

QUALISCAN QMS-12

Traversing Quality Control System



QUALISCAN QMS-12



QUALISCAN QMS-12

A modular system for measuring, logging and controlling critical parameters over the entire process including basis weight, coating weight, moisture, layer thickness and many more.

Customer benefits

- ✓ Savings in raw materials and improved economy of production process
- ✓ Uninterrupted monitoring and logging of actual product quality
- ✓ Improvement of product quality, especially in connection with control on the plant side
- ✓ Very short return on investment times for high profit potential
- ✓ Less rejects and material loss when changing products

Product highlights

- ✓ Modern construction with intelligent sensors and traversing frames
- ✓ Use of standard industry PCs with Windows Embedded operating system
- ✓ Components communicate through digital interfaces
- ✓ Easily expandable with additional measuring locations and sensors
- ✓ Open architecture: Standard components guarantee quick availability of spare parts



Control of basis weight and moisture on a Spunlace-Nonwoven system (courtesy of Selcuk Iplik Sanayi ve Ticaret A.S.)

Area of application

The Qualiscan QMS can be used in virtually every area of industry in which products are produced or finished (e.g. coated) as webs. The versatile sensors and measuring devices of the Qualiscan QMS can sense, log and continuously control – basically in-process – parameters such as basis weight, coating weight, moisture or thickness of web-type products.

The sensors of the Qualiscan QMS product family scan and control the parameters

- Basis weight
- Moisture
- Thickness
- Layer thickness
- Air permeability
- Ash content
- Product temperature
- Measuring gap temperature control
- Diebolt temperature (Autodie profile control)

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There is a large variety of areas of application. Here only some examples:

- Coating of textile, nonwovens, film, metal foil, paper or rubber
- Film extrusion and extrusion coating
- Paper and carton manufacturing
- Technical textiles and nonwovens for the construction sector, automotive industry, aerospace, medical technology, etc.

New areas of application open up continuously in cooperation with customers.

Principle of operation

Qualiscan QMS is a modular design measuring and control system for process parameters of web-type products. Different measuring sensors (also called modules) measure the desired parameters either stationary or traversing across the entire working width. For this purpose, the sensors are installed on scanners (also called traversing frames or measuring bridges). Depending on the scanner version, up to five sensors can be installed simultaneously.

The measured values are generated directly in the real-time processors of the sensors and scanners. The finished measuring data is transmitted to the central PC in the base via Ethernet. The latter handles the control of the scanners, visualization via touchscreen, logging of the data, recipes and (if desired) communication with host systems.



Basis weight control with the production of screen reinforcements from glass fibres and nonwovens (courtesy of Kirson Industrial Reinforcements GmbH)

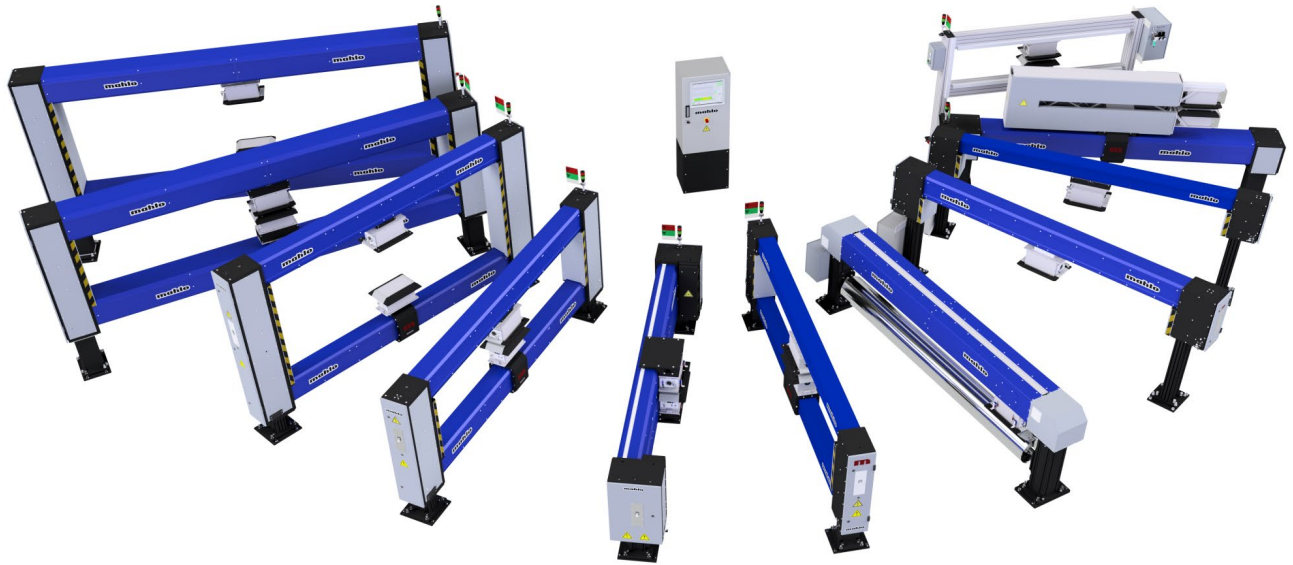
TRAVERSING QUALITY CONTROL SYSTEM



OVERVIEW

QUALITY CONTROL FOR COATING AND FINISHING WEB PROCESSES

Mahlo offers a variety of scanners. The Qualiscan QMS is therefore optimally equipped for all tasks and requirements.



Basic components

- One Mahlo control and display station as a minimum
- Central control cabinet with I/O for linking the machine signals
- One Mahlo scanner as a minimum, or permanently installed measuring devices
- Line speed tachometer for determining the web speed

Key operating functions

- Access to all functions via a rugged, industrial touchscreen
- Simultaneous representation of up to nine lateral or longitudinal profiles of all measured values
- Powerful recipe management for type-specific measuring tasks
- System access through up to five control and display stations linked per network
- Generous size of all symbols for ease of operation
- Incorporation and display of important machine functions

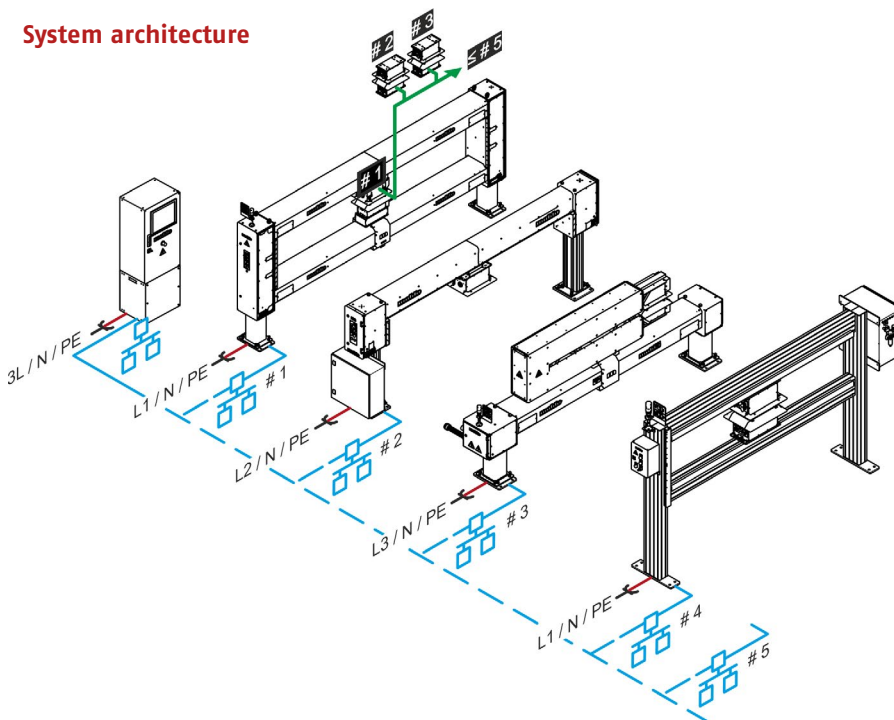
Options:

- **Qualiscan QMS Base:** System exclusively for stationary measuring points (Profix) on mounting frames.
- **Diecontrol APC Pro:** Module for cross-profile control for common extrusion dies with thermal bolts for film extrusion (flat film – cast film) and extrusion coating.

Optional add-ons

- mLog: Comprehensive software for data analysis and management
- OPC interface (server) for linking to host HMI systems
- Linking to the customer TCP/IP network
- Automatic generation of TEXT or EXCEL® files with all measured values
- Freely configurable control outputs (PID) with storage of parameters in recipes
- A/C units for high temperatures available for all control cabinets and control and display stations
- EX protection design of the scanners and sensors, in accordance with directive 2014/34/EU (ATEX) and NEC 500 Class 1, Division 1
- Dust and corrosion protection for scanners, sensors and control cabinets
- Water cooling of sensors for very high ambient temperatures
- OEM variant of all components for integration into existing systems
- Clean Room preparation available for all scanners

System architecture



The network structure allows for the easy expansion of the system. The individual components are connected via standard Ethernet network lines. Both the basis and scanners can be connected to the regular line supply. A wide range of special voltage is available as option.

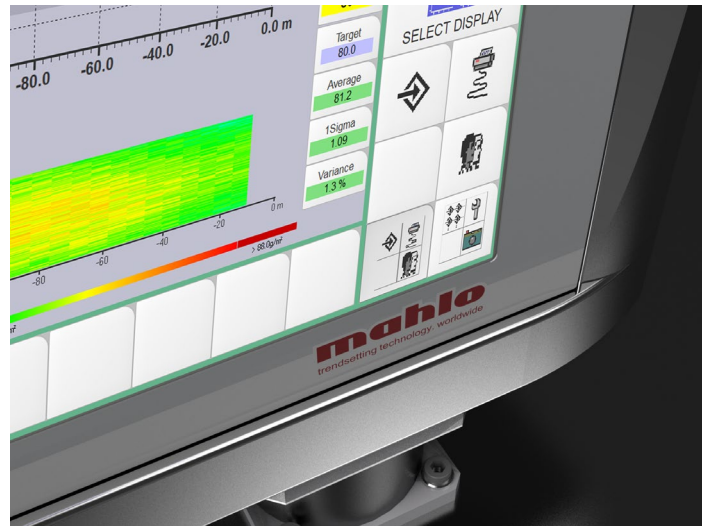
TRAVERSING QUALITY CONTROL SYSTEM



VISUALIZATION

EVERYTHING AT A GLANCE

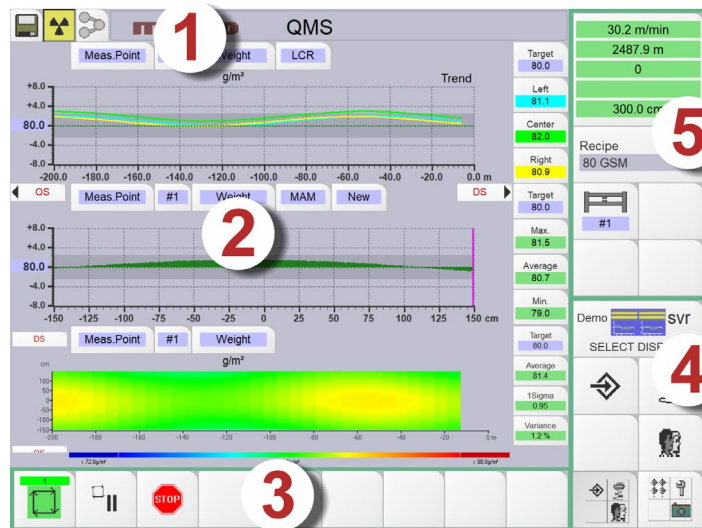
All entries are made directly on the touchscreen using large, ergonomic buttons. Operation is simple and intuitive. All key information is visible at a glance.



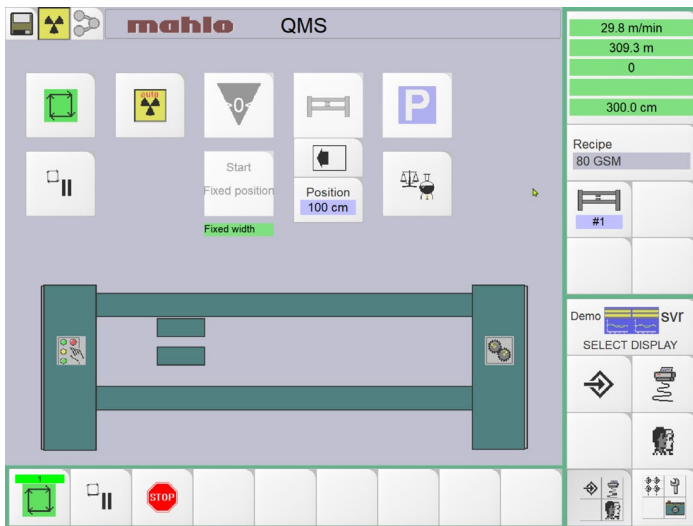
Visualization and operation per touchscreen

The user interface consists of five areas:

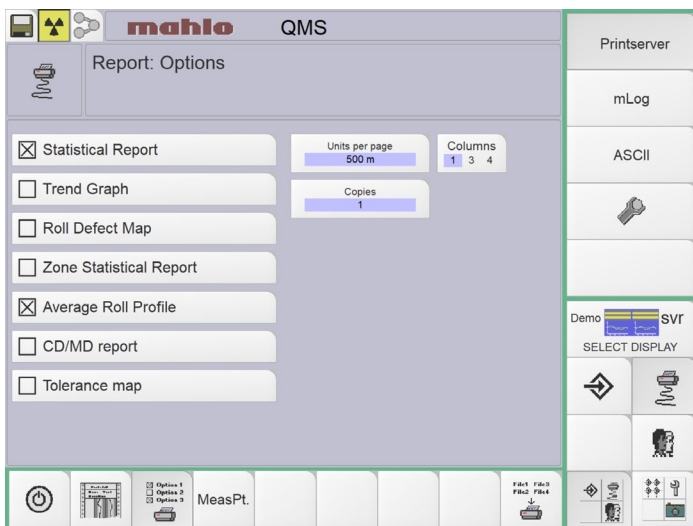
- 1. Title line:**
General information (including alarm bar)
- 2. Display area:**
Selectable screen pages (display forms)
- 3. Horizontal block:**
Buttons for basic functions and submenus
- 4. Selection block:**
Navigation within the operating software
- 5. Vertical block:**
Operating buttons for the menu selection



Main page with display of basis weight profile, trend and 2D trend



Scanner overview menu



Selection options for logging and reporting

Customer benefits

- ✓ All key data at a glance
- ✓ Menu guide in all common languages
- ✓ Ergonomic user prompting
- ✓ Simple operation

Product highlights

- ✓ Simultaneous management of various sensors
- ✓ Freely scalable trend diagrams
- ✓ Password protection: Unauthorised user are prevented from accessing the operating software
- ✓ Powerful recipe management

MECHANICS



SCANNER TYPES

UNIVERSAL APPLICATION

Principle of operation

The sensors in the scanner traverse precisely from edge to edge across the product web, driven by a frequency-controlled motor. The reversal points, usually the web edges, can be precisely defined in the software or by edge sensors.

