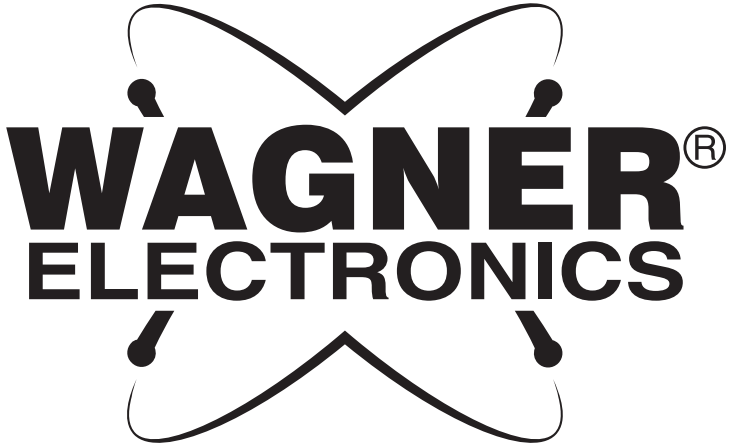

WAGNER MODEL L610

"DIGITAL RECORDING"

MOISTURE METER

OWNER'S MANUAL

DOCUMENT NO: 500-61001-001
REV: C

Copyright Notice

Wagner Model L610 “Digital Recording” Moisture Meter Owner’s Manual

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Technical Support

Should you require support, please consult your printed documentation to resolve your problem. If you are still experiencing difficulty, you may contact a Wagner Technical Service representative during normal business hours—7:30 a.m. to 4:00 p.m. Pacific Standard Time, Monday through Friday.

Voice: (541) 582-0541
Fax: (541) 582-4138
E-Mail: support@wwwagner.com
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Wagner Electronic Products, Inc.
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Rogue River, OR 97537

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FCC Compliance Statement

This equipment has been tested and found to comply within the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in residential installations.

This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause interference to radio or television equipment reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Move the equipment away from the receiver
- Plug the equipment into an outlet on a circuit different from that to which the receiver powered
- If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions.

CAUTION: Only equipment certified to comply with Class B (computer input/output devices, terminals, printers, etc.) should be attached to this equipment.

Finally, any changes or modifications to the equipment by the user not expressly approved by the grantee or manufacture could void the user's authority to operate such equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Canadian Department of Communications Compliance Statement

This Class B digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations.

Avis de conformité aux normes du ministère des Communications du Canada

Cet appareil numerique de la classe B respecte toutes les exigences du Reglement sur le material broilleur du Canada.

L610 Moisture Meter

In response to today's growing need for timely, accurate moisture monitoring information and record keeping, Wagner introduces the L610 Digital Recording Moisture Meter. This remarkable instrument combines Wagner's unique "Wood-Friendly" electromagnetic scanning with Wagner's latest microcomputer technology.

- Stores and displays up to 50 user-selected species adjustments by name.
- Stores up to 500 separate moisture readings.
- Stores readings in up to 5 groups.

Using non-volatile memory, stored readings are retained even when the batteries are removed. A backlit LCD display features a 2-line, 32 character display. Function buttons and scroll arrows operate a menu system that guides the user step-by-step through the selecting, storing and reporting process. The meter has auto-shut-off to extend battery life. It can operate accurately in virtually every wood drying and processing environment. Like all Wagner handmeters, it is virtually unaffected by wood temperature.**

** Contact Wagner technical support for guidelines when wood is below freezing.

To learn more about Wagner Electronics, visit us on the Web at: http://www.wwwagner.com

L610 Specifications

Physical Size (in):	L 8.5 x W 4 x H 3.75
(mm)	L 216 x W 102 x H 95
Scanning Area (in):	2.5 x 2.5
(mm)	63.5 x 63.5
Scanning Depth (in):	1.0 in. (25.4 mm)
Weight:	18 oz. (510 g)
Power:	4 AA Alkaline Batteries
Battery Life:	~8 hours of continual use.
Auto Power Shut Down:	After 1 minute of non-use.
Moisture Measurement Range:	5 to 30% (dependent on species setting)
Specify Gravity Range:	0.30 to 0.75
Meter Operating Temperature:	30° to 120°F
Patent Number:	5,486,815

Getting Started

This sections informs you about

- Turning on the meter
- Moisture readings
- Storing a reading
- What is a group
- Viewing statistics
- The menu system
- Changing species

Before you begin, make sure your hand-meter has a fresh set of batteries.

Turning on the meter

Turn on the meter by pressing the STORE button for one second. The display will momentarily show the model, software version, and revision numbers. Your meter is now ready to take moisture readings.

Moisture readings

Take moisture readings by pressing the bottom of the meter to the wood surface. The first line of the display shows the species for which the meter is calibrated. The second line shows the reading in percent moisture content.

Storing a reading

While pressing the bottom of the meter to the wood surface at the location of interest, press the STORE button to save that reading in a group.

What is a group?

A group is a set of readings that belong together. You determine which readings belong together. Switch to another group by first pressing the GROUP button. Press the ARROW buttons to select a different number. Press the STORE button to activate the selection. The active group number is shown in the bottom right corner of the display.

Viewing statistics

Statistical values such as mean, standard deviation, highest reading, and lowest reading are calculated on individual groups. They may be accessed for viewing by using the menu system.

The menu system

For example, to view the mean and standard deviation values for the active group, press the MENU button to activate the main menu. Press the ARROW button to scroll through the menu until the menu item Mean/Std is displayed. Press the STORE button to activate the menu item.

