MOISTURE METER

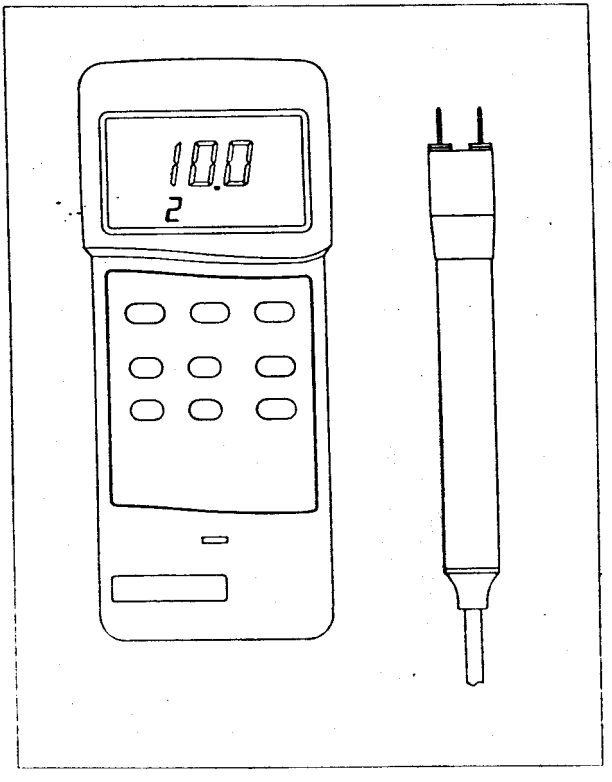


TABLE OF CONTENTS

1. FEATURES

* Measures moisture content over the range 9 % to 30 %.
* 9 material groups in memory, calibrations for about 150 different species of material (wood) are provided.
* Built-in self-calibration circuit.
* 0 to 50 °C manual temp. compensation setting.
* Microprocessor circuit assures maximum possible accuracy, provides special functions and features.
* Super large LCD with dual display.
* Heavy duty case designed for easy carrying and operation.
* Records Maximum & Minimum reading with recall.
* Data hold function for storing the current reading on display.
* Auto power shut off to save battery life.
* RS 232 PC serial interface.
* Built-in low battery indicator.
* Separate pin type moisture probe, easy operation & remote measurement.

2. SPECIFICATIONS

Applications	For surveying buildings for dampness and for the rapid determination of the moisture content of wood, chipboard.....
Principal	Uses 2 pins electrodes to measure the conductivity of the material, then converts the reading to % moisture Content.

4) Display will show the moisture contents in " % moisture content " directly.

* **If the sample under test has a high moisture content it may take a few minutes to obtain a stable reading.**
* For a moisture content (> 30%) the display will show " ---- ".

  For a moisture content (< 9%) the display will show " ---- ".

5–2 Measurement by reference method

For material not in the groups (1–9), the moisture meter may be used for reference by following the procedure below :

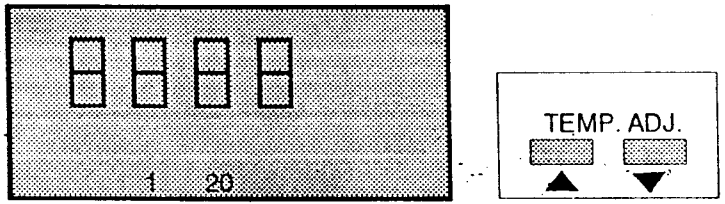
1) Turn unit on (Power Button).
2) Select the material group to " 1 ".
3) Insert the test pins into the materail under test.
4) The display will show the reference moisture content in %.

Consideration :

This value is only for reference. Although the measured data is for reference only, it can be used to estimated the dampness of tested sample. It is a useful tool for checking the reference moisture content of material types not included in table 1.

5–3 Temp. compensation adjusting

The Moisture Meter defaults to calibration for wood at 20 °C /68 °F. The meter reading can be corrected approximately by adding 0.5 % for every 5 °C below 20 °C. Or by subtracting 0.5 % for every 5 °C above 20 °C.
If the environment temperature is not 20 °C and a precise measurement is required, the following procedure should be followed.

