



# COMBO MOISTURE METER

## USER'S MANUAL



## MM9

*Please read these instructions carefully and thoroughly before using the product.*

### INTRODUCTION

Thank you for purchasing General Tools & Instruments' MM9 Combo Moisture Meter. Please read this user's manual carefully and thoroughly before using the instrument.

The MM9 is designed for use in woodworking, water damage restoration, building construction and home renovation.

Examples include:

- Checking for moisture and mold on or below the surface of carpets and subflooring
- Measuring the moisture content of wood, drywall or cement board before painting, wallpapering, sealing or treating
- Locating water leaks above ceilings, below floors or behind walls
- Selecting dry lumber

**The MM9 can be operated in either of two modes. One is pinless (non-invasive).** In this mode, the meter can detect moisture up to 3/8 in. below the surface of drywall, 1/4 in. below the surface of cement board, and 3/4 in. below the surface of wood without marring the material with pinholes. It infers the level of moisture from the material's capacitance, which the meter measures by gauging its effect on an electric field that the meter generates each time it is powered on.

The meter exploits two physical phenomena to make its pinless measurements:

1. The linear relationship between a solid material's moisture level and its dielectric constant—and therefore its capacitance.
2. The so-called fringing-field effect—the slight spreading of the electric field produced by current flowing between two electrodes when both electrodes are on the same side of a material.

Behind the top of the MM9 are two metal plates. When the meter is powered on, the plates are given small and opposite charges. The potential difference causes current to flow, creating a three-dimensional electric field.

When the top of the meter is placed against one side of a material with moisture on or slightly below its surface, the increased capacitance of the material distorts the electric field to an extent that can be sensed (as a change in flux over the sensing area) and measured.

The MM9 has been calibrated at the factory for use with drywall, cement board, softwood and hardwood. The capacitance of wood and the capacitance of building materials are affected differently by moisture because they have different densities. The meter compensates for density by adjusting the gain of its internal sensing circuitry.

The **MODE** button on the front of the meter provides a convenient way to switch among the four materials. The name of the material selected appears on the LCD, which displays the abbreviation REL, shorthand for RELative moisture measurement mode. Below the LCD is a bank of colored LEDs that roughly mirrors the digital reading above it in bar graph format, with green indicating “relatively dry” (with a moisture level below 30%), red indicating “relatively wet”, with a moisture level above 70%, and yellow indicating a level between those two values. An audible out-of-range alarm (beeper) sounds whenever wood is tested and found to have a moisture content above 16%, and when drywall or cement board is found to be more than 70% wet.

Although relative moisture readings have no specific value or accuracy, they are nonetheless useful for quickly comparing the moisture levels of materials, or the wetness of different areas of the same material. For example, you can use the meter to locate the source of a water leak above a ceiling by comparing readings at various points on it. If the ceiling is level, the point that produces the highest reading is below the source of the leak.

Any relative reading can be held by pressing the **HOLD** button on the front of the meter. This button makes it possible to make a measurement in a dark place and display it after bringing the meter into a lighted area.

**The MM9 can also be operated in pin mode.** In this mode, the meter bases its measurements on the relationship between the moisture content of a material and its electrical conductivity. The wetter a material, the higher its conductivity.

The two replaceable steel pins at the top of the MM9 serve as the electrodes of a conductance meter optimized for measuring moisture content. In pin mode, the meter displays measurements in the unit %WME (Wood Moisture Equivalent).

For hard materials like wood, the meter’s readings largely reflect surface moisture content because: 1) Moisture close to a surface has a greater effect on a reading than moisture deep below it; and 2) The pins of the MM9 are only 0.35 in. (9mm) long and therefore cannot be driven deep into a hard material. For softer materials like soil, paper or powders, readings are more likely to reflect the average moisture level of the material between its surface and the penetration depth of the pins (normally far less than 0.35 in.).

In pin measurement mode, the color of illuminated bar graph LEDs indicates the same relative moisture level as in pinless mode: below 30% for green LEDs, above 70% for red LEDs, and an intermediate level for yellow LEDs.

To extend battery life in both operating modes, the MM9 automatically 1) dims the brightness of its backlit LCD by one-half after 15 seconds and 2) powers itself off after 1 minute of inactivity.

The instrument is powered by a “9V” battery (included on the back of the blister card).

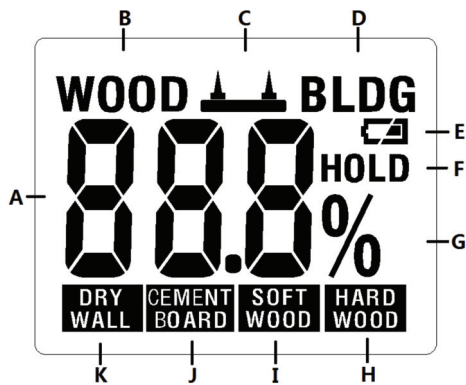
## PRODUCT OVERVIEW

Fig. 1 shows all of the controls, indicators and physical features of the MM9. Fig. 2 shows all possible display indications. Familiarize yourself with the position and function of all components before moving on to the Setup Instructions and Operating Instructions.