Changing species

If the meter is not set to the species you are measuring change it using the menu system. See the section “Factory Species List” for a complete list of available species. If your species is not listed, you may customize a species as outlined in the section “Changing Species.”

Taking Measurements

In order to take correct moisture content measurements, ensure that the meter's specific gravity (species) setting is the correct one for your species of wood as listed in the Species Setting Table or Species lists.

Be sure to press down firmly on the center of the meter with approximately 3 pounds of force to ensure good sensor plate contact with the wood surface. This is especially important on rough-sawn lumber. Do not take readings where there is a noticeable defect or knot in the lumber.

If there is visible surface moisture or water, wipe off any excess, and let the surface of the wood dry-out for a couple of minutes, then take the reading. If possible, turn the board over and measure the other side. If the thickness of the piece is greater than 3 inches, it is a good idea to take measurements on both sides.

Ensure that there is nothing (especially your hand or metal) under the material you are measuring. The actual moisture sensing area is a 2 ½ inch by 2 ½ inch rectangle on the meter's backside (opposite side of the panel meter). In order to take a valid measurement, this sensing area must be completely covered with the wood you are measuring. If the sensing area is not completely covered, your moisture reading will be inaccurate.

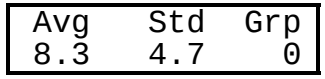
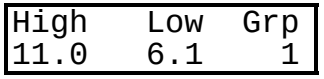
Additional meter corrections may be necessary if you are measuring Raft Wood (salt water permeated), or lumber treated with Copper, Chrome, Arsenic (CCA), or Ammonical, Copper, Quantenary (ACQ). Contact Wagner Technical Services for further information for these applications.

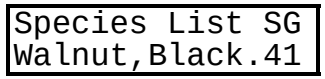
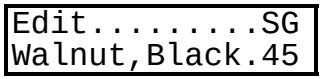
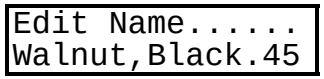
Meter Storage

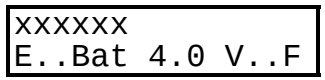
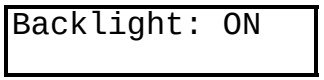
For a long service life, it is important to store your meter properly. Avoid excessively hot or cold locations. Do not store the meter in an area with excessive electro-magnetic interference, such as near an electric motor, or where it could be crushed, such as in front of a forklift. Do not leave the meter in an operating kiln during the drying cycle.

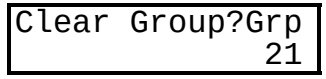
	Turning ON the Meter	%MC Readings	Storing Readings
OPERATION	To turn ON the Meter, press the **STORE** button for one second. The Meter will turn OFF after 1 minute of inactivity. Inactivity means no change in moisture readings or button presses.	The Meter takes continuous %MC readings and puts them on the display. When a reading is below 5%, the first line shows the current species and group field label. The second line shows the current %MC reading and group number. When a reading is above 5%, the first line becomes a bar graph representing the current %MC reading.	When a valid reading is stored, the second line will display a message stating that it was stored as sample # xxx. When attempting to store an invalid reading, a message will state the reading was too low and last sample # xxx.
DISPLAY			Storing MC # 14 or MC too low # 13
STORE	To turn the Meter ON, press the STORE button for one second.		Press the STORE button to store the current MC reading into the current group.
GROUP			
MENU			
ARROWS			

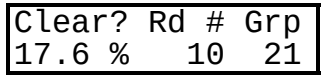
	Changing Groups	Menu Selection	Menu Selection List
OPERATION	Press the **GROUP** button to activate the Change Group function. Use the **ARROW** buttons to select the desired group number. Press the **STORE** button to accept the new group change. The group number range is from 0 to 4.	Press the **MENU** button to activate the Menu Selection function. Press the **ARROW** buttons to scroll through the menu list. Press the **STORE** button to activate the selected menu item.	AVG/STD Stats HI/LOW Stats Calibration Backlight Battery Check Clear Menu Change Species
DISPLAY	Change Group New Group #: 1	Menu Selection AVG/STD Stats	
STORE	Press the STORE button to accept the new group change.	Press the STORE button to activate the selected menu item.	
GROUP	Press the GROUP button to cancel a new group change.	Press the GROUP button to leave the Menu Selection function.	
MENU	Press the MENU button to cancel a new group change.	Press the MENU button to activate the selected menu item.	
ARROWS	Press the ARROW buttons to increment or decrement the group number.	Press the ARROW buttons to scroll through the menu list.	

	AVG/STD Stats	HI/LOW Stats
OPERATION	Enter the Menu Selection function and activate the AVG/STD Stats item. Use the **ARROW** buttons to scroll through the group statistics. Only groups which contain readings will be shown. Press the **STORE** button to return to the %MC Readings mode.	Enter the Menu Selection function and activate the HI/LOW Stats item. Use the **ARROW** buttons to scroll through the group statistics. Only groups which contain readings will be shown. Press the **STORE** button to return to the %MC Readings mode.
DISPLAY		
STORE	Press the STORE button to return to the %MC Readings mode.	Press the STORE button to return to the %MC Readings mode.
GROUP	Press the GROUP button to advance to the next valid group.	Press the GROUP button to advance to the next valid group.
MENU	Press the MENU button to return to the %MC Readings mode.	Press the MENU button to return to the %MC Readings mode.
ARROWS	Press the ARROW buttons to scroll through the AVG/STD group stats.	Press the ARROW buttons to scroll through the HI/LOW group stats.