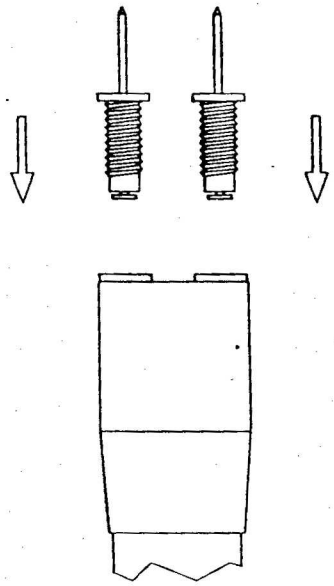


LCD Display

Press either TEMP ADJ Button to display 20 °C. The temperature can be increased or decreased in 1 °C steps by subsequent use the relevant TEMP ADJ Button.
When the required temperature value is reached the display will return to normal mode after 4 seconds non use.

5. MEASURING PROCEDURE

If the test pins (3−13, Fig. 1) are not installed to the probe head & packed separately, please refer the following diagram to fix the test pins into the probe.



5−1 Measurement by selecting the material group

1) Power the meter using the "Power On/Off Button " (3−4, Fig. 1).
Remove the " Protection Rubber " (3−14, Fig. 1) away from the " Test Pins " (3−13, Fig. 1)

2) Select the required material group via the " Material Select Button " (3−9, Fig. 1).
With reference to 4−1, table 1, select a material from group (1 − 9).

* For " Chipboard " select group 9.
* For general woods, please select the group " 1 " to " 9 ".
* For unknown materials, such as papers, paint etc please refer to the operation procedure 5−2.

For example :
If the wood is " LIME ", then select " 4 ".
If the material is " CHIPBOARD ", then select " 9 "

3) It is recommended that the test pins are inserted to a minimum depth of 2 mm into the material under test. If a depth of 2 mm can not be obtained, then insert the test pins to their maximum achievable depth.

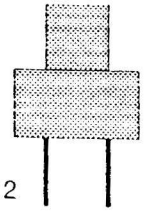


Fig. 2

Material Group 2

* Pine, Maritime
* Pine, New Zealand, White
* Pine, Parana
* Redwood, Californian
* Walnut, New Guinea

Material Group 3

* Ayan
* Bech, European
* Blackbutt
* Camphorwood, E. African
* Cedar, Western Red
* Chestnut
* Danta
* Greenheart
* Hemlock, Western
* Jarrah
* Jelutong
* Larch, European
* Larch, Japanese
* Loliondo
* Missanda
* Niangon
* Oak, Tasmanian
* Pine, American Long Leaf
* Pine, American Pitch
* Pine, Caribbean, Pitch
* Pine, Corsican
* Pine, Hoop
* Pine, Nicaraguan Pitch
* Pine, Ponderosa
* Pine, Sugar
* Queensland Walnut
* Sapele
* Seraya, Red
* Silky Oak, African
* Silky Oak, Australian
* Spruce, Norway (European)
* Spruce, Sitka
* Stringybar, Yellow
* Stringybark, Messmate
* Turpentine
* Walnut, European
* Walnut, Queensland
* Whitewood
* Yew

Material Group 4

* Abura
* Afzelia
* Binvang
* Birch, Yellow
* Bisselon
* Elm, English
* Elm, Rock
* Elm, White
* Kauri, New Zealand
* Lime
* Matai
* Oak, Turkey
* Odoko
* Pine, Kauri
* Pyinkado
* Totara

Material Group 5

* Baguacu, Brazilian
* Bitterwood
* Cordia, American light
* Erimado
* Hickory
* Iroko
* Keruing
* Larch, Western
* Padauk, African
* Pillarwood
* Sycamore
* Teak

Material Group 6

* Afrormosia
* Amboyna
* Basswood
* Coachwood
* Muninga
* Obeche
* Olivillo
* Persimmon
* Ramin
* Wawa

Material Group 7

* Gegu, nohor
* Guarea, white
* Opepe
* Santa Maria

Material Group 8

* Agba
* Birch, European
* Cedar, West Indian
* Cheery, European
* Fir, Noble
* Guarea, Black
* Kauri, Queensland
* Mahogany, African
* Muhuhi
* Musine
* Musizi
* Queensland Kauri
* Utile
* Walnut, African
* Wandoo

Material Group 9

* Chipboard

Material(Timber) / Group	
Queensland Kauri	8
Queensland Walnut	3
Ramin	6
Redwood, Baltic (European)	1
Redwood, Californian	2
Rosewood, Indian	1
Santa Maria	7
Sapele	3
Seraya, Red	3
Silky Oak, African	3
Silky Oak, Australian	3
Spruce, Norway (European)	3
Spruce, Sitka	3
Sterculia, Brown	1
Stringybar, Yellow	3
Stringybark, Messmate	3
Sycamore	5
Tallowwood	1
Teak	5
Totara	4
Turpentine	3
Utile	8
Walnut, African	8
Walnut, American	1
Walnut, European	3
Walnut, New Guinea	2
Walnut, Queensland	3
Wandoo	8
Wawa	6
Whitewood	3
Yew	3