**Fig. 1. The controls, indicators and physical features of the MM9**



- A. Hinged, spring-loaded protective pin cover and pinless sensor
- B. High-contrast, white-on-black LCD (see Fig. 2)
- C. LED bar graph; mirrors reading on LCD.
- D. **MODE** button. **In pinless mode**, brief presses cycle through four target options: drywall, cement board, softwood and hardwood. **In pin mode**, a brief press selects WME% moisture measurement of wood or building material. **Pressed and held for at least two seconds**, re-calibrates pinless mode operation.
- E. **Power** button. **Pressed briefly**, powers the meter on. **Pressed and held** for at least 2 seconds, powers the meter off.
- F. **HOLD** button. “Freezes” and releases readout. Also used to silence out-of-range alarms.
- G. Pin cover latch. Press to open cover, provide access to measurement pins, and begin operating in pin mode. Closing the cover automatically initiates operation in pinless measurement mode.
- H. Measurement pins
- I. Pin mode **CAL** (calibration) check button
- J. Pinless sensor contacts
- K. Pin cover spring-loaded hinge
- L. Pinless sensor contacts
- M. Pinless sensing area
- N. Battery compartment



**Fig 2. All possible display indications**

- A. Moisture level readout (a 3-digit value in pin mode, REL in pinless mode)
- B. Indicates operation in pin mode with a wood target
- C. Indicates operation in pin mode
- D. Indicates operation in pin mode with a building material target
- E. Low battery charge indication; replace the “9V” battery when it appears
- F. Indicates a held measurement
- G. Moisture measurement unit (%WME in pin mode; not applicable in pinless mode)
- H. Indicates operation in pinless mode with a hardwood target
- I. Indicates operation in pinless mode with a softwood target
- J. Indicates operation in pinless mode with a cement board target
- K. Indicates operation in pinless mode with a drywall target

## SETUP INSTRUCTIONS

### INSTALL BATTERY

Open the battery compartment at the bottom of the meter (Fig. 1, Callout N) by placing a fingernail in the slot on the right side of the housing where it meets the compartment door. Push the tab on the door gently to the left until it pops open. Slide the included “9V” battery into the compartment “terminals-first”, with the anode (+ terminal) on the right. Swing the door back toward its closed position until it snaps shut.

## OPERATING INSTRUCTIONS

**To power on the meter**, press and hold the **⏻** button (Fig. 1, Callout E) for at least three seconds. (To power off the meter, follow the same instruction.)

### MAKING RELATIVE MOISTURE MEASUREMENTS

**To measure the relative moisture level of drywall, cement board, hardwood or softwood, DO NOT PRESS THE PIN COVER LATCH** to swing open the top of the meter. Instead, just press the **MODE** button until the name of the target material appears on the LCD. Then scan the material by gently pressing the pinless sensing area (Fig. 1, Callout M) on the top of the meter against the material. Make sure no part of your hand or fingers is touching, or near, the sensing area. LCD will display the abbreviation **REL** (for RELative measurement), and, one or more bar graph LEDs below the LCD will illuminate to place the material’s moisture level within a spectrum bounded by “DRY”

and “WET”. The meter will also “beep” at either of two speeds to reflect the moisture level: slow for an intermediate level (with one or more yellow LEDs illuminated), and fast for a high level (with one or more red LEDs lit).

### MAKING PINLESS (RELATIVE) MEASUREMENTS

**To hold a relative reading**, briefly press the **HOLD** button within one minute of making the measurement. The display will add the word **HOLD** to the **REL** indication, and the bar graph LEDs will “freeze” in their current state (illuminated or not). If the reading is above the alarm limit for that material, the out-of-limit alarm will sound. Press and hold the **HOLD** button to silence it.

### MAKING PIN (ABSOLUTE) MEASUREMENTS

**To measure the absolute moisture measurement of wood or a building material**, power on the meter and press the pin cover latch (Fig. 1, Callout G). The pin cover will swing open to expose the two test pins, and the LCD will display the word **WOOD** (Fig. 2, Callout B) and the pin-mode icon (Callout C) at its right. Remove the black rubber insulating sleeves from the pins.

**To measure wood**, carefully press the test pins into the sample. Its absolute moisture level will be displayed as a percentage, with the unit %WME (Fig. 2, Callouts A and G). Simultaneously, the bar graph LEDs will illuminate to mirror the digital reading.

To measure a building material, press the **MODE** button to change the indication on the top line of the LCD from **WOOD** to **BLDG** (Fig. 2, Callout D). As with wood, carefully press the test pins into the sample. Its absolute moisture level will be displayed as a percentage, with the unit %WME. Again, one or more bar graph LEDs will illuminate to mirror the digital reading.

In wood measurement mode, the available moisture level range is 5% to 50%. When the level is below 5%, the LCD will show         . When it is above 50%, the LCD will show         .

In building material measurement mode, the available moisture level range is 1.5% to 33%. When the level is below 1.5%, the LCD will show         . When it is above 33%, the LCD will show         .

