

NIGOS
ELEKTRONIK·NIS

DVD-240

Dodirni vlagomer
Nondestructive moisture meter



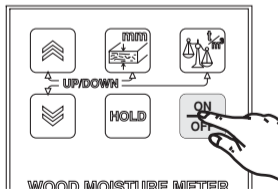
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1. QUICK REFERENCE GUIDE

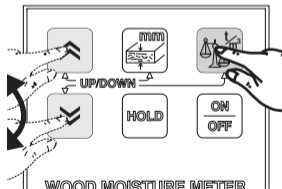
1. Turning the meter ON

- Press the button  briefly (back side untouched)
- Wait for autocalibration process (CAL) to end and 000 to be displayed



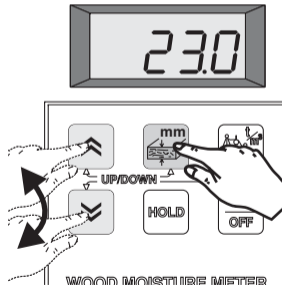
2. Wood density adjustment

- Press and hold button  ; use  and  to adjust timber density (given in t/m^3)



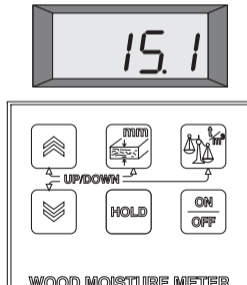
3. Wood thickness adjustment

- Press and hold button ; use  and  to adjust wood thickness (given in mm)



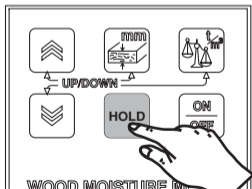
4. Measurement - moisture content reading

- Gently press the back side of the meter on the flat and smooth surface of wood sample "along fibers"
- Read the measured value on display (in %MC)
- Repeat the measurement in several points



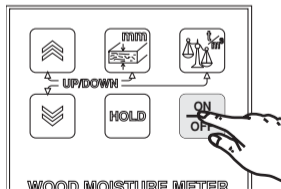
5. Measurement - option HOLD

- If needed, press briefly button **HOLD** to hold the measured value displayed for later reading
- Press same button again to continue measuring



6. Turning the meter OFF

- Press the button **ON/OFF** briefly



2. TECHNICAL SPECIFICATION



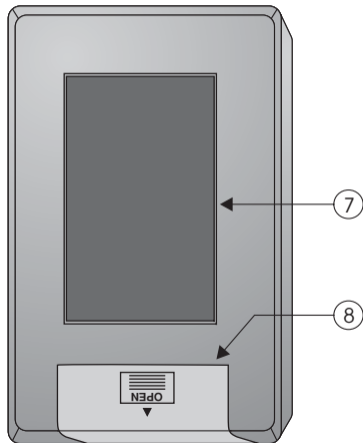
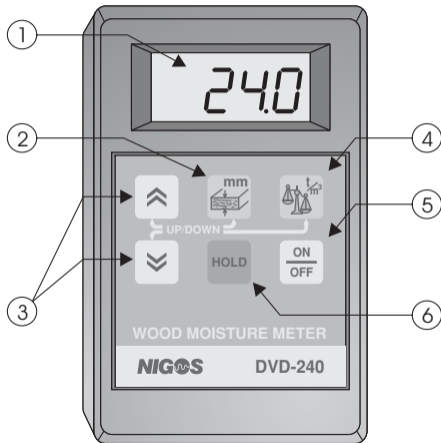
GENERAL CHARACTERISTICS

Power supply	9 V battery, Alkaline or NiCd Aku.
Display	LCD, digital
Operating conditions	T: 5 ÷ 50 °C; RH: 5 ÷ 90%
Storage	T: - 40 ÷ 85 °C; RH: 5 ÷ 90%
Device dimensions (W x H x D)	(80 x 140 x 40) (mm)
Sensor dimensions (W x H)	(42 x 78) (mm)
Weight	210 g

MEASUREMENT

Measurement resolution	0.1 %
Wood MC measurement range	(0 ÷ 100) (%)
Wood thickness range	(0.5 ÷ 40) (mm)
Wood density range	(0.30 ÷ 1.10) (t/m ³)

3. DESCRIPTION OF MOISTURE METER



DVD-240 FRONT SIDE LAYOUT

1. **LCD DISPLAY** displays:
 - Measured moisture content
 - Parameter values during set-up
 - State and error messages
2. **WOOD THICKNESS** button
3. Buttons **UP** and **DOWN** used for increase or decrease of value of selected parameter
4. **WOOD DENSITY** button
5. Power **ON / OFF** button
6. **HOLD** button

DVD-240 BACK SIDE LAYOUT

7. **SENSOR PLATE** measures moisture content when pressed against smooth wood surface
8. Battery compartment


Wood moisture content meter **DVD-240** is made for quick reading of wood moisture by simple pressing on flat wooden surface.

