measurement modes.

1. The MRH III utilises electronic technology to provide you with an accurate and easy to use non-invasive instrument for the non-destructive measurement and tracing of 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 used in Pin Probe (wood pin-meter resistance measurement) Mode. This enables the MRH III to measure the percentage moisture content (MC%) of wood and give an indication of the moisture content of wood-based products.

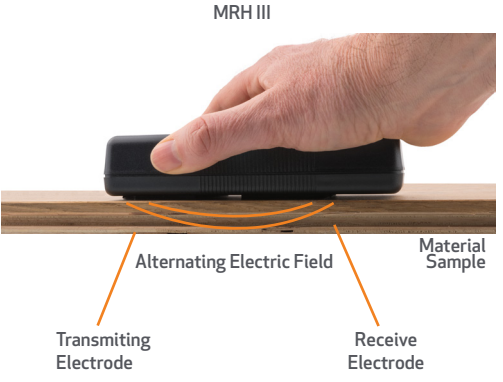
3. By inserting the optional plug-in Hygro-i2 probe, the instrument automatically changes to hygrometer mode. This enables the MRH III to measure relative humidity (RH), temperature, dew-point temperature and mixing ratio of the environment or equilibrium relative humidity in a structural material. A structural material such as a concrete slab can be tested using the in-situ method as per ASTM F2170 and the in-situ and hood methods as per British Standards BS 8201, 8203, 5325.

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.

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 III is a resistance-type pin meter for determining the percentage moisture content of wood.

In **Hygrometer mode** (i.e. with the Hygro-i2 Probe plugged in), the MRH III determines the capacitance of the RH probe sensor, which varies with the relative humidity of the test area environment. The MRH III displays this capacitance as percentage relative humidity (%RH). It also measures temperature and displays dew-point temperature and mixing ratio.

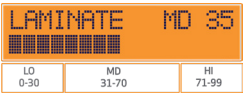
INSTRUMENT FEATURES

Your MRH III 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.
- 6 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 ▲ 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 III (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:



- 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 will be extended for an additional ten minutes.
- 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 time set.
- Backlight display time. To adjust the backlight display time, press the ▲ and ▼ keys together. Then scroll with the ▼ key from 10 – 60 seconds. When time is chosen select ▶ key to confirm and return to scale mode.
- Language display adjustment. To adjust the language display, press the ▲ and ▼ keys together. Then scroll with the ▲ key through the language library. When language is chosen select ▶ key to confirm and return to scale mode.
- 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 III is in HOLD mode, 'H' will flash on the display.
- If HOLD was selected prior to the MRH III automatically powering off, the frozen display reading is digitally memorized and restored next time ON is selected.

OPERATING INSTRUCTIONS

1 = Phono socket for Wood Probes.
2 = Hygro-i2 Probe Socket (automatic hygrometer mode when plugged in).
3 = Backlit display.
4 = Hold / Audio Mode.
5 = Scale Key.
6 = UP / DOWN Keys
7 = ON / OFF Key 10 minute switch off
8 = Light Key.

NON-DESTRUCTIVE MEASUREMENT MODE

1. Press the ⏻ key to power up. With no RH 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 III directly on the wood, roof, masonry, drywall, laminate 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 SG 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 23 and 24. For SG greater than 0.80 please refer to species adjustment table (Table on Page 21).

8. To turn audio tone on or off, press ⏻ key twice in quick succession.

9. The MRH III 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.

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 III 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 III 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 non-destructive or impedance type meter. Both types are calibrated using gravimetric or oven-drying test methods.

The Tramex MRH III 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 Douglas Fir with a specific gravity (SG) 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 SG of the material being tested has a significant effect on the reading.

On the MRH III 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 non-destructive 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 SG 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.

Typical MRH III Displays

Moisture Measurement Mode

Battery warning

NON-DESTRUCTIVE MEASUREMENT MODE – Comparative Scales

The MRH III 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.

Roof Scale - Roof Testing

a. The presence of moisture in roofing systems 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 III can be used to confirm a new roof has been installed dry and help trace leaks.

b. If the waterproofing membrane develops a leak, the water can travel within the 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 back to its source.

c. As there are many different types and thicknesses 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 0-99 comparative scale where the reading lies.

d. If gravel surfacing is present, this should be removed to ensure your MRH III 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).

