



SmartTest Series
Hand held MS2123 Moisture Series

Water Activity/Moisture Analyzer

Ref: HMS2123sWA_DS_E
Version: 2002-08-11

Ideal for low budget laboratories and quality control in the production

Gas RH, AH, Dew-point measurement

Liquid water activity and moisture analysis

Solid water activity and moisture analysis

- CPU Based Professional Intelligent Analyzer
- Multi-functions, Water Activity, Moisture/humidity, Temperature, pH and Conductance
- Versatile applications, for gases, liquids and solids with the same instruments, both for Laboratory Test or Field Smart Test
- Rugged design with Scientific algorithm for high accuracy
- Self diagnostic, professional intelligent, Menu-driven digital user interface
- Auto diagnostic and alarm
- Data log of measurements, read and print out, or download to PC supported

The instrument includes carrying case, sample holder, disposable sample cups, humidity calibration standards.

Optional samplers and Analyzing software for various application's choice.

HBD5ms2100 analyzer accepts a large choice of probes, suitable for the direct measurement of products in bulk and other applications.

For liquid measurement special, refer to H-IMS2123N_DS_E "Hand-held BD5 IMS2123N

Trace Moisture Analyzer"

Water is Activity Definition

Water activity is actually a new metrology point of view for moisture content.

Water activity A_w (or equilibrium relative humidity %ERH) measures the vapor pressure generated by the moisture present in a hygroscopic product.

$A_w = p / p_s$ and $\%ERH = 100 \times A_w$, where:

p : partial pressure of water vapor at the surface of the product

p_s : saturation pressure, or the partial pressure of water vapor above pure water at the product temperature

Water activity reflects the active part of moisture content or the part which, under normal circumstances, can be exchanged between the product and its environment.

Water activity is usually defined under static conditions of equilibrium.

Under such conditions, the partial pressure of water vapor (p) at the surface of the product is equal to the partial pressure of water vapor in the immediate environment of the product. Any exchange of moisture between the product and its environment is driven by a difference between these two partial pressures.

Accelerated water activity measurement in typically 5 minutes

Conventional water activity measurement with automatic detection of equilibrium. It lasts 10-60mins for various samples

How to Gauge the Moisture

First user must calibrate the instrument with the saturated sample at beginning. The data would be recorded by analyzer for future usage. Then for high moisture application, the analyzer can calculate the moisture directly by the measured activity data.

But for trace moisture analysis, user need to order MS2123-Vap Kit. By heating the sample and measure the difference of partial pressure of water vapor at the surface of the sample, to calculate the moisture content.



Typical Applications

- Food industry;
- Pharmaceutical and chemical industry
- photographic film industry
- metallurgy, crystalloid process
- coatings, plastic moulding

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- hygroscopic powders, pills, paper

Operation

The HBD5MS2123 Analyzer Set is simple to use:

1) From the keypad of the HBD5MS2100 Analyzer, use the MENU key to select the measuring mode.

Note: the HBD5MS2100 automatically remembers the last selected mode.

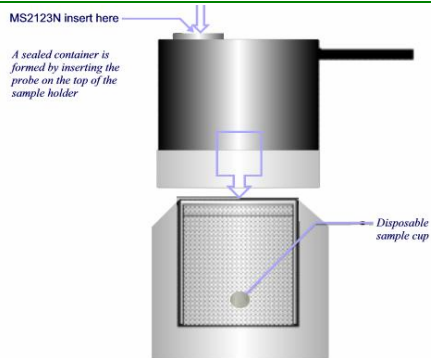
2) Sample

MS2123N-Cap

Insert the MS2123Ncap into the powder sample.

MS2123N-Clamp and/or Vap Kit

Place the sample inside the sample holder. Put the probe on top of the sample holder.



3) AwSmart or AwE mode: start the measurement by pressing on the ENTER key (keypad of the HBD5MS2100)

Example: on the bottom line of the display, the AwSmart mode is indicated by "AwSmart", followed by the time into the measurement and by the letter "Running" (process is running)

AwSmart: 00:02:20
0.500Aw. 22.00°C. R

4) When the measurement is ended, the display freezes. the letter "F" indicates that the process has stopped.

AwSmart: 00:02:20
0.500Aw. 22.00°C. F

5) Press the ENTER key to clear the display and to be ready for the next measurement

Testing Mode

The HBD5MS2100NC is a battery operated water activity Analyzer with a single probe input. It features three operating modes:

WASmart: accelerated water activity measurement with automatic end of measurement.