Device is placed in the plastic case with large display for indication of all measurement data and flat keyboard for device control.

There is a specially designed sensor plate on the back side of the meter which measures wood MC when pressed on the wood surface.

In order to achieve accurate measuring data using this meter it is required to perform certain procedures before measurement such as autocalibration and basic parameter adjustments. Following chapters of this manual will contain more information about these procedures.

4. TURNING METER ON / OFF AND AUTOCALIBRATION PROCEDURE

Turning the meter **ON** is performed with brief pressing on the button . Meter will perform certain additional functions immediately after powering on. When the button is pressed, message **CAL** is displayed for few seconds. During this time, meter **DVD-240** is performing **AUTOCALIBRATION** procedure, i.e. series of test-measurements required for its adaptation to current operating conditions (ambient temperature, air humidity, etc).

It is essentially important to ensure that meter during autocalibration has such position that sensor plate hangs free in the air, i.e. there is nothing behind sensor plate blocking it! Do not hold fingers or other objects behind sensor plate during autocalibration. Existence of any object near sensor plate during autocalibration procedure can corrupt this process and result in inaccurate measurement and measuring errors.


After a few seconds, when autocalibration procedure is finished, meter will display: **000**, which signals that it is ready for measurement or other adjustments.

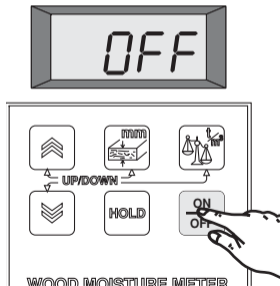
Autocalibration procedure is performed each time the meter is powered ON, which ensures reliability of measurement in all declared conditions.



If there is any doubt in measuring accuracy and possible error in autocalibration as a cause of false measurement, autocalibration should be repeated by simple turning off and turning on the meter again.

Meter can detect large calibration errors itself. In this situation, after removing all objects away from back side of the meter (so it "measures air"), message *LEr* is displayed.

Turning meter OFF is performed with short pressing on the button . Display will shortly display message *OFF* after which it will turn off. When it is turned off, the meter does not consume energy from the battery.



5. DEVICE SET-UP AND ADJUSTMENT FOR MEASUREMENT

Correctly performed autocalibration upon powering the meter ON is not enough for accurate measurement. It is required to set up the meter for specific type (i.e., density) of timber as well as appropriate thickness of wooden sample (board or veneer). This step during device set-up must not be forgotten because measured value greatly depends on this parameter setting.

Once the parameters are set-up, they remain memorized and ready for use for next measurements (if the same type of timber is tested), but parameter checking is suggested before each use.




5.1 WOOD DENSITY (TYPE) parameter setting

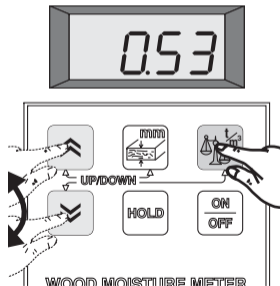
Information regarding type of wood for MC measurement is given via **WOOD DENSITY** for that type of wood. That is why it is required to determine wood density in t/m^3 as precisely as possible. Wood density is most commonly given as a table data for specific wood type (specie) when it is absolutely dry (with 0% MC).

Data regarding wood density of specific wood specie can be found in appendix of this manual, but other reliable sources can also be used.

Nondestructive portable moisture meter **DVD-240** supports selection of WOOD DENSITY in range **0.30 t/m^3** to **1.10 t/m^3** .