	Change Species	Edit SG Mode	Edit Name Mode
OPERATION	Enter the Menu Selection function and activate the Change Species item. Use the **ARROW** buttons to scroll through the species list. Press the **STORE** button to activate the selected species. The factory default species list is shown in the Appendix.	Enter the Edit SG mode through the Change Species item. Use the **ARROW** buttons to change the SG number. Press the **STORE** button to accept the change.	Enter the Edit Name mode through the Change Species item and Edit SG mode. Use the **ARROW** buttons to change the alpha character. Press the **MENU** button to move the edit cursor to the right. Press the **STORE** button to accept the change.
DISPLAY			
STORE	Press the STORE button to activate the selected species.	Press the STORE button to accept the change.	Press the STORE button to accept the change.
GROUP	Press the GROUP button to return to the %MC Readings mode.	Press the GROUP button to cancel any change.	Press the GROUP button to cancel any change.
MENU	Press the MENU button to activate the Edit SG mode.	Press the MENU button to activate the Edit Name mode.	Press the MENU button to move the edit cursor one character to the right. That character will be replaced with a BLANK.
ARROWS	Press the ARROW buttons to scroll through the species list.	Press the ARROW buttons to change the SG number.	Press the ARROW buttons to cycle through the alphabet.

	Battery Check	Backlight
OPERATION	Enter the Menu Selection function and activate the Battery Check item. When a low battery condition occurs, GRP will be replaced by BAT in the %MC Readings mode. Life time for alkaline batteries are ~8 hours (continuous use, backlight OFF).	Enter the Menu Selection function and activate the Backlight item. Press the **STORE** button to change state of the backlight.
DISPLAY		
STORE	Press the STORE button to return to the %MC Readings mode.	Press the STORE button to change state of the backlight.
GROUP	Press the GROUP button to return to the %MC Readings mode.	Press the GROUP button to return to the %MC Readings mode.
MENU	Press the MENU button to return to the %MC Readings mode.	Press the MENU button to return to the %MC Readings mode.
ARROWS	Press the ARROW buttons to return to the %MC Readings mode.	Press the ARROW buttons to return to the %MC Readings mode.

	Clear Menu	Clear Menu List	Clear Group
OPERATION	Enter the Menu Selection function and activate the Clear Menu item. Press the **ARROW** buttons to scroll through the Clear Menu list. Press the **STORE** button to activate the selected menu item.	Clear Group Clear Reading Restore Factory Clear All Groups	Enter the Clear Menu function and activate the Clear Group item. Press the **ARROW** buttons to select the group to clear. Only groups which contain readings will be shown. Press the **STORE** button to clear the selected group.
DISPLAY			
STORE	Press the STORE button to activate the selected menu item.		Press the STORE button to clear the selected group
GROUP	Press the GROUP button to leave the Clear Menu function.		Press the Group button to select the group to clear.
MENU	Press the MENU button to activate the selected menu item.		Press the Menu button to cancel operation.
ARROWS	Press the ARROW buttons to scroll through the menu list.		Press the ARROW buttons to select the group to clear.

	Clear Reading	Restore Factory	Clear All Groups
OPERATION	Enter the Clear Menu function and activate the Clear Reading item. Press the **ARROW** buttons to select the reading to clear. Press the **STORE** button to clear the selected reading.	Enter the Clear Menu function and activate the Restore Factory item. Press the **STORE** button to restore factory settings. Press **ANY OTHER** button to cancel operation and return to the %MC Readings mode.	Enter the Clear Menu function and activate the Clear All Groups item. Press the **STORE** button to clear all groups. Press **ANY OTHER** button to cancel operation and return to the %MC Readings mode.
DISPLAY			
STORE	Press the STORE button to clear the selected reading.	Press the STORE button to restore factory settings.	Press the STORE button to clear all groups.
GROUP	Press the Group button to change group to clear readings from.	Press the Group button to cancel operation.	Press the Group button to cancel operation.
MENU	Press the MENU button to return to the %MC Readings mode.	Press the MENU button to cancel operation.	Press the MENU button to cancel operation.
ARROWS	Press the ARROW buttons to select the reading to clear.	Press the ARROW buttons to cancel operation.	Press the ARROW buttons to cancel operation.

	Calibration
OPERATION	Enter the Menu Selection function and activate the Calibration item.
DISPLAY	Check Calibratn xx.x %MC
STORE	Press the any button to return to the %MC Readings mode.
GROUP	
MENU	
ARROWS	

Checking Calibration

Calibration is factory set. It may be checked by using a Wagner Calibration Verification Block (CVB) (P/N: 840-60130-002). Use only to verify L610 factory calibration is within tolerance limits. If calibration is out of tolerance, return L610 to factory or repair depot for re-calibration. Never adjust L610 to this device. Protect CVB from direct sunlight. Store in cool dry place. Follow these steps for checking calibration.

1. Enter the Calibration menu item.
2. Hold the meter in mid air so the bottom is several feet from any object. The correct reading for air is .0 %MC. If the reading is outside the range, -.5 to .5 %MC, the unit is out of calibration.
3. Place the CVB, rubber feet down, on a metal surface: such as a file cabinet, a piece of sheet metal, etc.
4. Orientate the long axis of the handmeter with the long axis of the CVB. Press the handmeter sensor in the center of the CVB and observe the reading. The correct reading is 18.5 %MC. If the reading is outside the range, 18.0 to 19.0 %MC, the unit is out of calibration.

Warning—There are two (2) hole plugs located on either side of the L610 handle. Do not remove these plugs because the adjustments below them are factory set and should not be adjusted by the customer. If adjustment is attempted, the unit will not be in calibration and will require factory re-calibration. Also if adjustment is attempted, warranty will be voided.