WAE: conventional water activity measurement with automatic detection of equilibrium and automatic end of measurement

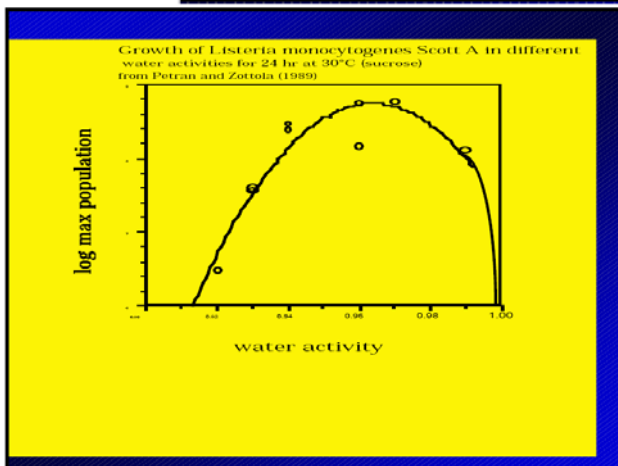
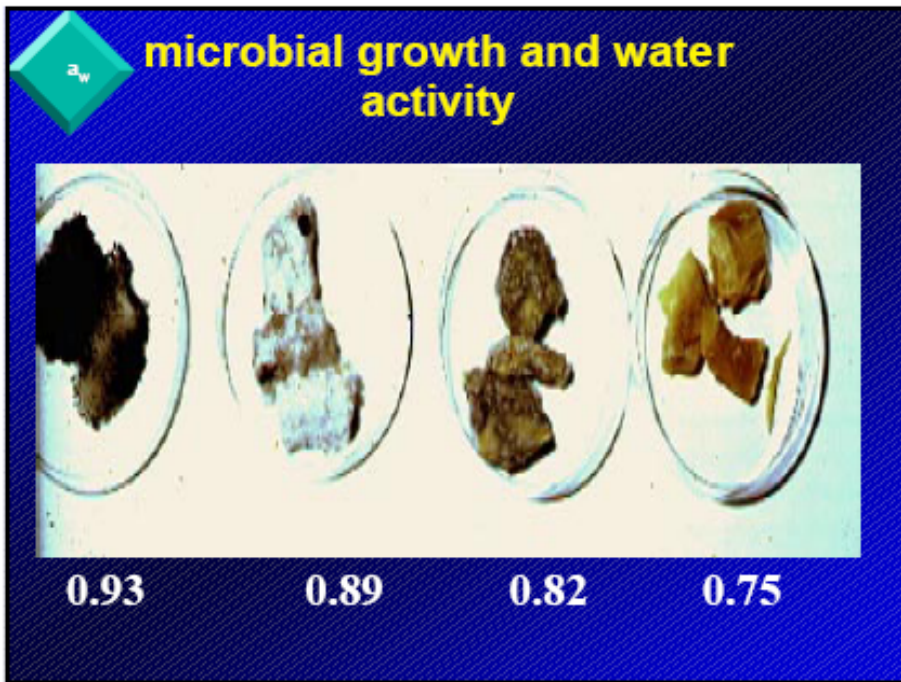
Standard: water activity and temperature measurement, limited to just indicating the values and the trend of the values

VapWay: Heating the sample to set temperature, then measure the moisture. Only used for trace solid moisture analysis.

The MS2123NC is compatible with all the models of MS2123 probes to permit the direct measurement of products in bulk and quality control of packaging materials.

The probes used with the HBD5MS2123 analyzer can be calibrated and adjusted at one or more points, directly from the instrument keypad. Reference humidity values are provided by using the humidity standards.

When used with an external AC adapter, this allows powering the instrument without draining the battery. Battery charging is possible with the appropriate type of battery.