If there are several measuring scanners in a production line, a "same spot measurement" of the sensors is carried out in identical measuring paths. A synchronous shaft ensures that the emitter and receiver move exactly simultaneously across the upper and lower beams of an O-frame. A processor in the scanner prepares and sends the measurement data via standard Ethernet network line to the central control and display station.

Webpro L-II

The traversing frame Webpro L-II is the top model of the range of scanners from Mahlo. It is available for traversing widths of up to 6.6 meters, and moves up to five Mahlo sensors in uninterrupted continuous use at high speed and with great precision perpendicular to the product web. Possible areas of application include lines for the production of film, plastic sheets, nonwovens and textiles up to 6.6 meters wide and machine speeds up to 2000 m/min. Larger widths are also available on request.

Other areas of application include:

- Production of fibreglass mats
- Various coating applications under challenging ambient conditions
- Paper impregnation for the production of furniture film and laminates
- PVC calendering for floors
- Coating of carpets
- Production of synthetic leather and plastic film
- Extrusion coating

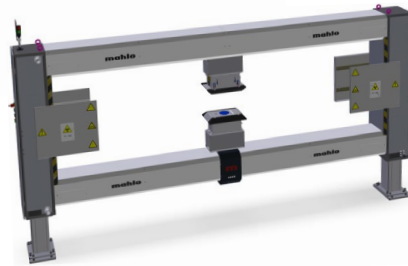
Webpro M

The traversing frames of the Webpro M type are used for diverse applications in various industries. They are especially known by their rugged and reliable design. Traversing frames of this type can be used for product widths up to max. 4 meters and can accommodate up to 3 Mahlo sensors. The compact design and use of precision linear guides permit installation even in restricted spaces and with widely different angles of inclination.

Possible areas of application range from nonwovens production lines via coating applications for textiles, paper, film or floor covering up to systems for extrusion coating and the manufacturing of synthetic leather.



Variant Webpro LH-II:
with large measuring gap up to
600 mm for thick products such as
insulating materials



Variant Webpro MH:
with large measuring gap up to
600 mm for thick products such
as insulating materials



Customer benefits

- ✓ Easy to install and connect
- ✓ Minimum upkeep and maintenance costs with a long service life
- ✓ Guarantees high measuring performance of the installed sensors with greatest scanning accuracy
- ✓ Accident-safe thanks to continuous monitoring of the motor current and integrated safety shutoff

Product highlights

- ✓ Intelligent scanner with integrated real-time computer
- ✓ Extremely rugged, mechanical configuration for trouble-free operation and long service life
- ✓ Low-maintenance design
- ✓ Many variants for a wide range of applications
- ✓ Built with commonly available standard components for optimum spare part availability

MECHANICS



SCANNER TYPES

UNIVERSAL APPLICATION

Webpro S-II

The traversing frames of the Webpro S-II type were designed with the objective of providing an extremely compact but still rugged and reliable traversing platform for applications in which space conditions do not permit the use of a conventional O-frame. The scanner manages a nominal width of max. 4 meters and can carry up to 2 sensors. The main area of application is fast-running coating machines, where their compact design usually leaves little space for the integration of conventional scanners. Vertical web paths are also more easily accommodated with this compact design. This includes systems for producing adhesive tapes, label rolls, self-adhesive films and light-tight coated textile and nonwoven substrates. The Webpro S-II scanner is also commonly found in the film industry.

Webpro XS-II

The traversing frames of the type Webpro XS-II are used for applications with smaller nominal product widths. They offer maximum functionality at minimum space requirements. Traversing frames of this type can be used for nominal widths from 0.2 to max. 2.2 meters and can accommodate one set of Mahlo sensors.. The compatible design and use of precision linear guides permit installation even in restricted spaces. Applications range from lab coating to coating for textiles, paper, film on to systems for the manufacturing of synthetic leather and extrusion coating.



Customer benefits

- ✓ Easy to install and connect
- ✓ Minimum upkeep and maintenance costs with a long service life
- ✓ Guarantees high measuring accuracies of the installed sensors with greatest scanning accuracy
- ✓ Accident-safe thanks to continuous monitoring of the motor current and integrated safety shutoff



Variant Webpro XSH-II:
with large measuring gap up to 100 mm for thick products such as insulating materials



Product highlights

- ✓ Intelligent scanner with integrated real-time computer
- ✓ Extremely rugged, mechanical configuration for trouble-free operation and long service life
- ✓ Low-maintenance design
- ✓ Many variants for a wide range of applications
- ✓ Built with commonly available standard components for optimum spare part availability

MECHANICS



SCANNER TYPES

UNIVERSAL APPLICATION

Uniscan M-II / Uniscan XS-II

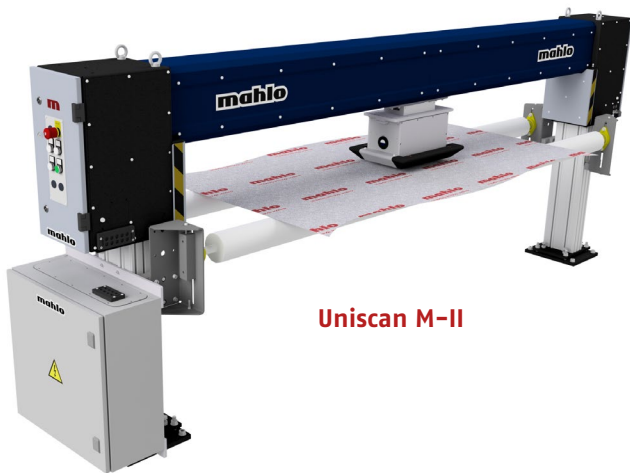
The traversing frames of the type Uniscan are the single-sided counterpart to the dual-sided O-frames of the Webpro series. They are specifically designed for the single-sided sensors of the Mahlo Qualiscan QMS family. Because of the single-sided design, the traversing frame easily finds space on existing lines. The measuring sensors can be positioned above, below or to the side of the scanner. The device variants Uniscan M-II, Uniscan XS-II differ in various parameters such as product width and maximum number of sensors.

Variant	Nominal product width, maximum mm	Number Sensors, maximum
Uniscan M-II	4000	3
Uniscan XS-II	2200	1

Possible applications include foil calendering, nonwovens applications and pulp drying, extrusion coating and coating or impregnating of paper, cardboard, films/foils or textile and also laboratory applications, depending on the choice of the traversing frame.

Webpro C

The traversing frames of the type Webpro C are used for applications where much dirt is generated or the traversing frame must be moved completely out of the product web. This type is available for horizontal or vertical product guidance and distinguishes itself by the robust and dirt-resistant design. It can be vertically employed to a product width of 1.8 meters and one sensor or horizontally of 2 meters and 2 sensors.



Uniscan M-II



Uniscan XS-II

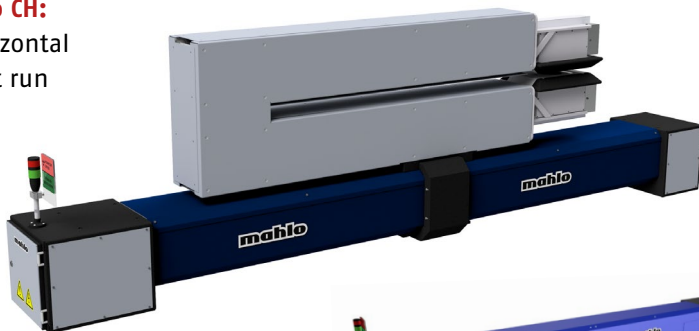
Customer benefits

- ✓ Easy to install and connect
- ✓ Minimum upkeep and maintenance costs with a long service life
- ✓ Guarantees high measuring accuracies of the installed sensors with greatest scanning accuracy
- ✓ Accident-safe thanks to continuous monitoring of the motor current and integrated safety shutoff

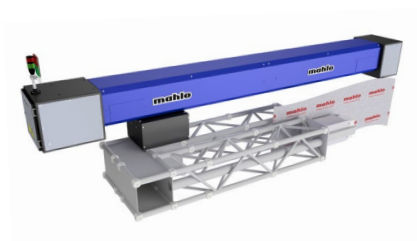
Product highlights

- ✓ Intelligent scanner with integrated real-time computer
- ✓ Extremely rugged, mechanical configuration for trouble-free operation and long service life
- ✓ Low-maintenance design
- ✓ Many variants for a wide range of applications
- ✓ Built with commonly available standard components for optimum spare part availability

Webpro CH:
for horizontal
product run



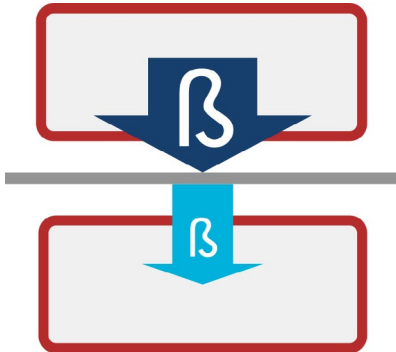
Variante Webpro CV:
for vertical product run





MEASURING METHOD

COMPREHENSIVE SOLUTIONS

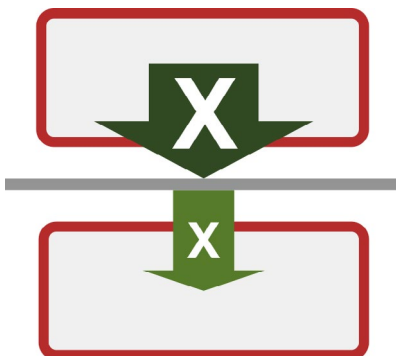


Beta transmission principle

+ Beta transmission – Basis weight, Thickness, Density

The intensity of beta rays is weakened according to the mass of the penetrated layer. This weakening allows determining the basis weight of nearly all materials. Different isotopes (Krypton, Strontium) are used for different weight ranges. With coating processes, the application quantity can be determined as weight difference using several sensors.

The density of the product web can also be determined in combination with thickness sensors. If the density of the measured product is known, however, and remains constant, the material thickness can also be determined via the basis weight.



X-Ray transmission principle

+ X-Ray transmission – Basis weight, Thickness, Density

The intensity of X-rays is weakened according to the mass of the penetrated layer. This weakening allows determining the basis weight of nearly all materials. Different high-voltage ranges are used for different weight ranges. No radiation protection precautions are required in Europe and many other countries for X-ray radiation energy less than 5 kV.

The advantage compared to beta emitters is the emission of the X-ray tube that can be shut off.

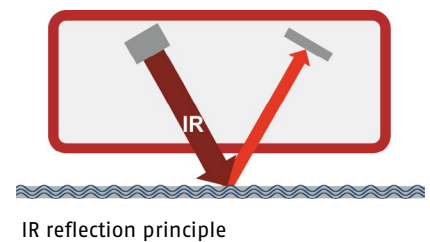
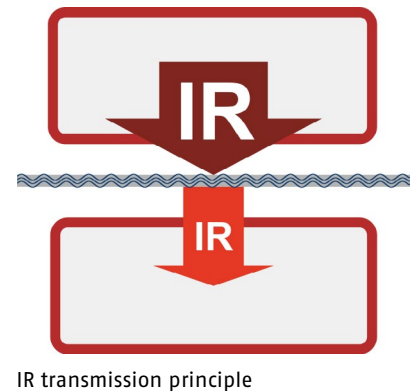
The density of the product web can also be determined in combination with thickness sensors. If the density of the measured product is known, however, and remains constant, the material thickness can also be determined via the basis weight.

+ Infrared transmission / Infrared reflection – Moisture, Basis weight

Water and other materials absorb light in the infrared range. They have characteristic spectral absorption signatures. This makes it possible to distinguish them in different spectral ranges. The moisture content and basis weight of different materials can be determined by measuring the weakened radiation.

IR measurement is especially suitable for the area of residual moisture and materials that exhibit an absorption spectrum in the infrared range. Transmission measuring allows penetrating the complete thickness of the product. This is necessary when the total composition of the material is of interest.

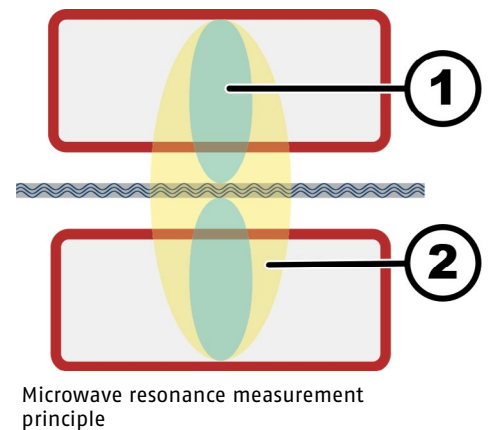
Measurement of the IR reflection is used primarily to determine the top layer or coating without measuring the underlying substrate material.



+ Microwave resonance measurement – Moisture

- ① Reference resonance
- ② Measuring resonance

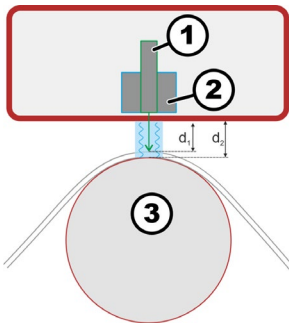
Two standing microwaves are generated in the sensor. One is used as reference. The second is influenced and damped by water, and the resonance frequency also changes. The moisture content in the material can be determined by comparing both waves. Measurement of the microwave resonance is suitable for residual and high moisture of all non-metallic products.