table 1

4–2 Sorting by 9 kind material group (group 1 to 9), table 2

Material Group 1

* Afara
* Ash. European
* Ash. Japanese
* Balsa
* Bange Wanga
* Bosquiea
* Boxwood, Maracaibo
* Cahoma
* Cypress, E. African
* Fir, Grand
* Gum, American Red
* Gum, Spotted
* Gurjun
* Kapur
* Karri
* Kuroka
* Maple, Pacific
* Maple, Rock
* Maple, Sugar
* Myrtle, Tasmanian
* Oak, American Red
* Oak, American White
* Oak, European
* Oak, Japanese
* Padang
* Panga panga
* Pine, Lodgepole
* Pine, Radiata
* Pine, Scots
* Pine, Yellow
* Poplar, Black
* Pterygota, African
* Redwood, Baltic (European)
* Rosewood, Indian
* Sterculia, Brown
* Tallowwood
* Walnut, American

Material Group 2

* Ash. American
* Berlina
* Canarium, African
* Douglas Fir
* Fir, Douglas
* Gum, Saligna
* Gum, Southern
* Hyedunani
* Ironbank
* Mahogany, West Indian
* Makore
* Mansonia
* Maple, Queensland
* Meranti, Red (Light or Dark)
* Meranti, White
* Merbau
* Okwen
* Olive. E African
* Pine, Bunya
* Pine, Huon

4. TABLE OF 9 KIND MATERIAL (TIMBER) GROUPS

4–1 Sorting by alphabetic order (a–z)

Material(Timber) / Group	
Abura	4
Afara	1
Afrormosia	6
Afzelia	4
Agba	8
Amboyna	6
Ash. American	2
Ash. European	1
Ash. Japanese	1
Ayan	3
Baguacu, Brazilian	5
Balsa	1
Bange Wanga	1
Basswood	6
Bech, European	3
Berlina	2
Binvang	4
Birch, European	8
Birch, Yellow	4
Bisselon	4
Bitterwood	5
Blackbutt	3
Bosquiea	1
Boxwood, Maracaibo	1
Cahoma	1
Camphorwood, E. African	3
Canarium, African	2
Cedar, West Indian	8
Cedar, Western Red	3

Material(Timber) / Group	
Cheery, European	8
Chestnut	3
Chipboard	9
Coachwood	6
Cordia, American light	5
Cypress, E. African	1
Danta	3
Douglas Fir	2
Elm, English	4
Elm, Rock	4
Elm, White	4
Erimado	5
Fir, Douglas	2
Fir, Grand	1
Fir, Noble	8
Gegu, nohor	7
Greenheart	3
Guarea, Black	8
Guarea, white	7
Gum, American Red	1
Gum, Saligna	2
Gum, Southern	2
Gum, Spotted	1
Gurjun	1
Hemlock, Western	3
Hickory	5
Hyedunani	2
Iroko	5
Ironbank	2

table 1

Material(Timber) / Group	
Jarrah	3
Jelutong	3
Kapur	1
Karri	1
Kauri, New Zealand	4
Kauri, Queensland	8
Keruing	5
Kuroka	1
Larch, European	3
Larch, Japanese	3
Larch, Western	5
Lime	4
Loliondo	3
Mahogany, African	8
Mahogany, West Indian	2
Makore	2
Mansonia	2
Maple, Pacific	1
Maple, Queensland	2
Maple, Rock	1
Maple, Sugar	1
Matai	4
Meranti, Red (Light or Dark)	2
Meranti, White	2
Merbau	2
Missanda	3
Muhuhi	8
Muninga	6
Musine	8
Musizi	8
Myrtle, Tasmanian	1
Niangon	3
Oak, American Red	1
Oak, American White	1
Oak, European	1

Material(Timber) / Group	
Oak, Japanese	1
Oak, Tasmanian	3
Oak, Turkey	4
Obeche	6
Odoko	4
Okwen	2
Olive. E African	2
Olivillo	6
Opepe	7
Padang	1
Padauk, African	5
Panga panga	1
Persimmon	6
Pillarwood	5
Pine, American Long Leaf	3
Pine, American Pitch	3
Pine, Bunya	2
Pine, Caribbean, Pitch	3
Pine, Corsican	3
Pine, Hoop	3
Pine, Huon	2
Pine, Kauri	4
Pine, Lodgepole	1
Pine, Maritime	2
Pine, New Zealand, White	2
Pine, Nicaraguan Pitch	3
Pine, Parana	2
Pine, Ponderosa	3
Pine, Radiata	1
Pine, Scots	1
Pine, Sugar	3
Pine, Yellow	1
Poplar, Black	1
Pterygota, African	1
Pyinkado	4

