

# **The meter GL2M type intended to moisture & relative permittivity measurements of the soft and thin layer**



The GL2M is very accurate and sensitive metering unit intended to determine moisture content in the tea leaf.

Every single measurement pertain to measure single layer (single leaf) - see addendum "A" of the manual.

Additionally are once taken also measurements of leaf body thickness and temperature, also air ambient relative humidity and temperature as well.

Before every measurement is essentially to run the calibration procedure.

To protect against potential errors is not possible to pass over it.

Mentioned procedure removes all ambient temperature and moisture influences on mechanical parameters of sensitive thickness sensor.

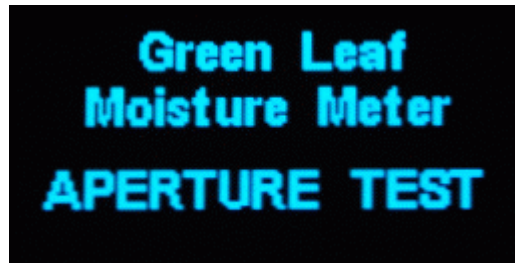
In case of big mechanical stress, like rapid drop the unit on the floor or on the desk would be required to take more detailed calibration doings described in the attached "thickness sensor calibration" point.

Driving down the external arm equipped with OLED display bring the meter to work and simultaneously bring also to taking hold of the sample inserted in to the measuring aperture. The internal arm touch the leaf body with controlled force about 1N regardless of the pushing force applyied on the external arm, defined further as " possible lowest force".

## 1.Starting the calibration procedures:

Before running the unit, the measuring aperture must be free of dust and other substances.

To start - PUSH and continue pushing the arm (with possible lowest force), you hear the 2kHz sound and see at the display the message as below:



If the aperture is clear and empty the GL2M proceed the thickness calibration state. If not, the procedure will restart. For positive check, the procedure takes about three second duration, at the end you hear short "chirp" and stop of the 2kHz sound, next see at the display:



The arrow inform that you need stop push the arm and let the arm lift up itself. Whenever the unit detect that the arm is lifted up you hear the 2kHz sound and see at the display:



The GL2M inform that now is in the offset calibration state. The procedure takes up to one second. duration, at the end you hear next short "chirp" , stop of the 2kHz sound and see the display:

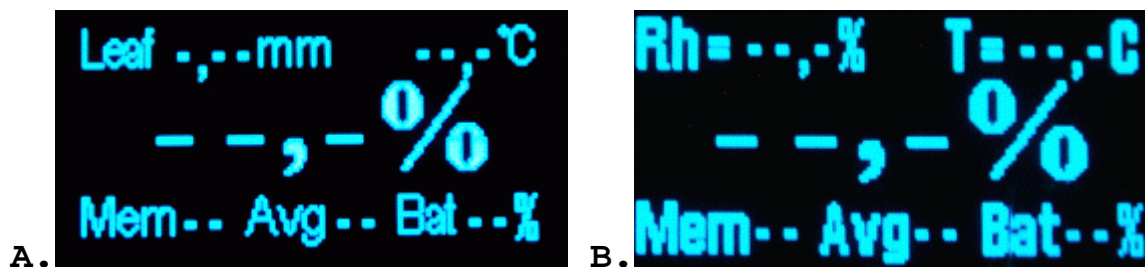


The arrow inform that you need again to push and continue pushing the arm (with possible lowest force).

Before you will push the arm you have to decide:

- a. to end the callibration procedure - the aperture must be still empty.
- b. to perform the thickness callibration you should to insert in to the aperture the attached stainless steel roundel with calibrated thickness - exact 1,000mm.

On push you hear the 2kHz sound again. The GL2M inform that finally is in the reference calibration state. The procedure takes last one second duration, at the end you hear short "chirp" and stop of the 2kHz sound, the display show one of 2 possible screens:



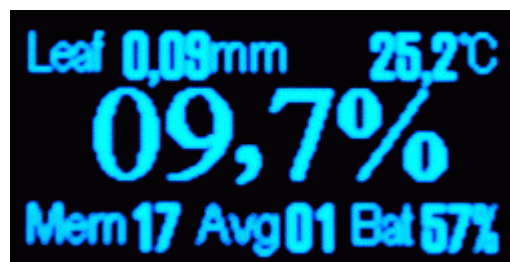
Screen "A" inform that the GL2M is ready to measure the leaf moisture content and also leaf body thickness and leaf temperature as well, screen "B" inform that the GL2M is ready to measure the leaf moisture content and also the ambient air relative humidity and ambient air temperature as well. With help of PC software the user can select desired option.

