

Moisture-Meter Survey

These compact tools can help prevent the most common woodworking problems

BY LON SCHLEINING

As wood scientist R. Bruce Hoadley says, 90% of woodworking problems involve moisture. I couldn't agree more. The most common problems caused by moisture are finishes that don't stick, joinery that breaks apart and boards that take on new and unwanted shapes after milling.

The solution to all of these problems is simple: Use wood that has been properly dried to the right moisture content (see the story below). The easiest way to see that your wood is dry enough is to use a moisture meter. Using a moisture meter, I can be sure that wood I'm about to use is at its

How dry is dry?

Wood is made of microscopic tubes and cells resembling a bundle of straws. Within these straws you find sap, called free water, which evaporates from a freshly cut tree. But the actual straws are made of cells that also contain fluid, called bound water. A certain amount of bound water will remain in the wood even as it dries.

The moisture content of wood is measured as a ratio of the weight of water in the wood to the weight of the wood when it is

completely dry. This ratio is expressed as a percentage. A piece of wood that goes from 14% to 8% moisture content shrinks, and if it goes back to 14%, it expands. If temperature and humidity vary, the moisture content of wood in that environment will also vary. If you don't account for moisture content, your furniture will certainly fail—panels bust out of their frames and case pieces crack apart.

With few exceptions, you can't simply cut down a tree and start building furniture. A



optimum moisture content: between 8% and 12%.

A moisture meter can really help you when you're working on a project and need additional lumber to complete the job. How can you be sure the new stock has the same moisture content as the stuff that you have been working on for the last several weeks? And if you dry your own lumber, it goes without saying that a moisture meter will let you know when your stock is ready to be worked.

There are many moisture meters on the market, with features and prices to accommodate a wide range of woodworkers. I

recently looked at a dozen priced from \$60 to \$350. I was happily surprised to find that their overall accuracy is quite good. So the choice comes down to which features you are willing to pay for and which ones you can do without.

Moisture meters come in two basic styles

There are two styles of moisture meters: pin and pinless. A pin-style moisture meter has two pins that are pushed into the wood. An electrical charge emits from one pin to the other, using the wood as the conductor. The meter measures electrical

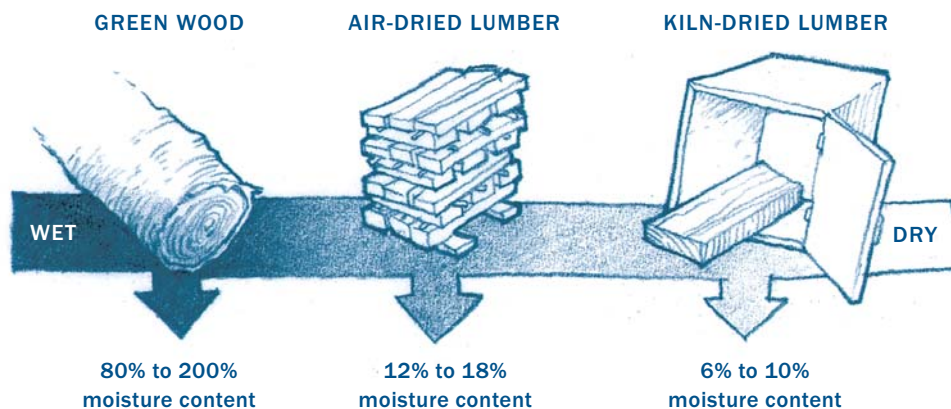
resistance within the board and gives a moisture reading. As wood dries, the conductivity changes (decreases).

Instead of an electrical charge, a pinless meter uses radio waves to penetrate the wood. The radio waves create an electromagnetic field. As the waves bounce back from the wood, the meter measures the reaction of the waves to the moisture in the wood. The meter translates this behavior into a percentage of moisture content.

Where a pin-style meter takes a reading at a specific spot, a pinless meter takes a reading that's the size of the sensing pad (usually about 1 in. by 2 in.). All styles of

freshly cut tree has a moisture content of 80% to 200%. When it air-dries, it will be left with a moisture content of about 12% to 18%. If wood is kiln-dried, the wood will reach a moisture content of 6% to 10%.