table 1

Default Memory for the species	9 material groups in memory, calibrations for about 150 different species of materil (wood) are provided. ***Ref. 4–1, 4–2***
Circuit	Custom design microprocessor LSI circuit.
Display	13 mm (0.5") super large LCD display.
Measurement	9 % to 30 % moisture content,
Resolution	0.1 % moisture content.
Accuracy *(23 ± 5 °C)*	± (4 % + 5 d) * *Above fibre satuartion (25% to 30%) readings the approximate value, reference only.* * *Spec. tested under the environment RF Field Strength less than 3 V/M & frequency less than the 30 MHz only.*
Probe	2 pin moisture electrodes.
Temperature Compensation	Manual temperature compensation of the meter in the range of 0 to 50 °C.
Calibration	Built in self calibration circuit.
Data Hold	Facility available.
Memory Recall	Records Maximum & Minimum value.
Power off	Manual and Auto shut off available.
Sampling Time	Approx. 0.8 second.
Data Output	RS 232 PC serial interface.
Operating Temp.	0 to 50 °C.
Operating Humidity	Less than 90% R.H.
Power Supply	DC 9V battery, heavy duty type. 006P, MN1604(PP3) or equivalent.
Power Current	Approx. DC 5.8 mA.
Weight	330 g/0.73 LB

Dimension	Main instrument: 180 x 72 x 32 mm (7.1 x 2.8 x 1.3 inch). Moisture Probe: Round 23 mm Dia. x 165 mm. Round 0.9 inch Dia. x 6.5 inch.
Accessories Included	Instruction manual..... 1 PC. Moisture probe..... 1 PC. Extra contact pins..... 10 PCs. Hard Carrying Case..... 1 PC.

3. FRONT PANEL DESCRIPTION

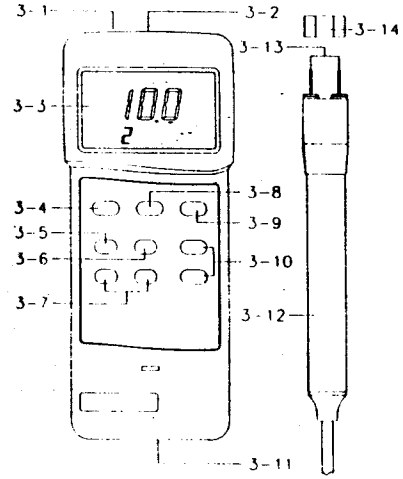


Fig. 1

3–1 RS232 output terminal
3–2 Probe Input Socket
3–3 Display
3–4 Power On/Off Button
3–5 Record Button
3–6 Recall Button
3–7 Temp. Compensation Adjust Button
3–8 Hold Button
3–9 Material Select Button
3–10 Calibration Button
3–11 Battery Compartment /Cover
3–12 Probe Handle
3–13 Test Pins
3–14 Protection Rubber

Consideration :

When the unit is turned off, the new temperature setting is lost and the unit will default again to 20 °C on power up.

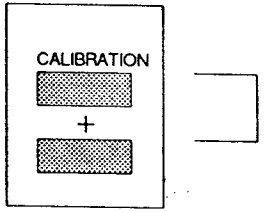
5–4 Other Functions

1) Data Hold
   * During measurement, pushing the " Hold Button " (3–8, Fig. 1) will hold the display values & the LCD will show the " D.H " symbol.
   * To cancel the Data Hold function, Press the Data Hold Button, once more.
2) Data Record(Max., Min. reading)
   * The DATA RECORD function displays the maximum and minimum readings. To start the DATA RECORD function, press the " Record Button " (3–5, Fig. 1) once. "REC" marker will appear on the LCD display.
   * With the " REC " symbol indicated on the display
     (a) Push the " RECALL Button " (3–6, Fig. 1) once, then the " Max " symbol with the maximum values recorded will appear on the LCD display.
     (b) Push the " RECALL Button " once again, the " Min " symbol with the minimum values recorded will appear on the LCD display.
     (c) To de–activate the Data Record function, Press the " Record Button " once again. All associated display units will disappear from the LCD.

6. CALIBRATION

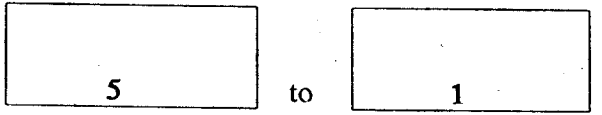
Remove the " Protection Rubber " (3–14, Fig.1) away from the " Test Pins " (3–13, Fig. 1).