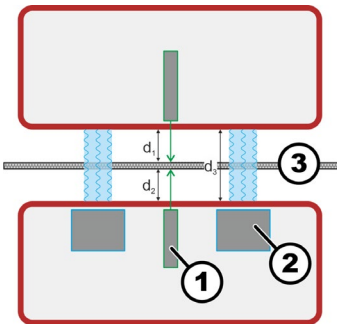
MEASURING METHOD

COMPREHENSIVE SOLUTIONS



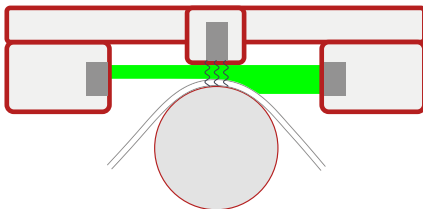
Laser triangulation principle, single-sided

- ① Laser
- ② Eddy current sensor
- ③ Reference roller or base plate



Laser triangulation principle, double-sided

- ① Laser
- ② Eddy current sensor
- ③ Product



Light-band shadowing principle

+ Laser triangulation – Thickness

Distance measurement through angle calculation (laser triangulation). A laser beam is projected onto a measuring object and reflected from there. Depending on the distance, the reflected laser beam hits a CCD receiver at a certain angle. The distance to the measuring object is calculated by the position of the light dot on the receiver as well as the distance of the laser to the receiver. The material thickness can be determined this way.

With the single-sided measuring process, measuring is done against a roller or product guide. Error in the runout of the roller can be compensated by eddy current sensors. The single-sided variant is very suitable for flexible products and for products structured on one side. In this case, the unstructured side is measured by the laser, while the structured side runs over the reference roller.

+ Light-band shadowing – Thickness

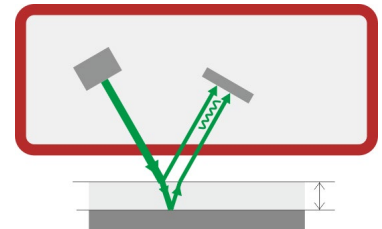
A light-band is directed onto a measuring object running over a roller. According to the thickness of the measuring object, the light-band is partially shadowed even with a transparent web; this is measured. An eddy current sensor measures the roller position. The material thickness of the measuring object can be determined from the difference of both measured values.

The shadowing sensor is a good choice for structured flexible products up to a thickness of approx. 10 mm.

+ White light interference – Thickness

White light is reflected differently from the upper and lower boundary surfaces of thin films. The reflected light waves are overlaid; they interfere. This interference is related to the coating thickness and can be measured with a spectrometer.

Different measuring ranges are covered by different types of light. The white light interference meter is especially suitable for transparent layers and film.

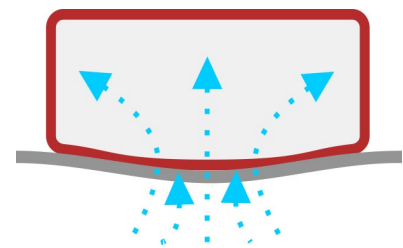


White light interference principle

+ Air flow measurement / Permeability – Air permeability

Air is suctioned through the material to be measured with a specific pressure. The generated air flow is measured, and the air permeability of the material can thus be determined.

Permeability measurement is used for all air-permeable materials such as textile, nonwoven, paper or composite material. The applications range from simple textiles to highly complex filter materials.



Air flow measurement principle

MEASURING METHOD



SELECTION OF SENSORS

ACCORDING TO APPLICATIONS

Applications	Measurement Tasks				
	Basis Weight				
	Sensors				
	Beta Transmission Gravimat FMI/DFI	X-Ray Transmission Gravimat FMX-T	NIR Filter Infralot IMF	NIR Spectrometer Infrascop NIR	Gamma Transmission Ashpro FMA
Polymer Extrusion					
Single-Layer Weight/Thickness	+	+	+		
Multi-layer Weight/Thickness	+	+		+	
Sheet Weight/Thickness	+	+	+		
Foam Weight/Thickness/Density	+	+			
Extrusion Coating	+	+	+	+	
Coatings					
Aqueous Coating on Paper	+	+	+	+	
Aqueous Coating on Polymer	+	+	+	+	
Solvent Coating on Paper	+	+	+	+	
Solvent Coating on Polymer	+	+			
Extrusion Coating on Paper	+	+	+	+	
Extrusion Coating on Polymer	+	+		+	
Silicone Coating on Paper				+	
Silicone Coating on Polymer					
Nonwovens					
Nonwoven Weight/Thickness/Density	+	+	+	+	
Moisture in Nonwovens					
Nonwoven Permeability					
Textile Coating					
Textile Weight/Thickness/Density	+	+	+	+	
Moisture in Textile					
Nonwoven Permeability					
Paper					
Paper Weight/Thickness	+	+	+	+	
Moisture in Paper					
Ash in Paper	+	+			+
Building Products					
Asphalt Shingles	+	+			
Fiberglass Wool Weight/Thickness/Density	+	+			
Foam Board Weight/Thickness/Density	+	+			
Fiberglass Mat Weight/Thickness	+	+			
Fiberglass Mat Binder		+	+		+
Fiberglass Mat Permeability					
Additional Applications					
Calender Weight/Thickness	+	+			
Paper/Polymer Filtration	+	+	+	+	
Battery Electrode	+	+			
Abrasives	+				
Lamination	+	+	+		

Typical application scenarios and respective suitable sensors.

Thickness			Moisture			Permeability
Laser Caliper Calipro DML	LED Array Shadow Caliper Calipro DMS	White Light Inter-ferometer Optoscope WLI	NIR Filter Infracot IMF	Microwave Resonance Aqualot HMF-T	NIR Spectrometer Infrascop NIR	Air Permeability Airpro APM
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SENSORS



GRAVIMAT FMI/DFI

BETA TRANSMISSION: BASIS WEIGHT, THICKNESS, DENSITY

Area of application

The beta sensor Gravimat DFI is universally suited for all products: Nonwovens, film, textile, carpet, synthetic leather, PVC floor covering, paper, carton, coating, lamination, extrusion, surface generation, etc.

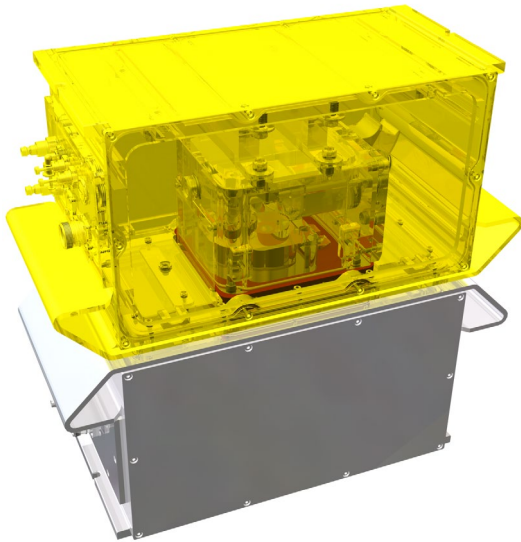
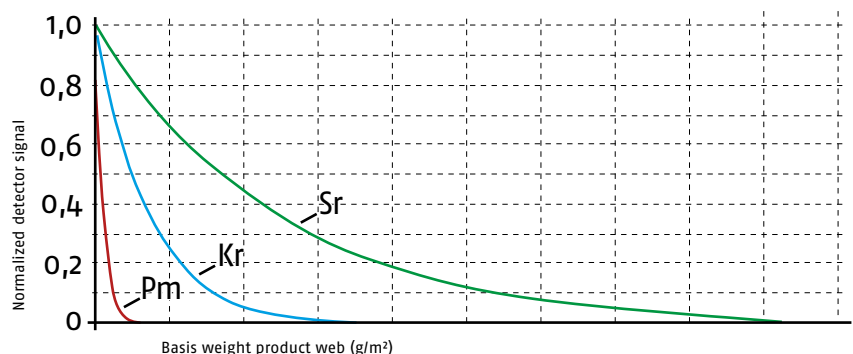
The Mahlo Gravimat DFI (Dynamic Flutter Independent) uses a revolutionary new sensor technology with the following properties:

- Complete insensitivity to waviness, edge curling and web flutter across the entire measuring gap
- Smallest beta ray source with maximum measuring capacity
- Highest scanning rates to detect smallest flaws of the product web
- Permanently error-free and cost-effective operation under toughest conditions.

Problems with product flatness exist with almost all production methods for product webs. Cast and extruded film tend to exhibit ripples and flutter, triggered by tension changes, electrostatic charges or band vibration. Paper and coating converters must deal with faulty substrates, edge curl and unsupported product web areas. Manufacturers of nonwovens and fabric are facing fluctuations of degree of drying, density and thickness of their product webs, caused by changes in centre of gravity.

All these effects cause measuring inaccuracies with conventional measuring systems. Special backscatter measuring procedures with gamma rays and X-rays are very sensitive toward distance changes to the sensor, some even require contact with the web. The new patented Mahlo DFI beta sensor is not affected by product flutter, changes of the passline, sagging or edge curl. The sensor measures with precision and is not affected by all changes in the degree of drying, density or thickness.

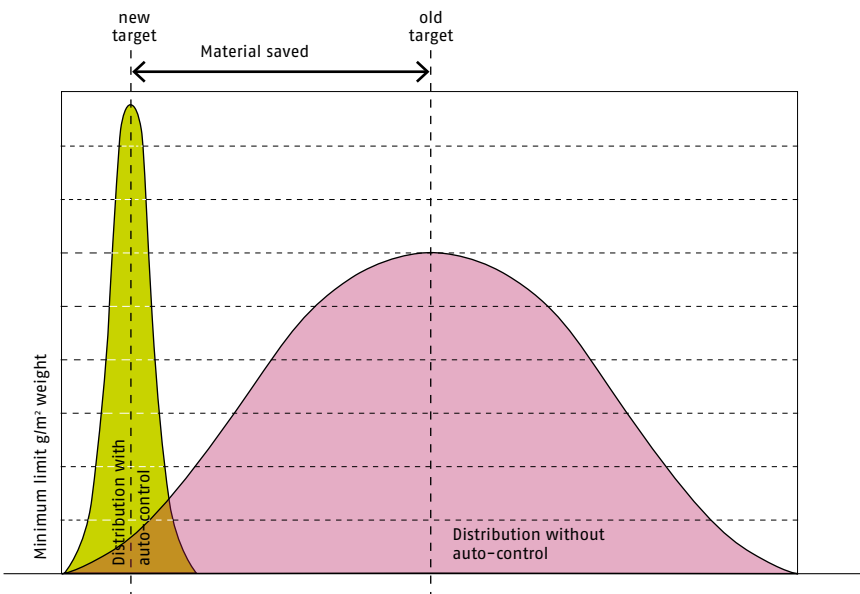
Gravimat FMI/DFI sensor response curve



Customer benefits

- ✓ Non-destructive, continuous determination of the basis weight of product webs
- ✓ Material savings
- ✓ Increased production
- ✓ Quality assurance and documentation
- ✓ Long service life through high-grade components

The automatic basis weight control significantly reduces the spread of the basis weight and thereby ensure a more consistent end product. Suitable defined setpoints with minimum tolerance ranges save material and energy costs to a significant degree, in addition to safeguarding product quality. In addition, process reliability and production throughput increase.



Product highlights

- ✓ Intelligent sensor with microprocessor for measurement preprocessing
- ✓ Unaffected by product flutter, sagging or edge curling
- ✓ Compensation of variations in temperature and air pressure
- ✓ High stability and measuring accuracy with minimal calibration effort
- ✓ Variable measuring gap geometry and wide measuring range for different customer requirements

SENSORS

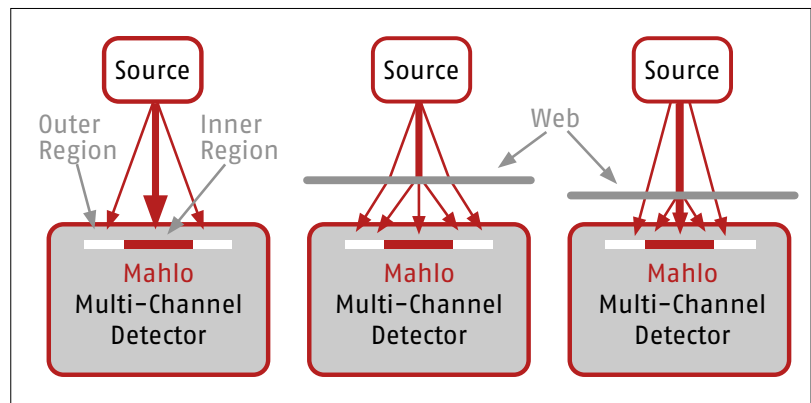


GRAVIMAT FMI/DFI

BETA TRANSMISSION: BASIS WEIGHT, THICKNESS, DENSITY

Principle of operation

The Mahlo Gravimat DFI uses multi-channel detector technology that captures the entire measuring signal, regardless of where the product web is located in the measuring gap. The resulting measurement is determined only by the basis weight, not by the web position in the measuring gap. This solution is simple, industrially rugged and completely effective. It is so effective, in fact, that Mahlo has been granted international patents for it.



Principle of operation, unaffected by web position

No heavy absorbers or highly radioactive sources are necessary, yet the accuracy, speed and resolution of the Mahlo Gravimat DFI are unmatched so far. An additional benefit of the Gravimat DFI is the fact, that the measuring gaps can now be significantly larger. There is no longer any risk of wet-coated material or products that can be easily damaged touching the measuring head. This reduces the problems of web tear or damages from fluttering products.

Device versions

Specification	Value	Unit
Isotope	Krypton-85 (Kr-85) Strontium-90 (Sr-90)	
Measuring range	10 – 1400 100 – 6000	g/m ²

SENSORS

GRAVIMAT FMX-T

X-RAY TRANSMISSION: BASIS WEIGHT, THICKNESS, DENSITY

Area of application

The Gravimat FMX-T sensor is ideal for products consisting of only one component. This measuring technique is mainly used for film, nonwovens, textile, panel production and extrusion.

X-ray tubes with different voltage ranges provide the Gravimat FMX-T with a rather wide scope of applications. The sensor < 5 kV is suitable for measuring ranges under 1000 g/m². Thanks to the low radiation energy, it is completely exempt from radiation safety requirements in Europe and many other countries. Sensors up to 50 kV are available for higher measuring ranges. They are suitable for thick materials such as insulating materials and allow for measuring gaps up to 600 mm.