**Caution:** If at any step of described calibrations you will stop manipulate the unit - the GL2M will automatically switch off after 5s. or 13s. depending on present calibration state.

## 2. Taking the measurement:

Let insert the leaf body in to the sensor aperture. Please pay attention to place the leaf body on the mirrored central point of the plastic red stand-off. In front of this point, at the upper arm is located the infrared temperature sensor which must "see" the leaf body to determine the leaf temperature. It is needful to provide accurate moisture content enumerations.

Next push and continue pushing the arm (with possible lowest force). The measurement takes about two second duration, at the end you hear short chirp and see at the display the data like example below:



Every measurement is automatically stored in one of 30 memory banks. At the above screen can see that presently, the working memory bank has the number "17".

The GL2M is programmed to take up to 16 different measurements with current averaging of all results in to the destinated memory bank.

The averaged values are: leaf moisture content, the leaf body thickness and leaf body temperature as well.

At the screen you can see the averaged results and also the current average number, at above screen it is "01".

The readiness duration between every measurement is no longer than 13s. After 16th measurement or after the measurement duration readiness state greather than 13s. the G2LM will switch off with increasing about one the number of working memory bank, for instance: 1 to 2,,, 29 to 30, and 30 again to 1.

If in course of the measurement duration period the user will simply push and close the arm without any leaf inserted in to the sensor aperture, the GL2M will automatically restart new callibration procedure preceding next measurement readiness. All without change of the working memory bank number. This option protects again "waste" the memory bank in case of bad or improper done measurement, for example after measurement realized with not acurately inserted leafe.

If the user's concern is to take measurement without averaging, is possible to realize it by closing the arm after (as described) every separate measurement or letting the GL2M to switch off automatically after 15s.

### **3.Charging the battery:**

The unit is powered with help of 3pcs. of AAA type rechargeable Ni-MH batteries. The state of capacity is focused at the display, like at the above example 57%. Below 10% of capacity the unit will automatically switch off, therefore to ensure working continuity is good to keep charged batteries as is only possible.

To charge batteries, is provided the micro USB socket available at the body of GL2M. The charging process will begin after connection with any USB plug from the working PC or external +5V/300mA charger.

**Caution:** During the charging process the unit can't measue anything except the battery state.

**Caution:** It can be used any +5V Battery Charger equiped with micro USB plug, for example cell phone charger.

The maximum charging time is less than 3 hours, the charging process is fully controlled through GL2M microcontroller and the charging state is shown at the display as next below:



To carry out the charge is required to connect the powered USB in to the GL2M USB socket. If the unit was in measurement readiness duration state or totally switched off the charging process will start accordingly, the display will show as above.

When the batteries achieve the maximum charge, the display will show 99% and the charging process will start to work in standby mode.

Therefore is possible to charge the batteries without paying attention on the process.

#### **4. Removing the batteries:**

In the reason of batteries malfunction or potential possible hardware electronics jamm - when the unit do not respond on any task described earlier is essential to remove and replace (if necessary new) bateries set.

To do it, unscrew 2 visible bolts, slide out the plastic compartment, open it and remove batteries.

**Caution:** Never use other than rechargeable Ni-MH 1.2V battery types, othewise the unit electronics will damage.



## 5.Data collect and parameter setup software:

The windows PC software let the user to modify some of GL2M parameters, download, store and printout the GL2M memory data banks and also the potential firmware upgrade as well. After running the PC software - "GLM.EXE" the PC screen show the window as below:

Green Leaf Moisture Meter v. 1.06

**ASONIK** [firma@asonik.pl](mailto:firma@asonik.pl) [www.asonik.eu](http://www.asonik.eu)

Results

No.	Moisture content [%]	Temperature [°C]	Thickness [mm]	Permittivity
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				

Device info

Serial number

Manufacture date

No. of runs

Firmware upgrade

Constants

Kt

Ke

Km

Mode  
readout moisture + ambient temperature

Edit  Store

Measurements

Clear  Save  Print

Connect  Close

Now connect the PC USB plug with GL2M USB socket. The connection procedure is the same as described by battery charging process. Firstly, after connection the GL2M display will show the battery charge screen. Next, after pushing the "Connect" button, just after come in to contact the GL2M display will show:



For the battery state safety the display shows also the battery charge state, in course of PC data connection the batteries are not charged.

