

VenScan LMS



**Inline moisture
measurement system for
impregnated papers**
(decorative papers, finish foils,
overlays, underlays, laminates,
balance papers)

- *Inline measurement from the first meter*
- *Independent of density due to 2-PMR technology*
- *Simple calibration in groups*
- *Robust and low-maintenance*

VenScan LMS

The VenScan LMS is an innovative system for in-process measurement of moisture of web-like products, such as impregnated paper, textiles, or films. It has been developed specially for this application. The system is installed at a suitable point in the production process. Fitted with an automatic motion facility, the sensor reliably finds the edge of the product even when product widths vary and it measures the water content there at predefined intervals. When required [for example, change of product], the measuring head can be withdrawn completely from the production process. This permits unhindered access to the production plant.

The VenScan LMS functions according to the 2-parameter microwave resonance method [2PMR], which is independent of the density. This method uses the dielectric behavior of bipolar water molecules in a high-frequency electromagnetic alternating field to determine their percentage proportion [moisture] in a solid. Because of the very low electric power of the sensor, approx. 20 mW, the measuring system does not present a health hazard even on direct contact with the skin and the material to be measured is not heated.

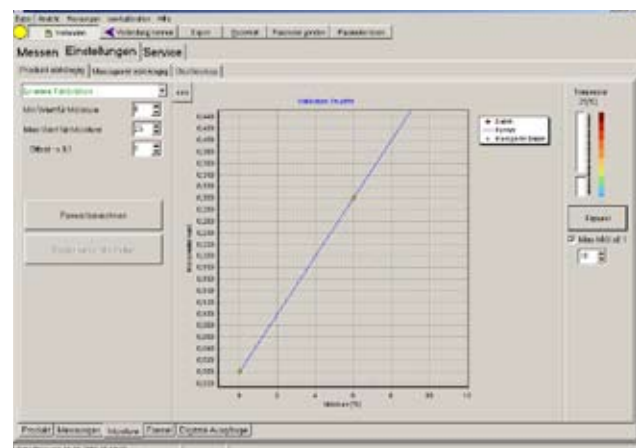
The measuring system can be simply calibrated by the user. The measurement data are displayed on the workstation supplied and can also be picked off as analog signals.

Features

- Inline moisture measurement of products forming webs
- Measurement of surface and core moisture independently of the density by means of 2-PMR technology
- Insensitivity to dust deposits
- Simple calibrations and compilation of product groups
- Long-term stability of calibration



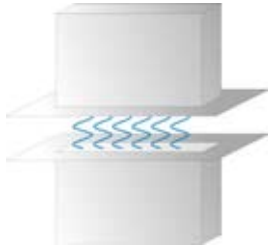
VenScan-LMS mounted behind the S-element (cooling roll)



The 2PMR Measuring Method

The moisture sensor of the VenScan LMS contains a tuned electromagnetic oscillating circuit and therefore constitutes a resonant system.

Fig. 1: Electromagnetic flux lines on a stray-field sensor



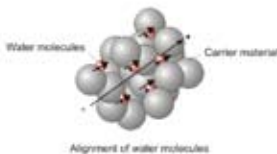
The measuring method is based on interactivity between the alternating electromagnetic field and the water molecules in the product. The water molecules in the product initially have random orientation.

Fig. 2: Water molecules are randomly oriented



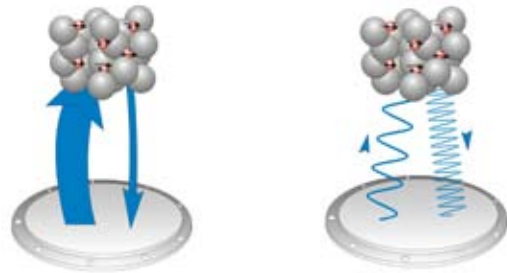
As a product with moisture content enters the alternating electromagnetic field of the measuring system, the water molecules are oriented toward the field [radio-frequency alternating field] because they behave like dipoles.

Fig. 3: Orientation of the water molecules



This transfers energy from the electromagnetic field to the product and reduces the propagation velocity of the electromagnetic wave.

Fig. 4: Energy transfer from field to the product Fig. 5: Reduction in propagation velocity



The system from which the excitation emanates therefore loses energy and the resonance frequency falls out of tune.

