Döscher & Döscher

VenScan LMS

Inline moisture measurement system for web-shaped materials

(decorative papers, finish foils, overlays, underlays, laminates)

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

VenScan LMS

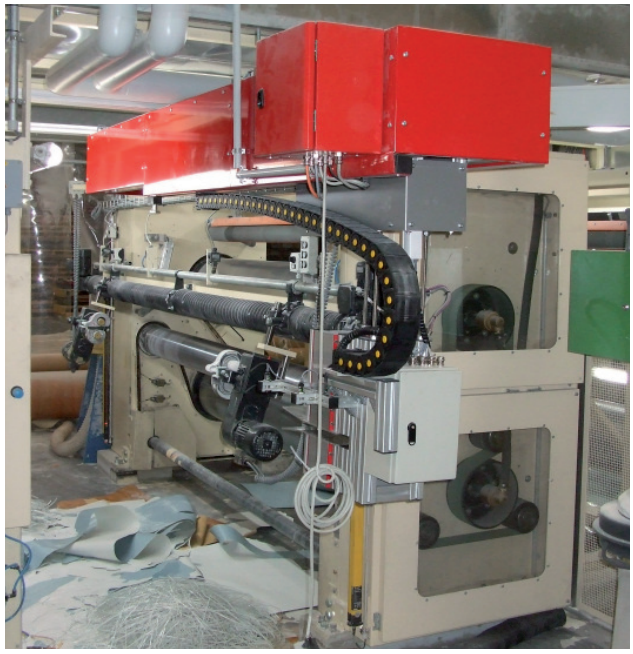
The VenScan LMS is an innovative system for in-process measurement of moisture of web-like products, such as impregnated paper, textiles, or films. It has been developed specially for this application. The system is installed at a suitable point in the production process. Fitted with an automatic motion 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 When required [for example, change of product], the measuring head can be withdrawn completely from the production process.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.

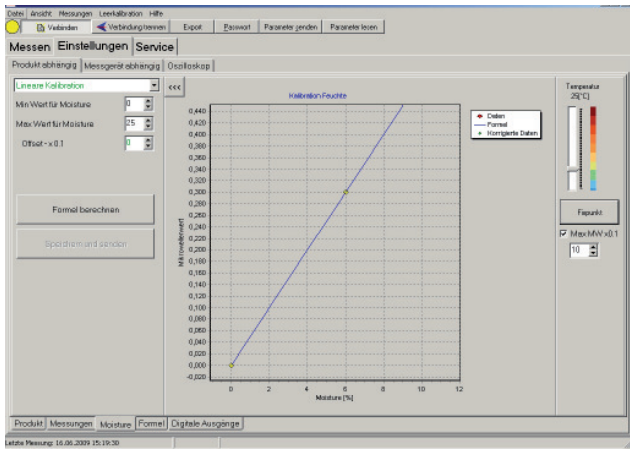
The measuring system can be calibrated simply by user. The measurement data can be displayed or recorded on a PC and can also be provided as analog signals.

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)

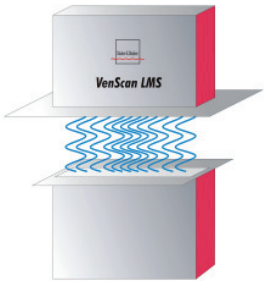


Screenshot of the calibration menue

The 2PMR Measuring Method

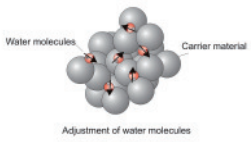
The moisture sensor of the VenScan LMS contains a tuned electromagnetic oscillating circuit and therefore constitutes a resonant system.

Fig. 1: Electromagnetic wave propagation



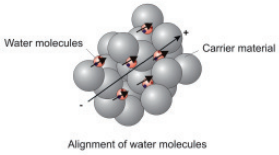
The measuring method is based on interactivity between the alternating electromagnetic field and the water molecules in the product. The water molecules in the product initially have random orientation.