Wood density adjustment is performed in following way:

- Press and hold button  (**WOOD DENSITY**). Device will display density value (in t/m^3) which was last entered;
- Holding the button  pressed, press the buttons  (**DOWN**) or  (**UP**) to adjust desired value for density. Long pressing on these buttons will provoke faster change of parameter in desired direction;
- Release all buttons. After this, device will again display currently measured wood moisture content.



5.2 WOOD THICKNESS parameter setting

Second essential parameter for correct moisture content measurement is thickness of the wooden sample. Measured MC value greatly depends on this parameter (especially when thinner samples are used - thinner than 15 mm), so it is required to determine the thickness as precise as possible. Value is entered in **mm** and in range **0.5 to 40 mm**.

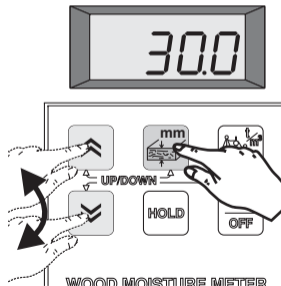
Thickness parameter setting is performed similar to wood density (type) parameter setting:

- Press and hold pressed button  (**WOOD THICKNESS**). Device will display value (in mm) which was entered during last parameter set-up;

- Keeping the button  pressed, press the buttons  (**DOWN**)

or  (**UP**) to adjust desired value. Long pressing on these buttons will provoke faster change of parameter in desired direction;

- Release all buttons. After this, device will again display currently measured wood moisture content.



After these procedures, all needed parameters are loaded in meter's memory.

Once entered, these parameters remain stored in the memory and they are active until next adjustment.

In case there is no need to change these parameters frequently, it is enough just to check these values before each measurement and proceed with measurement immediately.

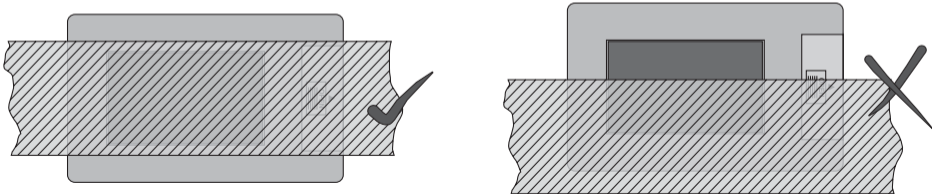
6. WOOD MOISTURE CONTENT MEASUREMENT

Wood moisture content measurement is main purpose of this device. Moisture content value is given in percentage (%) and displayed on LC display.

Measurement process is very simple and comes to (aside previously described adjustment) proper placing of the meter on the surface of wooden sample and reading of displayed value.

Proper placing of the meter on the surface of wooden sample means following:

- longer side of sensor plate must be parallel to wood fibers
- wooden sample must be wider than sensor plate and entire surface of sensor plate must be laid on wooden sample



Complete measurement procedure is performed in following way:

- Before the start of measurement turn the meter ON. Pay attention to autocalibration process which is performed automatically immediately after powering the meter (chapter 4);
- Check parameter settings for **WOOD DENSITY** and **WOOD THICKNESS** and correct the values if needed;
- Position the meter on the wooden sample (back side turned to sample), check if it is placed properly, gently press the meter and take a reading.

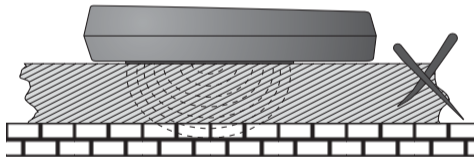
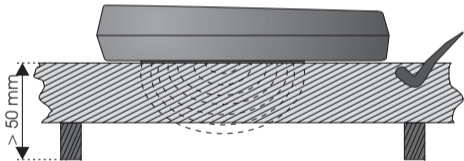
It is recommended to take a reading in several points (if conditions allow it) to achieve best possible knowledge of actual moisture content and its distribution throughout entire wooden sample.

After wood moisture content measurement is finished, turn the meter OFF in order to preserve battery.

6.1 Timber MC measurement procedure

For accurate MC measurement in timber boards following must be payed attention to:

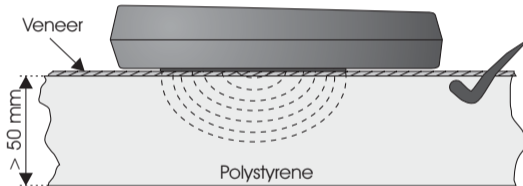
- Moisture distribution along depth of the board should be uniform (board surface must not be dried due to exposure to direct sun light or during extensive drying. If necessary, cut the sample in half).
- Place the board (sample) on wooden bars to avoid the influence of the ground on the measurement. Thick piece of polystyrene (styropor) can be used instead of bars.