Monitoring moisture content tells a woodworker when stock is ready to be worked. An ideal moisture content will vary depending upon where you live, but a rule of thumb is 8% to 12%.



LARGE-PIN METERS

Some pin-style meters offer an optional hammer probe, which is used to get a reading in thicker wood, such as 8/4 stock. If you dry your own lumber, a hammer probe will be a worthwhile accessory.

DELMHORST J-LITE

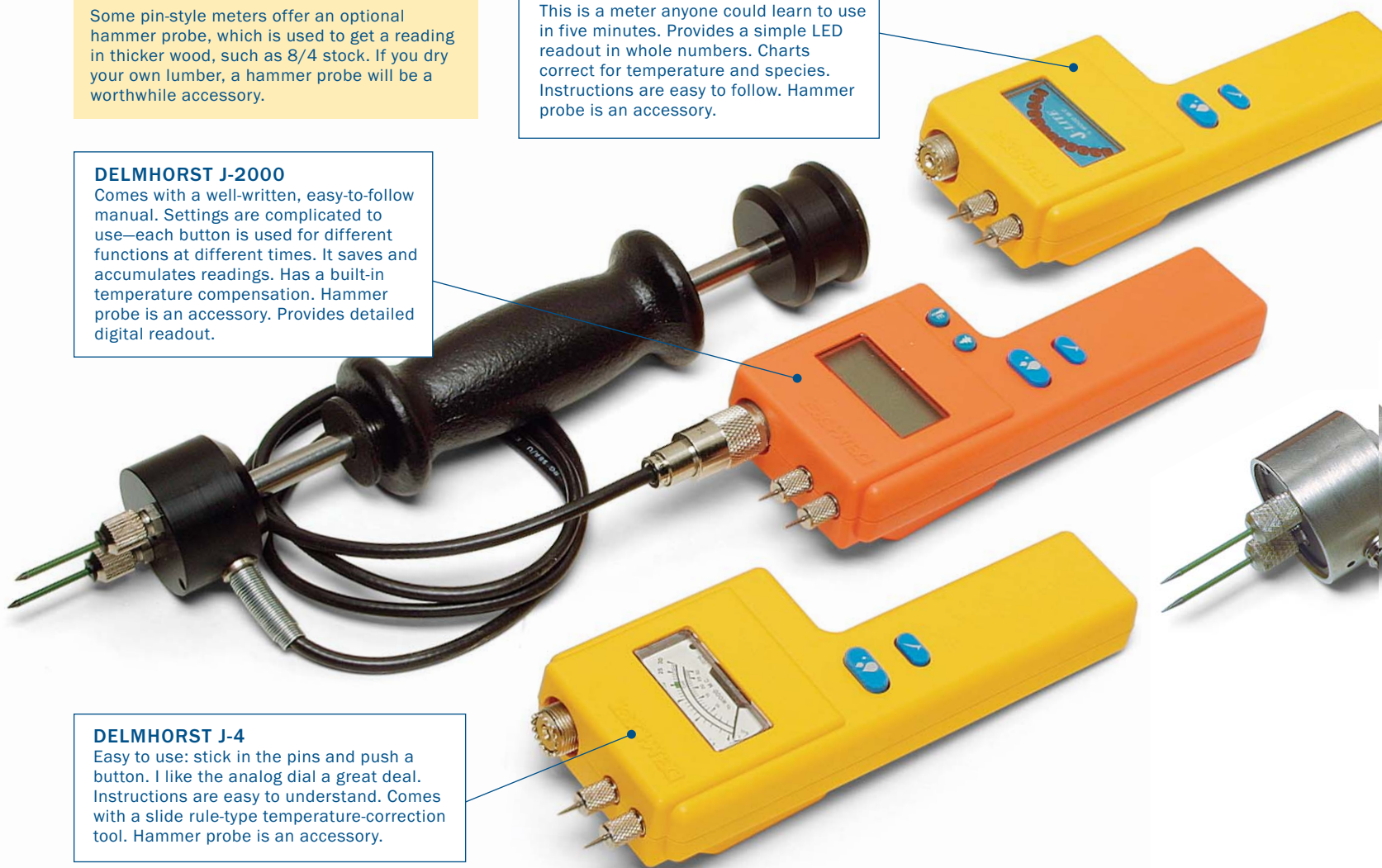
This is a meter anyone could learn to use in five minutes. Provides a simple LED readout in whole numbers. Charts correct for temperature and species. Instructions are easy to follow. Hammer probe is an accessory.