Simultaneously the PC screen will (as example) show:

No.	Moisture content [%]	Temperature [°C]	Thickness [mm]	Permittivity
1	22,2	22,0	0,231	17,65
2	16,0	22,1	0,221	12,69
3	15,7	22,6	0,266	12,44
4	13,5	22,9	0,147	10,71
5				
6	16,2	22,7	0,181	12,84
7				
8	0,0	22,7	0,410	0,01
9	13,5	22,9	0,143	10,65
10	12,5	23,1	0,121	9,87
11	17,1	23,1	0,251	13,50
12	4,4	23,2	0,101	3,46
13	14,9	23,4	0,409	11,74
14	6,3	23,8	0,170	4,93
15	82,0	24,6	1,737	64,31
16	11,7	24,1	0,208	9,16
17	9,8	25,2	0,097	7,64
18	3,4	23,9	0,037	2,65
19	10,7	23,4	0,153	8,40
20	4,4	24,4	0,038	3,42
21	10,7	23,7	0,121	8,47
22	9,7	23,7	0,110	7,61
23	11,1	22,8	0,248	8,75
24				
25				
26				
27				
28				
29				
30				

To disconnect - push the button "Disconnect".

To save the shown data table in to the PC files as "CSV" format - push the button "Save".

To printout on the attached printer or in the PDF format the shown data table - push the button "Print"

To clear the data table and simultaneously clear all GL2M data banks - push the button "Clear".

To switch between different GL2M working modes - push the button "Edit", select the desired option and push the button "Store"

The constants as "Kt", "Ke", "Km" are changable only in colaboration with ASONIK service specialists.

The firmware upgrade is possible only if available and exclusively in touch with ASONIK.




## **6.Thickness sensor calibration:**

In case of the thickness sensor mechanical deregulation is necessary to correct potential measurement errors. To fix the problem let measure any thin layer with known thickness.

The value should be in range between 0.20mm and 0.50mm. Next, with help of GLM software, change the parameter described as "Kt" to obtain as a result the exact measured value which corresponds the reference thickness.

Another thickness calibration method is described in point 1. connected with initial calibration procedures. In this case you must-have the attached stainless steel roundel with calibrated thickness - exact 1,000mm.

## 7. Technical Specification:

1. The meter designed for moisture content determination in tea leafes.
2. Relative permittivity measured range: 0,9 to 99,9
3. Relative permittivity measurement resolution: 0,1
4. Relative permittivity measurement max error < 2%  $\pm 0.1$
5. Leaf temperature measurement range: 0,1°C to 60,0°C
6. IR Leaf temperature measurement method, resolution 0,1°C
7. Leaf moisture content region of interest: 1,0% to 99,9%
8. Leaf moisture content measurement resolution: 0,1%
9. Leaf moisture content measurement error < 2%  $\pm 0.1$
10. Leaf thickness measurement range: 0,010mm up to 2,000mm
11. Leaf thickness measurement resolution: 0,001mm
12. Leaf thickness measurement error < 1%  $\pm 0.01$ mm
13. Press force on measured layer: 1,0N
14. Readout display: OLED 128 x 64 dots
15. Data interface: USB (micro USB socket)
16. Powering: 3 x Ni-MH 1.2V AAA cells("ReadyToUse" or "ReCyko")
17. Battery charge - built in charging controll.
18. External charge power source:  
+5V/300mA with micro USB power plug source
19. Calibration duration: up to 5 sec.
20. Measurement duration: up to 2 sec.
21. Measurement mode with current averaging up to 16 cycles
22. Built in memory for 30 readouts
23. Ambient air temperature and Rh measurement option
24. Ambient air temperature range: -40°C to + 60°C
25. Ambient temperature measurement accuracy tolerance:  $\pm 0,2^{\circ}\text{C}$
26. Ambient air Rh range: 0 to 99.9%
27. Ambient air Rh measurement accuracy:  $\pm 2\%$
28. One button handling - **ASONIK** created algorithm
29. Total weight: 500g
30. Dimensions: 45mm x 45mm x 125mm
31. Used materials: stainless steel, bronze, nylon, teflon
32. Food Grade approval
33. CE requirements
34. PC offtware  available: [GL2M v1.09](http://www.asonik.pl)