Fig. 6: Spectrum of resonances for various densities

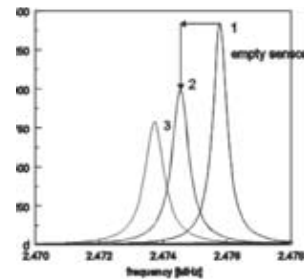
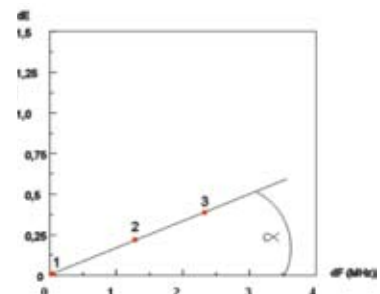


Fig. 7: Energy loss and frequency shift for various densities



An analysis of the signals obtained results in angle α . The tangent of angle α correlates to the relative product moisture per unit of mass rF(%).

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Results from practical use

Using 2-parameter microwave resonance [2-PMR] technology, it is possible to measure the relative proportion of free water in a solid. Chemically bound water or other volatile substances are ignored.

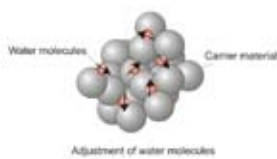


Figure: Carrier material with water molecules

Because the 2-PMR technology uses the interaction between a resonant electromagnetic system and the water molecules of a solid located in an alternating field, weight variations caused by drying are irrelevant to measurement.

This means that the sources of error familiar from moisture determination by means of a drying oven [conversion of chemically bound water to free water at $T > 130^{\circ}\text{C}$, weight loss due to volatile substances other than water, climatic conditions, varying drying times, buoyancy effects, etc.] are not relevant and do not result in measurement deviations.

Because of the high measurement frequency of up to 800 measurements per second, the measurement results can be output in real time as a numeric value and as a chart [moisture in % / time]. This ensures that dynamic moisture fluctuations, especially at the beginning of a process, are detectable.

A trend can be assigned to measurement values [e.g. moisture slowly reducing]. This ensures a better overview and better coordination of any actions to control moisture. At the same time, the system measures the product temperature contactlessly using a pyrometer. It can quickly be seen from what time a drying process starts running stably and the moisture value of the product complies with quality demands.

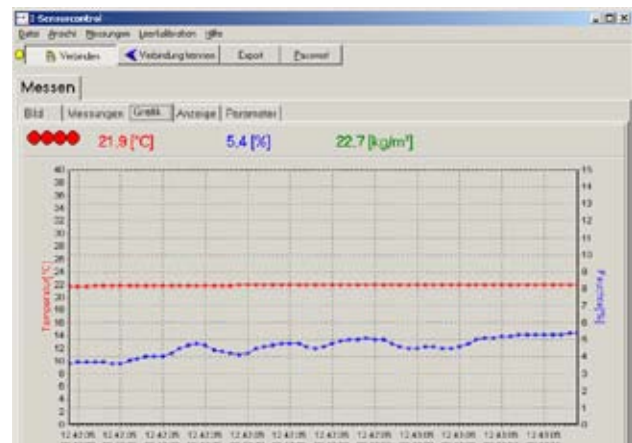


Figure: Moisture settling process

The measurement values for moisture and temperature are available in real time at 3 analog interfaces [4-20 mA] and are concurrently archived on the relevant workstation at a previously defined interval together with date and time information.

The advantages at a glance

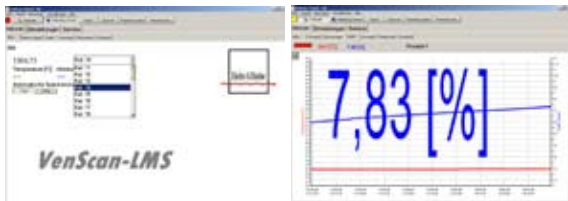
- Reliable inline measurement from the first meter
- Continuous control of the moisture content for materials on rolls from the first to the last meter (only possible at the beginning of production with the drying cabinet method)
- Detection of moisture fluctuations, e.g. due to initial products with different moistures [outer layers of a base paper roll absorb ambient moisture]
- Overview of the dynamic drying behavior [settling process]
- Measurement of the water content based on free water molecules only [other volatile substances and chemically bound water are ignored]
- Sources of error typical of thermogravimetric moisture determination do not occur
- Seasonally different climatic conditions do not influence the measurement
- 4-20 mA output signals for further processing in the plant controls
- Option: Intranet connection between the measurement system and the workstation by a COM server application



VenScan LMS

Software „ISensorControl“

ISensorControl permits simple operation [system settings, calibration, and visualization] of the VenScan LMS.