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

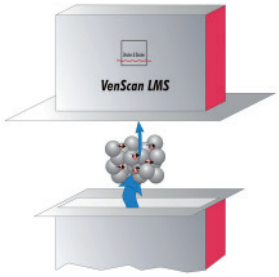
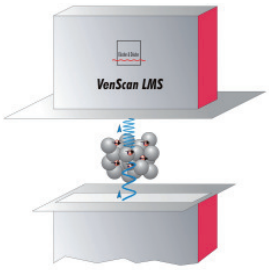


Fig. 5: Reduction in propagation velocity



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

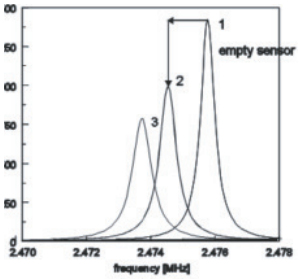
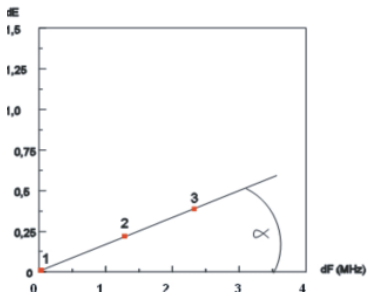


Fig. 7: Energy loss and frequency shift for various densities



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(%).

VenScan LMS

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.

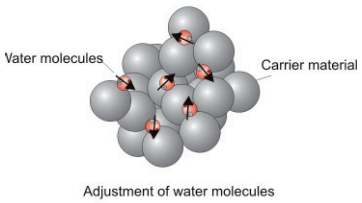


Figure: Carrier material with water molecules

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°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 detectible.

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.

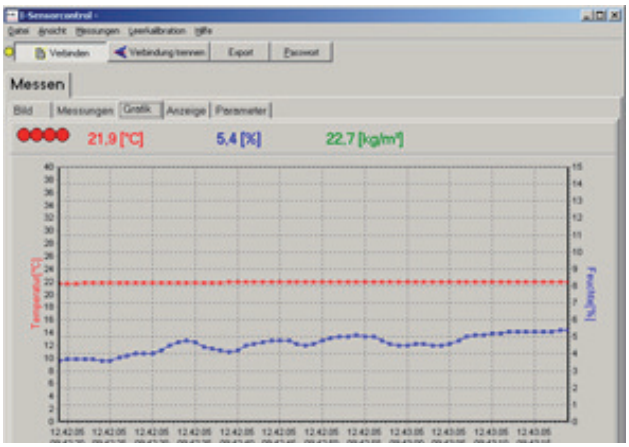
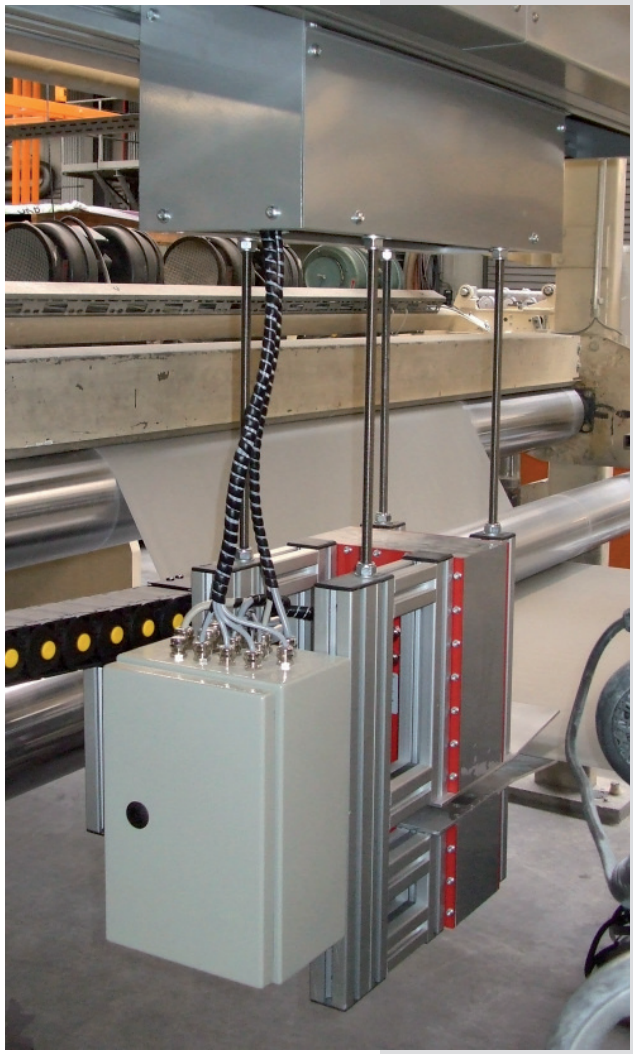


Figure: Moisture settling process

The measurement values for moisture and temperature are available in real time at 2 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