Technical Notes

Readings and Groups--The L610 can store up to 500 readings in up to 5 groups. Groups are numbered 0 to 4 and can be selected at random. There is no limit to the number of readings per group as long as the total readings of all groups do not exceed 500.

Automatic Menu Escape--When in the menu system and 15-seconds of no key presses, the Meter will automatically return to the %MC Reading mode ready to store the next reading in the current group.

Repeat Key--If a key (button) is held down for more than one (1) second, then the key pressed is repeated at a rate of one (1) repeat each second. After 5 repeats the rate doubles and after an additional 5 repeats the rate doubles again. Use this feature to scroll through long list of species or readings.

Factory Species List

The L610 has a factory default of 50 species. The specific gravity (SG) and name may be adjusted from the **Species** menu item. This allows you to tailor the Meter calibration to a species not listed.

Note: SA denotes South Africa.

Species	SG
Alder,Red	.41
Basswood,Amer	.37
Cedar,EastRed	.47
Cedar,WestRed	.32
Cherry,Black	.50
Douglas Fir	.50
Ebony,E Indn	.70
Elliottii,SA	.49
Euca Grand SA	.70
Fir,Balsam	.35
Fir,Cal Red	.38
Fir,Subalpine	.32
Fir,White	.39
Hemlock,East	.40
Hemlock,West	.45
Hickory,Nutmg	.60
Hickory,Pecan	.66
Hickory,Mockr	.72
Jarrah	.67
Keruing	.64*
Larch,Western	.52
Mahogany,True	.59*
Maple,Bigleaf	.48
Maple,Sugar	.63
Oak,Black,Red	.61
Oak,Califrnia	.51
Oak,North Red	.63
Oak,South Red	.59
Oak,Bur,White	.64
Oak,White	.66
Patula SA	.50
Pine,E White	.35
Pine,Jack	.43
Pine,Loblolly	.51
Pine,Ldgepole	.41
Pine,Longleaf	.59
Pine,Parana	.54*
Pine,Pnderosa	.40
Pine,Shrtleaf	.51
Pine,Slash	.59
Pine,Sugar	.36
Poplar,Yellow	.42
Primavere	.45*
Redwood, Old	.40
SYP	.51*
Taeda,SA	.58
Tamarack	.53
Teak	.59*
Walnut,Black	.55
Custm Species	.50

*The values for these species changed per Technical Bulletin #13, shown on next page.

Technical Bulletin 13

L610 SPECIES ADJUSTMENT

In our quest to continually upgrade our products and services, it has come to our attention that some of the lesser used species adjustment values (SG) stored in the default list of L610 hand-meter are not the correct values.

If you use any of the following species in your operation, please store the new values to ensure the greatest accuracy of your hand-meter. Should the internal lithium battery in the meter fail, or the meter is sent in for service, you will have to re-enter the appropriate values. Please place this bulletin in the back of your L610 manual.

Change SG:	From	To
Keruing	0.69	0.64
Mahogany, True	0.45	0.59
Pine, Parana	0.46	0.54
Primavere	0.40	0.45
SYP	0.55	0.51
Teak	0.55	0.59

(Revised 10/28/02)

This change can be performed by turning on the meter and editing the species value by pressing:
Menu > up/down arrows to select Change Species > Store> Select appropriate species with up/down arrows > Store > press Menu until “Edit” is displayed > up/down to select new SG value > Store to save.

Wagner Electronics
Technical Services Department

Species Setting Tables

for Hardwoods, Softwoods, and Imported Species

Hardwood Species

Spec. Gravity:	Hardwood Species:
0.41	Alder, Red
0.61	Apple
0.49	Ash, Black
0.58	Ash, Blue
0.56	Ash, Green
0.55	Ash, Oregon
0.55	Ash, Red
0.60	Ash, White
0.39	Aspen, Bigtooth
0.38	Aspen, Quaking
0.37	Basswood, American
0.64	Beech, American
0.55	Birch, Paper
0.65	Birch, Sweet
0.55	Birch, White
0.62	Birch, Yellow
0.38	Butternut
0.50	Cherry, Black
0.43	Chestnut, American
0.34	Cottonwood, Balsam Poplar
0.35	Cottonwood, Black
0.40	Cottonwood, Eastern
0.64	Dogwood, Flowering
0.50	Elm, American
0.63	Elm, Rock
0.53	Elm, Slippery
0.53	Hackberry
0.66	Hickory (Pecan), Bitternut
0.60	Hickory (Pecan), Nutmeg
0.66	Hickory, Pecan
0.62	Hickory (Pecan), Water
0.72	Hickory (True), Mockernut
0.75	Hickory (True), Pignut
0.72	Hickory (True), Shagbark
0.69	Hickory (True), Shellbark
0.50	Holly, American
0.63	Hophornbeam, Eastern
0.51	Laurel, California
0.69	Locust, Black
0.58	Madrone, Pacific
0.50	Magnolia, Southern
0.48	Maple, Bigleaf
0.57	Maple, Black
0.66	Maple, Hard
0.54	Maple, Red
0.47	Maple, Silver
0.51	Maple, Soft
0.63	Maple, Sugar
0.61	Oak (Red), Black
0.51	Oak, California Black
0.68	Oak (Red), Cherrybark
0.63	Oak (Red), Laurel
0.63	Oak (Red), Northern Red
0.63	Oak (Red), Pin
0.67	Oak (Red), Scarlet
0.59	Oak (Red), Southern Red
0.63	Oak (Red), Water
0.69	Oak (Red), Willow
0.64	Oak, Red (1).
0.64	Oak (White), Bur
0.66	Oak (White), Chestnut
0.63	Oak (White), Overcup
0.67	Oak (White), Post
0.67	Oak (White), Swamp Chestnut
0.72	Oak (White), Swamp White
0.66	Oak, White
0.64	Persimmon, Common
0.46	Sassafras
0.52	Sweetgum
0.49	Sycamore, American

(1). See page 21 for footnote sources.