DELMHORST J-2000

Comes with a well-written, easy-to-follow manual. Settings are complicated to use—each button is used for different functions at different times. It saves and accumulates readings. Has a built-in temperature compensation. Hammer probe is an accessory. Provides detailed digital readout.

DELMHORST J-4

Easy to use: stick in the pins and push a button. I like the analog dial a great deal. Instructions are easy to understand. Comes with a slide rule-type temperature-correction tool. Hammer probe is an accessory.



| MANUFACTURER/ MODEL | CONTACT | PRICE | SPECIES CORRECTION | WARRANTY |
|--------------------------|-------------------------------------|---------------------------|-----------------------|-------------|
| DELMHORST J-LITE | (800) 746-7342 www.delmhorst.com | \$125 \$200 with probe | Chart | Three years |
| DELMHORST J-4 | | \$175 \$250 with probe | Chart | One year |
| DELMHORST J-2000 | | \$290 \$365 with probe | Chart/internal | One year |
| LIGNOMAT MINI LIGNO C | (800) 227-2105 www.lignomat.com | \$105 \$175 with probe | Chart/internal | One year |
| LIGNOMAT MINI LIGNO DX/C | | \$230 \$300 with probe | Chart/internal | Three years |

LIGNOMAT MINI LIGNO DX/C

The meter has a lot of settings, but it's very easy to use. Hammer probe, which is an accessory, is just heavy enough to use easily to penetrate even the hardest woods. Offers internal calibration with easy-to-change settings. Both temperature and species correction are done internally, so there's no need for conversion charts. Comes with a simple instruction pamphlet.



LIGNOMAT MINI LIGNO C

Easy to use. Provides a simple LED readout in whole numbers. Automatically turns on when the pins touch the wood. Turns off automatically. Comes with a plastic case. Has a simple two-position switch for species correction. Standard pins are $\frac{1}{8}$ in. long, but the meter can be connected to an optional hammer probe.



Accounting for lumber species

Woods vary in density, which can affect the reading you get on a moisture meter.

Though a meter can't tell one species from another, it can correct a reading to account for this variation using a chart or a chart plus an internal setting.

It's easy to use a meter that has only a chart. Take a reading and then look in the chart to find the species you're testing. The chart gives you a number to correct your reading by. Say you're testing pine, and the meter reading is 12%. If the chart says the correction for pine is to add 1%, the actual moisture content is 13%.

When using a meter that has a chart plus internal species correction, first find in the chart the species you're testing. Then reset the meter for that species, and the meter will provide an internally adjusted, accurate reading.

Some manufacturers provide extensive correction charts, covering lots of wood species, while others include only common ones. If a board you're testing is not in your chart (and many exotics aren't), call the manufacturer or check its web site for the correction. Usually,

though, you can look up a wood species that has the same, or similar, density and use it as a substitute.

meters detect the moisture content effectively; they just go about it differently.

Pin-style meters—Depending on the model, the pins can penetrate anywhere from $\frac{1}{8}$ in. to more than 1 in. deep. Some pin-style meters come with a hammer-probe attachment that allows you to pound larger pins into the wood, providing a deeper measurement of the interior of a plank. All of the instruction manuals for the meters I looked at suggested that the pins always be parallel to the grain—that is, the pins should be in line with the grain.