6.2 Veneer MC measurement procedure

Veneer MC measurement is very specific, so it is required to perform following preparation for accurate reading.

- Precisely determine sample thickness, because thickness parameter has great influence for thin samples.
- Place veneer sample on expanded polystyrene layer at least 50 mm thick (polystyrene does not influence measuring!).




NOTES:

- Powering ON should be performed while meter is placed on the polystyrene layer (without veneer sample beneath meter). Remove hands aside and avoid moving near the meter during autocalibration procedure.
- It is more accurate to measure MC of multiple veneer layers (at least 3) with adequate thickness selection.
- In case veneer is already stacked, set the thickness to 40 mm (best is to avoid this kind of measurement).

6.3 HOLD function

Function **HOLD** is very useful in cases where timber sample is partially unaccessible, so it is impossible to see the display directly, but it is possible to reach the sample with the meter.

During measurement, after the meter is positioned properly and measurement conditions are stable, press  button. Meter will now freeze the measured value on the display, so it is readable even after the meter is removed from the wooden sample.

Turning the "frozen" display OFF is performed in the same way like turning ON, with the press of the button  .

7. MAINTENANCE AND BATTERY REPLACEMENT

Portable meter **DVD-240** has plastic housing which under normal exploitation conditions provide necessary mechanical firmness and protection. Rough manipulation, hitting and exposing the meter to extreme conditions (high temperature, high humidity, offensive chemicals, high mechanical tensions, etc) should be avoided. Do not open the device and perform unauthorized service because it can damage device and corrupt measuring accuracy.

Do not place stickers or other materials on sensor plate because it will corrupt measuring accuracy.

Device is supplied by one standard 9V alkaline battery. It is placed inside the housing in separate battery compartment which can be accessed from the back side of device. When low battery is detected, "LO BAT" symbol is displayed in upper left corner of the LC display.

Empty battery should be replaced with new one, same type.



8. APPENDIX**8.1 Appendix 1: Additional information regarding wood density and wood moisture content**

Wood density is given for wood specie (type) in absolutely dry condition (0% moisture content) and is expressed in t/m^3 or g/cm^3 . It is calculated as weight of absolutely dry wooden sample divided by its volume.

This density is often given as constant value for specific wood type from specific climate and it represents important data for wood moisture content measurement.

Wood moisture content for a given sample of wood is defined as the weight of water in wood expressed as a percentage of the weight of wood fibrous material (which is the weight of the absolutely dry sample). The moisture content is calculated by the following equation:

$$u (\%) = (m_u - m_o) / m_o \times 100$$

where:

$u (\%)$ - equals wood moisture content (MC)

m_u - equals weight of wet sample

m_o - equals weight of absolutely dry sample

i.e., wood moisture content (MC) in wooden sample equals weight of existent moisture content in sample divided with weight of absolutely dry (same) sample and multiplied by 100.

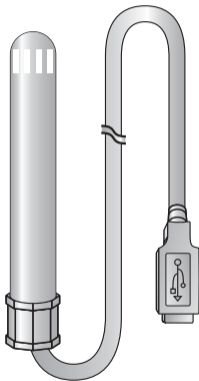
8.2 Appendix 2: Wood density table

WOOD SPECIE	DENSITY (t/m ³)			WOOD SPECIE	DENSITY (t/m ³)		
	min	average	max		min	average	max
Abachi (Samba)	0.25	0.35	0.52	Birch	0.46	0.6	0.8
Abura		0.5		Camphorwood	0.5	0.55	0.6
Acacia	0.6	0.65	0.75	Cedar	0.35	0.45	0.55
Afara, White		0.45		Cherry	0.52	0.55	0.62
Afrormosia		0.65		Chestnut	0.4	0.5	0.55
Agathis		0.45		Cypress		0.4	
Alder	0.45	0.4	0.6	Daru Daru		0.90	
Ash	0.41	0.65	0.82	Durian		0.60	
Atlas	0.6	0.75	0.85	Ebony	0.7	0.85	1.0
Balau		0.85		Elm	0.52	0.6	0.64
Balsa		0.2		Fir, Silver, Douglas	0.32	0.45	0.71
Beech	0.49	0.65	0.88	Hickory	0.66	0.7	0.8
Beech, Chilean		0.45		Hornbeam		0.8	
Bintangor		0.60		Iroko		0.6	