Spec. Gravity:	Hardwood Species:
0.58	Tanoak
0.50	Tupelo, Black
0.50	Tupelo, Water
0.55	Walnut, Black
0.39	Willow, Black
0.42	Yellow-Poplar

Softwood Species

Spec. Gravity:	Softwood Species:
0.46	Baldcypress
0.44	Cedar, Alaska
0.32	Cedar, Atlantic White
0.47	Cedar, Eastern Red Cedar
0.37	Cedar, Incense
0.31	Cedar, Northern White
0.43	Cedar, Port Orford
0.32	Cedar, Western Red Cedar
0.44	Cedar, Yellow
0.50	Douglas Fir
0.35	Fir, Balsam
0.38	Fir, California Red
0.37	Fir, Grand
0.39	Fir, Noble
0.43	Fir, Pacific Silver
0.32	Fir, Subalpine
0.39	Fir, White
0.40	Hemlock, Eastern
0.45	Hemlock, Mountain
0.45	Hemlock, Western
0.52	Larch, Western
0.35	Pine, Eastern White
0.43	Pine, Jack
0.51	Pine, Loblolly
0.41	Pine, Lodgepole
0.59	Pine, Longleaf
0.52	Pine, Pitch
0.56	Pine, Pond
0.40	Pine, Ponderosa
0.46	Pine, Red
0.48	Pine, Sand
0.51	Pine, Shortleaf
0.59	Pine, Slash
0.44	Pine, Spruce
0.36	Pine, Sugar
0.48	Pine, Virginia
0.38	Pine, Western White
0.40	Redwood, Old-Growth
0.35	Redwood, Young-Growth
0.42	Spruce, Black
0.35	Spruce, Engelmann
0.40	Spruce, Red
0.40	Spruce, Sitka
0.36	Spruce, White
0.51	SYP (Southern Yellow Pine)
0.53	Tamarack

Imported Species

Spec. Gravity:	Imported Species:
0.69	Afrormosia
0.64	Andiroba
0.54	Anegre
0.55	Avodire
0.62	Banak (Cuangare)
0.77	Benge (Ehie, Bubinga)
0.61	Caribbean Pine
0.44	Cativo
0.91	Courbaril (Jatoba)
0.51	Cypress
0.82	Degame
0.58	Determa
0.70	Ebony, East Indian
0.50	Gmelina
0.38	Hura

Spec. Gravity:	Imported Species:
1.00	Ipe
0.70	Iroko
0.80	Jarrah
0.46	Jelutong
0.76	Kapur
0.84	Kempas
0.64	Keruing (Apitong)
0.67	Koa
0.67	Lauan, Dark Red
0.50	Lauan, White (Light Red Meranti)
0.45	Limba
0.61	Mahogany, African
0.93	Mahogany, Santos
0.59	Mahogany, True
0.68	Manni
0.80	Merbau
0.65	Mersawa
0.63	Mueri (Cherry)
0.38	Obeche
0.66	Ocote Pine
0.44	Okoume
0.73	Opepe
0.54	Parana Pine
0.63	Peroba de campos
0.75	Peroba rosa
0.45	Primavera
0.80	Purpleheart
0.48	Radiata Pine
0.65	Ramin
0.64	Roble (Quercus)
0.85	Rosewood, Brazilian (Jacaranda)
0.85	Rosewood, Indian
0.61	Santa Maria
0.62	Sapele
0.41	Spanish Cedar
0.59	Teak
0.67	Yew

Specific Gravity Correction Value Sources

(1). This SG correction value was developed by Wagner Electronic Products, Inc.

Species Corrections

The dry specific gravity (density) values for a species are based on the best, current world data, and are used to determine the species correction factor within the meter. The values provide average density values for the species. A coefficient of variation (COV) of about 10% describes the variability inherent in many common domestic (US) species.

If the specific gravity of your lumber cannot be found with the resources listed above or you are dealing with an unknown species, the value may be determined by referring to the "Determining the Specific Gravity" section of this manual. Additional resources are: the Forest Products Lab at http://www.fpl.fs.fed.us/ and the Wood Handbook at http://www.fpl.fs.fed.us/documnts/fplgtr/fplgtr113/fplgtr113.htm

Wagner hand-meters can be used to measure non-wood materials if the density is similar to wood products. Non-wood species can be measured by using the meter reading as a relative value such as in "go/no-go" applications, or when determining if one measurement area contains more moisture than another, i.e. measurements that do not require a high absolute accuracy. SG formulas can't be applied to non-solid wood species due to the presence of glues and resins, which cause a non-linear moisture content curve. If greater accuracy is required, the ASTM oven-dry procedure can be used to determine a meter correction value for non-solid woods.

Please contact Wagner Electronics at (541) 582-0541 for additional information on species corrections if needed.

Checking the Moisture Content in Veneer

You can check the moisture content of veneer with your Wagner hand-held moisture meter as follows:

1. Put veneer into a tight stack of at least 1 inch, and separate the stack by at least 3 inch to 4 inch from the rest of the stack. Measuring a stack less than the scan depth of the meter will give you a reading that is lower than the true moisture reading. Refer to the species setting table for the wood you are using.