Principle of operation

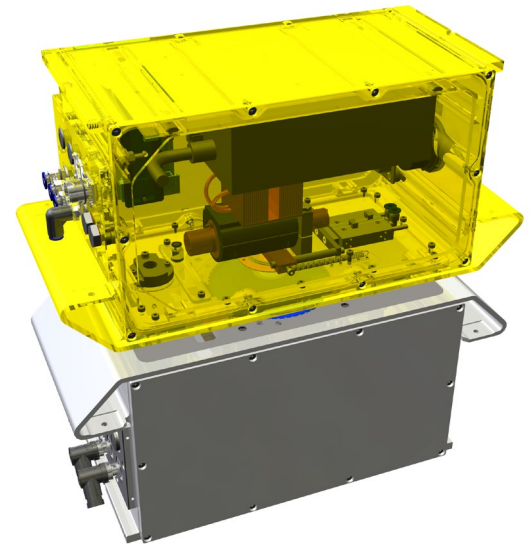
X-Ray transmission functions according to the same principle as beta transmission. Radiation penetrates the product to be measured and is weakened in the process. The basis weight can be determined by the degree of weakening. If the density of the measured product is known, and remains constant, the material thickness can also be determined via the basis weight. The difference is the type of radiation – that is, X-rays.

The benefit of X-rays is the higher local resolution, especially with lower weight ranges. Contrary to beta radiation, X-rays can be disabled. Contrary to isotope radiation (half-life), the output of the X-ray tube remains constant also over time.

Because of the optimised sensor design, temperature variations in the measuring gap affect the measuring value only to a very minor degree and can be compensated.

Device versions

Specification	Value			Unit
Acceleration voltage	<5	8 - 15	15 - 50	kV
Measuring range	PET: 5 - 1000	PET: 14000	PET: 99000 Glass: 20000	g/m ²



Customer benefits

- ✓ Non-destructive, continuous determination of basis weight / thickness
- ✓ High measuring accuracy
- ✓ Little maintenance required and low overall operating cost

Product highlights

- ✓ Non-radioactive
- ✓ Non-contacting, non-destructive
- ✓ Intelligent sensor with its own fast microprocessor
- ✓ High resolution

SENSORS



INFRASCOPE NIR

IR TRANSMISSION, IR REFLECTION: MOISTURE, BASIS WEIGHT



Area of application

Contactless and continuous monitoring of all quality parameters with highest accuracy is extremely important for all web producing industries. The Infrascop NIR sensor can be used in many different ways in the film and extrusion industry, the coating and finishing sector as well as the production of cellulose and paper.

Principle of operation

The Infrascop NIR is available both as transmission and reflection sensor. Both are working according to the same principle. Water and other materials absorb light in the infrared range and weaken the penetrating or reflected infrared radiation. A spectrometer measures the incoming infrared energy and converts it into measurements.

Customer benefits

- ✓ Non-contacting, non-destructive and continuous measurement
- ✓ Simultaneous determination of several components in a single material
- ✓ Less waste by monitoring quality features and through process optimization
- ✓ High measuring accuracy

With the transmission sensor, the light source is located in the sender, the spectrometer in the receiver. With the reflection sensor, both components are in the sender housing. By analysing different absorption spectra, the moisture content and basis weight of different other materials in the product web can be determined at the same time.



MULTI-CHANNEL FUNCTION (MULTICHANNEL)

The multi-channel function allows several measurements to be taken and analysed simultaneously with a single sensor, e.g. moisture, basis and individual components.

Considering the entire spectral range offers many advantages.

- By simultaneously analysing the entire NIR Spectrum, the sensor is able to differentiate between multiple components in the material web.
- Due to very high spectral resolution, the sensor can distinguish between components with nearly similar, but not identical, IR absorption.
- Improved process understanding by direct NIR spectral measurements and use of multivariate calibration modelling.

Device versions

NIR-T (IR transmission): To measure the entire thickness of the product web

NIR-R (IR reflection): To measure coatings

Specification	Value		Unit
Measurements	Basis weight, Moisture		
Type	NIR	NIR-Light	
Spectral range	900 – 2200	940 – 1700	nm
IR transmission, Measuring range Basis weight e.g. nonwovens ¹	10 – 500	1 – 300	g/m ²
IR reflection, Measuring range Basis weight e.g. nonwovens ¹	5 – 80		g/m ²
Measuring range Moisture ¹	0 – 15		% H ₂ O

1) Measuring range and measuring accuracy depending on the material (analysis of material sample necessary)

Product highlights

- ✓ Non-radioactive
- ✓ Intelligent sensor with its own fast microprocessor
- ✓ High spectral resolution
- ✓ Relatively insensitive against product flutter



DEVELOPMENT

To ensure high performance capability and maximum customer benefit of our products, we use the newest technologies and strong commitment to develop the products of tomorrow. So that the future can start for you today.

SENSORS



INFRALOT IMF

IR REFLECTION, IR TRANSMISSION:
MOISTURE, BASIS WEIGHT



Infrared sensor (IR transmission and IR reflection) for moisture and basis weight for the Qualiscan QMS quality control system.

Area of application

By analysing the light energy in the near-infrared range (NIR), important product-specific parameters such as moisture (material moisture), coating weight, the thickness of plastic film, or the organic components in nonwovens can be measured. This is done non-destructively and without adversely affecting the product's characteristics.

The NIR sensors of the Infracot IMF series are based on a classic filter measuring principle. However, this is updated with the very latest optical components and in accordance with the most recent trends in optical measuring technology.

Customer benefits

- ✓ Non-destructive, continuous determination of various parameters of product webs
- ✓ Same-spot measurement dry/wet – optimized measuring accuracy
- ✓ No moving parts – wear-free and low-maintenance
- ✓ Broad range of applications through use of various measuring wavelengths

No filter wheel – Same-spot measurement

With filter wheel systems, the wavelengths for dry (reference) and wet conditions are measured with a time delay. This can lead to measurement inaccuracies, which are particularly disadvantageous for inhomogeneous products such as thin nonwovens.

With the newly designed simultaneous filter from Mahlo all wavelengths are measured at the same time and at the same spot on the web. This eliminates measurement inaccuracies and allows a same-spot measurement of reference and absorption resonances.



MULTI-CHANNEL FUNCTION (MULTICHANNEL)

The multi-channel function allows several measurements to be taken and analysed simultaneously with a single sensor, e.g. moisture, basis and individual components.

Principle of operation

Light-specific wavelengths can excite the atomic bonds of certain molecules to oscillate. These amount to a multiple of the basic resonance of the molecules. A large part of the incident light energy is absorbed by the material being measured.

If the light energy reflected or transmitted by the material to be measured is examined separately for each wavelength, a relationship is established between the degree of absorption of this resonance wavelength and the number of absorbing molecules. In this example, the absorbed light energy at the resonance wavelength of the water molecule changes considerably depending on the moisture content of the material being measured.

For stable measurements in practice, the measured light energy of the resonance wavelength is compared with other reference wavelengths at which no absorption occurs. This principle is suitable for most organic molecules.

Device versions

IMF-R (reflection): For one-sided measurement of coatings and light-weight products

IMF-T (transmission): For measurement of the product's overall thickness and composition

Specification	Value		Unit
Measurements	Basis weight, Moisture		
Type	IMF-R	IMF-T	
Measuring range Basis weight e.g. nonwovens ¹	approx. 5 - 80	approx. 10 - 500	g/m ²
Measuring range Coating ¹	0.2 - 300	-	
Measuring range Moisture ¹	approx. 0.2 - 15 ²	approx. 0.2 - 15 ³	% H ₂ O

1) Measuring range and measuring accuracy depending on the material (analysis of material sample necessary)

2) Paper weight ≤ 80 g/m²

3) Paper weight ≤ 300 g/m²

Product highlights

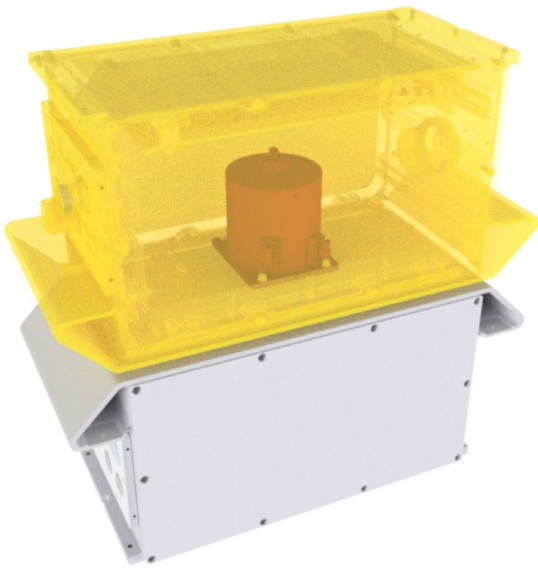
- ✓ Non-radioactive
- ✓ Static simultaneous filter – simultaneous measurement of all wavelengths
- ✓ Smart sensor with micro-processor
- ✓ High spectral resolution
- ✓ Insensitive to product flutter and soiling
- ✓ Completely Solid-State measurement

SENSORS



AQUALOT HMF-T

MICROWAVE RESONANCE: MOISTURE, BASIS WEIGHT



Sensor Aqualot HMF-T

Area of application

Product moisture is an extremely important parameter for the manufacturer and processor of web products such as paper, textiles, cardboard and nonwovens. Microwave-absorption technology has been used for quite some time to determine this quantity online in the process. However, up to now, limited resolution has restricted its use to measurement of larger quantities of water, thus preventing it from being used to measure thinner products or lower levels of moisture.

With this special measuring technique employed here it is now possible to detect even the smallest amounts of water with a high degree of accuracy and stability. This enables it to be used on even thin printing paper, airbag materials or the non-wovens used in the hygiene sector without its accuracy being affected by product colour or composition.

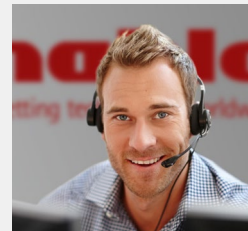
Customer benefits

- ✓ Non-destructive, continuous determination of the amount of moisture (H₂O) in product webs
- ✓ Extremely accurate and stable measurements; calibration reduced to a minimum
- ✓ Long life expectancy through the use of high quality components
- ✓ Wide measuring range through the use of various resonance configurations



FIRST AID

You can count on our service team, especially when 'first-aid' is required. A call is all it takes to get our technicians on-site. Around the clock – and around the globe. So that you can concentrate on your work without worry.



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SERVICE@MAHLO.COM

USA: SERVICE@MAHLOAMERICA.NET

Support-Hotline:

+49-(0)180-50 62 456

USA: +1-864-576-6288

Principle of operation

The measuring devices consist of two parts, which together form a resonance chamber, and the product passes through the centre of this divided chamber. A microwave emitter stimulates two standing waves in the resonance chamber, whereby one of the two corresponds to the absorption wavelengths of the water molecules in the microwave spectrum and the second serves as a reference.

Contrary to the traditional absorption technique, the Aqualot HMF sensors evaluate the shift in the resonant frequency of the two standing waves with respect to each other rather than the attenuation of the microwaves by the quantity of water molecules in the measuring gap. This special "microwave resonance" measuring principle is virtually insensitive to changes in product composition, which in daily practice helps keep the number of product-specific calibrations to a minimum. In addition, the device is characterised by its ability to resolve to an exceedingly high degree even the lowest percentages of moisture, thereby extending the use of microwave technology significantly in comparison with traditional measuring techniques.

Device versions

Specification	Value	Unit
Measurements	Moisture	
Measuring range ¹	3 - 450 3 - 1200	g/m ² H ₂ O

1) Measured moisture values can be given as absolute or percentage values if the basis weight of the product is known.

Product highlights

- ✓ Highly accurate and stable measurement thanks to microwave resonance analysis
- ✓ Unaffected by the color of the product web or its chemical composition
- ✓ Temperature compensation by using a pyrometer to detect product temperature
- ✓ Durable and fail-safe as there are no moving parts

SENSORS

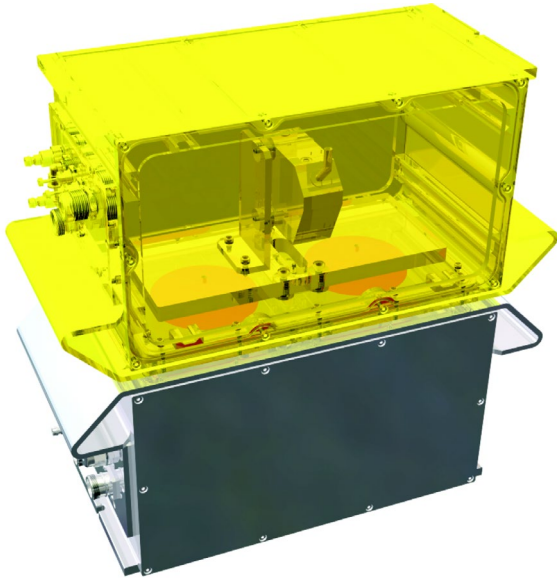


CALIPRO DML

LASER TRIANGULATION: THICKNESS

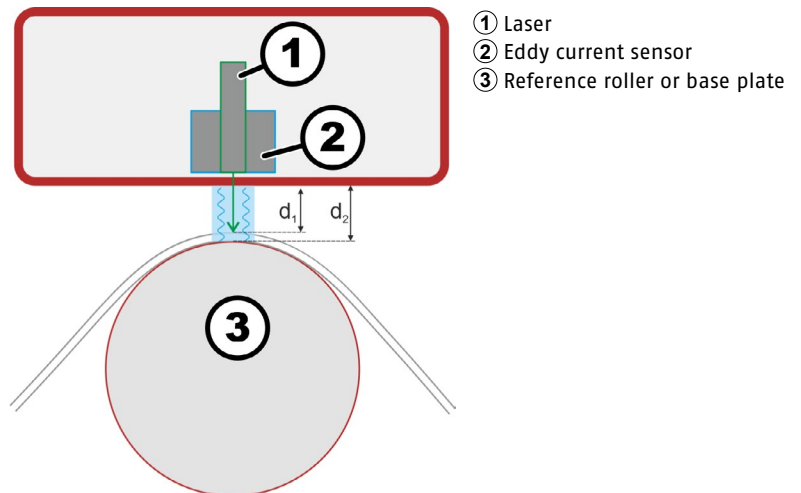
Area of application

In principle, the two-sided, non-contact, laser-type thickness gauge can be used to monitor virtually any product in web or sheet form. Successful applications of this measurement technology can be found in the paper and cardboard industry, in nonwovens, PVC flooring or artificial leather production, as well as in other calendered or extruded plastic sheets and board.