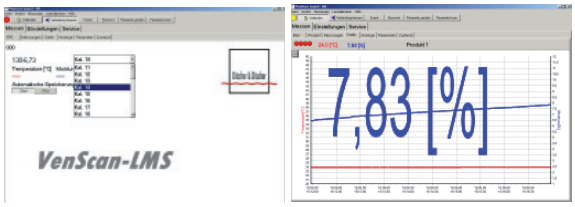
- Reliable inline measurement from the first meter
- Continuous control of the moisture content for materials on rolls from the first to the last meter (only possible at the beginning of production with the drying cabinet method)
- Detection of moisture fluctuations, e.g. due to initial products with 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
- Digital in- and outputs and analog signals [4-20 mA] for moisture and temperature

Calibration

- Recording of measurement points
- Calculation and storage of calibrations

Measurement

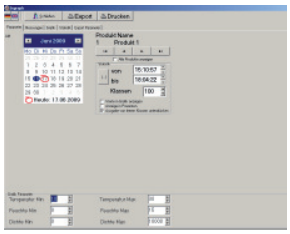
- Performing null measurements/ hardware calibrations
- Measurement data administration/ archiving intervals for moisture threshold values

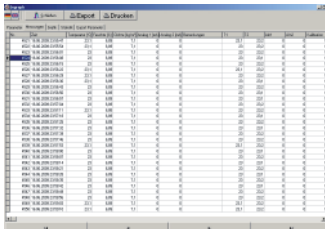
Visualization and data export

- 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.



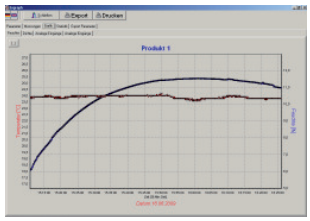


Selection of the stored data according to

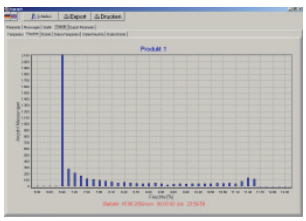
- Date
- Time
- Calibration

Visualization, analysis, and export

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



moisture and temperature trending



statistical analysis of measuring results

operater terminal [optional]

An operater terminal is used for operating the VenScan LMS inline moisture measurement system.
The operater terminal can be an in-house pc or a provided panel-pc.

The connection is established by using CAT5 or shielded twisted pair cable via RS-422 interfaces between operater terminal and connection box [max. distance 500 m].

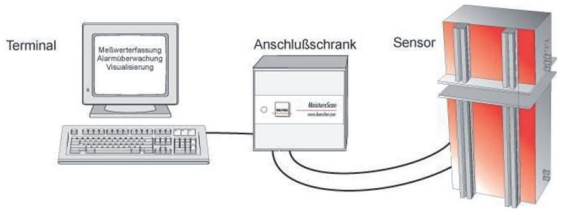
Connection can be also realised between the operater terminal and the connection box can via the company's intranet by means of a COM server [see right].

The optional panel-pc for operating VenScan LMS consists of a hard disk, USB 2.0 interfaces, an integrated network connection LAN [RJ45], and further modern equipment. PC is running under Windows XP as operating system. The integrated LAN connection can be used for remote service.

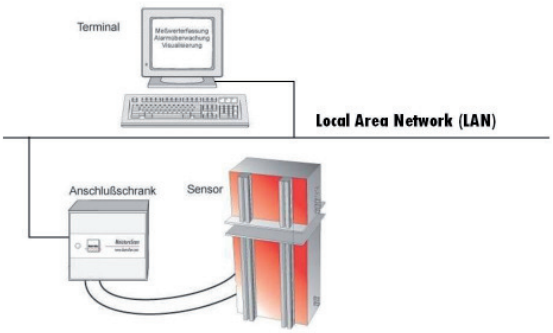
The software ISensorControl is already installed along with further auxiliary tools [e.g. current remote service software] and adapted to the measuring system supplied.

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
	operater terminal [optional]
	linear motion system

Technical data

Measuring range:	0 - 15 %
Repeatability:	+/- 0,1 %
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 calibrations:	32
Interfaces of workstation:	
- serial	RS422
Interfaces of sensor:	
- analog	1 x input [4 – 20 mA] 2 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 or at customer´s option
- Total width:	approx. 50 cm

Subject to change without prior notice!

Can be used for the following materials:	Web-shaped materials, e.g. decorative papers, finish foils, overlays, underlays, laminates, other papers

For futher Information please contact:

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