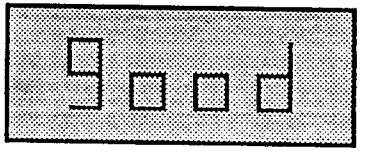
1) * Select the material groups to group " 1 " using the " Material Select Button " (3–9, Fig. 1).
   Push both Calibration Buttons simultaneously.



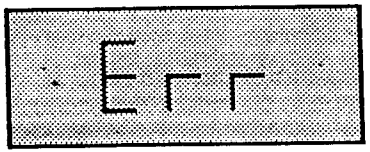
Push together at the same time

   * The display will count backwards from 5 to 1 after which the display will show " good "

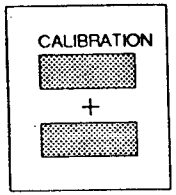




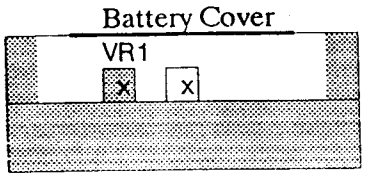
2) * If the display shows " Err " the meter will need to be re-calibrated using the following method.



3) Select the material group " 1 " using the " Material Select Button ".
Remove the battery cover using a small screwdriver or coin. Press and hold down the bottom Calibration Button. Using a screwdriver adjust VR1 until the display value reads 18.0. Release the button, calibration is now complete.



Only push the down button continuously.



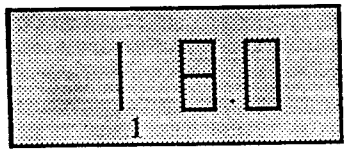


Fig. 3

7. MAINTENANCE

7-1 Replacement of Battery

A low battery is indicated by " LBT " in the left corner of the display. To replace the battery remove the battery cover with a small screwdriver or coin and replace with a DC 9 V battery (heavy duty type, 006P, MN1604/PP3 or equivalent).

7-2 Replacement of test pins

To replace test pins on the probe, first loosen the lock nut at the base of the pin, slide pin out and replace with new.

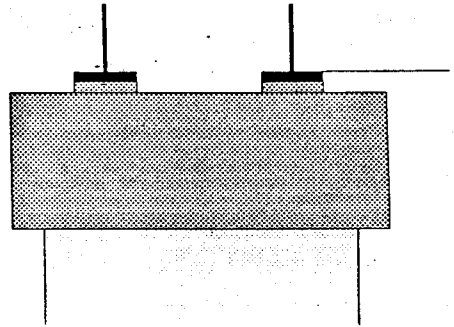


Fig. 4

8. RS232-PC INTERFACE

The instrument features an RS232 output via 3.5 mm. Terminal (3−1, Fig. 1).
The connector output is a 16 digit data stream which can be utilized to the user's specific application.

An RS232 lead with the following connection will be required to link the instrument with the PC serial input.

Meter (3.5 mm jack plug)	PC (9W 'D' Connector)
Center Pin	Pin 2
Ground/shield	Pin 5

The 16 digit data stream will be displayed in the following format :

D15 D14 D13 D12 D11 D10 D9 D8 D7 D6 D5 D4 D3 D2 D1 D0

Each digit indicates the following status :

D0	End Word
D1 to D4	Upper Display reading, D1=LSD, D4=MSD
D5 to D8	Lower Display reading, D5=LSD, D8=MSD
D9	Decimal Point(DP) for Upper display. 0 = No DP, 1= 1 DP, 2 = 2 DP, 3 = 3 DP
D10	Decimal Point (DP) for lower display 0 = No DP, 1= 1 DP, 2 = 2 DP, 3 = 3 DP

D11 & D12	Anunuciator for Upper Display		
	00 =No Symbol	07 = mg/L	14 =mS
	01 =° C	08 = m/s	15 =Lux
	02 =° F	09 = Knots	16 =Ft−cd
	03 = %	10 = Km/h	17 =dB
	04 = % RH	11 = Ft/min	18 =mV
	05 = % PH	12 = mile/h	
	06 = % O 2	13 = uS	
D13	Anunuciator for Lower Display		
	0 =No Symbol	1 =° C	2 = ° F
D14	Reading Polarity for the Display 0 = Both upper & lower display value are "+". 1 = Upper "−", Lower "+". 2 = Upper "+", Lower "−". 3 = Both upper & lower display value are "−".		
D15	Start Word		