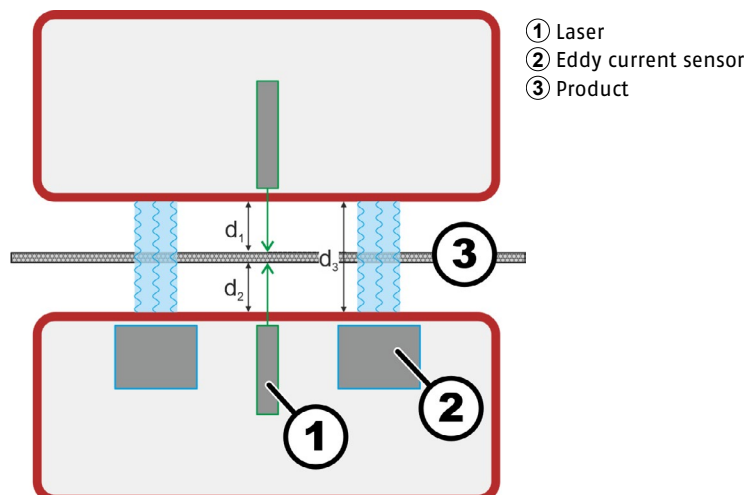


Customer benefits

- ✓ Direct determination of the thickness of the product web, without inferring from the density
- ✓ Displays the thickness cross-section over the width of the web, since the measurement is traversing
- ✓ Non-contacting, so there is no effect on product quality or production process
- ✓ Insensitive to changes in the product surface, resulting in a highly stable measurement



Calipro DML, single-sided version



Calipro DML with two-sided laser sensor

Principle of operation

Either one or two laser-triangulation sensors determine the exact distance between the gauging sensor(s) and product surface, either from one or both sides. Depending on the arrangement, an additional sensor, usually a high-precision eddy-current sensor, determines either the distance between the two gauging sensors or distance between the one sensor to the existing reference roller.

The thickness of the product is then determined by evaluating the difference between the two measured values. In the Calipro DML, this is done by an integrated microprocessor, which also synchronises the upper and lower laser. Automatic temperature compensation compensates for changes in distance caused by temperature fluctuations.

For porous and open-structured materials such as foam or non-wovens, the Calipro DML-S-L type is particularly suitable. A line laser is used to determine the actual thickness of the material without the porous surface affecting the measurement.



QUICK INSTALL

Our service team guarantees on-time and smooth installation of our equipment. So that your investment is turned quickly into profit.

Product highlights

- ✓ Non-contacting, non-destructive and high-precision determining of product thickness inprocess
- ✓ Available in several variants for varying accuracy requirements
- ✓ Can be configured one-sided against a reference roller or two-sided
- ✓ Large variety of different measuring ranges with a single device series
- ✓ High sampling rate and resolution of the crosssection
- ✓ Peak-picking, valley-picking or averaging modes are selectable by recipe

Device versions

Specification	Value				Unit
Type	DML-S (singlesided)	DML-D (dual-sided)	DML-S-L 50	DML-S-L 400	
Measuring gap, maximum	120 ¹	80 ¹	45	395	mm

1) Depends on the sensor variant

SENSORS



CALIPRO DMS

LIGHT-BAND SHADOWING: THICKNESS



Sensor Calipro DMS

Area of application

Some areas of application in thickness measurement are difficult to cover with classic laser measuring systems. These systems reach their limits if the material surface is very rough or strongly structured. Laser triangulation is not suitable for transparent, very translucent or black materials.

This is where the Calipro DMS shading sensor comes into play. The combination of eddy current sensor and shading sensor makes the measurement insensitive against material surface, colour, transparency, opacity and temperature variations.

Applications

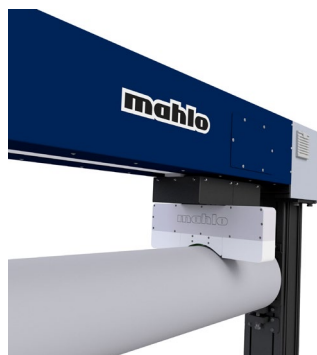
- Film extrusion & board extrusion
- Nonwoven
- Textile
- Finishing
- Calendering

Materials

- Mesh
- Nonwoven, foam, film
- Film and paper combinations
- PVC floor covering, entire range of colours

Customer benefits

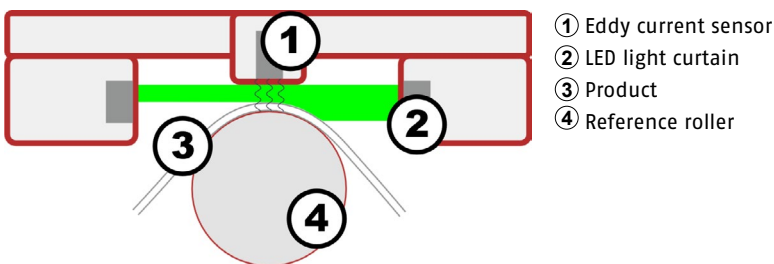
- ✓ Quick process optimization
- ✓ Material savings
- ✓ Quality assurance



Calipro DMS on one-sided Uniscan scanner

Principle of operation

A precise LED light curtain is directed onto a measuring object as a uniform, parallel beam of light. The transition between the bright and dark area at the receiver is detected as the measuring value. Depending on the material thickness, a certain area is thus shaded at the detector. The eddy current sensor measures the current roller position.



Shadowing sensor principle

The material thickness is calculated from the difference between eddy current sensor and shading sensor.

Device versions

The standard version is intended to be installed on a single-sided scanner. With the variant for dual-sided scanners, the Calipro DMS is mounted next to the installed sensor above the guide roller.



Calipro DMS and Gravimat DFI sensor for O-frame (e.g. Webpro M)



CONTINUANCE

Our decades of experience have made us the reliable partner which we are today. Independent, determined and forward-thinking. So that we can also be here for you tomorrow.

Product highlights

- ✓ High profile resolution
- ✓ Material-independent (colour, density, composition, etc.)
- ✓ Contactless, wear-free measurement
- ✓ No calibration effort
- ✓ No radiometric measurements

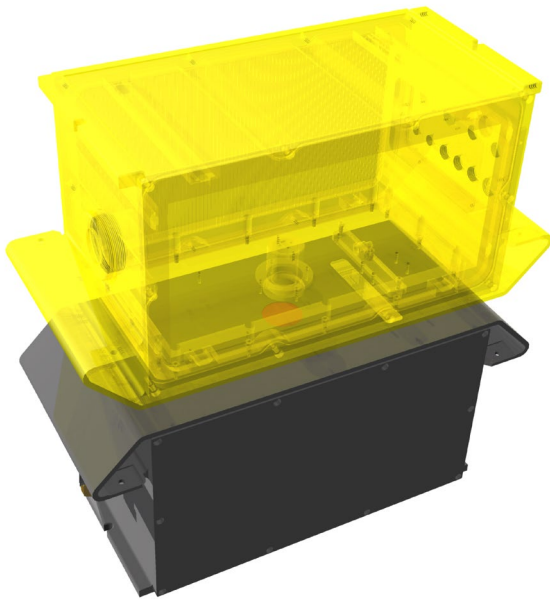
Specification	Value		Unit
Measuring gap, maximum	15	6	mm
Measuring range, maximum	12	5	mm

SENSORS



OPTOSCOPE WLI

WHITE LIGHT INTERFERENCE: THICKNESS,
LAYER THICKNESS



Area of application

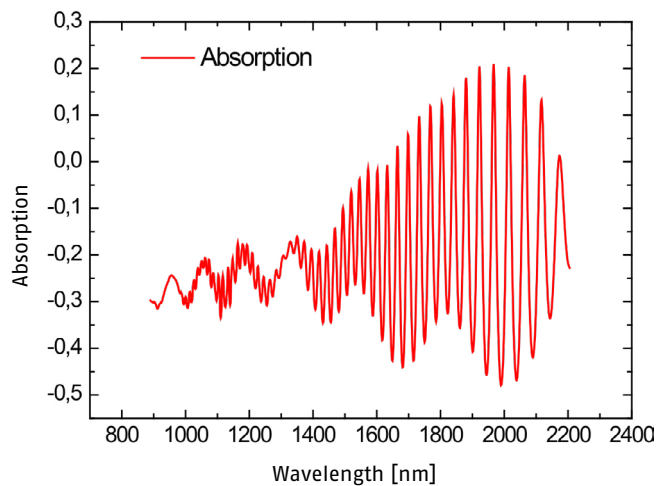
The Optoscope WLI sensor can measure the thickness of very thin, transparent mono- and multi-layer film and transparent coating on films, metal and glass. Both, the layer thickness and total thickness can be determined online using a special measuring process. Simultaneous measurement of two coating thicknesses is also possible with multi-layer coatings. Single-sided measurements, i.e. including coating on metalization, can be measured.

Different measuring ranges are covered through two variants of the sensor using different types of light (visible light, IR).

Customer benefits

- ✓ Simultaneous determination of two coating thicknesses
- ✓ Quick process optimization
- ✓ Material savings
- ✓ Quality assurance

WLI-Interference spectrum of a paint-coated (approx. 4.3 gsm) PET film (approx. 23 μm), measured in reflection

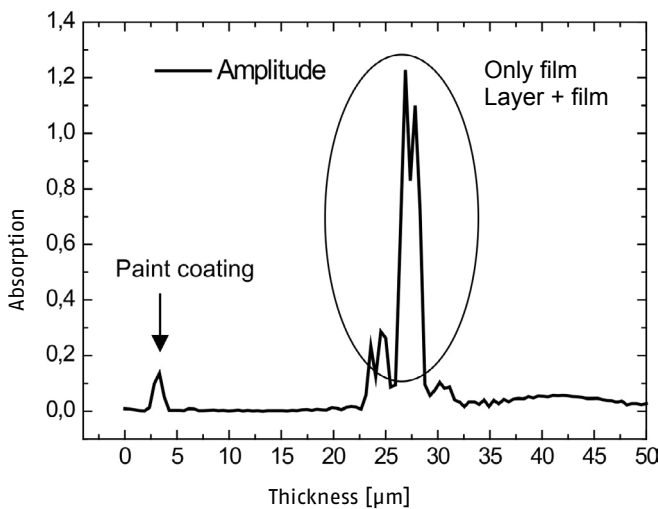


Principle of operation

If white light is reflected as thin layers, this reflection appears coloured like a rainbow. This effect can be observed, for example, with an oil film on a puddle of water. The light is partially reflected, both on the upper and lower oil-water interface. The overlaid reflections interfere. A similar interference is measurable on many coated webs and is related to the coating thickness.

In addition, this method is insensitive to fluctuations of the product position such as web flutter.

Determination of layer thickness by Fourier transformation



Product highlights

- ✓ Simple and fast measurement method
- ✓ High measuring accuracy and durability
- ✓ Measures thickness of the application coat and film thickness
- ✓ Capable of very thin measurements.

Device versions

Specification	Value	Unit
Type	WLI-R-UV/VIS WLI-R-NIR	
Measuring range	0.4 – 300 1 – 130	µm

SENSORS



AIRPRO APM

AIR FLOW MEASUREMENT: PERMEABILITY



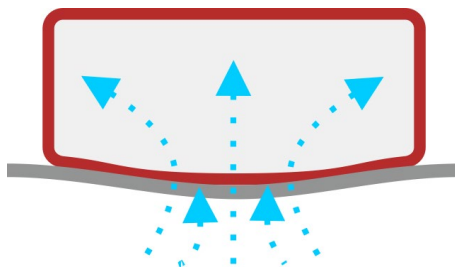
Area of application

In the textile and clothing sector, air permeability is important for the exchange of air between the inner layers of clothing and the environment. This will substantially influence the wearing comfort of clothes. Air permeability is also important for filters and breathable membranes. In the technical sector, it plays a role in air and gas filters – or with airbags in the automotive industry.

The Airpro APM allows for a highly dynamic and traversing measurement of air permeability and pressure drops on the running product web across the entire product width. Applications range from all types of surface structures, felts, dense paper and airbag fabric to extremely open nonwovens and paper filters.

Customer benefits

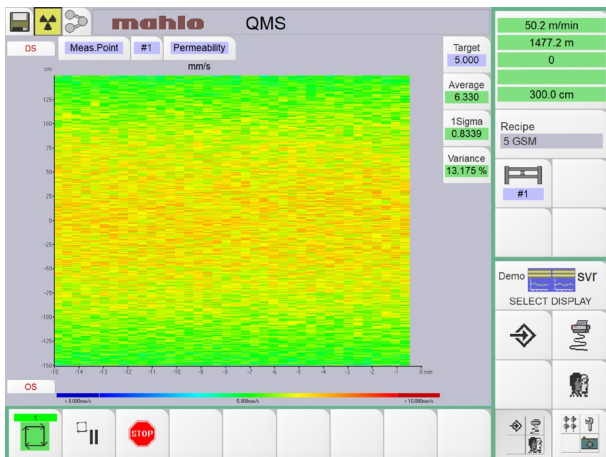
- ✓ Simple, fast measuring method
- ✓ Many units of measurement possible
- ✓ Logged quality



Air flow measurement principle

Principle of operation

Air is suctioned through the material to be measured with a specific pressure. The generated air flow is measured, and the air permeability of the material can thus be determined.



2D trend display of permeability

The operating software displays the measured values in real-time. A target-actual comparison makes quality problems immediately apparent. This allows still influencing the production process.

The graphic 2D trend depicts the exact curve of the air permeability profile over time and records it. This enables a detailed quality protocol – the grade of the product can be detected.



KNOWLEDGE

We have a common goal: Maximum performance for your system. To this end we are by your side from installation to maintenance of the machines to training of your employees. We provide comprehensive training to your staff for operation and maintenance. You will thus be able to solve problems even faster.