Pinless meters—The main advantage of pinless meters is that they leave no marks in the wood. The pinless meters I tested performed well and were easy to use. When testing lumber, the surface should be smooth enough to allow for good con-

tact, so a pinless meter wouldn't be my first choice for testing rough lumber. A good rule of thumb is that the board be smooth enough to run your finger over it without getting a splinter. Also, if you're checking a board at the lumberyard, these meters require you to remove the board from the pile; otherwise the meter might measure the next plank down along with the one on top. And very small pieces often are difficult for a pinless meter to read accurately. The meters I tested have a maximum scan depth of about $\frac{3}{8}$ in. (You can get models that scan deeper, but they are more expensive.)

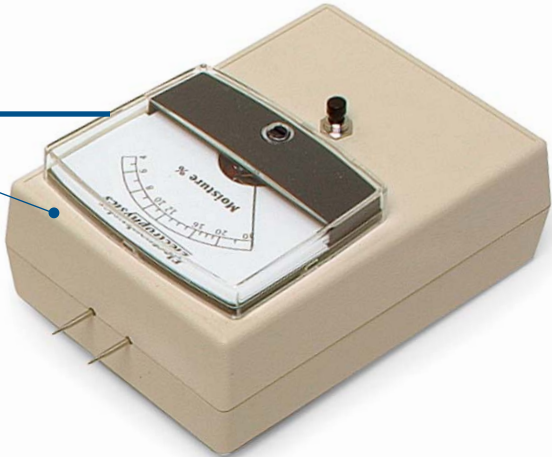
Pick a meter based on your needs

The meters I looked at varied, the smallest being little more than the size of a deck of cards, and the largest the size of a small

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| ALDER | 19.85 | -1.0 |
| ALDER | 19.90 | -1.0 |
| ALDER | 19.95 | -1.0 |
| ALDER | 20.00 | -1.0 |
| ALDER | 20.05 | -1.0 |
| ALDER | 20.10 | -1.0 |
| ALDER | 20.15 | -1.0 |
| ALDER | 20.20 | -1.0 |
| ALDER | 20.25 | -1.0 |
| ALDER | 20.30 | -1.0 |
| ALDER | 20.35 | -1.0 |
| ALDER | 20.40 | -1.0 |
| ALDER | 20.45 | -1.0 |
| ALDER | 20.50 | -1.0 |
| ALDER | 20.55 | -1.0 |
| ALDER | 20.60 | -1.0 |
| ALDER | 20.65 | -1.0 |
| ALDER | 20.70 | -1.0 |
| ALDER | 20.75 | -1.0 |
| ALDER | 20.80 | -1.0 |
| ALDER | 20.85 | -1.0 |
| ALDER | 20.90 | -1.0 |
| ALDER | 20.95 | -1.0 |
| ALDER | 21.00 | -1.0 |
| ALDER | 21.05 | -1.0 |
| ALDER | 21.10 | -1.0 |
| ALDER | 21.15 | -1.0 |
| ALDER | 21.20 | -1.0 |
| ALDER | 21.25 | -1.0 |
| ALDER | 21.30 | -1.0 |
| ALDER | 21.35 | -1.0 |
| ALDER | 21.40 | -1.0 |
| ALDER | 21.45 | -1.0 |
| ALDER | 21.50 | -1.0 |
| ALDER | 21.55 | -1.0 |
| ALDER | 21.60 | -1.0 |
| ALDER | 21.65 | -1.0 |
| ALDER | 21.70 | -1.0 |
| ALDER | 21.75 | -1.0 |
| ALDER | 21.80 | -1.0 |
| ALDER | 21.85 | -1.0 |
| ALDER | 21.90 | -1.0 |
| ALDER | 21.95 | -1.0 |
| | | |

SMALL-PIN METERS

ELECTROPHYSICS MT 270
Analog dial is easy to read. Extra pins also are loose (they were simply taped to an instruction sheet). This is the only pin-type meter I looked at that lacks a guard.



PROTIMETER DIGITAL-MINI
A functional meter with very accurate calibration. Sturdy construction. Offers digital readout. Comes with a good case and a belt loop. The species correction is detailed, with many options. There are, for example, six options for oak.