2. Electro Static Discharge (ESD) needs to be prevented, as Wagner's warranty doesn't cover ESD damage. The instruments are tested to withstand a 15 KV static charge but not the typical 150 - 250 KV found in a veneer charge. The veneer table should be earth grounded with a metal wand attached by wire to the table. The wand must then be run up and down the edge of a veneer stack to discharge static, or the person using the moisture meter must have a Velcro wrist band with a tethered strap which is grounded.

These same static precautions apply to lumber moving from a planer; the hand-meter is not an in-line measurement system. This unit is meant to check lumber while stationary.

If these guidelines are adhered to, the risk of ESD damage to your moisture meter is greatly reduced or eliminated. Please call the factory if you have any questions or concerns about this information.

Commentary on Species Adjustment

In 1992, a study was conducted at the Forest Research Laboratory of Oregon State University on species correction for the Wagner Hand-Held Moisture Meters. The species tested were Douglas Fir, Lodgepole Pine, Western Red Cedar, Western Hemlock, White Fir, Western Larch, Engelmann Spruce, and White Oak. Three to four 40-piece samples of each species were tested. Specific gravity was found to be the primary factor on species adjustment. A species equation as a function of specific gravity and the meter reading was obtained using multiple-regression technique (R-square = 0.95) as follows:

AF = 8.77 + (0.25 * MM) - (15.86 * SG) - (0.62 * SG * MM)

in which

AF = Adjustment Factor

MM = Meter Reading

SG = Species average Specific Gravity in oven dry weight and 12% moisture-content volume basis.

The species adjustments provide the adjusted moisture measurements that are based on the species adjustment determined using the species adjustment equation, with rounding to the nearest 0.5.

Wood is not a uniform material. Specific gravity of solid-sawn lumber varies within the piece and among pieces. In the OSU study, the average specific gravity for each species differed from the individual sample by plus or minus 1% to plus or minus 8%. For general applications, average specific gravity values can be found in the Wood Handbook (USDA Agriculture Handbook No. 72, 1999). Except for one species for which the experimental value is 7% higher, the species' overall average specific gravity values obtained in the OSU study are comparable with those in the Wood Handbook. The exception may be caused by unknown biases in the sampling scheme. The Wood Handbook values are used in the tables, except for the imported species.

Species adjustment can be determined for lumber sorted, or otherwise known, to have specific gravity different from the species' average. One example is lumber graded under the Dense rules. If the specific gravity of a lumber sample is known, species adjustment can be determined by the species adjustment equation.

The species adjustment equation provides a way to expand the use of your Wagner Hand-Held Moisture Meter for lumber of any species groups having similar species-specific gravity values. One example is Hem-Fir. For a species group, one way to determine the species adjustment is by the use of a weighted average of the individual species' average specific gravity values. The weighing procedure used in the ASTM D2555 by standing timber volume can be used. Species adjustment is not recommended for any species group having a broad range of species-specific gravity values. There are no recognized limits on species group species adjustment. Species adjustment for species groups should be used with knowledge on the variability on species involved and the affect of it on species adjustment. If the species mix in the lumber production of a species group is controlled or known to have specific gravity different from that used for the species group, a better estimation of species adjustment can be determined using the known specific gravity in the above species correction equation.

Determining Specific Gravity

Determining the Species Setting for an Unknown Species

The Species Setting Tables, based on specific gravity of solid wood, are provided in this manual. If you do not know the species of the wood you are using, or the specific gravity differs from the handbook because of a different growing region, use the following procedure.

Determining the Specific Gravity

1. Select a sample of wood that is approximately 12% moisture content, with all edges being true. Carefully measure the dimensions of the sample using a caliper. You will need the length, width, and thickness.
2. Convert these measurements to feet.
3. Carefully measure the weight of the sample.
4. Convert the weight to pounds.
5. Calculate specific gravity.

Example:

Length =	10 in.	10 in. / 12 in. = 0.833 ft.
Width =	7 ½ in.	7.5 in. / 12 in. = 0.625 ft.
Thickness =	1 ½ in.	1.5 in. / 12 in. = 0.125 ft.
Volume =	L x W x T	0.833 x 0.625 x 0.125 = 0.065 cu. ft.
Weight =	20 oz.	20 oz. / 16 oz. = 1.25 lb.

Specific Gravity:
(Weight / Volume) / Specific Gravity of water
(1.25 lb. / 0.065 cu. ft.) / 62.34 lb. / cu. ft. = 0.31

In order to ensure that the value obtained for the specific gravity is statistically significant, a number of pieces must be measured and the average determined. Use this value of specific gravity for the species setting in the meter.

Questions and Answers

Q: I'm nervous about buying a new technology. What about Wagner Electronic Products, Inc.? How long have they been building this type of moisture meter?

A: Since 1966, Wagner Electronic Products has been providing quality moisture measurement equipment. Wagner is the leading supplier of moisture measurement equipment for the primary forest products industry. Closely scrutinized and approved by numerous university studies and used for years by professional wood-grading associations, Wagner's meters continue to prove reliable and consistent, with unsurpassed convenience and ease-of-use.

Q: How do Wagner Hand-Held Moisture Meters operate?

A: Wagner Hand-Held Moisture Meters send technologically advanced electromagnetic radio waves deep into the wood without leaving destructive holes. Known around the world for speed and accuracy, Wagner meters supply instant readings, scanning large amounts of board feet in seconds. Virtually unaffected by temperature and * humidity, they scan right through finished products.