Product highlights

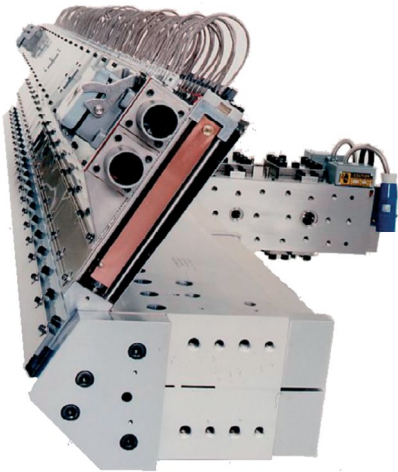
- ✓ Large measuring range
- ✓ High measuring accuracy
- ✓ Long service life



OPTIONS

DIECONTROL APC PRO

AUTOMATIC CONTROL OF AUTOMATIC THERMAL BOLTS ON EXTRUSION DIES

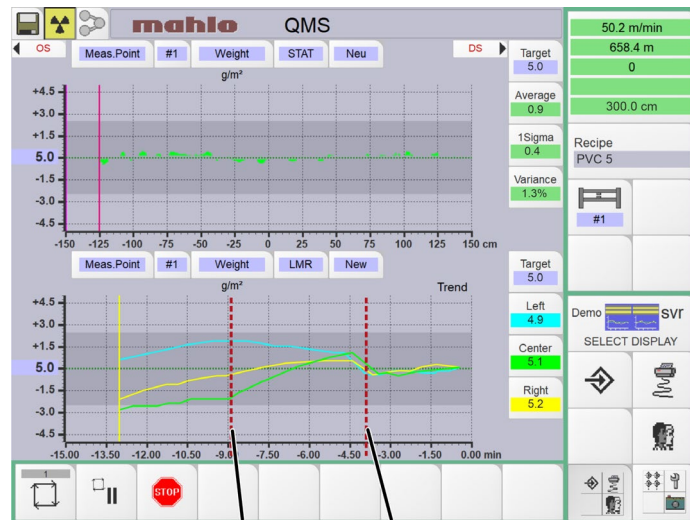


Extrusion die

Customer benefits

- ✓ Fully automatic reduction of the standard deviation of the thickness profile of the web
- ✓ Fast control for minimum production loss at startup and when changing batches
- ✓ Competitive advantage through marked quality improvement of the end product
- ✓ Significant raw material saving ensures short amortization times
- ✓ Fully automatic control reduces operator involvement
- ✓ Real-time monitoring of the diebolt with alarm function for fast correction
- ✓ Reduced thickness variations by a factor of 10 compared to manual control
- ✓ Reduction / elimination of gauge-banding at die lines

The Diecontrol APC Pro controls an automatic extrusion die based on transverse profile measurement. This produces uniformly thick film, sheet or coating even in case of variations in feed, material change or when starting up the line. The automatic control and nominal value optimization achieves significant material saving and quality improvement.



① Start of APC Pro control
② Standard deviation ≤ 0.5

- ① Start of APC Pro control
- ② Standard deviation ≤ 0.5

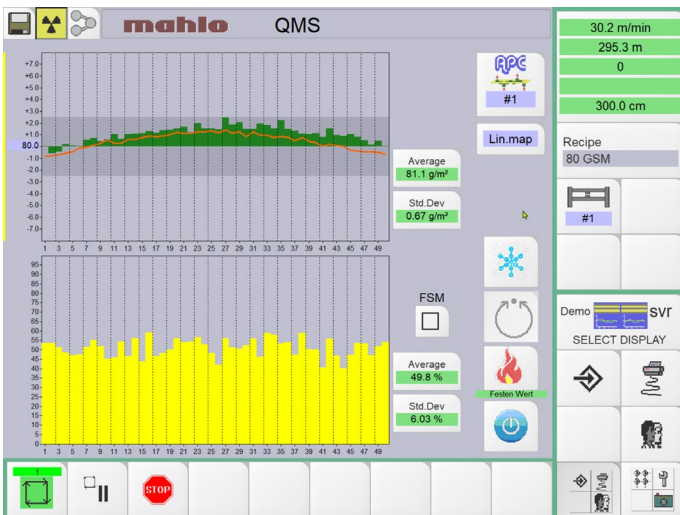
Area of application

These extrusion dies are used chiefly for film extrusion (flat film, cast film) and extrusion coating. However, special applications such as the production of special diaphragms are also possible. In all applications, the Diecontrol APC Pro is used to compensate deviations of thickness or the basis weight across the entire product width.

The Diecontrol APC Pro compensates deviations of the thickness or the basis weight with extrusion – exactly in the segment of the extrusion die in which the deviations occurred.

Increasing quality requirements necessitate constantly improved control procedures. For over many decades, Mahlo has been offering the right measuring and control systems for coating and finishing – including automatic die control.

The Diecontrol APC Pro is usually coupled to a Qualiscan QMS measuring system. It constantly measures deviations of the cross-machine direction profile (CD). This is how the Mahlo APC Pro controls the extrusion die. Variations in the cross-machine direction profile (CD) are reduced quickly and automatically.



APC Pro operation via touchscreen

Principle of operation

A flexible lip at the outlet of the extrusion die, controlled by many individual diebolts, regulates the uniform thickness of the material. Thus, the thickness can be set precisely in numerous short segments. This is automated via thermal bolts that change their temperature and thus length according to the applied power. The Mahlo APC Pro is able to control these dies with precision.

The user-friendly operation of our automatic process control system of the latest generation is completely integrated in the operating software of the Qualiscan QMS. The control hardware works with a reliable industrial PLC with quickly responding semiconductor relays. All components are individually protected and contain status indicators for communication and I/O. The Mahlo APC Pro systems are usually configured ready with matching connection for the extrusion die. This enables true plug & play.



FAST & EFFICIENT

Innovative functions such as controller initialisation, anticipatory neck-in compensation and rapid start focus on a single goal: to control the cross-machine direction profile (CD) in the shortest amount of time as evenly and uniformly as possible with minimum material effort.

Product highlights

- ✓ Quick-start - accelerated control with startup and product change
- ✓ Continuous monitoring of the diebolts for continuity (standard!)
- ✓ Automatic die-product web mapping
- ✓ Simple controller initialization and setting
- ✓ Anticipatory neck-in and edge-bead compensation
- ✓ Compatible with all automatic extrusion dies
- ✓ Modular construction for easy maintenance and expandability

OPTIONS

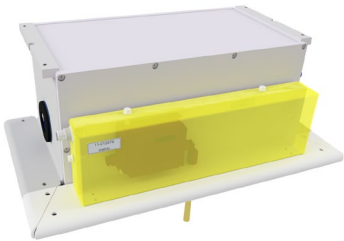


ACCESSORIES



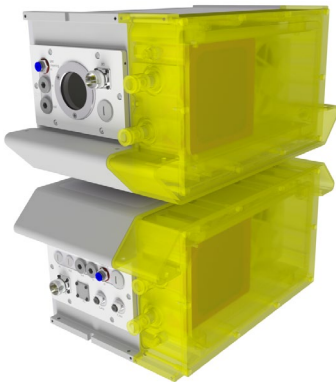
Gap Conditioning Device GCD measuring gap heating

The Gap Conditioning Device GCD blows heated air into the measuring gap to reach the defined temperature. The temperature of the heating air can thereby be adjusted with a precision of 1 degree. The measuring gap is kept clean and dry by the steady flow of heated air. The pressure of the heating air can be set with a pressure gauge.



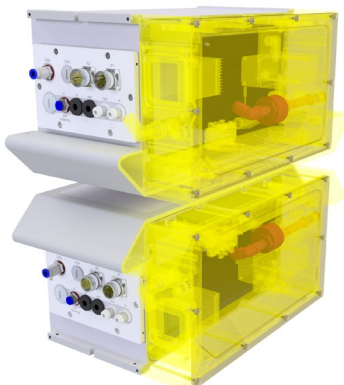
Temperature measurement Webtemp WTP

The sensor uses infrared radiation to measure the surface temperature of the running product web.



Cooling WCU – Water Cooling Unit

For sensor cooling. The sensors in the upper and lower traverse carrier are hereby supplied separately with coolant. The respective supply and drain lines are connected with the cooling unit via a connecting hose.



Cooling ACU – Air Cooling Unit

For sensor cooling. The sensors in the upper and lower traverse carrier are hereby supplied separately with compressed air. The compressed air is controlled to a precise temperature.

REFERENCE IMAGES



TYPICAL APPLICATIONS

USE IN EVERYDAY INDUSTRIAL ROUTINES

Installation at Selcuk Iplik , Turkey

The nonwovens manufacturer controls basis weight and moisture in its Spunlace lines with Qualiscan QMS from Mahlo. All images courtesy of Selcuk Iplik.



A Qualiscan QMS with a Webpro M scanner measures basis weight with beta sensor and moisture with an infrared sensor.



The traversing scanner of the Qualiscan QMS allows generating precise lateral and longitudinal profiles of parameters such as basis weight, thickness or moisture. They are presented clearly arranged in the operating software of the Mahlo system on a touchscreen (in the foreground).

Installation at Kirson Industrial Reinforcements GmbH, Germany

Kirson monitors the quality of its reinforcement web for products such as roof sheeting, floor covering or nonwovens with Mahlo Qualiscan QMS. All images courtesy of Kirson GmbH.



Checking the basis weight with the Gravimat DFI beta sensor in the O-frame Webpro M for the production of screen reinforcements from fibreglass and nonwovens.



The beta sensor measures basis weight via isotope rays. Complete insensitivity to web flutter across the entire measuring gap through DFI technology (Dynamic Flutter Independent). Even smallest beta ray sources thereby achieve their maximum measuring performance.

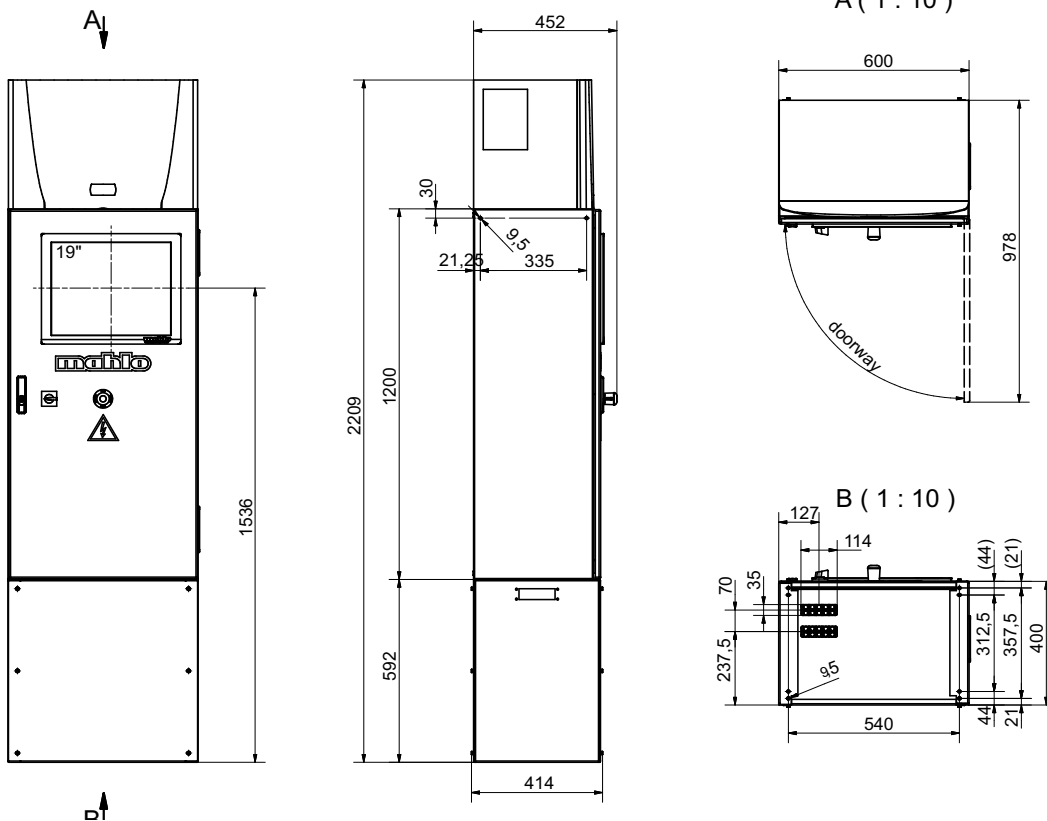
TECHNICAL DATA | BASE UNIT



Specification	Value	Unit
Control and display station	Touchscreen LCD TFT Panel	
Number of Scanner, maximum	6	
Temperature range (without Cooling)	5 - 45	°C
Power supply ¹	Any voltage and phase from 100 VAC 1-phase to 600 VAC 3-phase	
Line frequency	50 / 60	Hz
Power consumption, maximum ¹	6.2	kVA
Interface	TCP/IP (Ethernet)	

1) depends on equipment

Dimensions of base



Base unit with base frame and cooling

91-022206

TECHNICAL DATA | SCANNERS



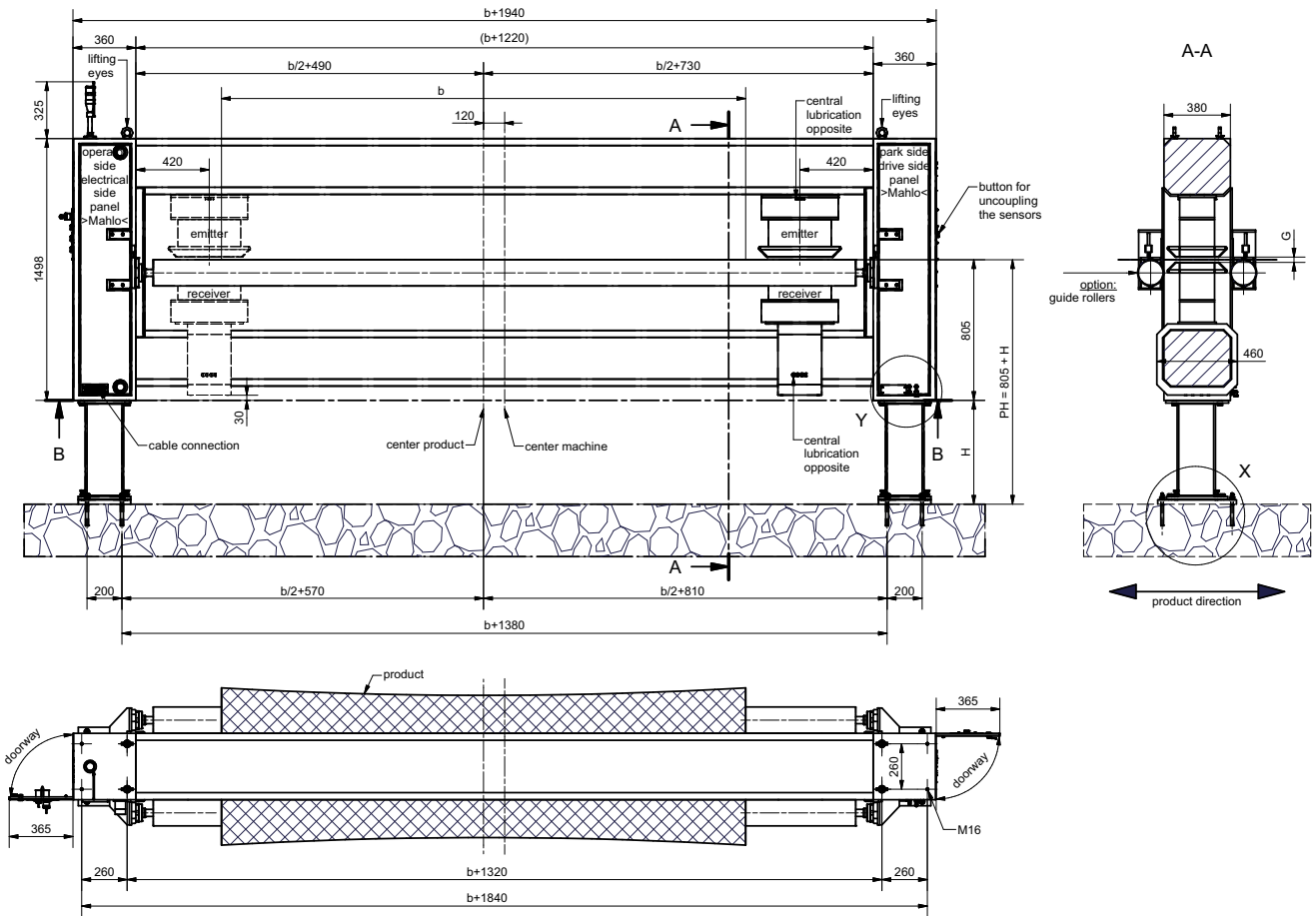
Device		Nominal product width [mm] ¹⁾		Number Sensors	Measuring gap, maximum [mm] ²⁾	Temperature range (without Cooling) [°C] ³⁾
		minimum	maximum			
Webpro	L-II	600	6600	5	160	5 - 45
	LH-II	600	6600	5	700	
	LC-II	600	6600	1	*	
	M	200	4000	3	80	
	MH	200	4000	3	600	
	S-II	200	4000	2	80	
	XS-II	200	2200	1	40	
	XSH-II	200	2200	1	100	
	CH (horizontal)	400	2000	1	80	
	CV (vertical)	400	1800	1	80	
Uniscan	M-II	200	4000	3		
	XS-II	200	2200	1		
Stationary measuring point		200	6000	3		