Masonry Scale - Testing Plaster, Brick and Block

Your MRH III 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 0-99 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 III 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.

Drywall Scale

Because of its deep signal penetration, your MRH III 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 III 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 III 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.

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 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.

NON-DESTRUCTIVE MEASUREMENT MODE – 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 21. 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 SG 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 23 and 24. For SG greater than 0.80 please refer to specific gravity adjustment chart (Table on page 21). For species not listed a more comprehensive list is available on the USDA website www.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. The Table on page 19 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% to 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.

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.

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.

Approx. relationship between RH and EMC.

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 +

Depth of field penetration

Depending on the density of the material being tested, the instrument field can penetrate approximately 30mm (1¼") below the surface. When testing thin materials such as wood veneers it is recommended that they are stacked to at least that thickness.

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 Tramex CME4 or CMEXpert should be used.

c. Your MRH III 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 III signal can be up to 1¼" (30 mm) When using any of these scales on wood or laminate over concrete or other screeds, the MRH III 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.

Specific Gravity Adjustment Table (SG > 0.80)

Reading S.G. set at 0.5	SG			
	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

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 III is not calibrated for concrete. The Tramex Concrete Encounter CME4, CMExpert and 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 III 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.

Chemical treatment or contamination

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

Table of Wood Specific Gravities (SG)

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) *Caryaillinoensis*.....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, Englemann	0.35
Spruce, Sitka	0.40

Exotic

Balsa	0.16
Ebony	1.10
Karri	0.82
Padauk	0.77
Tulipwood	0.96

Note on specific gravity (SG): The specific gravity (SG) of wood is the ratio of the density of wood to the density of water at a specified temperature (generally 4°C 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 (MC%), generally 12%.

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 30 to 41.

Temperature

Meter readings can be affected by wood temperature. The Wood Probe is calibrated at 20°C (68°F). At wood temperatures above 20°C (68°F), the meter readings are higher and at wood temperatures below 20°C (68°F) the meter readings are lower. A temperature adjustment chart is provided on page 28.

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

Excess moisture in wood flooring can cause major problems. For instance, if installed with excess moisture, the wood can subsequently shrink leading to job failure. 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.

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

Testing wood and wood products

a. When testing wood, power-on, insert wood probe into phono-socket at the top of the MRH III 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. The Table on page 19 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% to 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

For use in pin-mode only.

The instrument has been calibrated on wood at an ambient temperature of 20°C (68°F). 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 temperature		Meter reading						
°C	°F	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°C (50°F), actual moisture content is 17%.
i.e.15% + 2% = 17%

Example 2:
If meter reads 15% and temperature of wood is 50°C (122°F), 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°C, the correction is as follows: Species correction @15% = 16%, Temperature correction @ 40°C = - 3% Corrected reading: 13%.

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

SPECIES CORRECTION CHART

Meter reading (% moisture content)	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	14	15	16	17	18	18	19	20	21	22

Meter reading (% moisture content)	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Species							*Correct moisture content*											
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
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

Meter reading (% moisture content)	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Species	*Correct moisture content*																	
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	7	8	9	11	12	13	14	15	16	17	18	18	20	21	22	23	21	25
Cherry, Brazilian	7	8	9	11	12	13	14	15	16	17	18	18	20	21	22	23	21	25
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

Meter reading (% moisture content)	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Species	*Correct moisture content*																	
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
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

Meter reading (% moisture content)	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Species								*Correct moisture content*										
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

Meter reading (% moisture content)	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Species	*Correct moisture content*																	
Kempas	8	9	10	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
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	11	12	12	13	14	14	15	15	16	16	17	18	18
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

Meter reading (% moisture content)	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Species								*Correct moisture content*										
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

Meter reading (% moisture content)	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Species	*Correct moisture content*																	
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
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	21	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

Meter reading (% moisture content)	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Species	*Correct moisture content*																	
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

Meter reading (% moisture content)	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Species	*Correct moisture content*																	
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
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