a_w Microbial limits

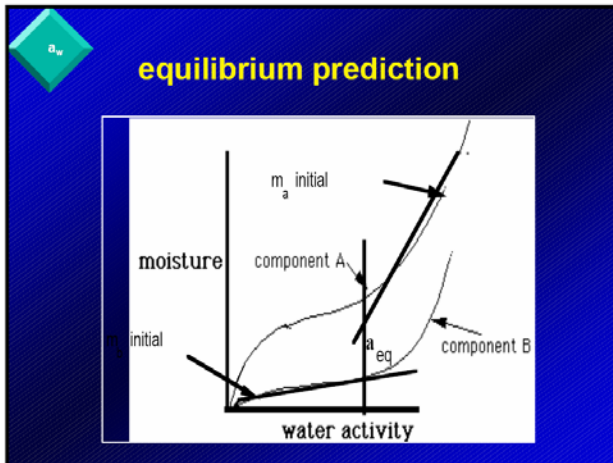
◆ **Preservation a_w Limits**

- bacteria ~ 0.91
- yeast ~ 0.88
- molds ~ 0.7
- all microbes ~ 0.6

The relations to limit the growth of Microorganisms on food

| Range of a_w | Microorganisms Generally Inhibited by Lowest a_w in This Range | Foods Generally within This Range |
|----------------|--|---|
| 1.00 – 0.95 | <i>Pseudomonas</i> , <i>Escherichia</i> , <i>Proteus</i> , <i>Shigella</i> , <i>Klebsiella</i> , <i>Bacillus</i> , <i>Clostridium perfringens</i> , some yeasts | Highly perishable (fresh) foods and canned fruits, vegetables, meat, fish, and milk |
| 0.95 – 0.91 | <i>Salmonella</i> , <i>Vibrio parahaemolyticus</i> , <i>C. botulinum</i> , <i>Serratia</i> , <i>Lactobacillus</i> , <i>Pediococcus</i> , some molds, yeasts (<i>Rhodotorula</i> , <i>Pichia</i>) | Some cheeses (Cheddar, Swiss, Muenster, Provolone), cured meat (ham) |
| 0.91 – 0.87 | Many yeasts (<i>Candida</i> , <i>Torulopsis</i> , <i>Hansenula</i>), <i>Micrococcus</i> | Fermented sausage (salami), sponge cakes, dry cheeses, margarine |
| 0.87 – 0.80 | Most molds (mycotoxigenic penicillia), <i>Staphylococcus aureus</i> , most <i>Saccharomyces</i> (<i>bailii</i>) spp., <i>Debaryomyces</i> | Fruit juice concentrates, sweetened condensed milk, syrups |
| 0.80 – 0.75 | Most halophilic bacteria, mycotoxigenic aspergilli | Jam, marmalade |
| 0.75 – 0.65 | Xerophilic molds (<i>Aspergillus chevalieri</i> , <i>A. candidus</i> , <i>Wallemia sebi</i>), <i>Saccharomyces bisporus</i> | Jelly, molasses, raw cane sugar, some dried fruits, nuts |
| 0.65 – 0.60 | Osmophilic yeasts (<i>Saccharomyces rouxii</i>), few molds (<i>Aspergillus echinulatus</i> , <i>Monascus bisporus</i>) | Dried fruits containing 15-20% moisture; some toffees and caramels; honey |
| <0.60 | No microbial proliferation | |

Moisture Analysis via water activity



water adsorption comparison

Sorption Data g water/ 100 g solids @ 25°C

| a _w | cellulose | gelatin | bran | xanthan | sucrose | RTE |
|----------------|-----------|---------|------|---------|---------|-----|
| 0.11 | 2.1 | 5 | 3.7 | 6.8 | 0.01 | 3 |
| 0.32 | 4 | 7 | 5.2 | 11 | 0.3 | 4 |
| 0.44 | 5 | 9 | 8.1 | 12.6 | 0.6 | 5.5 |
| 0.54 | 6 | 18 | 8.6 | 15.4 | 1.6 | 7 |
| 0.75 | 8.6 | 28 | 12.8 | 26.3 | 0.4 | 15 |
| 0.86 | 12.4 | 41 | 16 | 36.7 | 44.5 | 33 |

solute limitations

| solute | max solubility % | a _w @ max |
|----------|------------------|----------------------|
| lactose | 20 | 0.97 |
| glucose | 47 | 0.92 |
| KCl | 27 | 0.86 |
| Sucrose | 69 | 0.86 |
| sorbitol | 70 | 0.79 |
| NaCl | 26 | 0.75 |
| fructose | 75 | 0.63 |
| glycerol | 100 | 0 |

non-ideality

Sucrose water activity lowering

| g/ kg water | ideal a _w | actual a _w | γ | % sucrose |
|-------------|----------------------|-----------------------|-------|-----------|
| 116 | 0.994 | 0.994 | 1 | 10.4 |
| 342 | 0.982 | 0.980 | 0.998 | 25.5 |
| 1368 | 0.932 | 0.904 | 0.97 | 57.8 |
| 2322 | 0.891 | 0.814 | 0.914 | 69.9 |

Solute Effects - Raoult's Law

$$a_w = \gamma X_{water} = \gamma \frac{n_{water}}{n_{water} + n_{solute}}$$

assumes no interaction-
colligative (#) effect same as bp rise
or fp depression

proportional to molecular weight of
dissolved solute species

non-ideality of solute

Instrument Overview

The HBD5ms2123NC analyzer Set consists of the following items:

HBD5ms2100 Analyzer

| | | |
|----------------------|--|------------------|
| MS2123N probe | Universal for the measurement of gas, liquid, and solid product samples | |
| Application assembly | additional probes accessories | order separately |
| Special sensors | additional probes | order separately |
| Standard's Kit | 1 box each EA35 (35 %RH) and EA80 (80%RH) humidity calibration standards | |
| Carrying case | | |