- 1) Other nominal product width available upon request
- 2) Sensor-dependent
- 3) Cooling for higher temperatures available
- *) upon consultation

TECHNICAL DATA | SCANNERS



Dimensions Webpro L-II



Scanner Webpro L-II
91-017707-1



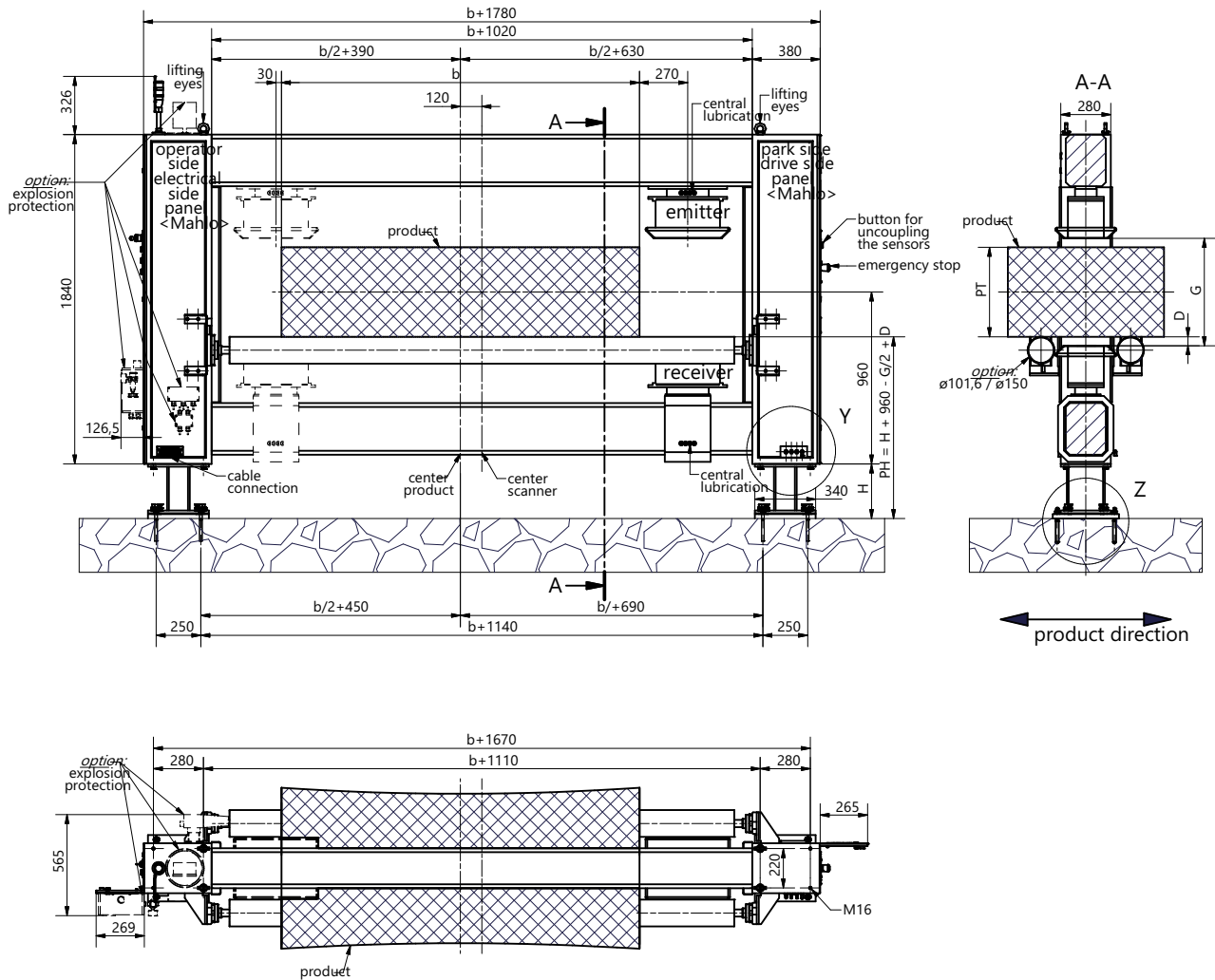
PERSONALITY

You're not just a number to us. Your individual needs and special requirements are our highest priority. We are there for you with our expertise, trend-setting technology and full dedication. So you can always play to win.

TECHNICAL DATA | SCANNERS



Dimensions Webpro MH



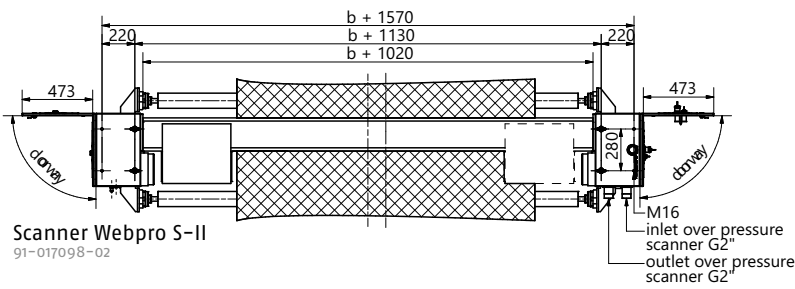
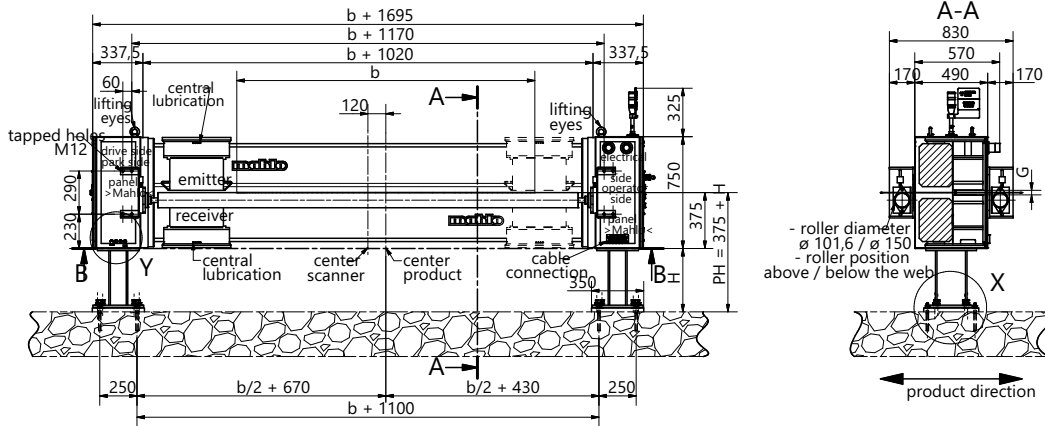
Scanner Webpro MH
91-016945-02



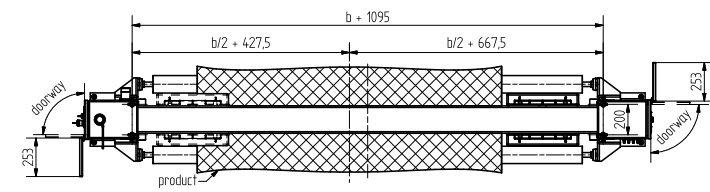
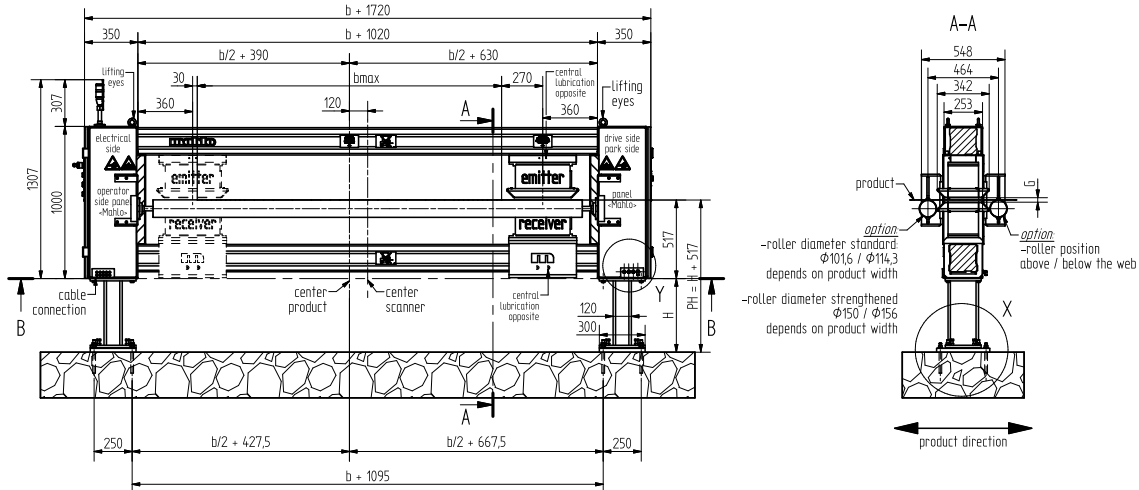
INNOVATIONS