* For frozen wood with up to 15% moisture content, accurate measurements can be obtained. When the frozen lumber moisture content is suspected to be over 15%, a relative reading can be obtained. Contact Wagner technical support if additional guidance is needed.

Q: What about gradients and wet pockets?

A: Although the various drying processes for green lumber can leave wet cores and pockets, moisture continues to pass from fiber to fiber within the wood until it has equalized through out the whole board, and then to surrounding humidity levels. Determining if a board or load of lumber will equalize within tolerance levels can be difficult and tricky, but Wagner Moisture Meters provide this information automatically. Penetrating deep into the wood, they mathematically determine equalized moisture content and are capable of checking truckloads of board feet for specified moisture content in minutes. For even more convenience, many companies use their Wagner Hand-Held Meters to read right through the plastic wrapping around the wood on new deliveries before they allow unloading!

Q: How can I take accurate moisture readings without sticking pins into my wood? Why doesn't my new Wagner Hand-Held Meter read the same moisture content as my old pin meter?

A: Pin-type meters work on a primitive, resistance principle that basically measures the flow of electricity through a substance. This method is subject to many environmental variables that can dramatically affect moisture readings such as chemicals in the water trapped within the wood and the temperature of the wood. Pin-type meter readings must always be corrected for any difference in temperature above or below 70 degrees F. Wagner Hand-Held Moisture Meters use advanced electro-magnetic wave technology and are sensitive to changes in density and the actual moisture content of the wood.

Q: What is the narrowest piece of lumber I can measure accurately with the Wagner Hand-Held Moisture Meter?

A: Model L610 measures boards as narrow as 2 1/2" in width.

Q: What thickness boards can I measure?

A: Model L610 meters are designed to measure wood from 1 inch to 3 inches thick.

Note: Make sure there is nothing behind boards less than 1" thick when you take the measurement because Wagner meters will read through the thinner board and measure the moisture in the material behind. Under no circumstances measure a piece of wood that is sitting on a metal table. (The Wagner L610 measures to a depth of 1", which will reach the center of a 2" board)

Q: Can I get accurate results on 4x or larger lumber?

A: No hand-held moisture meter can accurately read to the center of 4x material unless you are willing and able to drive pins 1" into the lumber all the way up and down its length and breadth. However using a Wagner Hand-Held Moisture Meter, you can quickly and easily scan 4x lumber on both sides (4 x 4's on all four sides). Then only the center 1 5/8" would be unmeasured.

Note: Most wood grading agencies are generally not concerned about the moisture content in the center of thicker beams and posts. They consider 1" deep scanning more than adequate.

Q: Where is the reading taken with a pin-type meter? With a Wagner Hand-Held?

A: Pin-type Meters take their measurements at the depth that you've been able to drive the pins. . . and only in a line between the non-insulated portion of the pins (often only the tips). In contrast, Wagner Hand-Held Moisture Meters generate a three-dimensional field that measures a 2 1/2" wide, 2 1/2" long, 1" (minimum) thick volume of wood under the entire sensor.

Q: How does this difference in measuring techniques affect accuracy?

A: If you're using a pin-type meter, the moisture content you are reading is determined by the micro-thin path the electricity takes to travel from one pin to the other. In effect, it measures only the moisture content of that very tiny path. If there is a single wet fiber between the pins, the electric charge will flow easily along that fiber and cause pin-type meters to exaggerate the moisture content in the wood when in fact it is just a very small fiber that is wet. However, if the place you choose to drive the pins into the wood is simply extraordinarily dry and untypical of the rest of the piece you will get an exaggerated dry reading. On the other hand, Wagner Hand-Held Moisture Meters take an average of the moisture content discovered by the full scan of the three-dimensional field so small wet fibers are not read as large wet spots. Plus, it only takes seconds to scan the entire board.

Q: How are moisture meters affected by surface moisture?

A: Most moisture meters can be affected by standing water, or visible water on the board. You should always wipe off as much excess water as possible. Once the standing water is removed, Pin-type meters with non-insulated pins will register a highly exaggerated moisture reading. Wagner Hand-Held

Meters will read slightly higher than normal (probably less than 3 to 4%). If water is allowed to soak into the wood, it will naturally show a higher moisture content. If a piece of wood is quite rough, it will soak up the water quite readily and readings will be affected.

Q: What are the effects of relative humidity on Wagner Hand-Held Moisture Meter readings?

A: As long as there is not condensation on the bottom surface of the instrument there is no effect from changes in relative humidity.

Q: Do the meters on the Wagner Hand-Held products ever require readjustment? Does my Wagner Hand-Held Moisture Meter need to be calibrated? If so, how often must it be done?

A: Occasionally Wagner Hand-Held Moisture Meters require adjustment. However, the process of checking zero points and calibration is very simple.

Note: Wagner Meters are originally calibrated at the factory. Type and amount of use will determine how long this original calibration will last. A calibration verification block is available for the customers who must check their calibration often. Anytime that the meter is not reading correctly on that calibration verification block, it should be sent into the factory for calibration.

Q: I have a very thin veneer over a door stock and I'm trying to measure the moisture content of the core. Can I measure accurately through laminated materials?

A: If you're measuring an all-wood door with a very thin veneer wood laminate, you can probably use a correction factor to determine the moisture content of the core material.

Note: If you're measuring a door that has a plastic laminate or Formica-type laminate, the Formica laminate is going to have its own density, which is going to affect the reading of the meter. You can determine the variance caused by the laminate by first measuring only the core and then the core with the laminate. For example, if the core measures 12% without the laminate and 13.5% with, you will then know to correct your readings of the combined material by 1.5%.