Meter reading (% moisture content)	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Species	*Correct moisture content*																	
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
Tigerwood	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Tingle, red	9	10	11	12	13	15	16	17	18	19	21	22	23	24	25	27	28	29
Tingle, yellow	9	10	11	12	13	14	15	17	18	19	20	21	22	23	25	26	27	28

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

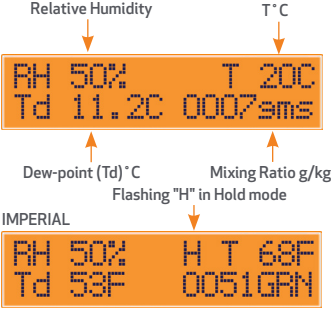
HUMIDITY MEASUREMENT MODE

The Hygro-i2 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 in-situ method as per ASTM F2170 and the in-situ and hood methods as per British Standards BS 8201, 8203, 5325.)

A typical MRH III display with the Hygro-i2 Probe is shown below.

When the Hygro-i2 Probe is plugged into the MRH III, the ▼ or ▲ key can be used for changing the temperature between °C and °F and the mixing ratio between g/kg and grains/lb.



Relative Humidity Measurement

There are two International Standard methods of relative humidity measurement in flooring that can be carried out with the MRH III with the Hygro-i2 probe attached:

(a) In-situ (below the surface of the slab) ASTM F2170 and BS 8201, 8203, 5325.
(b) RH Hood (on the surface of the floor slab) BS 8201, 8203, 5325.

(a) In-situ Relative Humidity Test Method – ASTM F2170 Guidelines.

- Perform 3 per first 1000ft² (100m²) and 1 per next 1000ft². Holes must be drilled dry and perpendicular (90°), do not use water for cooling or lubrication.
- Hole depth, when drying is from the top only, it is recommended that the hole should be drilled to approx 40% of the slab thickness.
- When drying is from both sides, it is recommended that the slab should be drilled to approx 20% of slab thickness.
- A hole cleaning brush is often required to ensure the drilled hole is free from any loose particles. A vacuum should also be used to ensure the drilled hole is free from any dust.
- The user should always refer to ASTM or national standard guidelines for definitive and current procedure and specifications.

MOISTURE TESTING GUIDELINES

When performing moisture testing of concrete it is important to get the most accurate and useful data from the tests. For this reason, Tramex recommend a two-pronged approach. The first step is to carry out a non-invasive moisture test with the Tramex CME4 or CMEX. This measures the top section of the concrete slab and gives an average percentage moisture content of the footprint area of the meter. These readings should be used to determine where and how in-situ relative humidity (RH) testing is performed. Tramex recommend that the test holes are drilled, sleeves are placed and capped and left for a period of time as outlined in International Standards (British Standards: 72 hours. ASTM: 24hours) The probes are then inserted. A suitable equilibration time is allowed before taking readings (see below).

The above recommendations are based on the requirements to prolong the life of the RH probe and to increase the accuracy of the test. Tramex recommend that the RH probes are not left in-situ for prolonged periods of time when the RH values are above 93%. With the Tramex system it is possible to remove the probe and seal the sleeve for future testing, thus giving a more reliable and accurate test.

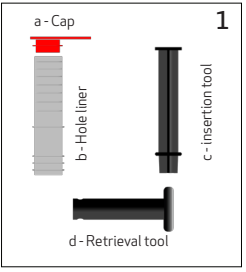
Equalibration Time:

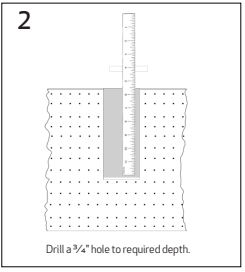
Allow at least 30 minutes for probe to reach temperature equilibrium before measuring relative humidity. It is vitally important that the concrete is at the same temperature as the probe.

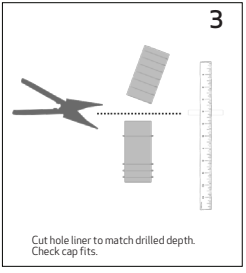
Even a slight difference in temperature will produce a significant error in relative humidity measurement. Check that meter readings do not drift by more than 1% RH over a 5 minute period.