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Dimensions Webpro S-II



Dimensions Webpro XS-II

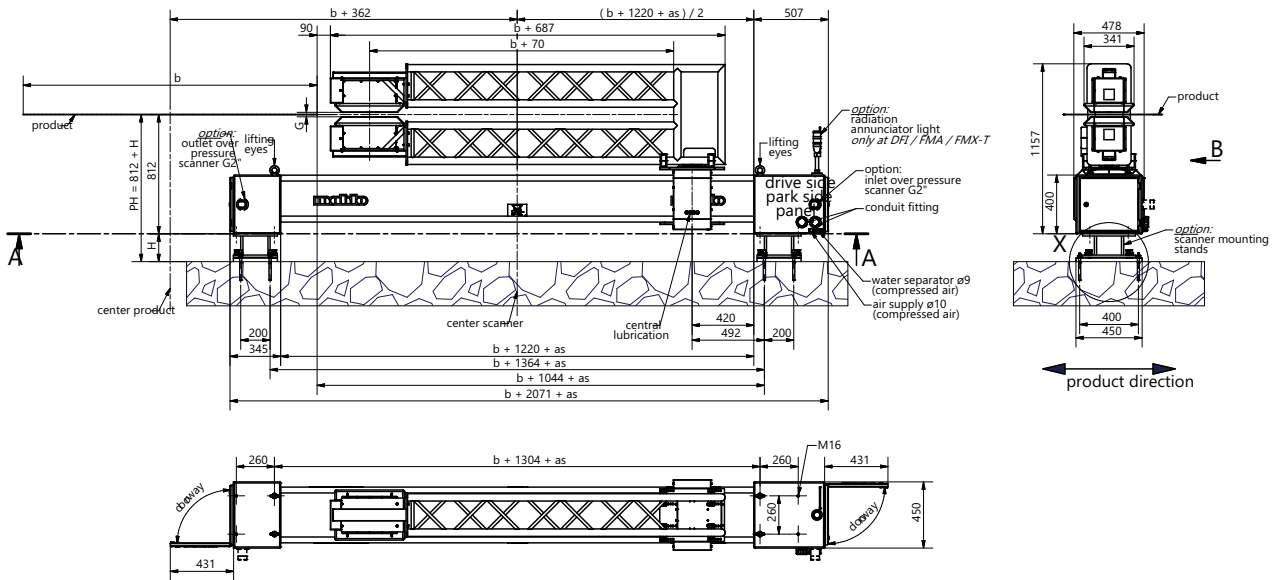


Scanner Webpro XS-II
91-019100-02

TECHNICAL DATA | SCANNERS

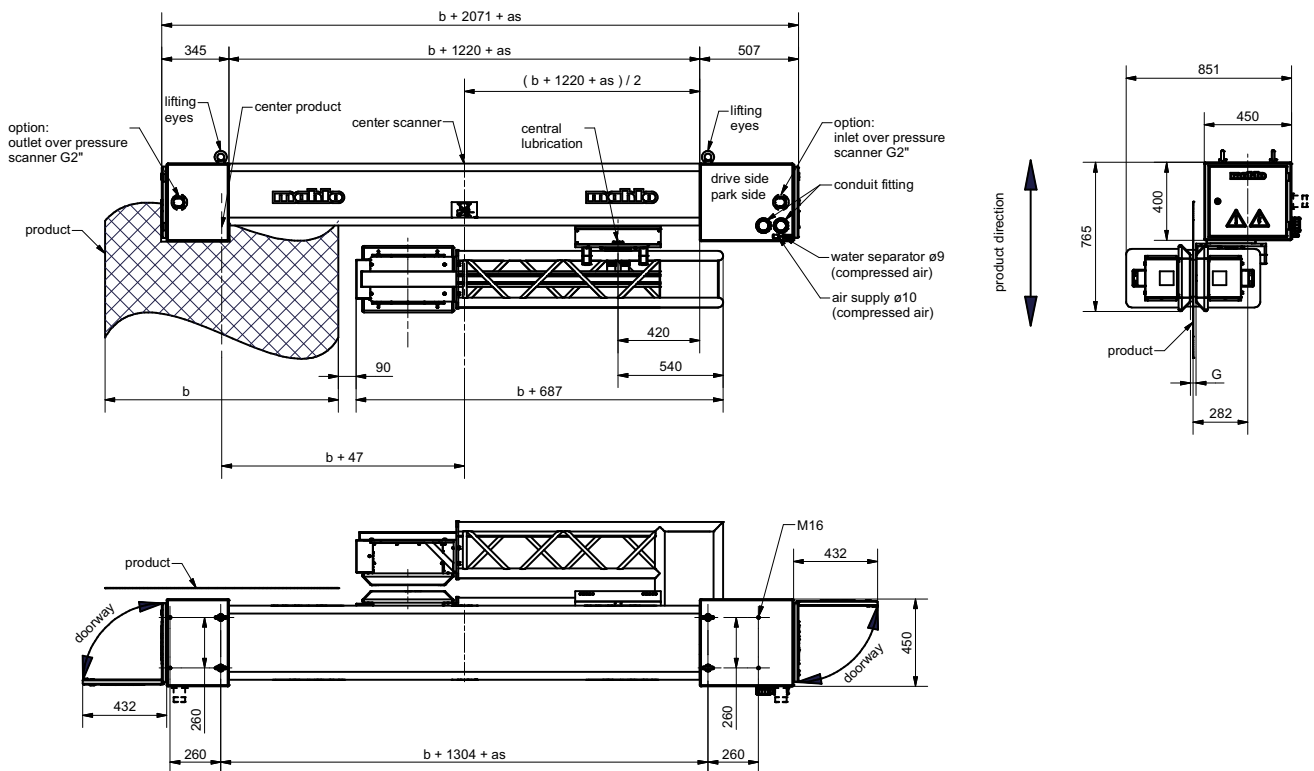


Dimensions Webpro CH



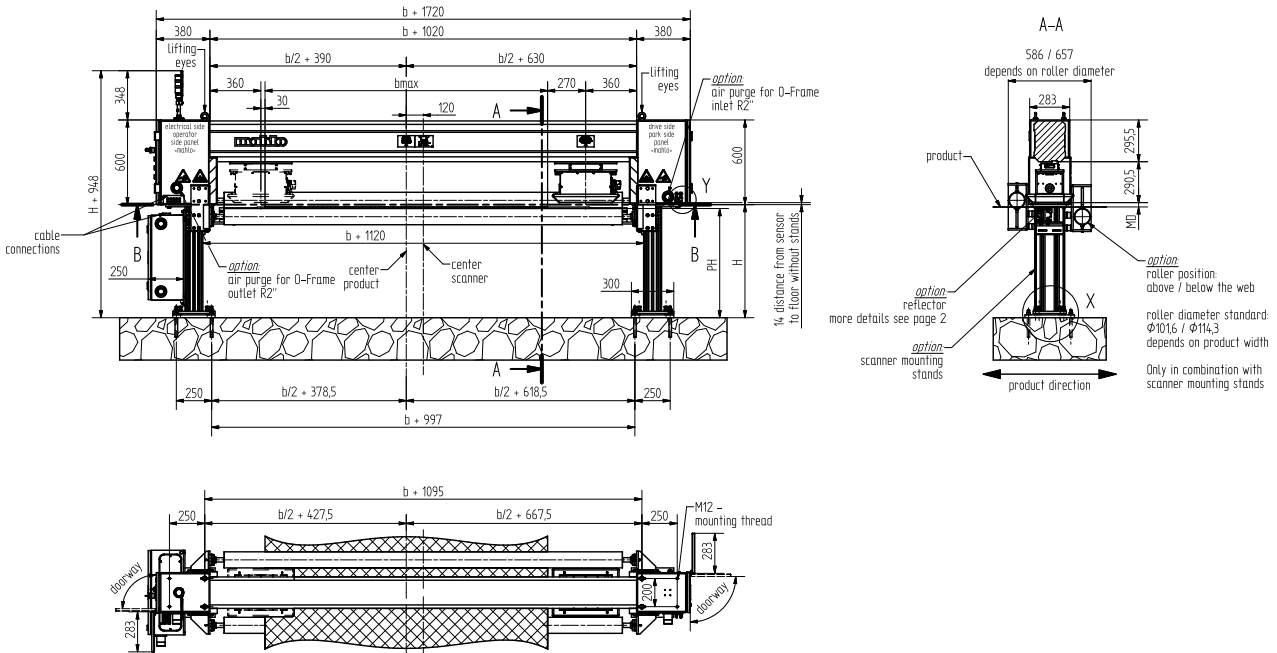
Scanner Webpro CH
91-016712-01

Dimensions Webpro CV



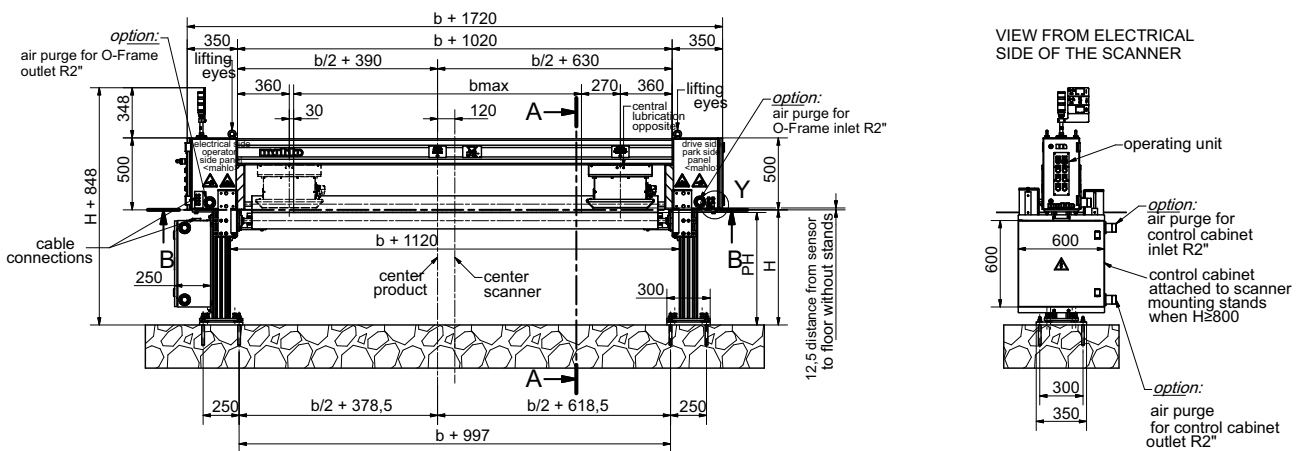
Scanner Webpro CV
91-016869-00

Dimensions Uniscan M-II



Scanner Uniscan M-II
91-021838-00

Dimensions Uniscan XS-II



Scanner Uniscan XS-II
91-021000-01

TECHNICAL DATA | SCANNERS



Gravimat FMI/DFI

Specification	Value				Unit
Measurements	Basis weight, Thickness, Density				
Measuring principle	Transmission of beta rays				
Isotope ¹	Krypton-85 (Kr-85)		Strontium-90 (Sr-90)		
Activity	3	5.5	9.62	0.5	GBq
Measuring range ²	10 - 1400	10 - 1400	10 - 1400	100 - 6000	g/m ²
Repeatability (1σ, 1s)	0.2	0.15	0.12	0.5	
Measuring gap	10 / 15 / 30 / 40 ³		10 / 15 / 30		mm
Temperature range without Cooling	10 - 45				°C

1) Please observe country-specific radiation protection requirements.

2) In reference to PET

3) Up to max. 100 mm at reduced accuracy

Gravimat FMX-T

Specification	Value			Unit
Measurements	Basis weight, Thickness, Density			
Measuring principle	Transmission of X-rays			
Acceleration voltage	<5	8 - 15	15 - 50	kV
Measuring range	PET: 5 - 1000	PET: 14000	PET: 99000 Glass: 20000	g/m ²
Repeatability (1σ, 1s)	0,08	0,13	0,48	
Measuring gap ¹	10 / 15 / 30 / 40	10 - 60	10 - 600	mm
Temperature range with Cooling	10 - 50	10 - 60	10 - 60	°C

1) Other measuring gaps upon request

TECHNICAL DATA | **SENSORS**



Infrascopie NIR

NIR-T (IR transmission)			
Specification	Value		Unit
Measurements	Basis weight, Moisture		
Measuring principle	Transmission of infrared light		
Type	NIR-T	NIR-T-Light	
Spectral range	900 - 2200	900 - 1700	nm
Measuring range Basis weight ¹	e.g. paper 10 - 300		g/m ²
	e.g. nonwovens 10 - 500		
Measuring range Moisture ¹	0 - 15	-	% H ₂ O
Measurement accuracy ¹	see ¹⁾		
Measuring gap	10 / 15 / 30		mm
Temperature range ²	10 - 60		°C

NIR-R (IR reflection)			
Specification	Value		Unit
Measurements	Basis weight, Moisture		
Measuring principle	Reflection of infrared light		
Type	NIR-R	NIR-R-Light	
Spectral range	900 - 2200	940 - 1700	nm
Measuring range Basis weight ¹	e.g. paper 10 - 60		g/m ²
	e.g. nonwovens 5 - 80		
Measuring range Moisture ¹	0 - 15		% H ₂ O
Measuring range Coating application ¹	e.g. silicon from 0.2	from 10	g/m ²
Measuring gap	10 / 15 / 30		mm
Temperature range ²	10 - 60		°C

1) Measuring range and measuring accuracy depending on the material (analysis of material sample necessary)
2) NIR: with Cooling; NIR Light: without Cooling

TECHNICAL DATA | SENSORS



Infralot IMF

Specification	Value		Unit
Measurements	Basis weight, Moisture		
Type	IMF-R	IMF-T	
Measuring principle	Reflection of infrared light	Transmission of infrared light	
Measuring range Basis weight ¹	e.g. paper approx. 10 – 60 e.g. nonwovens approx. 5 – 80	approx. 10 – 200 approx. 10 – 500	g/m ²
Measuring range Coating ¹	0.2 – 300	–	g/m ²
Measuring range Moisture ¹	approx. 0.2 – 15 ²	approx. 0.2 – 15 ³	% H ₂ O
Repeatability	depending on calibration		
Measuring gap	10 / 15 / 30 / 60	10 / 15 / 30	mm
Temperature range without Cooling	10 – 50		°C

- 1) Measuring range and measuring accuracy depending on the material (analysis of material sample necessary)
 2) Paper weight ≤ 80 g/m²
 3) Paper weight ≤ 300 g/m²



MULTI-CHANNEL FUNCTION (MULTICHANNEL)

The multi-channel function allows several measurements to be taken and analysed simultaneously with a single sensor, e.g. moisture, basis and individual components.

Aqualot HMF-T

Specification	Value		Unit
Measurements	Moisture		
Measuring principle	Microwave resonance measurement		
Measuring gap	10		mm
Measuring range ¹	3 – 450	3 – 1200	g/m ² H ₂ O
Resolution	0.1	0.3	g/m ²
Temperature range	without Cooling 10 – 50 with Cooling 10 – 85		°C

- 1) Measured moisture values can be given as absolute or percentage values if the basis weight of the product is known.

Calipro DML

DML (General)

Specification	Value	Unit
Measurements	Thickness	
Measuring principle	Laser triangulation	
Temperature range without Cooling	10 – 50	°C

DML-D (dual-sided)

Specification	Value	Unit
Distance compensation	No Yes	
Measuring gap ¹	10 – 120 ²	10 15 mm
Measurement accuracy, traversing, StdDev. 1σ CD ³	< 50	< 10 μm

DML-S (single-sided)

Specification	Value	Unit
Distance compensation	No Yes	
Measuring gap, maximum	80	20 mm
Measurement accuracy, traversing, StdDev. 1σ CD ³	see 1)	< 10 μm

DML-S-L (single-sided, Laser line)

Specification	Value	Unit
Type	50 400	
Measuring gap, maximum	45	395 mm
Length, Laser line	48 – 72	13 – 66 mm
Measurement accuracy, traversing, StdDev. 1σ CD ³	see 1)	see 1)

- 1) Other measuring gaps upon request
- 2) Depends on the sensor variant
- 3) Depending on ambient conditions such as roller run-out, web run, temperature, etc.

TECHNICAL DATA | SENSORS



Calipro DMS

Specification	Value		Unit
Measurements	Thickness		
Measuring principle	LED micrometer against reference roller		
Necessary reference roller arc of contact	>60		°
Measuring gap, maximum	15	6	mm
Measuring range, maximum	12	5	mm
Measurement accuracy, traversing, StdDev. 1σ CD ³	< 10	< 3	μm
Temperature range without Cooling	10 – 50		°C

1) Depending on ambient conditions such as roller run-out, web run, temperature, etc.

Optoscope WLI

Specification	Value		Unit
Measurements	Thickness, Layer thickness		
Measuring principle	LED micrometer against reference roller		
Type	WLI-R-UV/VIS	WLI-R-NIR	
Area of application	transparent layers	transparent and slightly opaque layers	
Measuring range	0.4 – 300	1 – 130	μm
Measurement accuracy ¹	0.01	0.02	μm
Temperature range without Cooling	10 – 50	10 – 60	°C

1) Under laboratory conditions

Airpro APM

Specification	Value	Unit
Measurements	Permeability	
Measuring principle	Air flow measurement	
Measuring range	1 – 5000	mm/s
Measurement accuracy	± 3 ¹	%
Temperature range without Cooling	10 – 50	°C

1) Of the measured value

Diecontrol APC Pro

Specification	Value			Unit
Type	1	2	3	
Number Bolt, maximum	180	162	144	W
	1 – 200	201 – 370	371 – 440	
Switching power per output,maximum	1	2	2	A
Power supply	400 3L / N			VAC
Line frequency	50/60			Hz
Interface	TCP/IP			



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