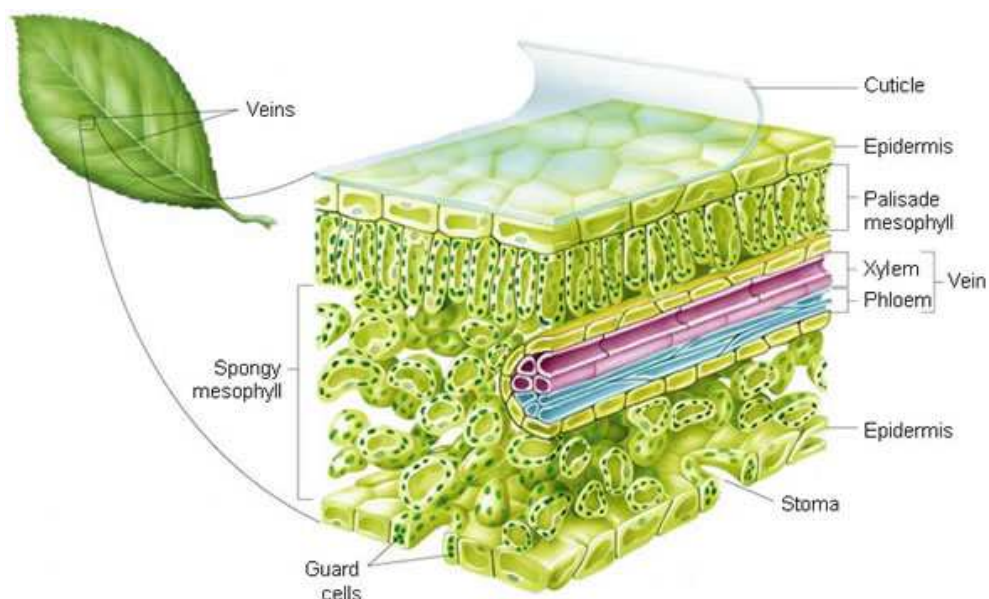
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# ASONIK

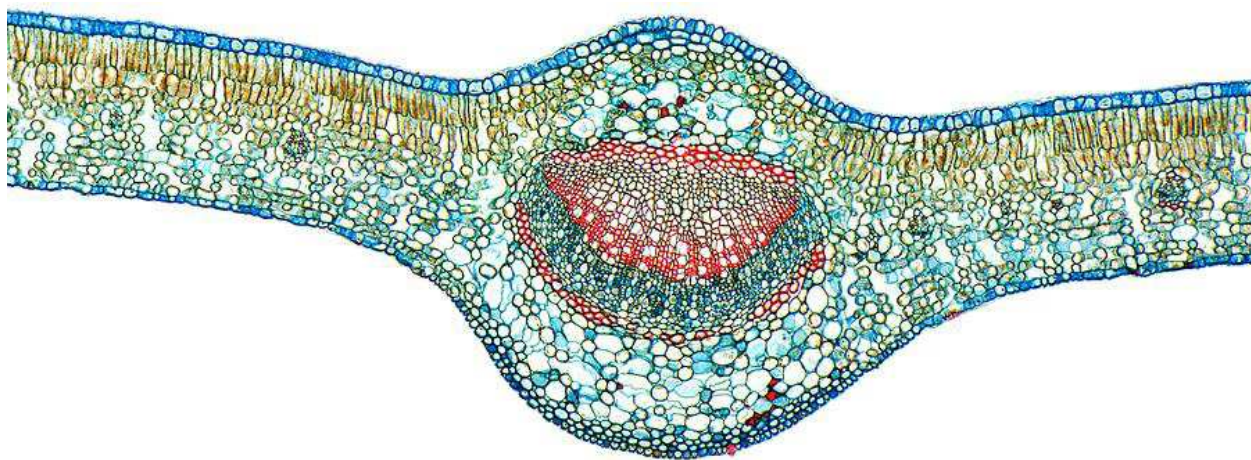
<http://www.asonik.pl> <mailto:asonik@asonik.pl>  
**POLAND, PL-62007 Tuczno, str. Słoneczna 6.**  
**Tel./Fax +48 61 8156261, Mobile:+48 509993249**

## Addendum "A".

Tea leaf anatomy with example of the common leaf anatomy:



Colorized tea leaf cross-section (scanning electron microscope):



The GL2M unit determine the water content as a result of measure the dielectric property of the part of leaf. It depends on place of test. Within every species of leaf, the anatomy is repetitive. Therefore taking measurement in a few parts of leaf (or many leafes in succesion), next averaging the results - is possible to obtain the very good approximation of dielectric constant right for the leaf, the water content as well.

Placing in the measuring aperture many leafes at once lead to false results because the serially placed few leafes are buliding other than on above drawings, nonroutine and incalculable spatial distribution of leaf particles. It preclude to take real measurements by GL2M.