WOOD SPECIE	DENSITY (t/m ³)			WOOD SPECIE	DENSITY (t/m ³)		
	min	average	max		min	average	max
Ivory Wood, Pink		0.8		Mahogany, African	0.41	0.5	0.9
Jelutong		0.45		Mahogany, Sapelli		0.65	
Juniper	0.3	0.4	0.64	Mahogany, White		0.45	
Kapur		0.75		Mahogany, Philippines		0.55	
Kekatang		0.82		Mango Wood		0.55	
Kempass		0.72		Maple	0.48	0.6	0.75
KerANJI		0.80		Meranti, Dark Red	0.4	0.6	0.63
Keruing		0.78		Meranti, Light Red		0.54	
Kranji		0.75		Meranti, White		0.58	
Kulim		0.78		Merawan		0.70	
Larch	0.4	0.5	0.82	Merbau		0.85	
Laurel, Chilean	0.45	0.48	0.5	Niangon		0.6	
Linden (Lime)	0.32	0.45	0.56	Nyatoh (Balam)		0.65	
Magnolia		0.5		Oak, European	0.39	0.65	0.93

WOOD SPECIE	DENSITY (t/m ³)			WOOD SPECIE	DENSITY (t/m ³)		
	min	average	max		min	average	max
Okume	0.31	0.4	0.57	Rosewood		0.80	
Olive Tree		0.75		Rubberwood		0.55	
Padauk		0.7		Seminai		0.95	
Palisander		0.7		Sequoia		0.35	
Pear	0.55	0.65	0.76	Seraya		0.50	
Perupok		0.50		Spruce		0.40	
Pine	0.38	0.45	0.48	Teak		0.60	
Pine, White, Yellow		0.35		Teak, Rhodesian		0.8	
Plum		0.7		Ulin		0.95	
Poplar	0.36	0.4	0.56	Walnut, African		0.45	
Pulai		0.45		Walnut, European	0.45	0.65	0.75
Punak		0.72		Willow, White		0.4	
Pyinkado		0.82		Yew	0.61	0.65	0.74
Ramin		0.52		Zebrano		0.65	

9. AIR TEMPERATURE AND RELATIVE HUMIDITY MEASUREMENT (OPTIONAL)



DSVT-03 PROBE GENERAL CHARACTERISTICS

Power supply	From DVD-240
Tube dimensions (D(mm) / Ø)	140 / 22
Cable length / connector	2m / USB type
Operating conditions	T: $-20 \div 80$ °C; RH: $0 \div 100\%$
Storage	T: $-40 \div 70$ °C; RH: $5 \div 90\%$
Weight	85 g

MEASUREMENT

Output signal	Digital, encoded
Temperature accuracy	Class 1
Relative humidity accuracy	Class 2

On customer request, probe **DSVT-03** for air temperature and relative humidity measurement is delivered. In that case, additional connector for connection of this probe (USB type) is installed on moisture meter **DVD-240**.

9.1 Air temperature and relative humidity measurement procedure

Air temperature and relative humidity measurement using portable moisture meter **DVD-240** and probe for air temperature and relative humidity **DSVT-03** is very simple and quick. It is only required to connect the probe to universal portable moisture meter **DVD-240** via special USB type connector, turn the meter on and press the button



to read current air temperature (in °C), i.e., press the button



to read current air humidity (in %).

It is required to wait at least 1 minute before initial measurement in order to allow the sensor inside the probe to adopt to ambient conditions (if it was previously stored on significantly different temperature or humidity). Also, for more accurate measurement, if hole measurement set is taken from cold into warm room, it should be left for short time (several minutes) to adopt, and then proceed with measurement.

During temperature and humidity measurement inside the dryer, probe body should be placed inside the chamber, while part of cable with connector and portable meter is held outside of it. This is precaution measure to avoid damaging the meter if operating conditions are exceeded. Measurement should be performed after sensor is adopted to ambient conditions inside the chamber (few minutes).

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