Q: Will Wagner Hand-Held Meters work the same on rough lumber as they do on smooth clean lumber?

A: There are little fibers in very rough material that actually allow a minute layer of air between the meter and the main body of the wood. However, this should not materially affect the reading, or if it does, only slightly lower.

Note: It's important on rough material to use some pressure and force the meter down firmly against the wood. Occasionally, the measurement of exceptionally rough material may necessitate adding 1 to 2% to get an accurate reading.

Q: Can you check moisture content of plywood, particleboard or wafer board with hand-held meters?

A: Because of the glues and mixed species nature of these materials, it is very difficult to take reliable moisture readings with pin-type or Wagner Hand-Held Moisture Meters.

Note: However, if you would like to work up your own calibrations for materials you use repetitively, you can contact Wagner for guidelines and suggestions.

Q: What about the orientation of the meter on the wood?

A: Your Wagner moisture meter uses advanced electromagnetic wave technology and is completely unaffected by orientation (cross-grain or with the grain) on the wood.

Q: Are the readings that I take with my Wagner Hand meter affected by the temperature of the wood like those taken with a pin-type meter? What about frozen wood?

A: Unlike pin-type meters which require corrections for temperatures above or below 70 degrees F, the readings on the Wagner Hand-Held Moisture Meter are essentially unaffected by the temperature of the wood. Moisture content can accurately be measured as soon as the hot wood is taken out of the kiln. When the same wood is measured hours later, again with the Wagner Hand-Held Meter, the readings stay consistently the same, unless the wood continues to dry during the cooling process.

For frozen wood, as long as the moisture content of the wood you are measuring is below 15%, you can get reliable readings. When moisture content readings in frozen wood exceed 15%, you will need to make corrections.

Q: How rugged are the Wagner Hand-Held Moisture Meters? Are they too delicate to be used on an abusive production line?

A: The Wagner L610 Moisture Meter is a tough production-line model. It can be damaged by being dropped or slammed down hard on wood surfaces, as can any meter. If a large volume of wood is to be measured, an in-line system should be used.

Q: How accurate is the Wagner Hand-Held Meter?

A: The Wagner Moisture Meter is as accurate, or more accurate than any moisture detector that is on the market. This can be verified by several university studies.

Q: Is the Wagner technology safe to use?

A: Wagner's Hand-Held Meters have been tested and certified to comply with FCC and CE regulations. Wagner's electromagnetic wave technology produces less electromagnetic radiation than standard house wiring.

Q: What is proper moisture content in wood? What moisture content is considered too high or too low?

A: There is no right answer for this question. As a rule, differences in woods and their uses determine the moisture content desired. For instance, if the wood is to be used in construction as a stud for building, the moisture content requirement could be under 15% to 19%. If the wood is to be glued, and it is too dry it will not bond. If it is too wet, it will not hold. Ideally the moisture content of wood to be used in furniture is between 6 and 8%.

To determine the proper moisture content for your application, contact your local university's forestry department or one of the associations supporting your industry's professionals. You may also call the Forest Products Research Laboratory in Madison, WI: 608-231-9200.

Warranty

Wagner Electronic Products, Inc. warrants this product against defects in material and workmanship for one (1) year from the date of purchase, subject to the following terms and conditions:

Wagner's liability under this warranty shall be limited, at Wagner's option, to the repair or replacement of this product or any part there of which is demonstrated to be defective. To exercise this warranty, customer must telephone, fax, or e-mail Wagner's Customer Service Department for a RMA (Return Materials Authorization) number and factory instructions for shipment. This limited warranty does not apply if accident, negligent handling, misuse, alteration, damage during shipment, or improper service have damaged the product. Wagner Electronic Products, Inc. shall in no event be liable for any breach of warranty or defect in this product, which exceeds the amount of the purchase price of the product. Wagner Electronic Products, Inc. shall not be liable for incidental or consequential damages for the breach of any express or implied warranty with respect to this product or its calibration.

With proper care and maintenance, as recommended in the manual, the meter should stay in calibration; however, because Wagner Electronic Products, Inc. has no control over the manner in which the unit will be used, it makes no warranty that the meter will stay in calibration for any specific period of time. Wagner Electronic Products, Inc. recommends purchasing a calibration block or returning the unit to the factory for diagnostic check-up and recalibration, on the anniversary date of purchase, each year the meter is in service.

This warranty is in lieu of all other warranties, whether oral or written, express or implied. Any implied warranties, including implied warranties of merchantability and fitness for a particular purpose, are excluded. Agents and employees of Wagner Electronic Products, Inc. are not authorized to make modifications to this warranty or additional warranties binding on Wagner Electronic Products, Inc. Accordingly, additional statements, whether oral or written, except written statements from an officer of Wagner Electronic Products, Inc. do not constitute warranties and should not be relied upon by the customer.

This warranty is personal to the customer purchasing the product from Wagner Electronic Products, Inc. and is not transferable.

Repair Service

In the event of damage or failure to your meter, contact Wagner for a RMA number prior to returning it for repair:

Voice: (541) 582-0541

Fax: (541) 582-4138

E-Mail: support@wwwagner.com

Mail: Technical Services Department

Wagner Electronic Products, Inc.

326 Pine Grove Road

Rogue River, OR 97537

Your meter will be repaired, calibrated and returned promptly.

Customer must pay the expense of shipping the product to Wagner. Wagner will pay the cost of return shipment by surface carrier within the Continental United States. Customer must pay all extra costs of expedited shipping or shipment to and from locations outside of the Continental United States.

Visit Our Moisture Measuring Center at:

www.moisturemeters.com