System configuration

Setting of

- Language [German, English]
- Communication interfaces
- Interfaces for standard signals 24 VDC, 4-20 mA
- Measurement parameters

Calibration

- Recording of measurement points
- Calculation and storage of calibrations

Measurement

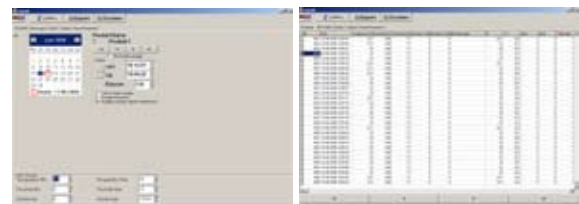
- Performing null measurements/ hardware calibrations
- Measurement data administration/ archiving intervals for moisture threshold values

Visualization and data export

- Graphical display of water content [%] and temperature [°C]
- Setting of display parameters
- Data export from the current day's data set

Software „ISensorGraph“

The data obtained from the inline moisture measurement and automatically stored can be selected, viewed, visualized, and analyzed using the ISensorGraph evaluation software. Selected data and graphics can be exported in common file formats.

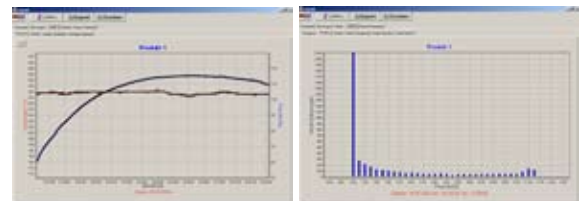


Selection of the stored data according to

- Date
- Time
- Calibration

Visualization, analysis, and export

- Graphical display of moisture (%) and temperature curves (°C)
- Statistical evaluation of measurement results
- Export of data and graphics



Workstation

The workstation is used for operating the VenScan LMS inline moisture measurement system.

The connection is established using CAT5 or shielded twisted pair [4 x 2 x 0.25mm²] cable via RS-422 interfaces in the workstation and connection box [max. distance 500 m].

Optionally, the connection between the workstation and the connection box can be established via the company's intranet by means of a COM server [see right].

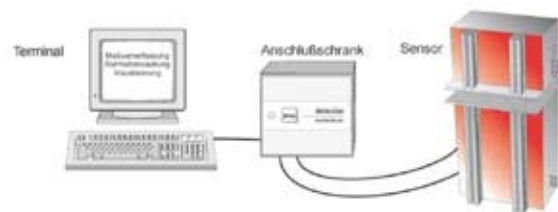
The workstation of the VenScan LMS consists of an amply dimensioned hard disk, a CD/DVD drive, USB 2.0 interfaces, an integrated network connection LAN [RJ45], and further modern equipment. The operating system used is Windows XP.

The integrated LAN connection can be used for remote servicing. Optionally, the workstation can be equipped with an ISDN controller or a 56k modem for remote servicing.

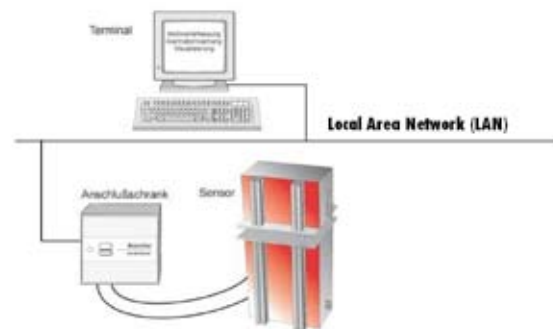
The software ISensorControl is already installed along with further auxiliary tools [e.g. current remote servicing software] and adapted to the measuring system supplied.

Connection options

CAT 5 connection set
[connection cabinet – terminal]



COM server connection set
Server for connecting the sensor to the terminal via the intranet [Ethernet LAN]
[connection cabinet - terminal]



VenScan LMS

Components

	Gap sensor
	Connection cabinet
	Terminal
	Movement unit

Technical data

Measuring range:	0 - 15 %
Repeatability:	+/- 0,1 % 1 for 0 - 10% relative humidity
Number of measurements:	up to 800 measurements per second, mean value calculation can be set in the software
Power supply:	24 VDC, 10 A
Product temperature:	0 – 70 °C
Ambient temperature:	0 – 40 °C
Max. number of different products in a plant:	32
Interfaces of workstation:	
- serial	RS422 [for connecting a further VenScan-LMS]
Interfaces of sensor:	
- analog	1 x input [4 – 20 mA] 3 x outputs [4 – 20 mA optionally for moisture and temperature]
- digital	2 x outputs [24 V DC, 0,1 A]
Dimensions:	
- Total length:	300 cm
- Total width:	approx. 50 cm

Subject to change without prior notice!

Can be used for the following materials:	decorative papers, finish foils, overlays, underlays, laminates, balance papers, other papers
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For further information please contact:

Tel.: +49-(0)40-879 76 77-0

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