PROTIMETER BLD-5700 TIMBERMASTER
Has a long and slender shape that fits easily into a pocket. Comes with a calibration device and remote sensor. Provides detailed digital readout. The only meter reviewed that comes with a remote temperature-sensing probe that automatically corrects for temperature.



TIMBER CHECK
This meter is very easy to use. It is a sturdy, functional meter and compact in size. Does not automatically shut off like some of the other meters and does not allow for calibration. Has a tight-fitting plastic cover for the pins.



radio plus the hammer probe and case. I compared the readings that each of these meters gave on four different boards. One had been oven-dried; the second had been kiln-dried to what turned out to be about 6% moisture content; the third had been partially air-dried and measured about 10%; and the fourth was very wet at about 30%. It's worth noting that the very dry and very wet boards exceeded the normally effective range of most of the meters (6% to 30%). I found that the readings did not vary by more than one or two percentage points. That's good enough for me to claim that all of the meters are reliable. What distinguishes some of these moisture meters from others are the accessories, the detail of the readings, their ease of use, including portability and how fragile or robust they would be under actual working conditions.

No matter what moisture meter you use, you're going to have to make adjustments based on the species you're testing (see p. 81). All of the meters I tested required a

| MANUFACTURER/ MODEL | CONTACT | PRICE | SPECIES CORRECTION | WARRANTY |
|-------------------------------------|--------------------------------------------|-------|-----------------------|-------------|
| ELECTROPHYSICS MT 270 | (800) 244-9908 www.electrophysics.on.ca | \$110 | Chart | Two years |
| PROTIMETER DIGITAL-MINI | (800) 321-4878 www.moisture-meter.com | \$250 | Chart | One year |
| PROTIMETER BLD-5700 TIMBERMASTER | | \$348 | Chart/internal | One year |
| TIMBER CHECK | (613) 256-5437 | \$60 | Chart | Three years |

PINLESS METERS

chart—for some it is to look up the corrected reading and for others it is to determine the code needed to set the moisture meter to a specific species. I like the meters that make species correction easy. The Wagner meters offer an erasable pad on the front that allows you to write the codes for the often tested species. I was also impressed at the extensive listing that some of these models had for species. For example, the Protimeter Digital-Mini had more than six species of oak to choose from.

I really like the look and feel of the Protimeter BLD-5700 Timbermaster, but it's really more meter than I need—even though I enjoyed using the temperature-sensing probe. If I ran a kiln, had an engineering background or routinely air-dried my own lumber, I would choose a meter with a hammer-probe attachment (see pp. 80-81), which allows the meter to take deeper readings, and with lots of features such as internal species correction. The Delmhorsts were certainly easy to use and had the most understandable manuals, but the meters were a bit on the bulky side to carry around.

If I were heading to the lumberyard today to purchase a load of vertical-grain Douglas fir, I'd probably take the Wagner MMC 210, which clips to a belt so it's handy. With it I can quickly and discreetly scan a stack of lumber without leaving pin holes in the boards. □

Lon Schleining is a contributing editor.



ELECTROPHYSICS CT 100

For species correction, this one has a reference chart that provides a number to set the meter to so you can get an accurate reading. The optional calibration plates are fragile and require careful handling, but they were packed in a sandwich bag. The meter could use even a simple case.

WAGNER MMC 205

This meter has nearly all of the features found on the MMC 210, except for a separate button for inputting the species code. It's accurate, easy to use, compact and ruggedly built.

WAGNER MMC 210

Has a very compact, functional design. Note pad on the front keeps track of the species correction for your most frequently tested types of wood. Comes with a case and a belt clip. The manual fits neatly within the storage case.

| MANUFACTURER/ MODEL | CONTACT | PRICE | SPECIES CORRECTION | WARRANTY |
|------------------------|--------------------------------------------|-------|-----------------------|-----------|
| ELECTROPHYSICS CT 100 | (800) 244-9908 www.electrophysics.on.ca | \$198 | Chart/internal | Two years |
| WAGNER MMC 205 | (800) 634-9961 www.moisturemeters.com | \$195 | Chart/internal | One year |
| WAGNER MMC 210 | | \$285 | Chart/internal | One year |