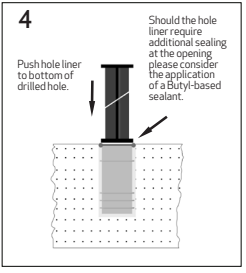
The sensor in the Hygro-i2 probe may take longer to recover if exposed to readings above 93% and can be damaged by prolonged exposure to high humidity.

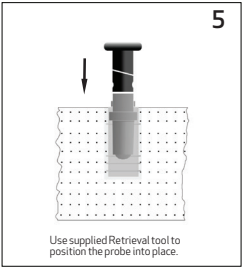
HOLE LINER INSTRUCTION ASTM F2170

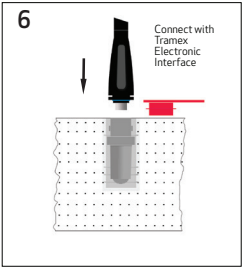




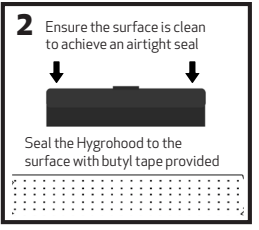


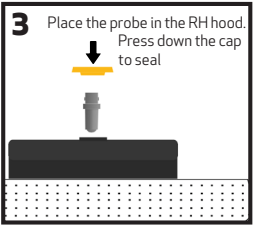


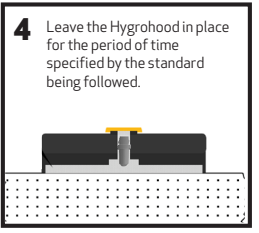


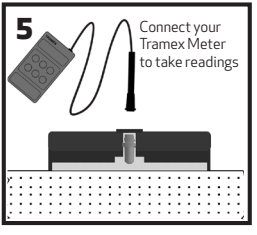


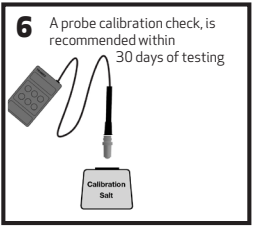
RH Hood Method











(b) On surface RH tests (RH hood method)

The Tramex RH Hood can be used to perform testing to British Standards BS 8201, 8203, 5325. The following components are required to perform a RH Hood test: MRH III, Insulated hood (RHIH), Hygro-i2 probe and interface. The Tramex CMEX II or WME can also be used with the RH Hood.

Pre test guidelines

The Tramex CME4 or CMEX II should be used first in non invasive mode to give an overall moisture condition of the floor slab. These readings will determine where to position the insulated hood. Careful consideration should be given to location of test site. The hood should not be located in direct sunlight or in an area which can be accidently disturbed. The floor slab surface should be cleaned of any foreign materials and swept clean of any dust or loose materials that could affect a proper seal between the hood and surface of the floor.

1. Using a double-sided preformed adhesive/butyl tape, seal the insulated RH hood to the concrete surface.
2. Insert Hygro-i2 probe into the hood using the insertion/ retrieval tool.

The sensor in the Hygro-i2 probe may take longer to recover if exposed to readings above 93% and can be damaged by prolonged exposure to high humidity.

3. Please refer to the period of time as specified by the standard being followed for the duration of the test. The user should always refer to national standard guidelines for definitive and current procedures and specifications.
4. When the time period has elapsed, check that meter readings do not drift by more than 1% RH over a 5 min period.Ensure the readings correspond with the floor covering/ adhesive manufacturers or national standard recommendations before applying floor covering. e.g. British standards code of practice BS8203 suggests that a concrete floor should be sufficiently dry to allow installation of a resilient floor covering when the measured relatively humidity falls to 75% or lower using the using the insulated impermeable box/hood method as specified in the above standard.

Use of artificial aids for accelerated drying of concrete is not recommended. If they are being used it is recommended that they be turned off at least four days before taking final readings.

CALIBRATION CHECK SALTS

A saturated salt solution is the most suitable method for on-site testing of humidity sensors. The advantage of the on-site salt calibration check is that the user can check that the sensors are performing satisfactorily without having the need to send the sensors to a testing laboratory, which can be expensive and time consuming. The sensors can be checked at a time that is convenient to the user, which means no down time for your equipment. ASTM F2170 requires that humidity probes are checked and readings recorded by the user within 30 days before use. This check can be achieved with a 75% RH saturated Sodium Chloride (NaCl) solution.