**To hold a digital reading**, briefly press the **HOLD** button within one minute of making the measurement. The LCD will add the word **HOLD** to the digital reading, and the bar graph LEDs will “freeze” in their current state (illuminated or not).

## MEASUREMENT TIPS

For best results in pinless (relative) mode, press the pinless sensing area against a flat area of a representative sample of the target material. The sample’s length and width should be at least as large as the dimensions of the sensing area: 1.5 x 1.5 in. (38 x 38mm).

Ideally, the material should also be at least 3/8 in. thick. That is the meter’s maximum measurement depth and the thickness it is calibrated for. If your sample is too thin, the meter will measure material beneath it as well and produce an inaccurate reading. Try compensating for thin samples by stacking them.

Measurements of wood are skewed by two variables: ambient humidity and the density of the wood species. The best way to compensate for the effect of these variables is to develop your own moisture level curves, based on your experience working with different species of wood on a day-to-day basis.

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## CALIBRATING THE METER

Although the MM9 auto-calibrates each time it is powered on, you can manually check its calibration in pin-mode operation, as well as re-calibrate its operation in pinless mode. Perform a re-calibration or calibration check whenever the meter cannot produce a reading, or if multiple measurements of the same sample produce very different readings.

### To manually check calibration in pin-mode operation:

1. Power the meter on, open the protective pin cover, and hold the meter in one hand with the top in the air. Make sure your fingers are not touching or near the sensing area.
2. Using the end of a paper clip as a tool, press the **CAL** button below the test pins (Fig. 1, Callout I). The LCD should show a value between 17.3% and 19.3%. If the reading is outside this range, the MM9 has an accuracy problem in pin mode. Contact General's Customer Service to arrange for a repair or replacement.

### To manually re-calibrate pinless mode operation:

1. Power the meter on and hold it in one hand with the top in the air. Make sure your fingers are not touching or near the sensing area.
2. Press and hold the **MODE** button until the display reads **101**. Then release the button; this will change the reading to **102**. Wait a few seconds. When the reading changes to **000**, re-calibration is complete.

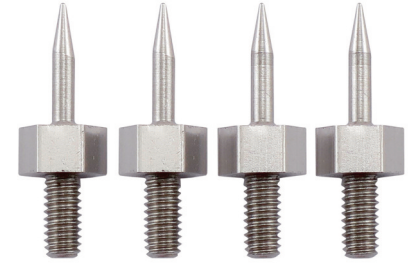
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## SPECIFICATIONS

Pin Mode Measurement Ranges	5 to 50% for wood 1.5 to 33% for building materials
Pin Mode Measurement Accuracy	±2% for wood and building materials
Pin Mode Calibration Check Range:	17.3% to 19.3%
Pinless Mode Maximum Sensing Depths	3/4 in. (20mm) in wood; 3/8 in. (9.5mm) in drywall; 1/4 in. (6.5mm) in cement board
Dimensions of Pinless Sensor	1.5 x 1.5 in. (38 x 38mm)
Out-of-Range Alarm Levels	>16% for wood >70% for drywall and cement board
LCD Size	2 in. (51mm) diagonal with three 0.5 in. (13mm) high digits
Measurement Resolution	0.1% in pin mode
Bar Graph Composition	3 each green, yellow and red LEDs
LED Bands	For all materials: green = 0 to 30%, yellow = 31 to 70%, red = >70%
Auto Power Off Trigger	1 minute of inactivity
Operating Temperature	32° to 104°F (0° to 40°C)
Storage Temperature	14° to 122°F (-10° to 50°C)
Dimensions	6.7 x 2.8 x 2.9 in. (178 x 70 x 74mm)
Weight	5.6 oz. (160g) without battery
Power Source	(1) "9V" battery (included)

## Replacement Test Pins Available

The MM9's stainless steel pins are replaceable. General's Item #PIN3 contains two pairs of compatible pins, each 0.3 in. (8mm) long.



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## WARRANTY INFORMATION

In the U.S., General warrants its instruments and accessories, and digital tools against defects in material or workmanship for one year from the date of purchase unless otherwise stated on the packaging, manual, and/or marketing materials. General also warrants its non-digital tools products against defects in material or workmanship on a limited lifetime term. The company will replace or repair the defective unit, at its option, subject to verification of the defect.

This warranty does not apply to defects resulting from abuse, neglect, accident, unauthorized repair, alteration, or unreasonable use of the product.

Any implied warranties arising from the sale of a General product, including but not limited to implied warranties of merchantability and fitness for a particular purpose, are limited to the above. General shall not be liable for loss of use of the product or other incidental or consequential damages, expenses, or economic loss, or for any claim of such damage, expenses, or economic loss.

State laws vary. The above limitations or exclusions may not apply to you.

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## RETURN FOR REPAIR POLICY

Every effort has been made to provide you with a reliable product of superior quality. However, in the event your instrument requires repair, please contact our Customer Service to obtain an RGA (Return Goods Authorization) number before forwarding the unit via prepaid freight to the attention of our Service Center at this address:

General Tools & Instruments  
75 Seaview Drive  
Secaucus, NJ 07094  
212-431-6100

Remember to include a copy of your proof of purchase, your return address, and your phone number and/or e-mail address.