Analyzer Series

| Items | Foods water activity test | Packing Safety kit ①Water activity ②pH ③Conductance | Moisture and water activity test powder ①Water activity ②Moisture | Moisture and water of activity test of tobacco alike loose materials and it's package | Full function |
|-----------------------------|---|--|---|---|-----------------|
| Analyzer | HBD5ms2100 WA | HBD5ms2100 WA | HBD5ms2100 sMS | HBD5ms2100 sMS | HBD5ms2100MS |
| Probe | MS2123-Clamp Kit | MS2123-Clamp Kit +pH kit+SCT kit | MS2123-Clamp Kit | AW2123Poke | H-MS2123N |
| Accessory spare needed | part in 5 years; Order fittings if needed | not spare needed | part in 5 years; Order fittings if needed | not spare needed | part not needed |
| Standards Order preparation | or user | Order preparation | or user | Order preparation | or user |
| Package needed | | needed | needed | needed | Needed |

Probes

Standard probe – order separately



H-MS2123N Probe

Universal sensor for gases, liquids, solids application
 Size: Dia.: Ø24; Length:300mm
 Weight: 300g
 Working temperature: <85 °C
 Environ temperature: <70 °C
 Sensors included



H-MS2123NP Probe

Universal sensor for industrial gases, liquids, and for solids application with MS2123N-Cap
 Size: Dia.: Ø24; Length:300mm
 Weight: 300g
 Working temperature: <85 °C
 Sampling Pressure: <1.0MPa
 Environ temperature: <70 °C
 Sensors included



H-MS2123N-HT Probe

Universal sensor for gases, liquids, solids application
 Size: Dia.: Ø24; Length:300mm
 Weight: 300g
 Working temperature: <300 °C
 Environ temperature: <70 °C
 Sensors included



H-MS2123NP-HT Probe

Universal sensor for industrial high temperature gases, liquids, solids application
 Size: Dia.: Ø24; Length:300mm
 Weight: 300g
 Working temperature: <300 °C
 Sampling Pressure: <1.0MPa
 Environ temperature: <70 °C
 Sensors included

Additional probes accessories – order separately



FixFit NPT 1"

For fixing to pipe or temporary device.
 Also needed for AW2123N-Cap
 Size: Dia.: Ø42; Length:30mm
 Weight: 300g
 Connect: NPT1"/ZG1".
 Material: SUS316



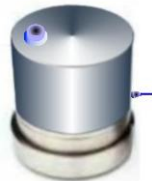
MS2123N-Cap

For powder samples, attached to HMS2123N



MS2123-Clamp Kit

for measurement of powder and bulk samples
 Requires use of a sample holder and disposable sample cups
 Sensors included



MS2123-Vap Kit

for measurement of powder and bulk samples with vaporization of the crystallized water internal of the samples.
 Heating Temperature:70°C, Max < 120 °C
 Requires use of a sample holder and disposable sample cups, supply of 300W AC power.
 Sensors included

Additional probes



AW2123Poke insertion probe

for the direct measurement of materials in bulk: powders, granules, grain and seeds
 max. 85 °C
 sintered steel filter
 tube length: 280 (11"), d: 10mm (0.4")
 cable: 2m (6.5ft)
 Sensors included



AW2123Lance sword probe

for measurement of packaging materials such as paper or cardboard stacks/rolls
 max. 85 °C
 blade length: 280 (11"), width: 18mm (0.7"), thickness.: 4mm (0.16")
 cable: 2m (6.5ft)
 Sensors included

Computer Software

| | | |
|----------------------|------------|---|
| Computer Acquisition | Win98.1-MS | RS485, STIM/Modbus communication, IEEE1451.1 NCAP |
| RS485 Kit | | 232 to 485 converter for PC serial port. |

Sensors and Accessories

| | |
|--------------|---|
| MS2123M12T85 | Spare sensor for HMS2123N probe replacement |
|--------------|---|

| | |
|----------------|---|
| MS2123M12T100 | Spare sensor for HMS2123N probe replacement |
| MS2123M12T180 | Spare sensor for MS2123N probe replacement |
| MS2110M12T300 | Spare sensor for MS2110N probe replacement |
| H3229pH | pH sensors for food. |
| Standard's Kit | 1 box each EA35 (35 %RH) and EA80 (80%RH) humidity calibration standards |
| DSC Kit | Accessory for Clamp Kit and Vap Kit. Each pack consists of 100 disposable sample cups (14mm deep and or 40mm) |

Package: 460x340x135 mm; 286x230x110 mm

Net Weight: ~0.5 kg

Packaged Weight: ~2.5 kg



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