Conditioning of the NaCl calibration check solution and test procedure.

As Relative Humidity (RH) is defined as the ratio of the partial vapor pressure in air to the saturated vapor pressure at a given temperature, it is important to understand that RH strongly depends on temperature. Therefore, it is essential to keep humidity sensors at the same temperature as the air in which the relative humidity is to be measured. When testing RH probes in a calibration check-salt chamber, it is necessary for the internal temperature of the salt chamber to be the same as that of the surrounding air and also the RH probe sensor. This can be achieved by removing the cap and exposing the salt-check solution to ambient conditions. The temperature can be checked with the use of an infra red thermometer. When the probe and solution are showing equal temperature insert the probe into the solution.

The test can be ended when RH% readings do not drift by more than 1% RH over a 5 minute period within the acceptable +/- 2% tolerance of the nominal 75% relative humidity. A temperature difference of +/- 1°C (1.8°F) can cause an error of up to +/-3 to 5% at 50% RH and +/-6% at 97% RH readings. Please note any further handling of the salt chamber can cause a heating effect so handle the salt chamber as little as possible.

Due consideration must also be given to the test site, do not perform in direct sunlight or close to sources of heat eg. heaters or spotlights.

Temperature stability is extremely important for the duration of the test.

Calibration check salts do not have an expiry date and have unlimited usage when cared for in the correct manner.

Do check the seal inside chamber is exposing as much of the vent as possible and that there is a mix of salt and water and no caking of salt to side walls of chamber.

Humidity probes exposured to conditions outside normal range, especially high humidity may temporarily offset the RH reading. After return to normal ambient condition it will slowly return towards calibration state by itself. Prolonged exposure to extreme conditions may accelerate ageing.

For further information please refer to the latest calibration check salt instructions which are supplied separately.

LIMITATION

The MRH III will not detect or measure moisture through any electrically conductive materials inculding metal sheeting or cladding, many types of black EPDM rubber or wet surfaces. The MRH III is not suited for taking comperative readings in the concrete substrate through thick floor coverings such as wood.

CALIBRATION

For regular on-site assesment your MRH III in moisture measurement mode, calibration-checks are available from the suppliers of your MRH III. Should it be found that readings are outside the set tolerances, it is recommended that the MRH III be returned for recalibration. Calibration adjustments should not be carried out by anyone other than Tramex or their authorised service provider who will issue a calibration certificate on completion. Requirements for quality management and validation procedures, such as ISO 9001, have increased the need for regulation and verification of measuring and test instruments. It is therefore recommended that calibration of the MRH III 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.

WARRANTY

Tramex warrants that this instrument will be free from defects and faulty workmanship for a period of one year from date of first purchase. If a fault develops during the warranty period, Tramex will, at its absolute discretion, either repair the defective product without charge for the parts and labour, or will provide a replacement in exchange for the defective product returned to Tramex Ltd. This warranty shall not apply to anny defect, failure or damage caused by improper use or inadequate maintenance and care.

In no event shall Tramex, its agents or distributors be liable to the customer or any other person, company or organisation for any special, indirect, or conseqential loss or damage of any type whatsover (including without limitation, loss of business, revenue, profits, data, savings or goodwill), whether occasioned by the act, breach, omission, deafult, or negligence of Tramex Ltd., whether or not foreseeable, arising howsoever out of or in connection with the sale of this product including arising out of breach of contract, tort, misinterpretation or arising from statute or indemnity. Without prejudice to the above, all other warranties, representations and conditions whether made orally or implied by circumstances, custom, contract, equity, statue or common law are hereby excluded, including all terms implied by Section 13, 14 and 15 of the Sale of Goods Act 1893 and Sale of Goods and Supply of Services Act 1980.

Warranty claims

A defective product should be returned by shipping pre paid, with full description of defect to your supplier or to Tramex at address shown on the back of this guide.

PRODUCT DEVELOPMENT

It is the policy of Tramex 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.

SAFETY

This Users guide does not purport to address the safety concerns, if any, associated with this instrument or its use. It is the responsibility of the user of this instrument to establish appropriate safety and health practices and determine the applicability of regulatory limitation prior to use.